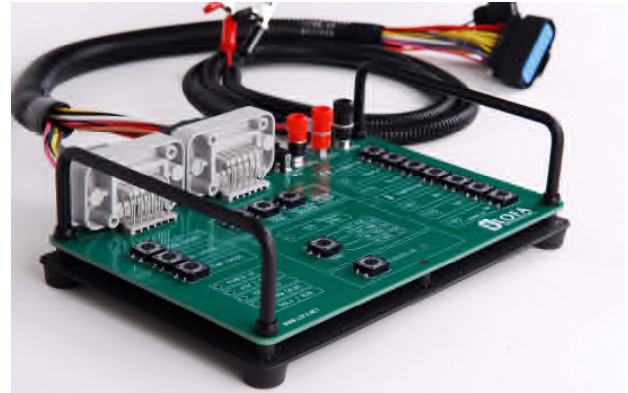


Introduction

The LOFA *Panel Tester* allows quick diagnoses of the proper operation of engine control panels. The available test harnesses provide simple plug and play connections to standard LOFA mechanical engine control panels as well as EP250TM, EL240TM and MC536 controllers. LEDs and a buzzer indicate the state of the panel outputs. Circuitry and pushbuttons stimulate all panel inputs to verify correct operation of the attached panel. The tester can also be used to calibrate tachometers for use with EP250TM and EM500 control panels.



The compact rugged design allows benchtop or field operation. Power options include a AC power supply as well as battery leads with alligator clips. Custom test harnesses can be developed to allow testing the engine harness in addition to the control panel.

Connecting Power

Additional equipment can be powered from the binder posts with jumpers.

Using Alligator Battery Clips

1. Remove the post thumb screws from the red and black binder posts.

Note

The binder post with the black base and red thumbscrew is used to test harnesses with a separate starter wire. No connection is normally made to this post.

2. Install the ring terminal of the red wire to the red post and the ring terminal of the black wire to the black binder post.
3. Reinstall the thumb screws to their respective binder posts.
4. Connect the red alligator clip to positive (+) terminal of the battery
5. Connect the black alligator clip to negative (-) terminal of the battery

Using AC Power Supply

1. Plug power supply plug into black jack.
2. Plug AC line cord into AC outlet.

Note

The panel tester does not have a power switch.
Powering down the tester requires disconnecting the power source.

Testing Panels

Preheat Modes

Various LOFA control panels support different preheat modes. These can be categorized as *Preheat Indication* and *Automatic Preheat Control* which can either be **Ground** or **Positive**. Ground signals provide a ground when active while positive signals provide battery power when active. When inactive neither provides ground or battery positive.

Note

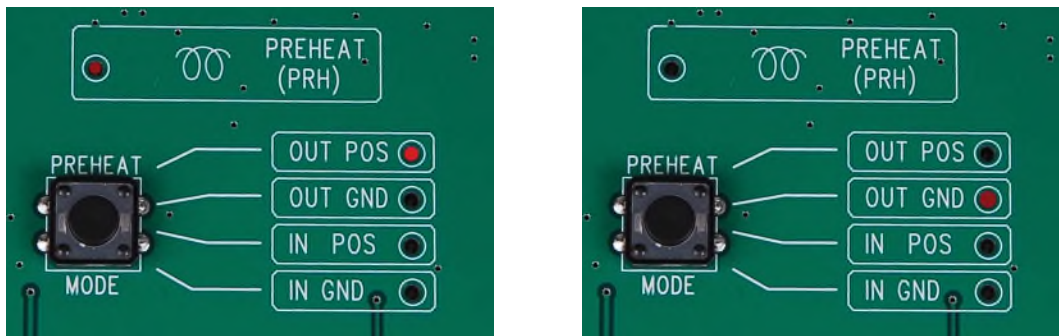
To properly test the panel requires knowing the preheat mode the panel supports.

Preheat Indication

Preheat indication modes are used when an external preheat timer controls the operation and duration of preheat or the panel is wired to use the key switch preheat position (the indent position between Run and Start). To test these modes, the tester needs to be set to **OUT POS** or **OUT GND** by pressing the **PREHEAT MODE** button until the appropriate LED is lit.

Note

The indicated PREHEAT MODE is the tester mode.



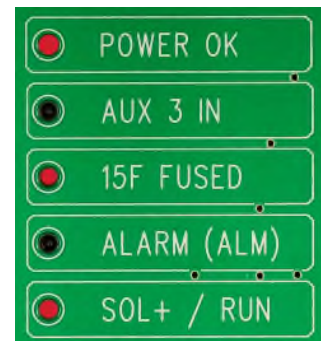
Automatic Preheat Control

With automatic preheat control modes; the control panel controls the operation and duration of preheat. To test these modes, the tester needs to be set to **IN POS** or **IN GND** by pressing the **PREHEAT MODE** button until the appropriate LED is lit.

Initial Tests

The **POWER OK** LED indicates that the panel test has power. After connecting the panel to the tester with the appropriate cables, turn the panel key switch to the run position. The panel LEDs should flash to test their function. The **SOL+ / RUN** LED should illuminate indicating the panel's solenoid output is enabled. If **15F FUSED** should illuminate if the pink/black harness wire is connected.

The **ALARM (ALM)** is an optional shutdown indication for a buzzer, flasher light or other controller. Typically the alarm output is energized briefly when the key switch is turned on as a self test. If the engine shuts down for any reason this alarm output will activate.



Note

ALARM (ARM) is optional and will not illuminate unless connected to the ALM terminal on the circuit board. The alarm output is only available on the EP and MC series panels.

After a short delay (typically 10 to 30 seconds) the solenoid output turns off unless the panel key switch is turned to the start position.

The solenoid power will turn back on when the panel's key switch is turned to start as indicated by the **STARTER 50** LED and the tester buzzer sounding.



After starting, the solenoid output will remain on as indicated by the *SOL+ / RUN* LED until the key switch is turned to the off position or the panel senses an input switch being grounded. If the *SOL+ / RUN* LED extinguishing without a shutdown input indicates a wiring fault or circuit board failure.

The *AUX 3 IN* LED is an optional input. This LED is typically not connected.

Preheat Test

Preheat Indication

To test preheat indication, press the *PREHEAT* pushbutton on the right side of the tester. When using the panel key switch preheat position, the *PREHEAT (PRH)* LED will illuminate when the key switch is in the preheat position.

WARNING!

When using the key switch preheat position, pressing the *PREHEAT* pushbutton when the tester is in *OUT GND* and the key switch is in the preheat position may damage the tester!
When the key switch preheat position is used the tester should be set to *OUT POS*.

Automatic Preheat Control

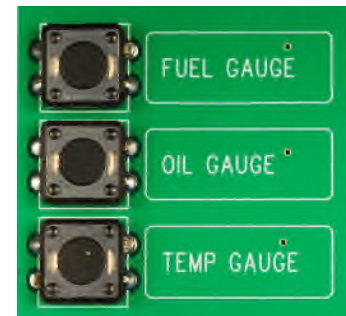
When the panel enables preheat control the *PREHEAT (PRH)* LED will illuminate. Automatic preheat control begins as soon as the panel key switch is turned to the run position. The preheat time can be verified by checking the time from the key switch being turn to run and the LED extinguishing.

Gauge Tests

The gauge pushbuttons are used to test proper gauge function and connection. Verify the correct gauge moves when the pushbutton is pressed to verify no wires have been crossed in the panel or harness.

When open circuited, the temperature gauge needle is zeroed. Pressing the *TEMP GAUGE* button grounds the temperature gauge signal causing the needle to peg.

When open circuited, the oil pressure gauge needle is pegged. Pressing the *OIL GAUGE* button grounds the oil pressure gauge signal causing the needle to zero.



Panel Tester Operation

When open circuited, the optional fuel level gauge needle is zeroed. Pressing the **FUEL GAUGE** button grounds the fuel level gauge signal causing the needle to peg.

Note

The solenoid output powers the gauges.
Gauges can only be tested while the tester is simulating a running engine.

Tachometer Test

The tester is equipped with a frequency generator to simulate engine RPM. The RPM output is activated when the circuit senses a start signal from the panel. **SPEED UP** increases the simulated RPM while **SPEED DOWN** decreases the simulated RPM. The change in RPM should be reflected by changes on the panel's tachometer.

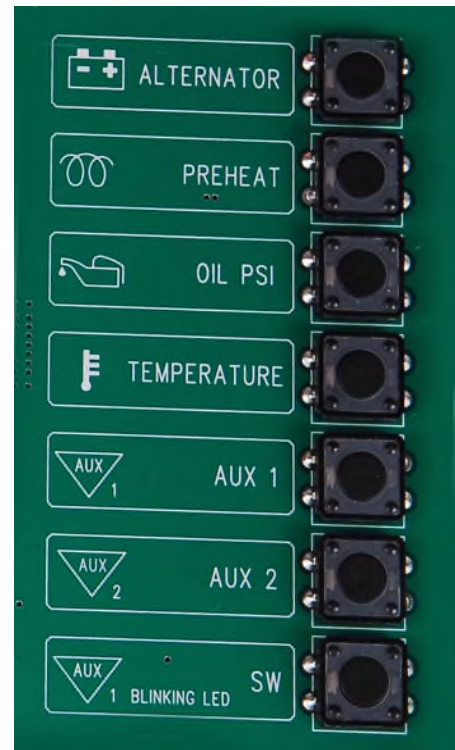


Input Tests

Pushbuttons on the right side of the tester stimulate the panel inputs. Briefly pressing these switches simulates a fault for ALTERNATOR (battery charge), OIL PSI (pressure), TEMPERATURE, AUX 1, AUX 2 and SW. The corresponding LED on the panel should illuminate as the pushbutton is pressed.

Note

SW is an additional shutdown input option for EP250 series panels. When the SW terminal on the circuit board is connected and grounded the AUX 1 LED blinks.

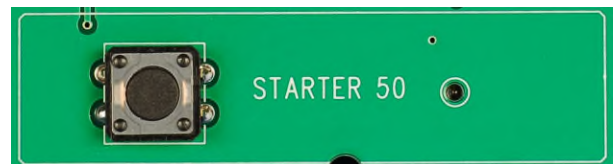


Shutdown Tests

Shutdown is overridden for the initial 10 seconds after the key switch is released from the start position. This delay allows the engine to build oil pressure and the alternator to start charging the battery.

After this delay, if an input pushbutton is pressed for 1 second or more and the panel is configured for shutdown for that input, the panel will turn the solenoid output off. This is indicated on the panel tester by the SOL+ / RUN LED extinguishing.

The **STARTER 50** pushbutton allows restarting the panel without using the panel key switch. Once a shutdown has been tested pressing the **STARTER 50** resets the controller. Each time the panels starter output is activated the buzzer on the tester sounds and the starter LED illuminates.



Note

Each time the panel senses the starter signal, shutdowns are overridden for 10 seconds.

WARNING!

DO NOT use the *STARTER 50* pushbutton with MC536 panels!
The MC536 starter output design may damage the tester!

Automatic Start Stop Tests

Automatic Start Stop is a variation of normal panel testing. When the automatic start conditions of the panel are met, the panel's autostart will enable the panel (as indicated by the *SOL+ / RUN* LED) and engage the starter (as indicated by the *STARTER 50* LED and buzzer). After a brief delay from the starter signal, the panel tester will simulate the engine RPM. When the autostart detects the RPM the starter output is turned off.

When the automatic conditions are met, the autostart will initiate as shutdown. Depending on the autostart programming this may include a cool down period. The shutdown is indicated by the *SOL+ / RUN* LED being extinguished.

Tachometer Calibration

The *CAL TACH 1800RPM* button allows calibrating a tachometer at 1800 RPM for EP250F and EM500 panels. Pressing the *CAL TACH 1800RPM* button causes the LED to illuminate indicating the RPM is now at 1800 RPM. The dip switch diagram below the LED is the switch setting for VDO tachometers used in LOFA panels.

Note

Unless calibrating a tachometer for EP250F or EM500 panels, the tester can not be used to calibrate tachometers for a specific engine.

EP250F panels can be automatically calibrated to the engine's pulses per revolution using a DPG 5200.

Alternately, EP250F panels can be calibrated by setting the pulses per revolution using a DPG 5200 or the *EP250 Configuration Kit*.

EM500 panels automatically synthesis the tachometer frequency based on the J1939 reported engine RPM.

General Troubleshooting

For additional information, refer to engine manufacturer troubleshooting guide.

No response from starter motor

Possible Cause	Possible Remedy
No battery voltage to starter	Verify wiring and battery connection (power and ground)
Battery discharged	Charge or replace battery, verify alternator charging
Tripped over current protection	Correct fault, replace or reset over current protection
No signal from control system	No power to control system (see Control System Troubleshooting below)
Defective starter solenoid	Replace starter solenoid
Defective starter motor	Replace starter motor

Engine will crank but not start

Possible Cause	Possible Remedy
Engine not getting fuel	Check fuel level, filter, fuel pump, verify no air in fuel lines
Fuel run/stop solenoid not engaged	See Fuel Solenoid Run/Stop Troubleshooting (below)
Tripped over current protection	Correct fault, replace or reset over current protection
No preheat (cold condition)	See Preheat Troubleshooting

Engine runs for 10 seconds and shuts down

Possible Cause	Possible Remedy
Shutdown switch input active	Verify shutdown source exists, correct condition or correct faulty circuit
Battery not charging	Verify alternator charging (see Alternator not charging battery below)
Control board did not sense start signal	Engine started through alternate method (i.e., manual air start, push start, etc.)
Defective control system	See Control Panel Troubleshooting (below)

Engine runs longer than 10 seconds and shuts down

Possible Cause	Possible Remedy
Shutdown switch input active	Correct engine fault, verify shutdown switch wiring
Circuit overload protection tripped	Correct overload, keep control system from overheating (over 185° F/85° C)
Voltage transients (spikes)	Add suppressor diodes, protect from nearby lightening strikes, shield induced spikes from other equipment, add electric motor control relay
Defective control system	See Control System Troubleshooting (below)

Alternator not charging battery

Possible Cause	Possible Remedy
Broken or slipping alternator drive belt	Adjust or replace alternator drive belt
Alternator not excited	Verify excitation circuit connected, replace faulty regulator
Alternator output not connected	Install charge wire
Alternator not grounded	Clean or add ground connection
Alternator faulty	Replace faulty alternator

Fuel Run/Stop Solenoid Troubleshooting**Engine does not stop immediately**

Possible Cause	Possible Remedy
Back feed from motor (i.e., cooling fan)	Add relay or blocking diode
Sticking solenoid linkage	Repair or replace solenoid linkage
Fuel valve without check valve	Install or repair check valve

Fuel run/stop solenoid does not engage

Possible Cause	Possible Remedy
No power to solenoid	Locate reason for lack of power and correct (Circuit overloaded? Failed suppressor diode? Faulty wiring?)
No power to solenoid pull coil	Correct faulty wiring, check pull control circuit (see Power Box Troubleshooting below)
Incorrect linkage adjustment	Adjust solenoid linkage
Faulty solenoid	Replace solenoid
Failed suppressor diode	Correct wiring (diode reversed?), replace suppressor diode
Optional e-stop engaged	Disengage e-stop

Engine not getting fuel

Possible Cause	Possible Remedy
Empty fuel tank	Fuel engine
Clogged filter	Replace filter
Air in fuel lines	Bleed fuel lines
Low fuel pressure	Replace faulty fuel pump and/or clogged filter
Faulty fuel pump	Replace fuel pump, correct wiring fault (electric fuel pump)

Preheat Troubleshooting

Engine is hard to start in cold conditions

Possible Cause	Possible Remedy
Start attempt before preheat complete	Wait for preheat time to elapse, crank as soon as time elapses
Incorrect preheat specification	Correct control system configuration, install correct control system
Heater faulty	Replace heater
Heater relay faulty	Replace relay
Preheat control not functioning	Correct wiring, correct control system configuration
Faulty control system	See Control System Troubleshooting (below)

Engine produces excessive white smoke after starting

Possible Cause	Possible Remedy
Afterglow not enabled	Reconfigure control system
Heater faulty	Replace heater
Heater relay faulty	Replace relay
Preheat control not functioning	Correct wiring, correct control system configuration
Faulty control system	See Control System Troubleshooting (below)

Control System Troubleshooting

Control system does not perform self test

Possible Cause	Possible Remedy
Tripped over current protection	Correct fault, replace or reset over current protection
Faulty connection to battery	Correct battery connections (see Battery Circuit Requirements above)

Control system performs normal self test, engine cranks, runs and shuts down

Possible Cause	Possible Remedy
Only Battery LED illuminated	Correct battery charge failure (see Battery not charging above)
Only Oil Pressure LED Illuminated	Correct low oil pressure condition or faulty switch, correct wiring fault
Only Temperature LED Illuminated	Correct overheating condition or faulty switch, correct wiring fault
Only Aux LED Illuminated	Correct fault condition (i.e. coolant level) or faulty switch, correct wiring fault
All normally closed shutdowns illuminate for one second (control system reset)	Add suppressor diodes, protect from nearby lightening strikes, shield induced spikes from other equipment, add electric motor control relay

Notes

Notes

Important Information

The information, specifications and illustrations in this publication are based on information available at the time of publication.

All items are subject to change at any time without notice.

Software Release History

1.00

- Initial release

Document Revision History

Initial: 21-Jul-2008.

Panel Tester Operation



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