J1939 Universal Control Instruments
for Electronically Governed Engines

L00 Series

L15 Series

L10 Series

L20 Series

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Powering the System

The M150L Control Panel is powered from the engine battery connection via the engine harness connector. Make sure the engine harness is connected to the M150L before proceeding. To power the system turn the key switch to the "ON" position. This will activate the control panel and apply power to the engine ECU. All system sensors will be activated at this time. When the ignition switch is initially set to the "ON' position, the digital control system performs a series of system startup checks. The tachometer needle will sweep from 0 to full range and then back to zero. After approximately 5 seconds the system startup test will complete and the digital display will begin to provide system data. Should the control panel sound an audible alarm OR the digital display indicate a fault condition do not start the engine. Review the fault condition and proceed to correct the fault condition. See Fault section of this manual for details on system faults.

Starting the Engine

To start the engine, turn the key switch to the "Start" position. Should a fault condition exist the engine ECU may prevent the engine from starting. If the user has connected the external engine shutdown and the input is active this will also prevent the engine from starting. All fault conditions will be indicated by the digital display. The display will indicate the active fault(s) by presenting a pop-up graphic describing the fault condition.

Controlling Engine Speed

When the engine is started, the engine speed will be set to the engine minimum speed setting. To change the engine speed toggle the throttle control ("Fast-Rabbit / Slow-Turtle") switch to reach the desired speed setting. The engine speed cannot be commanded below the minimum setting or above the maximum speed setting. See section Min/Max Engine speeds for more details.

Menu Navigation

The Mode Button is multi-functional and is used as an escape and enter key. When the Mode key is pressed for less than 1 second it is considered an escape action. When pressed for greater than 1 second is considered an enter function. For example, to enter a menu selection or save an entered value the button must be pressed and held for greater than 1 second. When escaping a menu selection, momentary Mode Button presses are used. The only exception to these actions is entering the main menu. From any runtime data display screen a momentary press of the Mode Button will activate the main menu.

Main Menu

The Main Menu allows the user to access all areas of the M150L Control System. To access the Main Menu press the Mode button. To access menu items highlight the desired selection using the "▼" or "▲" keys and press & hold the Mode button for 1 second.
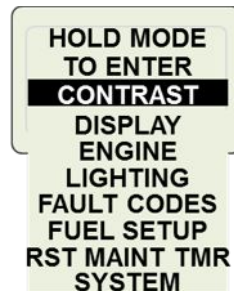
System I/O Indicators

The M150L provides constant monitoring of critical system inputs and indicates the status of these inputs on the controller display. The external engine shutdown, charge indicator and throttle switch inputs are assigned to the status icons. The presence of the ICON indicates the input is active.

OIL PRESS   Charge Indicator Status

44.6 PSI   External Engine Shutdown

Throttle Switch Status
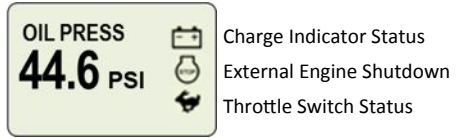
Note: Charge Indicator and Engine Shutdown inputs will not generate an alarm indication when engine is not running. However, ICONS will activate if input is active and engine is not running.

System Operation

## Audible Alerts

Audible alerts can be activated for several reasons;

1) Active Fault(s)
2) Acknowledged Active Fault reminder
3) Button Press
4) Setting Saved
5) Warning

Audible alerts for button presses, setting saved and warning beeps are configurable and can be turned on or off from the System / Audio menu. To configure audio settings enter Main Menu then scroll to System entry using "▼" or "▲"buttons.

Press & hold Mode button for > 1 second to select System menu. Scroll to Audio entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to enter Audio Menu. Use "▼" or "▲"buttons to select audio menu entry to configure.

```
SYSTEM              AUDIO SETTING        ALL BEEP
AUDIO        ➡      ALL           ➡      AUDIO STATUS
CSTM ALARMS         WARNING BEEP         ON
LANGUAGE            SETTING SAVED        OFF
                    BUTTON PRESS
```

Contrast Menu

The Contrast Menu allows the user to adjust the display contrast settings. Enter Main Menu then scroll to the Contrast entry using "▼" or "▲"buttons.

Select Contrast and adjust contrast using "▼" or "▲" buttons.

```
HOLD MODE          ADJUST
TO ENTER            LCD
CONTRAST         CONTRAST
DISPLAY         PRESS ▼ OR ▲
```
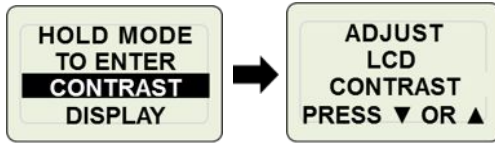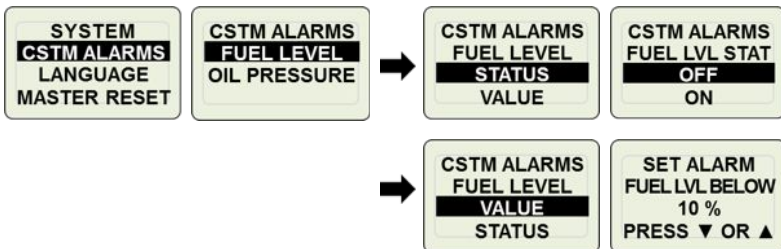
Custom Alarms

Fuel Level

A low fuel warning is configurable by the operator as a custom alarm. This warning will occur when the system fuel level drops below the value configured for this setting. This is a preventative measure to warn the operator that the fuel level is getting low. Should this message occur check the fuel level to determine if sufficient fuel is available. When the fuel level

```
LOW FUEL
TANK #1
WARNING
```

exceeds the value configured the warning message is automatically removed. This warning is generated by the control module and does not affect system operation in any way. This warning will be displayed anytime the fuel level drops below the level described above.

Note: The fuel level reading must be below the set-point value by .4% for > 10 seconds before alarm will sound. Fuel level reading must be above set-point value by 2% for > 10 seconds for the alarm to clear.

To select the custom alarm for fuel level enter the Main Menu then scroll to the System menu entry using "▼" or "▲"buttons. Press & hold Mode button for > 1

second to select the System menu. Scroll to the "CSTM ALARM" entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to enter custom alarm

menu selection (fuel level or oil pressure). Use "▼" or "▲"buttons to select the

desired alarm. Press & hold Mode button for > 1 second to enter the desired menu. The alarm can be activated or de-activated from the "Status" menu selection. The alarm set-point is set from the "Value" menu selection.

```
SYSTEM          CSTM ALARMS     CSTM ALARMS     CSTM ALARMS
CSTM ALARMS     FUEL LEVEL      FUEL LEVEL      FUEL LVL STAT
LANGUAGE        OIL PRESSURE    STATUS          OFF
MASTER RESET                    VALUE           ON
```

```
                                CSTM ALARMS     SET ALARM
                                FUEL LEVEL      FUEL LVL BELOW
                                VALUE           10 %
                                STATUS          PRESS ▼ OR ▲
```

Oil Pressure

A low oil pressure warning will occur when the oil pressure drops below the value configured for this setting. Should this message occur check the oil level to determine if the engine has sufficient oil available. When the oil pressure exceeds the value configured the warning message is automatically removed. This warning is generated by the control module and does not affect system operation in any way. This warning will not be displayed until the operator starts the engine OR the oil pressure drops below the pressure described above, while the engine is running.

Note: The oil pressure reading must be below the set-point value by .4% for > 10 seconds before alarm will sound. Oil Pressure reading must be above set-point value by 2% for > 10 seconds for the alarm to clear.

To select the custom alarm for oil pressure enter the Main Menu then scroll to the System menu entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to select the System menu. Scroll to the "CSTM ALARM" entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to enter custom alarm menu selection (fuel level or oil pressure). Use "▼" or "▲"buttons to select the desired alarm. Press & hold Mode button for > 1 second to enter the desired alarm menu. The alarm can be activated or de-activated from the "Status" menu selection. The alarm set-point is set from the "Value" menu selection.
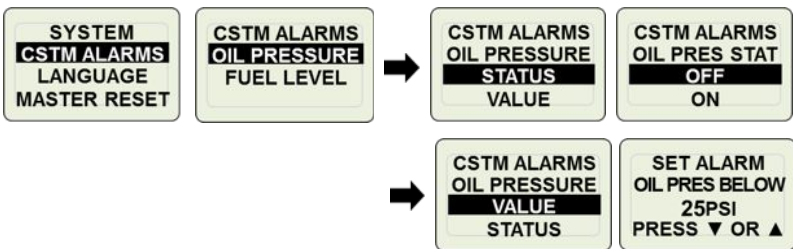
Fault Codes

Engine fault codes are generated from the engine ECU and communicated to the control panel via the CANBus communications link. The control panel reports the following faults using descriptive text; engine over temperature, low oil pressure, system charge, water in fuel, and communications failure. The engine ECU can generate additional fault codes and many engine manufacturers have engine specific codes. The control panel will present these additional codes as a "Check Engine" indication along with the SPN Number, FMI Code and fault count. Should a check engine fault be displayed the operator should access the Fault Code menu to determine the specific fault condition.

Active Fault Codes

All active system events (faults and warnings) are displayed on the LCD screen. Critical faults are backlight in Red. Warnings are backlight in Amber. Fault codes are accessed from the "Fault Codes" entry in the main menu. When a system fault occurs the display will activate a pop-up window describing the active fault condition and sound an audible tone. This pop-up will overlay on top of the currently active screen.

FAULT	DEFINITION
SYSTEM CHARGE	[1,2]Alternator not charging – ECU or M150L generated
ENGINE COMMUNICATIONS	[1]CANBus network failed – Engine ECU generated
CHECK ENGINE	[1]Engine Fault – Engine ECU generated
ENGINE TEMPERATURE HIGH	[1]Engine Temperature High – Engine ECU generated
SYSTEM VOLTAGE LOW	[1]ECU Voltage Low – Engine ECU generated
OIL PRESSURE LOW	[1]Engine Oil Pressure Low – Engine ECU generated [2]Engine Oil Pressure Low – M150L Custom Alarm
EXTERNAL ENGINE SHUTDOWN	[2]External Engine Shutdown – User generated

Table 1.0 – System Alarms

[1]Engine ECU may enter rpm limit mode or prevent engine from starting (this condition is controlled by engine ECU); fault may be generated without engine running.

[2]Engine continues to run – controlled by M150L control module; fault generated when engine started or engine is running.

System Charge Indicator

A "SYSTEM CHARGE INDICATOR" warning will be displayed when it is determined the system is discharging. This condition can occur two ways;

1) If configured from the factory, the engine ECU detects the condition and sends a DM1 message indicating a charge warning Or …..

2) The M150L Control Module will provide a charge warning when the alternator field input is indicating a negative current flow. In either condition the system will indicate an active fault to notify the operator that the system needs attention.

Engine Communications Failure

An "ENGINE COMMUNICATION FAILURE" is generated by the engine ECU. This fault occurs when the throttle speed control message (TSC1) is not received by the engine ECU at an acceptable update rate. This is typically 10 msec.

Check Engine

The "CHECK ENGINE" fault is a non-specific fault condition. This pop-up will occur when the engine generates any fault condition that is not specifically described in the fault section of this document. When a check engine fault occurs it is recommended that the operator go to the "Fault Codes" menu and review the detailed engine diagnostic data.

Engine Over-Temperature

The "ENGINE TEMPERATURE HIGH" fault is generated by the engine ECU which reads a temperature sender located on the engine. When an over temperature condition is determined by the ECU a fault message is transmitted by the engine ECU indicating an engine temperature above normal exists. Details about the over temperature alarm can be viewed in the Fault Code menu.

External Engine Shutdown

The "EXTERNAL ENGINE SHUTDOWN" popup will be generated when the control module has determined the "External Engine Shutdown" signal is active. When the external shutdown input is active (connected to gnd) the M150L Control System will shutdown the engine by disrupting the ignition voltage. This fault indication is software generated in the control system. If the external shutdown is active and the operator tries to start the engine a fault popup screen will activate indicating the condition exists. This condition will continue until the fault is removed.

System Voltage Low

The "SYSTEM VOLTAGE LOW" warning is generated via the engine ECU. The engine ECU continuously monitors the ECU supply voltage to determine system voltage level. Should the system voltage become too low the engine ECU will indicate voltage below normal by transmitting a fault message to the control panel. The engine fault popup screen will indicate that the system voltage is low.

Oil Pressure

The "OIL PRESSURE LOW" critical fault is typically generated by an oil pressure sender switch mounted on the engine. The engine ECU reads this switch and indicates an oil pressure fault OR oil pressure switch malfunction by transmitting a fault message to the control panel. The fault message has multiple definitions and could indicate oil pressure below normal or oil pressure sensor shorted or open. This message is received by the control panel and processed to the fault display. The display fault popup screen will indicate "OIL PRESSURE LOW" when an active oil pressure fault message is received. Details about the exact oil pressure failure can be viewed from the "Fault Codes" menu.
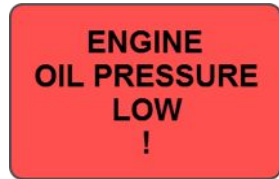
Acknowledging Active Faults

When the control system receives a new fault, the digital display responds by overlaying a fault pop-up graphic onto the currently active runtime display. This allows the operator to respond to the fault condition and provide the necessary actions. The display to the right represents an unacknowledged fault for an oil pressure low condition.

To acknowledge an active fault, press and hold the Mode button for greater than 1 second. This will remove the pop-up graphic and silence the audible fault indication. The control system will continue to backlight the LCD display indicating an active fault or warning exists.

Press & Hold
Mode Button
>1 second

Should the fault condition persist and not be acknowledged, the M150L will "Auto" acknowledge the fault after 1 minute of continuous fault indication. An auto acknowledge produces the same result as the user performing an acknowledge.

Note: If the fault condition is cleared the associated pop-up will automatically be removed. If the fault condition remains and the fault has been acknowledged, the audible fault indication will be re-activated every 5 minutes for 2 seconds and then silence. This feature is a continuous reminder to the operator that a fault is present.

Stored Faults

To access fault codes, enter the Main Menu and then scroll to the Fault Code entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to select the

"Fault Codes" entry. Select "View". If no fault codes exist the system will indicate no codes. If codes exist the system will display the SPN number, FMI code and the number of times the fault has occurred. If multiple faults exist the system will indicate the number of faults. When more than one fault exists use the "▼" or "▲" buttons to scroll through the fault code list.
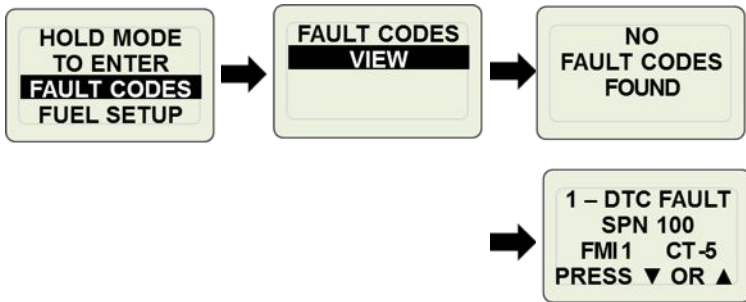
Language

Setting Language

The M150L System provides the user with the ability to select one of 5 languages. The languages provided are English (default), French, German, Italian and Spanish.

To select a language enter the Main Menu then scroll to the System menu entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to select System menu. Scroll to "Language" entry using "▼" or "▲"buttons. Press & hold

Mode button for > 1 second to enter Language selection menu. Use "▼" or "▲"buttons to select the desired language. Press & hold Mode button for > 1 second to enter selected language. M150L will immediately convert to the language selected.

Maintenance Timer

The M150L System provides an engine maintenance timer feature. The maintenance timer display indicates the amount of engine runtime since last maintenance. If the system is powered but the engine is not running no maintenance hours will be accumulated. When the maintenance timer exceeds the configured time, the system will activate an "Engine Maintenance Required" alert popup. If the timer is not reset the alert popup will reinitiate on each key "ON" cycle.

Setting Maintenance Timer

The maintenance timer is configurable and resettable by the operator. The timer will activate when set to a value > 0. To configure the maintenance timer enter the Main Menu and then scroll to the Engine entry using the "▼" or "▲"buttons.

ENGINE
MAINTENANCE
REQUIRED

Press & hold Mode button for > 1 second to select the Engine menu. Scroll to the "MAINT TIMER" entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to enter Maintenance Timer Menu. Use "▼" or "▲"buttons to set maintenance timer hours. Press & hold Mode button for > 1 second to enter the maintenance interval time. The timer has a settable range of 1-9999 hours. A setting of 0 hours turns off the timer.

HOLD MODE
TO ENTER
ENGINE
LIGHTING
➡
ENGINE
MAINT TIMER
THROTTLE TYPE
OIL PRESS SRC
➡
SELECT MAINT
TIMER
125HRS
PRESS ▼ OR ▲

Acknowledging Maintenance Timer

When the maintenance timer expires the control system will provide an alert popup indicating the maintenance time has expired. The alert will be cleared (acknowledged) by pressing and holding the Mode button. See acknowledging active faults section for more details. Accessing the maintenance timer reset menu via the "Hot Key" will also acknowledge the maintenance timer alert.

Resetting Maintenance Timer

To reset the maintenance timer enter the Main Menu and then scroll to the "RST MAINT TIMER" entry using the "▼" or "▲"buttons. Press & hold Mode button for > 1 second to select reset maintenance timer menu. Using the "▼" or "▲"buttons select "YES" to reset the timer. Press & hold Mode button for > 1 second to enter the timer reset request.

HOLD MODE
TO ENTER
RST MAINT TMR
SYSTEM
➡
RESET MAINT
TIMER
NO
YES

Resetting the maintenance timer can also be accomplished using an M150L built-in "Hot Key". The "Hot Key" entry is accomplished by simultaneously pressing the "▼" or "▲" buttons.

Simultaneous pressing will cause Hot Key to activate

Master Reset

A Master Reset allows the user to set the M150L back to factory default settings. Settings such as Language, Fuel Setup, Oil Pressure Sender, Throttle Type, Engineering Units will all be reset to their factory setting when a master reset is completed.

To select Master Reset enter the Main Menu and then scroll to the System entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to select System menu. Scroll to "Master Reset" entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to activate the master reset program. The M150L will require two user confirmations before proceeding with the master reset application.
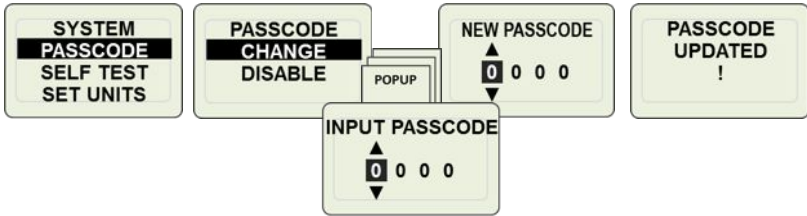

Passcode

The M150L allows the user to set a passcode which protects various parameters in the M150L database. Setting the passcode to 0000 will disable it. Any non-zero value for the passcode entry enables it and therefore protects critical data parameters.

To select Passcode enter the Main Menu then scroll to the System entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to select System menu.

Scroll to "Passcode" entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second enter passcode menu. The passcode menu allows the user to Disable or Change the current passcode configuration.
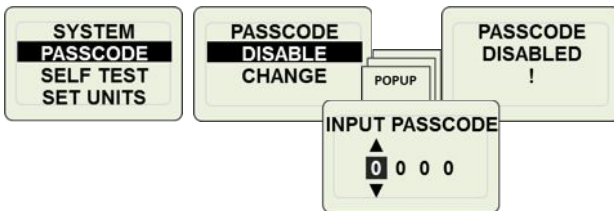
Changing the Passcode.

When the passcode protection is enabled the M150L will prevent changes to the following parameters;

Display Menu
    # of Screens
    Screen Setup
Engine Menu
    Throttle Type
    Oil Pressure Sender Source
    Set Min RPM
    Set Max RPM
    Maintenance Timer
Fuel Setup Menu
    Fuel Sender Source
System Menu
    Custom Alarms
    Master Reset
    Passcode

Note: When changing or Enabling the passcode, the changes will not go into effect until the system has seen a power cycle.
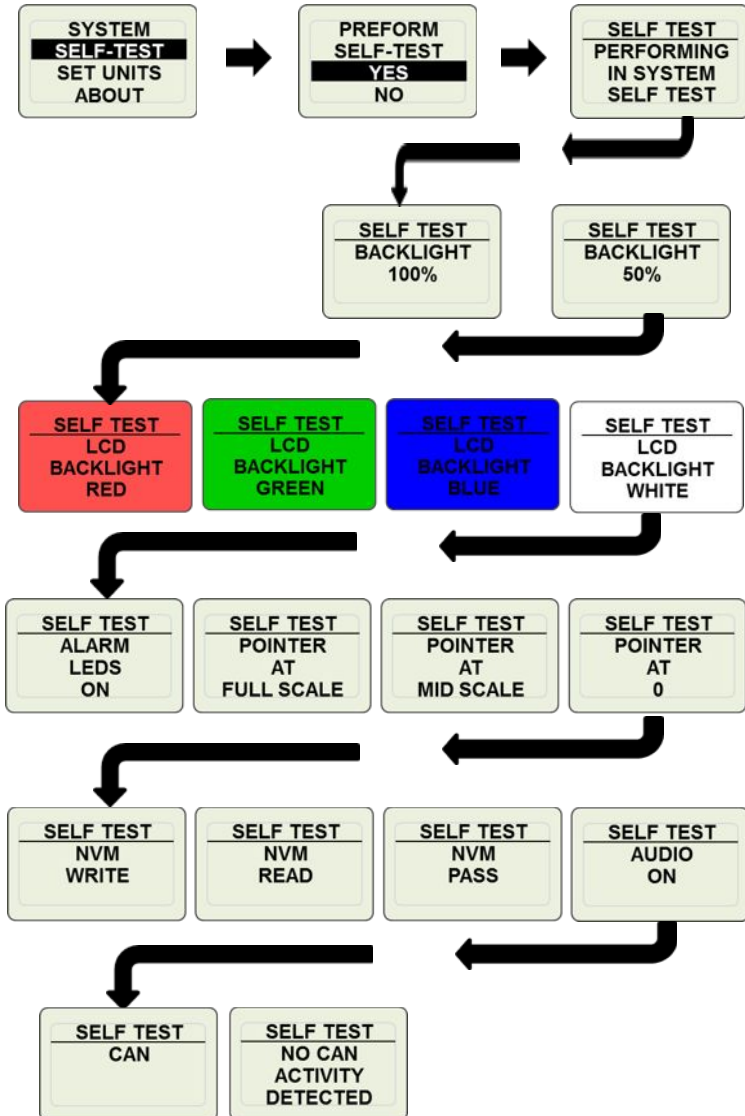
Disabling the Passcode.

Enabling the Passcode.

Self-Test

The self-test program allows the user to verify several areas of system operation. The areas tested are; dial/pointer/LCD backlight intensity, LCD backlight color (red, green, blue, white) , alarm LEDs, pointer movement (full-scale, mid-scale, 0), non-volatile (NVM) memory, buzzer and communications channel (CAN).

To select Self-Test enter the Main Menu and then scroll to the System entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to select System menu. Scroll to "Self-Test" entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to activate the Self-Test program.

Setting Engineering Units

Engineering units can be configured for the entire M150L System or individual unit categories.

To select engineering units enter the Main Menu and then scroll to the System entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to select System menu. Scroll to the "Set Units" entry using "▼" or "▲"buttons. Press & hold Mode button for > 1 second to enter "Set Units" menu. Use "▼" or "▲"buttons to select the desired configuration. Press & hold Mode button for > 1 second to configure the selected entry. The M150L will immediately convert to the engineering units selected.
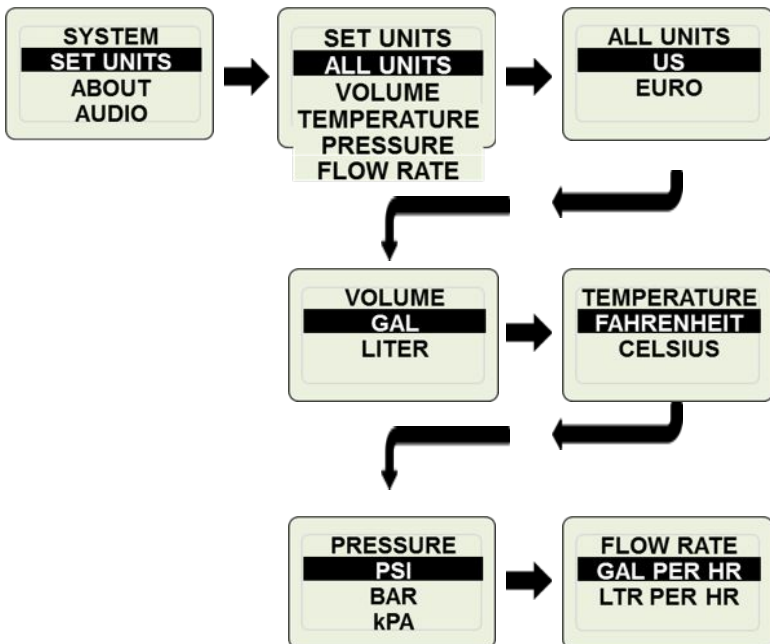
System Start Up

When powered the control panel digital display will show an introductory splash screen showing product model number, system revision level and date. (See display bottom left.) During this time a system self-check will be performed and the tachometer needle will complete a full sweep of the dial range. This will take approximately 5 seconds at which time the LCD display will present the default runtime data screen. As shipped from the factory the default runtime display is configured to present oil pressure. (See display bottom right.) The system is preconfigured to provide 9 data displays. As shipped from the factory, the Oil Pressure screen is displayed on startup after presenting the splash screen. The additional Viewing List of displays may be presented by pressing the "▼" or "▲"

buttons. See Viewing Data section for description of all display information.

Should any Engine Fault be active on startup a fault pop-up window will be displayed. See Faults section for more information.

Viewing Data

As shipped from the factory, the M150L contains 9 data displays in the viewing list. These displays can be accessed via the "▼" and "▲" buttons from the runtime

menu. This list is called the "Viewing List". The maximum number of displays that can be configured in the "Viewing List" is 18.

Default Startup Display

To configure a particular display as the default startup display, access the desired display from the viewing list and leave active for 5 minutes. The M150L system will automatically set this display as the default display.
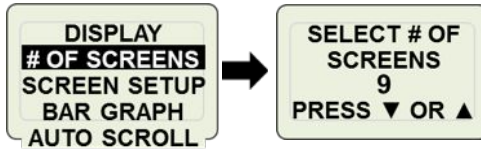
Configuring Display View List

The M150L allows the user to configure a list of displays for viewing. The "Viewing List" is selected from the list of System Displays. Any display contained in the "System Display List" can be assigned to any screen location in the "Viewing List".

To access the Display View List setup, enter Main Menu then scroll to Display entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to

select the "Display" entry. Use the "▼" or "▲" buttons to select a particular
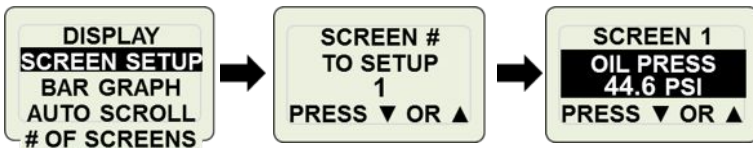
viewing list entry.
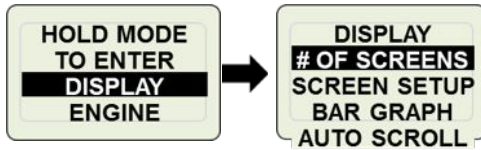
View List Screen Count

To configure the number of screens in the View List enter display menu then scroll to "# Of Screens" entry using "▼" or "▲" buttons. Press & hold Mode button for >

1 second to select. Set screen count using "▼" or "▲" buttons. Press & hold Mode

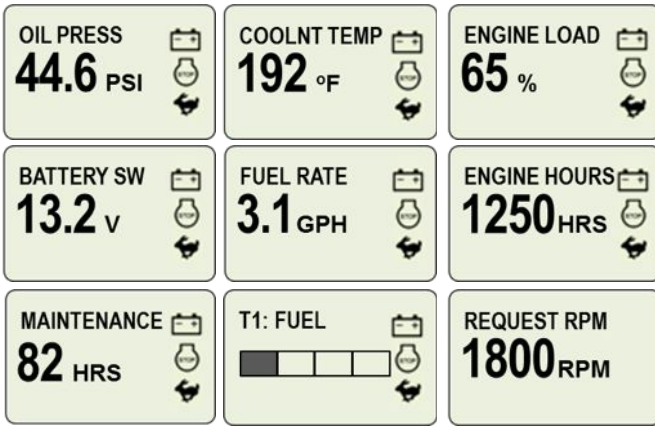button for > 1 second to enter screen count number.

View List Screen Setup

To configure data displays for the viewing list, enter display menu then scroll to "Screen Setup" entry using "▼" or "▲" buttons. Press & hold Mode button for > 1

second to select. Select screen # to be configured using "▼" or "▲" buttons. Press

& hold Mode button for > 1 second to select. Select data display using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to enter data display.

See System Display List for a complete list of available data displays.

Default Viewing List

OIL PRESS **44.6** PSI	COOLNT TEMP **192** °F	ENGINE LOAD **65** %
BATTERY SW **13.2** V	FUEL RATE **3.1** GPH	ENGINE HOURS **1250** HRS
MAINTENANCE **82** HRS	T1: FUEL	REQUEST RPM **1800** RPM

System Display List

AIR TEMP 72°F	BAROMETER 29.9 INHG	BATTERY 13.6 V
BATTERY SW 13.2 V	COOLNT LVL 95%	COOLNT TEMP 192 °F
ECU TEMP 192°F	ENGINE HOURS 1250 HRS	ENGINE LOAD 65 %
FUEL RATE 3.1 GPH	FUEL PRESS 48.0 PSI	FUEL RAIL 1 15100 PSI
FUEL RAIL 2 15100 PSI	FUEL TEMP 126 °F	MAINTENANCE 82 HRS
MNFLD PRESS 35.0 PSI	MNFLD TEMP 152°F	OIL LEVEL 95%
OIL PRESS 44.6 PSI	REQUEST RPM 1800 RPM	RPM 1000 RPM
T1: FUEL		

Bar Graph Data

The M150L has the ability to display select data parameters in bar graph form. When activated this feature allows the user to simultaneously display, at the bottom of the screen, the selected data on all screens contained in the "Viewing List".

Example; Fuel Level Bar Graph Data.

To select the Bar Graph data display enter display menu then scroll to "Bar Graph Data" entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to select. Select data to be viewed using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to enter data selection. Fuel level and engine load can be selected.

Select Bar Graph Data

Setting Throttle Type

The M150L provides two types of throttle operation, Ramp and Two-State. To access Throttle Type configuration, enter the Main Menu and then scroll to the "Engine" entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to select the "Engine" Menu. Scroll through the "Engine" menu using "▼" or "▲" buttons until Throttle Type is highlighted. Press & hold Mode button for > 1 second to select the "Throttle Type".

Ramp Throttle Operation

Ramp throttle operation allows the user to increment or decrement the desired engine RPM value by 10 RPM. To increment engine rpm simply press the throttle switch in the "Rabbit" position. Pressing the throttle switch in the "Turtle" direction will decrement the engine speed by 10 rpm. Holding the throttle switch in the "Rabbit" or "Turtle" position for > 2 seconds will cause the algorithm to speed up and the engine speed will increment or decrement at a rate of 50* RPM / second.

Note: The user cannot adjust the engine speed above or below the configured "Min" and "Max" engine speed settings. See section, Min/Max Engine Speeds for more details.

2-State Throttle Operation

Two state throttle operation allows the operator to quickly choose between two predetermined engine speeds at the single touch of the throttle control. The two predetermined engine speeds are defined by the rpm value configured in the Engine Settings menu for "Min" speed and "Max" speed. Pressing the throttle control in the "Rabbit" position sets the engine rpm to the configured "Max" speed setting. Pressing the throttle control in the "Turtle" position sets the engine rpm to the configured "Min" speed setting.

CAUTION: Changes to settings in the "Engine" menu will take affect while the engine is running. Any change to throttle type setting or engine min/max settings will become active after the change is saved AND a throttle command is issued.

Min/Max Engine Speeds

The M150L allows the user to configure minimum and maximum engine rpm limits. The minimum engine rpm value is determined by the "Min" speed setting in the Engine menu. The maximum engine rpm value is determined by the "Max" speed setting in the Engine menu. Once configured the M150L prevents the user from throttling the engine above or below these values.
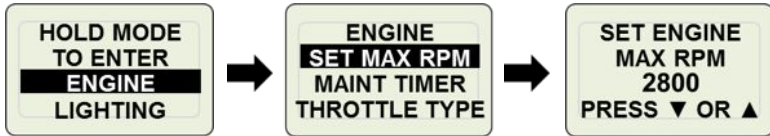
Min Engine Speed

To access the "Set Min RPM" setting, enter the Main Menu. Scroll to the "Engine" menu entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second

to select the "Engine" menu entry. Scroll through the "Engine" menu using "▼" or "▲" buttons until "Set Min RPM" entry is highlighted. Press & hold Mode button

for > 1 second to select the idle speed entry. Use the "▼" or "▲" buttons to set

the minimum engine rpm value. Press & hold Mode button for > 1 second to enter the Min RPM speed entry.

Max Engine Speed

To access the "Set Max RPM" setting, enter the Main Menu. Scroll to the "Engine" menu entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second

to select the "Engine" menu entry. Scroll through the "Engine" menu using "▼" or "▲" buttons until "Set Max RPM" entry is highlighted. Press & hold Mode button

for > 1 second to select the run speed entry. Use the "▼" or "▲" buttons to set the

maximum engine rpm value. Press & hold Mode button for > 1 second to enter the Max RPM speed entry.

HOLD MODE	ENGINE	SET ENGINE
TO ENTER	**SET MAX RPM**	MAX RPM
ENGINE	MAINT TIMER	2800
LIGHTING	THROTTLE TYPE	PRESS ▼ OR ▲

Installing the System

Installation Instructions for Type 2, 3, 3R, 3S, 4, 4X, 5, 6/6P, 12 and 13 (UL-50) Enclosures

File #E207562/E229365 - Integra® Enclosures

Mounting Brackets

A mounting bracket and screw pack are provided with the Premium enclosures. To assemble, turn the enclosure upside down on aflat surface, place the mounting bracket over the square boss either horizontally or vertically, and fasten the mounting bracket with the '1/4"-20 x0.25" SS, countersunk Phillips drive screws (torque limit = 20 in. lbs.). The enclosure can be mounted either horizontally or vertically, with the mounting brackets in any configuration, using any acceptable fastening technique.External mounting means are provided and molded into enclosures.

Covers/Doors

Covers/doors have a gasket pre-assembled to seal against the base. Attach to the base in these three standard configurations:

Non-Hinged Junction Pull Box:

Screw down in four comers with screws provided. Torque for comer screws is 10 inch-pounds. (Required for type 6P Rating)

Externally Hinged Cutout Box:

Externally hinged along one side of the major dimension of the enclosure with opposite side to the hinge screwed down with(2)# 10-32 x 0.75" SS, pan Phillips drive screws (4X rating). To achieve 6P rating - all 4 screws will be used and torqued to 10 inch-pounds (this applies to the Premium line).

Externally hinged along one side of the major dimension of the enclosure with opposite side to the hinges held by lockout-type latches.

Enclosures are provided with cover/door assembled to the base. For Premium lines, #10-32 x 0.75" SS, Phillips drive screws are provided to secure the cover/door to the base. When re-assembling, be sure to align gasket on cover/door with the sealing bead on the base.

Note: When starting and tightening screws, it is easiest to align and tighten screws by first starting all four screws, then tightening opposite corner screws to 10 inch-pounds.

When used as a Pull Box, installation in the U.S. shall be in accordance with Section 314-28 of the National Electric Code, ANSI/NFPA 70-2008. Installation in Canada shall be in accordance with Section 12-3036 of the Canadian Electrical Code, C22.1-2006.

Installation Instructions Notes:

(Premium and Impact Lines)

Installation of Conduit

Conduit holes can be cut using standard hole Locations are as desired per any applicable rules or codes.

Enclosures marked with a model type 6/6P rating require installation instructions that specify the use of UL approved conduit hubs. Maximum Hub size for G242410 and H181610 is 3" all other enclosures is 2". Any hub must be mounted on a flat surface.

Metallic Conduit

Secure the conduit connector into the conduit. Then secure the conduit connector into the pre-drilled hole in the enclosure with the connector locknut. Then secure the grounding bushing over the connector locknut.

Nonmetallic Conduit

Either assemble the conduit connector into the conduit,or the pre-drilled hole in the enclosure, whichever is easier, and secure with the connector locknut.

Grounding of Conduit

Any metallic conduit joining an enclosure must be grounded. Use Grounding Kit GK001.

1) All threaded inserts in the enclosure and for cover attachment are . #10-32.

2) Bonding between grounding bushings/lugs or between the grounding bushings/lugs and the devices installed inside the enclosure must be according to applicable governing Electrical Code.

3) Enclosure drilled for conduit or other modifications voids warranty and may not be returned.

4) Conduit must be aligned into or out of enclosure to prevent enclosure damage due to bending stress on enclosure walls.

5) <u>Do not use</u> PVC cement to connect fittings to enclosure.

6) Any fittings used , including conduit fittings, must be according to applicable Electrical Code and must maintain integrity of UL rating.

7) If the enclosure is provided with customer-specified modifications, the openings must be filied with listed fittings/components of the same environmental rating.

8) Type 2 and 3R if fitted with drain opening 1/8" min. to 1/4' max, located in the lowest part of the bottom wall.

⚠ CAUTION

The safety messages that follow have CAUTION level hazards.

ALWAYS ensure the power supply is OFF and battery cables are disconnected before you make any electrical connections.

Making the Connections

The control panel has one round connector with 21 contacts. This connector is an HDP24 Deutsch connector and provides the connection to the engine connector. (Note: Some engine may require an interface harness for this connection. Contact MBW Technical Support Team for details.) This connector also provides the user connections for fuel level, oil pressure and external engine shutdown. The supply power MUST be OFF when interconnecting the system.

Recommended order:

1) Verify the battery / battery switch connections to engine per the engine installation diagram. (Refer to engine manufacturer installation manual.) Verify engine is bonded to battery return (-). Verify engine block is connected to battery ground.

2) Disconnect battery.

3) Install control panel into housing. Attach engine connector to housing using supplied locknut and ring.

4) Fasten control panel to housing using #8 8-32 screws (not supplied).

5) Connect engine harness connector to mating control panel connector (HDP24-21 connector).

6) Connect battery.

7) Turn ignition key to "ON" position.

8) Ensure digital display is active. If display is not active;

9) Check battery and power connections.

10) Check the control panel resettable breaker.

11) Check ignition switch is on position.

12) Ensure system is displaying data for engine speed, oil pressure and temperature.

Adding Additional Gauges

The M150L allows the user to enhance the data viewing capability of the system by simply adding Plug N' Play analog gauges to the main controller module. The installation is simple requiring an interconnect cable (PN: HN0503) and the data gauge of choice. To add an analog gauge to the system plug the first gauge into the main controller harness using (PN:1000116-10). Any remaining gauges to be added will be serially connected by using harness HN0503. It is recommended that the last gauge in the sequence plug the unused connector with a dummy plug (PN:PJ0036). See system components section for gauge types offered.

Engine Connector

The engine connector is labeled "Engine" and requires no additional wiring. This connector mates directly to the on-engine harness connector. The table below describes the engine harness connections, associated connector pin number and wire color.

24-21
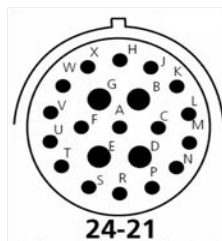
Desc	PIN Number	Engine Harness Connector – P2	Size	Wire Color
N/C	A	Pre-Heat Lamp	16 AWG	Tan
B+	B	Battery + (10A)	16 AWG	Red
N/C	C	Sensor Return	16 AWG	Black
Start	D	Starter (30)	16 AWG	Red/Black
Ground	E	Ground	16 AWG	Black
N/C	F			
Ignition Out	G	ECU Power (Ignition)	16 AWG	Purple
N/C	H			
Key Acc	J	Accessory (15)	16 AWG	Pink/Black
N/C	K			
N/C	L			
N/C	M			
Fuel Level	N	Fuel Level Sender	16 AWG	Green/Black
Oil Pressure	P	Oil Pressure Sender	16 AWG	Orange
Charge In	R	Charge Lamp	16 AWG	Dark Green
RS232 TX	S		16 AWG	White
RS232 RX	T		16 AWG	Blue
CAN Lo	U	CAN Low (twisted pair)	16 AWG	Light Green
CAN Hi	V	CAN High (twisted pair)	16 AWG	Yellow
N/C	W		16 AWG	White/Blue
ESTOP	X	External Engine Stop	16 AWG	Blue

External Engine Shutdown

To connect the external engine shutdown to the M150L install the engine shutdown (Blue) wire in the 'X' terminal of the engine connector. This is supplied with the external wire set PN:1000130-00. Connect the engine shutdown signal to this wire. This input requires a closure to ground. See Engine Connector wiring table for wiring details.

Fuel Sender

To connect the fuel level sender to the M150L install the Green/Black wire, supplied in wire set PN:1000130-00, in the 'N' terminal of the engine connector. Connect the fuel level sender to this wire. See Engine Connector wiring table for wiring details.

Note: The fuel level measurement algorithm is designed to provide enhanced filtering when the engine is running. When the engine is not running the algorithm filtering is reduced allowing for improved response when adding fuel to the tank.

Fuel Sender Specification

The M150L Control Panel interfaces with any standard 240-33 ohm US or 10-180 ohm Euro Sender. The system can be configured for operation with either sender or CANBus Data.

The M150L can be configured to measure analog senders or receive fuel data via Bus Data (i.e CANBus). If Bus Data is providing the source for fuel level data choose "BUS DATA" as the fuel setup input. See Appendix A for definition of Fuel Level message.

Configuring the Fuel Level Input

To configure the fuel sender, enter the Main Menu. Scroll to the "Fuel Setup" menu entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second

to select "Fuel Setup". Scroll through the "Fuel Setup" menu using "▼" or "▲"

buttons to select the desired fuel tank. Press & hold Mode button for > 1 second to select the desired fuel tank. Use the "▼" or "▲" buttons to select the fuel sender.

Should the sender not be installed or no connection made, the digital display will indicate "NO DATA" for the fuel level measurement value.

Oil Pressure Sender

To connect the oil pressure sender to the M150L install the Orange wire, supplied in wire set PN:1000130-00, in the 'P' terminal of the engine connector. Connect the oil pressure sender to this wire. See Engine Connector wiring table for wiring details. A small filtering algorithm is applied to the oil pressure measurement when an analog sender is used. The filtering removes momentary spikes in data as a result analog sender response times.

Oil Pressure Sender Specification

The M150L Control Panel interfaces with a VDO 10-180 ohm Oil Pressure Sender. The system can be configured for 0-5 Bar or 0-10 Bar operation.

Note: The M150L can be configured to measure analog senders or receive oil pressure data via Bus Data (i.e. CANBus). If Bus Data is the source for oil pressure choose "BUS DATA" as the oil pressure input. See Appendix A for definition of Oil Pressure message.

Configuring Oil Pressure Input

To configure the system to read an external oil pressure sender, enter the Main Menu. Scroll to the "ENGINE" menu entry using "▼" or "▲" buttons. Press & hold Mode button for > 1 second to select the "ENGINE" menu. Scroll through the "Engine" menu using "▼" or "▲" buttons to "Oil Pressure Src". Press & hold Mode button for > 1 second to select the oil pressure source menu. Use the "▼" or "▲" buttons to select the oil pressure sender.

Should the sender not be installed or no connection made, the digital display will indicate "NO DATA" for the oil pressure value. Oil Pressure alarms are typically provided by the Engine ECU. The M150L can be configured to provide a Low Oil Pressure alarm. See Custom Alarms section for more details. The custom alarm for oil pressure will not be active if a sender input is not available.

Technical Specifications

System

Display	Color LCD
Resolution	128 x 64 pixels
Operating Voltage	10.5 to 18VDC
Power Consumption – Tachometer	400 mA max
Power Consumption – Gauge Bus	90 mA max per gauge
Audible Alarm	4 KHZ Internal
External Engine Shutdown	Closure to Gnd
Communication	J1939
Operating Temperature	-20C to +70C (-4F to 158F)
Storage Temperature	-30C to +85C (-22F to 185F)
Reverse Polarity Protection	Yes
Salt Spray	IEC60068-2-52: 1996
EMC	IEC61000 and EN55022
Dimensions (MGT020 Gauge only)	3.375″ Dia x 4.29″
Dimensions (MGT021 Gauge only)	4.375″ Dia x 4.18″
System Protection	10A Resettable Circuit Breaker

Factory Settings

The following system settings will take affect when a master reset is applied.

| PARAMETER	DEFAULT VALUE
Display Settings	
# of screens	9
Viewing List configuration	See Default Viewing List
Bar Graph	Off
Auto Scroll	Off
Engine Settings	
Engine Idle	1000 RPM
Engine Run	3200 RPM
Throttle Type	RAMP Mode
Oil Pressure Sender Source	10-180 (10 Bar)
Maintenance Timer	0 Hours (off)
Fuel Setup	
Fuel Sender Source	240-33 ohm (USA Sender)
System	
Custom Alarms	Off
Language	English
Set Units	USA units

System Block Diagram
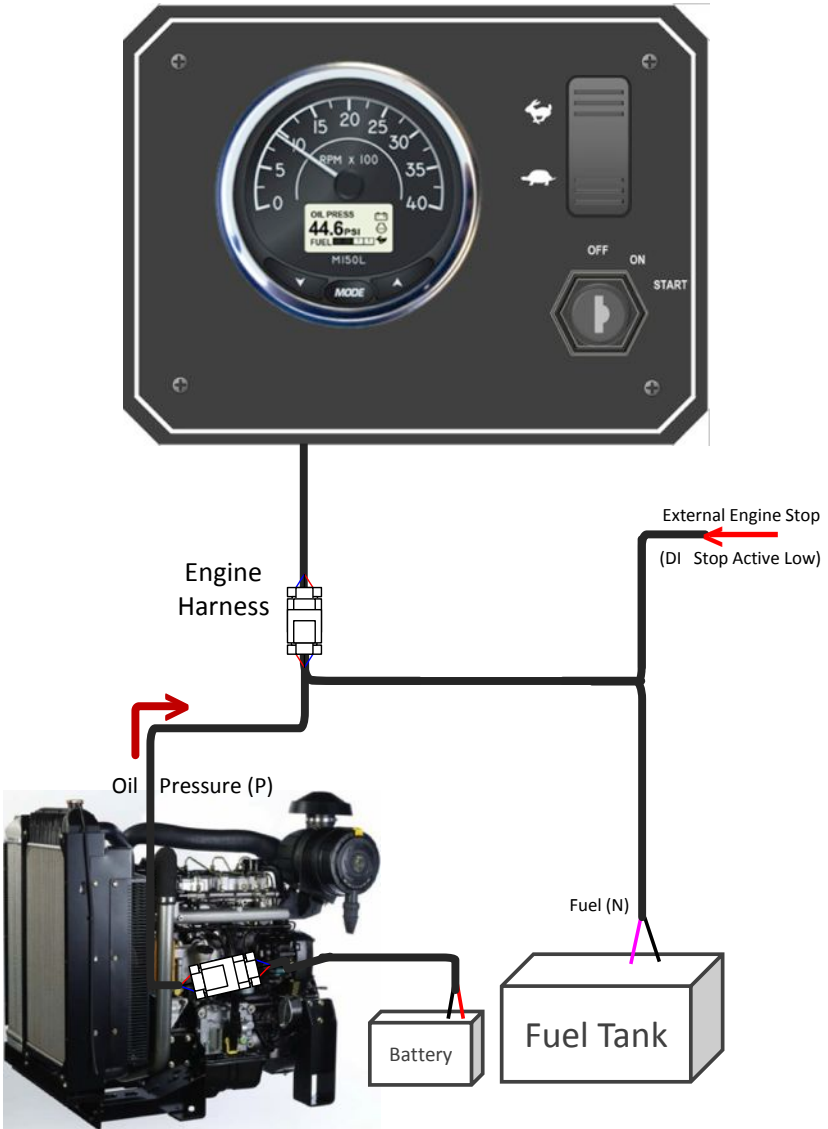
Wiring Diagram
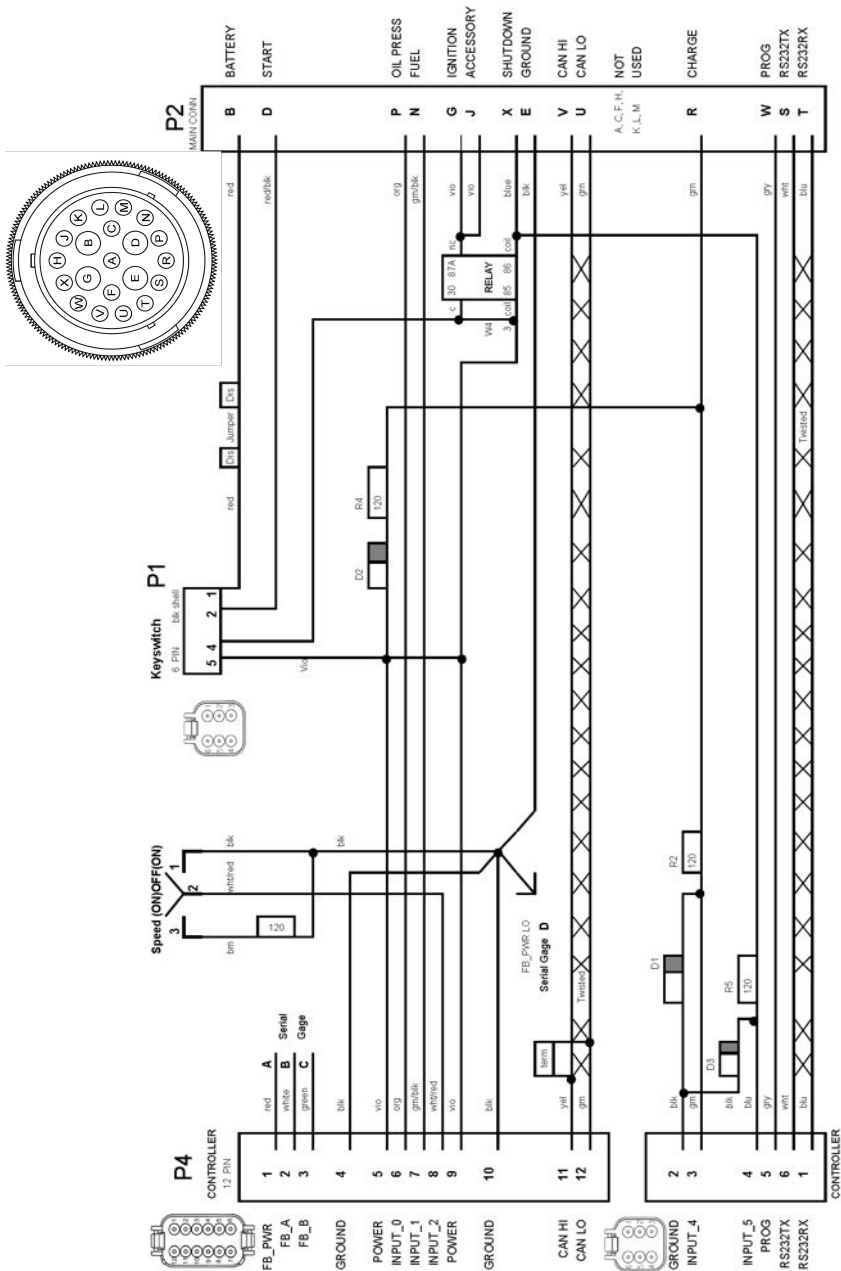
Connection Details

Control Harness

PN:1000116-00 The main control harness provides connections from the engine to the main controller (tachometer), throttle switch, key switch, circuit breaker and external engine shutdown.
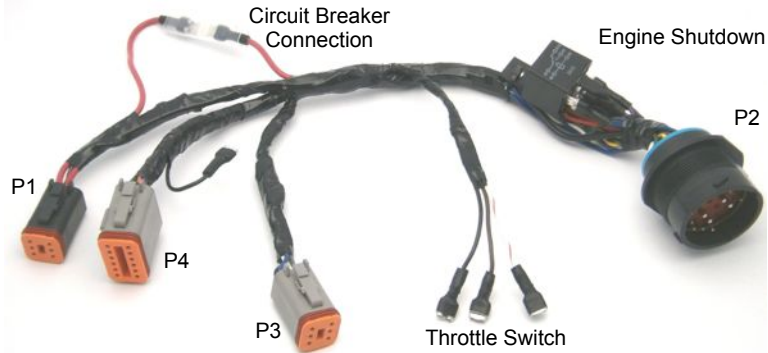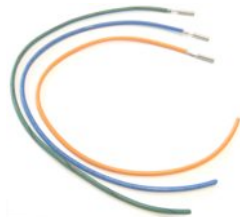

Control Harness PN:1000116-00

Control Harness Connector Details

Connector	Description
P1	6 Pin; connects to key switch, blk
P2	Engine connector
P3	6 Pin; connects to controller, gry
P4	12 Pin; connects to controller, gry
Black Quick Connect	Upper (rabbit) position of throttle switch
White/Red Quick Connect	Center position of throttle switch
Brown Quick Connect	Lower (turtle) position of throttle switch
Red Quick Connect	Battery; connection for resettable 10A breaker (resettable breaker not included in all models)

Wire Set – OP / Fuel Level / Engine Shutdown

PN:1000130-00   Engine connector (P2) wire set. Wire set allows connection of analog oil pressure sender, analog fuel level sender and external engine shutdown via connector P2.

Wire Color	Description	P2 Position
Orange	Oil Pressure	'P'
Blue	External Shutdown	'X'
Grn/Blk	Fuel Level	'N'

PN:1000116-10 Serial gauge Bus extension harness provides the ability to expand the system display capability. This is accomplished by adding parameter specific 2″ gauges to the main controller. No configuration is necessary. Just plug the expansion gauge into the harness and the data will be available. To install the extension harness connect the gnd of the 116-10 harness to the mating gnd connector on the 116-00 harness. Insert the gauge bus communications and power pins into the P4 connector of the 116-00 harness.

PN:1000116-10 Serial Gauge bus harness

Serial Gauge Bus Connector Details

Wire Color	Description	P4 Pin #
Red	Power	1
White	Serial Gauge Bus A	2
Green	Serial Gauge Bus B	3

Control Harness w/Gauge Bus Extension
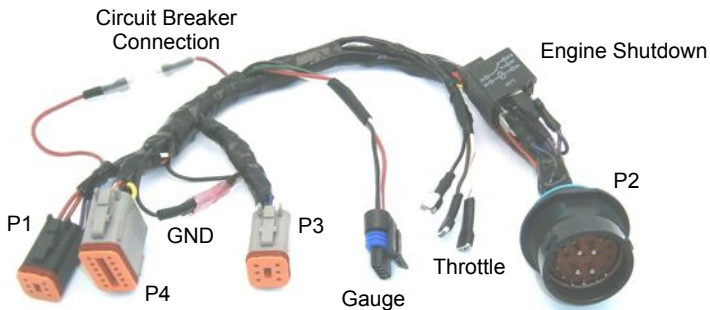
Harness PN:1000116-50

Connecting a Switch Gauge

The L15 Series panel provides expansion slots to allow application specific gauges to be field installed. Application specific switch gauges are commonly used to provide an external engine shutdown signal. The external engine shutdown requires a contact closure to ground to activate the engine shutdown signal. To connect a switch gauge to the external engine shutdown the M150L provides quick connect terminals in the control harness for easy installation.
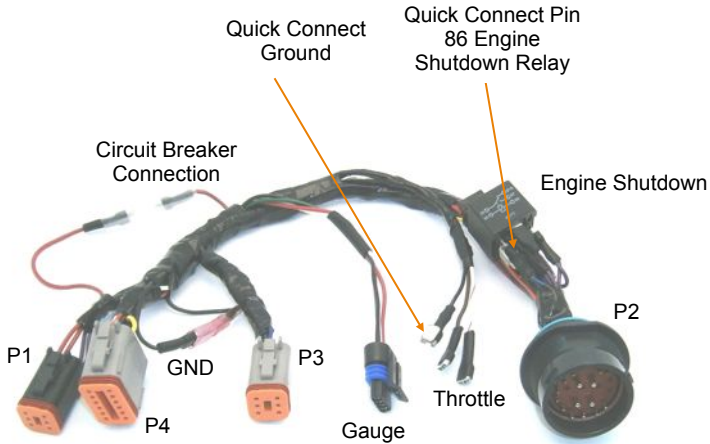
Harness PN:1000116-50

Connect the switch gauge contact (or lead terminal) to Pin 86 of the engine shutdown relay. Connect the switch gauge ground (this is typically the gauge housing) to the M150L ground connection shown above. When the switch gauge set point is reached the engine shutdown relay will activate and shutdown the engine.

System Components

PART NUMBER	DESCRIPTION
C1121/12	Boot; Pushbutton, Blk
CLB10311B3ABA	Breaker; 10A, w/o Boot
GE0171	Gauge; 2", Fuel Level, M150L Series
GE0172	Gauge; 2", 100 PSI Oil Press, M150L Series
GE0173	Gauge; 2", 250 Deg Wtr Temp, M150L Series
G8JN1C7TMFDC12	Relay; 12v, SPNO
HN0503	Harness; 2" Gauge to Gauge, Faria Bus
M150L00-00	Kit; Eng Ctrl, J1939, T3, 4"-4K
M150L00-50	Kit; Eng Ctrl, J1939, T3, 5"-4K
M150L01-00	CP; Eng Ctrl, J1939, T3, 4"-4K, 8x6, AL, PNL MNT
M150L01-50	CP; Eng Ctrl, J1939, T3, 5"-4K, 8x6, AL, PNL MNT
M150L10-00	CP; Eng Ctrl, J1939, T3, 4"-4K, 8x7 STEEL ENCL
M150L10-50	CP; Eng Ctrl, J1939, T3, 5"-4K, 8x7 STEEL ENCL
M150L15-00	CP; Eng Ctrl, J1939, T3, 4"-4K, 8x13 STEEL ENCL
M150L15-03	CP; Eng Ctrl, J1939, T3, 4"-4K, 8x13 STEEL ENCL, OP/TEMP/V
M150L15-04	CP; Eng Ctrl, J1939, T3, 4"-4K, 8x13 STEEL ENCL, OP/TEMP/V/FUEL
M150L15-50	CP; Eng Ctrl, J1939, T3, 5"-4K, 8x13 STEEL ENCL
M150L15-53	CP; Eng Ctrl, J1939, T3, 5"-4K, 8x13 STEEL ENCL, OP/TEMP/V
M150L15-54	CP; Eng Ctrl, J1939, T3, 5"-4K, 8x13 STEEL ENCL, OP/TEMP/V/FUEL
M150L20-00	CP; Eng Ctrl, J1939, T3, 4"-4K, NEMA 4X ENCL
MGT020	Gateway; 4"-4K Tach, J1939 Ctrl
MGT021	Gateway; 5"-4K Tach, J1939 Ctrl
MN10027-00	Manual; User/Install, M150L Series
MN10028-00	Manual; Mounting Template, M150L00 Series
PJ0036	Plug; Sealing, 4 Pin Packard
VE0028	Gauge; 2", Volt, M150L Series
1000017-23	Keyswitch; 4 pos, ACC-OFF-ON-START, common key
1000107-00	Switch; Rocker, (ON)-OFF-(ON)
1000116-00	Harness; Control, M150L
1000116-10	Harness; Control to Faria Bus, M150L
1000116-50	Harness; 1000116-00 and 1000116-10 assembly
1000130-00	Wire Set; OP/Fuel/Shutdown
1080002-01	Plug; Dome, 1/2" Dia, Blk
1080002-02	Plug; Dome, 3/4" Dia, Blk
1080002-03	Plug; Dome, 2.063" Dia, Blk

Troubleshooting Guide

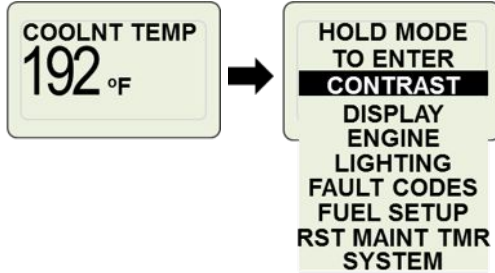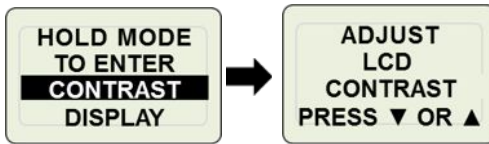| Symptom	Action
Key "ON"; No display or alarm sounded	- Verify Battery is connected and battery switch, if installed, is in "ON" position. - Check engine fuse. If fuse blown check engine wiring. - Check engine harness connection at control panel. - Reset circuit breaker
Key "ON"; No display or alarm sounded; Tachometer backlight flashing; No throttle control.	Check engine harness connection at control panel. Engine connector pin W is improperly wired. Pin W MUST be open.
Key "ON"; Alarm sounded but no display.	- Check display contrast/lighting level - Replace tachometer gauge
Key "ON"; Display "ON"; Engine data is missing or intermittent.	- Check Engine harness connections. - Check main fuse on engine. - Check for active alarms. - Check Diagnostic Trouble Codes.
Key "ON"; Display active and showing data but Engine will not start	- Check for system alarms. - Check Diagnostic Trouble Code screen for engine faults. - Check external engine shutdown input.
Key "ON"; Display active, no engine data, Engine will not start	- Check for system alarms. - Check Diagnostic Trouble Code screen for engine faults. - Check remote engine shutdown input. - Replace Control Panel.
Engine will Not Start; "External Engine Stop" Fault	External Engine Stop input is active.
FAST / SLOW throttle switch does not change engine speed.	- Engine Fault. Check DTC screen for specific engine failure. - Ensure Engine Speed settings do not exceed engine manufacturer recommendations.
Engine Speed will not ramp.	Check User Setting menu. Throttle Type set for 2-State.

Appendix A - Tier 3 Data Supported

Description	Identifier	PGN	SPN
Active DTCs	DM1	65226	
Active DTCs (emissions related)	DM12	65236	
Ambient Temperature	AMB	65269	171
Barometric Pressure	AMB	65269	108
Battery Potential Switched	VEP	65271	158
Battery Potential	VEP	65271	168
Coolant Level	EFL/P1	65263	111
Coolant Temperature	ET1	65262	110
Previously Active DTCs	DM2	65227	
Previously Active DTCs (emissions)	DM23	64949	
ECU Temperature	ET2	65188	1136
Engine Hours	HOURS	65253	247
Fuel Level	DD	65276	96
Fuel Pressure	EFL/P1	65263	94
Fuel Rail #1 Pressure	EFL/P2	65243	157
Fuel Rail #2 Pressure	EFL/P2	65243	1349
Fuel Rate	LFE	65266	183
Fuel Temperature	ET1	65262	174
Load	EEC1	61443	92
Manifold Pressure	IC1	65270	102
Manifold Temperature	IC1	65270	105
Oil Level	EFL/P1	65263	98
Oil Pressure	EFL/P1	65263	100
RPM	EEC1	61444	190
Water in Fuel Indication	OI	65279	97

Appendix B - Menu Overview

Main Menu

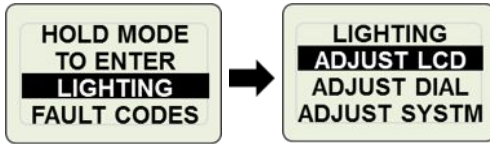| COOLNT TEMP 192 °F | ➡ | HOLD MODE TO ENTER **CONTRAST** DISPLAY ENGINE LIGHTING FAULT CODES FUEL SETUP RST MAINT TMR SYSTEM |

Contrast Menu

| HOLD MODE TO ENTER **CONTRAST** DISPLAY | ➡ | ADJUST LCD CONTRAST PRESS ▼ OR ▲ |

Display Menu

| HOLD MODE TO ENTER **DISPLAY** ENGINE | ➡ | DISPLAY **# OF SCREENS** SCREEN SETUP BAR GRAPH AUTO SCROLL |

Engine Menu

| HOLD MODE TO ENTER **ENGINE** LIGHTING | ➡ | ENGINE **THROTTLE TYPE** OIL PRESS SRC SET MIN RPM SET MAX RPM MAINT TIMER |

Lighting Menu

```
HOLD MODE          LIGHTING
 TO ENTER     ➡    ADJUST LCD
 LIGHTING          ADJUST DIAL
FAULT CODES        ADJUST SYSTM
```

Fault Codes

```
HOLD MODE          FAULT CODES
 TO ENTER     ➡       VIEW
FAULT CODES
FUEL SETUP
```

Fuel Setup

```
HOLD MODE          FUEL SETUP
 TO ENTER     ➡     T1: FUEL
FUEL SETUP
RST MAINT TMR
```

Reset Maintenance Timer

```
HOLD MODE          RESET MAINT
 TO ENTER     ➡       TIMER
RST MAINT TMR          NO
 SYSTEM               YES
```

System

```
HOLD MODE           SYSTEM
 TO ENTER     ➡      ABOUT
 SYSTEM              AUDIO
CONTRAST          CSTM ALARMS
                   LANGUAGE
                  MASTER RESET
                   PASSCODE
                   SELF TEST
                   SET UNITS
```

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MBW-Technologies, LLC (2 – Year) Limited Warranty

MBW Technologies, LLC ("MBW") warrants its Electronic Module, Display products, Electrical Cable and Electrical Connector products to be free from defects in materials and workmanship for a period of two (2) years from the date of shipment by MBW. Within this period, MBW will, at its sole option, repair or replace any Electronic Module or Display that fails in normal use and is returned to MBW (freight prepaid) within the warranty period. MBW is not responsible for charges connected with the removal of such product or reinstallation of replacement or repaired parts. This warranty does not cover failures due to abuse, misuse, accident, faulty installation or unauthorized alteration or repairs.

THE EXPRESS WARRANTY SET FORTH ABOVE IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Statements made by any person, including representatives of MBW, which are inconsistent or in conflict with the terms of this Limited Warranty, shall not be binding upon MBW unless reduced to writing and approved by an officer of MBW.

IN NO EVENT SHALL MBW BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitation may not apply to you. MBW retains the exclusive right to repair or replace the electronic module or display or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

Warranty Return Procedure:

To obtain warranty service, contact MBW Technologies, LLC Technical Support Department at (267) 932-8573 x341 or email Support@mbwtech.com to describe problem and determine appropriate action.

Faria Corporation
P. O. Box 983
Uncasville, CT 06382
860.848.9271
Fax: 860.848.2704

Beede Instrument Company, Inc.
88 Village Street
Penacook, NH 03303
603.753.6362
Toll-free: 800.451.8255
Fax: 603.753.6201

Made in the USA

Reference MBW P/N: MN10027-01