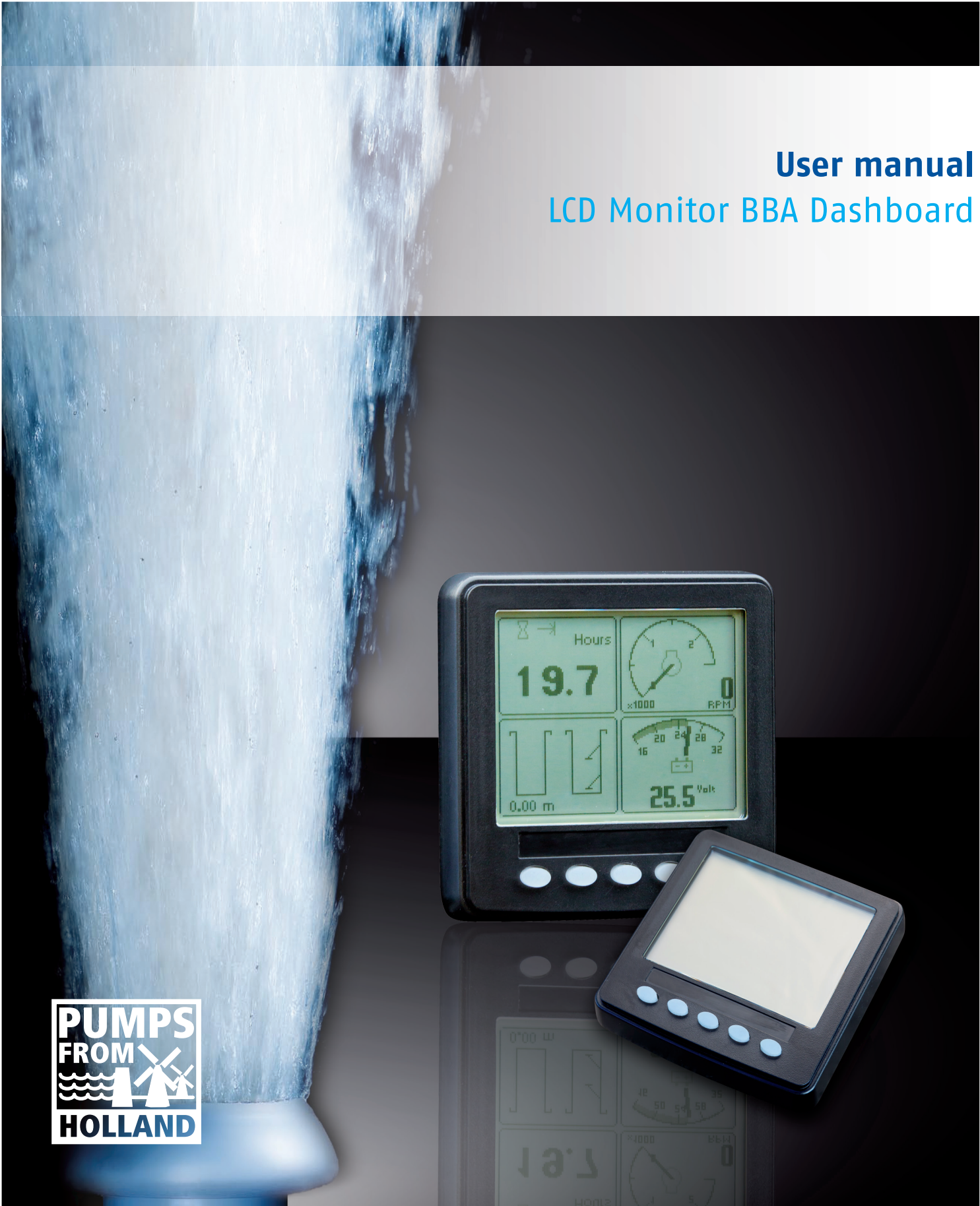


**User manual**  
LCD Monitor BBA Dashboard



## **SAFETY SYMBOLS**

*This manual uses the following conventions to present IMPORTANT SAFETY INFORMATION to you. Please read and follow ALL SAFETY INSTRUCTIONS.*

IMPORTANT SAFETY INFORMATION- A HAZARD THAT *MAY, IF NOT AVOIDED*, CAUSE MINOR/MODERATE INJURY.

IMPORTANT SAFETY INFORMATION- A HAZARD THAT *MIGHT* CAUSE SERIOUS INJURY OR LOSS OF LIFE.

IMPORTANT and URGENT SAFETY INFORMATION- A HAZARD THAT *WILL, IF NOT AVOIDED*, CAUSE SERIOUS INJURY OR LOSS OF LIFE.

## **CAUTION**

IMPORTANT SAFETY INFORMATION- A HAZARD THAT *MAY, IF NOT AVOIDED*, CAUSE EQUIPMENT DAMAGE.

## **NOTE**

## **ADDITIONAL IMPORTANT INFORMATION**

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## **Disclaimer**

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In the case of such discrepancies, the original English-language instructions will be considered the sole authentic source for the purpose of determining the content and meaning of the text.

This manual reflects the state of the art in technology at the time of publication.

BBA Pumps BV reserves the right to make changes to technical and design specifications at any time without prior notice.

This document must be completely read and understood prior to installing, testing, or operating the equipment described within. Further, this document must be retained for current and future users of this equipment. Failure to strictly follow the warnings and dangers presented within this document could result in damage to equipment, damage to property, bodily injury or death.

## **General safety instructions**

These products are not designed or approved for use as critical components of any safety device or system that is intended to prevent bodily injury, protect life, or prevent property damage. The specifying Original Equipment Manufacturer (OEM) and/or Installer of any BBA dashboard is responsible for all safety labeling and operator education regarding the safe operation of this panel and the operation of the specific machine that this panel is installed upon—including conformance to exhaust emissions regulations. Only trained and qualified persons may perform installation, testing, service, or repair work on the BBA Pumps products.

BBA Pumps products are not designed for, or intended for use on applications requiring explosive proof components. Further, BBA Pumps products are not designed for, or intended for application within hazardous or explosive environments. The installer of this BBA Pumps product is solely responsible for ensuring that CE standards are met with respect to the BBA Pumps dashboard applicability, machine guarding, general safety guidelines, labeling, and warnings.

For questions contact:

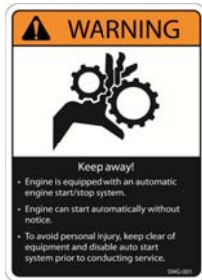
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E-mail: [info@bbapumps.com](mailto:info@bbapumps.com)

Website: [www.bbapumps.com](http://www.bbapumps.com)

## AUXILIARY Engine Stop DISCLAIMER

This panel or harness may include an optional Auxiliary Engine Stop feature. The sole design intent of the Auxiliary Engine Stop Feature is to provide for engine shutdown in the event of a key-switch malfunction. The panel key/ lever switch should always be used as the primary engine shutdown method. Please note that the Auxiliary Engine Stop feature is NOT intended to function as the machine/ equipment Emergency Stop, or be purposed as an Emergency Stop for safety purposes. The machine manufacturer must provide a separate Emergency Stop switch to meet safety mandates or emergency machine shutdown functionality.



### AUTO- Start DISCLAIMER

This panel/machine may be equipped with an automatic engine start-up system that could result in the automatic starting and stopping of the engine/ machine at any time. As such:

- The engine may start without warning or notice.
- It is SOLELY the responsibility of the owner/ installer/ operator to provide warning labels, visible warnings, and audible warnings to notify the operator of an impending start-up.
- ALWAYS use lockout/ tag out procedures prior to performing ANY service or configuration operations.
- DO NOT configure operator programmable features while the panel is in "AUTO" mode (Key in auto-start position). The panel should be configured ONLY when the key is in the

"Run" position.



### OPTIONAL EMERGENCY STOP:

1. Pull the AUX Engine STOP button "OUT" (away from the panel face) to allow engine operation.
2. Push the AUX Engine STOP button "IN" (toward the panel face) to initiate an AUXILLIARY Engine Stop.

## NOTE: GENERAL EMISSIONS DISCLAIMER

This panel may include provision(s) for operator input such as FORCE REGENERATION, INHIBIT REGENERATION, INTERLOCK, and others specific to US and International emissions regulations. Responsibility for emissions related inputs and compliance with emissions regulations is solely that of the owner and/or operator of the machine/ engine on which this panel is connected.

## CAUTION: EXHAUST EMISSIONS COMPLIANCE/ AUTO-START DISCLAIMER

This panel is equipped with operator programmable parameters that could result in the automatic starting and stopping of the engine/ machine. The engine/ machine, as a function of the emissions system can/ could initiate, via the engine ECU, certain required emissions operations such as regeneration of the DPF, or other emissions system maintenance, while the engine is running. The owner/ operator of the engine/ machine is solely responsible for any adverse effects or damage to the engine, engine emissions system, or other damage that could occur as a result of starting or stopping the engine/ machine during any ECU initiated emissions event.

## Automatic Operation

The BBA dashboard features advanced Automatic Start/Stop control which can meet almost any requirement. Two float inputs or a pressure transmitter support a number of control scenarios.

Single switch mode allows reliable operation with a single float switch. Dual float switch operation allows greater hysteresis when needed.

The transducer input supports simple start/stop operation by level or pressure and maintenance modes with speed modification.

- Programmable high and low set points control start/stop operation.
- Level maintenance modes monitor the operating point and adjust the engine speed to match the targeted set point with configurable aggressiveness.
- Dual switch inputs can be combined with the transducer input for redundant safety to protect against transducer sensor clog or failure.

## Throttle Control

The standard **Ramp Throttle** uses a momentary rocker switch to adjust the integral throttle control. All throttle commands are sent directly to the engine using CANbus throttle control.

**Note:** Throttle control requires CANbus throttling to be enabled in the ECU. CANbus throttling is also known as Torque Speed Control or TSC1.

Other throttle options include **Digital Rotary Throttle**, **Two-State Throttle** (Idle/Run) or **Three-State Throttle** (Idle/Intermediate/Run). The **Digital Rotary** can be installed with the **Throttle Ramp Throttle** or **Three-State Throttle** to adjust the *Idle*, *Intermediate* and *Run* speeds.

## Service Timers

The LCD display provides sixteen (16) service timers to alert the operator of needed maintenance. The time interval for each timer can be adjusted in 10 hour increments. A popup message is displayed after the display self test if a timer has expired alerting the user that service is required. The message is displayed on each power up until the elapsed timer is disabled or reset.

## Messenger Telemetry Option

The optional **Messenger** system provides a variety of features to protect and support the equipment investment. Remote monitoring can alert maintenance requirements, operational problems, improper operation and location with geo-fence alert. The Web-browser interface allows monitoring an entire fleet of equipment in a central location.

## Mechanically Governed Engines

On mechanically governed engines, the LCD panel performs the ECU function by monitoring low oil pressure, high temperature and two additional engine faults. Three analog inputs broadcast the oil pressure, engine temperature and fuel level across the CANbus to the display and other J1939 devices. The engine speed can be controlled using a mechanical throttle.

**Warning!** When replacement parts are required, BBA Pumps recommends using replacement parts supplied by BBA Pumps. Failure to heed this warning could lead to premature failure, product damage, personal injury or death.






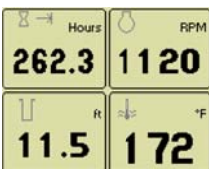



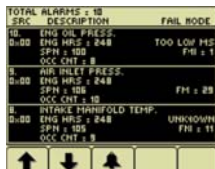


## Introduction

The BBA Pumps control panel is a universal platform to monitor, control and automatically start/stop both electronically and mechanically governed diesel engines. The microprocessor-based, solid-state design uses high power semiconductors instead of outdated electromechanical relays to ensure reliable high current switching. Graphical gauge pages or a single large analog gauge are displayed on the 4.25" diagonal LCD. Virtually any SAE J1939 parameter reported by the ECU (Engine Control Unit) can be displayed including RPM, coolant temperature, oil pressure, engine hours, voltage and diagnostic codes. An analog fuel level input broadcasts the fuel level across the CANbus to the display and other J1939 devices. The trans-reflective, backlit display is clearly readable in both bright sunlight as well as total darkness and is housed in a rugged IP67 rated housing.

Current alarm conditions are displayed in plain language on popup messages and can be viewed in the alarm list. Various diagnostic screens allow detailed investigation of the CANbus data stream. By accessing the **Configuration Menu**, users can customize displayed data to show metric or US units, display language and various other parameters such as the full-scale reading of gauges. Four bright LEDs below the display indicate Auto Standby, Preheat, Stop and Warning status.



Five buttons access a context dependent **button bar** when any button from 1 to 4 is pressed. The graphical menu structure uses easily understood icons to indicate the button's current function. After 5 seconds of inactivity the button bar disappears.

<p><b>Button 1</b> </p> <p><b>Analog Gauge Pages</b></p> <p>Repeated presses cycle through four pages of analog gauges (16 total).</p> 	<p><b>Button 2</b> </p> <p><b>Digital Gauge Pages</b></p> <p>Repeated presses cycle through four pages of digital gauges (16 total).</p> 	<p><b>Button 3</b> </p> <p><b>Single Analog Gauge</b></p> <p>Repeated presses cycle through available analog gauges.</p> 	<p><b>Button 4</b> </p> <p><b>Active Alarm Page</b></p> <p>Displays active alarms including a plain language description.</p> 	<p><b>Button 5</b> </p> <p><b>Gauge Adjust</b></p> <p>Configures the parameters displayed by gauge pages.</p> 
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**Note:** Most problems with electronically controlled engines can be pinpointed via ECU diagnostic messages. Use the display or ECU diagnostic tool to view fault codes. Engine state information and diagnostic codes displayed by the LCD display are provided via the CANbus.

## Manual Operation

Turning the control system key to the run position energizes the ECU, all LEDs illuminate once and a start-up screen is displayed while a self test is performed. If the display beeps for longer than 1 second, it indicates a self test fault. Users can attempt to rectify the fault by restoring factory defaults (see Configuration Menu for details). Contact BBA Pumps for assistance if the fault persists.

After the start-up screen is cleared, the display shows readings on its virtual gauges. Initially the analog gauges are displayed but the display uses the last displayed screen on subsequent startups (see Preferred Screen Store for details).

If the ECU is preheating when the key switch is turned to the run position, the **Preheat LED** is illuminated. Preheat time varies with atmospheric and engine conditions. After waiting for the **Preheat LED** to extinguish, the engine is cranked by turning and holding the key switch in the start position until the engine starts.

**Note:** *The ECU will not preheat unless conditions warrant. If necessary, starting the engine may be attempted by turning the key to the start position without waiting for preheat to expire.*



The key switch is spring loaded to return automatically to the run position when released. The key switch includes an interlock to prevent the key from being turned to the start position while the engine is running. The key switch must be turned to the off position to reset the starter interlock before the switch can be turned to the start position again.

## Throttle Control

The type of throttle operators installed along with the configured values of **Minimum Requested RPM**, **Idle RPM**, **Intermediate RPM**, **Run RPM** and **Maximum Requested RPM** determine throttle operation. The engine speed can be adjusted above **Run RPM** and below **Idle RPM** but the requests can not fall below **Minimum Requested RPM** or above **Maximum Requested RPM**. The ECU determines how the engine responds to the throttle requests and will not allow the engine speed to fall below the ECU minimum or maximum RPM.

**Note:** *The **Minimum Requested RPM** and **Maximum Requested RPM** can only be configured using the **Configurator**. See **Configuration** below for more information.*

## Ramp Throttle

The standard **Ramp Throttle** uses a momentary rocker switch to adjust the requested engine speed. When first started the requested engine speed is **Idle RPM**. Pressing and releasing the rabbit icon  increases the speed requested by 25 RPM. Pressing and holding the rabbit icon causes the speed to accelerate to full speed in a few seconds. Similarly, pressing the turtle icon  decreases the requested speed.

## Automatic Start/Stop Operation

Turning the control system key to the Autostart position causes all LEDs illuminate once, the **Auto Standby** indicator is illuminated and the start-up screen is displayed while a self test is performed. After the start-up screen is cleared, the display shows the transducer reading and switch status on the **Transducer/Switch** gauge. All other CANbus values will show **----** since the ECU is not energized at this time. After one minute the display is powered down to reduce battery drain. The automatic start/stop system is still functioning as indicated by the **Auto Standby** LED.

Once the configured automatic start condition exists, the display powers up, the panel starts the engine and follows the throttle control profile configured (see diagram). The flexible throttle profile includes various speeds and times for a variety of scenarios.

When the configured stop conditions exist, the panel reduces the engine speed per the throttle profile and stops the engine. If the configured start conditions exist before the shutdown process is complete the engine will return to the previous speed until the stop condition exists.

**Automatic Start/Stop Warning!** When the key is turned to the autostart position and a start condition exists, the panel will start **immediately!** **Always** configure parameters by turning the key to run. **Do not** configure the panel in the autostart position! **Always** use lock out/tag out procedures when servicing autostart equipment!

## Start and Stop Events

The Start and Stop Events are determined by the combination of Start/Stop Mode and Function. See the table below for

### Start/Stop Modes

<b>Sngl Switch</b>	Switch one controls automatic operation.
<b>Dual Switch</b>	Both switch inputs control automatic operation.
<b>Transducer</b>	The transducer input controls automatic operation.
<b>Xducer &amp; Sw</b>	The transducer input controls automatic operation with dual switch mode as the backup. The switch inputs override the transducer if actuated when the transducer is not calling for an automatic cycle.

### Start/Stop Functions

- Empty** Uses the selected mode to **reduce** the level or pressure.
- Fill** Uses the selected mode to **increase** the level or pressure.
- Maintain Out** Uses the transducer to maintain the level or pressure at or **below** the target.
- Maintain In** Uses the transducer to maintain the level or pressure at or **above** the target.

Mode	Function	Empty	Fill	Maintain Out	Maintain In
Sngl Switch	Start	SW1 Close	SW1 Open		
	Stop	SW1 Open	SW1 Close		
Dual Switch	Start	SW1 and SW2 Close	SW1 and SW2 Open		
	Stop	SW1 and SW2 Open	SW1 and SW2 Close		
Transducer	Start	Above High Set Point	Below Low Set Point	Above High Set Point	Below Low Set Point
	Stop	Below Low Set Point	Above High Set Point	Below Low Set Point	Above High Set Point
Xducer & Sw	Start	Above High Set Point or SW1 and SW2 Close	Below Low Set Point or SW1 and SW2 Open	Above High Set Point or SW1 and SW2 Close	Below Low Set Point or SW1 and SW2 Open
	Stop	Below Low Set Point or SW1 and SW2 Open	Above High Set Point or SW1 and SW2 Close	Above High Set Point or SW1 and SW2 Close	Below Low Set Point or SW1 and SW2 Open

**Note:** When the switch inputs are the source of the start event in Xducer & Sw mode, only the switches will stop the engine.

### Maintain Functions

The **Maintain In** and **Maintain Out** functions adjust the engine speed to keep the transducer level at the **Target Set Point**. The **Servo Gain** adjusts how aggressively the throttle is adjusted while the **Servo Delay** controls how often the throttle is adjusted.

**Note:** Maintain functions are only available in the Transducer or Xducer & Sw modes. The direction of the throttle adjustment is dependent on the selected mode as shown in the table.

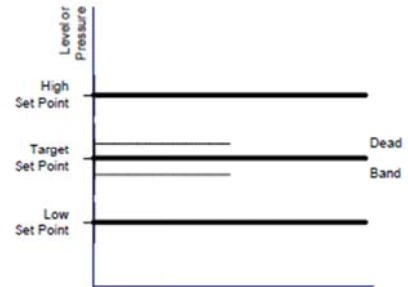


The direction of the throttle adjustment is dependent on the selected mode as shown in the table.

<i>Transducer State</i>	<b>Maintain Out</b>	<b>Maintain In</b>
<b>Above Target</b>	Increase Speed	Decrease Speed
<b>Below</b>	Decrease Speed	Increase Speed

### Dead Band

In some situations the transducer level may fluctuate around the **Target Set Point** such as the water level on a windy day. To limit throttle hunting using the maintain functions a dead band can be programmed. This value prevents throttle adjustment while the level is within the band (see diagram). In essence the speed is considered to be at the target whenever it is within the dead band.




**Note:** The dead band entered is amount above and below the target point. For example, if the target is 5.0 feet with a 0.1 foot dead band, the dead band is 4.9 to 5.1 feet.

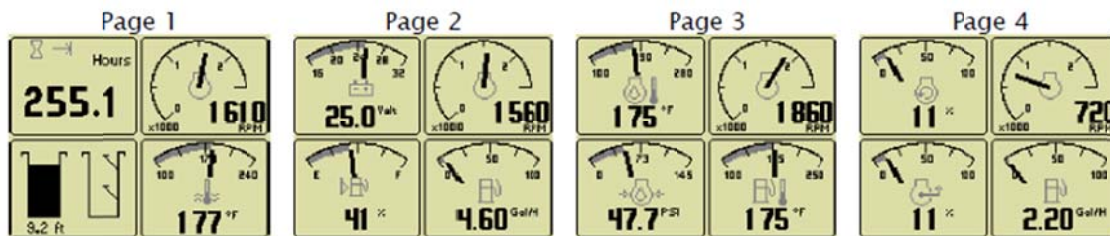
### LCD Display

Soft buttons simplify the user interface by displaying a **button bar** above the buttons when any of the first 4 buttons (buttons 1 to 4, starting from the left) are pressed. Icons on the button bar change to represent the current function of each button. The button bar disappears after 5 seconds if no further buttons are pressed.


**Note:** Different software versions may have slightly different displays.

### Analog Gauge Pages

**Analog Gauge Pages** provide four independent pages of analog gauges. To enable Analog Gauge Pages, press any of the first 4 buttons to show the top level button bar and then press button 1. Alternate pages are selected by repeated pressing of button 1 . The four standard gauge pages are shown below.



**Note:** Engine Hours are displayed as a digital value even on Analog Gauge Pages. The default gauge pages represent 13 selections since the tachometer is repeated in the upper left quadrant of each page.

All 16 gauges may be configured by the user to create an application-specific view of CANbus data. Gauges on the current page can be changed via **Adjust Mode**, accessed by pressing button 5  when the button bar is visible. Gauges can be changed on any of the four pages by selecting the page to be changed and then entering *Adjust Mode*.

In *Adjust Mode* a new button bar is displayed identifying the button functions. Button 1 corresponds to the upper left gauge, button 2 to the upper right gauge, button 3 to the bottom left gauge and button 4 to the bottom right gauge. Successive presses of the buttons selects a different parameter for the gauge. *Adjust Mode* is exited by pressing button 5 and storing the new configuration even when power is removed.

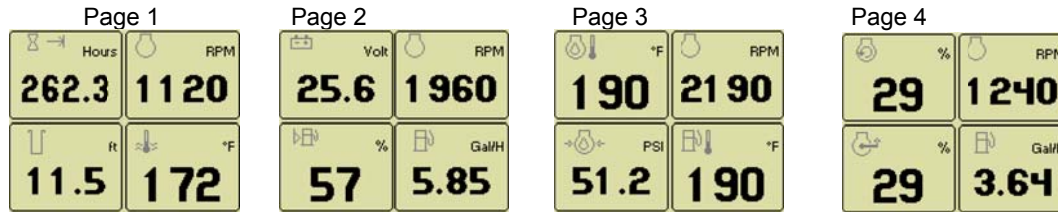


**Note:** A gauge selection can only appear once per page. To move a gauge selection, the existing gauge location must be changed first. Gauge selections are limited to the data currently being received. Gauge pages can be configured in Demo mode to select any supported parameter. See **Data Parameters Monitored** for a complete list of available parameters.

*Adjust Mode* can be disabled in the **Configuration Menu** to prevent accidental changes.

### Digital Gauge Pages

**Digital Gauge Pages** display the same data as the Analog Gauge Pages but in digital only format. To enable Digital Gauge Pages, press any of the first 4 buttons to show the top level button bar and then press button 2. Alternate pages are selected by repeated pressing of button 2. The four standard gauge pages are shown below.



**Note:** The 16 gauges are the same for Analog and Digital Gauge Pages. Adjustments in either Analog Gauge Pages or Digital Gauge Pages affect the same gauge in the other mode.

### Single Analog Gauge

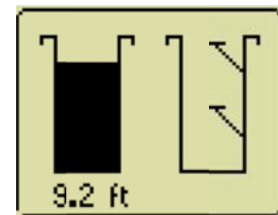
**Single Analog Gauge** uses the entire display for a single large analog gauge. This mode is enabled by pressing any of the first 4 buttons to show the top level button bar and then press button 3. The gauge displayed is selectable by repeatedly pressing button 3 while in the Single Analog Gauge mode while the menu bar is visible. The currently displayed gauge is stored when power is removed (see **Preferred Screen Store**).



**Note:** Gauge selections are limited to the data currently being received. See **Data Parameters Monitored** for a complete list of available parameters.

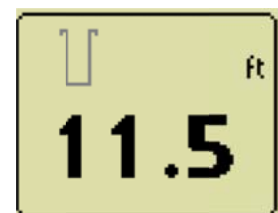
### Analog Transducer/Switch Gauge

The **Analog Transducer/Switch Gauge** displays the transducer value and the switch input states. The left column represents the values as a bar graph with a digital value displayed below. The right column shows whether the switches are 'open' represented by the pointer being down or 'closed' represented by the pointer being up.



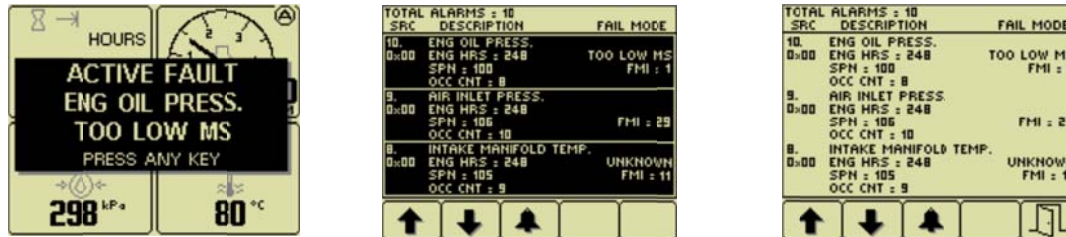
### Digital Transducer Gauge


The **Digital Transducer Gauge** displays the transducer value as a digital only value. The switch state is not displayed on the Digital Transducer Gauge.



## Active Alarms


A flashing popup window is overlaid on the current screen when an active alarm is received. The popup includes a plain language description in addition to the standard SPN/FMI (Suspect Parameter Number/Failure Mode Indicator) pair defined by the SAE J1939 standard. Additionally, if enabled, the beeper sounds as an audible cue.







Example alarm message, alarm list screens showing unacknowledged conditions and acknowledged alarms. After acknowledgement, the exit button  becomes active.

**Note:** Standard J1939 abbreviations are used for alarms. **MS** = Most Severe, **MOD**= Moderately Severe, **LS** = Least Severe.

## Alarm List

The Alarm List is accessed by pressing any button while an alarm popup is displayed or by pressing any of the first 4 buttons to show the button bar and then button 4 .

Alarms not yet acknowledged are shown in grey on black while acknowledged alarms are shown in black on grey. The list also indicates when the alarm occurred if engine hours are available. The most recent alarm is displayed at the top of the list. The list can be scrolled using buttons 1  and 2  and alarms acknowledged by pressing button 3 .





The Alarm List can be closed by pressing Button 5 once the alarms are acknowledged. An alarm indicator  is displayed near the upper right corner of the display as long as alarms are active. The indicator and alarm messages in the list are automatically removed when the alarm is no longer received for a few seconds.

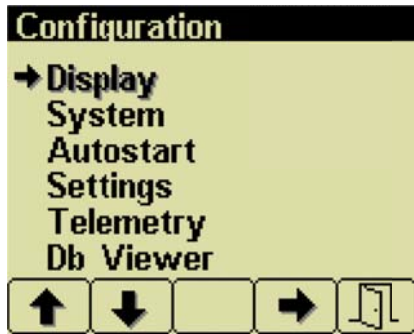
**Note:** Only active faults are displayed in the alarm list. Once a fault is corrected it is automatically removed from the list. To view previously active faults use the engine diagnostic tool.

## Configuration


To adapt the LCD panel to the requirements of a particular application, a large number of parameters are configurable. The most commonly modified parameters can be accessed by invoking the **Configuration Menu** of the display. Infrequently changed parameters and those parameters that typically need to be restricted such as Maximum RPM are accessible only through the **Configurator**. The **Configurator** is a Windows® PC program and a hardware adapter that allows total access to the parameters of the panel. For more information about the **Configurator**, please contact BBA Pumps.


### Configuration Menu

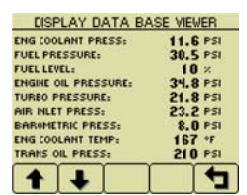
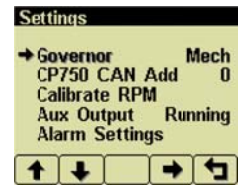
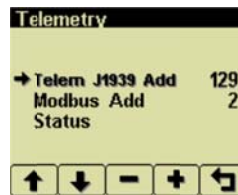
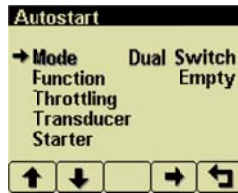
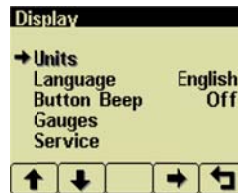
This **Configuration Menu** allows the user to set various operating parameters such as US or metric units, scale limits for tachometer and service timers. The configuration menu is entered by pressing and holding button 5 (the right hand button) in any mode for at least 3 seconds. If PIN (Personal Identification Number or 'password') entry is enabled the correct PIN must be entered to access the configuration menu. The top level configuration menu is displayed as shown. Buttons 1  and 2  allow you to choose from **Display**, **System**, **Autostart**, **Settings**, **Telemetry** or **Db Viewer**. Pressing button 4  selects the chosen menu item indicated by bold text and the selection arrow . Each item is described in detail on the following pages. Settings are automatically stored when exiting the current menu even when power is removed.



The Configuration menu and its six choices.

Pressing Button 4  selects the highlighted menu item.

Button 5  exits the configuration mode.

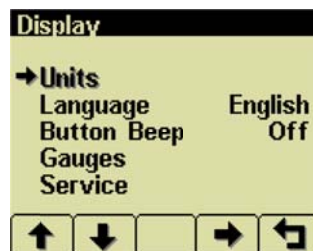


#### Note

Most configuration changes take affect immediately.  
Some such as Idle RPM take affect on the next power up.


#### Display Menu

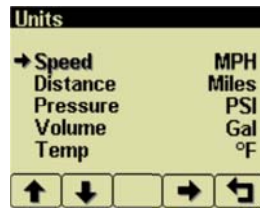
The *Display Menu* allows the user to configure items affecting how information is displayed.



## Units Menu

This menu allows the user to set the units used for speed, distance, pressure, volume and temperature independently.

Button 4  cycles through the available values for the selected item.



**Speed** MPH (miles per hour)  
km/h (kilometers per hour)  
Knts (knots)



**Distance** Miles  
km (kilometers)  
NM (nautical miles)

**Pressure** PSI (pounds per square inch)  
bar (barometric units)  
kPa (kilopascals)

**Volume** Gal (US gallons)  
lGal (Imperial gallons)  
Liters


**Temperature** °F (Fahrenheit)  
°C (Celsius).

## Language Menu



This menu allows the user to choose between English, Swedish, French, German, Spanish, Italian, Dutch and Portuguese. The currently selected value is indicated by the check mark . Button 4  selects the highlighted value.

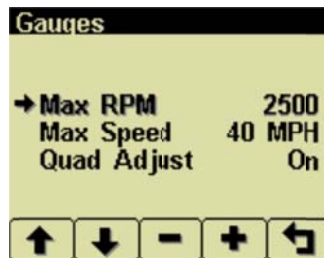


## Button Beep

The soft buttons emit an audible beep when this item is On. Button beep is disabled by setting this item to Off. The audible beep still sounds when an alarm occurs. Button 4  cycles between On and Off.

## Gauges Menu

This menu allows the user to configure aspects of the gauges displayed. Button 3  selects the previous value while Button 4  selects the next value of the highlighted item.



### Max RPM

Sets the full scale RPM indicated by the tachometer gauge.

**RPM** 2500, 3000, 3500, 4000, 4500, 5000, 6000, 7000, 8000 or 9000



### Max Speed

Sets the full scale speed indicated by the speedometer gauge.

**MPH** 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 70, 75, 80, 85, 95 or 100

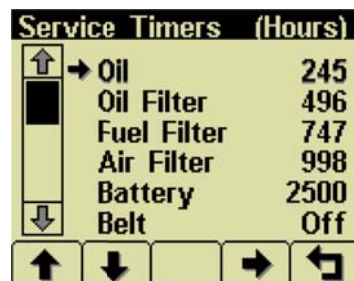
**km/h** 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150 or 160


### Quad Adjust

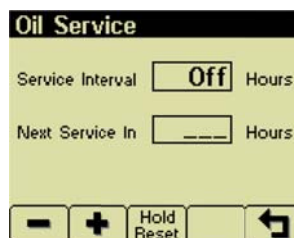
Allows the user to disable *Adjust Mode* of the Analog and Digital Gauge Pages. Button 3  disables while Button 4  enables Quad Adjust. Disabling *Adjust Mode* locks the current gauge configuration and prevents the operator from accidentally changing the gauge configuration.




### Service

Sets the sixteen (16) service intervals in hours and resets the service timer. Setting the service interval to 0 disables the timer and the word **Off** is displayed



Pressing Button 4  allows adjusting the selected service timer.




Button 1  decreases the service interval time while Button 2  increases the service interval time in 10 hour increments. Holding Button 3 for approximately 3  seconds resets *Next Service In* to the current service interval.

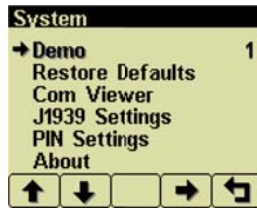
The service timer descriptions can be changed using the **Configurator**.

#### Note

It is not possible to set the service timers if engine hours are not being received by the display.

## System Menu



The **System Menu** allows the user to configure items affecting how the system functions. . Button 4  cycles through the available values for the selected item.



## Demo

The display supports several demo modes to operate with simulated data. Mode 1 simulates speed data and engine parameters. Mode 2 only simulates engine parameters. Mode 3 simulates speed data, engine parameters and alarms. Mode 0 disables Demo Mode. Demo is automatically set to 0 (Off) if live data is received.

## Restore Defaults

This allows resetting all configuration information to default US  or Metric  units. Additionally the display is reset to the initial configuration.



The default settings are:

Setting	Metric	
	US	
Language	English	
Button Beep	On	
Service Timers	Off	
Display Mode	Analog Gauges	
Gauge Pages	Defaults	
Quad Adjust	On	
Demo Mode	0 (Off)	
Engine Source	0	
Display CAN Address	40	
Alarm Filter	Glb	
SPN Version	1	
Speed Source	Auto	
PIN Entry	Off	
PIN	1111	
Max Gauge RPM	2500	
Max Gauge Speed	40 MPH	60 km/h
Speed Units	MPH	km/h
Distance Units	Miles	km
Pressure Units	PSI	kPa
Volume Units	Gal	l
Temperature Units	°F	°C

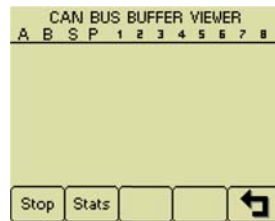
### Com Viewer

Displays CANbus data received and engine configuration transmitted by the ECU.

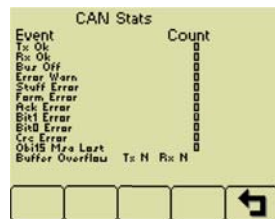


### J1939 Viewer

This screen provides a hexadecimal dump of the messages received on the CANbus. This viewer displays the raw data. To see the decoded data use the **Db Viewer**.

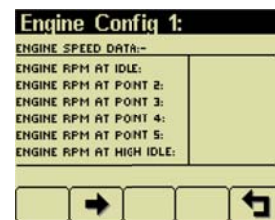


Button 1 **Stop** freezes the display while button 2 **Stats** shows CANbus data statistics screen.



### Engine Config

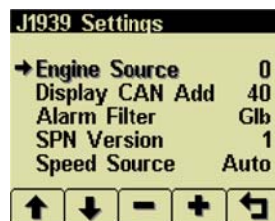
This screen displays the engine configuration information received from the ECU.



Button 2 **→** selects the next page of engine configuration while button 1 **←** selects the previous page.

### J1939 Settings

This screen allows adjustments specific to the J1939 data link.



### Engine Source

Selects which source the display listens to for gauge data. Every device on a J1939 network has a unique address (in the range 0-254) to which the display can choose to listen. The display listens to a single data source; usually the ECU at address 0.

### Note

Incorrectly configuring the Engine Source address will result in no data available for display.



## Display Add

As mentioned previously, every device has a unique address and the display is no different. The default display address is 40, the recommended address for single engine setups.

### Note

Incorrectly configuring the Display Address can result in data collisions on the CANbus.

## Alarm Filter

This setting specifies whether the display will display alarms from all sources (*Glb* or global) or only the source address specified in the **Engine Source** setting (*Src* or source).

## SPN Version

Selects the default SPN (Suspect Parameter Number) conversion method version to 1, 2 or 3. Version 4 is automatically detected, but older engines that use conversion method 1, 2 or 3 requires setting this parameter correctly.

### Note

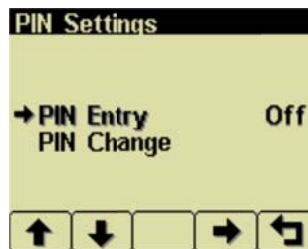
Consult your engine supplier to establish the appropriate SPN conversion method version. Selecting the wrong version will cause alarm data to be displayed incorrectly.

## Speed Source


There are 3 sources of speed data the display can decode. The settings for this parameter are *AUTO*, *NMEA*, *WHEEL*, *NAV* and *OFF*. *AUTO* prioritizes the sources (highest to lowest); *NMEA*, *WHEEL* (PGN 65265), *NAV* (PGN 65272). The selection can be forced to one of the available sources by selecting it explicitly. Selecting *OFF* stops the display listening to any source of speed data.






## PIN Settings

By default PIN security is disabled. The user is prompted to enter a PIN every time the **Configuration Menu** is accessed after this feature is enabled.



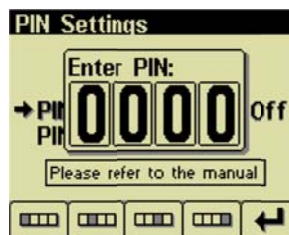
### PIN Entry

This allows turning PIN Entry *On* or *Off*. To enable the PIN entry feature select **PIN Settings** and press button 4  to enable. The current pin must be entered (default is 1111) as a security feature. Once the PIN has been entered the feature is enabled. PIN Entry is disabled by setting PIN Entry to *Off*.

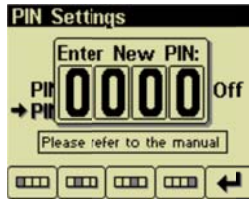
The digits of the PIN are entered by using the buttons corresponding to the digits of the PIN. Button 1  adjusts the first digit of the PIN. Button 2  adjusts the second digit, button 3  the third digit and button 4  the fourth digit. The PIN is entered using button 5. 

### PIN Change

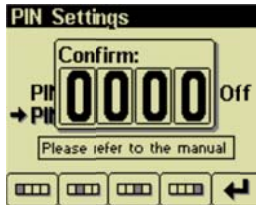
This allows changing the PIN. The user is prompted for the current PIN



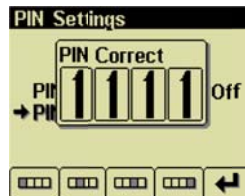
The user is prompted for the new PIN.



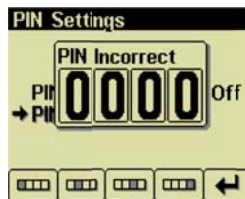
The new PIN must be confirmed before the PIN is changed.



If the new PINs match a confirmation screen is displayed.



If the two PINs entered do not match an error message is displayed and the PIN is unchanged.

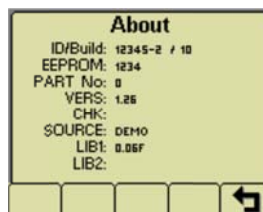


**Warning**

If the PIN is changed from the default and the new PIN is lost, the configuration mode will not be accessible. Clearing the PIN requires returning the display to BBA Pumps for service.

**About**

Displays the following product information:



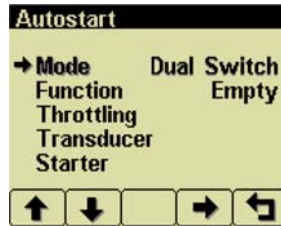
<b>ID/Build</b>	Serial number of the display
<b>EEPROM</b>	Number of writes on EEPROM
<b>PART No</b>	Unit part number
<b>VERS</b>	Software version number
<b>CHK</b>	Flash memory checksum
<b>SOURCE</b>	The source of received data
<b>LIB1</b>	Low level system library version
<b>LIB2</b>	Low level Graphical Display Interface library version (if used)

**Note**


This screen can not be exited until the checksum calculation is complete. Checksum calculation takes approximately 10 seconds and is complete when the checksum value changes from **Calculating...** to a hexadecimal value such as **0x704E – OK**

### Autostart Menu


This submenu allows the user to configure automatic start/stop operation. Refer to **Automatic Start/Stop Operation** for more information.



### Mode

This menu selects the basic automatic start/stop operation mode. Button 4  cycles between *Single Switch*, *Dual Switch*, *Transducer* or *Xducer & Sw*.

### Function

This menu selects the automatic start/stop function. Button 4  cycles between *Empty*, *Fill*, *Maintain Out* and *Maintain In*.

### Throttling Menu

The throttling menu allows the user to configure throttle control.



The throttling menu allows programming the automatic start/stop throttle profiles as shown in the following diagram.

### Idle RPM

Selects the RPM the control system will request for idle speed. Idle can be set to compensate for parasitic loads such as hydraulic pumps or compressors. Idle RPM is the low speed setting of the optional two state or three state throttle switches.

### Note

The minimum engine speed is set by the ECU. Requesting a lower speed causes the engine to run at the ECU minimum speed. RPM limits are programmed into the panel to limit the requested speed. Changing the panel **Minimum Requested RPM** and **Maximum Requested RPM** requires using the **Configurator**. **Intermediate RPM**

Selects the RPM the control system will request for intermediate speed. The intermediate speed can be used to prime pump or charge lines during automatic start/stop operation. Intermediate RPM is also the middle setting of optional three state throttle switches.

### Note

Setting the **Intermediate RPM** to the same speed as **Idle RPM** and **Ramp to Run** to 0 seconds is effectively two speed automatic operation.

### Run RPM

Selects the RPM the control system will request for run speed. The run speed is the normal operating speed during automatic start/stop operation.

Run RPM is the high speed setting of the optional two state or three state throttle switches.

### Ramp Up/Down

This submenu configures the speed profile for automatic start/stop operation.

Ramp Up/Down	
→ Warm Up s	0
Ramp Up s	0
Intermediate s	0
Ramp To Run s	0
Ramp Down s	0
Cool Down min	0

↑ ↓ - + ↻

#### Warm Up s

Selects the number of seconds to operate at idle speed before beginning the ramp to intermediate speed. The warm up time begins when the starter is disengaged.

#### Ramp Up s

Selects the number of seconds to ramp from idle speed to intermediate speed after warm-up

#### Intermediate s

Selects the number of seconds to operate at intermediate speed before ramping to run speed

#### Ramp to Run s

Selects the number of seconds to ramp from intermediate speed to run speed after intermediate warm-up

#### Ramp Down s

Selects the number of seconds to ramp from current speed to idle speed. The ramp down time begins when the automatic start/stop system detects a stop event.

#### Cool Down m

Selects the number of minutes to operate at idle speed after ramp down time. At the end of the cool down period the engine will be stopped.

### Servo

Configures the servo profile for autostart maintain modes

Servo	
→ Gain	5
Delay 10mS	1

↑ ↓ - + ↻

#### Gain

Controls the aggressiveness of the maintain servo modes.

#### Delay 10mS

Controls how quickly the maintain servo mode responds to changes in level.

## Transducer

This submenu configures the transducer type and set points.

Transducer	
→ Type	Level
Range ft(PSI)	23.1(10)
High Set Point ft	0.0
Maintain Point ft	0.0
Low Set Point ft	0.0
Dead Band ft	0.0

↑ ↓ - + ↩

### Type

Selects between *Level* and *Pressure*

### Range

Selects appropriate range for the transducer type.

### High Set Point

For **Empty** and **Maintain Out** modes, sets the level that **begins** an autostart cycle. For **Fill** and **Maintain In** modes sets the level that **ends** the cycle.

### Maintain Point

Sets the target point for maintain modes

### Low Set Point

For **Empty** and **Maintain Out** modes sets the level that **ends** an autostart cycle. For **Fill** and **Maintain In** modes sets the level that **begins** a cycle.

### Dead Band

Sets the amount of change from the target point required to alter the engine speed.

## Starter

This submenu configures starter control options for autostart

Starter	
→ Restart Attempts	3
Restart Delay s	10
Starter On s	10

↑ ↓ - + ↩

### Restart Attempts

Selects the number of times to attempt restart.

### Restart Delay Sec

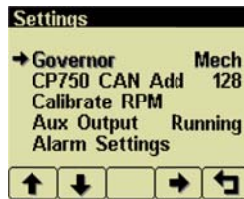
Selects the number of seconds to wait before attempting a restart.

### Start on Sec

Selects the maximum number of seconds the starter can be engaged.

## Settings Menu

This submenu allows the user to configure hardware.



### Governor

Selects between **Elect** (electronically governed) and **Mech** (mechanically governed) engines modes. For mechanically governed engines the functions as an ECU, broadcasting engine parameters such as oil pressure and temperature on the CANbus.

#### Note

Switching governor modes requires cycling power before calibrating the RPM. The **Configurator** must be used to configure mechanical engine parameters.

### CP750 CAN Add

Selects the address used by the display to communicate with the board. The default address is 128.

#### Note

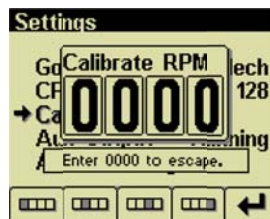
Engine data is always transmitted using address 0 in mechanically governed mode.

#### Warning

Incorrectly configuring the CP750 CAN Address prevents the display from receiving I/O Board data for the display menus and can result in data collisions on the CANbus.






### Calibrate RPM

Calibrates the tachometer input for mechanically governed engines to allow the display to measure the engine speed. This signal may be provided by an alternator frequency tap, proximity switch. An optional amplifier/divider can be added for use with a magnetic pickup.



#### Note

Calibrate RPM is only available on mechanically governed engines. The RPM must be calibrated for automatic start/stop operation to function.

Crank the engine and measure the engine RPM with a handheld tachometer. Select Calibrate RPM and enter the digits of the measured RPM using the buttons corresponding to the digits of the RPM. Button 1  adjusts the first digit of the RPM. Button 2  adjusts the second digit, button 3  the third digit and button 4  the fourth digit. The RPM is entered using button 5. 

When the calibration is complete the LEDs will begin a blinking sequence. The power must be cycled to continue configuration or operation.

Selects the Aux Output function and provides a 1 amp low side switch.

**Running** The output is active when the engine RPM exceeds 500 RPM

**AS Armed** The output is active when the keyswitch is in the Autostart position and the engine has not stopped due to a fault

**At Speed** The output is active when the engine is at or above the Operating RPM

**Prestart** The output is prestart alarm activated 10 seconds before the engine automatically starts.

#### Note

The Aux Output is available on a connector in the I/O Board only. Changing the prestart alarm time requires using the **Configurator**.

#### Alarm Settings

Configures the set points for the transducer alarm messages. The alarm is transmitted as SPN 1083 with FMI 1 for a low alarm and FMI 0 for a high alarm.



#### Low Level

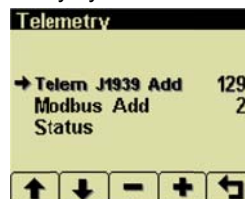
Sets the transducer low level alarm set point.

#### High Level

Sets the transducer high level alarm set point

#### Telemetry Menu

This menu allows configuring the optional telemetry system.



#### Telem J1939 Address

Defines address the telemetry module is using for CANbus communications.

#### Note

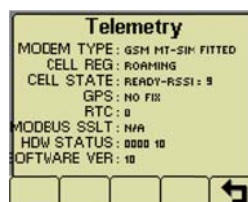
The display will be unable to communicate with the telemetry module if this address is incorrect.

#### Modbus Address

Selects the Modbus slave address the telemetry module will use for Modbus communications.

#### Status

Displays telemetry and modem status information retrieved from the telemetry module:






## Db Viewer

The Database Viewer displays and decodes all data monitored by the display. This diagnostic tool allows viewing data not normally displayed.

DISPLAY DATA BASE VIEWER	
ENG COOLANT PRESS:	11.6 PSI
FUEL PRESSURE:	30.5 PSI
FUEL LEVEL:	10 %
ENGINE OIL PRESSURE:	34.8 PSI
TURBO PRESSURE:	21.8 PSI
AIR INLET PRESS:	23.2 PSI
BAROMETRIC PRESS:	8.0 PSI
ENG COOLANT TEMP:	167 °F
TRANS OIL PRESS:	210 PSI

↑ ↓ □ ↶

The list can be scrolled using buttons 1  and 2  and closed by pressing Button 5. 

### Note

The Database Viewer is always in English regardless of language selected.

## Preferred Screen Store

The display automatically stores the current screen as the preferred screen after a delay of approximately 15 seconds. The display will use the last stored screen on the next power-up.

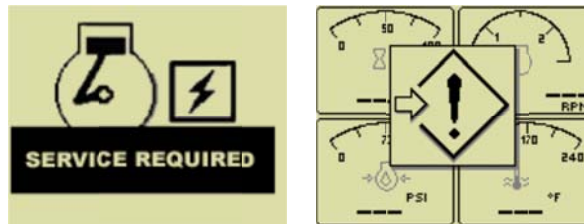
### Note

Selecting **Restore Defaults** restores the Analog Gauge Pages and default gauges.

## Popup Messages and Alerts

### Service Required

Users can set up to sixteen service timers in hours in the Configuration menu. The **Service Required** popup is displayed at power up when one or more service timers has expired. Pressing any button removes the popup. If no button is pressed the popup closes in approximately 5 seconds.



Pop-up warnings of service required and data communications failure.

### Data Communications Failure

The data communications failure popup icon flashes if the display does not detect data. The warning disappears and normal operation resumes once data is detected.

### Note

Incorrectly configuring the Engine Source address will result in no data available for display.

### Data Not Available



Gauges and the Db Viewer will display **----** if the desired data is not available. The display value returns to normal when parameter data is received.

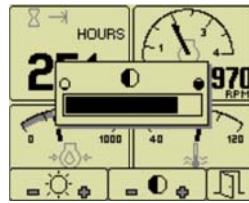
### Note

In **Autostart Standby** only the transducer gauge displays data since the ECU is not powered.




### Adjusting Lighting and Contrast

Pressing button 5 (the right-hand button) when there is no menu bar opens the lighting and contrast menu bar. The display has a number of back-lighting levels allowing the display to be read in the dark. The level is adjusted by pressing buttons 1 (decrease) or button 2 to (increase)  illumination. Contrast is adjusted in the same manner using buttons 3 and 4. .



#### Note

The display adjusts the contrast with ambient temperature. Manual contrast adjustments are only necessary with extreme climate change.

The menu is exited by pressing button 5 . The lighting and contrast settings are retained after the unit is powered off.

#### Note

If the contrast has been adjusted poorly, the factory setting is restored by pressing buttons 1 thru 4 simultaneously. This action does not change other user-configured settings.

### Button Lock

The display's five buttons can be locked so the operator does not accidentally change settings or access another display mode. Button Lock is enabled by pressing and holding buttons 1 and 5 simultaneously for one second. Repeating this operation restores normal button operation.

### Indicators

#### Auto Standby LED (Green)

A solidly illuminated **Auto Standby** LED indicates the keyswitch is in the auto start position and the system is ready to start.

#### Preheat LED (Amber)

A solidly illuminated **Preheat** LED indicates the engine is preheating. When the LED extinguishes, the preheat period is complete and the engine may be cranked.

#### Note

The LCD display only reports when the ECU is requesting preheat. Cold starting aids may not be installed in all engine configurations.



#### Engine Stop LED (Red)

A solidly illuminated **Engine Stop** LED indicates the ECU has stopped the engine due to a fault.

#### Note

ECU programming determines the response to warnings and failures. Typically the ECU can be programmed to shutdown, derate or run to failure. The LCD display only displays ECU reported conditions.



#### Warning LED (Amber)

A solidly illuminated **Warning** LED indicates a warning reported by the ECU.

#### Note

The Warning LED is not used in **Mechanical Governor** mode.

### Gauges

Analog gauges can be added by removing blind covers and installing the gauge. No wiring or interface is provided in standard control systems.

## Emissions System Functionality

### NOTE: GENERAL EMISSIONS DISCLAIMER

This panel may include provision(s) for operator input such as FORCE REGENERATION, INHIBIT REGENERATION, INTERLOCK, and others specific to US and International emissions regulations. Responsibility for emissions related inputs and compliance with emissions regulations is solely that of the owner and/or operator of the machine/ engine on which this panel is connected.



### CAUTION

Carefully read and understand the engine manufacturer owner/operator manual. Your engine manufacturer provides specific information regarding the exhaust emission system of your engine. This information is maintenance, procedural, and safety related. Failure to exactly follow the engine manufacturer instructions and schedules could potentially result in harm or injury to you and/or others.



The LCD display reports emissions messages received from the engine ECU. Depending on the received message, icons or symbols may be displayed on the screen. Some messages/ icons are displayed as an overlay (inhibit symbol shown at left). Other symbols/ icons may cover most of the screen. The operator **MUST** respond to the indications on the display following engine manufacturer recommended procedures/ actions. Please note that indications shown by the display may vary with respect to engine manufacturer and may vary between engine models from the same

**Examples (not exhaustive) of potential Exhaust Emission system display indications and general definitions are as follow:**



The engine particulate filter is potentially in need of regeneration.

Regeneration of the emissions system is active and high exhaust temperatures are potential. Engine performance MAY be affected



Red LED: May be illuminated alone or in conjunction with other symbols. May be flashing.



**EXCLAMATION- Black Background**  
**Engine Stop**  
May be illuminated alone or in conjunction with other symbols and/or LED's



Regeneration of the emissions system is inhibited due to activation of the inhibit switch

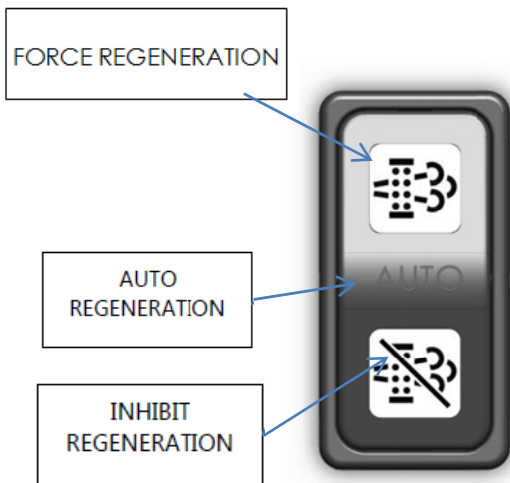


Information regarding diesel exhaust fluid (DEF)



Amber LED: May be illuminated alone or in conjunction with other symbols. May be flashing.

**EXCLAMATION Clear Background**  
**Engine Warning**  
May be illuminated alone or in conjunction with other symbols and/or LED's



#### REGEN/ INHIBIT Switch Overview

Operation of the REGEN/ INHIBIT switch differs with respect to engine manufacturer.

However, on single switch systems as shown, the REGEN side of the rocker switch is engaged (the dwell to hold the switch differs by manufacturer) to "FORCE" an emission system regeneration.

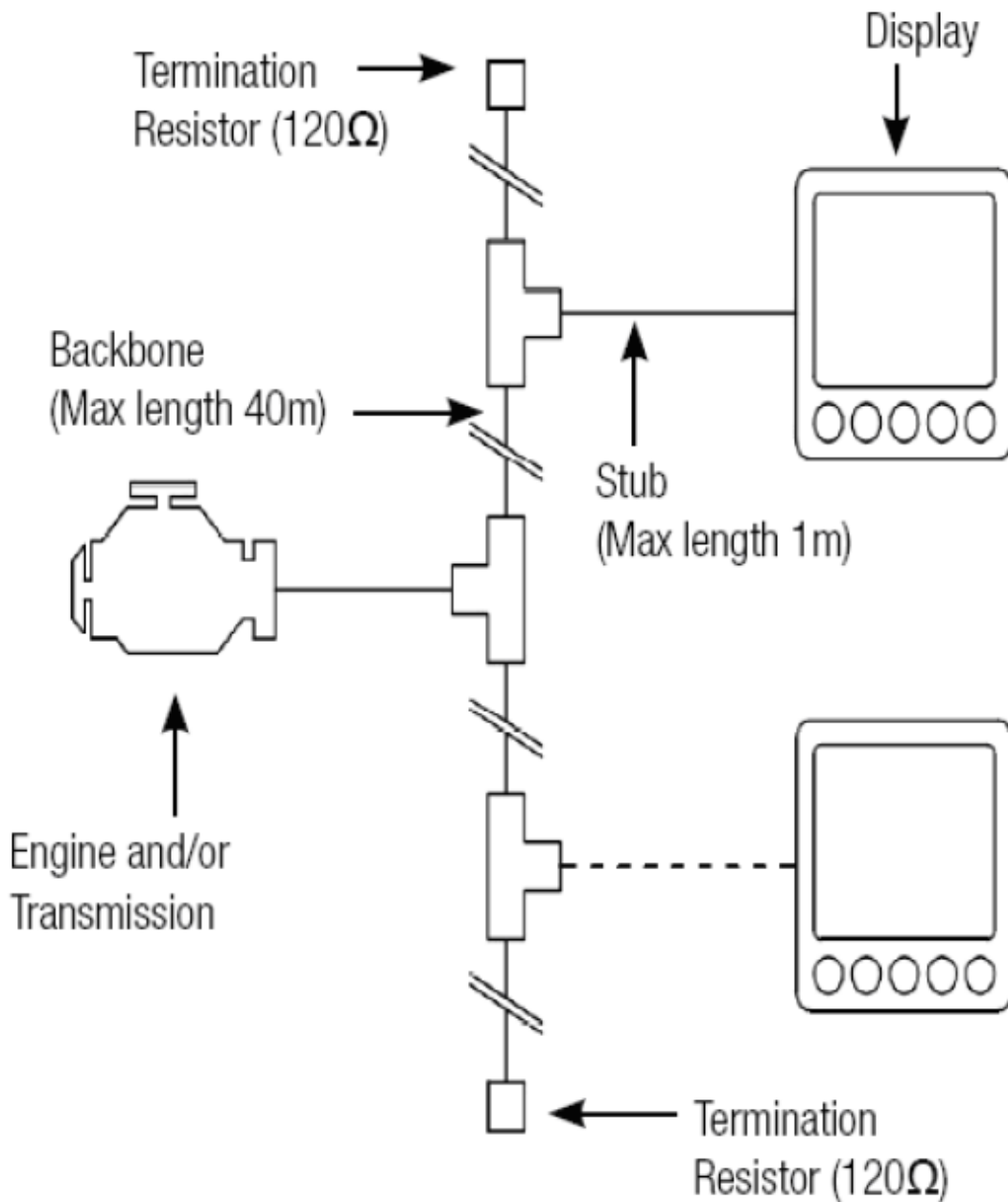
The center position of the switch allows the ECU to control regeneration "Automatically"

When the INHIBIT side of the rock switch is engaged, regeneration is "INHIBITED"

NOTE: Force Regeneration is available ONLY when allowed by the engine ECU via display of appropriate symbology (see engine manufacturer documentation for more information.)

### Typical J1939 Wiring Topology

Most electronically governed engine installations include a harness with built in J1939 backbone. Use twisted shielded pair with a drain wire for CANbus wiring terminated with 120Ω resistors at each end. The maximum length for the bus is 131 feet (40 m) and stubs should not exceed 39 inches (1m) in length.



### Harness

#### Sealed Connectors

The provided Deutsch sealed weather-proof plug includes a locking ring device which must be turned counter clockwise to separate the connectors. To positively seat the connectors the locking ring is turned clockwise.

### Warning

BBA Pumps does not recommend using dielectric grease or sealant with sealed connectors. These chemicals may cause seal damage and allow water entry. Use BBA Pumps provided cavity plugs to seal the connector if wires are removed.

### Unsealed Connectors

For unsealed connectors exposed to the elements, BBA Pumps recommends using dielectric grease to protect contacts.

### Warning

BBA Pumps does not recommend using sealant with unsealed connectors. Sealant traps moisture in the connector and encourages corrosion.

### Harness Routing

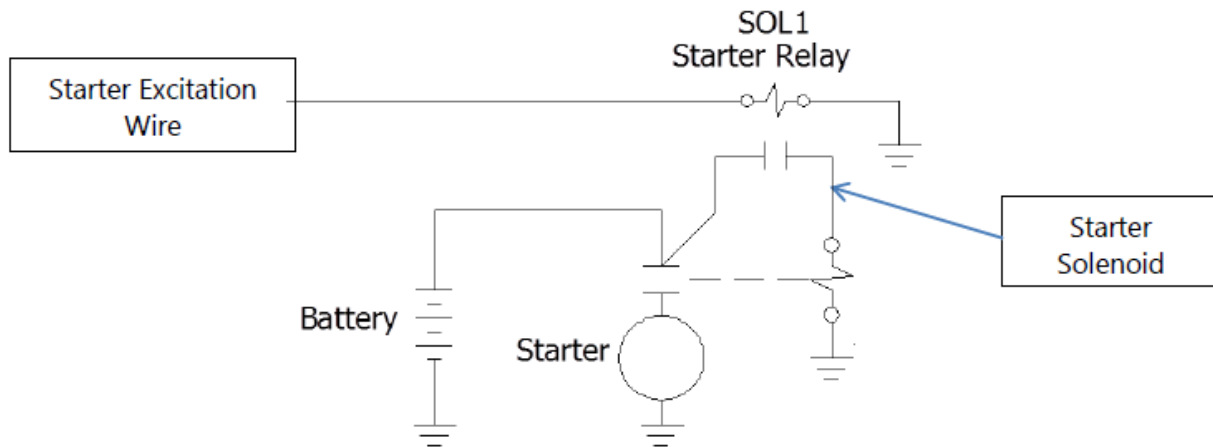
The minimum routing radius of the wiring harnesses should be at least two times the diameter of the wiring harness. Bends should be avoided within 1 inch (25 mm) of any connector in order to avoid seal distortion allowing moisture to enter the connector.

### Engine Starter Excitation Connection

BBA Dashboard LCD Panels are equipped with a heavy-duty, long-life key switch. However, when engine starter motors are energized, in-rush currents can be very high—especially in low battery voltage and low ambient temperature situations. Over time, high starter currents can potentially damage your key switch and panel circuits.

#### **High current failures are not warrantable failures!**

As such, the engine/starter wiring on all BBA dashboards must include a starter relay to minimize current through the key switch and/or auto-start circuit.



General Starter Relay Specifications		
Minimum Starter Relay (Continuous) Rating	60A@12V	30A@24V
Maximum Starter Relay Excitation Current Draw	5A@12V	3A@24V

BBA Pumps provides suitable heavy duty relays and generic starter relay wiring kits in both 12v and 24V.

## Battery Circuit Requirements

### **Warning**

---

Improper wiring can cause electrical noise, unreliable operation and may damage the control system or other components. All power connections must be free from foreign materials, including paint, which may interfere with proper connection. A reliable dedicated power circuit must be provided for the control system.

**BBA Pumps recommends the power connection be made directly to the battery.**

**Grounding through frame members is not recommended!**

All circuit paths must be capable of carrying any likely fault currents without damage. Do not reverse the battery polarity. Attempting to crank the engine when the polarity of the battery connections is reversed may damage the control system.

---

### **Battery Positive Connection**

The electronic control system operates on either a 12 VDC or 24 VDC electrical systems. The unswitched battery positive connection to the control system is made at the weather proof connector. The control system provides switched positive battery protected by solid-state MOSFETs. These outputs include integral protection against overloads and short circuits.

An integral 40 AMP slow blow fuse protects the unswitched battery positive circuit. Powering the control system through dedicated circuits reduces the possibility of system damage.

### **Warning**

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Disconnecting the battery while the engine is running may damage electrical components. When using a battery disconnect switch, BBA Pumps recommends using a 2 pole switch to disconnect both the battery and alternator output.

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### **Note**

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A maximum of three ring terminals should be connected to a power stud in order to ensure integrity of the connection. The use of more than three terminals can cause the connection to become loose.

---

### **Voltage Drop**

If control system voltage drops below 6 volts for more than one tenth of a second, the control system may reset causing the self test to reactivate. Resetting the control system is equivalent to quickly turning the key switch to off and back to run without starting the engine. Voltage drops can be caused by a discharged battery, transients from external equipment, improper wire sizes, faulty wiring or nearby lightning strikes.

## Suppression of Voltage Transients (Spikes)

### Warning

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The installation of voltage transient suppression at the transient source is required.  
BBA Pumps follows SAE recommended electrical environment practices.

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Inductive devices such as relays, solenoids and motors generate voltage transients and noise in electrical circuits. Unsuppressed voltage transients can exceed SAE specifications and damage electronic controls. Relays and solenoids with built-in voltage transient suppression diodes are recommended whenever possible. Refer to the illustration for proper installation of diodes when built-in voltage transient suppression is not available. Locate inductive devices as far as possible from the components of the electronic control system. When using electric motors it may also be necessary to add isolation relays to eliminate voltage transients, noise and prevent back feed.

#### Welding on Equipment with Electronic Controls

Proper welding procedures are required to avoid damage to electronic controls, sensors and associated components. The component should be removed for welding if possible.

The following procedure must be followed if the component must be welded while installed on equipment with electronic controls. This procedure will minimize the risk of component damage.

### Warning

---

Do not ground the welder to electrical components such as the control ground or sensors! Improper grounding can cause damage to electrical components! Clamp the ground cable from the welder to the component being welded. Place the clamp as close as possible to the weld to reduce the possibility of damage.

---

1. Stop the engine. Turn the key switch to the OFF position.
2. Disconnect the negative battery cable from the battery.
3. Open any installed battery disconnect switch.
4. Unplug the control system if possible.
5. Connect the welding ground cable as close as possible to the area to be welded.
6. Protect the wiring harness from welding debris and spatter.
7. Use standard welding methods to weld the materials.

## Control System Troubleshooting

### Control system does not perform self test

Possible Cause	Possible Remedy
Tripped overcurrent protection	Correct fault, replace or reset overcurrent protection
Faulty connection to battery	Correct battery connections (see <b>Battery Circuit Requirements</b> )
Faulty control system	Repair or replace control system

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

Possible Cause	Possible Remedy
Engine Stop LED illuminated	Correct ECU stop condition, use ECU diagnostics

### Display does not display data

Possible Cause	Possible Remedy
Display lost power	Turn on key, verify display plugged into harness
Engine Source address incorrect	Change Engine Address in Configuration
Display Address incorrect	Change Display Address to 40 (default)
Display configuration problem	Reset display using <b>Restore Defaults</b>
CANbus failure	Check CANbus (see <b>Testing CANbus</b> )
ECU not sending data	Repair or replace ECU

### Inaccurate RPM in Mechanical Mode

Possible Cause	Possible Remedy
Panel not calibrated	Run <b>Calibrate RPM</b> to correct error
Tachometer ratio changed	Recalibrate RPM

### Testing a Warning or Shutdown

Shutdown simulation with ECU controlled engines requires using the ECU diagnostic tool. Refer to the diagnostic tool documentation to simulate a warning or shutdown.

#### Testing CANbus

Most information provided to the LCD display is sent by the ECU via the CANbus. CANbus is an international data bus used to support SAE J1939. If this connection is broken or improperly terminated, the display cannot show ECU parameters such as engine hours, oil pressure and diagnostic codes. This test procedure helps identify the problem location.

1. Disconnect the battery.

#### Warning

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This test should be completed with the battery disconnected!  
Failure to disconnect the battery may cause ECU, panel or test equipment damage!

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2. Identify the engine diagnostic plug. Connect an ohmmeter across the CANbus pins of the diagnostic plug.
3. A reading of 60Ω indicates both ends of the bus are terminated and the bus is intact.
4. A reading of 120Ω indicates only one end of the bus is terminated. Identify the CANbus terminator on the engine harness and remove it.
  - a. An ohmmeter reading of 120Ω indicates the bus to the terminator in the panel is complete and the problem is between the panel and the engine terminator.
  - b. An open circuit ohmmeter reading indicates the bus to the engine terminator is complete and the problem is between the panel and the diagnostic plug.
5. Reinstall the terminator resistor and reconnect the battery.
  - a. If the ECU diagnostic tool is available, use it to verify the ECU is transmitting CANbus data. Refer to ECU documentation to identify and correct the error.
  - b. If another panel is available for testing, replace the panel to determine if the error is in the panel.



#### Diagnostic Trouble Codes (DTC)

CANbus Diagnostic Trouble Codes are a pair of numbers; the Suspect Parameter Number (SPN) and Failure Mode Identifier (FMI). The SPN indicates the faulting subsystem and the FMI identifies the type of failure.

#### Typical SPNs

Standard SPN codes are defined by SAE J1939-71. Not all standard codes are provided by ECUs. Manufacturers may add additional SPN codes beyond the codes identified in J1939-71. Refer to ECU documentation for supported SPNs.

SPN	Description
51	Throttle Position
91	Accelerator Pedal Position
94	Fuel Delivery Pressure
98	Engine Oil Level
100	Engine Oil Pressure
110	Engine Coolant Temperature
111	Coolant Level







































#### FMI
























FMI codes are defined by SAE J1939-71. Refer to ECU documentation for correct interpretation of FMI codes for a specific SPN.

FMI	Description
0	Data valid but above normal operational range
1	Data valid but below normal operational range
2	Data erratic, intermittent or incorrect
3	Voltage above normal or shorted high
4	Voltage below normal or shorted low
5	Current below normal or open circuit
6	Current above normal or grounded circuit
7	Mechanical system not responding properly
8	Abnormal frequency, pulse width or period
9	Abnormal update rate
10	Abnormal rate of change
11	Failure mode not identifiable
12	Bad intelligent device or component
13	Out of calibration
14	Special instructions
15	Data valid but above normal operational range (least severe)
16	Data valid but above normal operational range (moderately severe)
17	Data valid but below normal operational range (least severe)
18	Data valid but below normal operational range (moderately severe)
19	Received network data in error
20	
Thru	Reserved for future assignment
30	
31	Not available or condition exists

### Data Parameters Monitored

This table lists the engine and transmission parameters that are monitored via the CANbus. The parameters can be displayed by the user-configurable gauge pages or the single analog gauge. DB is an abbreviation for the internal database which stores all data transmitted from the engine/transmission. The complete database can be accessed on the display via the **Db Viewer** in the **Configuration** menu.

Icon	Parameter	Gauge Pages	Single Gauge	Database
<b>Electrical (Volts or Amps)</b>				
	Electrical Potential	•	•	•
	Battery Voltage, Switched	•	•	•
	Net Battery Current	•		•
	Alternator Voltage	•	•	•
	Alternator Current	•	•	•
<b>Fuel (L, Gal, lGal) or (L/h lGal/h) or (km/L, MPG or IMPG)</b>				
	Fuel Level	•	•	•
	Fuel Rate	•	•	•
	Fuel Temperature	•	•	•
	Instantaneous Fuel Economy	•		•
	Trip Fuel Economy	•		•
	Trip Fuel	•		•
	Trip Fuel Rate	•		•
	Total Fuel Used			•
	Fuel Leakage 1			•
	Fuel Leakage 2			•
<b>Distance (km, Miles or Nmiles)</b>				
	Distance Remaining	•		•
	Trip Distance	•		•
	Total Vehicle Distance	•		•
<b>Pressure (kPa, PSI or bar)</b>				
	Fuel Pressure	•		•
	Barometer Pressure	•		•
	Auxiliary Pressure 1	•	•	•
	Turbo Pressure	•	•	•
	Air Inlet Pressure	•		•
	Air Filter Differential Pressure	•		•
	Injector Metering Rail 1 Pressure	•		•
	Injector Metering Rail 2 Pressure	•		•
	Engine Coolant Pressure	•		•
	Engine Oil Pressure	•	•	•
	Transmission Oil Pressure	•	•	•
	Clutch Pressure	•		•
	Air Start Pressure	•		•
	Injector Control Pressure	•	•	•
<b>Temperature (°C or °F)</b>				
	Engine Coolant Temperature	•	•	•
	Engine Intercooler Temperature	•		•
	Engine Oil Temperature	•	•	•
	Transmission Oil Temperature	•	•	•
	Turbo Oil Temperature	•		•
	Intake Manifold Temperature	•	•	•
	Air Inlet Temperature	•	•	•
	Exhaust Temperature	•	•	•
	Auxiliary Temperature 1	•	•	•
	Engine ECU Temperature			•

Icon	Parameter	Gauge Pages	Single Gauge	Database
	Exhaust Gas Port 1 Temperature	•		•
	Exhaust Gas Port 2 Temperature	•		•
	Turbo Inlet Temperature	•		•
<b>Percentage (%)</b>				
	Acceleration Position	•		•
	Engine Oil Level	•	•	•
	Coolant Level	•	•	•
	Fan Speed	•		•
	Drivers Demand Percent Torque	•		•
	Actual Engine Percent Torque	•	•	•
	Percent Load at RPM	•	•	•
<b>Speed (RPM, km/h, MPH or KTS)</b>				
	Input Shaft Speed	•		•
	Output Shaft Speed	•		•
	Engine Speed	•	•	•
	Turbo 1 Speed	•		•
	Engine Desired Operating Speed	•		•
	Fan Speed	•		•
	Vehicle Speed	•	•	•
<b>Time (h)</b>				
	Total Engine Hours	•		•
	Trip Engine Hours	•		•
	Service Hours			•
<b>Miscellaneous</b>				
	Torque Converter Lock-Up Engaged			•
	Transducer	•	•	•
	Current Gear	•		•
	Selected Gear	•		•
	CANTX Disable			•
	CANplus I/O			•

### Abbreviations

The units *MPG* and *Gal* denote US gallons. For non-US US gallons (UK, Canada, etc) the units are denoted as *IMPG* or *IGal*. *N* denotes nautical miles. *KTS* denotes knots.

### Note

If a parameter   is not transmitted on the CANbus it will not be possible to select it. If a configured gauge parameter is unavailable is displayed.

### Glossary

- CAN** Controller Area Network (also referred to as CANbus); serial communications protocol for electronic engines use
- DTC** Diagnostic Trouble Code; the combination of SPN and FMI that identifies a specific error
- ECU** Engine Control Unit; electronic device responsible for controlling and monitoring engine operation
- ECM** Engine Control Module; an alternate name for the ECU
- FMI** Failure Mode Identifier; defines the type of failure detected in the subsystem identified by the SPN
- GPS** Global Positioning System; a system of satellites and receiving devices used to compute positions on the earth, used in navigation
- J1939** SAE engine data protocol using CAN 2.0B
- LCD** Liquid Crystal Display; a display technology that uses electric current to align crystals in a special liquid. When current is applied the crystals change their orientation creating a darker area
- NMEA** National Marine Electronics Association, serial communications protocol for marine use
- RS-232** Standard electrical interface for serial communications
- RS-485** Standard differential electrical interface for serial communications
- SAE** Society of Automotive Engineers; professional association of transportation industry engineers that sets most auto-industry standards for the testing, measuring, and designing of automobiles and their components
- Soft Buttons** Push buttons whose function changes according to use
- SPN** Suspect Parameter Number; a number used to identify a particular element, component or Parameter associated with an ECU

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