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INTRODUCTION

The John Deere Electronic Control system used on 8.1L engines has been modified to use the same RE162429 instrument panel with adjustable 2-state throttle used on the 10.5L and 12.5L engines.

The new JDEC system is similar to the old system, but with the following differences:

1. The new engine wiring harness includes alternator and starter relay wiring and a prewired connector to plug directly into the new RE162429 instrument panel for "plug-and-play" simplicity. If you choose to provide your own customer instrumentation and controls, the same plug can be used to provide a simple one-plug interface with your operator station. Some special features, such as cruise control, will require a few extra corrections.

2. The new system includes an optional push-button adjustable 2-state throttle feature that allows variable speed operation without a mechanical or potentiometer throttle. This feature is available only on ECUs that are not equipped with cruise-control.

3. The adjustable 2-state throttle feature can be used to easily preset maximum and minimum allowable operating speed when using a potentiometer throttle.

4. A new 2-inch digital diagnostic gauge, RE68155, displays diagnostic codes and warnings, engine hours, rpm, oil pressure, coolant temperature, system voltage, and many other engine parameters. It also includes "Warning" and "Stop Engine" lights. It is available by itself, or as part of the RE16429 instrument panel.

5. Additional gauge displays can be driven from the RE68155 diagnostic gauge to provide analog displays of rpm, oil pressure, coolant temperature, system voltage, % load, etc. An audible alarm is also available.

CONVERTING FROM THE OLD SYSTEM

If you are currently using the older version of the 8.1L JDEC control system, there are three different ways to adapt to the new system:

1. Using the RE162429 Plug-and-Play Instrument panel - -
   For simple power unit installations, the easiest and best way to apply the new system is to use the new RE162429 plug-and-play instrument panel. To use the new instrument panel, simply connect the wiring harness using the instructions provided with the engine, connect the system power and ground wires to the battery, plug in the RE162429 instrument panel, and turn the key.

2. Adapting Your Current Machine Wiring to the New RE505549 Engine Wiring Harness - -
   If you provide your own instrumentation and controls, the best way to simplify your installation is to adapt your machine wiring harness to interface with the new 21 pin instrument panel connector. This will provide a simple one-plug interface between your machine and the engine, and it will enable you to take advantage of some of the new features, such as the Adjustable 2-State Throttle. To adapt your custom instrumentation and controls wiring, refer to the section titled "Making Your Own Instrumentation and Controls Wiring Harness" at the end of this manual .

3. Continue to use the old RE500664 wiring harness - -
   The old RE500664 wiring harness does not provide some of the new features, such as the Adjustable 2-State Throttle, starter and alternator wiring, or one-plug instrumentation and controls connection. However, for customers who provide their own instrumentation and controls and prefer not to change their machine wiring harness right now, we will continue to offer the old RE500644 wiring harness for a limited time. The old wiring harness is not compatible with ECUs that have the Adjustable 2-State Throttle feature. Therefore, if you wish to continue using the old wiring harness you must specify an ECU with cruise-control, even if you don't use it. If you do not use cruise control, simply do not connect the cruise control wires, just like in the past. We strongly encourage you to adapt your machine wiring to the new RE505549 as quickly as possible.

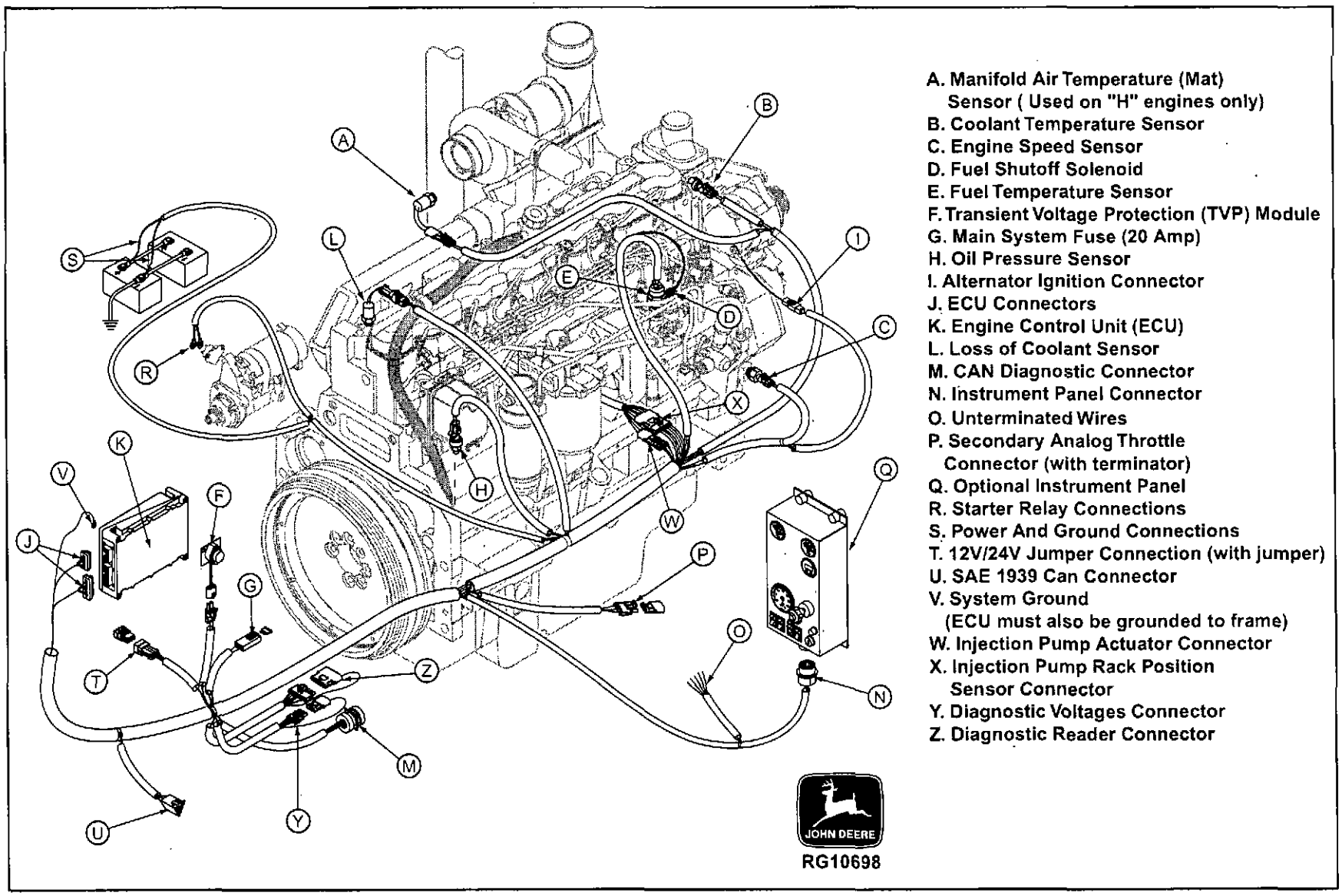


Figure AG-14 - 01, John Deere Electronic Control System

SOFTWARE

The ECU is equipped with a nonvolatile (permanent) memory with stored data that controls the engine's operation. Application features are programmed at the factory. Programmed features are documented on the 1600 Engine Option group, the engine performance curve and in these guidelines. The Engine Control Unit is programmed to limit the maximum fuel delivery as a function of engine speed. This allows the development of many torque curve shapes within the pump and engine's capabilities.

Optional torque and droop curves can be selected by the user through application wiring. The New John Deere ECU can have up to four programmed torque curves. The power levels for each curve are identified in the 1600 Engine Option group descriptions and on the engine performance curves. The highest Intermittent power level is programmed as torque curve 1. Optional power levels are programmed as torque curves 2 and 3. On "H" engines, torque curve 4 is the derate power for high air-to-air intake manifold temperatures. On "A" engines, torque curve 4 is just an optional torque curve.

For torque curve selection wiring details, see "Instrumentation and Controls Wiring" (Torque Select).

Governor Operation

The all speed governor can be set for either normal droop or isochronous operation. Normal droop, the default, gives a drop in engine speed with an increase in load or an increase in engine speed with a decrease in load. The normal % droop for your engine will be listed in the 1600 Engine Option group and on the engine performance curve. When isochronous governing is selected the droop is set to 0%, and there is no change in engine speed with changing loads until the engine's torque limit is reached.

For torque curve selection wiring details, see "Instrumentation and Controls Wiring" (Droop Select).

Engine Throttle

A new Adjustable 2-State throttle feature is being introduced on the 8.1L JDEC System. No mechanical or analog (potentiometer) throttle is required to operate the engine. The Adjustable 2-State throttle allows you to preset one high and one low operating speed, and switch between them electrically without the use of potentiometers or mechanical adjustments of any kind. This feature is available only on ECUs that are not equipped with cruise-control.

If an analog (foot or hand) throttle is desired, you can add up to two throttle potentiometers which would operate between the preset high and low operating speeds set.

Three switches make up the Adjustable 2-State Throttle, the High/Low Select switch, the Bump Enable switch, and the Speed Select switch.

1. **THE HIGH/LOW SELECT SWITCH**
   The High/Low Select switch allows you to choose between two operating speeds. Unless you adjust the speed points differently, the engine will operate at the factory pre-set fast idle speed when the High/Low Select switch is in the "Fast" position, and it will operate at the factory pre-set slow idle speed when the High/Low Select switch is in the "Slow" position. However, the preset "Fast" and "Slow" operating speeds may be reset to any desired speeds between factory fast and slow idles using the Speed Select and Bump Enable switches.

2. **THE BUMP ENABLE SWITCH**
   The Bump Enable switch serves as a lock for the Speed Select switch to make sure the operating speed is not changed accidentally or as a result of the Speed Select circuit failure. The Bump Enable switch must be "On" for the Speed Select switch to work.

3. **THE SPEED SELECT SWITCH**
   The Speed Select switch allows you to adjust either the "Fast" or Slow" preset speeds. When the High/Low Select switch is on "High", and the Bump Enable switch is "On", moving the Speed Select switch to the "-" (minus) position will decrease the pre-selected "Fast" speed slightly, and moving the Speed Select switch to the "+" (plus) position will increase the pre-selected "Fast" speed slightly (but not past fast idle). When the High/Low Select switch is on "Low", and the Bump Enable switch is "On", moving the Speed Select switch will adjust the "Slow" pre-set operating speed.

   Both preset speeds (high and low) will be remembered, even if the ignition is turned off. For example, if the engine is adjusted to 2000 rpm in the fast speed position, and the High/Low Select switch is left in the "Fast" position when the engine is shut off, the engine will return to 2000 rpm the next time the engine is started. If the ECU is ever completely disconnected from battery power, the maximum high and low speeds will return to the factory fast and slow idle speeds, and will have to be reset if desired.

Engine ECU Functions and Features

The John Deere Electronic Control Unit is available with these important features:

1. **SELF DIAGNOSTICS**
   The ECU will detect failures within the control system including sensors, actuators and the ECU itself. The ECU monitors the engine fuel, coolant, and oil pressure sensors for out-of-range values or erratic operation.

2. **CRUISE CONTROL**
   Engine ECU's are available with and without the Cruise Control function. The Cruise Control is an Off-Road type that maintains a constant engine RPM under varying load conditions. An automotive type cruise control maintains a constant road speed. This feature is available only on ECUs that are not equipped with the Adjustable 2-State Throttle.

The Cruise Cancel/Resume function is a one button Cancel then Resume function. The first time contact is made with Cruise Control active, the Cruise Control will disengage and the engine speed will drop to idle. If the contact is made again within one minute and with the engine speed above 1300 RPM, the Cruise Control will "Resume". This feature allows the placement of the Cancel/Resume button in a convenient location in the vehicle cab and does not require the use of the normal Cruise controls for momentary interruptions in cruise operation.

The Cancel/Resume function is intended for applications like Ag tractors and sprayers that turn around at the end of each row in a field. This allows the operator to use the throttle and/or brake to turn the vehicle around. When ready to resume field operations, the operator brings the engine speed above 1300 RPM and activates the Cancel/Resume function again to resume cruise speed. An internal timer gives the operator one minute to complete the turn around maneuver.

The Cruise Control has the normal functions of:

- Cruise Control power "ON" or "OFF"
- "Set" or "Bump Up" Engine Speed
- "Resume" or "Bump Down" Engine Speed
- Vehicle brake or clutch pedal to disengage Cruise Control

These feature generally function exactly like an automotive cruise control. Refer to the cruise control wiring instructions later in this section for more details.

On 12-volt ECU's, the engine speed can be set from two different locations. The primary location would normally be in the cab of the vehicle and is used to set a constant engine speed while the vehicle is being driven. The secondary cruise control is normally used in a location that provides for engine PTO speed control and is used with the engine in "neutral" or out of gear. Both locations can have the normal Cruise functions.

See the 1600 group descriptions and Engine Performance Curves to determine option codes with cruise control. See Application Feature Wiring for torque cruise control wiring details.

3. **ENGINE DIAGNOSTICS**
The ECU can detect abnormal engine operating conditions or faults in several engine systems. Faults are stored in the ECU for later use by service personnel, and may be reported to the operator with a Fault Lamp.

- **Low Oil Pressure Protection**
There are two low oil protection features, Low Oil Pressure WARNING and Low Oil Pressure SHUTDOWN. The set-points for Low Oil Pressure WARNING and SHUTDOWN are variable based on engine speed, and are preset at the factory.

  At the Low Oil Pressure WARNING set-point the ECU turns on the blinking fault lamp. On systems with the protection option enabled a slow power derate begins. If the oil pressure goes above the Low Oil Pressure WARNING set point, power slowly increases until the power is back to full power. The fault lamp will continue to flash until the power returns to normal even if the fault condition has gone away and the recovery is in process.

  At Low Oil Pressure SHUTDOWN set-point the ECU turns on a solid (non-blinking) fault lamp. On systems with the protection option enabled a faster power derate begins. On systems with the shutdown option enabled, if the oil pressure does not go above the SHUTDOWN set-point within 30 seconds, the engine will shutdown. If oil pressure goes above Low Oil Pressure SHUTDOWN set point within 30 seconds, power derate reverts to the Low Oil Pressure WARNING curve.

- **Coolant Temperature Protection**
There are three Coolant Temperature features, High Coolant Temperature WARNING , High Coolant Temperature SHUTDOWN, and Loss of Coolant SHUTDOWN.

  At the High Coolant Temperature WARNING set-point the ECU turns on the blinking fault lamp. On systems with the protection option enabled a slow power derate begins. If the coolant temperature goes below the High Coolant Temperature WARNING set point, power increases slowly until the power is back to full power. The fault lamp will continue to flash until the power returns to normal even if the fault condition has gone away and the recovery is in process.

  At High Coolant Temperature SHUTDOWN set-point the ECU turns on a solid (non-blinking) fault lamp. On systems with the protection option enabled a faster power derate begins. On systems with the shutdown option enabled, if the coolant temperature does not go below the SHUTDOWN set-point within 30 seconds, the engine will shutdown. If coolant temperature goes below High Coolant Temperature SHUTDOWN set point within 30 seconds, power derate reverts to the High Coolant Temperature WARNING curve.

  If a Loss of Coolant fault is detected the ECU turns on a solid (non-blinking) fault lamp. On systems with the protection option enabled a rapid power derate begins. On systems with the shutdown option enabled, if the Loss of Coolant switch does not reset within 30 seconds, the engine will shutdown. If the Loss of Coolant switch resets within 30 seconds, power increases at the same rate until back to full power.

- **High Charge Air Temperature (on "H" engines only)**
A high charge air temperature switch is required on air-to-air aftercooled engines. If the air temperature in the intake manifold rises above the maximum allowable temperature, the High Charge Air Temperature switch connects the "Torque Curve Select" input to ground and a derate power curve is selected. The ECU turns on a blinking fault lamp. There is no additional derate, nor is there a shutdown function for High Charge Air Temperature. If charge air temperature returns to an acceptable temperature, normal power is immediately available.

  Some intake manifold options have a 1/2"-14 NPSI straight pipe thread port available for installing the High Charge Air Temperature switch. If you select a manifold without a port, you must provide a 1/2"-14 NPSI straight pipe thread port in the aftercooler outlet tube for the high charge air temperature switch. The switch is should be ordered with the wiring harness. It must be located in the tube between the aftercooler and intake manifold, not between the turbo and aftercooler.

4. ENGINE PROTECTION

The ECU can detect several types of engine problems and may take actions to minimize engine damage that may result if these problems are not corrected. There are two levels of engine problems, "Warning" and "Shutdown".

"Warning" faults are engine problems that may lead to engine failures if not corrected. "Warning" faults include higher than normal fuel temperature, lower than normal oil pressure, higher than normal coolant temperatures, higher than normal charge air temperatures, or power derates. The fault lamp will be flashing or blinking when a "Warning" problem is detected.

"Shutdown" faults are engine problems that indicate imminent engine failure. "Shutdown" problems include extremely low oil pressure, extremely high coolant temperatures, and loss of coolant. "Shutdown" problems are indicated by a continuously "ON" fault lamp.

See the 1600 group descriptions and Engine Performance Curves to determine which injection pump/ECU options include engine protection or shutdown features. See Application Feature Wiring (External Shutdown) for details on how the OEM can use these features with an external signal such as a loss of prime switch.

- **No Protection**
  Engine ECU's with "No Protection" do not derate the engine when coolant temperature, oil pressure, or charge-air temperature "Warning" faults are detected and do not shutdown the engine when there is a "Shutdown" fault. The fault lamp will blink or flash when a "Warning" fault is detected by the ECU and will be continuously "ON" when a "Shutdown" fault is detected. The engine operator is responsible for reducing engine speed and power when a "Warning" fault exists and for shutting down the engine when a "Shutdown" fault exists.

  The fuel temperature derate schedule is still active, even in "No Protection" ECUs

  If engine coolant temperature and oil pressure sensors are not installed on engines with "No Protection" ECUs, no fault will be detected and the fault light will not light.

  "No Protection" ECU's can not warn of a broken or disconnected wire in the coolant temp and oil pressure sensor circuit.

  Excessive fuel temperature or a broken or disconnected fuel temperature sensor will generate a fault code, derate the engine, and activate the fault light, even in "No Protection" ECUs.

- **Engine Protection without Shutdown**
  The Engine Protection feature is only in ECU's with Engine Protection programmed into the ECU. All engine protection sensors including coolant temperature and oil pressure must be installed if engine protection is specified. Otherwise, a fault will be detected, and the fault lamp will light.

  The engine derate schedules will be active but the engine will not shutdown if a "Shutdown" fault is detected. The fault lamp will blink or flash when a "Warning" fault is detected by the ECU or when the engine is derated by the ECU. The fault lamp will be continuously "ON" when a "Shutdown" fault is detected. The engine operator is responsible for shutting down an engine with a "Shutdown" fault.

- **Engine Protection with Shutdown**
  The Engine Shutdown feature is only in ECU's with Engine Protection and Shutdown programmed into the ECU. All engine protection sensors including coolant temperature and oil pressure must be installed if engine protection is specified. Otherwise, a fault will be detected, and the fault lamp will light.

  The engine derate schedules will be active and the engine will shutdown in 30 seconds if a "Shutdown" fault is detected. The fault lamp will blink or flash when a "Warning" fault is detected by the ECU or when the engine is derated by the ECU. The fault lamp will be continuously "ON" for 30 seconds before shutting down when a "Shutdown" fault is detected. On mobile applications the operator may delay a shutdown for 30 seconds by pushing a "Shutdown Override" button.

On an ECU with the Shutdown feature, shutting down the engine and turning "off" the key switch will reset the engine Shutdown feature and will allow at least 30 seconds of running after restart. After 30 seconds, the engine will again shutdown unless the "Shutdown" fault condition has cleared

The "Shutdown Override" switch resets the shutdown timer to 30 seconds, and may be used repeatedly. However, continuously holding down the "Shutdown Override" switch will not reset the 30 second timer.

The High Charge Air Temperature switch works independent of the "Shutdown" and "Warning" functions. Excessively high charge air temperatures will put engines with Engine Protection enabled into a power derate mode and a "Warning" fault will be set. The fault lamp will flash or blink to indicate that a power derate has taken place. The fault lamp will continue to blink until the High Charge Air Temperature switch has reset to the normal position and the engine power derate has been ramped back up to full power.

5. **SERVICE DIAGNOSTICS**
Fault codes generated by the ECU are stored for later retrieval through the serial interface or the Deere Diagnostic Tool link. The controller will also send a signal to a fault lamp.

6. **EXTERNAL DERATE AND SHUTDOWN INPUT**
The loss-of-coolant circuit can also be used to trigger a derate and shutdown from an external source such as high hydraulic temperature or loss of prime. Since the loss-of-coolant circuit is used, it will act exactly like a loss of coolant fault, depending on what protection level has been specified (see description, above), and it will generate the same fault code.

The engine will continue to run for 30 second after the external derate/ shutdown is triggered. If an immediate shutdown is required, a separate magnetic shutdown switch should be added to Wire #002C in the engine wiring harness to break the connection to the battery.

7. **EXTERNAL FAULT LAMP DRIVER**
A driver for an external fault lamp is also provided. It will blink for warnings and come on continuously for shutdown faults.

8. **STARTING CONTROL**
The John Deere Electronic Control system can be used to automatically turn on an electric intake heater. The ECU can turn on the intake heater whenever the ignition switch is in the "Run" position and the temperature is low enough to require intake heat. It will stay on until shortly after the engine starts. The ECU can also operate a "Wait" light. The wait light comes on at the same time as the intake heater, and stays on until the intake heater has had enough time to heat the intake air adequately to begin cranking.

See Application Feature Wiring (Starting and Intake Heater Controls) for wiring details.

9. **FUEL TEMPERATURE COMPENSATION**
A conventional diesel engine loses power as the fuel temperature increases because the injection pump delivers less fuel. The John Deere Electronic Control System monitors fuel temperature and varies the pump displacement as needed to provide constant power from 104 to 158 degrees F (40-70 C).

At fuel temperatures above 158 degrees F (70 C), an "Excessive Fuel Temperature" fault code will be displayed on the on-board or service diagnostic reader, and power will decrease slowly to a preset default level.

POWER REQUIREMENTS

12-volt or 24-volt operation must be specified when ordering the engine. The engine ECU has the following voltage requirements:

12 Volts DC	24 Volts DC	Description
0 to 5.3 Volts	0 to 10.6 Volts	System does not operate - No ECU damage
5.3 to 9.0 Volts	10.6 to 18.0 Volts	Cranking Voltage Range - Some features "inactive"
9.0 to 16.0 Volts	18.0 to 32.0 Volts	Normal Operation - All features "active"
16.0 to 26.5 Volts	32.0 to 36.0 Volts	Over-voltage, ECU can operate for up to 5 minutes without damage - Some features "inactive"
>26.5 Volts	>36.0 Volts	ECU damage

Table AG-14 - 01, ECU Power (voltage) Requirements

Transient Voltage Protection

There are two different Transient Voltage Protection (TVP) modules; 12 Volt and 24 Volt. The 12 Volt TVP module protects the engine ECU from transient voltage spikes (such as alternator load dump) greater than 26 volts. The 24 Volt TVP module protects against voltage spikes greater than 36 volts. The TVP module can be wrapped in the wiring harness or mounted in the vehicle. If the TVP module is mounted in the vehicle, it should be mounted vertically with the pigtail wires exiting form the bottom of the module. The mounting location should be away from battery fumes, engine heat and vibration, such as in a control cabinet, vehicle chassis, or cab. Mounting ears of the TVP module may not withstand over tightening of mounting bolts. The TVP module does not protect against sustained overvoltage to the ECU.

The TVP Module mates with the TVP Connector in the engine wiring harness. The TVP module is not always required. Some alternators have internal TVP protection. A TVP module will be provided if needed, depending on the alternator option specified. If you provide your own alternator, a TVP module must be used.

Reverse Current Protection

The ECU has limited internal reverse current protection if the ECU power supply is connected in reverse. The ECU will not be damaged with reverse voltage up to 26.5 Volts on a 12 Volt system and 36.0 Volts on a 24 Volt system. Reverse current at higher voltages will damage the ECU. A fuse in the wiring harness protects against over current.

Starter Relay

The standard Engine wiring harness and optional instrument panel is designed for use with a starter relay located on a bracket within 2 feet (600 mm) of the starter. Factory starter options with relay will be available. If a factory relay option is not specified, you should provide your own relay mounted very near the starter. Under no circumstances should the starter solenoid be operated directly from the key switch without a relay.

ECU MOUNTING REQUIREMENTS

The ECU is enclosed in a "wedge box" style enclosure. It is designed for off-engine mounting only. The ECU connector is a "Metri-Pack" connector. The wiring harness is mated to the ECU connector with a jack screw. The recommended torque on the jack screw is 0.8 to 1.5 Nm.

The ECU should be mounted securely with the four corner mounting holes in a vertical plane with the mating connectors pointing downward. This orientation provides maximum moisture resistance. Other acceptable mounting orientations are shown below. The wiring harness must be routed downward from the ECU enclosure so that moisture cannot drain into the connector. A "drip loop" is required when the harness is to be routed above the ECU enclosure.

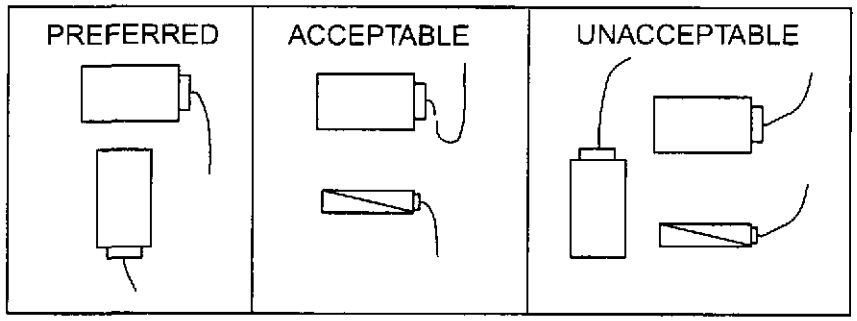


Figure AG-14 - 02, ECU Mounting Requirements

The application wiring harness should be routed to provide access to the diagnostic connectors for service diagnostic work.

The ECU must be in a location with a temperature range of -40°F / -40°C (minimum) to 169°F / 76°C (maximum).

The ECU is not intended to be mounted in a location that is subject to severe vibration or high shock loading.

The ECU case must be grounded to the chassis to protect against electrostatic discharge. The strap can be as small as 12 gage (primarily for mechanical strength reasons). This is in addition to the small ground connection in the factory wiring harness that grounds the ECU case to the wiring harness.

Never cut or splice into the ECU wiring harnesses. Do not wire any other loads into the ECU wiring harnesses, except for unterminated wires.

All wiring must be installed and routed to avoid sharp bends, kinking, pinching, cutting, rubbing or excessive pulling. Use cable clamps or wire ties as needed. Do not over tighten wire ties. Do not run screws through the wiring harnesses. Protective shields may be needed to protect the harnesses from road hazards, sharp surfaces, corrosive materials or excessive heat.

Welding Precautions

Welding causes high currents or electrostatic discharge in electronic components that can cause permanent damage to the ECU. We recommend that "No Welding" signs be prominently displayed on the vehicle chassis. The following steps should be used to protect from damage when welding on the vehicle chassis:

1. Remove the ground connection from the ECU to the vehicle frame.
2. Disconnect the connectors from the ECU.
3. Connect the welder ground close to the welding point and be sure ECU or other electronic components are not in the ground path.

ENGINE HARNESS WIRING

The engine comes with a package of components to be installed by the distributor or OEM that includes engine sensors, ECU, Transient Voltage Protection module (if needed) and engine wiring harness. The engine harness includes starter and alternator connections. It is also possible to order the engine without sensors or wiring harness, if the OEM prefers to order those parts separately. Only the specified John Deere sensors can be used. Other sensors should not be applied.

The engine harness has two ECU connectors, four connectors installed on the fuel injection pump, connectors for the RE162429 instrument panel, auxiliary speed sensor, engine coolant sensor, high engine coolant switch, TVP Module, 20 amp fuse, 9 pin Deutsch CAN plug, 6 pin diagnostic reader connection, and 4 pin diagnostic voltage connection. Unterminated wires for customer interface are also in the wiring harness.

The two capped diagnostic connectors are for troubleshooting and system checkout service procedures only. Keep protected with caps when not in use. Water or dirt in these connectors may cause erratic engine operation. One of these plugs mates with Electronic Governor Tester. See Component Technical Manual for instructions on using the Tester.

The Engine wiring harness should be connected per the factory instructions packaged with the engine. The starter relay may be available on the engine or can be provided by the user, but it must be installed near the starter so the wiring harness will reach it. Special wiring for optional features such as cruise control or auxiliary throttles will be described in the "Optional Features" section that follows later in this manual.

12-Volt / 24-Volt Jumper Plug

The same wiring harness is used for either 12-volt or 24-volt systems. However, internal ECU wiring is actually slightly different. For 12-volt systems, Wire #432 is attached to the "Start" terminal of the key switch (Wire #422), but for 24-volt systems, Wire #442 is attached to the "Start" terminal of your key switch. This is accomplished by inserting one of two jumpers provided with the engine in a special connector in the wiring harness.

For 12-volt systems . . .
Jumper #RE505597 connects Wire #432 to Wire #422.
For 24-volt systems . . .
Jumper #RE505598 connects Wire #442 to Wire #422.

The RE505597 12-volt jumper will be installed in the engine wiring harness at the factory. For 24-volt applications, it should be removed and replaced with RE505598.

RE162429 Instrument Panel Plug

A 21-pin Deutsch connector provided on the engine wiring harness plugs directly into the bottom of the new RE162429 Instrument panel. To operate a new electronic 8.1L engine with the RE162429 instrument panel, you need only install the engine wiring harness, connect the power and ground to the battery, plug the 21-pin Deutsch connector into the RE162429 Instrument Panel, and turn the key. The RE162429 panel operates on 12 or 24 Volts.

Power and Ground Connections

After all other wiring is completed, and immediately before operating the system for the first time, the main power and ground connections to the battery should be made. Unterminated system power and ground wires are provided in the engine wiring harness for this purpose. These wires should be connected directly to the battery if possible. The battery can be located up to 10 feet (3 M) from the engine. Connect as follows:

Battery Power- (Wire #002C, red, 10 Gauge)
Should be connected directly to the positive terminal of the battery.

Ground Wire- (Wire #050H, black, 10 gauge)
Should be connected directly to the negative terminal of the battery.

The ECU case must also be grounded to the chassis separately to protect against electrostatic discharge. The strap can be as small as 12 gage (primarily for mechanical strength reasons). This is in addition to the ECU ground connection wire on the engine wiring harness.

ONBOARD DIAGNOSTIC GAUGE REQUIREMENT

All applications using a 8.1L engine with JDEC control system must be equipped with a permanent onboard diagnostic gauge. The new RE68155 Diagnostic Gauge is available either separately or as part of the RE162429 instrument panel for this purpose.

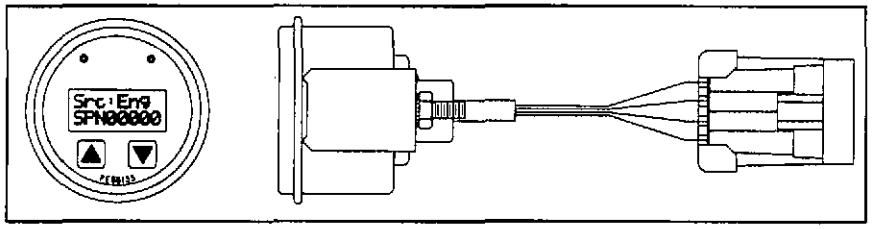


Figure AG-14 - 03, RE68155 Diagnostic Gauge

The RE68155 diagnostic gauge works with the 8.1L JDEC control system. It has a "Warning" light, "Stop Engine" light, and a digital display that shows diagnostic codes when the ECU detects a fault. It digitally displays hours, rpm, oil pressure, coolant temperature, and many other parameters. It can also be used to drive analog displays of rpm, oil pressure, coolant temperature, and many other parameters available on the digital display. It fits in a standard 2 inch SAE instrument panel opening.

If you don't wish to use the RE68155 Diagnostic gauge, you must provide your own on-board diagnostic system using the information provided over the SAE J1939 Controller Area Network (CAN) described later in this manual.

INSTRUMENTATION AND CONTROLS WIRING

To complete a runable engine, instrumentation and operator controls must be added. At minimum, a control wiring harness, ignition switch, diagnostic gauge, and a set of 2-state throttle actuating switches and/or an analog throttle must be provided. Many other optional controls and displays can also be added if desired. See the "Optional Features" section that follows later in this manual.

There are three ways to add basic instrumentation and operator controls to the system:

1. Use the John Deere RE162429 instrument panel.
2. Adapt the instrumentation and wiring harness used in the John Deere RE162429 instrument panel to your own panel and controls.
3. Provide your own instrument panel wiring harness and controls.

The easiest way to provide all the control system parts that do not come on the engine is to use the John Deere RE162429 instrument panel.

Using the RE162429 Instrument Panel

The 21-pin Deutsch connector on the engine wiring harness plugs directly into the bottom of the RE162429 Instrument panel. To operate an 8.1L engine with the RE162429 instrument panel, you need only install the engine wiring harness, connect the power and ground to the battery, plug the 21-pin Deutsch connector into the RE162429 Instrument Panel, and turn the key. The RE162429 panel operates on 12 or 24 volts.

The RE162429 panel includes the following standard features:

- Ignition switch
- Panel mounted fuse
- Adjustable 2-state throttle switches
- Shutdown override button
- RE68155 Diagnostic Gauge
- Tachometer
- Oil pressure analog gauge
- Coolant temperature analog gauge.
- Cutouts for 3 additional gauges

Optional Features

Wiring connectors for some optional or operator selectable features are provided within the RE162429 instrument panel. Connectors for some other optional features are provided in the engine wiring harness.

The RE162429 panel is prewired for the following optional or user-selectable features:

- Analog throttle potentiometer
- Analog gauges for voltage, % load, etc.
- Audible Warning Alarm Module
- Gauge backlighting (12 Volt standard, 24 Volt optional)
- Backlight dimmer (brightness adjustment)
- Intake air heater "WAIT" lamp

The engine wiring harness is prewired for the following optional features:

- Intake air heater control
- Selectable torque curves
- Selectable droop or isochronus governor regulation
- Auxiliary tachometer output
- Cruise Control
- Secondary analog throttle potentiometer
- Auxiliary fault lamp
- User selectable external derate/shutdown input

Optional features are wired as follows:

- **ANALOG THROTTLE POTENTIOMETER**
  A throttle potentiometer can be installed if desired. The throttle potentiometer can be used to adjust operating speed between the maximum and minimum speeds preset with the Adjustable 2-state Throttle. The Adjustable 2-State throttle must be set in the "Low Speed" position for the Analog throttle to work.

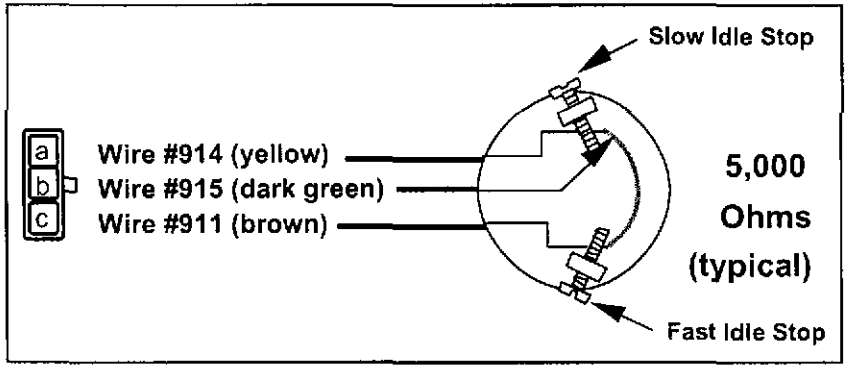


Figure AG-14 - 04, Analog Throttle Potentiometer

The RE162429 Instrument Panel is prewired to accept a RE69667 potentiometer throttle with 3-way female Weather-Pack connector. A cutout is provided in the panel to mount the RE69667 throttle. In the instrument panel, a special RE503681 throttle emulator was plugged into the analog throttle connector at the factory so the system can operate without a throttle potentiometer. To install the RE69677 or similar throttle, unplug the RE503681 throttle emulator, and plug the throttle into the same connector. Either the RE503681 throttle emulator or the potentiometer throttle must be plugged in for the system to operate properly. Do not leave the analog throttle connector in the instrument panel open.

Other throttle potentiometers including foot throttles that fit this plug may be available from Morse or other controls manufacturers. It is best to keep overall system resistance at about 5000 Ohms, but overall resistance from 2000 to 15000 Ohms should work. Wiper to low end resistance should be 0 Ohm minimum, 1250 Ohm maximum.

Note: If the voltage on Wire #915 goes above 4.75 volts or below 0.25 volts, the ECU *will generate a fault code and return the* engine to slow idle. It does this so that a break in Wire #914 does not cause the engine to go to fast idle unexpectedly.

To prevent error codes and unexpected changes in speed, the fast and slow idle stops on the throttle potentiometer must be adjusted so that the voltage on Wire #915 can't go below 0.25 volt or above 4.75 volts.

Once the stops are adjusted to limit low and fast idle voltage, the "Auto-Cal" feature of the ECU will check the exact range of your throttle potentiometer and adjust the ECU to that range. However, your initial installation must be within certain resistance limits for the Auto-Cal feature to work.

- **THROTTLE POTENTIOMETER PRE-ADJUSTMENT PROCEDURE**
  Before plugging it into the wiring harness, adjust the throttle potentiometer using the following procedure:

  1. With the potentiometer against the slow idle stop, adjust the stop so that the resistance measured between the ground and wiper connections of the potentiometer (Wire #914 and #915) is between 6% and 12% of overall potentiometer resistance (300 to 600 Ohms for a 5,000 Ohm potentiometer like RE69667).

  2. With the potentiometer against the fast idle stop, adjust the stop so that the resistance measured between the power and wiper connections of the potentiometer (Wire #911 and #915) is also between 6% and 12% of overall potentiometer resistance (300 to 600 Ohms for a 5,000 Ohm potentiometer like RE69667).

  This does not have to be a precise adjustment. The Auto-Cal feature will make a precise adjustment automatically. Once it has been done a few times, you will probably find that adjusting each throttle stop screw a predetermined number of turns is accurate enough.

- **POTENTIOMETER WITHOUT MECHANICAL ADJUSTMENT STOPS**
  If a potentiometer without fast and slow idle stops is used, additional fixed resistors can be wired in series with Wire #914 and Wire #911 as shown below to prevent the analog throttle voltage from going outside the upper and lower limits and generating a fault code.

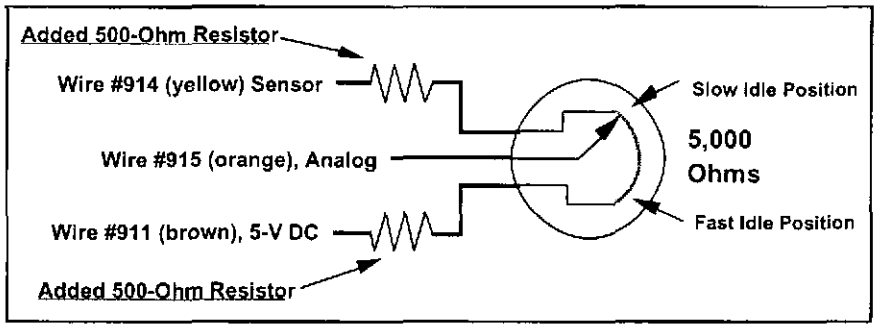


Figure AG-14 - 05,
Potentiometer Without Mechanical Adjustment Stops

For automatic adjustment of factory preset fast idle and slow idle settings by the Auto-Cal system, each added resistor should be between 10-15% of the nominal throttle potentiometer resistance. A 5,000 Ohm throttle potentiometer is shown with two 500 Ohm resistors, but resistors up to 750 Ohms could have been used with this potentiometer. Total resistance of the potentiometer and both resistors should be in the range of 2000 to 15,000 Ohms.

- **ANALOG GAUGES FOR VOLTAGE, FUEL FLOW, ETC.**
  The RE162429 instrument panel comes with an analog tachometer, oil pressure gauge, and coolant temperature gauge. The instrument panel also includes panel cutouts and wiring for up to three additional analog gauges.

  Optional JDEC analog gauges are available for system voltage and % load. An audible alarm module is also available. Additional gauges may be made available in the future.

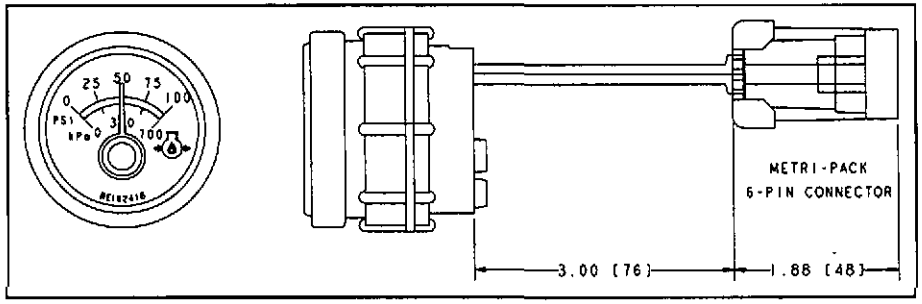


Figure AG-14 - 06, Typical Auxiliary Analog Gauge

Inside the RE162429 instrument panel is a special RE162450 Databus module with 13 Metri-Pack and Deutsch connectors. The six 6-way female Metri-Pack connectors shown below are for auxiliary analog gauges.

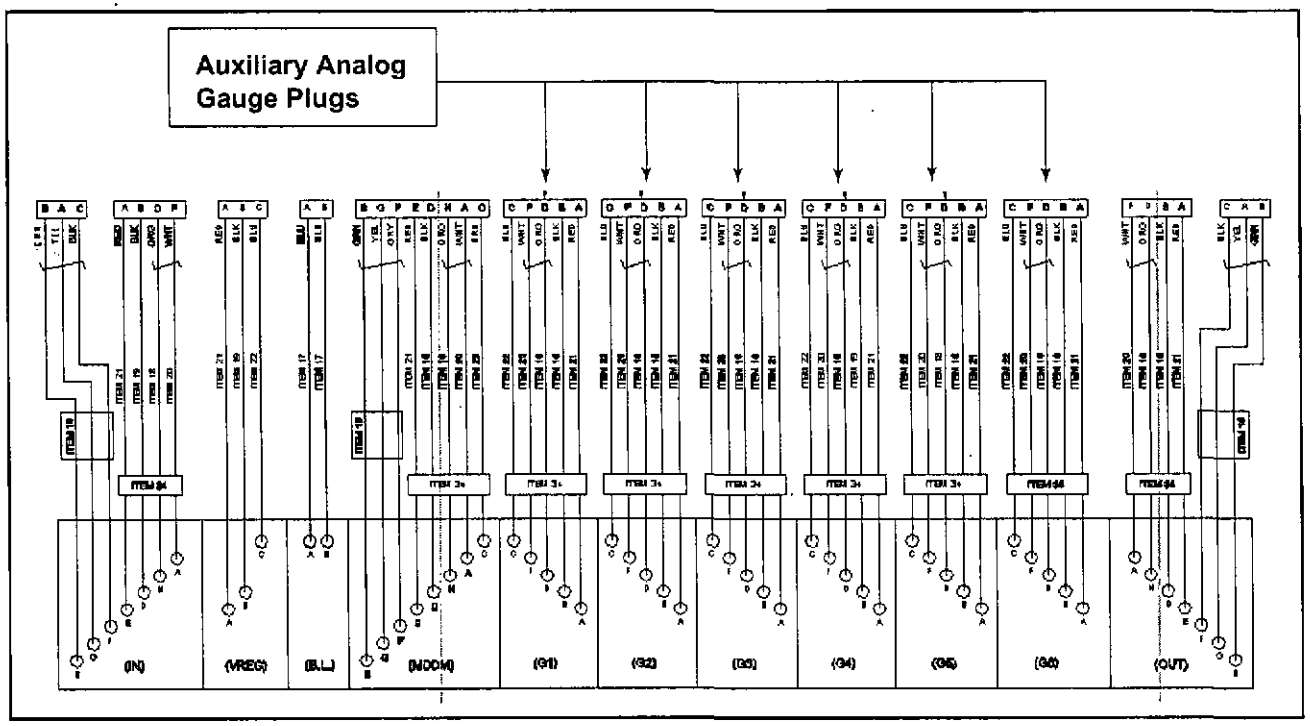


Figure AG-14 - 07, Auxiliary Analog Gauge Plugs

Any JDEC Auxiliary Analog Gauge or the alarm module can be plugged into any of the 6 gauge connectors in the Databus module. The optional analog gauges operate by reading a proprietary signal from the JDEC Diagnostic gauge. The gauge will know what part of the signal to use, regardless of which gauge terminal it's plugged in to. Only gauges specifically designed for this system will work. Do not attempt to plug any other gauges into the Databus module.

The tachometer fits into a standard SAE 3-inch tach cutout. All other gauges and the audible alarm module fit into a standard SAE 2 inch gauge cutout.

The audible alarm module is also prewired for a single-pole, double (normally open / normally closed) throw relay output. The relay output can drive 0.5 Amps at 125 VAC max, 1 Amp at 24 VDC max, or 62.5 VA, 30 Watts max. This was designed to typically drive a control relay that controls a larger load.

- **GAUGE BACKLIGHTING**

User selectable 12-volt backlighting for all gauges is prewired in the RE162429 instrument panel. A separate 24-/12-volt power regulator must be purchased to operate the backlighting in a 24-volt system.

The following two connectors, located inside the RE162429 Instrument Panel on the Databus module, must be properly connected to turn the backlighting function on:

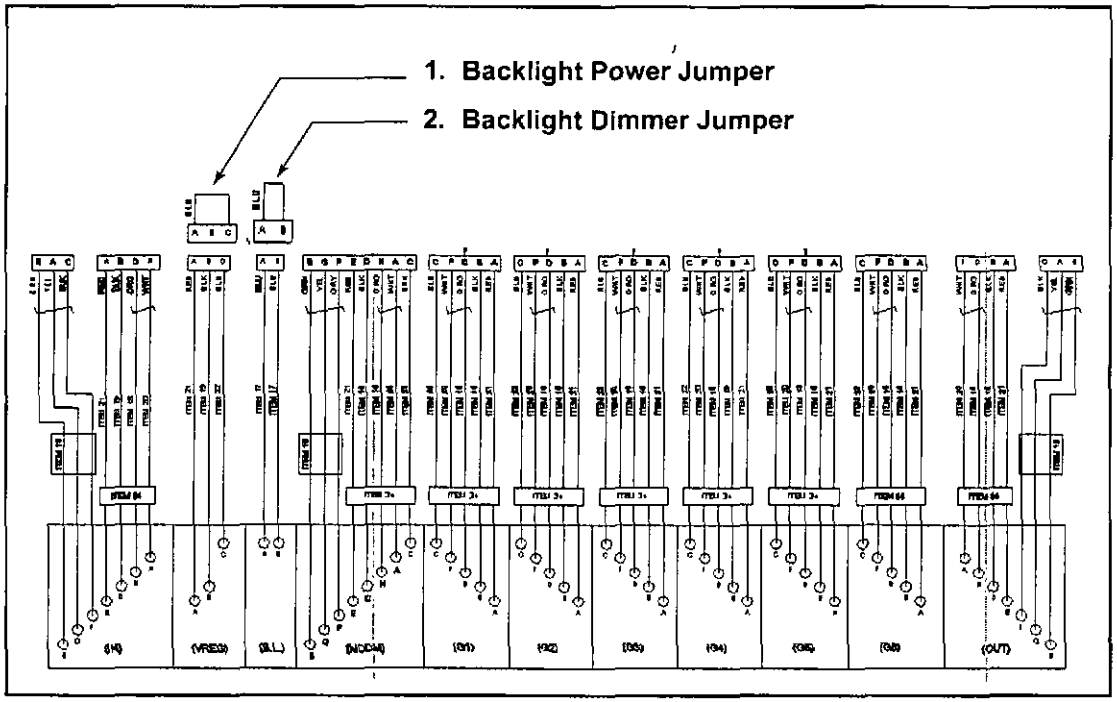


Figure AG-14 - 08, Backlight Connectors

1. **Backlight Power Connector (3-pin female Metri-Pack)**

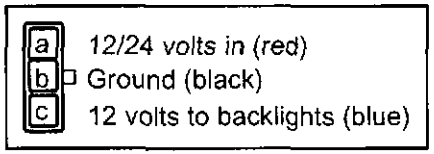


Figure AG-14 - 09, Backlight Power Connector

For 12-volt operation, Pin A must be connected to Pin C . This provides 12-volt power directly to the backlight circuit. A special connector with jumper wire is provided with the RE162429 panel for this purpose. Just plug it into the connector.

For 24-volt operation, an RE162448 24-volt-to-12-volt converter must be plugged into the 3-pin connector, to reduce 24-volt battery power to 12 volts.

Note: Do not connect Pin A directly to Pin C for 24-volt operation. This will provide 24 volts to the 12-volt instrumentation backlights, and failures of the diagnostic gauge, tachometer, and all other auxiliary gauges will occur. Always order and install the RE162448 24-volt-to-12-volt converter for 24-volt backlighting. The gauges will operate on either 12 or 24 volt. RE162448 is only required if backlighting is used.

2. **Backlight Dimmer Connector (2-pin female Metri-Pack)**

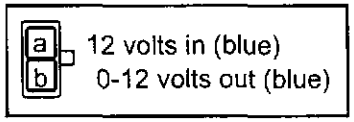


Figure AG-14 - 10, Backlight Dimmer Connector

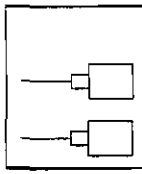
Wiring of the dimmer connector is the same for 12-volt or 24-volt operation. For no backlighting, do not connect anything to this connector. For backlighting to be on full all the time, pin A must be connected to pin B. A male connector with jumper wire is provided with the RE162429 panel for this purpose. Just plug it into the female connector. To turn backlighting on and off, a simple on-off toggle switch can be added to the wire between pin A and pin B.

For variable brightness backlighting, order and install an RE162449 dimmer assembly. It plugs right into the dimmer connection and fits into a .453" (11.5 mm) hole in the panel. A 3500-Ohm variable resistor could also be used between pin A and pin B to adjust backlight intensity. However, adjustment precision and dead-band will vary depending on the number of gauges used.

- **INTAKE AIR HEATER "WAIT" LAMP**

The John Deere Electronic Control system can be used to automatically turn on the electric intake air heater starting aid on 8.1L engines. A "WAIT" lamp can be added to the instrument panel, which comes on when the ignition key is switched to the "Run" position and the temperature is low enough to require intake heat. It will stay on until the intake heater has had enough time to heat the intake air adequately for starting. The operator can then turn the key the rest of the way to the "Start" position.

The "WAIT" lamp is a customer installed option. A plugged mounting hole and wiring connections are provided in the instrument panel for an RE67334 wait lamp assembly. The RE67334 "WAIT" lamp assembly connects with two 0.187" insulated female, solderless terminals in the panel wiring harness.



Circuit	Color	Size	Destination
012	Red	18 AWG	to fuse holder
474	Red	18 AWG	to pin A on Deutsch connector

Figure AG-14 - 11, "WAIT" Lamp Assembly Connectors

To use the 12-volt "WAIT" lamp feature, order and install one RE67334 "WAIT" lamp assembly. For 24-volt operation, remove the 12-volt light bulb from the RE67334 assembly, and replace with a R132093, 24-volt bulb.

- **INTAKE AIR HEATER CONTROL**
  Unterminated Wire #429 is used to operate a relay that turns the intake air heater starting aid on and off. It functions as a normally open switch. It closes to ground to operate the relay. The intake heater will be turned on whenever the ignition switch is in the "Run" position and the temperature is low enough to require intake heat. It will stay on until shortly after the engine starts. The load side of the relay that is attached to the heater must be rated for at least 260 amps continuous, and the switch side of the relay that is attached to Wire #429 must not draw more than 500 mA. We don't know of any commercially available relays that will carry 260 amps on the load side with 500 mA or less on the switch side. Therefore, a two-stage relay installation such as shown below is normally required.

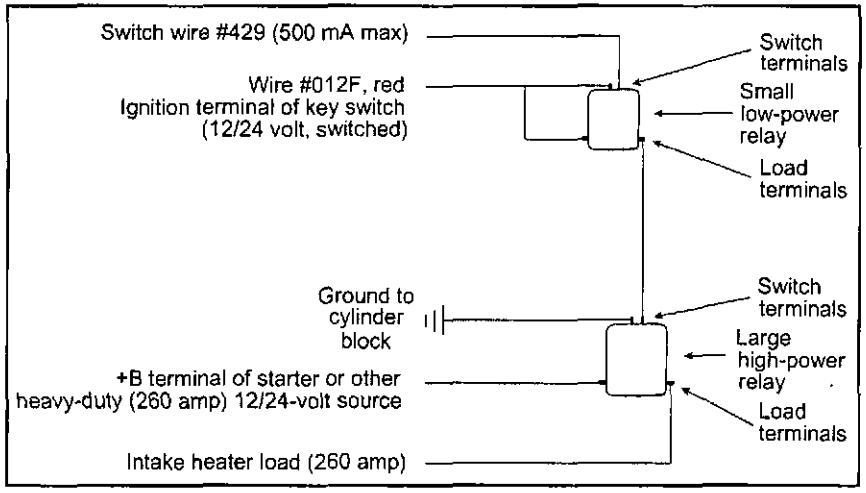


Figure AG-14 - 12, Two-stage Relay Installation

- **TORQUE SELECT - Wire #927B (Purple)**
  Wire #927B in the unterminated wire bundle on the engine wiring harness is the Torque Select wire. The Torque Select Input must be wired as described below to obtain the desired torque curve.

  Torque Curve 1: Fuel Limit Select Input (Wire #927B) is an open circuit.

  Torque Curve 2: Fuel Limit Select Input (Wire #927B) is connected to Sensor ground (Wire #914C) through a 2000-ohm ±10% resistor (at least 1/2-watt rating).

  Torque Curve 3: Fuel Limit Select Input (Wire #927B) is connected to Sensor ground (Wire #914C) through a 375-ohm ±10% resistor (at least 1/2-watt rating).

  Torque Curve 4: Fuel Limit Select Input (Wire #927B) is shorted to Sensor ground (Wire #914C).

Wire #14C (sensor ground) can also be found in the unterminated wire bundle in the engine wiring harness.

The 1600 engine option group and the engine performance curve lists the torque curves available for a specific engine application. Torque Curve 4 is used for the High Air Temperature derate on "H" engine models.

If only one torque curve is desired, no switch is required. If more than one torque curve are desired, multiple torque curves can be obtained by using a simple switching arrangement.

A simple on/off toggle switch and resistor as shown below can be used to switch between torque curve 1 (max intermittent or standby power), and any one of the other curves. When the switch is open, the ECU will call for torque curve 1, when the switch is closed, the ECU will call for one of the other curves depending on the resistance in the line. The switch could be operated manually, or it could be operated by some other machine system, such as a hydraulic pressure switch or a switch on the transmission control.

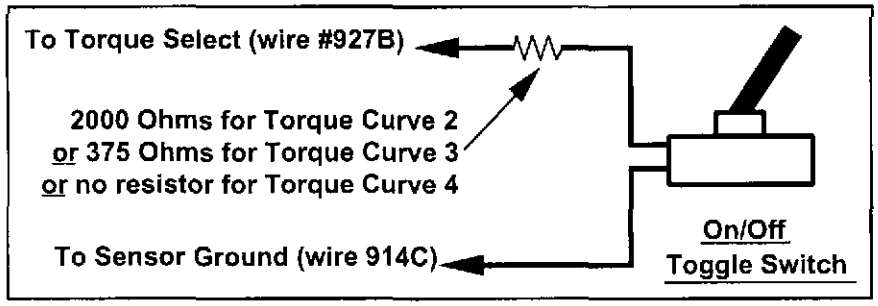


Figure AG-14 - 13, Torque Curve Select Switch

Multiple switches could be used to provide any of the four torque curves under different operating conditions.
You could operate with torque curve 1 for normal operation, torque curve 2 for transport, torque curve 3 for unloading, etc.

- **DROOP SELECT - Wire #925 (Dark Green)**
  Wire #925 in the unterminated wire bundle on the engine wiring harness is the Droop Select wire. The All Speed governor and high idle speed can be switched between droop mode and isochronous governing at any time. The factory low idle speed is always set for isochronous governing.
  The Droop Select input must be wired as follows to obtain the desired droop:

  Normal Droop: Wire #925 is open Circuit.

  Isochronous: Wire #925 is shorted to Sensor Ground (Wire #914C in the unterminated wire bundle).

  If only normal droop is desired, do not connect Wire #925.

  The 1600 engine option group defines the normal droop specification for a specific application.

- ***TACHOMETER OUTPUT - Wire #439 (White)***
  Wire #439 in the unterminated wire bundle on the engine wiring harness is provided to drive a user supplied tachometer. It can be used if the OEM prefers a tachometer other than the RE162419 auxiliary analog tachometer used with the RE162429 instrument panel.

  The ECU provides a buffered output of the magnetic speed sensor signal through Wire #439. This signal can be monitored by a customer supplied tachometer, or several other systems in the installation without degrading the signal. The ECU outputs 27 pulses per engine revolution to the Tachometer output.

- **CRUISE CONTROL**
  The cruise-control feature is intended for use on mobile applications. Refer to the following diagram when wiring the Cruise Control feature.

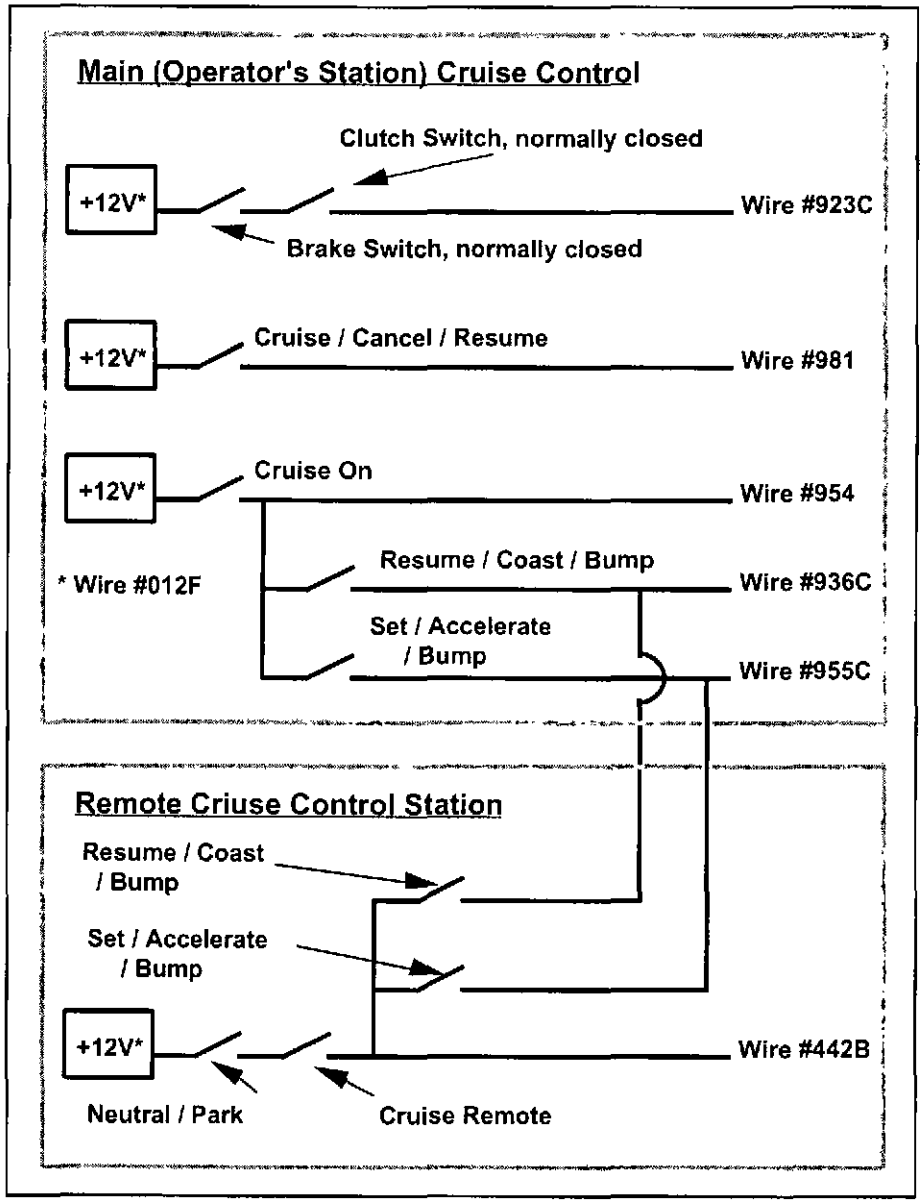


Figure AG-14 - 14, Cruise Control Wiring Diagram

The cruise control wires shown on the previous diagram (including switched battery power, Wire #012F) are accessed through the unterminated wire bundle in the engine wiring harness. For details of each wire and feature, refer to the following individual wire instructions

Cruise On - Wire #954 (yellow)

The Cruise Control at the operators station can be turned "ON" by supplying system voltage (Wire #012F, red) to the Cruise On Wire #954.

Two other conditions must exist for the Cruise Control function to be active. The Cruise Brake Enable - Wire #923C must also be connected to the positive system voltage lead (Wire #012F, red); and on 12-volt systems, the Cruise Remote - Wire #422B must be unpowered (i.e., turned "off").

Power for the Wire #936C and Wire #955C should come from Wire #954 as shown in Figure 124A-14. See the following sections on the functions of Wire #936C and Wire #955C

Cruise Resume / Coast / Bump Speed Down - Wire #936C (light blue)

At the main cruise control station, a momentary contact switch should be connected from Wire #936C to Wire #954. When the Cruise Control is "ON", a momentary contact on this circuit will return the engine speed to it's previous set speed. When contact is maintained, the engine speed set point will slowly decrease. The Cruise Resume / Coast / Bump Speed Down function has a ramped speed adjustment rate. The engine speed will decrease faster the longer the contact is held "ON".

At the remote cruise control station (if used), a momentary contact switch should be connected from Resume / Coast / Bump-down Wire (#936C) to Wire #442B.

Cruise Brake Enable - Wire #923C (orange)

The Cruise Brake Enable - Wire #923C should be connected to system voltage (Wire #012F, red) through a normally closed switch on the vehicle brake system. When the brakes are engaged, the circuit will be broken and the cruise control will disconnect but will retain the engine set speed in memory. For a transmission with a clutch, normally closed clutch and brake switches in series should be used.

The Cruise Brake Enable circuit (Wire #923C) disconnects both the main cruise controls in the operators station, and the remote cruise control station, if used.

Cruise Set / Accelerate / Bump Speed Up - Wire #955C (dark green)

At the main cruise control station, a momentary contact switch should be connected from Wire #955C to Wire #923C. When the Cruise Control is "ON", a momentary contact on this circuit will set the engine speed in memory. When contact is maintained, the engine speed set point will slowly increase. The Cruise Set / Accelerate / Bump Speed Up function has a ramped speed adjustment rate. The engine speed will increase faster the longer the contact is held "ON".

At the remote cruise control station (if used), a momentary contact switch should be connected from the Set / Accelerate / Bump Up Wire (#955C) to Wire #422B.

Cruise Cancel/Resume - Wire #981 (brown)

The Cruise Cancel/Resume Wire (#981) is connected to battery voltage (Wire #012F, red) with a momentary contact switch. A high quality switch with gold contacts should be used.

The Cancel/Resume function is active for one minute while the operator turns around the vehicle. If the Cancel/Resume contact is not made, the engine reverts to normal Cruise Control (i.e., resuming speed requires using the "Resume" switch).

Cruise Cancel/Resume will not resume at engine speeds below 1300 RPM

The cruise Cancel/Resume function does not operate when Cruise Remote - Wire #422B is active.

12-volt Cruise Remote - Wire #422B (red)

For a 12-volt ECU only: On ECU's with cruise control, Wire #422B is used to turn a second cruise control station on and off. This is intended for use where a remote engine speed adjustment is needed, such as at an external PTO location. When Wire #422B is connected to +12 volts (Wire #012F, red), the second cruise control station is switched on. When Wire #422B is turned "off" (no voltage, open circuit) the second cruise control station is switched off. The primary (dashboard) cruise control must be turned off for the second station to be used. If the ECU detects that two Cruise Control stations are "ON", the Cruise Control will not function.

The remote cruise control feature is not available on 24-volt systems. Wire #422B functions as the "24-volt start" wire in 24-volt systems. Refer to the "System Power and Ground" wiring section for details.

- **SECONDARY ANALOG THROTTLE POTENTIOMETER**

A second 3-pin male Weather-Pack throttle connector is provided on the Engine wiring harness for installations where two analog throttles are needed. The Adjustable 2-State throttle must be set in the "Low Speed" position for either analog throttle to work. The "Secondary" analog throttle can be used with or without the "Primary" analog throttle installed.

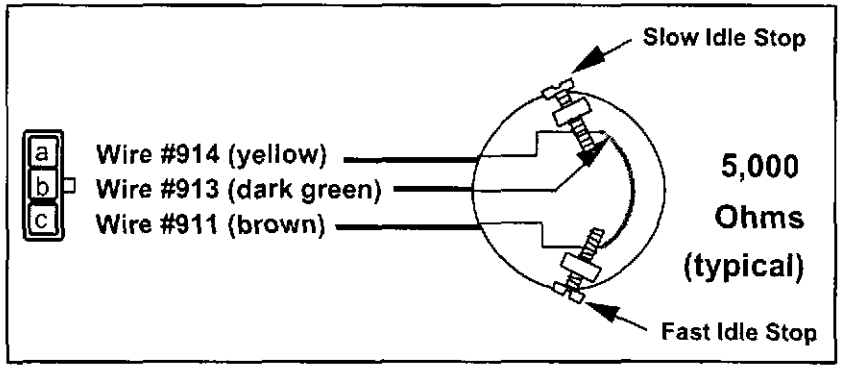


Figure AG-14 - 15, Secondary Analog Throttle Potentiometer

The second analog throttle feature is intended for use when a foot throttle and a hand throttle must both be provided. It can also be used when two throttle inputs are operated by the same lever or pedal for back-up purposes. When both analog throttles are used, the throttle signals will be additive, up to the factory preset fast idle setting or the maximum speed set with the Adjustable 2-State Throttle. There will be no "dead band" in either throttle. When you move the foot throttle, speed will immediately increase regardless of where the hand throttle is set.

The secondary analog throttle feature is not intended for use with two throttles located remotely from each other. Because the throttle signal is additive, if either throttle is at the full speed position, the other throttle will have no control. Both throttles must be in the slow idle position for the engine to operate at slow idle.

For remote throttle applications, we suggest the use of the cruise control feature instead of the secondary throttle.

If used, the Secondary Analog Throttle must be wired and adjusted exactly the same as the primary analog throttle. It can be used with the RE69667 potentiometer throttle or any similar unit.

Unlike the primary throttle, if the secondary throttle is not used, the special RE503681 throttle emulator is not required. To install a secondary analog throttle, unplug the dust cap provided with the wiring harness, and plug the throttle into the same connector. If a secondary throttle is not used, the dust cap should be left in place.

- **AUXILIARY FAULT LAMP**

Wire #916 (light blue) switches a customer supplied fault lamp on during a system fault condition. It is designed to operate the ground side of a 12-volt or 24-volt indicator light. Wire #916 should be connected to the ground terminal of a 12-volt or 24-volt light bulb socket. The positive terminal of the light bulb socket should be connected to positive system voltage (Wire #012F, red). The fault lamp will "blink" when a "Warnings" problem is detected by the ECU. "Warnings" include lower than normal oil pressure, higher than normal coolant temperatures, higher than normal charge air temperatures, or power derates. The fault lamp will be continuously "ON" when a "Shutdown" problem is detected. "Shutdown" problems include extremely low oil pressure, extremely high coolant temperatures, and loss of coolant. On ECU's with shutdown enabled, a solid "ON" fault lamp indicates that the engine will shutdown within 30 seconds.

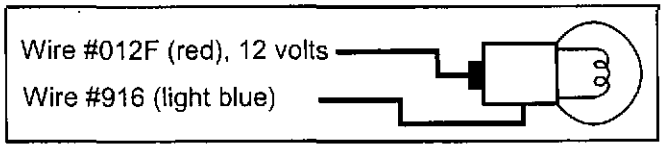


Figure AG-14 - 16, Auxiliary Fault Lamp Wiring

This circuit will support a maximum current of 100 mA. It should not be used to drive any load larger than a 1-Watt bulb. For driving larger loads, such as audible alarms, we recommend installing the RE162427 alarm module that plugs into the databus module in the instrument panel. It includes a relay for additional loads up to 0.5 Amps at 125 volts AC, 1 Amp at 12-24 volts DC, or 62.5 VA, 30 Watts max.

Wires #916 and #012F can be found in the unterminated wire bundle. Connecting this circuit is not required unless you want an auxiliary fault lamp. The RE68155 Diagnostic gauge already has amber and red "Warning" and "Stop Engine" lamps built in.

- **EXTERNAL DERATE / SHUTDOWN INPUT**

Wire #941C is provided in the unterminated wire bundle to allow the OEM to trigger the engine warning, derate, and shutdown sequence from external switches, such as a loss of prime switch, hydraulic overtemperature switch, or low coolant level switch. Any number of normally open switches that switch to ground to trigger the warning/derate/shutdown sequence can be added in parallel.

When Wire #941C is open (not grounded), the engine will operate normally. When Wire #941C is switched to ground, the ECU will turn on a solid fault lamp. It may also activate a derate/shutdown sequence, depending on which ECU you have specified:

1. **For ECUs without the "Engine Protection" feature enabled:** The ECU will not derate the engine or shut it down. It is up to the operator to shut down the engine and resolve the problem.

2. **For ECUs with the "Engine Protection" feature enabled:** The ECU will reduce engine power at the rate of 1% per second for a maximum reduction of 60% (40% of normal power remaining), but it will not shut the engine down. It is up to the operator to shut down the engine and resolve the problem.

3. **For ECUs with the "Engine Protection and Shutdown" feature enabled:** The engine will reduce engine power at the rate of 1% per second for 30 seconds. At 30 seconds, the engine will automatically shut down.

If Wire #941C returns to an open circuit condition within the 30-second delay period, the engine will resume original power (rising at a rate of 1% per second), and the engine will not shut off. The fault lamp will continue to flash until the power returns to normal, then it will shut off.

Note: The engine will not shut down immediately when Wire #941C is grounded, so it should not be used if an immediate shutdown is required. If an immediate shutdown is required, a separate magnetic shutdown switch should be added to Wire #002C in the engine wiring harness to break *the connection to the battery*.

The cylinder head temperature switch is connected in parallel with Wire #941C, so a loss of coolant will trigger the same warning/derate/shutdown sequence as an external switch. This should not effect the operation of Wire #941C during normal use, but if the engine shuts down due to the signal on Wire #941C, it could be either from an external switch or from the cylinder head temperature switch.

CONTROLLER AREA NETWORK (CAN)

The CAN bus is a high speed open interconnect network for electronic systems on on-highway and off-road vehicles and stationary equipment. It allows electronic systems to communicate with each other through a standard architecture of electronic signals over shielded twisted pair wires. Engines can communicate with throttles, transmissions and brakes, vehicles can communicate with trailers, agricultural and construction equipment can communicate with implements and accessories, stationary equipment can communicate with controllers or other networked equipment. Information on the network can be displayed to the operator on a Virtual Terminal (instrument panel) or relayed to another location via telemetry. Up to 30 Electronic Control Units or modules can be connected together through a single CAN network segment.

A CAN connection (SAE J1939) is provided in two different locations on the Engine wiring harness. A round Deutsch 9-pin connector is provided primarily for service/diagnostic purposes. A Deutsch 3-pin wedge connector, intended for customer computer interface, has also been provided.

The pins in the Deutsch connectors are:

Deutsch 9- pin round Connector Pin	**Function**
Pin A, Wire #050D (black)	Ground
Pin B, Wire #012B (red)	Power Supply (+12 or +24 volts)
Pin C, Wire #904D (yellow)	CAN_H
Pin D, Wire #905D (dark green)	CAN_L
Pin E, Wire #020D (black)	Shield
Pins F through J	Spare (unused)

Deutsch 3-pin wedge Connector Pin	**Function**
Pin A, Wire #904A (yellow)	CAN_H
Pin B, Wire #905A (dark green)	CAN_L
Pin C, Wire #020A (black)	Shield

Standard CAN bus messages are listed in the Component Technical Manual. Special CAN messages are required for use with electronically controlled Allison transmissions.

For details on how to use this system, refer to SAE J1939/11 published by the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale PA 15097-0001.

PROVIDING YOUR OWN INSTRUMENT PANEL

If you choose not to use the RE162429 instrument panel, you will have to provide your own ignition switch, fuse holder, throttle device, wiring harness, diagnostic gauge, and any other instrumentation and controls you need.

You can design your own instrumentation and controls wiring harness, or you can adapt to the RE505259 wiring harness and RE162450 databus module used on the RE162429 panel.

Using The RE505259 Instrument Panel Harness and RE162450 Databus Module

To adapt the RE505259 Instrument panel harness and RE162450 databus module, refer to the following diagram, and to the notes following the diagram. The wire numbers shown on the diagram are printed on each wire.

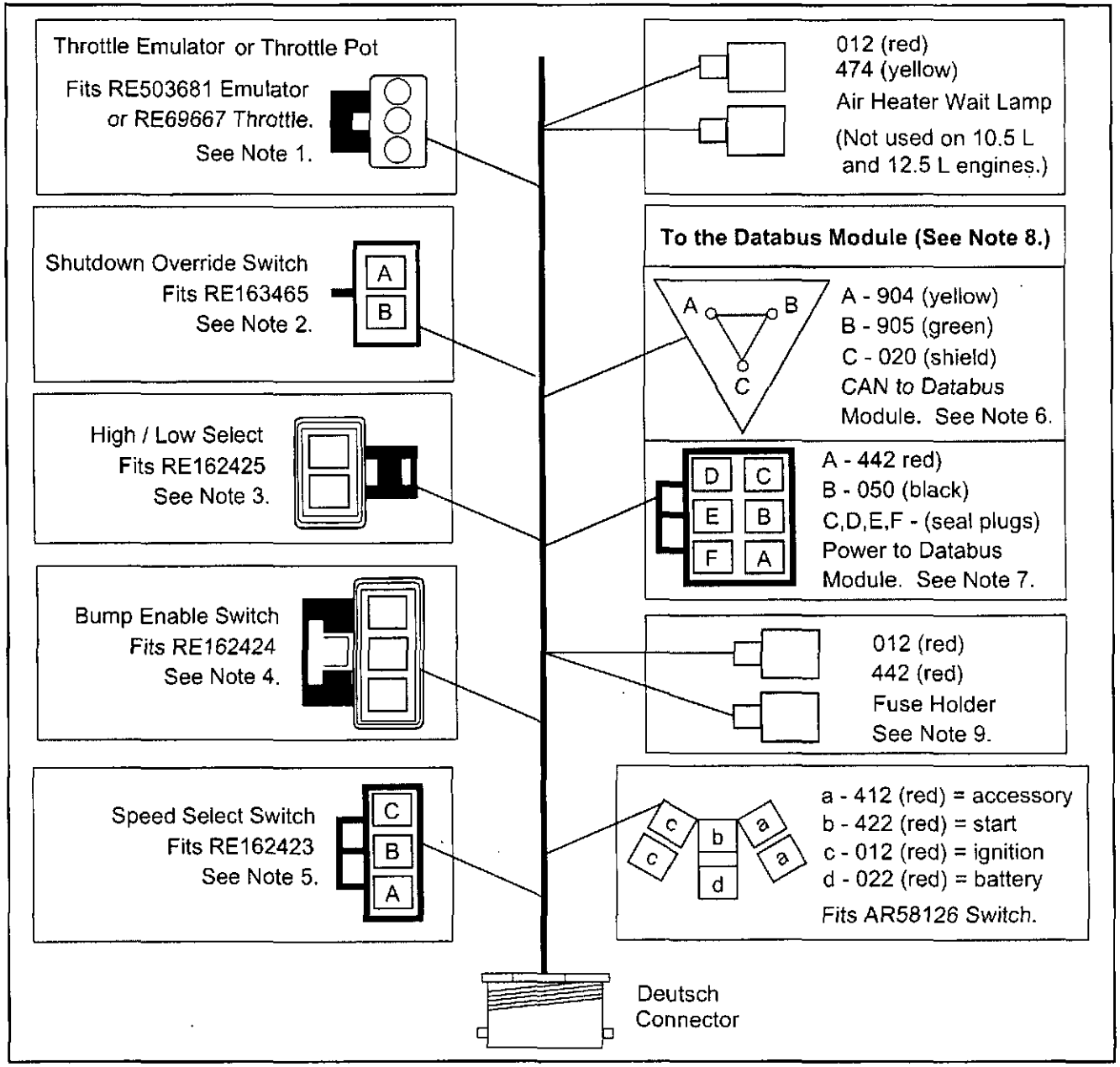
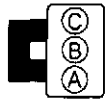


Figure AG-14 - 17, RE505259 Instrument Panel Harness

1. **Analog Throttle Potentiometer**
The RE69667 analog throttle is a customer installed option. The standard panel has a RE503681 throttle emulator installed to properly terminate the throttle inputs of the ECU. RE503681 is a resistor network that places the analog throttle input in the active area of its operating range. The harness connection is a Packard Weather-Pack 3-cavity, female connector, #12020829, with male terminals, #12124582, and cable seals installed. Note that these are the opposite terminals usually used with this connector.

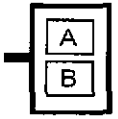


Pin	Circuit	Color	Size	Destination
C	911	Brown	18 AWG	to Pin "M" on Deutsch Connector
B	913	Orange	18 AWG	to Pin "L" on Deutsch Connector
A	914	Yellow	18 AWG	to Pin "C" on Deutsch Connector

Figure AG-14 - 18, Analog Throttle Potentiometer Pin Connectors

See previous sections for analog throttle functional details.

2. **Shutdown Override Switch**
The shutdown override switch is a single-pole, single-throw, normally-open, momentary rocker switch used to temporarily override an engine shutdown. The harness connection is a Packard Metri-Pack 150 Series two cavity male connector, #12162000 with #12045773 sealed male terminals, cable seals and a #12052634 TPA or secondary lock.



Pin	Size	Destination
A	18 AWG	to Pin "N" on 21-Pin Connector
B	18 AWG	to Pin "P" on 21-Pin Connector

Figure AG-14 - 19, Shutdown Override Switch Pin Connectors

On Engine ECU's with the Engine Protection Shutdown feature active, the Engine Protection shutdowns can be overridden for 30 seconds at a time. This can be used to move a vehicle to a safe location.

The Shutdown Override is activated when pin A (Wire #464) is connected to pin B (Wire #918). For ECUs with the Engine Protection Shutdown feature active, the 2-pin connector should be connected to a normally open momentary switch. A special RE163465 push button assembly is available from John Deere for this purpose that plugs directly into the shutdown override connector.

If the circuit is open (button not pushed), the engine will shutdown 30 seconds after an automatic shutdown sequence starts. Each time the circuit is completed (button pushed), the shutdown timer is reset to a full 30 seconds and the engine will run in a derated power mode. Repeated connection of the Shutdown Override circuit each 30 seconds will allow for continued engine operation.

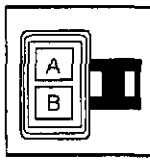
Note: Holding the Shutdown Override continuously "ON" will not reset the 30 second timer.

Manually shutting down the engine and turning power "off" to the ECU will reset the ECU. Using the Shutdown Override is not required on engine starts or restarts if the ECU power has been turned "off".

On Engine ECU's that do not have the shutdown feature active, the Shutdown Override is disabled.

3. **High/Low Speed Select**
The RE162425 high/low speed selector switch is part of the Adjustable 2-State Throttle. The RE162425 switch is a single-pole, double-throw switch used to select between high idle and low idle.

The mating connector to this switch is a Packard Metri-Pack 150 Series two-cavity female connector, #12052641, with #12048074 sealed female terminals, cable seals and a #12052634 TPA or secondary lock.



Pin	Circuit	Color	Size	Destination
A	914	Yellow	18 AWG	to Pin "S" on Deutsch Connector
B	947	Violet	18 AWG	to Pin "R" on Deutsch Connector

Figure AG-14 - 20, High/Low Speed Select Pin Connectors

The switch contains two resistors, 390 Ohm and 1.3K Ohm. When in the slow idle position, the 390-Ohm resistor is placed in the circuit and when in the high idle position, the 1.3k-Ohm resistor is placed in the circuit.

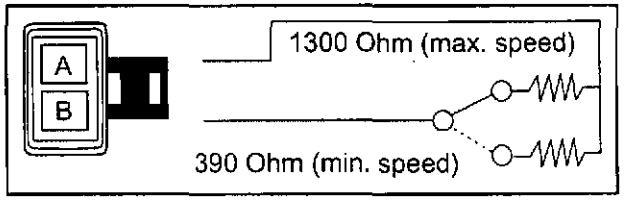


Figure AG-14 - 21, High/Low Speed Select Resistor Wiring

This connector cannot be left open on ECUs equipped with the adjustable 2-state throttle. If the 2-state toggle-switch throttle is not used, one of the two following things must be done:

1. For continuous operation at the factory preset rated speed, with no ability to operate at low idle or any other reduced speed, a 1300-Ohm resistor can be permanently wired between Wires #947 and #914.

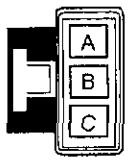
2. For use with an analog throttle potentiometer without a 2-state toggle-switch throttle, a 390-Ohm resistor should be permanently wired between Wires #947 and #914.

   The adjustable 2-state throttle is not active in ECUs equipped with cruise control, so this terminal need not be connected on cruise control ECUs.

4. **Bump Enable Switch**
The bump enable switch is used in conjunction with the speed select switch (see note 5, below) to adjust minimum and maximum operating speed. The bump enable switch enables the speed select switch to be read by the ECU. To adjust the minimum or maximum operating speed, the bump enable switch and speed select switch must be operated simultaneously. This prevents unexpected operating speed changes in the event of a failure of the speed select circuit.

As a convenience for the operator, the RE162424 bump enable switch used in the RE162429 Instrument Panel has two enabling positions, up or down, with the center off. The switch is a single-pole, double-throw, momentary with a detented center off position. Both active positions are wired to connect the same two-wire circuit when pressed.

The mating connector on the RE505259 instrument panel harness for this switch is shown below. It is a Packard Metri-Pack 150 Series three-cavity female connector, #12110293, with #12048074 sealed female terminals, #12048086 cable seals, and #12052845 TPA or secondary locks. The unused cavity has a #12059168 cavity plug installed.

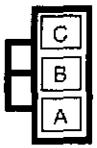


Pin	Circuit	Color	Size	Destination
A	923	Orange	18 AWG	to Pin "X" on Deutsch Connector
B	012	Red	18 AWG	to IGN circuit from key switch
C		Cavity Plug		Unused

Figure AG-14 - 22, Bump Enable Switch Pin Connectors

5. **Speed Select Switch**
The speed select switch, also known as the bump switch, is used to increment and decrement the minimum and maximum operating speeds. It must be used with the bump enable switch (see note 4, above).

The mating connector on the RE505259 instrument panel harness for this switch is shown below. It is a Packard Metri-Pack 150 Series three-cavity male connector, #12129615, with #12045773 sealed male terminals, #12048086 cable seals, and #12052845 TPA or secondary locks.



Pin	Circuit	Color	Size	Destination
C	936	Blue	18 AWG	to Pin "T" on Deutsch Connector
B	012	Red	18 AWG	to IGN circuit from key switch
A	955	Green	18 AWG	to Pin "W" on Deutsch Connector

Figure AG-14 - 23, Speed Select Switch Pin Connectors

The RE162423 speed select switch used in the RE162429 Instrument Panel is a single-pole, double-throw, momentary switch with a detented center off position, wired as follows.

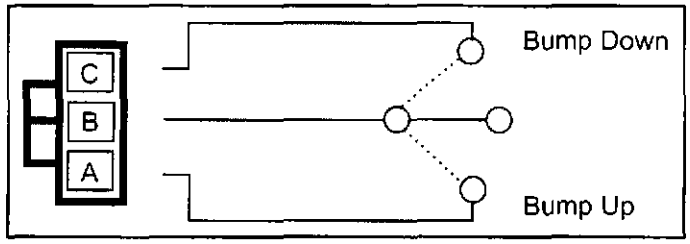


Figure AG-14 - 24, Speed Select Switch Wiring

When the bump enable switch is closed, and the speed select switch is momentarily moved to the "bump up" position, the operating speed will go up slightly. If the speed select switch is momentarily moved to the "bump down" position, the operating speed will go down slightly. Maximum operating speed will be adjusted if the high/low speed select switch is in the "High" position. Minimum operating speed will be adjusted if the high/low speed select switch is in the "Low" position.

Both preset speeds (high and low) will be remembered, even if the ignition is turned off. If the ECU is ever disconnected from battery power, the maximum high and low speeds will be reset to the factory fast and slow idle speeds, and will have to be reset if desired.

If the adjustable 2-state toggle-switch throttle is not used, nothing needs to be plugged in to this connector

6. CAN Connection to RE162450 Databus Module

The CAN connection to the databus module is made through SAE J1939 compatible shielded, twisted-pair cable. The mating connector on the RE505259 instrument panel harness for the databus CAN connection is a Deutsch DT06-3S-E003 connector with W3S-1939 secondary locking wedge, as shown below. It plugs in to the databus as shown. The shield is attached to black wires at each end for proper termination in the connectors.

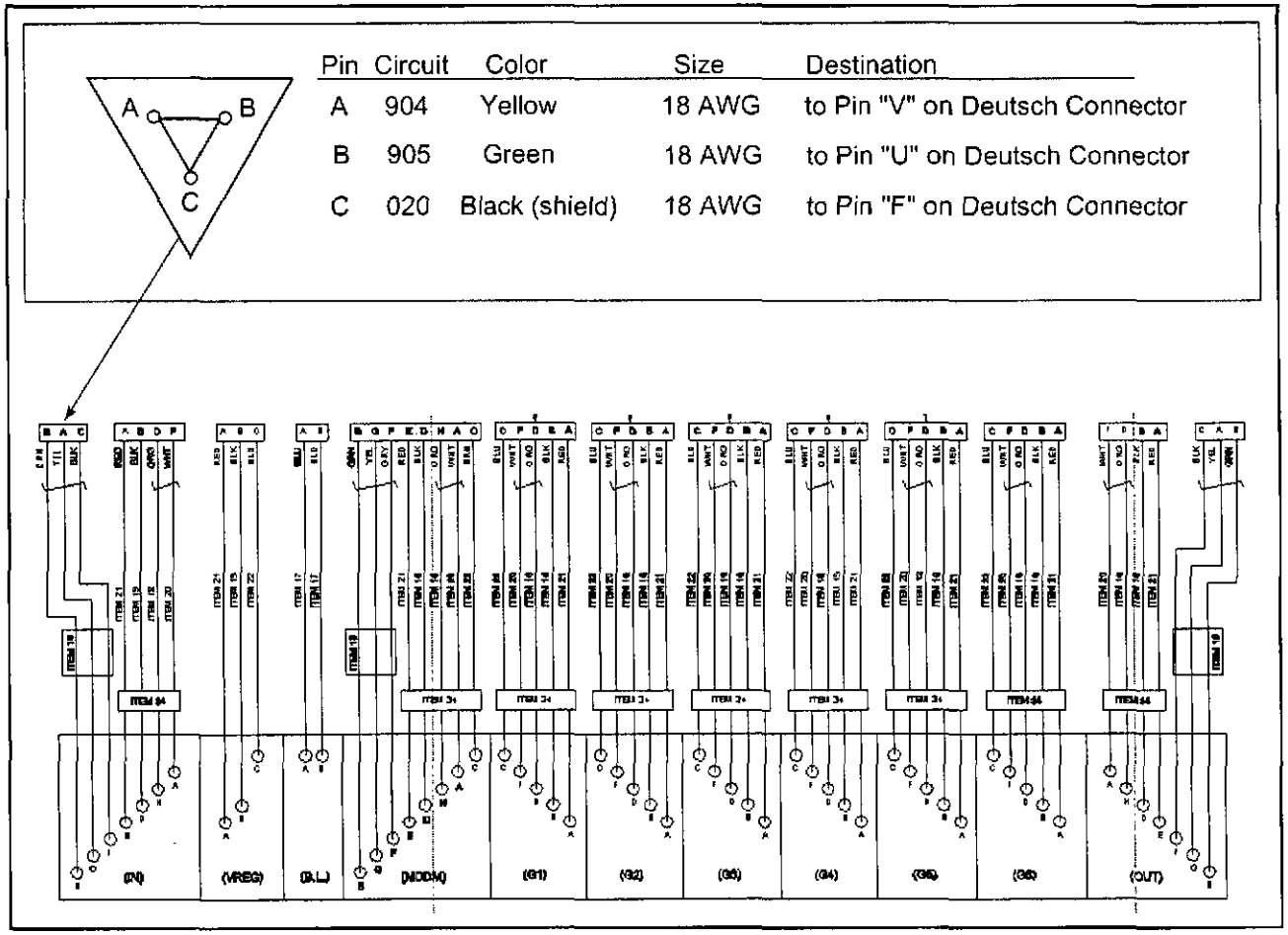


Figure AG-14 - 25, CAN Connectors

7. Power Connection to the Databus Module

Power is provided to the databus module through a Packard Metri-Pack 150 Series 6-cavity male connector, #12124107, with #12045773 sealed male terminals, #12048086 cable seals, and #12052845 TPA or secondary locks on the RE505259 instrument panel harness. The unused cavities are plugged with #12059168 cavity plugs. The connector on the instrument panel harness is shown below. It plugs in to the databus as shown.

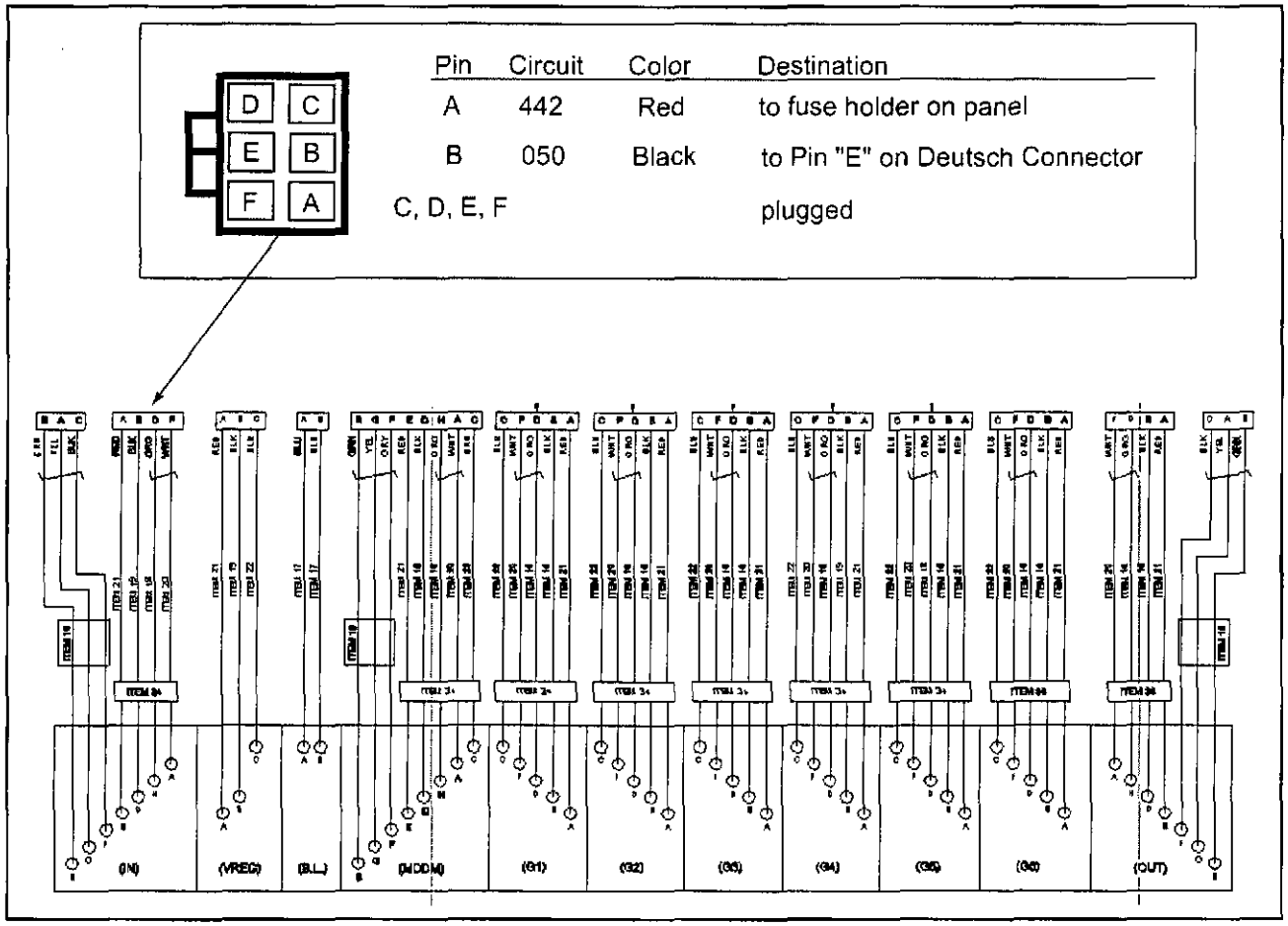


Figure AG-14 - 26, Power Connection to the Databus Module

8. Diagnostic Gauge Connection to the Databus Module

The main purpose of the databus module is to provide wiring for the Diagnostic gauge and up to six auxiliary analog gauges (tach, oil pressure, etc.) with backlighting and dimmer controls. Details of how to use the databus module are covered in several previous sections. The only thing not covered has been the location of the RE68155 diagnostic gauge, which plugs into the 8-pin connector as shown below. The last two connectors on the right are used for bus termination, or to connect a complete auxiliary (flybridge) instrument panel in marine applications. The connector on the far right carries the CAN signal. When the auxiliary panel is not used, a terminator cap with a 120 Ohm resistor must be installed on both the CAN signal connector, and the analog auxiliary gauge connector, as shown below. The special terminator caps with resistors come with the databus module.

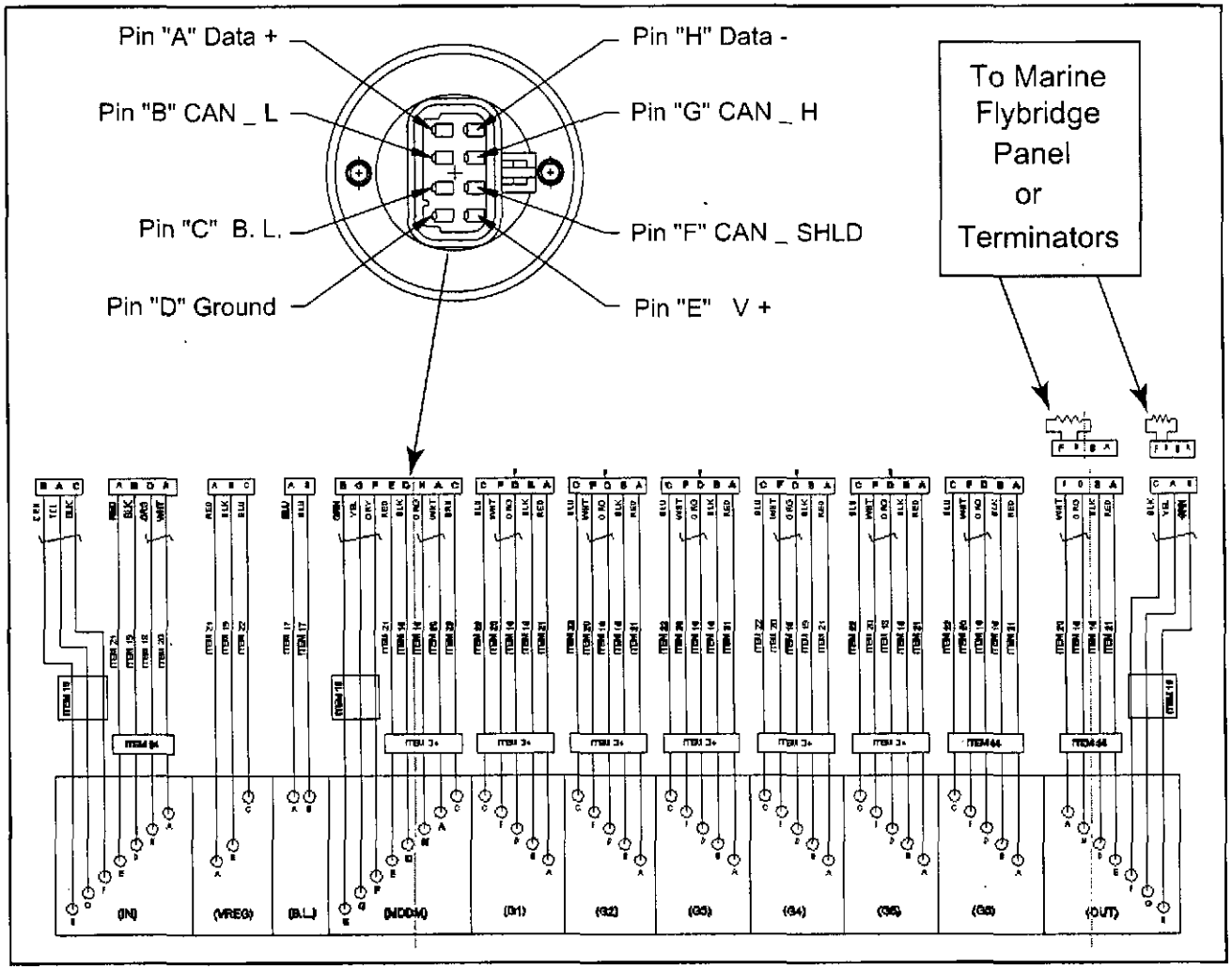
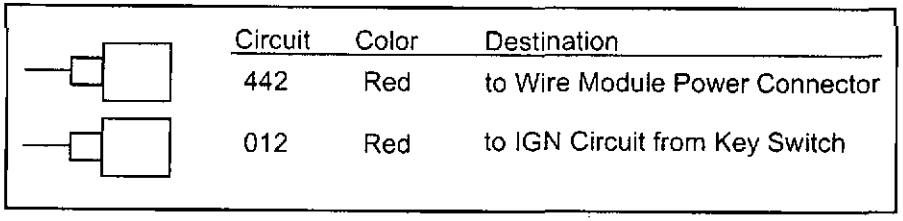


Figure AG-14 - 27, Diagnostic Gauge Connection to the Databus Module

9. Fuse Holder

The panel mounted fuse holder connects with two 0.25" insulated female, solderless disconnect terminals, similar to Amp #42844-1. Connect one wire to IGN, circuit 012, from the key switch and the other wire to Pin A, circuit 442, of the Packard connector described in Note 7 above.



Circuit	Color	Destination
442	Red	to Wire Module Power Connector
012	Red	to IGN Circuit from Key Switch

Figure AG-14 - 28, Fuse Holder Connectors

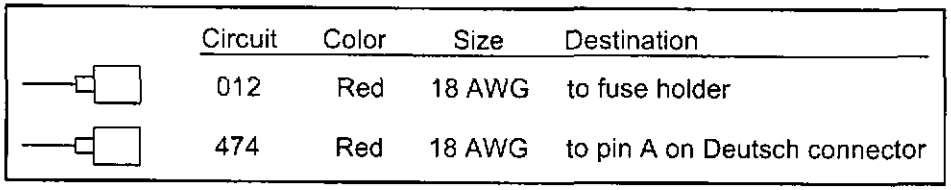
These connectors are designed to fit the AE21116 fuse socket. Any fuse socket with 1/4" male blade connectors can be used. A 5-Amp fuse with the following characteristics (per SAE J1284) must be used:

Rating	Blow time
110%	100 hours, minimum
135%	1500 seconds, maximum
200%	5 seconds, maximum
350%	0.08 seconds, minimum

Table AG-14 - 02, Fuse Characteristics (per SAE J1284)

10. Intake Air Heater Wait Lamp

A plugged mounting hole is provided for the RE67334 heat lamp assembly. The lamp socket connects with two 0.187" insulated female, solderless disconnect terminals, similar to Amp #640919-1. Connect one wire to IGN, circuit 012, from the key switch and the other wire to Pin A, circuit 474, of the Deutsch connector.



Circuit	Color	Size	Destination
012	Red	18 AWG	to fuse holder
474	Red	18 AWG	to pin A on Deutsch connector

Figure AG-14 - 29, Intake Air Heater Wait Lamp Connectors

MAKING YOUR OWN INSTRUMENATION AND CONTROLS WIRING HARNESS

A 21-pin Deutsch connector is provided on the Engine wiring harness that comes with the engine to interface with your instrumentation and controls. To make your own instrumentation and control wiring harness, refer to the above sections on individual component wiring and function, and to the following chart on the 21-pin Deutsch connector.

Instrument Panel Connector Pin Assignments			
Pin	**Wire**	**Description**	**Used On**
A	474	Intake heater wait lamp	To ground side of intake air heater wait lamp
B	022C	Battery power	To "B" terminal of your ignition switch
C	914B	Sensor return	To the primary analog throttle potentiometer or emulator
D	422	Starter relay	To "Start" terminal on your ignition switch
E	050D	Ground	Grounded to the battery and ECU. Use for any non-sensor ground (lights, gauge power, etc)
F	020C	CAN shield	To any CAN connectors including the diagnostic gauge
G	012B	Battery power to ECU (switched)	Must be wired to the "Ignition" terminal of key switch.
H	N/A	N/A	This pin is not currently used
J	412	Alternator ignition	Should be wired to the "Accessory" terminal of a two pole ignition switch. Must not be wired directly to the same switch terminal as Wire #012B (power to ECU). If a single pole ignition switch is used, a diode is required in the circuit (refer to the Electrical section of DSEG01 for single pole ignition switch wiring requirements).
K	N/A	N/A	This pin is not currently used
L	915	Primary analog throttle input voltage	To center (sensing) terminal of the primary analog throttle potentiometer (or throttle emulator)
M	911B	+5 Volts (sensor power)	To the throttle potentiometer
N	918	Shutdown override return	To shutdown override switch
P	464B	Shutdown override	To shutdown override switch
R	947	High/Low speed select	To the High/Low speed select switch
S	414B	High/Low speed return	To the High/Low speed select switch
T	936	Resume / Coast / Bump Speed Down	To the 2-state throttle speed select switch and/or the cruise control resume/coast switch
U	905C	CAN low	To the 9 and 3 pin CAN connectors, Diagnostic gauge and/or Instrument panel databus module
V	904C	CAN high	To the 9 and 3 pin CAN connectors, Diagnostic gauge and/or Instrument panel databus module
W	955	Set / Accelerate / Bump Speed Up	To the 2-state throttle speed select switch and/or the cruise control set/accelerate switch
X	923	Bump enable and brake enable	To the cruise brake enable switch and/or 2-state throttle bump enable switch

Table AG-14 - 03, Pin Connector Assignments for "Make-Your-Own" Instrument Panel

To connect your instrumentation and controls to the 21-pin Deutsch connector on the Engine wiring harness, refer to the illustration below, and the above

To connect your instrumentation and controls to the 21-pin Deutsch connector on the Engine wiring harness, refer to the illustration below, and the above sections on individual component wiring and function. Your wiring harness will need a Deutsch (part number - HDP-24-24-21PE) 21-pin connector mounted with a 112263-90 nut and 112264 washer.

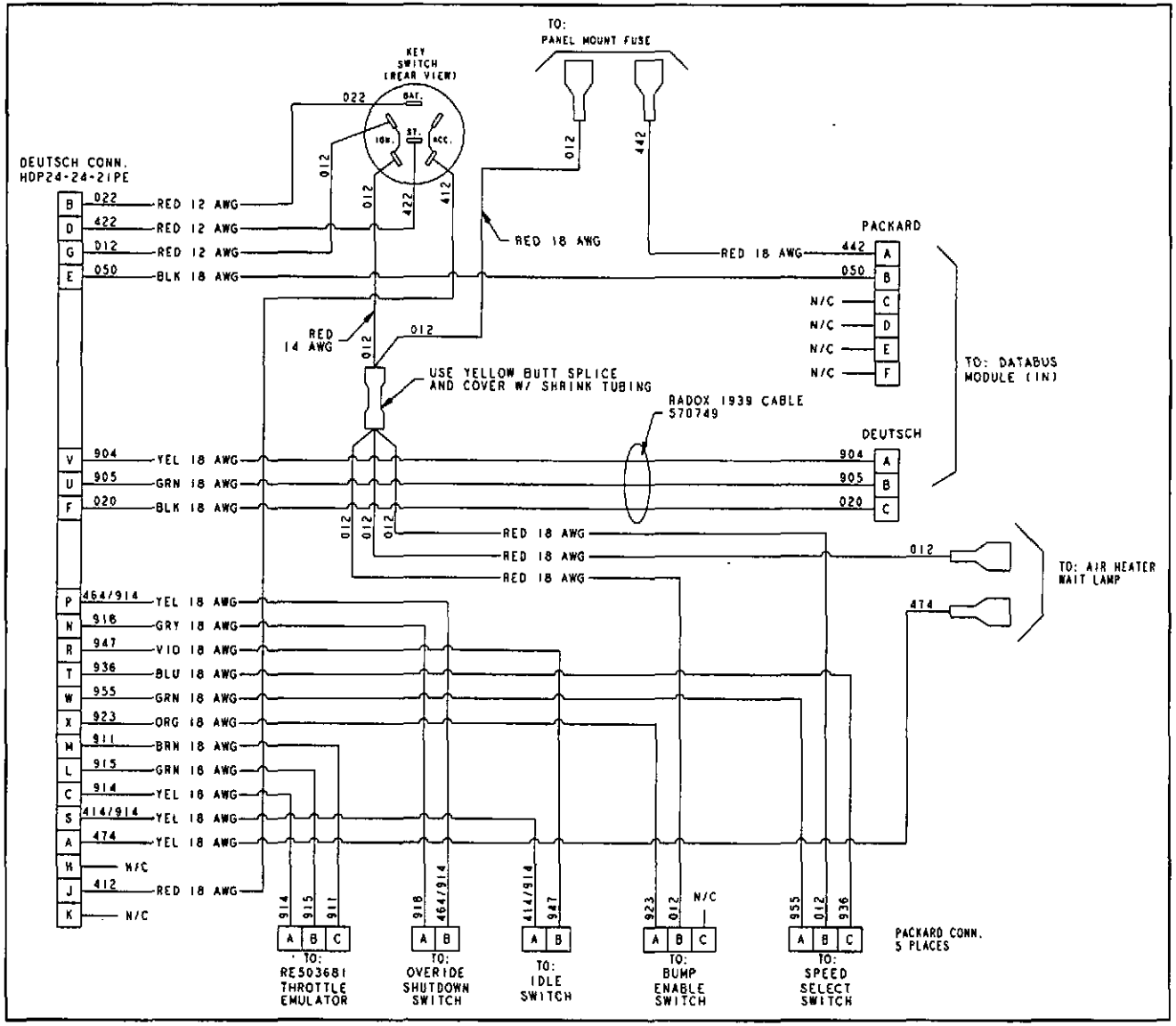


Figure AG-14 - 30, Instrumentation and Controls Connections

Using The RE68155 Diagnostic Gauge With Your Own Design Wiring Harness

To connect the RE68155 Diagnostic Gauge, we strongly recommend using the RE162450 databus module. The databus module has internal noise filters to reduce radio frequency noise picked up from the harness. If you do not use the RE162450 databus module you can wire directly to the diagnostic gauge as shown below. However, you may suffer from RF noise problems.

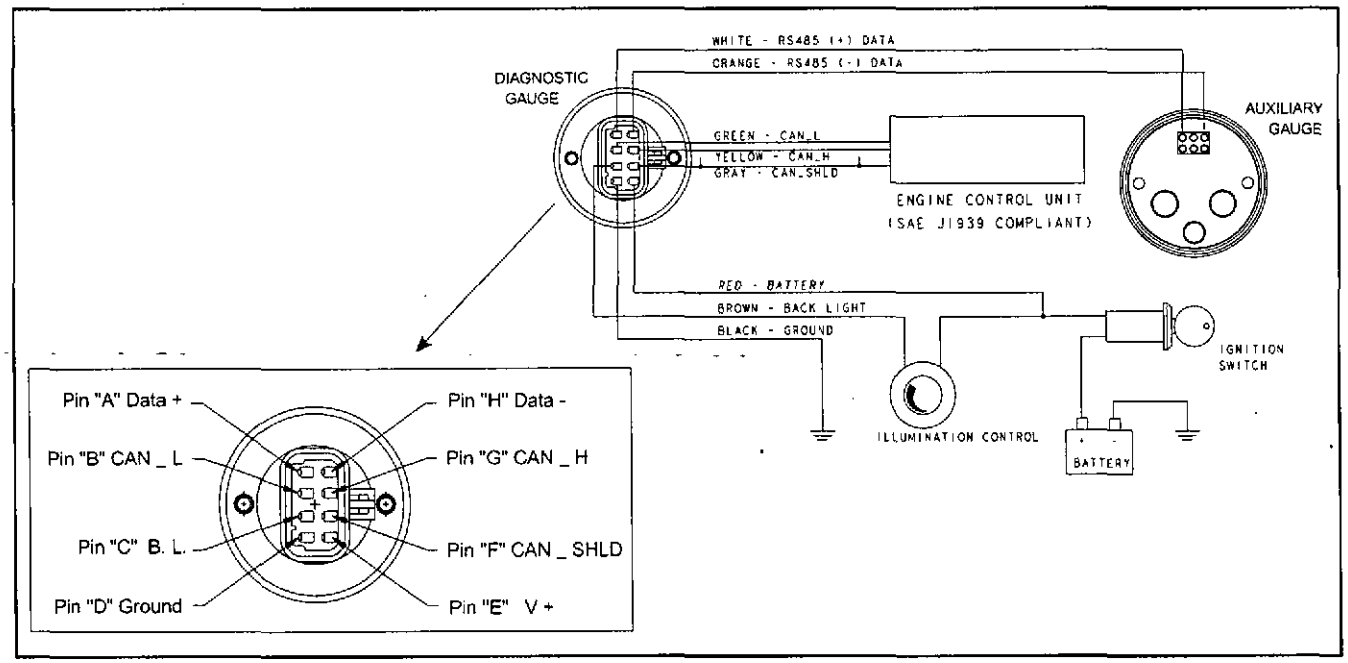


Figure AG-14 - 31, Direct Wiring to the diagnostic Gauge

Note: The above illustration does not show complete wiring for auxiliary analog gauges.

Pin "E" is the battery connection, and has an allowable voltage range of 9 to 32 volts with respect to pin "D", or ground, for proper operation.

The mating connector for the diagnostic gauge is a Packard Metri-Pack, 150 Series, 8-way female connector.

Part	Part Number
Female connector assembly	12047937
TPA	12066304
sealed terminals, 16-18 AWG(1.0-.8 sq mm)	12048074
sealed terminals, 20-22 AWG(.5-.35 sq mm)	12084200
cable seals, 2.85-2.03 mm dia	12048086
cable seals, 2.15-1.60 mm dia	12089678
cable seals, 1.70-1.29 mm dia	12048087

The terminal and cable seals should be selected for the size of wire used. All of the terminal positions on the diagnostic gauge connector are used. If the mating connector does not use a position for a particular application, each unused position should be filled with a cavity plug, part number 12059168, to ensure sealing of the entire connector assembly.

If dimming is desired, an electronic dimming switch such as RE162449 would normally be used. The dimming switch controls the voltage to the backlight circuit from full voltage (approximately 14 volts for a 12-volt system) for full brightness, to approximately 0 volts for the lowest brightness. The maximum voltage rating of RE162449 is 14.7 volts. If a 24-volt system is used, a voltage regulator such as RE162448 must be used to reduce the 24 volts to 12 volts for the backlighting circuit. The backlight system in the diagnostic gauge and the other electric gauges uses Light Emitting Diodes (LEDs). LEDs require approximately 2 volts to turn on. The voltage range for usable backlighting will be about 2 volts to 14 volts.

Using Auxiliary Analog Gauges With Your Own Design Wiring Harness

To use auxiliary analog gauges with the RE68155 diagnostic gauge, we strongly recommend using the RE162450 databus module. The databus module has internal noise filters to reduce radio frequency noise picked up from the harness. If you do not use the databus module you can wire auxiliary analog gauges directly as shown below. However, you may suffer from RF noise problems.

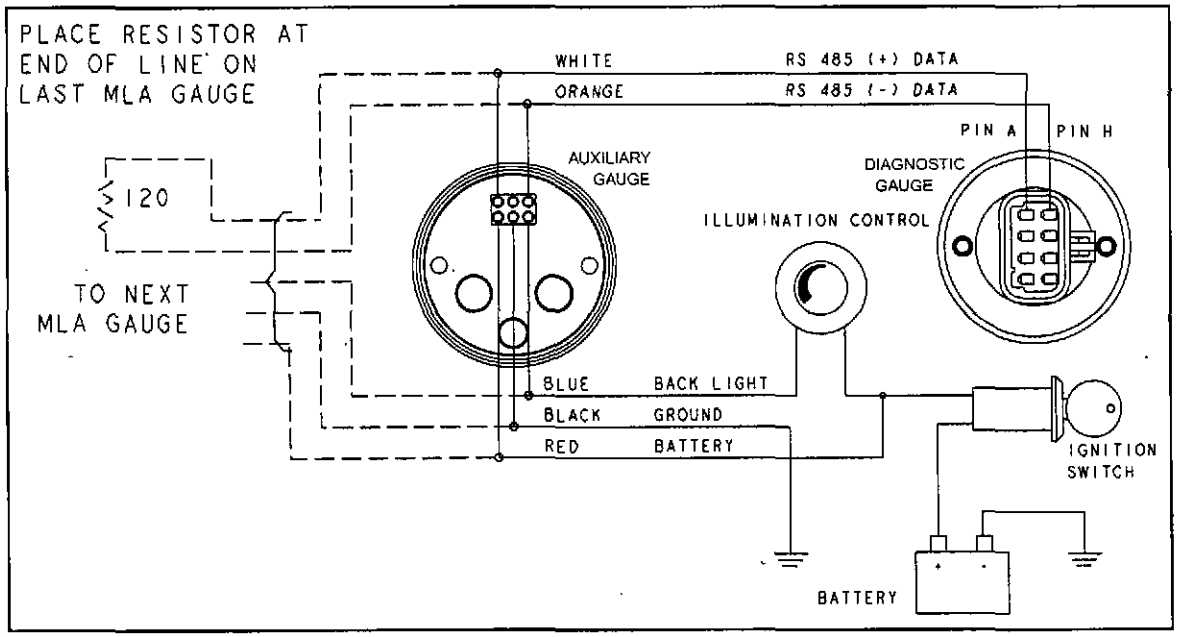


Figure AG-14 - 32, Direct Wiring of the Auxiliary Analog Gauges

A 120-Ohm resistor must be installed after the furthest auxiliary analog gauge from the diagnostic gauge, as shown. This resistor is included with the databus module.

MAKING YOUR OWN ENGINE / ECU WIRING HARNESS

This manual alone does not provide enough information to make your own engine/ECU wiring harness. To manufacture your own harness you will need this manual, a copy of the R502338 ECU wiring diagram, and the latest manufacturing drawing of the standard John Deere wiring harness for your engine. Only the specified John Deere sensors can be used. Other sensors should not be applied.

REFERENCE INFORMATION

"Metri-Pack" and "Weather Pack" connectors are products of the Packard Electronics Division of Delphi Automotive Systems.

Delphi Automotive Systems
Worldwide Headquarters,
United States & Canada Headquarters
One Pontiac Plaza
Pontiac, Michigan 48340-2952
USA
Toll Free: [1] 888.255.7179
Tel: [1] 810.857.4323
Fax: [1] 810.857.4248
web: http:\\www.delphiauto.com/electric/

Delphi Automotive Systems
Asia Pacific Headquarters
1-1-110 Tsutsujigaoka
Akishima-shi, Tokyo 196
Japan
Tel: [81] 425.49.7200
Fax: [81] 425.42.3018

Delphi Automotive Systems
European Headquarters
117 Avenues des Nations, BP 60059
Zac Paris Nord II
95972 Roissy Charles de Gaulle Cedex
France
Tel: [33] 1.4990.4990
Fax: [33] 1.4990.4950

Delphi Automotive Systems
Mexico & South American Headquarters
Av. Goiás, 1820
São Caetano do Sul
São Paulo 09550-050
Brasil
Tel: [55] 11.741.9500
Fax: [55] 11.741.9599

For information on SSAE J1939 CAN standards contact:

Society of Automotive Engineers (SAE)
400 Commonwealth Drive
Warrendale PA 15097-0001
USA
Tel: [1] 412 776-4841
Fax: [1] 412 776-5760
Email: isales@sae.org
web: http:\\www.sae.org/

Electronic Throttle Manufacturer:

Teleflex Morse Electrical Systems
(formerly Morse Controls)
6980 Professional Parkway East
Sarasota, FL 34240

Tel: 941-907-1000
Fax: 941-907-1020
web: http://www.tflx.com
Technical Support: techsupport@tflx.com

Deutsch Industrial Products Division
37140 Industrial Avenue
Hemet, CA 92545
Tel: [1] 909.765.2250
Fax: [1] 909.765.2255

Deutsch U.S. Distributor:
Ladd Industrial Sales
144 Westpark Road
Centerville, OH 45459
Toll Free: [1] 800.223.1236
Tel: [1] 513.438.0033
Fax: [1] 513.438.9755