Document Number:
XE-ELA1PM-R0A

ENGINE THROTTLE

with DISPLAY and MONITORING SYSTEM

MODEL: ELA100

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INTRODUCTION

Overview

The **ThrottleXcel** is an all-in-one instrument panel that integrates a traditional style remote hand throttle with engine monitoring and display. It offers complete remote display and engine control (as a remote throttle, the **ThrottleXcel** is not an engine governor) in a single compact unit.

The panel has a 4-digit LED display for engine RPM, three LED bar graphs that provide a constant display of the engine oil pressure, engine coolant temperature, and battery voltage. It has a message display that shows the time and date during normal operations and fault warning alarms as they occur. When selected by the operator it shows monitored information, stored data, and program options.

The **ThrottleXcel** panel has a built-in FRC **infinityPRO** remote engine throttle. This hand throttle uses optical technology with an Infrared Encoder (IRE) to detect the direction and speed of the control knob as it is rotated. There is no potentiometer, electromechanical switch, or mechanical stop. The electrical signal from the encoder is interpreted by a microprocessor and the engine RPM control signal is adjusted. This causes the engine RPM to increase or decrease proportionally to how fast the control knob is rotated. The engine RPM control signal is set at idle when power is applied to the **ThrottleXcel** regardless of the control knob position.

Engine information is input via the J1939 data bus and/or installed sensors.

Features

Always Starts From Idle RPM

Large RPM Display

Three Bi-Color LED Bar Graphs

Message Display

Visual Warning Alarms

Programmable Alarm Levels

Records Date and Time of Warning Alarm Occurrences

Records Accumulated Hours

Interlock Signal Recognition

Remote Hand Throttle with Idle Button and No Mechanical Stops

High Idle Function

Audible Alarm Buzzer (Optional)

Interconnected Multiple Panels (Optional)

Specifications

The **ThrottleXcel** is available in various models. Each model is programmed to interface with specific engines. All models provide the same functions, controls, and digital readouts.

Display Module

Supply Power:	12/24 VDC
Supply Current:	0.5 Amps
Dimensions:	4 5/8" Wide by 6 3/4" High

LED Bar Graphs

Oil Pressure:	10 - 100 PSI (10 PSI Increments)
Temperature (Engine Coolant):	130 - 240 °F (10° Increments)
Battery Voltage:	11.5 - 16 Volts (0.5 Volt Increments)

Engine Sensors

Engine Oil Pressure:	0 - 100 PSI, 1/8" NPTF
Engine Coolant Temperature:	100 - 250 °F, 1/2" - 14 NPT
Transmission Temperature:	140 - 320 °F, 1/8" NPTF

Audible Alarm Buzzer (Optional)

Voltage:	12 VDC
Volume:	96 dB

GENERAL DESCRIPTION

The **ThrottleXcel** all-in-one instrument panel with remote hand throttle is compatible with the following engines:

ELA101	Cummins IS Series
ELA102	Detroit Diesel
ELA104	Navistar
ELA105	Caterpillar
ELA106*	Ford
ELA107	Mack
ELA108	Scania
ELA109*	GMAC
ELA110	Mercedes

* **Note:** An adapter and cable assembly replaces the basic 8-pin cable when connecting the ThrottleXcel to a Ford or GMAC engine.

The **ThrottleXcel** is a remote engine display with monitoring and has a remote throttle for engine RPM control, it is not an engine governor.

Components

The information available on the J1939 data bus varies depending on the particular engine type. The sensors (if any) that need to be installed will also vary depending on the engine.

The **ThrottleXcel** consist of the following components:

Contol Module

Engine Coolant Temperature Sensor (As Necessary)

Engine Oil Pressure Sensor (As Necessary)

Audible Alarm Buzzer (Optional)

Transmission Temperature Sensor (Optional)

Cables

Contol Module

The control module is waterproof and takes up 4 5/8 by 6 3/4 inches of panel space. All controls and indicators are located on the front of the control module. (Refer to Controls and Indicators.)

Engine Coolant Temperature Sensor

The engine coolant temperature sensor is installed as necessary.

Oil Pressure Sensor

The oil pressure sensor is installed as necessary.

Audible Alarm Buzzer (Optional)

The optional buzzer is installed as required. A ground is provided at the 12-pin connector pin 6 to activate the buzzer (max current: 300mA).

Transmission Temperature Sensor (Optional)

The optional transmission fluid temperature sensor is installed as required.

Cables

There are two cables that connect to the control module. The 8-pin connector is for the remote throttle interface, the 12-pin connector is for the monitoring and display interface.

Controls and Indicators

All controls and indicators are located on the front of the control module. (Refer to Figure 1.) See Operation and Programming Sections for more information.

RPM Display

Shows the current engine RPM in bright red digits during normal operations. It is used to show error codes, fault warnings, stored data, and program features.

SILENCE Button

Pressed to suppress audio alarms. Used when accessing stored data and program features. See the Programming Section for more information.

BATTERY VOLTAGE LED Display

Shows the real time battery voltage. The LEDs are green when the voltage is within normal limits and red when it is not.

OK TO PUMP LED

This LED are on when the required interlock conditions are met and the throttle is ready to begin pump operations.

Remote Hand Throttle Control Knob

When rotated changes the engine RPM. The engine RPM increases or decreases proportionally to the speed and direction the control knob is rotated.

IDLE Button

When pressed immediately sets the engine RPM to idle. This button can be used in an emergency or for normal shut down after operations.

Message Display

The message display shows the time and date during normal operations and warning alarms as they occur. It is used when accessing stored data and program features.

TEMPERATURE LED Display

Shows real time engine coolant temperature. The LEDs are green when the temperature is within normal limits and red when it is not.

OIL PRESSURE LED Display

Shows real time engine oil pressure. The LEDs are green when the pressure is within normal limits and red when it is not.

MENU Button

Used when accessing stored data and program features.

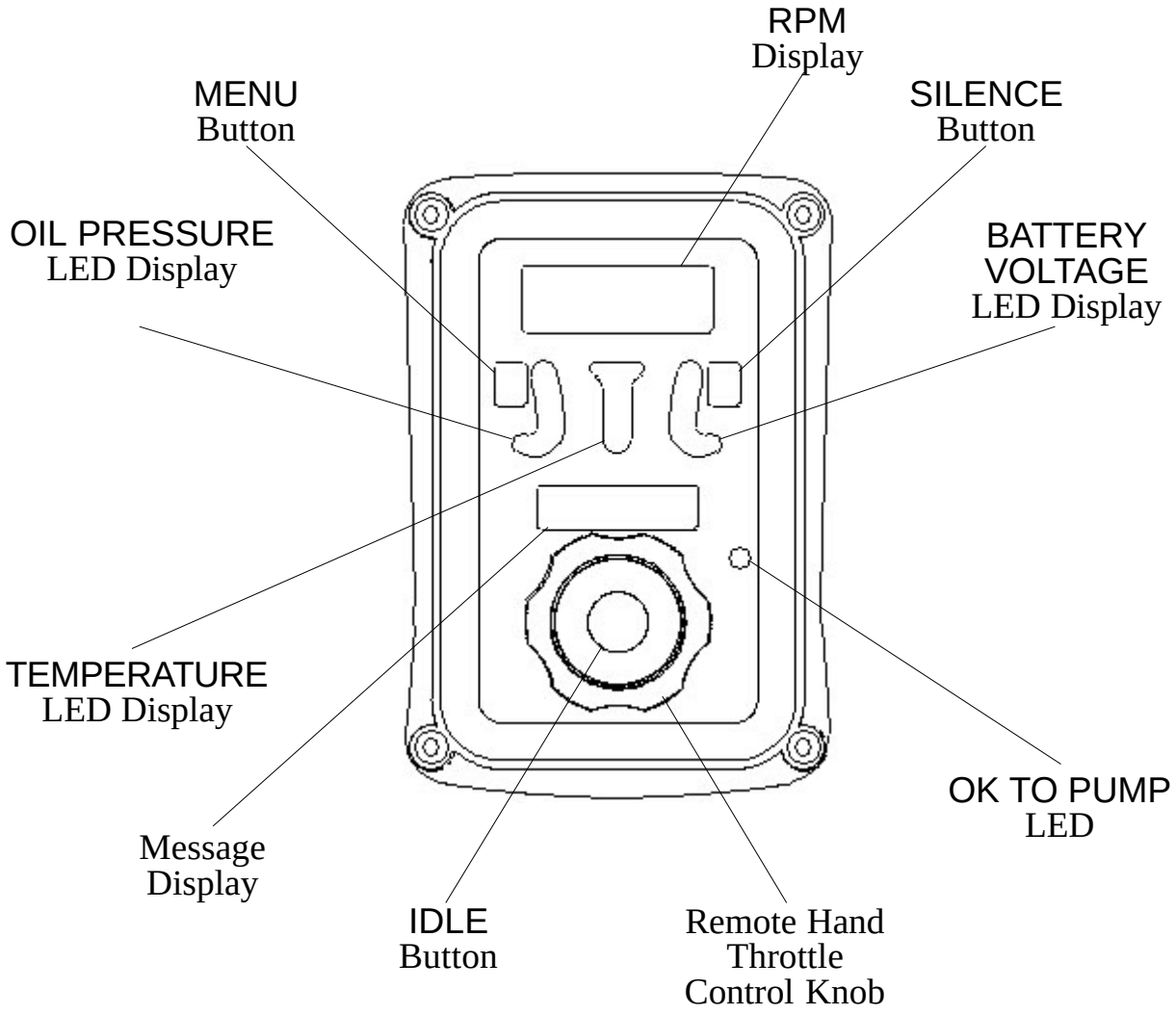


Figure 1. Controls and Indicators

INSTALLATION

Install Control Module

1. Measure and mark mounting location for control module panel cutout and mounting screw holes. Make sure there is clearance behind the panel for the module and cables before cutting holes. Refer to Figure 2 for layout and dimensions.
2. Cut out a 3 1/2 by 5 3/4 inch hole.
3. Drill four holes, clearance or tapped, for 10-32 mounting screws.
4. Place control module in position and secure with screws.
5. Connect cables at rear of the control module. (Refer to Wiring Section.)

Install Engine Sensors

For most engines, the **ThrottleXcel** receives engine RPM, oil pressure, and coolant temperature data over the J1939 databus from the engine ECM. Some engines do not broadcast this data over the data bus and sensors may need to be installed.

Note: The ThrottleXcel may need a programming change for some sensor inputs to be recognized. If the sensor was not ordered as part of the Throttlexcel kit you may need to contact FRC technical support for programming information.

The sensors are wired to the 12-pin connector at the rear of the control module. Refer to the Wiring Section for pinout and wire color information.

An input is provided for an optional transmission temperature sensor.

Install Buzzer

Pin 6 on the 12-pin connector at the rear of the control module is provided to connect an optional buzzer. Connect the ground side of the buzzer to pin 6. (Maximum current through pin 6 is 300 mA.) Refer to the Wiring Section. FRC buzzer requires a 1 1/8 inch hole.

Install High-Idle Kit

The high-idle is activated when + VDC is provided to pin 7 (High-Idle Active Input) of the 12-pin connector and pin 6 (Interlock Input) of the 8-pin connector. Refer to High-Idle Wiring.

Note: It is important that the connection to the Interlock Input from the High-Idle circuit be isolated from the apparatus interlock wiring with the two diodes. **The pump must NOT be engaged when using the high-idle function and the OK TO PUMP LED will be off.**

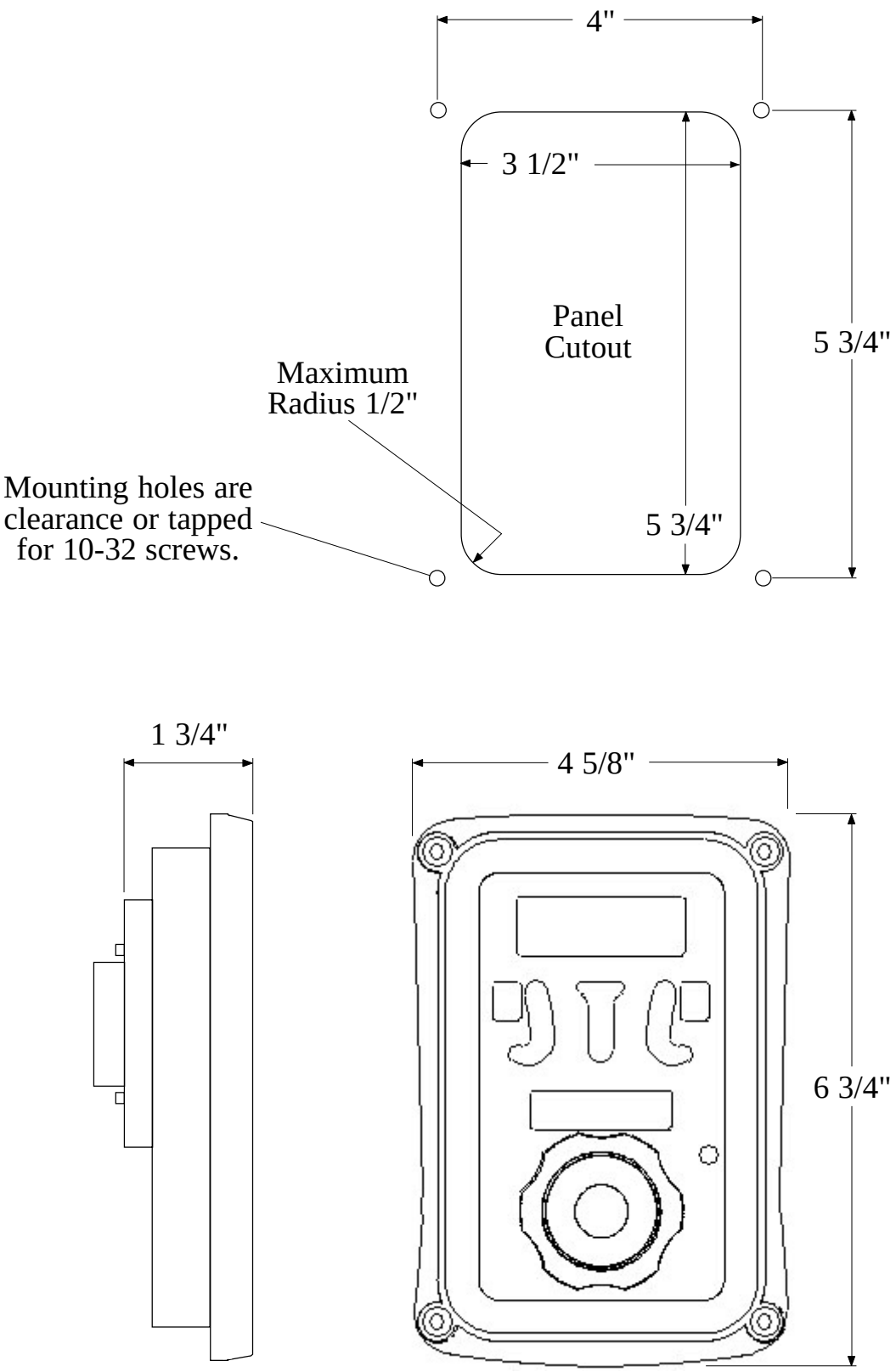


Figure 2. Control Module Mounting Dimensions

OPERATION

On power-up the **ThrottleXcel** is in normal operating mode. The RPM display shows engine RPM, the three LED bar graphs are green indicating readings within normal ranges, and the message display alternates between showing the date and time.

If a monitored function is not within normal parameters the display flashes, the RPM display shows an error or fault warning code and a description shows in the message display. (Refer to Table 1. Error Codes or Table 2. Fault Warning Codes.)

If one of the inputs displayed by the LED bar graphs is not within normal range the LEDs will be red.

When all necessary throttle enables are active and the interlock circuit is complete the OK TO PUMP LED will light and the remote throttle will be controlling engine RPM. The engine RPM control signal is set at idle regardless of the control knob position.

Remote Hand Throttle

The remote hand throttle is used to adjust engine RPM. The **ThrottleXcel** senses how fast and in what direction the control knob is rotated and sends a signal to the ECM to increase or decrease the engine RPM proportionally.

If the control knob is rotated quickly; the RPM changes quickly.

If the control knob is rotated slowly; the RPM changes slowly.

- Rotate the control knob clockwise to increase engine RPM.
- Rotate the control knob counterclockwise to decrease engine RPM.
- Press the red IDLE button to immediately return the engine to idle.

SILENCE Button

During normal operations the silence button is used to suppress an optional audio alarm.

MENU Button

During normal operations the menu button is used to access the accumulated hours mode.

Table 1. Error Codes

RPM Display	Message Display	Probable Cause
E01	NO DATA	>Datalink cable not connected / connected to wrong port >Broken wire / bad connector contact on datalink cable
E02	N/A	N/A
E03	NO RPM	>Datalink cable not connected / connected to wrong port >Engine not running / ignition key on >Broken wire / bad connector contact on alternator cable
E04	N/A	N/A
E05	N/A	N/A
E06	N/A	N/A
E07	N/A	N/A
E08	Trans	>Sensor cable not connected >Broken wire / bad connector contact on sensor cable >Defective temperature sensor
E09	ENG OIL’	>Sensor cable not connected >Broken wire / bad connector contact on sensor cable >Defective pressure sensor
E10	ENG T’	>Sensor cable not connected >Broken wire / bad connector contact on sensor cable >Defective temperature sensor

Table 2. Fault Warning Codes

RPM Display	Message Display	Description
F01	-	N/A
F02	-	N/A
F03	HI RPM	High RPM
F04	-	N/A
F05	-	N/A
F06	HI BATT	High battery voltage
F07	LOW BATT	Low battery voltage
F08	TRAN TEMP	High transmission temperature
F09	LOW OIL	Low engine oil pressure
F10	ENG TEMP	High engine coolant temperature

Display Stored Data

Both the RPM and the message displays are used to show stored data.

Accumulated Hours and Transmission Temperature

Accumulated hours are stored in memory for engine operation, pump operation, last incident, and current incident. The menu button allows the operator to gain access to this stored data. When in the accumulated hours mode the RPM display shows the hours. The message display will show the following:

Pump Operating Hours	Pump hrs
Engine Operating Hours	Eng hrs
Last Incident Hours	Last Inc
Current Incident Hours	Curr Inc
Transmission Temperature	Trans' T

The accumulated hours mode is a display only mode and no changes can be made to the data.

The engine must be in idle to access the accumulated hours.

Press the MENU button to enter the accumulated hours mode.

Stored accumulated hours will be displayed.

The RPM display shows the number of hours.

The message display shows what the hours are for.

Press the MENU button to show the next stored hours.

Each time the MENU button is pressed the displays change to show the next block of stored accumulated hours.

Press and hold the MENU button for 5 seconds.

The displays continuously cycle to show all of the stored accumulated hours.

Press the SILENCE button to exit the accumulated hours mode.

Fault Warnings

Each time a fault occurs, the type of fault, date, and time are stored in memory. The memory holds the last ten (10) fault occurrences to be displayed at a later time. Refer to the Programming Section for details on retrieving fault warnings.

Maximum Engine RPM

The maximum RPM that the engine reaches is stored in the memory to be displayed at a later time. Refer to the Programming Section for details on retrieving the maximum engine RPM.

High-Idle

The **ThrottleXcel** programming includes a high-idle function that is controlled by a High-Idle Switch.

To activate the high idle, set interlocks as called for by SOP (normally this would include the transmission in neutral and the parking brake on). Set the High Idle switch to ON.

Note: The pump must NOT be engaged when using the high-idle function and the OK TO PUMP LED will be off.

Change High-Idle Setting

The high-idle is set at about 1000 RPM at the factory. (This value will vary depending on the specific engine.)

1. With the engine running, set the high-idle switch to ON.

   Result: Engine RPM goes to high-idle.

2. Press and hold the IDLE button for 10 seconds.
3. Keep pressing the IDLE button and rotate the control knob to the desired RPM.
4. Release the IDLE button to store the new high-idle setting

PROGRAMMING

To gain access to the program features a four digit program code must be entered. Review the Program Code Descriptions for the proper four digit code.

Both the MENU and SILENCE buttons are used to enter a program code. The RPM display is used to show the codes.

Enter Program Code

Note: There is a time out feature that returns the program to normal operation in three seconds if input is not detected at the buttons.

1. Press the SILENCE button and hold it for 3 seconds until the RPM display shows four dashes. The program is ready for a four digit program code to be input.
2. Press the MENU button. The RPM display shows the number 1000. Each time the MENU button is pressed the first digit increments by 1. Set the first digit to the desired number.
3. Press the SILENCE button. Each time the SILENCE button is pressed the second digit increments by 1. Set the second digit to the desired number.
4. Press the MENU button. Each time the MENU button is pressed the third digit increments by 1. Set the third digit to the desired number.
5. Press the SILENCE button. Each time the SILENCE button is pressed the fourth digit increments by 1. Set the fourth digit to the desired number.
6. Wait a few seconds:

   If a valid four digit program code is entered the display changes to show a program value or an option.

   If an invalid code is entered the display will show WRONG CODE.

Program Code Descriptions

When a valid four digit program code has been entered, stored data or program options will show in the displays.

The MENU and SILENCE buttons are used to change the data. The SILENCE button will select the digit that is to be changed. The MENU button will change the digit or change the option choice.

Data Display Codes 1000

1110 - Fault Warnings

This code will show the last ten (10) fault warnings that have occurred. The RPM display will show a fault code and the message display will alternate between showing the date and time that the fault occurred. Refer to Table 2. Fault Warnings

1120 - Maximum Engine RPM

This code will display the maximum RPM that the engine has attained.

1130 - Software Revision

This code will display the current software revision code.

Parameter Settings Codes 2000

2110 - Clock

This code will allow the clock display to be changed.

2120 - Date

This code will allow the date display to be changed.

2130 - Clear Fault Warnings

This code will allow the stored fault warnings to be cleared from memory. It will clear the history of all ten (10) fault warnings. Select YES or no.

2140 - RPM Calibration

This code will allow the digits in the RPM display to be adjusted to match a tachometer. This is for engines that do not receive RPM data over the datalink and have the yellow RPM signal wire (pin 12 on the 12-pin connector) connected to an RPM source.

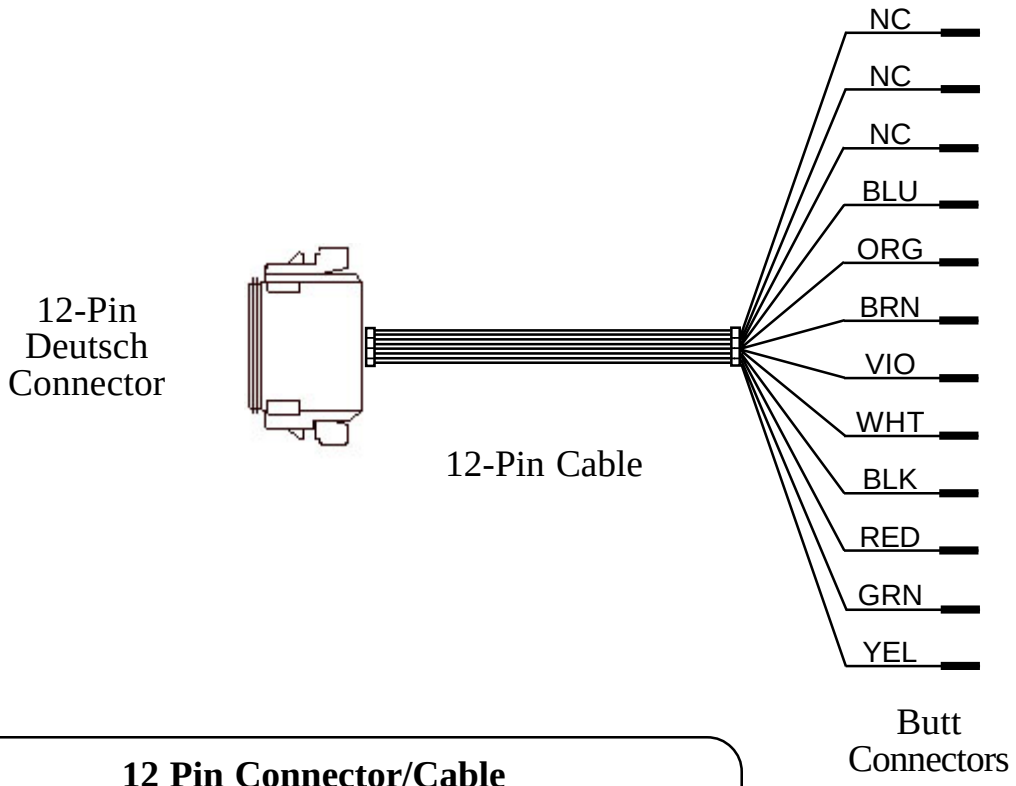
Exit Program Code Mode

Press the SILENCE button first then the MENU button and hold them both for 3 seconds to exit the program code mode and return to normal operation.

WIRING

The following figures include the schematics, wiring diagrams, block diagrams, and cables for the **ThrottleXcel**.

Connectors and Cables

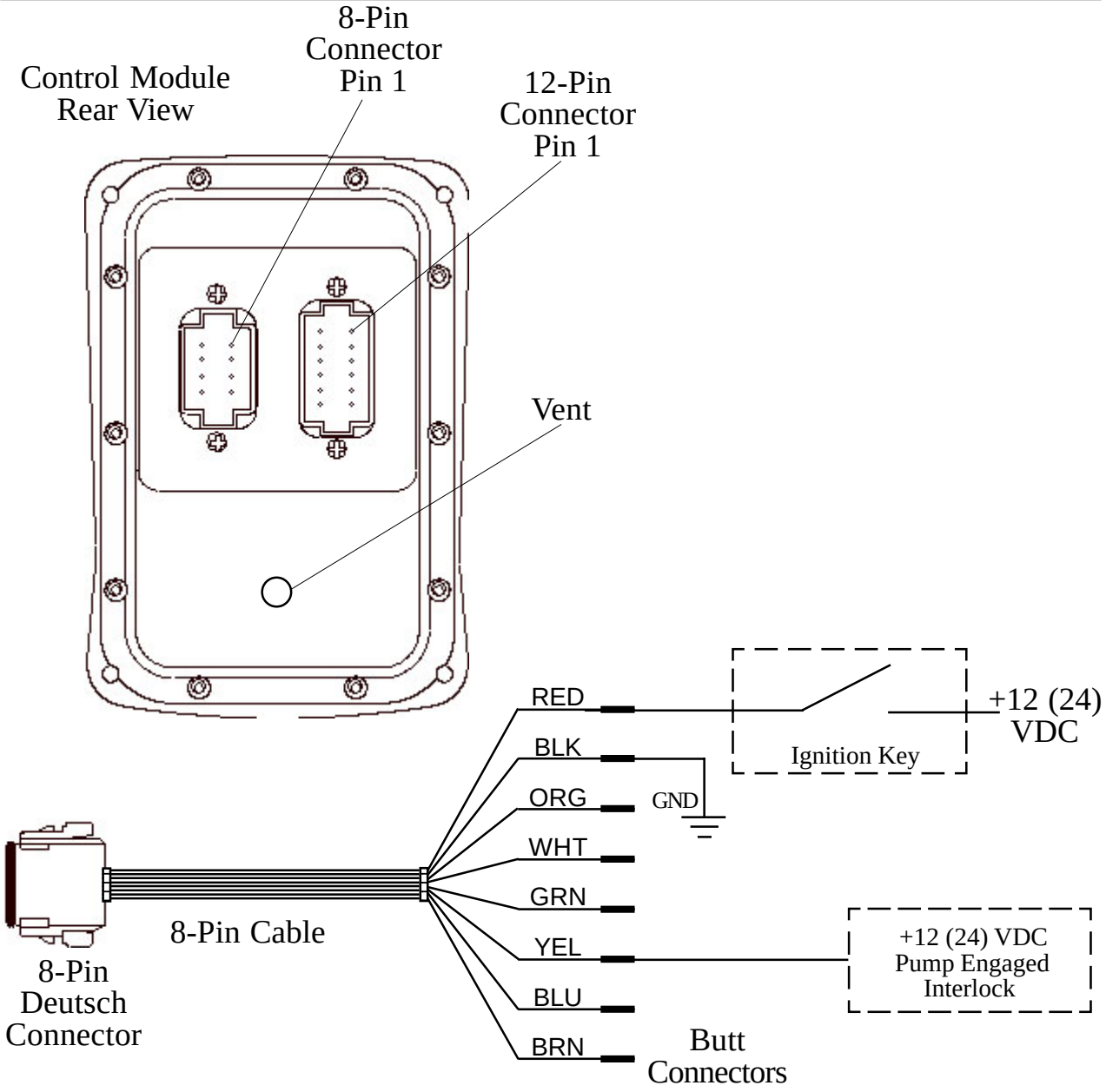


12 Pin Connector/Cable

Pin	Wire Color	Description
1	NC	-
2	NC	-
3	NC	-
4	Blue	Engine Oil Press. Sensor Signal
5	Orange	Engine Coolant Temp. Sensor Signal
6	Brown	Buzzer Ground (300mA)
7	Violet	High Idle Active Input (+ VDC)
8	NC	-
9	Black	CAN J1939 (–)
10	Red	CAN J1939 (+)
11	Green	Transmission Temp. Sensor Signal
12	Yellow	RPM Signal

Notes:
- Not all wires are used for all engines.
- For Ford 6.0L, 6.4L engines the yellow RPM signal wire, pin 12, should be connected to the Clean Tachometer Output [for 6.0L green/white wire, circuit #76] [for 6.4L dark blue wire].
- High idle not available for Ford, Mack, or GMC.
- The J1939 CAN bus is terminated with a 120 ohm resistor.
- When using an FRC provided sensor cable, the red wire is sensor signal and the black wire connects to a ground.

Figure 3. ELA 12-Pin Connector Wiring



8 Pin Connector/Cable

Pin	Wire Color	Description
1	Red	Supply Voltage (12/24 VDC)
2	Black	Ground
3	Orange	+5 VDC Reference From ECM
4	White	Throttle Signal To ECM
5	Green	Signal Return From ECM
6	Yellow	Interlock Input (+ VDC)
7	Blue	Throttle Enable Signal Output
8	Brown	Foot Pedal Signal Input

Notes:
- Not all wires are used for all engines. Refer to the engine specific wiring diagram for interface connections.
- An adapter and cable assembly replaces the basic 8-pin cable when connecting the ThrottleXcel to a Ford 6.0, 6.4 or GMC engine. Refer to the engine specific wiring diagram.

Figure 4. ELA 8-Pin Connector Wiring

Cummins Harness Connections

Interface Information

The ECM Remote Accelerator (Throttle) Option has to be set to ON. The diagnostic tool cannot be used to do this, an Insight service tool must be used. Refer to an authorized dealer to program this option.

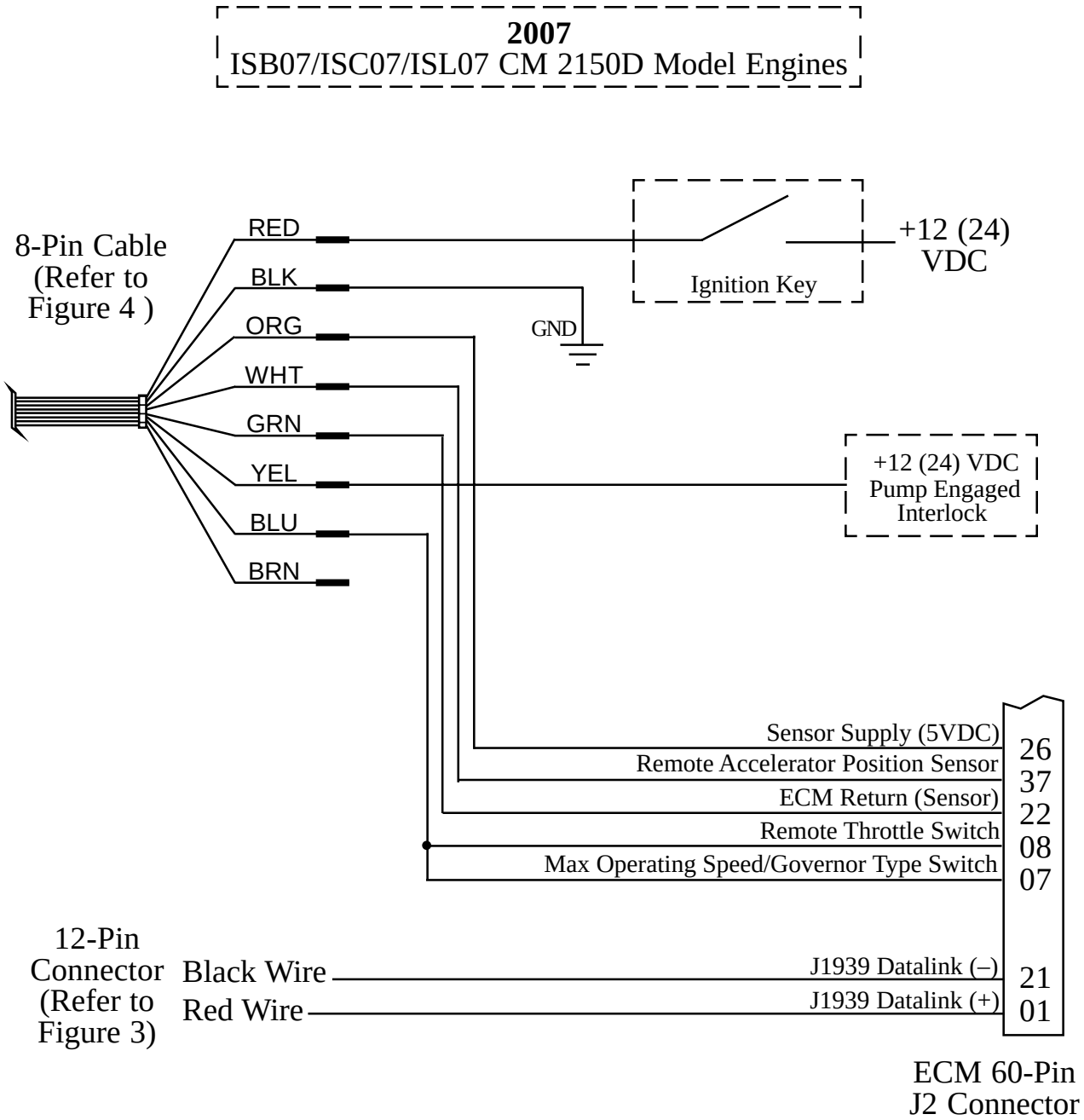


Figure 5. Cummins ELA101 Wiring (Sheet 1 of 2)

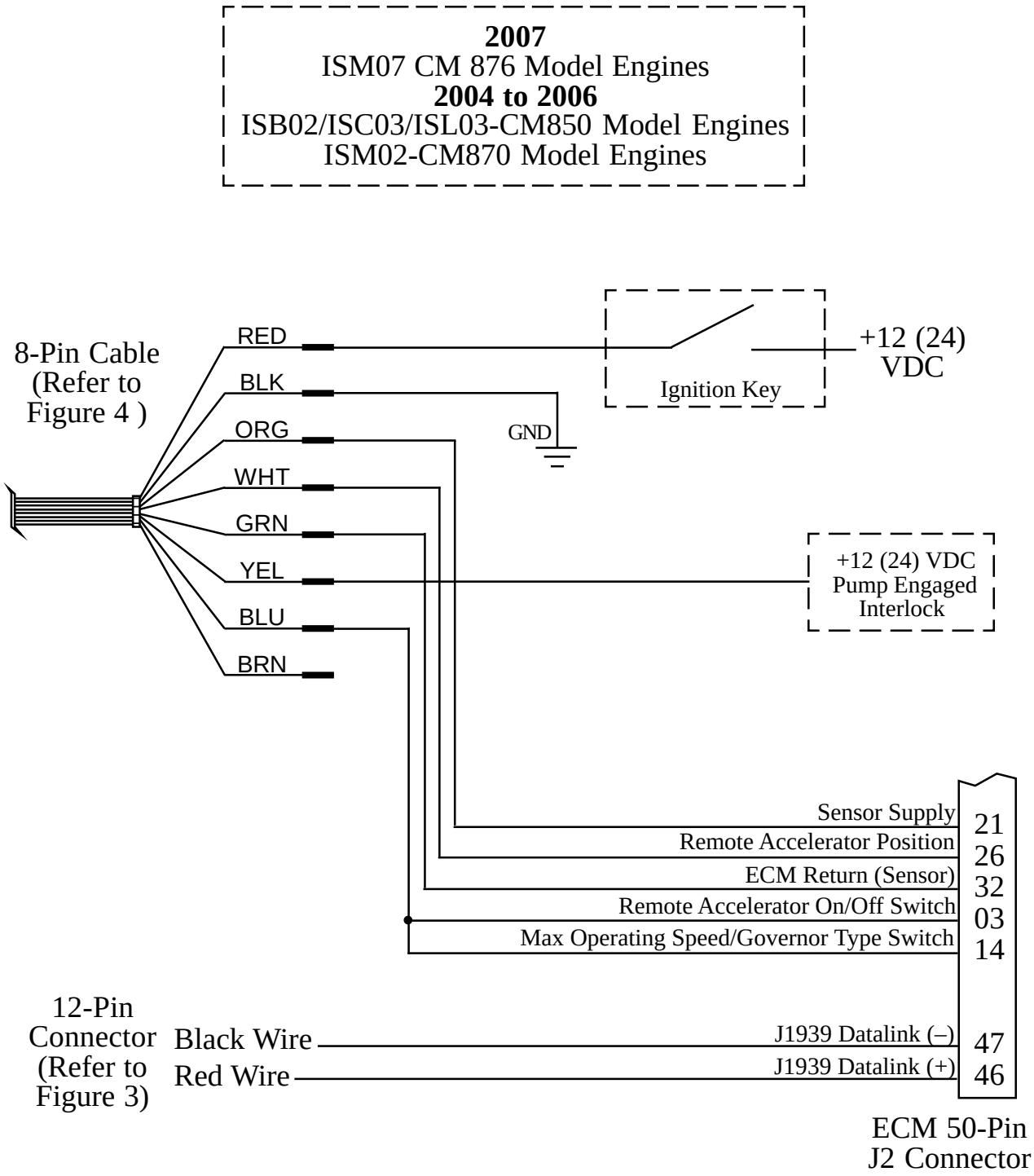


Figure 5. Cummins ELA101 Wiring
(Sheet 2 of 2)

Detroit Diesel (Series 50 and 60) Harness Connections

Interface Information

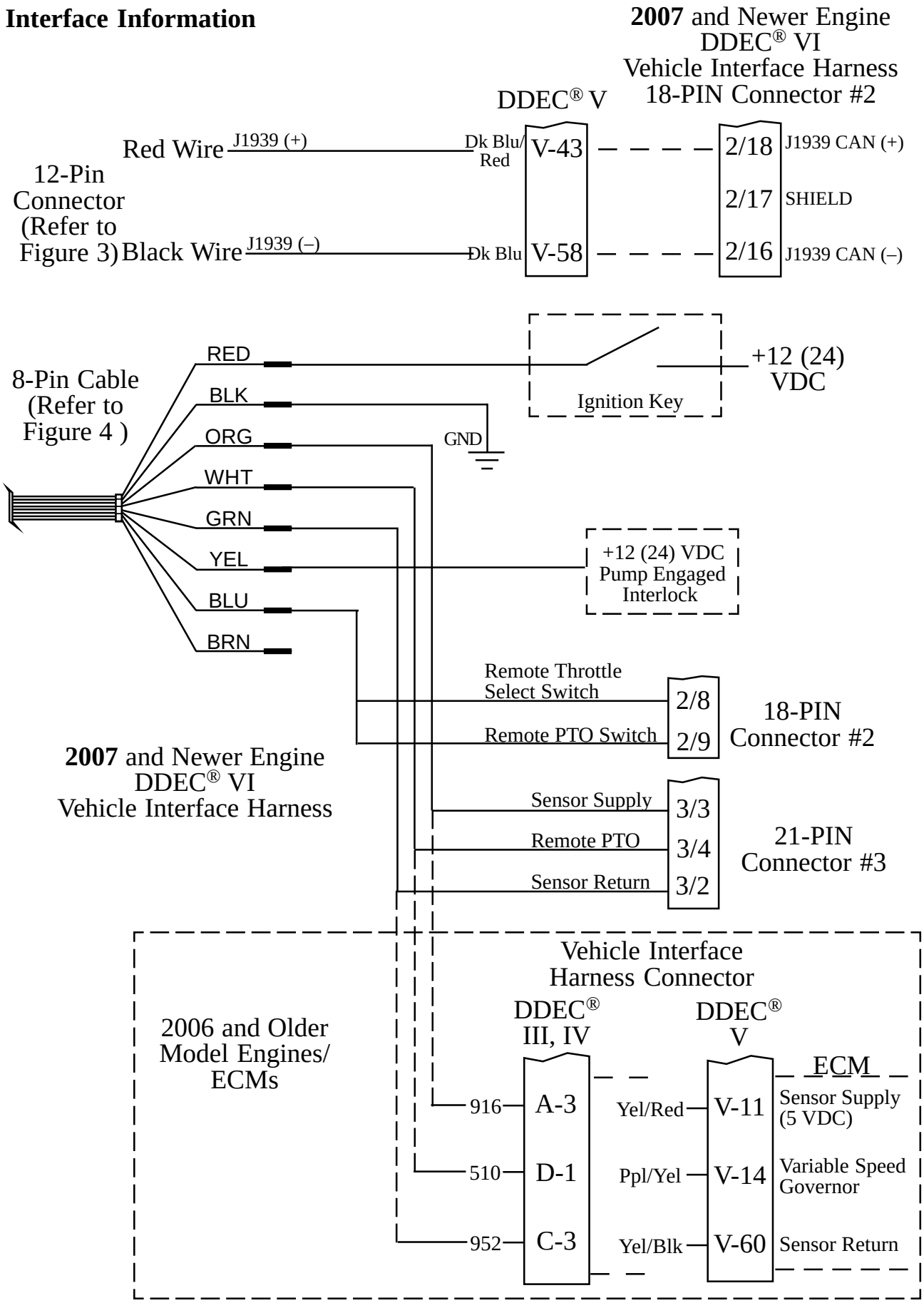


Figure 6. Detroit Diesel (Series 50 and 60) ELA102 Wiring

Navistar Harness Connections

Interface Information

The ECM must be programmed for a remote throttle input. When using code 12VZA or 12VXY, the following parameters need to be set:

PTO-REMOTE-PEDAL to 1-Yes; PTO-REM-PEDAL-RTZ to 1-RTZ-not;

PTO-DISABLE-CAB-INTERFACE to 1-Yes; DRIVELINE-MODE to 1

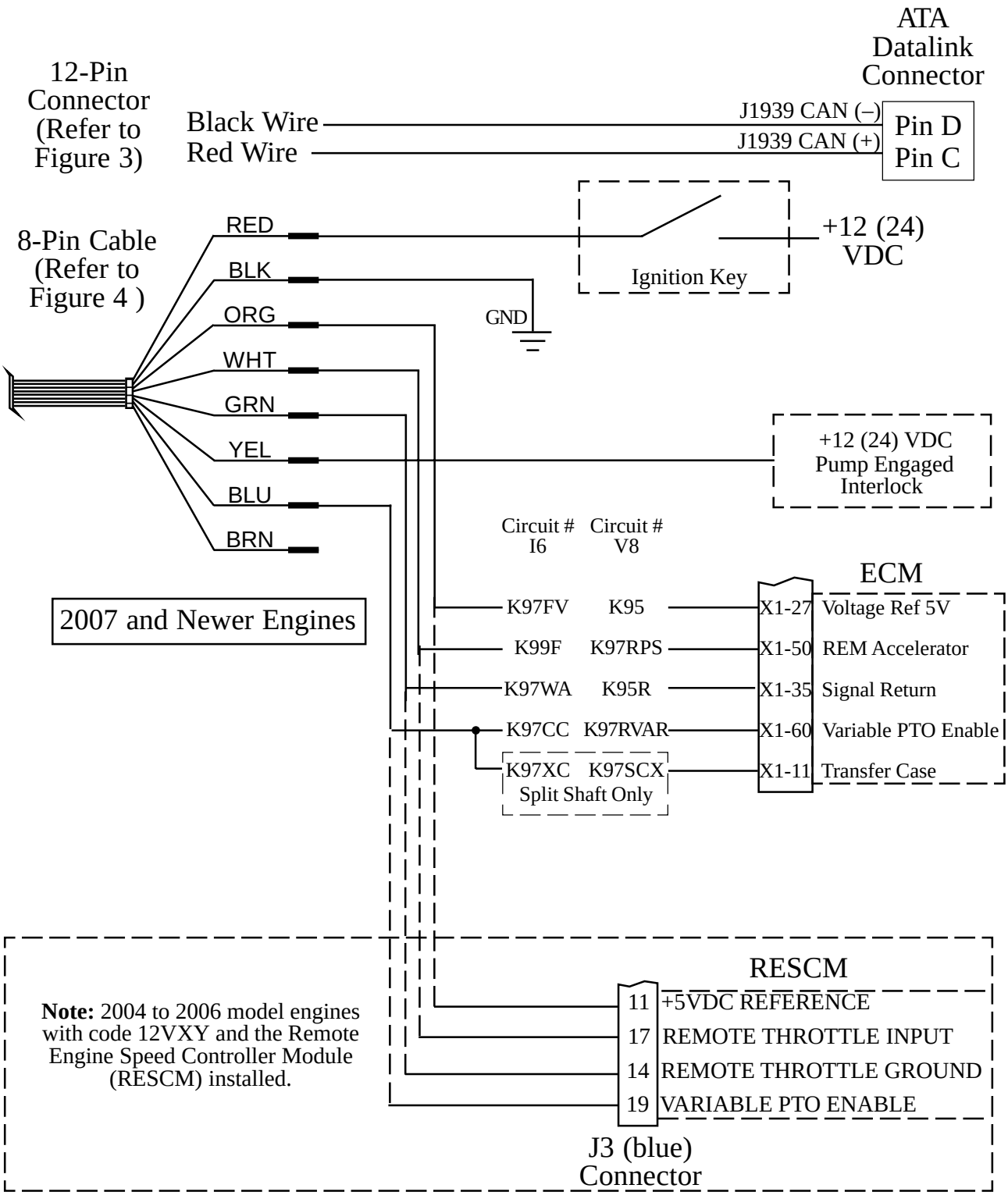


Figure 7. Navistar ELA104 Wiring

Caterpillar Harness Connections

Interface Information

The parameter settings for PTO Cofiguration is programmed to Remote Throttle or Remote Throttle with J1939 Speed Command.

ECM software with a Personality Module release date of May08 for C7, C9, C13, C15 engines, will have the Remote Throttle with J1939 Speed Command setting available. This setting alows the engine speed to be controlled during PTO operations by a J1939 compliant device.

Refer to an authorized dealer to program one of these options.

C7,C9,C10,C11,C12,C13,C15 Engine Interface

Engines with **70-Pin OEM connector**.

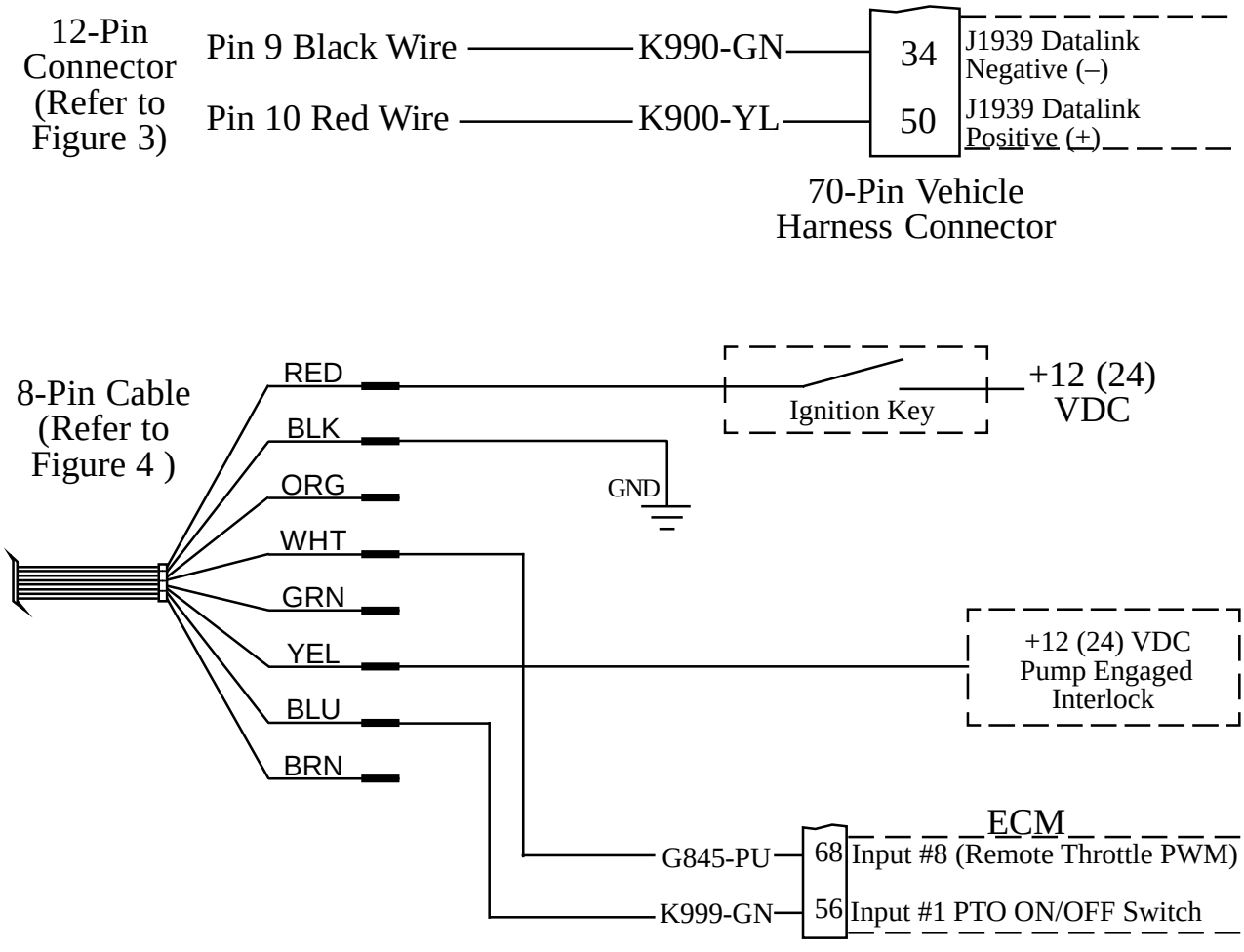


Figure 8. Caterpillar ELA105 Wiring (Sheet 1 of 3)

C10, C12 Engine Interface

Engines with **40-Pin OEM connector**.

Note: Refer to 12-Pin connector Figure 3 for seperate sensor and RPM connections.

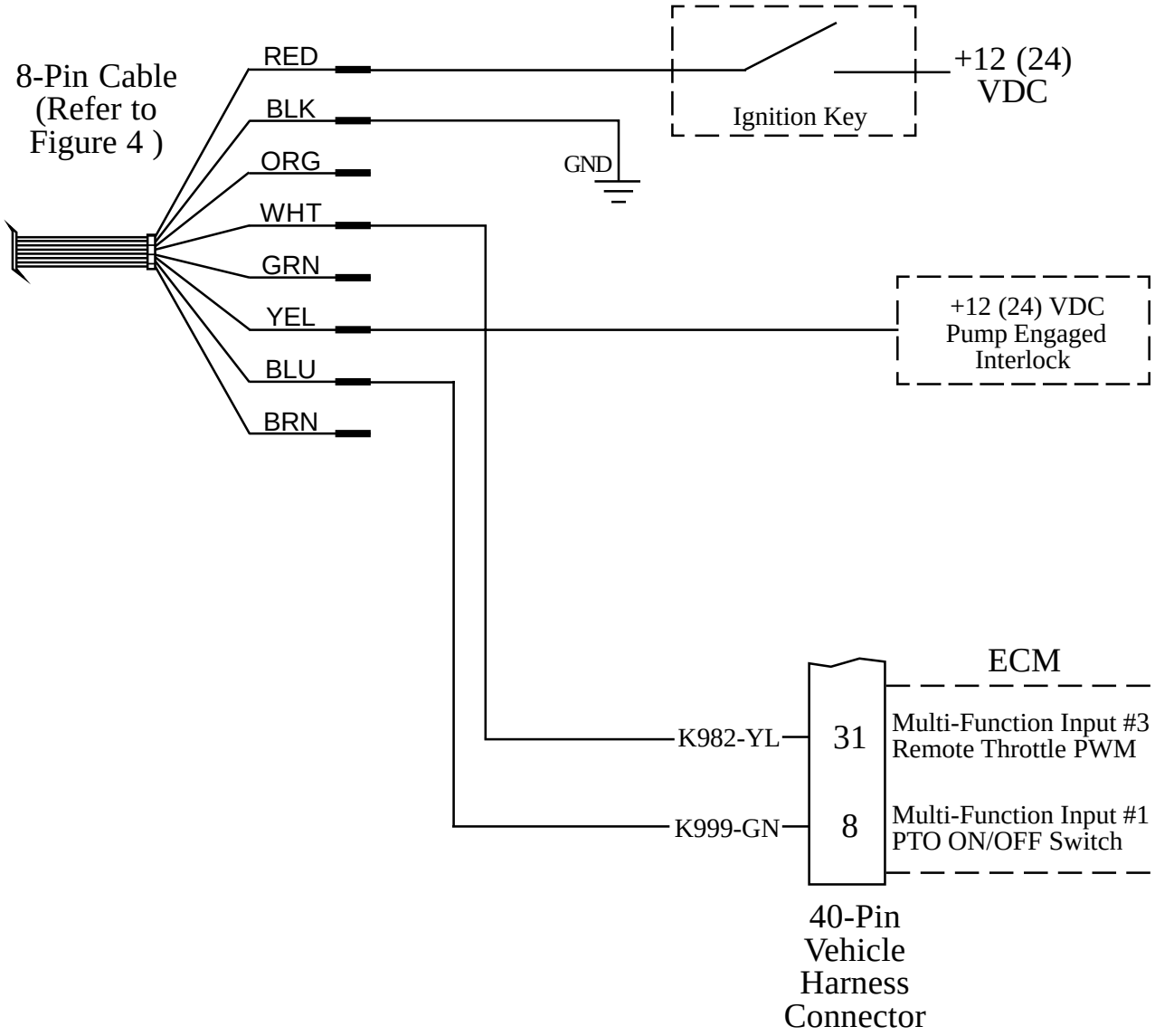


Figure 8. Caterpillar ELA105 Wiring (Sheet 2 of 3)

Older Engine Interface

Engines with 40-pin OEM connector.

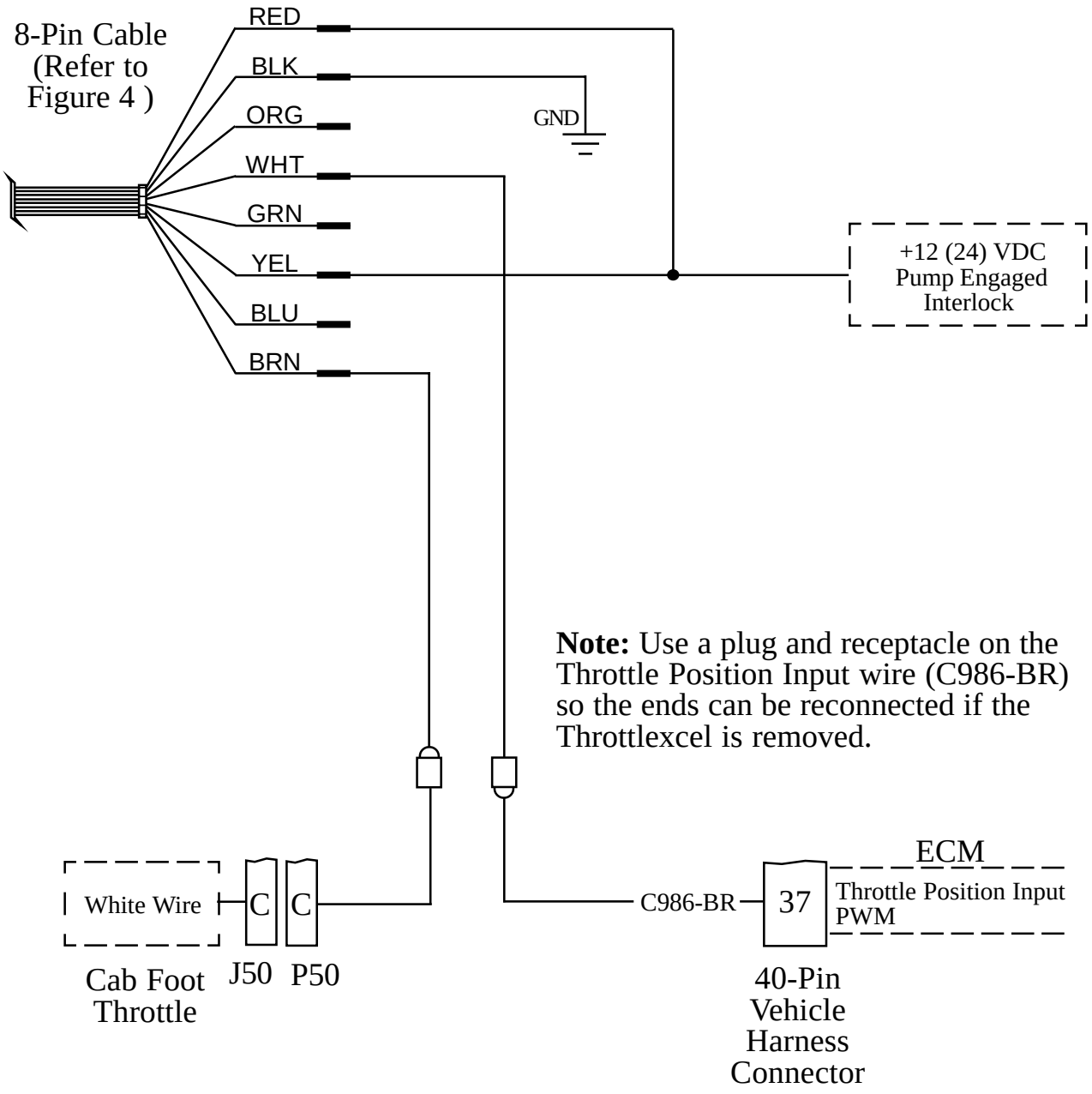


Figure 8. Caterpillar ELA105 Wiring (Sheet 3 of 3)

Ford Harness Connections

7.3 L Power Stroke Engine Interface

The 8-Pin cable needs to be wired to the cab foot throttle harness. Use a voltmeter to determine which pins are 5 V Reference, Idle Validation, and Engine Control Signal.

Idle Validation will be at ground. When the foot pedal is pressed it will rise to 12 VDC.

Engine Control Signal will be 0.6 volts at idle and rise to approximately 2.7 volts as the foot pedal is pressed.

Note: Refer to 12-Pin connector Figure 3 for seperate sensor and RPM connections.

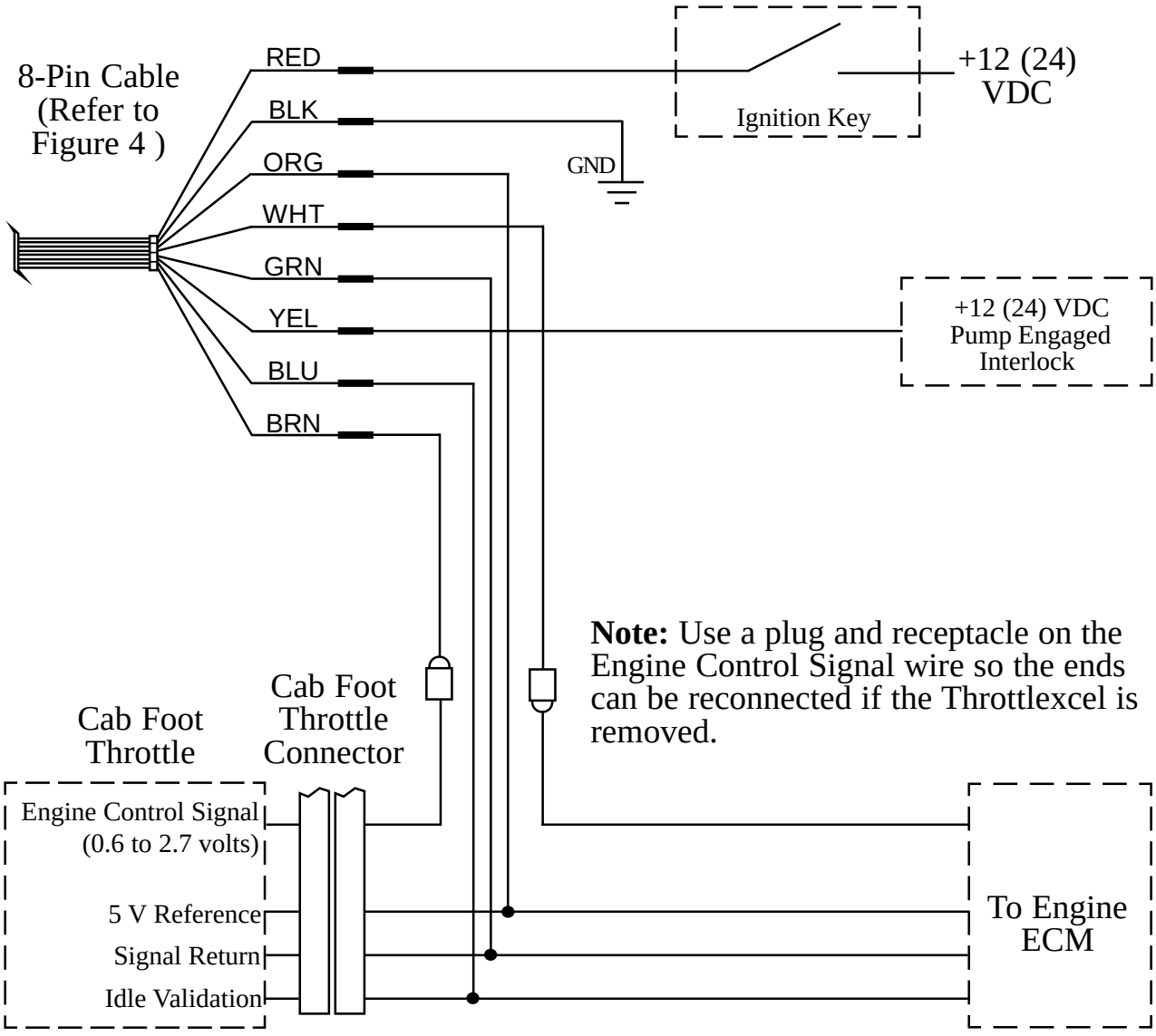
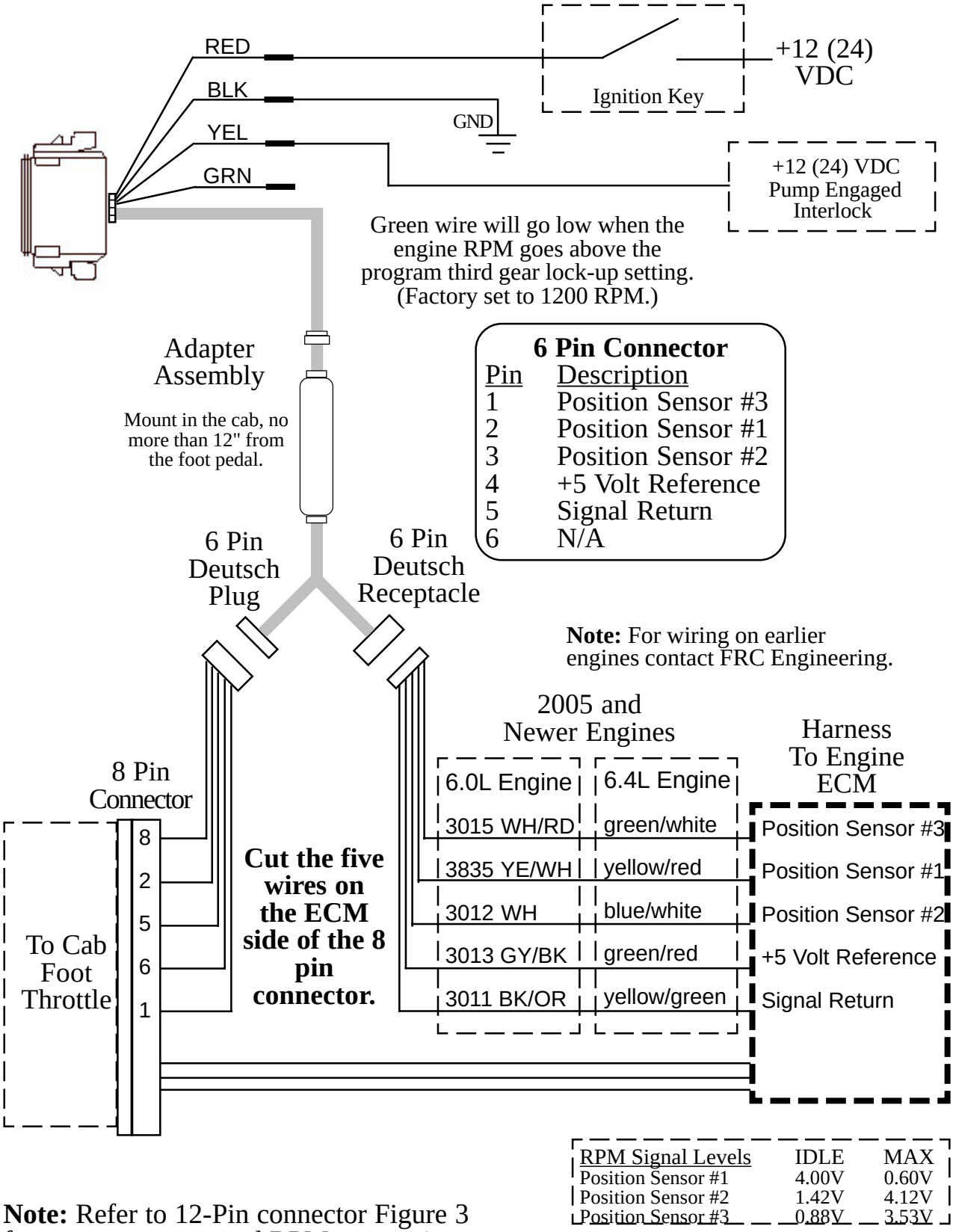


Figure 9. Ford 7.3L ELA106-A Wiring

6.0L and 6.4L Diesel Engine Interface

An adapter and cable assembly is needed to interface the ELA106-B with the Ford engine. Two 6 pin connectors are provided and need to be spliced into the harness between the cab foot throttle and the ECM.



Note: Refer to 12-Pin connector Figure 3 for seperate sensor and RPM connections.

Figure 10. Ford 6.0L and 6.4L ELA106-B Wiring

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Mack Harness Connections

Interface Information

The 8-Pin cable needs to be wired to the cab foot throttle harness. Use a voltmeter to determine which pins are 5 V Reference and Engine Control Signal.

Engine Control Signal will be 0.7 volts at idle and rise to approximately 3.8 volts as the foot pedal is pressed.

Note: Refer to 12-Pin connector Figure 3 for seperate sensor and RPM connections.

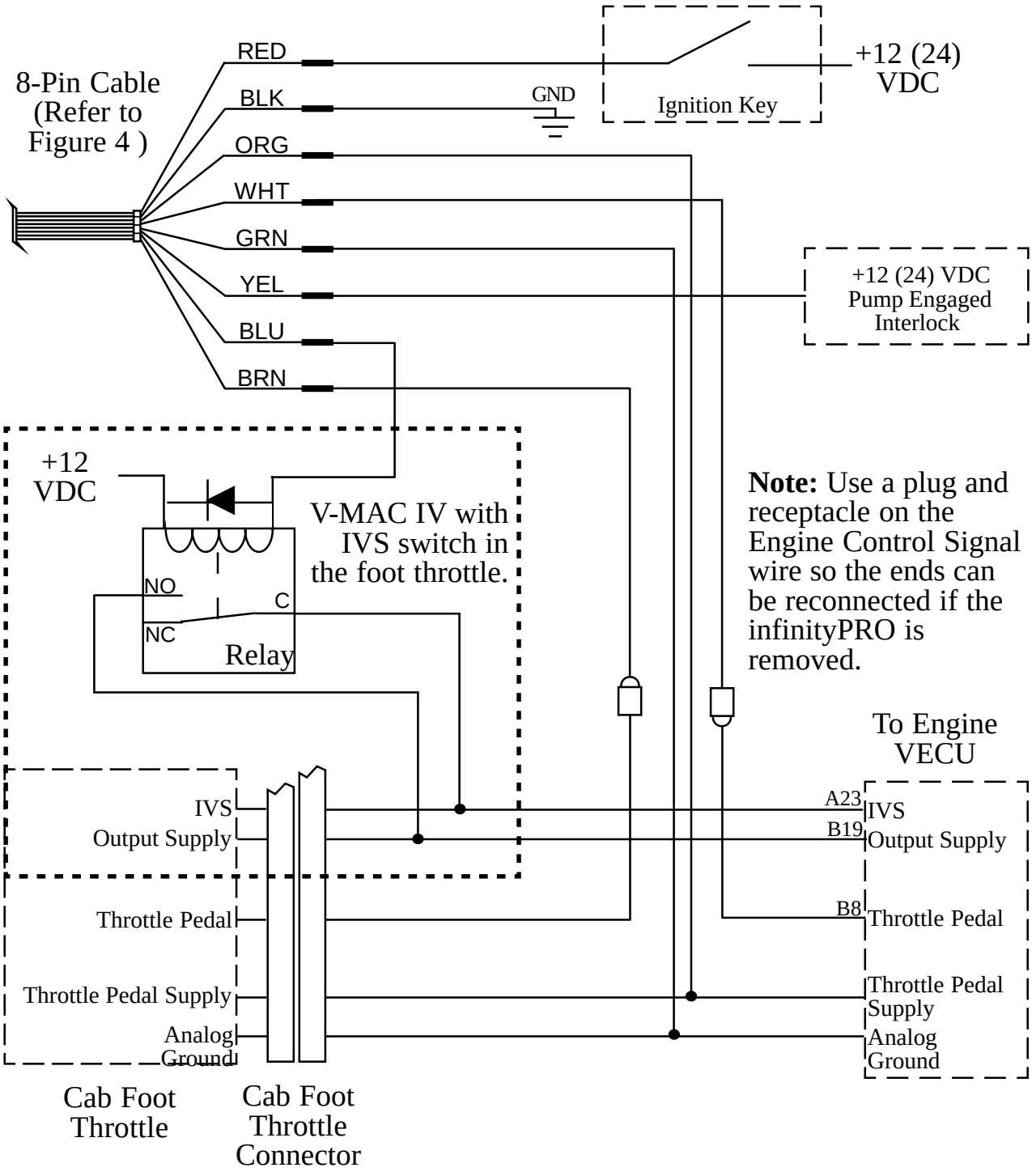
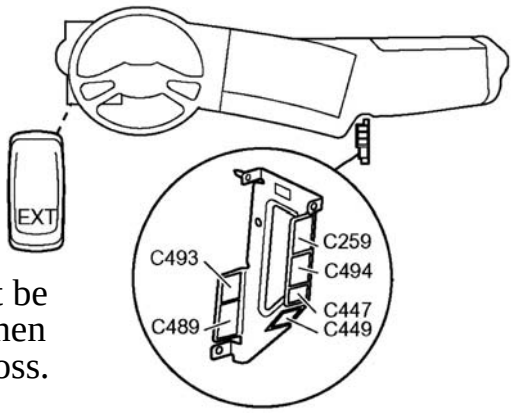


Figure 11. Mack ELA107 Wiring

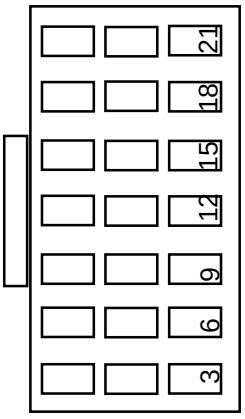
Scania Harness Connections

Interface Information

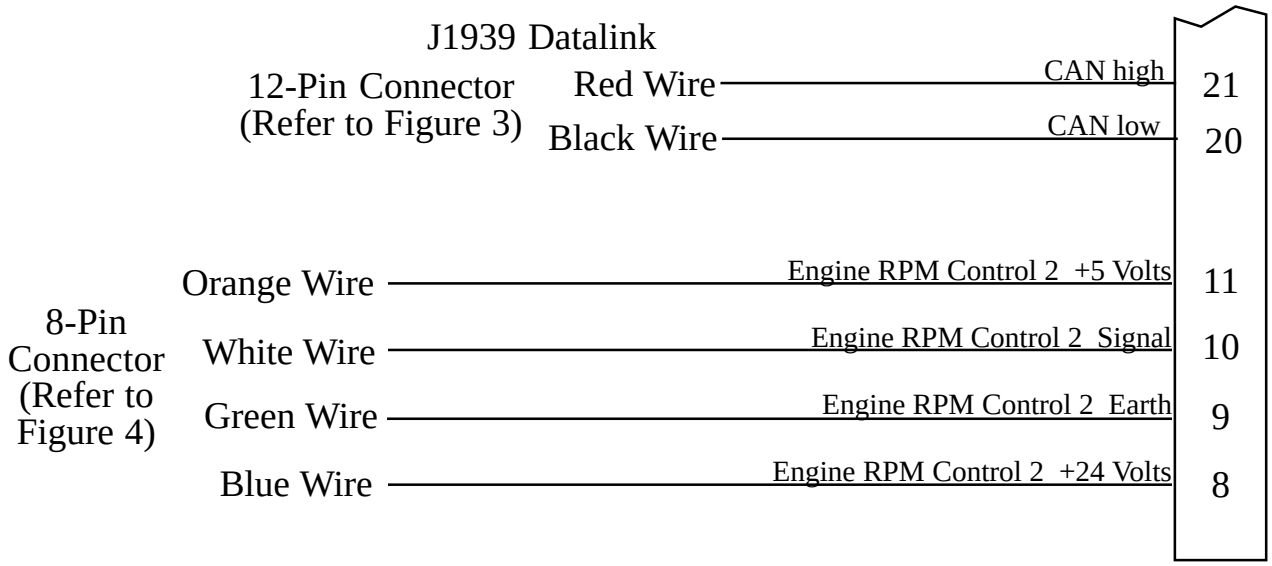
For use on P, R, and T-series trucks equipped with a bodywork control unit (BWS). Connector C259 is available on all vehicles ordered with any of the bodywork options. It is located on the plate for the electrical bodywork interface for body builders. Connector C259 is white and has 21 pins. (February 2005 and newer.)



The EXT switch must be in the ON position when operating the PumpBoss.



Contact Housing (MCP)



Note: Signal to pin 10 is 0.6 to 3.0 V

C259
Connector

Figure 12. Scania ELA108 Wiring

GMC Harness Connections

Interface Information

An adapter and cable assembly is needed to interface the ELA409 with GMC engines. There are multiple types available for diesel or gas in variations that depend on the model and year of the engine.

Notes: Refer to 12-Pin connector Figure 3 ELA 21-Pin Connector Wiring for seperate sensor and RPM connections. When using an FRC provided sensor cable, the red wire is sensor signal and the black wire connects to a ground.

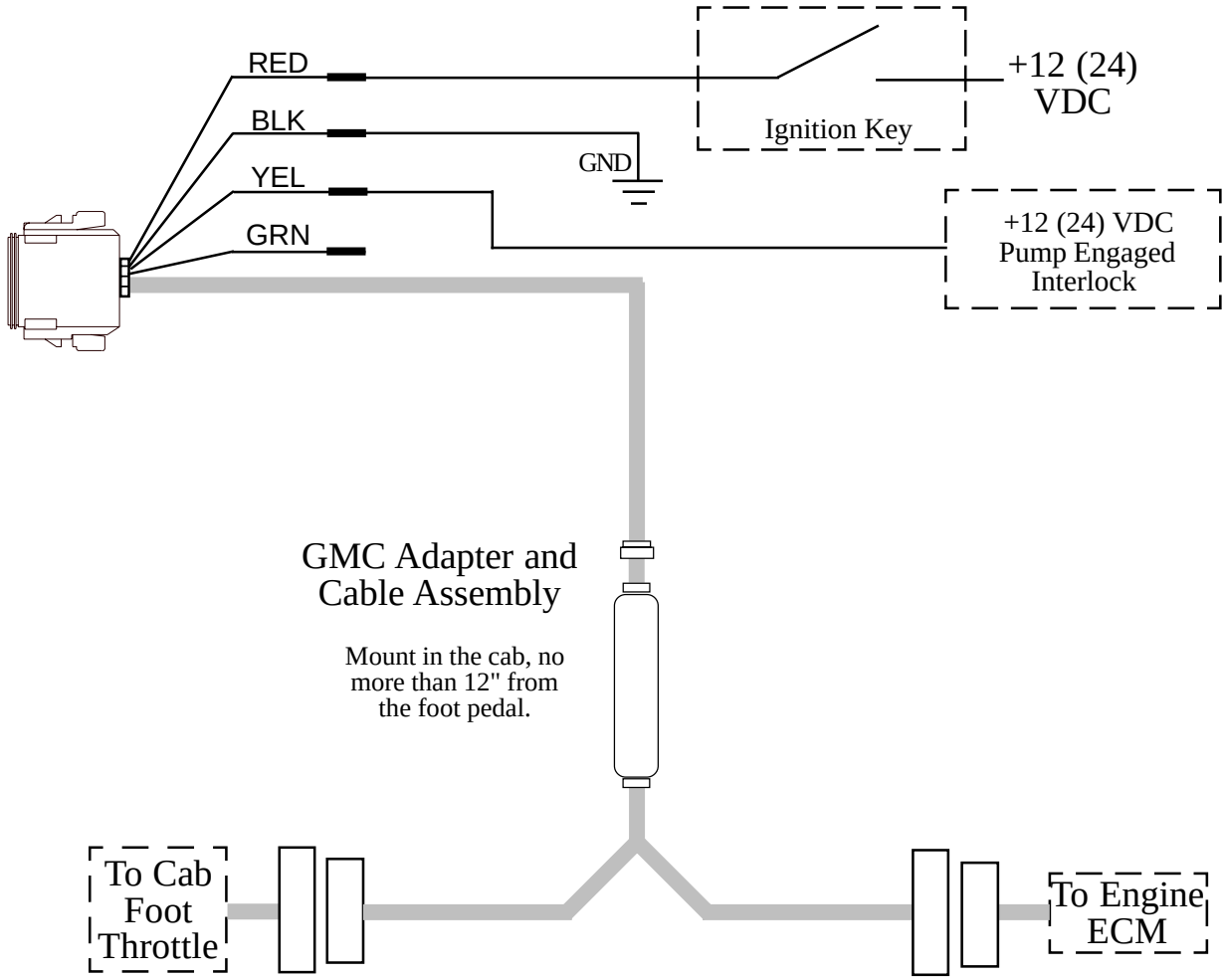


Figure 13. GMC ELA109 Wiring

Mercedes Harness Connections

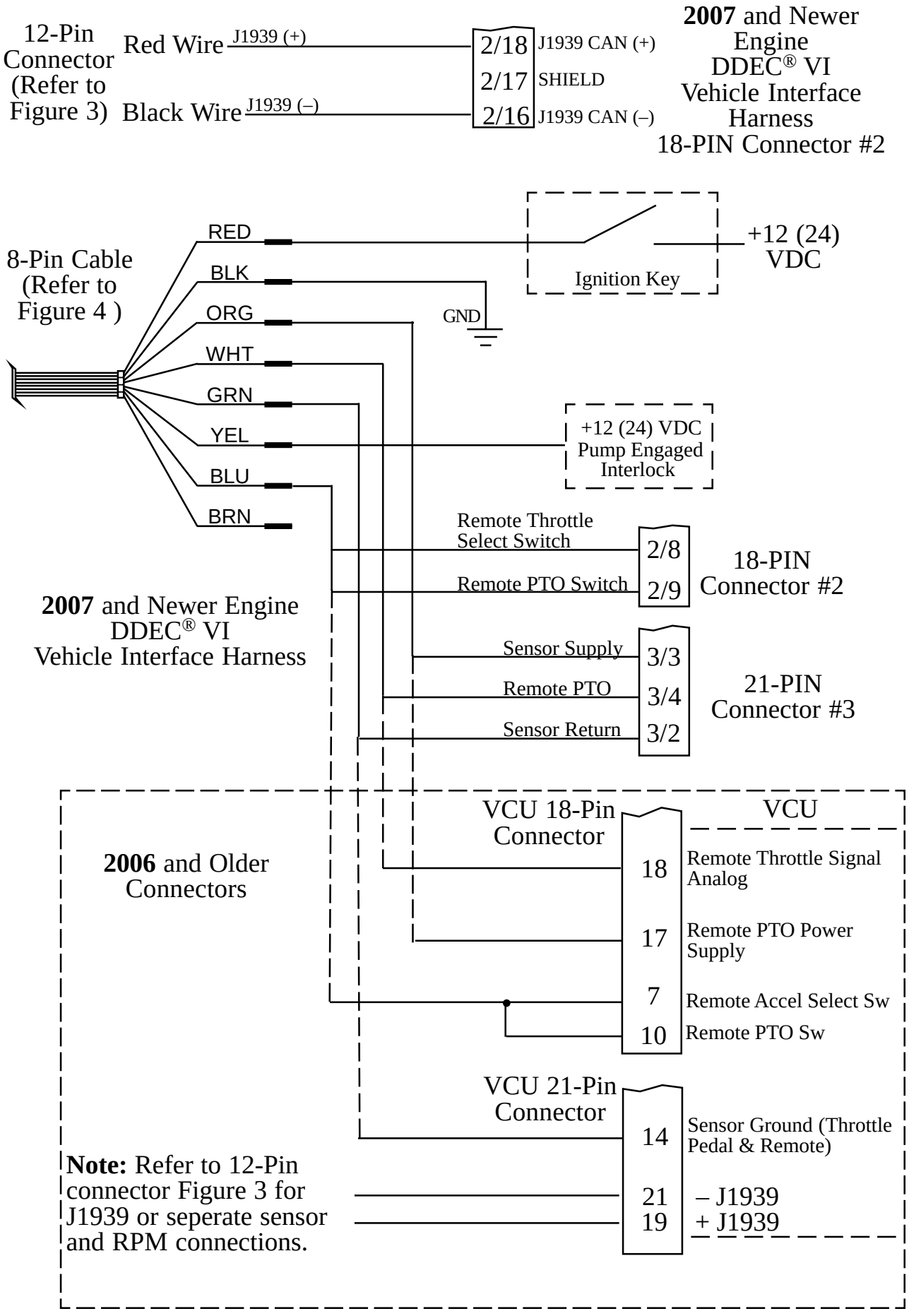


Figure 14. Mercedes ELA110 Wiring

High Idle Wiring

The **ThrottleXcel** programming includes a high idle function. To activate the high idle provide + VDC to pin 7 (High Idle Active Input) of the 12-pin connector and pin 6 (Interlock Input) of the 8-pin connector. The high idle connection to pin 6 must be isolated form the interlock circuit using two diodes (see schematic).

Note: It is important that the connection to the Interlock Input from the High Idle circuit be isolated from the apparatus interlock wiring with the two diodes. Refer to the wiring diagram. **The pump must NOT be engaged when using the high idle function.**

The high idle is set at about 1000 RPM at the factory. (This value will vary depending on the specific engine.) To adjust this setting refer to High Idle in the Operation Section.

Not available for Ford, Mack, or GMC.

A High Idle Kit is available from FRC.
P/N XE-TG38HK-A0A
Includes:
ON/OFF Switch
Indicator Light
Two Diodes

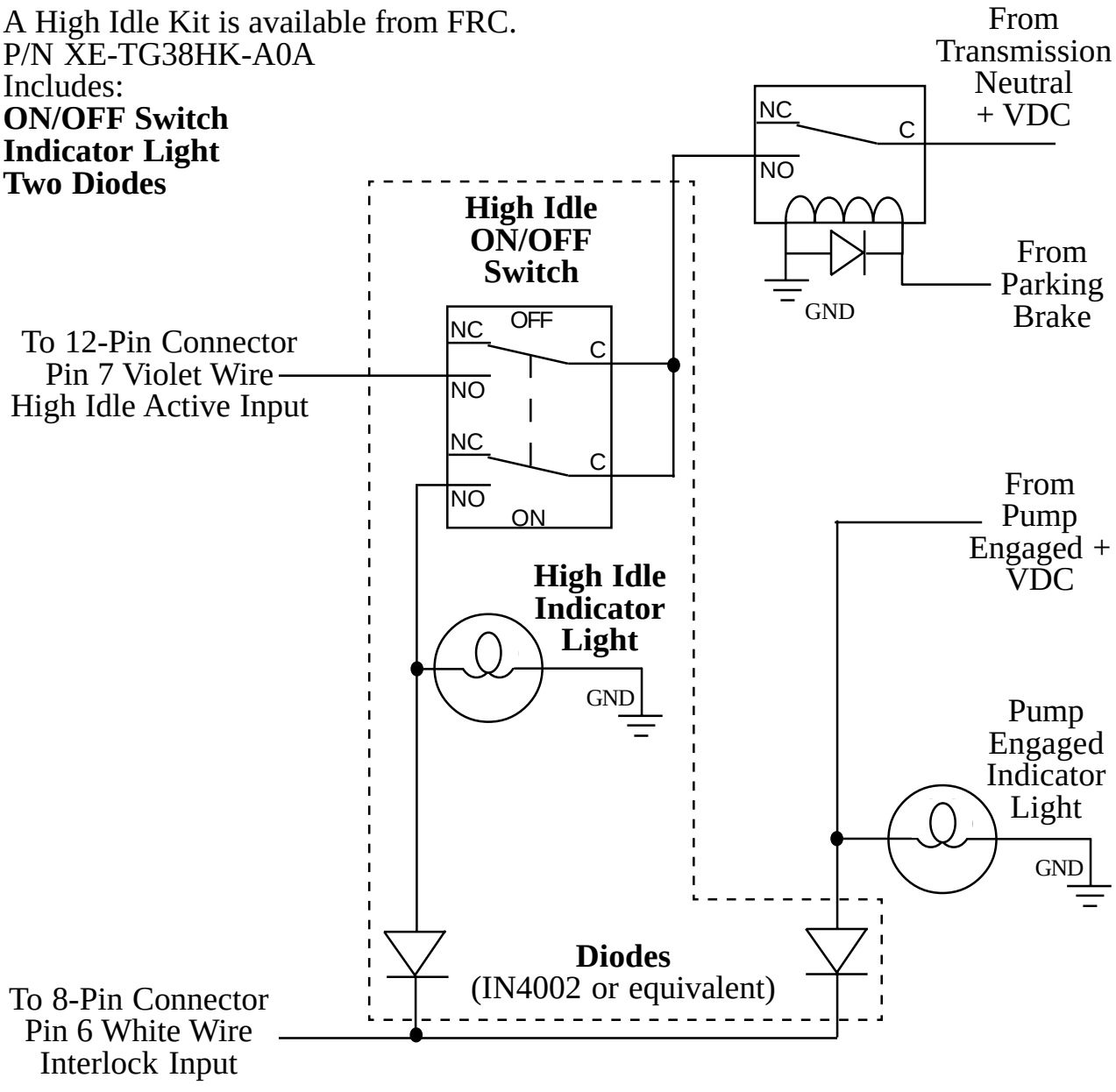


Figure 15. High Idle Wiring

FLYBACK DIODE INFORMATION

It is good engineering pratice to include a flyback diode when switching an inductive load (soleniod coil, relay coil, electric motor winding, etc.). It is recommended that a flyback diode be installed on inductive devices that share a common power source/ground with a FRC governor.

Typical circuit showing a flyback diode installed across an inductive load. (Relay Coil, Solenoid, etc.)

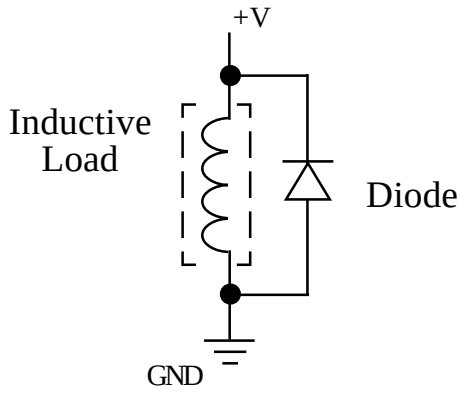


Diagram showing a flyback diode connected on a typical pump primer motor solenoid.

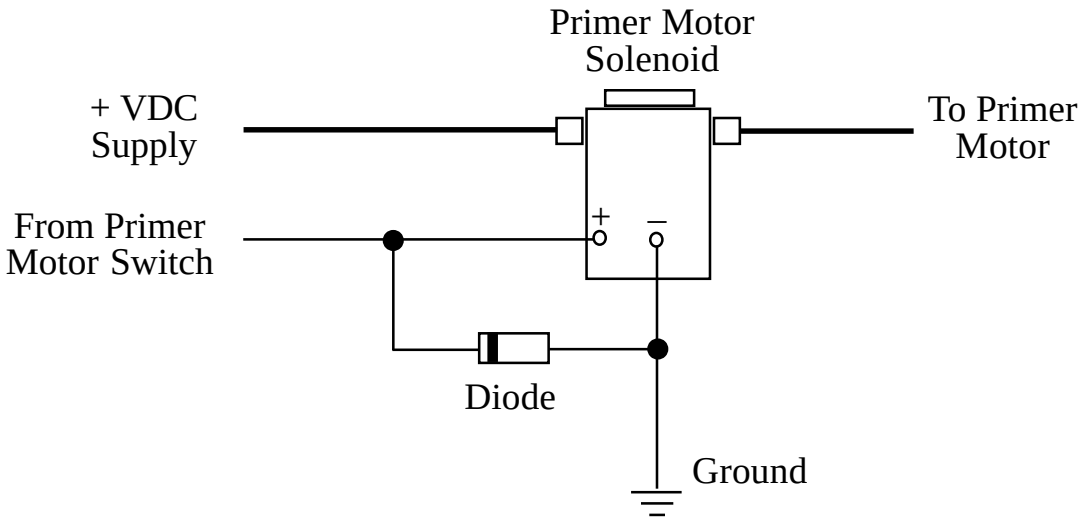


Figure 16. Flyback Diode