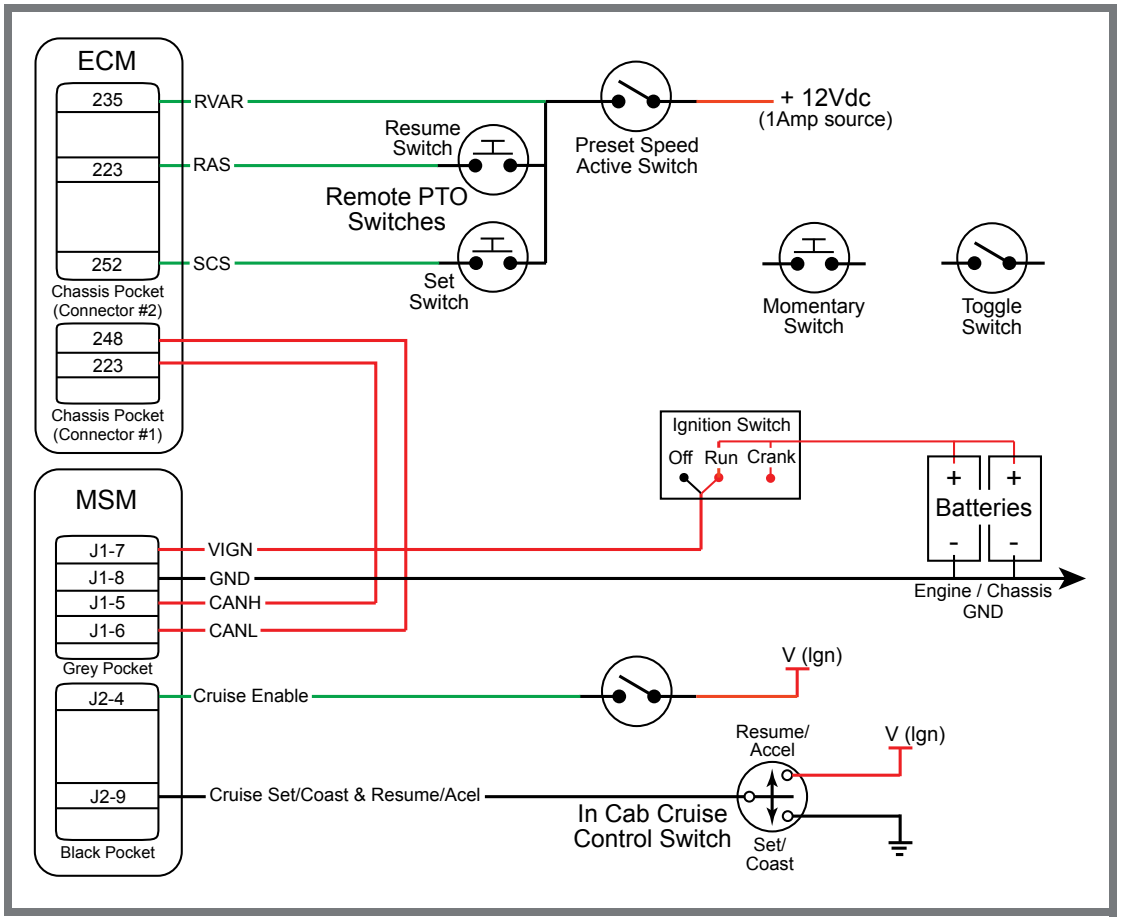
PBB-71000 (Part of CT-471)
(October, 2010 Edition)

2010 BODY BUILDER



Diamond Logic® Control Systems

Features and Programmable Parameters

A NAVISTAR COMPANY

TABLE OF CONTENTS

PREFACE

Foreword

The CT-471 – Body Builder Books … is a set of booklets of which this Diamond Logic® Control Systems is a part. The complete set includes a *General Information* Body Builder booklet for information about the International® product line; *model series* Body Builder booklets which contain information related to the features and specifications for each of their respective models; this *Component* Body Builder booklet containing information for components which have common application in two or more truck series.

This manual describes engine speed control features for operating auxiliary equipment as applied to the Diamond Logic® Control (DLC) and Diamond Logic® Control II (DLC II) systems. It replaces the manual *Body Builder Installation and Use Guidelines* TMT-2284 (November, 1994) which concentrated on the three controller system.

Technical Service Help Line

Navistar, Inc. provides a telephone service that answers technical questions about vehicle maintenance and repair. The telephone number for Customers and Equipment Manufacturers (Body Builders) is:

1 - 800 - 336 - 4500

The Technical Service staff will be pleased to assist you with your questions about the installation and use of the engine speed controls reviewed here. You may also contact Technical Service with your programming problems that cannot be resolved locally.

Publication Purpose

The purpose of this document is two-fold:

WITH REGARD TO ENGINE SPEED CONTROL FEATURES:

- This document provides the information needed to integrate International® MaxxForce® electronic engines with auxiliary equipment such as air compressors, hydraulic pumps, generators and the equipment they power.
- This manual is not a cookbook. The circuits described in this manual should be used as a guide. You must adapt the principles illustrated and develop designs that suit your durability, installation, and parts availability needs. This manual shows individual examples of engine speed control interfaces. These individual examples can be combined to form multi-function applications. For example, the same vehicle can use multiple engine speed control features such as the remote throttle feature to provide the power needed to operate a crane, or use preset engine speed control to operate an air compressor. The objective of this manual is to provide background and examples to permit you to properly install and operate equipment for your vehicle.

WITH REGARD TO PROGRAMMABLE PARAMETERS:

- This information is intended to support the process used by MaxxForce® Engine customers to specify values to be programmed for both factory programmable parameters and field programmable parameters.
- The purpose of this information is to provide general functionality information about programmable parameters available for the Diamond Logic® Control (DLC) and Diamond Logic® Control II (DLC II) systems. In areas where additional detail is desired about a specific parameter or feature, refer to the reference section of this manual for comprehensive documentation.

DISCLAIMER: NAVISTAR, INC. DOES NOT TAKE ANY RESPONSIBILITY FOR CUSTOMER OR BODY BUILDER WIRING.

NOTE: After-market installed wiring for engine speed control must comply with the following guidelines:

1. Sealed switches and connectors must be used for switches and connections that are exposed to the weather or to salt spray emanating from the vehicle's tires.
2. Route and clip wiring to minimize chaffing and exposure to weather. Use conduit, loom, and/or tape to achieve this.
3. Fuse all power leads as close to the power source as possible. Remember fuses protect the wiring — size fuses accordingly.
4. All ground connections that will be made to the frame or body must be connected to clean bare metal. Remove all dirt, paint, grease and rust that would insulate the terminal from ground. After connecting the ground, seal the connection with a good quality grease or surface sealant to protect the connection from corrosion.
5. Spliced wires should be twisted together and soldered. Use a heat shrink tube with a meltable inner wall to seal the connection. Do not expose splices to the weather.

CAUTION: To avoid damage to vehicle electronic components, disconnect both the positive (+) and the negative (-) battery cables prior to electric welding. Attach the welder's ground cable as close as possible to the joint being welded. If it is necessary to weld close to an electronic component, it is recommended that the electronic component be temporarily removed.

WARNING: **To avoid serious personal injury, death or possible engine damage, when welding or using an acetylene torch always wear welding goggles and gloves. Insure that acetylene and oxygen tanks are separated by a metal shield and are chained to a cart. Do not weld or heat areas near fuel tanks or fuel lines. Utilize proper shielding around hydraulic lines.**

WARNING: **To avoid serious personal injury, possible death, or damage to the vehicle, make sure the Transmission is in neutral, parking brake is set, and the wheels are blocked.**

Disclaimer

The Body Builder Books provide product information to assist those who wish to modify these products for individual applications. International® does not recommend or approve any firm or party nor make any judgements on the quality of the work performed by a particular firm or party. Individuals who use the services of a Body Builder must satisfy themselves as to the quality of the work.

The party installing a body, a fifth wheel, any other equipment, or making any modifications to complete the vehicle for delivery and make it road-ready is responsible to see that the completed vehicle complies with all applicable certification procedures and safety standards, as may be set forth in Federal, State, and local statues, rules and regulations.

Specifications, descriptions and illustrative material in this literature are as accurate as known at time of publication but are subject to change without notice. International® cannot accept responsibility for typographical errors which may have occurred. Illustrations are not always to scale and may include optional equipment and accessories but may not include all standard equipment.

Note: All body builders must fulfill DOT, NHTSA, Federal and State requirements. Since these state requirements may vary it is the duty of the body builder to ensure compliance.

Publication Ordering Information

You can easily order the CT-471 Body Builder set or any of its components by accessing the Marketing Resource Center and clicking the “Order Literature” link using your regular User ID and password.

Revisions to the following product publications are available automatically by subscribing to the Product Information Revision Service. Also, additional copies of product publications can be ordered individually on a one-time basis. When ordering, include the publication number, description and quantity required.

Body Builder Book – Complete Set **CT-471**

TerraStar™ Series: Medium Conventional Body Builder Diagrams **PBB-43100**

DuraStar® Series: Medium Conventional Body Builder Diagrams **PBB-44100**

PayStar® Series: Premium On/Off Highway Conventional Body Builder Diagrams **PBB-45100**

WorkStar® Series: Medium & Heavy Conventional Body Builder Diagrams **PBB-50100**

Diamond Logic® Control Systems **PBB-71000**

Body Builder on CD **CT471-CD**

Book 1: MaxxForce® 7, DT, 9, and 10

ENGINE SPEED CONTROL FEATURES

What International® is doing for you

International® vehicles provides a variety of engine speed control features to operate auxiliary equipment. Auxiliary equipment is typically powered by a Power Take Off (PTO) which is interfaced either to the vehicle transmission or tailshaft. PTO features are provided to permit precise management and control of auxiliary equipment.

This document provides information needed to integrate MaxxForce® electronically controlled engines with auxiliary equipment such as air compressors, hydraulic pumps, generators, and the equipment they power. The features for engine speed control offer:

1. More flexible installation locations – control stations can be installed anywhere you can run wires or where a Remote Engine Speed Controller can be mounted. In fact, by using a RESCM the wire lengths can be shortened considerably. Instead of running wires the length of the truck to the engine controller, the wires and switches can be wired to a RESCM which can be located within close proximity of the engine speed control station (currently mounted on the back of the battery box or under the cab, depending on the configuration). Engine speed control can be initiated from outside or inside the vehicle's cab.
2. Capability to use either discrete hardwires to the engine controller or to the multiplexed Remote Engine Speed Controller (RESCM).
3. Precise engine speed governing - the electronic engines will maintain engine speed within 50 RPM (2 percent) of the set point. Accurate engine speed control should provide predictable flow and pressure from hydraulic pumps.
4. Two built-in engine speed selections (besides idle) for operating auxiliary equipment. Variable speed selections are also available through switches to increase or decrease engine speed. Vernier throttle control through a remote throttle potentiometer can also be used.
5. Control stations can be disabled by integrating equipment interlocks into them.
6. Diagnostics and programming are accomplished using either a PC-based software package or an electronic service tool.
7. Increases in engine speed are ramped, instead of accelerating the engine at full fuel levels. The slower load transfer rates can increase the equipment life of some mechanical systems.
8. Soft features. Feature selection and operating set points and limits can be changed to adapt the chassis to the new equipment.
9. A Password protects the configuration and speed settings from tampering.
10. Reduced assembly, maintenance, and repair costs over comparable mechanical control systems.

Hardware and software aspects of each engine speed control feature are discussed in this document. All options for features can be programmed at the factory. Features can be changed in the field after the vehicle has been manufactured using a pc-type computer. Section 2 reviews monitoring feature operation and programing with the PC-based ServiceMaxx.

International® Diamond Logic® Electrical System Overview

The design of the electrical system significantly reduces the direct wiring to the powertrain components. This system uses an Electrical System Controller (ESC) which can be considered a vehicle control module. All of the in-cab switches which were formerly direct wired to the powertrain modules are now connected to this ESC which then communicates the values to the other devices via J1939. Vehicles implementing this system also use a J1939 driven cluster and still, in general, maintain the same powertrain interfacing (Engine-Transmission-ABS) as in previous vehicles. Even with this increased J1939 usage, the standard J1587 communications are still available for uses such as diagnostics as the supplier chooses.

ECM Engine Control System

The Electronic Control Module (ECM) is one of two electronic controllers on the MaxxForce® engine. The ECM and Injector Drive Module (IDM) are mounted directly on the engine. These two controllers work in conjunction to allow the engine to run and operate. The ECM is considered the computer brain for the engine, while the IDM acts as a computer brain for the fuel injection. The ECM also interfaces with other vehicle features such as communicating with the Cruise Control switches, PTO switches, and Accelerator Pedal to name a few.

The ECM engine control system has been specifically designed to work with the new multiplex system, using the J1939 datalink to communicate with the ESC. As a result, some of the hard wired switches from the days of old have been removed from the engine controller and have been replaced by a multiplexed switch that has its information sent to the engine controller over the J1939 datalink. A few examples of switches that are now multiplexed are: Cruise Control and PTO switches, Brake Pedal switch, and Clutch Pedal switch to name a few.

Remote Engine Speed Controller

The Electrical System utilizes multiplexed wiring technologies for interfacing major functional areas of the vehicle. The electrical system includes the Remote Engine Speed Control Module (RESCM) to provide a means to control engine speed from a remote location on the vehicle. The RESCM is responsible for interfacing control signals to the operator and communicates signal status over J1939 datalink. Furthermore, the system relies on software algorithms to accomplish logic functions instead of implementing similar features using complex wire harness designs with relays and switches. A natural benefit of this system is increased diagnostic capability in terms of on-line, off-line, and off-board testing as well as simplifying the harness design. In layperson's terms, the electrical system uses switches that communicate digital messages over a two-wire datalink, rather than having to hard-wire a large bundle of wires that would often extend from one end of the truck to the other. Also, the RESCM is able to accomplish all of the functionality that the old hard-wire method was able to achieve.

Body Builder Wiring

When control over engine speed is required from outside the vehicle cab, a remote mounted switch must be used. Feature code 12VZA {ENGINE CONTROL, REMOTE MOUNTED Provision for; Includes Wiring for Body Builder Installation of PTO Controls; With Ignition Switch Control for

MaxxForce post 2007 Emissions Electronic Engines} or 12VXY {ENGINE CONTROL, REMOTE MOUNTED Provision for; Includes Module and Connector for Body Builder Installation of Remote Engine Speed Control, With SAE J1939 Communication} can be ordered to facilitate switch installation by the body builder. Even though this electrical system tends not to use discrete hard-wires, International offers both hard-wired and RESCM inputs to facilitate engine speed control messages.

Again, hard-wired body builder wiring connections are provided only when code 12VZA is specified. The control module and the wiring connections for body builder use are generally located underneath the hood of the truck It is highly recommended that a male/female connector pair be used to interface with the body builder wires. Recommended connectors can be found in Appendix D2 and D3. Hard-wired connections should be avoided if possible in order to make electrical diagnostics and servicing convenient. Electrical wires spliced to these connections should be twisted together and then soldered. A heat shrink tube should be used to seal the connections and the splices should not be exposed to the weather. Each wire connection has a circuit number printed on the insulation. Table 1.1 summarizes the circuit numbers and functions available with the hardwired version, 12VZA. In addition, the table includes information on wire gauge sizes and colors.

Table B1.1 – Functions Available with 12VZA, Hardwired Body Builder Wiring

CIRCUIT NUMBER I6	ECM PIN	FUNCTION	WIRE GAUGE	WIRE COLOR I6	WIRE COLOR V8
KQ97CB	X1-16	Preset PTO Enable	18	Purple	Purple
KQ97CC	X1-60	Variable PTO Enable	18	Purple	Purple
K4Q46B	X1-68	Set PTO Speed	18	Grey	Purple
KQ46A	X1-49	Resume PTO Speed	18	Grey	Purple
KQ47B	X1-72	Speedometer	18	Grey	Purple
KQ97AR	X1-71	Tachometer	18	Purple	Purple
KQ97DF	12V 1 Amp Source	Voltage PTO	14 (V8) 16 (I6)	Purple	Purple
K99F	X1-50	REM Accelerator	18	Purple	Purple
K97XC	X1-11	Transfer Case	18	Purple	Purple
K97WA	X1-35 (I6) X1-38 (V8)	Signal Return	18	Purple	Purple
K97EW	X1-22	Engine Warning	18	Purple	Purple
K97SE	X1-21	Stop Engine	18	Purple	Purple
K97FV	X1-27 (I6) X1-32 (V8)	Voltage Ref 5V	18	Purple	Purple

ServiceMaxx and Feature Programming

After engine assembly, changes can be made using the ServiceMaxx Software package and a PC. The scope of the changes that may be needed is discussed in this section. International® primarily uses the ServiceMaxx Software package for engine control diagnostics and programming. The ServiceMaxx Software permits monitoring of engine speed control functions during engine operation. This tool also permits modification of engine speed control parameters via re-programming. The specific functions for monitoring and programming are discussed in this section. In order to use the software package, a PC-type computer must be interfaced to the controller through the PC's communications port using an adapter harness. Appendix A shows the required part numbers to connect the computer. The software package can be installed on a computer by following the instructions on the installation disk.

Monitoring Engine Speed Control Parameters with ServiceMaxx Software

ServiceMaxx Software can be used to monitor engine speed control parameters during equipment operation. Table 2.1 shows the data display items for engine speed control features that are displayed by the diagnostic software. Beside each item is a short explanation of the data displayed. Switch states and accelerator pedal values contained in Table 2.1 are shown while the engine is not running and the ignition key is on. This Key On/Engine Off functionality permits a particular installation to be verified prior to actual use. Active values for PTO related parameters appear only

when PTO MODE is set to REMOTE, IN-CAB or IN-CAB+REMOTE. The next section discusses programming for each engine speed control feature.

Table 2.1 – Service Tool Display Items for Monitoring Speed Control Features

SERVICEMAXX SOFTWARE DISPLAY ITEM	VALUE	DISPLAY ITEM CONTENTS
Accel Pedal	0.00%	Displays the Throttle Percent of the Driver's Foot Pedal.
Engine Speed	0.00 RPM	Displays Engine Speed in revolutions per minute.
PTO On/Off *	Off	Displays the status of the in-cab ON/OFF switch.
PTO Set Switch	Off	Displays the status of the SET switch.
PTO Coast Switch	Off	Displays the status of the SET switch (Hold SET for COAST).
PTO Resume Switch	Off	Displays the status of the RESUME switch.
PTO Accel Switch	Off	Displays the status of the RESUME switch (Hold the RESUME switch for the ACCE function).
PTO Brake Switch	Off	Displays the status of the service brake switch.
PTO Clutch Switch	On	Displays the status of the clutch or neutral position switch.
PTO Ctrl Mode	Inactive	Displays ACTIVE when engine speed control is active.
PTO Set RPM	700 RPM	Displays desired engine speed in RPM when speed control is active.
Rem VAR PTO	Off	Displays ON when Remote Variable PTO Switch is enabled.
Rem Preset PTO	Off	Displays ON when Remote Preset Switch is enabled.
Rem Throttle	N/A	Displays ON when the remote throttle is enabled to control desired engine speed. Remote throttle displays FAIL when the remote throttle is faulted.
Split Shaft	N/A	Displays driveline status (neutral or split shaft).

* This display item name is only valid for ServiceMaxx Software. The corresponding parameter name for the EST is “PTO Speed”.

Programming Engine Speed Control Parameters with ServiceMaxx Software – What Can You Change with ServiceMaxx Software?

Many of the parameters for PTO Engine Speed Control features can be programmed at the factory. Parameters can be re-programmed in the field after the vehicle has been manufactured. A PC using ServiceMaxx Software is used to modify the factory settings for engine speed control features. Re-programming permits customization of feature operation to exactly match the auxiliary equipment being operated; it also permits changing from one feature to another. Table 2.2 shows which parameters are used for each engine speed control feature. Each of the parameters can be accessed and reprogrammed with the ServiceMaxx Software. Parameter settings can be reviewed and changed by selecting the appropriate engine speed control parameters within the VEHICLE PROGRAMMING menu.

When a feature is added or modified, all parameters should be checked to ensure that the equipment will operate as intended. Particular attention should be given to parameters that have a “Yes” in the column for the feature in Table 2.2. A more comprehensive discussion of all parameters is provided in Section 3.

Additional references for feature programming can be found in “Appendix B” of this manual. For further assistance, contact your International® dealer or call Technical Service at 1-800-336-4500 for help with field re-programming.

Table 2.2 – Speed Control Feature Parameter Matrix

PROGAMMABLE PARAMETER NAME	PRESET ENGINE SPEED CONTROL	VARIABLE ENGINE SPEED CONTROL	REMOTE THROTTLE PEDAL	REMOTE ENGINE SPEED CONTROL	MOBILE ENGINE SPEED CONTROL	SPLIT SHAFT
PTO: Power Take Off Mode	Yes	Yes	Yes		Yes	
PTO: In-Cab Mode	Yes	Yes	No		Yes	
PTO: in-Cab Control	Yes **	Yes **	No *		No	
PTO: Remote Pedal	No **	No **			No	
PTO: Preset RPM 1 (Set)	Yes	No			Yes	
PTO: Preset RPM 2 (Resume)	Yes	No			Yes	
PTO: Preset RPM 3	Yes	No			Yes	
EPG: Preset RPM 4	Yes	No			Yes	
PTO: Preset RPM 5	Yes	No				
PTO: Preset RPM 6	Yes	No				
PTO: Max RPM	Yes	Yes				
PTO: RPM Ramp Rate	No	Yes				
PTO: Max Vehicle Speed	No	No				
EPG: Driveline Mode	No	No				

* Program as required for use with the Preset or the Variable Engine Speed Control features when they are used in combination with the Remote Throttle.

** Program as required for use with the Remote Throttle when the Remote Throttle is used in combination with the Preset or the Variable Engine Speed Control features.

Engine Speed Control for Power Take Off (PTO) Applications

There are 3 different engine speed control features available for vehicle vocations:

- Preset Engine Speed Control
- Variable Engine Speed Control
- Mobile Variable Engine Speed Control

The first two features require a non-moving (stationary) vehicle for operation. The “Preset” feature always controls engine speed to a previously programmed value, while the “Variable” feature permits a desired engine speed to be selected via the in-cab or remote mounted switches. The “Mobile Variable” feature is the same as the “Variable” feature, with the exception that the vehicle can be moving or stationary during PTO operation.

Table 3.1 lists the programmable parameters that apply to these three PTO Engine Speed Control features. For each programmable parameter, this table shows the minimum and maximum permissible values that can be programmed, engineering units, and the resolution (increment) applicable for a particular parameter.

Detailed descriptions are provided for each of the programmable parameters in the “Programmable Parameters”, Section 9.

Table 3.1 –Programmable Parameter Attributes for PTO Engine Speed Control

PROGRAMMABLE PARAMETER NAME	PROGRAMMABLE PARAMETER ATTRIBUTES			
	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
PTO: Power Take Off Mode	N/A	0	3	1
PTO: In-Cab Mode	N/A	0	3	1
PTO: In-Cab Control	N/A	0	1	1
PTO: Preset RPM 1 (Set)	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: Preset RPM 2 (Resume)	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: Preset RPM 3	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: Preset RPM 4	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: Preset RPM 5	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: Preset RPM 6	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: Max RPM	RPM	LOW IDLE	GOVERNED SPEED	.25
PTO: RPM Ramp Rate	RPM/SEC	1	1500	.25
PTO: Max VS	MPH	0	20	.5
PTO: Remote Pedal Enable	N/A	0	1	1

Preset Engine Speed Control

This feature provides six pre-determined engine speed settings (besides low idle) for equipment operation. Preset Engine Speed Control satisfies the majority of the intended engine speed control

applications. Use Preset Engine Speed Control when a constant engine speed is required to operate equipment. In-cab engine speed controls can be used for presets 1 through 6 where remotely mounted controls may be used for presets 1 and 2.

Typical operation of this system requires the operator to perform the following steps:

1. Activate the system
2. Select the desired engine speed using the SET/CRUISE or RESUME/ACCEL switch. The RESUME/ACCEL switch will increment the six predetermined engine speed settings; SET/CRUISE will decrement the six predetermined engine speed settings.

The desired engine speed set-point can be field programmed to any speed between low idle and high idle speed. Preset Engine Speed Control operates only while the vehicle is stationary. Manipulation of cab located sensor inputs (i.e., Neutral Safety, Service Brake, or Clutch Pedal) will cause the engine speed control to disengage.

Table 3.2 summarizes the operation of preset engine speed control. The columns are labeled with the switch being used. The first row discusses what happens when the switch contacts are momentarily closed. The second row discusses the effect of held switches (continuous contact) or multiple use of the same switch.

Table 3.2 – Preset Engine Speed Control Switch Use

ON	OFF	SET/CRUISE	RESUME/ACCEL	BRAKE	CLUTCH
Single Press (Momentary Contact)					
Enables engine speed control	Disables engine speed control	Sets the desired engine speed to the “Set” Switch RP Preset speeds 1-6	Sets the desired engine speed to the “Resume” Switch RPM Preset speeds 1-6	Deactivates engine speed control and establishes a standby state. Engine speed returns to low idle rpm.	Deactivates engine speed control and establishes a standby state. Engine speed returns to low idle rpm.
Held Switch (Continuous Contact)					
Enables engine speed control	Enables engine speed control	Same [1]	Same [1]	The change in brake status establishes the standby state.	The change in brake status establishes the standby state.

[1] = The held switch acts like the switch is being “hit” multiple times.

- In-Cab Operation of Preset Engine Speed Control

When control over engine speed is not needed outside the vehicle's cab, the in-cab switches can be used to activate engine speed control and select the desired engine speed.

Press the CRUISE “ON” Switch to enable engine speed control. Note: This switch is located on the steering wheel. See Figure . NOTE: There is no indication to the user that the Cruise On switch has been depressed. Next, select the desired engine speed using either the SET/CRUISE or the RESUME/ACCEL switch. The engine speed acceleration will be limited according to the value programmed for the parameter ***PTO RPM***

Ramp Rate. This acceleration limit should be programmed as required to minimize stress on auxiliary equipment drive links.

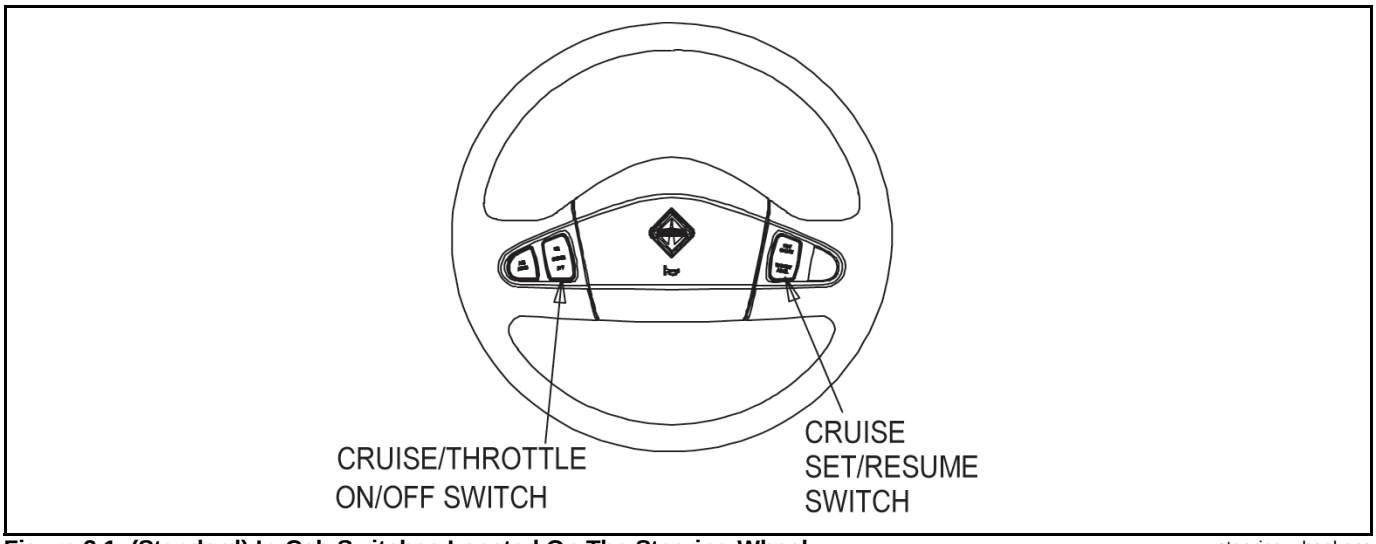


Figure 3.1 (Standard) In-Cab Switches Located On The Steering Wheel steering wheel.eps

Engine speed will be reduced to idle by any of the following actions:

- CRUISE “OFF” switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)

Note that these actions are always applicable for in-cab PTO Operation, regardless of the value programmed for the parameter “PTO IN-CAB CONTROL”. Only when engine speed is controlled by remote input signals and the cab interface is disabled will the engine speed be unaffected by the above actions.

WARNING: **Shift of automatic transmission from neutral to forward or reverse gear while operating any PTO mode is not recommended; vehicle may lurch forward when transmission is placed in gear due to increased power output of the engine which is operating at the elevated engine speed.**

WARNING: **To avoid sudden, unexpected vehicle movement and possible personal injury:**

- **Always fully set the parking brake when using the Preset PTO Engine Speed Control Feature.**
- **Do not abort the Preset Engine Speed Control Feature by shifting an automatic transmission from neutral gear into a forward or reverse gear.**
- **Turn off the engine when you leave the vehicle. Never leave the vehicle unattended with the engine running.**

- In-Cab Switch Configuration for Preset Engine Speed Control

The right-hand portion of Figures 3.2a and 3.2b illustrate the circuitry provided for in-cab operation of Preset Engine Speed Control. Though the ECM2 pins and RESCM are shown in Figures 3.2a, 3.2b and 3.3, in-cab

PTO operation does not require any additional wiring to these modules, nor any other module. The circuitry provided by International must not be tampered with.

If Preset PTO Engine Speed Control is already active and a different switch is pressed, engine speed will change from the original speed commanded by the ECM to the new speed corresponding to the latest switch that was pressed by the operator.

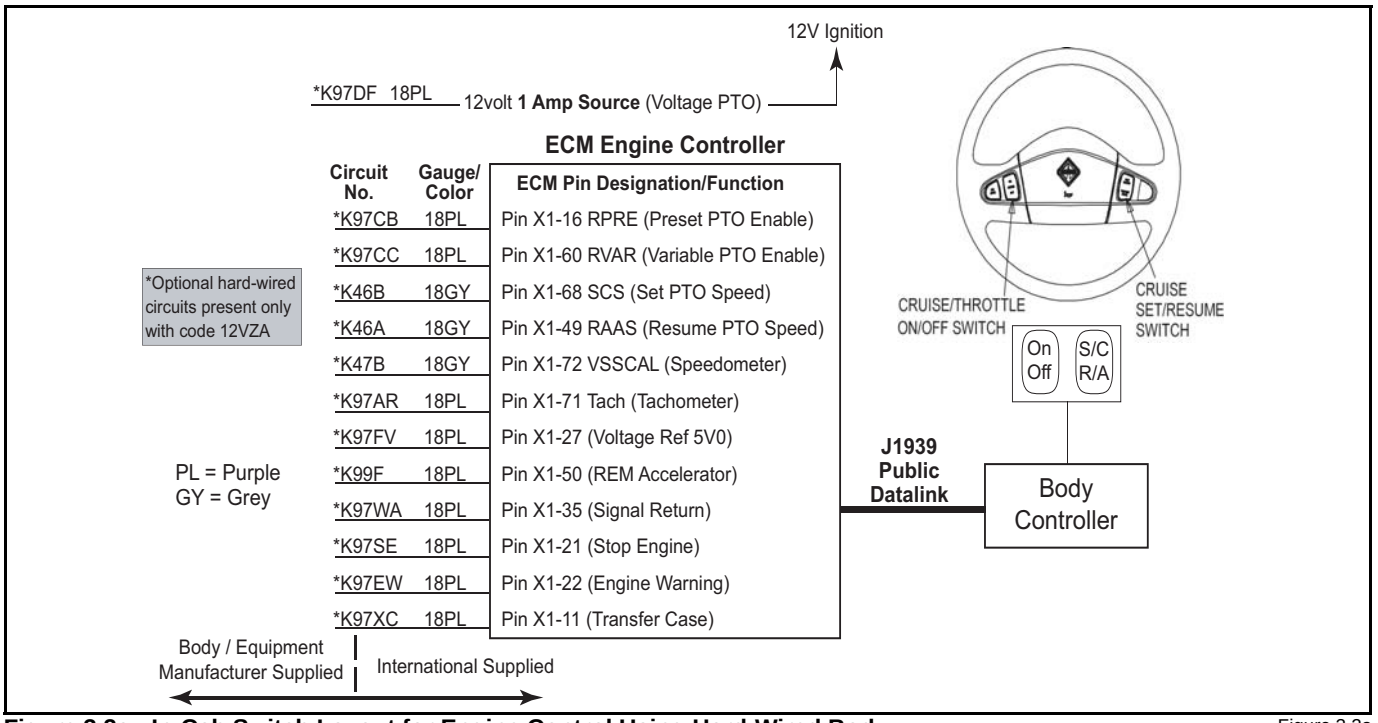


Figure 3.2a - In-Cab Switch Layout for Engine Control Using Hard-Wired Body Builder Wiring Present - I6 Engines

Figure 3.2a

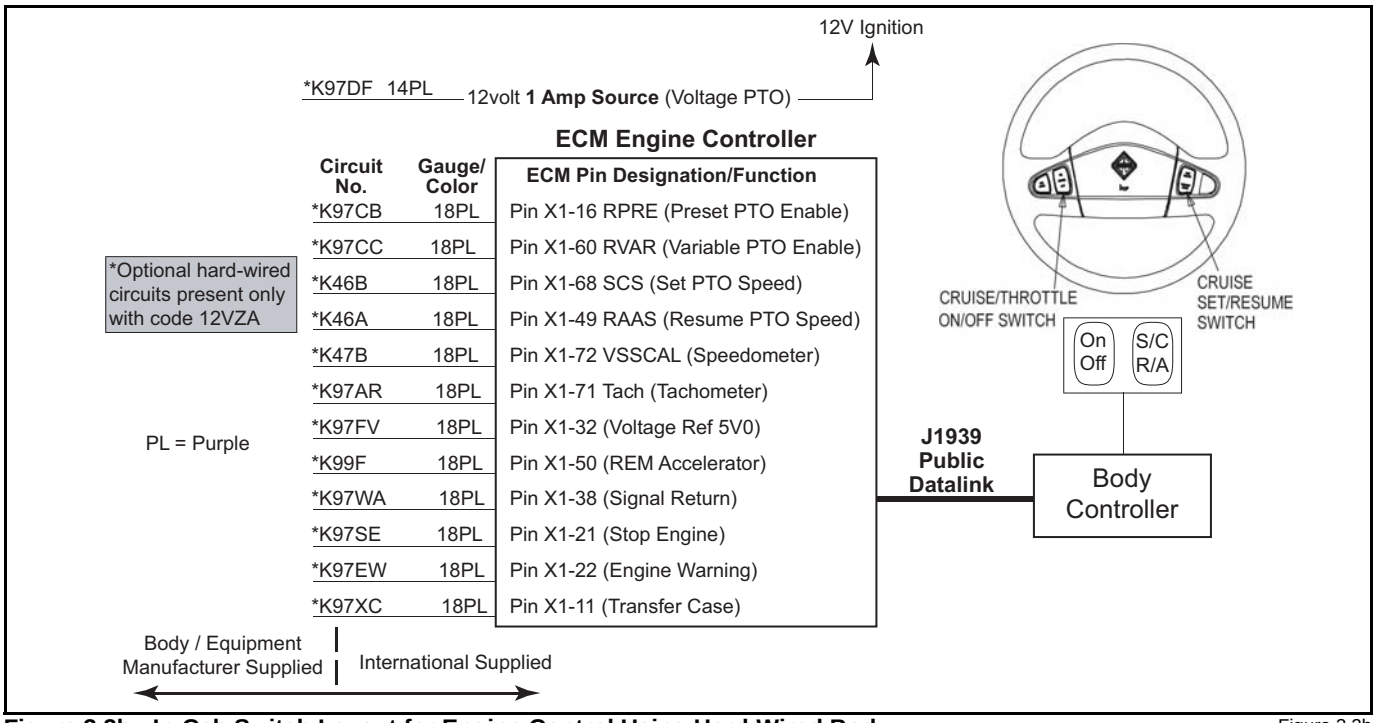


Figure 3.2b - In-Cab Switch Layout for Engine Control Using Hard-Wired Body Builder Wiring Present - V8 Engines

Figure 3.2b

- Remote Operation of Preset Engine Speed Control

When control over engine speed is required from outside the vehicle's cab, remote mounted switches (either hard-wired, code 12VZA, or multiplexed using the RESCM, code 12VXY) must be used to turn on PTO engine speed control and select the desired engine speed. Figures 3.4a, 3.4b and 3.5 illustrate how remotely located switches must be interfaced to the ECM to accomplish Preset PTO Engine Speed Control. Figures 3.4a and 3.4b detail the hard-wired body builder circuitry (12VZA) while Figure 3.5 shows the circuitry needed for the multiplexing RESCM (12VXY). The hard-wired version does not include such features as Remote Throttle or Transfer Case/Split Shaft. If those features are desired, the Remote Engine Speed Control Module (RESCM) must be ordered. The RESCM uses the J1939 datalink to transmit (multiplex) the messages to the engine controller that were previously hard-wired with past generation International trucks. Switch functionality remains the same as described for the in-cab located switches (see Table 3.2).

A REMOTE PRESET PTO ON/OFF switch (RPRE) is required to remotely turn on the Preset Engine Speed Control. The desired engine speed is then selected using a remotely located SET/CRUISE or RESUME/ ACCEL switch. Once a desired engine speed has been selected using one of these switches, engine speed will begin to increase. This rate of increase will be limited according to the value programmed in the parameter PTO RPM Ramp Rate. This acceleration limit should be programmed as required to minimize stress on auxiliary equipment power drive links.

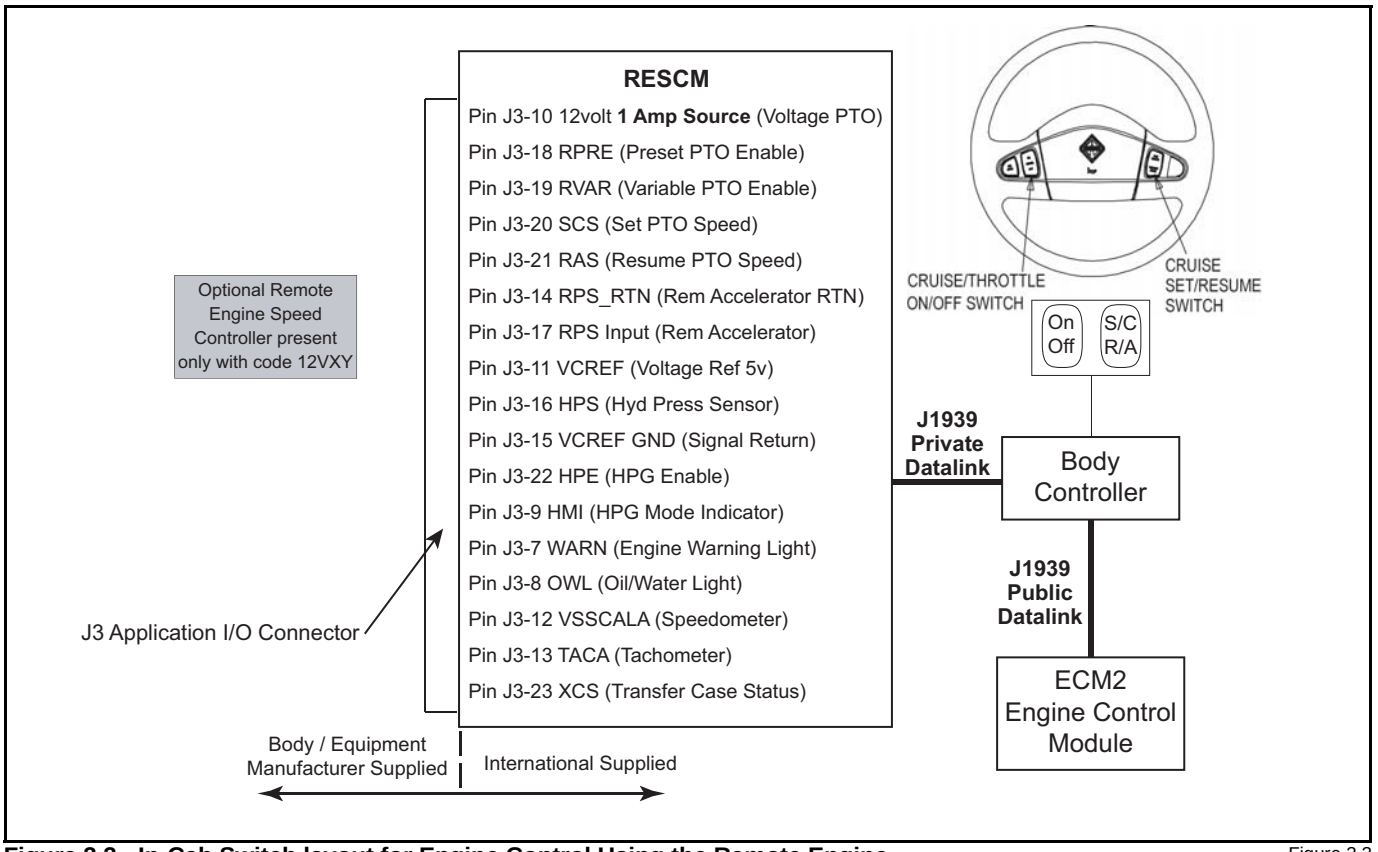


Figure 3.3 - In-Cab Switch layout for Engine Control Using the Remote Engine Speed Controller Present

Figure 3.3

WARNING: **Be aware that the Remote Set Switch and Remote Resume Switch are connected in parallel (logic "OR-ed") with the cab-mounted SET/CRUISE and RESUME/ACCEL switches respectively. This means that once preset PTO Engine Speed Control has been placed in "standby" on-mode (by pressing either the In-Cab located CRUISE ON switch, or the remotely located REMOTE PRESET PTO ON switch), the desired engine speed can be modified both from within the cab or from the remote located PTO Engine Speed Control switches. This is ALWAYS TRUE, even when the PTO MODE parameter is programmed for REMOTE OPERATION ONLY.**

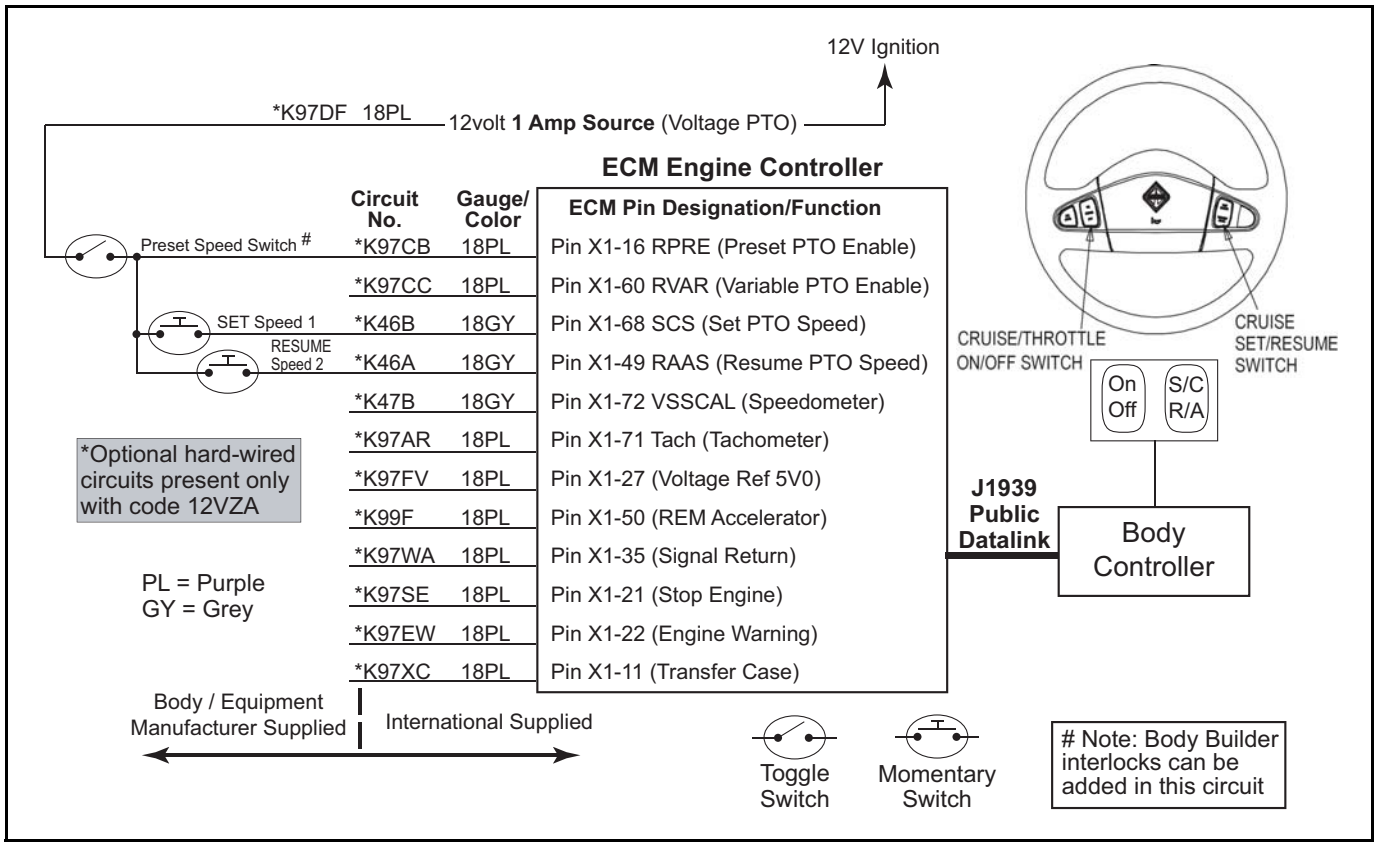


Figure 3.4a - Remote Installation for Preset Engine Control Using Hard-Wired Body Builder Wiring - I6 Engines

Figure 3.4a

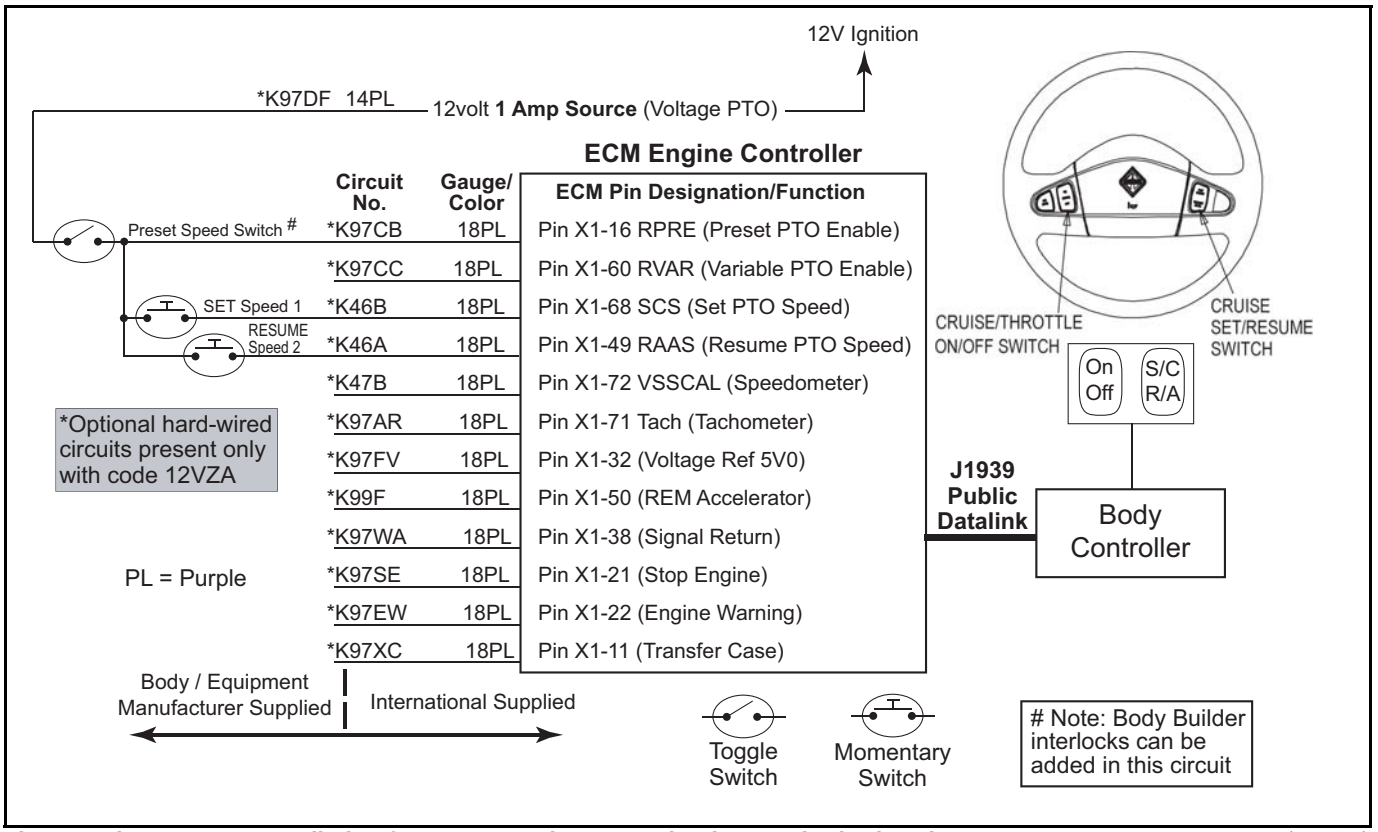


Figure 3.4b - Remote Installation for Preset Engine Control Using Hard-Wired Body Builder Wiring - V8 Engines

Figure 3.4b

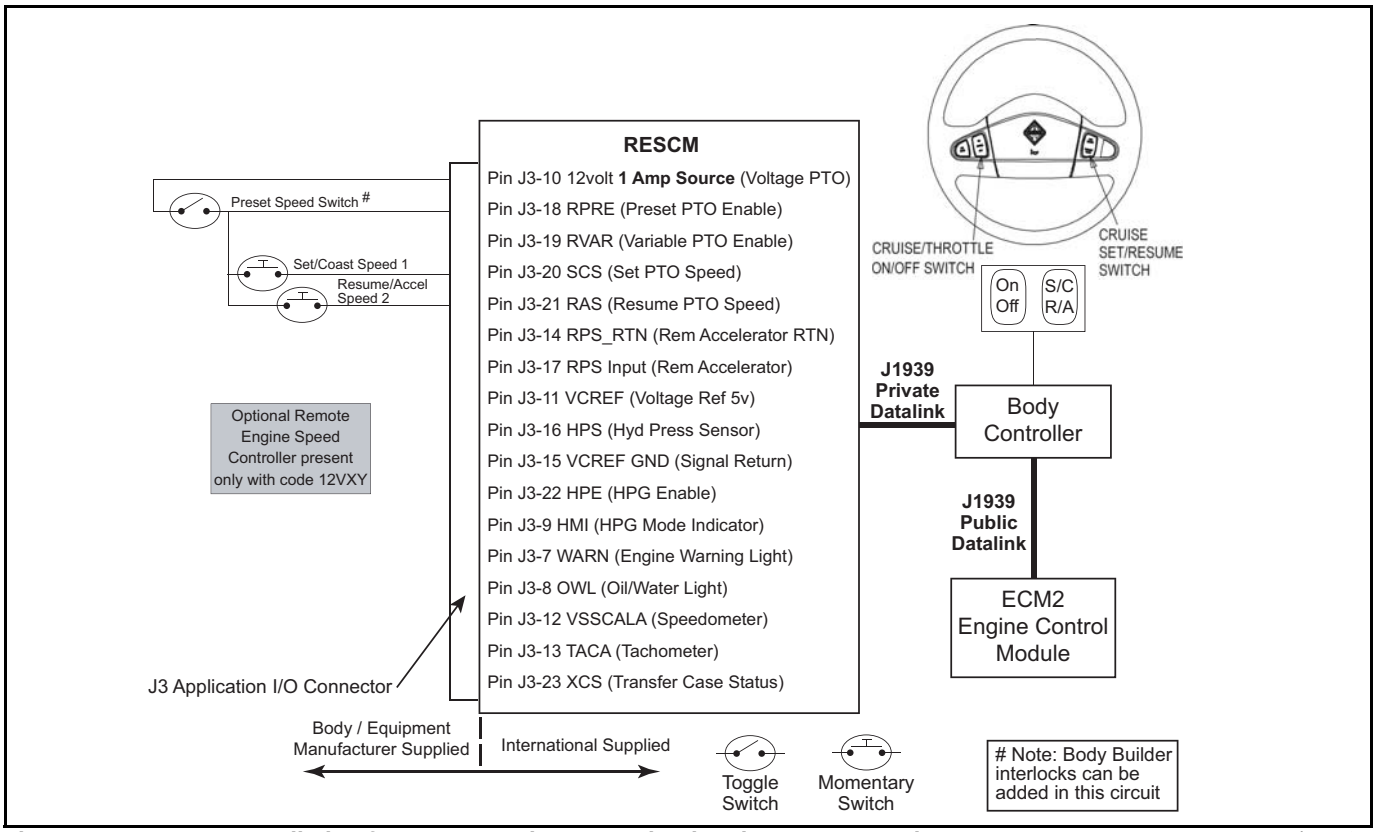


Figure 3.5 - Remote Installation for Preset Engine Control Using the Remote Engine Speed Controller

Figure 3.5

Variable Engine Speed Control

Variable engine speed control permits a desired engine speed to be achieved between low idle and high idle speed even without use of the accelerator pedal or Remote Throttle.The switches that must be used to achieve this functionality are ON, OFF, SET/CRUISE, and RESUME/ACCEL. These switches can be remote and/or cab mounted. If only temporary increases in engine speed are needed, consider using Preset Engine Speed Control in combination with the Remote Throttle. Table 3.3 summarizes the operation of Variable Engine Speed Control. Columns are labeled according to the switch being used. The first row presents the control system's response when the toggle switch position is changed by the operator. The second row documents the control system's response when the switch contacts are momentarily closed. The third row discusses the effect of maintaining a switch in the closed (pressed) condition; this row also discusses multiple applications of the same switch.

Table 3.3 – Variable Engine Speed Control Switch Interpretations

ON	OFF	SET/CRUISE	RESUME/ACCEL	BRAKE	CLUTCH
On/Off Switch (Toggle Switch)					
Turns engine speed control ON.	Turns engine speed control OFF.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Single Press (Momentary Contact)					
Not Applicable	Not Applicable	Latch the current engine speed as the desired engine speed. Decrease engine speed by 25 RPM, if active.	Resume speed control function at the last desired engine speed. Increase engine speed by 25 RPM, if active.	Deactivate vehicle speed control and maintain standby state. (Pedal use returns the engine to the low idle speed.)[1]	Deactivate vehicle speed control and maintain standby state. (Pedal use returns the engine to the low idle speed.)[1]
Held Switch (Continuous Contact)					
Not Applicable	Not Applicable	Decrease engine speed if engine speed control is active.[2]	Increase engine speed if engine speed control is active.[2]	Any change in brake status establishes a standby state.[1]	Any change in driveline status establishes a standby state.[1]

[1] = Engine speed control stops only when there is a transition from one pedal state (pedal pressed or pedal released) to the other and only when the disable cab controls parameter is not selected.

[2] = The held switch acts like the switch is being “hit” multiple times until the switch is released. When the RESUME switch is held closed, the engine speed will be commanded to accelerate. The standby state will be momentarily recognized, then engine speed will continue to accelerate.

- In-Cab Operation of Variable Engine Speed Control

In-cab located switches can be used to turn on engine speed control and select the desired engine speed. Press the CRUISE “ON” Switch to enable engine speed control. This switch is located on the steering wheel. NOTE: There is no indication to the user that the Cruise On switch has been depressed. Next, select the desired engine speed using the SET/CRUISE switch. Then press RESUME/ACCEL or SET/CRUISE until the desired engine speed is achieved.

The accelerator pedal can be used, as well, to increase or decrease engine speed as desired; the desired engine speed will be maintained by the engine controller once a momentary press of the SET/CRUISE switch occurs. Once an initial engine operating speed is selected, a momentary press of the RESUME/ACCEL and/or SET/CRUISE switches will cause engine speed to increase or decrease by a small amount. This incremental amount can be used to fine tune the engine speed selected. Should speed control be interrupted (i.e., by the brake or the clutch switch), the RESUME/ACCEL switch can be pressed to return to the last engine speed set point. The engine's acceleration rate will be limited according to the value programmed for the parameter **PTO RPM Ramp Rate**. This acceleration rate should be programmed as required to minimize stress on auxiliary equipment power drive links. Anytime Variable Engine Speed Control is active, the engine will maintain the selected speed until one of the following events occur:

- CRUISE “OFF” switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)

Note that these actions are always applicable for in-cab PTO Operation, regardless of the value programmed for the parameter “PTO IN-CAB CONTROL”. Only when engine speed is controlled by remote input signals and the cab interface is disabled will the engine speed be unaffected by the above actions.

WARNING: **Shift of automatic transmission from neutral to forward or reverse gear while operating any PTO mode is not recommended; vehicle may lurch forward when transmission is placed in gear due to increased power output of the engine which is operating at the elevated engine speed.**

WARNING: **To avoid sudden, unexpected vehicle movement and possible personal injury:**

- **Always fully set the parking brake. Do not use the gearshift lever instead of the parking brake.**
- **Turn off the engine when you leave the vehicle. Never leave the vehicle unattended with the engine running.**

- In-Cab Switch Configuration for Operation of Variable Engine Speed Control

Once again, the right-hand portion of Section 3.2 illustrates the circuitry provided by International® for in-cab operation of Variable Engine Speed Control. This circuitry is provided by International and must not be tampered with.

- Remote Operation of Variable Engine Speed Control

When control over engine speed is required from outside the vehicle cab, remote mounted switches must be used to turn on PTO engine speed control and select the desired engine speed. Figures 3.6a, 3.6b and 3.7 illustrate how remotely located switches must be interfaced to the ECM to accomplish Variable Engine Speed Control. Switch functionality remains the same as described for the in-cab located switches (see Table 3.3).

The Remote Throttle (see Section 5) can be used as well to increase or decrease engine speed as desired. The desired engine speed will be maintained by the engine controller once a momentary press of the SET/COAST switch occurs. Once an initial engine operating speed is selected, a momentary press of the RESUME/ACCEL and/or SET/COAST switches will cause engine speed to increase or decrease by a small amount. This incremental amount can be used to fine tune the engine speed selected. Should speed control be interrupted (i.e. by the brake or the clutch switch), the RESUME/ACCEL switch can be pressed to return to the last engine speed set point. The engine’s acceleration rate will be limited according to the value programmed for the parameter ***PTO RPM Ramp Rate***. This acceleration rate should be programmed as required to minimize stress on auxiliary equipment power drive links. Any time Variable Engine Speed Control is active, the engine will maintain the selected speed until one of the following events occur:

- CRUISE “OFF” switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)

CAUTION: Be aware that the Remote Set Switch and Remote Resume Switch are connected in parallel (logic `OR-ed') with the cab-mounted SET/CRUISE and RESUME/ACCEL switches respectively. This means that once preset Variable PTO Engine Speed Control has been placed in “standby” on-mode (by pressing either the in-cab located CRUISE ON switch, or the remotely located REMOTE VARIABLE PTO ON switch), the desired engine speed can be modified both from within the cab or from the remote located PTO Engine Speed Control switches. This is ALWAYS TRUE, even when the PTO MODE parameter is programmed for REMOTE OPERATION ONLY.

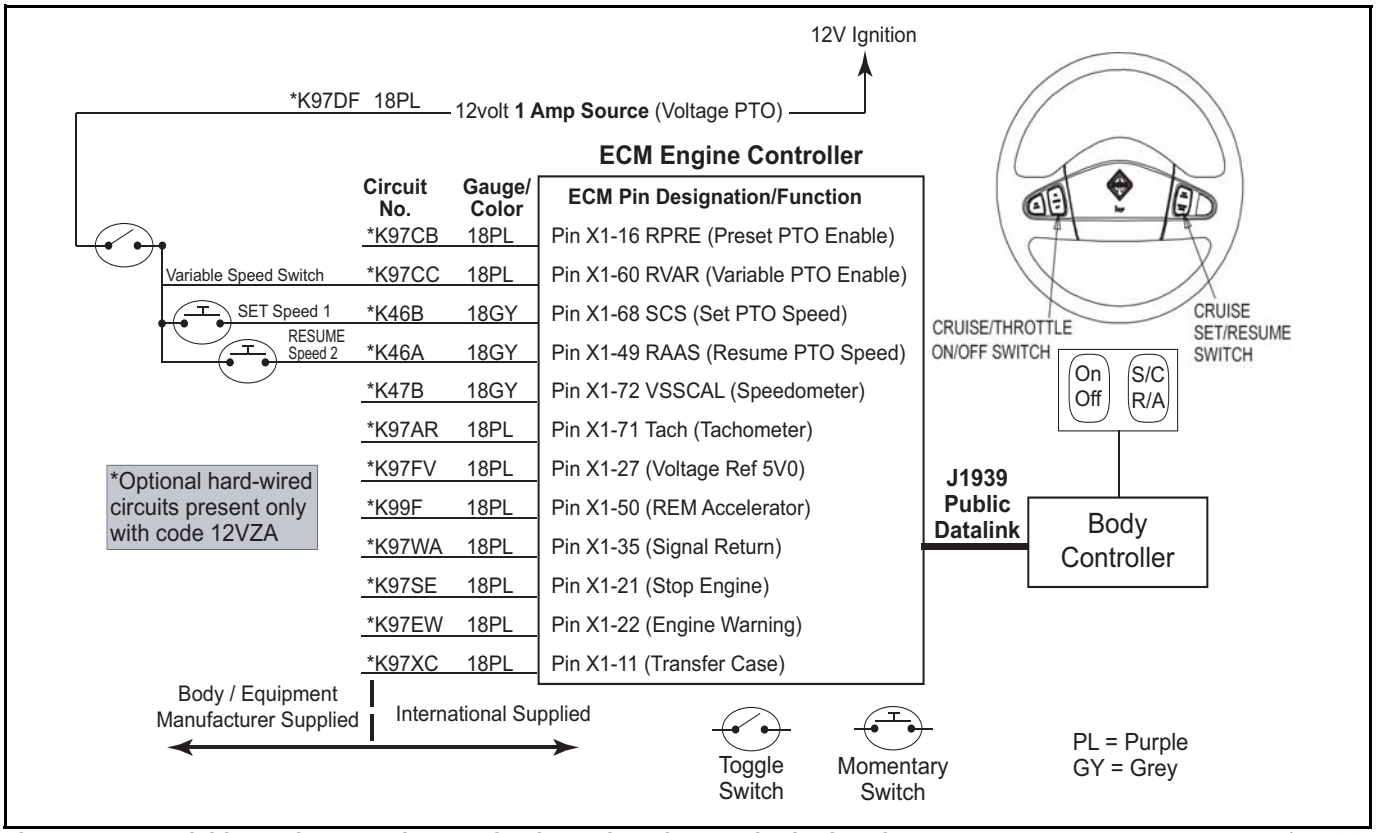


Figure 3.6a - Variable Engine Speed Control Schematic Using Hard-Wired Body Builder Wiring - I6 Engines

Figure 3.6a

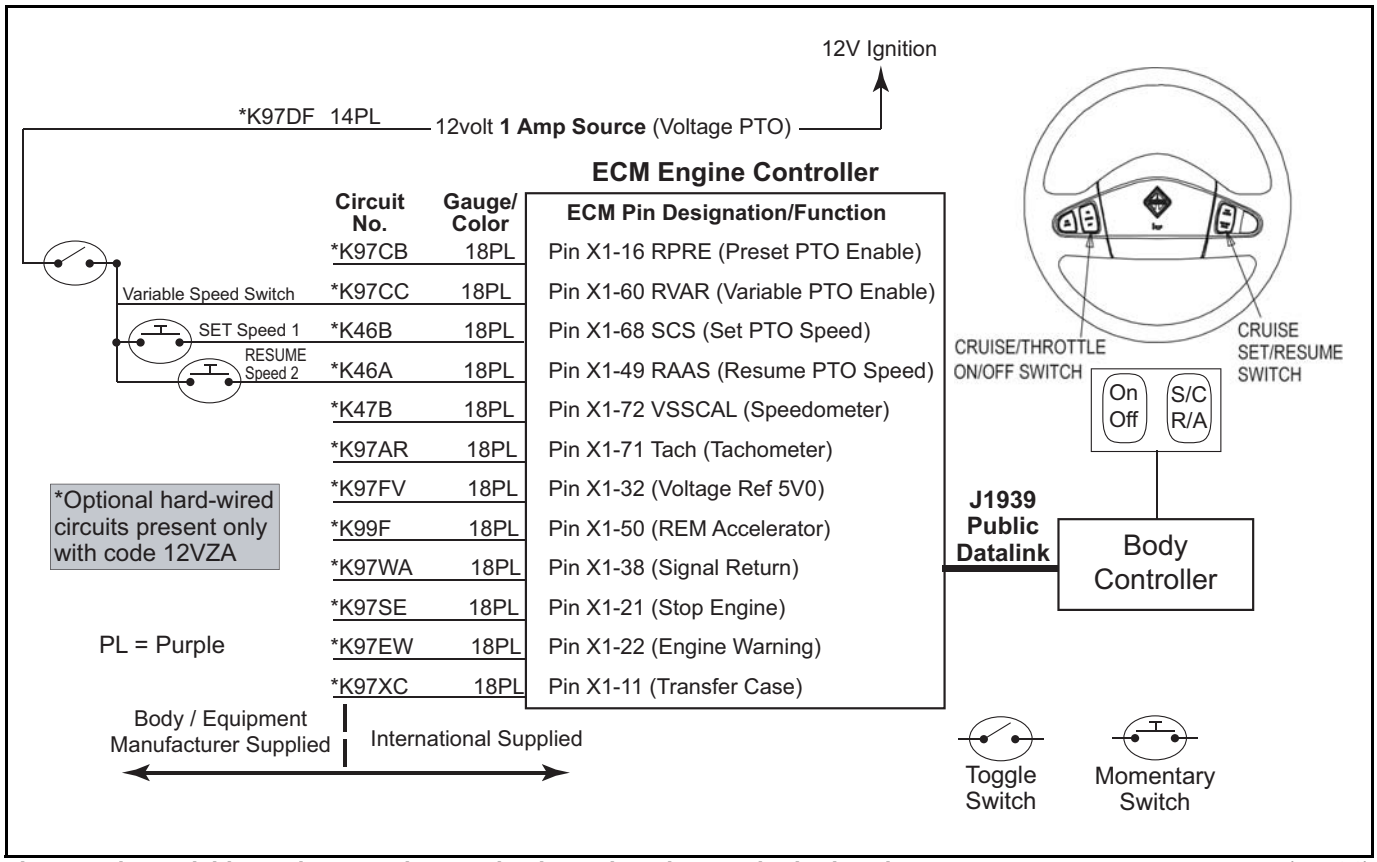


Figure 3.6b - Variable Engine Speed Control Schematic Using Hard-Wired Body Builder Wiring - V8 Engines

Figure 3.6b

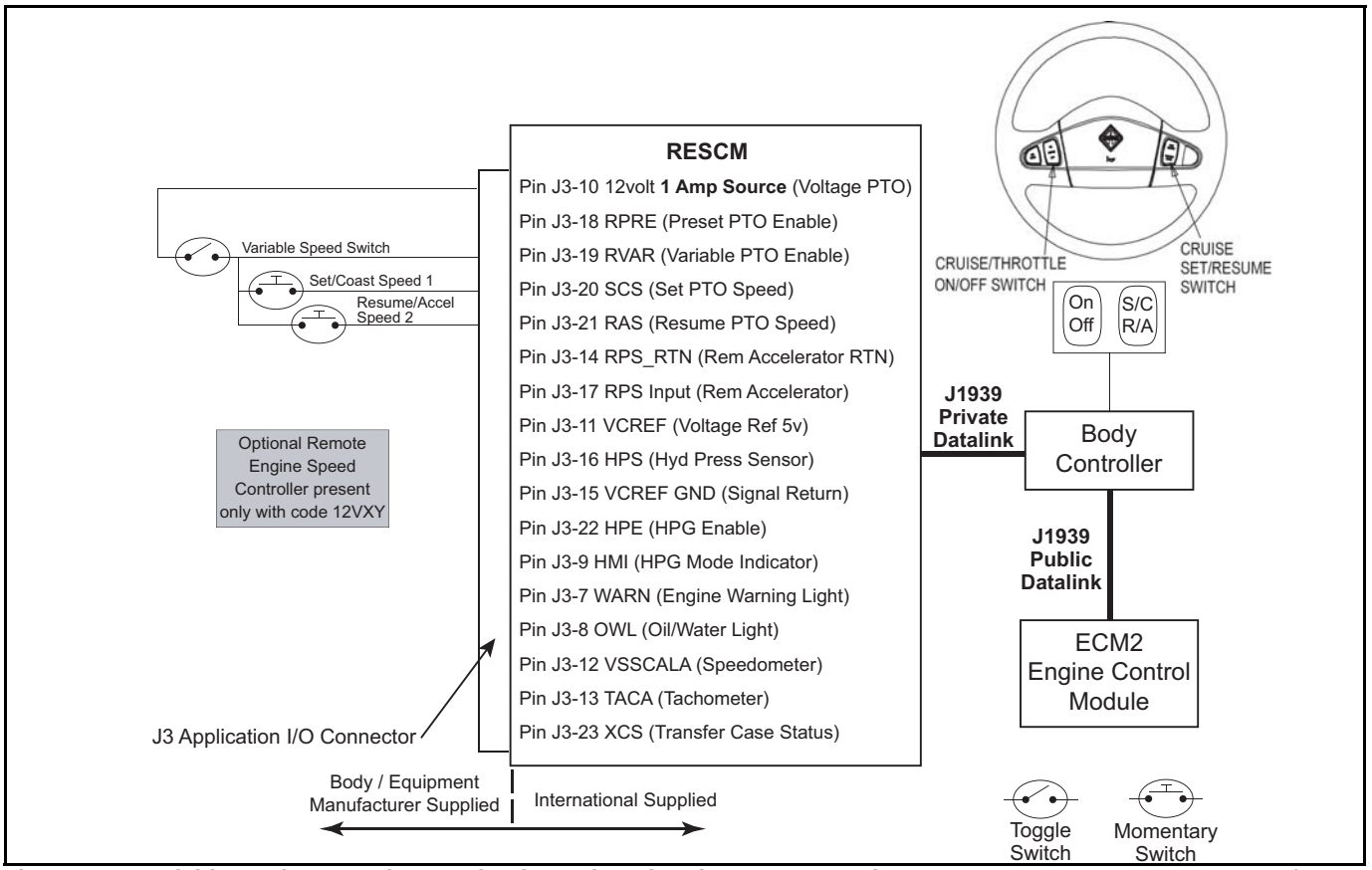


Figure 3.7 - Variable Engine Speed Control Schematic Using the Remote Engine Speed Controller

Figure 3.7

Engine Speed Control for Mobile Applications

This section discusses the Variable Mobile Engine Speed Control. Mobile Variable Engine Speed Control functions like cruise control, except that the engine speed (instead of the vehicle speed) is being controlled. Mobile control can be performed only below a programmed maximum vehicle speed. The default vehicle speed limit is 20 MPH.

Functionality for mobile control is identical to the functionality described previously for Variable PTO Engine Speed Control, with the exception that the vehicle is no longer required to be stationary; vehicle movement is permitted up to a maximum threshold, specified by the programmable parameter ***PTO Max Veh Speed***.

When the specified vehicle speed limit is exceeded, Variable Engine Speed Control will be placed in the “standby” mode of operation and engine speed will return to idle. Pressing the RESUME/ACCEL switch after the vehicle speed has slowed to a value less than the programmed maximum speed limit will reestablish engine speed control at the previously selected engine speed. Changes in the status of the brake and clutch switches will also return the engine to its idle speed.

Switch functionality remains the same as described for the Variable Stationary Engine Speed Control switches (see Table 3.3).

Press the CRUISE ON switch to turn on Engine Speed Control. Press the SET/CRUISE switch to select an engine speed. Then press RESUME/ACCEL or SET/CRUISE until the desired engine speed is achieved. Momentary presses of the RESUME/ACCEL and SET/CRUISE switches will cause the engine speed to increase or decrease by a small amount. This incremental amount can be used to fine tune the engine speed selected. Should speed control be interrupted by the brake or the clutch switches, press the RESUME/ACCEL switch to return to the last engine speed set point. The engine's acceleration will be limited to the ***PTO RPM Ramp Rate***. The acceleration limit can be set to reduce the stress on the auxiliary equipment power couplings.

Transfer Case/Split Shaft Operation

This section describes the Transfer Case/Split Shaft feature and its applications. This feature is used in conjunction with Engine Speed Control and is targeted for applications that use a transfer case or auxiliary driveshaft. The auxiliary drive unit is often connected to a pump that performs vacuum functions (i.e. sewage removal truck or fire pumps). Figure 4.1 illustrates the wiring required for a typical Split Shaft application.

Transfer Case Switch Operation

The transfer case status switch must be in the proper state indicating that it is “OK” to operate. The transfer case status switch input is provided as a safety interlock feature and must be wired as shown in Figure 4.1. The purpose of the transfer case input is to inihibit the system from entering engine speed control mode if the transfer case is operating in driveline mode versus split shaft mode. The transfer case status switch must be wired such that when the transfer case is in split shift mode, pin J3-23 of the RESCM sees 12 volts.

EPG Driveline Mode

This parameter indicates how the driveline disengagement signal should be interpreted by the ECM and is proggrammable by Navistar, Inc. only.

- 0: NEUTRAL OPERATION, driveline must be disengaged at all times for operation of the split shaft feature.
- 1: SPLIT SHAFT, a transition in driveline status will cause the split shaft feature to be deactivated.

Wheel Based Vehicle Speed

If the system is configured to function in Split Shaft mode (EPG driveline mode parameter equals SPLIT SHAFT), then the engine ECM must receive wheel based vehicle speed from a brake system electronic control unit (ECU). This message (PGN 65265, bytes 2 and 3) must be broadcast by the brake system over the Public J1939 data link. At this time, only one brake system supports this message, the Bendix EC-30. The availability of this parameter for the EC-30 system is currently a programmable feature. This programmable feature must be enabled for the EPG system to function, otherwise, it will not allow the system to enter into Engine Speed Control. If the brake system ECU broadcasts the wheel based vehicle speed parameter as being 0 mph, then it will allow the system to function. This is a safety interlock feature to ensure that the vehicle is not moving while the system is functioning in Split Shaft mode.

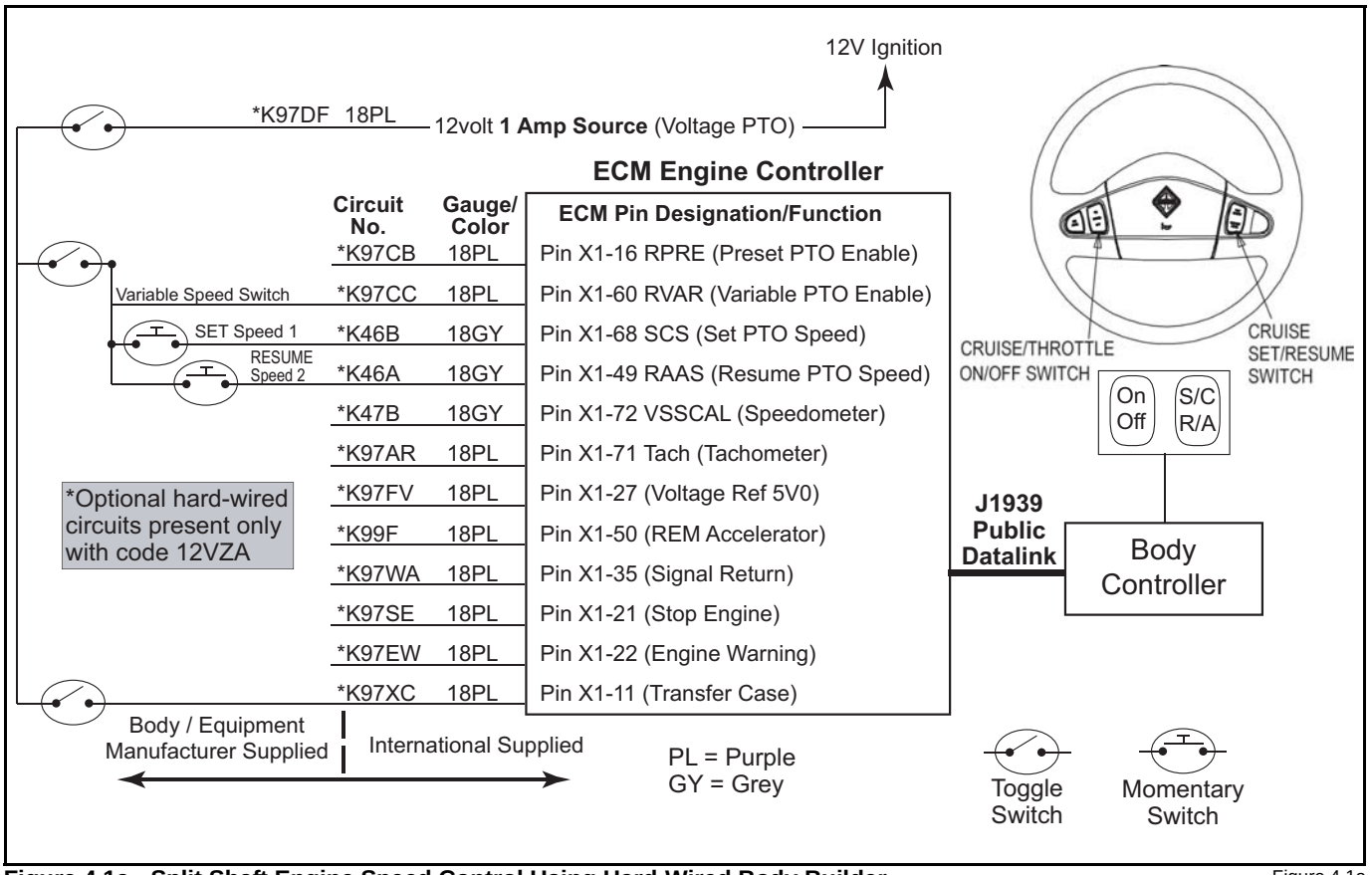


Figure 4.1a - Split Shaft Engine Speed Control Using Hard-Wired Body Builder Wiring - I6 Engines

Figure 4.1a

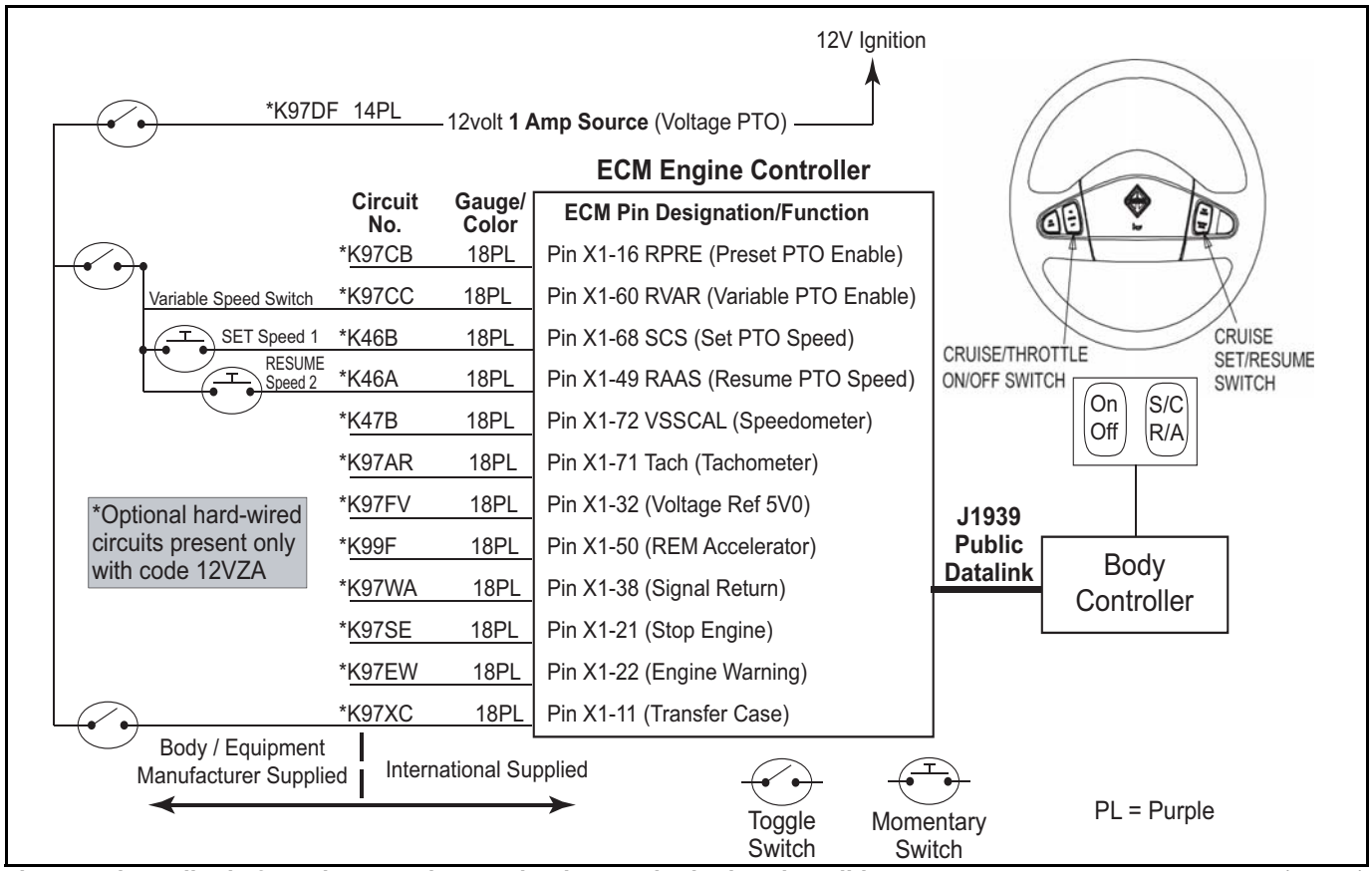


Figure 4.1b - Split Shaft Engine Speed Control Using Hard-Wired Body Builder Wiring - V8 Engines

Figure 4.1b

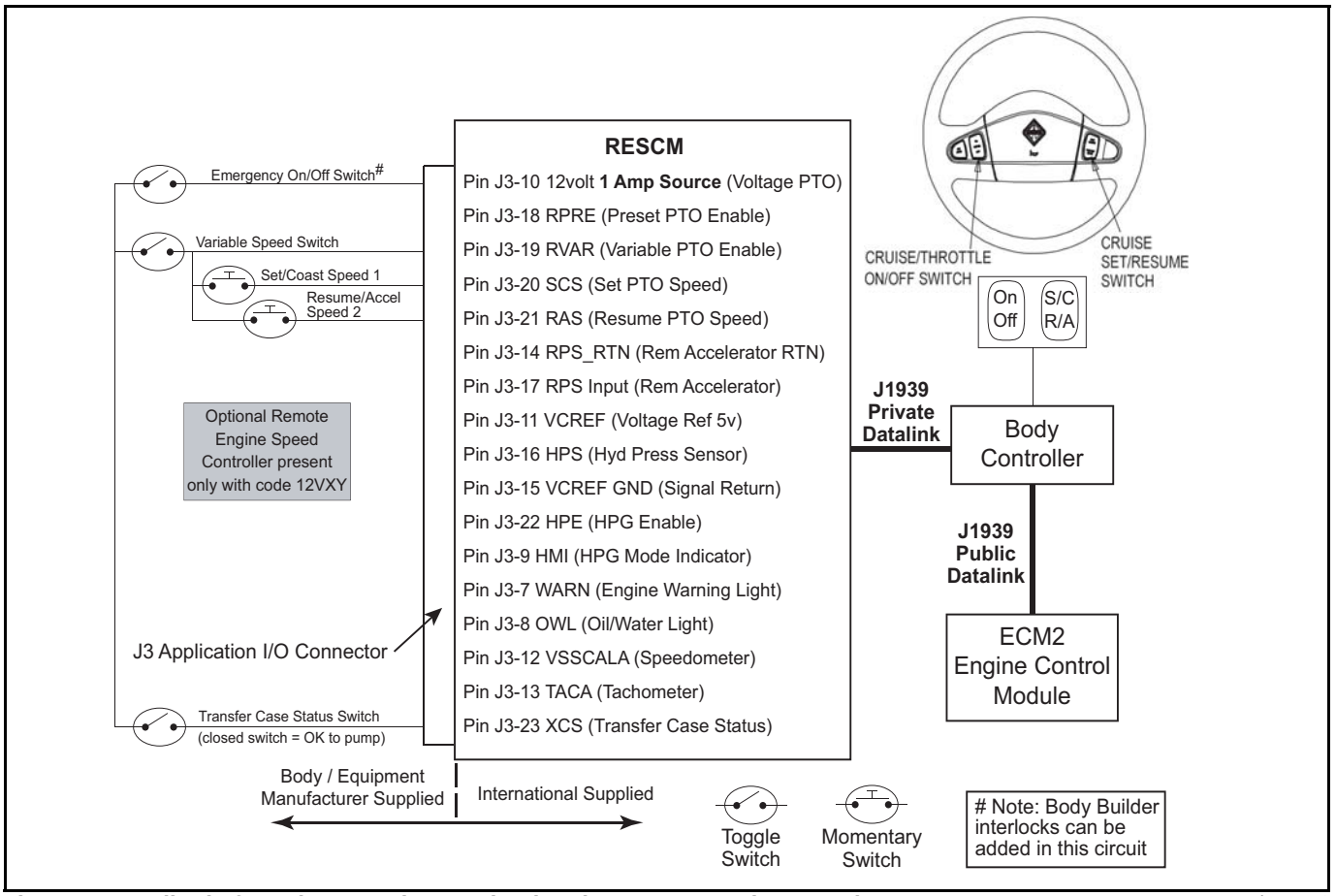


Figure 4.2 - Split Shaft Engine Speed Control Using the Remote Engine Speed Controller

Figure 4.2

Remote Throttle Control

The Remote Throttle Control functions like an additional accelerator pedal or hand throttle. Remote throttles provide equipment operators with direct control over engine speed from a location outside of the vehicle cab. By using a potentiometer, a remote throttle is useful when an infinitely variable range of engine speeds is desired to operate equipment. Remote throttles can be used to provide temporary increases in engine speed when Preset or Variable Engine Speed Control is in use.

The hand and/or foot actuated potentiometer can be located on one or more locations on tehe vehicle (see Figure 5.2). Increasing or decreasing the voltage from the potentiometer will result in a corresponding increase or decrease in engine speed (similar to stepping on or releasing the accelerator foot pedal in the vehicle cab).

Note: To be noticed by the Engine Control System, the engine speed requested by the Remote Throttle must exceed the engine speed requi\ested by the cab accelerator pedal and other engine speed control requests. **Reason**: The highest engine speed requested becomes the engine speed commanded to the engine.

Use of either the Remote Preset PTO Switch or Remote Variable PTO Switch is required to activate or deactivate the Remote Throttle and the Engine Control System must be programmed to accept the Remote Throttle input. Use spring loaded designs for throttle devices so that the engine returns to idle when the throttle is released.

Note: The only way the Remote Throttle Control System can be disabled is to turn it off with the switch previously used to turn it on.

The programmable parameter ***PTO Remote Pedal*** must be programmed to "1" to enable operation of the Remote Throttle input. Also, the maximum engine speed permitted when operating with the Remote Throttle will be limited to the value programmed for ***PTO MAX RPM*.**

Figure 5.2 shows the circuits needed to operate the Remote Throttle feature. The remote potentiometer circuits are interfaced to the RESCM or the hard-wired ECM pins. The RESCM communicates the status of these circuits via J1939 to the engine control system via the ESC while the hard-wired pins communicate directly to the ECM. The same potentiometer that is used for the cab's accelerator pedal can be used for this remote potentiometer. Terminals A, B and C are cavities in the 6-way Packard mating connector to the accelerator pedal sensor. Do not cross the wires to terminals A, B and C. Cross wiring terminals B and C will provide a high voltage level on the APS signal at the sensor's mechanical idle position. The remote throttle input must be turned on and off by an enable switch. Enabling either the Remote Preset PTO Switch or the Remote Variable PTO Switch will turn the Remote Throttle input on. These two switches must not be enabled at the same time - it's one or the other. Opening the switch circuit disables the Remote Throttle input.

The ServiceMaxx tool can be used for trouble shooting and verifying the Remote Throttle installation.The PTO Remote Pedal parameter must indicate ON and either the Rem Var PTO Switch or the Rem Preset PTO Switch must indicate ON. When these conditions are met, the Accel Pedal parameter will display the percent throttle commanded to the ECM. If the Remote Throttle parameter indicates FAIL, a fault exists in the circuits or in the potentiometer itself.

Display of the parameter Accel Pedal should be used to set mechanical stops for custom throttle designs. Mechanical stops must be used with potentiometer based throttle control systems to prevent the supply of inadequate or excess voltage to the engine controller. The ECM detects under and over voltage conditions for Remote Throttle; occurrence of one of these conditions will result in activation of a fault code.

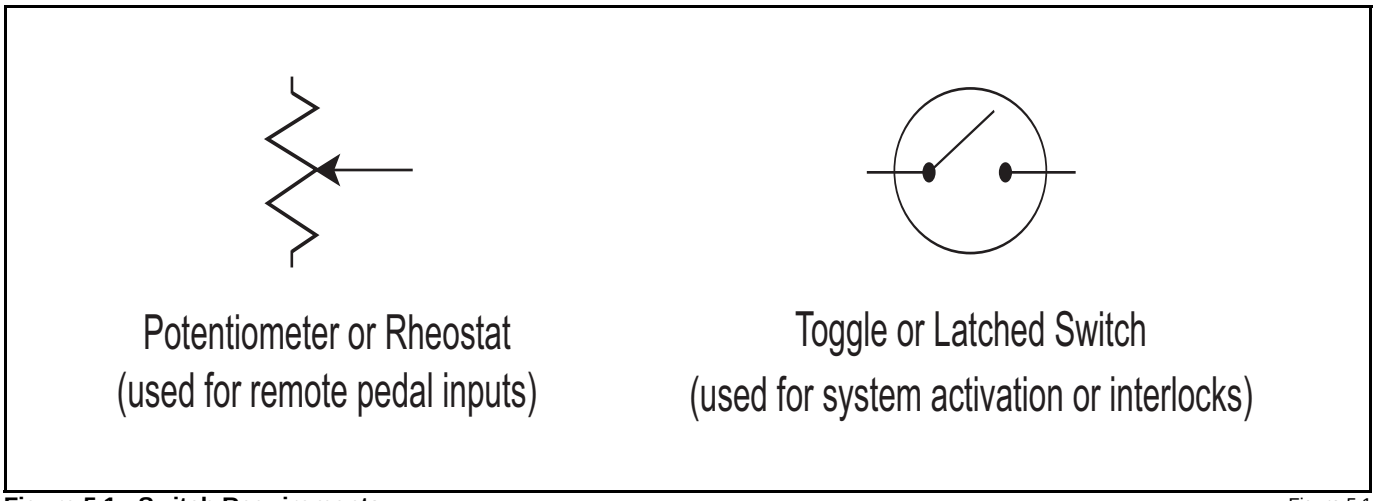


Figure 5.1 - Switch Requirements Figure 5.1

Accelerator Pedal Sensor Notes and Diagnostics

Appendix D lists part numbers for floor mounted and suspended accelerator pedals and the accelerator pedal sensor kits. These parts include a jumper harness for the sensor with a Packard Weather-Pack connector. The typical wire colors for the jumper harness are shown in Table 5.1. The Weather-Pack connector can be cut off and the circuits spliced according to their identifying colors.

Table 5.1 – Accelerator Pedal Sensor Wire Colors and Signals

APS CAVITY	A	B	C	D	E	F
Signal	Sensor Output	Sensor Ground	Sensor Supply (5Vdc)	Normally Closed Idle Validation	Normally Open Idle Validation	Idle Validation Switch Common
Color	Black	White	Red	Green	Blue	Orange

The RESCM remote throttle input is preloaded with a resistor fixed in connector J3, pins 17 and 14. This resistor fixes the input at 0%. If using a remote throttle pedal of any kind, remove this resistor when installing the remote throttle connections. If not installing a remote throttle, leave this resistor in place. **Do not remove the jumper in J3 pins 1-2. These are addressing wires and must be left in place.**

The accelerator pedal sensor includes an Idle Validation Switch (IVS). The “Normally Closed” contacts are connected to the common terminal when the sensor is at the idle position. The “Normally Open” contacts are connected to the common terminal when the sensor is in the off-idle position. Due to the thick film construction of the sensor, the IVS has a contact resistance of ~80 Ohms. Do not use this switch in series with the sensor circuits.

The remote throttle potentiometer is protected through circuit diagnostics. Faults are detected when the potentiometer is open or short circuited. These faults recover when the fault condition is corrected. Table 5.2 summarizes typical voltage levels for throttle operation and diagnostics. The voltage levels are designed to be compatible with a total resistance of 2.5K Ohms. As the voltage detected increases, the engine speed demanded by the remote pedal input increases. Diagnostic

ranges are provided at the top and bottom of the potentiometer voltage. The voltage shown in Table 5.2 is between RESCM pins J3-14 (Rem Accelerator RTN), J3-17 (Rem Accelerator) and J3-11 (Voltage Ref 5V).

Table 5.2 – Remote Accelerator Pedal Sensor Voltage Levels

VOLTAGE	RESULT
0 – 0.15	Out of Range Low or Open, Fault Code 213
0.15 – 0.90	0%, Low Idle Speed demanded
0.90 – 3.50	0 – 100%, Normal Operating Range
3.50 –- 4.55	100%, PTO Max RM Demanded
4.55 and above	Out of Range High, Fault Code 214

New designs incorporating the accelerator pedal sensor must include their own return springs to ensure that the sensor returns to the idle position when the control is released. The sensor's internal stops must not be used to limit the travel of its drive mechanism. To make sure the sensor always returns to the idle position, pre-load the internal return spring by 15.2 degrees. Another reason to pre-load the return spring in this manner is that the voltage output from the sensor will fall into the out of range low diagnostic region if the sensor is not pre-loaded by 15.2 degrees of travel. Sensors that are disconnected from the drive mechanism will generate a diagnostic code. The maximum range of travel applied to the accelerator pedal must be limited to a maximum of 52.3 degrees beyond 15.2 degrees pre-load for the idle position. For additional information, see SAE recommended practice "J1843, Accelerator Pedal Position Sensor for Use with Electronic Controls in Medium and Heavy Duty Vehicle Applications".

- Hand Operated Throttle Control Kit

See Appendix D for a hand operated throttle parts list.

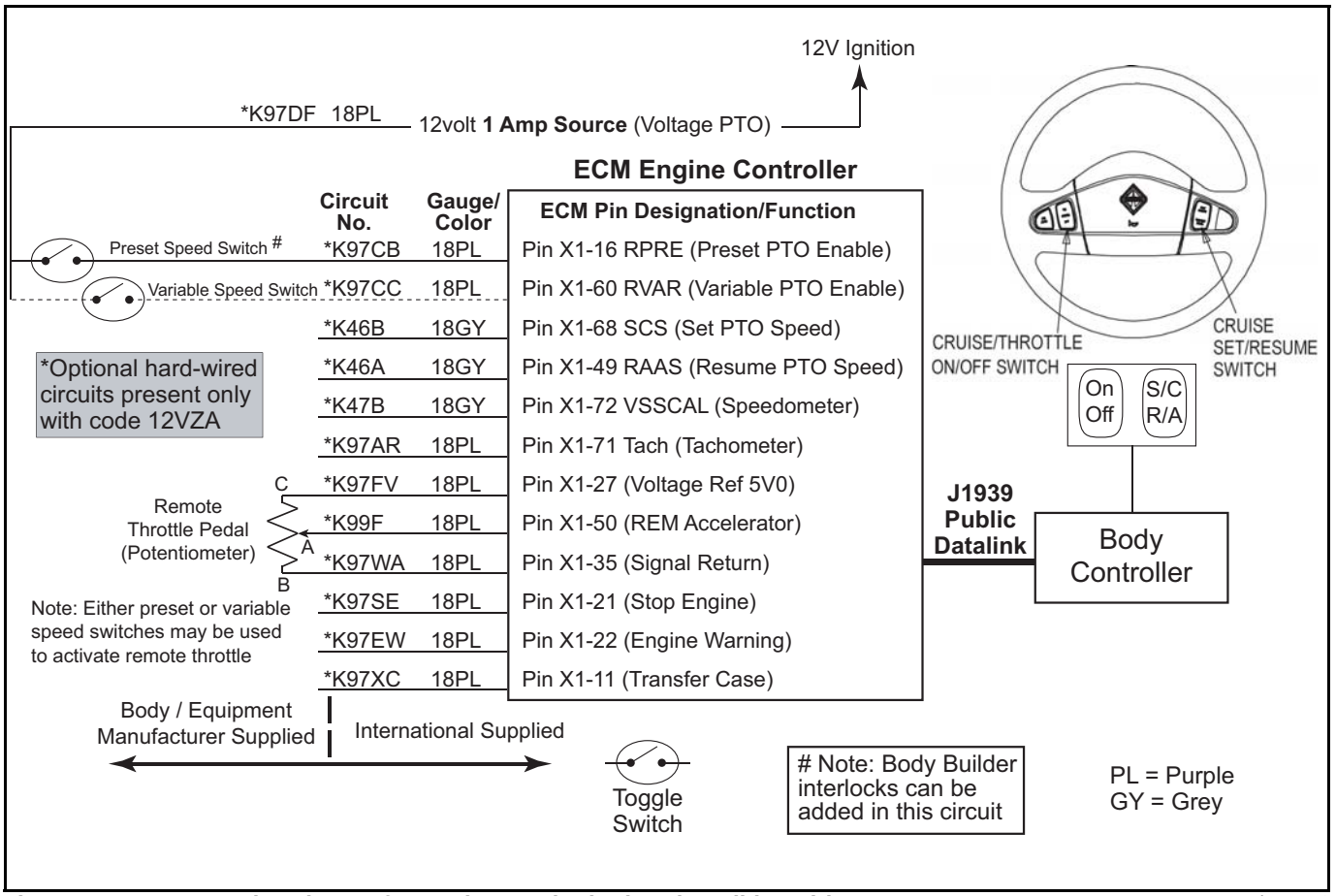


Figure 5.2a - Remote Throttle Interface Using Hard-Wired Body Builder Wiring - I6 Engines

Figure 5.2

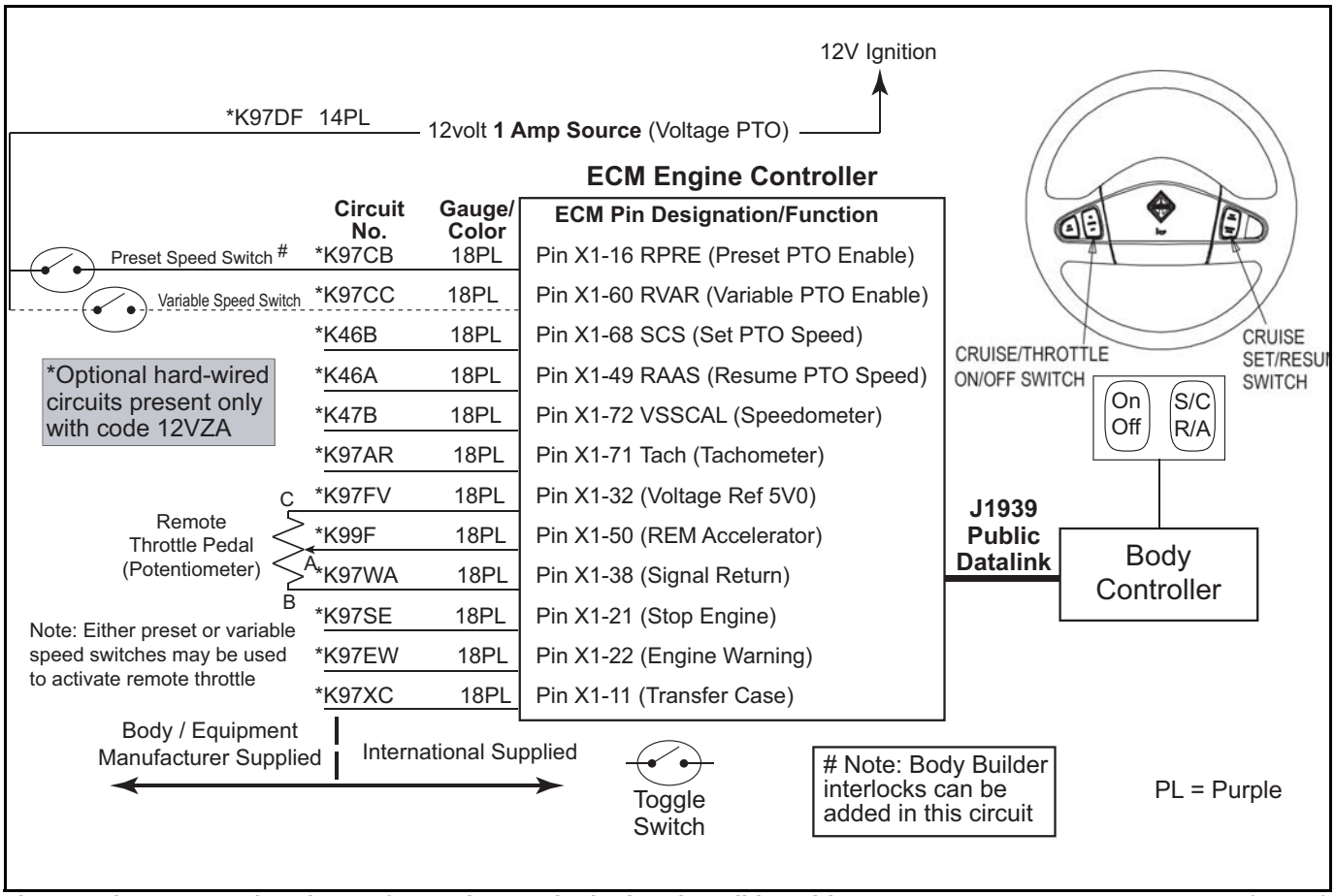


Figure 5.2b - Remote Throttle Interface Using Hard-Wired Body Builder Wiring Engines - V8 Engines

Figure 5.2b

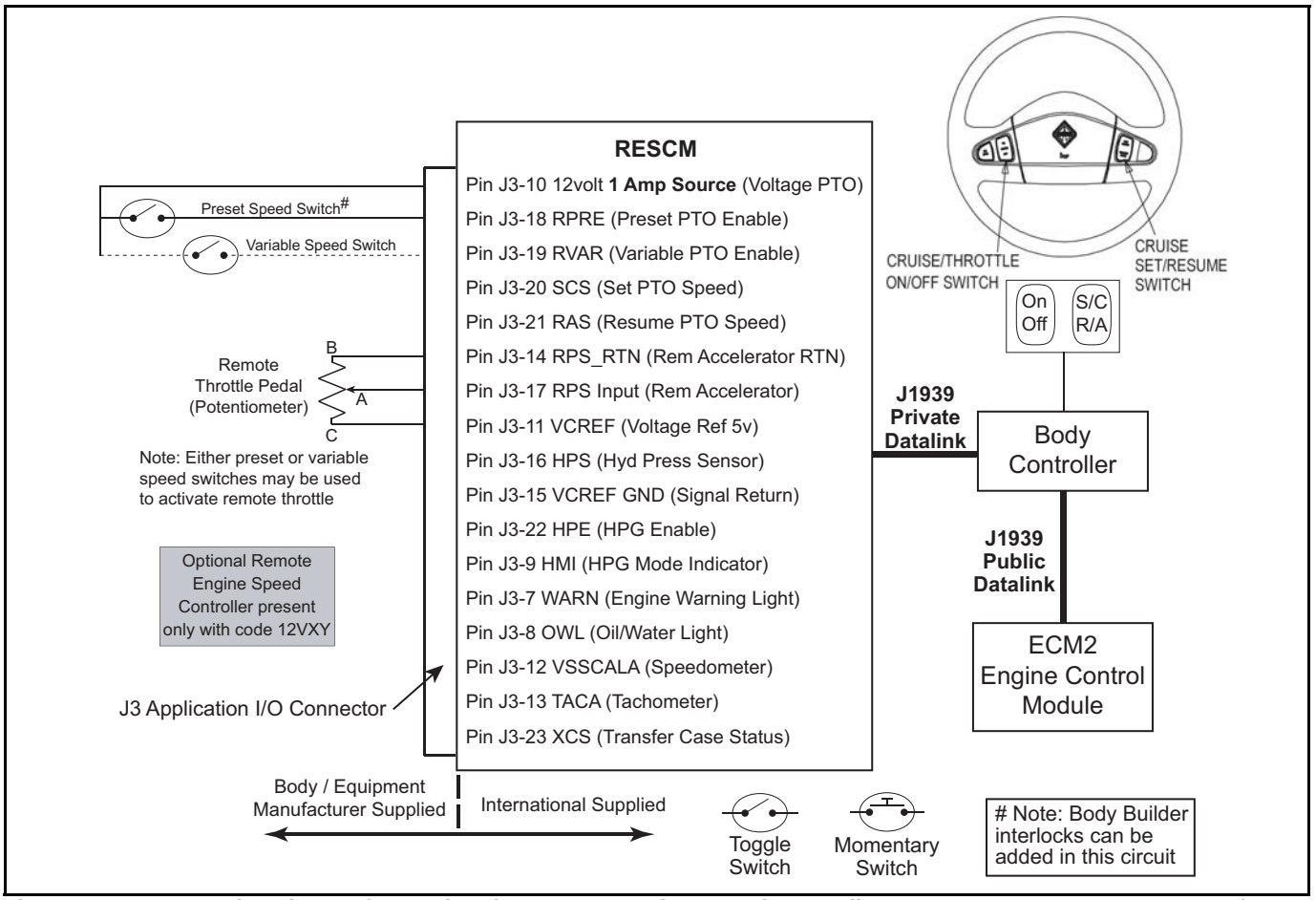


Figure 5.3 - Remote Throttle Interface Using the Remote Engine Speed Controller Figure 5.3

Remote Engine Start and Stop

This section describes the circuit modifications necessary to stop and start the engine from a remote location. Modifications that implement remote start must also implement remote stop. When remote stop is implemented, all ignition sources to the engine control system must be interrupted.

CAUTION: International® does not suggest adding a remote start on vehicles with manual transmissions. The following modifications are suggestions only and do not take into account any interlocking that might be needed to maintain safe vehicle operation. It is our belief that safe modifications to start/stop circuitry will vary with truck application and should be the responsibility of the party making the modification.

The circuit modifications to implement remotely controlled engine stops and starts are shown in Figure 6.1 and Figure 6.2.

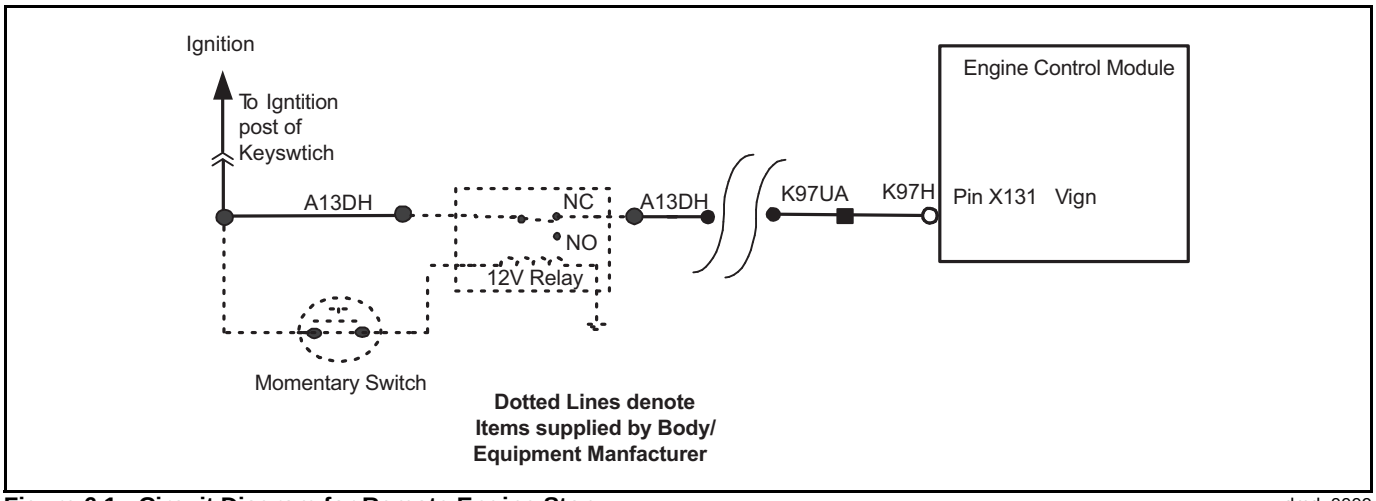


Figure 6.1 - Circuit Diagram for Remote Engine Stop dmd_0009

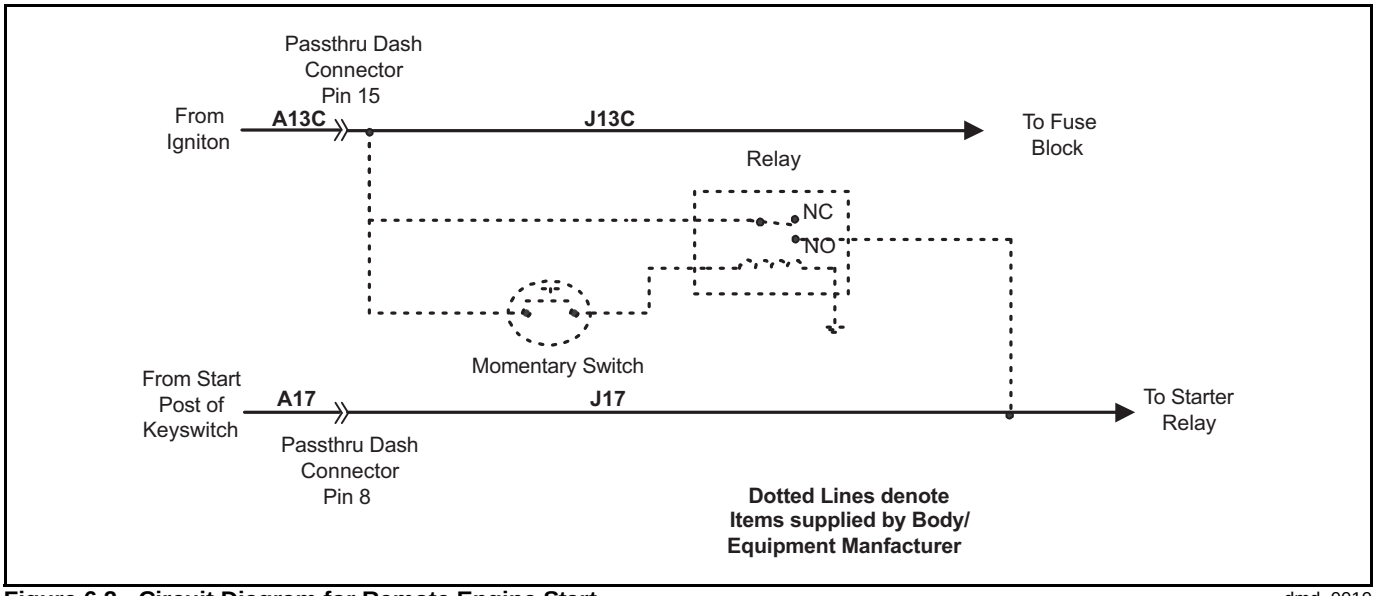


Figure 6.2 - Circuit Diagram for Remote Engine Start dmd_0010

Body Builder Connections and Circuit Protection

This section discusses general information related to the installation of new circuits to a chassis. Available options for power connections and recommendations for the installation of new power circuits are reviewed. Wire, fuse and circuit breaker sizing for circuit protection are displayed, along with unique ECM circuits that must never see 12 volts with the key switch in the OFF or Accessory positions.

Body Builder Connections

An option for connecting to the vehicle lighting system is available from the factory. The feature code for this option is 08HAB. Table 7.1 gives the circuit information available for this feature. For wiring schematic and connector & terminal part numbers, see circuit diagram book.

Table 7.1 Body Builder Connections

CONNECTION	CAVITY	CIRCUIT	DESCRIPTION	FUSE (AMPS)	AVAILABLE CURRENT AT CONNECTOR (AMPS)	SHARING (TRUCK LAMP FED FROM SAME FUSE)
4450	A	N68BB	Tail Lamp	20	20	None
	B	N56BB	Left Rear Turn Lamp/Stop	10	8	Truck Left Rear Turn Lamp
	C	N57BB	Right Rear Turn Lamp/Stop	10	8	Truck Right Rear Turn Lamp
	D	N58BB	Marker Lamp	20	20	None
	E	N71BB	Back-Up Lamp	10	6	Truck Back-Up Lamps
	F	N12BB	Accessory Feed	20	20	None
	G	N11-GBB	Ground (12 ga)	–	–	None
4460	A	N56BA	Left Front Turn Lamp	10	8	Truck Left Front Turn Lamp
	B	N57BA	Right Front Turn Lamp	10	8	Truck Right Front Turn Lamp

Note: Any unused circuit cavities must be plugged with sealing plugs provided with chassis harness.

Connectors 9900 and 9910 have their mating connectors attached filled with cavity plugs. To use connectors, remove cavity plugs and use the following:

Table 7.2 Connectors 4450 & 4460

CONNECTORS		
4450 & 4460	**Terminals**	**Wire Gauge**
	2033912C1	12, 14
	2033911C1	16, 18, 20
	Cavity Seals	**Wire Gauge**
	0589390C1	12
	0589391C1	14
	1652325C1	16, 18, 20
Mating Connector Part Nos.		
4450	Connector	2039312C91
	Lock	2039342C1
4460	Connector	1671611C1
	Lock	1671608C1

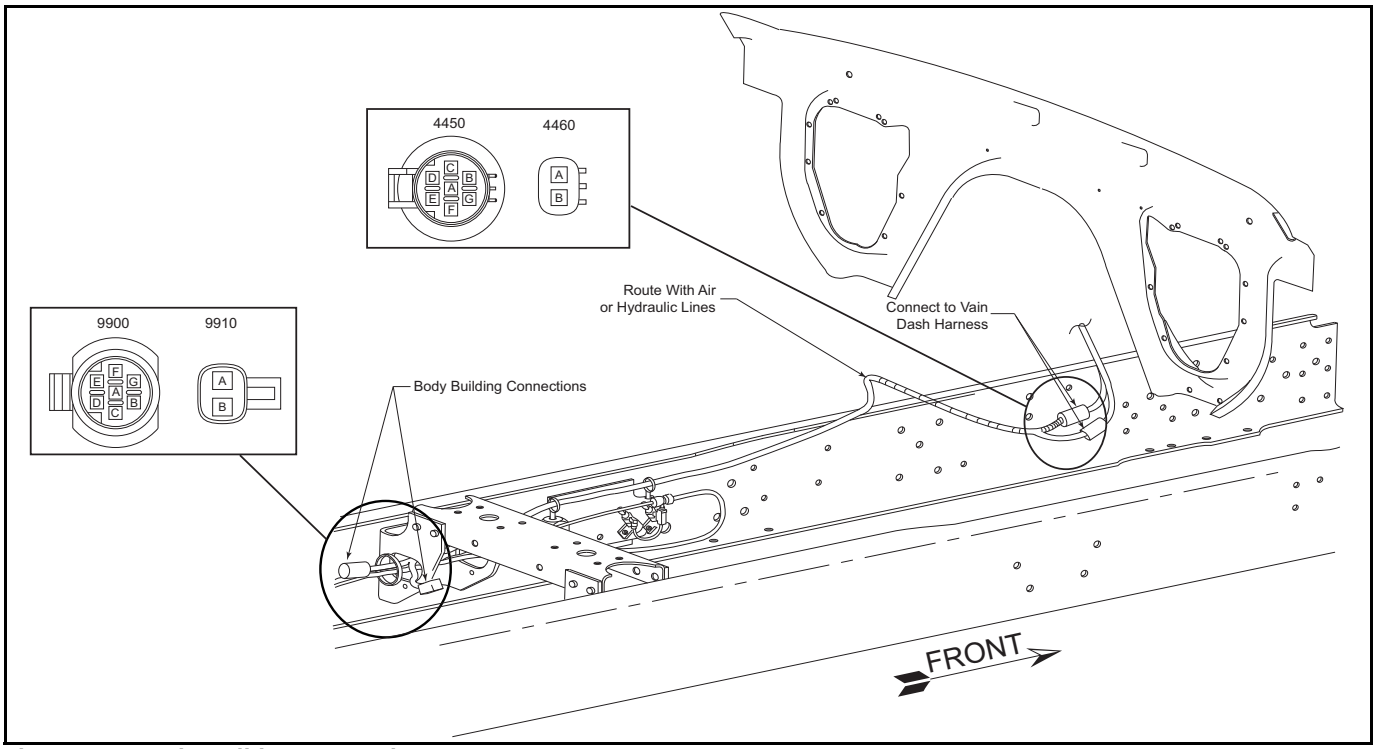


Figure 7.1 - Body Builder Connections dmd_0011

Circuit Protection

All new circuits that are added to the chassis after its assembly must be protected by fuses or circuit breakers. The fuse or circuit breaker should be located as close as possible to the connection point into the chassis wiring. The size of the protection device is determined by the size of the wire used for the circuit. Common wire gauges and device sizes are shown below:

Table 7.3 - Wire Gauges and Circuit Protection Devices

WIRE GAUGE	PROTECTIVE DEVICE SIZE	MAXIMUM CURRENT (AMPS)
18 Ga	10 AMP Fuse/Circuit Breaker	8A
16 Ga	15 AMP Fuse/Circuit Breaker	12A
14 Ga	20 AMP Fuse/Circuit Breaker	16A
12 Ga	25 AMP Fuse/Circuit Breaker	20A
10 Ga	30 AMP Fuse/Circuit Breaker	24A
8 Ga	12 Gauge Fusible Link	80A
6 Ga	10 Gauge Fusible Link	108A
4 Ga	2-12 Gauge Fusible Link	160A

CAUTION: Wire gauge is designed to match fuse/circuit breaker rating. Do not increase the size of a circuit breaker or fuse. To do so could cause wiring to overheat and burn.

International® part numbers for narrow blade circuit breakers according to type and size are shown below. Type III circuit breakers can only be reset manually. Type I circuit breakers continuously try to reset when tripped. Use Type I circuit breakers only where required by the function performed by the circuit to be protected. In general, Type III circuit breakers should be adequate for most needs.

Table 7.4 - Circuit Breaker Part Numbers

SIZE	CIRCUIT BREAKER TYPE	PART NUMBER	COLOR
3000, DuraStar®, WorkStar® TerraStar™ and TranStar® Series			
7.5A	Type III - Manual Reset	3536177C1	Brown
10A	Type III - Manual Reset	3536178C1	Red
15A	Type III - Manual Reset	3536179C1	Blue
20A	Type III - Manual Reset	3536180C1	Yellow
25A	Type III - Manual Reset	3536181C1	White
30A	Type III - Manual Reset	3536182C1	Green
9000*i* and PayStar® Series			
10A	Type I - Continuous Reset	2007463C1	Black
20A	Type I - Continuous Reset	2007465C1	Black
10A	Type III - Manual Reset	2011944C1	Red
20A	Type III - Manual Reset	2011946C1	Yellow
25A	Type III - Manual Reset	2011947C1	White
30A	Type III - Manual Reset	2011948C1	Green

Circuit breakers and fuses can be installed in the chassis wiring using the following i-line connectors:

- 1676841C91 – In-line socket and cable for circuit breaker/fuse (20A maximum)
- 1682115C91 –- In-line socket and cable for circuit breaker/fuse (30A maximum)

Back Feeds

The circuits that are connected to the following Engine Control Module pins must always be connected to switched ignition power. Connecting any one of these circuits to battery power can cause the ECM to remain powered when the ignition switch is turned off. This can produce excess battery current causing the batteries to be discharged overnight.

- Remote PTO (Pre-Set)
- Engine Coolant Temperature
- Idle Validation Switch
- Drive Disengage Signal
- Remote PTO (Variable)
- Engine Oil Temperature
- Warn Engine Lamp

- Coolant Level Sensor
- Injection Pressure Regulator (I6 only)
- Ambient Temperature Sensor
- Map Sensor Output
- Glow Plug Relay (V8 only)
- Intake Air Heater Relays (I6 only)

Welding

Whenever welding is done on any part of the vehicle, the batteries should be disconnected - both power and ground including the electronic power feeds. The electronic components may easily be damaged from the high voltage used and R.F. energy present in the arc.

WARNING: **To avoid serious personal injury, death or possible engine damage, when welding or using an acetylene torch always wear welding goggles and gloves. Insure that acetylene and oxygen tanks are separated by a metal shield and are chained to a cart. Do not weld or heat areas near fuel tanks or fuel lines. Utilize proper shielding around hydraulic lines.**

CAUTION: To avoid damage to vehicle electronic components, disconnect both the positive (+) and the negative (-) battery cables prior to electric welding. Attach the welder's ground cable as close as possible to the joint being welded. If it is necessary to weld close to an electronic component, it is recommended that the electronic component be temporarily removed.

General Information

This section reviews information of general interest about the circuits provided with the chassis. Installation of a Master Disconnect switch and two-way radios are reviewed. Access points for the Speedometer and Tachometer Signals and the ATA Data Link (SAE RP J1708/J1587) are reviewed along with other general information.

Remote PTO Engine Speed Control Circuits

Do not use the electrical wires provided for Remote Engine Speed Control connections to power other electrical chassis components. The activation switches (i.e., Set/Coast, Resume/Accel) should be momentary with Normally Open contacts. The +12 Volt connection should be used only to power these switches to allow them to activate Remote Engine Speed Control.

High Voltages In Harnesses

WARNING: **Do not probe the harnesses between the engine electronics and the engine. The injector solenoids have a higher electrical potential.**

Master Disconnect Switch

Specify sales order code 08WCS or 08WAD for a factory installed Master Disconnect Switch. The disconnect switch cannot be put into the battery ground cable as was previously done. The electronic modules will provide a ground path around the Master Disconnect switch if this method is employed.

The engine modules must always be connected to the batteries, even when the Master Disconnect switch is opened. On each vehicle, separate power and ground circuits are provided to the engine electronics.

To install a Master Disconnect Switch, break into the positive battery cable going from the batteries to the cranking motor and insert the disconnect switch into that circuit, as shown in Figure 8. Insure that adequate insulation is used between the positive battery cable, the switch mounting, and the surrounding area. Place boots or covers over the disconnect switch studs to protect the batteries and cables from accidental shorting. Do not disturb the direct connections from the battery to the engine electronics.

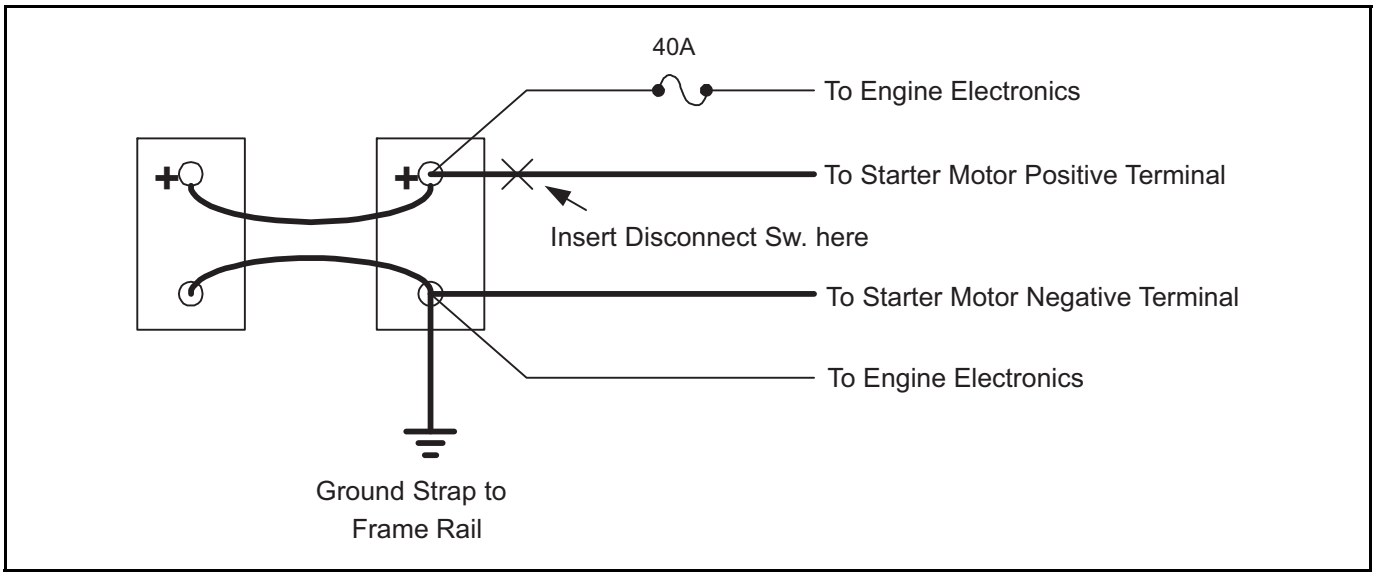


Figure 8.1 - Master Disconnect Switch Insertion Point dmd_0012

Two-Way Radio Installation

A qualified technician should do all two-way radio installations. The power connections for any radio installation should always go to the vehicle's batteries with proper circuit protection installed closest to the batteries. A filter may have to be added to the radio power feed. Wire routing should always be routed away from all vehicle harnesses to prevent pickup from the vehicle electrical system into the radio and/or from the radio system into the vehicle electrical system. Evaluation of the antenna location should be assessed before permanent mounting is made to assure minimum interference to the radio reception and vehicle electrical system.

ATA Data Link Connections

The engine control system provides a data link compatible with the specifications in TMC RP 1202. These requirements are the same as those given by SAE recommended practices J1708 and J1587. Temporary connections can be made using the 9-way Deutsch diagnostic connector located in the cab by the operator's side under left corner of instrument panel. Do not make permanent connections to the ATA data link without a full understanding of load requirements and data protocol required for

the device being attached. See “Appendix C” for more information on the data provided by the engine on the data link.

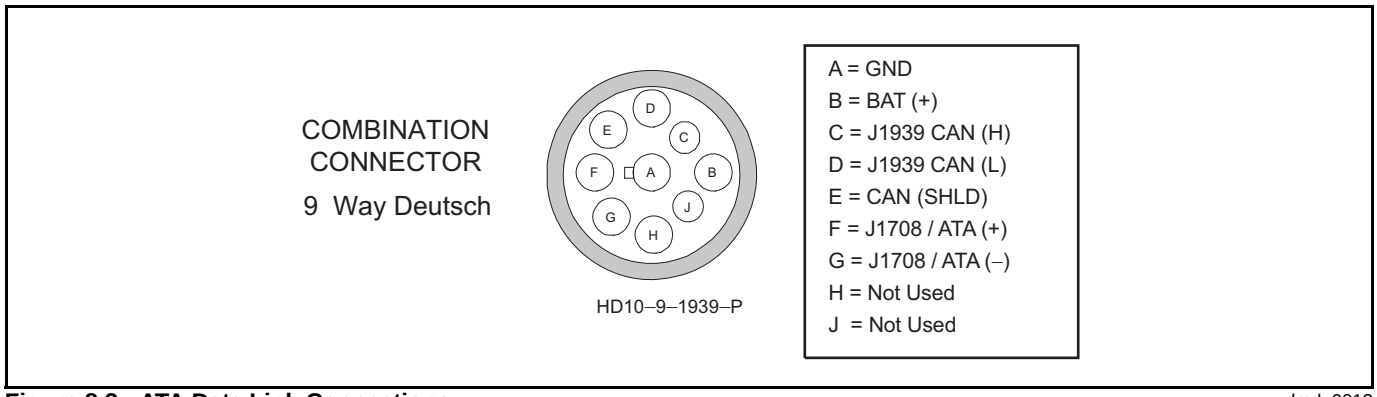


Figure 8.2 - ATA Data Link Connections dmd_0013

J1939 Data Link Connections

The engine control system provides a CAN data link. The requirements for this CAN data link are provided by SAE recommended practices J1939. Note that modules on the CAN data link may not support all parameters in the J1939 standard. Temporary connects can be made using the 9-way Deutsch diagnostic connector located in the cab by the operator's side under left corner of instrument panel. Do not make permanent connections to the CAN data link without a a full understanding of load requirements and data protocol required for the device being attached. See “Appendix C” for more information on the data provided by the engine on the data link.

Clutch Switch and Neutral Position Switch Connections

The clutch and neutral position switches are part of the engine control system circuits. These circuits should never be disturbed. If there is a need for either one of these functions, then contact International® Tech Central for guidance.

Speedometer and Tachometer Outputs

Interfaces conforming to TMC RP 123 are provided for speedometer and tachometer signals. Speedometer output is calibrated to 30,000 pulses per mile. Tachometer output is 12 pulses per engine revolution. Access to these signals is provided by the electrical wire connections located at the bulkhead. The speedometer and tachometer output signals are provided by circuits X1-72 and X1-71 respectively.

The sink and source currents for the available interfaces are shown below. Both interfaces source 5 milliamps and sink 5 milliamps. These interfaces are noted below in Table 8.1. The signal waveform provided is a square wave with a 50% duty cycle. See TMC RP 123 for more information about the signal waveform.

Table 8.1 – Signal Interface Parameters

PARAMETER	POTENTIAL	PARAMETER	CURRENT
V_o low	0 to 0.5 Volts	Isink (V_o low)[1]	50 microamps
V_o high	4 V to V battery	Isource (V_o high)	5 milliamps

[1] = Designates enhanced interfaces that sink 5 milliamps of current instead of 50 microamps.

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PROGRAMMABLE PARAMETERS

Parameter Tables

Two tables are provided in this section. Information presented in these tables is summarized as follows:

- **Parameter Attributes Table**

  Provides information about parameter type (read only, write only, or read/write), minimum and maximum permissible values, and engineering units.

- **Parameter Cross Reference**

  Provides a cross reference of different parameter names that actually refer to the same parameter.

Parameter Attributes Table

Table 1.1 - Parameter Attributes Table. Information generated directly from the International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997)

SUPPLIER NAME	EERS PARAMETER NAME	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
64001	NO. OF RELATIVE COMPRESSION TEST EXECUTIONS	**F**	N/A	0	65535	1
64011	CYL. 1 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64021	CYL. 2 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64031	CYL. 3 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64041	CYL. 4 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64051	CYL. 5 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64061	CYL. 6 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64071	CYL. 7 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
64081	CYL. 8 COMPRESSION/COMBUSTION RPM DIFFERENCE	**F**	RPM	0	255	1
66001	MANUFACTURING DATE ECU	**F**	N/A			1
66011	SERIAL NUMBER ECU	**F.**	N/A			1
66021	H/W VERSION ECU	**F.**	N/A			1
66031	SOFTWARE STRATEGY VERSION	**F.**	N/A			1
66041	SOFTWARE CALIBRATION VERSION	**F**	N/A			1
67001	PROGRAMMABLE PARAMETER LIST CHECKSUM	**F**	N/A			1

NOTE:[1] W: EST Write Only Parameter
B: EST Customer Programmable Parameter (Both EST Read and EST Write Parameter)
F: Factory Programmable Parameters (non-EST programmable).

Information shown in **BOLD** indicates modification from the EERS database.

Table 1.1 - Parameter Attributes Table. Information generated directly from the International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	EERS PARAMETER NAME	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
67011	CALIBRATION SOFTWARE CHECKSUM	**F**	N/A			1
67021	STRATEGY SOFTWARE CHECKSUM	**F**	N/A			1
68011	LAST SERVICE TOOL ID - CUSTOMER LEVEL 1	**F**	N/A			1
68011	LAST SERVICE TOOL ID - CUSTOMER LEVEL 2	**F**	N/A			1
68021	LAST SERVICE TOOL ID - CALIBRATION	**F**	N/A			1
68031	LAST SERVICE TOOL DATE PROGRAMMED CALIBRATION	**F**	N/A			1
68041	LAST SERVICE TOOL ID - STRATEGY	**F**	N/A			1
68051	LAST SERVICE TOOL DATE PROGRAMMED STRATEGY	**F**	N/A			1
69001	ENG-OILP-SIG-ENAB	**F**, B	N/A	0	2	1
69011	WATER IN FUEL ENAB	**F**, B	N/A	0	1	1
69021	FUEL PRESSURE SIGNAL ENAB	**F**, B	N/A	0	1	1
70001	RETARDER - SERVICE BRAKE INTERFACE	**F**, B	N/A	0	3	1
71001	GLOW PLUG	**F**, B	N/A	0	1	1
79021	VNT WARM-UP ENAB	**F**, B	N/A	0	1	1
74001	IDLE SHUTDOWN MODE	**F**	N/A	0	3	1
74011	IDLE-SHUTDWN-TIME	**F**, B	MINUTES	2	120	1
74021	IST-MAX-AIT	**F**, B	C	-40	150	.25
74031	IST-MIN-AIT	**F**, B	C	-40	150	.25
75001	PTO-CONTROL (ON/OFF)	**F**, B	N/A	0	3	1
75011	MAX ROAD SPEED FOR MOBILE CONTROL	**F**, B	MPH	0	20	.5
75021	INCAB-PTO-MODE	**F**, B	N/A	0	3	1
75031	DISABLE CAB INTERFACE FOR PTO	**F**, B	N/A	0	1	1
75041	REMOTE THROTTLE FOR PTO CONTROL	**F**, B	N/A	0	1	1
75051	SET ENGINE SPEED **(SPEED 1)**	**F**, B	RPM	LIDLE	GOV SPEED	.25
75061	RESUME ENGINE SPEED **(SPEED 2)**	**F**, B	RPM	LIDLE	GOV SPEED	.25
75071	ENGINE RESPONSE RATE FOR PTO	**F**, B	RPM/SEC	1	1500	.25
75081	MAX PTO ENGINE SPEED	**F**, B	RPM	LIDLE	GOV SPEED	.25

NOTE:[1] W: EST Write Only Parameter
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F: Factory Programmable Parameters (non-EST programmable).

Information shown in **BOLD** indicates modification from the EERS database.

Table 1.1 - Parameter Attributes Table. Information generated directly from the International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	EERS PARAMETER NAME	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
75091	PTO PRESET ENGINE SPEED 3	**F**, B	RPM	LIDLE	GOV SPEED	.25
75101	PTO PRESET ENGINE SPEED 4	**F**, B	RPM	LIDLE	GOV SPEED	.25
75111	PTO PRESET ENGINE SPEED 5	**F**, B	RPM	LIDLE	GOV SPEED	.25
75121	PTO PRESET ENGINE SPEED 6	**F**, B	RPM	LIDLE	GOV SPEED	.25
75131	DISABLE RETURN	**F**, B	N/A	0	1	1
76001	CRUISE CONTROL	**F**, B	N/A	0	3	1
76011	CRUISE-MIN-ENG-SPD	**F**	RPM	1000	1400	.25
76021	CRUISE-RAMP-RATE	**F**	MPH/SEC	0	15	.0625
76031	MIN CRUISE CONTROL SPEED	**F**, B	MPH	20	100	.5
76041	MAX CRUISE CONTROL SPEED	**F**, B	MPH	30	100	.5
77001	ENG-PROT-MODE	**F**, B	NA	0	5	1
77011	ECT-WARNING	**F**	C	90	127.5	.5
77021	ECT-CRITICAL	**F**	C	90	127.5	.5
77031	PROT-ENGINE SPD 1	**F**	RPM	LIDLE	GOV SPEED	.25
77041	PROT-ENGINE SPD 2	**F**	RPM	LIDLE	GOV SPEED	.25
77051	PROT-ENGINE SPD 3	**F**	RPM	LIDLE	GOV SPEED	.25
77061	OIL-PRESS-WARN-SPD1	**F**	PSI	0	80	.5
77071	OIL-PRESS-WARN-SPD2	**F**	PSI	0	80	.5
77081	OIL-PRESS-WARN-SPD3	**F**	PSI	0	80	.5
77091	OIL-PRES-CRIT-SPD1	**F**	PSI	0	80	.5
77101	OIL-PRES-CRIT-SPD2	**F**	PSI	0	80	.5
77111	OIL-PRES-CRIT-SPD3	**F**	PSI	0	80	.5
78001	OVER TEMPERATURE PROTECTION	**F**	N/A	0	3	1
79001	VEH-ROAD-SPD-GOV	**F**, B	N/A	0	1	1
79011	MAX-ENGINE SPEED (NO VSSN)	**F**, B	N/A	700	ENG-HIDLE	.25
79021	VEHICLE SPEED LIMIT	**F**, B	MPH	1	100	.25
80001	TWO SPEED AXLE	**F**, B	N/A	0	1	1

NOTE:[1] W: EST Write Only Parameter
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F: Factory Programmable Parameters (non-EST programmable).

Information shown in **BOLD** indicates modification from the EERS database.

Table 1.1 - Parameter Attributes Table. Information generated directly from the International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	EERS PARAMETER NAME	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
80011	TIRE-REVS-PER-MILE	**F**, B	REVS/MILE	300	676	.1
80021	REAR-AXLE-RATIO-HI	**F**, B	N/A	2.5	20	.001
80031	REAR-AXLE-RATIO-LO	**F**, B	N/A	2.5	20	.001
80041	TRANS-LO-NUM-RATIO	**F**, B	N/A	0.6	20	.001
80051	VEH-SPEED-CAL-LOW	**F**, B	PPM	18017	157157	1
80061	VEH-SPEED-CAL-HI	**F**, B	PPM	18017	157157	1
80071	TAIL-SHAFT-TEETH	**F**, B	N/A	5	255	1
81001	TORQUE-TAILORING	**F**	N/A	0	2	1
81011	TT-LOW-NVS-RATIO	**F**	RPM/MPH	0	255	1
81021	TT-HI-NVS-RATIO	**F**	RPM/MPH	0	255	1
83001	TOTAL-FUEL	**F**	GALLONS	0	536,870,911.875	.125
83011	ENGINE-HOURS	**F**	HOURS	0	214,748,364.75	.05
83021	TOTAL-MILES	**F**	MILES	0	429.496,729.5	.1
83111	TOTAL IDLE FUEL USED	**F**	GALLONS	0	536,870,911.875	.125
83121	ENGINE ON TIME AT IDLE	**F**	HOURS	0	214,748,364.75	.05
83131	TOTAL PTO FUEL USED	**F**	GALLONS	0	536,870,911.875	.125
83141	ENGINE ON TIME IN PTO	**F**	HOURS	0	214,748,364.75	.05
84001	EL-OVERSPEED 1	**F**	HOURS		214,748,364.75	.05
84011	EL-OVERSPEED 2	**F**	HOURS		214,748,364.75	.05
84021	EL-LOWOILPRS-1	**F**	HOURS		214,748,364.75	.05
84031	EL-LOWOILPRS-2	**F**	HOURS		214,748,364.75	.05
84041	EL-OVERHEAT-1	**F**	HOURS		214,748,364.75	.05
84051	EL-OVERHEAT-2	**F**	HOURS		214,748,364.75	.05
84061	EL-LOWCOOL-1	**F**	HOURS		214,748,364.75	.05
84071	EL-LOWCOOL-2	**F**	HOURS		214,748,364.75	.05
84081	EL-OVERSPEED-MI1	**F**	MILES		429,496,729.5	.1
84091	EL-OVERSPEED-MI2	**F**	MILES		429,496,729.5	.1

NOTE:[1] W: EST Write Only Parameter
B: EST Customer Programmable Parameter (Both EST Read and EST Write Parameter)
F: Factory Programmable Parameters (non-EST programmable).

Information shown in **BOLD** indicates modification from the EERS database.

Table 1.1 - Parameter Attributes Table. Information generated directly from the International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	EERS PARAMETER NAME	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
84101	EL-LOWOILP-MI1	**F**	MILES		429,496,729.5	.1
84113	EL-LOWOILPRS-2	**F**	MILES		429,496,729.5	.1
84121	EL-OVERHEAT-MI1	**F**	MILES		429,496,729.5	.1
84131	EL-OVERHEAT-MI2	**F**	MILES		429,496,729.5	.1
84141	EL-LOWCOOL-MI1	**F**	MILES		429,496,729.5	.1
84151	EL-LOWCOOL-MI2	**F**	MILES		429,496,729.5	.1
85001	VEHICLE-IDENT	**F**	N/A			1
86001	TOTAL TATTLETALES	**F**	N/A	0	65,535	1
87001	CUSTOMER PASSWORD	W	N/A	ACCEPT VAL		1
88001	ENG-SERIAL-NO	**F**	N/A			1
89001	VEH-SPD-SIG-MODE	**F**	N/A	0	4	1
89011	DRIVELINE DISENGAGED MODE	**F**	N/A	0	5	1
89021	BRAKE SIGNAL PROCESSING MODE	**F**	N/A	0	4	1
90001	COOL-FAN-ENABLE	**F**	N/A	0	5	1
90011	AC-DEMAND-ENABLE	**F**	N/A	0	3	1
90021	COOL-FAN-ON-TEMP	**F**, B	C	-40	150	.25
90031	COOL-FAN-OFF-TEMP	**F**, B	C	-40	150	.25
91001	RAD-SHUT-ENABLE	**F**, B	N/A	0	1	1
91011	SHUTTER-OPEN-ECT	**F**, B	C	-40	150	.25
91021	SHUTTER-CLOSE-ECT	**F**, B	C	-40	150	.25
92001	CONDUCT-CLNT-SNSR	**F**, B	N/A	0	1	1
93001	HYD-PRESS-GOV-ENAB	**F**, B	N/A	0	1	1
93011	EPG-DRIVELINE STATUS	**F**, B	N/A	0	1	1
94001	COLD-AMB-PROT-MODE	**F**, B	N/A	0	1	1
95001	SERVICE-INT-ENABLE	**F**, B	N/A	0	1	1
95011	SI-FUEL-INTERVAL	**F**, B	GALLONS	0	65535	1
95021	SI-HOUR-INTERVAL	**F,** B	HOURS	0	2000	.5

NOTE:[1] W: EST Write Only Parameter
B: EST Customer Programmable Parameter (Both EST Read and EST Write Parameter)
F: Factory Programmable Parameters (non-EST programmable).

Information shown in **BOLD** indicates modification from the EERS database.

Table 1.1 - Parameter Attributes Table. Information generated directly from the International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	EERS PARAMETER NAME	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
95031	SI-DIST-INTERVAL	**F**, B	MILES	0	65535	1
95041	SI-FUEL-START	**F**	GALLONS	0	536,870,911.875	.125
95051	SI-HOUR-START	**F**	HOURS	0	214,748,364.75	.05
95061	SI-DISTANCE-START	**F**	MILES	0	429,496,729.5	.1
95071	SI-SRV-SOON-PCT	**F**	N/A	5	100	1
95081	SI-LAMP-CONT-ON	**F**, B	N/A	0	1	1
95091	SI-LAMP-ACT-TIME	**F**, B	SECONDS	0	1275	5
95101	SI-RESET-REQST	**F**, B	N/A	0	1	1
97001	TRACTION ACONTROL ENABLE	**F**, B	N/A	0	1	1
99061	ENABLE STATIONARY REGENERATION FEATURE	**F**	N/A	1	1	1
99071	ENABLE INHIBIT REGENERATION FEATURE	**F**	N/A	1	1	1
99081	MAX VEH SPD WHICH STATIONARY REGEN CAN BE ENAB	**F**	MPH	0	2	0.5
99091	MAX VEH SPD WHICH REGEN INHIBIT CAN BE ENAB	**F**	MPH	0	25	0.5
99101	MAX VEH SPD WHICH NORM REGEN INHIB CAN BE ENAB	**F**	MPH	0	15	0.5

NOTE:[1] W: EST Write Only Parameter
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Information shown in **BOLD** indicates modification from the EERS database.

Parameter Cross Reference

Table 1.2 - Parameter Cross Reference Table. Information generated directly from International® EERS System (International® EMR Report, Location Melrose Park, Rules Effective August, 1997)

SUPPLIER NAME	PARAMETER NAME	SALES DESCRIPTION	SERVICE DESCRIPTION
69001	ENG-OILP-SIG-ENAB	OIL PRESS SIG ENABLE	ENG-OILP-SIG-ENAB
70001	RETARDER-SERVICE BRAKE INTERFACE	RETARDER MODE	VEHICLE-RETARDER
71001	GLOW PLUG	GLOW PLUG ENABLE	GLOW PLUG
72001	EXHAUS- BACKPRESS	EXHAUST BACKPRESS	EXHAUST-BACKPRESS
73001	ENG-CRANK-INHIBIT	CRANK INHIBIT MODE	ENG-CRANK-INHIBIT
73011	ENG-CRANK-INHIB-TIME	CRNK INH RUN MODE TM	ENG-CRK-INHIB-TIME
74001	IDLE SHUTDOWN MODE	IDLE SHUTDN TMR MODE	ENG-SHUTDOWN-CNTRL
74011	IDLE-SHTDWN-TIME	IDLE SHUTDOWN TIME	IDLE SD TIME
74021	IST-MAX-AIT	IST MAX INTAKE TEMP	IST MAX AIT
74031	IST-MIN-AIT	IST MIN INTAKE TEMP	IST MAX AIT
75001	PTO-CONTROL (ON/OFF)	PTO MODE	PTO-CONTROL
75011	MAX ROAD SPEED FOR MOBILE CONTROL	PTO MAX ROAD SPEED	MAX-RD-SPD-IN-PTO
75021	INCAB-PTO-MODE	PTO INCAB MODE	INCAB-PTO-MODE
75031	DISABLE CAB INTERFACE FOR PTO	PTO OPER. DISABLE	DISABLE-PTO-CAB-IF
75041	REMOTE THROTTLE FOR PTO CONTROL	PTO REMOTE PEDAL	PTO-REMOTE-PEDAL
75051	SET ENGINE SPEED (SPEED 2)	PTO PRESET SPEED 1	PTO-CNTRL-SET-RPM
75061	RESUME ENGINE SPEED (SPEED 1)	PTO PRESET SPEED 2	PTO-CNTRL-RES-RPM
75071	ENGINE RESPONSE RATE FOR PTO	PTO SPEED RAMP RATE	PTO-RPM-RAMP-RATE
75081	MAX PTO ENGINE SPEED	PTO MAX ENG SPEED	MAX-PTO-SPEED
76001	CRUISE-CONTROL	CRUISE CONTROL	CRUISE-CONTROL
76011	CRUISE-MIN-ENG-SPD	CRUISE MIN RPM	CRUISE-MIN-ENG-SPD
76021	CRUISE-RAMP-RATE	CRUSE RAMP RATE	CRUISE-RAMP-RATE
76031	MIN CRUISE CONTROL SPEED	CRUISE CTL MIN SPEED	MIN-CRUS-CNTRL-SPD
76041	MAXIMUM CRUISE CONTROL SPEED	CRUISE CTL MAX SPEED	MAX-CRUS-CNTRL-SPD
77001	ENG-PROT-MODE	WARN MODE	ENG-PROT-MODE
77011	ECT-WARNING	COOLANT WARNING TEMP	ECT-WARNING
77021	ECT-CRITICAL	COOLANT SHUTDOWN TMP	ECT-CRITICAL
77031	PROT-ENG-SPD1	OIL WARNING RPM 1	PROT-ENG-SPD1
77041	PROT-ENG-SPD2	OIL WARNING RPM 2	PROT-ENG-SPD2

Table 1.2 - Parameter Cross Reference Table. Information generated directly from International® EERS System (International® EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	PARAMETER NAME	SALES DESCRIPTION	SERVICE DESCRIPTION
77051	PROT-ENG-SPD3	OIL WARNING RPM 3	PROT-ENG-SPD3
77061	OIL-PRES-WARN-SPD1	OIL PRESS WARNING 1	OIL-PRES-WARN-PSI1
77071	OIL-PRES-WARN-SPD2	OIL PRESS WARNING 2	OIL-PRES-WARN-PSI2
77081	OIL-PRES-WARN-SPD3	OIL PRESS WARNING 3	OIL-PRES-WARN-PSI3
77091	OIL-PRES-CRIT-SPD1	OIL PRESS SHUTDOWN 1	OIL-PRES-CRIT-PSI1
77101	OIL-PRES-CRIT-SPD2	OIL PRESS SHUTDOWN 2	OIL-PRES-CRIT-PSI2
77111	OIL-PRES-CRIT-SPD3	OIL PRESS SHUTDOWN 3	OIL-PRES-CRIT-PSI3
78001	OVER TEMPERATURE PROTECTION	CTC MODE	COOLANT-TEMP-COMP
78011	CTC-INITIAL	CTC INIT TEMP	CTC-INITIAL
78021	CTC-TRANSITION	CTC TRANSITION TEMP	CTC-TRANSITION
78031	CTC-TAIL-FACTOR	CTC TAILORING FACTOR	CTC-TAIL-FACTOR
79001	VEH-ROAD-SPD-GOV	SPEED LIMITING	VEH-ROAD-SPD-GOV
79011	MAX. ENGINE SPEED (NO VSSN)	MAX ENG RPM W/O VSS	MAX-ENGSPD-NO-VSSN
79021	VEHICLE SPEED LIMIT	MAX VEHICLE SPEED	MAX-VEHICLE-SPEED
80001	TWO-SPEED-AXLE	TWO SPEED AXLE ENBLE	TWO-SPEED-AXLE
80011	TIRE-REVS-PER-MILE	TIRE REVOLUTIONS	TIRE-REVS-PER-MILE
80021	REAR-AXLE-RATIO-HI	REAR AXLE RATIO 1	REAR-AXLE-RATIO-H
80031	REAR-AXLE-RATIO-LO	REAR AXLE RATIO 2	REAR-AXLE-RATIO-LO
80041	TRANS-LO-NUM-RATIO	TRANS TOP GEAR RATIO	TRANS-LO-NUM-RATIO
80051	VEH-SPEED-CAL-HIGH	HI AXLE RATIO PULSES	VEH-SPEED-CAL-HIGH
80061	VEH-SPEED-CAL-LOW	LO AXLE RATIO PULSES	VEH-SPEED-CAL-LOW
80071	TAIL-SHAFT-TEETH	TAILSHAFT GEAR TEETH	TAIL-SHAFT-TEETH
81001	TORQUE-TAILORING	TORQUE LVL TAILORING	TORQUE-TAILORING
81011	TT-LOW-NVS-RATIO	N/VS LOWER GEAR PT	TT-LOW-NVS-RATIO
81021	TT-HI-NVS-RATIO	N/VS UPPER GEAR PT	TT-HI-NVS-RATIO
82001	TRANSMISSION-TYPE	TRANSMISSION TYPE	TRANSMISSION-TYPE
82011	ENG-FAM-RATING-CD	ENG RATING CODE	ENG-FAM-RATING-CD
82021	ENG-LOW-IDLE-SPEED	MIN ENGINE IDLE	ENG-LOW-IDLE-SPEED
82031	ENG-HI-IDLE-SPEED	MAX ENGINE IDLE	ENG-HI-IDLE-SPEED
82041	ENG-GOVERNED-SPEED	RATED ENGINE SPEED	ENG-GOVERNED-SPEED

Table 1.2 - Parameter Cross Reference Table. Information generated directly from International® EERS System (International® EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	PARAMETER NAME	SALES DESCRIPTION	SERVICE DESCRIPTION
82041	ENG-RATED-SPEED	RATED ENGINE SPEED	ENG-RATED-SPEED
82051	ENG-RATED-HP	RATED ENGINE POWER	ENG-RATED-HP
82061		ENG FAMILY EXT	ENG-FAM-EXT
83001	TOTAL-FUEL	TOTAL FUEL USED	TOTAL-FUEL
83011	ENGINE-HOURS	ENGINE RUN HOURS	TOTAL-ENG-HOURS
83021	TOTAL-MILES	TOTAL DISTANCE	TOTAL-MILES
84001	EL-OVERSPEED-1	ENGINE SPEED FAULT 1	EL-OVERSPEED-HRS-1
84011	EL-OVERSPEED-2	ENGINE SPEED FAULT 2	EL-OVERSPEED-HRS-2
84021	EL-LOWOILPRS-1	OIL PRESSURE FAULT 1	EL-LOWOILP-HRS-1
84031	EL-LOWOILPRS-2	OIL PRESSURE FAULT 2	EL-LOWOILP-HRS-2
84041	EL-OVERHEAT-1	COOLANT TEMP FAULT 1	EL-OVERHEAT-HRS-1
84051	EL-OVERHEAT-2	COOLANT TEMP FAULT 2	EL-OVERHEAT-HRS-2
84061	EL-LOWCOOL-1	COOLANT LEVEL FAULT1	EL-LOWCOOL-HRS-1
84071	EL-LOWCOOL-2	COOLANT LEVEL FAULT2	EL-LOWCOOL-HRS-2
84081	EL-OVERSPEED-MI1	ENGINE SPEED FAULT1	EL-OVERSPEED-MLS-1
84091	EL-OVERSPEED-MI2	ENGINE SPEED FAULT 2	EL-OVERSPEED-MLS-2
84101	EL-LOWOILP-MI1	OIL PRESSURE FAULT 1	EL-LOWOILP-MLS-1
84113	EL-LOWOILP-MI2	OIL PRESSURE FAULT 2	EL-LOWOILP-MLS-2
84121	EL-OVERHEAT-MI1	COOLANT TEMP FAULT 1	EL-OVERHEAT-MLS-1
84131	EL-OVERHEAT-MI2	COOLANT TEMP FAULT 2	EL-OVERHEAT-MLS-2
84141	EL-LOWCOOL-MI1	COOLANT LEVEL FAULT1	EL-LOWCOOL-MLS-1
84151	EL-LOWCOOL-MI2	COOLANT LEVEL FAULT2	EL-LOWCOOL-MLS-2
85001	VEHICLE-IDENT	VIN	VEHICLE-IDENT
86001	TOTAL-TATTLETALES	TOTAL TATTLE TALES	TOTAL-TATTLETALES
87002	CUSTOMER PASSWORD	CUSTOMER PASSWORD	PASSWORD-1
88001	ENG-SERIAL-NO	ENGINE SERIAL #	ENG-SERIAL-NO
89001	VEH-SPD-SIG-MODE	VEH SPEED SIGNAL	VEH-SPD-SIG-MODE
90001	COOL-FAN-ENABLE	FAN CONTROL MODE	FAN-CONTROL-MODE
90011	AC-DEMAND-ENABLE	AC DEMAND INPUT	AC-DEMAND-INPUT
90021	COOL-FAN-ON-TEMP	FAN ON TEMP	FAN-CNTRL-ON-TEMP

Table 1.2 - Parameter Cross Reference Table. Information generated directly from International® EERS System (International® EMR Report, Location Melrose Park, Rules Effective August, 1997) (Continued)

SUPPLIER NAME	PARAMETER NAME	SALES DESCRIPTION	SERVICE DESCRIPTION
90031	COOL-FAN-OFF-TEMP	FAN OFF TEMP	FAN-CNTRL-OFF-TEMP
91001	RAD-SHUT-ENABLE	SHUTTER CONTROL	SHUTTER-CNTRL-ENAB
91011	SHUTTER-OPEN-ECT	SHUTTER OPEN COOLANT TEMP	SHUTT OPEN ECT
91021	SHUTTER-CLOSE-ECT	SHUTTER CLOSE COOLANT TEMP	SHUTT CLOSE ECT
92001	CONDUCT-CLNT-SNSR	COOLANT TANK	COOLNT-TANK-SELECT
93001	HYD-PRESS-GOV-ENAB	EPG ENABLE	HYD-PRESS-GOV-ENAB
93011	EPG-DRVLINE-STATUS	EPG DRVLINE STATUS	EPG-DRVLINE-STATUS
93021	EPG-MODE-IND-ENABL	EPG MODE INDICATOR	EPG-MODE-IND-ENABL
93031	EPG-RAMP-RATE	EPG RAMP RATE	EPG-RAMP-RATE
93041	EPG-INTG-GAIN-OFST	INT GAIN OFFSET	EPG-INTG-GAIN-OFST
93051	EPG-PROP-GAIN-OFST	EPG PROP GAIN OFFSET	EPG-PROP-GAIN-OFST
94001	COLD-AMB-PROT-MODE	COLD AMBIENT PROT MODE	CAP MODE
95001	SERVICE-INT-ENABLE	SERVICE INTERVAL ENABLE	SRVC INT ENAB
95011	SI-FUEL-INTERVAL	SERV INT FUEL INTERVAL	SI FUEL INT
95021	SI-HOUR-INTERVAL	SERV INT HOUR INTERVAL	SI HOUR INT
95031	SI-DIST-INTERVAL	SERV INT DISTANCE INTERVAL	SI DISTANCE INT
95041	SI-FUEL-START	SERV INT FULE START	SI FULE START
95051	SI-HOUR-START	SERV INT HOUR START	SI HOUR START
95061	SI-DISTANCE-START	SERV INT DISTANCE START	SI DISTANCE START
95071	SI-SRV-SOON-PCT	SERV INT SERV SOON PCT	SI SRV SOON PCT
95081	SI-LAMP-CONT-ON	SERV INT LAMP CONT ON	SI LMP CONT ON
95091	SI-LAMP-ACT-TIME	SERV INT LAMP ACTIVE TIME	SI LMP ACTV TIME
95101	SI-RESET-REQST	SERV INT RESET REQUEST	SI RESET REQUEST

Parameter Table Descriptions

Programmable parameters are grouped according to control system feature. Features are listed in alphabetical order. An index is also provided for help in locating parameters.

Since interactions exist between certain control system features, text is provided at the end of each section to clarify what parameters not belonging to the given feature must be considered when programming parameters belonging to the given feature. Refer to the text in each section preceded by the heading: “Other parameters which must be considered when programming this feature:”

Feature Name: Accumulators

TOTAL-FUEL (gallons)

Records total fuel usage since installation of this ECM.

ENGINE-HOURS (hours)

Records total engine on time since installation of this ECM. “On” time is defined as any time the engine is running.

TOTAL-MILES (miles)

Records total distance traveled since installation of this ECM total idle fuel used, engine on time at idle, total PTO.

Other parameters which must be considered when programming this feature:

None

Feature Name: Cold Ambient Protection

COLD AMBIENT PROTECT ENABLE

Enable/Disable of Cold Ambient Protection Feature.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is enabled and may be activated by the ECM when activation criteria are met.

Cold ambient protection permits the engine to idle at an elevated RPM when certain operating temperature conditions are met. For more information, refer to International® publications listed in the reference section of this document.

Other parameters which must be considered when programming this feature:

1. **IDLE SHUTDOWN MODE** (Idle Shutdown Control Feature):
   If this parameter is programmed to enable the IST feature, CAP CANNOT be enabled. This is because the functionality of these two features conflicts.
2. **PTO-CONTROL ON/OFF** (Power Take Off Control Feature):
   CAP is disabled anytime PTO Control is operating in “Active” mode.
3. **ENG-PROT-MODE** (Engine Warning and Protection Control Feature):
   Disables CAP when coolant level is detected to be low.
4. **TRANS_MODE** (Transmission Type Feature):
   If this parameter is programmed to indicate a manual or Allison WT transmission, then the maximum engine speed achievable by CAP is limited to CAP_N_NLMX (parameter not yet

Feature Name: Coolant Tank Selection

CONDUCT-CLNT-SNSR

Specifies type of coolant tank and/or coolant level sensor installed on truck.

- 0: Normally open coolant level sensor switch installed (plastic tank).
- 1: Conductive coolant level probe installed (metal tank).

Other parameters which must be considered when programming this feature:

None

Feature Name: Coolant Temperature Compensation

OVER TEMPERATURE PROTECTION

Enable/Disable Coolant Temperature Compensation feature.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is enabled and may become active for certain engine operating conditions.

IMPORTANT: *Vehicles using PTO speed control for emergency vehicle applications may need to disable the Coolant Temperature Compensation feature in order to comply with NFPA 1901.*

The event logging feature will log occurrence of an engine shutdown event according to engine hours and odometer reading.

Other parameters which must be considered when programming this feature:

None

Feature Name: Cruise Control

CRUISE-CONTROL

Enable/Disable Cruise Control Feature

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is enabled and may be turned on and activated by the operator.

IMPORTANT**:** *If Cruise control is disabled, do not program any additional cruise control parameters. Instead, go to the PTO Control section.*

CRUISE-MIN-ENG-SPD (mph)

Cruise Control Low RPM Limit

Minimum engine speed permitted for activation of cruise control.

CRUISE-RAMP-RATE (mph/second)

Cruise Control Vehicle Speed Ramp Rate

Maximum rate of vehicle acceleration permitted when the Accel button is pressed.

MIN CRUISE CONTROL SPEED (mph)

Cruise Control Low Vehicle Speed Limit

Minimum vehicle speed permitted for cruise control engagement (cruise control “active”).

MAXIMUM CRUISE CONTROL SPEED (mph)

Cruise Control Maximum Vehicle Speed Limit

Maximum vehicle speed permitted for cruise control engagement and operation (cruise control “active”).

If cruise control is disabled, do not enter a value for this parameter. Leave the parameter value blank.

This parameter should not be programmed with a value that exceeds the maximum road speed limit.

Other parameters which must be considered when programming this feature:

1. **RETARDER-SERVICE BRAKE INTERFACE** (Vehicle Retarder Feature):
   For this parameter programmed to a non-zero value, VRE will be enabled when the brake pedal is depressed and Cruise Control is in a “standby” or “active” mode of operation.
2. **PTO-CONTROL ON/OFF** (Power Take Off Control):
   The PTO Control and Cruise Control features operate in a mutually exclusive manner if they are both programmed to be enabled. Cruise Control will function at vehicle speeds greater than 35 mph; PTO control will function at speeds less than 20 mph when PTO-CONTROL is set to 3 (MOBILE-VARIABLE); otherwise, PTO Control will operate only when the vehicle is not moving.
3. **VEH-ROAD-SPD-GOV** (Road Speed Limiting)
   VEHICLE SPEED LIMIT (Road Speed Limiting):
   In order to encourage use of cruise control for best fuel economy, the MAXIMUM CRUISE CONTROL SPEED should not be programmed to be less than the value programmed for the VEHICLE SPEED LIMIT in the Road Speed Limiting feature.

Feature Name: Customer Password

CUSTOMER PASSWORD

Specifies alphanumeric characters that become the customer password for the engine in this vehicle; 4 characters minimum, 8 characters maximum.

Other parameters which must be considered when programming this feature:

None

Feature Name: Engine Fan Control

COOL-FAN ENABLE

Enable/Disable different features of the Engine Fan Control.

- 0: DISABLE, feature is turned off at all times.
- 1: FOR COOLING ONLY, fan activation is performed for engine cooling and air conditioner performance requirements only.
- 2: FOR COOLING AND VEHICLE RETARDER: fan activation is performed based on engine cooling and air conditioner requirements, as well as for use as a vehicle retarding device.
- 3: Variable Engine Fan Speed Control.
- 3: Three Speed Fan Control.

AC-DEMAND-ENABLE

Indicates to ECM that an air conditioner pressure demand switch should be used to engage the engine cooling fan.

- 0: DISABLE, air conditioner demand switch is not available.
- 1: ENABLE, air conditioner demand switch is available to the ECM.

COOL-FAN-ON-TEMP (degrees centigrade)

Specifies coolant temperature threshold for fan control operation. Engine fan will be turned on by ECM when coolant temperature is above this threshold.

COOL-FAN-OFF-TEMP (degrees centigrade)

Specifies coolant temperature threshold for fan control operation. Engine fan will be turned off by ECM when coolant temperature is below this threshold.

Other parameters which must be considered when programming this feature:

1. **RETARDER-SERVICE-BRAKE-INTERFACE** (Vehicle Retarder Feature):
   The Vehicle Retarder Feature should be enabled via this parameter if COOL-FAN ENABLE is programmed to a “2”.
2. **RAD-SHUT-ENABLE** (Radiator Shutter Control):
   This parameter indicates to the ECM that the position of the radiator shutter is controlled by the ECM. This parameter must be properly programmed to ensure that the radiator shutters are opened when required to achieve engine cooling by the Engine Cooling Fan feature.

Feature Name: Engine Serial Number

ENG-SERIAL-NO

Engine Serial Number

Specifies the 17 alphanumeric characters that make up the engine serial number for the engine in this vehicle.

Other parameters which must be considered when programming this feature:

None

Feature Name: Event Logging

EL-OVERSPEED-1 (hours)

Log of engine hour meter for either the last occurrence of an engine overspeed event, or the next to last occurrence of an engine overspeed event.

EL-OVERSPEED-2 (hours)

Log of engine hour meter for either the last occurrence of an engine overspeed event, or the next to last occurrence of an engine overspeed event.

EL-LOWOILP-1 (hours)

Log of engine hour meter for either the last occurrence of low oil pressure detected, or the next to last occurrence of low oil pressure detected.

EL-LOWOILP-2 (hours)

Log of engine hour meter for either the last occurrence of low oil pressure detected, or the next to last occurrence of low oil pressure detected.

EL-OVERHEAT-1 (hours)

Log of engine hour meter for either the last occurrence of engine overheat condition detected, or the next to last occurrence of engine overheat condition detected.

EL-OVERHEAT-2 (hours)

Log of engine hour meter for either the last occurrence of engine overheat condition detected, or the next to last occurrence of engine overheat condition detected.

EL-LOWCOOL-1 (hours)

Log of engine hour meter for either the last occurrence of low coolant level detected, or the next to last occurrence of low coolant level detected.

EL-LOWCOOL-2 (hours)

Log of engine hour meter for either the last occurrence of low coolant level detected, or the next to last occurrence of low coolant level detected.

EL-OVERSPEED-MI-1 (miles)

Log of vehicle odometer reading for either the last occurrence of an engine overspeed event, or the next to last occurrence of an engine overspeed event.

EL-OVERSPEED-MI-2 (miles)

Log of vehicle odometer reading for either the last occurrence of an engine overspeed event, or the next to last occurrence of an engine overspeed event.

EL-LOWOILP-MI-1 (miles)

Log of vehicle odometer value for either the last occurrence of low oil pressure condition detected, or the next to last occurrence of low coolant level detected.

EL-LOWOILP-MI-2 (miles)

Log of vehicle odometer value for either the last occurrence of low oil pressure condition detected, or the next to last occurrence of low coolant level detected.

EL-OVERHEAT-MI-1 (miles)

Log of vehicle odometer value for either the last occurrence of engine overheat condition detected, or the next to last occurrence of engine overheat condition detected.

EL-OVERHEAT-MI-2 (miles)

Log of vehicle odometer value for either the last occurrence of engine overheat condition detected, or the next to last occurrence of engine overheat condition detected.

EL-LOWCOOL-MI-1 (miles)

Log of vehicle odometer value for either the last occurrence of low coolant level detected, or the next to last occurrence of low coolant level detected.

EL-LOWCOOL-MI-2 (miles)

Log of vehicle odometer value for either the last occurrence of low coolant level detected, or the next to last occurrence of low coolant level detected.

Other parameters which must be considered when programming this feature:

None

Feature Name: Glow Plug Enable

GLOW-PLUG

Specifies enable/disable of the glow plug feature for the International® I-6 engine.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is enabled for use on this vehicle. Glow plugs will be activated any time the ECM determines that glow plugs are required for engine start and warm up.
- 2: INLET AIR HEATER ENABLE, intake air heater iwll be activated anytime the ECM determines heaters are required for engine warmup and start.
- 3: WAIT TO START LAMP ENABLE

Other parameters which must be considered when programming this feature:

None

Feature Name: Electronic Pressure Governor

HYD-PRESS-GOV-ENAB

Enable/Disable electronic pressure governor feature.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is enabled and may be turned on and activated by the operator.

EPG-DRVLINE-STATUS

Electronic Pressure Governor DDS

Specifies how the driveline disengaged signal should be processed by the ECM for use by Electronic Pressure Governor feature.

- 0: NEUTRAL OPERATION, driveline must be disengaged at all times for operation of the electronic pressure governor.
- 1: SPLIT SHAFT, driveline must be engaged at all times for operation of the electronic pressure governor.

Other parameters which must be considered when programming this feature:

PTO-CONTROL ON/OFF: This parameter must be programmed to “tbd” before the Electronic Pressure Governor feature can be activated.

Feature Name: Idle Shutdown Timer

IDLE-SHUTDOWN-MODE

Specifies configuration of the IDLE SHUTDOWN TIMER feature.

- 0: DISABLE, feature is turned off at all times.
- 1: IDLE SHUTDOWN – PTO OPTION, shutdown the engine after a programmed period of time when PTO Speed Control is NOT active, engine speed is at low-idle, and there is no detectable load on the engine.
- 2: IDLE SHUTDOWN – NO LOAD, shutdown the engine after a programmed period of time when no detectable load is placed on the engine. Shutdown criteria are based completely on engine load. Shutdown will occur independent of PTO Speed Control status or engine speed magnitude.
- 3: IDLE SHUTDOWN – TAMPER PROOF, operation is same as option 2 except IST will continue to function normally when an APS signal fault or a brake signal fault is detected. In addition, a rationality check is performed on the APS signal to ensure tampering has not been performed.

IST-MAIN-AIT (degrees centigrade)

Specifies maximum ambient air temperature threshold for operation of the Idle Shutdown feature. Engine Idle shutdown feature must be enabled by programming IDLE-SHUTDOWN-MODE to 1, 2, or 3.

If ambient air is above the threshold specified by this parameter, the idle shutdown feature is disabled to permit prolonged use of air conditioning.

IST-MIN-AIT (degrees centigrade)

Specifies minimum ambient air temperature threshold for operation of the Idle Shutdown feature. Engine Idle shutdown feature must be enabled by programming IDLE-SHUTDOWN-MODE to 1, 2, or 3.

If ambient air is below the threshold specified by this parameter, the idle shutdown feature is disabled to permit prolonged use of the cab heater/defroster, and to permit operation of the COLD AMBIENT PROTECTION feature.

IDLE SHUTDOWN TIME (minutes)

Specifies minimum idle duration time before a shutdown can be commanded by the ECM.

Other parameters which must be considered when programming this feature:

COLD AMBIENT PROTECT ENABLE (Cold Ambient Protection Feature):
If CAP is enabled (via programming of COLD AMBIENT PROTECT ENABLE to “1”), the IST feature must NOT be enabled. This is because the functionality of CAP and IST are in conflict. If IST is enabled, the CAP feature will be overridden and will not function at any time.

PTO-CONTROL ON/OFF (Power Take Off Control):
IST will be disabled when PTO Control is operating in “Active” mode for IDLE-SHUTDOWN-MODE programmed to “1”.

REMOTE THROTTLE FOR PTO CONTROL (Power Take Off Control):
For this parameter programmed to a “1” and PTO control actively operating in remote mode, IST will be disabled regardless of the value programmed for IDLE-SHUTDOWN-MODE.

Feature Name: Engine Signal Enable

ENG-OILP-SIG-ENAB

Specifies if engine oil pressure sensor is available for processing by the ECM.

- 0: DISABLE, sensor is not available.
- 1: ENABLE, sensor is available.
- 2: ENABLE EOP switch feature.

If enabled, the ECM will process the signal and broadcast engine oil pressure information over the ATA data link.

This feature must be enabled for operation of Oil Pressure Warning and Protection.

WATER IN FUEL ENABLE

Specifies if WIF sensor is available for processing by the ECM.

- 0: DISABLE:, sensor is nsot available.
- 1: ENABLE, sensor is available.

FUEL PRESSURE SIG-ENAB

- 0: DISABLE, sensor is not available.
- 1: ENABLE, sensor is available.

Other parameters which must be considered when programming this feature:

ENG-PROT-MODE (Engine Warning and Protection Feature):
If this parameter is programmed to 2, 3, or 4, ENG-OILP-SIG-ENAB must be programmed to 1.

Feature Name: Power Take-Off Control

PTO CONTROL (ON/OFF)

Enable/Disable several different options for PTO Speed Control.

- 0: DISABLE, feature is turned off at all times.
- 1: REMOTE OPERATION ONLY, feature is operated only with remote located PTO ON/OFF switches.
- 2: IN-CAB OPERATION ONLY, feature is operated only with in-cab located PTO speed control switches.
- 3: REMOTE AND IN-CAB OPERATION, feature can be operated with either the remote located or the in-cab located PTO ON/OFF switches. In cases where both switches are used simultaneously, commands given to the ECM from the remote switches will take precedence over commands given to the ECM from the in-cab located PTO switches.

MAX ROAD SPEED FOR MOBILE CONTROL (mph)

Limit maximum vehicle speed when operating in Mobile Engine Speed Control.

Enabled only when the parameter INCAB-PTO-MODE is set to MOBILE VARIABLE.

IN-CAB PTO MODE

Specifies how in-cab located Cruise Control switches are interpreted by the PTO Speed Control for in-cab operation of PTO Speed Control.

- 0: DISABLED, in-cab located Cruise Control switches are not used by the PTO Speed Control feature.
- 1: STATIONARY PRESET, in-cab located Cruise Control switches are used by the PTO Speed Control feature for PRESET PTO Control operation when the vehicle is stationary.
- 2: STATIONARY VARIABLE, in-cab located Cruise Control switches are used by the PTO Speed Control for VARIABLE PTO Control operation whenever the vehicle is stationary. VARIABLE operation means the in-cab located cruise control switches can be used only when PTO Speed Control is active to modify the desired engine speed maintained by the ECM.
- 3: MOBILE VARIABLE, in-cab located Cruise Control switches are used by the PTO Speed Control for VARIABLE PTO Control operation when the vehicle is either stationary of moving forward at a speed less than MAX-ROAD-SPEED-FOR-MOBILE-CONTROL.

DISABLE CAB INTERFACE FOR PTO

Disable use of in-cab located control system interfaces when PTO Speed is controlled by remote input signals.

In-cab interfaces include the accelerator pedal, driveline engagement signal, brake pedal, and cruise control switches.

- 0: ENABLE, use information from all in-cab located operator interfaces
- 1: DISABLE, Ignore all information from in-cab located operator interfaces.

NOTE:*This parameter should only be set to "1" when in-cab located operator interfaces (accelerator, brake, clutch, and cruise switches) must be ignored during operation of stationary remote PTO speed control.*

REMOTE THROTTLE FOR PTO CONTROL

Enable/Disable use of remote throttle for PTO Speed control.

- 0: DISABLE, do not use remote throttle.
- 1: ENABLE, use remote throttle.

SET ENGINE SPEED (SPEED1) (rpm)

SET/COAST decrements through preset settings.

Applicable only for PTO_MODE programmed to STATIONARY PRESET mode of operation.

RESUME ENGINE SPEED (SPEED2) (rpm)

RESUME/ACCEL increments through preset settings.

Applicable only for PTO_MODE programmed for STATIONARY PRESET mode of operation.

ENGINE SPEED (SPEED 3) (rpm)

Applicable only for PTO_MODE programmed for STATIONARY PRESET mode of operation.

ENGINE SPEED (SPEED 4) (rpm)

Applicable only for PTO_MODE programmed for STATIONARY PRESET mode of operation.

ENGINE SPEED (SPEED 5) (rpm)

Applicable only for PTO_MODE programmed for STATIONARY PRESET mode of operation.

ENGINE SPEED (SPEED 6) (rpm)

Applicable only for PTO_MODE programmed for STATIONARY PRESET mode of operation.

MAX PTO ENGINE SPEED (rpm)

Maximum engine speed permitted for PTO speed control.

Limits engine speed during variable speed control use and during operation with remote throttle pedal.

Other parameters which must be considered when programming this feature:

COLD AMBIENT PROTECT ENABL (Cold Ambient Protection): CAP is disabled anytime PTO Control is operating in “Active” mode.

CRUISE-CONTROL (Cruise Control Feature): The PTO Control and Cruise Control features operate in a mutually exclusive manner if they are both programmed to be enabled. Cruise Control will function at vehicle speeds greater than 35 mph; PTO control will function at speeds less than 20 mph when PTO-CONTROL is set to 3 (MOBILE-VARIABLE); otherwise, PTO Control will operate only when the vehicle is not moving.

RETARDER-SERVICE BRAKE INTERFACE (Vehicle Retarder Feature): For this parameter programmed to a non-zero value, VRE will be enabled when the brake pedal is depressed and PTO Control is in “standby” or “active” modes of operation.

HYD-PRESS-GOV-ENAB (Electronic Pressure Governor Feature): PTO-CONTROL must be programmed to “tbd” before the EPG feature can be activated.

Feature Name: Radiator Shutter Control

RAD-SHUT-ENABLE

Enable/Disable of Radiator Shutter Control Feature.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is enabled, position of radiator shutter is controlled by the ECM.

SHUTTER-OPEN-ECT (degrees centigrade)

Specifies coolant temperature threshold for shutter control operation. Radiator shutters will be opened by the ECM when coolant temperature is above this value.

SHUTTER-CLOSE-ECT (degrees centigrade)

Specifies coolant temperature threshold for shutter control operation. Radiator shutters will be closed by the ECM when coolant temperature is below this value.

Other parameters which must be considered when programming this feature:

AC-DEMAND-ENABLE (Engine Fan Control Feature)

COOL-FAN-ON-TEMP (Engine Fan Control Feature)

COOL-FAN-OFF-TEMP (Engine Fan Control Feature)

To maximize fuel economy, the above parameters should be programmed to ensure that the engine fan is normally not operating when the radiator shutters are closed (except when the fan is being used as a vehicle retarding device).

Feature Name: Road Speed Limiting

VEH-ROAD-SPD-GOV

Enable/Disable for Road Speed Limiting Feature.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is turned on and active at all times.

MAX-ENGINE SPEED (NO VSSN) (rpm)

Engine speed will be limited to this value when a vehicle speed sensor fault is present and the Road Speed Limiting feature is enabled.

VEHICLE SPEED LIMIT (mph)

Maximum vehicle speed is limited to this value when VEH-ROAD-SPD-GOV is “1” (Road Speed Limiting is enabled).

Other parameters which must be considered when programming this feature:

MAXIMUM CRUISE CONTROL SPEED (Cruise Control): In order to encourage use of cruise control for best fuel economy, the MAXIMUM CRUISE CONTROL SPEED should not be programmed to be less than the value programmed for VEHICLE SPEED LIMIT in the Road Speed Limiting feature.

Feature Name: Service Interval

SERVICE-INT-ENABLE

Enable/Disable operation of SERVICE INTERVAL feature.

- 0: DISABLE, feature is turned off at all times.
- 1: ENABLE, feature is turned on, ECM monitors accumulation of specified parameter(s) (distance in miles, operating time in hours, and/or fuel used in gallons), and activates a CHANGE OIL LAMP when the specified interval(s) is reached.

SI-FUEL-INTERVAL (gallons)

Fuel used interval at which the ECM will activate the CHANGE OIL LAMP. Setting SI-FUEL-INTERVAL = 0 will disable the FUEL INTERVAL portion of the feature.

SI-HOUR-INTERVAL (hours)

Engine operating hours interval at which the ECM will activate the CHANGE OIL LAMP. Setting SI-HOUR-INTERVAL = 0 will disable the HOUR INTERVAL portion of the feature.

SI-DIST-INTERVAL (miles)

Vehicle miles interval at which the ECM will activate the CHANGE OIL LAMP. Setting SI-DIST-INTERVAL = 0 will disable the DISTANCE INTERVAL portion of the feature.

SI-FUEL-START (gallons)

Accumulated total engine fuel (obtained from ECM ACCUMULATORS) used to reset SERVICE INTERVAL feature. This value is used by the ECM to calculate interval status by comparison with current accumulator value.

SI-HOUR-START (hours)

Accumulated total engine hours (obtained from ECM ACCUMULATORS) used to reset SERVICE INTERVAL feature. This value is used by the ECM to calculate interval status by comparison with current accumulator value.

SI-DIST-START (miles)

Accumulated total vehicle miles (obtained from ECM ACCUMULATORS) used to reset SERVICE INTERVAL feature. This value is used by the ECM to calculate interval status by comparison with current accumulator value.

SI-SRV-SOON-PCT

Percent of specified interval(s) (distance in miles, operating time in hours, and/or fuel used in gallons), at which ECM will activate the CHANGE OIL LAMP. CHANGE OIL LAMP will operate in a flashing mode until 100% of the specified interval(s) is reached.

SI-LAMP-CONT-ON

Enable/Disable CHANGE OIL LAMP continuous mode of operation.

- 0: DISABLES continuous OIL CHANGE LAMP operation. Duration of CHANGE OIL LAMP operation will be controlled by SI-LAMP-ACT-TIME parameter when specified interval is reached.
- 1: ENABLES continuous CHANGE OIL LAMP operation. CHANGE OIL LAMP will operate continuously when specified interval is reached.

SI-LAMP-ACT-TIME (seconds)

Duration of CHANGE OIL LAMP operation. ECM will activate CHANGE OIL LAMP for this period of time when a specified interval is reached, the SI-LAMP-CONT-ON parameter is disabled (=0), and a key-off/ key-on cycle is performed.

SI-RESET-REQST

Performs a SERVICE INTERVAL feature reset.

- 0: DISABLE, No reset is performed.
- 1: ENABLE, SERVICE INTERVAL feature is reset. Upon a key-off/key-on, SI-FUEL-START, SI-HOUR-START and SI-DISTANCE-START parameters are updated with current ECM ACCUMULATOR values to begin a new SERVICE INTERVAL feature cycle, and SI-RESET-REQST parameter is automatically reset to 0.

Other parameters which must be considered when programming this feature:

None

Feature Name: Torque Level Tailoring

TORQUE-TAILORING

Enable/Disable different options for Torque Level Tailoring.

- 0: DISABLE, feature is turned off at all times.
- 1: TRANSMISSION GEAR SELECT, torque curve selection is based on the engine and vehicle operating conditions only.

- 2: TORQUE CURVE SWITCH SELECT, torque curve selection is based on a dedicated operator selection switch.

TT-LOW-NVS-RATIO

The tailored torque curve will be used by the ECM for N/VS ratios (ratio of engine speed to vehicle speed) larger than the value programmed for this parameter.

For N/VS ratios less than this value but greater than TT-HI-NVS-RATIO the ECM will interpolate between the tailored torque curve and the regular torque curve, based on the actual value of the N/VS ratio.

TT-HI-NVS-RATIO

The regular torque curve will be used by the ECM for N/VS ratios (ratio of engine speed to vehicle speed) less than the value programmed for this parameter.

For N/VS ratios greater than this value but less than TT-LOW-NVS-RATIO, the ECM will interpolate between the tailored torque curve and the regular torque curve, based on the actual value of the N/VS ratio.

Other parameters which must be considered when programming this feature:

TWO-SPEED-AXLE (Two Speed Axle Feature)

TIRE-REVS-PER-MILE (Two Speed Axle Feature)

REAR-AXLE-RATIO-HI (Two Speed Axle Feature)

REAR-AXLE-RATIO-LO (Two Speed Axle Feature)

TRANS-LO-NUM-RATIO (Two Speed Axle Feature)

VEH-SPEED-CAL-HIGH (Two Speed Axle Feature)

3. **VEH-SPEED-CAL-LOW** (Two Speed Axle Feature)

4. **TAIL-SHAFT-TEETH** (Two Speed Axle Feature)

For TORQUE TAILORING = 1, all the above parameters in the Two Speed Axle feature must be programmed correctly in order to calculate N/VS ratio properly. N/VS ratio is used to select or interpolate between the standard and tailored torque curves for TORQUE TAILORING = 1.

Feature Name: Transmission Type

TRANSMISSION-TYPE

Type of transmission installed on vehicle. The value programmed into this parameter will determine the type of governing used by the ECM for controlling engine speed. Options for this parameter are as follows:

- 0: MANUAL TRANS - BROAD REGULATION; a manual transmission is installed, broad (10 to 20%) engine speed regulation will be provided by the ECM governor.
- 1: MANUAL TRANS - CLOSE REGULATION, a manual transmission is installed, close (2 to 5%) engine speed regulation will be provided by the ECM governor.
- 2: ALLISON AT/MT, Allison automatic transmission is installed, broad (10 to 20%) engine speed regulation will be provided by the ECM governor.
- 3: NO TRANS, No transmission is specified. Diagnostics for the vehicle speed sensor will be disabled, broad (10 to 20%) engine speed regulation will be provided by the ECM governor.
- 4: ALLISON MD, Allison MD World Transmission is installed.
- 4: EATON
- 4: DANA

IMPORTANT: *In order to comply with selected Federal Motor Vehicle Safety Standards, vehicles with an automatic transmission may be required to have the engine starter wired in series with the vehicle neutral switch, or the* ***Engine Crank Inhibit*** *feature must be enabled.*

ENG-FAM-RATING-CD

Specifies engine family for the engine installed in this vehicle.

ENG-LOW-IDLE-SPEED (rpm)

Low idle engine operating speed used when engine is warm.

ENG-HI-IDLE-SPEED (rpm)

Specifies high idle engine operating speed to be used at all times.

ENG-RATED-SPEED (rpm)

Specifies rated engine operating speed.

ENG-RATED-HP (horsepower)

Specifies rated horsepower.

REGULATION TYPE

- 0: Type 0
- 1: Type 1
- 2: Type 2
- 3: Type 3

NEXT GENERATION VEHICLE (Vehicle Type)

- 0: QSP
- 1: NGV
- 2: CCV (common chassis vehicle)
- 3: SCV (stripped chassis vehicle)
- 4: LCF (low cab forward)

Other parameters which must be considered when programming this feature:

None

Feature Name: Two-Speed Axle

TWO-SPEED-AXLE

Specifies presence or absence of two-speed axle on this vehicle.

If a two-speed axle is installed and this parameter is set to a “1” (enabled), the ECM will process the two-speed axle signal as part of the vehicle speed calculation.

TIRE-REVS-PER-MILE (rotations per mile)

Specifies tire rotations per mile of distance traveled.

REAR-AXLE-RATIO-HI

Specifies rear axle gear ratio for two powertrain operating conditions:

1. Two-speed axle operating in “high” range.
2. Two-speed axle not present.

REAR-AXLE-RATIO-LO

Specifies rear axle gear ratio for low range operation of the two-speed axle.

TRANS-LO-NUM-RATIO

Specifies top gear ratio (lowest numerical gear ratio) for transmission.

VEH-SPEED-CAL-HIGH (pulses per mile)

Specifies relationship between pulses counted by ECM for each mile of distance traveled for two powertrain operating conditions:

1. Two-speed axle operating in “high” range.
2. Two-speed axle not present.

VEH-SPEED-CAL-LOW (pulses per mile)

Specifies relationship between pulses counted by ECM for each mile of distance traveled when two-speed axle is operating in “low” range.

TAIL-SHAFT-TEETH

Specifies total number of transmission tailshaft gear teeth, used for calculation of vehicle speed.

Other parameters which must be considered when programming this feature:

TORQUE-TAILORING (Torque Level Tailoring)

TT-LOW-NVS-RATIO (Torque Level Tailoring)

TT-HI-NVS-RATIO (Torque Level Tailoring)

Correct functionality of the Torque Level Tailoring feature (for TORQUE TAILORING programmed to “1”) requires that all parameters in the Two-Speed Axle feature be programmed correctly.

Feature Name: Vehicle Identification Number

VEHICLE-IDENT

Specifies the 17 Alphanumeric Characters that make up the vehicle identification number for this vehicle.

Other parameters which must be considered when programming this feature:

None

Feature Name: Vehicle Retarder Mode

RETARDER-SERVICE BRAKE INTERFACE

Specifies desired mode of operation for the vehicle retarder as follows:

- 0: DISABLE, feature is disabled at all times.
- 1: LATCH, feature is enabled for the following conditions:
  When cruise control or PTO speed control is in any non-zero mode of operation (standby or active), the vehicle retarder will become active when the brake pedal is depressed. This active condition is latched by the ECM. The vehicle retarder will remain in this active latched condition until the accelerator pedal is depressed or until low idle engine speed is achieved.
- 2: COAST, feature is enabled for the following conditions:
  When cruise control or PTO speed control is in any non-zero mode of operation (standby or active), the vehicle retarder will be active anytime the brake pedal is depressed. The vehicle retarder will be inactive anytime the brake pedal is released.

- 3: TRANSMISSION/DRIVELINE, should be selected whenever a transmission or driveline mounted retarder will be used. The transmission/driveline mounted retarder will be enabled whenever engine speed exceeds a value specified by the engine controller calibration. Otherwise, conditions are the same as for the Latched mode described previously (RETARDER-SERVICE-BRAKE-INTERFACE = 1).
- 4: COMPRESSION BRAKE LATCHED, should be selected whenever a compression brake will be used. The compression brake will be enabled whenever engine speed exceeds a value specified by the engine controller calibration.
- 5. COMPRESSION BRAKE COAST, when cruise control or PTO speed control is in any non-zero mode of operation (standby or active), the compression brake will be active any time the brake pedal is depressed.
- 6: COMPRESSION BRAKE WITH CRUISE CONTROL, while in cruise control mode the compression brake will become active if the cruise set speed is overcome (i.e. going down a grade) and will become inactive after desired speed resumes.
- 7. EXHAUST BRAKE WITH CRUISE CONTROL, while in cruise control mode, the exhaust brake will become active if cruise set speed is overcome (i.e. going down a grade) and will become inactive after desired speed resumes.

The vehicle retarder will be enabled during an engine overspeed condition for any of the above non-zero Vehicle Retarder operating modes.

Other parameters which must be considered when programming this feature:

None

Feature Name: Vehicle Speed Signal

VEH-SPD-SIG-MODE

Specifies how vehicle speed information will be provided to the ECM. Parameter should always be a zero.

- 0: VEHICLE SPEED SENSOR, Vehicle speed sensor is available.
- 1: J1587, future feature usage.
- 2: J1939, future feature usage.

Other parameters which must be considered when programming this feature:

All parameters in Cruise, PTO, Road Speed Limiting, and Two-Speed Axle features require proper indication of vehicle speed; therefore, the proper programming of the VEH-SPD-SIG-MODE parameter is required to achieve proper functionality of these features.

Feature Name: Warn Mode

ENG-PROT-MODE

Enable/Disable several different options for the Engine Warning and Protection System.

- 0: STANDARD WARNING (RPM, ECT), Detection of engine over speed and engine overheat are provided as the default operating mode. No engine shut down is available. The Oil and Water Lamp (OWL) is illuminated (either flashing or constant) and a fault code is activated.
- 1: 3-WAY WARNING (RPM, ECT, EOP, ECL), Engine over speed, engine overheat, engine pressure low, and loss of engine coolant are provided as the engine warning operating mode. No engine shut down is available. OWL is illuminated (either flashing or constant) and a fault code is activated.
- 2: 3-WAY PROTECTION (RPM, ECT, EOP, ECL), Engine over speed, engine overheat, engine pressure low, and loss of engine coolant are provided as the engine warning operating mode. Engine shut down is available if the critical condition is detected. Critical engine conditions include overheat, low oil pressure, and low coolant level. OWL is illuminated (either flashing or constant) and a fault code is activated.

- 3: 2-WAY WARNING (RPM, ECT, EOP), Engine over speed, engine overheat, and engine pressure low are provided as the engine warning operating mode. No engine shut down is available. OWL is illuminated (either flashing or constant) and fault codes are activated as required.
- 4. 4-WAY WARNING (RPM, ECT, EOP, ECL, GENSET SPEED CONTROL),

ECT-WARNING (degrees centigrade)

Specifies temperature threshold where the OIL/WATER lamp and the warning buzzer should be turned on due to an engine overheat condition.

ECT-CRITICAL (degrees centigrade)

Specifies temperature threshold where an engine shut down should be commanded due to an engine overheat condition.

The Engine Warning and Protection System feature must be enabled.

PROT-ENG-SPD1 (rpm)

Specifies RPM breakpoint where OIL-PRES-CRIT-SPD1 will be used by the ECM as the oil pressure threshold for detecting low oil pressure.

PROT-ENG-SPD2 (rpm)

Specifies RPM breakpoint where OIL-PRES-CRIT-SPD2 will be used by the ECM as the oil pressure threshold for detecting low oil pressure.

PROT-ENG-SPD3 (rpm)

Specifies RPM breakpoint where OIL-PRES-CRIT-SPD3 will be used by the ECM as the oil pressure threshold for detecting low oil pressure.

OIL-PRES-WARN-SPD1 (psig)

The OIL/WATER lamp and the warning buzzer are turned on for engine oil pressure less than this threshold and engine speed greater than PROT-ENG-SPD1.

The event logging feature will log occurrence of this event according to engine hours and odometer reading.

OIL-PRES-WARN-SPD2 (psig)

The OIL/WATER lamp and the warning buzzer are turned on for engine oil pressure less than this threshold and engine speed greater than PROT-ENG-SPD1 and less than PROT-ENG-SPD2.

The event logging feature will log occurrence of this event according to engine hours and odometer reading.

OIL-PRES-WARN-SPD3 (psig)

The OIL/WATER lamp and the warning buzzer are turned on for engine oil pressure less than this threshold and engine speed greater than PROT-ENG-SPD2 and less than PROT-ENG-SPD3.

OIL-PRES-CRIT-SPD1 (psig)

Specifies when engine shut down will be commanded due to engine oil pressure less than this threshold and engine speed greater than PROT-ENG-SPD1. The event logging feature will log occurrence of this event according to engine hours and odometer reading.

OIL-PRES-CRIT-SPD2 (psig)

Specifies when an engine shut down will be commanded due to engine oil pressure less than this threshold and engine speed greater than PROT-ENG-SPD1 and less than PROT-ENG-SPD2. The event logging feature will log occurrence of this event according to engine hours and odometer reading.

OIL-PRES-CRIT-SPD3 (psig)

Specifies when an engine shut down will be commanded due to engine oil pressure less than this threshold and engine speed greater than PROT-ENG-SPD2 and less than PROT-ENG-SPD3. The event logging feature will log occurrence of this event according to engine hours and odometer reading.

The event logging feature will log occurrence of this event according to engine hours and odometer reading.

Other parameters which must be considered when programming this feature:

ENG-OILP-SIG-ENAB (Oil Pressure Signal Enable): This parameter must equal “1” for correct operation of Engine Oil Pressure Warning and Protection.

International® Proprietary Parameters

International® Proprietary Parameter Attributes Table

Table 3.1 International Proprietary Parameter Attributes Table. Information generated directly from EERS Release System (International EMR Report, Location Melrose Park, Rules Effective August, 1997)

SUPPLIER NAME	EERS SALES DESCRIPTION	TYPE[1]	UNITS	LOWER LIMIT	UPPER LIMIT	INCREMENT
42000	READ-ECM-FAULTS	R	N/A			1
43002	CLEAR-ECM-FAULTS	W	N/A			1
44000	ECM-SELF-TEST	R	N/A			1
66010	SERIAL-NO-CEC	R	N/A			
68000	LAST-SERVICE-TOOL1	R	N/A			1
68010	LAST-SERVICE-TOOL2	R	N/A			1

[1] = R: EST Read Only Parameter
W: EST Write Only Parameter

Proprietary Parameter Cross Reference Table

Table 3.2 Proprietary Parameter Cross Reference Table. Information generated directly from International® EERS System (International EMR Report, Location Melrose Park, Rules Effective August, 1997)

SUPPLIER NAME	PARAMETER NAME	SALES DESCRIPTION	SERVICE DESCRIPTION
			CAL-TRANS-OUT-RPM
0			CAL-MAX-CRUS-RPM
0			CAL-CRUS-PTO-SEP
0			CAL-MAX-RPM-NOVSS2
0			CAL-CRUS-SPD-DIFF
0			CAL-MAX-RPM-NOVSSN
1			CAL-SPEED-DIFF
42000	READ-ECM-FAULTS		READ-ECM-FAULTS
43002	CLEAR-ECM-FAULTS		CLEAR-ECM-FAULTS
44000	ECM-SELF-TEST		ECM-SELF-TEST
45000			CAL-GEARED-SPD-NGD
66010	SERIAL-NO-CEC	ECM SERIAL NUMBER	MOD-SERIAL-NUM
68000	LAST-SERVICE-TOOL1	LAST SERVICE TOOL 1	LAST-SERVICE-TOOL1
68010	LAST-SERVICE-TOOL2	LAST SERVICE TOOL 2	LAST-SERVICE-TOOL2
68023	LAST-TOOL-CALIB	LAST CALIB TOOL	LAST-TOOL-CALIB
68033	LAST-TOOL-CAL-DATE	LAST CALIB DATE	LAST-TOOL-CAL-DATE
68043	LAST-TOOL-STRATEGY	LAST STRATEGY TOOL	LAST-TOOL-STRATEGY
68053	LAST-TOOL-STR-DATE	LAST STRATEGY DATE	LAST-TOOL-STR-DATE

Feature Name: Clear ECM-Faults

CLEAR-ECM-FAULTS

Command ECM to clear fault codes.

Other parameters which must be considered when programming this feature:

None

Feature Name: ECM Self-Test

ECM-SELF-TEST

Command ECM to perform diagnostic self-test.

Other parameters which must be considered when programming this feature:

None

Feature Name: ECM Compatibility Data

PP LIST LEVEL

Indicates what powertrain control features are configured for this vehicle.

Other parameters which must be considered when programming this feature:

None

Feature Name: ECM Manufacturing Data

MANUFACTURING DATE

Specifies manufacturing date of this ECM.

The year, month, day, and hour of manufacture is displayed. Each of the separate fields uses two numbers. For example, the display “97013018” means this ECM was manufactured on January 30, 1997 at 6 PM.

SERIAL-NO-CEC

ECM serial number.

H/W VERSION

ECM Hardware level.

S/W STRATEGY VERSION

Level of software functionality programmed into this ECM.

S/W CALIBRATION VERSION

Calibration level programmed into this ECM.

In general, calibration refers to the set of parameters used by the control system that are not programmable by the customer or by the factory (i.e. control system gains, out-of-range thresholds, ramp rates, etc,).

Other parameters which must be considered when programming this feature:

None

Feature Name: Programming Trace

LAST-SERVICE-TOOL1

Logs identification of last service tool used to modify a programmable parameter.

LAST-SERVICE-TOOL2

Logs most recent date when a customer service tool was used to modify a programmable parameter.

LAST-TOOL-CALIB

Identifies identification of programming tool last used to modify engine calibration data. Also indicates locations of calibration parameters modified by the service tool.

LAST-TOOL-CAL-DATE

Date when factory programming tool last downloaded calibration data.

LAST-TOOL-STRATEGY

Identifies factory programming tool last used to modify the engine control software. Also indicates memory locations modified in the control system software.

LAST-TOOL-STR-DATE

Logs most recent date when a programming tool downloaded control system software to the ECM.

Other parameters which must be considered when programming this feature:

None

Feature Name: Read ECM Faults

READ-ECM-FAULTS

Query ECM memory for fault codes.

Other parameters which must be considered when programming this feature:

None

Feature Name: Software Parameter Audits

PP LIST CHECKSUM

Used by ECM to validate integrity of values programmed into memory by factory and/or customer.

S/W CALIBRATION CHECKSUM

Used by ECM to validate integrity of calibration data programmed into memory.

S/W STRATEGY CHECKSUM

Used by ECM to validate integrity of software instructions programmed into memory.

Other parameters which must be considered when programming this feature:

None

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INTRODUCTION

There are several other features available for OEM vehicles that are typically associated with truck equipment manufacturers (TEMs) or body builders. These inputs and outputs allow the body builder to configure the final vehicle with such features as auxiliary speed control inputs (also known in the industry as Power Take-Off (PTO), remote accelerator pedal, auxiliary engine shutdown, and a transfer case switch. These optional inputs and outputs can be wired up if required by the application. Some of these I/O were discussed in previous sections under different use cases. It is the responsibility of the OEM to determine which use case most closely corresponds to their vehicle and wire the truck up appropriately. The body builder inputs and outputs available to the OEM are:

- Remove Preset PTO Active Switch (RPRE)
- Remote Variable PTO Active Switch (RVAR)
- Resume/Accel Switch (RAS)
- Set/Coast Switch (SCS)
- Transfer Case Switch (XCS)
- Remote Pedal Sensor (RPS)

In addition to these, a +5 Vdc and a ground reference are available for the Remote Pedal feature.

AUXILIARY ENGINE SPEED CONTROL

There are 3 different engine speed control features available for vehicle vocations:

- Preset Engine Speed Control
- Variable Engine Speed Control
- Mobile Variable Engine Speed Control

The first two features require a non-moving (stationary) vehicle for operation. The “Preset” feature always controls engine speed to a previously programmed value, while the “Variable” feature permits a desired engine speed to be selected via the in-cab or remote mounted switches. The “Mobile Variable” feature is the same as the “Variable” feature, with the exception that the vehicle can be moving or stationary during PTO operation.

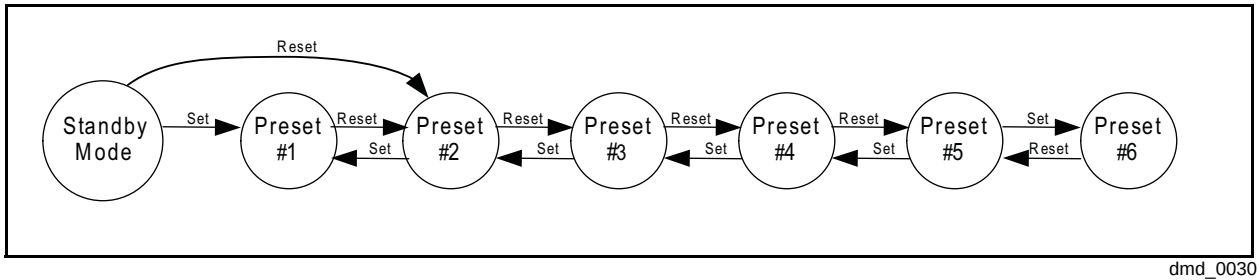
All three Auxiliary Engine Speed Control modes require special programming and setup of programmable parameters covered in the Programmable Parameters section of Book 1. This section only covers the physical wiring and connections required for auxiliary engine speed control.

Preset Engine Speed Control

This feature provides six predetermined engine speed settings (besides low idle) for equipment operation. Preset Engine Speed Control satisfies the majority of the intended engine speed control applications. Use Preset Engine Speed Control when a constant engine speed is required to operate equipment. In-cab engine speed controls (cruise control switches) can be used on a multiplexed vehicle. Remotely mounted controls can be hardwired into these body builder pins of the ECM. On non-multiplexed vehicles that require both the cruise control option as well as the preset engine speed control feature, you must utilize a Multiplex Signal Module (MSM) available from Navistar. As the operation is the same for in-cab or remotely mounted switches, the naming convention of SET/CRUISE and RESUME/ACCEL is used for both applications.

Typical operation of this system requires the operator to perform the following steps:

1. Activate the system
2. Select the desired engine speed using the SET/CRUISE or RESUME/ACCL switch. The RESUME/ACCEL switch will increment the six predetermined engine speed settings; SET/CRUISE will decrement the six predetermined engine speed settings according to the following diagram.



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The desired engine speed set-point can be field programmed to any speed between low idle and high idle speed. Preset Engine Speed Control operates only while the vehicle is stationary. Manipulation of cab located sensor inputs (i.e., Neutral Safety, Service Brake, or Clutch Pedal) will cause the engine speed control to disengage.

The following table summarizes the operation of preset engine speed control. The columns are labeled with the switch being used. The first row discusses what happens when the switch contacts are momentarily closed. The second row discusses the effect of held switches (continuous contact) or multiple use of the same switch.

Preset Engine Speed Control Switch Use

ON	OFF	SET/CRUISE	RESUME/ACCEL	BRAKE	CLUTCH
Single Press (Momentary Contact)					
Enables engine speed control	Disable engine speed control	Sets the desired engine speed to the "Set" Switch RPM Preset speeds 1-6	Sets the desired engine speed to the "Resume" Switch RPM Preset speeds 1-6	Deactivates engine speed control and establishes a standby state. Engine speed returns to low idle RPM.	Deactivates engine speed control and establishes a standby state. Engine speed returns to low idle RPM.
Held Switch (Continuous Contact)					
Enables engine speed control	Enables engine speed control	Same [1]	Same [1]	The change in brake status establishes the standby state.	The change in driveline status establishes the standby state.

[1] = The held switch acts like the switch is being "hit" multiple times.

In-Cab Operation of Preset Engine Speed Control (Multiplexed Vehicle Required)

When control over engine speed is not needed outside the vehicle's cab, the in-cab switches can be used to activate engine speed control and select the desired engine speed. Press the CRUISE "ON" Switch to enable engine speed control. Next, select the desired engine speed according to the value programmed for the parameter ***PTO RPM Ramp Rate***. This acceleration limit should be programmed as required to minimize stress on auxiliary equipment drive links. Engine speed will be reduced to idle by any of the following actions:

- CRUISE "OFF" switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)

Note that these actions are always applicable for in-cab PTO Operation, regardless of the value programmed for the parameter "PTO IN-CAB CONTROL". Only when engine speed is controlled by remote input signals and the cab interface is disabled will the engine speed be unaffected by the above actions.

WARNING: **Shift of automatic transmission from neutral to forward or reverse gear while operating any PTO mode is not recommended; vehicle may lurch forward when transmission is placed in gear due to increased power output of the engine which is operating at the elevated engine speed.**

WARNING: **To avoid sudden, unexpected vehicle movement and possible personal injury:**

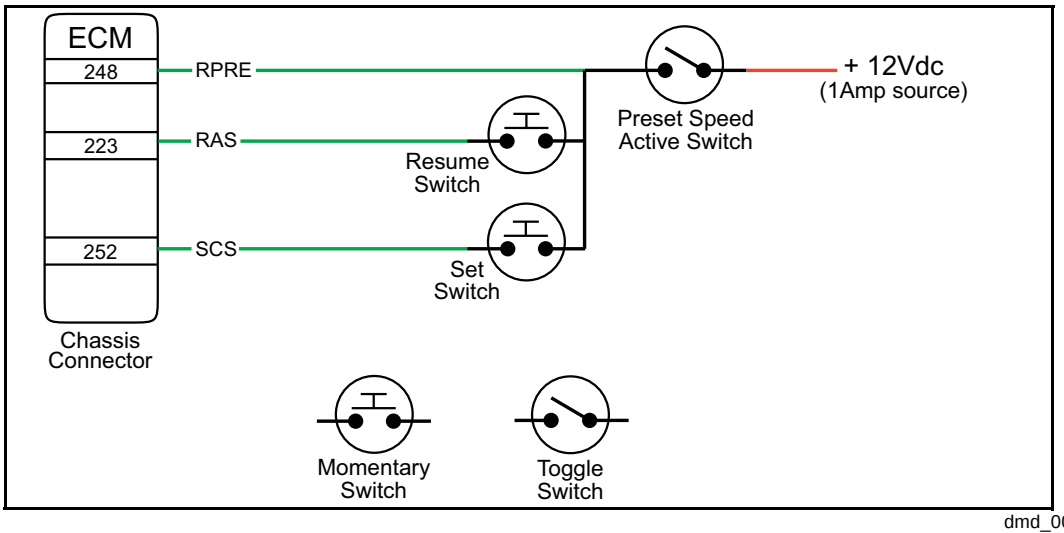
- **Always fully set the parking brake when using the Preset PTO Engine Speed Control Feature.**
- **Do not abort the Preset Engine Speed Control Feature by shifting an automatic transmission from neutral gear into a forward or reverse gear.**
- **Turn off the engine when you leave the vehicle. Never leave the vehicle unattended with the engine running.**

Remote Operation of Preset Engine Speed Control

- Multiplexed Vehicles or Non-Multiplexed Vehicles without Cruise Control

When control over engine speed is required from outside the vehicle's cab, remote mounted switches must be used to turn on PTO engine speed control and select the desired engine speed. The diagram below illustrates how remotely located switches must be interfaced to the ECM to accomplish Preset PTO Engine Speed Control. This diagram does not show the cruise control switches wired up inside the cab on the multiplexed vehicle. Switch functionality remains the same as described for the in-cab located switches (see **Preset Engine Speed Control Switch Use** table).

A REMOTE PRESET PTO ON/OFF switch (RPRE) is required to remotely turn on the Preset Engine Speed Control. The desired engine speed is then selected using a remotely located SET/CRUISE or RESUME/ACCEL switch. Once a desired engine speed has been selected using one of these switches, engine speed will begin to increase. This rate of increase will be limited according to the value programmed in the parameter ***PTO RPM Ramp Rate***. This acceleration limit should be programmed as required to minimize stress on auxiliary equipment power drive links.



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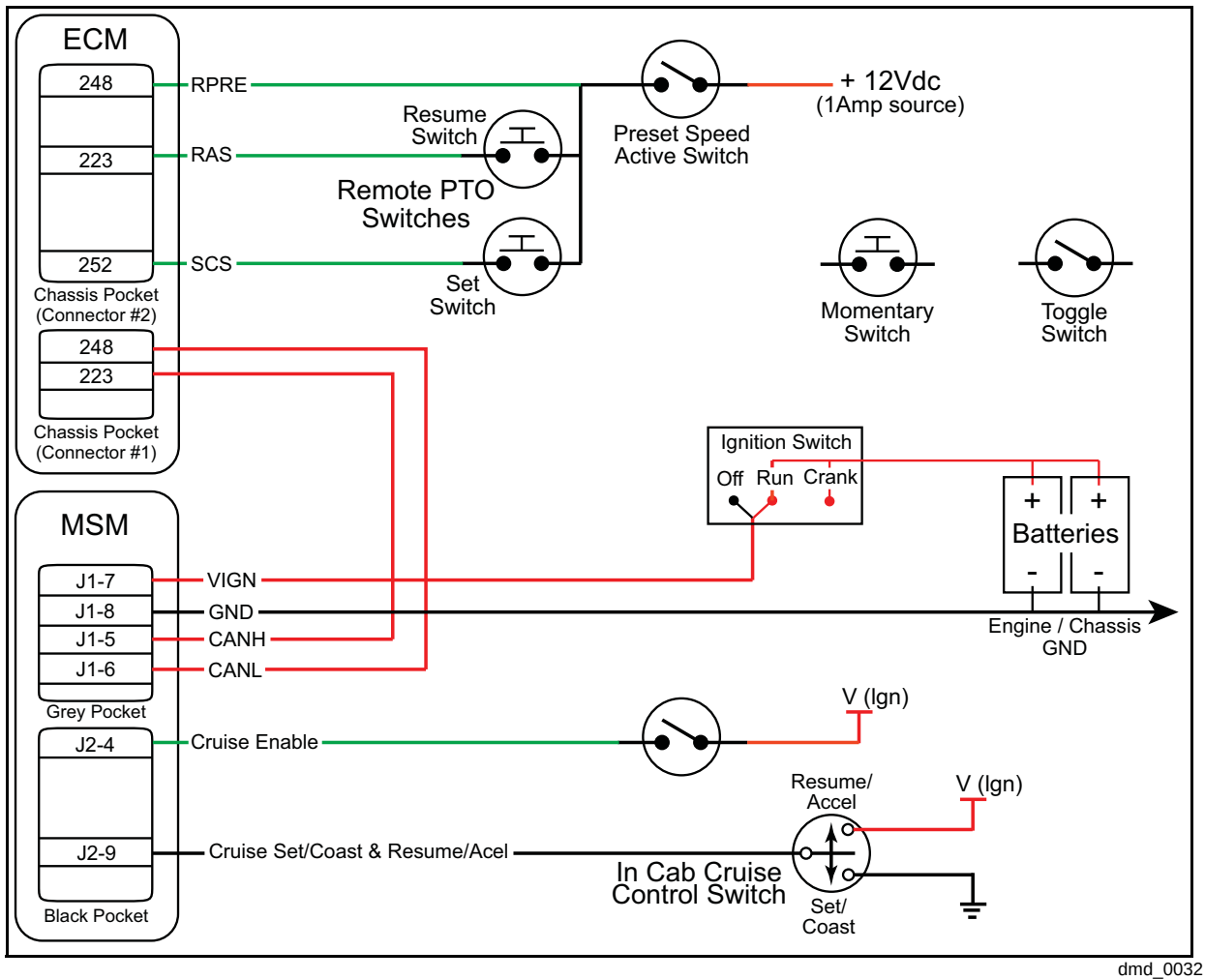
- Non-Multiplexed Vehicles with Cruise Control Option

If the OEM is incorporating the powertrain into a non-multiplexed vehicle and cruise control is to be an option, then the Navistar Multiplex Signal Module (MSM) must be used. In this case the MSM will be wired where the in-cab cruise control switches are wired, while the auxiliary engine speed control switches will be wired directly into the body builder pins of the Engine Control Module (ECM).

As before, a REMOTE PRESET PTO ON/OFF switch (RPRE) is required to remotely turn on the Preset Engine Speed Control. The desired engine speed is then selected using a remotely located SET/CRUISE or RESUME/ACCEL switch. Once a desired engine speed has been selected using one of these switches, engine speed will begin to increase. This rate of increase will be limited according to the value programed in the parameter ***PTO RPM Ramp Rate***. This acceleration limit should be programmed as required to minimize stress on auxiliary equipment power drive links.



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Variable Engine Speed Control

Variable Engine Speed Control permits a desired engine speed to be achieved between low idle and high idle speed even without use of the accelerator pedal or Remote Throttle. The switches that must be used to achieve this functionality are ON, OFF, SET/CRUISE, and RESUUME/ACCEL. These switches can be remote and/or cab mounted (cab mounted only on multiplexed vehicles). If only temporary increases in engine speed are needed, consider using Preset Engine Speed Control in combination with the Remote Throttle. On non-multiplexed vehicles that require both the Cruise Control option as well as the Preset Engine Speed Control feature, a Multiplex Signal Module (MSM) available from Navistar, must be utilized.

The following table summarizes the operation of Variable Engine Speed Control. Columns are labeled according to the switch being used, and interpretations include 1) the control system's response when the toggle switch position is change by the operator, 2) the control system's response when the switch contacts are momentarily closed, and 3) the effect of maintaining a switch in the closed (pressed) condition, and also multiple applications of the same switch.

Variable Engine Speed Control Switch Interpretations

ON	OFF	SET/CRUISE	RESUME/ ACCEL	BRAKE	CLUTCH
On/Off Switch (Toggle Switch)					
Turns Engine Speed Control ON	Turns Engine Speed Control OFF	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Single Press (Momentary Contact)					
Not Applicable	Not Applicable	Latch the current engine speed as the desired engine speed. Decrease engine speed by 25 RPM, if active.	Resume speed control function at the last desired engine speed. Increase engine speed by 25 RPM, if active.	Deactivate vehicle speed control and maintain standby state. (Pedal use returns the engine to the low idle speed.) [1]	Deactivate vehicle speed control and maintain standby state. (Pedal use returns the engine to the low idle speed.) [1]
Held Switch (Continuous Contact)					
Not Applicable	Not Applicable	Decrease engine speed if engine speed control is active. [2]	Decrease engine speed if engine speed control is active. [2]	Any change in brake status establishes a standby state.[1]	Any change in driveline status establishes a standby state.[1]

[1] = Engine speed control stops only when there is a transition from one pedal state (pedal pressed or pedal released) to the other and only when the disable cab controls parameter is not selected.

[2] = The held switch acts like the switch is being "hit'" multiple times until the switch is released. When the RESUME switch is held closed, the engine speed will be commanded to accelerate. The standby state will be momentarily recognized. Then the engine speed will continue to accelerate.

In-Cab Operation of Variable Engine Speed Control (Multiplexed Vehicles only)

In-cab located switches can be used to turn on engine speed control and select the desired engine speed. Press the CRUISE “ON” Switch to enable engine speed control. Next, select the desired engine speed using the SET/CRUISE switch. Then press RESUME/ACCEL or SET/CRUISE until the desired engine speed is achieved.

The accelerator pedal can be used, as well, to increase or decrease engine speed as desired; the desired engine speed will be maintained by the engine controller once a momentary press of the SET/CRUISE switch occurs. Once an initial engine operating speed is selected, a momentary press of the RESUME/ACCEL and/or SET/CRUISE switches will cause engine speed to increase or decrease by a small amount. This incremental amount can be used to fine tune the engine speed selected. Should speed control be interrupted (i.e., by the brake or the clutch switch), the RESUME/ACCEL switch can be pressed to return to the last engine speed set point. The engine’s acceleration rate will be limited according to the value programmed for the parameter ***PTO RPM Ramp Rate***. This acceleration rate should be programmed as required to minimize stress on auxiliary equipment power drive links. Anytime Variable Engine Speed Control is active, the engine will maintain the selected speed until one of the following events occurs:

- CRUISE “OFF”switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)

Note that these actions are always applicable for in-cab PTO operation, regardless of the value programmed for the parameter ***PTO IN-CAB CONTROL***. Only when engine speed is controlled by remote input signals and the cab interface is disabled will the engine speed be unaffected by the above actions.

WARNING: **Shift of automatic transmission from neutral to forward or reverse gear while operating any PTO mode is not recommended; vehicle may lurch forward when transmission is placed in gear due to increased power output of the engine which is operating at the elevated engine speed.**

WARNING: **To avoid sudden, unexpected vehicle movement and possible personal injury:**

- **Always fully set the parking brake when using the Preset PTO Engine Speed Control Feature.**
- **Do not abort the Preset Engine Speed Control Feature by shifting an automatic transmission from neutral gear into a forward or reverse gear.**
- **Turn off the engine when you leave the vehicle. Never leave the vehicle unattended with the engine running.**

Remote Operation of Variable Engine Speed Control

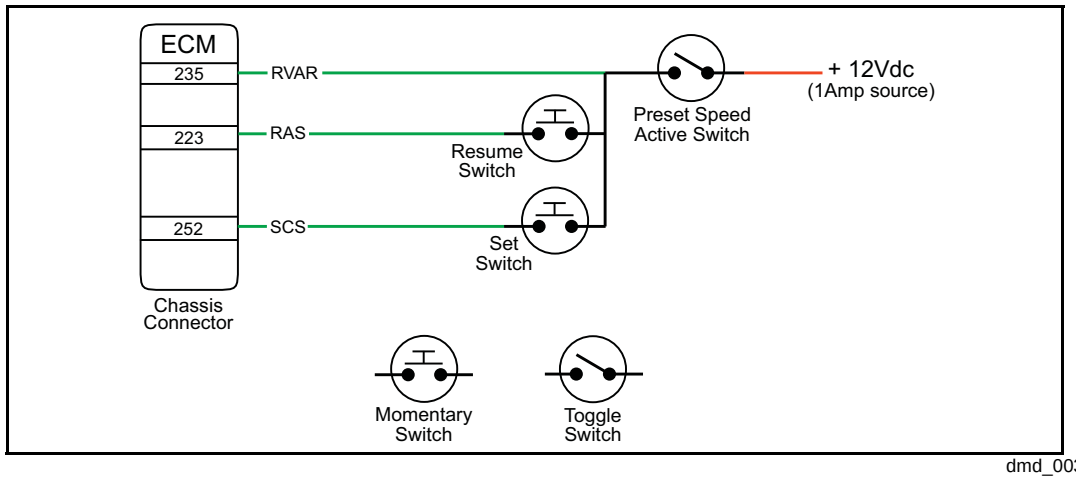
- Multiplexed Vehicles or Non-Multiplexed Vehicles without Cruise Control

When control over engine speed is required from outside the vehicle's cab, remote mounted switches must be used to turn on PTO engine speed control and select the desired engine speed. The next diagram illustrates how remotely located switches must be interfaced to the ECM to accomplish Variable Engine Speed Control. Switch functionality remains the same as described for the in-cab located switches (see **Variable Engine Speed Control Switch Interpretations** table).

The Remote Throttle can be used as well to increase or decrease engine speed as desired. The desired engine speed will be maintained by the engine controller once a momentary press of the SET/COAST switch occurs. Once an initial engine operating speed is selected, a momentary press of the RESUME/ACCEL and/or SET/COAST switches will cause engine speed to increase or decrease by a small amount. This incremental amount can be used to fine tune the engine speed selected. Should speed control be interrupted (i.e. by the brake or the clutch switch), the RESUME/ACCEL switch can be pressed to return to the last engine speed set point. The engine's acceleration rate will be limited according to the value programmed for the parameter ***PTO RMP Ramp Rate***. This acceleration rate should be programmed as required to minimize stress on auxiliary equipment power drive links. Any time Variable Engine Speed Control is active, the engine will maintain the selected speed until one of the following events occur:

- CRUISE "OFF" switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)

CAUTION: Be aware that on multiplexed vehicles, the Remote Set Switch and Remote Resume Switch are connected in parallel (logic 'OR-ed') with the cab-mounted SET/CRUISE and RESUME/ACCEL switches respectively. This means that once preset Variable PTO Engine Speed Control has been placed in "standby" on-mode (by pressing either the in-cab located CRUISE ON switch, or the remotely located REMOTE VARIABLE PTO ON switch), the desired engine speed can be modified both from within the cab or from the remote located PTO Engine Speed Control switches. This is ALWAYS TRUE, even when the PTO MODE parameter is programmed for REMOTE OPERATION ONLY.

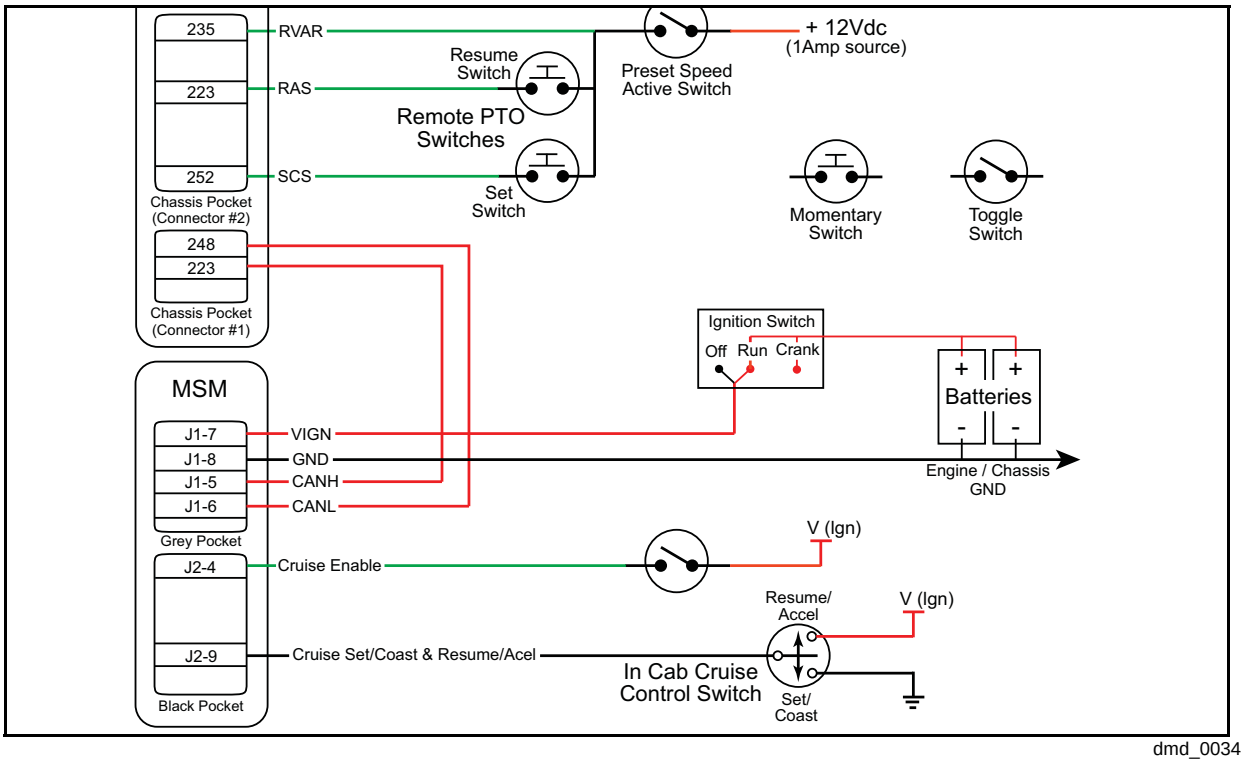


- Non-Multiplexed Vehicles with Cruise Control Option

If the OEM is incorporating the powertrain into a non-multiplexed vehicle and cruise controls to be an option, then the Navistar Multiplex Signal Module (MSM) must be used. In this case, the MSM module will be wired where the in-cab Cruise Control switches are wired, while the Auxiliary Engine Speed Control switches will be wired directly into the body builder pins of the Engine Control Module (ECM).

As before, the Remote Throttle can be used as well to increase or decrease engine speed as desired. The desired engine speed will be maintained by the engine controller once a momentary press of the SET/COAST switch occurs. Once an initial engine operating speed is selected, a momentary press of the RESUME/ACCEL and/or SET/COAST switches will cause engine speed to increase or decrease by a small amount. This incremental amount can be used to fine tune the engine speed selected. Should speed control be interrupted (i.e. by the brake or the clutch switch), the RESUME/ACCEL switch can be pressed to return to the last engine speed set point. The engine's acceleration rate will be limited according to the value programmed for the parameter ***PTO RMP Ramp Rate***. This acceleration rate should be programmed as required to minimize stress on auxiliary equipment power drive links. Any time Variable Engine Speed Control is active, the engine will maintain the selected speed until one of the following events occur:

- CRUISE "OFF" switch is pressed
- Brake pedal is pressed
- Clutch pedal is pressed
- Automatic transmission is shifted out of neutral (NOT RECOMMENDED)



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Engine Speed Control for Mobile Applications

This section discusses the Variable Mobile Engine Speed Control. Variable Mobile Engine Speed Control functions like cruise control, except that the engine speed (instead of the vehicle speed) is being controlled. Mobile control can be performed only below a programmed maximum vehicle speed. The default vehicle speed limit is 20 MPH.

Functionality for mobile control is identical to the functionality described previously for Variable PTO Engine Speed Control, with the exception that the vehicle is no longer required to be stationary; vehicle movement is permitted up to a maximum threshold, specified by the programmable parameter ***PTO Max Veh Speed***.

When the specified vehicle speed limit is exceeded, Variable Engine Speed Control will be placed in the “standby” mode of operation and engine speed will return to idle. Pressing the RESUME/ACCEL switch after the vehicle speed has slowed to a value less than the programmed maximum speed limit, will reestablish engine speed control at the previously selected engine speed. Changes in the status of the brake and clutch switches will also return the engine to its idle speed.

Switch functionality remains the same as described for the Variable Stationary Engine Speed Control switches (see **Variable Engine Speed Control Switch Interpretations** table).

Press the CRUISE ON switch to turn on Engine Speed Control. Press the SET/CRUISE switch to select an engine speed. Then press RESUME/ACCEL or SET/CRUISE until the desired engine speed is achieved. Momentary presses of the RESUME/ACCEL and SET/CRUISE switches will cause the engine speed to increase or decrease by a small amount. This incremental amount can be

used to fine tune the engine speed selected. Should speed control be interrupted by the brake or the clutch switches, press the RESUME/ACCEL switch to return to the last engine speed set point. The engine's acceleration will be limited to the ***PTO RPM Ramp Rate***. The acceleration limit can be set to reduce the stress on the auxiliary equipment power couplings.

TRANSFER CASE / SPLIT SHAFT

This section describes the Transfer Case/Split Shaft feature and its applications. This feature is used in conjunction with Engine Speed Control and is targeted for applications that use a transfer case or auxiliary driveshaft. The auxiliary drive unit is often connected to a pump that performs vacuum functions (i.s. sewage removal truck or fire pumps).

Transfer Case Switch Operation

The transfer case status switch must be in the proper state indicating that it is "OK" to operate. The transfer case status switch input is provided as a safety interlock feature and must be wired as shown in the next diagram. The purpose of the transfer case input is to inhibit the system from entering engine speed control mode if the transfer case is operating in driveline mode versus split shaft mode. The transfer case status switch must be wired such that when the transfer case is in split shaft mode, pin C-11 of the ECM sees 12 volts.

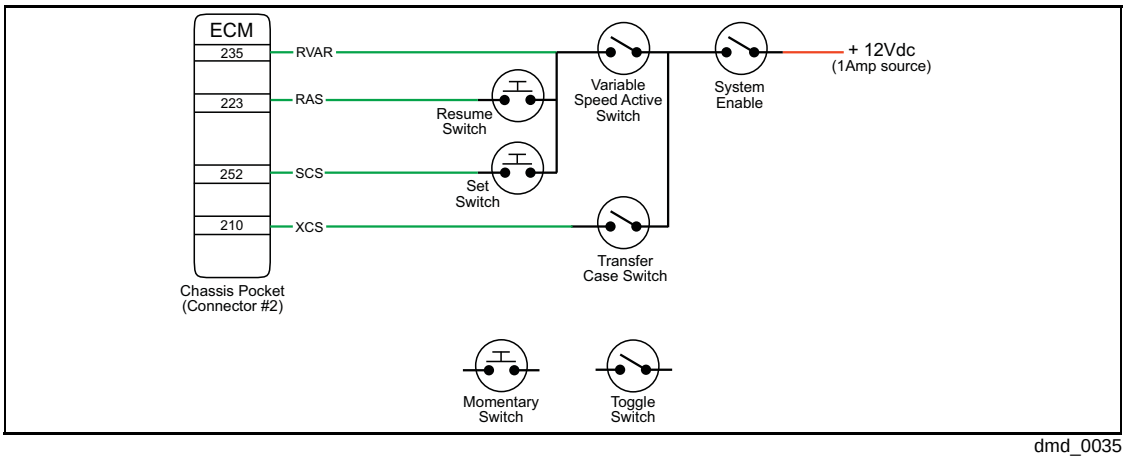
EPG Driveline Mode

This parameter indicates how the driveline disengagement signal should be interpreted by the ECM and is programmable by Navistar, Inc. only.

- 0: NEUTRAL OPERATION, driveline must be disengaged at all times for operation of the split shaft feature.
- 1: SPLIT SHAFT, a transition in driveline status will cause the split shaft feature to be deactivated

Wheel Based Vehicle Speed

If the system is configured to function in Split Shaft mode (EPG driveline mode parameter equals SPLIT SHAFT), then the engine ECM must receive wheel based vehicle speed from a brake system electronic control unit (ECU). This message (PGN 65265, bytes 2 and 3) must be broadcast by the brake system over the Public J1939 datalink. At this time, only one brake system supports this message, the Bendix EC-30. The availability of this parameter for the EC-30 system is currently a programmable feature. This programmable feature must be enabled for the EPG system to function; otherwise, it will not allow the system to enter into Engine Speed Control. If the brake system ECU broadcasts the wheel based vehicle speed parameter as being 0 mph, then it will allow the system to function. This is a safety interlock feature to ensure that the vehicle is not moving while the system is functiong in Split Shaft mode.



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REMOTE THROTTLE

The Remote Throttle Control functions like an additional accelerator pedal or hand throttle. Remote throttles provide equipment operators with direct control over engine speed from a location outside of the vehicle cab. By using a potentiometer, a remote throttle is useful when an infinitely variable range of engine speeds is desired to operate equipment. Remote throttle can be used to provide temporary increases in engine speed when either Preset or Variable Engine Speed Control is in use (i.e. enable via either RPRE or RVAR enable switches listed in the Introduction).

The hand and/or foot actuated potentiometer can be located on one or more locations on the vehicle. Increasing or decreasing the voltage from the potentiometer will result in a corresponding increase or decrease in engine speed (similar to stepping on or releasing the accelerator foot pedal in the vehicle cab). Navistar provides many kits to make the selection of a remote pedal easier. It is not required to use Navistar supplied parts, but they are the only parts validated to function. Use of other parts is at the OEM's discretion.

Note: To be noticed by the Engine Control System, the engine speed requested by the Remote Throttle must exceed the engine speed requested by the cab accelerator pedal and other engine speed control requests. **Reason**: The highest engine speed requested becomes the engine speed commanded to the engine.

Use of either the Remote Preset PTO Switch or Remote Variable PTO Switch is required to activate or deactivate the Remote Throttle and the Engine Control System must be programmed to accept the Remote Throttle input. Use spring loaded designs for throttle devices so that the engine returns to idle when the throttle is released.

Note: The only way the Remote Throttle Control System can be disabled is to turn it off with the switch previously used to turn it on.

The programmable parameter ***PTO Remote Pedal*** must be programmed to "1" to enable operation of the Remote Throttle input. Also, the maximum engine speed permitted when operating with the Remote Throttle will be limited to the value programmed for ***PTO MAX RPM***.

The diagram under ***Navistar Supplied Hand Operated Throttle Control Kit*** shows the circuits needed to operate the Remote Throttle feature. A single track accelerator pedal must be used for the remote pedal, unlike the dual track pedal used in cab. The remote throttle input must be turned on and off by an enable switch. Enabling either the Remote Preset PTO Switch or the Remote Variable PTO Switch will turn the Remote Throttle input on. These two switches must not be enabled at the same time - it's one or the other. Opening the switch circuit disables the Remote Throttle input.

The ServiceMaxx tool can be used for trouble shooting and verifying the Remote Throttle installation. The PTO Remote Pedal parameter must indicate ON and either the Remote Variable PTO Switch (RVAR) or the Remote Preset PTO Switch (RPRE) must indicate ON. When these conditions are met, the Accelerator Pedal parameter will display the percent throttle commanded to the ECM. If the Remote Throttle parameter indicates FAIL, a fault exists in the circuits or in the potentiometer itself.

ServiceMaxx programming should be used to set mechanical stops for custom throttle designs. Mechanical stops must be used with potentiometer based throttle control systems to prevent the supply of inadequate or excess voltage to the engine controller. The ECM detects under and over voltage conditions for Remote Throttle; occurrence of one of these conditions will result in activation of a fault code.

Navistar Supplied Pedal Sensor - Notes and Diagnostic

Appendix D lists part numbers for floor mounted and suspended accelerator pedals and the accelerator pedal sensor kits. These parts include a jumper harness for the sensor with a Packard Weather-Pack connector. The typical wire colors for the jumper harness are shown in the following table. The Weather-Pack connector can be cut off and the circuits spliced according to their identifying colors.

Accelerator Pedal Sensor Wire Colors and Signals

APS CAVITY	A	B	C	D	E	F
Signal	Sensor Output	Sensor Ground	Sensor Supply (5Vdo)	Normally Closed Idle Validation	Normally Open Idle Validation	Idle Validation Switch Common
Color	Black	White	Red	Green	Blue	Orange

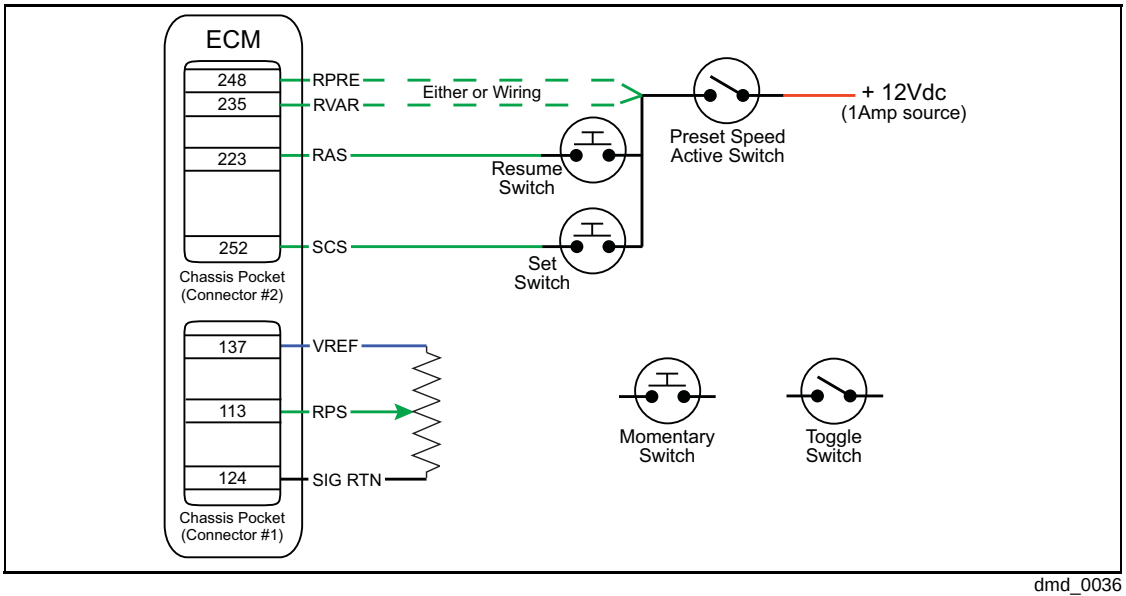
The accelerator pedal sensors listed in Appendix D include an idle Validation Switch (IVS). The "Normally Closed" contacts are connected to the common terminal when the sensor is at the idle position. The "Normally Open" contacts are connected to the common terminal when the sensor is in the off-idle position. Due to the thick film construction of the sensor, the IVS has a contact resistance of ~80 Ohms. Do not use this switch in series with the sensor circuits.

The remote throttle potentiometer is protected through circuit diagnostics. Faults are detected when the potentiometer is open or short circuited. These faults recover when the fault condition is corrected.

New designs incorporating the accelerator pedal sensor must include their own return springs to ensure that the sensor reurns to the idle position when the control is released. The sensor's internal stops must not be used to limit the travel of its drive mechanism. To make sure the sensor always returns to the idle position, pre-load the internal return spring by 15.2 degrees. Another reason to preload the return spring in this manner is that the voltage output from the sensor will fall into the out of range low diagnostic region if the sensor is not pre-loaded by 15.2 degress of travel. Sensors that are disconnected from the drive mechanism will generate a diagnostic code. The maximum range of travel applied to the acceleraor pedal must be limited to a maximum of 52.3 degrees beyond 15.2 degrees pre-load for the idle position. For additional information, see SAE recommended practice "J1843, Accelerator Pedal Position Sensor for Use with Electronic Controls in Medium and Heavy Duty Vehicle Applications".

Navistar Supplied Hand Operated Throttle Control Kit

See Appendix D for hand operated throttle parts list options.



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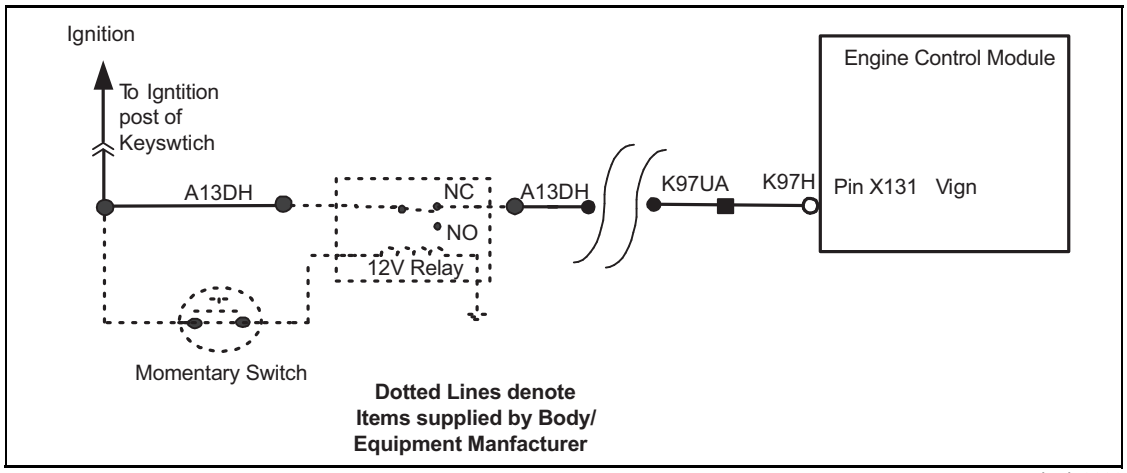
REMOTE ENGINE START / STOP

This section describes the circuit modifications necessary to stop and start the engine from a remote location. Modifications that emplement remote start must also implement remote stop. When remote stop is implemented, all ignition sources to the engine control system must be interrupted.

CAUTION: Navistar does not suggest adding a remote start on vehicles with manual transmissions. The following modifications are suggestions only and do not take into account any interlocking that might be needed to maintain safe vehicle operation. It is our belief that safe modifications to start/stop circuitry will vary with the truck application and should be the responsibility of the party making the modification.



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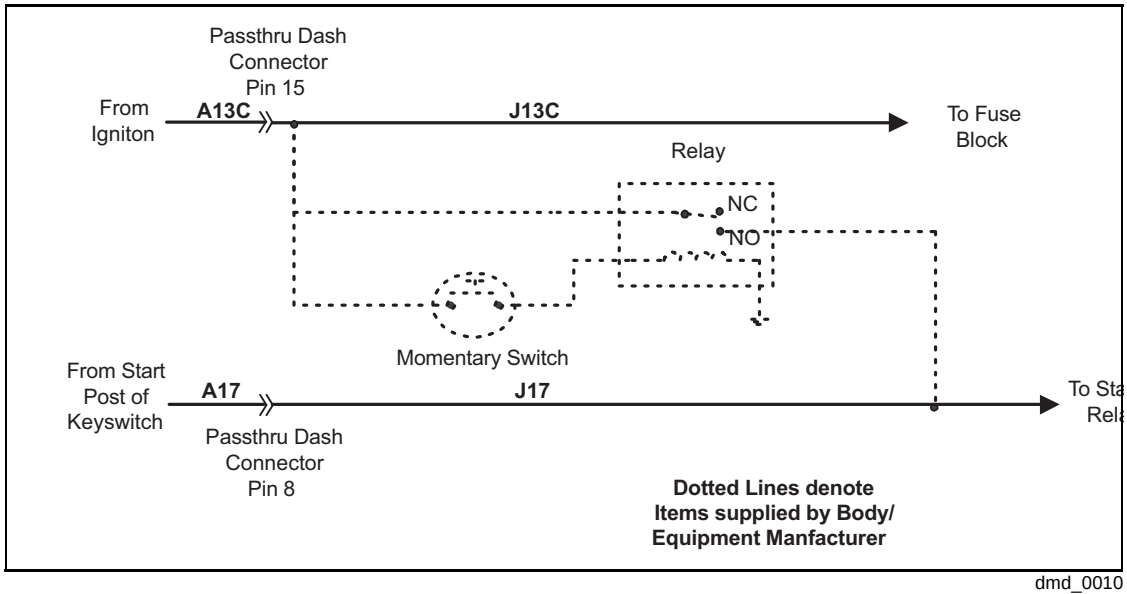

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APPENDIX A

Diagnostic Service Tools

Diagnostic service tools are available from your International® Dealer. The following kits apply the most to electrical diagnosis and engine control system feature programming:

ZTSE4357	Digital Multimeter
ZTSE4444B	EZ-Tech™ IC4 COM Interface
ZTSE4505D	Breakout Harness Kit
ZTSE4282	Crimping Tool Set
ZTSE4403	Terminal Release Tool Kit
ZTSE4443	Terminal Extraction Kit
ZTSE4496	Terminal Repair Kit
J-45067	EZ-Tech™ Electronic Service Tool

The ServiceMaxx Software is the primary Internationa[l® EZ TECH™ service tool.

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APPENDIX B

References And Service Publications

Publications for diagnosing and repairing International® Electronic Engines are available to assist diagnosis and repair of the engine control system electronics. The circuit diagram books can be valuable aids in diagnosing and repairing electrical and electronic problems. The electrical trouble shooting guides discuss terminal crimping, connector repair and the tools required to perform repairs.

International® DT 466E and 530E Manuals

EGES 175-1	Diagnostic manual
EGES 215	Diagnostic manual (ESN 1194039-above)
EGED 180-2	Hard start diagnostics form
EGED 185-1	Electronic control diagnostics form
EGES 220	Hard start diagnostics form (ESN 1194039-above)
EGES 225	Electronic control diagnostics form (ESN 1194039-above)
EGES 160-2	Service manual (ESN 931164-1205049)
EGES 210-1	Service manual (ESN 1194039-above)
1171734R7	466E Operations manual
1171735R5	530E Operations manual
1171764R2	530E Green Diesel Operations manual

International® DT 466, DT 530 and HT 530 Manuals 2000 and Later (Without EGR)

EGES 215	Diagnostic manual
EGED 220	Hard start diagnostics form
EGED 225	Electronic control diagnostics form
EGES 210-1	Service manual
1171753R3	DT 466 Operations manual
1171755R3	DT 530 and HT 530 Operations manual

International® DT 466, DT 570 and HT 570 Manuals 2004 – 2006 (With EGR)

EGES 265-1	Diagnostics manual
EGED 285	Hard start diagnostics form
EGED 290	Electronic control diagnostics form
EGED 270	Service manual
1171809R5	DT 466, DT 570, and HT 570 Operations manual
1171840R1	DT 466 Green Diesel Operations manual

MaxxForce® DT, MaxxForce® 9 and MaxxForce® 10 Manuals 2007 and Later (With EGR)

EGES 335	Diagnostic manual
EGED 375	Hard start diagnostics form
EGED 380	Performance diagnostics form
EGES 385	Electronic control diagnostics form
EGES 370	Service manual
1171895R1	Operations manual

MaxxForce®11 and MaxxForce®13 Manuals 2010

EGES 470	Diagnostic manual
EGES 465	Service manual
EGED 425	Performance diagnostics form

APPENDIX C

ATA Data Link Support

NOTE: *ATA support is obsolete. Not all diagnostic features are supported with ATA*.

The parameters transmitted by the system over the ATA data link are reviewed below in Table . The parameters are defined by SAE Recommended Practice J1587. For information regarding MIDs, PIDs and their content please refer to Appendix C2, SAE Recommended Practice J1587.

EECM Transmitted ATA Parameters – V7.0

Appendix C.1 – EECM TRANSMITTED ATA PARAMETERS – V7.0

PARAMETER NAME (Units)	PID	FREQUENCY (Hz)	DATA LENGTH (bytes)	NOTES[1]
Retarder Inhibit Status	62	1.0	1	10
Torque Limiting Factor (%)	68	1.0	1	1
Two-Speed Axle Switch Status	69	1.0	1	
Idle Shutdown Timer Status	71	1.0	1	16
Auxiliary Water Pump Pressure (psi)	73	1.0	1	18
Maximum Road Speed Limit (mph)	74	on request	1	3,11
Road Speed Limit Status	83	1.0	1	11
Road Speed (mph)	84	10.0	1	5
Cruise Control Status	85	5.0	1	12
Cruise Control Set Speed (mph)	86	0.1	1	12
Cruise Control High Set Limit (mph)	87	on request	1	3,12
Cruise Control Low Set Limit (mph)	88	on request	1	3,12
Power Take off Status	89	1.0	1	8
Percent Accelerator Pedal Position (%)	91	10.0	1	5
Percent Engine Load (%)	92	10.0	1	
Engine Oil Pressure (psig)	100	1.0	1	5,9
Boost Pressure (psig)	102	1.0	1	5
Barometric Pressure (psia)	108	1.0	1	5
Engine Coolant Temperature (°F)	110	1.0	1	5
Engine Coolant Level (%)	111	0.1	1	1,9
Engine Retarder Status	121	5.0	1	10

Appendix C.1 – EECM TRANSMITTED ATA PARAMETERS – V7.0 (Continued)

PARAMETER NAME (Units)	PID	FREQUENCY (Hz)	DATA LENGTH (bytes)	NOTES[1]
Engine Crank Inhibit Torque Curve Selection Switch Status Engine Fan Control Status Radiator Shutter Enable Status Air Conditioning Demand Status [Auxiliary Input and Output Status #2]	154	1.0	2	1,17
Remote PTO Interface Status Electronic Pressure Governor Status Electronic Pressure Governor Mode Indicator [Auxiliary Input and Output Status #1]	155	1.0	2	1,14
Injection Control Pressure (Mpa) [Lubrication Rail Pressure]	164	1.0	2	5
Rated Horsepower (HP) [Rated Engine Power]	166	on request/ on change	2	3,7
Battery Voltage (Volts) [Battery Potential Voltage]	168	1.0	2	5
Ambient Air Temperature (°F)	171	0.1	2	5
Engine Oil Temperature (°F)	175	1.0	2	5
Fuel Rate (gal/sec)	183	5.0	2	
Power Take Off Set Speed (rpm)	187	0.1	2	4,14,15
Idle Engine Speed (rpm)	188	on request/0.1	2	1,3,6
Rated Engine Speed (rpm)	189	on request	2	3,7
Engine Speed (rpm)	190	10.0	2	
Transmission Output Shaft Speed (rpm)	191	10.0	2	5
Transmitter System Diagnostic Code Table	194	on request/1.0	variable	2
Diagnostic Data/Count Clear Response	196	on request	variable	2
Vehicle Identification Number	237	on request	17	
Change Reference Number	240	on request	9	1
Component Identification	243	on request	17	1
Total Miles (miles)	245	0.1	4	
Total Engine Hours (hours)	247	on request	4	
Total Fuel Used (gal)	250	on request	4	

[1] = 1. SAE J1587 RP definition is amended as described in Appendix A of IF36 Interface Requirements Specification

2. The details of diagnostic messages and responses are discussed in section 3.3.1.2 ATA Diagnostic Data of the IF36 Interface Requirements Specification

3. Value may vary from the value programmed as a result of some error conditions. The value will always reflect the operating parameters of the EECM

4. Values will reflect the engine speed commanded for PTO use by the Preset or Variable SCCS inputs
5. Not broadcast when signal fault is detected
6. Broadcast at 0.1 Hz rate until Idle Engine Speed stabilizes at ***N_LIDLE[PP]***
7 Broadcast immediately following a EECM power-up sequence and then broadcast as changes occur
8 Only broadcast when the DDS signal is enabled
9. Only broadcast when Engine Warning/Protection System is enabled
10. Only broadcast when Vehicle Retarder is enabled
11. Only broadcast when Road Speed Limiting is enabled
12. Only broadcast when Cruise Control is enabled
13. Only broadcast when Exhaust Back Pressure Control is enabled
14. Only broadcast when remote PTO or Electronic Pressure Governor is enabled
15. Only broadcast when in-cab PTO is enabled
16. Only broadcast when Idle Shutdown Timer is enabled
17. Only broadcast when Engine Fan Control, Radiator Shutter Enable, Service Interval Lamp, or TCSS is enabled
18. Only broadcast when Electronic Pressure Governor is enabled

[ ] Indicates J1587 description

Appendix C.2 – Amendments to SAE J1587 RP Definitions

PID 111, Engine Coolant Level:

A constant value of **100 percent** shall be transmitted as long as the sensor determines that there is engine coolant. When the sensor determines that there is no engine coolant (or insufficient coolant level), then the value provided in PID 111 shall be **0 percent**.

PID 62, Retarder Inhibit Status:

62 a; where a = Retarder Inhibit Status

Parameter Data Length: 1 Character
Data Type: Binary Bit-Mapped
Resolution: Binary
Maximum Range: 0 to 255
Transmission Update Period: On Request
Message Priority: 8
Bit 8-5: Reserved - all bits set to 1
Bit 4-3: Engine Brake System Signal #2 Status
Bit 2-1: Engine Brake System Signal #1 Status

PID 154, Auxiliary Input/Output Status (Remote Interface):
154 a b

a = Auxiliary Input #5 through #8 Status

Bits 1-2, (Aux. Input #5) Reserved – both bits set to 1
Bits 3-4, (Aux. Input #6) Reserved – both bits set to 1
Bits 5-6, (Aux. Input #7) ATA_ACD_STS (*Air Conditioning Demand Status*)
Bits 7-8, (Aux. Input #8) ATA_TCSS_STS (*Torque Curve Selection Switch*)

b = Auxiliary Output #5 through #8 Status

Bits 1-2, (Aux. Output #5) ATA_ECI_STS (*Engine Crank Inhibit*)
Bits 3-4, (Aux. Output #6) Reserved – both bits set to 1
Bits 5-6, (Aux. Output #7) ATA_RSE_STS (*Radiator Shutter Enable Status*)
Bits 7-8, (Aux. Output #8) ATA_EFC_STS (*Engine Fan Control Status*)

Each bit field will be coded as follows; 00 = off, 01 = on, 10 = faulted, 11 = not available

Priority 3 shall be used to transmit this PID in lieu of the standard transmission priority specified in SAE J1587 RP.

PID 155, Auxiliary Input/Output Status (Remote Interface):
155 a b

a = Auxiliary Input #1 through #4 Status

Bits 1-2, (Aux. Input #1) PTOR_PRE Status (*Remote Preset Requested*)
Bits 3-4, (Aux. Input #2) PTOR_VAR Status, (*Remote Variable Requested*)
Bits 5-6, (Aux. Input #3) RPS_Status, (*Remote APS Active or Inactive*)
Bits 7-8, (Aux. Input #4) HPE Status, (*Electronic Pressure Governor Enable*)

b = Auxiliary Output #1 through #4 Status

Bits 1-2, (Aux. Output #1) HMI Status, (*Electronic Pressure Governor Mode Indicator*)
Bits 3-4, (Aux. Output #2) Reserved – both bits set to 1
Bits 5-6, (Aux. Output #3) Reserved – both bits set to 1
Bits 7-8, (Aux. Output #4) Reserved – both bits set to 1

Each bit field will be coded as follows; 00 = off, 01 = on, 10 = faulted, 11 = not available

Priority 3 shall be used to transmit this PID in lieu of the standard transmission priority specified in SAE J1587 RP.

PID 188, Idle Engine Speed:

The Idle Engine Speed is a dynamic quantity as the engine warms up. Thus to reflect the idle speed the Engine seeks to maintain, PID 188 will be transmitted to reflect the changes. The transmission frequency shall not exceed **0.1 Hz**. When the normal idle speed has been reached, this value will be transmitted via PID 188 once to reflect the normal idle speed. Thereafter, the value for PID 188 may be obtained only upon request. The data format for PID 188 shall be as described in SAE J1587 RP.

PID 240, Change Reference Number:

The data content of the change reference number parameter below identifies the hardware and software present for MRD Next Generation Electronics components. The number of data bytes field content reflects this change. The following defines the format of PID 240 to be transmitted by International®:

240 n aaaaaaaa b

240	=	Change Reference Number PID
n	=	9: number of data bytes in message.
aaaaaaaa	=	EECM Software Strategy Version number. Display as alphanumeric, such as: **EC0B6001**.
b	=	EECM Software Calibration Version number. Display as **001** through **255**.

Priority 3 shall be used to transmit this PID in lieu of the standard transmission priority specified in SAE J1587 RP. All EECM software contains a unique 16-bit checksum of ROM contents (Program Software and Data).

PID 243, Component Identification Parameter:

243 n 128 ccccc * ddddddddddd

243	=	Component Identification PID
n	=	number of data bytes in message
128	=	the MID of the EECM
ccccc	=	073 078 084 032 032: “INT” The ATA/VRMS notation for the International® brand of engines and vehicles from International®.
*	=	042: “*” field delimiter
ddddddddddd	=	engine model ASCII characters. Up to 10 characters with the last character “*”. example: *084 045 052 052 052 069 042 042 042 042 = “T-444E****”*

EECM Transmitted ATA Fault Code List – V7.0

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0

PID	SID	FMI	CODE	DESCRIPTION
168	0	3	1112	B+ Out of Range HIGH
168	0	4	1113	B+ Out of Range LOW
110	0	4	1114	Engine Coolant Temperature Signal Out of Range LOW
110	0	3	1115	Engine Coolant Temperature Signal Out of Range HIGH
TBD	TBD	10	1116	GSC Input Circuit Fault
102	0	3	1121	Manifold Absoslute Pressure Signal Out of Range HIGH
102	0	4	1122	Manifold Absoslute Pressure Signal Out of Range LOW
164	0	4	1124	Injector Control Pressure Signal Out of Range LOW
164	0	3	1125	Injector Control Press. Signal Out of Range HIGH
0	118	4	1126	Brake Control Pressure Signal Out of Range LOW
0	118	3	1127	Brake Control Pressure signal Out of Range HIGH
91	0	4	1131	Accelerator Position Sensorl Out of Range LOW
91	0	3	1132	Accelerator Position Sensor Out of Range HIGH
91	0	2	1133	Accelerator Position Sensor In-range Fault.
91	0	7	1134	Accelerator Position Sensor and Idle Validation Switch Disagree
0	230	11	1135	Idle Validation Switch Signal Fault
94	0	4	1136	Engine Fuel Pressure Signal Out of Range LOW
94	0	3	1137	Engine Fuel Pressure Signal Out of Range HIGH
TBD	TBD	4	1141	Vehicle Speed Sensor Signal Out of Range LOW
TBD	TBD	3	1142	Vehicle Speed Sensor Signal Out of Range HIGH
0	21	2	1143	Camshaft Position Signal Incorrect for Crankshaft Position Sync
0	21	8	1144	Camshaft Position Signal Noise Detected
0	64	12	1146	Crankshaft Position Signal Inactive: Open/Short
0	64	2	1147	Crankshaft Position Incorrect Signal Signature
108	0	3	1151	Barometric Pressure Signal Out of Range HIGH
108	0	4	1152	Barometric Press. Signal Out of Range LOW
171	0	4	1154	Intake Air Temperature Signal Out of Range LOW
171	0	3	1155	Intake Air Temperature Signal Out of Range HIGH
102	0	0	1156	Manifold Absolute Pressure In Range HIGH - Manifold Absolute Pressure Above Barometric Absolute Pressure at Start

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
102	0	1	1157	Manifold Absolute Pressure In Range HIGH - Manifold Absolute Pressure Above Barometric Absolute Pressure at Start
105	0	4	1161	Manifold Air Temperature Signal Out of Range LOW
105	0	3	1162	Manifold Air Temperature Signal Out of Range HIGH
0	0	0	1178	Variable Geometry Turbocharger Actuator Temperature above High Limit
TBD	TBD	10	1181	Manifold Air Temperature Stuck In Range Fault
100	0	4	1211	Engine Oil Pressure Signal Out of Range LOW
100	0	3	1212	Engine Oil Pressure Signal Out of Range HIGH
0	29	4	1213	Remote Throttle Signal Out of Range LOW
0	29	3	1214	Remote Throttle Signal Out of Range HIGH
0	247	2	1222	Brake Switch Circuit Fault
111	0	2	1236	Engine Coolant Level In Range Circuit Fault
97	0	3	1253	Water In Fuel Signal Out of Range LOW
97	0	4	1254	Water In Fuel Signal out of Range HIGH
97	0	5	1255	Water in Fuel Signal Open/Circuit Fault
TBD	TBD	3	1276	Injection Pressure Regulator Short to B+, Over Temperature
TBD	TBD	4	1277	Injection Pressure Regulator Short to Ground
TBD	TBD	5	1278	Injection Pressure Regulator Open/Circuit Fault
TBD	TBD	6	1279	Injection Pressure Regulator Current Above Maximum
0	0	1	1287	Intake Throttle Valve Low Control Output Circuit Check Self Test Failed
0	0	0	1288	Intake Throttle Vlve High Control Output Circuit Check Self Test Failed
51	0	0	1289	Intake Throttle Valve In Range Fault - Bottom Adaptation
51	0	1	1291	Intake Throttle Valve In Range Fault - Top Adaptation
0	0	2	1292	Intake Throttle Valve Position In Range Fault
0	0	3	1293	Intake Throttle Valve Position Signal Out of Range HIGH
0	0	4	1294	Intake Throttle Valve Position Signal Out of Range LOW
51	0	3	1295	Intake Throttle Valve Signal Out of Range HIGH
51	0	4	1296	Intake Throttle Valve Signal Out of Range LOW
51	0	5	1297	Intake Throttle Valve Signal Open/Circuit Fault
51	0	2	1298	Intake Throttle valve Operation Fault - Under Voltage, Over Amperage, Over Temp.
0	0	10	1299	Engine Oil Pressure In Range Fault
175	0	4	1311	Engine Oil Pressure Signal out of Range LOW

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
175	0	3	1312	Engine Oil Pressure Signal Out of Range HIGH
TBD	TBD	2	1326	GSC Circuit Fault
TBD	TBD	2	1337	Transfer Case In range Fault
0	0	0	1362	EGR Valve Internal High Circuit Failure
0	0	1	1363	EGR valve Internal Low Circuit Failure
27	0	4	1397	EGR Position In Range Fault
0	0	7	1398	EGR Position Stuck In Range Fault
0	0	4	1729	Exhaust Gas Differential Pressure Signal Out of Range LOW
0	0	3	1731	Exhaust Gas Differential Pressure Signal Out of Range HIGH
0	0	4	1737	Exhaust Gas Temperature 1 Signal Out of Range LOW
0	0	4	1738	Exaust Gas Temperature 1 Signal Out of Range HIGH
0	0	4	1741	Exhaust Gas Temperature 2 Signal Out of Range LOW
0	0	3	1742	Exhaust GasTemperature 2 Signal Out of Range HIGH
0	0	4	1744	Exhaust Gas Temperature 3 Signal Out of Range LOW
0	0	3	1744	Exhaust Gas Temperature 3 Signal Out of Range HIGH
TBD	TBD	7	2159	Brake Applied While Accelerator Position Sensor Applied
0	0	2	2174	Variable Geometry Turbocharger Communication Fault
0	0	7	2175	(TBD) Variable Geometry Turbocharger Performance Fault
0	27	0	2176	(TBD) Variable Geometry Turbocharger Control Over Duty
0	27	1	2177	(TBD) Variable Geometry Turbocharger Control Under Duty
97	0	2	2179	Water-In-Fuel Detected
0	0	7	2232	Resume Normal Speed control Due to Momentary Controller Area Network Loss
0	42	2	2242	PCV Adaptation In Range Fault
100	0	1	2313	Engine Oil Pressure Below Warning Level
100	0	7	2314	Engine Oil Pressure Below Critical Level
190	0	0	2315	Engine Speed Above Warning Level
0	0	2	2319	Torque Limited to Control Engine Overheat
110	0	0	2321	Engine Coolant Temperature Above Warning Level
110	0	7	2322	Engine Coolant Temperature Above Critical Level
111	0	1	2323	Engine Coolant Level Below Warning/Critical Level
71	0	14	2324	Engine Stopped by IST

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
0	0	10	2327	Injector Control Pressure Abnormal Rate of Change
164	0	13	2332	Injector Control Pressure Signal Above Key-On Engine-Off Specification
164	0	1	2335	Injector Control Pressure Unable to Build During Engine Cranking
0	34	1	2351	Exhaust Back Pressure Below Desired Level
0	34	0	2352	Exhaust Back Pressure Above Desired Level
0	146	7	2368	EGR Communication Fault
0	0	2	2369	Engine Oil Service Required
94	0	0	2371	Fuel Pressure Above Normal
94	0	1	2372	Fuel Pressure Below Normal
0	0	0	2388	EGR Flow Excessive - Possible Leak to Atmosphere
0	0	0	2388	EGR Flow Excessive - Possible Leak to Atmosphere
0	0	1	2389	EGR Flow Insufficient - Possible Plugged System
27	0	11	2391	EGR Valve Internal Circuit Failure
27	0	6	2392	EGR Duty Cycle Above Limit
27	0	2	2393	EGR Position Sensor Fault
0	0	2	2394	EGR Valve not Receiving Electronic Control Module Controller Area Network Messages
0	0	3	2395	Exhaust Gas Recirculation High Control OOC Self-Test Failed
0	0	4	2396	Exhaust Gas Recirculation Low Control OOC Self-Test Failed
0	0	7	2544	Electronic Control Module Unable to Send Controller Area Network Messages
0	0	7	2545	Electronic Control Module not Receiving Body Controller Area Network Messages
121	0	1	2546	Brake Control Pressure Below Desired
121	0	0	2547	Brake Control Pressure Above Desired
0	0	2	2549	Electronic Control Module not Receiving Variable Geometry Turbocharger Controller Area Network Messages
0	0	10	2673	Exhaust Gas Temperature 2 not Warning Along with Engine
0	0	2	2674	Exhaust Gas Temperature 2 Reading Off Compared to Exhaust Gas Temperature 1 and Exhaust Gas Temperature 3
0	0	2	2675	Exhaust Gas Temperature 1 Temperature not Increasing with Engine Temperature
0	0	1	2676	Exhaust Gas Temperature 1 too Far Off from Exhaust Gas Temperature 2 and Exhaust Gas Temperature 3
0	0	2	2677	Exhaust Gas Temperature 3 not Warming Along with Engine

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
0	0	1	2678	Exhaust Gas Temperature 3 Reading Off Compared to Exhaust Gas Temperature 1 and Exhaust Gas Temperature 2
0	0	1	2681	(TBD) Exhaust Gas Temperature 2 Reading Off Compared to Exhaust Gas Temperature 1 and Exhaust Gas Temperature 3
0	0	1	2687	Exhaust Gas Differential Pressure is too Low for Given Engine Conditions
0	0	0	2688	Diesel Particulate Filter Over Temperature - Possible Filter Damage
0	0	7	2691	Diesel Particulate Filter Regeneration Attempt Failed
0	0	8	2692	Diesel Particulate Filter Regeneration Attempt Aborted
0	0	2	2693	Diesel Particulate Filter Regeneration Duration Above Limit
0	0	14	2695	Diesel Particulate Filter Degraded Mode Operation
TBD	TBD	0	2698	Exhaust Gas Differential Pressure Above Desired Level
0	0	1	2699	Exhaust Gas Differential Pressure Below Desired Level
0	0	2	2732	Exhaust Gas Differential Pressure Stuck In Range Fault
0	0	10	2733	Exhaust Gas Differential Pressure Mismatch Between Key-On/Off
0	0	7	2773	Diesel Oxidation Catalyst Unable to Reach Regeneration Temperature
0	0	13	2782	Diesel particulate Filter servicing Required
0	0	13	2783	Diesel particulate Filter Load Above Warning Level
0	0	13	2784	Diesel Particulate Filter Load Above Critical Level 1 - Engine Derate
0	0	13	2785	Diesel Particulate Filter Load Above Critical Level 2 - Further Engine Derate
164	0	0	3333	Injector control Pressure Signal Above Desired Level
164	0	1	3334	Injector Control Pressure Signal Below Desired Level
0	34	17	3338	Key-On-Engine-Running STD - Exhaust Back Pressure Unable to Build during Test
0	34	15	3339	Key-On-Engine-Running STD - Exhaust Back Pressure too High during Test
0	34	4	3341	(TBD) Exhaust Back Pressure Signal Out of Range LOW
0	34	3	3342	(TBD) Exhaust Back Pressure Signal Out of Range HIGH
0	27	0	3345	AMT - Exhaust Back Pressure too High during Variable Geometry Turbocharger Test
27	0	0	3346	AMT - Exhaust Back Pressure too High During EGR Test
0	27	1	3347	AMT - Exhaust Back Pressure Unable to Build during Variable Geometry Turbocharger Test
27	0	1	3348	AMT - Exhaust Back Pressure Unable to Build During EGR Test
164	0	15	3373	Injector Control Pressure Key-On Engine-Running STD Signal too High During Test

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
164	0	17	3374	Injector Control Pressure Key-On Engine-Runnning STD - Unable to Build During Test
0	0	2	3786	Diesel particulate Filter Test - Test Unsuccessful
0	0	6	4411	Cylinder 1 Close Coil: Open Circuit
0	0	6	4412	Cylinder 2 Close Coil: Open Circuit
0	0	6	4413	Cylinder 3 Close Coil: Open Circuit
0	0	6	4414	Cylinder 4 Close Coil: Open Circuit
0	0	6	4415	Cylinder 5 Close Coil: Open Circuit
0	0	6	4416	Cylinder 6 Close Coil: Open Circuit
0	0	6	4417	Cylinder 7 Close Coil: Open Circuit
0	0	6	4418	Cylinder 8 Close Coil: Open Circuit
0	1	5	4421	Cylinder 1 Open Coil: Open Circuit
0	2	5	4422	Cylinder 2 Open Coil: Open Circuit
0	3	5	4423	Cylinder 3 Open Coil: Open Circuit
0	4	5	4424	Cylinder 4 Open Coil: Open Circuit
0	5	5	4425	Cylinder 5 Open Coil: Open Circuit
0	6	5	4426	Cylinder 6 Open Coil: Open Circuit
0	7	5	4427	Cylinder 7 Open Coil: Open Circuit
0	8	5	4428	Cylinder 8 Open Coil: Open Circuit
0	1	4	4431	Cylinder 1 Open Coil: Short Circuit
0	2	4	4432	Cylinder 2 Open Coil: Short Circuit
0	3	4	4433	Cylinder 3 Open Coil: Short Circuit
0	4	4	4434	Cylinder 4 Open Coil: Short Circuit
0	5	4	4435	Cylinder 5 Open Coil: Short Circuit
0	6	4	4436	Cylinder 6 Open Coil: Short Circuit
0	7	4	4437	Cylinder 7 Open Coil: Short Circuit
0	8	4	4438	Cylinder 8 Open Coil: Short Circuit
0	0	3	4441	Cylinder 1 Close Coil: Short Circuit
0	0	3	4442	Cylinder 2 Close Coil: Short Circuit
0	0	3	4443	Cylinder 3 Close Coil: Short Circuit
0	0	3	4444	Cylinder 4 Close Coil: Short Circuit
0	0	3	4445	Cylinder 5 Close Coil: Short Circuit

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
0	0	3	4446	Cylinder 6 Close Coil: Short Circuit
0	0	3	4447	Cylinder 7 Close Coil: Short Circuit
0	0	3	4448	Cylinder 8 Close Coil: Short Circuit
0	1	7	4461	Cylinder 1 CCT Failed
0	2	7	4462	Cylinder 2 CCT Failed
0	3	7	4463	Cylinder 3 CCT Failed
0	4	7	4464	Cylinder 4 CCT Failed
0	5	7	4465	Cylinder 5 CCT Failed
0	6	7	4466	Cylinder 6 CCT Failed
0	7	7	4467	Cylinder 7 CCT Failed
0	8	7	4468	Cylinder 8 CCT Failed
0	151	5	4515	Bank 1 Injector Open Coil Short
0	0	6	4516	Bank 1 Injector Close Coil Short
0	152	5	4521	Bank 2 Injector Open Coil Short
0	0	6	4522	Bank 2 Injector Close Coil Short
0	21	12	4551	Camshaft Position Signal Inactive
0	22	2	4552	Camshaft Position Loss of Sync
0	22	12	4553	Camshaft Position Signal Inactive
0	22	7	4454	Crankshaft Position Loss of Sync
0	64	8	4455	Crankshaft Position Signal Noise Detected
0	0	8	4561	Cylinder Balance Below Minimum Limit
0	2	1	4562	Cylinder Balance Below Minimum Limit
0	3	1	4563	Cylinder Balance Below Minimum Limit
0	4	1	4564	Cylinder Balance Below Minimum Limit
0	5	1	4565	Cylinder Balance Below Minimum Limit
0	6	1	4566	Cylinder Balance Below Minimum Limit
0	7	1	4567	Cylinder Balance Below Minimum Limit
0	8	1	4568	Cylinder Balance Below Minimum Limit
0	1	0	4571	Cylinder Balance Maximum Limit Exceeded
0	2	0	4572	Cylinder Balance Maximum Limit Exceeded
0	3	0	4573	Cylinder Balance Maximum Limit Exceeded

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
0	4	0	4574	Cylinder Balance Maximum Limit Exceeded
0	5	0	4575	Cylinder Balance Maximum Limit Exceeded
0	6	0	4576	Cylinder Balance Maximum Limit Exceeded
0	7	0	4577	Cylinder Balance Maximum Limit Exceeded
0	8	0	4578	Cylinder Balance Maximum Limit Exceeded
0	0	13	4611	Crankshaft Position Signature One Tooth Off
0	21	7	4612	Camshaft Position to Crankshaft Position Incorrect Reference
0	0	2	5618	SPI-BUS Error 1
0	0	12	5619	SPI-BUS Error 2
0	0	12	5627	Checksum Program
0	0	2	5628	Checksum Dataset
254	0	12	5632	RAM/CPU Self-Test Fault
0	0	0	5633	CPU Load Above Maximum
0	0	12	5634	MQPS Daisy Chain Failure
0	0	12	5635	OCT Daisy Chain Failure
0	0	12	5636	UPS Daisy Chain Failure
0	0	14	5641	(TBD) CC Monitoring Error - Revert to Level 1
0	0	14	5642	Fuel Cut-Off Monitoring error - Revert to Level 1
0	0	14	5643	Post Injection Monitoring Error - Revert to Level 1
0	0	2	5644	Engine Speed Limitation error
253	0	7	5645	Electronic Control Module Internal EEPROM Failure
0	0	14	5646	Engine Speed Monitoring Error - Revert to Level 1
0	0	14	5647	PVS Monitoring Error - Revert to Level 1
0	0	14	5648	(TBD) PTO Monitoring Error - Revert to Level 1
0	0	14	5649	A/D Conversion Monitoring Error - Revert to Level 1
0	0	14	5651	MFMA Monitoring Error - Revert to Level 1
0	0	14	5652	NVMY Channel Error
0	0	14	5653	PPS Monitoring Error - Revert to Level 1
0	0	14	5654	Controller Area Network Monitoring Error - Revert to Level 1
0	0	14	5655	Service Tool Monitoring error - Revert to Level 1
0	0	14	5656	Processor Monitoring Error Detected

APPENDIX C.3 – TRANSMITTED ATA FAULT CODE LIST – V7.0 (Continued)

PID	SID	FMI	CODE	DESCRIPTION
0	0	4	5666	(TBD) VCC1 Voltage Below Minimum
0	0	3	5667	(TBD) VCC1 Voltage Above Maximum
0	0	4	5668	(TBD) VCC2 Voltage Below Minimum
0	0	3	5669	(TBD) VCC2 Voltage Above Maximum
0	0	4	5671	(TBD) VCC3 Voltage Below Minimum
0	0	3	5672	(TBD) VCC3 Voltage Above Maximum

APPENDIX D

Engine Speed Control Parts

Engine Speed Control Related Kits And Parts

Appendix D1 provides part information that is useful for building remote engine speed control applications. The following kits and individual parts are available from International® dealers. Consult Parts Information Letter 94-08-04 or your International parts catalog for more information.

Appendix D.1 – Engine Speed Control Related Kits and Parts

PART NUMBER	DESCRIPTION
2016250C91	Floor-mounted Accelerator Pedal assembly with integrated pedal sensor and jumper harness.
2016247C92	Suspended accelerator pedal assembly with integrated pedal sensor. Does not include jumper harness.
1698044C1	Jumper harness for the integrated pedal sensor.
1695251C91	Integrated Pedal Sensor with sensor jumper harness. Requires user-supplied method for mechanical actuation of the sensor with a spring return.
2037274C1	Sealed Toggle Switch (for ON/OFF switch)
2037275C1	Sealed Momentary Switch (for SET/RESUME) switch
879630R1	Terminals for switch connections – Packard 56 series (quantity 8)
2644005R1	Heat shrink tubing 9 mm ID by 25 mm long (quantity 8)
2037311C1	Hand-operated Speed Control
587570C91	3-way connector body for Hand-operated Speed Control
587577C1	Terminals for 3-way connector body
1652325C1	Terminal seals for 3-way connector body
Integrated Pedal Sensors provided by 2016250C91, 2016247C92 and 1696727C91 can be used to build remote engine speed controls. Any engine speed from low idle to a programmed maximum engine speed can be selected with such controls. The accelerator pedals provide for foot-operated engine speed controls. Controls incorporating the integrated sensor 1696727C91 can be designed. Such controls must provide mechanical actuation for the remote pedal sensor. Refer to Section 4 for more information on the application of integrated pedal sensors for engine speed control. 1698044C1 provides an interface harness for suspended accelerator pedals (part number 2016247C92). The floor-mounted accelerator pedal and Integrated Pedal Sensor kit include this harness.	
2016250C91	Floor-mounted Accelerator Pedal assembly with integrated pedal sensor and jumper harness.
2016247C92	Suspended accelerator pedal assembly with integrated pedal sensor.
1695251C91	Integrated Pedal Sensor with sensor jumper harness. The sensor requires a user-supplied method for mechanical actuation with a spring return.
1698044C1	Jumper harness for the integrated pedal sensor.

Appendix D.1 – Engine Speed Control Related Kits and Parts (Continued)

PART NUMBER	DESCRIPTION
Pedal Sensor Jumper Harness Mating Connector and Terminals	
One end of the jumper harness 1698044C1 plugs directly into the integrated pedal sensor. The mating connector and terminals for the other end are shown below.	
587574C91	Jumper harness mating connector with seal and integral lock (6-way Packard Weather Pack)
587575C1	Push-Pull terminals for mating connector
589391C1	Wire seals – crimp to wire insulation.
Integrated Pedal Sensor Mating Connector and Terminals	
The mating connector and terminals for the integrated pedal sensor is shown below. The connector seals and terminals work best with 16 or 18 gauge (AWG) terminals using GXL insulation. This connector is provided on the jumper harness, 1698044C1.	
1687790C1	Integrated pedal sensor mating connector with seals (6-way Packard Metri-Pack).
1673745C1	Pull to seat terminals for mating connector.
Engine Speed Control Switches provided in the Cab	
2004675C1	Cab ON/OFF switch with a THROTTLE legend.
2004674C1	Cab ON/OFF switch with a CRUISE/THROTTLE legend
2004676C1	Cab SET/COAST and RESUME/ACCEL switch for both engine speed control and cruise control applications
In addition to the ON/OFF and SET/RESUME switches, a clutch switch must be installed for a manual transmission and the brake switches must be connected to the brake switch relay. The clutch switch part number is 1622366C91. Use part number 2012557C1 for the brake switch relay. Refer to the electrical circuit diagrams for circuit information.	
1622366C91	Cab clutch switch for vehicles equipped with manual transmissions
2012557C1	Cab brake switch relay for electronic engines with cruise or engine speed controls and International® electronic engines.
Terminal Crimp and Connector Repair Tools	
Terminals must receive adequate crimps onto the wire to make good electrical contact and prevent wire from wire pulling out. Connectors and terminals require crimping tools to attach terminals and removal tools to remove the terminal from the connector cavity. Common crimp and terminal removal tools are shown below for the connectors discussed in this document.	
ZTSE4180	Automatic Wire Strippers for 8 to 22 AWG wires
ZTSE4176	Crimp tool for Packard Weather Pack contacts and seals. Crimps the wire/cavity seal and the core at the same time.
ZTSE4181	Packard terminal crimp tool for 10 to 18 gauge wire. Crimps core wing and insulation wings separately.
ZTSE4175	Terminal removal tool for Packard Weather Pack connectors
ZTSE4283	Terminal removal tool for Packard Metri-Pack connectors

Appendix D.2 - Deutsch DT Series Connectors and Terminals

# OF CAVITIES	TYPE	COLOR	WIRE SIZE	PART NUMBER		
				INTERNATIONAL®	DEUTSCH	PACKARD
2	Male	Black	–	1684261C1	D-DT06-25	–
–	Body Lock	–	–	1684263C1	D-WS2	–
6	Male	Grey	–	2005240C1	D-DT06-6S	–
–	Body Lock	–	–	2005242C1	D-W6S	–
12	Male	Black	–	1689500C1	D-DT06-12SB	–
–	Body Lock	–	–	1661376C1	D-W12S	–
–	Female Terminals	–	16, 18	1680205C1	–	D-1062-16-0122
2	Female	Black	–	1684260C1	D-DT04-2P	–
–	Body Lock	–	–	1684262C1	D-WP2	–
6	Female	Grey	–	2005241C1	D-DT04-6P	–
–	Body Lock	–	–	2005243C1	D-W6P	–
12	Female	Black	–	1689499C1	D-DT04-12PB	–
–	Body Lock	–	–	1689501C1	D-W12P	–
–	Male Terminals	–	16, 18	1680206C1	–	D-1060-16-0122
–	Cable Seals	–	16, 18	0453133C1	–	D-114017

Appendix D.3 - Metri-Pak (Packard) 280 Series Connectors And Terminals

# OF CAVITIES	TYPE	COLOR	WIRE SIZE	PART NUMBER		
				INTERNATIONAL®	DEUTSCH	PACKARD
1	Male	Black	–	1664531C1	12065172	–
–	Body Lock	–	–	1675053C1	12065249	–
2	Male	Black	–	1671610C1	15300027	–
–	Body Lock	–	–	1671608C1	15300014	–
5	Male	Black	–	1661375C2	12084891	–
–	Body Lock	–	–	1661376C1	15300017	–
–	Female Terminals	–	16, 18	2033819C1	–	12077411
1	Female	Black	–	1669834C1	12065171	–
–	Body Lock	–	–	1675053C1	12065249	–
2	Female	Black	–	1671611C1	15300002	–
–	Body Lock	–	–	1671608C1	15300014	–
5	Female	Black	–	1677851C1	12085036	–
–	Body Lock	–		1677914C1	12084673	–
–	Male Terminals	–	16, 18, 20	2033911C1	–	12048159
–	Cable Seals	Grey	14P, 16X	0589391C1	–	12010293
		Lt. Green	16P, 18P, 20	1652325C1		12015323
	Connector Plugs (for Empty Cavities)	Green	All	0587579C1	–	12010300

Nomenclature for wire size:

P = GXL
X = SXL