Welcome to the TS3353EN Troubleshooting Manual. We make every effort to keep our service information current and accurate. Because of the time lag involved with writing and printing processes, the transmission TCM may report a code that has not yet been added to this document. If you encounter a code that is not yet in this publication, please call the Allison Transmission Technical Assistance Center at 1-800-252-5283.

Go to the Table of Contents.

Troubleshooting Manual

2005 DECEMBER

TS3353EN

Allison Transmission

5000, 6000, 8000, 9000 Series Transmissions
Commercial Electronic Controls 2 (CEC2)

M 5610A	M 5610AR		
S 5610H	S 5610MR	S 5610M	
M 6610A	M 6610AR		
S 6610H	S 6610HR	S6610M	S 6610MR
M 8610A	M 8610AR		
S 8610H	S 8610HR	S 8610M	S 8610MR
M 9610A	M 9610AR		
S 9610A	S 9610AR	S 9610M	S 9610MR
S 9805M	S 9805MR		
S 9810A	S 9810AR	S 9810H	S 9810HR
S 9810M	S 9810MR		

Allison Transmission, General Motors Corporation
P.O. Box 894 Indianapolis, Indiana 46206-0894
www.allisontransmission.com

Printed in USA

FOREWORD—How to Use This Manual

This manual provides troubleshooting information for Allison Transmission (AT), 5000, 6000, 8000, and 9000 Series Off-Highway Transmissions which have CEC2. Service Manuals SM1866EN (5000, 6000), SM1228EN (8000) and SM1833EN (9000), plus Parts Catalogs PC1860EN (5000, 6000), PC1249EN (8000), and PC1830EN (9000) may be used in conjunction with this manual.

This manual includes:

- Description of the CEC2 system
- Description of the electronic control system components
- Description of diagnostic codes, system responses to faults, and troubleshooting
- Wire, terminal, and connector repair information.

Specific instructions for using many of the available or required service tools and equipment are not included in this manual. The service tool manufacturer will furnish instructions for using the tools or equipment.

Additional information may be published from time to time in Service Information Letters (SIL) and will be included in future revisions of this and other manuals. Please use these SILs to obtain up-to-date information concerning Allison Transmission products.

This publication is revised periodically to include improvements, new models, special tools, and procedures. A revision is indicated by a letter suffix added to the publication number. Check with your Allison Transmission service outlet for the currently applicable publication. Additional copies of this publication may be purchased from authorized Allison Transmission service outlets or from:

SGI, Inc.
Attn: Allison Literature Fulfillment Desk
8350 Allison Avenue
Indianapolis, IN 46268
TOLL FREE: 888-666-5799
INTERNATIONAL: 317-471-4995

Take time to review the Table of Contents and the manual. Reviewing the Table of Contents will aid you in quickly locating information.

NOTE: Allison Transmission provides service of wiring harnesses and wiring harness components as follows:

- ***Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix C in this manual. Allison Transmission is responsible for warranty on these parts.***
- ***Repair parts for the external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes AT, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI will have parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:***

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Phone: 519-627-1673
Fax: 519-627-4227

St. Clair Technologies, Inc.
Calle Damanti S/N Col
Guadalupe–Guaymas
Sonora, Mexico 85440
Phone: 011-526-2222-43834
Fax: 011-526-2222-43553

- ***St. Clair Technologies, Inc. stocks an external harness repair kit as a source for some external harness repair parts. SCTI is the source for external harness repair parts.***

IMPORTANT SAFETY NOTICE

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions used in this manual. These warnings and cautions advise against using specific service procedures that can result in personal injury, equipment damage, or cause the equipment to become unsafe. These warnings and cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, or advise the service trade of all conceivable procedures by which service might be performed or of the possible hazardous consequences of each procedure. Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service procedures used.

Also, be sure to review and observe WARNINGS, CAUTIONS, and NOTES provided by the vehicle manufacturer and/or body builder before servicing the Allison transmission in that vehicle.

Proper service and repair is important to the safe and reliable operation of the equipment. The service procedures recommended by Allison Transmission and described in this manual are effective methods for performing troubleshooting operations. Some procedures require using specially designed tools. Use special tools when and in the manner recommended.

The WARNINGS, CAUTIONS, and NOTES in this manual apply only to the Allison transmission and not to other vehicle systems which may interact with the transmission. Be sure to review and observe any vehicle system information provided by the vehicle manufacturer and/or body builder at all times the Allison transmission is being serviced.

WARNINGS, CAUTIONS, AND NOTES

Three types of headings are used in this manual to attract your attention:

WARNING!	**Is used when an operating procedure, practice, etc., which, if not correctly followed, could result in injury or loss of life.**

CAUTION:	Is used when an operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE: Is used when an operating procedure, practice, etc., is essential to highlight.

INTRODUCTION

TRADEMARKS USED IN THIS MANUAL

The following trademarks are the property of the companies indicated:

- LPS® Cleaner is a registered trademark of LPS Laboratories.
- Loctite® is a registered trademark of the Loctite Corporation.
- Teflon® is a registered trademark of the DuPont Corporation.
- Pro-Link® is a registered trademark of MicroProcessor Systems, Inc.
- Allison DOC™ For PC–Service Tool is a trademark for General Motors Corporation

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SECTION 1—GENERAL DESCRIPTION

1–1. TRANSMISSION

The Commercial Electronic Controls 2 (CEC2) system features clutch control to provide superior shift quality over a wide range of operating conditions.

The ranges available in CEC2-equipped Off-Highway transmissions are as follows.

- 5610, 6610, 9610—six forward, neutral, two reverses
- 8610—six forward, neutral, reverse
- 9805—eight forward, neutral
- 9810—eight forward, neutral

Figure 1–1 is a block diagram of the basic transmission system inputs and outputs.

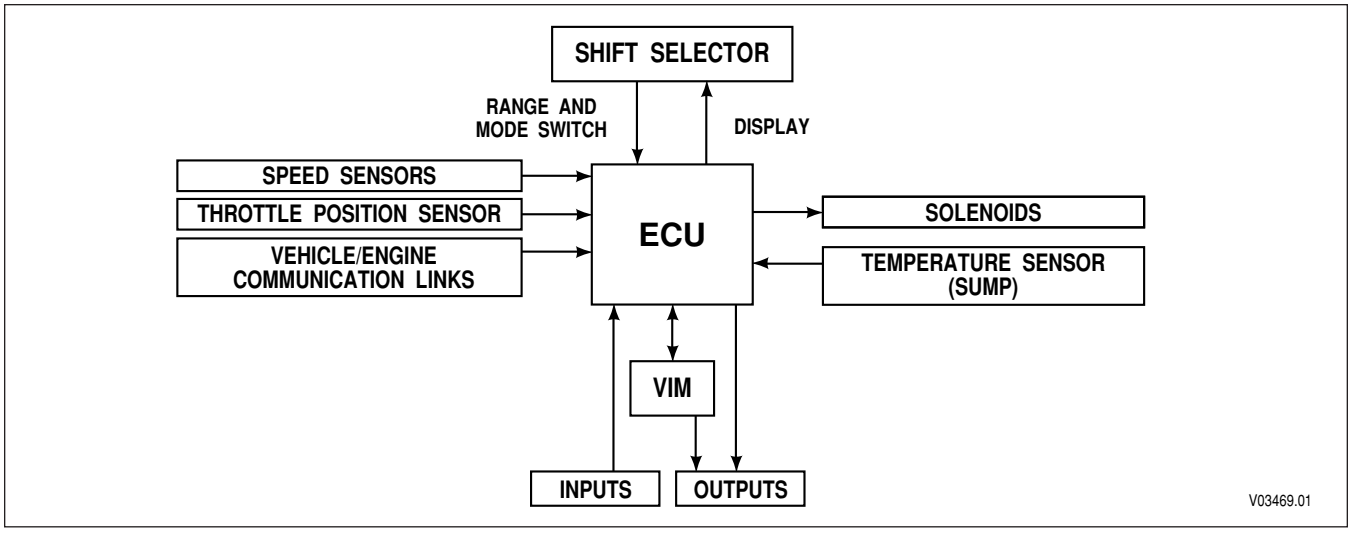


Figure 1–1. Electronic Control Unit Block Diagram

Figure 1–2 shows the CEC2 electronic control components.

CEC2 consists of the following elements:

- Remote 12/24V Max Feature Sealed Electronic Control Unit (ECU)
- Remote Pushbutton or Lever Shift Selector
- Optional Secondary Shift Selector
- Throttle Position Sensor (TPS) (or electronic engine throttle data)
- Input, Turbine, and Output Speed Sensors
- Electro-Hydraulic Valve Bodies
- Wiring Harnesses
- Vehicle Interface Module (VIM)

NOTE: ***• All external harnesses are OEM supplied.***
• The VIM is an OEM option.

GENERAL DESCRIPTION

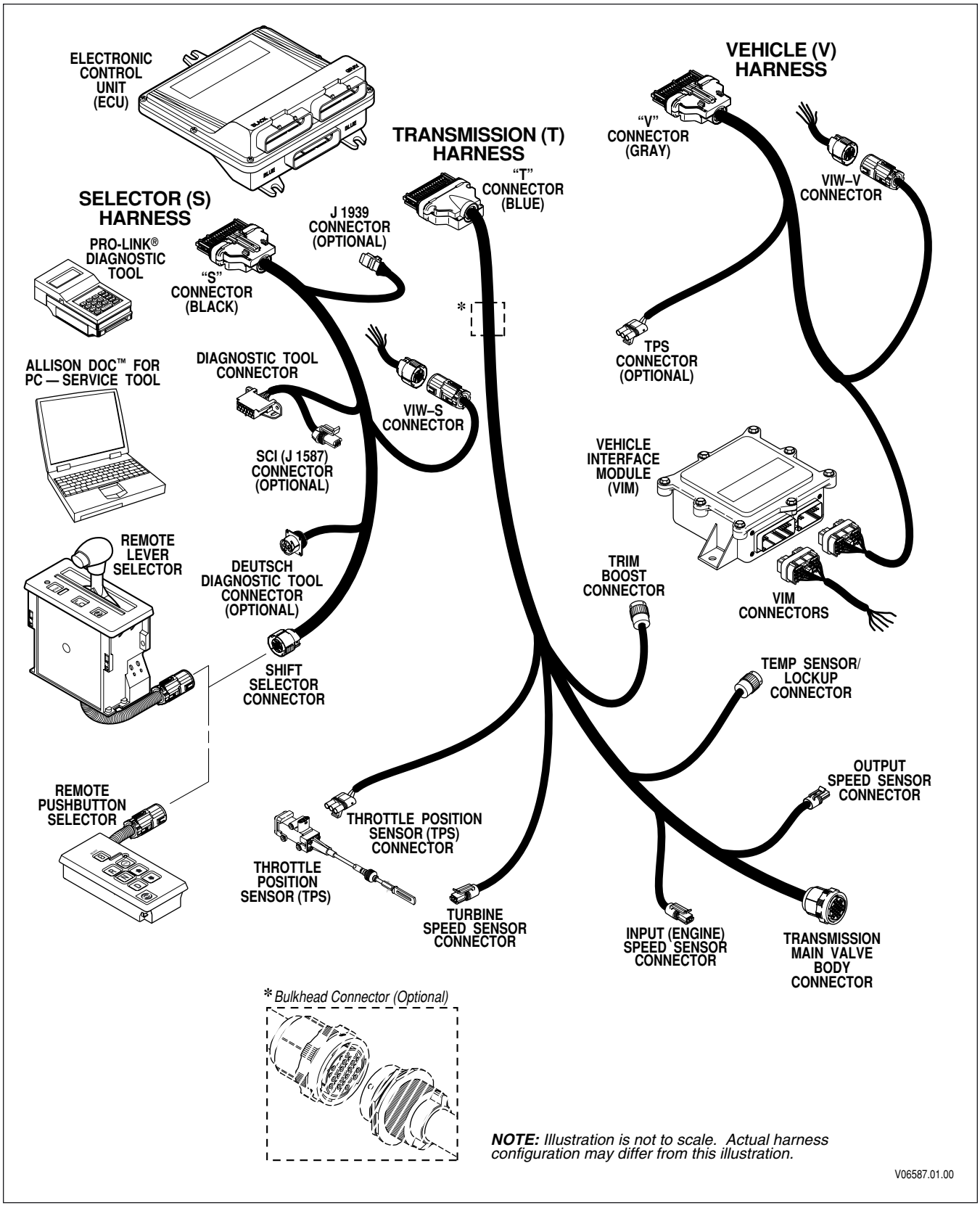


Figure 1–2. CEC2 Components

GENERAL DESCRIPTION

1–2. ELECTRONIC CONTROL UNIT (ECU)

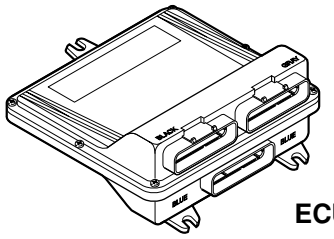
The ECU (Figure 1–3) contains the microcomputer which is the brain of the control system. The ECU receives and processes information defining:

- Shift selector position
- Throttle position
- Sump temperature
- Input speed
- Turbine speed
- Transmission output speed

The ECU uses the information to:

- Control transmission solenoids and valves.
- Supply system status.
- Provide diagnostic information.

Each ECU has a date code stamped on the label which is attached to the outer case of the ECU. This is the date when the ECU passed final test. This date is commonly used to denote the change configuration level of the ECU. It is normal for the ECU date displayed electronically to be a few days prior to the date shown on the label.



NOTE: *ECU wiring harness connector retainers are individually keyed and color-coded to make sure that the proper connector is attached to the correct ECU socket. The color of the connector retainer should match the color of the connector strain relief (see Appendix C, Paragraph C–1).*

V03352.00.02

Figure 1–3. Electronic Control Unit (ECU)

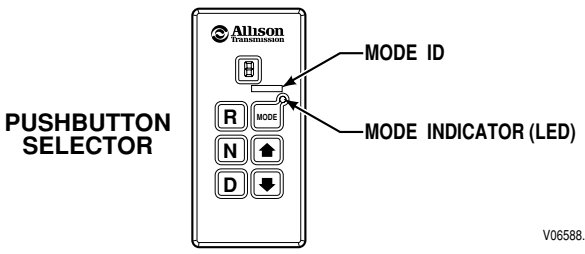
1–3. SHIFT SELECTOR

Pushbutton and lever shift selectors for CEC2 are remote mounted from the ECU and connected to the ECU by a wiring harness. Both of these shift selectors have a single digit LED display and a mode indicator LED. During normal transmission operation, illumination of the LED indicator shows that a secondary or special operating condition has been selected by pressing the MODE button. During diagnostic display mode, illumination of the LED indicator shows that the displayed diagnostic code is active. Display brightness is regulated by the same vehicle potentiometer that controls dash light display brightness. More information on both types of shift selectors is continued below.

A. Pushbutton Shift Selector *(Figure 1–4)*

The full-function pushbutton shift selector has a **MODE** button and diagnostic display capability through the single digit LED display. The full-function pushbutton shift selector has the following six (6) pushbuttons:

- **R** (Reverse)
- **N** (Neutral)
- **D** (Drive)
- ↓ (Down) and ↑ (Up) arrows
- **MODE**



V06588.01.00

Figure 1–4. Typical Full-Function Pushbutton Shift Selector

GENERAL DESCRIPTION

Manual forward range downshifts and upshifts are made by pressing the ↓ (Down) and ↑ (Up) arrow buttons after selecting **D** (Drive). The **N** (Neutral) button has a raised lip to aid in finding it by touch. The **MODE** button is pressed to select a secondary or special operating condition, such as ECONOMY shift schedule. Diagnostic information is obtained by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time.

B. Lever Shift Selector *(Figure 1–5)*

The lever shift selector can have as many as six forward range positions, as well as two **R** (Reverse) positions (**R1** and **R2**) and **N** (Neutral). There is a hold override button which **must** be pressed and held in order to move between certain selector positions. The hold override button **must** be pressed when shifting between **R**, **N,** and **D**. The hold override button is released when the desired selector position is reached. The selector lever can be moved freely between **D** and the numbered forward ranges without pressing the hold override button. The lever selector can be chosen with the lever on the left side or on the right side and with the **R** (Reverse) position toward the front or toward the rear of the selector. Diagnostic information is obtained from the single digit LED display by pressing the **DISPLAY MODE** button.

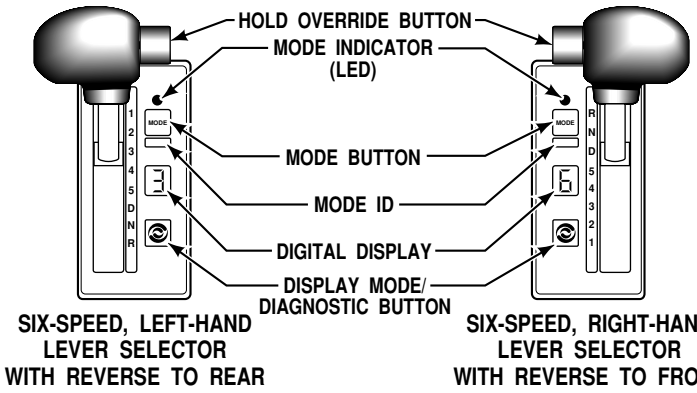


Figure 1–5. Typical Lever Shift Selector

1–4. THROTTLE POSITION SENSOR *(Figure 1–6)*

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS contains a pull actuation cable and a potentiometer. One end of the cable is attached to the engine fuel lever and the other, inside a protective housing, to the TPS potentiometer. Output voltage from the TPS is directed to the ECU through the external harness. The voltage signal indicates the throttle position and, in combination with other input data, determines shift timing.

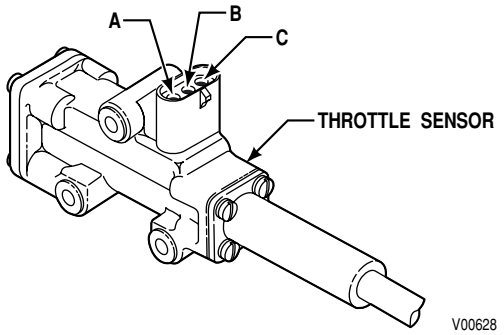


Figure 1–6. Throttle Position Sensor

GENERAL DESCRIPTION

1–5. SPEED SENSORS *(Figure 1–7)*

Three speed sensors—input speed, turbine speed, and output speed—provide information to the ECU. The input speed signal is generated by the gear teeth on the top PTO gear. The turbine speed signal is generated by serrations on the pitot can attached to the splitter low drum. The output speed signal is generated by a toothed member attached to the output shaft. The speed ratios between the various speed sensors allow the ECU to determine if the transmission is in the selected range. Hydraulic problems are detected by comparing the speed sensor information for the current range to that range's speed sensor information stored in the ECU memory.

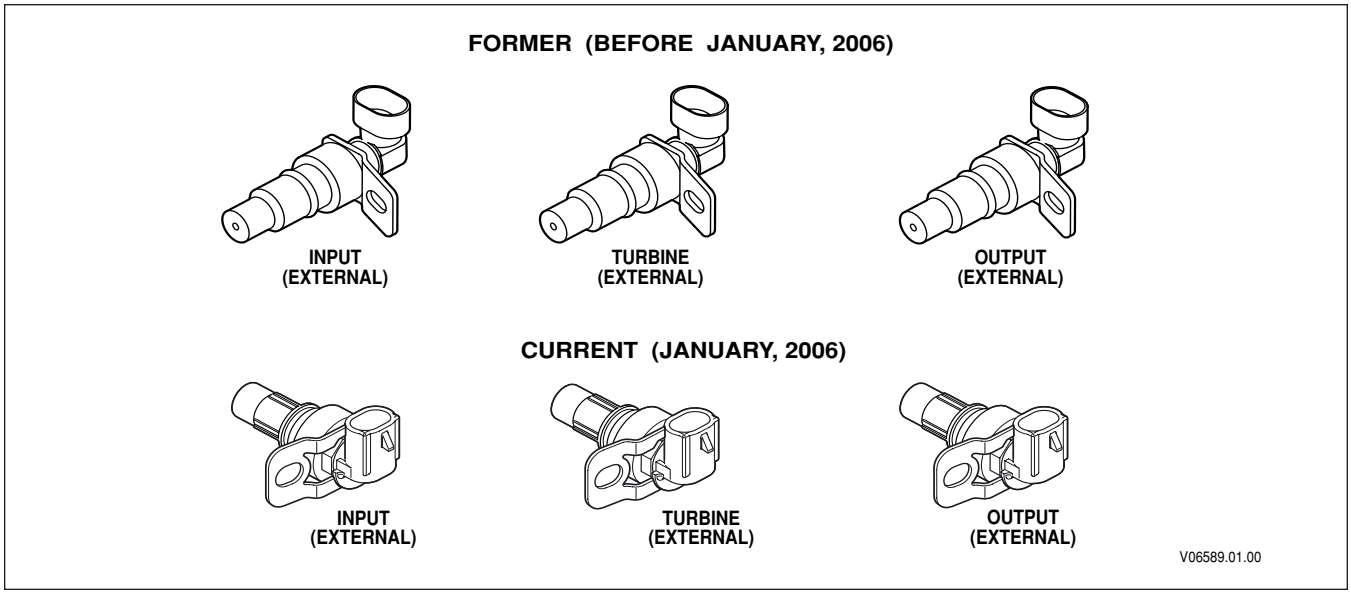


Figure 1–7. Speed Sensors

1–6. ELECTRO-HYDRAULIC VALVE COMPONENTS *(Figure 1–8)*

The CEC2 electro-hydraulic valve bodies contain various solenoids to control the absence or presence of solenoid pressure. Solenoid pressure, or lack of pressure, positions shift valves which apply or release transmission clutches to produce the range commanded by the ECU inputs. The ECU is connected to the solenoids by a wiring harness with sealed multi-pin twist-lock connectors at the control valve bodies.

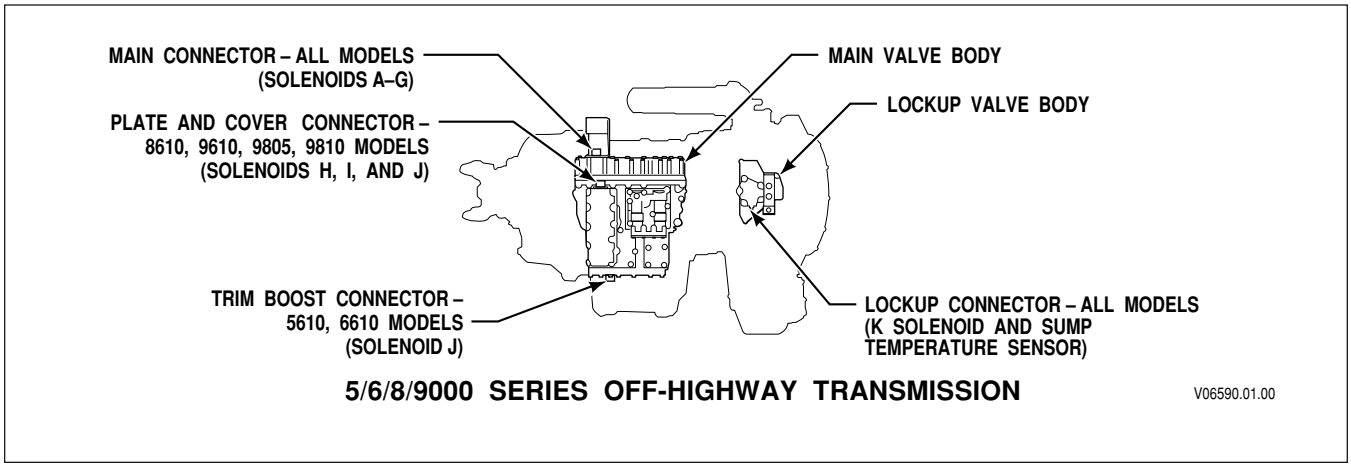


Figure 1–8. CEC2 Control Module

GENERAL DESCRIPTION

The sump temperature sensor in the lockup body sends information to the ECU. When oil temperature is below –25ºF (–32ºC), all shifts are blocked. When oil temperature is between –25ºF* (–32ºC) and 20ºF* (–7ºC), transmission shifting is limited to neutral, to limited forward ranges*, and reverse. Above 250ºF* (121ºC), the Hot light comes on (if equipped), and a trouble code is stored in memory. Refer to chart in Section 5, Code 24 for sump temperature sensor (thermistor) characteristics. Some applications (emergency vehicles, for example) are often exempt from shift inhibit during temperature extremes, but the **CHECK TRANS** light may still come on and codes may be logged in the ECU memory.

1–7. WIRING HARNESSES

A. External Wiring Harness *(Figure 1–9)*

CEC2 uses three external wiring harnesses to provide a connection between:

- ECU
- Transmission (including input, turbine, and output speed sensors)
- Throttle position sensor
- Vehicle interface module (VIM)
- Shift selectors
- Diagnostic tool connector
- Vehicle interface.

The transmission harness may include a bulkhead fitting to separate cab and chassis components.

NOTE: Allison Transmission provides service of wiring harnesses and wiring harness components as follows:

- ***Repair parts for internal wiring harness and wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix C in this manual. Allison Transmission (AT) is responsible for warranty on these parts.***
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Sonora, Mexico 85440
Phone: 011-526-2222-43834
Fax: 011-526-2222-43553

- ***St. Clair Technologies, Inc. stocks a CEC2 external harness repair kit, P/N 29532362, as a source for some external harness repair parts. SCTI is the source for external harness repair parts.***

* This is a programmed value subject to change.

GENERAL DESCRIPTION

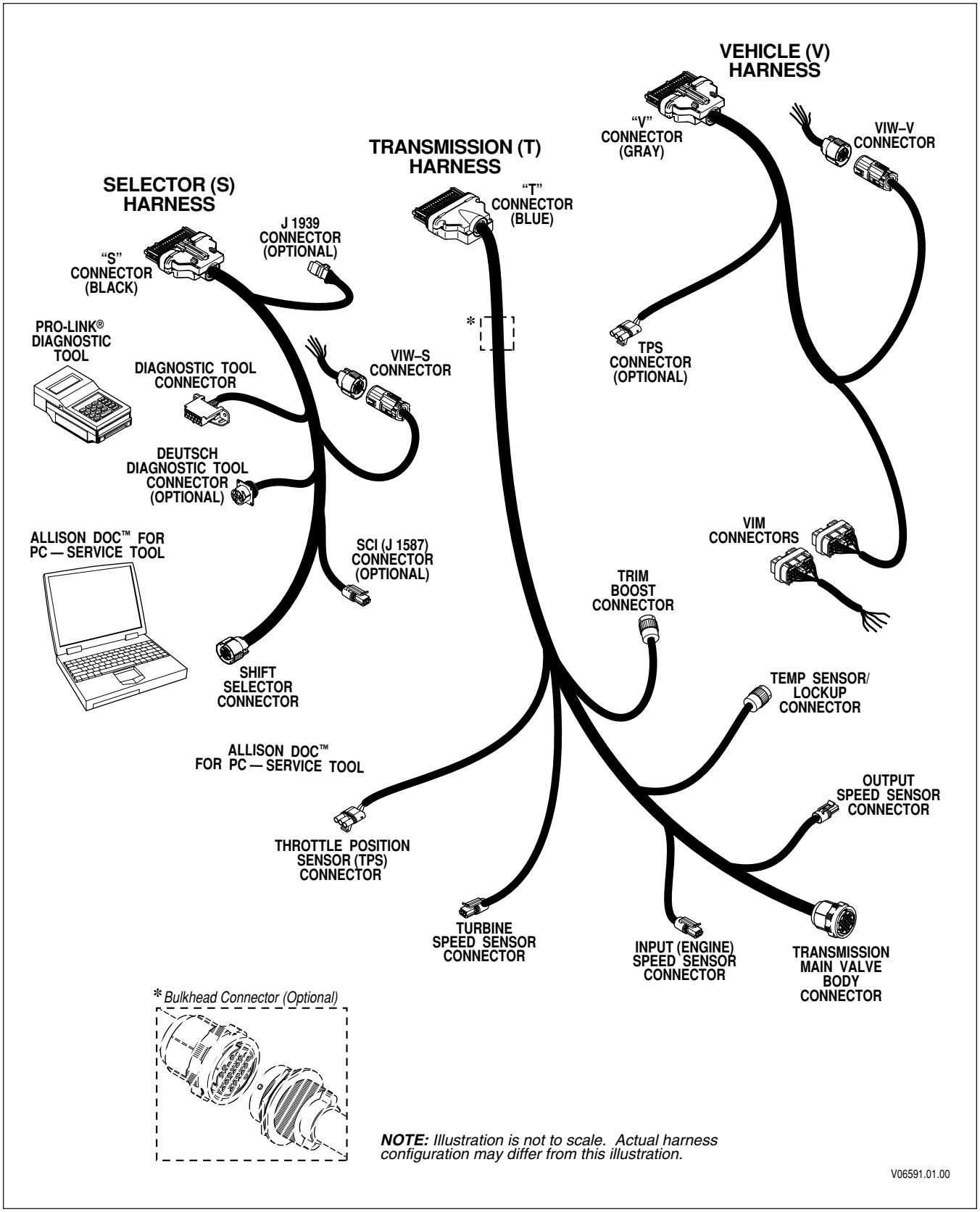

Figure 1–9. CEC2 External Wiring Harnesses

GENERAL DESCRIPTION

B. Internal Wiring Harnesses *(Figure 1–10)*

The internal wiring harnesses provide connection between the external harness, solenoids, and the temperature sensor.

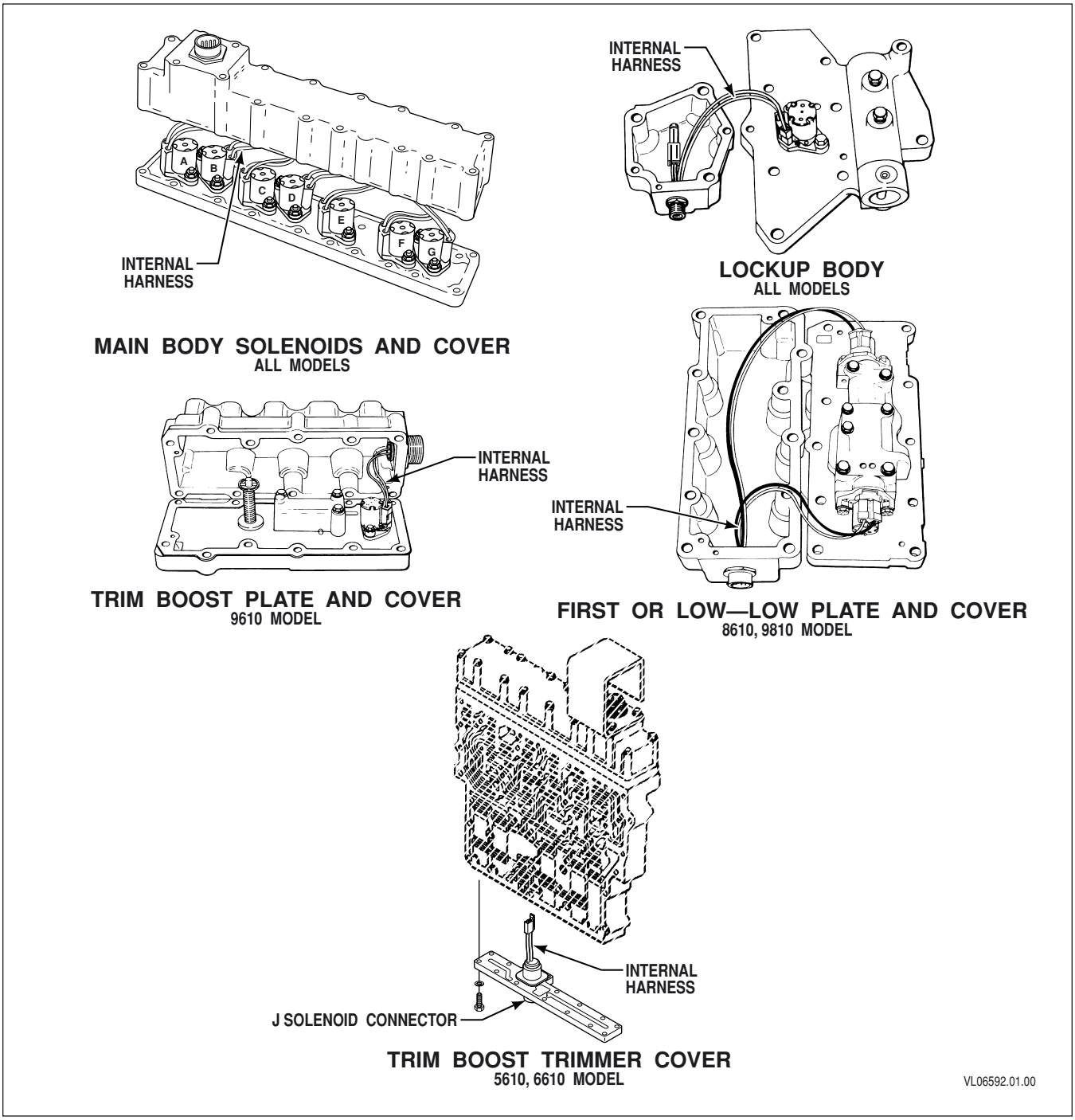

Figure 1–10. CEC2 Internal Wiring Harnesses

GENERAL DESCRIPTION

1–8. VEHICLE INTERFACE MODULE *(Figure 1–11)*

The vehicle interface module (VIM) provides relays, fuses, and connection points to interface with the vehicle electrical system. VIMs are available for both 12V and 24V electrical systems. The VIM for 12V systems uses all 12V relays. The VIM for 24V systems has all 24V relays. Refer to the parts catalog for the transmission assembly number that you are servicing for detailed parts information. Refer to Pages B–19 and B–20 for VIM wire number and terminal information. Further information is available in Appendix E.

Some OEMs may provide their own equivalent for the VIM which performs the same functions as the VIM shown in Figure 1–11.

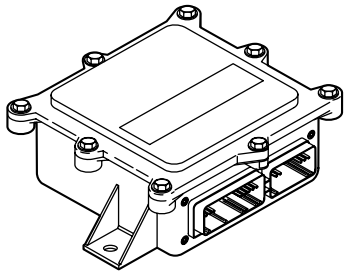

Figure 1–11. Vehicle Interface Module (VIM)

1–9. AUTODETECT FEATURE

Autodetect is active on the first 10* engine starts. Autodetect takes place within the first 5–25* seconds of each engine start monitored. For CEC2, autodetect searches for the presence of a throttle information source. Autodetect searches for a TPS (analog) source or a data link source via J1939 or J1587.

* This is a programmed value subject to change.

GENERAL DESCRIPTION

NOTES

SECTION 2—DEFINITIONS AND ABBREVIATIONS

2–1. CHECK TRANS LIGHT

When the ECU detects an abnormal condition, the **CHECK TRANS** light (usually located on the vehicle instrument panel) illuminates and action is automatically taken to protect operator, vehicle, and transmission. A diagnostic code will nearly always be registered when the **CHECK TRANS** light is on; however, not all diagnostic codes will turn on the **CHECK TRANS** light. Codes related to the **CHECK TRANS** light are detailed in the code chart (refer to Section 5).

Illumination of the **CHECK TRANS** light indicates that a condition was detected that requires service attention. Operation of the transmission may or may not be restricted. Depending upon the cause for the **CHECK TRANS** light illumination, the ECU may or may not respond to shift selector requests. The transmission may be locked in a range. The range selected will flash on the shift selector display. Both upshifts and downshifts may be restricted when the **CHECK TRANS** light is illuminated. Seek service assistance as soon as possible.

Each time the engine is started, the **CHECK TRANS** light illuminates briefly and then goes off. This momentary lighting indicates the light circuit is working properly. If the light does not come on during engine start, request service immediately.

2–2. DIAGNOSTIC DATA READER *(Figure 2–1)*

Allison DOC™ For PC–Service Tool is the Allison Transmission preferred diagnostic tool. The Pro-Link® 9000 diagnostic tool can be used for limited support only. Addition information is available in Appendix J of this manual.

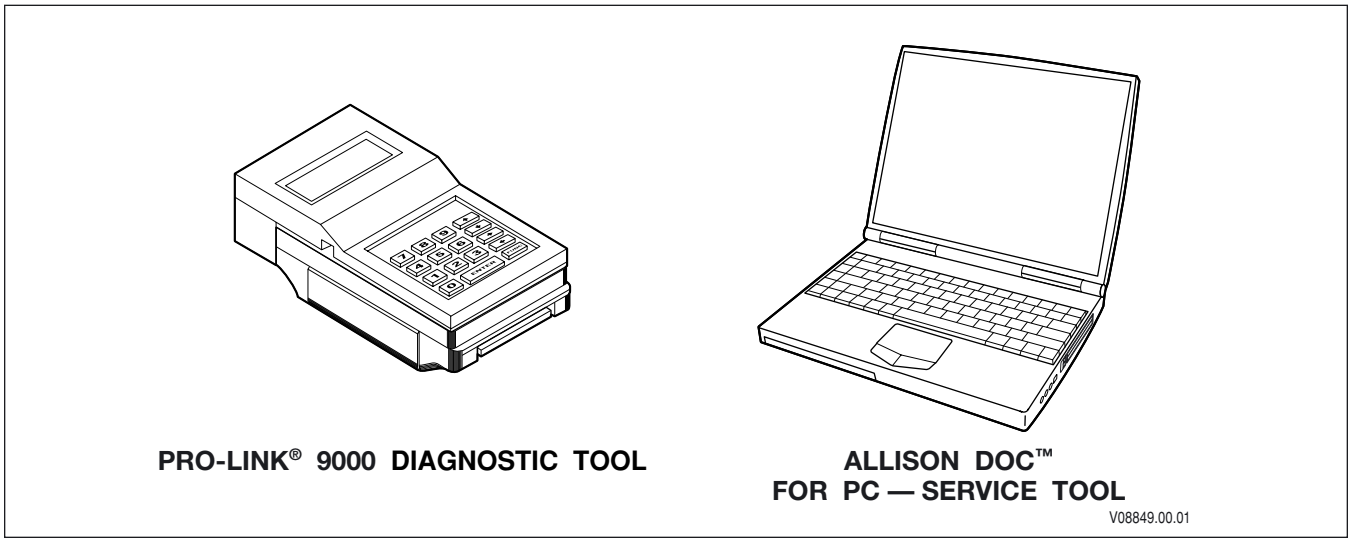

Figure 2–1. Current Diagnostic Data Readers

DEFINITIONS AND ABBREVIATIONS

2–3. ABBREVIATIONS

A/N	**A**ssembly **N**umber
Amp	Unit of electrical current
AT	Allison Transmission
CAN	**C**ontroller **A**rea **N**etwork—A network for all SAE J1939 communications in a vehicle (engine, transmission, etc.)
CEC1/CEC2	**C**ommercial **E**lectronic **C**ontrols 1 or 2—Designation for electronic controls used in off-highway and some older on-highway transmissions
COP	**C**omputer **O**perating **P**roperly—Hardware protection which causes the ECU to reset if software gets lost
CT	**C**losed **T**hrottle
DDU	**D**igital **D**isplay **U**nit—Optional means of obtaining diagnostic information.
DNS	**D**O **N**OT **S**HIFT—Refers to the **DO NOT SHIFT** diagnostic response during which the **CHECK TRANS** light is illuminated and the transmission will not shift and will not respond to the Shift Selector
DOC	**D**iagnostic **O**ptimized **C**onnector
DVOM	**D**igital **v**olt/**o**hm**m**eter
ECU	**E**lectronic **C**ontrol **U**nit (also commonly referred to as the “computer”)
GPI	**G**eneral **P**urpose **I**nput—Input signal to the ECU to request a special operating mode or condition
GPO	**G**eneral **P**urpose **O**utput—Output signal from the ECU to control vehicle components (such as PTOs, backup lights, etc.) or allow a special operating mode or condition
J1587	Engine/transmission serial data communications link
J1939	High-speed vehicle serial data communications link
LED	**L**ight-**E**mitting **D**iode—Electronic device used for illumination
NVL	**N**eutral **V**ery **L**ow—The ECU has sensed turbine speed below 150 rpm when output speed is below 100 rpm and engine speed is above 400 rpm when **N** (Neutral) was selected
OEM	**O**riginal **E**quipment **M**anufacturer—Maker of vehicle or equipment
Ohm	Unit of electrical resistance
PCCS	**P**ROM **C**alibration **C**onfiguration **S**ystem
PCMCIA	**P**ersonal **C**omputer **M**emory **C**ard **I**nternational **A**ssociation—Memory device for use with Pro-Link® containing Allison Transmission programming and diagnostics
PROM	**P**rogrammable **R**ead **O**nly **M**emory
PSS	**P**rimary **S**hift **S**elector—Main shift selector in a two-selector control system
PTO	**P**ower **T**ake**o**ff
SCI	**S**erial **C**ommunication **I**nterface—Used to transmit data and messages between the diagnostic tool and the ECU and other systems such as electronically-controlled engines

DEFINITIONS AND ABBREVIATIONS

2–3. ABBREVIATIONS *(cont'd)*

SOL OFF	All **SOL**enoids **OFF**
SPI	**S**erial **P**eripheral **I**nterface—The means of communication between the microprocessor and the interface circuits
SSS	**S**econdary **S**hift **S**elector—Alternate shift selector in a two-selector control system
TPS	**T**hrottle **P**osition **S**ensor—Potentiometer for signaling the position of the engine fuel control lever
V	**V**ersion—Abbreviation used in describing ECU software levels
V	**V**olt—i.e., 24V
VDC	**V**olts **D**irect **C**urrent (DC)
VIM	**V**ehicle **I**nterface **M**odule—A watertight box containing relays and fuses—interfaces the transmission electronic control system with components on the vehicle
VIW	**V**ehicle **I**nterface **W**iring—Interfaces ECU programmed input and output functions with the vehicle wiring
Volt	Unit of electrical force
VOM	**V**olt/**o**hm**m**eter
WOT	**W**ide **O**pen **T**hrottle
∞	Infinity—Condition of a circuit with higher resistance than can be measured, effectively an open circuit

DEFINITIONS AND ABBREVIATIONS

NOTES

SECTION 3—BASIC KNOWLEDGE

3–1. BASIC KNOWLEDGE REQUIRED

To service CEC2, the technician must understand basic electrical concepts. Technicians need to know how to use a volt/ohmmeter (VOM) to make resistance and continuity checks. Most troubleshooting checks consist of checking resistance, continuity, and checking for shorts between wires and to ground. The technician should be able to use jumper wires and breakout harnesses and connectors. Technicians unsure of making the required checks should ask questions of experienced personnel or find instruction.

The technician should also have the mechanical aptitude required to connect pressure gauges or transducers to identified pressure ports used in the troubleshooting process. Pressure tap locations and pressure values are shown in the Service Manual for the transmission being checked.

Input power, ground, neutral start circuitry, etc., can cause problems with electronic controls or vehicle functioning and may not generate a diagnostic code. A working knowledge of CEC2 vehicle installation is necessary in troubleshooting installation-related problems.

Reliable transmission operation and performance depend upon a correctly installed transmission. Refer to Section 4–3, Shift Inhibits, or Section 4–2, General Troubleshooting of Performance Complaints, for information concerning performance complaints (non-code) troubleshooting. A complete wiring schematic is shown in Appendix G. Refer to CEC2 Controls and Off-Highway Tech Data on the Allison Transmission extranet through an Allison distributor, dealer, or OEM.

NOTE: ***Allison Transmission provides service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness and wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix C in this manual. Allison Transmission (AT) is responsible for warranty on these parts.***
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- ***St. Clair Technologies, Inc. stocks an external harness repair kit as a source for some external harness repair parts. SCTI is the source for external harness repair parts.***

BASIC KNOWLEDGE

3–2. USING THE TROUBLESHOOTING MANUAL

Use this manual as an aid to troubleshooting CEC2. Every possible problem and its solution cannot be encompassed by any manual. However, this manual does provide a starting point from which most problems can be resolved.

3–3. SYSTEM OVERVIEW

CEC2 functions are controlled by the ECU. The ECU reads the following components to determine when to command a shift:

- Shift selector range selection
- Output speed
- Throttle position.

When a shift occurs, the ECU monitors:

- Turbine speed
- Output speed
- Throttle position during the shift.

When the ECU detects an electrical fault, it logs a diagnostic code indicating the faulty circuit and may alter the transmission operation to prevent or reduce damage.

When the ECU detects a non-electrical problem while trying to make a shift, the ECU may try that shift a second or third time before setting a diagnostic code. Once that shift has been retried, and a fault is still detected, the ECU sets a diagnostic code and holds the transmission in a lock-to-range mode of operation.

3–4. IMPORTANT INFORMATION IN THE TROUBLESHOOTING PROCESS

Before beginning the troubleshooting process, read and understand the following:

- CEC2 wire identification presents the wire number followed by the ECU terminal source (i.e., 157-S30). If there is a letter suffix following the wire number, there is a splice between the ECU source and wire destination (i.e., 116A-T19).
- Shut off the engine and ignition before any harness connectors are disconnected or connected.
- Remember to do the following when checking for shorts and opens:
  - **Shorts:** Minimize movement of wiring harnesses when looking for shorts. Shorts involve wire-to-wire or wire-to-ground contacts and moving the harnesses may eliminate the problem.
  - **Opens:** Wiggle connectors, harnesses, and splices when looking for opens. This simulates vehicle movements which occur during actual operation.
- When disconnecting a harness connector, be sure that pulling force is applied to the connector itself and **not the wires** extending from the connector.
- Resistance checks involving the wiring between the ECU connectors and other components adds about one Ohm of resistance to the component resistance shown.
- Inspect all connector terminals for damage. Terminals may have been bent or lost the necessary tension to maintain firm contact.
- Clean dirty terminals or connectors with isopropyl alcohol and a cotton swab, or a good quality, non-residue, non-lubricating, cleaning solvent such as LPS® Electro Contact Cleaner or LPS® NoFlash Electro Contact Cleaner.

CAUTION:	The cleaning solvent **must not be** chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.

CAUTION:	Care should be taken when welding on a vehicle equipped with electronic controls. Refer to Appendix E, Paragraph 1–1.

- Diagnostic codes displayed after system power is turned on with a harness connector disconnected, can be ignored and cleared from memory. Refer to Section 5, Diagnostic Codes, for the code clearing procedure.

3–5. TESTING FOR OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

(Use Digital Volt/Ohmmeter J 34520-A and Jumper Wire Set J 39197)

NOTE: Please refer to Paragraph 4–1 to begin the troubleshooting process.

1. Make sure all connectors are tightly connected and re-test the circuit.
2. Disconnect and inspect all connectors.
3. Thoroughly clean corroded or dirty terminals. If dirty or corroded terminals are the probable cause of the problems, reconnect the clean connectors and operate the vehicle normally. If the problem recurs, proceed with Step (4).

CAUTION:	The cleaning solvent **must not be** chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.

4. Review the CEC2 wire numbering system described in Paragraph 3–4.
5. If all connectors are clean and connected correctly, determine which wires in the chassis harness are indicated by the diagnostic code. For example, Code 45 12, indicates a failure in the F solenoid circuit—wires 102-T1 and 120-T4.
   a. Test continuity of wires 102-T1 and 120-T4 by performing the following (refer to Figure 3–1):
      (1) Disconnect the blue “T” connector from the ECU and disconnect the harness from the transmission main connector. At one end of the harness, using jumper wire kit J 39197 and connector probes in J 39775-CP, connect wire 102-T1 and 120-T4 to each other, being careful not to distort the terminals. Jumpering the wires together creates a circuit between wires 102-T1 and 120-T4.

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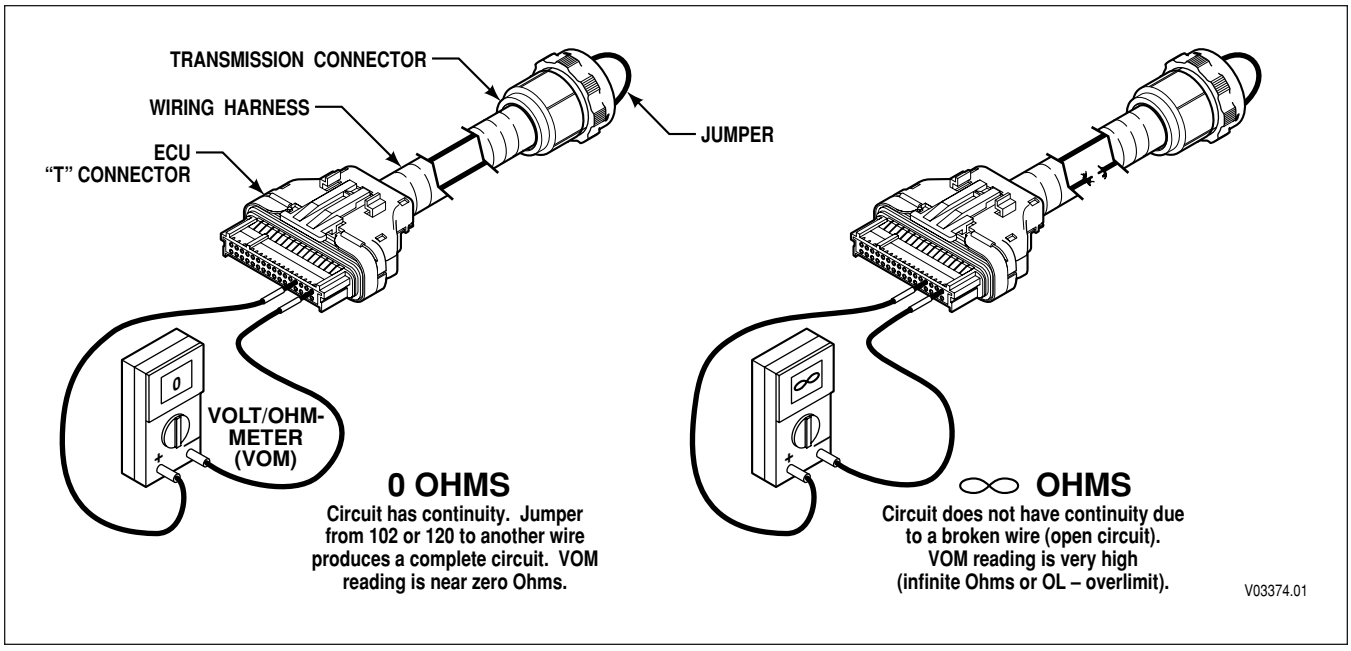

Figure 3–1. Open Circuit

(2) On the opposite end of the harness, test the continuity of the jumpered pair. No continuity in a jumpered pair circuit (infinite resistance reading) indicates an open in the wire being tested. Locate and repair the damaged portion of the wire.

b. If the continuity test is good (0–2 Ohms resistance), remove the jumpers. Test the harness for shorts between wires and shorts-to-ground by performing the following (refer to Figure 3–2):

(1) At the ECU end of the harness, touch one VOM probe to one wire of the circuit being tested and touch the other probe to each terminal in the same connector, then touch the probe to chassis ground and to the transmission main housing. Do this for both wires in the circuit being tested.

(2) If at any time the VOM shows zero to low resistance, or the meter's continuity beeper sounds, there is a short between the two points being probed—wire-to-wire or wire-to-ground. Isolate and repair the short.

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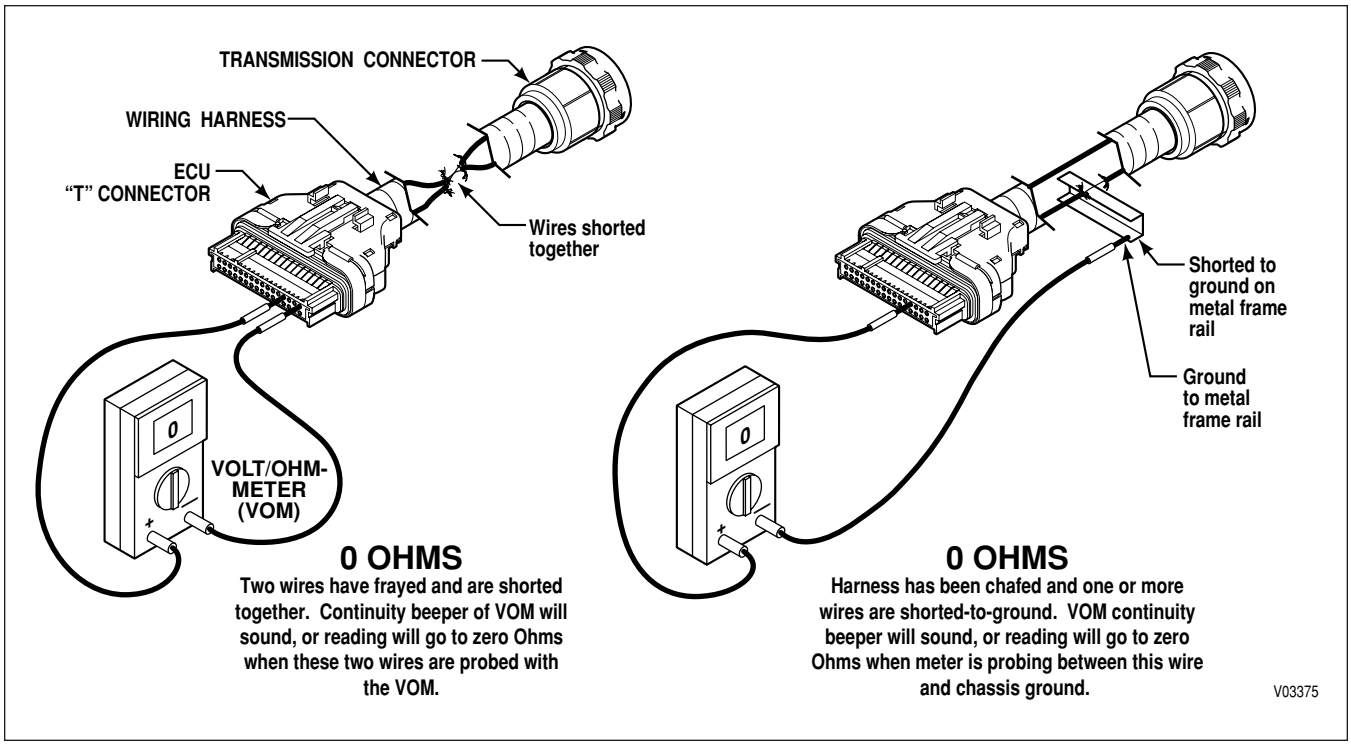

Figure 3–2. Shorts Between Wires or to Ground

3–6. TESTING AT TRANSMISSION CONNECTOR AND THE INTERNAL HARNESS FOR OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

1. Disconnect the external wiring harness from the transmission.
2. Inspect the connectors. Any terminals which are corroded or dirty **must be** thoroughly cleaned.

CAUTION:	The cleaning solvent **must not be** chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.

3. If the connectors are clean and connected correctly, determine which wires in the harness to test. Use the diagnostic code system schematic to locate the wire terminals. For this example, Code 45 12 indicates a failure in the F solenoid circuit—wires 102-T1 and 120-T4 (refer to Figure 3–3 and 3–4).

NOTE: Resistance of all solenoids (except J on 5610, 6610 models only) should be 12–24 Ohms. Solenoid J resistance on the 5610, 6610 should be 10–13 Ohms.

a. At the transmission main valve body connector, test for the resistance of the F solenoid circuit. Resistance of the solenoid circuit should be 12–24 Ohms. No continuity in the circuit (infinite resistance) indicates an open in the internal harness, the feedthrough connector, or the solenoid

coil. Locate and repair the open in the internal harness or replace the internal harness, replace the feedthrough connector, or replace the solenoid.

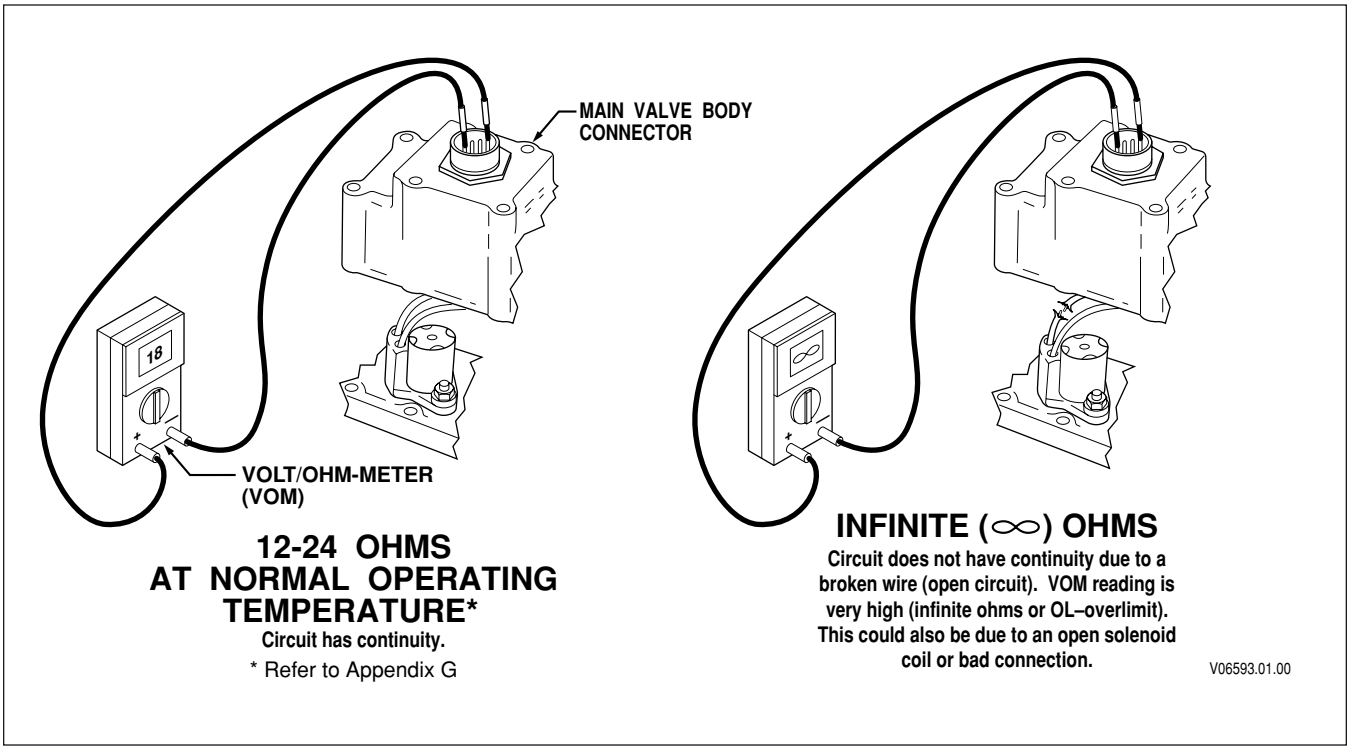

Figure 3–3. Testing for Continuity

b. If the resistance test is good, test the harness for shorts between wires and to ground by performing the following (refer to Figure 3–4):

(1) At the transmission connector, touch one probe of the VOM to one wire of the circuit being tested and touch the other probe to each terminal in the connector and to chassis ground and the transmission main housing. Do this for both wires in the circuit being tested.

(2) If the VOM shows zero to low resistance, or the continuity beeper sounds, there is a short between the two points being probed, wire-to-wire or wire-to-ground. An indication of a short may be caused by a splice to the wire being tested. Consult the wiring diagram in Appendix G for splice locations. If the short is not a splice, then isolate and repair the short.

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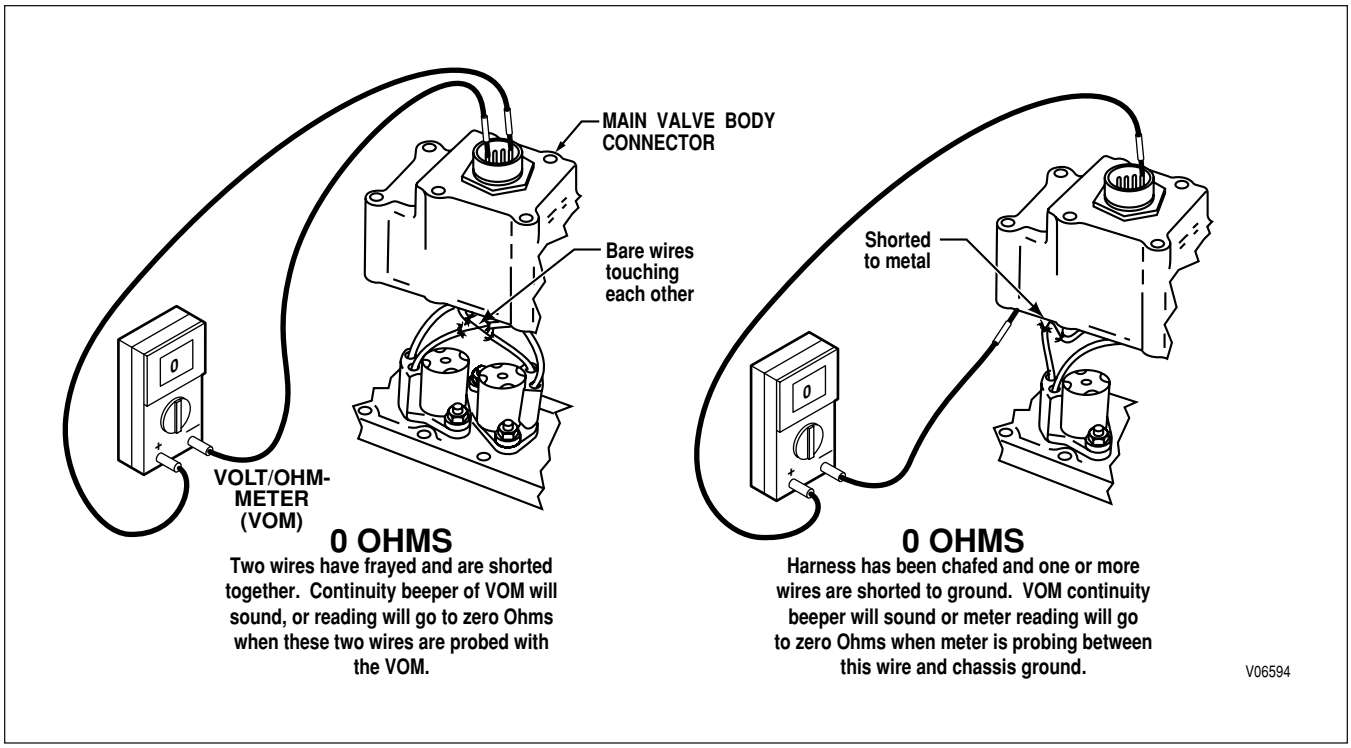

Figure 3–4. Shorts Between Wires or to Ground

NOTE: When conducting circuit tests that include the external harness, add one (1) Ohm to the values shown.

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NOTES

SECTION 4—TROUBLESHOOTING—NO CODES PRESENT

4–1. BEGINNING THE TROUBLESHOOTING PROCESS

1. Begin troubleshooting by determining the transmission fluid level and ECU input voltage. Remember that some problems may be temperature related. Do troubleshooting at the temperature level where the problem occurs. Determine diagnostic codes by using:
   - Shift selector display (refer to Paragraph 5–2 for code reading)
   - Allison DOC™ For PC–Service Tool (Allison Transmission preferred diagnostic tool)
   - Pro-Link® 9000 diagnostic tool (limited support only)
2. When a problem exists but a diagnostic code is not indicated, refer to Section 4–3, Shift Inhibits, or Section 4–2, General Troubleshooting of Performance Complaint, for a listing of various electrical and hydraulic problems, their causes, and remedies.
3. If a diagnostic code is found in the ECU memory, record all available code information and clear the active indicator (refer to Section 5).
4. Test drive the vehicle to confirm a diagnostic code or performance complaint.
   - If the code reappears, refer to Section 5, Diagnostic Codes, and the appropriate code chart. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.
   - If the code does not reappear, it may be an intermittent problem. Use the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool and Section 5, Paragraph 5–1. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for possible cause(s) of the problem.
   - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

NOTE: Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.

4–2. GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

IMPORTANT:

Determine the following before beginning specific troubleshooting, removing the transmission, or removing attached components.

- Are there active diagnostic codes?
- Is the lever shift selector lever in **N** (Neutral) to allow starting the engine?
- Is the battery properly connected and charged?
- Have the items in Paragraph 4–1, been reviewed?
- Is the fluid level correct?
- Is voltage to the ECU correct?
- Is the engine properly tuned?
- Is fuel flow to the engine correct?

TROUBLESHOOTING—NO CODES PRESENT

- Is air flow to the cooler and radiator unrestricted?
- Is the driveline properly connected?
- Are there signs of fluid leakage under the vehicle? What is the origination point?
- Are hydraulic connections correctly made and not leaking?
- Is vehicle acceleration from a stop changed?
- Are electrical connections correctly made?
- Are there any other obvious vehicle or transmission problems?

Use the various sections of this manual to isolate the listed problems. The following charts address specific vehicle complaints. Some complaints involve diagnostic codes, so all troubleshooting should involve determining if the system has set any diagnostic codes.

Table 4–1. Troubleshooting Performance Complaints

Problem	Probable Cause	Suggested Remedy
SHIFT SELECTOR DISPLAYS "CATEYE" (-/-) AND VEHICLE IS NOT OPERABLE	No communication between the ECU and a remote shift selector	Refer to code 23 XX troubleshooting procedure
	ECU interprets transmission not in neutral	Refer to code 56 XX troubleshooting procedure
SHIFT SELECTOR DISPLAY IS BLANK	VIM Fuse is blown	Replace VIM fuse
	Fuse blown in OEM substitute	Replace fuse for VIM
	Failed SDL (Serial Data Link)	Should change to "cateye" within 12 seconds (refer to Code 23 16)
SHIFT SELECTOR NOT LIGHTED AT NIGHT (WHEN HEADLIGHTS ARE ON)	Wires 186, 187, or 188 are not connected or are improperly connected.	Find wires 186, 187, and 188 and connect them or install wires, if necessary.

TROUBLESHOOTING—NO CODES PRESENT

Table 4–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
VEHICLE WILL NOT START (ENGINE WILL NOT CRANK)	Lever shift selector not in neutral	Select **N** (Neutral) and restart
	Dead battery	Recharge battery
	Disconnected battery	Reconnect battery
	Faulty starter circuit	Repair vehicle starter circuit
	Faulty neutral start relay	Replace neutral start relay
	Faulty wiring in neutral start circuit	Repair wiring
	Voltage to ECU too low	Test battery and charging system voltage. Refer to Code 13 12 troubleshooting procedure.
	Faulty ignition wire (146)	Repair wire 146
	Faulty lever shift selector	Replace lever shift selector. Refer to Code 23 XX troubleshooting procedure.
	Lack of battery voltage on Circuit 123 from ECU when in neutral	Repair Circuit 123 or replace the ECU
All display segments of display lighted	No calibration installed in ECU. Voltage to ECU too low	Load Calibration Test battery and charging system voltage. Refer to Code 35 00 troubleshooting procedure.
CHECK TRANS LIGHT WILL NOT GO OUT AT START-UP		
A. Vehicle Drives Normally	Faulty **CHECK TRANS** relay or circuit.	Replace relay or repair circuit
	Faulty wiring harness	Repair harness
	An LED rather than a lamp is installed for the **CHECK TRANS** light and the LED is partially lighted from leakage current	Install a lamp rather than an LED for the **CHECK TRANS** light
	Faulty ECU	Replace the ECU
B. Vehicle Does Not Drive	Faulty harness	Repair harness (refer to Section 4 and Appendix C)
	Faulty interface wiring to vehicle electrical system	Repair wiring (refer to Appendix C)
	Faulty ECU	Replace the ECU

TROUBLESHOOTING—NO CODES PRESENT

Table 4–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
CHECK TRANS LIGHT FLASHES INTERMITTENTLY	Intermittent power to ECU	Determine input power to the ECU and correct if necessary
	Loose **CHECK TRANS** relay	Replace **CHECK TRANS** relay
	Loose wiring to **CHECK TRANS** light	Repair wiring
	Faulty or incorrect ground wire attachment	Repair ground circuit
	Intermittent opening in Circuit 115	Repair Circuit 115
NO **CHECK TRANS** LIGHT AT IGNITION	Faulty light bulb or socket	Replace light bulb or socket
	Faulty relay	Replace relay
	Incorrect power to relay	Test power line from ignition switch to relay and repair
	Incorrect wiring to and from **CHECK TRANS** light bulb	Repair wiring (refer to Appendix C)
	Faulty wiring harness	Test wiring between ECU and **CHECK TRANS** light, and repair where necessary (refer to Appendix C)
	Circuit 115 open	Repair Circuit 115
	Faulty ECU	Replace the ECU
ECU WILL NOT TURN OFF WHEN IGNITION SWITCH OFF	Faulty ignition switch	Replace ignition switch
	Externally-generated speed sensor signal(s) (refer to Appendix H for detailed inspection)	Find source of false speed sensor signal(s) and correct problem
TRANSMISSION WILL NOT SHIFT TO FORWARD OR REVERSE (STAYS IN NEUTRAL)	Oil temperature too low	Refer to Code 24 12 troubleshooting procedure.
	Throttle position sensor or linkage is not functioning properly	Refer to throttle position sensor for correct set-up (Appendix D). Refer to Code 21 XX troubleshooting procedure.
	Voltage to ECU too low	Test vehicle battery and charging system. Refer to Code 13 12 troubleshooting procedure.
	Shift selector is not functioning properly	Replace shift selector. Refer to Code 23 XX troubleshooting procedure.

TROUBLESHOOTING—NO CODES PRESENT

Table 4–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION WILL NOT SHIFT TO FORWARD OR REVERSE (STAYS IN NEUTRAL) *(cont'd)*	Disconnected or dirty connectors	Perform connector checkout (refer to Appendix C)
	Faulty wiring harnesses	Repair harness (refer to Appendix C)
	Speed sensor(s) not functioning properly	Repair or replace speed sensor(s) or circuitry (refer to Appendix C and the appropriate transmission service manual). Refer to Codes 22 XX and 25 XX troubleshooting procedures.
	Faulty solenoid circuitry	Refer to Codes 45 XX and 46 XX troubleshooting procedures.
	Faulty ECU	Replace the ECU
	Input function inhibit active	Test input function programming with Allison DOC™ or Pro-Link®. Correct wiring.
TRANSMISSION WILL NOT STAY IN FORWARD OR REVERSE	Quick-to-neutral circuit (input function) faulty	Repair quick-to-neutral circuit
	Leaking at solenoid assembly	Rebuild solenoid assembly (refer to appropriate transmission service manual)
	Faulty solenoid — leaking	Replace solenoid (refer to appropriate transmission service manual)
TRANSMISSION WILL NOT MAKE A SPECIFIC SHIFT	Low engine power	Correct engine problem, refer to engine service manual
	Incorrect fluid level	Correct fluid level
	Extreme fluid temperature	Inspect cooling system and fluid level. Refer to Code 24 23 troubleshooting procedure.
	Faulty speed sensor/circuit	Repair circuit or replace speed sensor(s). Refer to Code 25 XX troubleshooting procedure.
	Faulty solenoid circuitry	Refer to Codes 45 XX and 46 XX troubleshooting procedures.
	Faulty temperature sensor/circuit	Test for temperature reading which inhibits shifts

TROUBLESHOOTING—NO CODES PRESENT

Table 4–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION WILL NOT MAKE A SPECIFIC SHIFT *(cont'd)*	Incorrect calibration	Install proper calibration
	Faulty shift selector	Replace shift selector. Refer to Code 23 XX troubleshooting procedure.
	Hydraulic problem	Refer to Range Clutch Troubleshooting section
	Faulty ECU	Replace the ECU
TRANSMISSION DOES NOT SHIFT PROPERLY (ROUGH SHIFTS, SHIFTS OCCURRING AT TOO LOW OR TOO HIGH SPEED)	Engine idle speed too fast (neutral to range shift)	Adjust engine idle speed (refer to vehicle service manual)
	Faulty throttle sensor/circuit	Refer to throttle sensor section for installation and operation information (Appendix D). Refer to Code 21 XX troubleshooting procedure.
	ECU input voltage low	Test power, ground, charging system, and battery function
	Incorrect shift calibration for vehicle	Install correct calibration
	Instrument panel tachometer incorrect	Repair or replace tachometer
	Incorrectly calibrated electronic speedometer	Calibrate electronic speedometer
	Faulty speed sensor/circuit	Repair circuit or replace speed sensor. Refer to Code 22 XX troubleshooting procedure.
	Loose speed sensor	Tighten speed sensor retaining bracket bolt
	Incorrect fluid level	Correct fluid level
	Crossed wires in harness	Test for crossed wires and correct
	Intermittent problems	Inspect and test wiring harnesses and connectors (refer to Appendix C)
	Loose or damaged speed gear	Tighten loose part or replace loose part, if necessary

TROUBLESHOOTING—NO CODES PRESENT

Table 4–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION DOES NOT SHIFT PROPERLY (ROUGH SHIFTS, SHIFTS OCCURRING AT TOO LOW OR TOO HIGH SPEED) *(cont'd)*	Shift valve sticking	Overhaul valve body assembly (refer to appropriate transmission service manual)
	Trimmer valves sticking	Overhaul valve body assembly (refer to appropriate transmission service manual)
	Faulty trim boost solenoid circuitry	Refer to Code 45 21 troubleshooting procedure
	Trim boost regulator sticking	Overhaul valve body assembly (refer to appropriate transmission service manual)

4–3. SHIFT INHIBITS—NO DIAGNOSTIC CODES

Shift Inhibits are conditions present in the transmission that prevent shifting from taking place due to the state of the transmission. The shift inhibits described below are **not** the result of any malfunction in the transmission or the transmission's control system. As such, **no code** will be related to these inhibits. Use Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool to access the Shift Inhibits data screen in the Diagnostic menu.

1. INPUT SPEED N–>F INHIBIT (INPUT SPD N–>F)

If Input (engine) speed is above a calibration value, and the "SPLOGIC OUTPUT SPEED" is LO, then neutral to drive shifts are allowed. This display updates from N to Y only after a forward range is selected. It will update from Y to N when either the input speed falls below the calibration value or a range other than forward is selected. This value is currently set too high to generate any indication other than N.

2. INPUT SPEED N–>R INHIBIT (INPUT SPD N–>R)

If Input (engine) speed is above a calibration value, then neutral to reverse shifts are inhibited. This display updates from N to Y instantly when the input speed exceeds a calibration value. It will update from Y to N instantly when the input speed falls below the calibration value. This value is currently set too high to generate any indication other than N.

3. SPECIAL FUNCTION RANGE INHIBIT (SPL FUNC RNG)

This inhibit is active (Y) when the Neutral to Range inhibit function is inhibiting shifts. INPUT wire #137 is assigned for Neutral to Range Inhibit operation and is typically tied into the equipment Park Brake System. If this wire is OFF, normal Neutral to Range shifts will not be inhibited by this function. If this wire is ON, the shift selector LED window will flash R or 6, when the selector is moved from Neutral to Reverse or Drive position, and no movement will occur. Determine from I/O menu on Diagnostic Data Reader the state of wire 137. If wire 137 is ON, then the transmission will not shift out of Neutral. Troubleshoot the wiring system to correct the problem.

TROUBLESHOOTING—NO CODES PRESENT

4. MEDIUM COLD OIL INHIBIT (MED COLD OIL)

When the transmission oil is cold (–25ºF to 20ºF), this inhibit limits operation to Reverse, Neutral, and 1st range, and the **CHECK TRANS** light, if available, is illuminated. This inhibit is not utilized for emergency vehicle application.

5. WHEEL LOCK INHIBIT (WHEEL LOCK)

When the output shaft decelerates too rapidly, this inhibit will activate and prevent downshifts. This condition only lasts for approximately 6 seconds. In addition, the lockup clutch, if applied at the time of the rapid decel, will disengage and an alternate shift schedule will be utilized, which may command the transmission to upshift.

6. SPLOGIC THROTTLE and SPLOGIC OUT SPD

SPLOGIC THROTTLE and SPLOGIC OUT SPD inhibitors identify the low (LO)–20 percent ON and 17 percent OFF, and high (HI)–185 rpm ON and 180 rpm OFF, state condition of the Special Pattern Logic.

7. SPECIAL PATTERN LOGIC (SPLOG)

Special Patten Logic is used to determine program actions or inhibits based on the transmission range commanded, range selected, throttle position, and transmission output speed. This inhibit requires the operator to command a range. Depending on the status of 'SPLOGIC THROTTLE' (LO/HI) and 'SPLOGIC OUT SPD' (LO/HI), the 'SPECIAL PATTERN LOGIC' will do one of the following:

- **INHIBIT WARNING (INHIB WARN)** Direction change shifts are inhibited and the shift select range flashes. Look to SPLOGIC THROTTLE or SPLOGIC OUT SPD for HI state indication as possible source of inhibit.
- **COMMAND FORWARD NEUTRAL FORWARD REVERSE (CFNFR)** CFNFR is used to make sure the transmission is below a specific forward range before a shift to either Neutral or Reverse is commanded. Whenever Neutral or Reverse is selected from a forward range, this logic is applied. If the current range is greater than a calibration constant, CFNFR signals the ECU which commands the preselect downshifts until the calibration range is attained, then Neutral is commanded. If the current range is equal to or less than the calibration constant, the ECU will command Neutral. Also, while this logic is applied, the selector digit will flash.
- **NEUTRAL WARNING (NEUT WARN)** The Transmission will shift to Neutral, and the selector digit will flash.
- **ENABLE SHIFTS (ENABLE SHIFT)** This allows the selected direction change shift to be commanded provided the shift is not already inhibited by one of the following direction change inhibit features:

  — Input speed Neutral to Range inhibit

  — Direction change via Neutral Inhibit

  — Any special input function direction change inhibit

TROUBLESHOOTING—NO CODES PRESENT

ADDITIONAL RANGE INHIBIT SCENARIOS

1. No Codes. No R. 1C/L only, regardless of selector forward range selection. R flashes and 1 in all forward selector positions.

   - Bed Hoist Interlock and Hold in Range features are both active. Both are used when the dump bed is raised on end dump trucks. Test wire 177 via 'I/O Wires' diagnostic data menu. If the wire is ON, Reverse will not be available. Test wire 163 via 'I/O Wires' diagnostic data option. If this wire is ON, all forward range selector positions will show a 1 in the selector LED window, and 1st converter and lockup are the only available ranges, unless engine speed attains Hold Override speed, at which time a shift to 2nd higher ranges will occur.

2. No Codes. Won't upshift except at high engine speed. No flashing indicator in shift selector LED window.

   - Delta (Δ) P Hold function is active. Test wire 117 via 'I/O Wires' diagnostic data option menu. If the wire is ON, all upshifts are at the Hold Upshift engine rpm, not the normal full throttle upshift rpm. NOTE: This function is temperature specific. Sump temperature must be at least 120˚F before function is enabled.

3. No Codes. R and 1st available. Sometimes will shift to 2nd and even 3rd range, but not typically above 3rd.

   - Lockup not active. Compare engine rpm versus turbine rpm via 'Diagnostic Data' tools menu. If not the same, or within 1 percent, not enough rpms available at Output Shaft to achieve the next shift.
   - If Sump Temperature is below 70°F or 100°F, depending upon calibration, Lockup will not be available. Measure Sump Temperature via 'Diagnostic Data' diagnostic tools menu.
   - If Automatic Lockup Off function is ON, lockup will not be available. Test wire 154 via 'I/O Wires' diagnostic tools menu.
   - Anti-lock brake function is active. Check wire 177.

4. No Codes. No R.

   - SPLOGIC THROTTLE is HI. This will inhibit N to R shifts. Test TPS % via 'Diagnostic Data' diagnostic tools menu.

TROUBLESHOOTING—NO CODES PRESENT

NOTES

SECTION 5—TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

5–1. DIAGNOSTIC CODE MEMORY

Diagnostic codes are logged in a list in memory (sometimes referred to as the queue), listing the most recently occurring code first and logging up to five codes. The codes contained in the list have information recorded as shown in the table below (codes are examples). Access to the code list position, main code, subcode and active indicator is through either the shift selector display, Allison DOC™ For PC–Service Tool, or the Pro-Link® 9000 diagnostic tool. Access to ignition cycle counter and event counter information is through either of the diagnostic tools only. Further detail on the use of Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tools is presented in Appendix J of this manual.

Table 5–1. Code List

Code List Position	Main Code	Subcode	Active Indicator	Ignition Cycle Counter	Event Counter
d1	21	12	YES	00	10
d2	45	12	YES	00	04
d3	23	12	YES	08	02
d4	34	12	YES	13	01
d5	56	11	YES	22	02
Displayed on shift selector and diagnostic tool d = “diagnostic”			YES = LED indicator illuminated	Not available on shift selector display	

The following paragraphs define the different parts of the code list.

A. Code List Position. The position which a code occupies in the code list. Positions are displayed as “d1” through “d5” (Code List Position #1 through Code List Position #5).

B. Main Code. The general condition or area of fault detected by the ECU.

C. Subcode. The specific area or condition related to the main code in which a fault is detected.

D. Active Indicator. Indicates when a diagnostic code is active. The MODE indicator LED on the shift selector is illuminated or the diagnostic tool displays **YES**.

E. Ignition Cycle Counter. Determines when inactive diagnostic codes are automatically cleared from the code list. The counter is increased by one each time a normal ECU power down occurs (ignition turned off). Inactive codes are cleared from the code list after the counter exceeds 25.

F. Event Counter. Counts the number of occurrences of a diagnostic code. If a code is already in the code list and the code is again detected, that code is moved to position d1, the active indicator is turned on, the Ignition Cycle Counter is cleared, and 1 is added to the Event Counter.

5–2. CODE READING AND CODE CLEARING

Diagnostic codes can be read and cleared by the following methods:

- Allison DOC™ For PC–Service Tool (Allison preferred diagnostic tool)
- Pro-Link® 9000 diagnostic tool (limited support only)
- By entering the diagnostic display mode and using the shift selector display.

The use of Allison DOC™ For PC–Service Tool and Pro-Link® 9000 diagnostic tool is described in the instruction manual furnished with each tool or briefly in Appendix J of this manual. The method for reading and clearing codes described in this section refers to entering the diagnostic display mode by the proper button movements on the shift selector.

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

The diagnostic display mode may be entered for viewing of codes at any speed. Active codes can only be cleared when the output speed = 0 and no output speed sensor failure is active.

A. Reading Codes. Enter the diagnostic display mode by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time on a pushbutton selector, or by momentarily pressing the **DISPLAY MODE** button on a lever shift selector.

NOTE: If a DO NOT SHIFT condition is present (CHECK TRANS light illuminated) at this time, the shift selector may or may not respond to requested range changes.

The code list or queue position is the first item displayed, followed by the main code and the subcode. Each item is displayed for about one second. The display cycles continuously until the next code list position is accessed by pressing the **MODE** button. The following list represents the display cycle using code 25 11 as an example:

1. Code list position—**d**, **1**
2. Main code—**2**, **5**
3. Subcode —**1**, **1**
4. Cycle repeats—**d**, **1**, **2**, **5**, **1**, **1**

To view the second, third, fourth, and fifth positions (d2, d3, d4, and d5), momentarily press the **MODE** button as explained above.

Momentarily press the **MODE** button after the fifth position is displayed to restart the sequence of code list positions.

An active code is indicated by the illumination of the LED indicator when a code position is displayed while in the diagnostic display mode.

Any code position which does not have a diagnostic code logged will display "–" for both the main and subcodes. No diagnostic codes are logged after an empty code position.

B. Clearing Active Indicators. A diagnostic code's active indicator can be cleared, which allows the code inhibit to be cleared but remains in the queue as inactive.

The active indicator clearing methods are:

1. Power down—All active indicators, except code 69 34 (refer to the code chart), are cleared at ECU power down.
2. Self-clearing—Some codes will clear their active indicator when the condition causing the code is no longer detected by the ECU.
3. Manual—Some active indicators can be cleared manually, while in the diagnostic display mode, after the condition causing the code is corrected.

CAUTION:	If an active indicator is cleared while the transmission is locked in a forward range (lock-to-range), the transmission will remain in the forward range after the clearing procedure is completed. Neutral **must be** manually selected.

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

C. Manually Clearing Codes and Active Indicators from the Code List. To clear active indicators or all codes:

1. Enter the diagnostic display mode.
2. Press and hold the **MODE** button for approximately three seconds until the LED indicator flashes. All active indicators are cleared. To remove all inactive codes, press and hold the **MODE** button for about ten seconds until the LED indicator flashes again. All active indicators will be cleared at ECU power down.
3. Codes that cannot be manually cleared will remain.

D. Exiting the diagnostic display mode. Exit the diagnostic display mode using one of the following procedures:

1. On a pushbutton shift selector, press the ↑ (Up) and ↓ (Down) arrow buttons at the same time or press any range button, **D**, **N**, or **R**. The shift (**D**, **N**, or **R**) is commanded if not inhibited by an active code.
2. On a lever shift selector, momentarily press the **DISPLAY MODE** button or move the shift lever to any shift position other than the one it was in when the diagnostic display mode was activated. If the shift is inhibited, the ECU will continue to command the current transmission range attained and the lever should be returned to its original position.
3. Wait until timeout (approximately 10 minutes) and the system will automatically return to the normal operating mode.
4. Turn off power to the ECU (turn off the vehicle engine at the ignition switch).

5–3. DIAGNOSTIC CODE RESPONSE

The following ECU responses to a fault provide for safe transmission operation:

- **D**o **N**ot **S**hift (DNS) Response
  - — Release lockup clutch and inhibit lockup operation.
  - — Inhibit all shifts.
  - — Turn on the **CHECK TRANS** light.
  - — Shift selector display flashes the range selected.
  - — Ignore any range selection inputs from the pushbutton or lever shift selector.
- **SOL**enoid **OFF** (SOL OFF) Response
  - — All solenoids are commanded off.

5–4. SHIFT SELECTOR DISPLAYS RELATED TO ACTIVE CODES

- "Cateye"—The forward slash segments and the middle horizontal segments (-/-) may be on under the following conditions:
  - — RSI link fault is active (code 23 12 or 23 14)
  - — Shift selector display line fault is active (23 16)
  - — When two COP timeouts occur within two seconds of each other (reference code 69 33)
  - — Range verification ratio test–Neutral (56 99)

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

- All Segments Displayed—All display segments will be illuminated if a severity 1 diagnostic code is present during initialization, or if an electrical code for any solenoid is logged before initialization completes.

5–5. DIAGNOSTIC CODE LIST AND DESCRIPTION

Table 5–2. CEC2 Diagnostic Codes

Main Code	Sub-code	Description	CHECK TRAN Light	Inhibited Operation Description
13 (pg 5–12)	12	ECU input voltage, low	Yes	DNS
	23	ECU input voltage, high	Yes	DNS
21 (pg 5–16)	12	Throttle position sensor, failed low	Yes	Use throttle default values
	23	Throttle position sensor, failed high	Yes	Use throttle default values
22 (pg 5–20)	14	Engine speed sensor reasonableness test	Yes	Use default engine speed
	15	Turbine speed sensor reasonableness test	Yes	DNS, lock in current range
	16	Output speed sensor reasonableness test	Yes	DNS, lock in current range
23 (pg 5–24)	12	Primary shift selector or RSI link fault	Yes	Hold in last valid direction. May cause “cateye” (-/-) display.
	13	Primary shift selector mode function fault	No	Mode change not permitted
	14	Secondary shift selector or RSI link fault	Yes	Hold in last valid direction. May cause “cateye” (-/-) display.
	15	Secondary shift selector mode function fault	No	Mode change not permitted
	16	Shift Selector display line fault	Yes	None. May cause “cateye” (-/-) display.
24 (pg 5–26)	12	Sump fluid temperature, cold	Yes	DNS, lock-to-range
	23	Sump fluid temperature, hot	Yes	No upshifts above a calibration range
25 (pg 5–30)	11	Output speed sensor, detected at 0 output rpm, 1st	Yes	DNS, lock in current range (1st)
	22	Output speed sensor, detected at 0 output rpm, 2nd	Yes	DNS, lock in current range (2nd)
	33	Output speed sensor, detected at 0 output rpm, 3rd	Yes	DNS, lock in current range (3rd)
	44	Output speed sensor, detected at 0 output rpm, 4th	Yes	DNS, lock in current range (4th)

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

Table 5–2. CEC2 Diagnostic Codes *(cont'd)*

Main Code	Sub-code	Description	CHECK TRAN Light	Inhibited Operation Description
25 *(cont'd)*	55	Output speed sensor, detected at 0 output rpm, 5th	Yes	DNS, lock in current range (5th)
	66	Output speed sensor, detected at 0 output rpm, 6th	Yes	DNS, lock in current range (6th)
	77	Output speed sensor, detected at 0 output rpm, 7th	Yes	DNS, lock in current range (7th)
	88	Output speed sensor, detected at 0 output rpm, 8th	Yes	DNS, lock in current range (8th)
26 (pg 5–33)	00	Throttle source not detected	No	Use throttle default values
33 (pg 5–34)	12	Sump fluid temperature sensor failed low	Yes	Use default value of 93˚C (200˚F)
	23	Sump fluid temperature sensor failed high	Yes	Use default value of 93˚C (200˚F)
34 (pg 5–37)	12	Factory calibration compatibility number wrong	Yes	DNS, SOL OFF
	13	Factory calibration fault	Yes	DNS, SOL OFF
	14	Power off fault	Yes	Use previous location, or factory calibration
	15	Diagnostic queue fault	Yes	Use previous location, or clear diagnostic queue
	16	Real time fault	Yes	DNS, SOL OFF
	17	Customer modifiable constants fault	Yes	DNS, SOL OFF
35 (pg 5–38)	00	Power interruption (code set after power restored)	No	None (hydraulic default during interruption)
	16	Real time write interruption	Yes	DNS, SOL OFF
36 (pg 5–41)	00	Hardware/software not compatible	Yes	DNS, SOL OFF
45 (pg 5–42)	12	General solenoid failure—F	Yes	DNS
	13	General solenoid failure—K	Yes	DNS, Inhibit lockup
	14	General solenoid failure—B	Yes	DNS, Inhibit Reverse
	15	General solenoid failure—G	Yes	DNS

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

Table 5–2. CEC2 Diagnostic Codes *(cont'd)*

Main Code	Sub-code	Description	CHECK TRAN Light	Inhibited Operation Description
45 *(cont'd)*	16	General solenoid failure—E	Yes	DNS
	21	General solenoid failure—H/J	Yes	Turn off trim boost J, DNS H
	22	General solenoid failure—A	Yes	No action taken
	23	General solenoid failure—D	Yes	DNS
	24	General solenoid failure—I	Yes	No action taken
	26	General solenoid failure—C	Yes	DNS
46 (pg 5–46)	21	Hi side overcurrent, H/J solenoid	Yes	Turn off H/J solenoid, DNS 8610, 9810
	26	Hi side overcurrent, C, D, E solenoid circuit	Yes	Turn off C, D, E solenoids
	27	Hi side overcurrent, A, B, F, G, I, K solenoid circuit	Yes	DNS. Turn off A, B, F, G, I, K solenoids.
56 (pg 5–48)	11	Range verification ratio test, 1st	Yes	DNS
	22	Range verification ratio test, 2nd	Yes	DNS
	33	Range verification ratio test, 3rd	Yes	DNS
	44	Range verification ratio test, 4th	Yes	DNS
	55	Range verification ratio test, 5th	Yes	DNS
	66	Range verification ratio test, 6th	Yes	DNS
	77	Range verification ratio test, 7th or R1	Yes	DNS
	88	Range verification ratio test, 8th or R2	Yes	DNS
	99	Neutral verification ratio test, N	Yes	DNS, "cateye" (-/-) display
65 (pg 5–50)	00	Engine rating too high	Yes	DNS, Lock-in-neutral
66 (pg 5–52)	00	Serial communications interface fault	No	Use default throttle values
69 (pg 5–54)	27	ECU, inoperative A, B, F, G, I, K solenoid	Yes	DNS, SOL OFF
	28	ECU, inoperative H/J solenoid	Yes	DNS, SOL OFF
	29	ECU, inoperative C, D, E solenoid	Yes	DNS, SOL OFF
	33	ECU, Computer Operating Properly (COP) fault	Yes	Reset ECU, shutdown ECU on 2nd occurrence (power loss; hydraulic defaults). May cause "cateye" (-/-) display or all segments blank display

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

Table 5–2. CEC2 Diagnostic Codes *(cont'd)*

Main Code	Sub-code	Description	CHECK TRAN Light	Inhibited Operation Description
69 *(cont'd)*	34	ECU, EEPROM, fault	Yes	DNS, SOL OFF
	35	ECU, EEPROM, fault	Yes	Reset ECU
	39	Communication chip addressing error	Yes	Use defaults for J1939 data
	42	SPI output failure	No	GPO 1–8 and reverse warning inoperable
	43	SPI input failure	Yes	DNS, lock-in-range

CODE 13 XX—ECU INPUT VOLTAGE

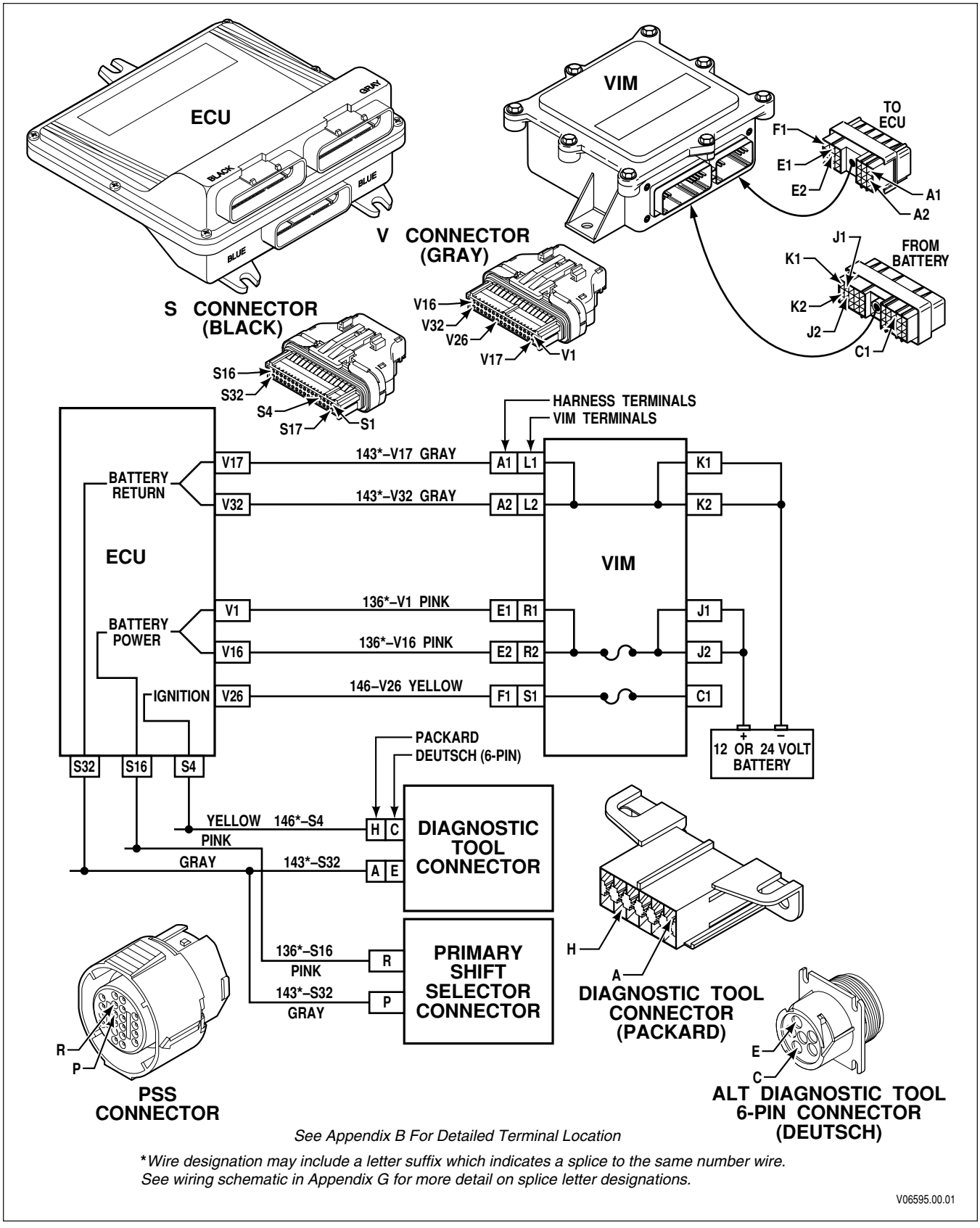


Figure 5–1. Code 13 Schematic Drawing

CODE 13 XX—ECU INPUT VOLTAGE *(Figure 5–1)*

Main code 13 indicates either a high or low input voltage. Low voltage is less than 8 volts. High voltage is over 33 volts.

Common causes for a low voltage code are:

- Bad batteries
- Faulty vehicle charging system
- No dedicated power and ground connection directly to the battery or through an electronic bus bar to the battery

Common causes for the high voltage code are:

- Faulty vehicle alternator
- Faulty vehicle voltage regulator

Main Code	Subcode	Meaning
13	12	Battery voltage to the ECU too low
13	23	Battery voltage to the ECU too high

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

B. Troubleshooting:

1. Connect a diagnostic tool and turn on vehicle ignition. Select Diagnostic Data to find input voltage. Record reading.
2. Turn off vehicle ignition and remove the connectors from the ECU.
3. Test the system voltage at wire 136A and 136C, pin V1 and V16. If power is low or high at this point, and the diagnostic tool reading is also low or high, the vehicle wiring is suspect. Test for fuse problems, lack of battery-direct power and ground, faulty charging system/batteries, and loose or dirty connections (refer to Appendix A). Power may also be low or high at pins V1 and V16 (system power) if the batteries/charging system is faulty. Bad grounds may also cause incorrect input power readings.
4. If power is correct but the diagnostic tool reading indicates incorrect voltage, closely inspect terminals V1 and V16 or S16; make sure they are not corroded or deformed. Clean or replace as necessary (refer to Appendix C, Paragraph C–1).
5. If the voltage condition is intermittent, closely inspect the vehicle wiring for transmission system power and grounds. Inspect for loose, dirty, or painted connections. Inspect the VIM for loose, incorrect, or overheating relays or fuses (refer to APPENDIX E—WELDING ON VEHICLE/ VEHICLE INTERFACE MODULE). Inspect for wires that are chafed and touching other components.
6. If no other cause is found, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works,

CODE 13 XX—ECU INPUT VOLTAGE *(Figure 5–1)*

inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

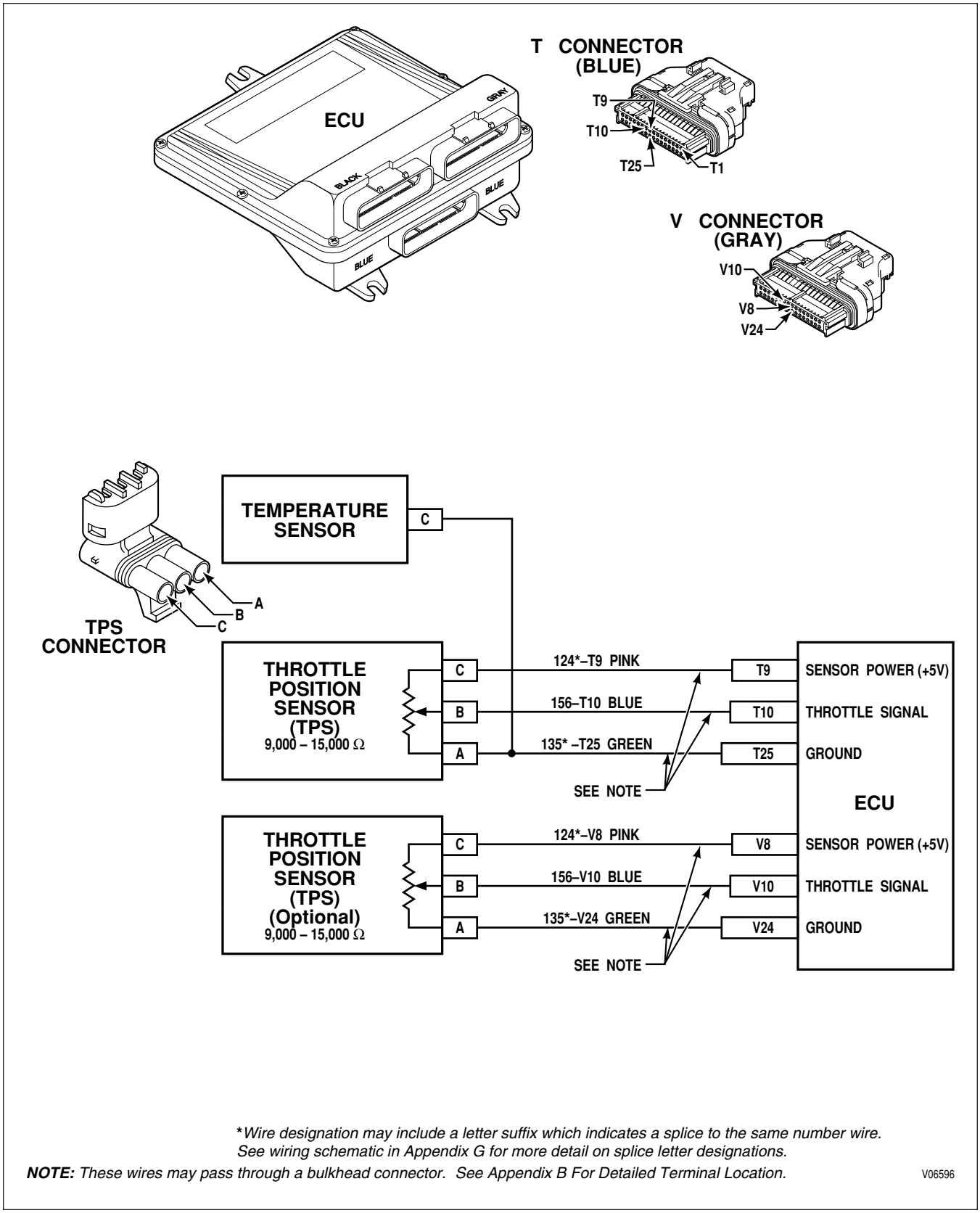
Table 5–3. Voltage Chart

Voltage	Condition
33.0 (High Set Point)	High Fail Limit, Set Code, DNS
32.0	Maximum Continuous ECU Voltage
8.0 (Low Set Point)	Low Voltage Fail Limit, Set Code, DNS
7.0	Software Off (ECU loses power)
4.5	Neutral Start Off

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

NOTES

CODE 21 XX—THROTTLE FAULT



*****Wire designation may include a letter suffix which indicates a splice to the same number wire. See wiring schematic in Appendix G for more detail on splice letter designations.

NOTE: *These wires may pass through a bulkhead connector. See Appendix B For Detailed Terminal Location.*

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Figure 5–2. Code 21 Schematic Drawing

CODE 21 XX—THROTTLE FAULT *(Figure 5–2)*

The throttle position sensor (TPS) **must have been** recognized by autodetect or manually selected using Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool (refer to the manual supplied with the diagnostic tool being used) before these codes can be logged. See Paragraph 1–9 for further information.

Main code 21 indicates the throttle position sensor has been retracted or extended by its linkage into an error zone. This may be due to a fault with the sensor, or a fault in the wiring to the sensor or to the ECU. Code 21 12 is set when the ECU receives TPS counts of 14 or less. Code 21 23 is set when the ECU senses TPS counts of 233–255. Whenever a code 21 XX condition is detected, the system uses default throttle values.

NOTE: Code 21 XX in conjunction with code 33 XX indicates the potential loss of common ground wire 135 between the throttle and temperature sensor.

Main Code	Subcode	Meaning
21	12	Throttle position sensor failed low
21	23	Throttle position sensor failed high

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 4–1. Also, measure the ECU input voltage.

B. Troubleshooting:

1. Plug in a diagnostic tool, select Diagnostic Data, and read throttle counts and percent. If the TPS failed high (code 21 23), the problem may be toward the full throttle end of the TPS travel. If the TPS failed low (code 21 12), the problem may be at the closed throttle end of the TPS travel.

NOTE: Code 21 12 may occur when the throttle source is J1587 or J1939 and an analog throttle source is falsely detected. This condition may be due to a problem in an unused TPS branch of a universal external harness. To prevent this occurrence, remove wire 156 from the ECU connector and insert a cavity plug in the space vacated by the wire. Be sure that the unused TPS branch is routed away from potential induced voltage sources and the connector is protected from external contamination.

NOTE: Code 21 12 can result when the +5V line (wire 124) which powers the analog sensor is shorted to ground. Wire 124 also powers the shift selector and is present in all three ECU connectors.

2. If counts are high but the percentage never reaches 100 percent, TPS linkage may have bound up and overstroked the TPS to set a false 100 percent reading. After TPS overstroking ceases, the TPS will not automatically return to 100 percent. After the TPS is correctly installed and adjusted, use Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool to reset throttle calibration or cycle the ignition 5 times to reset the 0 percent and 100 percent settings. Refer to the TPS section of this book (Appendix D) for installation and adjustment procedures.

3. If the throttle counts do not change or are erratic, test the throttle sensor wiring for opens, shorts between wires, or shorts-to-ground. Also test for correct TPS voltages using test wiring harness J 41339. If wiring problems are found, isolate and repair the fault (refer to Appendix C for repair information).

CODE 21 XX—THROTTLE FAULT *(Figure 5–2)*

4. If the wiring is satisfactory, replace the throttle position sensor and adjust its linkage so the counts are not in the error zones (refer to Appendix D).

5. If the TPS and its linkage adjustment are correct and the wiring to the sensor is satisfactory, the condition is intermittent. Replace the sensor and properly adjust the new sensor.

6. If the condition recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the TPS circuit. Refer to Appendix C for connector repair information.

7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

NOTE: A good throttle position sensor should have resistance of:

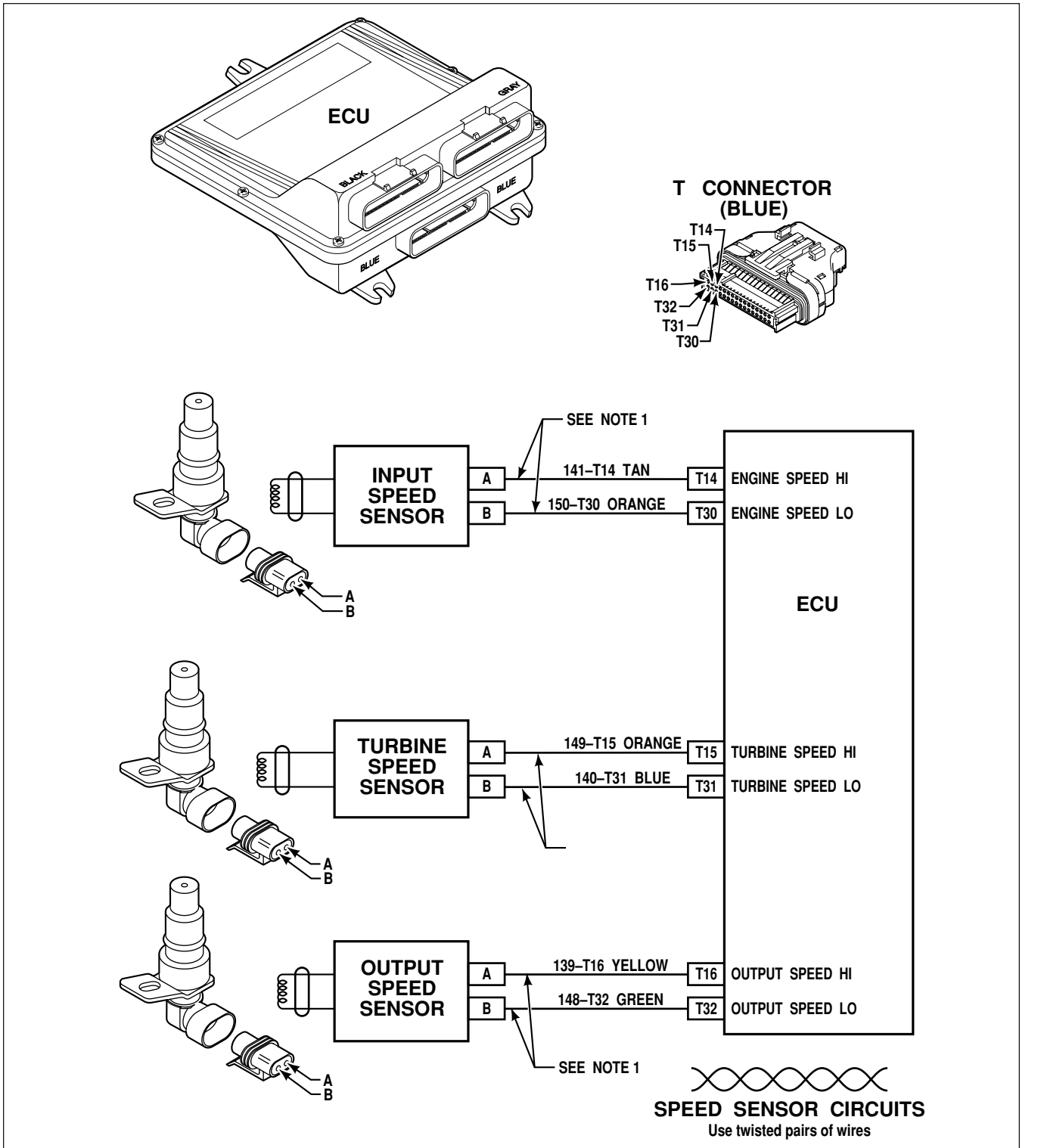
(1) 9000–15,000 Ohms across terminals A and C.

(2) 500 Ohms, moving to 9000–15,000 Ohms as TPS is moved from the fully retracted to the fully extended position, measured across terminals A and B (refer to Figure 1–6).

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

NOTES

CODE 22 XX—SPEED SENSOR/CIRCUITRY FAULT



See Appendix B For Detailed Terminal Location.

NOTE 1: *These wires may pass through a bulkhead connector.*

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Figure 5–3. Code 22 Schematic Drawing

CODE 22 XX—SPEED SENSOR/CIRCUITRY FAULT *(Figure 5–3)*

Main code 22 indicates a fault within a speed sensor, the wiring to a speed sensor, incorrect speed sensor gap, or damaged bumps or teeth which create the speed signal. This fault is determined by the reasonableness of a speed sensor signal when compared with the other two speed sensors and the commanded range. A speed sensor will not pass the reasonableness test if there is no signal at all from that sensor when a signal should be present.

NOTE: If the input (engine) speed sensor code (22 14) is active and a range verification test is failed, the range verification code will not be set but a DO NOT SHIFT response is commanded.

Main Code	Subcode	Failed Sensor
22	14	Input (Engine) Speed
22	15	Turbine Speed
22	16	Output Speed

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 4–1. Also, measure the ECU input voltage.

B. Troubleshooting:

1. Determine if the sensor is loose, missing, or disconnected. If not, disconnect the wiring harness from the sensor and measure the resistance of the sensor (see chart below). Also inspect the terminals for dirt, corrosion, or damage. If resistance is not correct, replace the sensor.

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

2. Remove the transmission harness connector from the ECU. Test the sensor circuit (in the external harness) for open wires, shorts between wires, or shorts-to-ground. Isolate and repair any faults (refer to Appendix C for repair information).
3. If no opens or shorts are found, the condition must be intermittent. Replace the sensor indicated by the trouble code. Before replacing a speed sensor, inspect the sensor for physical damage or contamination. Refer to the appropriate transmission service manual for proper replacement procedure.
4. If the condition recurs, install new wiring (twisted-pair) for the sensor circuit between the ECU and the transmission. Use St. Clair P/N 200153 Service Harness Twisted Pair for this purpose.

CODE 22 XX—SPEED SENSOR/CIRCUITRY FAULT *(Figure 5–3)*

5. If the condition again recurs, connect the diagnostic tool and select the speed signal indicated by the trouble code. Drive the vehicle and watch the speed reading on the diagnostic tool. If the signal is erratic, the following may be inducing the erratic signal:

   - Sensor gap
   - Vehicle vibration
   - External AC signal source
   - Intermittent connector contact.

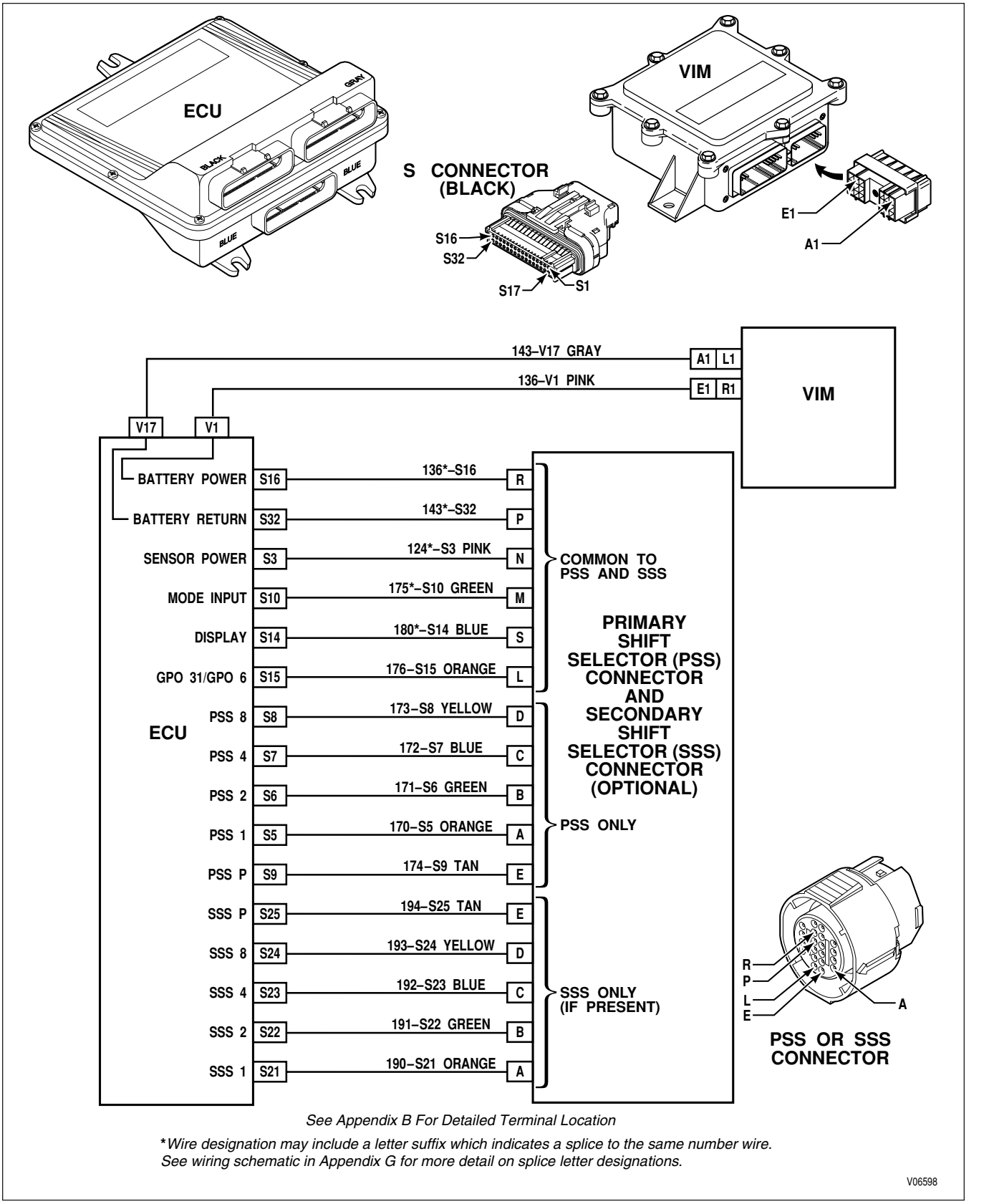
   Inspect the sensor and its surroundings for irregularities that would affect sensor gap. Isolate and correct any abnormal vehicle vibrations, particularly driveline and abnormal engine torsionals. Refer to the Off-Highway Tech Data on the Allison Transmission extranet through an Allison distributor, dealer, or OEM. Also refer to the Applications Manual, Section C. Re-test the sensor wiring for intermittent conditions (refer to Appendix A).

6. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

NOTES

CODE 23 XX—SHIFT SELECTOR



See Appendix B For Detailed Terminal Location

**Wire designation may include a letter suffix which indicates a splice to the same number wire. See wiring schematic in Appendix G for more detail on splice letter designations.*

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Figure 5–4. Code 23 Schematic Drawing

CODE 23 XX—SHIFT SELECTOR *(Figure 5–4)*

Main code 23 indicates a fault with a shift selector or the wiring between a shift selector and the ECU.

Main Code	Subcode	Meaning
23	12	Primary shift selector fault—a "cateye" (-/-) type display may occur
23	13	Primary shift selector mode function fault. Mode change not permitted
23	14	Secondary shift selector fault—a "cateye" (-/-) type display may occur
23	15	Secondary shift selector mode function fault. Mode change not permitted
23	16	Shift selector display line fault

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 4–1.

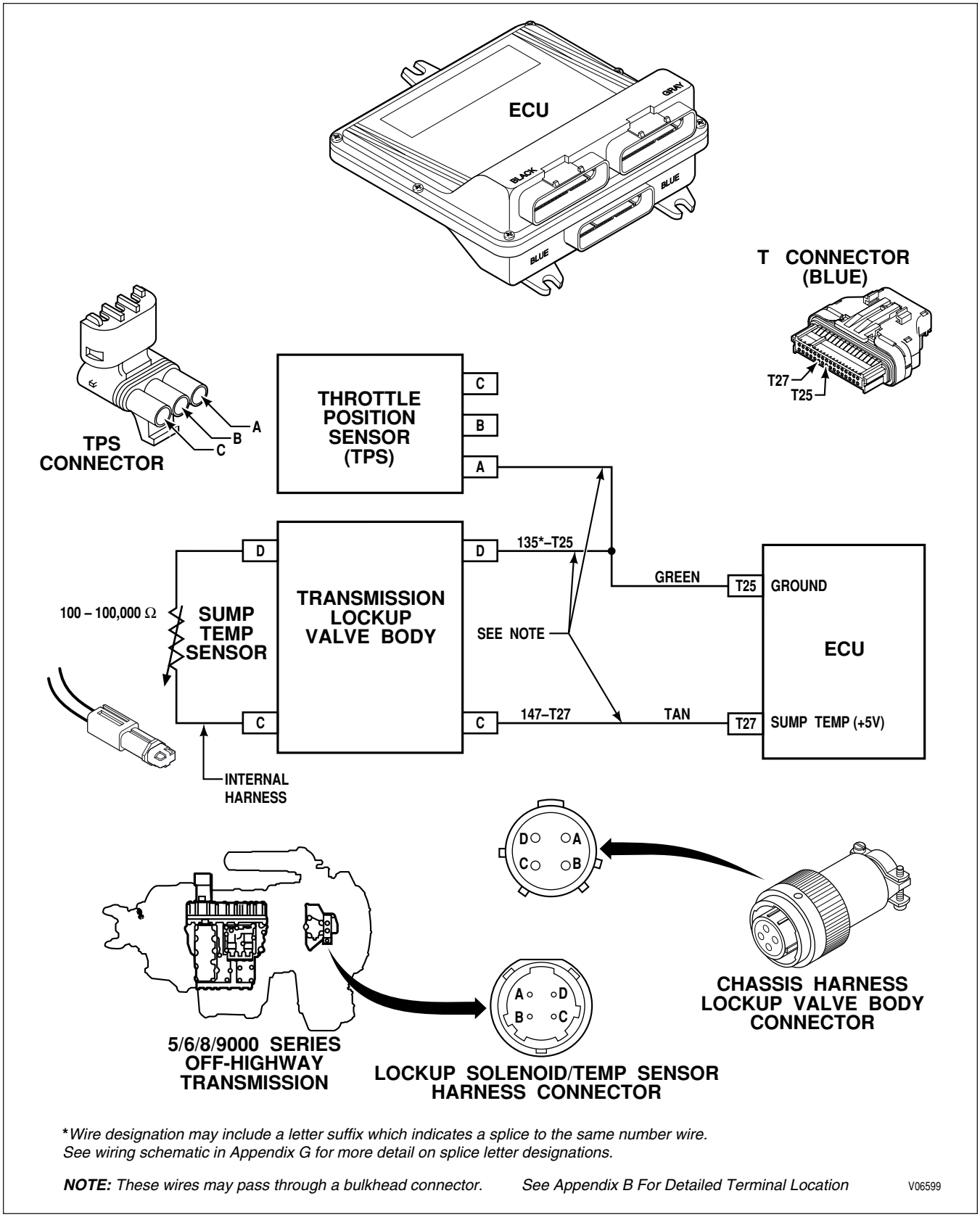
B. Troubleshooting:

1. Clear the active indicator for code 23 XX. If code recurs, continue to Step (2).
2. Inspect for a poor connection at the shift selector.

NOTE: Code 23 12 can result when the +5V line (wire 124) which powers the shift selector is shorted to ground. Wire 124 also powers the TPS and is present in all three ECU connectors.

3. Disconnect the selector "S" harness connector from the ECU and from the shift selector and test for opens, shorts, and shorts-to-ground between the shift selector and ECU (refer to Section 3). Repair as needed (refer to Appendix C).
4. If no problem is found with the shift selector connection or wiring, replace the shift selector.
5. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 24 XX—SUMP FLUID TEMPERATURE



*****Wire designation may include a letter suffix which indicates a splice to the same number wire.*
See wiring schematic in Appendix G for more detail on splice letter designations.

NOTE: *These wires may pass through a bulkhead connector.* *See Appendix B For Detailed Terminal Location* V06599

Figure 5–5. Code 24 Schematic Drawing

CODE 24 XX—SUMP FLUID TEMPERATURE *(Figure 5–5)*

Main code 24 indicates the ECU has detected either a high or low fluid temperature in the transmission (via the sump temperature sensor in the internal lockup valve body harness). All shifts are inhibited when code 24 12 is set (only Neutral range operation is allowed). No upshifts are allowed above a calibration range when code 24 23 is set. All inhibits are cleared when the temperature conditions are normal. A related code is 33 12 which indicates a temperature reading outside the usable range of the sensor and indicates a probable sensor failure.

Detailed troubleshooting information for the sump thermistor is shown in Appendix L.

Main Code	Subcode	Meaning
24	12	Sump fluid temperature cold
24	23	Sump fluid temperature hot

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 4–1. Also, measure the ECU input voltage.

B. Troubleshooting:

Code 24 12:

1. If the outside temperature is between –25˚F (–32˚C) and +20˚F (–7˚C), the ECU will allow reverse, neutral, and limited forward drive operation. Only hold override upshifts are allowed (refer to Table 5–4 on next page.) The sump **must be warmed** to an acceptable temperature to avoid logging codes and transmission diagnostic response.

NOTE: Code 24 12 can result when the +5V line (wire 147) which powers the sump temperature sensor is shorted to ground.

2. After allowing the temperatures to normalize, if ambient temperature does not match the sump temperature reading (test using a diagnostic tool), compare resistance versus sump fluid temperature. Refer to Appendix L. If resistance measurement is acceptable, then test the sensor wiring for opens, shorts, or shorts-to-ground.
3. If the sensor wiring is satisfactory, remove the lockup body cover and replace the temperature sensor which is in the internal lockup harness (refer to appropriate transmission service manual).
4. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage that may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 24 XX—SUMP FLUID TEMPERATURE

Table 5–4. Transmission Operation as a Function of Temperature

Condition	˚F	˚C
Temperature sensor failed high (refer to code 33 23)	350*	177
Hot fluid (code 24 23) maximum range limited	250*	121
Medium cold fluid R, N, D allowed (hold override upshifts only)	20*	–7
Temperature sensor failed low (refer to code 33 12)	–55*	–48

Code 24 23:

1. Install temperature gauges for transmission temperature and engine water temperature. Drive the vehicle. Verify that the code can be reproduced and verify the reading shown on the diagnostic tool. Observe the gauges and test for hot fluid when the code is produced.
2. If the fluid is not hot when the code is produced, remove the transmission "T" harness connector at the ECU and the transmission. Test the fluid temperature sensor wiring for opens, shorts, and shorts-to-ground. Compare the resistance readings of the sensor and the actual temperature shown on the gauge with the chart information in Figure 5–6. If wiring problems or a great difference between temperature and resistance compared with the chart are found, remove the lockup valve body cover and replace the temperature sensor which is part of the internal lockup harness (refer to the appropriate transmission service manual). If wiring problems are found, repair or replace as necessary.
3. If the fluid is hot when the code is produced, observe the gauges to see if the engine became hot before the transmission. If the engine cooling system is overheating and heating the transmission, the problem is with the engine or its cooling system.
4. If the transmission became hot before the engine, allow the vehicle to idle for 3–5 minutes and determine the transmission fluid level. Correct the fluid level if necessary.
5. If no problems are found in the transmission, remove the transmission and disassemble, inspecting for causes of overheating (stuck stator, plugged orifices, dragging clutches, etc.). Refer to the appropriate transmission service manual.

C. Resistance Vs. Temperature Characteristics

Figure 5–6 is a graph of the temperature indicated by the resistance measured in the thermistor. The thermistor has a negative temperature coefficient which means the indicated temperature increases as the measured resistance decreases within a range of about 200,000 Ohms down to about 50 Ohms.

* This is a programmed value subject to change.

CODE 24 XX—SUMP FLUID TEMPERATURE

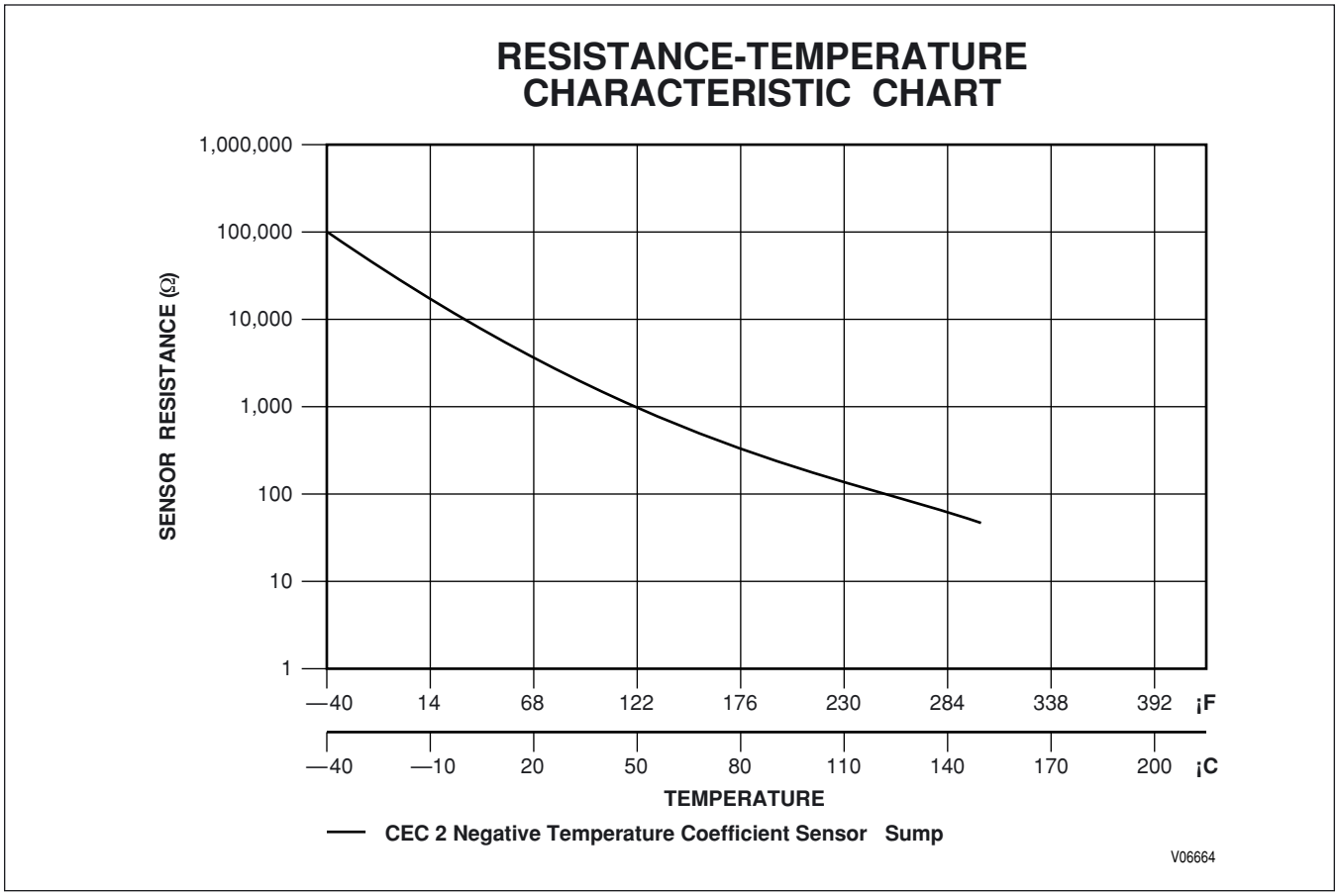


Figure 5–6. Temperature Sensor Chart

NOTE: ***Look carefully at the graph. The scale for the resistance (on the left side) is not constant (linear). It is logarithmic which means it can display a great range of values within a small space. Each section of the graph is ten units, but the units vary from 1 to 100,000 Ohms.***

The following table shows the range of resistance values that correspond to the sump fluid temperature shown in one degree increments over the operating range of the thermistors.

Table 5–5. Sump Thermistor—Resistance (Ohms) vs. Temperature

Sump Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nominal Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nominal Ohms	Hi Ohms
–50	–58	202642	182288	226183	–11	12.2	17043	16424	17900
–49	–56.2	188561	169859	210206	–10	14	16120	15540	16924
–48	–54.4	175549	158357	195459	–9	15.8	15251	14709	16006
–47	–52.6	163519	147708	181840	–8	17.6	14434	13927	15143
–46	–50.8	152390	137844	169255	–7	19.4	13666	13190	14331
–45	–49	142089	128702	157621	–6	21.2	12942	12497	13567
–44	–47.2	132550	120224	146860	–5	23	12261	11844	12848
–43	–45.4	123711	112359	136900	–4	24.8	11619	11228	12171
–42	–43.6	115517	105057	127678	–3	26.6	11014	10648	11533

CODE 24 XX—SUMP FLUID TEMPERATURE

Table 5–5. Sump Thermistor—Resistance (Ohms) vs. Temperature *(cont'd)*

Sump Thermistor					Sump Thermistor				
Degree C	**Degree F**	**Lo Ohms**	**Nominal Ohms**	**Hi Ohms**	**Degree C**	**Degree F**	**Lo Ohms**	**Nominal Ohms**	**Hi Ohms**
–41	–41.8	107917	98276	119134	–2	28.4	10444	10101	10932
–40	–40	100865	95956	107181	–1	30.2	9906	9585	10365
–39	–38.2	94317	89769	100181	0	32	9399	9098	9831
–38	–36.4	88235	84019	93681	1	33.8	8921	8638	9329
–37	–34.6	82582	78674	87642	2	35.6	8470	8203	8854
–36	–32.8	77326	73701	82030	3	37.4	8044	7793	8407
–35	–31	72437	69073	76811	4	39.2	7643	7406	7985
–34	–29.2	67886	64764	71956	5	41	7263	7041	7587
–33	–27.4	63649	60749	67497	6	42.8	6905	6696	7211
–32	–25.6	59702	57008	63228	7	44.6	6567	6369	6855
–31	–23.8	56024	53520	59308	8	46.4	6247	6061	6519
–30	–22	52594	50266	55654	9	48.2	5944	5769	6202
–29	–20.2	49394	47229	52247	10	50	5658	5493	5902
–28	–18.4	46408	44394	49069	11	51.8	5387	5231	5618
–27	–16.6	43620	41746	46102	12	53.6	5131	4984	5349
–26	–14.8	41016	39271	43332	13	55.4	4888	4750	5095
–25	–13	38583	36958	40745	14	57.2	4659	4528	4854
–24	–11.2	36308	34794	38328	15	59	4441	4318	4626
–23	–9.4	34181	32770	36088	16	60.8	4235	4118	4410
–22	–7.6	32190	30875	33954	17	62.6	4039	3929	4205
–21	–5.8	30327	29101	31976	18	64.4	3854	3750	4011
–20	–4	28582	27439	30125	19	66.2	3678	3580	3827
–19	–2.2	26948	25881	28391	20	68	3511	3418	3653
–18	–0.4	25417	24420	26767	21	69.8	3353	3265	3487
–17	1.4	23981	23051	25245	22	71.6	3202	3120	3330
–16	3.2	22634	21766	23818	23	73.4	3060	2981	3180
–15	5	21371	20660	22480	24	75.2	2924	2850	3039
–14	6.8	20185	19427	21225	25	77	2795	2725	2904
–13	8.6	19072	18363	20046	26	78.8	2673	2606	2776
–12	10.4	18026	17363	18940	27	80.6	2556	2493	2655
28	82.4	2445	2385	2540	67	152.6	520.9	509.8	540.9
29	84.2	2340	2282	2430	68	154.4	502.8	492.1	522.2
30	86	2240	2185	2326	69	156.2	485.4	475.2	504.1
31	87.8	2144	2092	2227	70	158	468.7	458.9	486.8
32	89.6	2053	2003	2132	71	159.8	452.7	443.2	470.2
33	91.4	1967	1919	2043	72	161.6	437.3	428.2	454.2
34	93.2	1884	1839	1957	73	163.4	422.5	413.7	438.9
35	95	1806	1763	1875	74	165.2	408.3	399.8	424.1
36	96.8	1731	1690	1797	75	167	394.6	386.5	410

CODE 24 XX—SUMP FLUID TEMPERATURE

Table 5–5. Sump Thermistor—Resistance (Ohms) vs. Temperature *(cont'd)*

Sump Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nominal Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nominal Ohms	Hi Ohms
37	98.6	1660	1620	1723	76	168.8	381.5	373.6	396.3
38	100.4	1592	1554	1653	77	170.6	368.9	361.3	383.2
39	102.2	1527	1491	1585	78	172.4	356.7	349.4	370.6
40	104	1465	1430	1521	79	174.2	345	338	358.5
41	105.8	1406	1373	1459	80	176	333.8	327	346.8
42	107.6	1349	1318	1401	81	177.8	322.9	316.4	335.6
43	109.4	1296	1265	1345	82	179.6	312.5	306.2	324.7
44	111.2	1244	1215	1291	83	181.4	302.5	296.4	314.3
45	113	1195	1167	1240	84	183.2	292.8	288.9	304.3
46	114.8	1148	1122	1192	85	185	283.5	277.8	294.6
47	116.6	1103	1078	1145	86	186.8	274.5	269	285.4
48	118.4	1060	1036	1100	87	188.6	265.9	260.5	276.5
49	120.2	1019	996.3	1058	88	190.4	257.6	253.3	268
50	122	980.3	958.1	1017	89	192.2	249.5	244.3	259.7
51	123.8	942.9	921.6	978.4	90	194	241.8	236.7	251.7
52	125.6	907.1	886.7	941.4	91	195.8	234.4	229.4	244
53	127.4	872.9	853.3	905.9	92	197.6	227.2	222.3	236.6
54	129.2	840.1	821.4	871.9	93	199.4	220.2	215.5	229.5
55	131	808.8	790.8	839.4	94	201.2	213.5	208.9	222.6
56	132.8	778.8	761.5	808.3	95	203	207.1	202.5	215.9
57	134.6	750	733.5	778.5	96	204.8	200.9	196.4	209.5
58	136.4	722.5	706.6	750	97	206.6	194.8	190.5	203.3
59	138.2	696.2	680.9	722.7	98	208.4	189	184.8	197.3
60	140	670.9	656.2	696.5	99	210.2	183.4	179.2	191.5
61	141.8	646.7	632.6	671.4	100	212	178	173.9	185.9
62	143.6	623.5	609.9	647.3	101	213.8	172.8	168.8	180.5
63	145.4	601.2	588.2	624.2	102	215.6	167.8	163.8	175.3
64	147.2	579.9	567.4	602.1	103	217.4	162.9	159	170.3
65	149	559.4	547.4	580.8	104	219.2	158.2	154.4	165.4
66	150.8	539.8	528.2	560.5	105	221	159.6	149.9	160.7
106	222.8	149.2	145.6	156.2	129	264.2	79.56	77.35	83.77
107	224.6	145	141.4	151.8	130	266	77.54	75.37	81.65
108	226.4	140.9	137.4	147.5	131	267.8	75.58	73.46	79.6
109	228.2	136.9	133.5	143.4	132	269.6	73.67	71.6	77.61
110	230	133.1	129.7	139.4	133	271.4	71.82	69.8	75.68
111	231.8	129.4	126.1	135.6	134	273.2	70.03	68.05	73.8
112	233.6	125.8	122.6	131.9	135	275	68.29	66.35	71.98
113	235.4	122.3	119.2	128.2	136	276.8	66.6	64.7	70.21
114	237.2	118.9	115.9	124.8	137	278.6	64.96	63.11	68.5

CODE 24 XX—SUMP FLUID TEMPERATURE

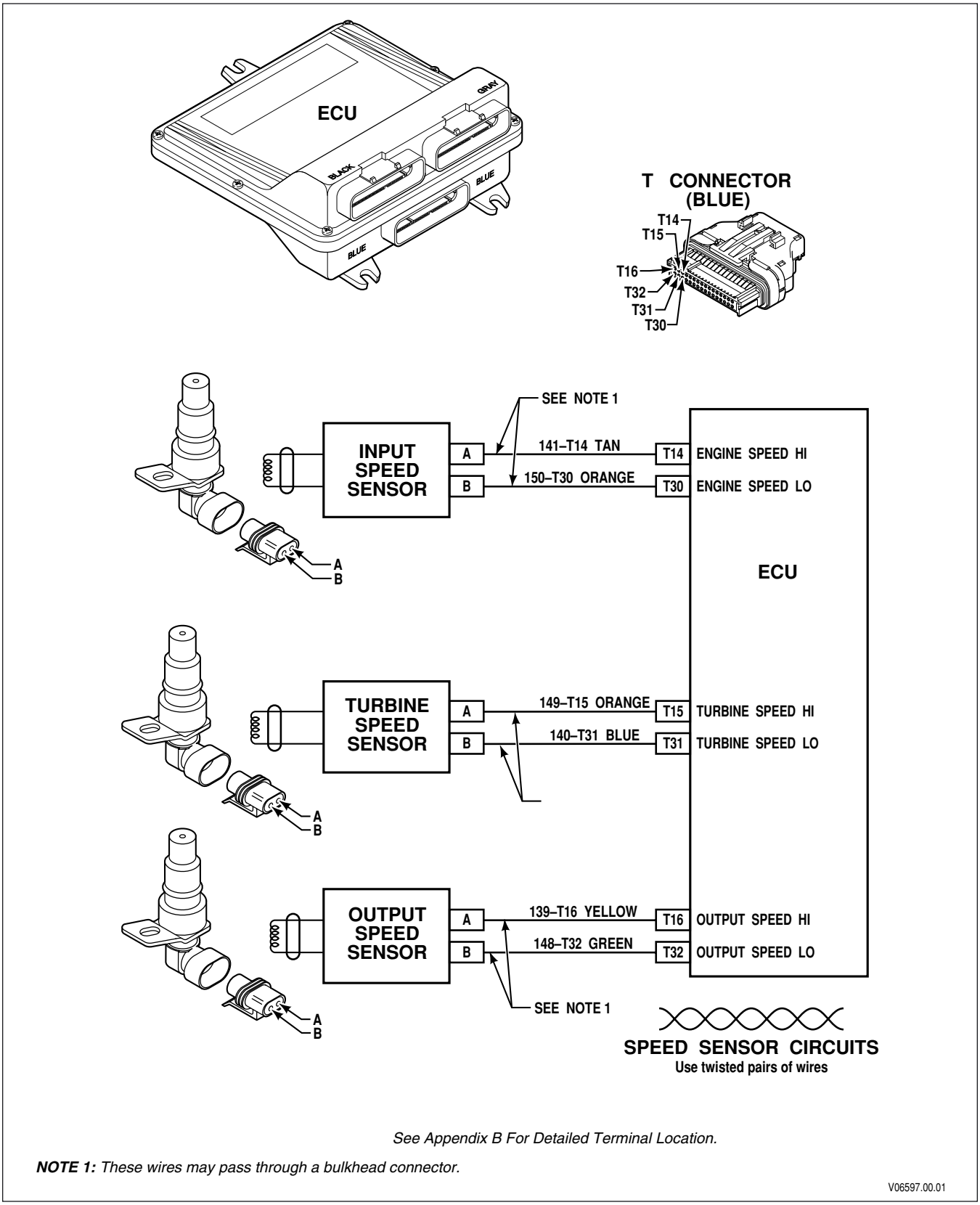
Table 5–5. Sump Thermistor—Resistance (Ohms) vs. Temperature *(cont'd)*

Sump Thermistor					Sump Thermistor				
Degree C	**Degree F**	**Lo Ohms**	**Nominal Ohms**	**Hi Ohms**	**Degree C**	**Degree F**	**Lo Ohms**	**Nominal Ohms**	**Hi Ohms**
115	239	115.7	112.7	121.4	138	280.4	63.37	61.56	66.83
116	240.8	112.5	109.6	118.1	139	282.2	61.82	60.05	65.21
117	242.6	109.5	106.6	114.9	140	284	60.32	58.59	63.64
118	244.4	106.5	103.7	111.9	141	285.8	58.86	57.17	62.11
119	246.2	103.7	100.91	108.9	142	287.6	57.45	55.79	60.63
120	248	100.9	98.2	106	143	289.4	56.07	54.45	59.18
121	249.8	98.23	95.58	103.2	144	291.2	54.73	53.15	57.78
122	251.6	95.63	93.04	100.5	145	293	53.43	51.89	56.42
123	253.4	93.12	90.58	97.9	146	294.8	52.17	50.66	55.09
124	255.2	90.68	88.2	95.36	147	296.6	50.94	49.47	53.81
125	257	88.32	85.89	92.9	148	298.4	49.75	48.31	52.55
126	258.8	86.03	83.65	90.51	149	300.2	48.59	47.18	51.34
127	260.6	83.8	81.49	88.19	150	302	47.46	46.09	50.15
128	262.4	81.65	79.38	85.95	—	—	—	—	—

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

NOTES

CODE 25 XX—OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE



See Appendix B For Detailed Terminal Location.

NOTE 1: *These wires may pass through a bulkhead connector.*

V06597.00.01

Figure 5–7. Code 25 Schematic Drawing

CODE 25 XX—OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE *(Figure 5–7)*

Main code 25 occurs if the output speed sensor reports a zero speed reading while both engine and turbine speeds are approximately equal, turbine speed is above a calibration value, and neutral is not selected or commanded. Main code 25 indicates either the output speed sensor has failed or the required oncoming clutch or clutches did not come on. Code 25 11 can be generated by a false turbine speed reading. This may be due to crosstalk between solenoid and turbine speed sensor circuits caused by direct wire-to-wire short or by water in the electrical connectors. See Section 4 for corrective action.

NOTE: If code 25 XX is in memory at ECU initialization (ignition on), all display segments are illuminated.

Main Code	Subcode	Meaning
25	11	Output speed sensor, detected at zero speed, 1st range
25	22	Output speed sensor, detected at zero speed, 2nd range
25	33	Output speed sensor, detected at zero speed, 3rd range
25	44	Output speed sensor, detected at zero speed, 4th range
25	55	Output speed sensor, detected at zero speed, 5th range
25	66	Output speed sensor, detected at zero speed, 6th range
25	77	Output speed sensor, detected at zero speed, 7th range
25	88	Output speed sensor, detected at zero speed, 8th range

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 4–1. Also, measure battery and ECU input voltages.

NOTE: Intermittent connections or lack of battery-direct power and ground connections can cause this and other codes.

B. Troubleshooting:

1. Determine transmission fluid level to be sure it is correct.
2. Determine if code 22 16 is present. If code 22 16 is in the code list, go to code 22 XX section and follow troubleshooting steps for code 22 16.
3. Connect the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool with ignition on, engine off, and determine if there are turbine speed indications. If turbine speed is indicated, refer to Paragraph 4–2 for corrective action.
4. This code requires accurate output and turbine speed readings. If there were no transmission problems detected, use the diagnostic tool and watch the speed readings for noise (erratic signals) from low speed to high speed in the range indicated by the code.
5. If a noisy sensor is found, measure the sensor resistance (refer to the following sensor resistance chart) and test its wiring for opens, shorts, and shorts-to-ground (refer to code 22 XX). Also closely inspect the terminals in the connectors for corrosion, contamination, or damage. Be sure the wiring to the sensors is a properly twisted wire pair. Remove sensor and inspect for damage at the tone wheel end. Inspect for looseness of the tone wheel. Refer to the appropriate service manual if repair of a loose tone wheel is necessary. Replace the sensor if it is damaged or if its

CODE 25 XX—OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE *(Figure 5–7)*

resistance is incorrect (refer to appropriate service manual for proper procedure) and isolate and repair any noted wiring problems. (Use St. Clair P/N 200153 Service Harness Twisted Pair for this procedure.)

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

6. If no apparent cause for the code can be located, replace the turbine and output speed sensors. Refer to the appropriate transmission service manual for proper procedure.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.
8. If the output speed sensor and wiring are satisfactory, install pressure gauges into the appropriate clutch pressure taps (refer to appropriate transmission service manual) and make the shift again. See if the clutches have low or no pressure.
9. If a clutch is leaking pressure, remove the valve body and check for damaged valve body gaskets and stuck or sticky valves. If no problems are found, replace the solenoids for the clutches used in the range indicated by the code. Refer to the appropriate transmission service manual for replacement procedure.
10. If, after detecting leaking pressure and replacing solenoids, the problem persists, inspect clutch or piston seals for wear. Remove the transmission and repair or replace as necessary (refer to the proper transmission service manual).

CODE 26 XX—THROTTLE SOURCE NOT DETECTED

Main code 26 occurs when the ECU has not detected a throttle source. This is a new code related to the autodetect feature which is described in Paragraph 1–9.

Main Code	Subcode	Meaning
26	00	Throttle source not detected

Code 26 00 means that the ECU has not detected the presence of engine throttle data or analog circuitry. For details about autodetect, refer to Paragraph 1–9. For information about the use of Allison DOC™ For PC–Service Tool, refer to Allison Transmission publication GN3433EN, User Guide or Appendix J. For information about the use of Pro-Link® 9000 diagnostic tool, refer to the User's Manual, GN2928EN, or Appendix J.

A. Active Indicator Clearing Procedure

- Power down
- Manual

B. Troubleshooting

When code 26 00 is logged and an analog TPS is known to be installed, refer to code 21 XX for troubleshooting steps. If a J1587 or J1939 throttle signal is used, refer to code 66 00 for troubleshooting steps.

C. Autodetect Feature

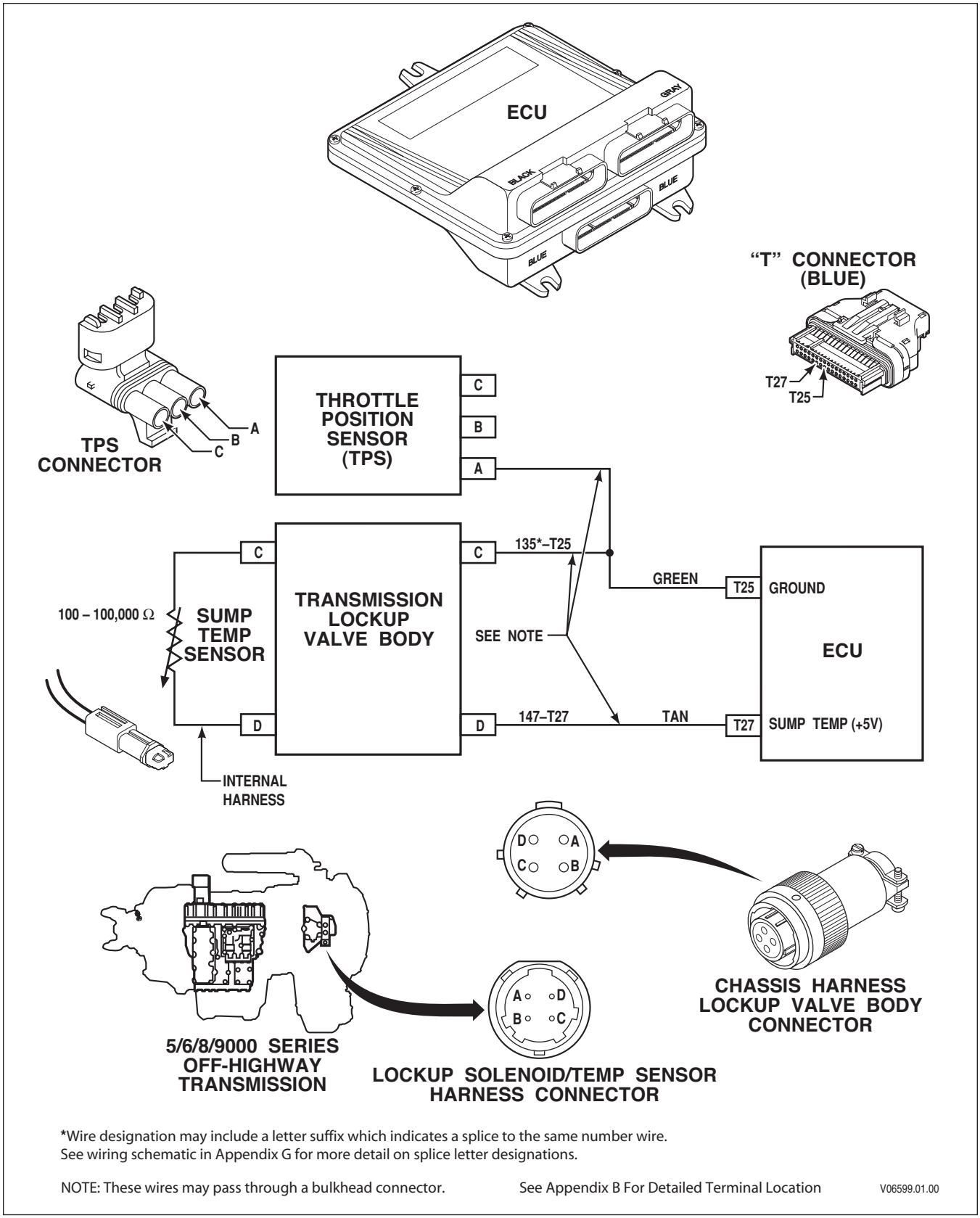
Autodetect is active on the first 10* engine starts. Autodetect takes place within the first 5–25* seconds of each engine start monitored. For CEC2, autodetect searches for the presence of a throttle information source. Autodetect searches for a TPS (analog) source or a data link source via J1939 or J1587.

Even after autodetect has been completed, it can be reset to monitor an additional group of engine starts. Reset may be necessary if a device known to be present is not detected or if an autodetectable component or sensor was added after the initial vehicle build. Reset is accomplished by using the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool. If using the CEC2 compatible Pro-Link® 9000 diagnostic tool, select "RESET AUTODETECT." The Allison DOC™ For PC–Service Tool or CEC2 Pro-Link® diagnostic tool can also be used to override autodetect and manually enter the component or sensor to be recognized by the ECU by changing appropriate "customer modifiable constants". The throttle source is the only customer modifiable constant (CMC) that is autodetected. Other CMCs can be changed at any time and are not related to autodetect. Consult the Pro-Link® 9000 diagnostic tool manual for detailed instructions related to CEC2 "customer modifiable constants." Additional details for the autodetectable throttle feature is given below.

Whenever autodetect is functioning and no throttle source is found, a code 26 00 is logged. If a datalink throttle source (J1939 or J1587) is detected, autodetect stops looking for that function. However, if no analog throttle source was detected prior to engine start 10*, autodetect continues for engine starts 10* through a calibration number. Autodetect for analog throttle stops as soon as a device is detected or when the calibration number of starts is reached. If an analog throttle source is known to be present, but is not detected, troubleshooting of the analog throttle circuit is required. After the analog throttle circuit is repaired, reset autodetect or manually select the analog throttle function using Allison DOC™ For PC–Service Tool or Pro-Link® diagnostic tool. An engine throttle source **must be** present.

* This is a programmed value subject to change.

CODE 33 XX—SUMP FLUID TEMPERATURE SENSOR



*Wire designation may include a letter suffix which indicates a splice to the same number wire.
See wiring schematic in Appendix G for more detail on splice letter designations.

NOTE: These wires may pass through a bulkhead connector. See Appendix B For Detailed Terminal Location V06599.01.00

Figure 5–8. Code 33 Schematic Drawing

CODE 33 XX—SUMP FLUID TEMPERATURE SENSOR *(Figure 5–8)*

Detailed troubleshooting information for the sump temperature thermistor is shown in Figure 5–9.

Main code 33 indicates the sump temperature sensor is providing a signal outside the usable range of the ECU. This code indicates the sensor failed showing abnormally high or low temperature readings. Main code 33 can be caused by a component or circuit failure or by extremely high or low temperatures. There are no operational inhibits related to main code 33. The ECU assumes a hardware failure and that transmission temperatures are normal (200ºF; 93ºC). Temperatures above or below normal may cause inhibited range operation.

NOTE: Code 33 23 in conjunction with code 21 23 indicates the loss of common ground (wire 135) between the throttle and temperature sensors.

Main Code	Subcode	Meaning
33	12	Sump oil temperature sensor failed low (–55ºF; –48ºC)
33	23	Sump oil temperature sensor failed high (350ºF; 177ºC)

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 4–1. Also, determine the transmission fluid level.

B. Troubleshooting:

NOTE: Code 33 12 can be caused when the +5V power line (wire 147) is shorted to ground or open.

1. If possible, measure the sump temperature using the fastest sample rate available on the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool. This is necessary to catch momentary changes due to an intermittent open or short to ground. If Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool is not available, use the shift selector display to determine if the code is active (refer to Paragraph 5–2). Disconnect the transmission "T" harness at the ECU and check resistance of the sensor and compare with Figure 5–9.
2. If Step (1) reveals that the extreme temperature indication is no longer present, the temperature limit could have been reached due to operational or ambient temperature extremes. Also, you may be experiencing an intermittent problem and the code will not be active. Proceed cautiously, it is unlikely there is a sensor hardware fault.
3. Disconnect the external harness at the transmission. Inspect the connectors and terminals for dirt, corrosion, or damage. Clean or replace as necessary.
4. Test the sensor wires in the external harness for opens (code 33 23), shorts between wires, or shorts-to-ground (code 33 12—refer to Section 4). If wiring problems are found, isolate and repair as described in Appendix C, in this manual.
5. Inspect for chafing of the sensor wires. Eliminate the chafe point. If no chafe point is found, replace the sensor (refer to Paragraph 1–3 or Appendix C in this manual or the appropriate service manual for the transmission being serviced).

CODE 33 XX—SUMP OIL TEMPERATURE SENSOR *(Figure 5–8)*

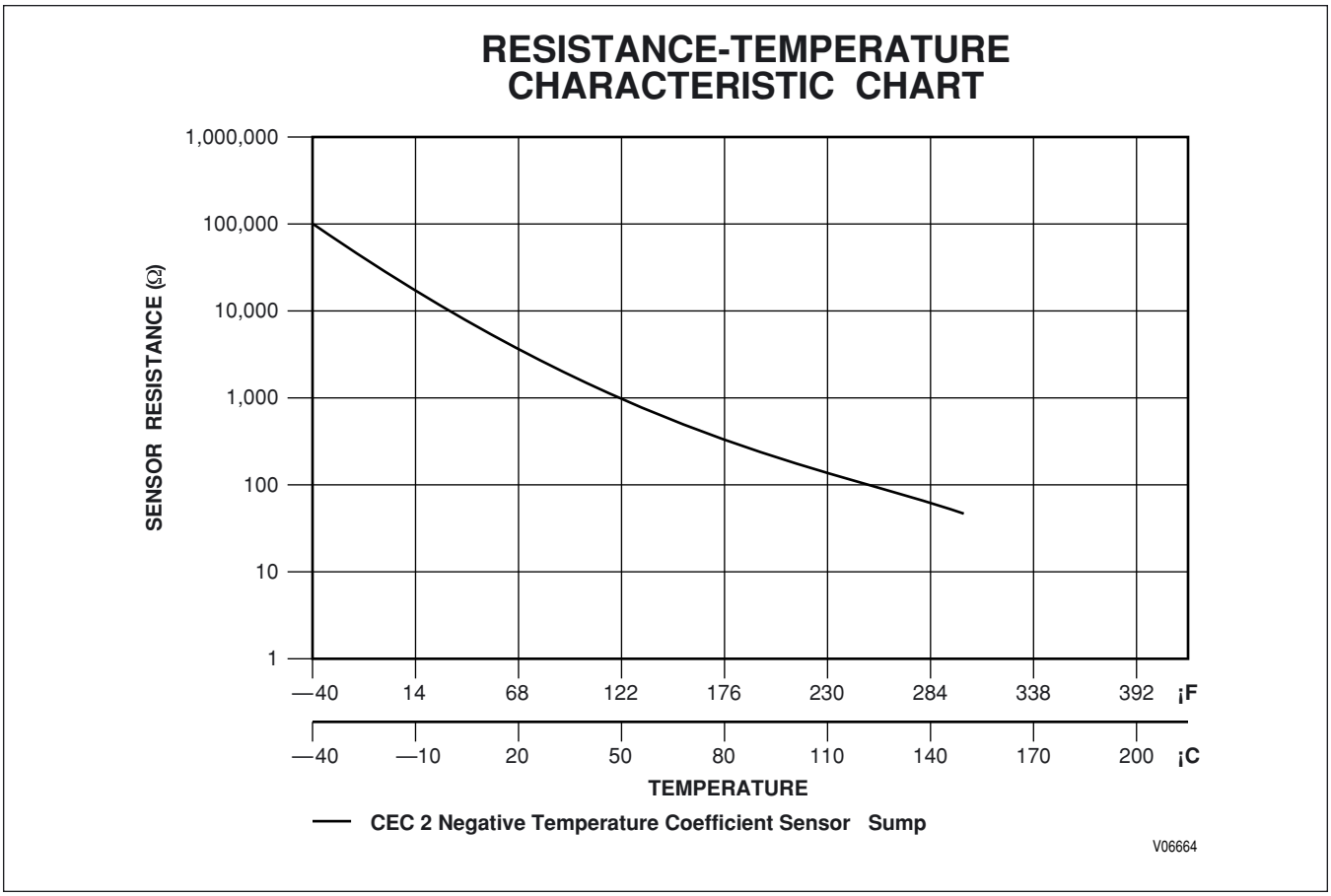


Figure 5–9. Temperature Sensor Chart

6. If the problem recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the temperature sensor circuit.

7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 34 XX—CALIBRATION COMPATIBILITY OR CHECKSUM FAULT

Main code 34 indicates there is a problem with the calibration.

Main Code	Subcode	Meaning
34	12	Factory calibration compatibility number wrong
34	13	Factory calibration checksum
34	14	Power off block checksum
34	15	Diagnostic queue block checksum
34	16	Real-time block checksum
34	17	Customer modifiable constants checksum

A. Active Indicator Clearing Procedure:

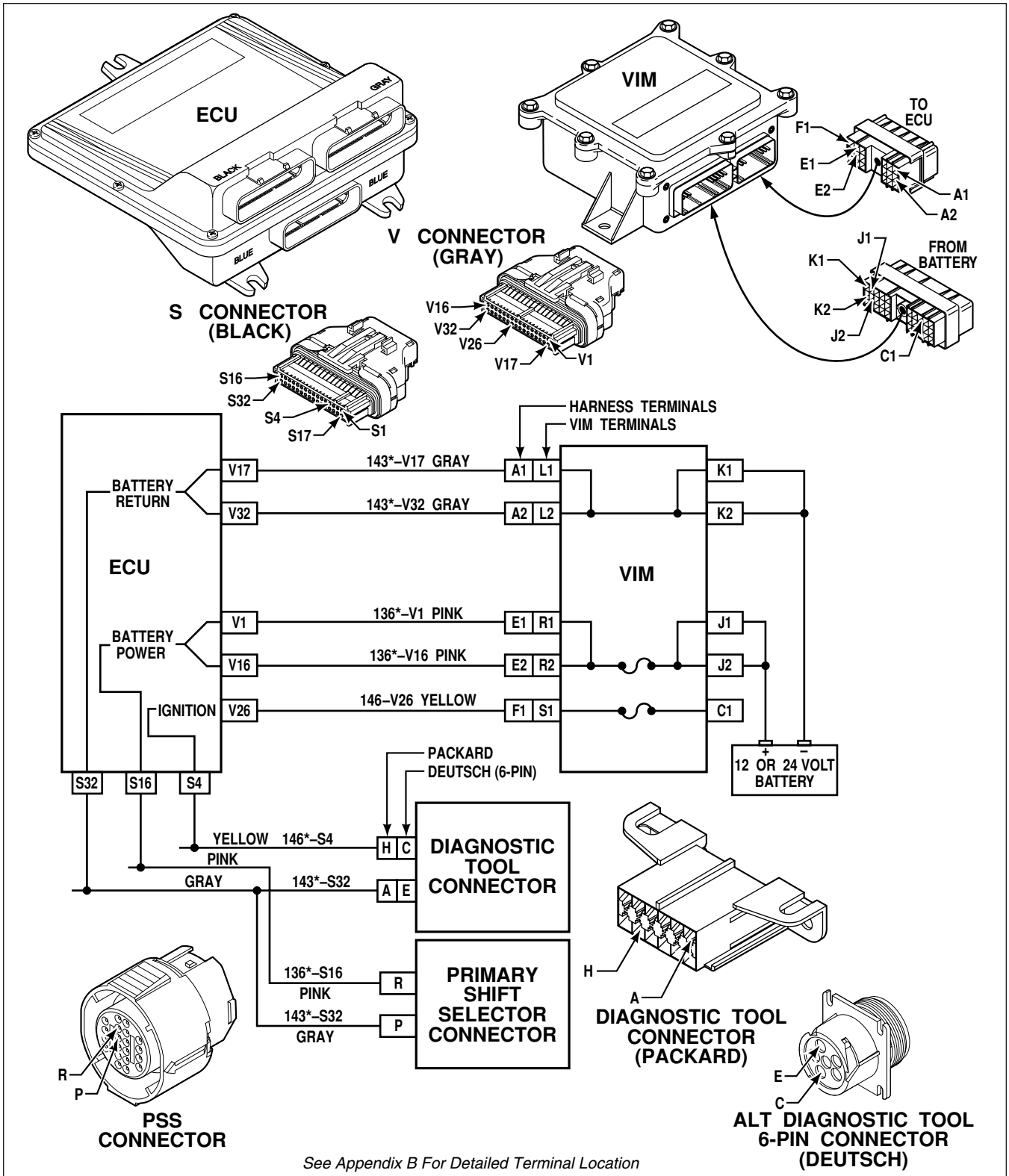
- Power down

NOTE: ***Copying the current calibration from the ECU and reloading it will not correct the fault. The calibration must be downloaded directly from PCCS.***

B. Troubleshooting:

1. If the code set is 34 14 and it occurs in conjunction with code 35 00 (Power Interruption), proceed to find the cause for code 35 00 and correct it.
2. After the cause for code 35 00 has been corrected, drive the vehicle to see if code 34 14 recurs. If code 34 14 recurs, proceed to Step (3).
3. Reprogram the correct calibration. Contact Allison Transmission to do recalibration. Be certain the calibration and the software level are compatible.
4. If the code recurs after reprogramming, replace the ECU.
5. If the code set is 34 17, reprogram the GPI/GPO package after re-calibration of the ECU.

CODE 35 XX—POWER INTERRUPTION



See Appendix B For Detailed Terminal Location

**Wire designation may include a letter suffix which indicates a splice to the same number wire.*
See wiring schematic in Appendix G for more detail on splice letter designations.

V06595.00.01

Figure 5–10. Code 35 Schematic Drawing

CODE 35 XX—POWER INTERRUPTION *(Figure 5–10)*

Main code 35 indicates the ECU has detected a complete power loss before the ignition was turned off or before ECU shutdown is completed. When this happens, the ECU is not able to save the current operating parameters in memory before turning itself off.

Main Code	Subcode	Meaning
35	00	Power interruption. (Not an active code; only appears after power is restored.) During power interruption, **CHECK TRANS** light is not illuminated and the transmission will not shift.
35	16	Real-time write interruption. (Power interruption at the same time the ECU is recording a critical code to the real-time section.)

A. Active Indicator Clearing Procedure:

- Power down
- Manual—except code 35 16

NOTE: Before troubleshooting, read Paragraph 4–1. Also, measure battery and ECU input voltages.

B. Troubleshooting:

1. If the vehicle has a master switch controlling battery power to the ECU and an ignition switch, turning the master switch off before turning the ignition switch off can cause this code. Turning the master switch off before ECU shutdown is completed will also cause this code. No troubleshooting is necessary.
2. If improper switch sequencing is not the cause, test ECU power and ground for opens, shorts, and shorts-to-ground. Not using battery-direct power and battery ground connections can cause this code. A defective charging system, or open battery fuse or fusible link can also cause this code. The battery fuse or fusible link may be at the battery or in the VIM. Dirty, corroded, or painted power and ground connections can also cause this code.
3. If all system power and ground connections are satisfactory and the problem persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem reoccurs, reinstall the replacement ECU.

CODE 36 XX—HARDWARE AND SOFTWARE NOT COMPATIBLE

Main code 36 indicates the system has detected a mismatch between the ECU hardware and the ECU software.

Main Code	Subcode	Meaning
36	00	Mismatch between ECU hardware and software

A. Active Indicator Clearing Procedure:

- Power down

B. Troubleshooting:

Correction for code 36 00 requires the installation of software that is compatible with the ECU hardware involved. If a different calibration is required, update the ECU hardware to be compatible.

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

NOTES

CODE 45 XX—GENERAL SOLENOID FAILURE

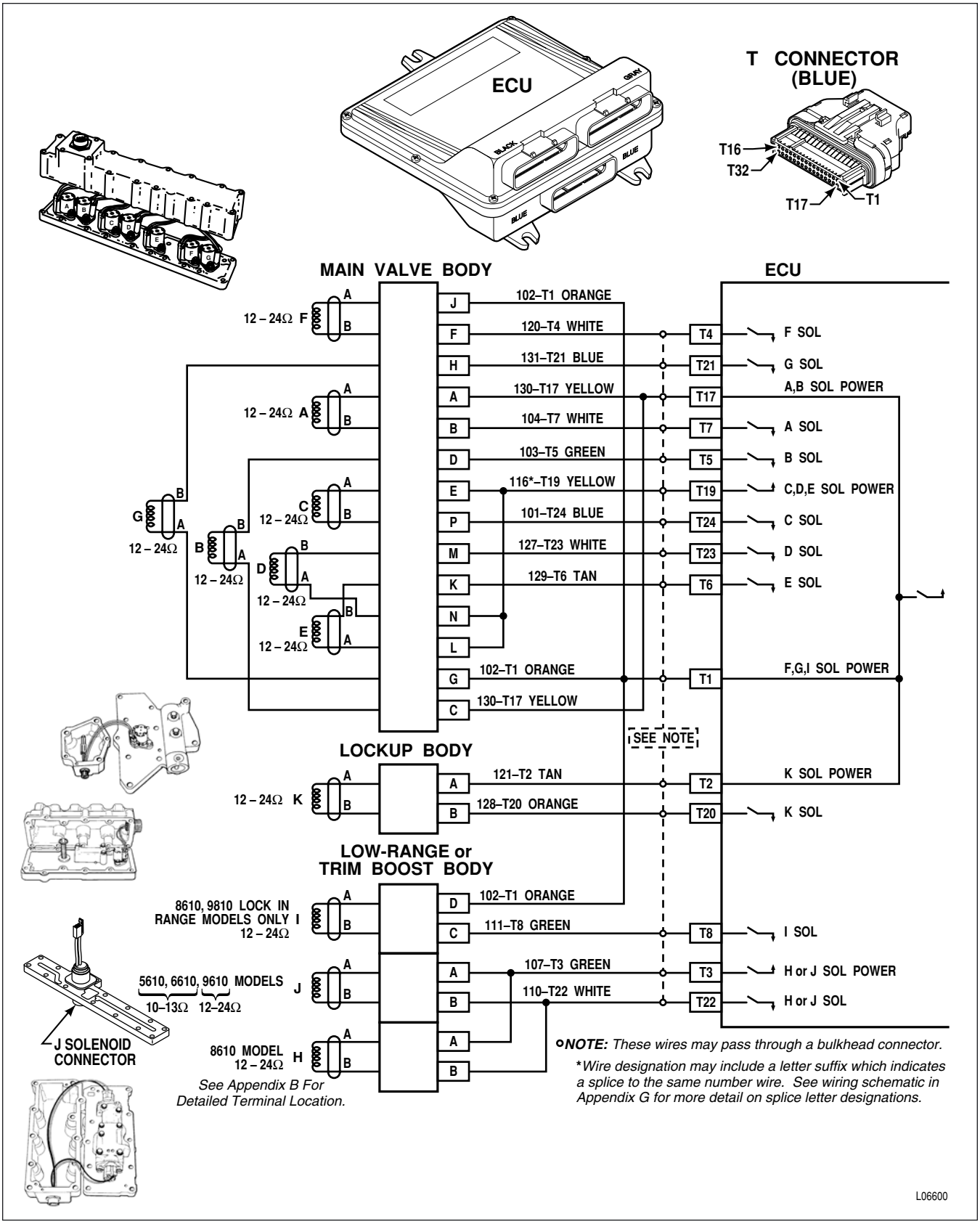


Figure 5–11. Code 45 Schematic Drawing

CODE 45 XX—GENERAL SOLENOID FAILURE *(Figure 5–11)*

Main code 45 indicates the ECU has detected either an open circuit condition in a solenoid coil or the wiring to that solenoid. The **DO NOT SHIFT** response is activated when some subcodes are detected and the **CHECK TRANS** light is illuminated.

Main Code	Subcode	Meaning
45	12	General Failure, F Solenoid Circuit
45	13	General Failure, K Solenoid Circuit
45	14	General Failure, B Solenoid Circuit
45	15	General Failure, G Solenoid Circuit
45	16	General Failure, E Solenoid Circuit
45	21	General Failure, H/J Solenoid Circuit
45	22	General Failure, A Solenoid Circuit
45	23	General Failure, D Solenoid Circuit
45	24	General Failure, I Solenoid Circuit
45	26	General Failure, C Solenoid Circuit

A. Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.

NOTE: Before troubleshooting, read Paragraph 4–1. Also, measure battery and ECU input voltages.

PROBING THE CONNECTOR

When testing the control system with the internal harness connected, the resistance of each solenoid can be checked using a VOM.

B. Troubleshooting:

1. Inspect the valve body connector and make sure it is tightly connected. Clean or replace as necessary (Appendix C).

2. If the connector is connected, clean, and not damaged, test the solenoid circuit in the valve body for opens. Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If the open circuit is found, replace the faulty component (refer to the appropriate transmission service manual), and eliminate the open. The fault may be in the solenoid itself.

3. If the open is not found at the transmission connector, disconnect the transmission harness connector at the ECU and inspect the terminals in the connector and the ECU for damage or contamination. Clean or replace as necessary. If the terminals are satisfactory, test the wires of the solenoid circuit in the transmission harness for continuity. If the open is found in one of the wires, isolate and repair it. If this is not feasible, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose). Refer to Appendix C for information on connector/wire repair.

CODE 45 XX—GENERAL SOLENOID FAILURE *(Figure 5–11)*

4. If multiple code 45s occur (45 12, 45 13, 45 14, 45 15, 45 22, and 45 24), and wiring and solenoids test okay, a common solenoid driver is probably failed open.
5. Replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the problem recurs, reinstall the new ECU to complete the repair.
6. If code 45 21 occurs repeatedly and the H/J solenoid and wiring test okay, the solenoid driver may be failed open. Follow Step (5) above.
7. If codes 45 16, 45 23, and 45 26 occur repeatedly and solenoids and wiring test okay, the solenoid driver may be failed open. Follow Step (5) above.
8. If the open is not found in either the transmission or the harness or the ECU drivers, the condition must be intermittent.
9. Use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the solenoid circuit indicated by the diagnostic code. Refer to Appendix C for information on connector assembly/disassembly.
10. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.
11. If condition persists, remove the solenoid cover and closely inspect the solenoid and internal harness for damage. Repair or replace as necessary (refer to the appropriate transmission service manual).

TROUBLESHOOTING—DIAGNOSTIC CODES PRESENT

NOTES

CODE 46 XX—HI SIDE OVERCURRENT FAULT

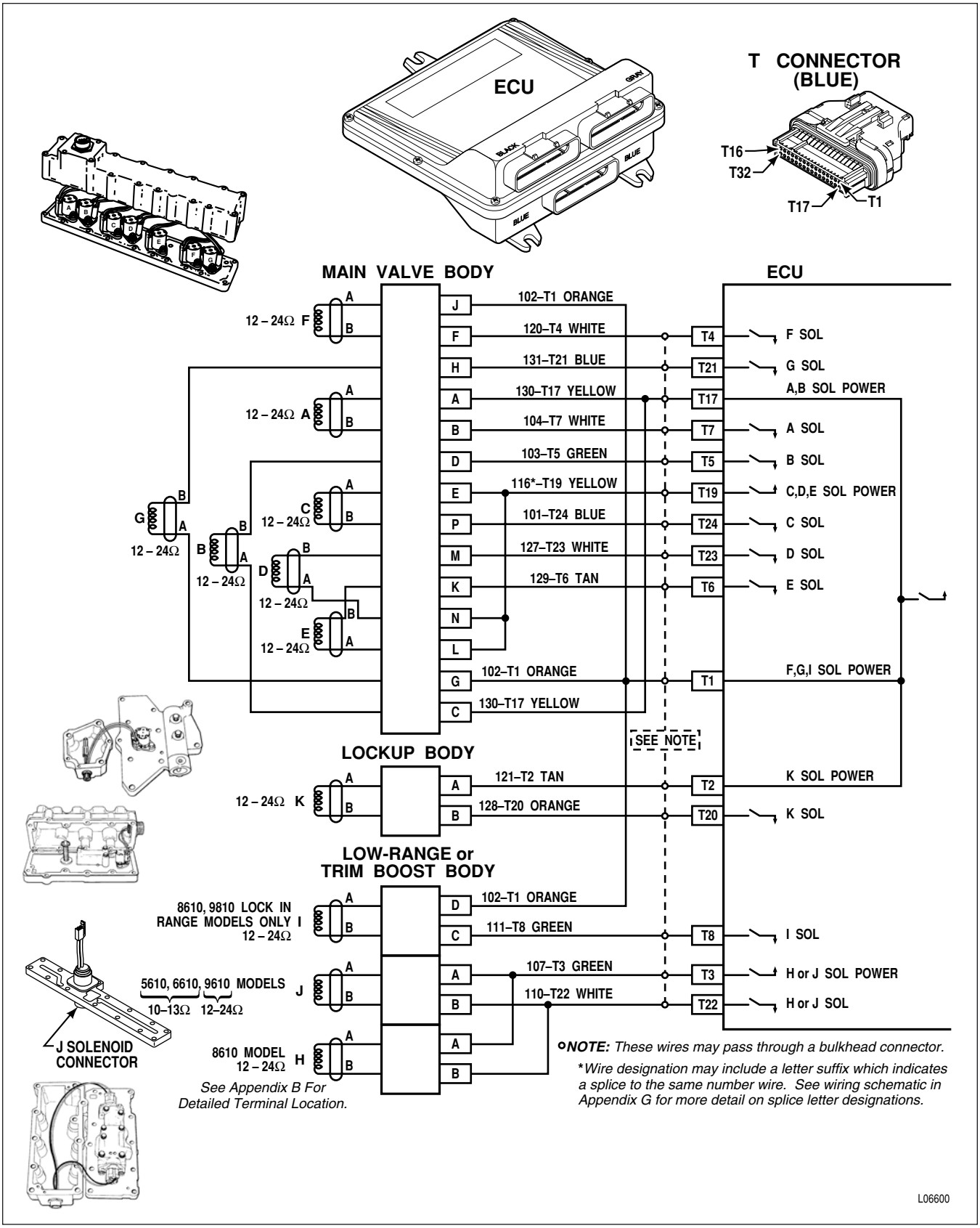


Figure 5–12. Code 46 Schematic Drawing

CODE 46 XX—HI SIDE OVERCURRENT FAULT *(Figure 5–12)*

Main code 46 indicates that an overcurrent condition exists in one of the switches sending power to the transmission control solenoids.

Main Code	Subcode	Meaning
46	21	High side overcurrent, H/J solenoid circuit
46	26	High side overcurrent, C, D, E solenoid circuit
46	27	High side overcurrent, A, B, F, G, I, K solenoid circuit

A. Active Indicator Clearing Procedure:

- Power down
- Manual

B. Troubleshooting:

1. Probable cause is a wiring problem. A solenoid wire is probably shorted to ground or the solenoid has a shorted coil which would cause an overcurrent condition. May also be an ECU problem.
2. Follow the troubleshooting steps for code 45 XX.

CODE 56 XX—RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

Main code 56 indicates either a failed **Range** verification speed sensor ratio test or a failed **Neutral** verification speed sensor ratio test.

The **Range** ratio test occurs after a shift and determines if a clutch has lost torque carrying capability. If the output speed is above a programmed output speed for a range, but the correct speed sensor ratio is not present, the **DO NOT SHIFT** response is commanded and a code (one of 56 11 to 56 88) is logged. A range that can carry the torque without damage is commanded or attempted. Turbine and output speed sensor readings are used to calculate the actual ratio that is compared to the commanded ratio. (Refer to Sections B and D below.)

The **Neutral** ratio test occurs when Neutral is selected. If a minimum turbine speed is not detected after Neutral is selected, the **DO NOT SHIFT** response is commanded, code 56 99 is logged, and the shift selector will display a flashing "cateye" (-/-) to warn the operator that the transmission may be in gear. (See Section C and D below.)

Main Code	Subcode	Meaning
56	11	Range verification ratio test (between shifts) 1
56	22	Range verification ratio test (between shifts) 2
56	33	Range verification ratio test (between shifts) 3
56	44	Range verification ratio test (between shifts) 4
56	55	Range verification ratio test (between shifts) 5
56	66	Range verification ratio test (between shifts) 6
56	77	Range verification ratio test (between shifts) 7
56	88	Range verification ratio test (between shifts) 8
56	99	Neutral verification ratio test, N

A. Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: When a code 22 16 (output speed fault) is also present, follow the troubleshooting sequence for code 22 16 first. After completing the 22 16 sequence, drive the vehicle to see if a code 56 XX recurs.

NOTE: Before troubleshooting, measure battery and ECU input voltages.

NOTE: Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.

B. Troubleshooting 56 11 to 56 88 Codes:

Erratic shifting and intermittent 56xx codes have resulted from false output speed sensor readings. A loose transmission output nut allows the output speed sensor pickup gear to slip giving false readings.

Remove the output speed sensor and be sure the pickup gear is tight by using a pry tool. If the gear can be moved by hand, tighten the transmission output nut. Follow the output nut installation procedures in the service manual.

CODE 56 XX—RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

C. Troubleshooting 56 99 Codes:

Code 56 99 was introduced in J03 calibrations starting in January 2003. The presence of code indicates low turbine speed when Neutral is selected. This indicates a "lock in range" condition to the ECU.

The following have all been associated with this code:

- Main control valve body solenoid stuck open from debris allowing clutch to engage.
- Main control valve body shift valve stuck open from debris allowing clutch to engage.
- Broken turbine or splitter input shafts
- Faulty turbine speed sensor
- Damaged chassis harness to the turbine speed sensor.

D. General Troubleshooting 56 11 to 56 99 Codes:

1. After the transmission is at operating temperature, allow vehicle engine to idle on level ground for 3–4 minutes. Determine the transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code. Not enough or too much fluid may produce inadequate clutch pressure.
2. This code requires accurate output and turbine speed readings. If there were no transmission problems detected, use the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool and test speed sensor signals for noise (erratic signals) from low speed to high speed in the range indicated by the code.
3. If a noisy sensor is found, test the resistance of the sensor (refer to the temperature variation chart below) and its wiring for opens, shorts, and shorts-to-ground (refer to code 22 XX). Carefully inspect the terminals in the connectors for corrosion, contamination, or damage. Be sure the wiring to the sensors is a properly twisted wire pair. Replace a speed sensor if its resistance is incorrect. Isolate and repair any wiring problems. Use a twisted-pair if a new speed sensor circuit is needed—Service Harness Twisted Pair P/N 200153 is available from St. Clair Technologies for this purpose.

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

4. If no apparent cause for the code can be found, replace the turbine and output speed sensors (refer to the appropriate transmission service manual for proper procedure).
5. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.
6. Connect a pressure gauge and test main pressure. If the pressure is not adequate, the pump is probably worn. Refer to the appropriate service manual for main pressure specifications.
7. If main pressure is adequate, test clutch pressure for the range indicated by following the procedure in the appropriate service manual. The transmission range indicated by the trouble code can be found by referring to the solenoid and clutch chart on the hydraulic schematic in

CODE 56 XX—RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

Appendix F. Drive the vehicle or use Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool clutch test mode and test clutch pressure.

8. If a clutch is leaking pressure, remove the main control valve body and inspect for damaged valve body gaskets and stuck or sticking valves (refer to the transmission service manual). If no problems are found, replace the solenoids for the clutches used in the range indicated by the code.
9. If replacing solenoids does not correct the pressure problem, a worn clutch or worn piston seals are probably the source of the pressure leak. Remove the transmission and repair or replace as necessary (refer to the appropriate transmission service manual).

CODE 65 00—ENGINE RATING HIGH

Main code 65 indicates the vehicle's engine horsepower/governor speed rating is too high. This code is set only when computer-controlled engines are used. Code 65 means the engine computer is able to tell the transmission, the engine horsepower and/or governor speed is beyond the transmission rating or does not match the transmission shift calibration.

When a code 65 is set, no shifts out of neutral are allowed. It is possible the transmission calibration selected for this engine is improper. Contact Allison Transmission for assistance in selecting a proper calibration.

If the engine is beyond transmission ratings, contact the vehicle OEM for correction.

This code cannot be cleared until the proper level engine is installed or the transmission is properly calibrated.

CODE 66 00—SCI (SERIAL COMMUNICATION INTERFACE) FAULT *(Figure 5–13)*

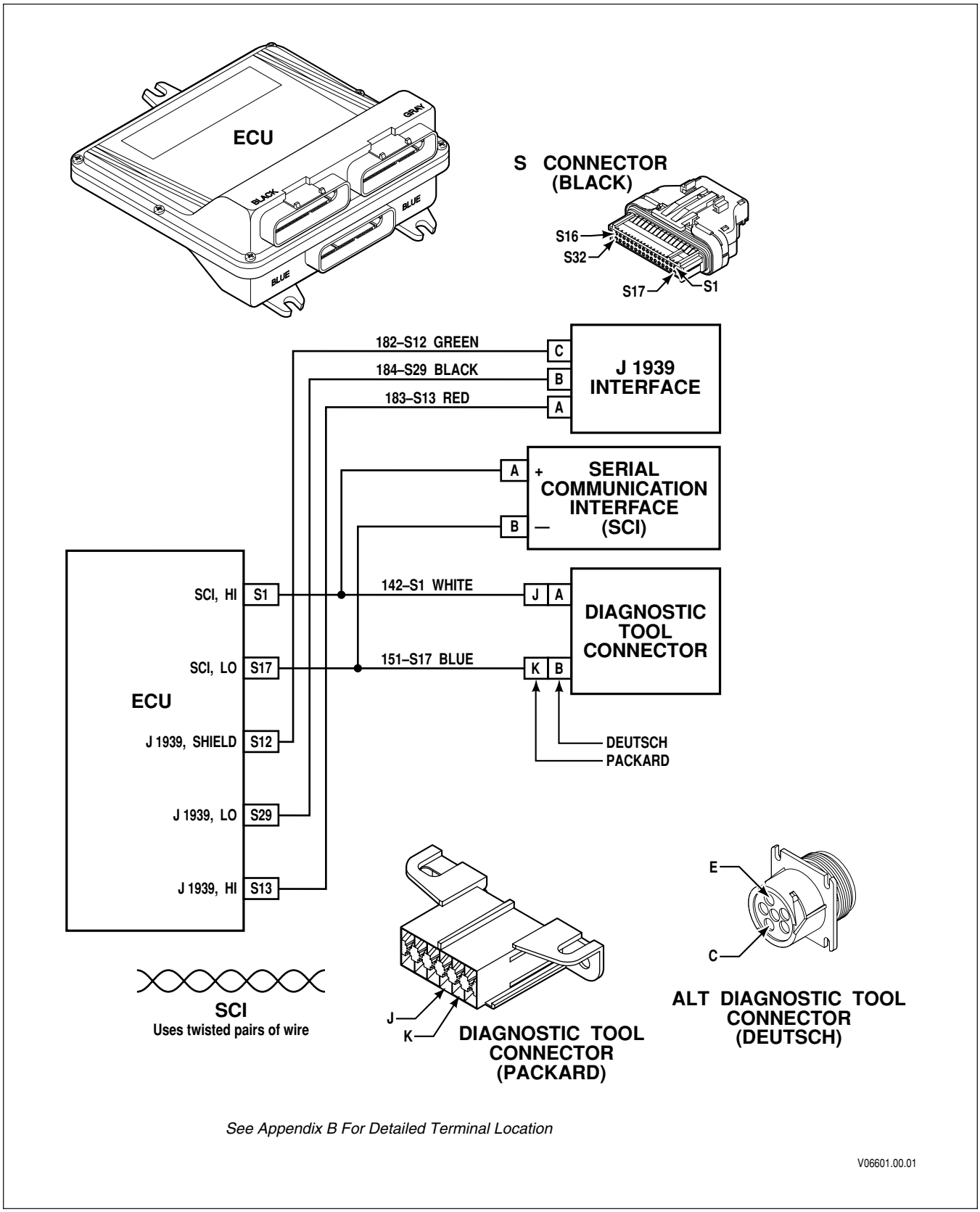


Figure 5–13. Code 66 Schematic Drawing

CODE 66 00—SCI (SERIAL COMMUNICATION INTERFACE) FAULT

The datalink for the throttle position sensor (TPS) **must have been** recognized by autodetect or manually selected using the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool (refer to Allison Transmission publication GN3433EN, User's Guide, for the Allison DOC™ For PC–Service Tool or CEC2 Pro-Link® 9000 User's Manual, GN2928EN) before these codes can be logged. See Paragraph 1–9 for further information.

Main code 66 indicates the ECU is expecting to get its throttle position signal across a serial communication interface from a computer-controlled engine. Either the engine computer is not sending the throttle information or the wiring between the engine and transmission computers has failed.

Code 66 00 can occur when the transmission ECU remains powered when the engine ECM is powered down. The transmission sees this as a communication link failure.

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

B. Troubleshooting:

1. Test for a throttle signal from the engine to the transmission, an engine computer malfunction, or an engine throttle fault.

NOTE: ***Throttle position data sent from a computer-controlled engine may register a low number of counts on Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool, but the counts will not change as throttle percentage is changed.***

2. Test wires 142 and 151 between the engine and transmission ECU for an open or short. Inspect all connectors and make sure they are clean and tightly connected.

NOTE: ***These codes can also be set if J1939 communications fail. Test wires 183-S13, 184-S29, and 182-S12 for opens or shorts.***

3. Use the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool to determine that the ECU is receiving power when it should not.

CODE 69 XX—ECU MALFUNCTION

Main code 69 indicates a problem which has been identified as being from within the ECU.

A “cateye” (-/-) display or a blank display may occur with subcode 33.

Main Code	Subcode	Meaning
69	27	ECU, Inoperative A, B, F, G, I, K solenoid switch
69	28	ECU, Inoperative H/J solenoid switch
69	29	ECU, Inoperative C, D, E solenoid switch
69	33	ECU, computer operating properly fault
69	34	ECU EEPROM, fault
69	35	ECU EEPROM, fault
69	39	Communication chip addressing error
69	42	SPI output failure
69	43	SPI input failure

A. Active Indicator Clearing Procedure:

- Power down
- Manual—except subcodes 33, 35, 42, and 43
- Self-clearing—subcode 42 and subcodes 33 and 35; after an ECU reset

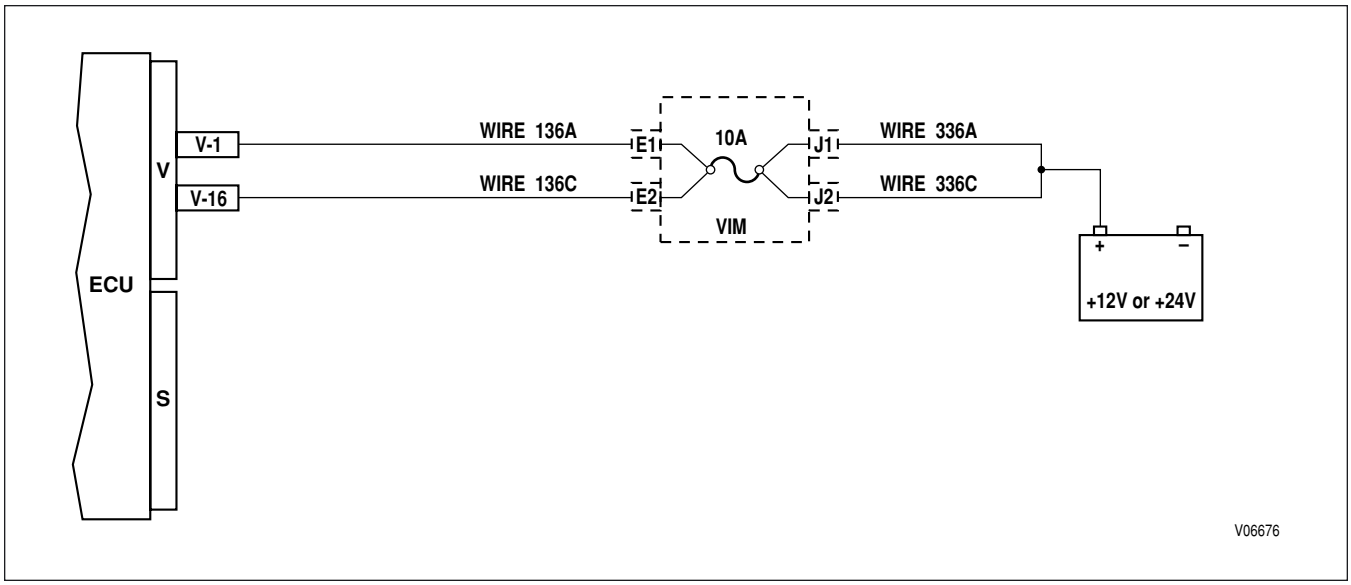
NOTE: Subcode 34 cannot be cleared.

B. Troubleshooting:

1. For subcodes 27, 28, and 29, test for shorts to battery before replacing the ECU. Follow the troubleshooting steps for code 45 XX for testing for shorts to battery. If no shorts are found, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the problem recurs, reinstall the new ECU to complete the repair.
2. For all other subcodes, replace the ECU.

SECTION 6—VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–1. ECU POWER



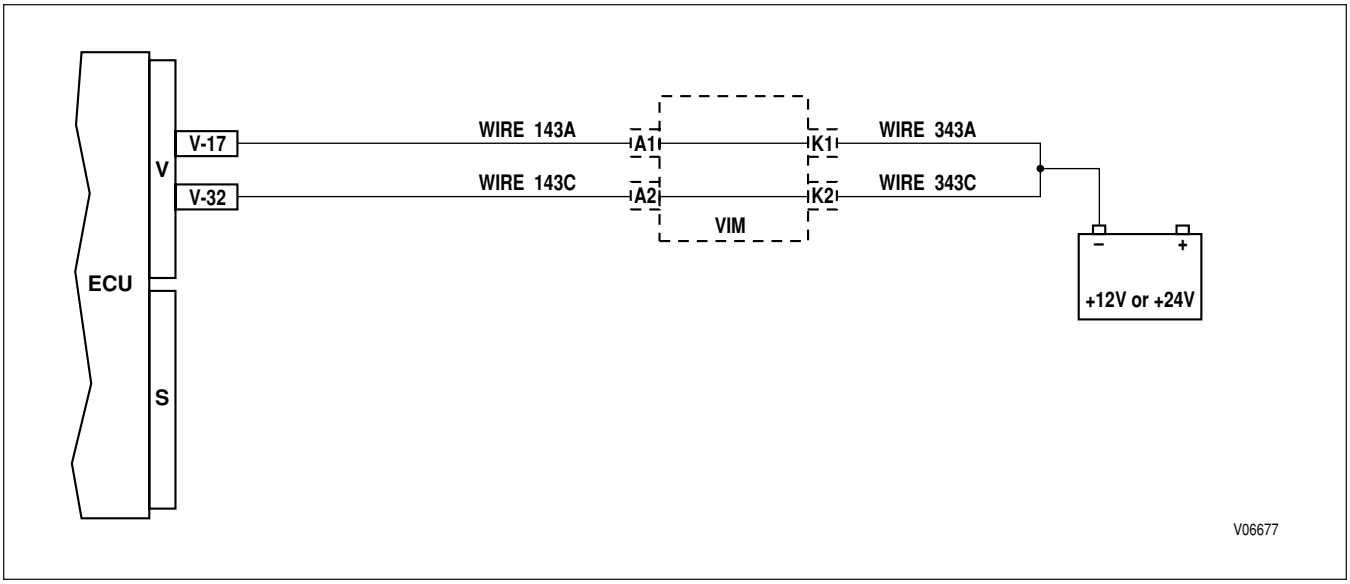
Positive battery voltage **must be** supplied directly to the ECU from the battery positive terminal or a dedicated "electronic" bus bar.

- These wires are connected through the VIM.
- Power is provided through a 10 amp fuse in the VIM.
- Wires **must be** kept as short as possible.
- **No other loads** can be added to these wires.
- Minimize the number of electrical connections between the ECU and battery to reduce the potential for poor connections, corrosion, etc.
- Wires from the battery to the splice point before the VIM **must be** no smaller than 10 AWG. They may need to be larger, depending on length.
  - — Wiring shall be sized to maintain a minimum of 10.5V at the ECU during max current draw conditions (9 amp).

NOTE: Always remove all connectors from the ECU whenever welding on the vehicle.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–2. SYSTEM GROUNDS

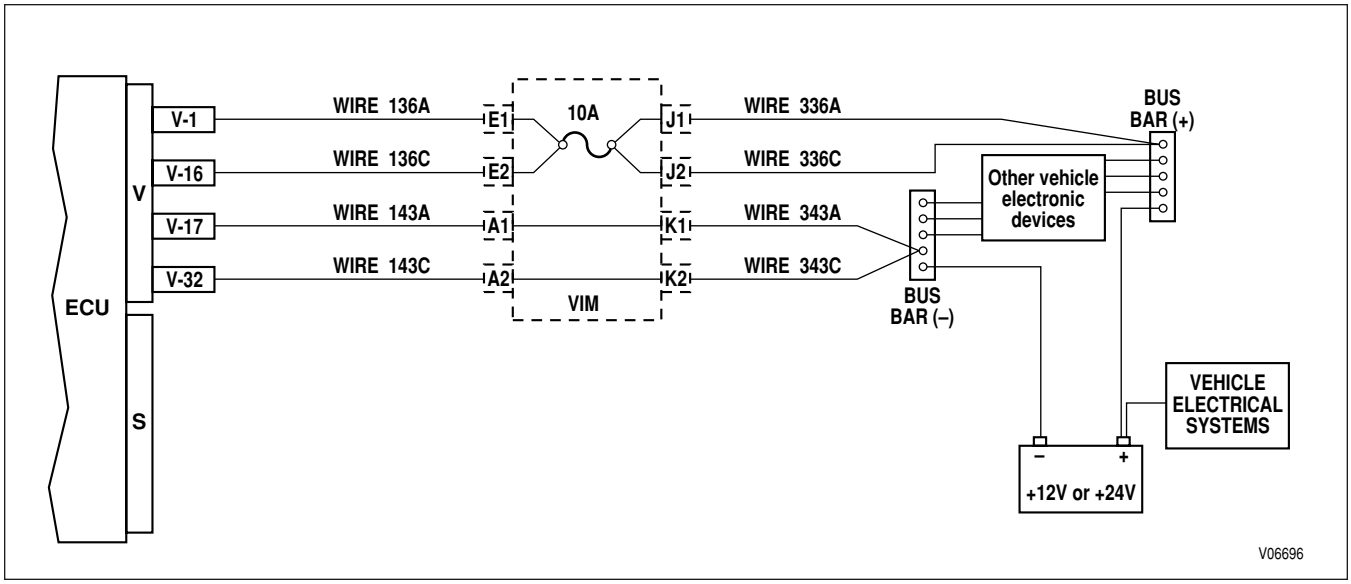


Ground **must be** supplied directly to the ECU from the battery negative terminal or a dedicated "electronic" bus bar.

- These wires are connected through the VIM.
- **Never use** chassis grounds for these wires.
- If a power supply other than a battery is used, these wires **must be** connected directly to the negative side of the power supply.
- Wires from the battery to the splice point before the VIM **must be** no smaller than 10 AWG. They may need to be larger, depending on length.
  - — Wiring shall be sized to maintain a minimum of 10.5V at the ECU during max current draw conditions (9 amp).

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

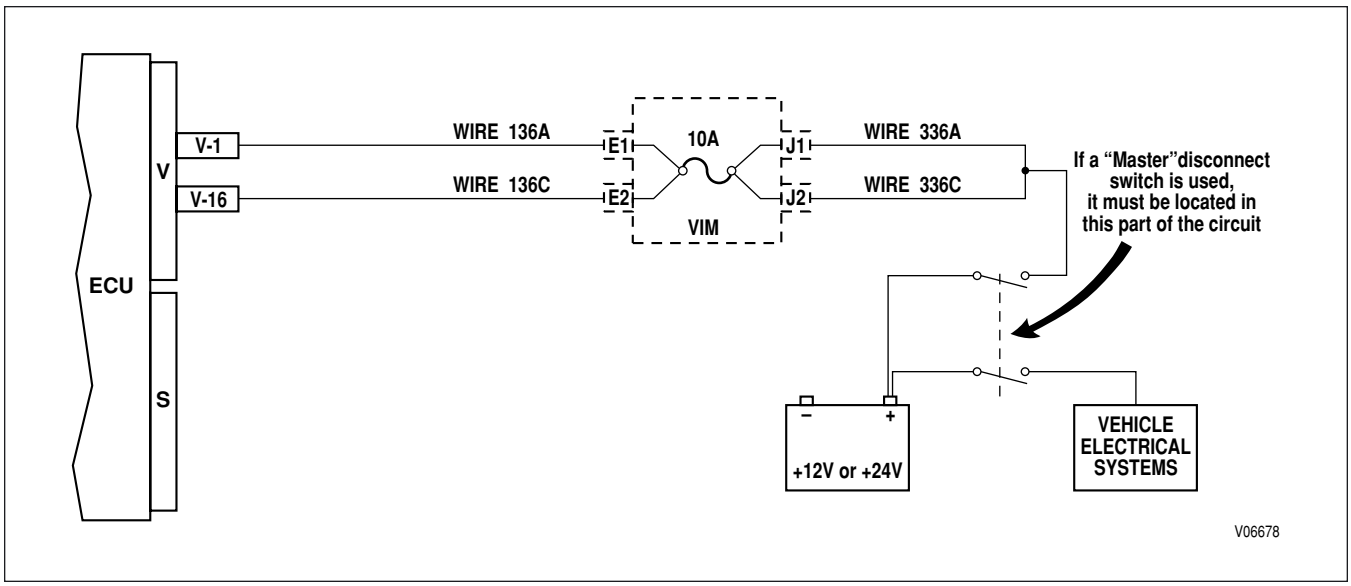
6–3. POWER AND GROUND USING A BUS BAR



No additional electrical loads with high inductance (motors, solenoids, relays, etc.) may be added to the bus bars.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–4. INSTALLING A MASTER DISCONNECT SWITCH

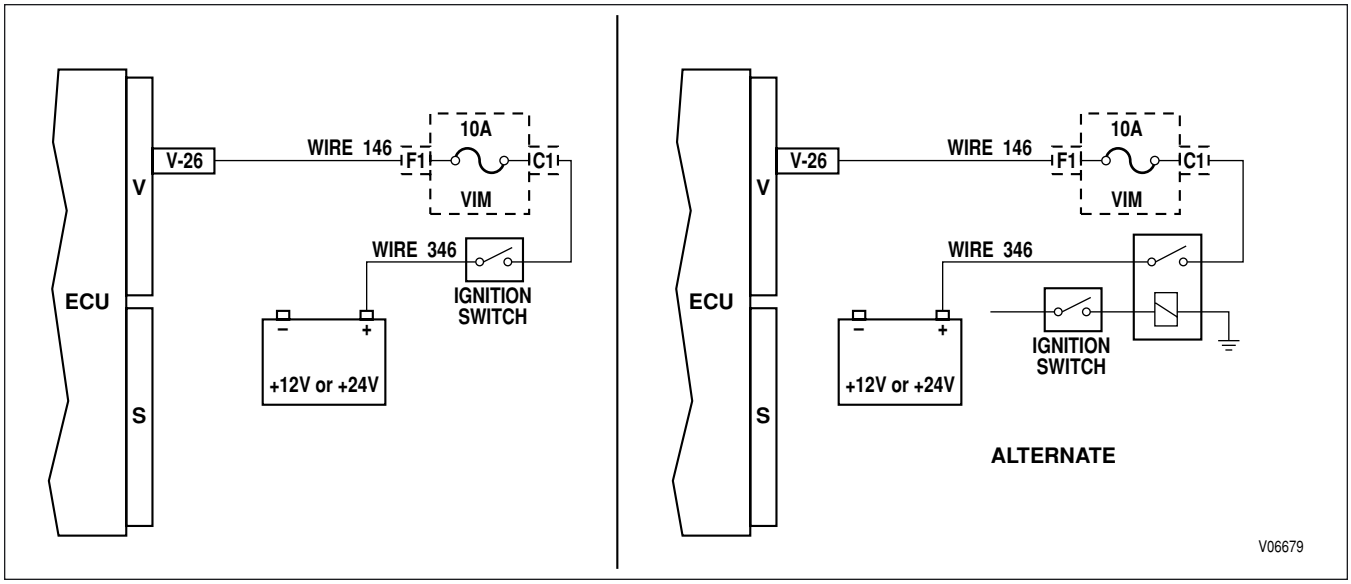


If the vehicle is equipped with a master disconnect switch, the disconnect **must be** on the positive (power) side of the system.

NOTE: ***Locating the master switch on the negative (ground) side of the system may result in the ECU being powered at all times, even when the switch is in the off position, resulting in excessive battery drain.***

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–5. IGNITION POWER



Ignition power is wired through the VIM, via a 10 amp fuse.

- It can also be interfaced via the VIW-S connector.

Positive voltage should be supplied to the ECU when the vehicle ignition switch is turned on.

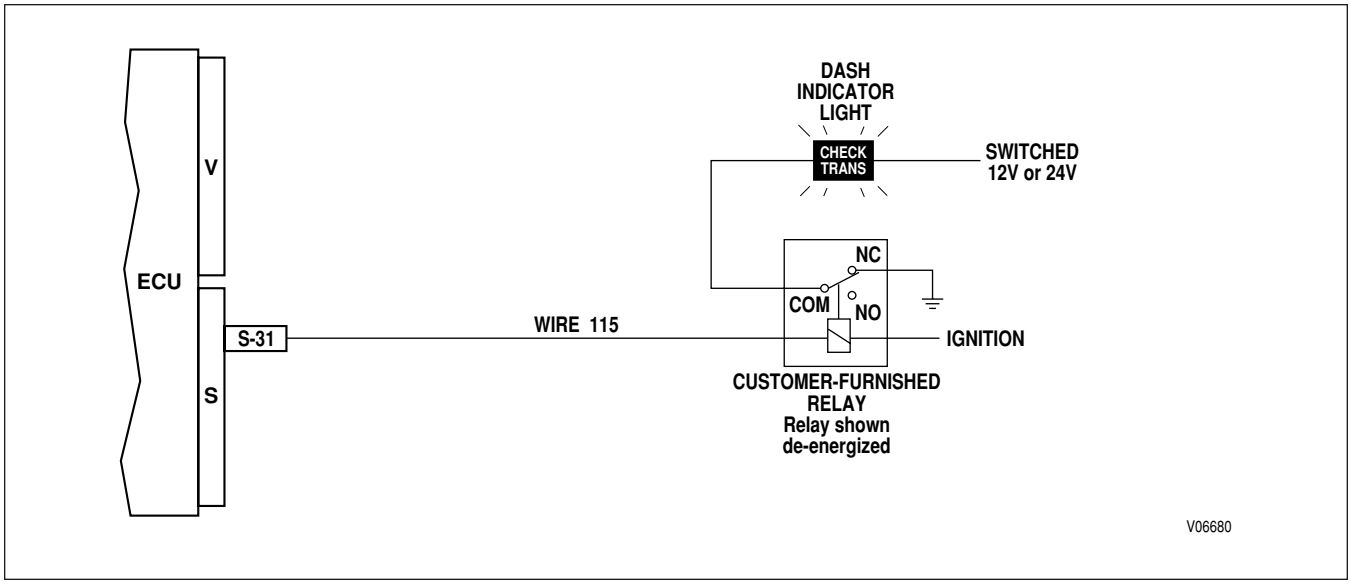
- The signal turns the ECU from its power-down state to on when the proper ECU parameters are met.
  - — At this point, the ECU reads calibration data in memory, checks all sensors for readiness, then commands the control module to initialize the transmission and shift selector in neutral.
  - — Throttle position calibration is adjusted as necessary from stored data.

Ignition power can be either 12V or 24V.

NOTE: ***The ECU requires ignition input that is free of all unsuppressed inductive loads. Use a relay (refer to Ignition Power-Alternate diagram) when any inductive loads exist in the feed to wire 146 or wire 346.***

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–6. CHECK TRANS LIGHT

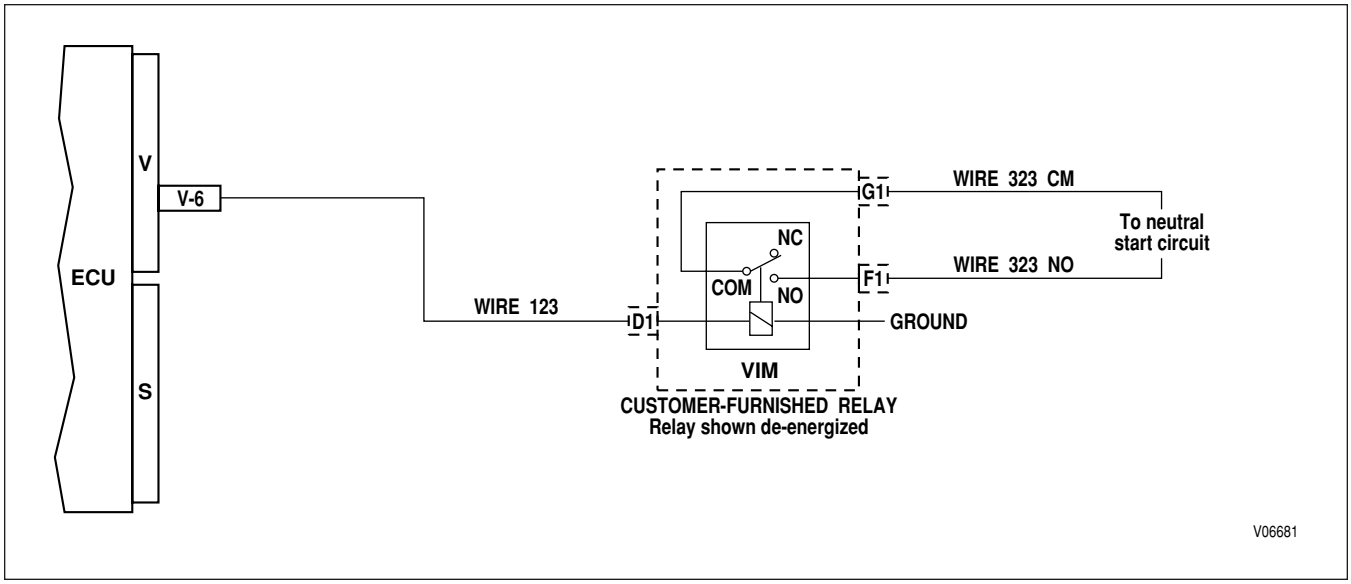


Wire 115 goes from ground to open when the ECU senses a major transmission problem.

- An external relay is required if the current is 0.5 amps or greater.
- **Do not use** this signal in a vehicle shut-down system.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–7. NEUTRAL START

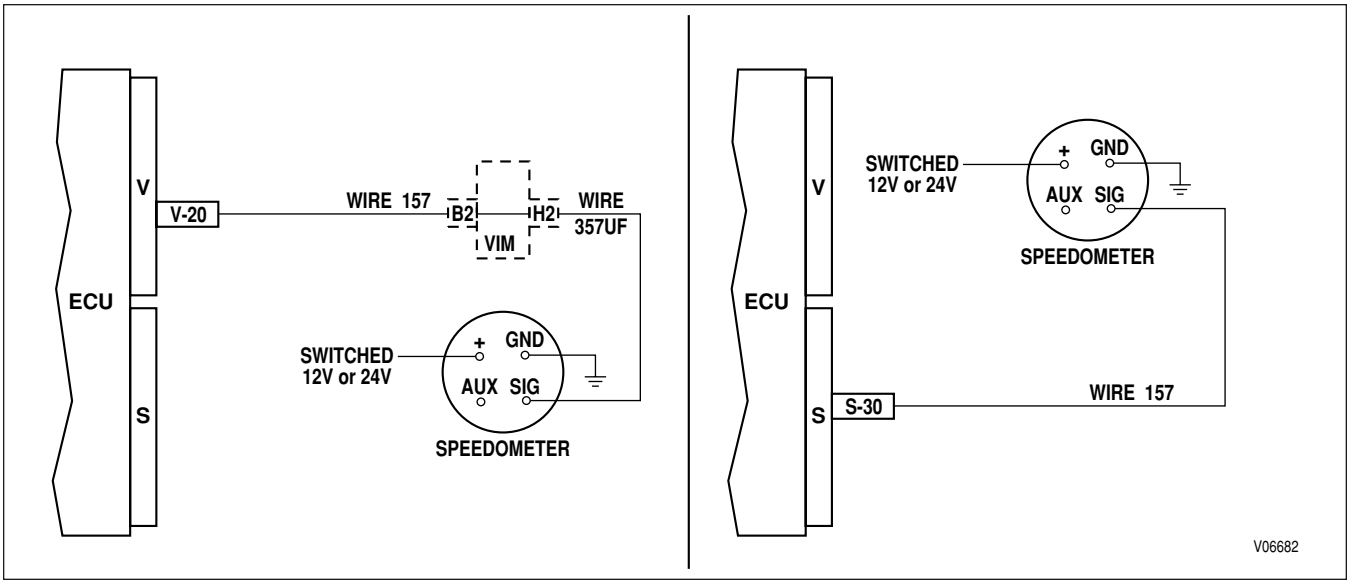


Wire 123 enables the Neutral Start circuit.

- Wire 123 goes from open to positive voltage when Neutral has been selected and attained.
- Wire 123 is interfaced through the VIM.
  - This signal is used with a relay in the VIM to verify that the transmission is in neutral for starting the engine.
- The relay contact circuit **must be** protected by a customer-furnished 15 amp fuse.
- Voltage during engine cranking **must not** fall below the relay drop-out voltage.
- This feature **cannot be** used for interfacing with auxiliary vehicle systems which require neutral indication.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–8. SPEEDOMETER SIGNAL

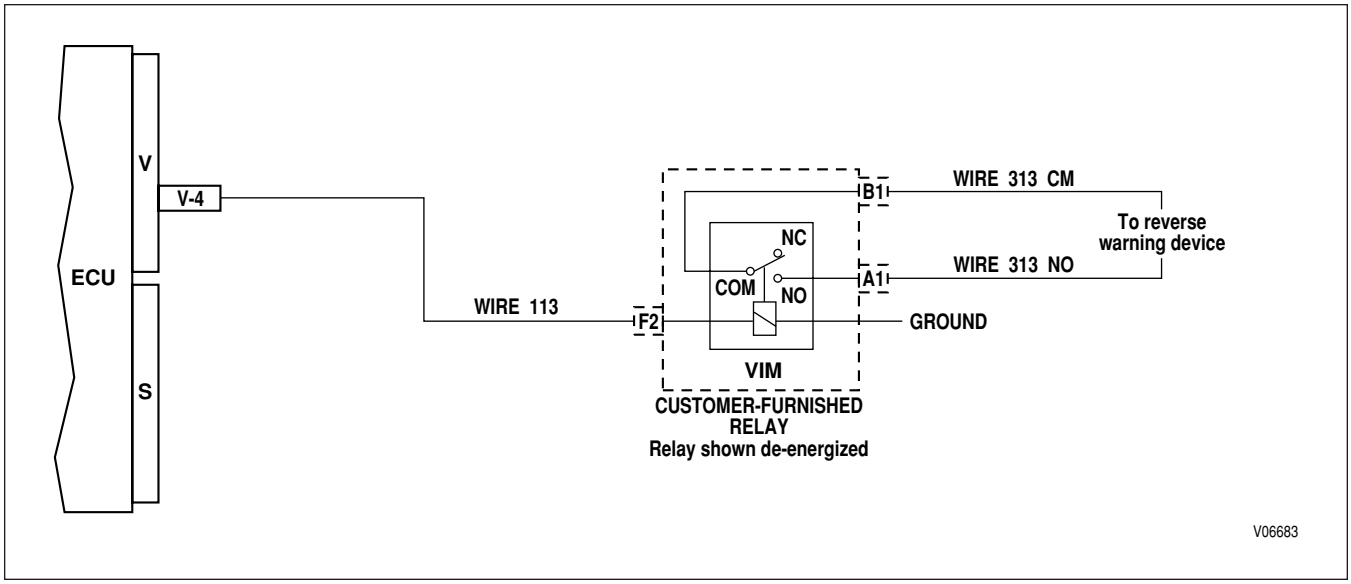


The voltage pulse signal conforms to a 50 percent (non-zero crossing) duty cycle square wave.

- The number of pulses per output shaft revolution may vary by model.
- The signal can be used directly by the speedometer or signal converter.
- **Do not** splice into the transmission harness to access speed sensor signals.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–9. REVERSE WARNING

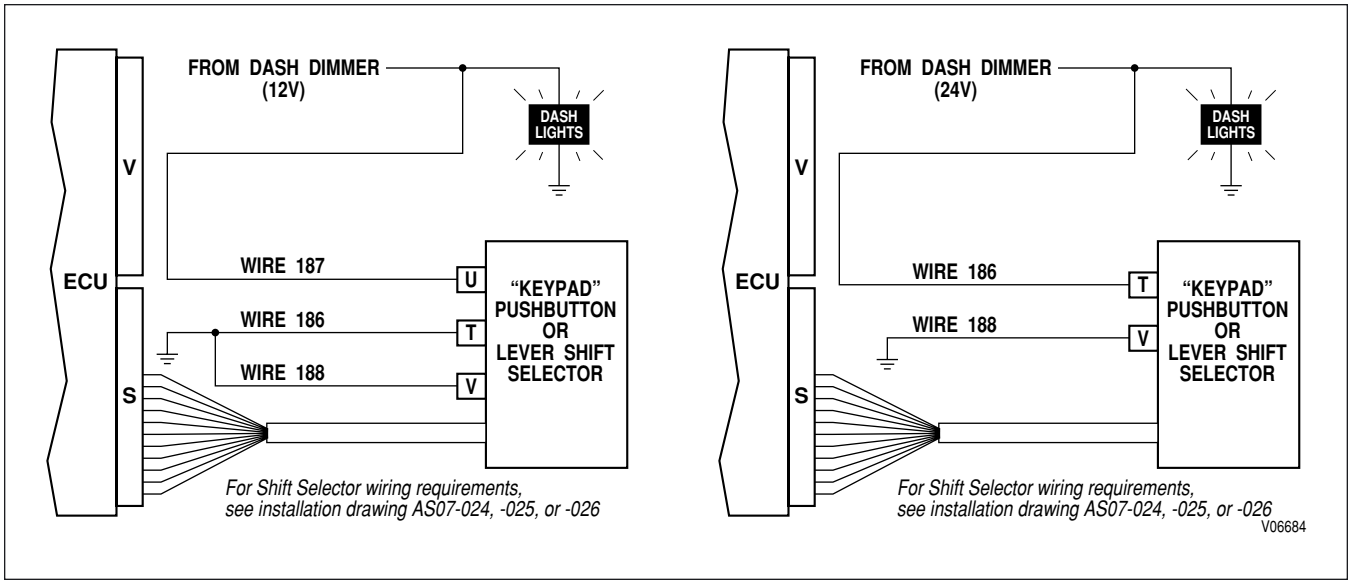


This interface enables the Reverse Warning indicator circuit.

- When the ECU commands reverse, wire 113 goes from open to ground.
- This signal can be used with an external relay for warning devices, backup lights, etc.
  - A reverse warning relay is provided in the VIM.
  - The relay's contact circuit **must be** protected by a customer-furnished 15 amp fuse.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–10. SHIFT SELECTOR / DISPLAY DIMMER



This interface supplies a variable input signal to the ECU through the vehicle's dash dimmer control.

- Lighting configuration vary depending on shifter type.

Pushbutton selector:

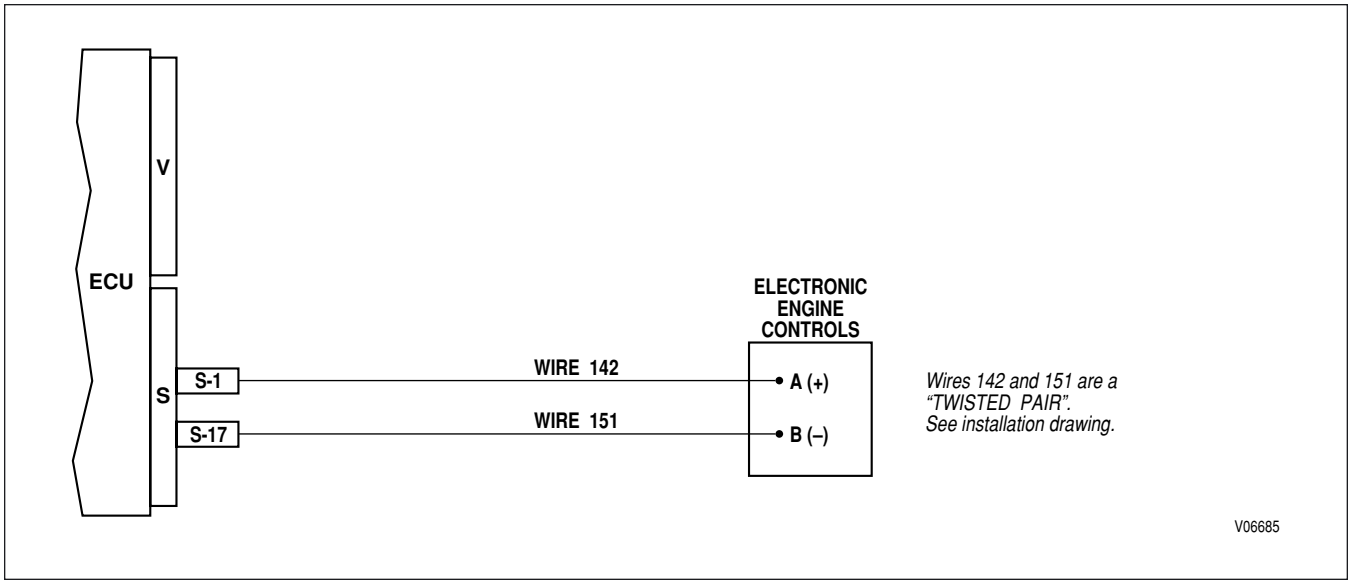
- Digital display—variable
- MODE button backlighting—variable
- Pushbuttons—infinitely variable

Lever selector:

- Digital display—variable
- MODE button backlighting—infinitely variable
- Selectable ranges—no backlighting

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–11. SERIAL COMMUNICATION INTERFACE (SCI)—J1587/J1708



SCI conforms to Society of Automotive Engineers (SAE) data interchange protocols J1587 and 1708.

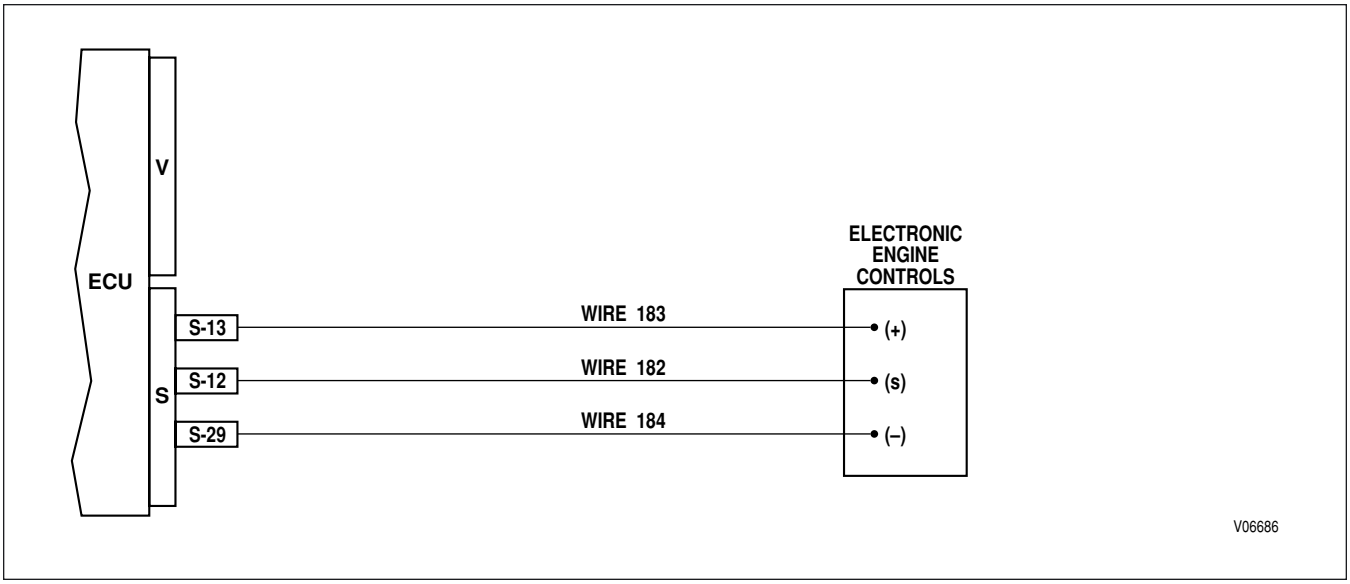
- SCI is accomplished through an optional SCI connector on the Selector (S) harness.
- This interface communicates at 9600 bits per second.

Consult the engine manufacturer for appropriate engine-side installation instructions.

The Allison DOC™ For PC–Service Tool and Pro-Link® 9000 diagnostic tool communicate with the ECU over the SCI per SAE J1587.

VEHICLE INTERFACE WIRING—MANDATORY (VIW-M)

6–12. COMMUNICATION INTERFACE—SAE J1939



SAE J1939 is a high speed communication interface capable of 250,000 bits per second.

- This interface's higher speed improves system interactions due to the "real time" distribution and sharing of data between control systems.

Interface is accomplished through a dedicated three-pin connector on the Selector (S) harness.

SECTION 7—WIRING SCHEMATICS OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

7–1. CALIBRATION COMPATIBILITY

Table 7–1. Release History (Last Update November 1, 2005)

CC Level*	Software Level	Date
J00	J00	January 2000
J00	J02	September 2001
J03	J06	January 2003
J06	J06	November 2004
J07, J08	J08	October 2005

*** NOTE: The calibration compatibility (CC) level is used with the listed software level.**

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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7–2. INPUT FUNCTIONS

Table 7–2. Input Function Software Compatibility

		Software Level			
Function	**Description**	**J00/J02**	**J03**	**J06**	**J08**
1	Secondary Shift Schedule	X	X	X	X
5	Two-Speed Axle Enable	X	X	X	X
8	Hold-in-Range	X	X	X	X
9	D-1 Selection	X	X	X	X
11	Stall Check	X	X	X	X
14*	Manual Lockup (non-roading)	X	X	X	X
16	Shift Selector Transition	X	X	X	X
17	Neutral-to-Range Inhibit	X	X	X	X
20	Anti-Lock Brake Response		X	X	X
25	Quick-to-Neutral	X	X		
29*	Manual Lockup Enable (non-roading)	X	X		
29	Automatic Lockup Off			X	X
29A	Automatic Lockup Off	X	X		
34	Retarder Enable (With VIM)	X	X	X	X
34	Retarder Enable (Without VIM)	X	X	X	X
52	Park Brake Enable	X	X		
52A	Load Dump Brake Enable	X	X		
53	Delta-p (ΔP) Hold	X	X	X	X
54	R1 and R2 With Single Reverse Shift Selector	X	X	X	X
55	Manual Mode	X	X	X	X
56	Bed Hoist Interlock	X	X	X	X
58	Alternate Shift Selector With Manual Mode		X	X	X
62	Engine Speed/torque Control (TSC1)		X	X	X
63	Special Function Override #1 (Power)		X	X	X
64	Special Function Override #1 (Ground)		X	X	X

**** NOTE: Input Function 14 used with Input Function 29 (refer to wiring schematics)***

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

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INPUT FUNCTION

1. SECONDARY SHIFT SCHEDULE—ALSO REFER TO OUTPUT 16; SECONDARY MODE INDICATOR

USES: Provides operator selection of dual shift schedules.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

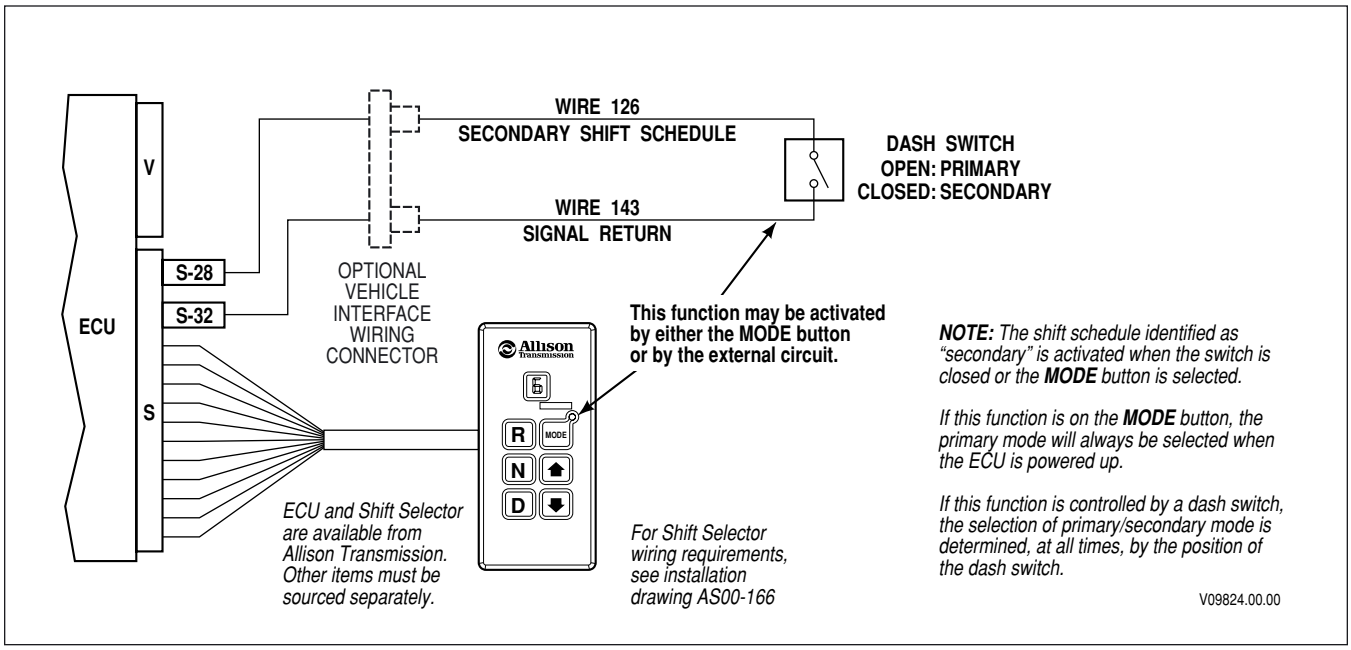

Figure 7–1. Secondary Shift Schedule

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

5. TWO SPEED AXLE INPUT—ALSO SHOWN: OUTPUT 18, TWO SPEED AXLE OUTPUT

USES: Provides output speed interlock for axle engagement, input to ECU, and input to speedometer to adjust for axle ratio change.

VARIABLES TO SPECIFY: Output speed to activate, output speed to deactivate

VOCATIONS: Dump truck, on/off-highway truck, crash truck, crane

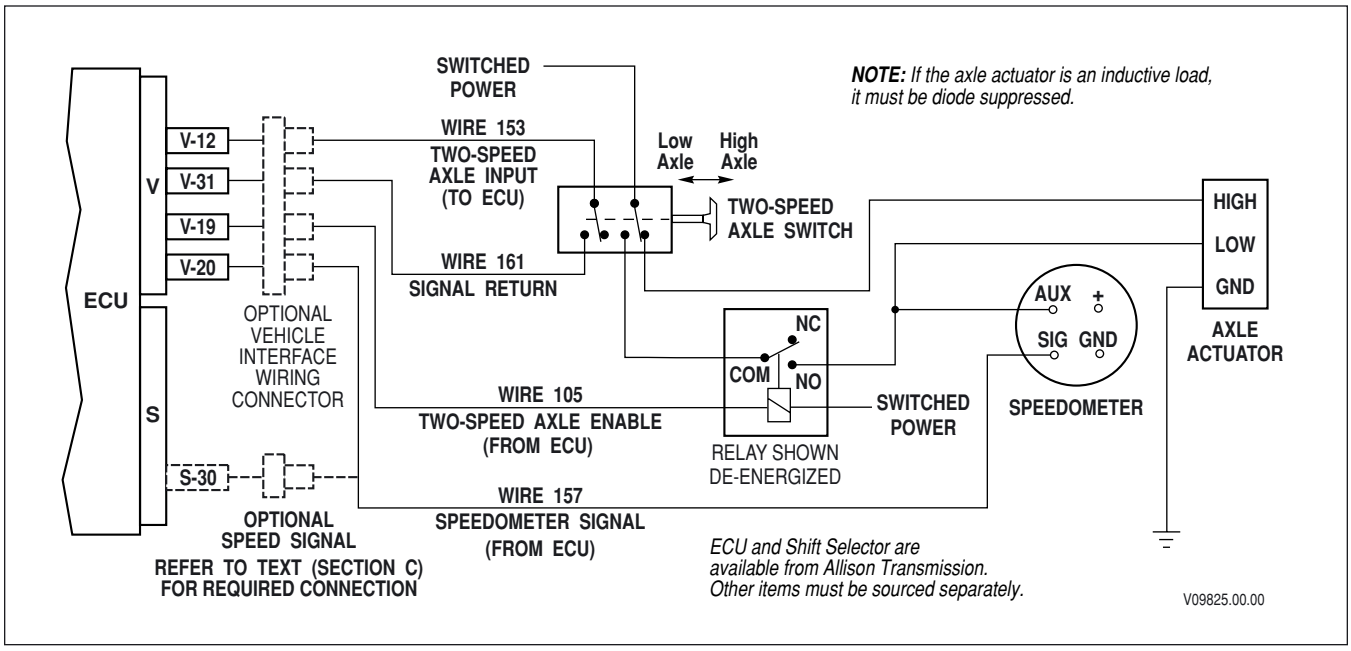

Figure 7–2. Two Speed Axle Input and Output

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

8. HOLD IN RANGE

USES: Provide a discrete input to hold the transmission in present range.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

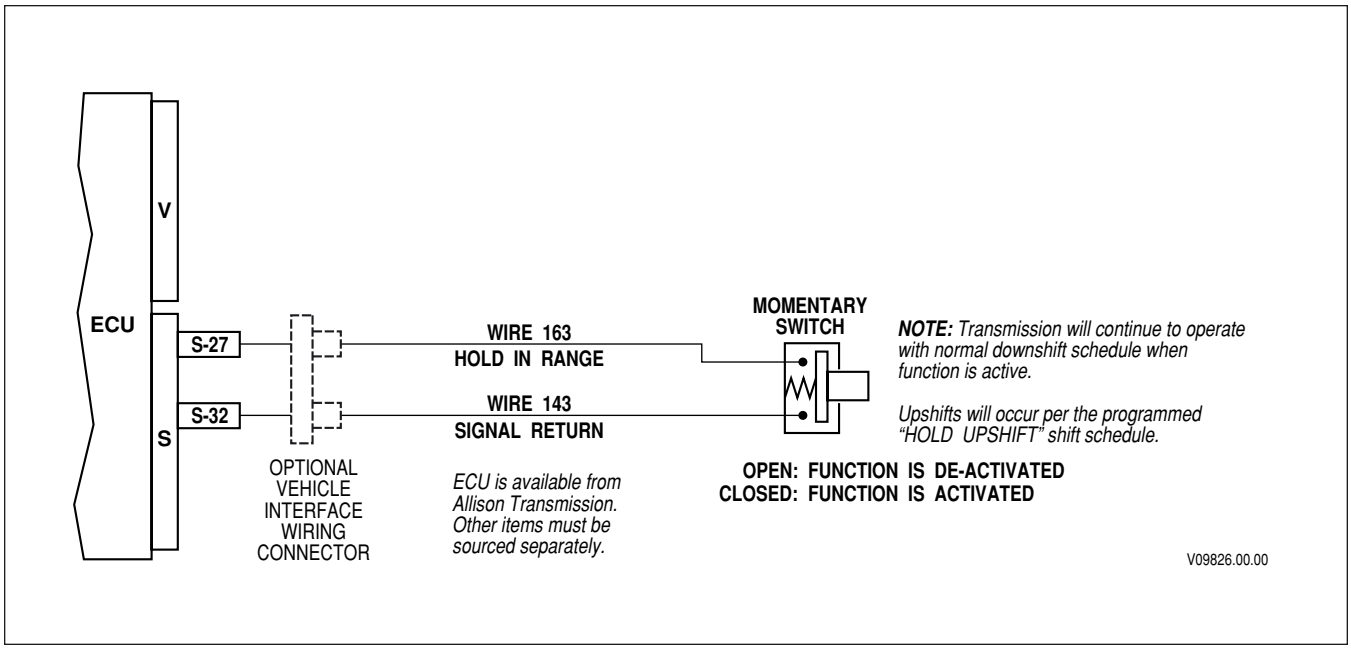

Figure 7–3. Hold In Range

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

9. D1 SELECT

USES: Provides a convenient means to attain a programmed hold range for pushbutton shift selectors. Primary and Secondary modes may be programmed separately.

VARIABLES TO SPECIFY: Range selected with **MODE** button in Primary mode. Range selected with **MODE** button in Secondary mode (usually 1st range).

VOCATIONS: Various

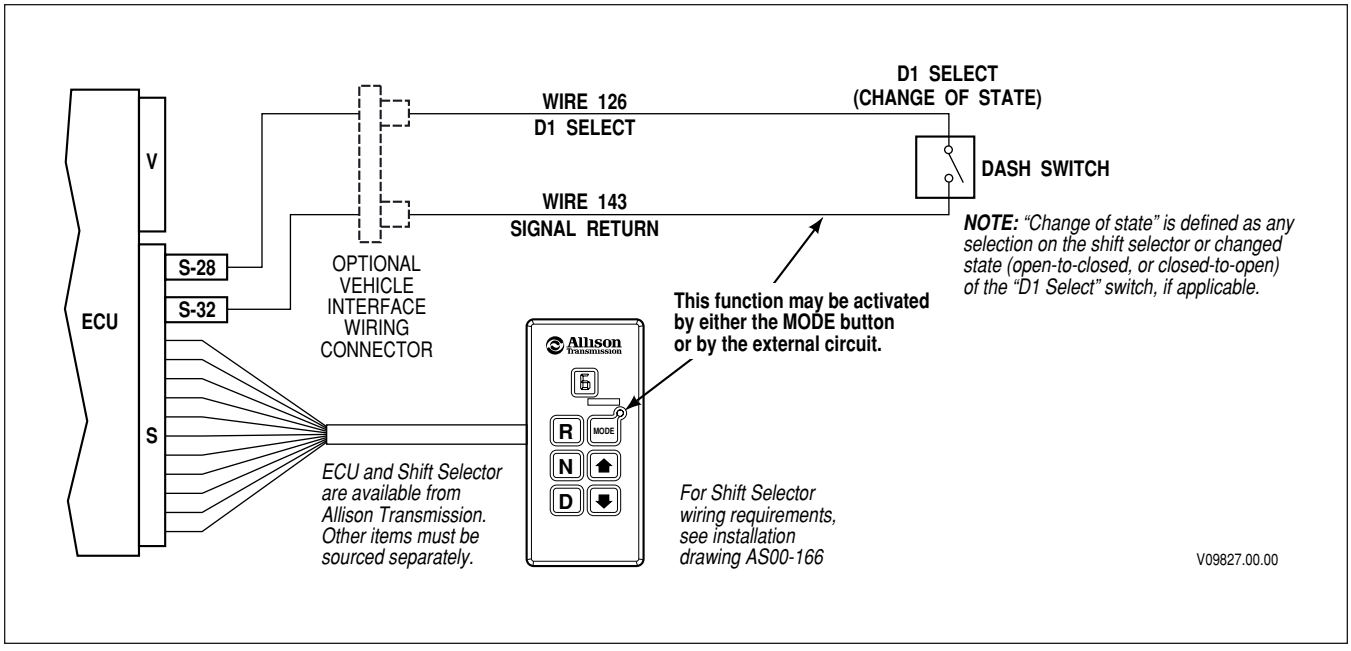

Figure 7–4. D1 Select

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION

11. STALL CHECK

USES: Provides a means of selecting a programmed gear for determining engine speed at converter stall.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING! **This function is for diagnostic purposes only and must not be activated during normal vehicle operation.**

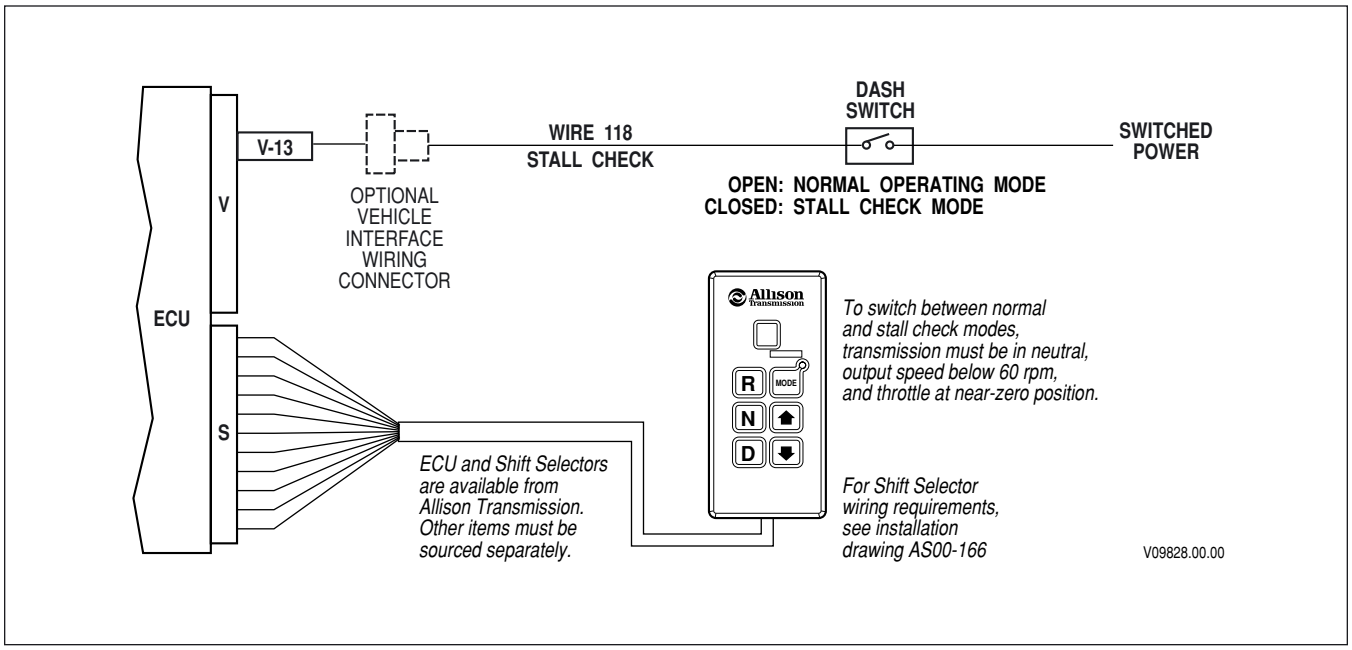

Figure 7–5. Stall Check

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

14. MANUAL LOCKUP—ALSO SHOWN: INPUT 29, MANUAL LOCKUP ENABLE

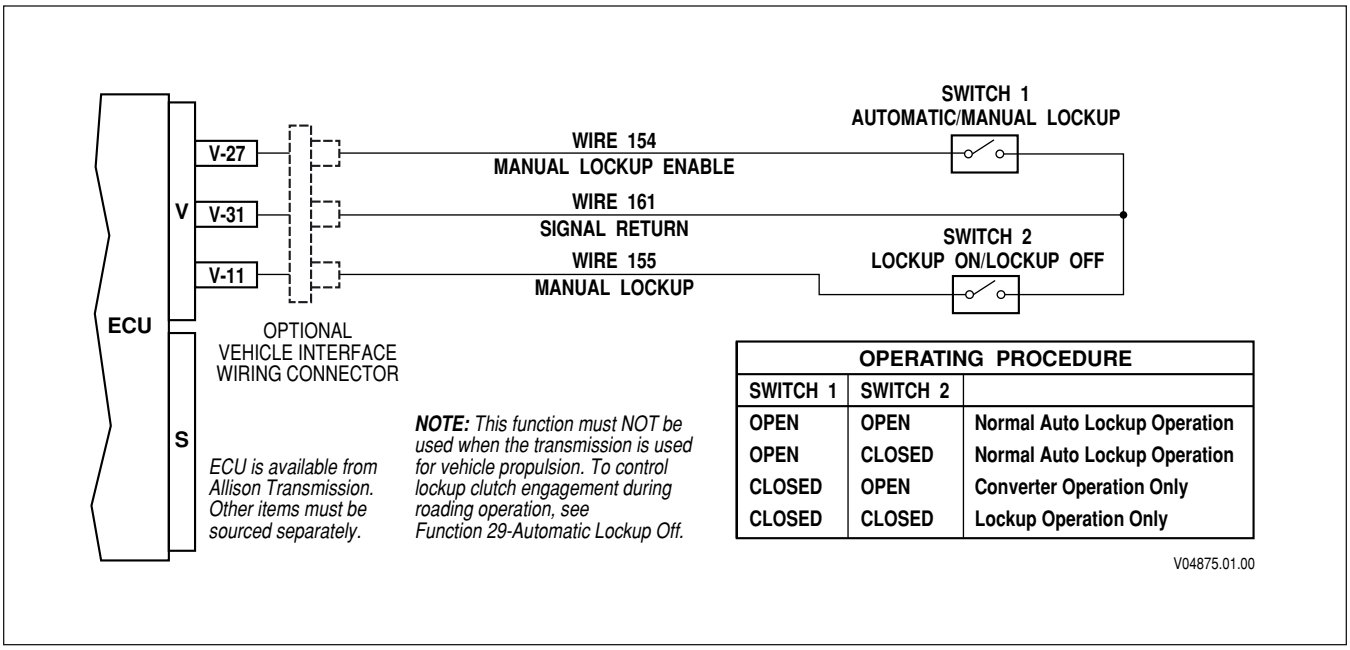
USES: Provides for the manual application of the lockup clutch for non-roading applications. Uses two inputs; one to select manual versus automatic lockup shift mode, and the second as the switching mechanism to command the lockup clutch on and off.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping, mud pumps, hoists, drilling, trenchers

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.



OPERATING PROCEDURE		
SWITCH 1	SWITCH 2	
OPEN	OPEN	Normal Auto Lockup Operation
OPEN	CLOSED	Normal Auto Lockup Operation
CLOSED	OPEN	Converter Operation Only
CLOSED	CLOSED	Lockup Operation Only

Figure 7–6. Manual Lockup

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

16. SHIFT SELECTOR TRANSITION

USES: When two shift selectors are used, to select which one is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

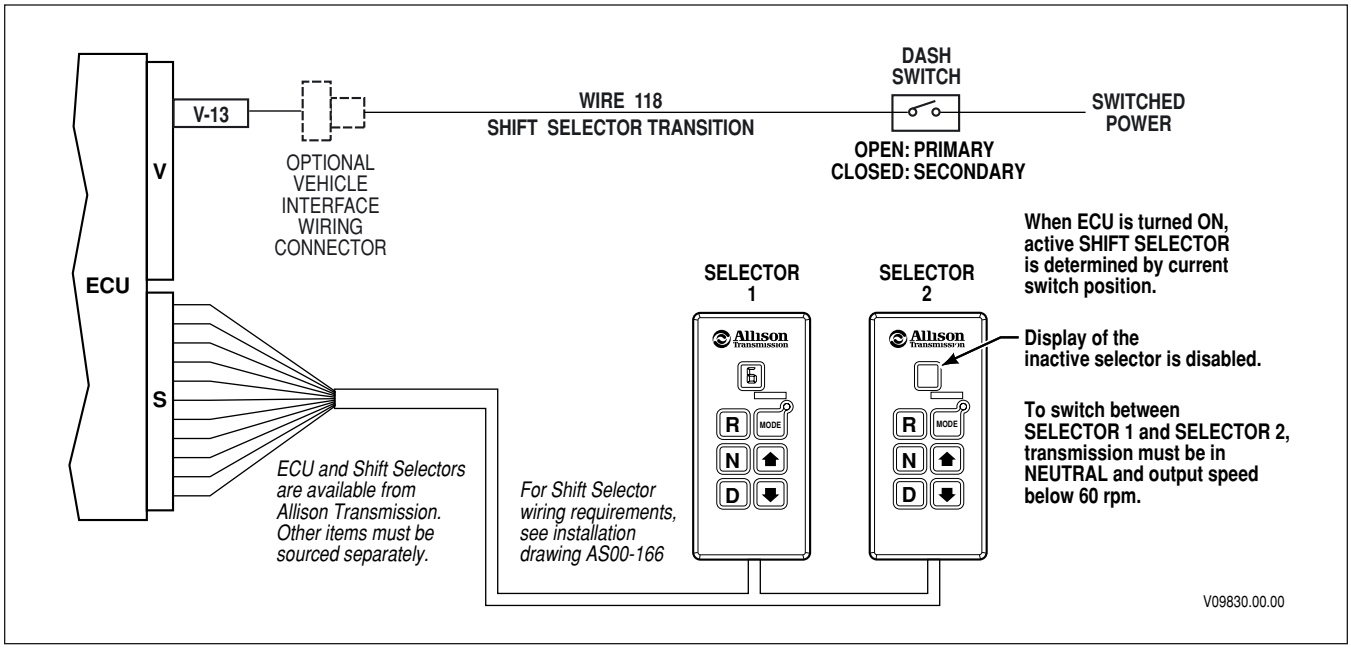


Figure 7–7. Shift Selector Transition

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

17. NEUTRAL TO RANGE INHIBIT

USES: Holds transmission in NEUTRAL regardless of the range position of the shift selector.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

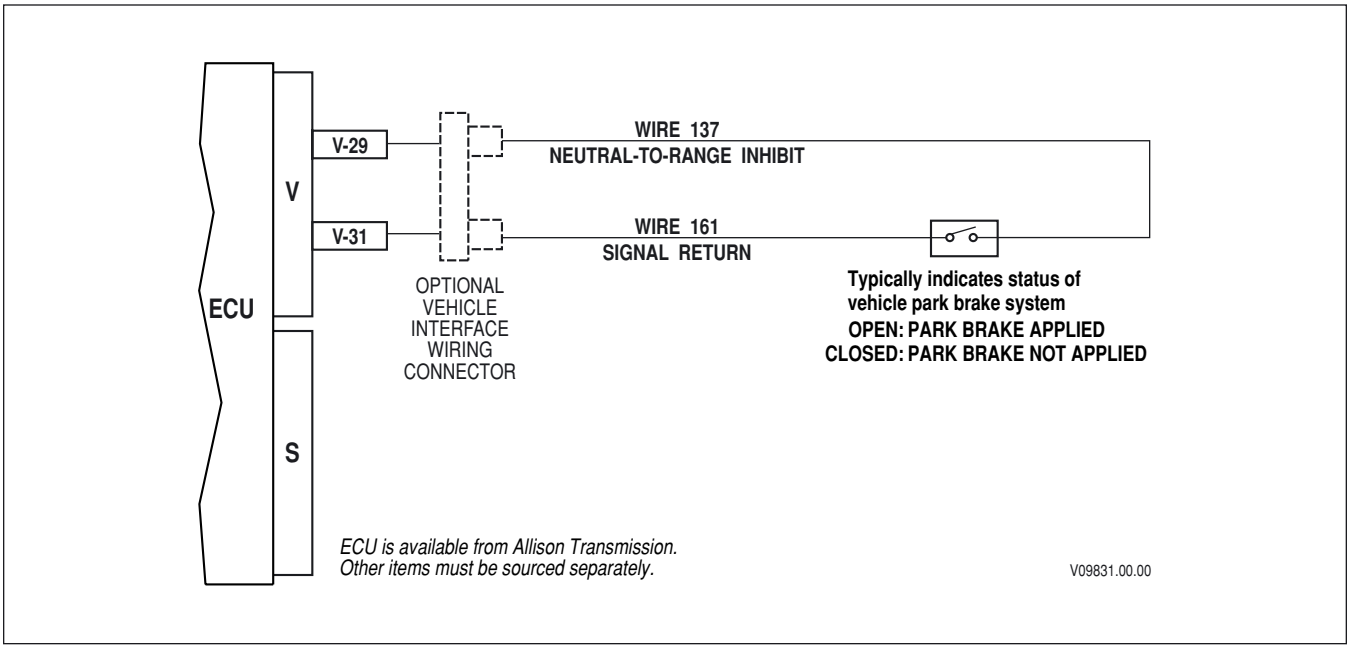

Figure 7–8. Neutral To Range Inhibit

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

20. ANTI-LOCK BRAKE RESPONSE

USES: Provides for enhanced control of the transmission lockup clutch and retarder during hard braking conditions. Can be used separately of in conjunction with ABS.

VARIABLES TO SPECIFY: None

VOCATIONS: On/Off-highway trucks, oil field service vehicles

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

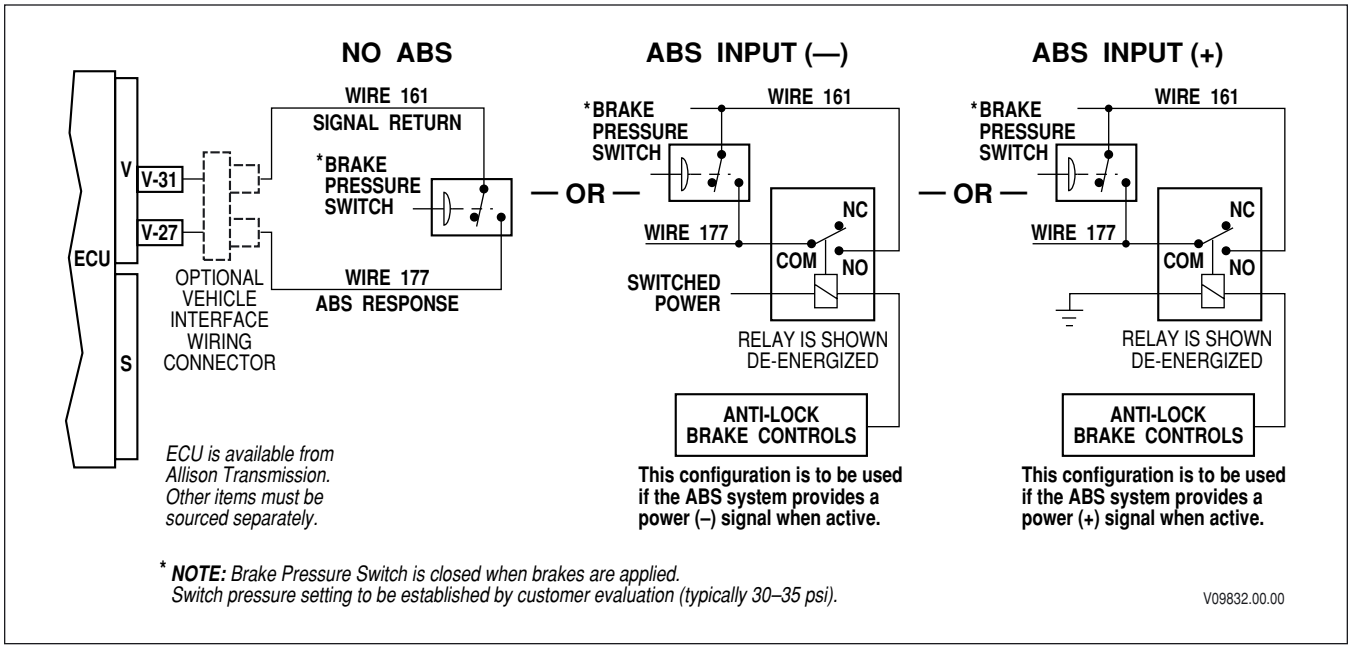

Figure 7–9. Anti-Lock Brake Response

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

25. QUICK TO NEUTRAL

USES: Automatically shifts transmission to NEUTRAL when function is activated.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping, trenchers, augers

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

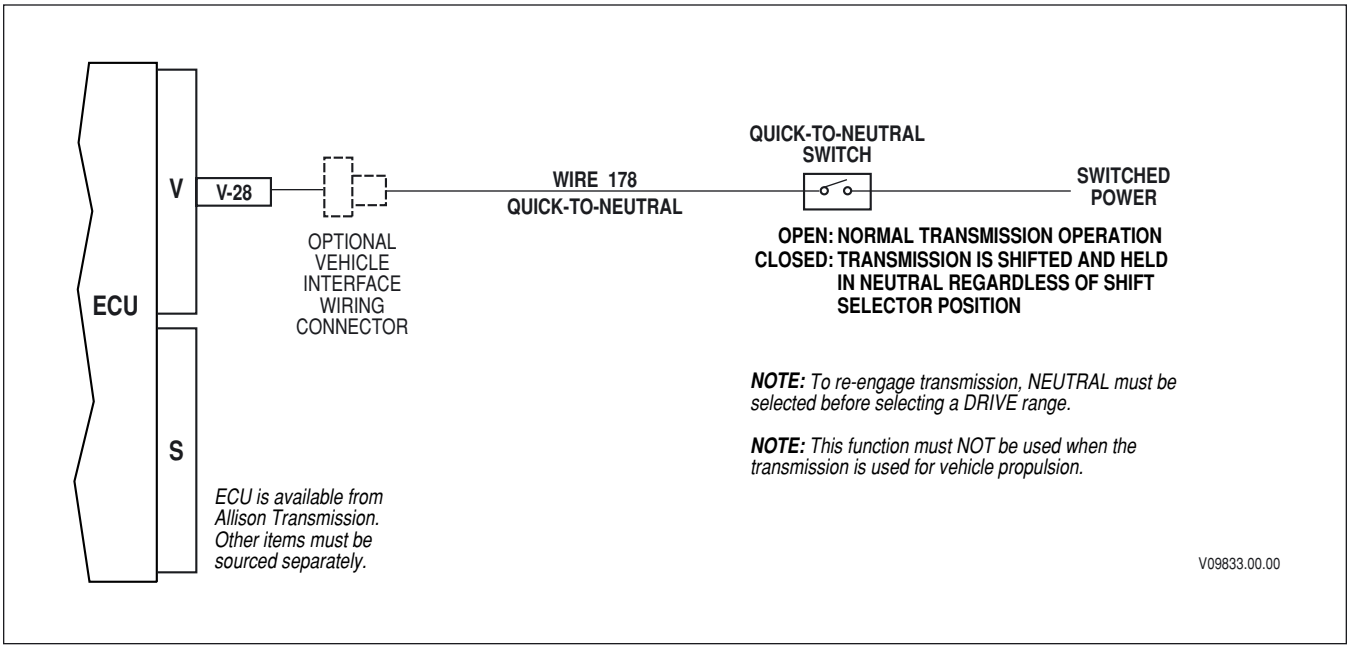

Figure 7–10. Quick To Neutral

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

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INPUT FUNCTION

29. MANUAL LOCKUP ENABLE (ALSO SHOWN: INPUT 14, MANUAL LOCKUP) (NON-ROADING)

USES: Provides for the manual application of the lockup clutch for non-roading applications. Uses two inputs: one to select manual versus automatic lockup shift mode, and the second as the switching mechanism to command the lockup clutch on and off.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping, mud pumps, hoists, drilling, trenchers

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

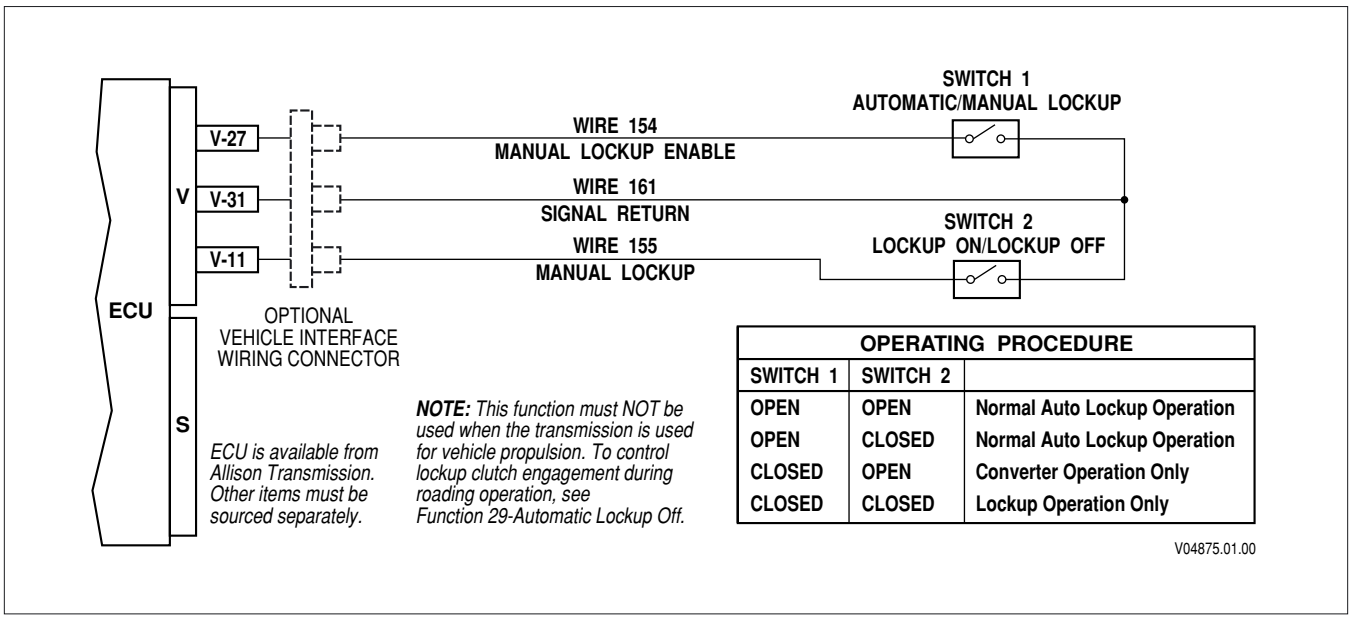

Figure 7–11. Manual Lockup Enable

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

29. AUTOMATIC LOCKUP OFF

USES: Provides for disengagement of the lockup clutch for vehicle roading applications. Used primarily as a means to disable the lockup clutch and keep the transmission in "converter mode" for specialized types of low-speed operation and/or emergency situations.

VARIABLES TO SPECIFY: None

VOCATIONS: Dump truck, on/off-highway truck

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

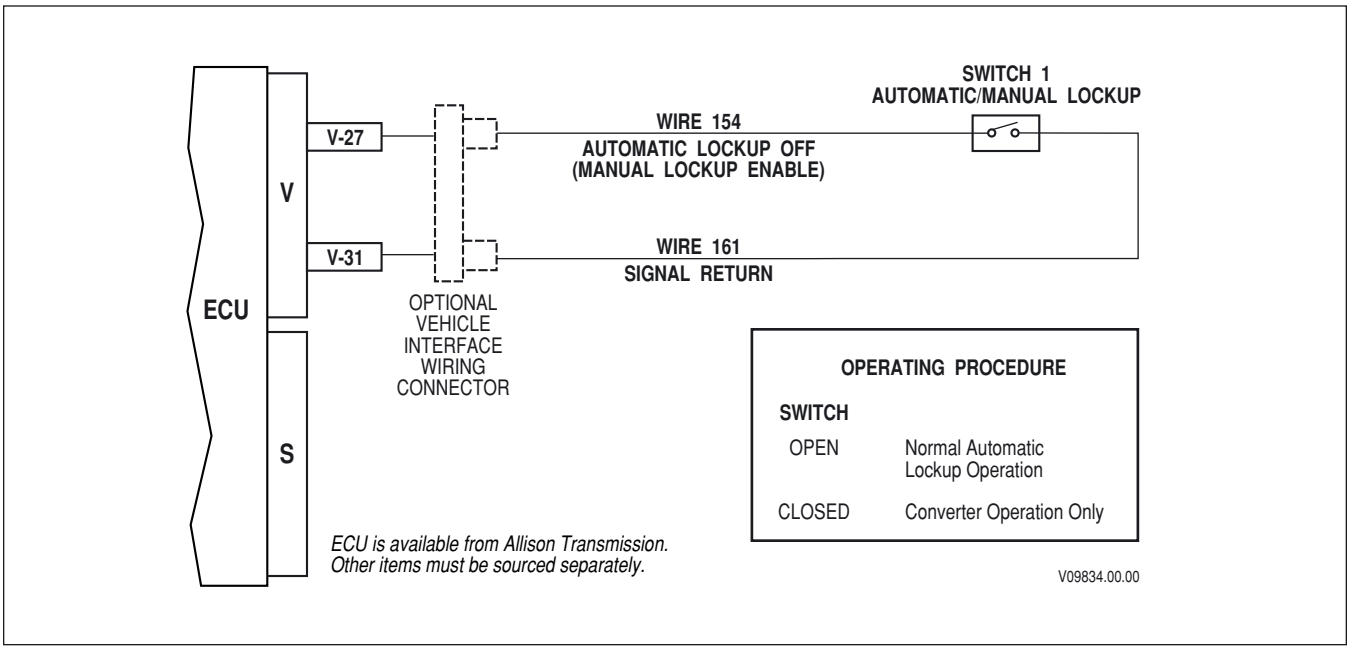

Figure 7–12. Automatic Lockup Off

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

29A. AUTOMATIC LOCKUP OFF

USES: Provides for disengagement of the lockup clutch for vehicle roading applications. Used primarily as a means to disable the lockup clutch and keep the transmission in "converter mode" for specialized types of low-speed operation and/or emergency situations.

VARIABLES TO SPECIFY: None

VOCATIONS: Dump truck, on/off-highway truck

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

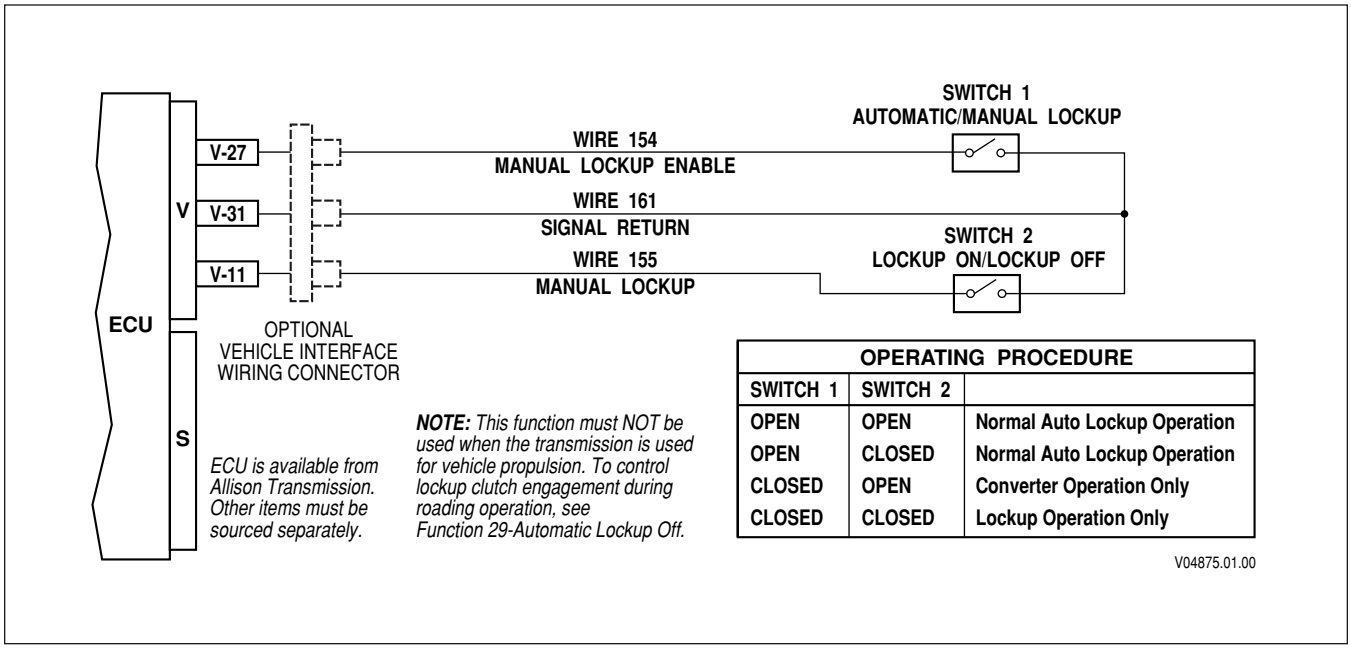

Figure 7–13. Automatic Lockup Off

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

34. RETARDER ENABLE (WITH VIM)—ALSO SHOWN: OUTPUT 9, RETARDER INDICATOR

USES: Used to signal the ECU that the retarder is requested, and to indicate that conditions are appropriate to apply the retarder.

VARIABLES TO SPECIFY: None

VOCATIONS: Various vehicular applications

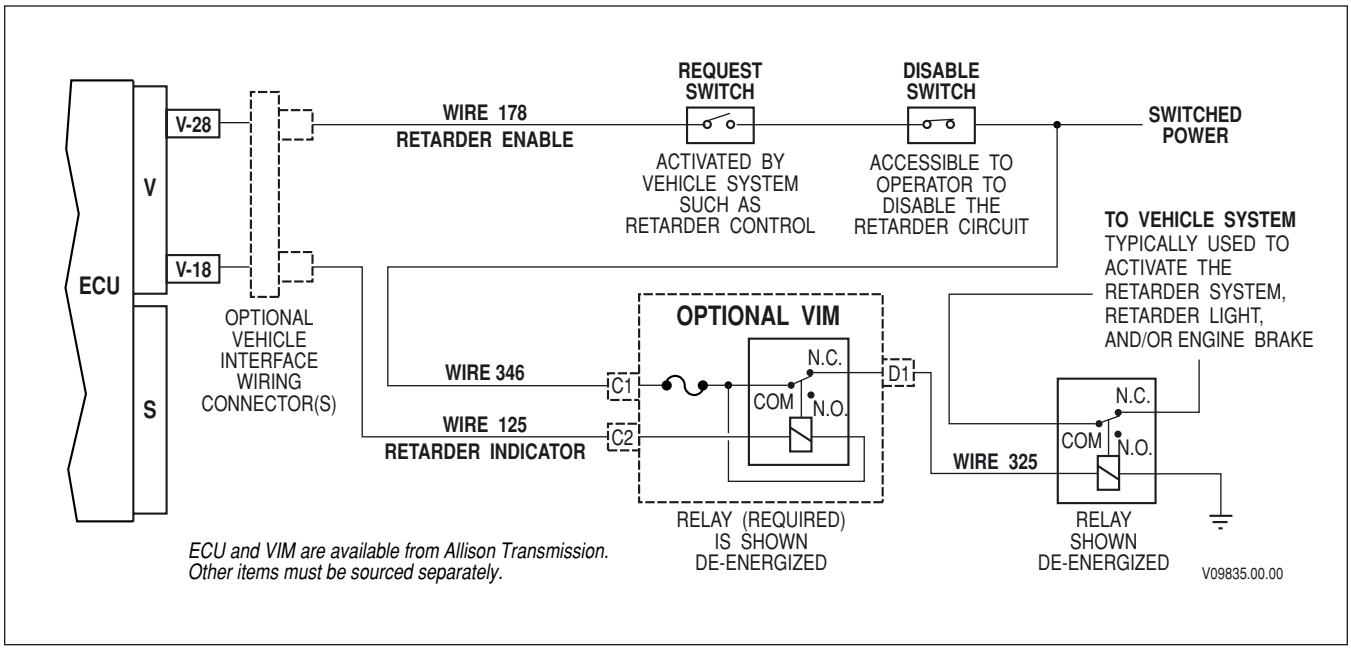

Figure 7–14. Retarder Enable (With VIM)

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

34. RETARDER ENABLE (WITHOUT VIM)—ALSO SHOWN: OUTPUT 9, RETARDER INDICATOR

USES: Used to signal the ECU that the retarder is requested, and to indicate that conditions are appropriate to apply the retarder.

VARIABLES TO SPECIFY: None

VOCATIONS: Various vehicular applications

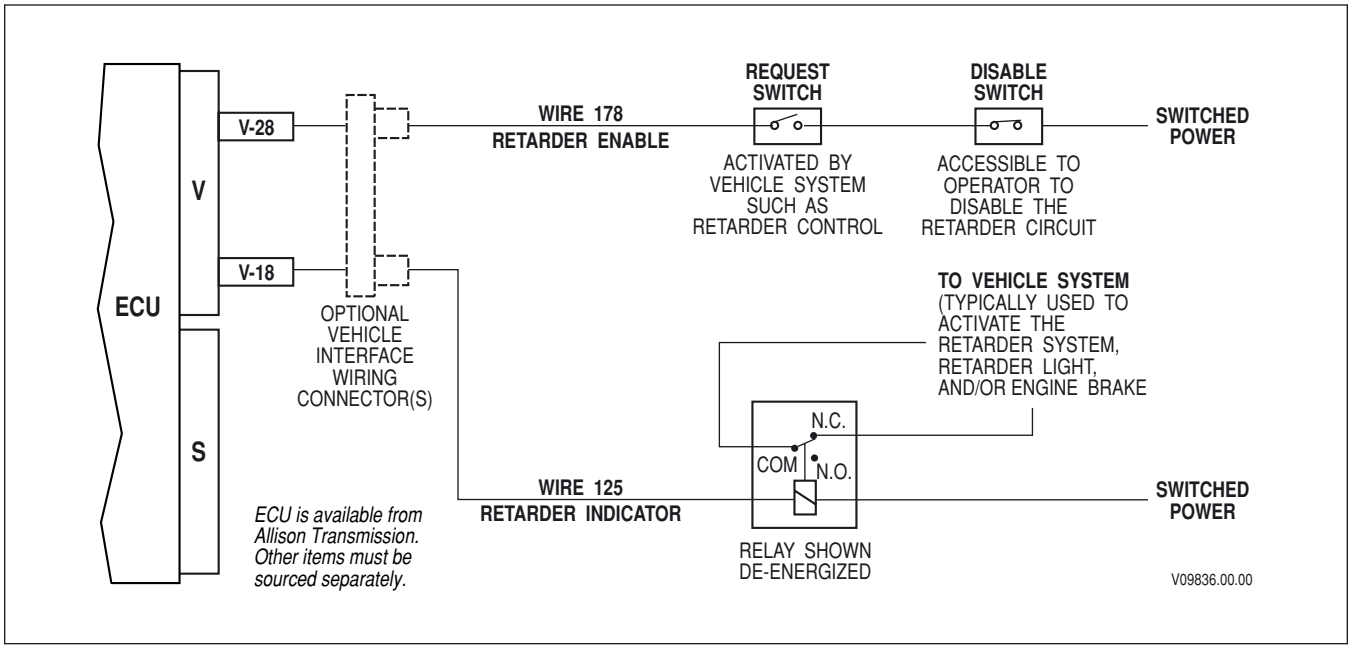

Figure 7–15. Retarder Enable (Without VIM)

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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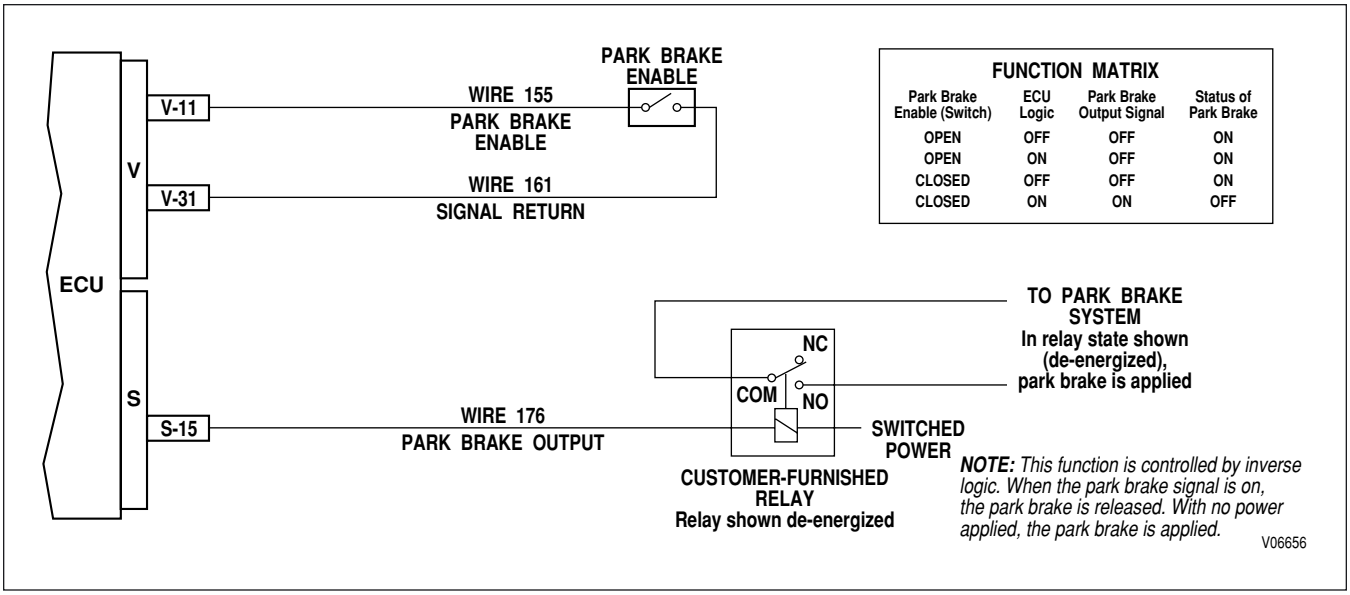
INPUT FUNCTION

52. PARK BRAKE ENABLE (ALSO SHOWN: OUTPUT 31, PARK BRAKE OUTPUT)

USES: Turns on the park brake when the transmission is in neutral and output rpm is below a programmed speed. Turns park brake off, after a programmed delay, when the transmission is shifted into a forward or reverse range.

VARIABLES TO SPECIFY: 1. Time delay to release brake after a range (other than neutral) is selected.
2. Output speed below park brake is enabled.

VOCATIONS: Various vehicular applications



FUNCTION MATRIX

Park Brake Enable (Switch)	ECU Logic	Park Brake Output Signal	Status of Park Brake
OPEN	OFF	OFF	ON
OPEN	ON	OFF	ON
CLOSED	OFF	OFF	ON
CLOSED	ON	ON	OFF

Figure 7–16. Park Brake Enable

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

52A. LOAD DUMP BRAKE ENABLE (ALSO SHOWN: OUTPUT 31A, LOAD DUMP BRAKE OUTPUT)

USES: Turns on the load dump brake when the transmission is in neutral and output rpm is below a programmed speed. Turns load dump brake off, after a programmed delay, when the transmission is shifted into a forward or reverse range.

VARIABLES TO SPECIFY: 1. Time delay to release brake after a range (other than neutral) is selected.
2. Output speed below which load dump brake is enabled.

VOCATIONS: Various vehicular applications

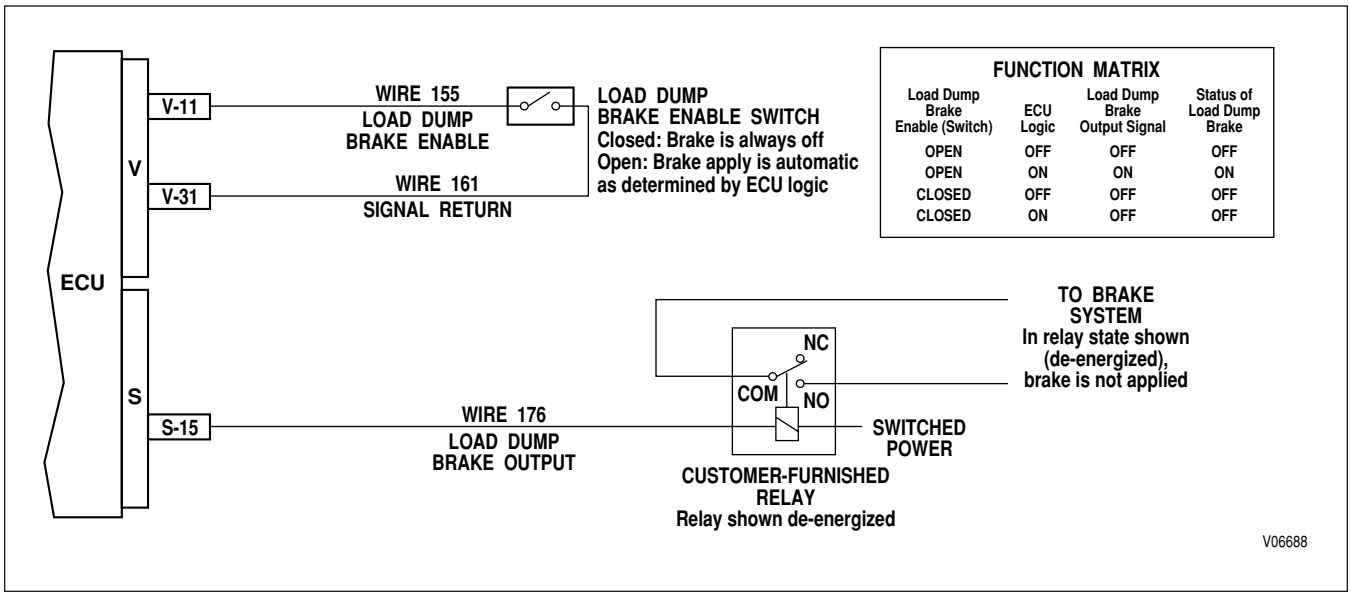

Figure 7–17. Load Dump Brake Enable

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

53. ΔP ("DELTA-P") HOLD

USES: Prevents transmission upshifts when main oil pressure ΔP pressure switch is closed.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

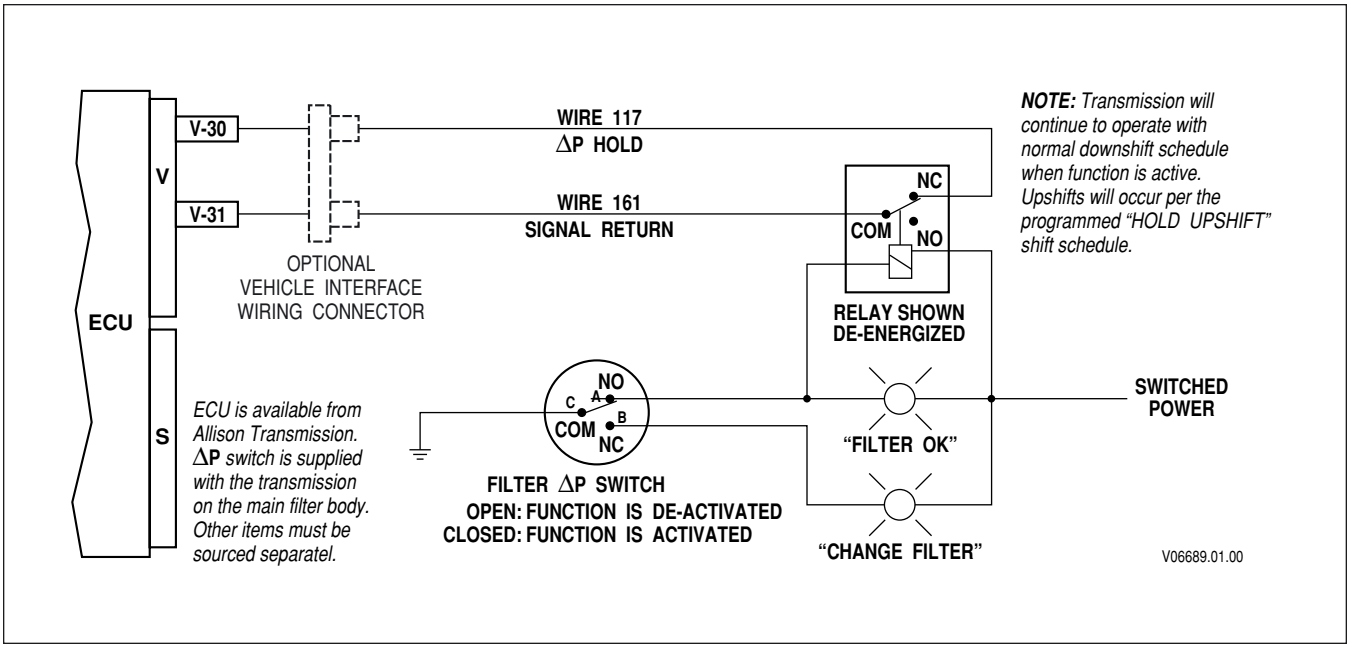

Figure 7–18. ΔP ("Delta-P") Hold

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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INPUT FUNCTION

54. R1 AND R2 REVERSE OPERATION WITH SINGLE-REVERSE SHIFT SELECTOR

USES: Provides for operation with alternate reverse ranges in an installation with a single-reverse shift selector.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

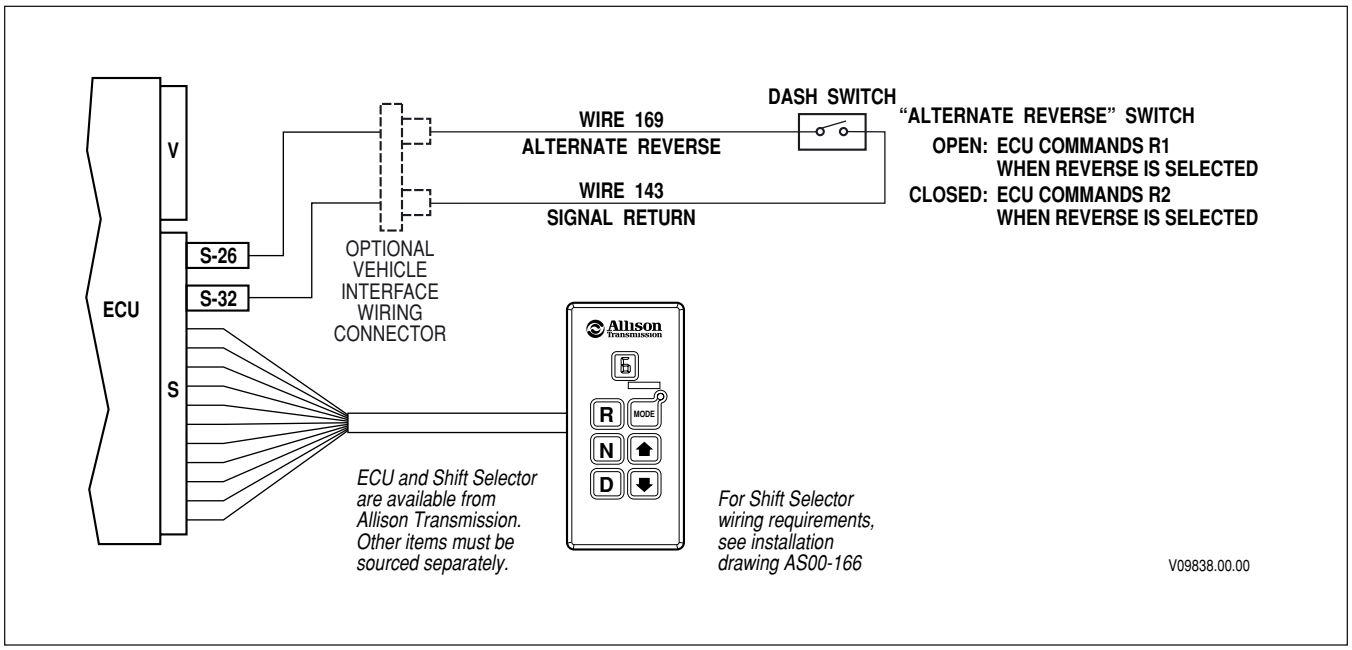

Figure 7–19. R1 and R2 Reverse Operation With Single-Reverse Shift Selector

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

55. MANUAL MODE—ALSO REFER TO OUTPUT 32, MANUAL MODE INDICATOR

USES: Provides manual mode operation for service troubleshooting and non-vehicular (stationary) applications.

VARIABLES TO SPECIFY: None

VOCATIONS: All

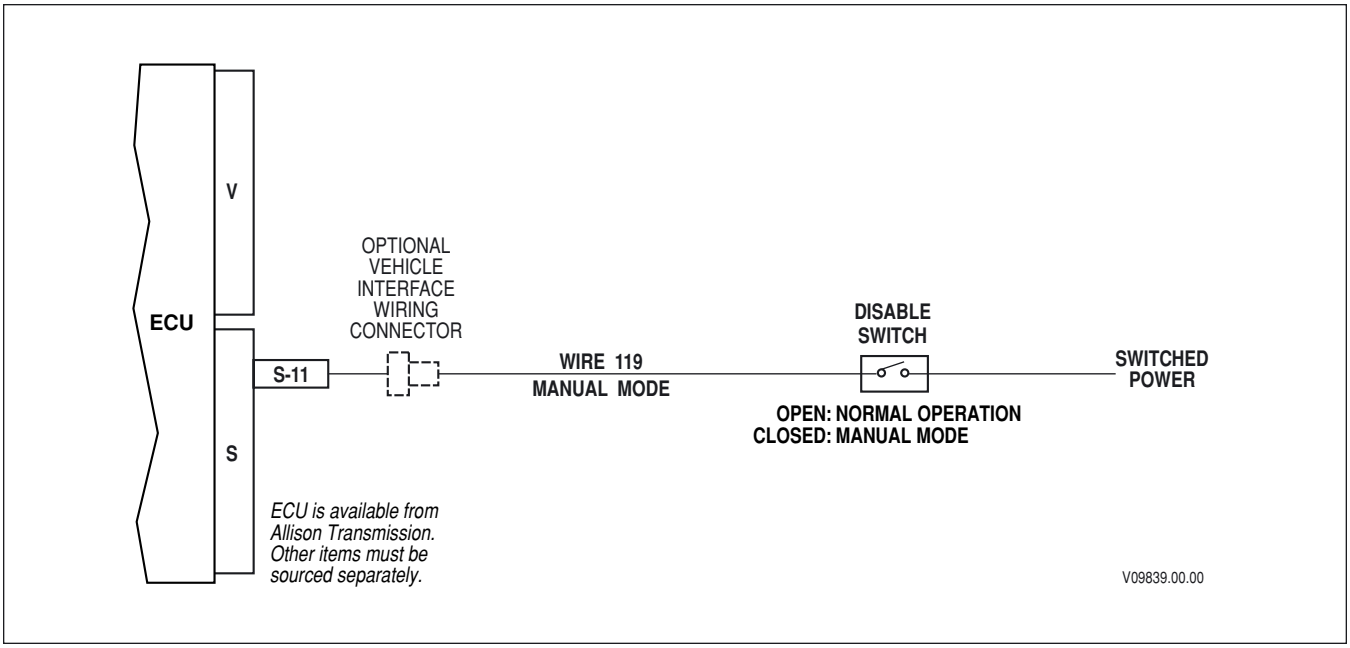

Figure 7–20. Manual Mode

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

56. BED HOIST INTERLOCK

USES: Shifts the transmission to NEUTRAL if the dump bed switch is opened when the transmission is in REVERSE.

VARIABLES TO SPECIFY: None

VOCATIONS: Rear dump truck

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

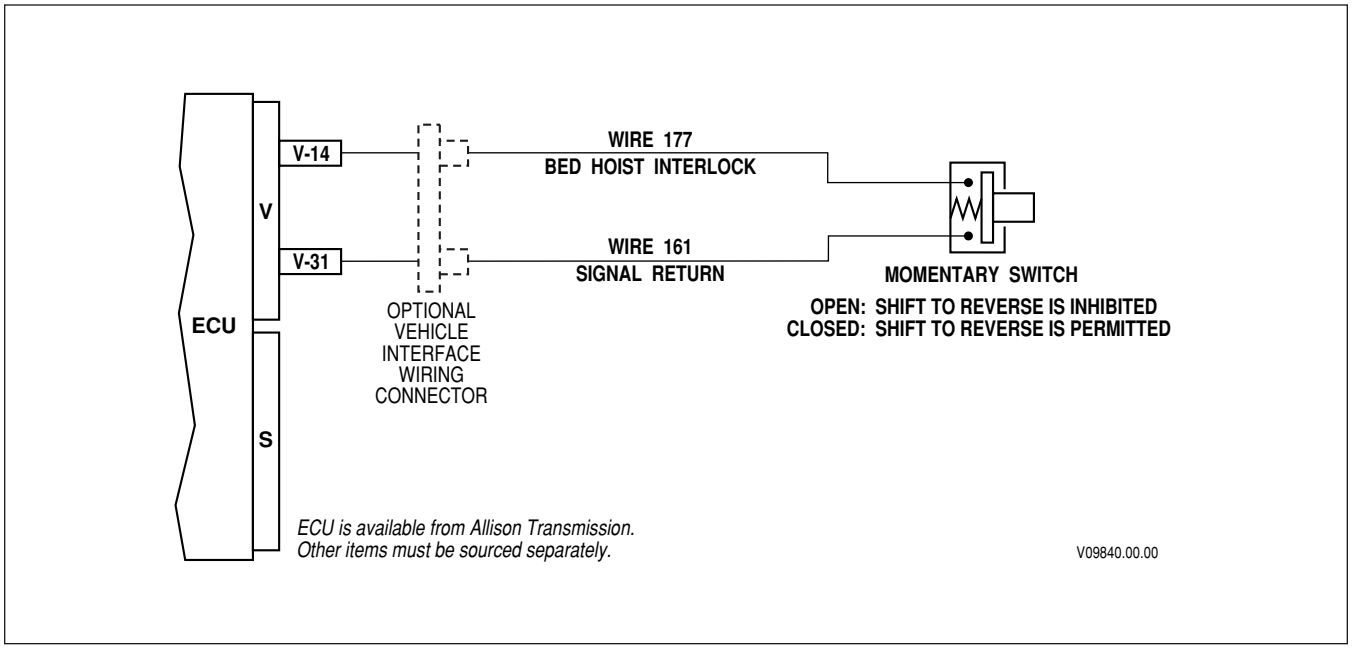

Figure 7–21. Bed Hoist Interlock

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

58. ALTERNATE SHIFT SELECTOR WITH MANUAL MODE

USES: Transfers shift control to secondary shift selector and converts shift calibration to manual mode. For use in dual mode (vehicle and pump) applications.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field dual mode

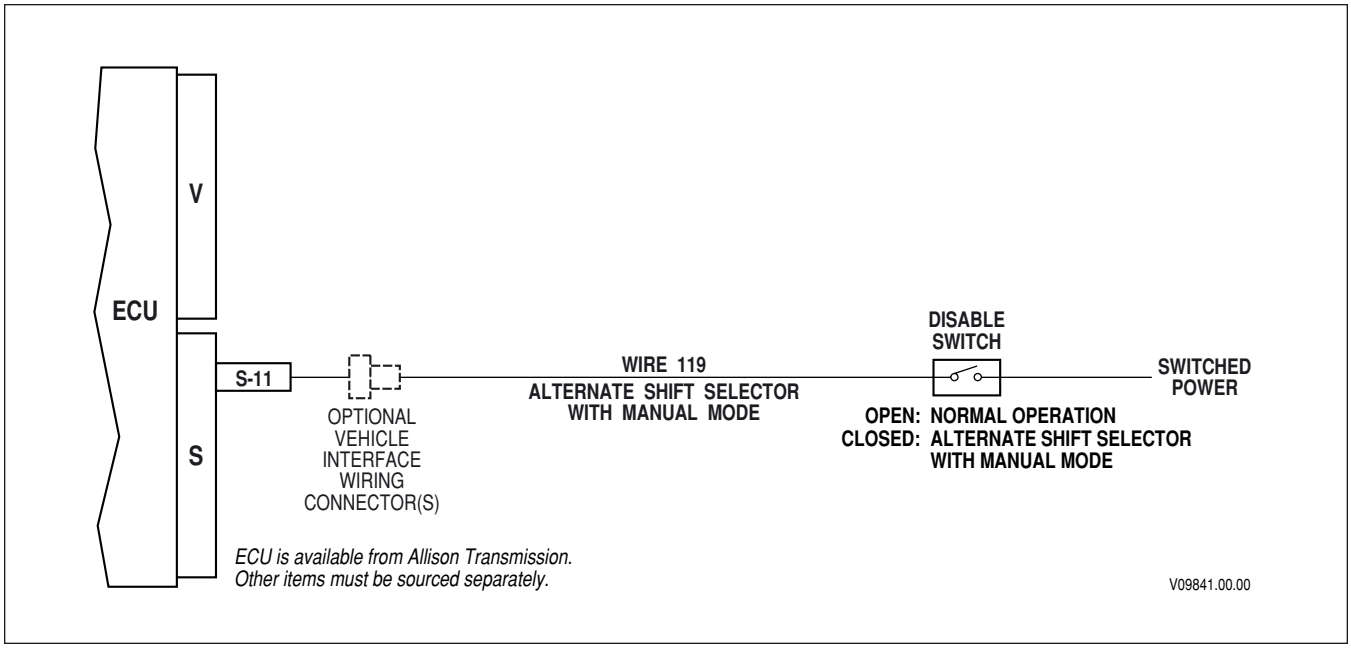

Figure 7–22. Alternate Shift Selector With Manual Mode

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

62. ENGINE SPEED / TORQUE CONTROL

USES: Sets engine speed or torque limits in specific ranges. Used to limit torque in lower ranges or maximum vehicle speed in upper ranges.

VARIABLES TO SPECIFY: Affected ranges, speed limits, torque limits

VOCATIONS: Various

WARNING!

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

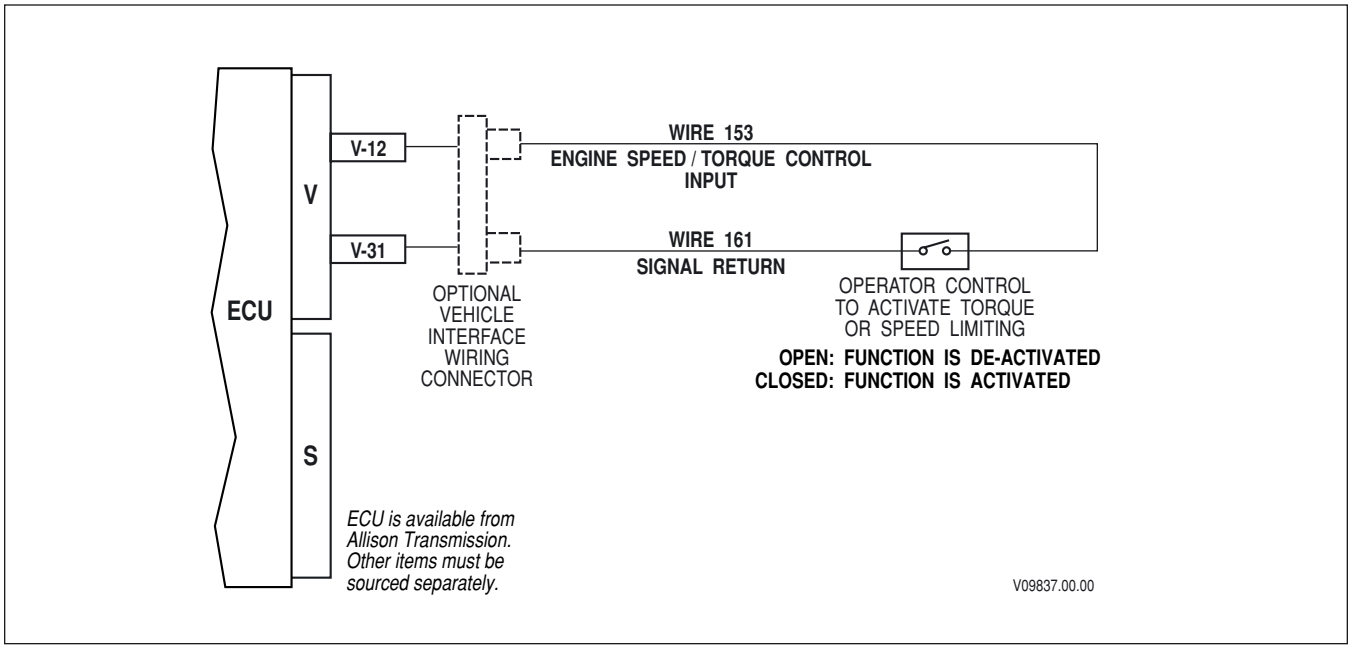

Figure 7–23. Engine Speed / Torque Control

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION

63/64. SPECIAL FUNCTION OVERRIDE

USES: Disables selected input functions during emergency conditions.

VARIABLES TO SPECIFY: None

VOCATIONS: Airport crash truck

WARNING!

This function is required for Crash Truck installations when any of the following functions are included in the controls calibration:

1. **Hold-in-Range**
2. **Neutral-to-Range Inhibit**
3. **Engine Speed / Torque Control**

If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.

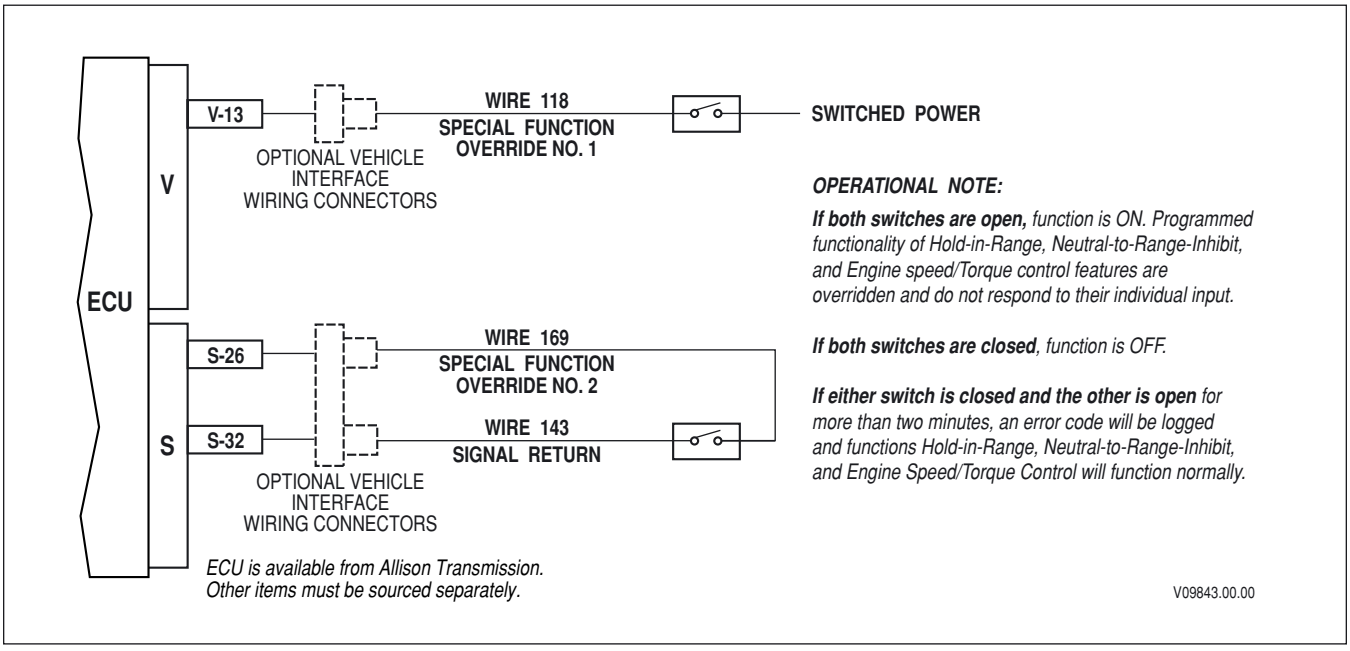

Figure 7–24. Special Function Override

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

7–3. OUTPUT FUNCTION

Table 7–3. Output Function Software Compatibility

		Software Level			
Function	**Description**	**J00/J02**	**J03**	**J06**	**J08**
1	Lockup Indicator	X	X	X	X
4	Range Commanded Indicator	X	X	X	X
5	Output Speed Indicator A	X	X	X	X
6	Output Speed Indicator B	X	X	X	X
7	Engine Overspeed Indicator	X	X	X	X
9	Retarder Indicator (with VIM)	X	X	X	X
9	Retarder Indicator (without VIM)	X	X	X	X
16	Secondary Mode Indicator	X	X	X	X
18	Two-speed Axle Output	X	X	X	X
31	Park Brake Output	X	X		
31	Neutral-to-Range Brake Output			X	X
31A	Load Dump Brake Output	X	X		
32	Manual Mode Indicator	X	X	X	X
34	Alternate Speed/Torque Control Select for Garage Shift		X	X	X
40	Engine Speed/Torque Control Indicator		X	X	X

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

1. LOCKUP INDICATOR

USES: Turn on dash indicator when transmission lockup clutch is engaged. Used to indicate when maximum engine braking is available.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

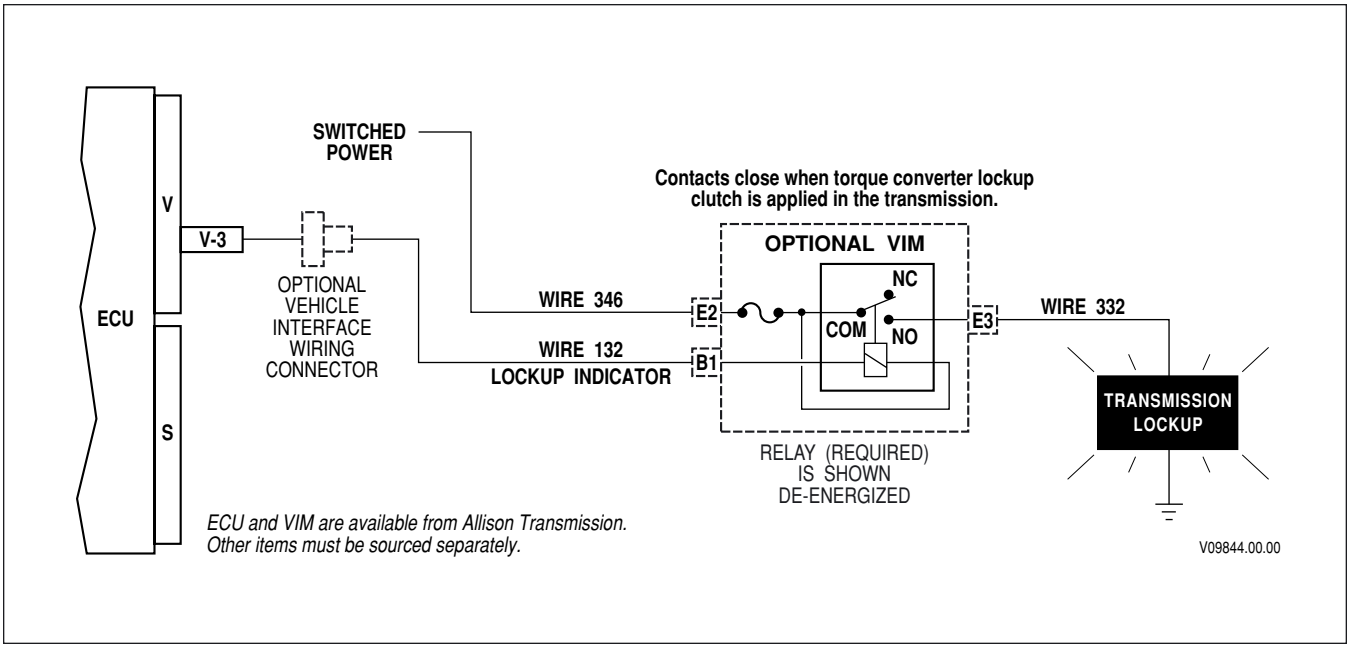

Figure 7–25. Lockup Indicator

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

4. RANGE SELECTED/COMMANDED INDICATOR

USES: Used with auxiliary vehicle systems to permit operation only in specified transmission range(s).

VARIABLES TO SPECIFY: Range or ranges to be indicated

VOCATIONS: Various

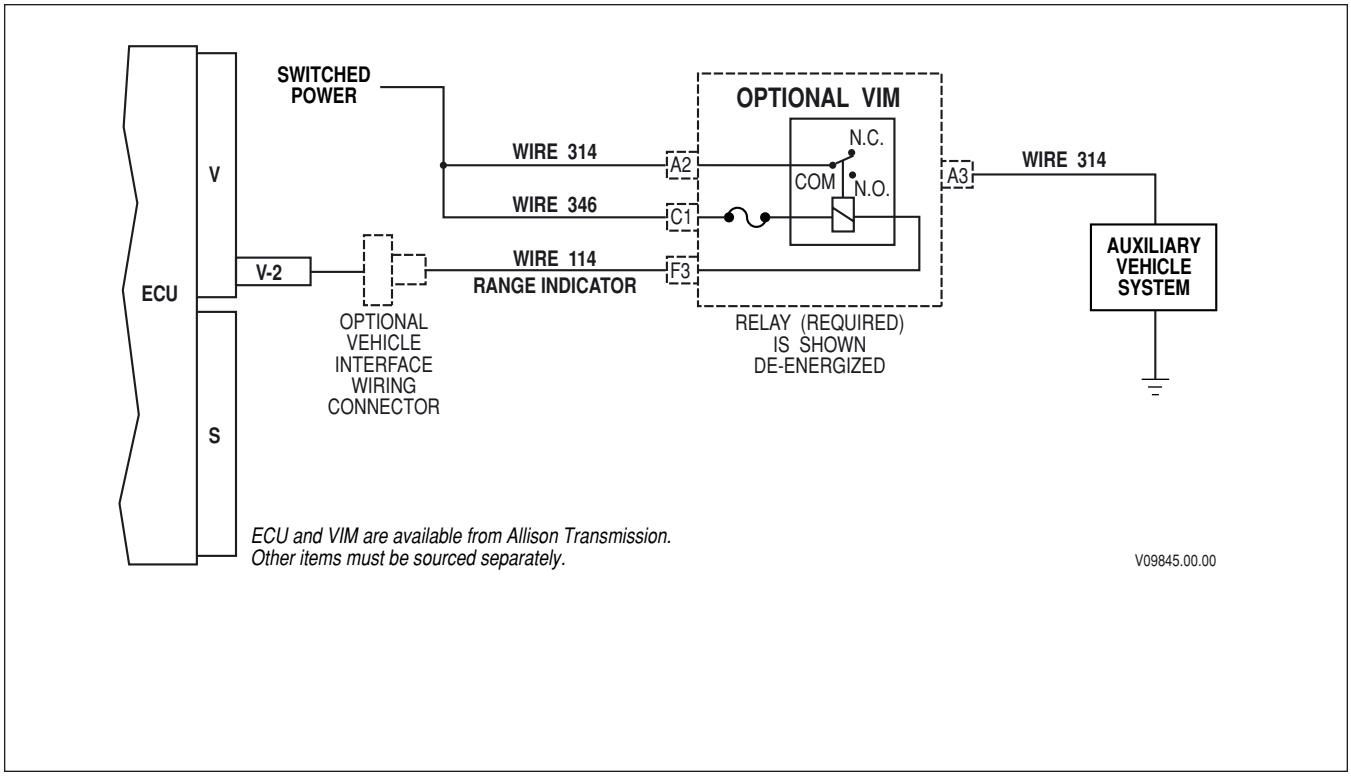

Figure 7–26. Range Commanded Indicator

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

5. OUTPUT SPEED INDICATOR—A

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn ON output and to turn OFF output. The ON value **must be** higher than the OFF value.

VOCATIONS: Various

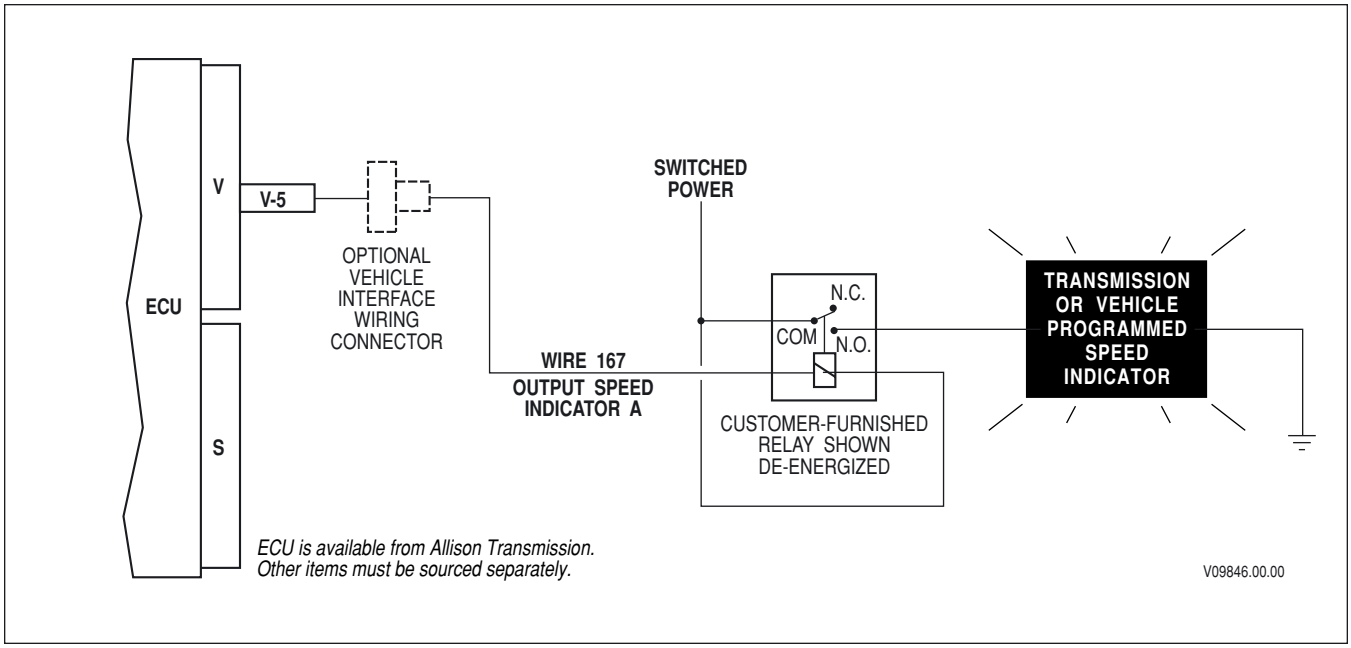

Figure 7–27. Output Speed Indicator—A

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

6. OUTPUT SPEED INDICATOR—B

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn ON output and to turn OFF output. The ON value **must be** higher than the OFF value.

VOCATIONS: Various

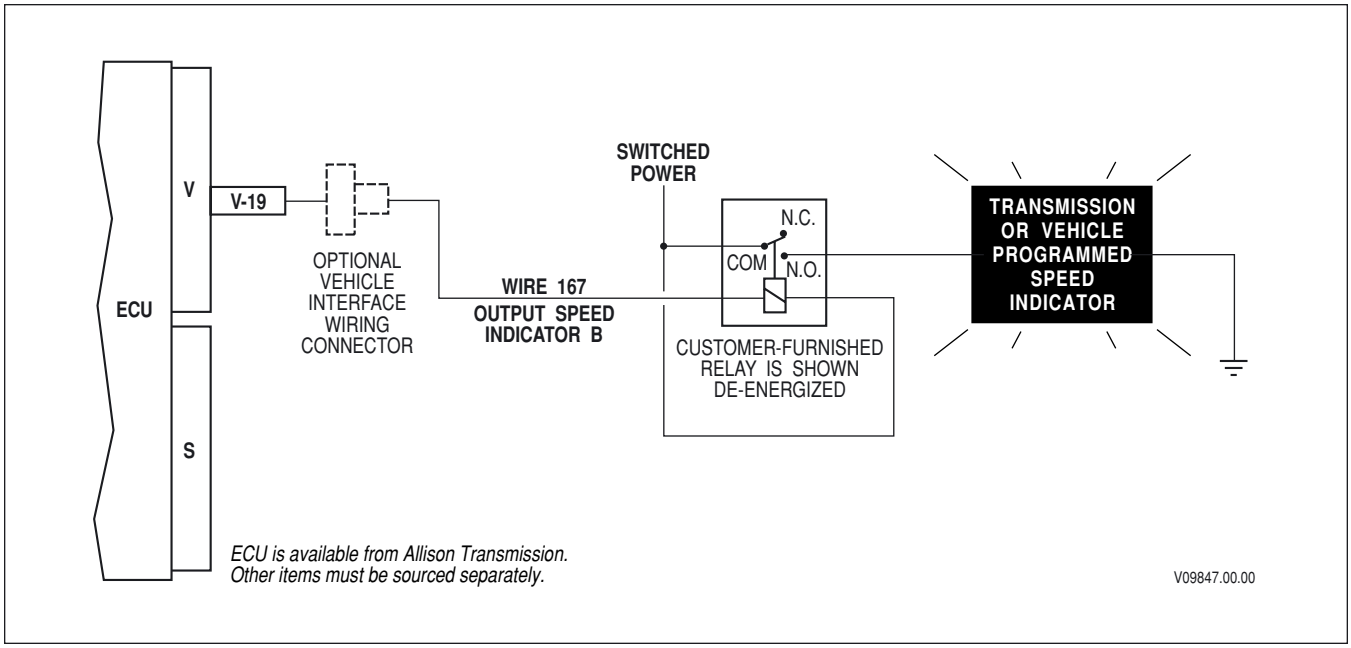

Figure 7–28. Output Speed Indicator—B

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

7. ENGINE OVERSPEED INDICATOR

USES: To turn on dash light when engine reaches an overspeed condition.

VARIABLES TO SPECIFY: Rpm to turn ON; rpm to turn OFF.

VOCATIONS: Various

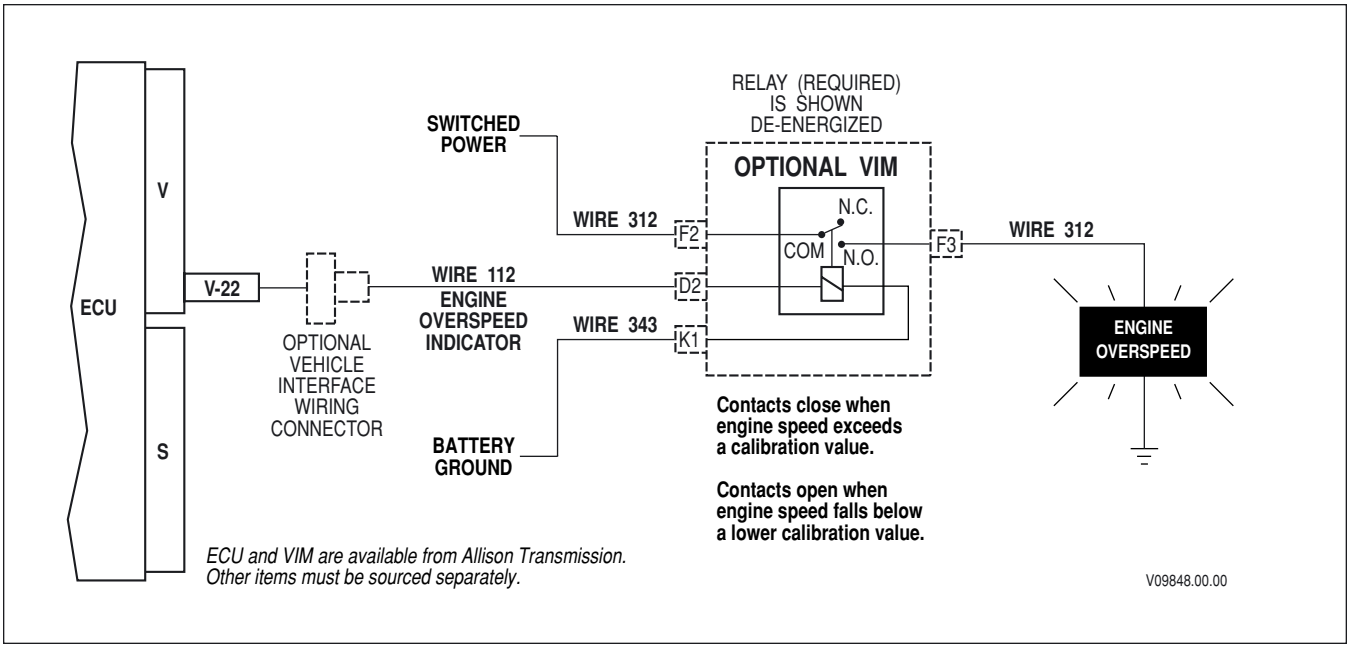

Figure 7–29. Engine Overspeed Indicator

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

9. RETARDER INDICATOR (WITH VIM)—ALSO SHOWN: INPUT 34, RETARDER

USES: Signals that the retarder is active. Typically used to turn on the vehicle brake lights and dash-mounted indicator light when the retarder is in use.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

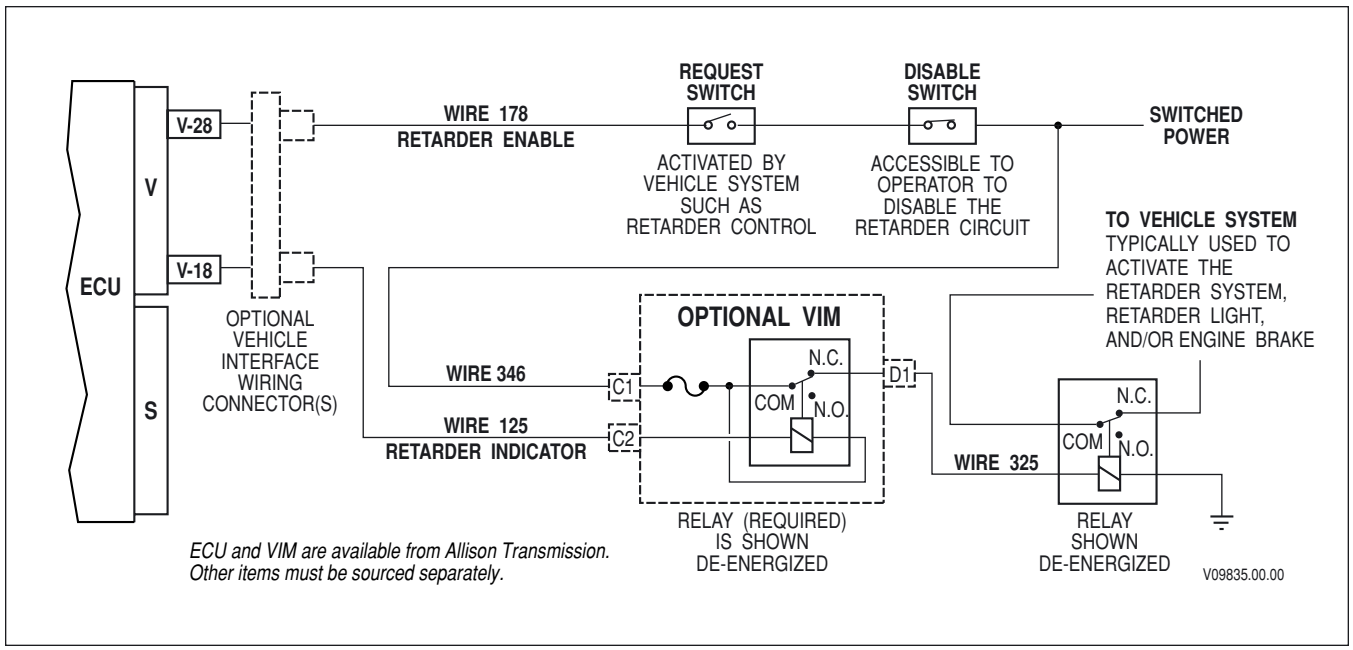

Figure 7–30. Retarder Indicators (With VIM)

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

9. RETARDER INDICATOR (WITHOUT VIM)—ALSO SHOWN: INPUT 34, RETARDER

USES: Signals that the retarder is active. Typically used to turn on the vehicle brake lights and dash-mounted indicator light when the retarder is in use.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

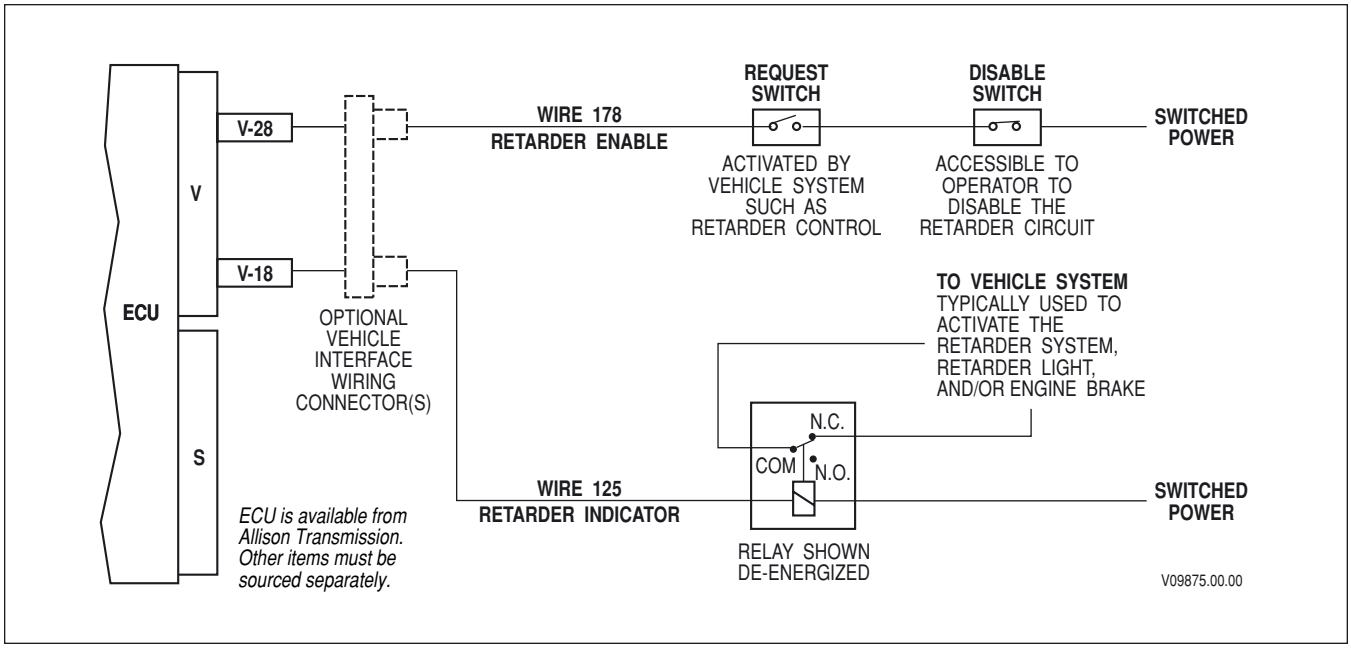

Figure 7–31. Retarder Indicators (Without VIM)

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

16. SECONDARY MODE INDICATOR—ALSO REFER TO INPUT 1, SECONDARY SHIFT SCHEDULE

USES: To indicate that Secondary Mode is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

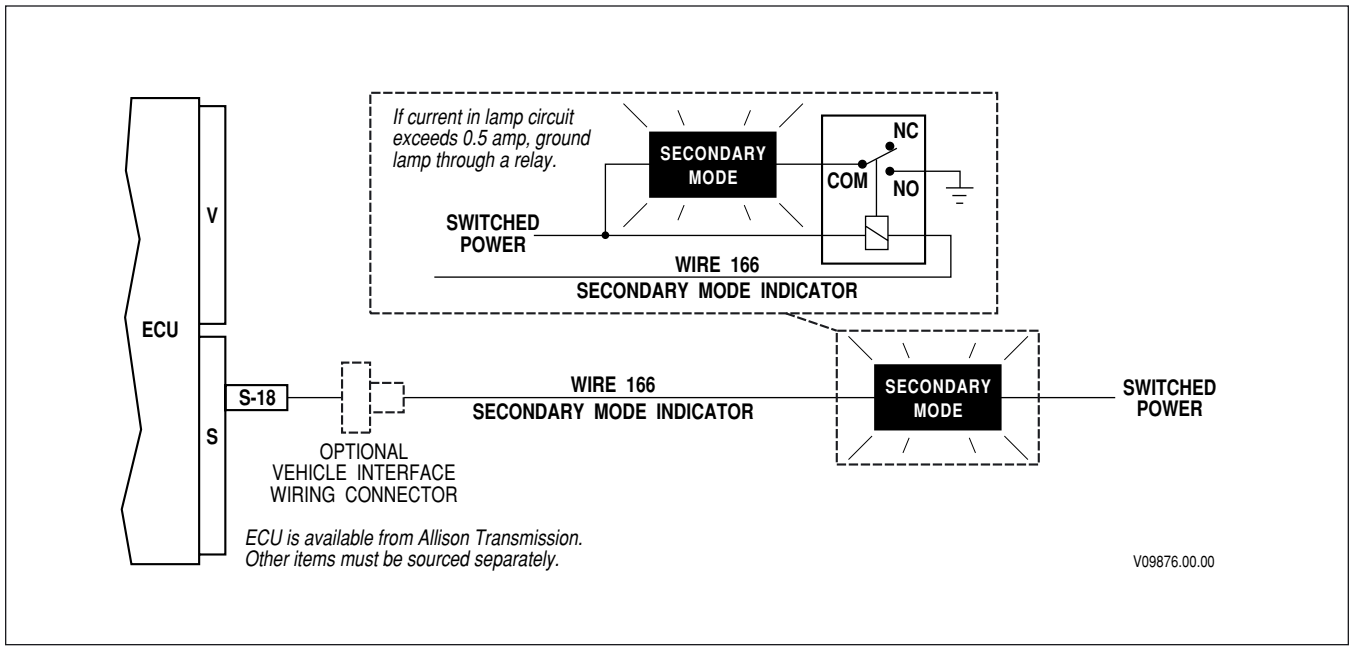

Figure 7–32. Secondary Mode Indicator

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

18. TWO-SPEED AXLE OUTPUT—ALSO SHOWN: INPUT 5, TWO-SPEED AXLE INPUT)

USES: Signals that conditions are acceptable for low speed axle operation. Use in conjunction with Two-Speed Axle input function.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

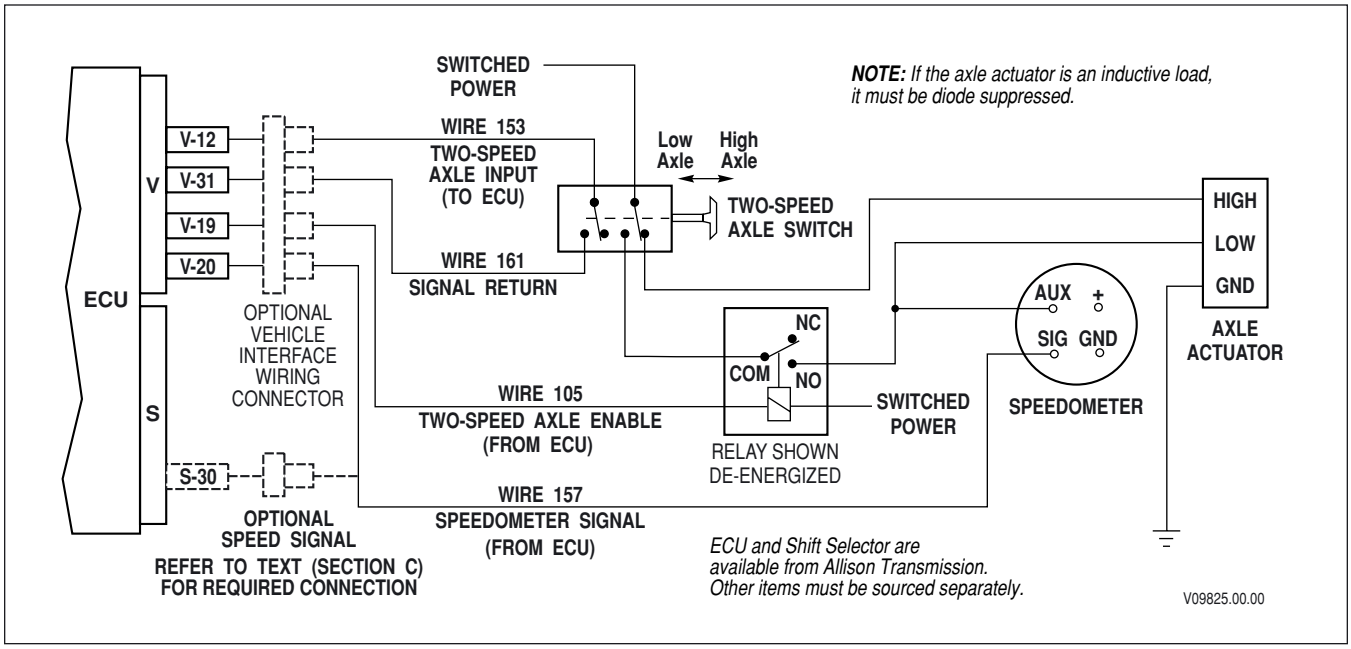

Figure 7–33. Two-Speed Axle Output

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

31. PARK BRAKE OUTPUT

USES: Turns on the park brake when the transmission is in neutral and output rpm is below a programmed speed. Turns off the park brake when the transmission is shifted into a forward or reverse range.

VARIABLES TO SPECIFY: 1. Time delay to release brake after a range (other than neutral) is selected.
2. Output speed below park brake is enabled.

VOCATIONS: Various vehicular applications

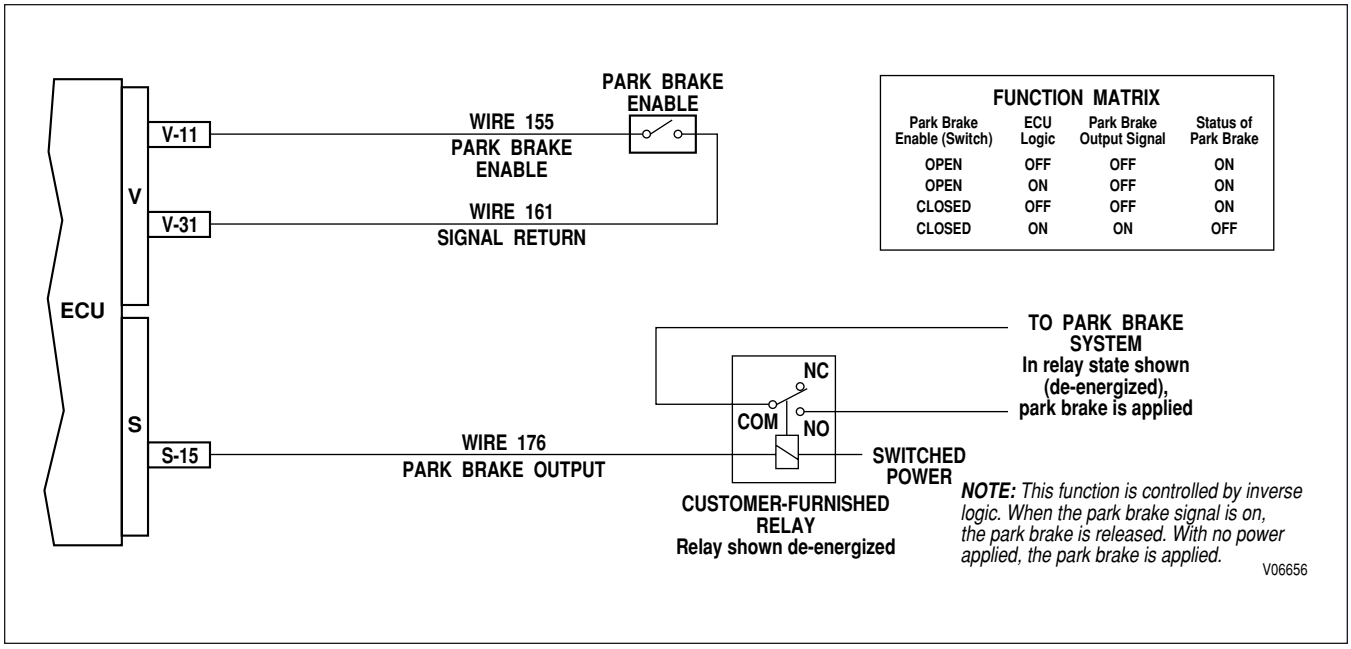

Figure 7–34. Park Brake Output

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

31. NEUTRAL-TO-RANGE PARK BRAKE OUTPUT

USES: Turns on a **NEUTRAL** to range shift brake, after a programmed delay, when the transmission is in **NEUTRAL** and output rpm is below a programmed speed. Turns off **NEUTRAL** to range shift brake, after a programmed delay, when the transmission is shifted into a forward or reverse range.

VARIABLES TO SPECIFY: 1. Time delay to release brake after a range (other than neutral) is selected.
2. Output speed below park brake is enabled.

VOCATIONS: Various vehicular applications

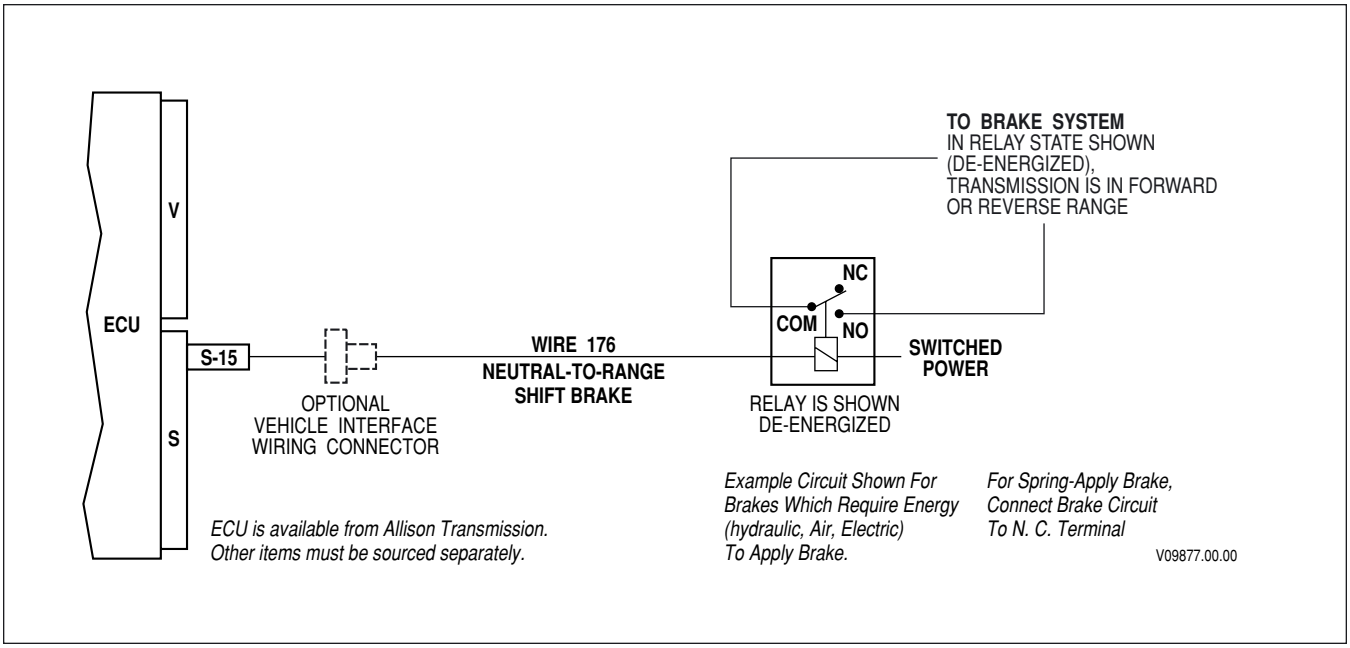

Figure 7–35. Park Brake Output

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

31A. LOAD DUMP BRAKE OUTPUT (ALSO SHOWN: INPUT 52A, LOAD DUMP)

USES: Turns on the load dump brake when the transmission is in neutral and output rpm is below a programmed speed. Turns off brake, after a programmed delay, when the transmission is shifted into a forward or reverse range.

VARIABLES TO SPECIFY: 1. Time delay to release load dump brake after a range (other than neutral) is selected.
2. Output speed below park brake is enabled.

VOCATIONS: Various vehicular applications

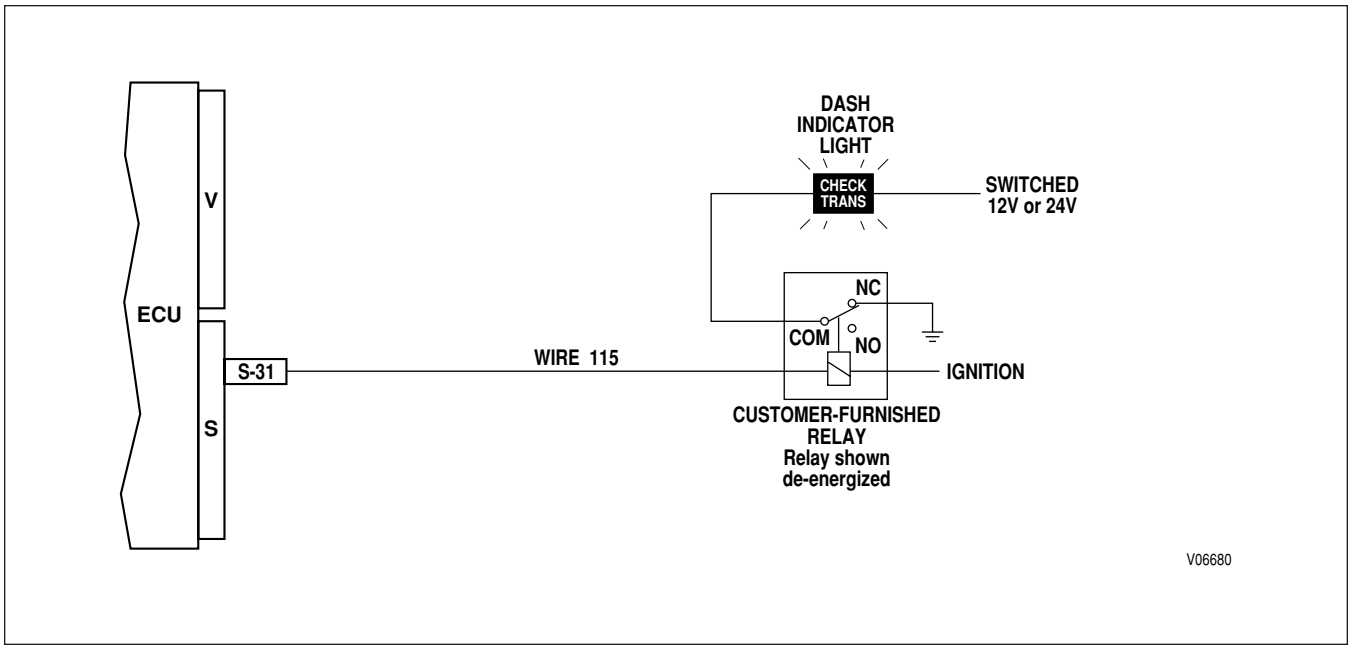

Figure 7–36. Park Brake Output

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

32. MANUAL MODE INDICATOR—ALSO REFER TO INPUT 55, MANUAL MODE)

USES: To turn on a dash light when transmission is operating in manual mode.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

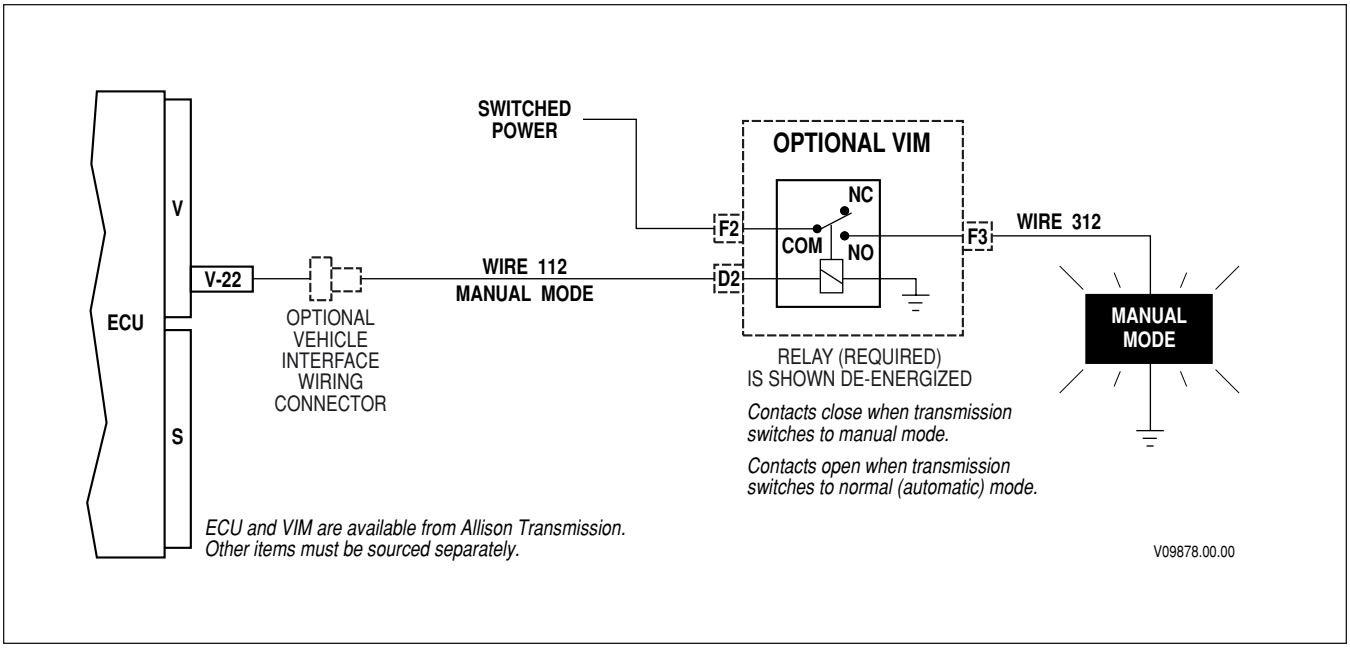

Figure 7–37. Manual Mode Indicator

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

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OUPUT FUNCTION

34. ALTERNATE SPEED / TORQUE CONTROL SELECT FOR GARAGE SHIFTS

USES: To control engine speed or torque during garage shifts.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

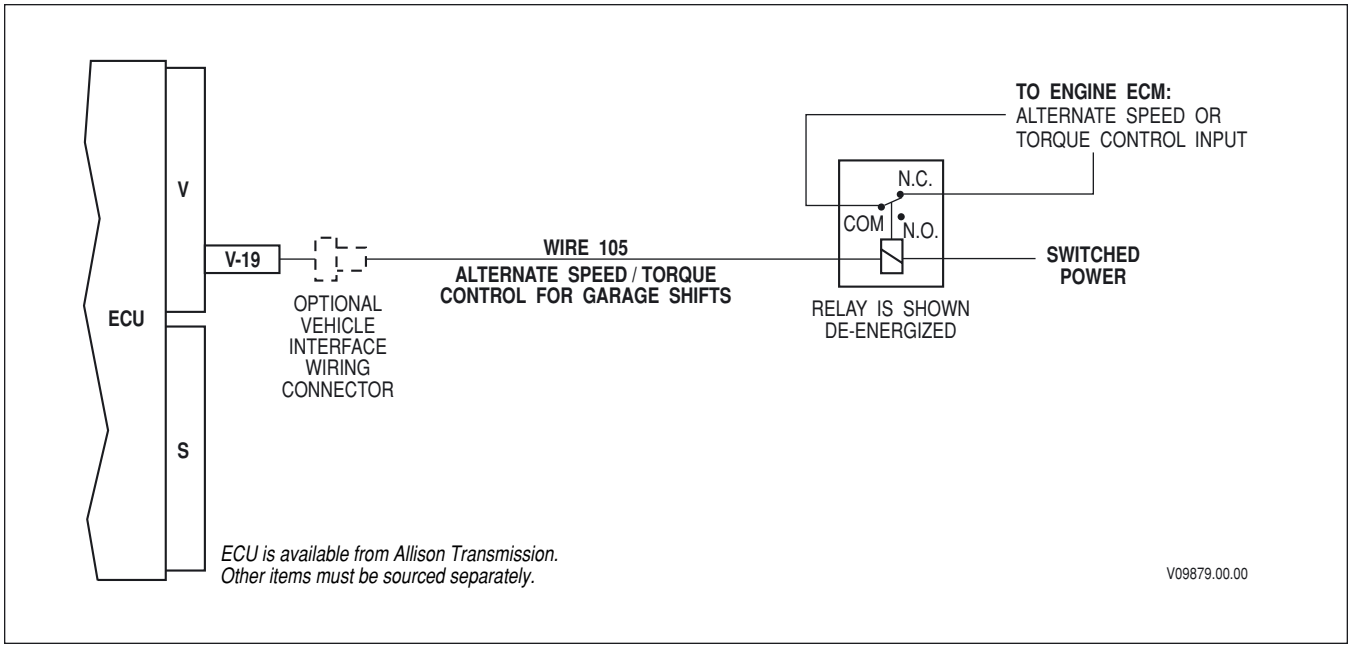

Figure 7–38. Alternate Speed / Torque Control Select For Garage Shifts

WIRING SCHEMATICS—OPTIONAL INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

OUPUT FUNCTION

40. ENGINE SPEED / TORQUE CONTROL INDICATOR

USES: To indicate when engine speed / torque control is active.

VARIABLES TO SPECIFY: Ranges in which speed / torque control is activated.

VOCATIONS: Various

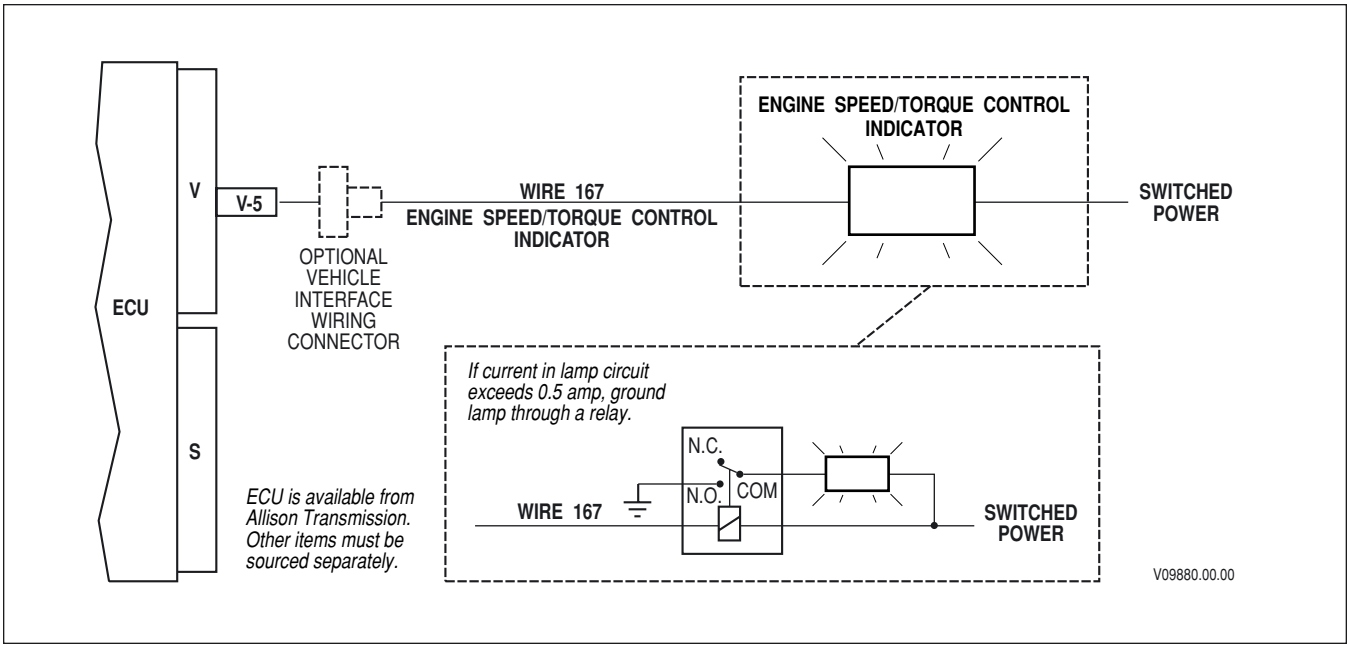

Figure 7–39. Engine Speed / Torque Control Indicator

SECTION 8—CUSTOMER MODIFIABLE CONSTANTS (CMC)

Table 8–1 describes all CEC2 Controls parameters that can be modified in the field to suit specific needs of the end user. Table 8–2 lists the standard values and optional values of the parameters. Only field personnel who have attended the Allison DOC™ For PC–Service Tool Training Class or Allison CEC2 Pro-Link® Reprogramming Class are qualified to modify any of the CMCs.

Message: TRANSMISSION ECU DOES NOT SUPPORT REPROGRAM EEPROM—If this message appears, the ECU is not capable of providing this information.

Message: NO CMCs FOUND—This message appears if the ECU does not support the reprogram EPROM feature, but none of the **enabled*** Input/Output functions have CMCs associated with them.

Table 8–1. Description of Parameters

1. Transmission S/N	10 characters (alphanumeric)—"0"–"9" and uppercase "A"–"Z" only
2. Transmission Install Dates	6 digits—date format "mm-dd-yy"
3. Starting Range (Primary)	Range the transmission will be in when starting out from zero output speed while in Primary Mode. Starting range may be overridden by shift selector position.
4. Starting Range (Secondary)	Range the transmission will be in when starting out from zero output speed while in Secondary Mode. Starting range may be overridden by shift selector position.
5. Minimum Range (Primary)	Lowest possible range that can be obtained while in Primary Mode.
6. Minimum Range (Secondary)	Lowest possible range that can be obtained while in Secondary Mode.
7. Top Range Availability (Primary)	Highest possible range that can be obtained while in Primary Mode
8. Top Range Availability (Primary)	Highest possible range that can be obtained while in Secondary Mode.
9. Stall Check Range (Primary)	Selected range for checking engine speed at converter stall while in Primary Mode.
10. Stall Check Range (Secondary)	Selected range for checking engine speed at converter stall while in Secondary Mode
11. Retarder Option (Primary)	Denotes which retarder option will be active while in Primary Mode.
12. Retarder Option (Secondary)	Denotes which retarder option will be active while in Secondary Mode.
12a. Retarder Modifier (Primary)	Denotes which retarder modifier will be active while in Primary Mode.
12b. Retarder Modifier (Secondary)	Denotes which retarder modifier will be active while in Secondary Mode.
13. Available Reverses (Primary)	Denotes which reverse option (R1 corresponds to low speed reverse, R2 corresponds to high speed reverse) will be active while in Primary Mode.
14. Available Reverses (Secondary)	Denotes which reverse option (R1 corresponds to low speed reverse, R2 corresponds to high speed reverse) will be active while in Secondary Mode.
15. Neutral Tracking	Denotes which neutral (N1 or N2) will be active. N1 corresponds to splitter-low clutch. N2 corresponds to splitter-high clutch.
16. D1 Select Position (Primary)	Denotes the range that will be held when the MODE button is pushed while in the Primary Mode (pushbutton selectors only).
17. D1 Select Position (Secondary)	Denotes the range that will be held when the MODE button is pushed while in the Secondary Mode (pushbutton selectors only).
18. Max Output Speed Low Axle Select	Denotes the maximum transmission output speed allowable for a shift to low axle.

* I/O functions or specific wires must be **enabled** in calibration in order for the function or wire to work.

CUSTOMER MODIFIABLE CONSTANTS

Table 8–1. Description of Parameters *(cont'd)*

19. Bedhoist Interlock Enable	Enables/disables the bedhoist interlock function. The enabled function restricts reverse operation while lifting the dump bed.
20. Override Throttle Source Autodetect	Shows if the throttle source has been overridden to accept a signal other than what Autodetect has identified.
21. Range Selector 1st Range	When the ECU commands 1st range, the range indicator output is active and "YES" is selected.
22. Range Selector 2nd Range	When the ECU commands 2nd range, the range indicator output is active and "YES" is selected.
23. Range Selector 3rd Range	When the ECU commands 3rd range, the range indicator output is active and "YES" is selected.
24. Range Selector 4th Range	When the ECU commands 4th range, the range indicator output is active and "YES" is selected.
25. Range Selector 5th Range	When the ECU commands 5th range, the range indicator output is active and "YES" is selected.
26. Range Selector 6th Range	When the ECU commands 6th range, the range indicator output is active and "YES" is selected.
27. Range Indicator Neutral	When the ECU commands Neutral range, the range indicator output is active and "YES" is selected.
28. Range Indicator Reverse 1	When the ECU commands Reverse 1 range, the range indicator output is active and "YES" is selected.
29. Range Indicator Reverse 2	When the ECU commands Reverse 2 range, the range indicator output is active and "YES" is selected.
30. Speed to Turn "ON" Output Speed Indicator "A"	Speed at which the Output Speed Indicator A output becomes activated.
31. Speed to Turn "OFF" Output Speed Indicator "A"	Speed at which the Output Speed Indicator A output becomes de-activated.
32. Speed to Turn "ON" Output Speed Indicator "B"	Speed at which the Output Speed Indicator B output becomes activated.
33. Speed to Turn "OFF" Output Speed Indicator "B"	Speed at which the Output Speed Indicator B output becomes de-activated.
34. Turbine Speed to Turn "ON" Overspeed Indicator	Turbine speed at which the Engine Overspeed Indicator output becomes activated.
35. Turbine Speed to Turn "OFF" Overspeed Indicator	Turbine speed at which the Engine Overspeed Indicator output becomes de-activated.
36. Preselect Downshift Target Range with Retarder (Primary)	Denotes the limiting range in which preselect downshifts will occur when the retarder circuit is activated while in the Primary Mode.
37. Preselect Downshift Target Range with Retarder (Secondary)	Denotes the limiting range in which preselect downshifts will occur when the retarder circuit is activated while in the Secondary Mode.
38. Speed to Turn Park Brake Signal "ON"	Denotes the allowable transmission output speed at which the parking brake may be applied.

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CUSTOMER MODIFIABLE CONSTANTS (CMC)

Table 8–2. Standard Values/Optional Values

Features	Operating Mode	Standard Value	Optional Values
Stall Check Range	Primary	5th Range	3rd, 4th, 5th Range
	Secondary	5th Range	3rd, 4th, 5th Range
Retarder Option	Primary	Various	1, 3, 4, 5
	Secondary	Various	1, 3, 4, 5
Retarder Modifier	Primary	Various	None, A, B, AB
	Secondary	Various	None, A, B, AB
Available Reverse	Primary	R1 and R2	R1, R2, R1 and R2
	Secondary	R1 and R2	R1, R2, R1 and R2
Neutral Tracking		N1	N1, N2
D1 Select	Primary	6th Range	All Forward Ranges
	Secondary	6th Range	All Forward Ranges
Max Output Speed Low Axle Select		40 rpm	40–1000 rpm
Bedhoist Interlock Enable		Enabled	Enabled, Disabled
Range Indicator—Reverse 2		Yes	Yes, No
Range Indicator—Reverse 1		Yes	Yes, No
Range Indicator—Neutral		No	Yes, No
Range Indicator—1st Range		Yes	Yes, No
Range Indicator—2nd Range		Yes	Yes, No
Range Indicator—3rd Range		Yes	Yes, No
Range Indicator—4th Range		Yes	Yes, No
Range Indicator—5th Range		Yes	Yes, No
Range Indicator—6th Range		Yes	Yes, No
Tubine Speed to turn Engine Overspeed ON		2350 rpm	2000–3000 rpm
Tubine Speed to turn Engine Overspeed OFF		2300 rpm	1950–2950 rpm
Retarder Preselect Range	Primary	3rd Range	1st, 2nd, 3rd, 4th Range
	Secondary	3rd Range	1st, 2nd, 3rd, 4th Range
Override Throttle Source Autodetect		Autodetect	Autodetect, J1587, J1939, Analog
Top Range	Primary	6th Range	4th, 5th, 6th Range
	Secondary	6th Range	4th, 5th, 6th Range
Minimum Range	Primary	1st Range	1st, 2nd, 3rd, 4th Range
	Secondary	1st Range	1st, 2nd, 3rd, 4th Range
Starting Range	Primary	1st Range	1st, 2nd, 3rd, 4th Range
	Secondary	1st Range	1st, 2nd, 3rd, 4th Range

CUSTOMER MODIFIABLE CONSTANTS

Table 8–2. Standard Values/Optional Values *(cont'd)*

Features	Operating Mode	Standard Value	Optional Values
Speed to turn ON Output Speed Indicator A		60 rpm	60–4000 rpm
Speed to turn OFF Output Speed Indicator A		50 rpm	50–3990 rpm
Speed to turn ON Output Speed Indicator B		60 rpm	60–4000 rpm
Speed to turn OFF Output Speed Indicator B		50 rpm	50–3990 rpm
Park Brake Signal ON Speed		50 rpm	50–150 rpm
Transmission Serial Number	10 Characters—"0"–"9" and uppercase "A"–"Z" only		
Transmission Installation Date	6 Digits—Date Format "mm-dd-yy"		

APPENDICES

APPENDICES

NOTES

APPENDIX A—IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

Intermittent codes are a result of faults that are detected, logged, and then disappear, only to recur later. If, when troubleshooting, a code is cleared in anticipation of it recurring and it does not, determine if items in the following list are the source of the fault.

A. Circuit Inspection

1. Intermittent power/ground problems—can cause voltage problems during the ECU diagnostic process which can set various codes depending upon where the ECU was in the diagnostic process.
2. Damaged terminals.
3. Dirty or corroded terminals.
4. Terminals not fully seated in the connector. Test indicated wires by uncoupling connector and gently pulling on the wire at the rear of the connector and checking for excessive terminal movement.
5. Connectors not fully mated. Inspect for missing or damaged locktabs.
6. Screws or other sharp pointed objects pushed into or through one of the harnesses.
7. Harnesses which have rubbed through and may be allowing intermittent electrical contact between two wires or between wires and vehicle frame members.
8. Broken wires within the braiding and insulation.

B. Finding an Intermittent Fault Condition

To find a fault, such as one of those listed, examine all connectors and the external wiring harnesses. Harness routing may make it difficult to see or feel the complete harness. However, it is important to thoroughly examine each harness for chafed or damaged areas. Road vibrations and bumps can damage a poorly installed harness by moving it against sharp edges and cause some of the faults. If a visual inspection does not identify a cause, move and wiggle the harness by hand until the fault is duplicated.

The next most probable cause of an intermittent code is an electronic part exposed to excessive vibration, heat, or moisture. Examples of this are:

1. Exposed harness wires subjected to moisture.
2. A defective connector seal allowed moisture to enter the connector or part.
3. An electronic part (ECU, shift selector, solenoid, or throttle sensor) affected by vibration, heat, or moisture may cause abnormal electrical conditions within the part.

When troubleshooting Item 3, eliminate all other possible causes before replacing any parts.

Another cause of intermittent codes is good parts in an abnormal environment. The abnormal environment will usually include excessive heat, moisture, or voltage. For example, an ECU that receives excessive voltage will generate a diagnostic code as it senses high voltage in a circuit. The code may not be repeated consistently because different circuits may have this condition on each check. The last step in finding an intermittent code is to observe if the code is set during sudden changes in the operating environment.

Troubleshooting an intermittent code requires looking for common conditions that are present whenever the code is diagnosed.

APPENDIX A—IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

C. Recurring Conditions

A recurring condition might be:

- Rain
- Outside temperature above or below a certain temperature
- Only on right-hand or left-hand turns
- When the vehicle hits a bump, etc.

If such a condition can be related to the code, it is easier to find the cause. If the time between code occurrences is very short, troubleshooting is easier than if it is several weeks or more between code occurrences.

APPENDIX B—WIRE/CONNECTOR CHART

The connector information in this appendix is provided for the convenience of the servicing technician. The connector illustration and pin identifications for connection to Allison Transmission components will be accurate. Allison Transmission components are:

- ECU
- Speed sensors
- Transmission connectors
- Shift selectors.

Other types of connectors for optional or customer-furnished components are provided based on typical past practice for an Allison-designed system.

Contact St. Clair Technologies, Inc. or your vehicle manufacturer for information on connectors not found in this appendix.

NOTE: The following abbreviation guide should be used to locate connector termination points for wires in the CEC2 wiring harness(es).

Table B–1. Appendix B Abbreviation Guide

Termination Point Abbreviation	Connector Name
AGND	Analog Return (Ground)
ASOL	Solenoid A—Main Valve Body Cover
BSOL	Solenoid B—Main Valve Body Cover
CSOL	Solenoid C—Main Valve Body Cover
DDRD	Diagnostic Data Reader Connector—Deutsch
DDRP	Diagnostic Data Reader Connector—Packard
DSOL	Solenoid D—Main Valve Body Cover
ECU–S	Electronic Control Unit—Selector (S) Connector
ECU–T	Electronic Control Unit—Transmission (T) Connector
ECU–V	Electronic Control Unit—Vehicle (V) Connector
ESOL	Solenoid E—Main Valve Body Cover
FSOL	Solenoid F—Main Valve Body Cover
GSOL	Solenoid G—Main Valve Body Cover
H/JSOL	Solenoid H/J— Trim Boost or 1–2 Cover
ISOL	Solenoid I—1–2 Cover
J1939	J1939 Datalink From ECU Selector (S) Harness
KSOL	Solenoid K—Lockup Cover
LOW	Low or 1–2 Cover
LU	Lockup Cover
MNVB	Main Valve Body Cover
NE	Input (Engine) Speed Sensor
NO	Output Speed Sensor
NT	Turbine Speed Sensor
PSS	Primary Shift Selector

APPENDIX B—WIRE/CONNECTOR CHART

Table B–1. Appendix B Abbreviation Guide *(cont'd)*

Termination Point Abbreviation	Connector Name
RNGTRM	Chassis Ground Ring Terminal
SCI	Serial Communication Interface
SSS	Secondary Shift Selector
TB	Trim Boost Cover
TEMP	Sump Temperature Sensor—Lockup Cover
TPS	Throttle Position Sensor
VIM	Vehicle Interface Module
VIWS	Vehicle Interface Wiring—ECU Selector (S) Harness
VIWV	Vehicle Interface Wiring—ECU Vehicle (V) Harness

NOTE: ***Detail information related to each connector end view in this appendix was taken from the CEC2 System Wiring Schematic in Appendix G. Consult the wiring schematic for the relationship of each connector to other system components.***

APPENDIX B—WIRE/CONNECTOR CHART

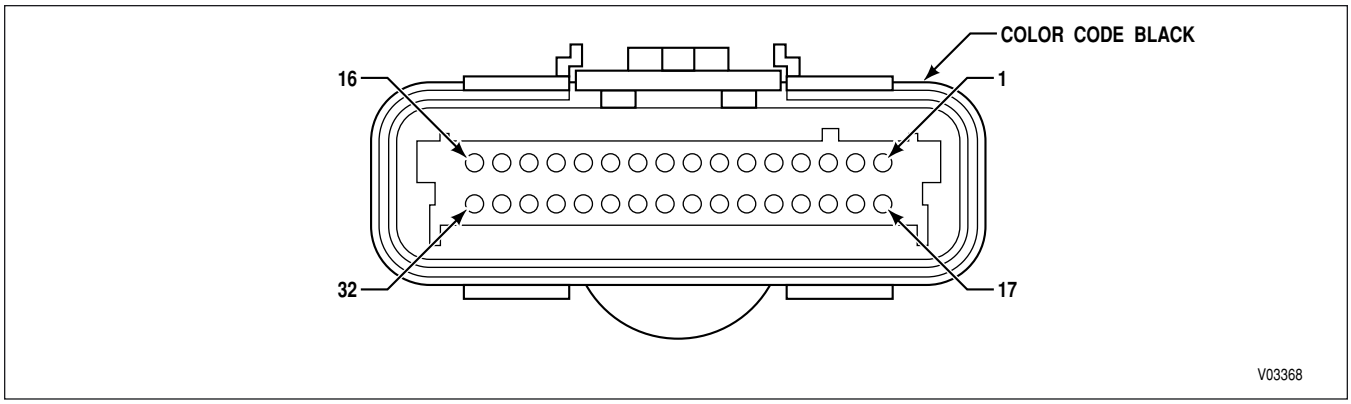


Figure B–1. ECU Connector "S"

ECU CONNECTOR "S" (BLACK)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
1	White	142-S1	Serial Communication Interface, High	DDRP-J, DDRD-F, SCI-A
2	Tan	159-S2	Diagnostic Communication Link (ISO9141)	VIWS-A
3	Pink	124-S3	Shift Selector Power	PSS-N, SSS-N
4	Yellow	146-S4	Ignition Sense	VIWS-E, DDRP-H, DDRD-E,
5	Orange	170-S5	Primary Shift Selector, Data Bit 1	PSS-A
6	Green	171-S6	Primary Shift Selector, Data Bit 2	PSS-B
7	Blue	172-S7	Primary Shift Selector, Data Bit 4	PSS-C
8	Yellow	173-S8	Primary Shift Selector, Data Bit 8	PSS-D
9	Tan	174-S9	Primary Shift Selector, Parity	PSS-E
10	Green	175-S10	Shift Selector Mode Input	PSS-M, SSS-M
11	Yellow	119-S11	General Purpose Input 4	VIWS-M
12	Green	182-S12	CAN Controller Shield (J1939)	J1939C
13	Pink	183-S13	CAN Controller, High (J1939)	J1939A
14	Blue	180-S14	Shift Selector Display	PSS-S, SSS-S
15	Orange	176-S15	General Purpose Output 6	PSS-L, SSS-L, VIWS-L
16	Pink	136-S16	Battery Power	PSS-R, SSS-R
17	Blue	151-S17	Serial Communication Interface, Low	DDRP-K, DDRD-B, SCI-B
18	Tan	166-S18	General Purpose Output 7	VIWS-N
19				
20				
21	Orange	190-S21	Secondary Shift Selector, Data Bit 1	SSS-A
22	Green	191-S22	Secondary Shift Selector, Data Bit 2	SSS-B
23	Blue	192-S23	Secondary Shift Selector, Data Bit 4	SSS-C
24	Yellow	193-S24	Secondary Shift Selector, Data Bit 8	SSS-D
25	Tan	194-S25	Secondary Shift Selector, Parity	SSS-E
26	Blue	169-S26	General Purpose Input 12	VIWS-S
27	Blue	163-S27	General Purpose Input 6	VIWS-R
28	Yellow	126-S28	General Purpose Input 9	VIWS-C
29	Gray	184-S29	CAN Controller, Low (J1939)	J1939-B
30	Tan	157-S30	Vehicle Speed	VIWS-D
31	Green	115-S31	Check Transmission	VIWS-B
32	Gray	143-S32	Battery Return	PSS-P, SSS-P, VIWS-P, DDRP-A, DDRD-D

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

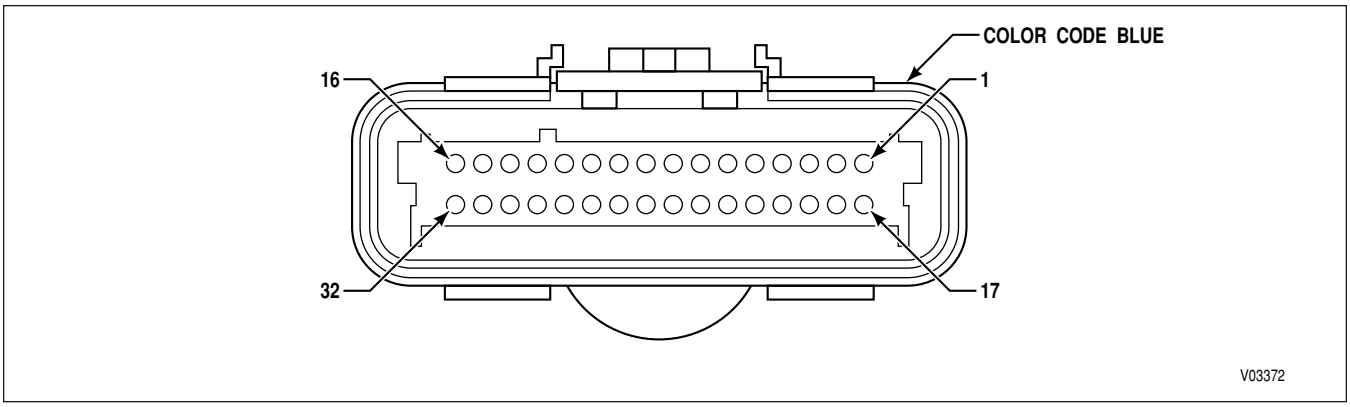


Figure B–2. ECU Connector "T"

ECU CONNECTOR "T" (BLUE)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
1	Orange	102-T1	Solenoid Power, Solenoids F, G, and I(1)	MNVB-J, MNVB-G, LOW-D(1)
2	Tan	121-T2	Solenoid Power, Solenoid K	LU-A
3	Green	107-T3	Solenoid Power, Solenoid J(2) or H(2)	TB-A(2) or LOW-A(2)
4	White	120-T4	F Solenoid, Low	MNVB-F
5	Green	103-T5	B Solenoid, Low	MNVB-D
6	Tan	129-T6	E Solenoid, Low	MNVB-K
7	White	104-T7	A Solenoid, Low	MNVB-B
8	Green	111-T8	I Solenoid, Low(1)	LOW-C(1)
9	Pink	124-T9	TPS Power	TPS-C
10	Blue	156-T10	Throttle Position Sensor Input	TPS-B
11				
12				
13	Yellow	195-T13	Transmission Identification	MNVB-R
14	Tan	141-T14	Engine Speed Sensor, High	NE-A
15	Orange	149-T15	Turbine Speed Sensor, High	NT-A
16	Yellow	139-T16	Output Speed Sensor, High	NO-A
17	Yellow	130-T17	Solenoid Power, Solenoids A and B	MNVB-A, MNVB-C
18				
19	Yellow	116-T19	Solenoid Power, Solenoids E, D, and C	MNVB-L, MNVB-N, MNVB-E
20	Orange	128-T20	K Solenoid, Low	LU-B
21	Blue	131-T21	G Solenoid, Low	MNVB-H
22	White	110-T22	J or H Solenoid, Low(2)	TB-B or LOW-B(2)
23	White	127-T23	D Solenoid, Low	MNVB-M
24	Blue	101-T24	C Solenoid, Low	MNVB-P
25	Green	135-T25	Analog Return	TPS-A, LU-C
26				
27	Tan	147-T27	Sump Temperature Sensor Input	LU-D
28				
29				
30	Orange	150-T30	Engine Speed Sensor, Low	NE-B
31	Blue	140-T31	Turbine Speed Sensor, Low	NT-B
32	Green	148-T32	Output Speed Sensor, Low	NO-B

(1) I Solenoid only present on DP 8610 and S 9810M models in the low shift body.

(2) J Solenoid is present on 5610, 6610, and M 9610 models in the trim boost body. H Solenoid is only present on 8610 and S 9810M models in the low shift body.

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

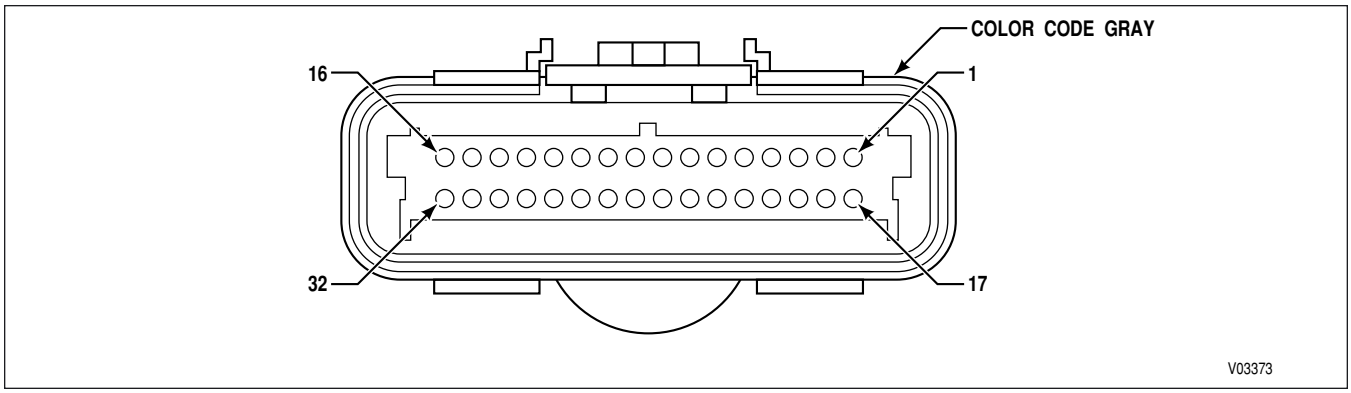


Figure B–3. ECU Connector "V"

ECU CONNECTOR "V" (GRAY)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
1	Pink	136-V1	Battery Power	VIM-E1
2	White	114-V2	General Purpose Output 1	VIM-F3
3	Orange	132-V3	General Purpose Output 2	VIM-B1
4	White	113-V4	Reverse Warning	VIM-F2
5	White	167-V5	General Purpose Output 8	VIWV-V
6	Tan	123-V6	Neutral Start	VIM-D1
7				
8	Pink	124-V8	Sensor Power	TPS-C (Optional)
9	Blue	179-V9	Engine Water Temperature	VIWV-M
10	Blue	156-V10	Throttle Position Sensor	TPS-B (Optional)
11	Green	155-V11	General Purpose Input 1	VIWV-A
12	Yellow	153-V12	General Purpose Input 2	VIWV-B
13	Blue	118-V13	General Purpose Input 3	VIWV-C
14	Tan	177-V14	General Purpose Input 10	VIWV-S
15				
16	Pink	136-V16	Battery Power	VIM-E2
17	Gray	143-V17	Battery Return	VIM-A1
18	White	125-V18	General Purpose Output 4	VIM-C2
19	Green	105-V19	General Purpose Output 5	VIWV-E
20	Tan	157-V20	Vehicle Speed	VIM-B2
21				
22	Tan	112-V22	General Purpose Output 3	VIM-D2
23				
24	Green	135-V24	Analog Return	TPS-A (Optional), VIWV-N
25				
26	Yellow	146-V26	Ignition Sense	VIM-F1
27	White	154-V27	General Purpose Input 5	VIWV-D
28	Orange	178-V28	General Purpose Input 11	VIWV-R
29	Orange	137-V29	General Purpose Input 7	VIWV-U
30	Green	117-V30	General Purpose Input 8	VIWV-P
31	Yellow	161-V31	Digital Return (GPI)	VIWV-L
32	Gray	143-V32	Battery Return	VIM-A2

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

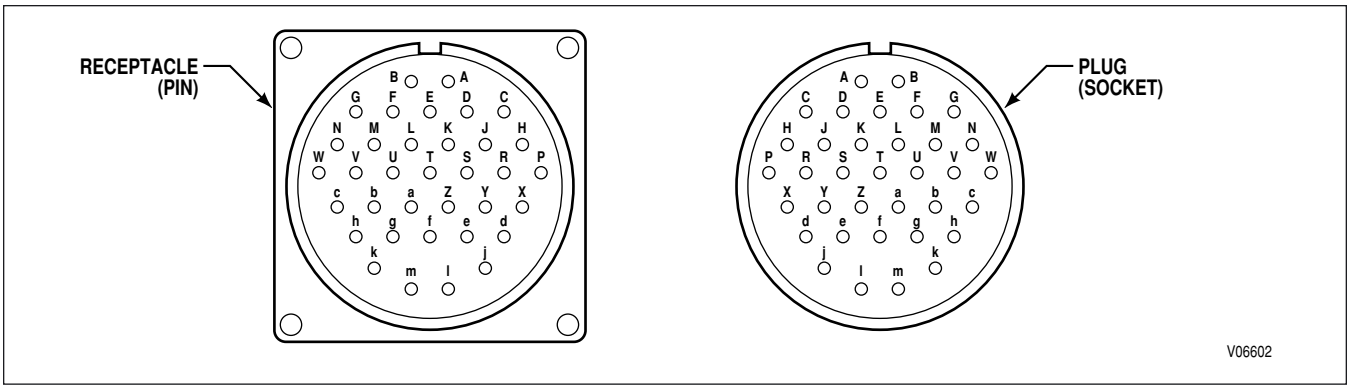


Figure B–4. ITT Cannon Bulkhead Connector

BULKHEAD CONNECTOR FOR "T" HARNESS (Receptacle With Sockets, Plug With Pins)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Yellow	130-T17	Solenoid Power, Solenoids A and B	ECU-T17, MNVB-A, MNVB-C
B	White	104-T7	A Solenoid, Low	ECU-T7, MNVB-B
C	Green	107-T3	Solenoid Power, Solenoid J or H	ECU-T3, TB-A or LOW-A
D	White	110-T22	J or H Solenoid, Low	ECU-T22, TB-B or LOW-B
E	Tan	121-T2	Solenoid Power, Solenoid K	ECU-T2, LU-A
F	White	120-T4	F Solenoid, Low	ECU-T4, MNVB-F
G				
H	Blue	131-T21	G Solenoid, Low	ECU-T21, MNVB-H
I	Yellow	116-T19	Solenoid Power, Solenoids E, D, and C	ECU-T19, MNVB-L, MNVB-N, MNVB-E
J	Orange	102-T1	Solenoid Power, Solenoids F, G, and I	ECU-T1, MNVB-J, MNVB-G, LOW-D
K	Green	103-T5	B Solenoid, Low	ECU-T5, MNVB-D
L				
M	Orange	128-T20	K Solenoid, Low	ECU-T20, LU-B
N				
P	Tan	129-T6	E Solenoid, Low	ECU-T6, MNVB-K
R	Yellow	195-T13	Transmission Identification	ECU-T13, MNVB-R
S				
T	Pink	124-T9	TPS Power	ECU-T9, TPS-C
U				
V				
W	Blue	156-T10	Throttle Position Sensor Input	ECU-T10, TPS-B
X	Green	111-T8	I Solenoid, Low	ECU-T8, LOW-C
Y				
Z				
a	Tan	141-T14	Engine Speed Sensor, High	ECU-T14, NE-A
b	Orange	149-T15	Turbine Speed Sensor, High	ECU-T15, NT-A
c	Yellow	139-T16	Output Speed Sensor, High	ECU-T16, NO-A
d	Tan	147-T27	Sump Temperature Sensor Input	ECU-T27, LU-D
e	Orange	150-T30	Engine Speed Sensor, Low	ECU-T30, NE-B
f	Blue	101-T24	C Solenoid, Low	ECU-T24, MNVB-P
g	Green	135-T25	Analog Return	ECU-T25, TPS-A, LU-C

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

BULKHEAD CONNECTOR FOR "T" HARNESS (Receptacle With Sockets, Plug With Pins) *(cont'd)*

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
h	Blue	140-T31	Turbine Speed Sensor, Low	ECU-T31, NT-B
j				
k	Green	148-T32	Output Speed Sensor, Low	ECU-T32, NO-B
l				
m	White	127-T23	D Solenoid, Low	ECU-T23, MNVB-M

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

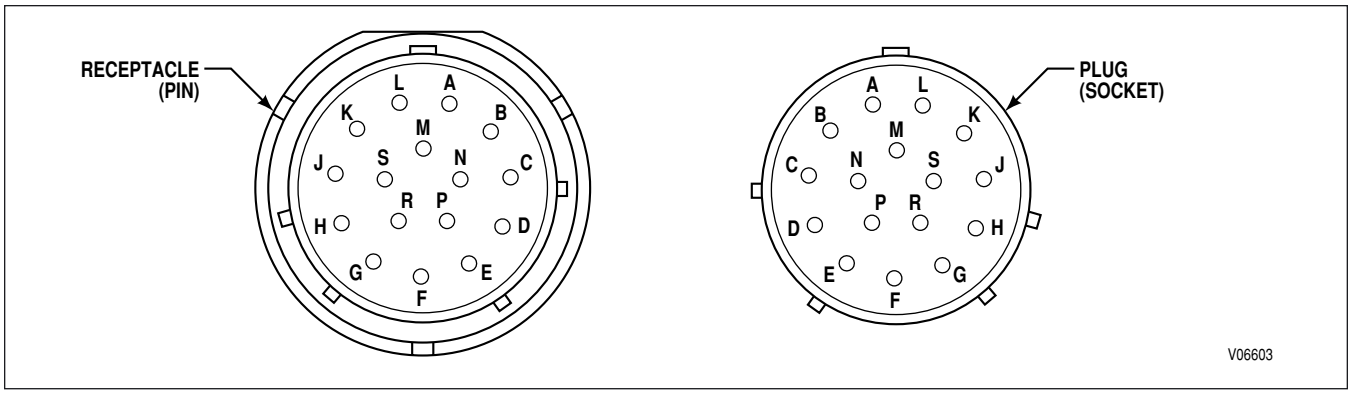


Figure B–5. Main Valve Body Cover Connector

CANNON 16-WAY MAIN VALVE BODY COVER CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Yellow	130-T17	Solenoid Power, Solenoids A and B	ECU-T17, MNVB-C
B	White	104-T7	A Solenoid, Low	ECU-T7
C	Yellow	130-T17	Solenoid Power, Solenoids A and B	ECU-T17, MNVB-A
D	Green	103-T5	B Solenoid, Low	ECU-T5
E	Yellow	116-T19	Solenoid Power, Solenoids E, D, and C	ECU-T19, MNVB-L, MNVB-N
F	White	120-T4	F Solenoid, Low	ECU-T4
G	Orange	102-T1	Solenoid Power, Solenoids F, G, and I	ECU-T1, MNVB-J, LOW-D
H	Blue	131-T21	G Solenoid, Low	ECU-T21
J	Orange	102-T1	Solenoid Power, Solenoids F, G, and I	ECU-T1, MNVB-G, LOW-D
K	Tan	129-T6	E Solenoid, Low	ECU-T6
L	Yellow	116-T19	Solenoid Power, Solenoids E, D, and C	ECU-T19, MNVB-N, MNVB-E
M	White	127-T23	D Solenoid, Low	ECU-T23
N	Yellow	116-T19	Solenoid Power, Solenoids E, D, and C	ECU-T19, MNVB-L, MNVB-E
P	Blue	101-T24	C Solenoid, Low	ECU-T24
R	Yellow	195-T13	Transmission Identification	ECU-T13
S			Future Use	

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

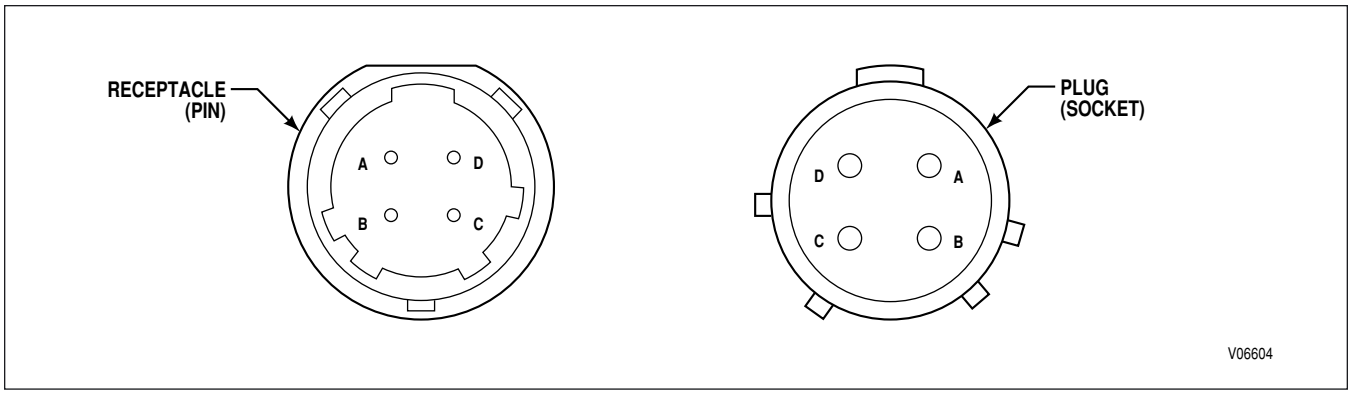


Figure B–6. Lockup Valve Body Cover Connector

CANNON 4-WAY LOCKUP VALVE BODY COVER CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Tan	121-T2	Solenoid Power, Solenoid K	ECU-T2
B	Orange	128-T20	K Solenoid, Low	ECU-T20
C	Green	135-T25	Analog Return	ECU-T25, TPS-A
D	Tan	147-T27	Sump Temperature Sensor Input	ECU-T27

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

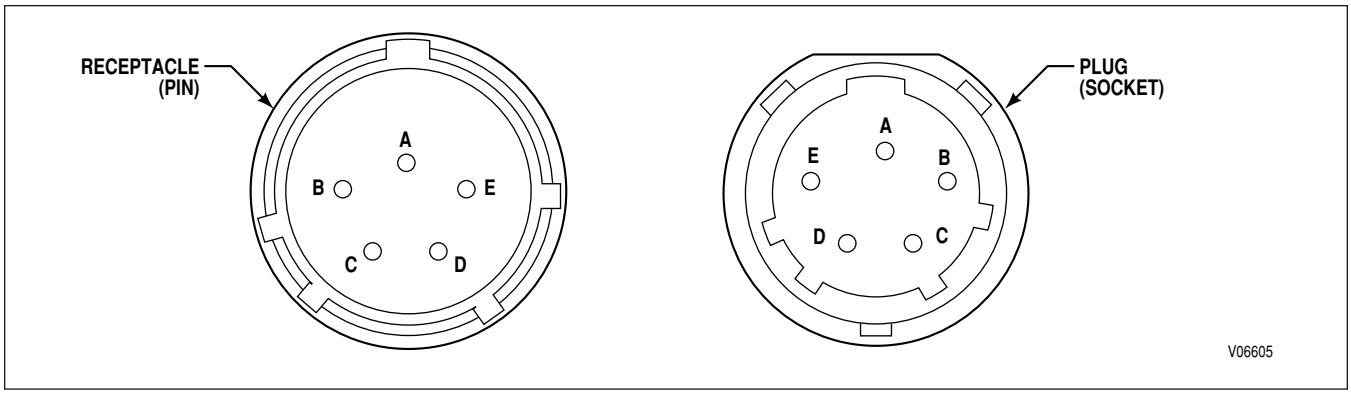


Figure B–7. Trim Boost or Low Valve Body Cover Connector

CANNON 5-WAY TRIM BOOST BODY COVER CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Green	107-T3	Solenoid Power, Solenoid J(1)	ECU-T3
B	White	110-T22	J Solenoid, Low	ECU-T22
C			Not Used	
D			Not Used	
E			Not Used	

(1) J solenoid is used on all 5610, 6610, and 9610 models.

CANNON 5-WAY LOW BODY COVER CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Green	107-T3	Solenoid Power, Solenoid H(1)	ECU-T3
B	White	110-T22	H Solenoid, Low	ECU-T22
C	Green	111-T8	I Solenoid, Low(2)	ECU-T8
D	Orange	102-T1	Solenoid Power, Solenoids F, G, and I	ECU-T1, MNVB-G, MNVB-J
E			NOT USED	

(1) H solenoid is used on all 8610 and 9810 models.

(2) I solenoid is used for lock-in-range on the 8610 and 9810 models.

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

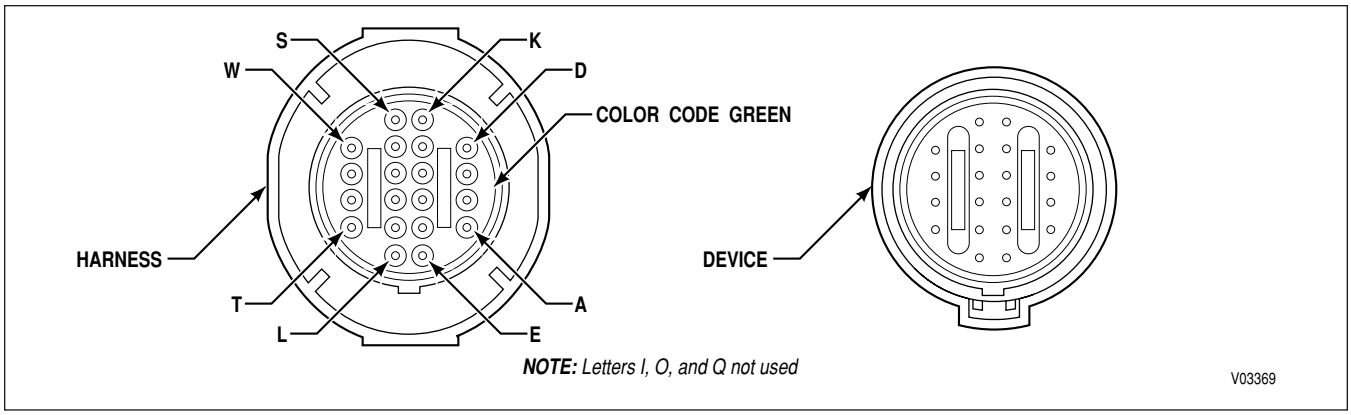


Figure B–8. Remote Selector Connector

REMOTE SHIFT SELECTOR CONNECTOR—PRIMARY SELECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Orange	170-S5	Primary Shift Selector, Data Bit 1	ECU-S5
B	Green	171-S6	Primary Shift Selector, Data Bit 2	ECU-S6
C	Blue	172-S7	Primary Shift Selector, Data Bit 4	ECU-S7
D	Yellow	173-S8	Primary Shift Selector, Data Bit 8	ECU-S8
E	Tan	174-S9	Primary Shift Selector, Parity	ECU-S9
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6 or 31	VIWS-L, SSS-L, ECU-S15
M	Green	175-S10	Shift Selector Mode Input	SSS-M, ECU-S10
N	Pink	124-S3	Sensor Power	SSS-N, ECU-S3
P	Gray	143-S32	Signal Return	VIWS-P, SSS-P, DDRP-A, DDRD-E, ECU-S32
R	Pink	136-S16	Battery Power	SSS-R, ECU-S16
S	Blue	180-S14	Shift Selector Display	SSS-S, ECU-S14
T	Blue	186	Chassis Return (12V) or Output From 12V Dimmer (24V)	SSS-T, VIWS-T
U	Red	187	Selector Backlighting/Feed (12V) or Not Used (24V)	SSS-U, VIWS-U
V	White	188	Selector Backlighting/Return (12V and 24V)	SSS-V, VIWS-V
W				

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

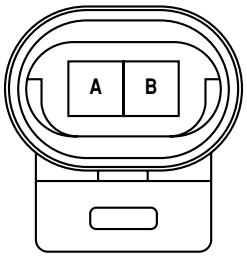
APPENDIX B—WIRE/CONNECTOR CHART

REMOTE SHIFT SELECTOR CONNECTOR—SECONDARY SELECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Orange	190-S21	Secondary Shift Selector, Data Bit 1	ECU-S21
B	Green	191-S22	Secondary Shift Selector, Data Bit 2	ECU-S22
C	Blue	192-S23	Secondary Shift Selector, Data Bit 4	ECU-S23
D	Yellow	193-S24	Secondary Shift Selector, Data Bit 8	ECU-S24
E	Tan	194-S25	Secondary Shift Selector, Parity	ECU-S25
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6 or 31	VIWS-L, PSS-L, ECU-S15
M	Green	175-S10	Shift Selector Mode Input	PSS-M, ECU-S10
N	Pink	124-S3	Sensor Power	PSS-N, ECU-S3
P	Gray	143-S32	Signal Return	VIWS-P, PSS-P, DDRP-A, DDRD-E, ECU-S32
R	Pink	136-S16	Battery Power	PSS-R, ECU-S16
S	Blue	180-S14	Shift Selector Display	PSS-S, ECU-S14
T	Blue	186	Chassis Return (12V) or Output From 12V Dimmer (24V)	PSS-T, VIWS-T
U	Red	187	Selector Backlighting/Feed (12V) or Not Used (24V)	PSS-U, VIWS-U
V	White	188	Selector Backlighting/Return (12V and 24V)	PSS-V, VIWS-V
W				

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART



SPEED SENSOR

V06606

Figure B–9. Speed Sensor Connector

INPUT (ENGINE) SPEED SENSOR CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Tan	141-T14	Input (Engine) Speed Sensor Hi	ECU-T14
B	Orange	150-T30	Input (Engine) Speed Sensor Lo	ECU-T30

TURBINE SPEED SENSOR CONNECTOR

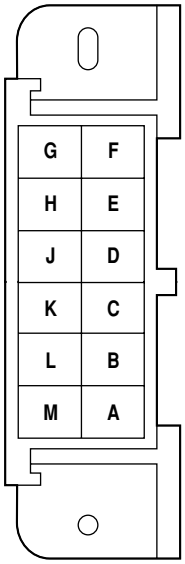
Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Orange	149-T15	Turbine Speed Sensor Hi	ECU-T15
B	Blue	140-T31	Turbine Speed Sensor Lo	ECU-T31

OUTPUT SPEED SENSOR CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Yellow	139-T16	Output Speed Sensor Hi	ECU-T16
B	Green	148-T32	Output Speed Sensor Lo	ECU-T32

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART



V00644.01

Figure B–10. Diagnostic Tool Connector (Packard)

DIAGNOSTIC CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Gray	143-S32	Signal Return	ECU-S32, VIWS-P, PSS-P, SSS-P
B				
C				
D				
E				
F				
G				
H	Yellow	146-S4	Ignition Sense	ECU-S4, VIWS-E
J	White	142-S1	Serial Communication (+)	ECU-S1, SCI-A
K	Blue	151-S17	Serial Communication (–)	ECU-S17, SCI-B
L				
M				

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

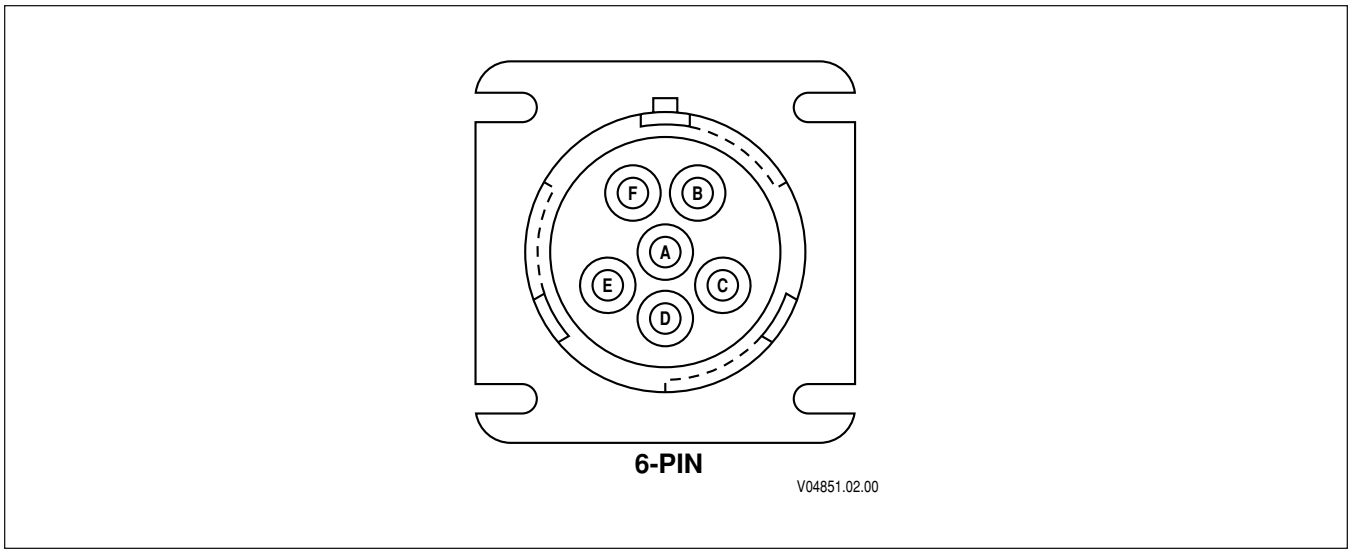


Figure B–11. Optional Deutsch Diagnostic Tool Connector or Optional DDU Connector

OPTIONAL 6-PIN DIAGNOSTIC CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	White	142-S1	Serial Communication (+)	ECU-S1, SCI-A
B	Blue	151-S17	Serial Communication (–)	ECU-S17, SCI-B
C	Yellow	146-S4	Ignition Sense	ECU-S4, VIWS-E
D				
E	Gray	143-S32	Signal Return	ECU-S32, VIWS-P, PSS-P, SSS-P
F				

6-PIN CONNECTOR FOR OPTIONAL DDU (AT DDU)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A				
B	Blue	151-S17	Serial Communication (–)	ECU-S17, SCI-B
C				
D	Gray	143-S32	Signal Return	ECU-S32, VIWS-P, PSS-P, SSS-P
E	Yellow	146-S4	Ignition Sense	ECU-S4, VIWS-E
F	White	142-S1	Serial Communication (+)	ECU-S1, SCI-A

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

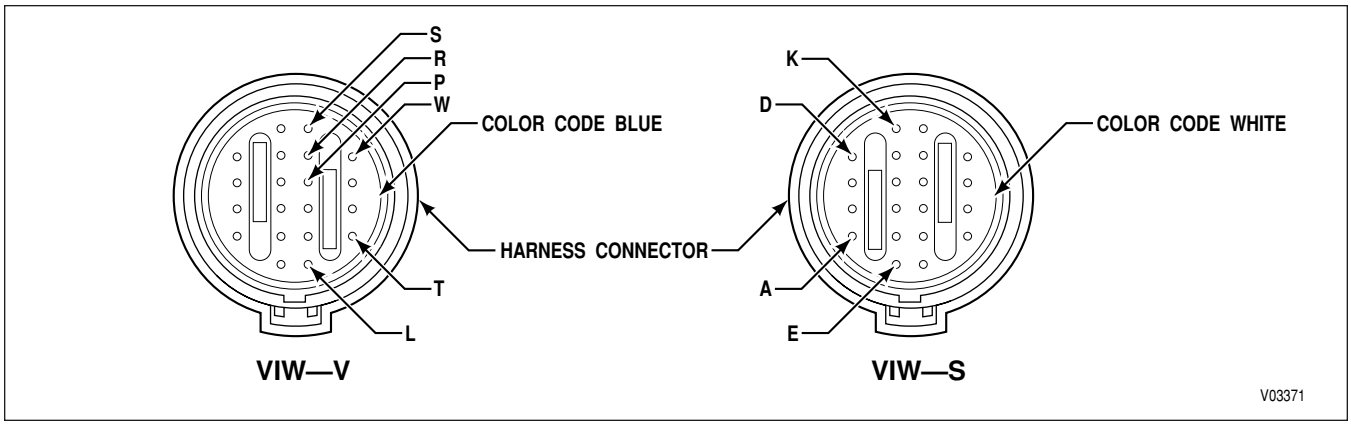


Figure B–12. VIW Connector (Packard Micro-Pack)

VIW–V CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Green	155-V11	General Purpose Input 14, 52, or 52A	ECU-V11
B	Yellow	153-V12	General Purpose Input 5	ECU-V12
C	Blue	118-V13	General Purpose Input 11 or 16	ECU-V13
D	White	154-V27	General Purpose Input 29 or 29A	ECU-V27
E	Green	105-V19	General Purpose Output 18	ECU-V19
F				
G				
H				
J				
K				
L	Yellow	161-V31	Signal Return (GPI)	ECU-V31
M	Blue	179-V9	Engine Water Temperature (Ref)	ECU-V9
N	Green	135-V24	Analog Return	ECU-V24, TPS-A
P	Green	117-V30	General Purpose Input 53	ECU-V30
R	Orange	178-V28	General Purpose Input 25 or 34	ECU-V28
S	Tan	177-V14	General Purpose Input 51	ECU-V14
T				
U	Orange	137-V29	General Purpose Input 17	ECU-V29U
V	White	167-V5	General Purpose Output 5	ECU-V5
W				

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

VIW–S CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s) *
A	Tan	159-S2	Diagnostic Communication Link (ISO 9141)	ECU-S2
B	Green	115-S31	Check Transmission	ECU-S31
C	Yellow	126-S28	General Purpose Input 1 or 9	ECU-S28
D	Tan	157-S30	Vehicle Speed	ECU-S30
E	Yellow	146-S4	Ignition Sense	ECU-S4, DDRP-H, DDRD-C
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6 or 31	ECU-S15, PSS-L, SSS-L
M	Yellow	119-S11	General Purpose Input 50	ECU-S11
N	Tan	166-S18	General Purpose Output 16	ECU-S18
P	Gray	143-S32	Signal Return	ECU-S32, PSS-P, SSS-P, DDRP-A, DDRD-E
R	Blue	163-S27	General Purpose Input 8	ECU-S27
S	Blue	169-S26	General Purpose Input 54	ECU-S26
T	Blue	186	Chassis Return (12V) or Output From 12V Dimmer (24V)	PSS-T, SSS-T
U	Red	187	Selector Backlighting/Feed (12V) or Not Used (24V)	PSS-U, SSS-U
V	White	188	Selector Backlighting/Return (12V and 24V)	PSS-V, SSS-V
W				

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

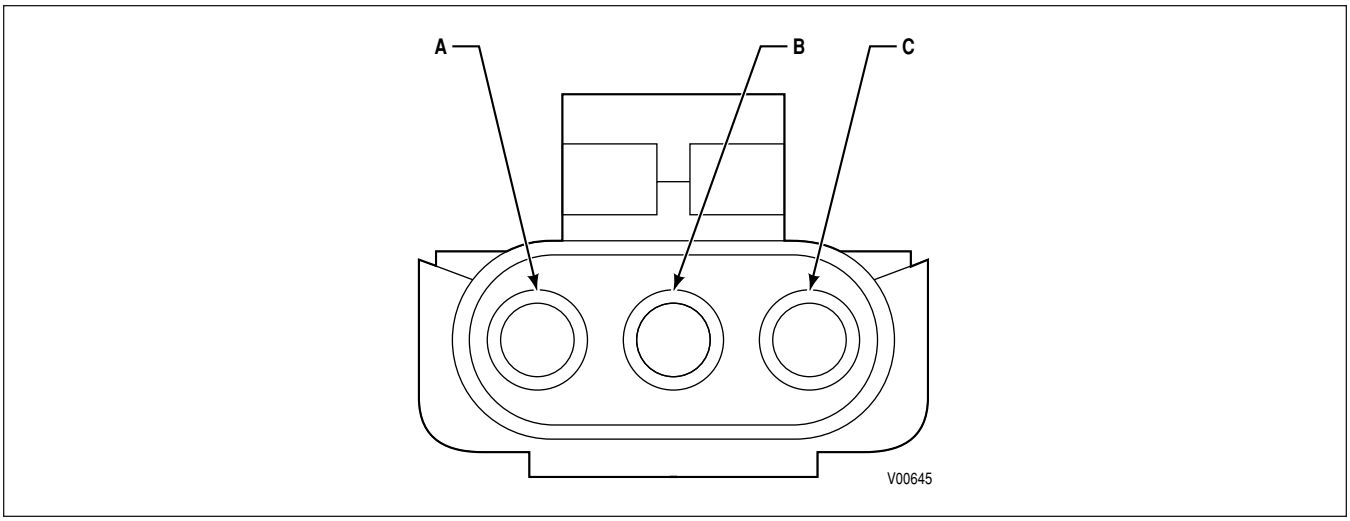


Figure B–13. TPS Connector

THROTTLE POSITION SENSOR CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Green	135-T25 or 135-V24	Analog Return	ECU-T25 or V24, LU-C, VIWV-N
B	Blue	156-T10 or V10	TPS Sensor Input	ECU-T10 or V10
C	Pink	124-T9 or V8	TPS Power	ECU-T9 or V8

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

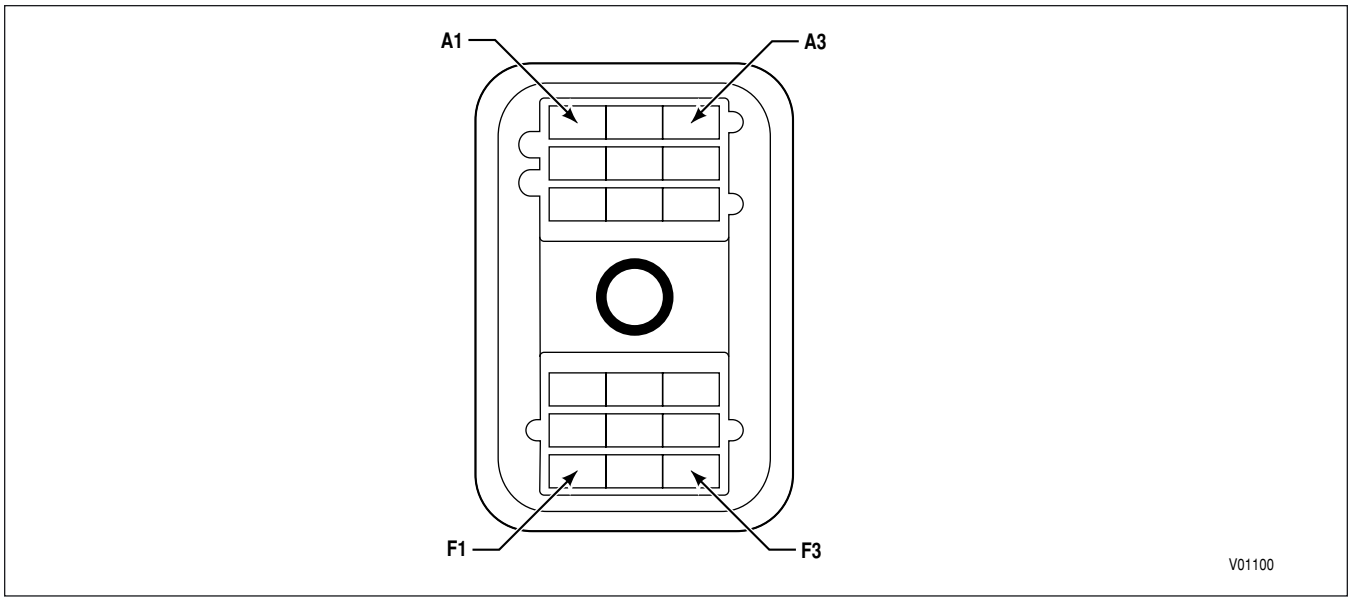


Figure B–14. VIM Connector (Harness)

VIM CONNECTOR (HARNESS)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A1	Gray	143-V17	Battery (–)	ECU-V17
A2	Gray	143-V32	Battery (–)	ECU-V32
A3			Reserved	
B1	Orange	132-V3	GPO 1	ECU-V3
B2	Tan	157-V20	Vehicle Speed	ECU-V20
B3			Reserved	
C1			Reserved	
C2	White	125-V18	GPO 9	ECU-V18
C3			Reserved	
D1	Tan	123-V6	Neutral Start (+)	ECU-V6
D2	Tan	112-V22	GPO 7 or 32	ECU-V22
D3			Reserved	
E1	Pink	136-V1	Battery (+)	ECU-V1
E2	Pink	136-V16	Battery (+)	ECU-V16
E3			Reserved	
F1	Yellow	146-V26	Ignition Sense	ECU-V26
F2	White	113-V4	Reverse Warning	ECU-V4
F3	White	114-V2	GPO 4	ECU-V2

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

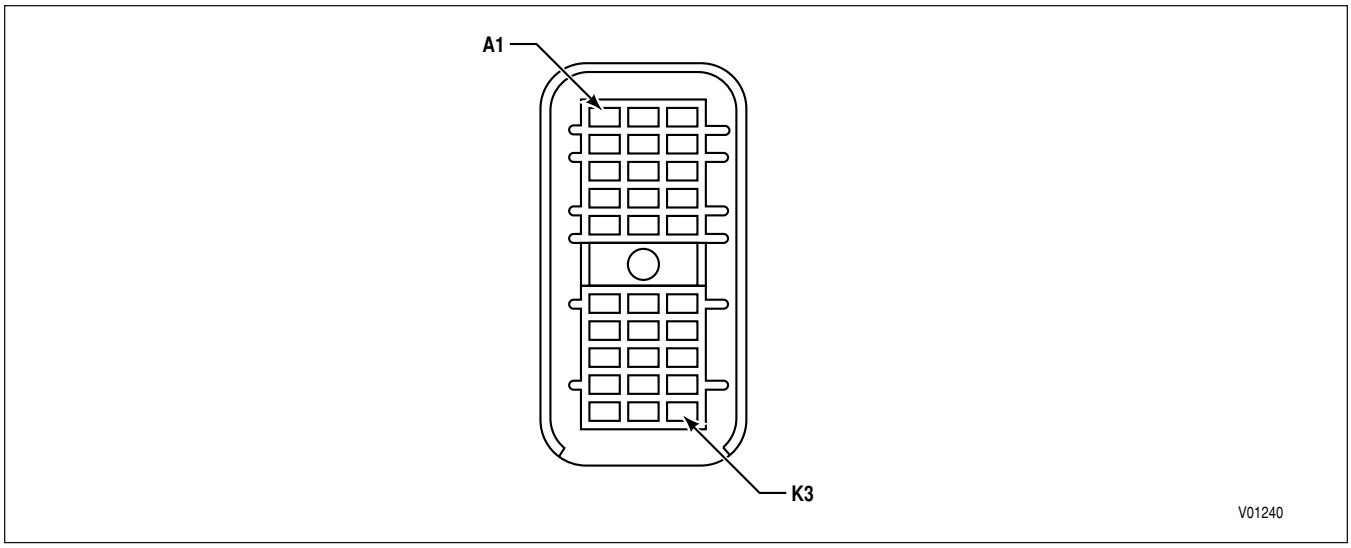


Figure B–15. VIM Connector (Harness)

VIM CONNECTOR (HARNESS 30-WAY)

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A1		313NO	Reverse Warning Relay—Normally Open	
A2		314CM	Output Wire 114 Relay—Common	
A3		314NO	Output Wire 114 Relay—Normally Open	
B1		313CM	Reverse Warning Relay—Common	
B2		314NC	Output Wire 114 Relay—Normally Closed	
B3			Reserved	
C1		346	Ignition Power	
C2		312NC	Output Wire 112 Relay—Normally Closed	
C3			Reserved	
D1		325NC	Output Wire 125 Relay—Normally Closed	
D2		332NC	Output Wire 132 Relay—Normally Closed	
D3			Reserved	
E1		325CM	Output Wire 125 Relay—Common	
E2		332CM	Output Wire 132 Relay—Common	
E3		332NO	Output Wire 132 Relay—Normally Open	
F1		323NO	Neutral Start Relay—Normally Open	
F2		312CM	Output Wire 112 Relay—Common	
F3		312NO	Output Wire 112 Relay—Normally Open	
G1		323CM	Neutral Start Relay—Common	
G2			Reserved	
G3			Reserved	
H1			Reserved	
H2		357UF	Optional Speed Signal	
H3			Reserved	
J1			Battery Power	
J2			Battery Power	
J3			Reserved	
K1			Battery Return	
K2			Battery Return	
K3			Reserved	

* Termination Points are determined by OEM electrical system design.

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

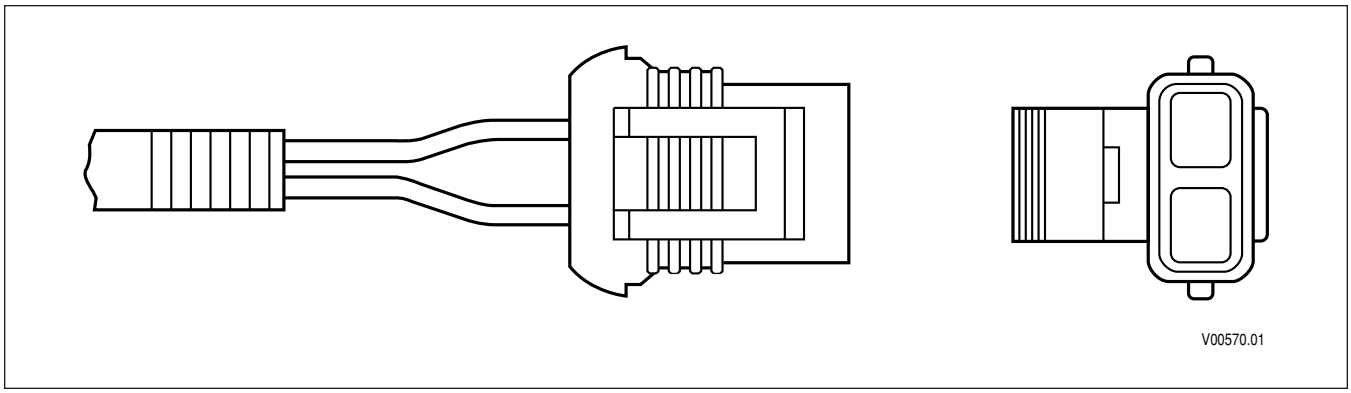


Figure B–16. SCI Interface Connector

SCI INTERFACE CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	White	142-S1	Serial Communication Interface, Hi	ECU-S1, DDRP-J, DDRD-A, DDU-A
B	Blue	151-S17	Serial Communication Interface, Lo	ECU-S17, DDRP-K, DDRD-B, DDU-B

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B—WIRE/CONNECTOR CHART

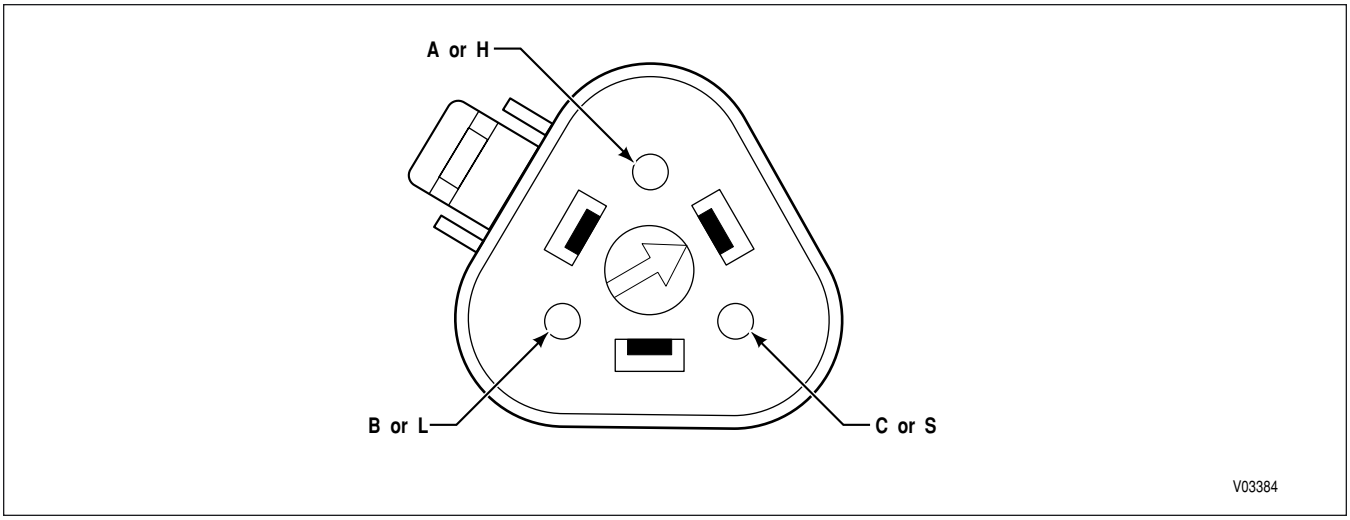


Figure B–17. J1939 Interface Connector

J1939 INTERFACE CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A or H	Red	183-S13	J1939 Controller, Hi	ECU-S13
B or L	Gray	184-S29	J1939 Controller, Lo	ECU-S29
C or S	Green	182-S12	J1939 Shield	ECU-S12

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

Contents **Page**

NOTE: ***Allison Transmission provides service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix C in this manual. Allison Transmission is responsible for warranty on these parts.***

- ***Repair parts for the external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes AT, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI will have parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:***

St. Clair Technologies, Inc.
920 Old Glass Road
Wallaceburg, Ontario N8A 4L8
Phone: (519) 627-1673
Fax: (519) 627-4227

St. Clair Technologies, Inc.
Calle Damanti S/N Col
Guadalupe–Guaymas
Sonora, Mexico 85440
Phone: 011-526-2222-43834
Fax: 011-526-2222-43553

- ***St. Clair Technologies, Inc. stocks an external harness repair kit as a source for some external harness repair parts. SCTI is the source for external harness repair parts.***

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

List Of Special Tools Required To Service CEC2 Wiring Harnesses

Tool Number	Tool Type	Paragraph Reference
23046604	Splice, Sealed (14–16 AWG)	1–10
23046605	Splice, Sealed (18–22 AWG)	1–10
J 25070	Heat Gun	1–10
J 34182	Crimper	1–6, 1–7, 1–9
J 35123	Crimper (Alternate)	1–2
J 35606	Crimper (Alternate)	1–5
J 35615	Wire Stripper	1–10
J 35689-A	Remover	1–2, 1–3
J 38125-10	Remover	1–5
J 38125-13	Remover	1–4
J 38125-6	Crimper	1–4, 1–5
J 38125-7	Crimper	1–2, 1–4
J 38125-8	Crimper	1–10
J 38582-3	Remover	1–6
J 38852	Crimper (Alternate)	1–5
J 39227	Remover	1–1
J 41193	Connector Repair Kit (FMTV)	1–7
J 41193-1	Guide Pin	1–7
J 41193-2	Insertion Tool	1–7
J 41193-3	Terminal Remover	1–7
J 42215	Crimper	1–1, 1–3
None	50–70 Percent Tin Resin Core Solder	1–8
None	Pen-Type Soldering Iron (Max OD = 0.125 inch)	1–8
None	Desoldering Braid	1–8

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

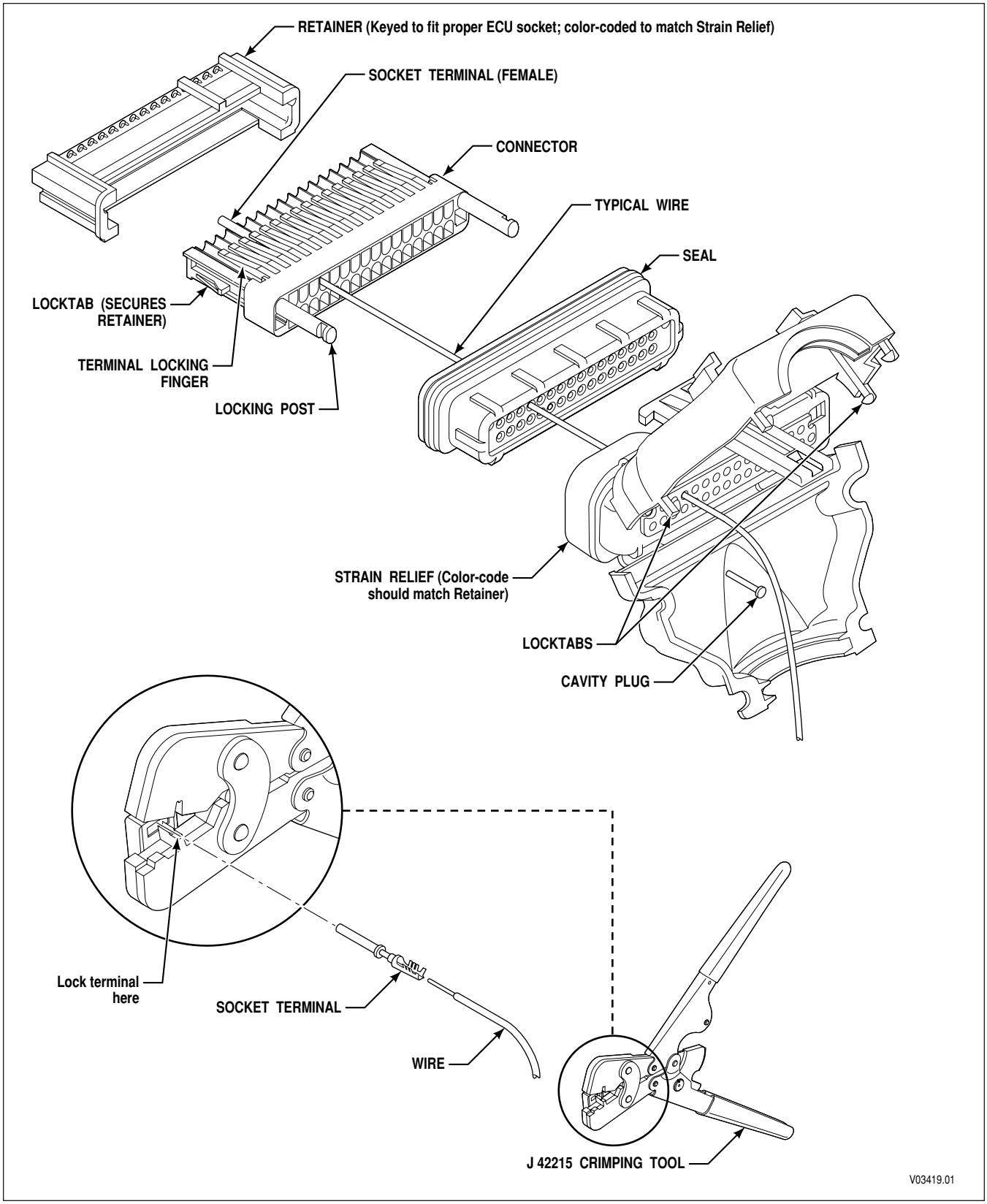


Figure C–1A. Delphi-Packard Micro-Pack Connector (ECU)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

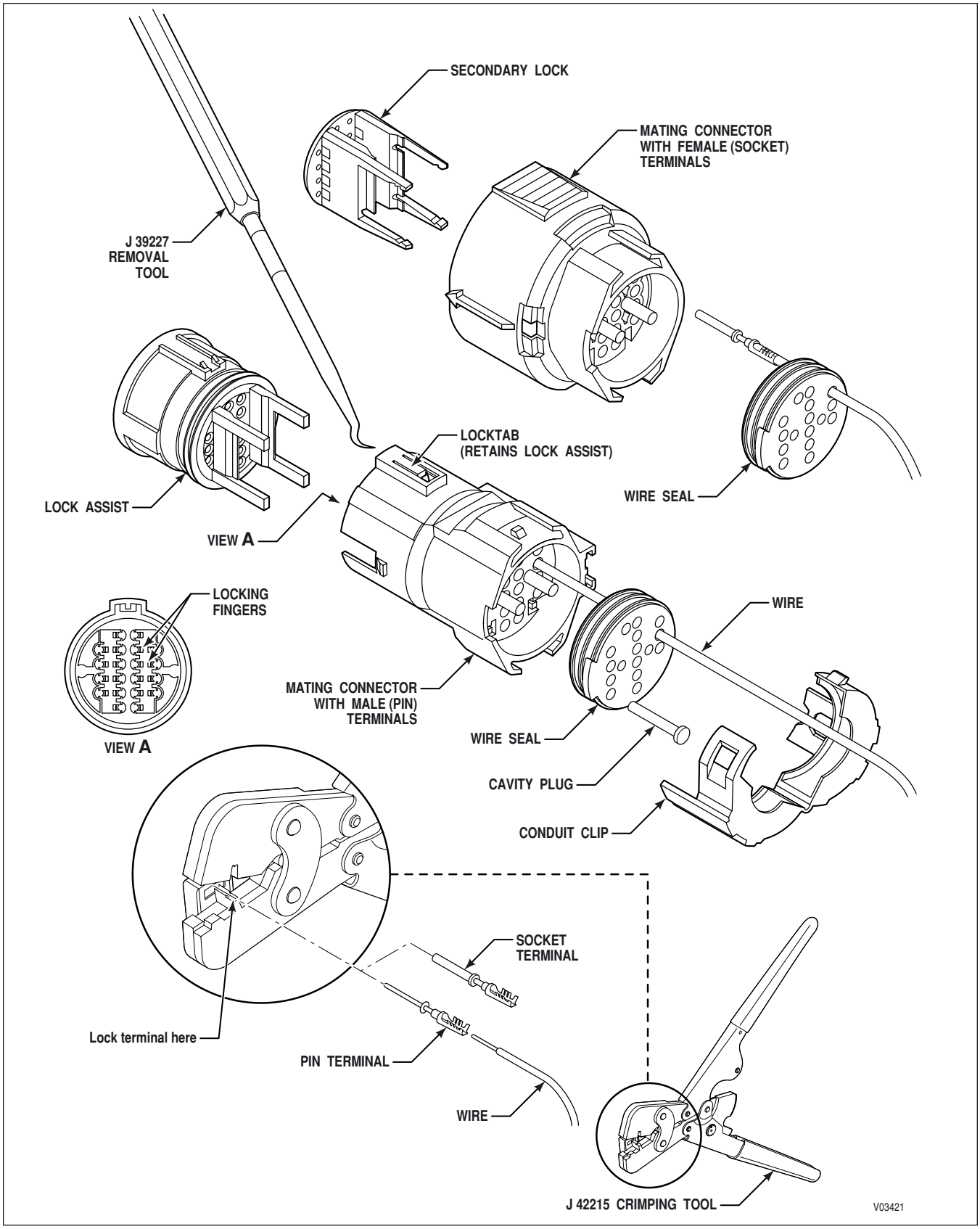


Figure C–1B. Delphi-Packard Micro-Pack Connector (VIWV, VIWS, Shift Selector)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–1. DELPHI-PACKARD MICRO-PACK 100W CONNECTORS (ECU, VIWV, VIWS, SHIFT SELECTORS)

A. Connector/Terminal Repairs

Crimping Tool	J 42215
Remover Tool	J 39227

Use	Description	Manufacturers P/N
Electronic Control Unit (Harness)	Strain Relief, 32-Way Black	12191001 *
	Seal, 32-Way	15305333 *
	Cavity Plug	12129557 *+
	Connector	15305371 *
	Retainer, Black	12129021 *
	Terminal, Socket	12084912 *
	CPA (Connector Position Assurance)	12177289 *
	Strain Relief, 32-Way Gray	12191002 *
	Retainer, Gray	12129022 *
	Strain Relief, 32-Way Blue	12191003 *
	Retainer, Blue	12129023 *
VIWV and VIWS (Harness)	Connector, Gray	12160542 +
	Wire Seal, Green	12110693 +
VIWV Only	Lock Assist, Blue	12191177
	Terminal, Pin	12160551 +
	Cavity Plug	12129557 *
	Conduit Clip, Black	12176394 *+
VIWS Only	Lock Assist, White	12191178
Shift Selector (Harness)	Connector, Gray	12160280 *
	Wire Seal, Gray	15304882 *
	Secondary Lock, Green	12160494 *
	Terminal, Socket	12084912 *
Shift Selector (Device)	Connector, Gray	12160542 +
	Wire Seal, Green	12110693 +
	Lock Assist/Seal, Green	12191176 +
	Conduit Clip, Black	12176394 *+
VIWV and VIWS (Device)	Connector, Gray	12160280 *
	Wire Seal, Gray	15304882 *
VIWV Only	Secondary Lock, Blue	12191172
	Terminal, Socket	12084912 *
VIWS Only	Secondary Lock, White	12191173

* These parts are contained in Allison Kit P/N 29532362.
\+ These parts are contained in Allison Kit P/N 29530475.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Terminal Removal

1. ECU Harness Connectors *(Figure C–1A)*

CAUTION:	The color-code of the strain relief should match the color-code of the retainer. However, cases have been reported where this has not occurred. The retainer color-code and key configuration makes sure that the proper wiring harness connector is in the right socket of the ECU. The color-code of the strain relief is of secondary importance and may not agree with the retainer. Change the strain relief to match the color-code of the retainer (Figure C–1A) when color-code mismatch is found.

   a. Use a small-bladed screwdriver to gently release the locktabs at the splitline of the strain relief.

   b. Spread the strain relief open.

   c. Remove the retainer from the connector by using a small-bladed screwdriver to depress the locktabs on the side of the connector.

   d. Remove a selected terminal by pushing forward on the wire or by lifting the locking finger and pulling the wire and terminal rearward out of the connector.

2. VIWV and VIWS Harness Connectors and Shift Selector (Device) Connectors *(Figure C–1B)*

   a. Lift locktab on the side of the connector and remove the lock assist.

   b. Open the conduit clip on the back of the connector after lifting locktabs on each side and sliding clip back to release it from connector.

   c. Use the J 39227 tool to release the locking finger inside the connector and pull the terminal/wire out the rear of the connector.

3. VIWV and VIWS (Device) Connectors and Shift Selector Harness Connectors *(Figure C–1B)*

   a. Carefully insert a small screwdriver blade between the connector body and the secondary lock. Twist/pry to remove the secondary lock from the connector body.

   b. Open the conduit clip on the back of the connector after lifting locktabs on each side and sliding clip back to release it from connector.

   c. Use the J 39227 tool to release the locking finger inside the connector and pull the terminal/wire out the rear of the connector.

C. Terminal Crimping

1. Carefully strip insulation to leave 0.20 ± 0.02 inch (5.0 mm ± 0.5 mm) of bare wire showing.

2. Insert the new terminal to be crimped in the J 42215 crimping tool. There is a spring-loaded terminal positioner at the front of the tool to hold the terminal in place. Squeeze the crimper handles for a few clicks to start the crimping process but leave room to insert the wire end.

3. Insert the bare wire end into the terminal. Squeeze the crimper handles to complete the crimping process and until the crimper handles open when released to remove the terminal/wire from the tool.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping *(cont'd)*

4. Complete terminal installation for VIW and Shift Selector Connectors as follows: *(Figure C–1B)*
   a. Insert the wire seal in the back of the connector.
   b. Push the terminal/wire assembly through the proper hole in the back of the wire seal. Push the wire in until the terminal clicks into position. Gently pull rearward on the wire to be sure the terminal is fully seated. Install cavity plugs as needed.
   c. Install the lock assist or secondary lock into the connector body.
   d. Close the conduit clip around the conduit and lock the clip into the rear of the connector body.
5. Complete terminal installation of the ECU Connectors as follows: *(Figure C–1A)*
   a. Align the locking posts on the connector with the seal and push the locking posts through the seal into the mating holes in the strain relief (if the connector was removed from the strain relief).
   b. Push the terminal/wire assembly through the proper hole in the back of the seal. Push the wire in until the terminal clicks into position.

NOTE: All terminals must be properly positioned to install the retainer in Step (5c).

   c. Install the retainer on the connector body to lock the terminals in position. Pull rearward on the wire to be sure the terminal is fully seated. Install cavity plugs as needed.
   d. Position the conduit inside the strain relief and snap the strain relief halves together.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

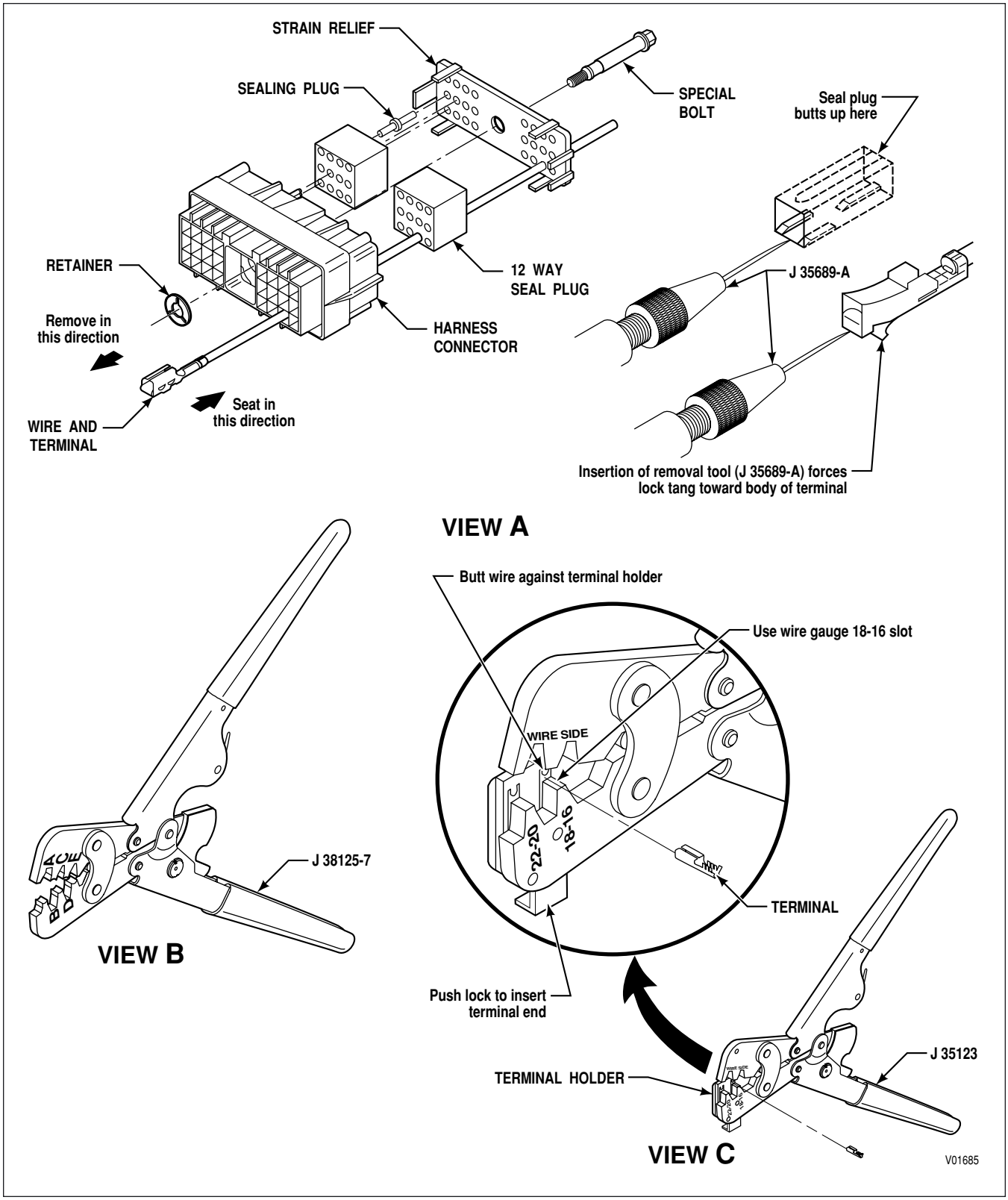


Figure C–2. Delphi-Packard Metri-Pack 150 Series Connectors—Pull-to-Seat (Speed Sensor, 30-Way and 18-Way VIM)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–2. DELPHI-PACKARD METRI-PACK 150 SERIES CONNECTORS—PULL-TO-SEAT (SPEED SENSOR, 30-WAY AND 18-WAY VIM)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7
Wire Crimp	Anvil "E"
Insulation Crimp	Anvil "C"
Alternate Crimping Tool	J 35123
Remover Tool	J 35689-A

Use	Description	Manufacturers P/N
Input Speed (Ni) Sensor	Connector	12162193
	Terminal	12103881
Turbine Speed (Nt) Sensor	Connector	12162193
	Terminal	12103881
Output Speed (No) Sensor	Connector	12162193
	Terminal	12103881
Vehicle Interface Module (VIM)	Connector (VIM)	
	Connector Body	12040920
	9-Way Seal (x2)	12040936
	18-Way Strain Relief	12110545
	Special Bolt	12129426
	Bolt Retainer	12034236
	Cavity Plug	12034413
	Terminal	12103881
Vehicle Interface Module (Vehicle)	Connector (OEM)	
	Connector Body	12034397
	15-Way Seal (x2)	12040879
	30-Way Strain Relief	12110546
	Special Bolt	12129426
	Bolt Retainer	12034236
	Cavity Plug	12034413
	Terminal	12103881

B. Terminal Removal

NOTE: Do not solder crimps.

1. Insert needle end of terminal remover J 35689-A into the small notch between the connector and the terminal to be removed (Figure C–2, View A). Push the lock tang toward the terminal.
2. Push the wire and terminal out of the connector (this is a "pull-to-seat" terminal).
3. Pull terminal as far as necessary from the connector. This will be limited by the number of other wires inserted into the connector and by the distance between the back side of the connector and the beginning of the harness covering.
4. If terminal is to be replaced, cut the terminal between the core and insulation crimp to minimize wire loss.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping—VIM And Speed Sensor Terminals (Standard Crimping Tool)

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used), through the wire seal, and out the other side of the connector before stripping.
2. Carefully strip insulation 0.18 ± 0.02 inch (4.5 mm ± 0.5 mm). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
3. Place core crimp portion of terminal on bed of anvil "E" and squeeze crimper enough to keep terminal from dropping (Figure C–2, View B).
4. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Position insulation crimp of terminal on anvil "C" so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
6. Be sure lock tang is lifted to allow proper reseating of the terminal.
7. Pull on the wire to pull the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pushed.)

D. Terminal Crimping Using Alternate Tool J 35123

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used) and the wire seal, and out the other side of the connector prior to stripping.
2. Insert remover tool in front side of connector to release locktab and push terminal out front of connector. Pull the terminal and wire out the front of the connector to complete Steps (3) through (7).
3. Push open the terminal holder on the crimper tool J 35123 and insert a terminal into the opening marked 18–16 (Figure C–2, View C) so that the crimp ends point up. Release the terminal holder.
4. Slightly close the crimping tool (close until one click is heard) but do not start to crimp the terminal. Place the terminal on the wire so it is in the same position as it will be when pulled back into the connector. The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Insert the wire into the terminal until the wire contacts the holder. (By doing this, the core and insulation should be properly positioned for the core and insulation crimp wings.)
6. Squeeze the crimper fully until it opens when released.
7. Open the terminal holder and remove the wire and terminal from the crimping tool.
8. Pull on the terminal to assure a tight crimp.
9. Be sure lock tang is lifted to allow proper reseating of the terminal.
10. Pull on the wire to pull the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pushed.)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

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APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

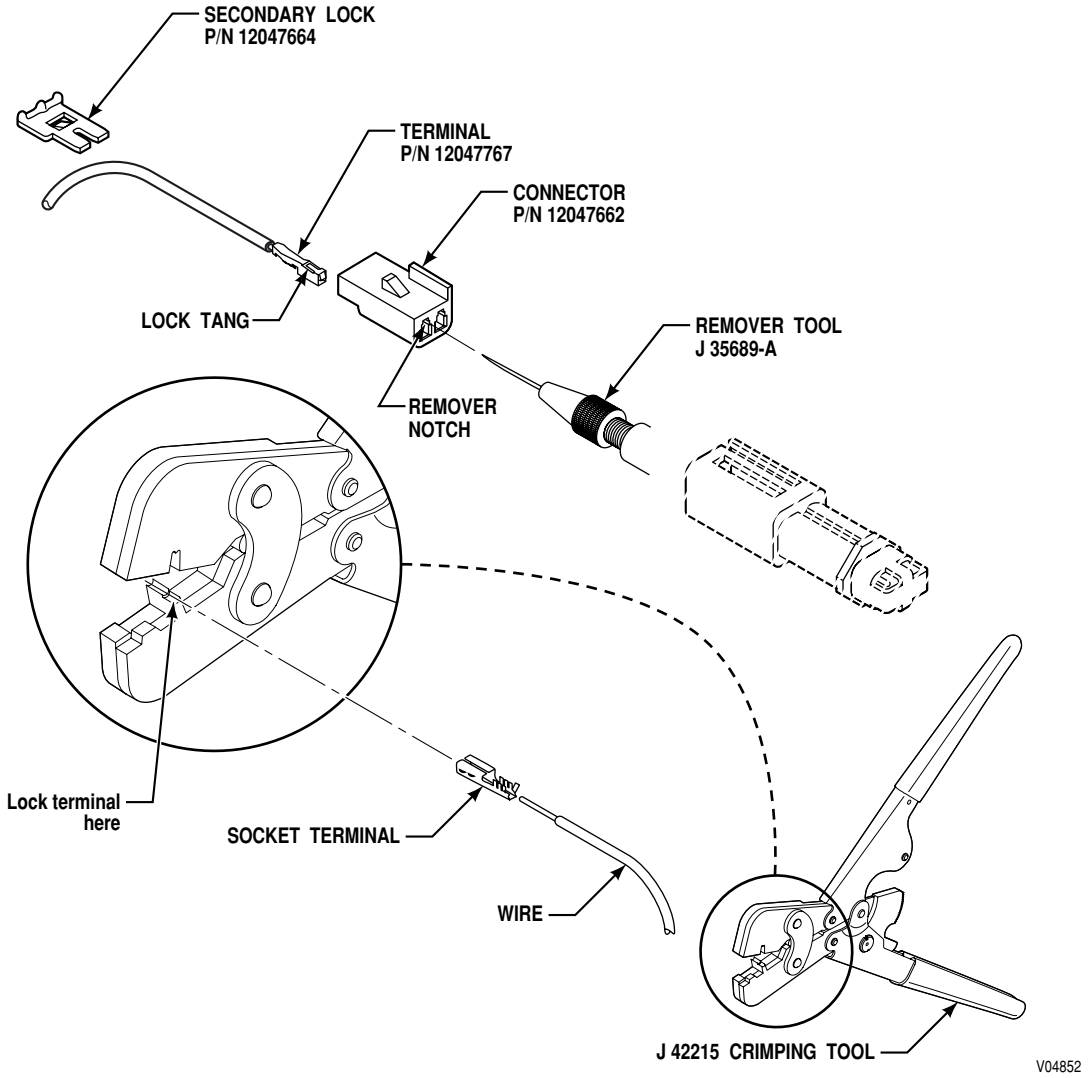

Figure C–3. Delphi-Packard Metri-Pack 150 Series Connector—Push-To-Seat (Sump Temperature Thermistor)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–3. DELPHI-PACKARD METRI-PACK 150 SERIES CONNECTORS—PUSH-TO-SEAT (SUMP TEMPERATURE THERMISTOR)

A. Connector/Terminal Repairs:

Crimping Tool	J 42215 (with terminal positioner removed)
Remover Tool	J 35689-A

Use	Description	Manufacturers P/N
Sump Temperature Thermistor	Sump Temperature Sensor	12129691
	Connector, Black	12047662
	Terminal	12047767
	Secondary Lock	12047664

B. Terminal Removal:

1. Remove the secondary lock from the connector.
2. Insert needle end of terminal remover J 35689-A into the small notch in the front of the connector cavity of the terminal to be removed (refer to Figure C–3).
3. Push the lock tang toward the terminal.
4. Pull the wire and terminal out of the connector.
5. Cut the terminal between the core and insulation crimp to minimize wire loss.

C. Terminal Crimping:

1. Strip insulation approximately 0.18 inch (4.5 mm).
2. Remove the spring-loaded terminal positioner from the J 42215 crimping tool.
3. Insert the new terminal to be crimped in the J 42215 crimping tool. Squeeze the crimper handles a couple clicks to start the crimping process but leave room to insert the wire end.
4. Insert the bare wire end into the terminal. Squeeze the crimper handles to complete the crimping process and until the crimper handles open when released to remove the terminal/wire from the tool.
5. Be sure the lock tang is positioned to allow proper retention of the terminal in the connector.
6. Push the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pulled.)
7. Install the secondary lock in the connector.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

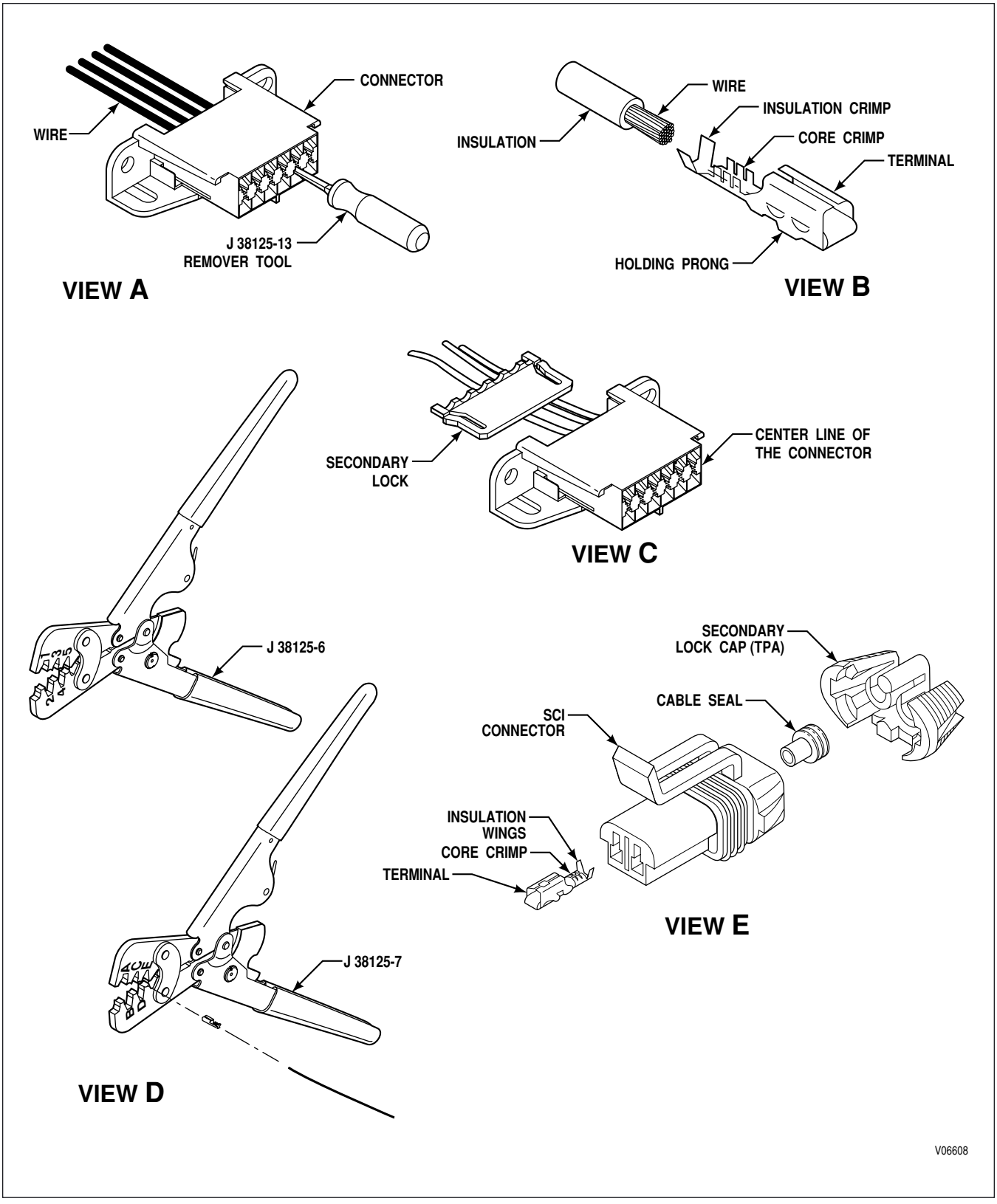

Figure C–4. Delphi-Packard Metri-Pack 280 Series Connectors—Push-to-Seat (Diagnostic Tool Connector and SCI)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–4. DELPHI-PACKARD METRI-PACK 280 SERIES CONNECTORS—PUSH-TO-SEAT (DIAGNOSTIC TOOL CONNECTOR AND SCI)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-6 and 7
Wire Crimp	Anvil "2"
Insulation Crimp	Anvil "A"
Remover Tool	J 38125-13

Use	Description	Manufacturers P/N
Diagnostic Connector	Connector	12048105
	Terminal (2-Wire)	12066214
	Secondary Lock	12020219
	Cover	12048107
SCI Connector	Connector	15300027
	Terminal (Socket)	12077411
	Secondary Lock	15300014
	Cable Seal	12089444

B. Terminal Removal

1. Remove secondary lock from back of connector (Figure C–4, View C or E). (Use a small screwdriver or pick in the slots on each side of the connector.)
2. Insert remover tool J 38125-13 into open (front) end of connector at terminal to be serviced (Figure C–4, View A).
3. Push the lock tang of the terminal straight and pull wire and terminal out the back of connector.
4. If the terminal is to be replaced, cut terminal between core and insulation crimp (this minimizes wire length loss).
5. For the SCI connector (View E), be sure the cable seal is in correct position on the wire before installing a new terminal.

C. Terminal Crimping

1. Carefully strip insulation 0.24 ± 0.01 inch (6.0 ± 0.25 mm).
2. Insert terminal into crimping tool (Figure C–4, View D), anvil "2."
3. Slightly close crimping tool to hold the terminal steady.
4. Align the terminal with its position in the connector and insert wire so that the stripped portion of the wire is in the core crimping area and the insulated portion of the wire is in the insulation crimping area (Figure C–4, View B).
5. Crimp the stripped section of the wire (Figure C–4, View D).
6. Remove the terminal from the crimping tool.
7. Use a pair of needle nose pliers, if necessary, to start the bend on the insulation crimp wings (Figure C–4, View D).
8. Crimp the insulated section of wire using anvil "A" of the crimpers shown (Figure C–4, View D).
9. Remove the terminal from the crimping tool.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping *(cont'd)*

10. Tug on terminal to make sure the crimp is tight.
11. Insert terminal into connector with the locktab toward the center line of the connector (Figure C–4, View C or E).
12. The terminal should "click" into place and you should not be able to pull the terminal out by hand.
13. Reinstall the secondary lock.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

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APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

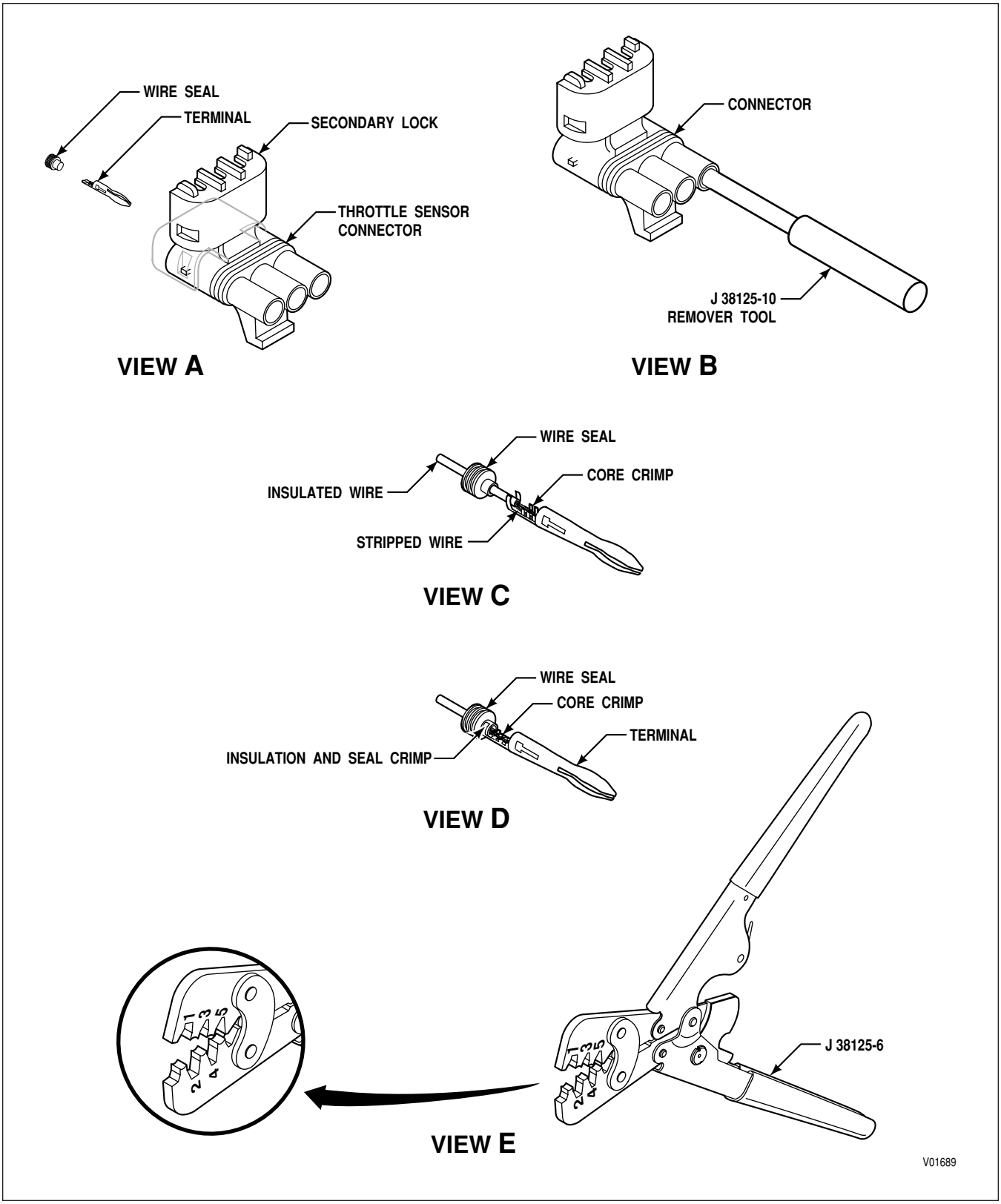

Figure C–5. Delphi-Packard WeatherPack Connector (TPS)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–5. DELPHI-PACKARD WEATHERPACK CONNECTORS (TPS)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-6
Wire Crimp	Anvil "2"
Insulation Crimp	Anvil "5"
Alternate Crimping Tool	J 35606 or J 38852
Remover Tool	J 38125-10

Use	Description	Manufacturers P/N
Throttle Position Sensor (TPS)	Connector	12015793
	Terminal	12089040
	Wire Seal	12015284 or 12089444

B. Terminal Removal

1. Unlatch and open the secondary lock on the connector (Figure C–5, View A).
2. On the front of the connector, insert remover tool J 38125-10 over the terminal. Push the tool over the terminal and pull the terminal out of the back end of the connector (Figure C–5, View B).
3. If terminal is to be replaced, cut terminal between core and insulation crimp (this minimizes wire loss).

NOTE: Two special tools are available for this operation: tool J 38125-6 (Paragraph C); tool J 35606 or J 38852 (Paragraph D).

C. Terminal Crimping Using Crimping Tool J 38125-6

1. Place the wire seal onto the wire before stripping the wire (Figure C–5, View C).
2. Strip wire to 0.24 ± 0.01 inch (6.0 ± 0.25 mm).
3. Place terminal onto crimping tool J 38125-6 (Figure C–5, View E), anvil "2."
4. Slightly close crimping tool to hold terminal steady.
5. Insert wire so that the stripped portion of wire is in the core crimp area and the insulated portion of the wire is in the insulation crimping area (Figure C–5, View C).
6. Crimp the stripped section of the wire.
7. Remove the terminal from the crimping tool.
8. Push the wire seal into the terminal (Figure C–5, View D). The second crimp will wrap around the wire seal. This will seal the insulated area of wire.
9. Use a pair of needle nose pliers, if necessary, to squeeze the terminal wings together to fit in anvil "5."
10. Crimp wire seal in anvil "5."
11. Tug on terminal and be sure the crimp is tight.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping Using Crimping Tool J 38125-6 *(cont'd)*

12. Insert the terminal into the connector. The terminal will "click" into place and should not pull out.
13. Secure the secondary lock. Both sides of the connector must be latched.

D. Terminal Crimping Using Alternate Crimper Pliers J 35606 or J 38852

1. Place the wire seal onto the wire before stripping the wire (Figure C–5, View C).
2. Strip wire to 0.24 ± 0.01 inch (6.0 ± 0.25 mm).
3. Insert terminal into crimping tool J 35606 (Figure C–6, View A), opening marked 18–20.
4. Position the terminal so the crimp wings are pointing up from the bottom jaw of the crimper and are properly positioned.
5. Slightly close the crimping tool to hold the terminal steady.
6. Slide the wire seal to the edge of the insulation and insert the wire and seal into the terminal (Figure C–6, View B).
7. Position the wire and seal and squeeze the crimping tool until it opens when released.
8. Tug on terminal to be sure the crimp is tight.
9. Insert terminal into connector. The terminal will "click" into place and should not pull out.
10. Relatch the secondary lock. Both sides of the connector must be latched.

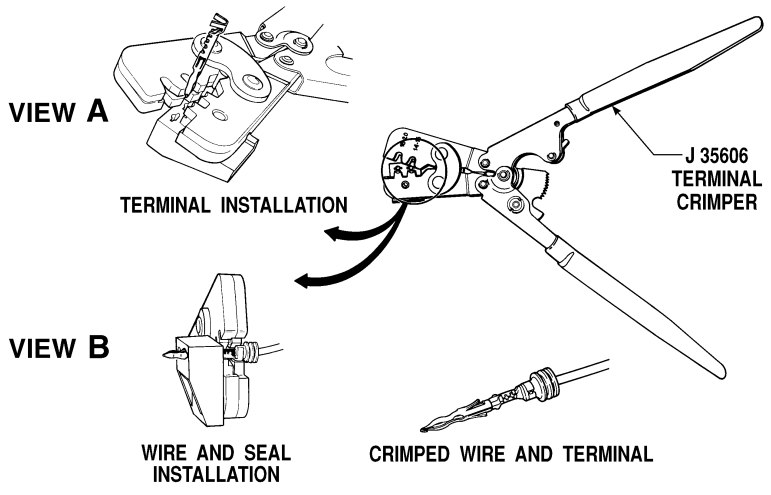

Figure C–6. Terminal Crimping With Tool J 35606

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

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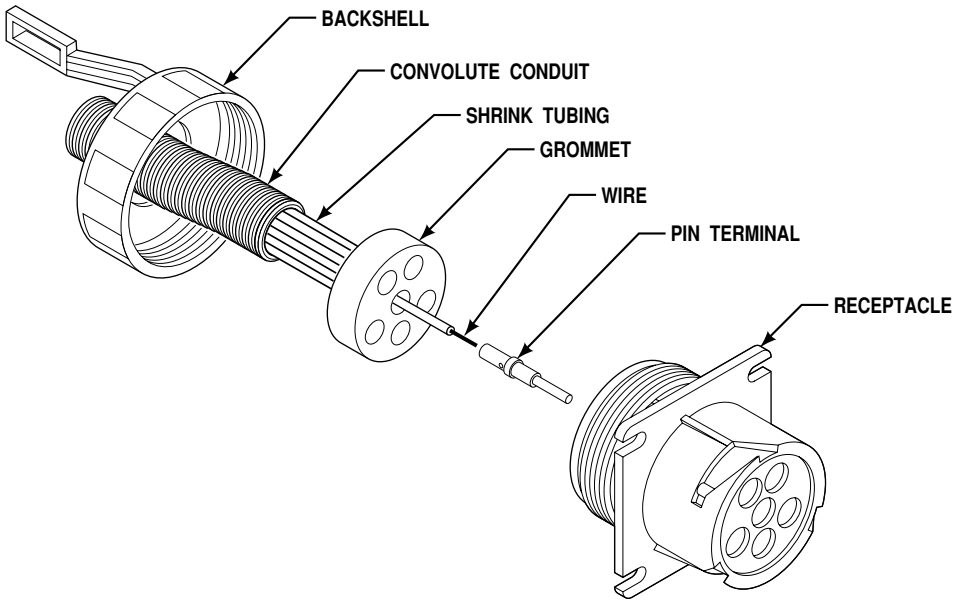
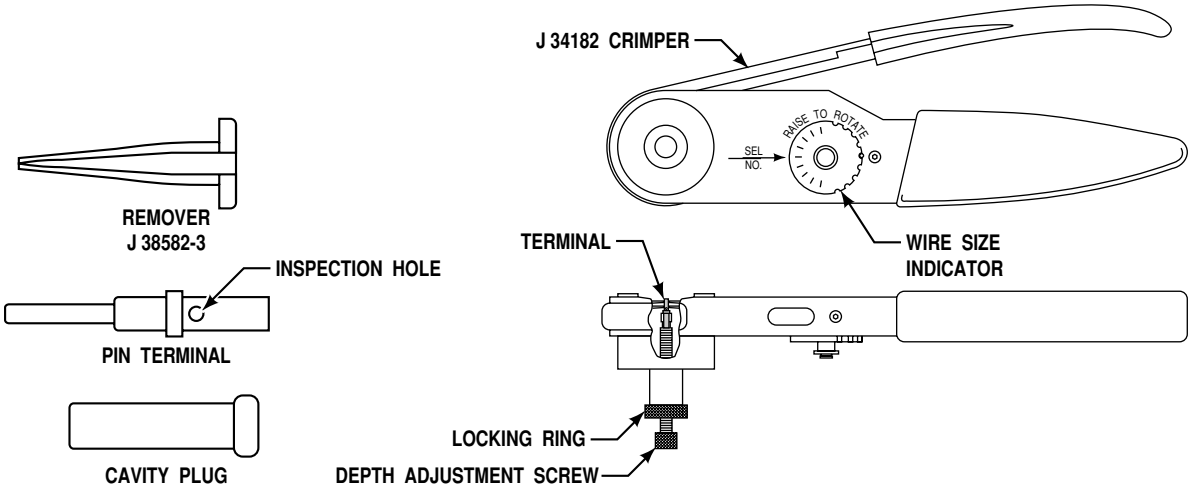
APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS



VIEW A



VIEW B

V06609

Figure C–7. Deutsch Connector (6-Way Optional Diagnostic Tool Connector or Optional DDU)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–6. DEUTSCH CONNECTOR (6-WAY OPTIONAL DIAGNOSTIC TOOL CONNECTOR OR OPTIONAL DDU)

A. Connector/Terminal Repairs

Crimping Tool	J 34182
Remover Tool (DDR Connector)	J 38582-3 (12–14 GA)

Use	Description	Manufacturers P/N
6-Way Optional DDR	6-Way Plug	HD10-6-12P
	Terminal (Pin)	0460-218-1231
	Cavity Plug	114017
	Backshell	HD18-006
	Cover (Cap)	HDC16-6

B. Terminal Removal (Refer to Figure C–7, View A)

1. Loosen and slide the backshell along the convolute conduit.
2. Remove the convolute conduit from the base of the backshell follower. Peel enough conduit from the harness to allow working access.
3. Slide the grommet clear of the receptacle housing.
4. Remove shrink tubing as necessary to allow working access.
5. Fully insert the proper remover/extractor tool into the back of the connector until it releases the terminal.
6. Pull the terminal, wire, and tool out the back of the connector.
7. If replacing the terminal, cut the wire through the middle of the terminal crimp (this minimizes wire loss).

C. Terminal Crimping (Refer to Figure C–7, View B)

1. Strip approximately 0.24–0.31 inch (6–8 mm) of insulation from the wire.
2. Set the crimping tool wire size to number 12. To set the wire size, remove the retainer pin. Lift and rotate the indicator until the correct wire number is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the top of the terminal is just above flush with the crimping hole (the crimp jaws will contact the middle of the terminal barrel). Tighten the lock ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.02–0.04 inch (0.5–1.0 mm)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to be sure the crimp is tight.
8. For the optional DDR connector, apply a one inch (25 mm) long piece of heat shrink tubing over the wire insulation just behind the terminal. Apply heat to shrink and lock tubing to the insulation.

D. Terminal Insertion

1. Insert wire with crimped terminal through the proper hole in the grommet.
2. Keep pushing on wire until the terminal “locks” into position.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

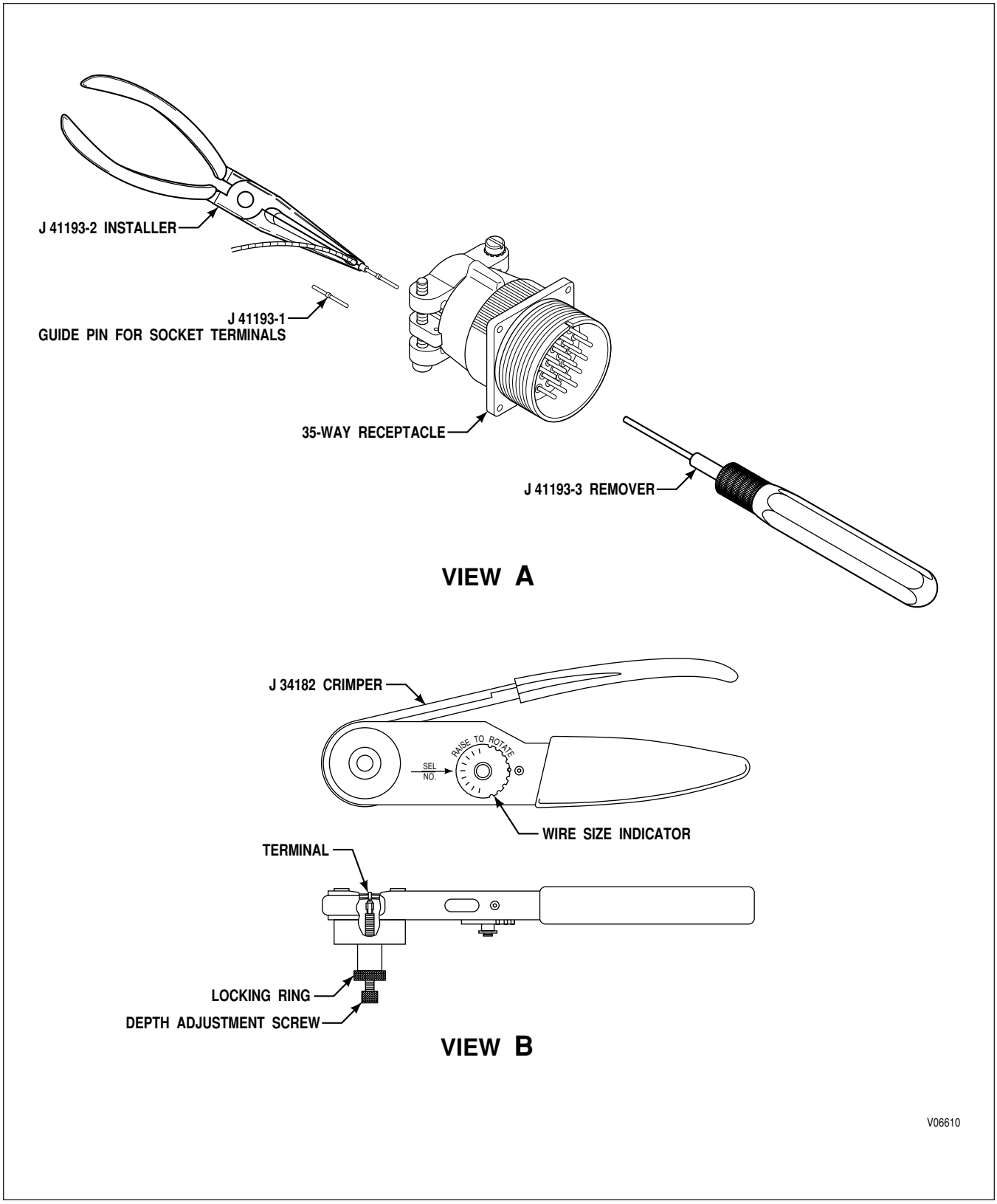


Figure C–8. ITT Cannon Connector—Crimped (35-Way T-Harness Bulkhead)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–7. ITT CANNON CONNECTOR—CRIMPED (35-WAY T-HARNESS BULKHEAD)

A. Connector/Terminal Repair

Crimping Tool	J 34182
Connector Repair Kit	J 41193
Guide Pin	J 41193-1
Insertion Tool	J 41193-2
Terminal Remover	J 41193-3

Use	Description	Manufacturers P/N
T-Harness Bulkhead	35-Way Receptacle	3100-F28-15S
	Terminal (Socket)	031-0560-161
	Cavity Plug	225-0017-000
	35-Way Plug	3106-F28-15P
	Terminal (Pin)	330-0351-016

B. Terminal Removal (Refer to Figure C–8, View A)

1. Select the J 41193-3 remover tool.
2. Choose either the pin or socket terminal remover tip and lock it into the handle.
3. Place the tip of the remover tool over the pin or into the socket and push the contact/terminal out the rear of the connector using slow, even pressure.
4. Pull the wire and terminal out the back of the connector.
5. If replacing the terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

C. Terminal Crimping (Refer to Figure C–8, View B)

1. Strip approximately 0.24–0.31 inch (6–8 mm) of insulation from the wire.
2. Set the crimping tool wire size to number 16. To set the wire size, remove the retainer pin. Lift and rotate the indicator until 16 is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal down into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the wire end of the terminal is just above flush with the top of the crimping hole. The crimp jaws will now contact the middle of the terminal barrel. Tighten the lock ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.020–0.040 inch (0.5–1.0 mm)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to be sure the crimp is tight.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Insertion

1. Select the proper insertion tool for the connector or receptacle that is being reassembled.
2. Place the terminal and wire in the insertion tool (refer to Figure C–8, View A).
3. Insert the terminal through the correct hole in the back of the connector and push until the terminal is seated. Remove the insertion tool. Check to see that the terminal is at the same height as other terminals. Tug on the wire at the rear of the connector to be sure the terminal is locked in place.
4. Insert cavity plugs into all unused cavities.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

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APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

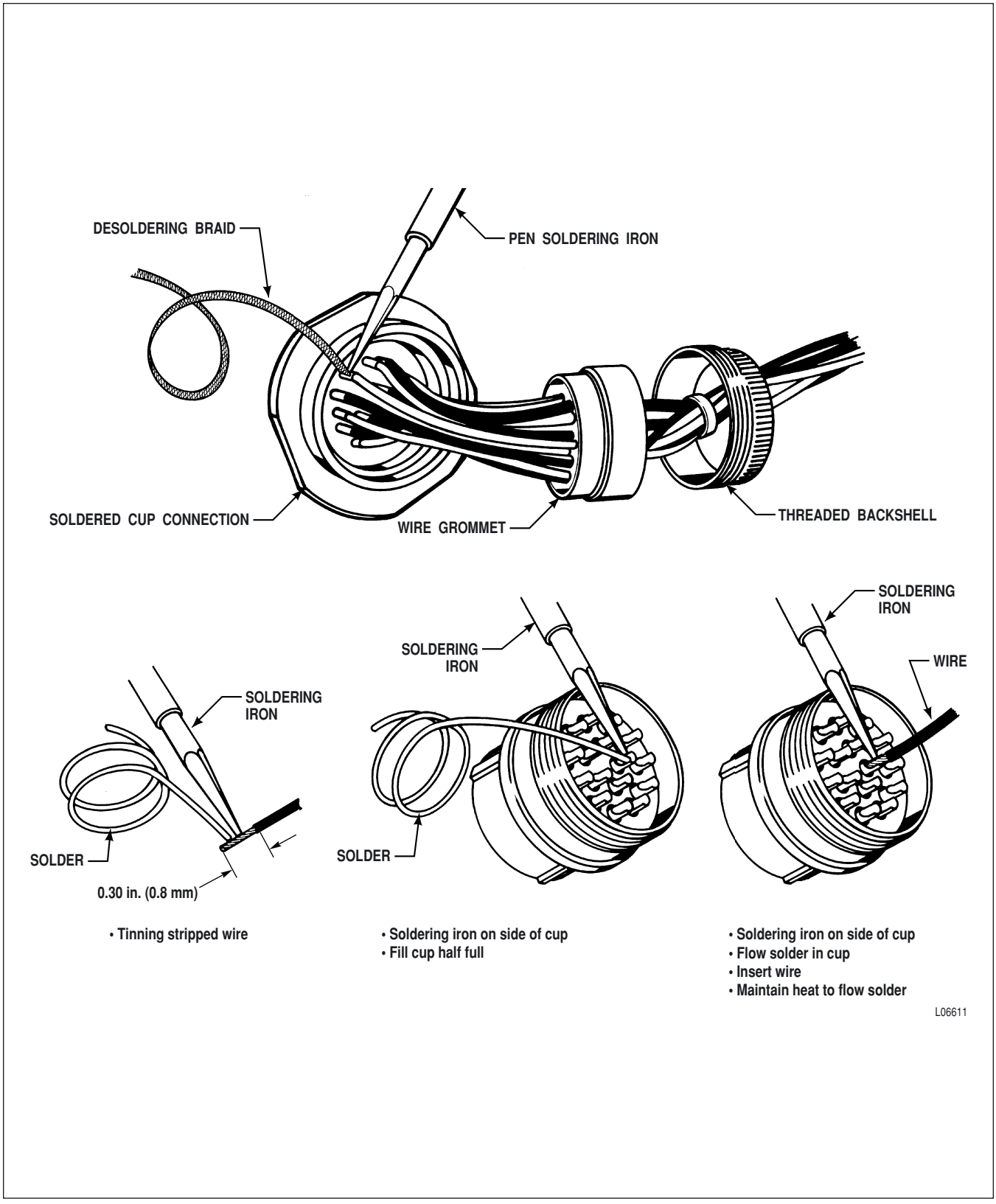


Figure C–9. ITT Cannon Connectors—Soldered (Main Valve Body Internal Harness, Main Valve Body Harness, Lockup Body Harness, Trim Boost or Low Body Harness)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–8. ITT CANNON CONNECTORS—SOLDERED (MAIN VALVE BODY INTERNAL HARNESS, MAIN VALVE BODY HARNESS, LOCKUP BODY HARNESS, TRIM BOOST OR LOW BODY HARNESS)

A. Connector Terminal Repair (Refer to Figure C–9)

Use	Description	Manufacturers P/N
Main Valve Body Internal Harness	Jam-Nut Receptacle (16-Pin)	MS3114E20-16P
Main Valve Body Harness	Straight Plug (16-Socket)	KPT-06-F20-16S
Lockup Body Harness	Straight Plug (4-Socket)	KPT-06-F8-4S
Trim Boost or Low Body Harness	Straight Plug (5-Socket)	KPT-06-F14-5S

B. Special Tools

- 50–70 percent tin resin core solder, 18–20 SWG (0.036 to 0.040 inch (0.086–1.0 mm))
- Pen-type soldering iron (60W maximum)—tip no larger than 0.125 inch (3.175 mm)
- Desoldering braid

NOTE: ***Proper solder, techniques, equipment, and cleanliness are important to achieve a good solder joint. Before beginning any desoldering or soldering, tin the tip of the soldering iron. Clean connector and terminals being soldered of all dirt, grease, and oil. Always heat the piece onto which solder is to flow. A cold solder joint can cause intermittent continuity problems. Avoid a cold solder joint by heating the piece(s) being soldered to melt the solder rather than merely heating the solder until it melts. Excess solder applied to a stranded wire travels up the wire, stiffening it and making it inflexible. The wire can break at the point where the solder stops. Do not use acid core solder.***

C. Wire Removal—Desoldering

1. Unscrew the connector's backshell and slide the backshell away from the connector.
2. Use a small screwdriver to slide the grommet away from the connector. Slide the grommet far enough to allow access to the terminals and wire ends. If the grommet is hard to slide, lubricate the wires with isopropyl alcohol. If necessary, move some of the harness covering. If no solder is present, proceed as in Section 1–7 for crimped terminals.
3. Place the desoldering braid (wick) on top of the soldered terminal cup and wire. Place the hot soldering iron on the desoldering braid and wait until the solder wicks up the braid. Remove the wire.
4. If other terminals are being repaired, repeat the desoldering operation as required.
5. Remove the wires from the grommet.

D. Soldering Wire Into Terminal

NOTE: ***If installing a new connector on a harness, be sure the backshell and grommet are in place before soldering the wires to the terminals. Clean wires and terminals to remove all dirt or grease.***

1. Strip approximately 0.31 ± 0.03 inch (8 ± 0.8 mm) of insulation from the wire.
2. Tin the stripped end of the wire.
3. Insert the wire through the proper hole in the grommet.

NOTE: ***Lubricate the wire(s) with isopropyl alcohol only if the wire(s) will not slide through the grommet. If installing a new connector on the harness, be sure the backshell is in place before inserting the wire(s) through the grommet.***

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Soldering Wire Into Terminal *(cont'd)*

4. Mount the connector in a holding fixture at a 45 degree angle. Hold the solder in the terminal cup and apply heat to the side of the cup until the solder flows. If a new connector is being used, begin soldering at the bottom center connection and work up and out from there.
5. Slowly feed solder into the cup until it is half-full. When the cup is half-full, remove the solder supply before removing the soldering iron. Half-fill all cup terminals that are to have wires inserted.

NOTE: Feed solder slowly enough to prevent a flux gas pocket from forming. A gas pocket prevents sufficient solder from flowing into the cup—a false fill. Correct a false fill by reheating the cup and adding solder.

6. Start at the lowest cup and apply heat to the side of the cup until the solder melts.

NOTE: Do not overheat the connector while soldering. If the connector gets too hot, stop work until it cools.

7. Carefully insert the stripped end of the wire into the cup until the wire bottoms in the cup. The wire's insulation should be approximately 0.0625 inch (1.59 mm) above the solder.
8. Maintain heat until the solder has flowed in the cup and onto the wire. Overheating can cause the solder to wick up the stranded wire.

NOTE: Indications of a good solder connection are:

- ***A minimum amount of solder showing***
- ***Wire strands are clearly outlined in the joint***
- ***The joint is completely covered with solder***
- ***Fillets have a smooth even contour***
- ***Edges are feathered***
- ***The joint is bright, smooth, and appears clean***

Too little solder is better than too much. If the solder wicks up the wire, the wire may break at the point at which the solder stops.

9. After soldering and inspecting all connections, remove flux residue with a contact cleaner.
10. Slide the grommet into place and screw on the backshell.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

NOTES

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

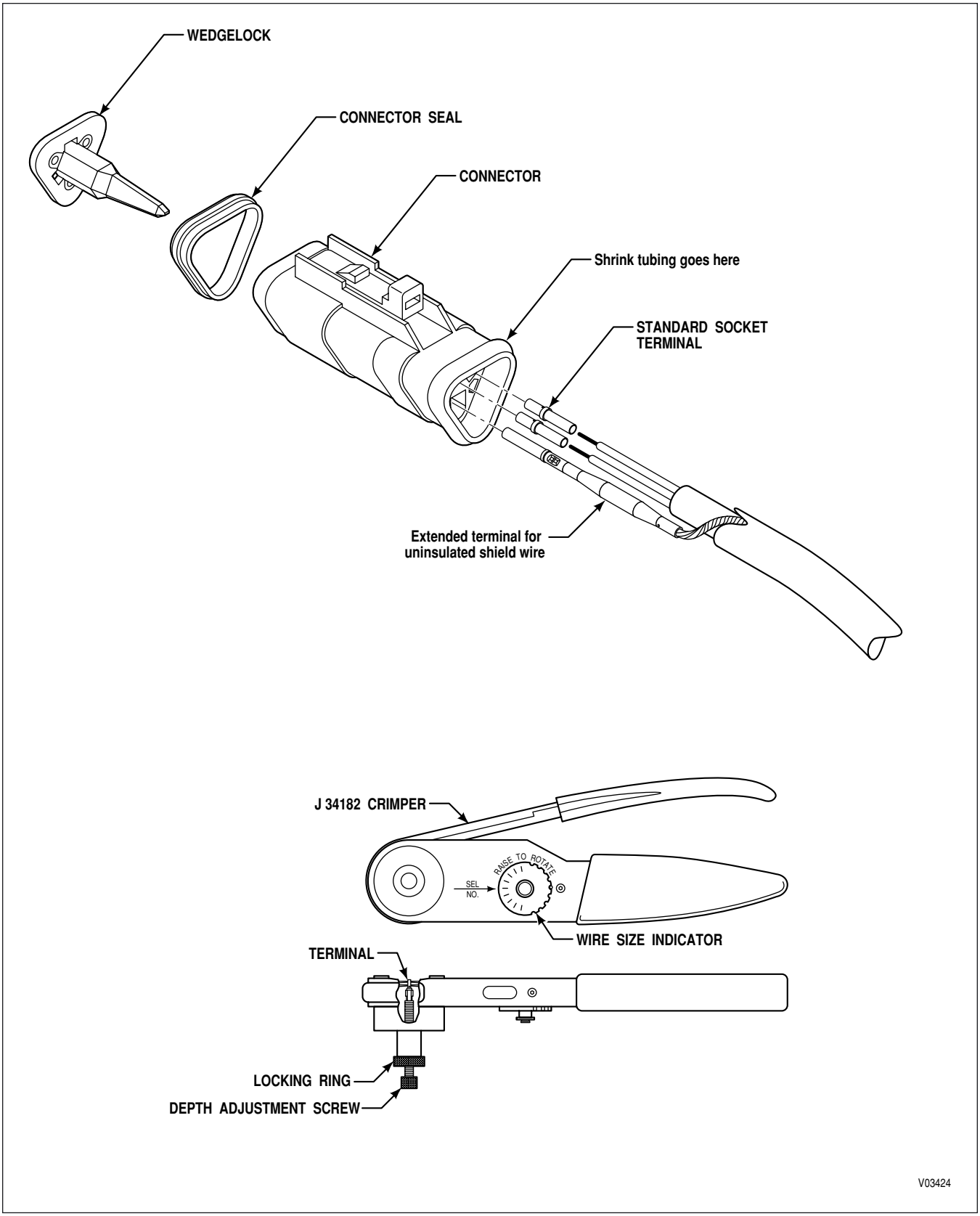


Figure C–10. Deutsch DT Series Connector (3-Way J1939 Interface)

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–9. DEUTSCH DT SERIES CONNECTOR (3-WAY J1939 INTERFACE)

A. Connector/Terminal Repair

Crimping Tool J 34182

Use	Description	Manufacturers P/N
J1939 Interface	Connector, Plug, 3-Way	DT06-3S-E008
	Wedgelock, Plug	W3S-1939
	Contact, Socket (Standard)	100504-23
	Contact, Socket (Extended)	0462-221-1631
	Cable, J1939 Databus	23-000-13

B. Terminal Removal (Refer to Figure C–10)

1. Use a small-bladed screwdriver to remove the wedgelock that holds the terminals in place.
2. Use a sharp knife to carefully remove the shrink tubing from the rear of the connector plug.
3. Use a small screwdriver to release the locking lever for all of the terminals. Pull the wire and terminal out the rear of the connector.
4. Slide a new piece of shrink tubing over the removed terminals and onto the cable.
5. If replacing the terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

C. Terminal Crimping (Refer to Figure C–10)

1. Strip 0.24–0.31 inch (6–8 mm) of insulation from the wire. (There is no insulation on the shield wire.)
2. Set the crimping tool wire size to number 18. To set the wire size, remove the retainer pin. Lift and rotate the indicator until 18 is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal down into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the wire end of the terminal is just above flush with the top of the crimping hole. The depth adjustment screw will need to be backed out a large amount to accept the extended shield terminal. The crimp jaws will now contact the middle of the terminal barrel. Tighten the lock ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.02–0.04 inch (0.5–1.0 mm)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to be sure the crimp is tight.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Insertion

1. Slide the wire with crimped terminal attached into the rear of the connector.
2. Push the terminal and wire into the connector until it locks into position (refer to Figure C–10). Check the front of the connector to see that the terminal is at the same height as other terminals. Tug on the wire at the rear of the connector to be sure the terminal is locked in place.
3. Insert the wedge lock to hold the terminals in place. Slide the sealing plug back into place at the rear of the connector.
4. Slide the shrink tubing over the raised area at the rear of the connector. Use a heat gun to shrink the tubing into position over the connector and cable.

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C–10. REPAIR OF A BROKEN WIRE WITH IN-LINE BUTT SPLICE

A. Connector Check Before Repair

NOTE: ***Before repairing or replacing wiring harness, sensor, solenoid, switch, or ECU as indicated for a diagnosed problem, follow the procedure below:***

1. Disconnect the connector or connectors associated with the problem and inspect for:
   - Bent terminals
   - Broken terminals
   - Dirty terminals
   - Pushed back terminals
   - Missing terminals
   - Condition of mating tabs
   - Condition of mating terminals

   Be Sure terminals are secure in the connector. Clean, straighten, or replace parts as required.
2. Reconnect all previous unmated connectors. Be Sure connectors are fully inserted or twisted until they lock in place. Connectors with locking tabs make an audible “click” when the lock is engaged.
3. If trouble recurs after starting the vehicle, follow proper repair procedures for trouble code or complaint.
4. If trouble does not recur, or if the correct repairs and/or replacements have been made, the problem should be corrected.

B. Special Tools

- Heat Gun, J 25070 or equivalent
- Crimping Tool for Pre-insulated Crimp J 38125-8 (refer to Figure C–11)

NOTE: ***Use crimping anvils “F” and “G.”***

- Wire Strippers, J 35615
- Splices P/N 23046604 14–16 AWG
- Splices P/N 23046605 18–22 AWG

NOTE: ***Each splice must be properly crimped and then heated to shrink the covering to protect and insulate the splice. Insulation piercing splice clips should not be used.***

APPENDIX C—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

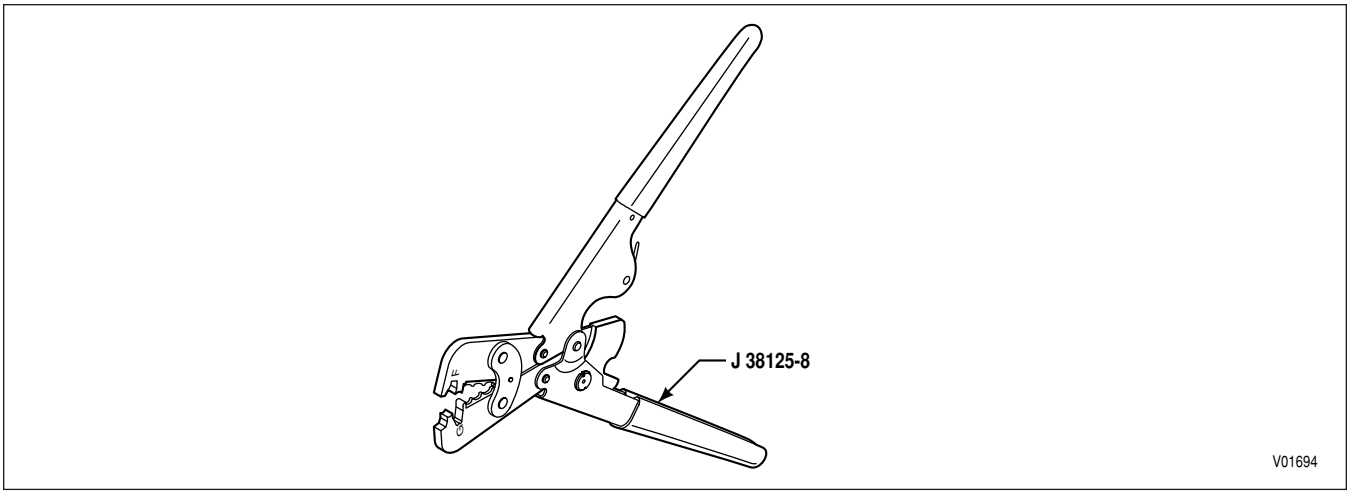


Figure C–11. Crimper J 38125-8

C. Straight Lead Repair Procedure

1. Locate damaged wire.
2. Remove insulation 0.3 inch (8.0 mm).
3. Insert one wire into crimp barrel and crimp.
4. Insert other wire into crimp barrel and crimp.
5. Pull on connection to be sure of crimping integrity.
6. Heat splice with heat gun until covering shrinks and adhesive flows from under the covering.
7. The splice is now sealed and insulated. Electrical tape should not be used and is not necessary.

APPENDIX C — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
ECU S	12191001	STRAIN RELIEF, 32-WAY BLACK	DELPHI-PACKARD	1-PC/ECU S	12186041	12186041	ECU HEADER
ECU S	15305333	SEAL, 32-WAY	DELPHI-PACKARD	1-PC/ECU S			
ECU S	15305371	INNER CONNECT, 32-WAY	DELPHI-PACKARD	1-PC/ECU S			
ECU S	12129021	TPA, 32-WAY BLACK	DELPHI-PACKARD	1-PC/ECU S			
ECU S	12084912	TERMINAL, SOCKET 100W	DELPHI-PACKARD	1-PC/ECU S			
ECU S	12129557	CAVITY PLUG, 100W	DELPHI-PACKARD	1-PC/ECU S			
ECU S	12177289	CPA, 32-WAY RED	DELPHI-PACKARD	1-PC/ECU S			
ECU V	12191002	STRAIN RELIEF, 32-WAY GRAY	DELPHI-PACKARD	1-PC/ECU V	12186043	12186043	ECU HEADER
ECU V	15305333	SEAL, 32-WAY	DELPHI-PACKARD	1-PC/ECU V			
ECU V	15305371	INNER CONNECT, 32-WAY	DELPHI-PACKARD	1-PC/ECU V			
ECU V	12129022	TPA, 32-WAY GRAY	DELPHI-PACKARD	1-PC/ECU V			
ECU V	12084912	TERMINAL, SOCKET 100W	DELPHI-PACKARD	1-PC/ECU V			
ECU V	12129557	CAVITY PLUG, 100W	DELPHI-PACKARD	1-PC/ECU V			
ECU V	12177289	CPA, 32-WAY RED	DELPHI-PACKARD	1-PC/ECU V			
ECU T	12191003	STRAIN RELIEF, 32-WAY BLUE	DELPHI-PACKARD	1-PC/ECU T	12129008	12129008	ECU HEADER
ECU T	15305333	SEAL, 32-WAY	DELPHI-PACKARD	1-PC/ECU T			
ECU T	15305371	INNER CONNECT, 32-WAY	DELPHI-PACKARD	1-PC/ECU T			
ECU T	12129023	TPA, 32-WAY BLUE	DELPHI-PACKARD	1-PC/ECU T			
ECU T	12084912	TERMINAL, SOCKET 100W	DELPHI-PACKARD	1-PC/ECU T			
ECU T	12129557	CAVITY PLUG, 100W	DELPHI-PACKARD	1-PC/ECU T			
ECU T	12177289	CPA, 32-WAY RED	DELPHI-PACKARD	1-PC/ECU T			
PSS/SSS	12160280	CONN 20F MIC/P 100W GRAY	DELPHI-PACKARD	1-PC/COMP S	12160542	12160542	CONN 20M MIC/P 100W GRAY
PSS/SSS	15304882	CABLE SEAL, 14F GRAY	DELPHI-PACKARD	1-PC/COMP S	12110693	12110693	CABLE SEAL, 14M GREEN
PSS/SSS	12160494	LOCK, SECONDARY 20F GREEN	DELPHI-PACKARD	1-PC/COMP S	12191176	12191176	LOCK ASSIST/SEAL, 20M GREEN
PSS/SSS	12084912	TERMINAL, SOCKET 100W	DELPHI-PACKARD	1-PC/COMP S	12160551	12160551	TERMINAL, PIN 100W
PSS/SSS	12129557	CAVITY PLUG, 100W	DELPHI-PACKARD	1-PC/COMP S	12129557	12129557	CAVITY PLUG, 100W
PSS/SSS	12176394	CONDUIT CLIP, 13 mm BLACK	DELPHI-PACKARD	1-PC/COMP S	12176394	12176394	CONDUIT CLIP, 13 mm BLACK
DDR P	12048105	CONNECTOR, 12-WAY	DELPHI-PACKARD	1-PC/COMP S			DIAGNOSTIC DATA READER
DDR P	12048107	COVER, CONNECTOR	DELPHI-PACKARD	1-PC/COMP S			
DDR P	12034046	TERMINAL, 280F SPECIAL	DELPHI-PACKARD	1-PC/COMP S			
DDR P	12066214	TERMINAL, 280F (W/SCI), 2-WIRE	DELPHI-PACKARD	1-PC/COMP S			
DDR P	12020219	LOCK, SECONDARY	DELPHI-PACKARD	1-PC/COMP S			
DDR D	HD10-6-12P	CONNECTOR, REC., 6-WAY	DEUTSCH IPD	1-PC/COMP S			DIAGNOSTIC DATA READER
DDR D	0460-256-12233	CONTACT, PIN #12	DEUTSCH IPD	1-PC/COMP S			
DDR D	0460-204-0831	CONTACT, PIN #8	DEUTSCH IPD	1-PC/COMP S			
DDR D	114017	SEALING PLUG	DEUTSCH IPD	1-PC/COMP S			
DDR D	HD18-006	BACKSHELL - STRAIN RELIEF	DEUTSCH IPD	1-PC/COMP S			
DDR D	HDC16-6	CAP, DDR CONNECTOR	DEUTSCH IPD	1-PC/COMP S			
SCI	15300027	CONNECTOR, 2-WAY	DELPHI-PACKARD	1-PC/COMP S	15300002	15300002	CONNECTOR, 2-WAY
SCI	12077411	TERMINAL, SOCKET	DELPHI-PACKARD	1-PC/COMP S	12048159	12048159	TERMINAL, PIN

APPENDIX C — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
SCI	12089444	SEAL, WIRE TYPE, SILICONE	DELPHI-PACKARD	1-PC/COMP S	12089444	12089444	SEAL, WIRE TYPE, SILICONE
SCI	15300014	LOCK, SECONDARY	DELPHI-PACKARD	1-PC/COMP S	15300014	15300014	LOCK, SECONDARY
J1939	DT06-3S-E008	CONNECTOR, PLUG 3-WAY	DEUTSCH	1-PC/ECU S		DT04-3P-E008	CONNECTOR, REC., 3-WAY
J1939	W3S	WEDGELOCK, PLUG	DEUTSCH	1-PC/ECU S		W3P	WEDGELOCK, RECEPTACLE
J1939	3662-204-1690	CONTACT, SOCKET #16	DEUTSCH	1-PC/ECU S	29511369	3660-201-1690	CONTACT, PIN #16
J1939	0462-221-1631	CONTACT, EXTENDED SOCKET	DEUTSCH	1-PC/ECU S		0460-247-1631	CONTACT, EXTENDED PIN
J1939		CABLE, J1939 DATABUS		1-PC/ECU S			
VIM	12040920	CONNECTOR, BODY, 18-WAY	DELPHI-PACKARD	1-PC/COMP V	12052130	12052130	VIM HEADER ASSEMBLY
VIM	12040936	SEAL, 9-WAY	DELPHI-PACKARD	1-PC/COMP V			
VIM	12110545	STRAIN RELIEF, 18-WAY	DELPHI-PACKARD	1-PC/COMP V			
VIM	12129426	BOLT, 7mm HEAD EXT.	DELPHI-PACKARD	1-PC/COMP V			
VIM	12034236	RETAINER CLIP, BOLT	DELPHI-PACKARD	1-PC/COMP V			
VIM	12103881	TERMINAL, 150F	DELPHI-PACKARD	1-PC/COMP V			
VIM	12034413	CAVITY PLUG, METRI-PACK	DELPHI-PACKARD	1-PC/COMP V			
VIW S	12160542	CONN 20M MIC/P 100W GRAY	DELPHI-PACKARD	1-PC/COMP S	12160280	12160280	CONN 20F MIC/P 100W GRAY
VIW S	12110693	CABLE SEAL, 14M GREEN	DELPHI-PACKARD	1-PC/COMP S	15304882	15304882	CABLE SEAL, 14F GRAY
VIW S	12191178	LOCK ASSIST/SEAL, 20M WHITE	DELPHI-PACKARD	1-PC/COMP S	12191173	12191173	LOCK, SECONDARY 20F WHITE
VIW S	12160551	TERMINAL, PIN 100W	DELPHI-PACKARD	1-PC/COMP S	12084912	12084912	TERMINAL, SOCKET 100W
VIW S	12129557	CAVITY PLUG, 100W	DELPHI-PACKARD	1-PC/COMP S	12129557	12129557	CAVITY PLUG, 100W
VIW S	12176394	CONDUIT CLIP, 13 mm BLACK	DELPHI-PACKARD	1-PC/COMP S	12176394	12176394	CONDUIT CLIP, 13 mm BLACK
VIW V	12160542	CONN 20M MIC/P 100W GRAY	DELPHI-PACKARD	1-PC/COMP V	12160280	12160280	CONN 20F MIC/P 100W GRAY
VIW V	12110693	CABLE SEAL, 14M GREEN	DELPHI-PACKARD	1-PC/COMP V	15304882	15304882	CABLE SEAL, 14F GRAY
VIW V	12191177	LOCK ASSIST/SEAL, 20M BLUE	DELPHI-PACKARD	1-PC/COMP V	12191172	12191172	LOCK, SECONDARY 20F BLUE
VIW V	12160551	TERMINAL, PIN 100W	DELPHI-PACKARD	1-PC/COMP V	12084912	12084912	TERMINAL, SOCKET 100W
VIW V	12129557	CAVITY PLUG, 100W	DELPHI-PACKARD	1-PC/COMP V	12129557	12129557	CAVITY PLUG, 100W
VIW V	12176394	CONDUIT CLIP, 13 mm BLACK	DELPHI-PACKARD	1-PC/COMP V	12176394	12176394	CONDUIT CLIP, 13 mm BLACK
VIW V	12191505	COVER, CONNECTOR	DELPHI-PACKARD	1-PC/COMP V			
NE	12162193	CONNECTOR, 2-WAY	DELPHI-PACKARD	1-PC/COMP T	12066016		ENGINE SPEED SENSOR
NE	12103881	TERMINAL, 150F	DELPHI-PACKARD	1-PC/COMP T	Actual sensor uses molded receptacle similar to 12066016		
NO	12162193	CONNECTOR, 2-WAY	DELPHI-PACKARD	1-PC/COMP T			OUTPUT SPEED SENSOR
NO	12103881	TERMINAL, 150F	DELPHI-PACKARD	1-PC/COMP T	Actual sensor uses molded receptacle similar to 12066016		
NT	12162193	CONNECTOR, 2-WAY	DELPHI-PACKARD	1-PC/COMP T			TURBINE SPEED SENSOR
NT	12103881	TERMINAL, 150F	DELPHI-PACKARD	1-PC/COMP T	Actual sensor uses molded receptacle similar to 12066016		
TPS	12015793	CONNECTOR, 3-WAY	DELPHI-PACKARD	1-PC/COMP V,T			TPS HEADER
TPS	12089040	TERMINAL, PIN	DELPHI-PACKARD	1-PC/COMP V,T	TPS header similar to 12010717 connector with 12089188 sockets molded into the TPS.		
TPS	12089444	SEAL, WIRE TYPE, SILICONE	DELPHI-PACKARD	1-PC/COMP V,T			
SCIX	15300002	CONNECTOR, SHROUD 2-WAY	DELPHI-PACKARD	SCI ADAPTER	15300027	15300027	CONNECTOR, 2-WAY
SCIX	12048159	TERMINAL, PIN	DELPHI-PACKARD	SCI ADAPTER	12077411	12077411	TERMINAL, SOCKET
SCIX	12089444	SEAL, WIRE TYPE, SILICONE	DELPHI-PACKARD	SCI ADAPTER	12089444	12089444	SEAL, WIRE TYPE, SILICONE
SCIX	15300014	LOCK, SECONDARY	DELPHI-PACKARD	SCI ADAPTER	15300014	15300014	LOCK, SECONDARY

APPENDIX D—THROTTLE POSITION SENSOR ADJUSTMENT

A. Description of Operation *(Figure D–1)*

1. To properly communicate throttle position to the Electronic Control Unit (ECU), the throttle position sensor (TPS) must convert its mechanical movement to an electrical form the ECU can understand. To accomplish this, contacts move across a resistive strip inside the sensor which translates position into voltage.

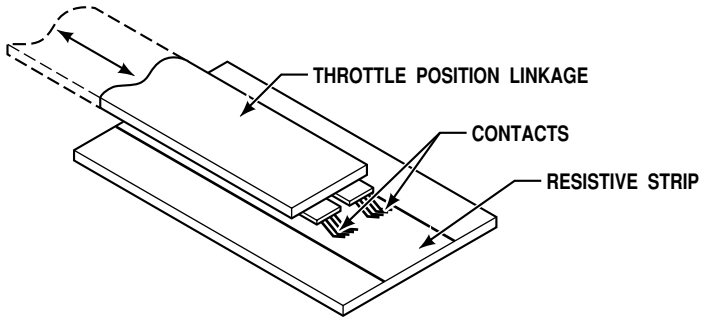


Figure D–1. Throttle Position to Voltage Conversion

2. Each position gives a different voltage. The ECU then converts the voltage to counts. Each count corresponds to approximately 0.007 inch (0.179 mm) of throttle sensor movement. Figure D–2 diagrams the counts and throttle movement relationship.

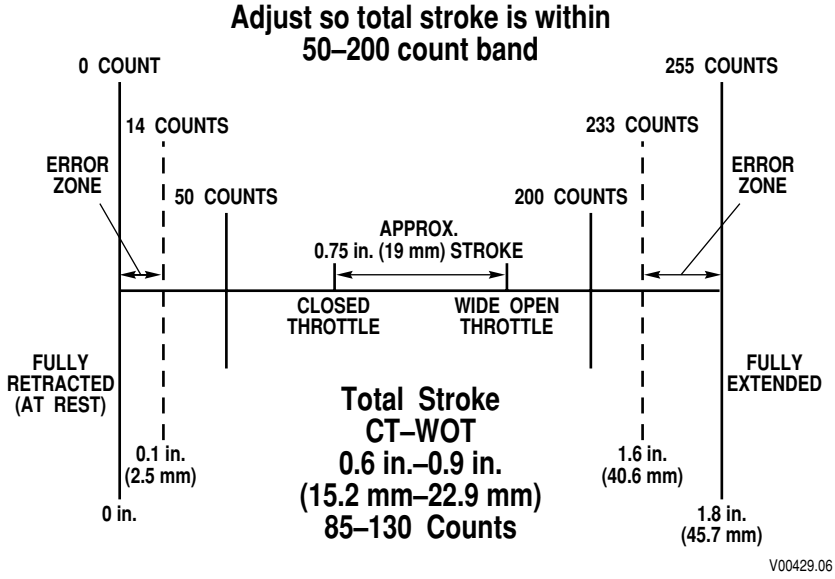


Figure D–2. Throttle Position Determination Diagram

3. Throttle percentage is proportional to counts; low counts correspond to low percent and high counts correspond to high percent (refer to Table D–1).

4. The conversion from counts to percent throttle is performed easily once the idle and full throttle positions are set (refer to adjustment procedures below). The idle and full throttle positions

APPENDIX D—THROTTLE POSITION SENSOR ADJUSTMENT

correspond to counts which can be viewed with a diagnostic tool. The ECU determines percent throttle by the equation:

$$\% \text{ Throttle} = \frac{\text{Current Count—Idle Count}}{\text{Full Throttle Count—Idle Count}} \times 100$$

Where:

Idle Count = Count on diagnostic tool when engine is idling.

Current Count = Count on diagnostic tool at the present throttle position.

Full Throttle Count = Count on diagnostic tool at wide open throttle.

NOTE: ***Refer to Appendix J for diagnostic tool user information.***

5. The throttle position sensor is self-calibrating within its normal operating range. Each time the vehicle is started and the ECU is initialized, the idle counts that are used for closed throttle are increased by 15 counts from its previous lowest reading. Also, the wide open throttle counts are reduced by 15 counts from its previous highest reading. Once new counts are read from the current sensor position, the idle and wide open throttle count set points are continually readjusted to the lowest and highest counts, respectively. This compensates for fuel control system wear or previous mechanical adjustment. One area of particular concern is when the throttle sensor extends into the error zone. This indicates a TPS misadjustment to the ECU and 100 percent throttle is assumed until readjustment is performed. Simply clearing the code 21 XX will not resolve the 100 percent (WOT) shifting situation.

NOTE: ***After replacing or adjusting the throttle position sensor linkage, the technician should use the diagnostic tool to clear the throttle calibration. Go to the diagnostic tool selection menu and locate ACTION REQUESTS. Select RESET THROTTLE CALIBRATION and ENTER to set the 0 percent throttle counts. After the idle counts are established, the throttle should be moved to the Full position to establish the full or Wide Open Throttle (WOT) position (100 percent). The full throttle counts will be the same as the idle counts until the throttle is moved. The full throttle counts are set when maximum travel is reached so stopping before actual full throttle will set the 100 percent point artificially low. Refer to Figure D–2 for proper counts and percentage. Refer to Figure D–3 for illustration of throttle position adjustment.***

B. Throttle Position Sensor (TPS) Adjustment

When properly installed by the equipment manufacturer, the TPS should not require adjustment. Confirm that the throttle sensor is installed to manufacturer specifications before adjusting the throttle position sensor. The idle count should be 50 or higher and full throttle count 200 or lower. The TPS is self-calibrating meaning there is no optimum closed throttle or wide open throttle count value. As long as the counts are within the 50 to 200 range, the TPS is set properly. Total stroke of 85–130 counts must be maintained. Watch the movement of the throttle sensor as the controls move it through its full stroke. Be sure there is no misalignment or obstruction to smooth movement through the full stroke. Make certain the idle and full throttle positions are not in the error zones (refer to Figure D–2). The error zones occur when the idle position is less than 14 counts, or when the full throttle position is more than 233 counts. When idle or wide open throttle positions are in the error zones, codes 21 12 and 21 23 occur, respectively. These codes cause the transmission to shift as if the throttle is fully depressed (100 percent throttle) affecting shift quality and causing decreased fuel efficiency. Code 21 XX may be caused by a short or open circuit in the chassis harness or by incorrect voltages. If this occurs, refer to code 21 XX chart.

NOTE: ***Use Test Harness J 41339 for measuring voltages.***

APPENDIX D—THROTTLE POSITION SENSOR ADJUSTMENT

Table D–1. Volts Versus Count for Throttle Sensor Display Reading

CTS	Volts	CTS	Volts	CTS	Volts	CTS	Volts	CTS	Volts	CTS	Volts
0	0	41		81		121		161		201	
1	0.0196	42		82		122		162		202	
2		43		83		123		163		203	
3		44		84		124		164		204	
4		45	0.882	85	1.666	125	2.451	165	3.235	205	4.019
5	0.098	46		86		126		166		206	
6		47		87		127		167		207	
7		48		88		128		168		208	
8		49		89		129		169		209	
9		50	0.98	90	1.764	130	2.549	170	3.333	210	4.117
10	0.196	51		91		131		171		211	
11		52		92		132		172		212	
12		53		93		133		173		213	
13		54		94		134		174		214	
14		55	1.078	95	1.863	135	2.647	175	3.431	215	4.215
15	0.276	56		96		136		176		216	
16		57		97		137		177		217	
17		58		98		138		178		218	
18		59		99		139		179		219	
19		60	1.176	100	1.96	140	2.745	180	3.529	220	4.313
20	0.392	61		101		141		181		221	
21		62		102		142		182		222	
22		63		103		143		183		223	
23		64		104		144		184		224	
24		65	1.274	105	2.058	145	2.843	185	3.627	225	4.411
25	0.49	66		106		146		186		226	
26		67		107		147		187		227	
27		68		108		148		188		228	
28		69		109		149		189		229	
29		70	1.372	110	2.156	150	2.941	190	3.725	230	4.509
30	0.588	71		111		151		191		231	
31		72		112		152		192		232	
32		73		113		153		193		233	
33		74		114		154		194		234	
34		75	1.47	115	2.225	155	3.039	195	3.823	235	4.607
35	0.686	76		116		156		196		236	
36		77		117		157		197		237	
37		78		118		158		198		238	
38		79		119		159		199		239	
39		80	1.568	120	2.353	160	3.137	200	3.921	240	4.705
40	0.784										

APPENDIX D—THROTTLE POSITION SENSOR ADJUSTMENT

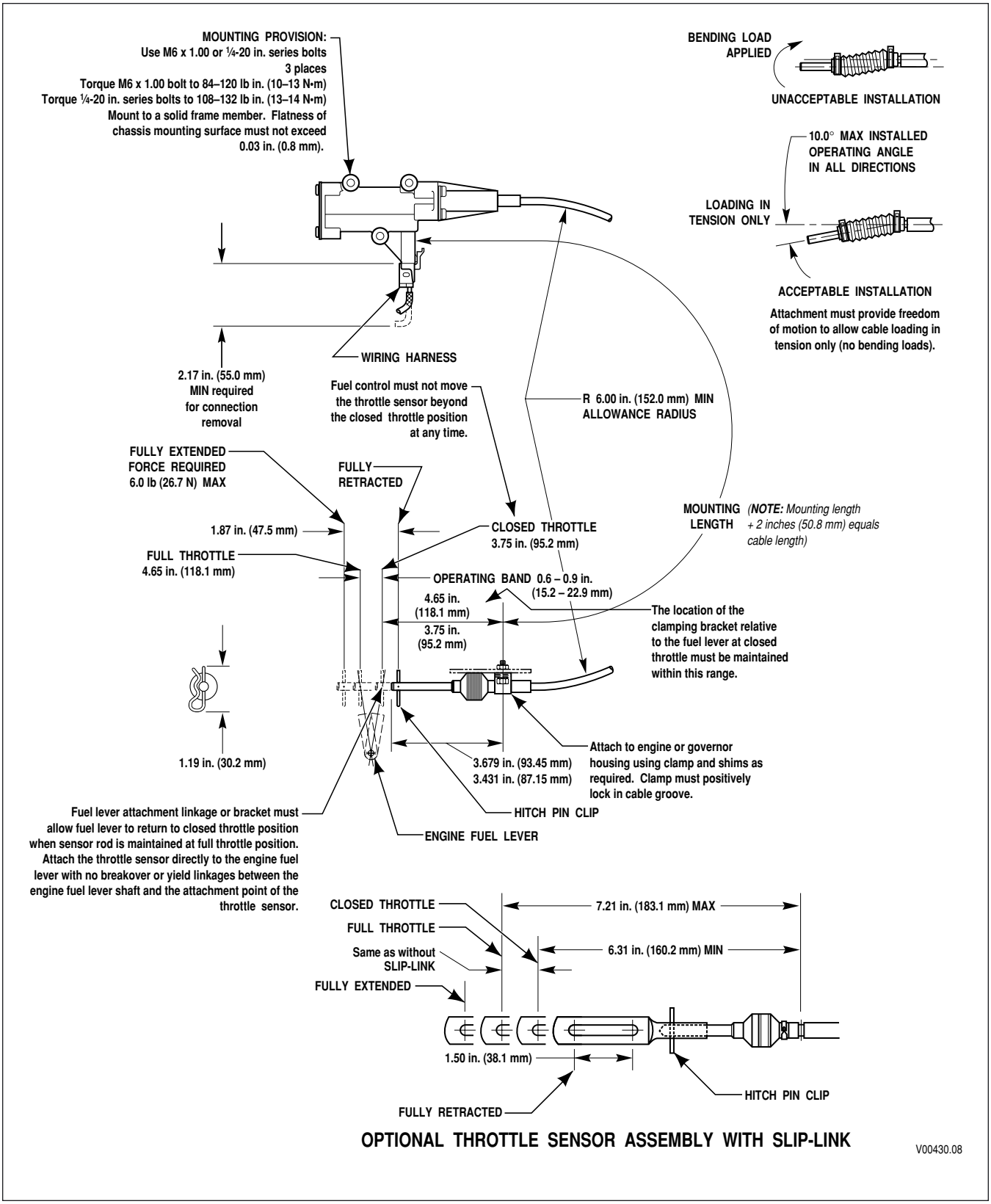


Figure D–3. Throttle Position Sensor Adjustment

APPENDIX E—WELDING ON VEHICLE/VEHICLE INTERFACE MODULE

E–1. WELDING ON VEHICLE

When frame or other welding is required on the vehicle, take the following precautions to protect the electronic control components:

1. Disconnect the wiring harness connectors at the transmission electronic control unit.
2. Disconnect the positive and negative battery connections, and any electronic control ground wires connected to the frame or chassis.
3. Cover electronic control components and wiring to protect them from hot sparks, etc.
4. Do not connect welding cables to electronic control components.

WARNING!	**Do not jump start a vehicle with arc welding equipment. Arc welding equipment's dangerously high currents and voltages cannot be reduced to safe levels.**

E–2. VEHICLE INTERFACE MODULE

The Allison Vehicle Interface Module (VIM) containing all Allison system relays and fuses can be used as the interface to all vehicle wiring. Refer to Figure E–2 for VIM component location and pin-out. To close an open VIM, tighten the bolts in the numerical order shown in Figure E–1 to provide a sealed, water-tight box. Torque the bolts to 4–6 lb ft (5–8 N·m).

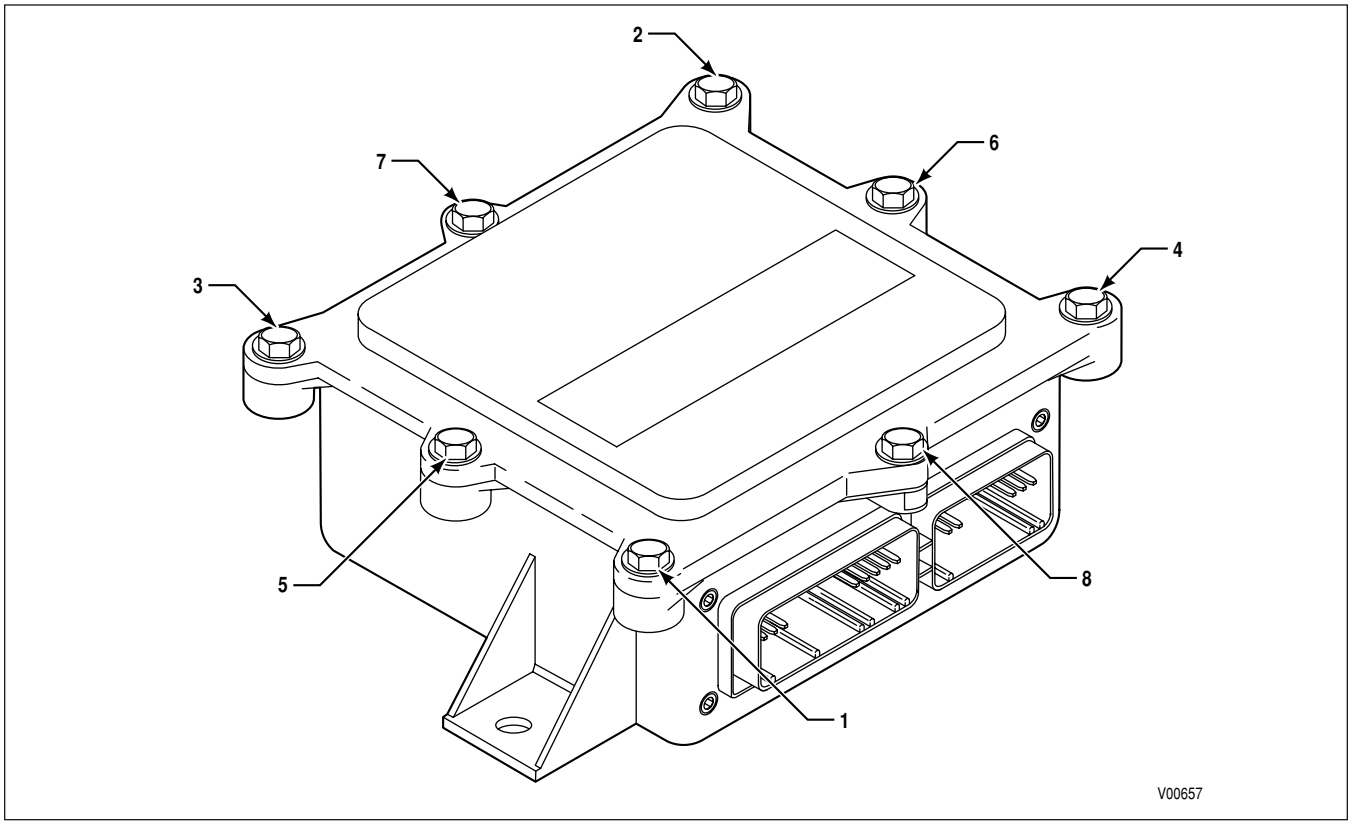


Figure E–1. Vehicle Interface Module

APPENDIX E—WELDING ON VEHICLE/VEHICLE INTERFACE MODULE

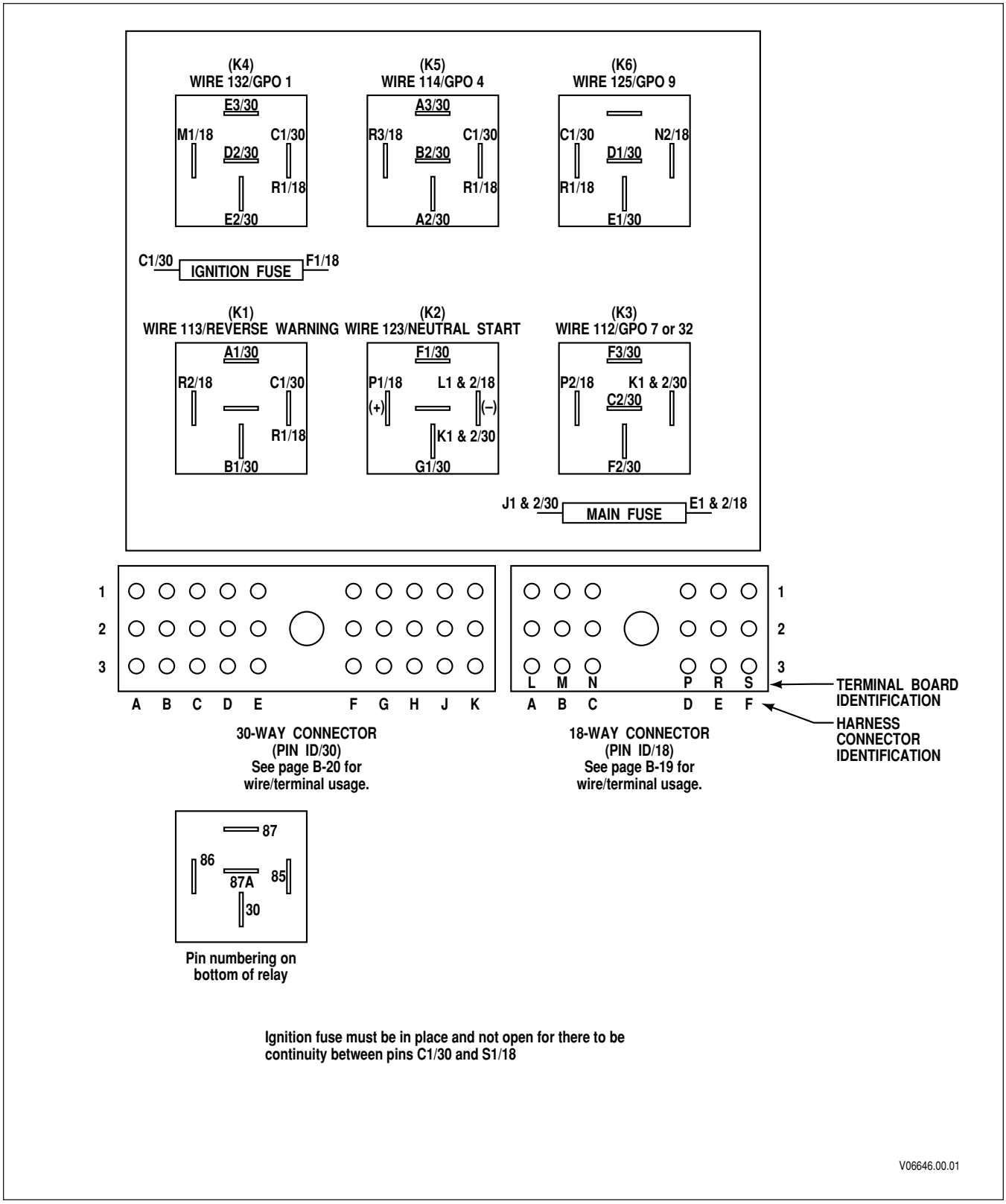


Figure E–2. VIM Components Location and Pin-Out Diagram

APPENDIX F—HYDRAULIC SCHEMATICS

APPENDIX F—HYDRAULIC SCHEMATICS

NOTES

APPENDIX F—HYDRAULIC SCHEMATICS

SHIFT SELECTOR POSITION	SOLENOIDS ENERGIZED	CLUTCHES ENGAGED
6	E, G*	HIGH, SPLITTER HIGH
5	E, F	HIGH, SPLITTER LOW
4	D, G*	INTERMEDIATE, SPLITTER HIGH
3	D, F	INTERMEDIATE, SPLITTER LOW
2	C, G*	LOW, SPLITTER HIGH
1	C, F	LOW, SPLITTER LOW
N	A*, F	SPLITTER LOW
R1	A*, B, F	SPLITTER LOW, REVERSE
R2	A*, B, G*	SPLITTER HIGH, REVERSE

NOTES: VALVE POSITIONS SHOWN ARE WITH TRANSMISSION IN NEUTRAL WITH ENGINE RUNNING

* NOT USED IN MODELS WITH LOCK—IN—NEUTRAL

MAIN PRESSURE
CONVERTER–IN
CONVERTER–OUT
LUBRICATION
EXHAUST OR SUMP
SPLITTER–LOW
SOLENOID PRESSURE

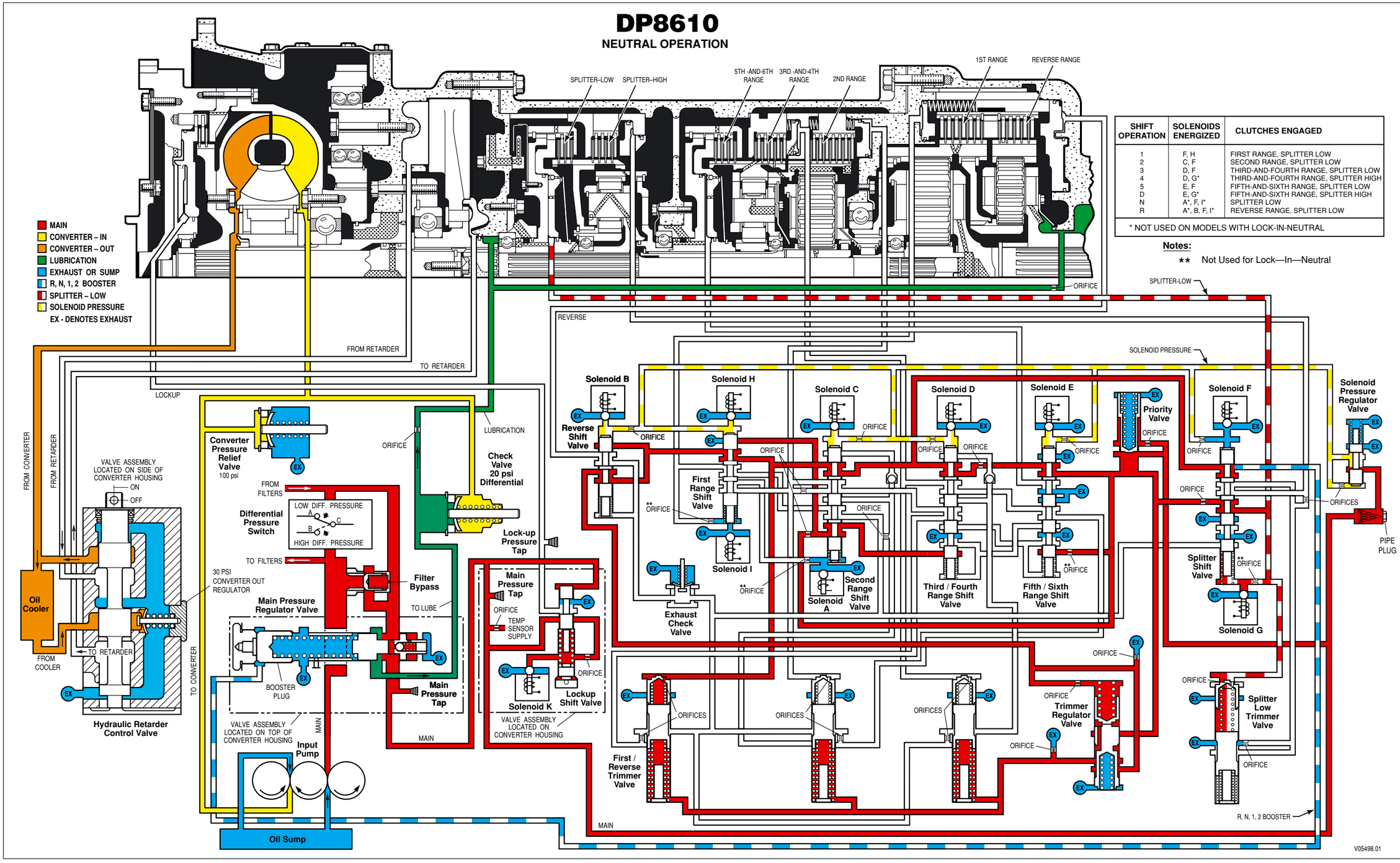
Splitter Low Clutch
Splitter High Clutch
High Clutch (Fifth-and-Sixth Range)
Intermediate Clutch (Third-and-Fourth Range)
Low Clutch (First-and-Second Range)
Reverse Clutch
This Ground Sleeve Vent is Open for all TC Series except TC682 & TC683
Ground Sleeve
LOCKUP PRESSURE
SPLITTER–LOW
SPLITTER–HIGH
REVERSE
FROM FILTERS
TO CONVERTER
Differential Pressure Switch
LOW DIFF. PRESSURE
HIGH DIFF. PRESSURE
TO FILTERS
Converter Pressure Relief Valve 80 psi (552 kPa)
Filter Bypass
Main Pressure Regulator
VALVE ASSEMBLY LOCATED ON TOP OF CONVERTER HOUSING
Main Pressure Port
Oil Cooler
Speedo Gear Lube
ORIFICES
Input Pump
Sump
Lube Pressure Regulator 22.5 psi (155 kPa)
Solenoid Pressure Tap
Solenoid Pressure Regulator Valve
PIPE PLUG
Solenoid B
Solenoid C
Solenoid D
Solenoid E
Priority Valve
Solenoid F
Low Pressure Tap
Reverse Pressure Tap
Lockup Pressure Tap
Reverse Shift Valve
Low Shift Valve
Intermediate Shift Valve
High Shift Valve
ORIFICE
Splitter Low Pressure Tap
Splitter High Pressure Tap
High Pressure Tap
Splitter Shift Valve
Solenoid G*
Exhaust Regulator Valve
Solenoid A*
Interm. Pressure Tap
ORIFICE (BLOCKED FOR LOCK–IN–NEUTRAL)
Lockup Shift Valve
Solenoid K
VALVE ASSEMBLY LOCATED ON CONVERTER HOUSING
Reverse Trimmer Valve
Solenoid J
Trimmer Pressure Tap
Low Range Trimmer Valve
Intermediate Range Trimmer Valve
Trim Boost Regulator Valve
Splitter High Trimmer Valve
Splitter Low Trimmer Valve
MAIN PRESSURE
H03568

Figure F–1. 5610, 6610 Models—Hydraulic Schematic

APPENDIX F—HYDRAULIC SCHEMATICS

DP8610

NEUTRAL OPERATION



SHIFT OPERATION	SOLENOIDS ENERGIZED	CLUTCHES ENGAGED
1	F, H	FIRST RANGE, SPLITTER LOW
2	C, F	SECOND RANGE, SPLITTER LOW
3	D, F	THIRD-AND-FOURTH RANGE, SPLITTER LOW
4	D, G*	THIRD-AND-FOURTH RANGE, SPLITTER HIGH
5	E, F	FIFTH-AND-SIXTH RANGE, SPLITTER LOW
D	E, G*	FIFTH-AND-SIXTH RANGE, SPLITTER HIGH
N	A*, F, I*	SPLITTER LOW
R	A*, B, F, I*	REVERSE RANGE, SPLITTER LOW

* NOT USED ON MODELS WITH LOCK-IN-NEUTRAL

Notes:

** Not Used for Lock—In—Neutral

Figure F–2. 8610 Models—Hydraulic Schematic

APPENDIX F—HYDRAULIC SCHEMATICS

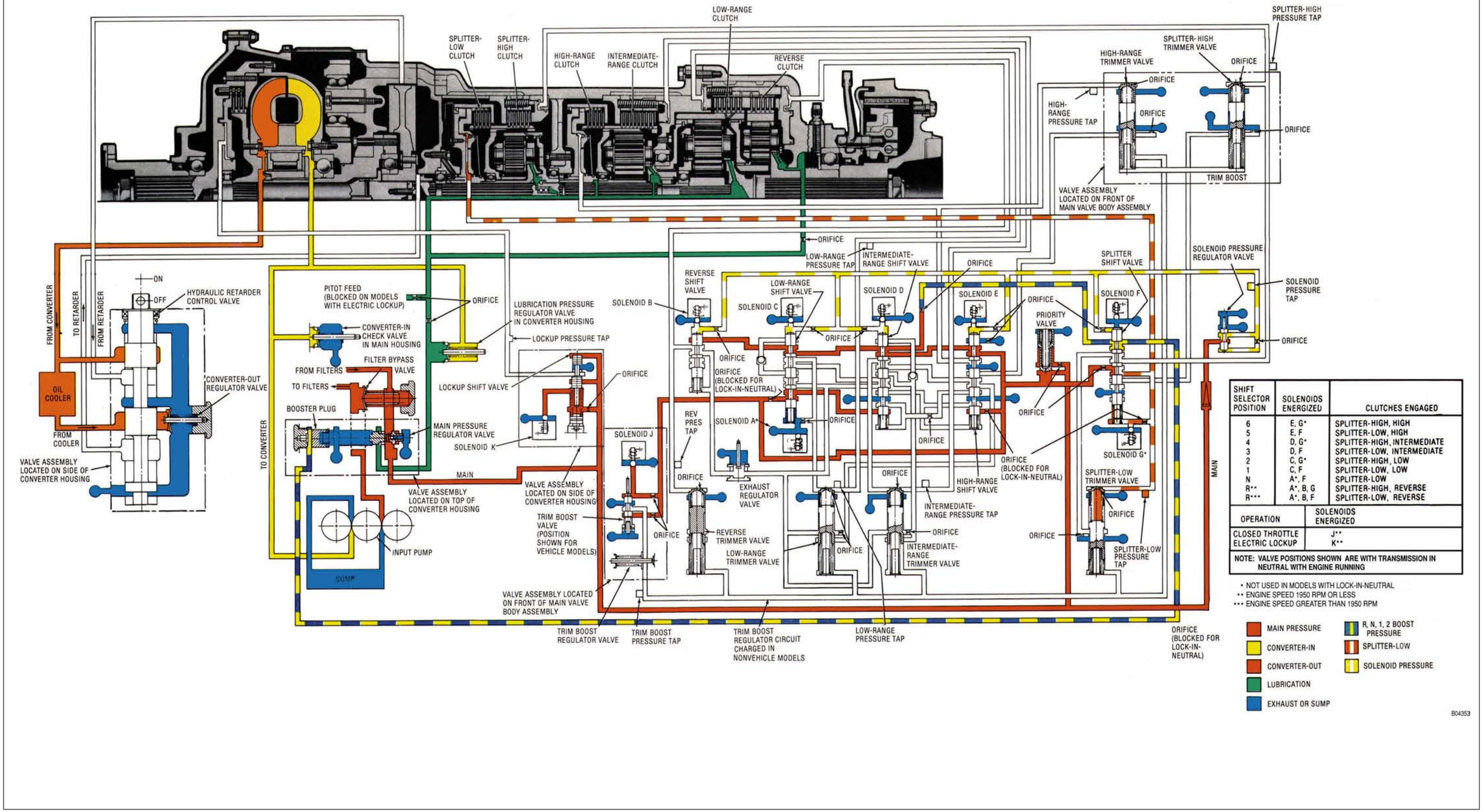
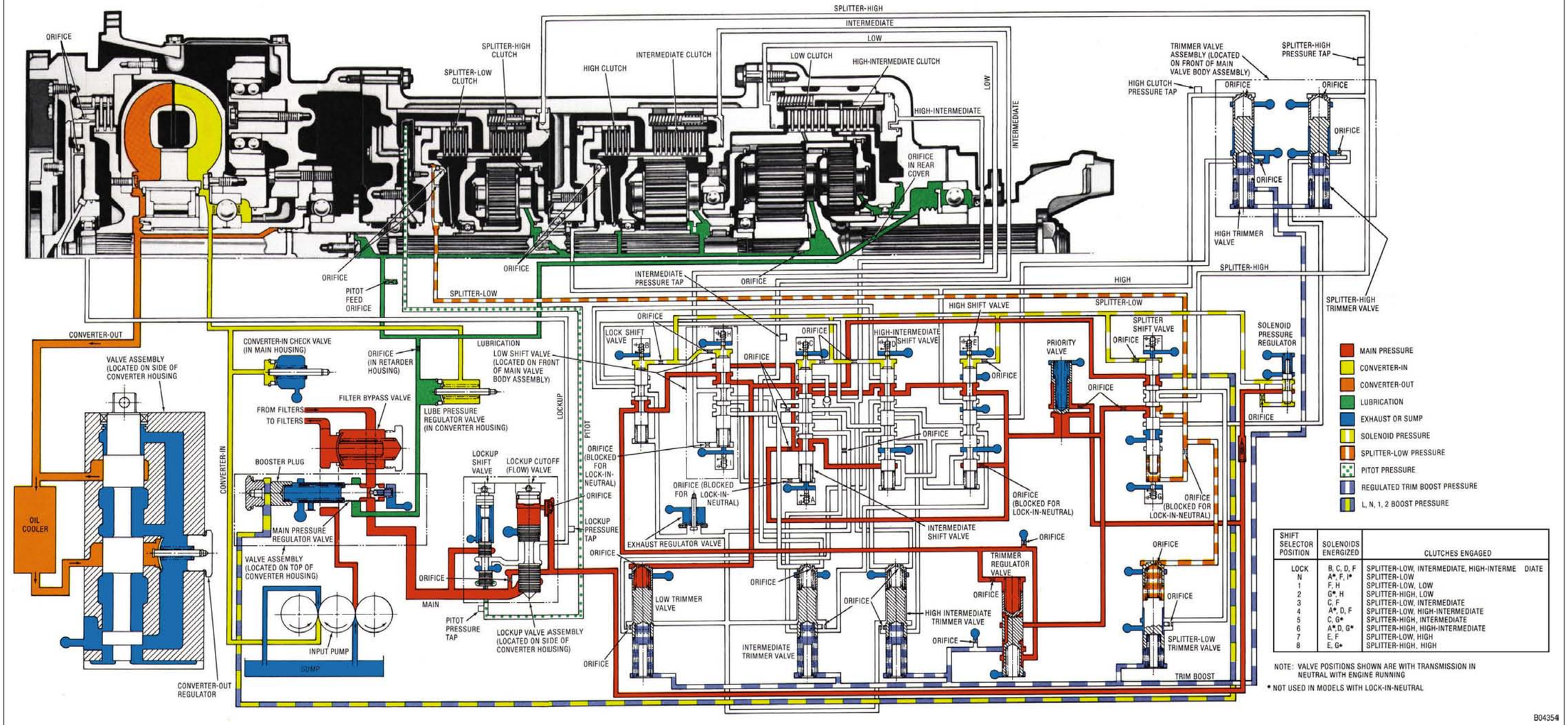


Figure F–3. M 9610 Models—Hydraulic Schematic

APPENDIX F—HYDRAULIC SCHEMATICS



SHIFT SELECTOR POSITION	SOLENOIDS ENERGIZED	CLUTCHES ENGAGED
LOCK	B, C, D, F	SPLITTER-LOW, INTERMEDIATE, HIGH-INTERME DIATE
N	A*, F, I*	SPLITTER-LOW
1	F, H	SPLITTER-LOW, LOW
2	G*, H	SPLITTER-HIGH, LOW
3	C, F	SPLITTER-LOW, INTERMEDIATE
4	A*, D, F	SPLITTER-LOW, HIGH-INTERMEDIATE
5	C, G*	SPLITTER-HIGH, INTERMEDIATE
6	A*, D, G*	SPLITTER-HIGH, HIGH-INTERMEDIATE
7	E, F	SPLITTER-LOW, HIGH
8	E, G*	SPLITTER-HIGH, HIGH

NOTE: VALVE POSITIONS SHOWN ARE WITH TRANSMISSION IN NEUTRAL WITH ENGINE RUNNING

* NOT USED IN MODELS WITH LOCK-IN-NEUTRAL

Figure F–4. S 9805M, S 9810 Models—Hydraulic Schematic

APPENDIX G—CEC2 SYSTEM/ECU WIRING SCHEMATICS

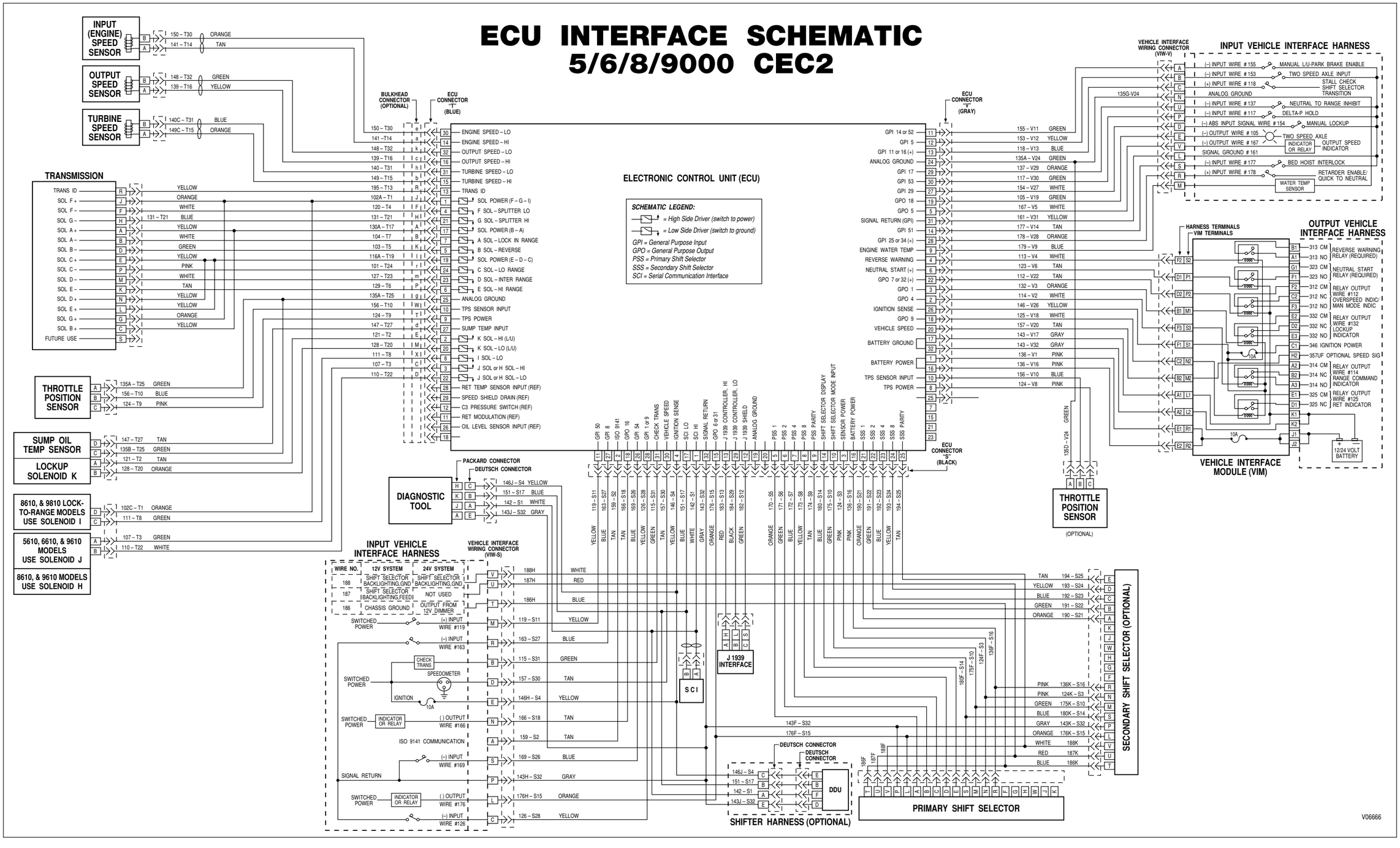


Figure G–1. CEC2 Wiring Schematic

APPENDIX G—CEC2 SYSTEM/ECU WIRING SCHEMATICS

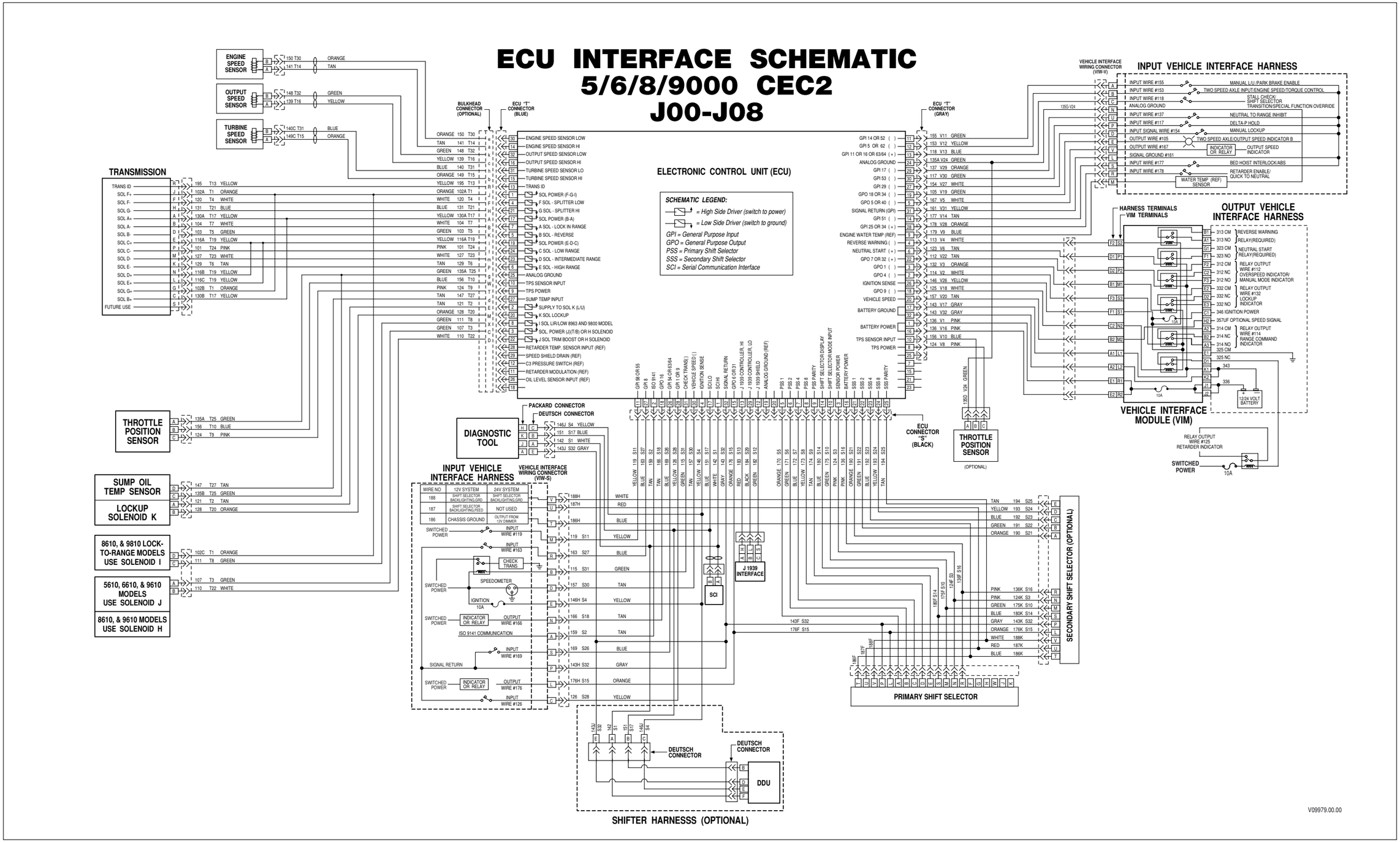


Figure G–2. CEC2 Wiring Schematic-With VIM

APPENDIX G—CEC2 SYSTEM/ECU WIRING SCHEMATICS

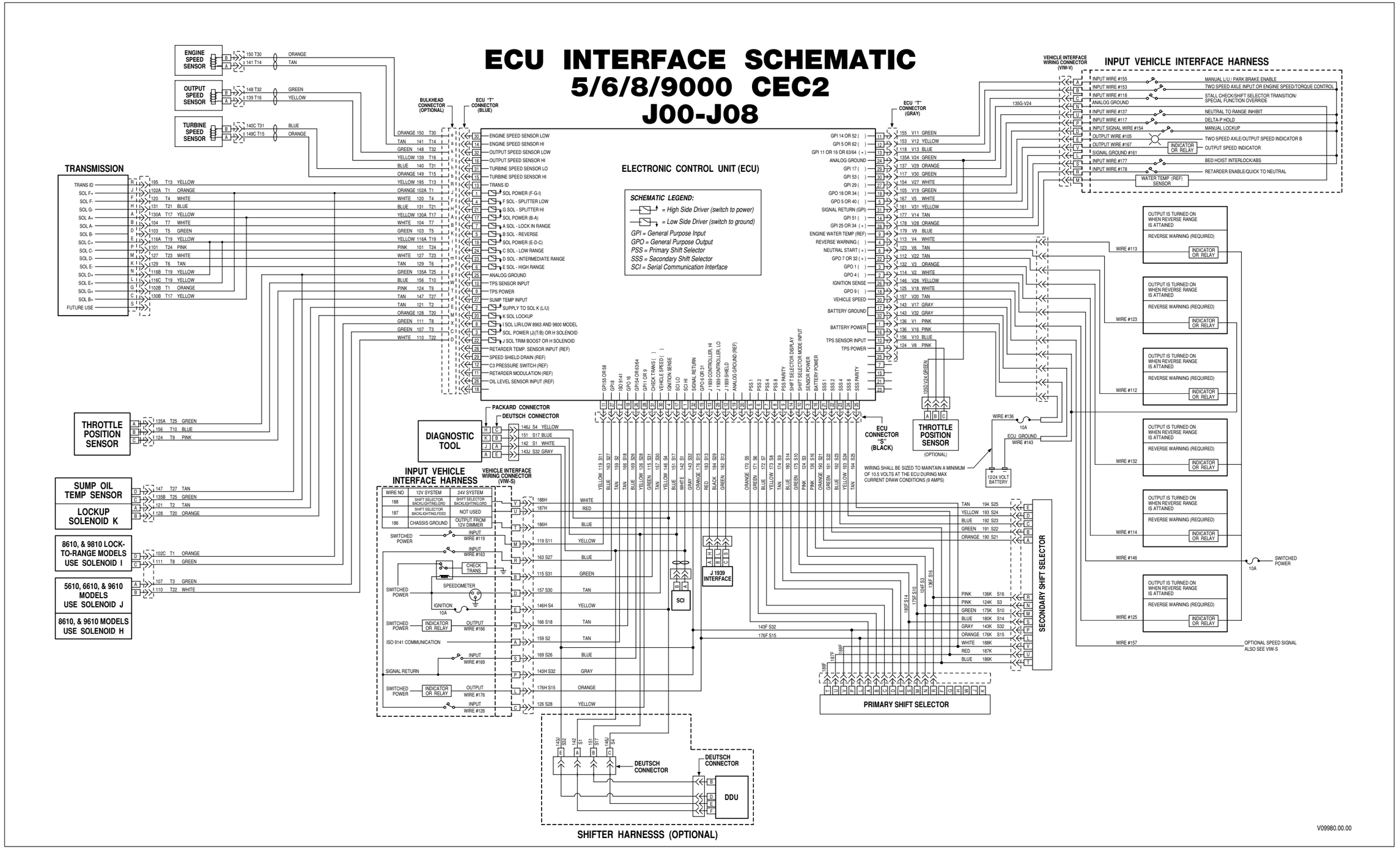
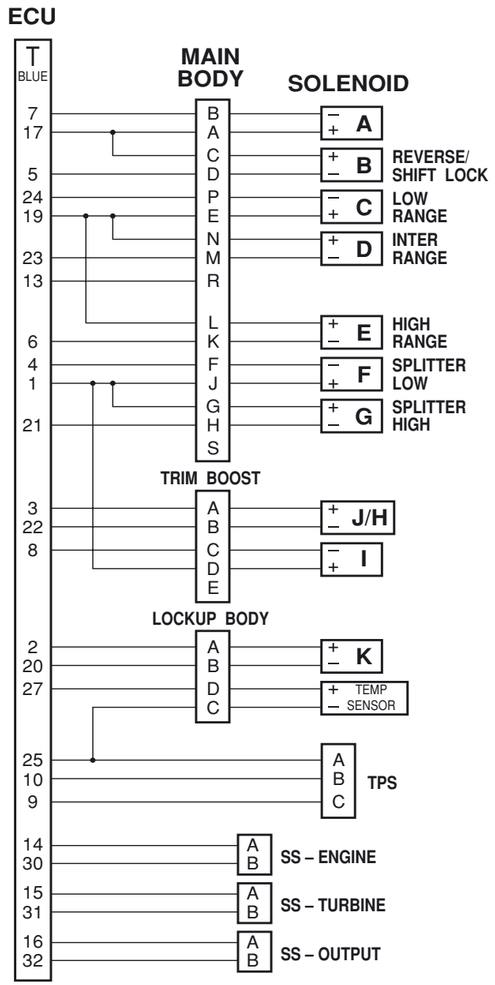


Figure G–3. CEC2 Wiring Schematic-Without VIM

APPENDIX G—CEC2 SYSTEM/ECU WIRING SCHEMATICS



LIR 5610 6610 9610	LTN 5610 6610 9610	LIR 8610	LTN 8610	LIR 9810	LTN 9805, 9810
Range Lock	Not Used	Range Lock	Not Used	Range Lock	Not Used
Rev 1 Rev 2	Rev 1 Rev 2	Rev 1	Rev 1	Lock Shift	Lock Shift
1st 2nd	1st 2nd	2nd	2nd	3rd 5th	3rd 5th
3rd 4th	3rd 4th	3rd 4th	3rd 4th	4th inter 6th high	4th inter 6th high
5th 6th	5th 6th	5th 6th	5th 6th	7th 8th	7th 8th
Rev 1 1–3–5	Rev 1 1–3–5	Rev 1 1–2–3–5	Rev 1 1–2–3–5	1–3–4–7	1–3–4–7
Rev 2 2–4–6	Not Used	4–6	Not Used	2–5–6–8	Not Used
J Sol Trim Boost	J Sol Trim Boost	H Sol 1st	H Sol 1st	H Sol 1st/2nd	H Sol 1st/2nd
Not Used	Not Used	Range Lock	Not Used	Range Lock	Not Used
Lockup	Lockup	Lockup	Lockup	Lockup	Lockup

LEGEND: LIR = Lock-in-Range
LTN = Lock-to-Neutral
TPS = Throttle Position Sensor
SS = Speed Sensor

V06647.01.01

Figure G–4. CEC2 Solenoid Function By Model

APPENDIX G—CEC2 SYSTEM/ECU WIRING SCHEMATICS

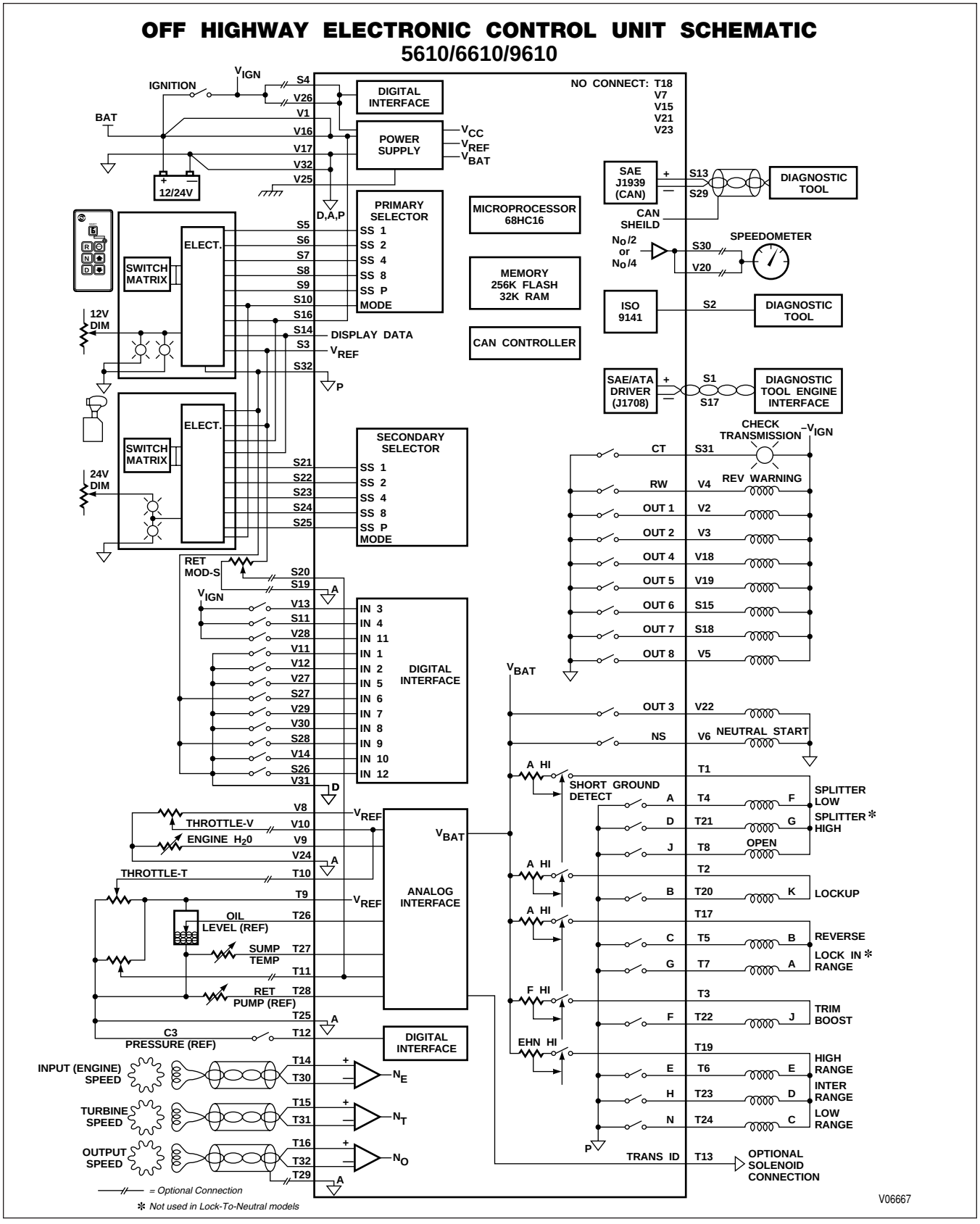


Figure G–5. ECU Schematic—5610, 6610, 9610

APPENDIX G—CEC 2 SYSTEM/ECU WIRING SCHEMATICS

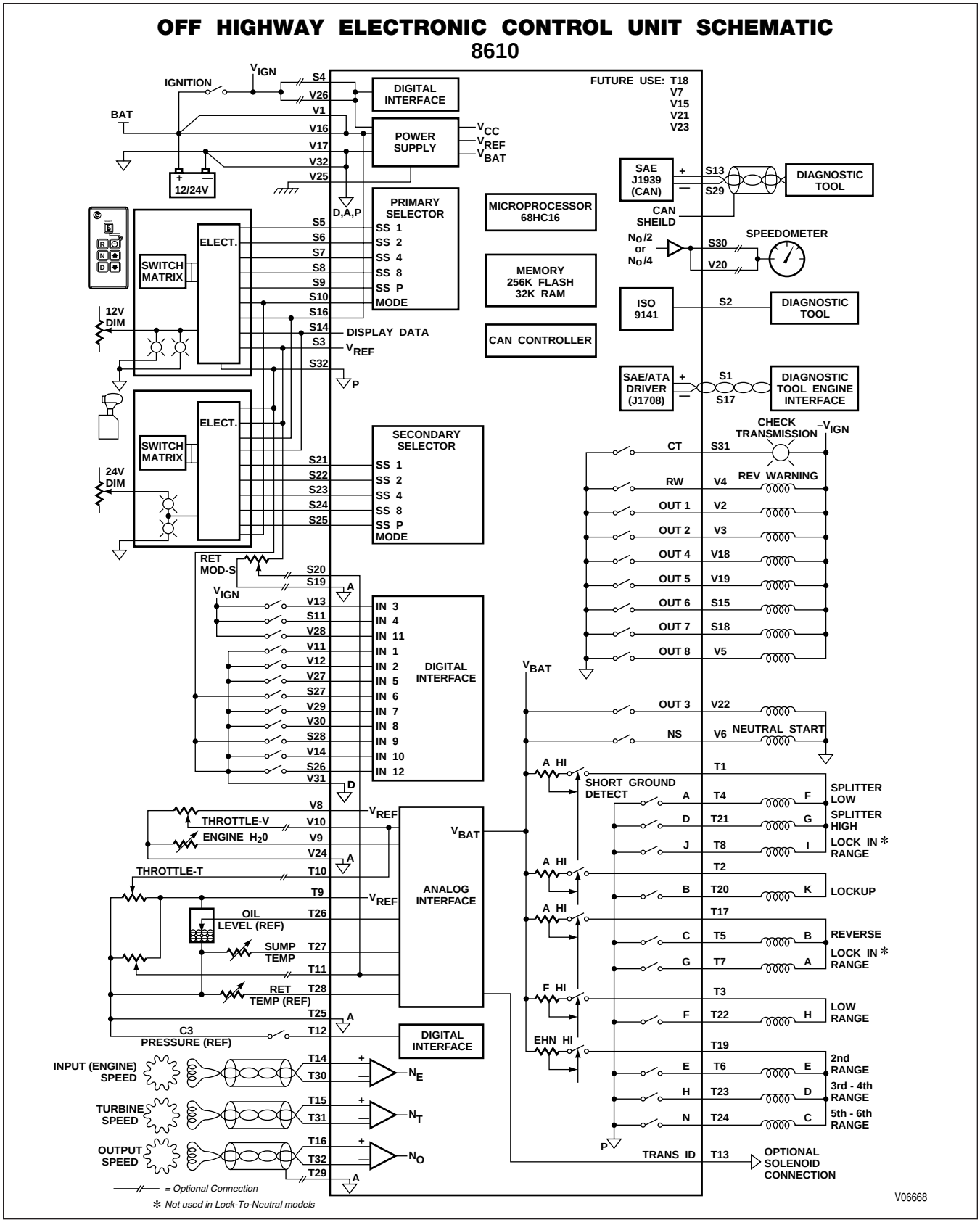


Figure G–6. ECU Schematic—8610

APPENDIX G—CEC2 SYSTEM/ECU WIRING SCHEMATICS

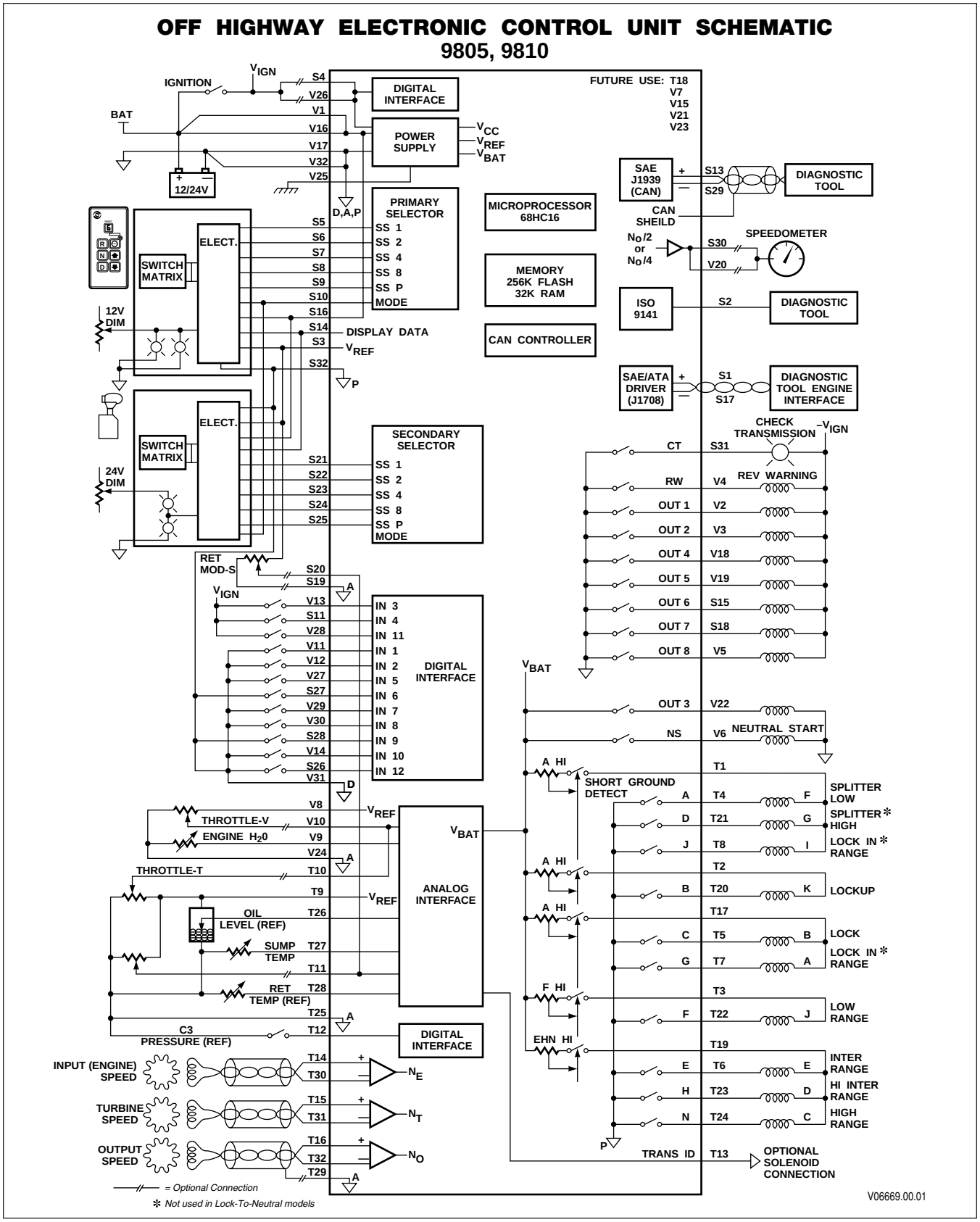


Figure G–7. ECU Schematic—9805, 9810

APPENDIX G—CEC 2 SYSTEM/ECU WIRING SCHEMATICS

NOTES

APPENDIX H—EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE

H–1. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE

All electrical and electronic systems generate electromagnetic fields that can interfere with other electronic systems. Allison Transmission electronic transmission controls comply with Federal Communications Commission (FCC) regulations and other guidelines concerning emitted radio frequency interference for transportation electronics. The position of Allison Transmission is that manufacturers and installers of EMI/RFI emitting equipment are responsible for adhering to FCC regulations and other guidelines concerning emitted radio frequency interference for transportation electronics.

Some radio-telephone or two-way communication radios (land-mobile radio), or the manner in which they are installed, can adversely affect vehicle operation or be affected by other vehicle components. Expenses incurred to protect vehicle-related systems from EMI/RFI emissions by radio-telephone or two-way communications radios (land-mobile radio) or to integrate such devices into vehicles are not the responsibility of Allison Transmission.

H–2. GENERAL GUIDELINES FOR RADIO EQUIPMENT INSTALLATION

The following general guidelines for installing radio-telephone or two-way communications radios (land-mobile radio) in a vehicle supplement, but DO NOT replace, detailed instructions provided by the radio equipment manufacturer. Detailed installation instructions are the sole responsibility of the radio equipment manufacturer.

Experience has shown that most EMI/RFI problems can be prevented or eliminated by following the guidelines. If EMI/RFI problems persist after following the guidelines and after ensuring the installation conforms to the guidelines, contact the vehicle and radio equipment manufacturers for additional installation or equipment operation instructions.

A. Transmitter Installation

1. Locate remote radio transmitters as far away from other electronic devices and as near to the side of the vehicle body as possible.
2. Mount transceivers (transmitter and receiver in one box) under the dash so as not to interfere with vehicle controls or passenger movement.

B. Antenna Installation

Each vehicle and body style react differently to radio frequency energy. When dealing with an unfamiliar vehicle, test various antenna locations by using a magnetic mount antenna and checking for adverse effects. Antenna location is a major factor in EMI/RFI problems.

C. Antenna Cable Routing

1. Use high quality, 95 percent shield coverage, coaxial (coax) cable. Route the coax well away from any electronic components.
2. Route antenna cables as far away from vehicle wiring as possible to reduce the likelihood of the vehicle wiring acting as an antenna for interference.

D. Radio Wiring and Connector Location

1. Connect transmitter power leads directly to the battery.
2. For transceivers (transmitter and receiver in one box) with ignition control, place a 12V power contactor at the vehicle battery. Drive the contactor coil, through an appropriate in-line fuse, from an ignition circuit not powered during engine cranking.
3. Any negative lead from a handset or control unit must return to battery negative.
4. Connect the positive lead from a handset or control unit directly to battery.
5. Fuse handset or control unit positive and negative leads separately from the transceiver negative and positive leads. Use correctly rated fuses.

APPENDIX H—EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE

E. Power and Ground Wire Routing

Route radio power and ground wires as far away as possible from electronic control modules.

F. Troubleshooting

The following are common causes of EMI/RFI problems:

- Power leads connected to points other than the battery
- Improper antenna location
- Poor shielding or connections to antenna cable
- Transmitter or transceiver wiring too close to vehicle electronics

H–3. EXTERNALLY-GENERATED SPEED SENSOR SIGNALS

A. Testing for Externally-Generated Speed Sensor Signals

Use the following procedures to determine if speed sensor signals generated by a source external to the transmission or wiring harness are present:

1. Turn ignition ON.
2. Keep engine OFF.
3. If the ECU is ON (shift selector display remains illuminated), connect the Allison DOC™ For PC–Service Tool or Pro-Link® 9000 diagnostic tool.

NOTE: ***If false speed signals were present at the previous shutdown, the ECU might still be "on" even though the ignition is "off." Pro-Link® 9000 is powered by ignition power so the ignition must be "on" to use the Pro-Link® 9000 diagnostic tool to read the speed signals.***

4. Read speed sensor signals.
5. If a speed sensor signal is other than one (1), then there is a short to another circuit that is carrying an AC signal.
6. Measure the resistance of the sensor.
7. Test for shorts to other circuits within the harness or transmission connector.
8. Test to be sure there is no conductive material inside the connector.
9. Inspect to be sure speed sensor circuit wires are a twisted pair.
10. Test to be sure a properly grounded drain wire.
11. Test for the presence of a strong external AC signal.
12. Repair or replace parts as required.

APPENDIX J—DIAGNOSTIC DATA READER INFORMATION

J–1. ALLISON DOC FOR PC-SERVICE TOOL

NOTE: Allison DOC™ For PC–Service Tool is the preferred Allison Transmission diagnostic tool.

NOTE: Refer to Allison DOC™ For PC–Service Tool User Guide, GN3433EN, for the most current information.

Allison DOC™ (Diagnostic Optimized Connection) For PC–Service Tool is a PC-based diagnostic tool for use with 5/6/8/9000 Series Transmissions utilizing CEC2 controls. The Allison DOC™ For PC–Service Tool is a full-feature diagnostic software application supporting CEC2 control systems. When installed on a PC, it will allow the technician to acquire data from the transmission's control system and through the use of embedded troubleshooting manuals, conduct systematic troubleshooting of transmission complaints.

Basic Features

The Allison DOC™ For PC–Service Tool uses a Windows® style GUI and includes:

- User selected views of multiple transmission parameters
- View Active and historical diagnostic trouble codes (DTCs)
- Graphical instrument panel view of transmission parameters
- Strip chart function
- User configurable Snapshot function
- User configurable Print function
- Code driven links to embedded CEC2 Troubleshooting Manuals
- Reprogramming capability (available after satisfying Allison Transmission training certification requirements)
- Demo Mode which allows the user to practice the program without being connected to a vehicle
- Animated, screen by screen, help support (found in Help, Video-based training materials, Allison DOC™ For PC–Service Tool Training Videos)
- Application Configuration: This menu function serves as the platform for three different features
    1. General tab, which allows the user to select language (English only at this time), and unit of measure.
    2. ECU/TCM Reprogramming tab, used to enable the reprogramming capability of the Allison DOC™ For PC–Service Tool.
    3. Update Application tab, will access a web URL that will contain minor updates for the diagnostic tool to support changes in the various transmission control systems.
- Data Bus Viewer allows the user to capture (see and save) the raw data transmitted on the various vehicle data buses supported by Allison DOC™ For PC–Service Tool (J1708, J1939, and J1850).
- Printed user's manual and laminated Job Aid Card.
- Adobe Acrobat® 5.0 bundled on the CD for reading the Troubleshooting Manual.
- Microsoft® Media Player® 6.4 and 7.0 bundled on the CD for displaying various and updated training videos (available from the application Help menu).

PC Platform Definition

Allison DOC™ For PC–Service Tool has been tested with and is known to operate on PCs with the following configurations*:

- Microsoft Windows 95®, Windows NT® (SP3 or higher), Windows 2000®, Windows ME®, and Windows XP®.
- 100 MB for free hard disk space required without the training videos. Additional 500 MB of hard drive space is required if the user wishes to load the training videos. Videos can also be viewed directly from the Allison DOC™ For PC–Service Tool installation CD.
- 64 MB of RAM (128 MB for optimal performance)
- Pentium II processor (Pentium® III processor for optimal performance)
- One available COM (serial) port and parallel port

APPENDIX J—DIAGNOSTIC DATA READER INFORMATION

- 1024 X 768 screen resolution
- 256 color palette
- Small font
- Windows™ Media Player® is provided on the Allison DOC™ For PC CD and is installed with the application.

NOTE:

1. ***The Allison DOC™ For PC–Service Tool will not function correctly on PCs not meeting the above listed definition and will not be supported.***
2. ***PCCS does not support Windows®, NT®, or ME®.***
3. ***PCCS is a separate, stand-alone software application.***

The Allison DOC™ For PC–Service Tool is the preferred diagnostic tool of Allison Transmission. Information about translator device support, support information, essential tool status, and purchasing information is as follows:

Translator Device Support

Allison DOC™ For PC–Service Tool software has been functionally tested with the following translator devices:

- MPSI MagiKey® (PDM), Driver version 3.2 (or later)

  For availability contact:

  NEXIQ Technologies (MPSI)
  6405 Nineteen Mile Road
  Sterling Heights, MI 48314-2115
  Phone 1-800-639-6774
  Fax 1-810-731-3348
  www.mpsilink.com

  SPX Corporation (Kent-Moore Service Solutions)
  28635 Mound Road
  Warren, MI 48092
  Phone 1-800-328-6657
  Fax 1-800-578-7375
  www.toolsfortrucks.com

- Noregon Systems Data Link Adapter (DLA)

  For availability contact:

  Noregon Systems
  500 Shepherd Street
  Winston-Salem, NC 27103
  Phone 1-800-570-0571
  Fax 1-336-760-2540
  www.sales@Noregon.com

- Dearborn Group Dearborn protocol Adapter (DPA) II®, Driver version 2.3

NOTE: ***The DPA II translator device does not work with Allison DOC™ For PC–Service Tool installed in PCs with Windows 95® operating systems.***

For availability contact:

Dearborn Group Technology
27007 Hill Tech Court
Farmington Hills, MI 48331
Phone 1-248-488-2080
Fax 1-248-488-2082
www.dgtech.com

APPENDIX J—DIAGNOSTIC DATA READER INFORMATION

- B&B Electronics device will require the user to install an additional driver set found on the Allison DOC™ For PC–Service Tool installation CD called "Noregon RP 1210A APL"

  B&B Electronics
  707 Dayton Road
  Ottawa, IL 61350
  Phone: 1-815-433-5100
  Fax: 1-815-433-5104
  www.vehicleinterface.com

- SPX Adapter J1850-VPW, P/N: J-44652, (for vehicles equipped with a J1850 communication link)

For availability contact:

SPX Corporation (Kent-Moore Service Solutions)
28635 Mound Road
Warren, MI 48092
Phone: 1-800-328-6657
Fax: 1-800-578-7375

PC Platform Definition

Allison DOC™ For PC–Service Tool has been tested with and is known to operate on PCs with the following configurations:

- Microsoft® Windows 95®, Windows 98®, Windows NT® (SP3 or higher), Windows 2000®, Windows ME®, and Windows XP®.
- 100 MB of free hard disk space required without the training videos. An additional 500 MB of hard drive space is required to load the training videos. Videos can also be viewed directly from the Allison DOC™ For PC–Service Tool installation CD.
- 64 MB of RAM (128 MB for optimal performance).
- Pentium II processor (Pentium III processor for optimal performance) One available COM (serial) port and parallel port
- 1024 X 768 screen resolution
- 256 color palette
- Small font
- Windows™ Media Player® is provided on the Allison DOC™ For PC–Service Tool CD and is installed with the application.

NOTE:

- ***The Allison DOC™ For PC–Service Tool will not function correctly on PCs that do not meet the above listed definition and will not be supported.***
- ***PCCS (Production Calibration Configuration System) does not support Windows™, NT®, ME® when recalibrating 3000 and 4000 Product Families transmissions.***
- ***PCCS is a separate, stand-alone software application.***

Support Information

Allison DOC™ For PC–Service Tool is shipped with:

- Allison publication GN3433EN, User Guide
- Extensive updated Help menu (within the software)
- Updated-laminated tri-fold Job Aid Card, JA3434EN.

APPENDIX J—DIAGNOSTIC DATA READER INFORMATION

All of these sources of information will provide you with the necessary guidelines to:

- Install
- Utilize
- Manipulate the software application.

The Technical Support Help Desk is available to register owners of Allison DOC™ For PC–Service Tool and to address issues related to the installation of the application and connectivity to a vehicle. For PC or operating system problems, please contact your company information technology department or refer to the documentation provided with your PC.

Please check the Allison website, www.allisontransmission.com/service/allisontransmissiondiagnostictools, regularly for important information that could clarify some of the common questions/concerns with respect to the different Allison Transmission diagnostic tools.

Essential Tool Status

Allison DOC™ For PC–Service Tool has been classified as an ESSENTIAL TOOL for facilities authorized as 5610, 6610, 8610, 9610, 9805, and 9810 Series transmission maintenance or overhaul service outlets. Service outlets currently enrolled in the Essential Tool program have received the traditional Essential Tool notification letter.

Reprogramming Requirements

Allison DOC™ For PC–Service Tool incorporates a reprogramming function, which allows modification of certain transmission control systems (WTEC) values. The Allison Transmission Diagnostic Tool Service Training program or equivalent, has to be completed in order to activate the reprogramming capabilities. Appropriate proof of certification must be submitted to SPX/Kent-Moore (along with the serial number provided with the installation CD package) to receive the corresponding authorization password, which will activate the reprogramming function of the Allison DOC™ For PC–Service Tool. To learn more about course availability, please contact the local Allison Transmission distributor training facility or visit Allison Transmission website at www.allisontransmission.com/service/training.

Purchasing Information

Allison DOC™ For PC–Service Tool is available on CD only and can be purchased through SPX/Kent-Moore using the following part number:

User	Part Number
New User	J-44950-C
Current registered owners of Allison DOC™ For PC	J-44950-UPD2

NOTE:

- ***Registered owners of Allison DOC™ For PC–Service Tool Do Not have to uninstall the application in order to install Allison DOC™ For PC–Service Tool.***
- ***Registered owners of Allison DOC™ For PC–Service Tool who had previously enabled the Reprogramming function must re-authorize this function in Allison DOC™ For PC–Service Tool with SPX/Kent-Moore.***

For more information (price and availability), please contact:

SPX Corporation (Kent-Moore Service Solutions)
28635 Mound Road
Warren, MI 48092
Phone: 1-800-328-6657
Fax: 1-800-578-7375

APPENDIX J—DIAGNOSTIC DATA READER INFORMATION

J–2. PRO-LINK® 9000 DIAGNOSTIC TOOLS

NOTE: Allison DOC™ For PC–Service Tool is the preferred Allison Transmission diagnostic tool. Pro-Link® 9000 diagnostic tool will provide limited support.

Pro-Link® 9000 diagnostic tool is available through NEXIQ. It is a portable microcomputer-based receiver/transmitter/display unit. Pro-Link® 9000 transmits and receives data to and from the ECU, processes the data, and displays appropriate information. Use Pro-Link® 9000 during installation checkout and troubleshooting. There is a new Pro-Link® 9000 cartridge needed for use with CEC2. The new Multi-Protocol Cartridge (MPC) contains a programmed PCMCIA card which permits reprogramming of GPI/GPO packages. Reprogramming includes selection of a GPI/GPO package, enabling/disabling of wires and modification of certain data parameters. Operating instructions are supplied with each Pro-Link® 9000 diagnostic tool and further information is also available in the Product section below. Connect the Pro-Link® 9000 diagnostic tool to the diagnostic connector provided in the selector wiring harness.

The CEC2 system will require new Pro-Link® 9000 hardware for reprogramming and diagnostics. The following is a list of manufacturer's description and part numbers for current Pro-Link® 9000 hardware:

Product	Part Number
Allison CEC1 and 2 transmission systems reprogramming card* Includes: Allison CEC 1 and 2 systems card and manual ** Allison training certificate required*	804007
Allison CEC1 and 2 transmission systems diagnostic card Includes: Allison CEC 1 and 2 systems card and manual	804009
Pro-Link® Plus main unit Includes: VT Pro-Link® software, power and data cable, and storage case	108004
Multi-Protocol Cartridge (MPC) Supports: J1708, J1939, 160 baud, and ISO 9141 communications, OEM specific application memory cards	208040
Printer Includes: One roll of thermal paper, Instruction manual, rechargeable battery and a cable to connect the printer to the Pro-Link® Plus	178001
6-Pin Deutsch Adapter	404024
PC/Terminal Cable Set *Required to update PC card application*	501005
Pro-Link® 9000 Operator's Manual on CD	854049

NOTE:The new MPC must be used to reprogram CEC2 systems.

The Pro-Link® 9000 Diagnostic tool is available through:

NEXIQ
1-800-639-6774
Fax: 1-248-232-6611

The Multi-Protocol Cartridge (MPC) and the Reprogramming Card are required to modify customer constants and alter calibration packages within the CEC2 ECU. After completing an Allison-approved training class, those ordering a reprogramming cartridge are required to submit a copy of their completion certificate with their order. This serves as proof of eligibility to purchase these items. Training is available from Allison Transmission (AT) and AT distributors.

APPENDIX J—DIAGNOSTIC DATA READER INFORMATION

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