



Welcome to the TS2973EN 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 OCTOBER  
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TS2973EN

## Allison Transmission

### VOCATIONAL MODELS

#### 3000 VOCATIONAL MODELS

3000 HS	3500 RDS			B 300(P)(R)
3000 RDS	3500 EVS			B 400(P)(R)
3000 EVS				T 200
3000 MH				T 300
3000 PTS				
3000 TRV				
3200 SP	3500 SP	3700 SP		
3200 TRV				
MD 3060	MD 3560	MD 3070PT		
MD 3066				

#### 4000 VOCATIONAL MODELS

4000 EVS	4500 EVS	4700 EVS	4800 EVS	B 500
4000 HS	4500 HS	4700 RDS		
4000 MH	4500 RDS			
4000 RDS	4500 SP			
4000 TRV	4500 TRV			
HD 4060	HD 4560	HD 4070	HD 4076	B 500P
HD 4060P	HD 4560P	HD 4070P		B 500R
HD 4060R	HD 4560R	HD 4070R		B 500PR
HD 4060PR	HD 4560PR	HD 4070PR		T 425
				T 450



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## FOREWORD—How to Use This Manual

This manual provides troubleshooting information for the 3000 and 4000 Product Families Transmissions. Service Manuals SM2148EN and SM2457EN, plus Parts Catalogs PC2150EN and PC2456EN may be used in conjunction with this manual.

This manual includes:

- Description of the WTEC III electronic control 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 new date on the title page and in the lower left corner of the rear cover. Contact your Allison Transmission service outlet for the currently applicable publication. Additional copies of this publication may be purchased from authorized Allison Transmission service outlets. Look in your telephone directory under the heading of Transmissions—Truck, Tractor, etc.

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 is providing for 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 E in this manual. Allison Transmission (AT) 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

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 Calle Damanti S/N Col  
 Guadalupe—Guaymas  
 Sonora, Mexico CP85440  
 Phone: 011-526-2222-43834  
 Fax: 011-526 2222-43553

- St. Clair Technologies, Inc. stocks a WTEC III 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.

## 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.*

## TRADEMARKS USED IN THIS MANUAL

The following trademarks are the property of the companies indicated:

- Allison DOC™ is a trademark of General Motors Corporation.
- DEXRON® is a registered trademark of General Motors Corporation.
- LPS® Cleaner is a registered trademark of LPS Laboratories.
- Loctite® is a registered trademark of the Loctite Corporation.
- MagiKey® is a registered trademark of NEXIQ Technologies, Inc.
- Teflon® is a registered trademark of the DuPont Corporation.
- TranSynd™ is a trademark of Castrol Ltd.

## SHIFT SELECTOR TERMS AND DISPLAY INDICATIONS

Shift selector terms and displays are represented in this manual as follows:

- Button Names — ↑, ↓, “display mode”, **MODE**, etc.
- Transmission Ranges—**D** (Drive), **N** (Neutral), **R** (Reverse), **1** (First), **2** (Second), etc.
- Displays—“**o**, **L**”; “**o**, **K**”, etc. (Display occurs one character at a time.)



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**NOTES**

## SECTION 1—GENERAL DESCRIPTION

## 1-1. TRANSMISSION

The World Transmission Electronic Controls (WTEC III) system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. The 3000 and 4000 Product Families transmissions configurations can be programmed to have up to six forward ranges, neutral, and one reverse range. The MD 3070, 3700 SP, HD 4070/4076, 4700 RDS, 4700/4800 EVS, 4700/4800 SP have up to seven forward ranges and one reverse.

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

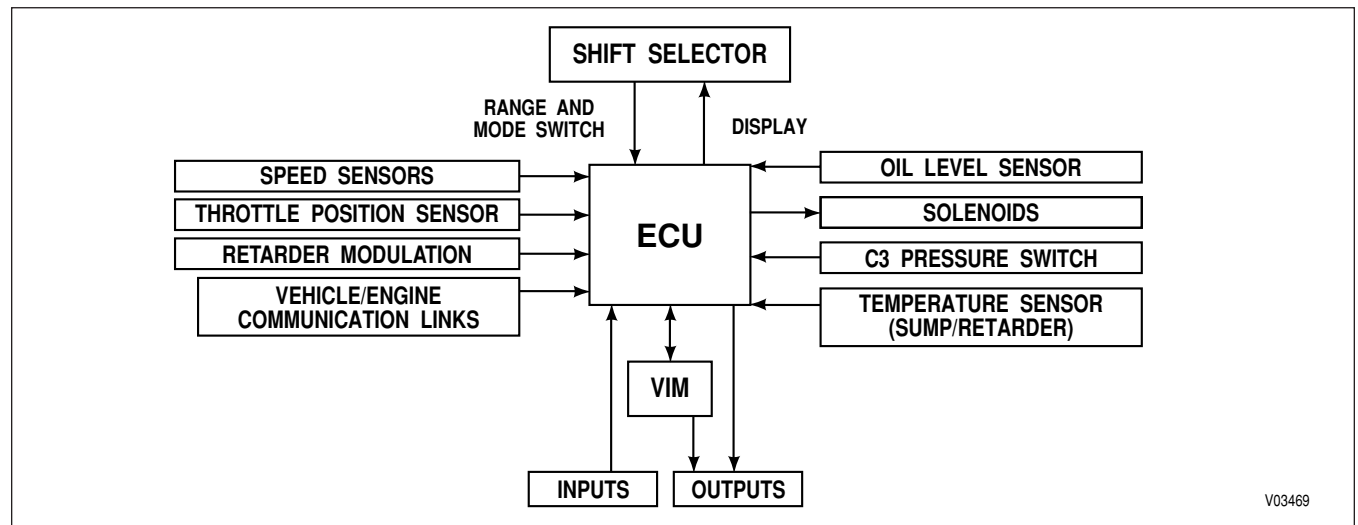


Figure 1-1. Electronic Control Unit Block Diagram

Figure 1-2 shows WTEC III electronic control components.

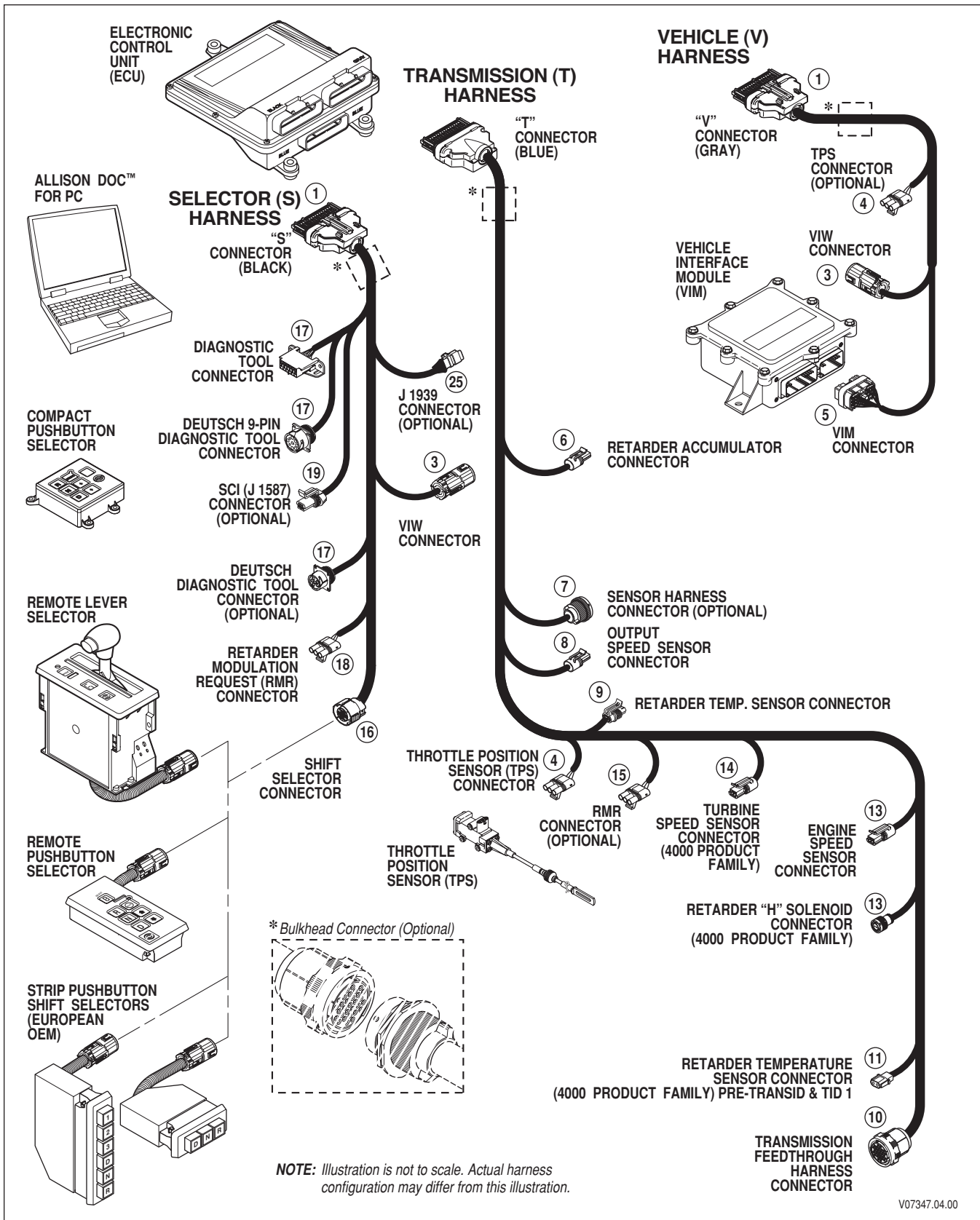
WTEC III Electronic Controls consist of the following elements:

- 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 or PWM signal)
- Engine, Turbine, and Output Speed Sensors
- Control Module (Electro-Hydraulic Valve Body)
- Wiring Harnesses
- Vehicle Interface Module (VIM)
- Autodetect Feature
- TransID Feature
- Optional Retarder Controls
- Optional Engine Coolant Temperature Input.

**NOTE:**

- *All external harnesses are OEM supplied*
- *The VIM is an OEM option*

GENERAL DESCRIPTION



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Figure 1-2. WTEC III Electronic Control 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
- Throttle position
- Sump/retarder temperature
- Engine 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 testing. 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.

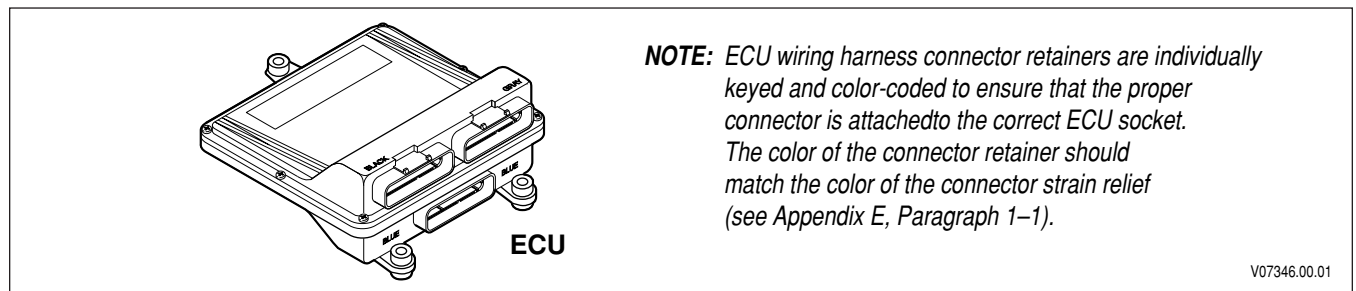


Figure 1-3. Electronic Control Unit (ECU)

### 1-3. SHIFT SELECTOR

Pushbutton and lever shift selectors for the WTEC III Series are remote mounted from the ECU and connected to the ECU by a wiring harness. All shift selectors except the strip-type pushbutton have a single digit LED display and a mode indicator (LED). During normal transmission operation, illumination of the LED mode 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)

There are three full-function pushbutton shift selectors and a strip pushbutton shift selector. Strip pushbutton shift selectors are used by European OEMs. A full-function shift selector has a **MODE** button and diagnostic display capability through the single digit LED display. The strip pushbutton shift selector does not have a **MODE** button, diagnostic capability, or adjustable illumination. The full-function pushbutton shift selector has six (6) pushbuttons which are **R** (Reverse), **N** (Neutral), **D** (Drive), ↓ (Down), ↑ (Up), and **MODE**. Manual forward range downshifts and upshifts are made by pressing the ↓ (Down) or ↑ (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 and oil level (if sensor is present) information is obtained by pressing the ↓ (Down) and ↑ (Up) arrow buttons at the same time.

## GENERAL DESCRIPTION

The strip pushbutton shift selector has either three or six range selection positions as shown in Figure 1–4. When a strip pushbutton shift selector is used, diagnostic information must be obtained by using the Allison DOC™ For PC–Service Tool, or a customer-furnished remote display.

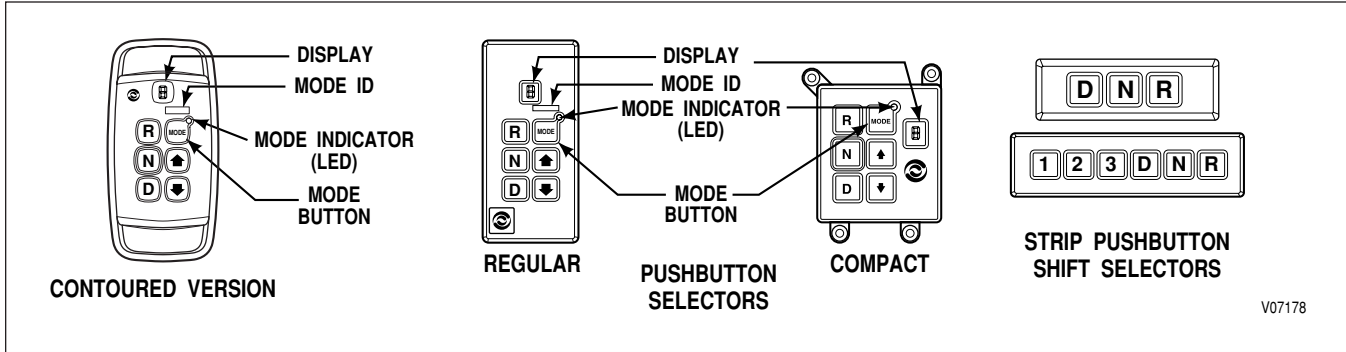


Figure 1–4. Pushbutton Shift Selectors

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

The lever shift selector can have as many as six forward range positions (seven for the 7-speed models), as well as **R** (Reverse) 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 and oil level (if sensor is present) information is obtained from the LED display by pressing the **DISPLAY MODE/DIAGNOSTIC** button.

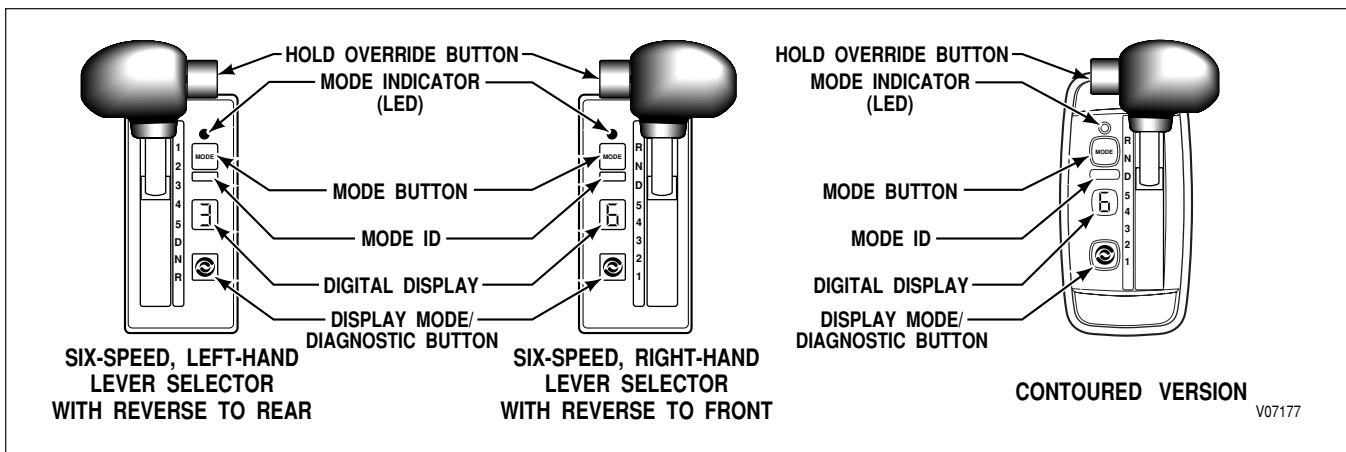


Figure 1–5. Typical Lever Shift Selector

## GENERAL DESCRIPTION

### 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.

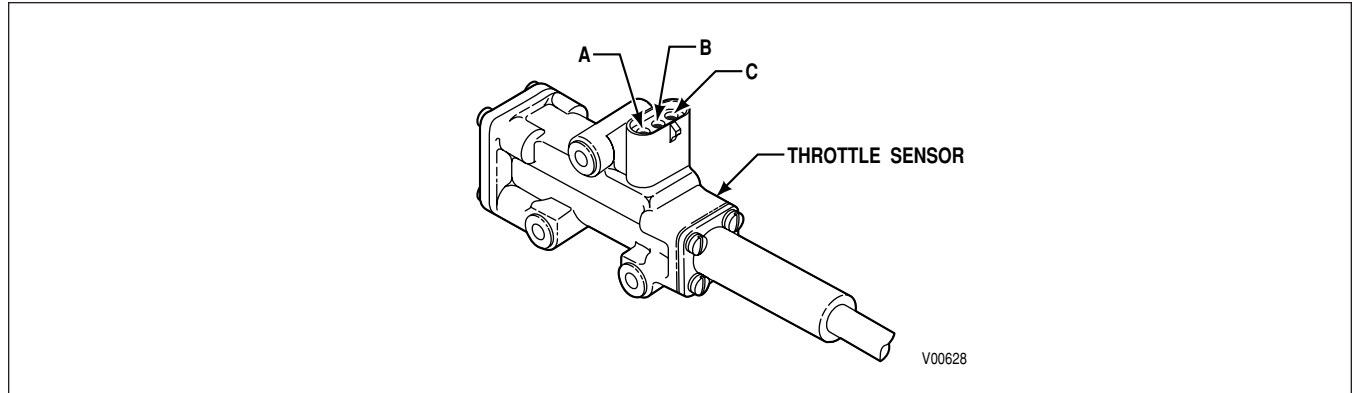


Figure 1-6. Throttle Position Sensor (Without Mounting Brackets)

### 1-5. SPEED SENSORS (Figure 1-7)

The following three sensors provide information to the ECU:

- Engine speed—signal is generated by ribs on the torque converter pump.
- Turbine speed—signal is generated by the rotating-clutch housing spline contours.
- Output speed—signal is generated by a toothed member attached to the output shaft (except for the 3000 Product Family 7-speed models, where the toothed member is the transfer case idler gear).

The speed ratios between the various speed sensors allow the ECU to determine if the transmission is in the selected range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the smoothest shifts possible. 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.

**GENERAL DESCRIPTION**

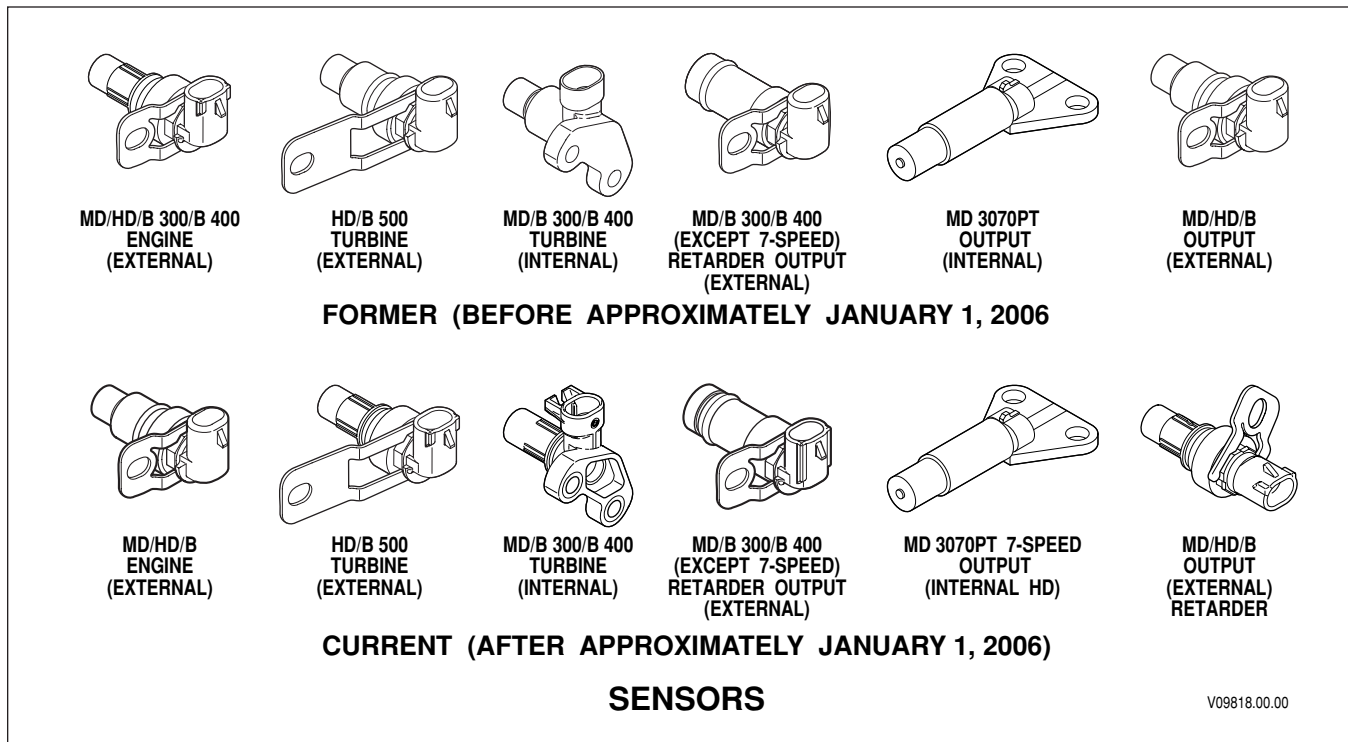


Figure 1-7. Speed Sensors

**1-6. CONTROL MODULE (Figure 1-8)**

Pulse width modulated solenoids are used in the valve bodies. For valve locations, refer to SIL 27-WT-93.

The WTEC III Series transmission control module contains a channel plate on which is mounted a:

- Main valve body assembly.
- Stationary-clutch valve body assembly.
- Rotating-clutch valve body assembly.

The main valve body assembly contains:

- G solenoid and the C1 and C2 latch valves controlled by the solenoid.
- Main and lube regulator valves.
- Control main and converter regulator valves.
- Converter flow valve and exhaust backfill valves.

The stationary-clutch valve body assembly contains:

- C solenoid (C3)
- D solenoid (C4)
- E solenoid (C5)
- Solenoid regulator valves controlled by the solenoids
- C3 accumulator relay valve

## GENERAL DESCRIPTION

The rotating-clutch valve body assembly contains:

- A solenoid (C1)
- B solenoid (C2)
- F solenoid (lockup)
- Solenoid regulator valves controlled by the solenoids
- C3 pressure switch

The low valve body assembly (3000 and 4000 Product Families 7-speed) contains N and J solenoids.

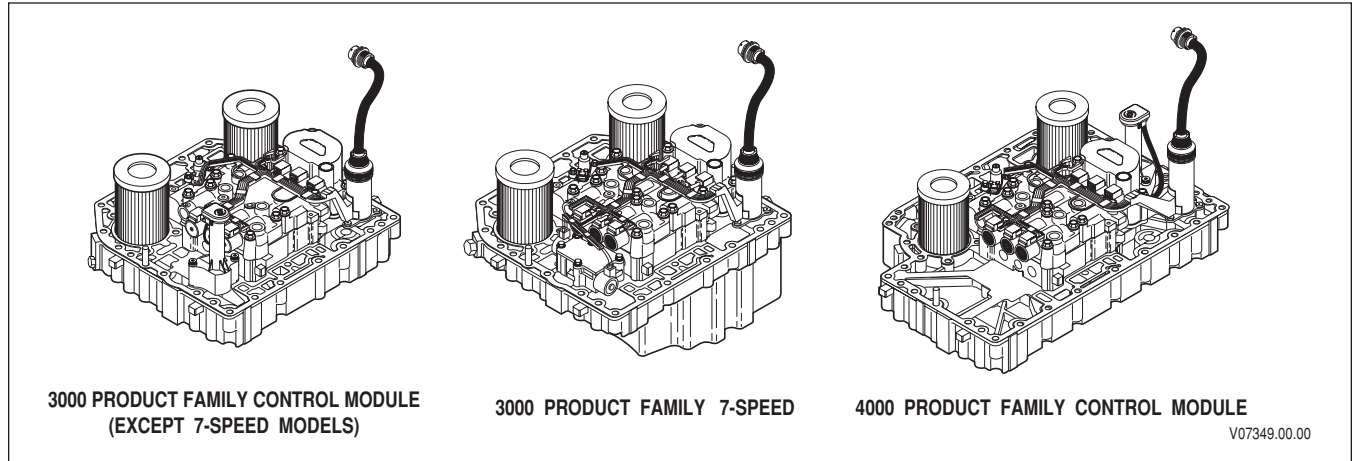


Figure 1-8. WTEC III Control Modules

A temperature sensor (thermistor) is located in the internal wiring harness. Changes in sump fluid temperature are indicated by changes in sensor resistance which changes the signal sent to the ECU. Refer to Figure 6-8 in Section 6, Code 24.

The oil level sensor (OLS) is a float type device mounted on the control module channel plate. The OLS senses transmission fluid level by electronically measuring the buoyancy forces on the float. The sensor operates on 5 VDC supplied by the ECU. The oil level sensor is standard on 3000 and 4000 Product Families transmissions. An OLS is required on all models with a shallow sump but is optional on other models. The oil level sensor is not available on the 3000 Product Family 7-speed models.

The C3 pressure switch is mounted on the rotating-clutch valve body assembly and indicates when pressure exists in the C3 clutch-apply passage. An accumulator/relay valve is in-line ahead of the C3 pressure switch and prevents high frequency hydraulic pulses generated by the C3 solenoid from cycling the C3 pressure switch.

Also mounted on the control module is the turbine speed sensor for the 3000 Product Family transmissions. The turbine speed sensor is directed at the rotating-clutch housing. The turbine speed sensor on the 4000 Product Family transmissions is located on the outside of the main housing.



## GENERAL DESCRIPTION

### 1-7. WIRING HARNESES

#### A. External Wiring Harness (*Figure 1-9*)

The ECU uses three connectors labeled Black, Blue, and Gray, which are used to receive input from the following:

Transmission	TPS	Diagnostic tool connector
Engine	Vehicle interface module (VIM)	Retarder
Turbine	Retarder control module	Retarder temperature sensor
Output speed sensor	Shift selector	Accumulator

Many harnesses will include a bulkhead fitting to separate cab and chassis components. Also, many different styles and materials for harnesses are likely to be encountered.

**NOTE:** *Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:*

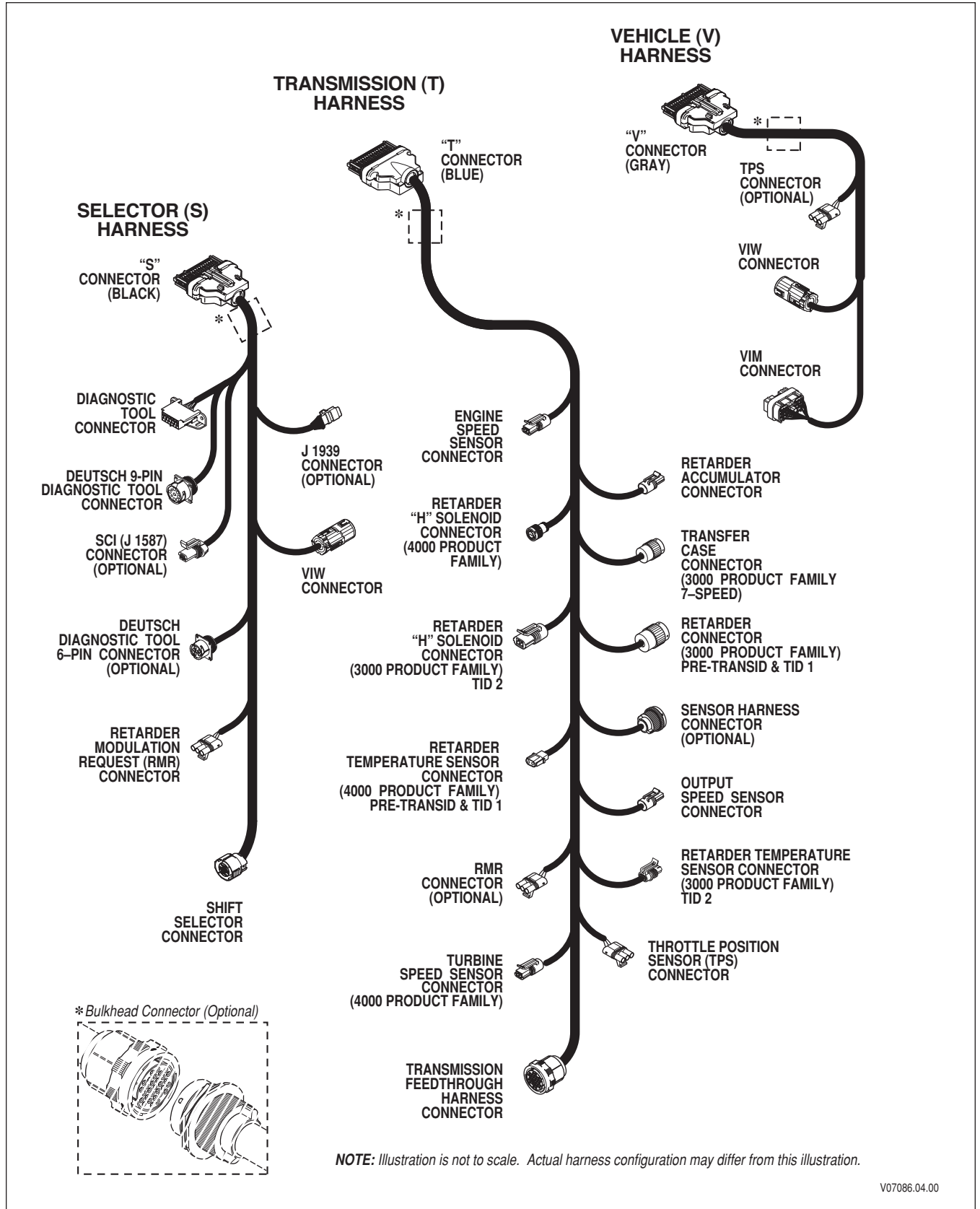
- *Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission 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 Allison Transmission, 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, Canada N8A 4L8  
Phone: 519-627-1673  
Fax: 519-627-4227*

*St. Clair Technologies, Inc.  
Calle Damanti S/N Col  
Guadalupe—Guaymas  
Sonora, Mexico CP85440  
Phone: 011-526 2222-43834  
Fax: 011-526-2222-43553*

- *St. Clair Technologies, Inc. stocks a WTEC III 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.*

GENERAL DESCRIPTION



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Figure 1-9. WTEC III External Wiring Harnesses

## GENERAL DESCRIPTION

### B. Internal Wiring Harness (Figure 1-10)

The internal wiring harness provides connection between the external harness, the pulse width modulated solenoids, oil level sensor, C3 pressure switch, and the temperature sensor.

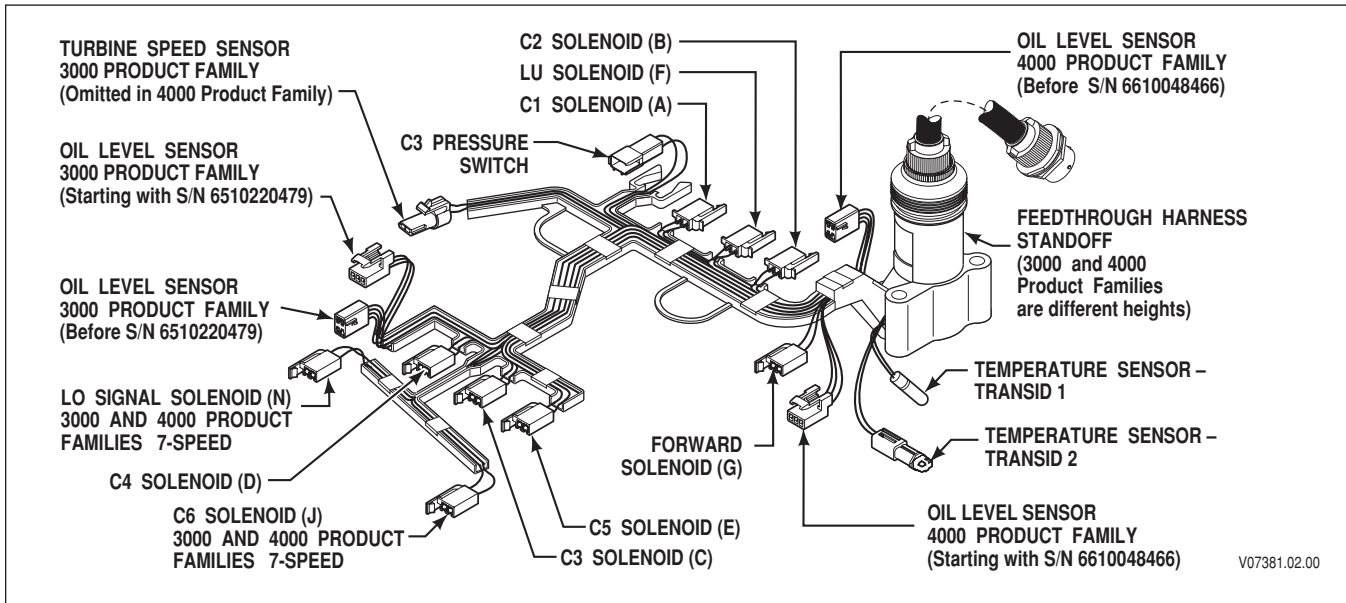


Figure 1-10. WTEC III Internal Wiring Harness

### 1-8. VEHICLE INTERFACE MODULE (Figure 1-11)

The vehicle interface module (VIM) provides relays, fuses, and connection points for interface with the output side of 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 D-30 and D-31 for VIM wire number and terminal information.

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

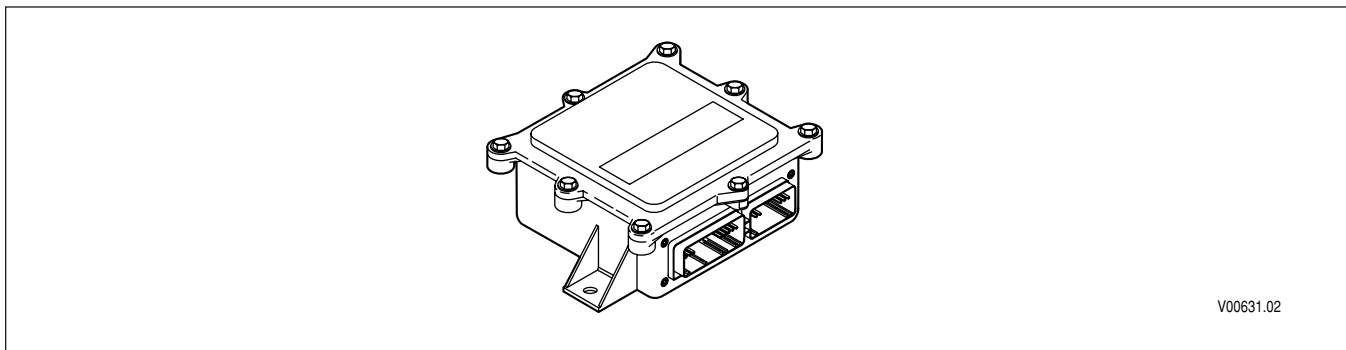


Figure 1-11. Vehicle Interface Module (VIM)

WTEC III ELECTRONIC CONTROLS TROUBLESHOOTING MANUAL
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## GENERAL DESCRIPTION

### 1-9. AUTODETECT FEATURE (V8, V8A, V9 SOFTWARE)

Autodetect is active on the first 24 engine starts or a larger calibration number of engine starts, depending upon the component or sensor being detected (details follow in A through D below). Autodetect takes place within the first 30 seconds of each engine start monitored. Autodetect searches for the presence of the following transmission components or data inputs:

Retarder	Present, Not Present
Oil level sensor (OLS)	Present, Not Present
Throttle	Analog, J1939, J1587
Engine coolant temperature	Analog, J1939, 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 Allison DOC™ For PC–Service Tool. Select “RESET AUTODETECT INFORMATION.” Allison DOC™ For PC–Service 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 four items above are the only customer modifiable constants (CMCs) that are autodetected. Other CMCs can be changed at any time and are not related to autodetect. Consult Allison publication GN3433EN, User Guide, for detailed instructions related to WTEC III “customer modified constants.” Additional details for each of the four autodetectable features are given below.

#### A. Retarder

Autodetect searches for the presence of the H (retarder) solenoid during the first 24 engine ignition cycles. The H solenoid **must be present** on the 24th engine start or the retarder is not detected and will not function on subsequent engine starts.

#### WARNING

If the retarder is present but not detected by autodetect, the retarder will not function. Be sure to test for proper retarder function immediately after the 24th engine start. If the retarder is not functioning, test H solenoid for open, short-to-ground, or short-to-battery condition. Use Allison DOC™ For PC–Service Tool to reset autodetect or to manually select the presence of the retarder after the H solenoid circuit is repaired.

#### B. Oil Level Sensor (OLS)

**NOTE:** *If an OLS is known to be present, but has not been detected, a possible cause is that the transmission fluid level is too low. Determine the fluid level before beginning OLS troubleshooting.*

No oil level sensor diagnostics take place until the OLS is detected. Frequently test for the presence of oil level diagnostics if the transmission is known to contain an OLS. If an OLS is not detected during the first 24 engine starts, autodetect continues for a larger calibration number of engine starts.

Autodetect stops when an OLS is detected or when the calibration number of starts is reached. When the larger calibration number of engine starts is reached, the ECU concludes that no OLS is present. If an OLS is known to be present, but has not been detected, troubleshooting the OLS circuit is required. After the OLS circuit is repaired, reset autodetect or manually select the OLS function using Allison DOC™ For PC–Service Tool.