



# WTEC II ELECTRONIC CONTROLS TROUBLESHOOTING MANUAL

## P R E F A C E



Welcome to the TS2470EN 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

**1998 MAY**

REV. 1 1999 OCTOBER

REV. 2 2004 JULY

REV. 3 2005 DECEMBER

**TS2470EN**

## Allison Transmission

### MD/HD/B SERIES TRANSMISSIONS

#### WTEC II Controls

(Pre-TransID and TID 1)

**MD 3060/MD 3066/MD 3560(P)(R)**

**MD 3070PT**

**HD 4060/HD 4560(P)(R)**

**B 300/B 400/ B 500(P)(R)**



Allison Transmission, General Motors Corporation

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## FOREWORD — How to Use This Manual

This manual provides troubleshooting information for Allison Transmission (AT), MD/HD/B Series Transmissions. Service Manuals SM2148EN and SM2457EN, and Parts Catalogs PC2150EN and PC2456EN may be used in conjunction with this manual.

This manual includes:

- Description of the WTEC II 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 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. 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 WTEC II wiring harnesses and wiring harness components as follows: (See Service Information Letter 1-WT-97 for further information.)*

- *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.*
- *Since January, 1998, all WTEC II 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 has parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:*

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## 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:

- LPS<sup>®</sup> Cleaner is a registered trademark of LPS Laboratories.
- Biobor JF<sup>®</sup> is the registered trademark for a biological inhibitor manufactured by Hammonds Fuel Additives Corporation.
- Loctite<sup>®</sup> is a registered trademark of the Loctite Corporation.
- Teflon<sup>®</sup> is a registered trademark of the DuPont Corporation.
- Allison DOC<sup>™</sup> For PC–Service Tool is a registered trademark of General Motors Corporation.

## SHIFT SELECTOR TERMS AND DISPLAY INDICATIONS

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

- Button Names —  $\uparrow\downarrow$ , **DISPLAY MODE**, **MONITOR**, **SELECT**, etc.**HHHH**
- Transmission Ranges — **D** (Drive), **N** (Neutral), **1** (First), **R** (Reverse), etc.
- Displays — “**OL**”, “**OK**”, etc.



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SECTION 1—GENERAL DESCRIPTION

1-1. TRANSMISSION

The World Transmission Electronic Controls WTEC II system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. MD 3000 (except 3070), HD 4000, and B Series configurations can be programmed to have up to six forward ranges, neutral, and one reverse range. The MD 3070 has seven forward ranges and one reverse range. Figures 1-1 and 1-2 show electronic control unit components.

WTEC II Electronic Controls consist of the following components:

- Basic or Max Feature Electronic Control Unit (ECU)
- Pushbutton or Lever Shift Selectors (remote or integral to the ECU)
- Optional Secondary Shift Selector
- Engine, Turbine and Output Speed Sensors
- Throttle Position Sensor (TPS) (or electronic engine throttle signal or PWM signal)
- Control Module (Electro-Hydraulic Valve Body)
- Wiring Harnesses
- Vehicle Interface Module (VIM)
- Optional Retarder Controls
- TransID Feature

**NOTE:** Model Year '94 and earlier MD/HD/B Series Electronic Controls operate on 12VDC. Vehicles with a 24VDC system require a voltage equalizer or converter to supply 12V to the electronic control system. Model Year '95 and later transmissions operating on 24VDC require a 24V VIM and a 24V wiring harness which includes shielding for the turbine and output speed sensors.

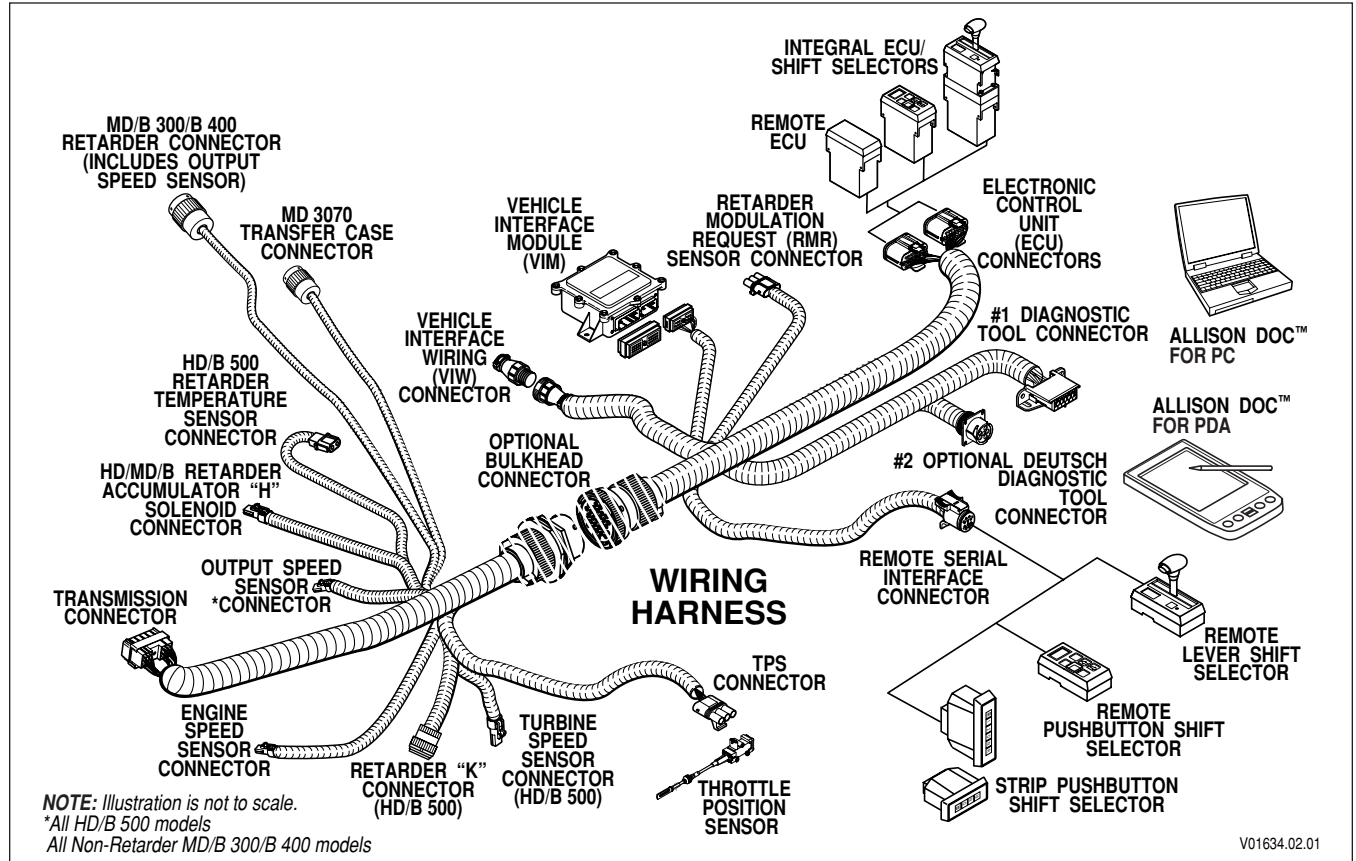


Figure 1-1. WTEC II Electronic Control Components (Units Produced Before 9/94)

GENERAL DESCRIPTION

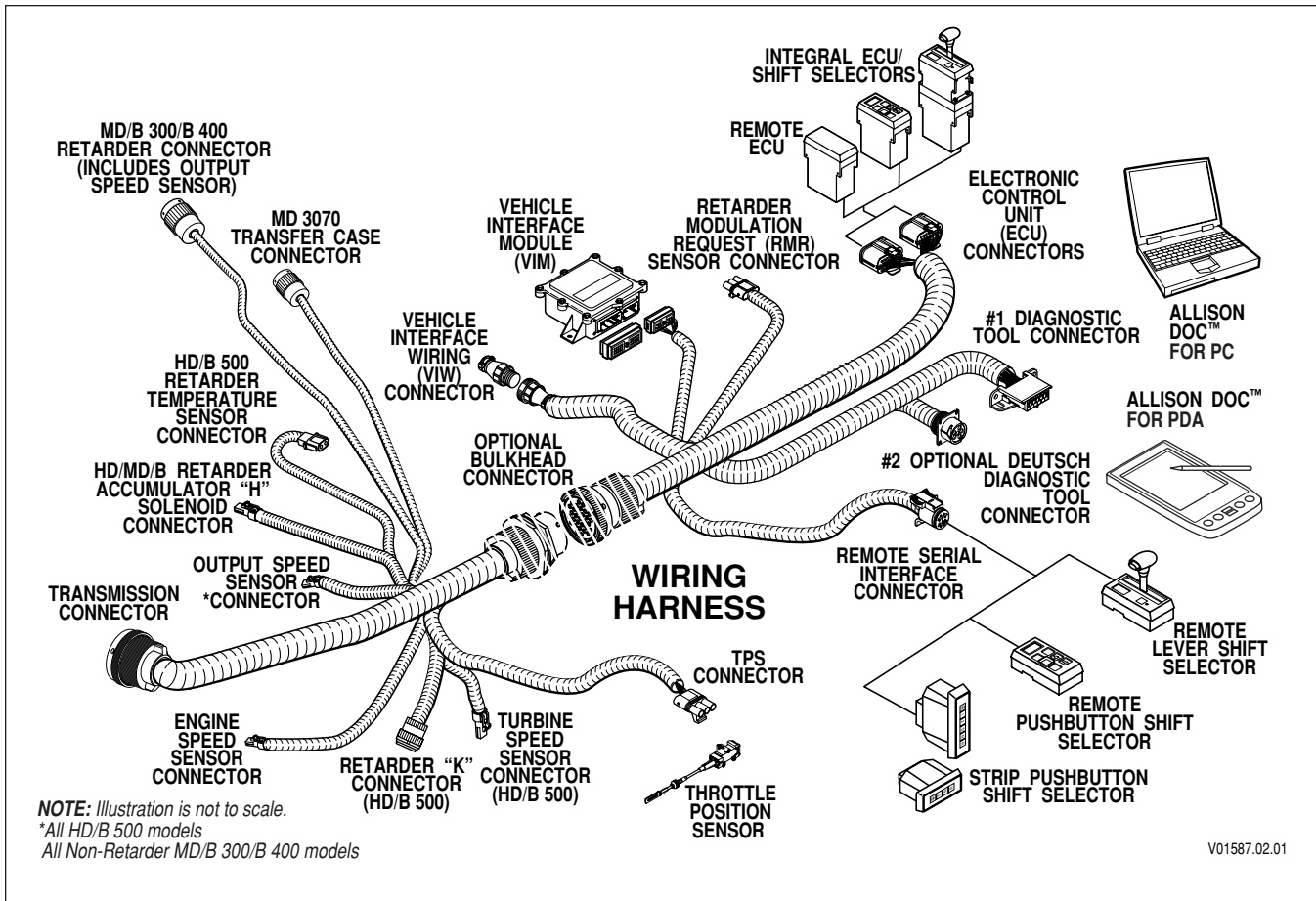


Figure 1-2. Electronic Control Unit Components (Units Produced 9/94-12/97)

Figure 1-3 is a block diagram of the basic system's inputs and outputs.

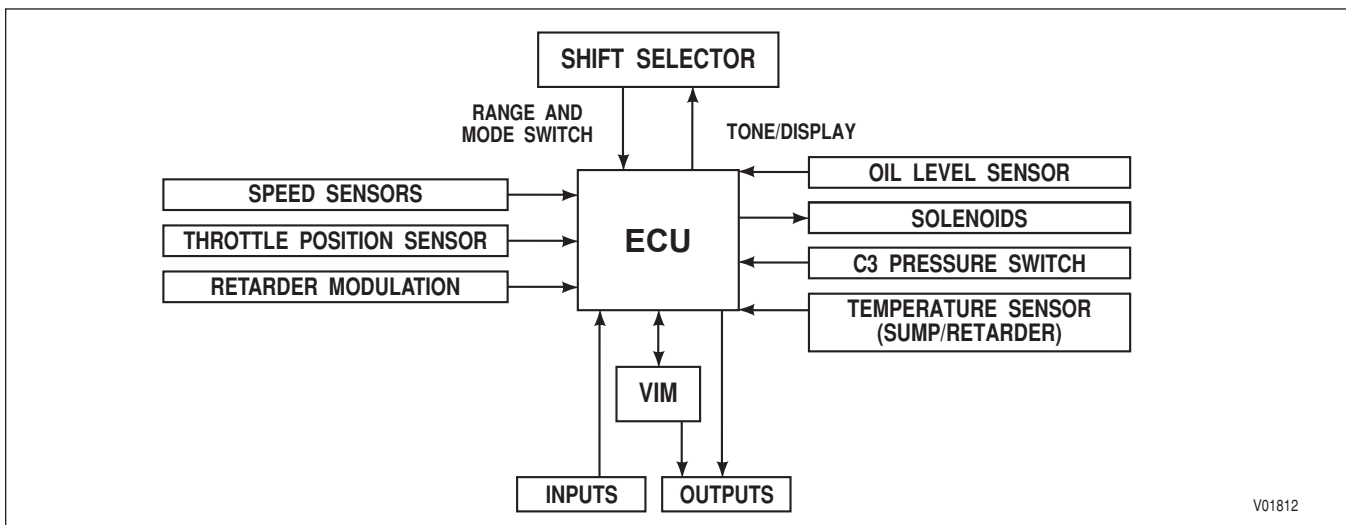


Figure 1-3. Electronic Control Unit Block Diagram

## GENERAL DESCRIPTION

### 1-2. ELECTRONIC CONTROL UNIT (ECU)

The ECU (Figure 1-4) contains the microcomputer which is the brain of the control system. The ECU receives and processes information defining: shift selector position, throttle position, sump/retarder temperature, engine speed, turbine speed, and transmission output speed. The ECU uses the information to control transmission solenoids and valves, supply system status, and provide diagnostic information.

The ECU contains an Electronically Erasable Programmable Read Only Memory (EEPROM) which is programmed with the shift calibration and other data for a specific transmission assembly, engine, and vehicle vocation.

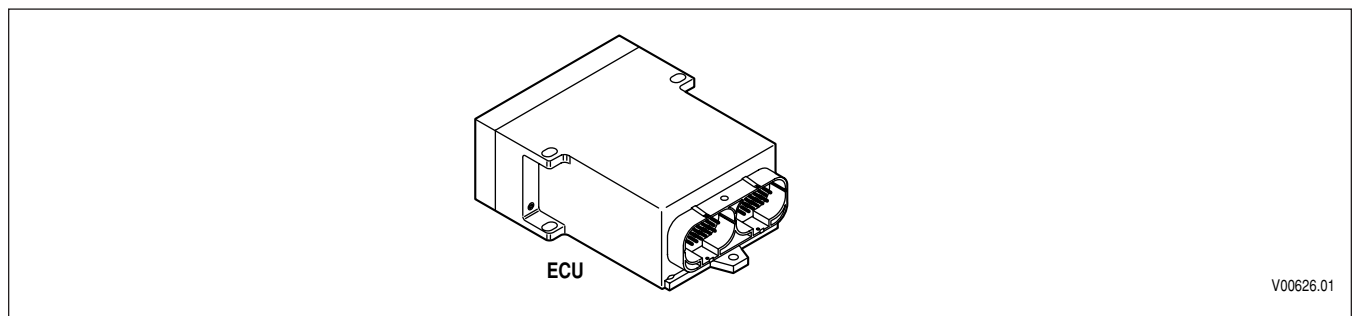


Figure 1-4. Electronic Control Unit (ECU)

### 1-3. SHIFT SELECTOR

Pushbutton and lever shift selectors are available for the MD/HD/B Series. Either shift selector may be ordered attached to (integral with), or remote from, the ECU. Both shift selectors are equipped with a digital display. However, the strip pushbutton shift selector does not have a digital display.

On the shift selectors, between the range selected and the range monitored (attained) digits, is a **MODE ON** indicator position. During normal transmission operation **MODE ON** indicates that a secondary or special operating condition has been selected by pressing the **MODE** button. In diagnostic display mode, **MODE ON** indicates the displayed diagnostic code is active. There is a **SERVICE** indicator icon under the **MODE ON** indicator. It is illuminated when codes 21 XX, 63 00, and 66 00 are active (for ECUs programmed after 9/26/94). When a transmission fault occurs that causes the **DO NOT SHIFT** light to turn on, the shift selector sounds a tone to indicate transmission shifting is restricted.

#### A. Pushbutton Shift Selector (Figure 1-5)

The full-function pushbutton shift selector has six (6) buttons and a digital display. The six buttons are: **R** (Reverse), **N** (Neutral), **D** (Drive),  $\uparrow$  (Up),  $\downarrow$  (Down), and **MODE**. Manual forward range downshifts; upshifts are made by pressing the  $\uparrow$  (Up) or  $\downarrow$  (Down) arrow buttons after selecting **D** (Drive). The **N** (Neutral) button has a raised lip to aid in finding it by touch. The digital display on the pushbutton selector indicates the range selected on the left side and the range monitored (attained) on the right side. The **MODE** button is pressed to select a secondary or special operating condition, such as **ECONOMY** shift schedule. The vehicle dimmer-control changes display brightness. Diagnostic information is obtained by pressing the  $\uparrow$  (Up) and  $\downarrow$  (Down) arrow buttons at the same time.

### GENERAL DESCRIPTION

A strip pushbutton shift selector does not have a **MODE** button, **SERVICE** icon, or diagnostic display capability. The Allison DOC™ For PC–Service Tool (Figure 1–5), or a customer-furnished remote display **must be used** for diagnostic purposes.

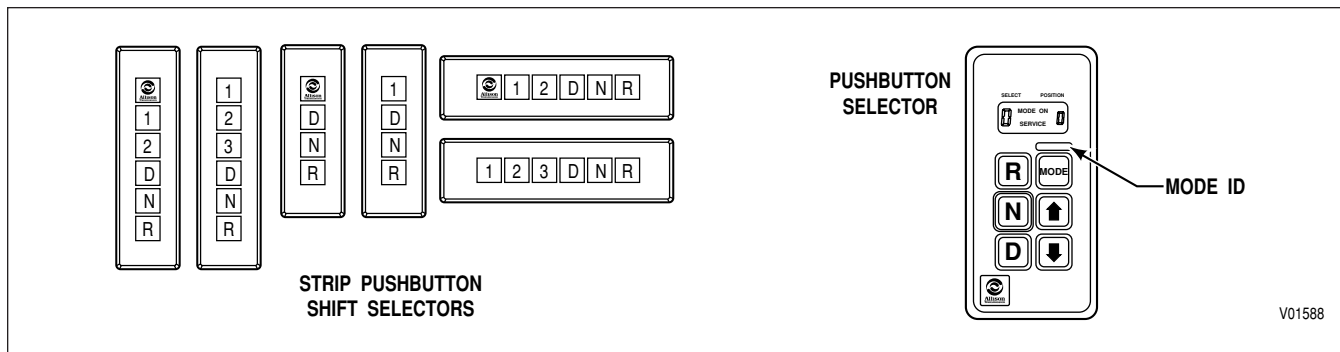


Figure 1–5. Pushbutton Shift Selectors

#### B. Lever Shift Selector (Figure 1–6)

The lever shift selector can only be ordered with as many as six forward range positions (seven for the MD 3070), as well as **R** (Reverse) and **N** (Neutral). The shift hold mechanism is released by pressing a button on the side of the shift handle. The range selector lever can be moved freely between numbered forward ranges. Press and hold the shift hold button to move into or out of the **D** (Drive) position or when moving into or out of **N** (Neutral) or **R** (Reverse).

The digital display on the lever selector indicates the selected range at the top and the range monitored (attained) at the bottom. A **MODE** button and a recessed **DISPLAY MODE** button are also on the face of the lever shift selector. 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 **DISPLAY MODE** button. The vehicle dimmer-control changes display brightness.

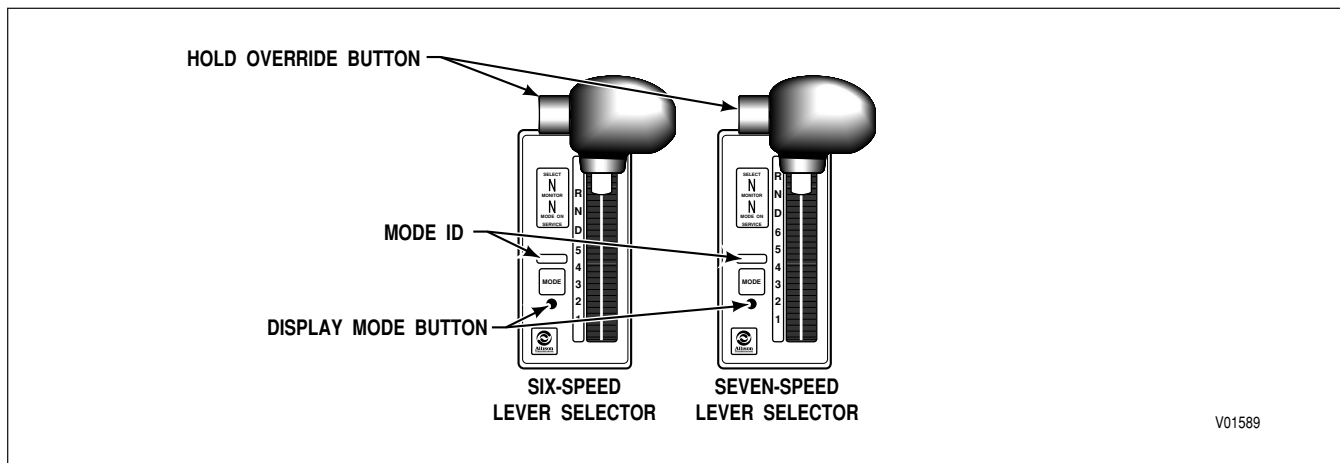


Figure 1–6. Six-Speed And Seven-Speed Lever Shift Selectors

## GENERAL DESCRIPTION

### 1-4. THROTTLE POSITION SENSOR (Figure 1-7)

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.

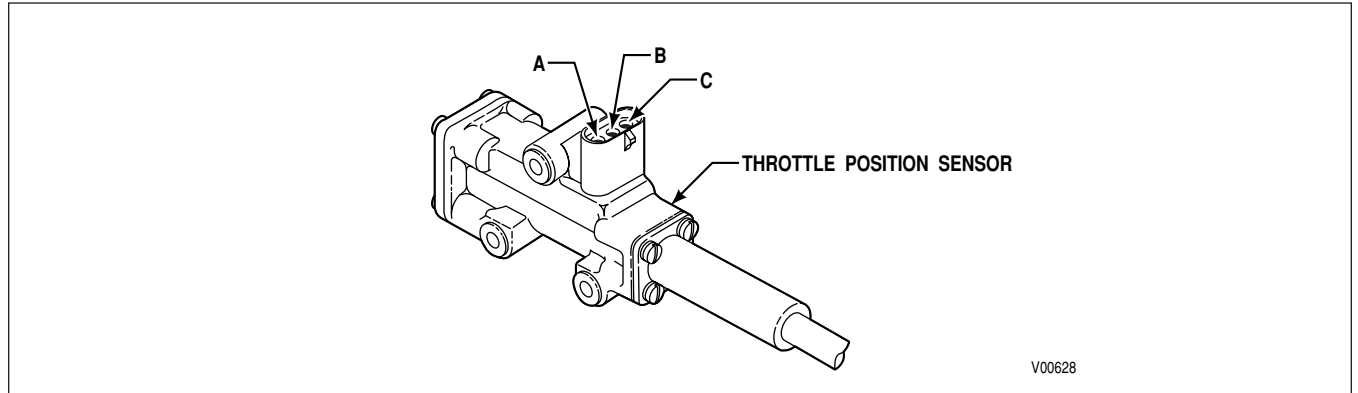


Figure 1-7. Throttle Position Sensor (TPS)

### 1-5. SPEED SENSORS (Figure 1-8)

The following speed sensors provide information to the ECU as follows:

- Engine speed—generated by ribs on the shell of the torque converter pump.
- Turbine speed—generated by the rotating-clutch housing spline contours.
- Output speed—generated by a toothed member attached to the output shaft (except for the MD 3070, where the toothed member is the transfer case idler gear).

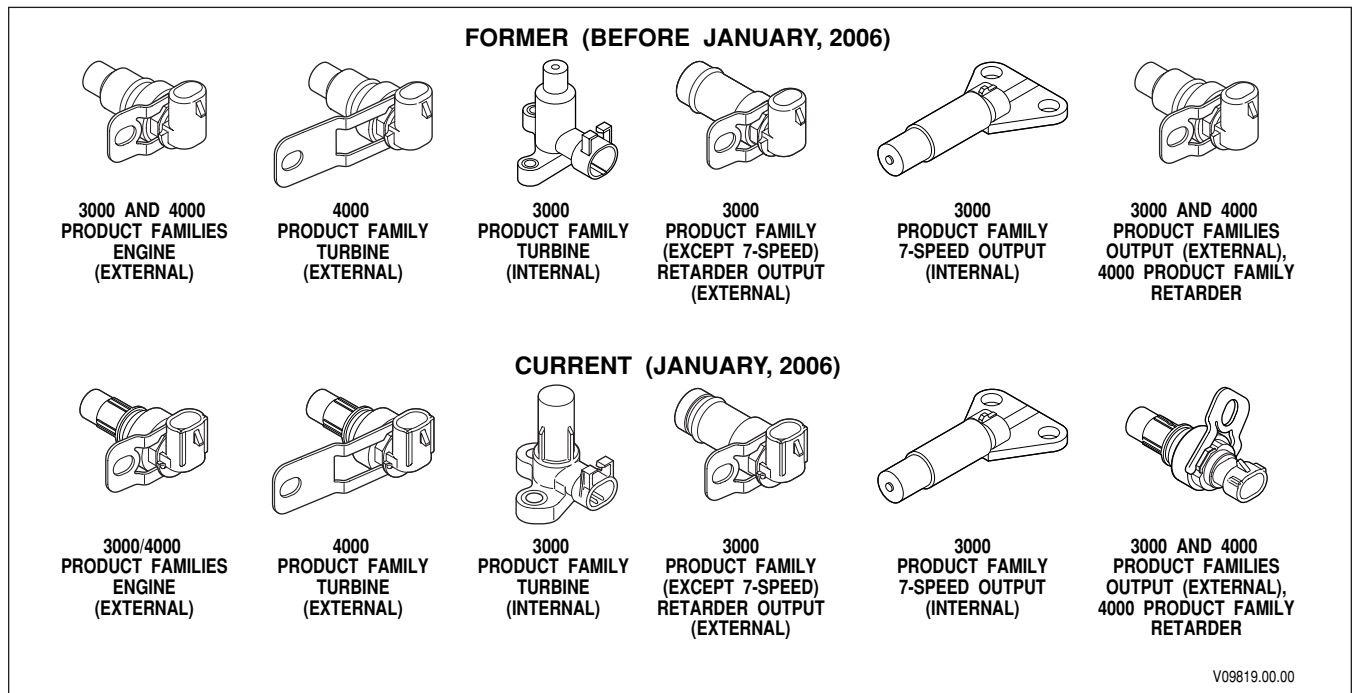


Figure 1-8. Speed Sensors

## GENERAL DESCRIPTION

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.

### 1-6. CONTROL MODULE (*Figure 1-9*)

The MD/HD/B Series transmission control module contains a channel plate on which is mounted:

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

Pulse width modulated solenoids are used in the valve bodies. For valve locations, refer to SIL 27-WT-93, Rev. A. The rotating-clutch valve body assembly contains:

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

The stationary-clutch valve body assembly contains:

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

The main valve body assembly contains:

- G solenoid and 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

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 (see chart in Section 6, Code 24).

The oil level sensor (OLS) is required on all models with a shallow sump but is optional on other models. The OLS is a float-type device, mounted on the control module channel plate, which senses transmission fluid level by electronically measuring the buoyancy forces on the float. The sensor operates on 5VDC supplied by the ECU.

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 in the control module is the turbine speed sensor for the MD/B 300/B 400 models. The turbine speed sensor is directed at the rotating-clutch housing. (The turbine speed sensor on HD/B 500 models is located on the outside of the main housing.)

## GENERAL DESCRIPTION

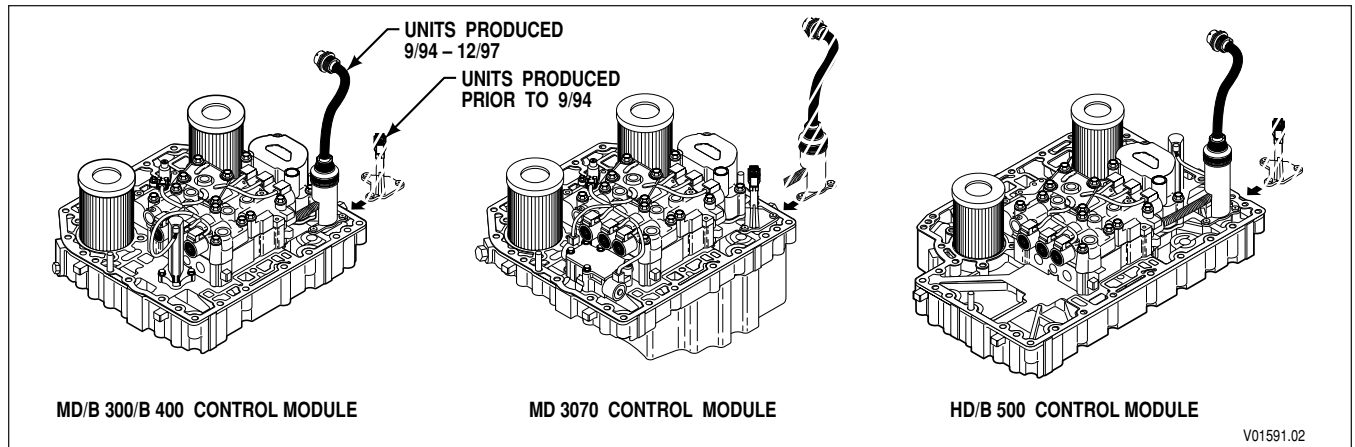


Figure 1-9. Control Module

### 1-7. WIRING HARNESSES

#### A. External Wiring Harness (Figures 1-10 and 1-11)

The external wiring harness provides a connection between the following:

- ECU
- Transmission (including engine, turbine, and output speed sensors)
- Throttle position sensor (TPS)
- Vehicle interface module (VIM)
- Retarder, retarder control module, and retarder temperature sensor
- Shift selectors
- Diagnostic tool connector
- Accumulator
- Vehicle interface

Many harnesses will include a bulkhead 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 WTEC II wiring harnesses and wiring harness components as follows (refer to Service Information Letter (SIL) 1-WT-97 for further information):

- 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.
- Since January, 1998, all WTEC II 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 (AT), manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI has 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 Damante S/N Col  
 Guadalupe-Guaymas  
 Sonora, Mexico CP85440  
 Phone: 011-526-2222-43834  
 Fax: 011-526-2222-43553



GENERAL DESCRIPTION

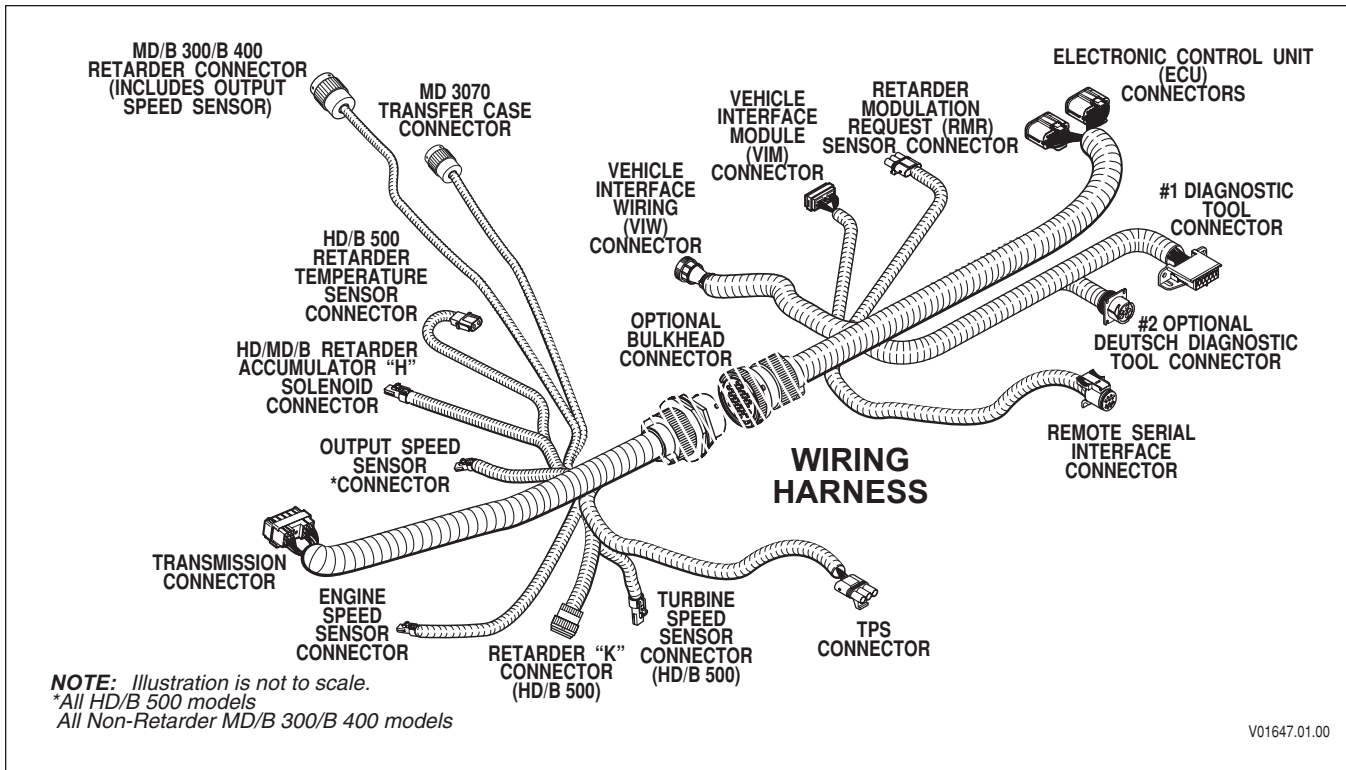


Figure 1-10. WTEC II External Wiring Harness (Units Produced Before 9/94)

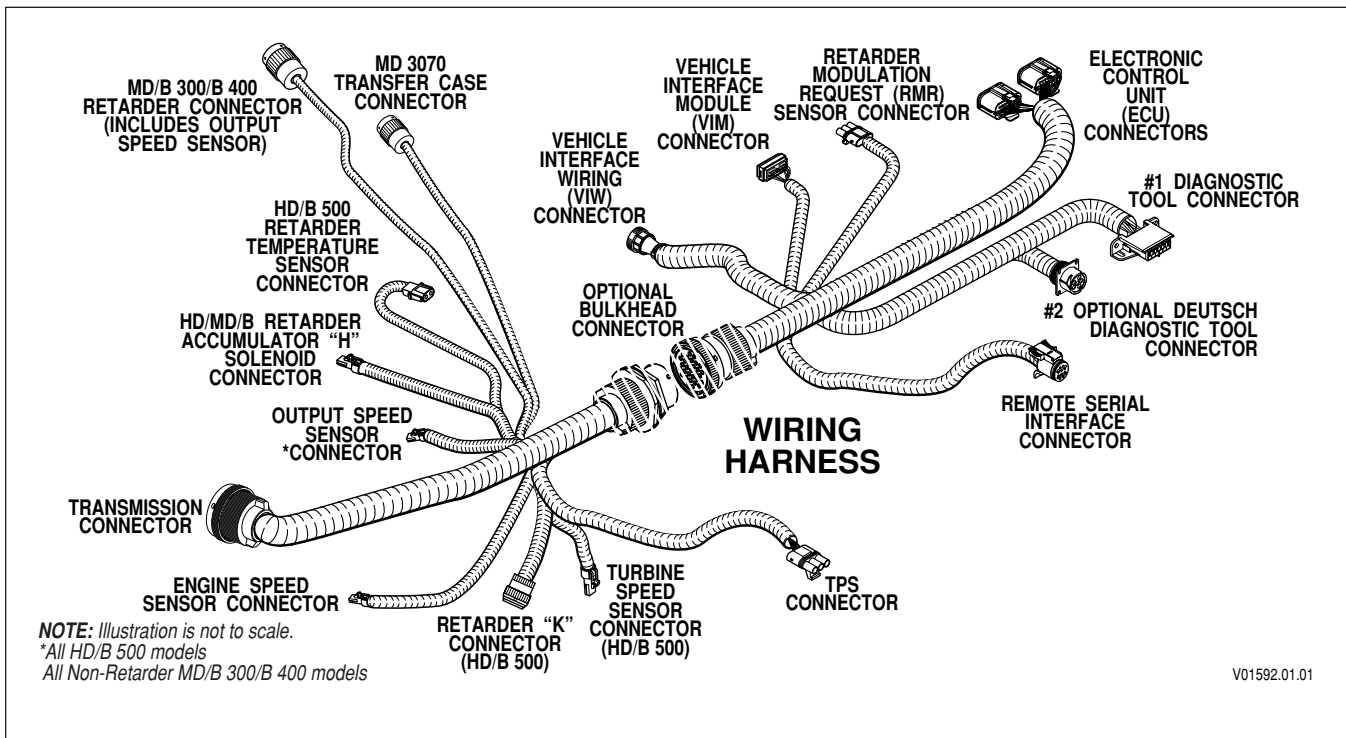


Figure 1-11. WTEC II External Wiring Harness (Units Produced 9/94-12/97)

## GENERAL DESCRIPTION

### B. Internal Wiring Harness (Figures 1-12, 1-13, and 1-14)

The internal wiring harness provides connection between the following:

- External harness
- Pulse width modulator (PWM) solenoids
- Oil level sensor (OLS)
- C3 pressure switch
- Temperature sensor

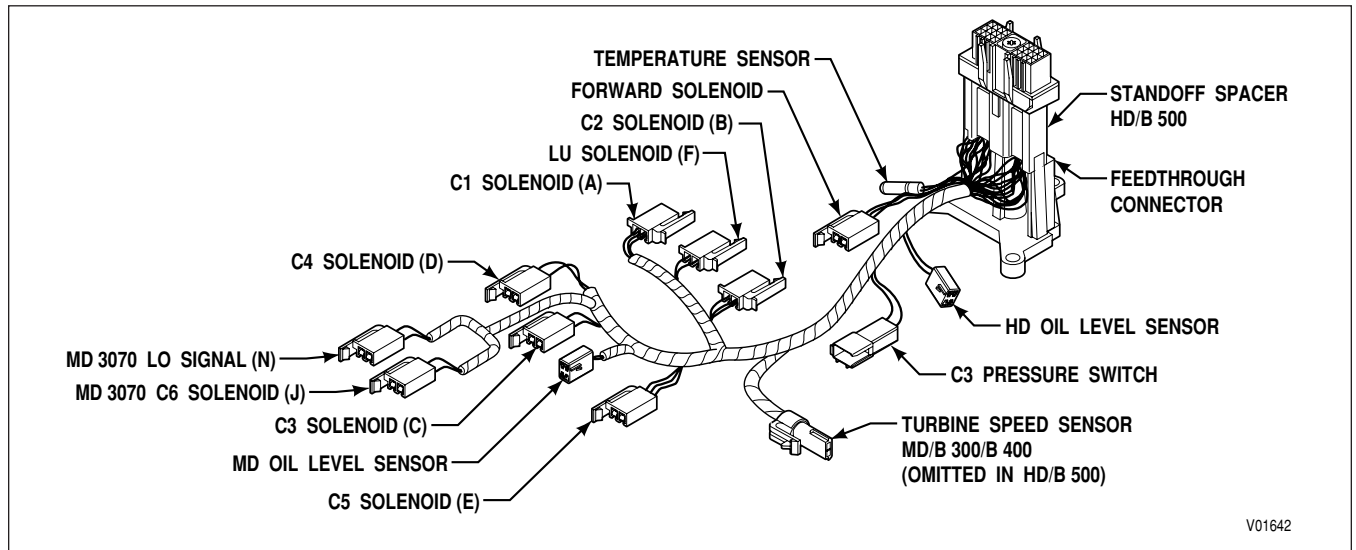


Figure 1-12. WTEC II Internal Wiring Harness (Units Produced Before 9/94)

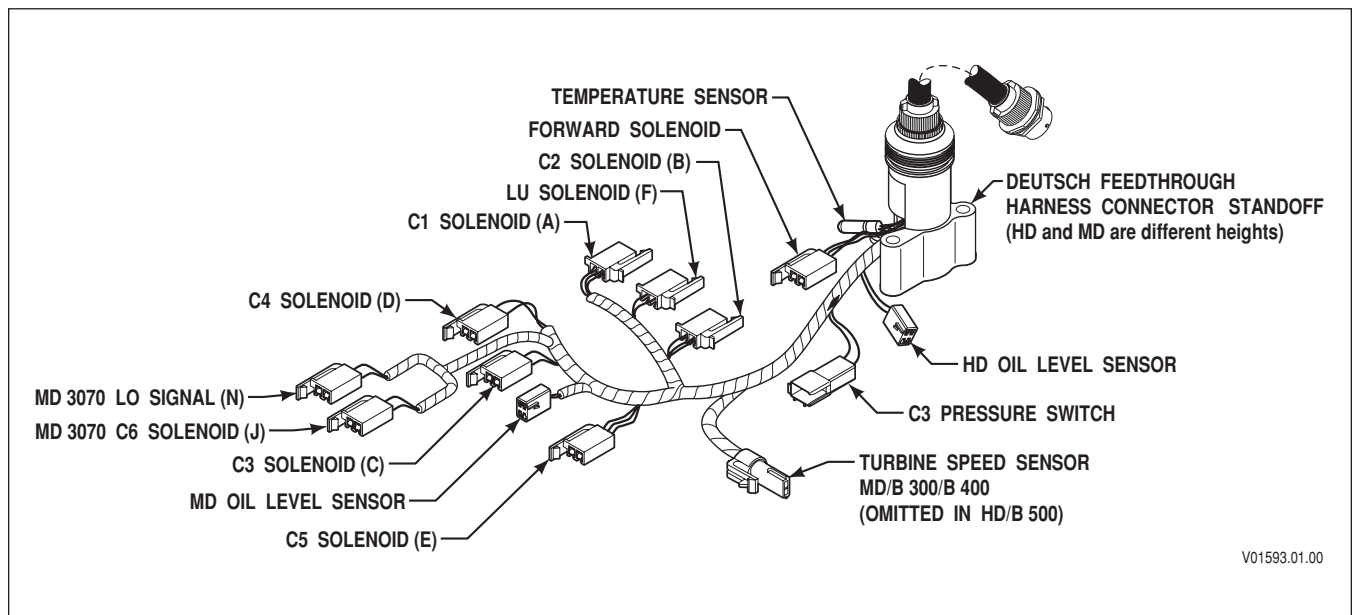
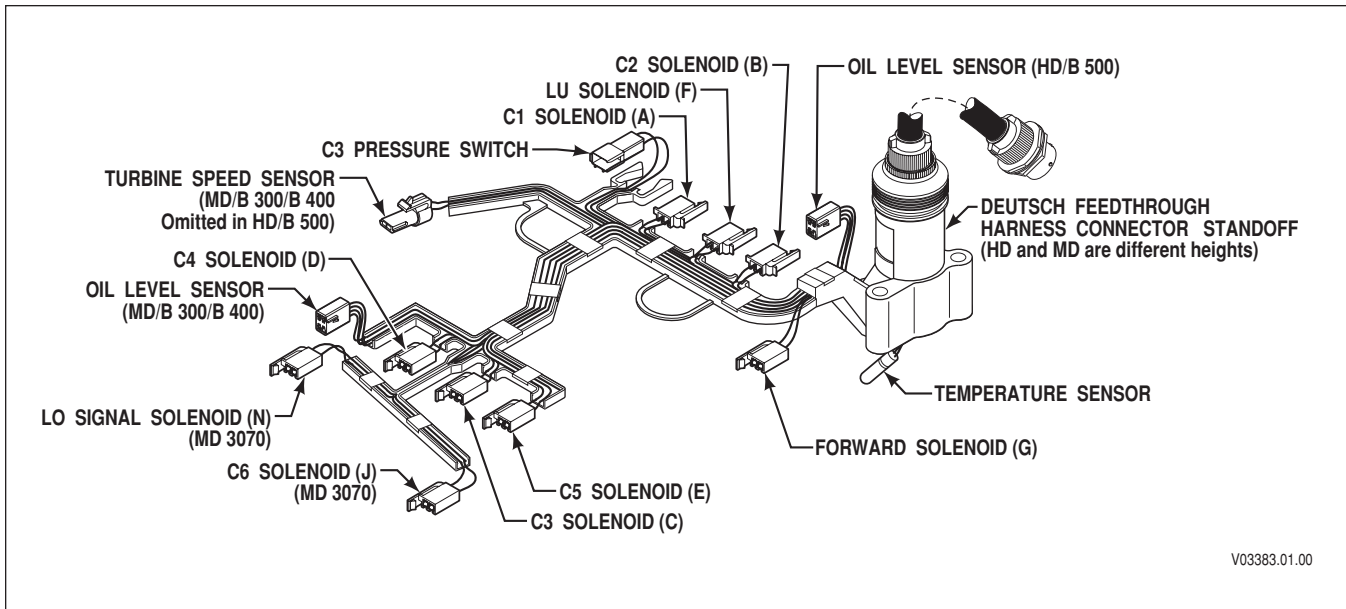


Figure 1-13. WTEC II Internal Wiring Harness (Units Produced 9/94-11/96)

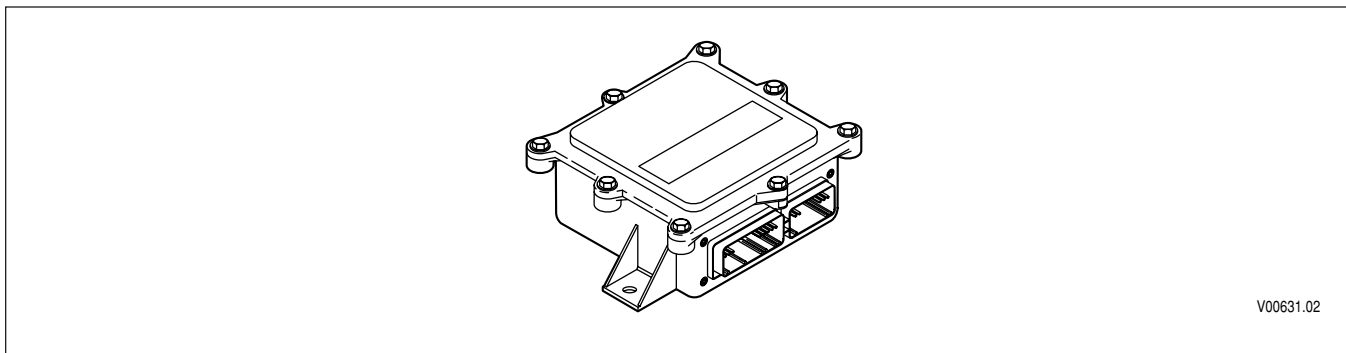
**GENERAL DESCRIPTION**



**Figure 1-14. WTEC II Internal Wiring Harness (Units Produced 11/96-12/97)**

**1-8. VEHICLE INTERFACE MODULE (Figure 1-15)**

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 had four 24V relays and two 12V relays prior to Model Year 1995 and all 24V relays beginning with Model Year 1995. Refer to the Parts Catalog for the transmission assembly number that you are servicing for detailed parts information. Refer to Foldout D-2 for VIM wire number and terminal information.



**Figure 1-15. Vehicle Interface Module (VIM)**

## GENERAL DESCRIPTION

### 1-9. TRANSID FEATURE

#### A. General Description

The TransID feature has been provided so that Allison Transmission can make component changes which require calibration changes but still retain both the original transmission assembly number (A/N) and the original calibrated ECU A/N. The purpose of TransID is to reduce the need for OEMs to use cross-reference lists of transmission and calibrated ECU A/Ns when such changes to the transmission are made. TransID allows OEMs to order specific transmission A/Ns and calibrated ECU A/Ns and receive all changes made to the transmission and all of the corresponding calibrations. This will reduce the number of A/N changeovers with which an OEM must contend.

The basis for the TransID system is the creation of a TransID wire in the WTEC II and III system to provide a signal to the ECU of the TransID level of the transmission. This wire for WTEC II and III will be connected directly to the Analog Ground (wire 135) to signal TransID level 1 (TID 1). TransID levels 2 through 8 will only apply to WTEC III and are covered in Allison publication TS2973EN, WTEC III Troubleshooting. The connection point of the TransID wire will provide the signal to tell the ECU which calibration is required by the transmission.

Whenever a TransID level change is to be made, the new TransID level calibrations will be placed in the PROM Calibration Configurator System (PCCS) ninety days before the change(s) is(are) made in production to the transmissions. All ECUs programmed and sold after that date will then be loaded with the new TransID level calibration. These ECUs will contain calibrations for the new level transmission and all previous TransID levels and will automatically load the correct calibration for the transmission. This eliminates worry on the part of the OEM of coordinating the implementation of the new ECU and the new transmission and allows their focus to be on using the stock of the earlier level ECU.

#### B. Transmission Changes Versus TransID Number

##### 1. TransID 1

The internal wiring harness wiring change to make a TID 1 transmission was put into production before the introduction of the WTEC III system and does pertain to some WTEC II units. The TID 1 internal harness was made by connecting the C3 Pressure Switch ground (digital/signal ground; WTEC II wire 161) to the Sump Temperature Sensor and Oil Level Sensor ground (analog ground; wire 135) in the internal harness. In WTEC II, the signal ground wire (wire 161) is routed through the transmission connector, terminal W, and then to the ECU, terminal B27. In WTEC III, this same wire in the internal harness becomes the TransID wire (wire 195), and it goes to the ECU, terminal T13 (blue connector). The purpose of TransID 1 was to provide a common transmission for use with both WTEC II and WTEC III systems (V7A and V8).

The only difference between a pre-TransID transmission and a TransID 1 transmission is the internal wiring harness which connects the digital and analog grounds on the TID 1 harness. Adapter harness P/N 200100 can be ordered from St. Clair Technologies to provide the same connection outside the transmission and allow a pre-TransID transmission to be “converted” to a TransID 1 transmission.

All models of the MD/HD/B Series transmissions were built with the TransID 1 internal (feedthrough) harness beginning in September, 1996. Two changes were rolled into this update: the wiring change for TID 1 and a change to use a molded channel rather than the braided covering which was previously used. Both changes were rolled into the same internal harness P/N even though there was a delay in implementing the channel which resulted in the two S/N breaks. Table 1-1 lists the internal harness P/Ns for the different transmission models along with the S/Ns for both changes for each harness.