



# 1000/2000/2400 ELECTRONIC CONTROLS TROUBLESHOOTING MANUAL

## P R E F A C E



Welcome to the TS3192EN 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

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## Allison Transmission ELECTRONIC CONTROLS

1000 and 2000 Product Families



Allison Transmission, General Motors Corporation  
P.O. Box 894 Indianapolis, Indiana 46202-0894  
[www.allisontransmission.com](http://www.allisontransmission.com)

## FOREWORD — How to Use This Manual

This manual provides troubleshooting information for Allison Transmission 1000 and 2000 Product Families transmissions. Service Manual SM3191EN, Mechanics Tips MT3190EN, and Parts Catalog PC3062EN may be used in conjunction with this manual.

This manual includes:

- Description of the 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 rear cover. 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 service of wiring harnesses and wiring harness components as follows:*

- *Repair parts for the internal wiring harness 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 the vehicle OEM or the OEM is responsible for warranty on these 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.

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## SERVICE LITERATURE

This service literature provides fully illustrated instructions for operation, maintenance, service, overhaul, and parts support for your transmission. To ensure maximum performance and service life from you unit, you may order publications from:

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

### 1000 and 2000 Product Families Service Literature

Publication Name	Publication No.
Automatic Transmission Fluid Technician's Guide	GN2055EN
*Mechanic's Tips	MT3190EN
*In-Chassis Maintenance	JA3664EN
*EVS Operator's Manual	OM3761EN
*HS Operator's Manual	OM3757EN
*RDS Operator's Manual	OM3759EN
*MHS Operator's Manual	OM3364EN
*PTS Operator's Manual	OM3758EN
*BUS Operator's Manual	OM3765EN
*1000, 2000, 2400 Operator's Manual	OM3063EN
*Owner's Manual (2000MH)	OM3364EN
*Parts Catalog	PC3062EN
Parts Catalog On CD-ROM	CD3062EN
Principles Of Operation	PO3065EN
Service Manual	SM3191EN
Electronic Troubleshooting Manual	TS3192EN
* Also Available On The Internet At <a href="http://www.allisontransmission.com">www.allisontransmission.com</a>	



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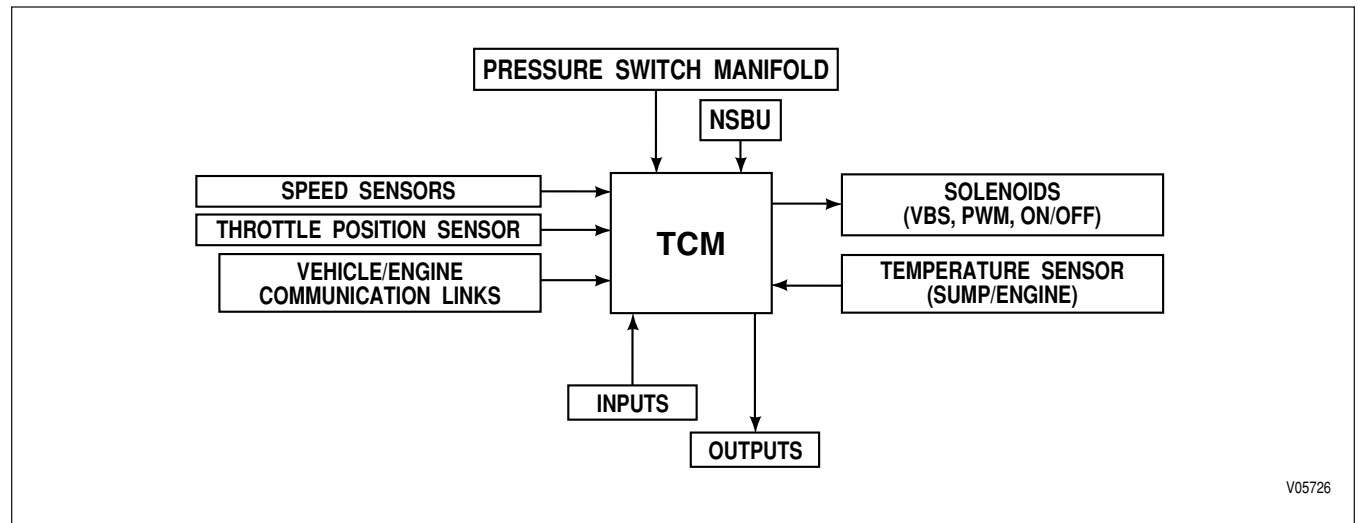
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## SECTION 1—GENERAL DESCRIPTION

### 1-1. TRANSMISSION

The 1000 and 2000 Product Families Electronic Controls system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. The 1000 and 2000 Product Families configurations can be programmed to provide five forward speeds, neutral, and reverse. The fifth range has an overdrive gear ratio. The 1000 and 2000 Product Families incorporate a variety of standard and optional design features.

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



**Figure 1-1. Transmission Control Module Block Diagram**

Figure 1-2 shows the electronic control components.

Electronic Controls consist of the following elements:

- Remote 12V or 24V Sealed Transmission Control Module (TCM)
- Throttle Position Sensor (TPS), electronic engine throttle data, or PWM signal
- Speed Sensors — Input (Engine), Turbine, and Output
- Control Valve Assembly (Electro-Hydraulic Valve Body)
- NSBU Switch
- Pressure Switch Manifold (PSM)
- Wiring Harnesses

**NOTE:** *All external harnesses are OEM-supplied.*



## GENERAL DESCRIPTION

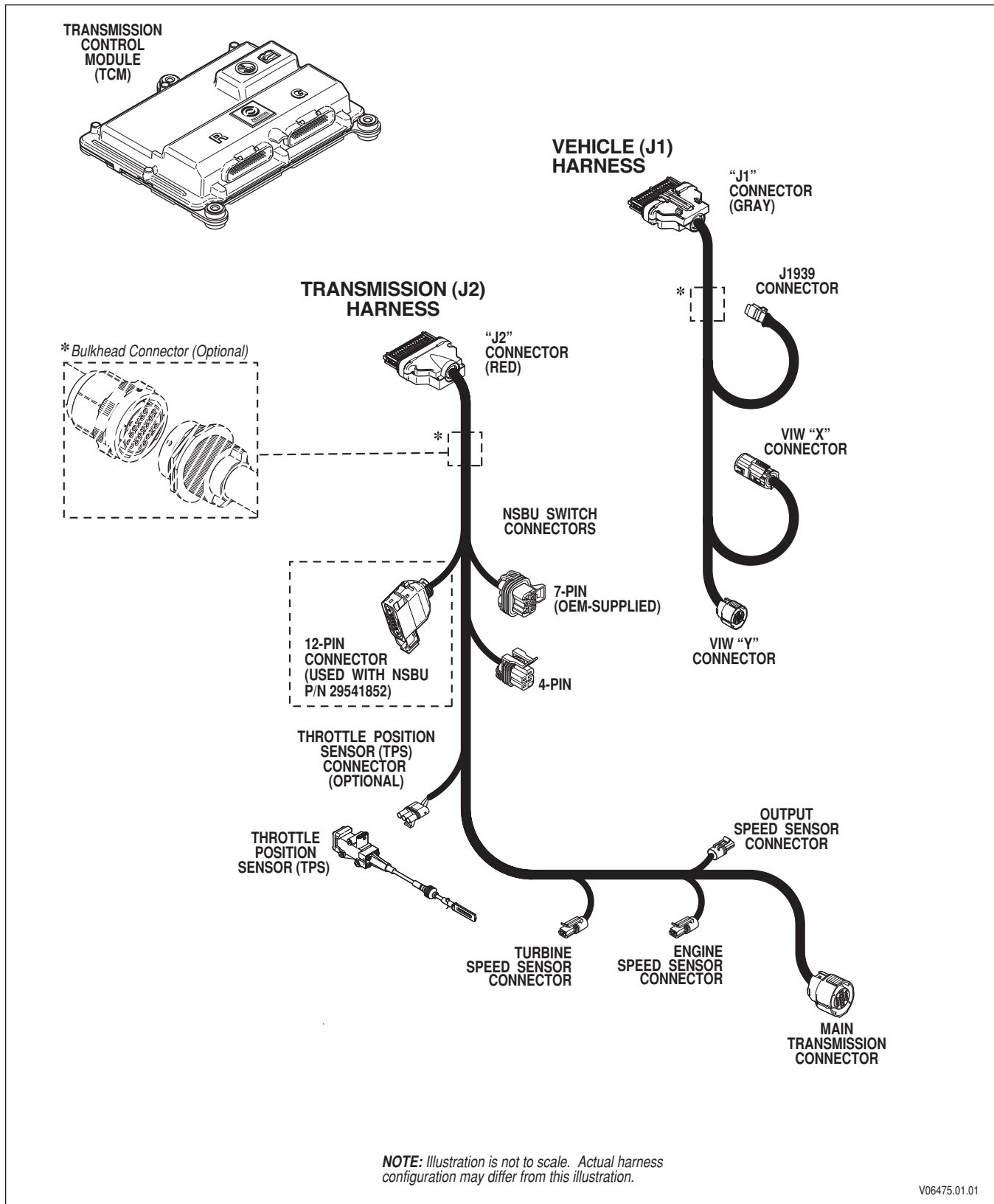


Figure 1-2. Electronic Control Components

## GENERAL DESCRIPTION

### 1-2. TRANSMISSION CONTROL MODULE (TCM)

The electronic control of the transmission is performed by a microcomputer. The microcomputer is an independent controller and is referred to as a Transmission Control Module (TCM). TCMs are available in both 12V and 24V configurations to match the configuration of the vehicle electrical system.

The TCM (Figure 1-3) receives and processes signals from various switches and sensors. The TCM determines shift sequences, shift timing, and clutch apply and release pressures. The TCM uses the information to control transmission solenoids and valves, supply system status, and provide diagnostic information.

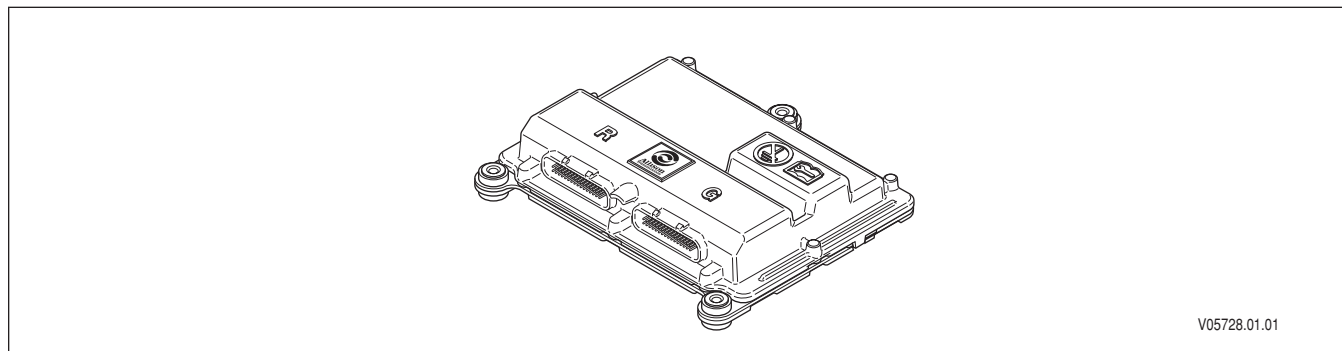


Figure 1-3. Transmission Control Module (TCM)

### 1-3. SHIFT SELECTOR

The vehicle is equipped with a lever-type shift selector (Figure 1-4). In addition to the lever assembly provided for the operator, other components associated with the shift selector are the manual selector valve in the main control valve body and an NSBU switch mounted on the selector shaft. Shift selector components (with the exception of the transmission selector shaft) are customer-supplied.

#### A. Shift Selector Range Positions

The operator chooses the transmission range by moving the selector lever to the appropriate gate position (Figure 1-4). When properly adjusted, the shifter gates prevent inadvertent shifting between ranges and correspond to the internal transmission detent positions. A positive detent is provided in the transmission to maintain the selector shaft in the selected position.

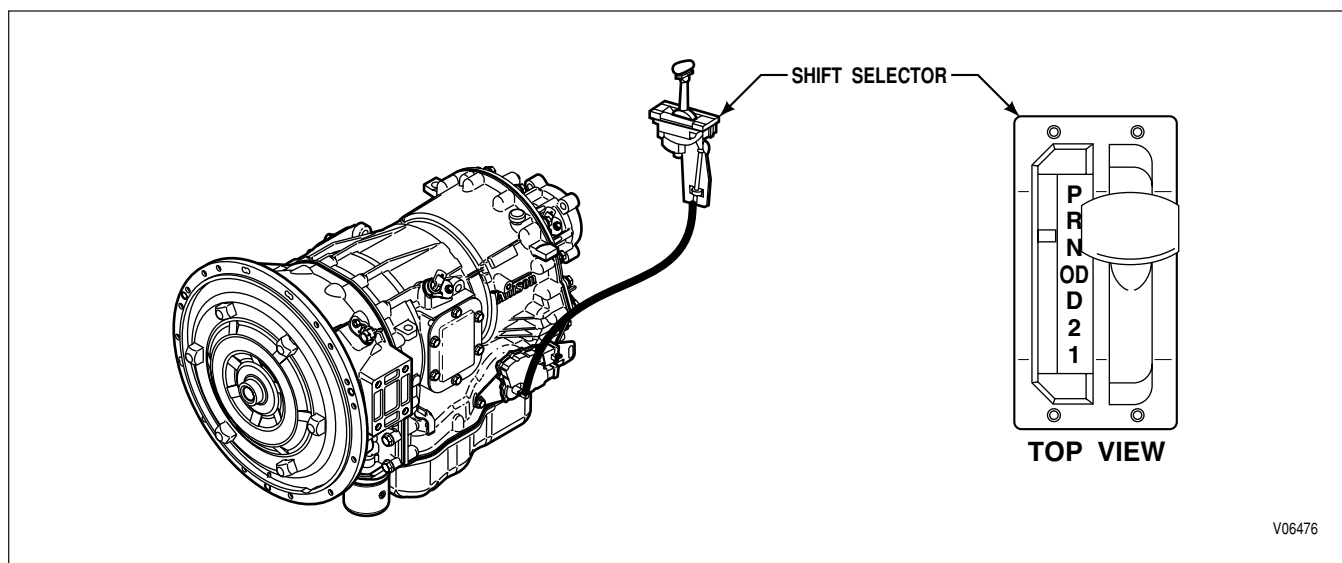


Figure 1-4. Typical Lever-Type Shift Selector

## GENERAL DESCRIPTION

The TCM shift calibration determines the available forward ranges for each selector position. Although specific installations vary, typical selector positions for the 1000 and 2000 Product Families are:

**P** — Park. Parking pawl or parking brake is engaged, if available. This position is not available on all shift selectors.

**R** — Reverse.

**N** — Neutral. May be used when starting the engine and for stationary operations. The NSBU Switch disables the starter switch if a range other than **N** (Neutral) or **P** (Park) is selected before starting the vehicle.

**OD** — Overdrive. The highest forward range used for normal driving. The transmission shifts to first range for starting, then automatically upshifts through the ranges (as operating conditions permit) until the highest range is attained.

**D, 2, 1** — Forward Range. The transmission shifts to first range for starting. The range selected on the shift selector is the highest range which will be attained during automatic shifting.

### B. Manual Selector Valve

The manual shift selector shaft is attached to the manual selector valve within the transmission main control valve body. The selector valve has three positions: Reverse, Neutral, and Forward.

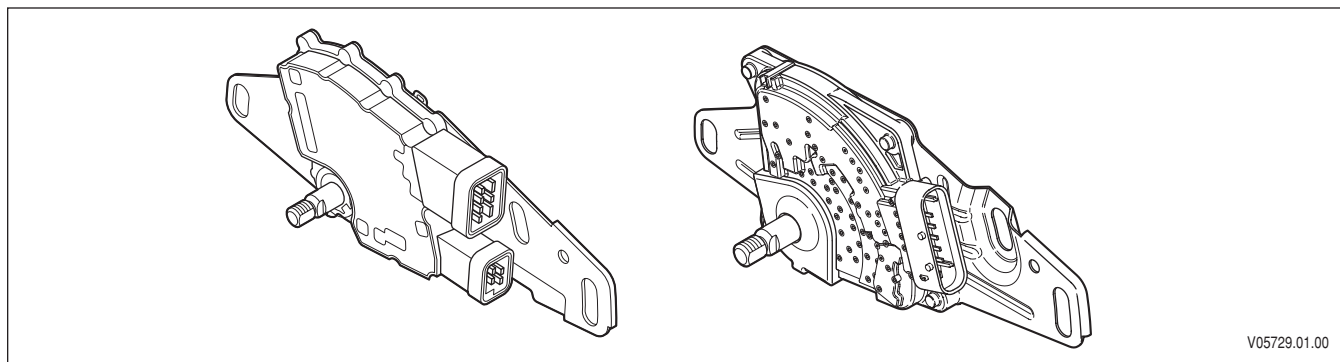
**NOTE:** *For transmissions equipped with a Park position, the selector valve remains in the Neutral position when the selector is moved to Park.*

The Neutral and Reverse selector valve positions (refer to Appendix H—Hydraulic Schematics) exhaust the C1 and C2 rotating clutches. By exhausting C1 and C2 clutches, forward range is inhibited. This provides the capability for the operator to override the electronically commanded ranges if **N** (Neutral) is required.

### C. NSBU Switch

The installation of a transmission-mounted neutral start/reverse signal switch is required. This switch, commonly called an “NSBU Switch” (Figure 1–5), mounts directly onto the transmission housing from the outside and detects the angular position of the shift selector shaft. This position is communicated to the TCM so that certain vehicle control functions can be coordinated with the position of the shift controls. The NSBU switch has redundant circuitry to alert the TCM in the event of a single wire or switch failure.

The neutral signal output of the NSBU switch is typically used as confirmation that the transmission is in **N** (Neutral) before the engine starter is engaged. The NSBU switch is interfaced to the starter circuit with weatherproof electrical connectors. The reverse signal provision may be used to activate vehicle back-up lights and/or reverse warning devices.



V05729.01.00

Figure 1–5. NSBU Switch

## GENERAL DESCRIPTION

### 1-4. THROTTLE POSITION SENSOR

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS (Figure 1-6) 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 TCM through the external harness. The voltage signal indicates the throttle position and, in combination with other input data, determines shift timing.

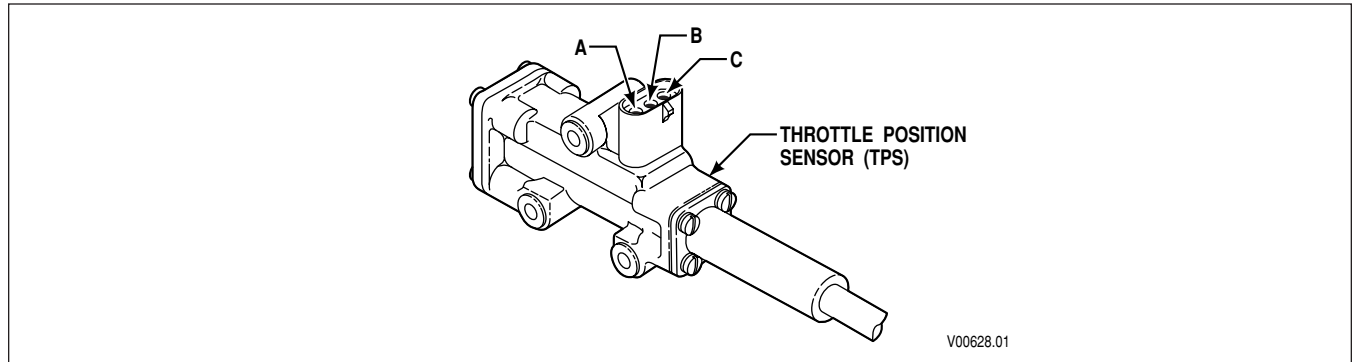


Figure 1-6. Throttle Position Sensor

### 1-5. SPEED SENSORS

There are three speed sensors available for use with 1000 and 2000 Product Families transmissions: the input (engine) speed sensor, the turbine speed sensor, and the output speed sensor (Figure 1-7). The speed sensors provide rpm information to the TCM. The speed ratios between the various sensors allow the TCM to determine the transmission operating range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the best possible shift quality.

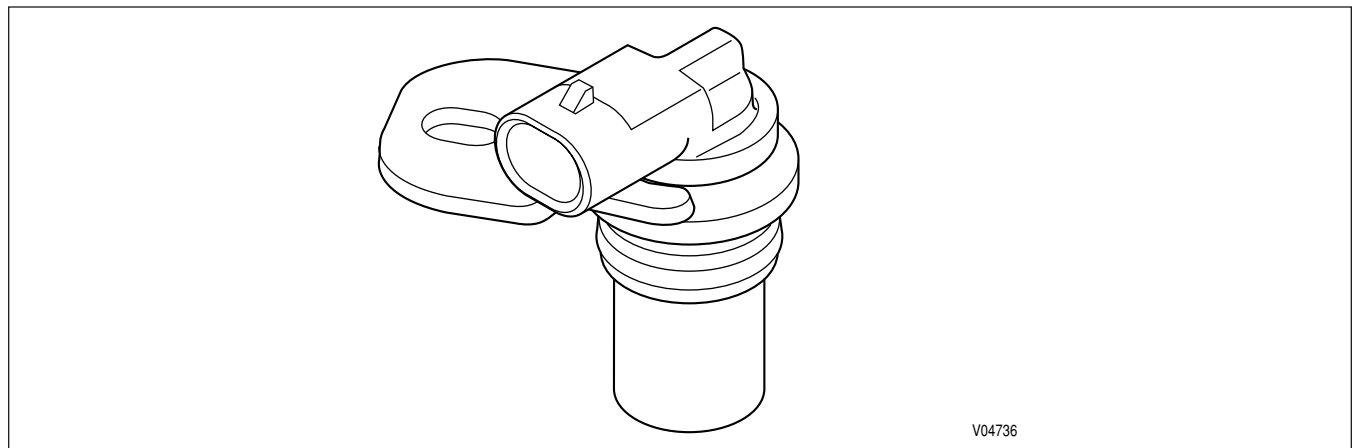


Figure 1-7. Typical Speed Sensor

The speed sensors are variable reluctance devices which convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing which is mounted adjacent to a rotating ferrous member (such as a gear tooth). Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (such as a gear tooth) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The TCM calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

## GENERAL DESCRIPTION

**NOTE:** *Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*

### A. Input (Engine) Speed Sensor

The input speed sensor is externally mounted in the torque converter housing directed at the ribs protruding from the torque converter. The input speed sensor connector should be positioned at approximately four o'clock, as viewed from the left side of the transmission (Figure 1-8).

### B. Turbine Speed Sensor

The turbine speed sensor is externally mounted in the main housing directed at the tone wheel or PTO drive gear attached to the rotating clutch module. The turbine speed sensor connector should be positioned at approximately three o'clock, as viewed from the left side of the transmission (Figure 1-8).

### C. Output Speed Sensor

The output speed sensor is externally mounted in the rear cover and directed at the teeth of a tone wheel splined to and rotating with the output shaft. The output speed sensor connector should be positioned at approximately five o'clock, as viewed from the left side of the transmission (Figure 1-8).

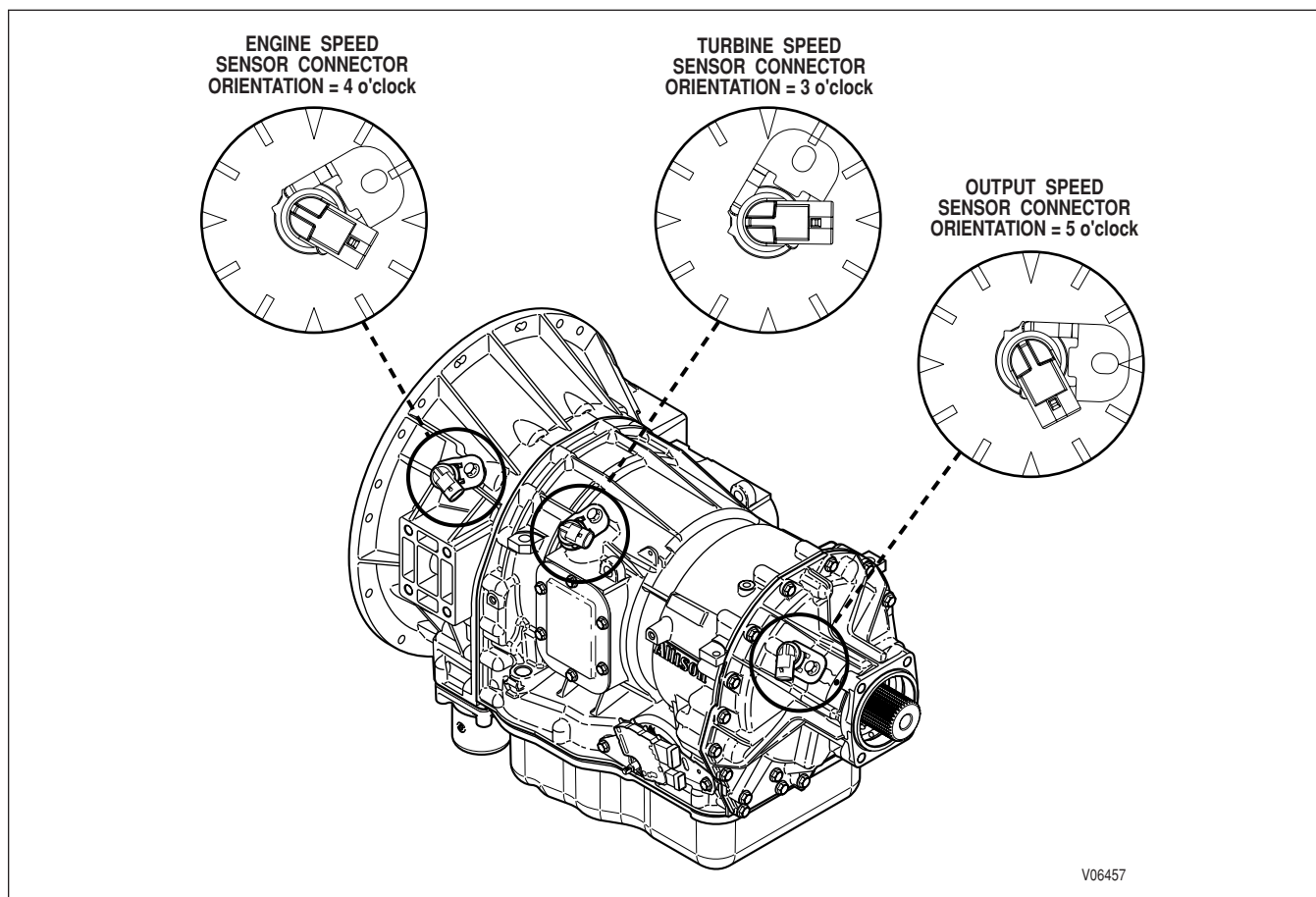


Figure 1-8. Speed Sensor Connector Orientation

## GENERAL DESCRIPTION

### 1-6. CONTROL VALVE ASSEMBLY

The hydraulic control valve assembly (Figure 1-9) governs fluid flow to the clutches (including the torque converter clutch). Solenoids, actuated by the TCM, control valve movement.

The control valve assembly consists of two components. The main valve body contains the trim valves, the TCC valve, the exhaust backfill valve, and the control main relief valve. The shift valve body contains the shift valves, the control main pressure valve, and the manual selector valve. The control valve assembly attaches to the bottom of the gearbox module and is enclosed by the oil pan. An internal wiring harness connects the solenoids and PSM to the main transmission connector and external wiring harness.

#### A. Modulated Main Pressure

Modulated main pressure was added to the 1000 and 2000 Product Families in the second quarter of 2003. Starting with DEE software level, the TCM will autodetect if the hardware is present. Main pressure is reduced by utilizing an additional on/off solenoid ("G") that is located in the control valve body assembly. The G solenoid body is bolted to the revised main valve body. Main pressure will be reduced under various conditions such as low throttle, low torque, low engine speeds, and low output speeds. The primary benefit of modulating main pressure is to increase cooler flow at low engine speeds.

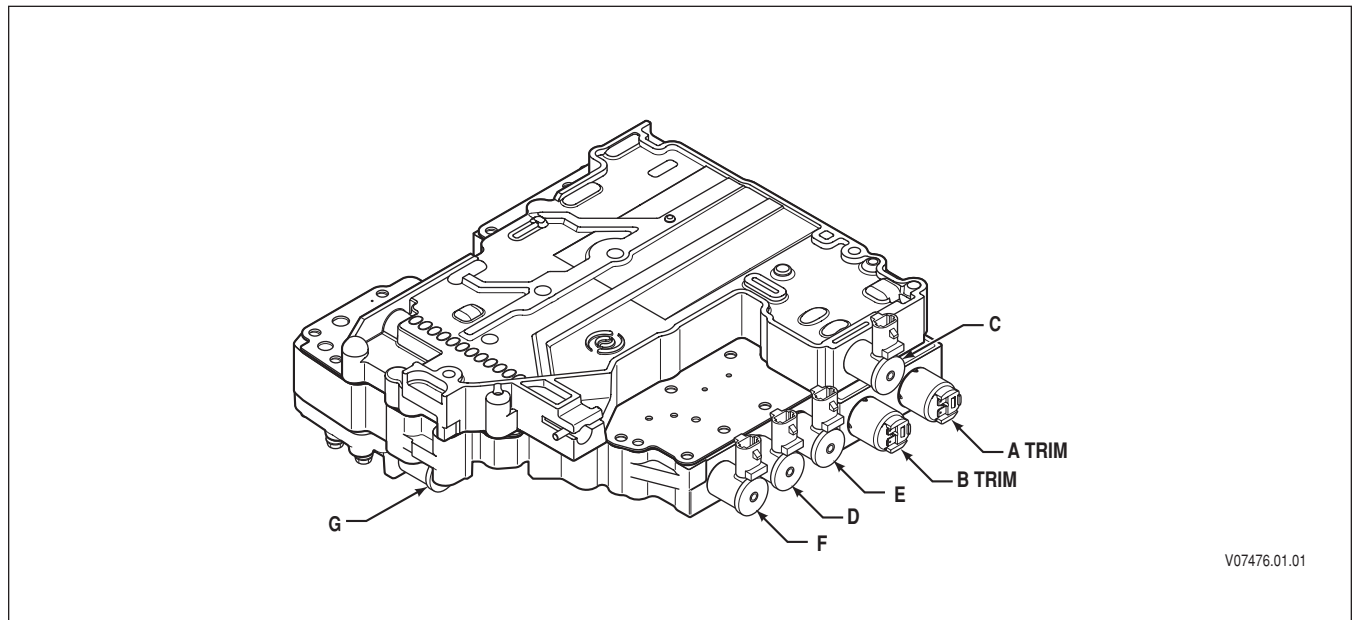


Figure 1-9. Control Valve Assembly

### 1-7. WIRING HARNESSES

#### A. External Wiring Harness (Figure 1-10)

The external wiring harness requirements are typically met through the use of two separate harnesses — one connecting the TCM to the transmission, throttle position sensor, NSBU switch, and speed sensors; another connecting the TCM to the Scan Tool (ST) and other vehicle interfaces. Each harness may be a single piece or may be divided into two segments joined by bulkhead connectors. All wiring harnesses and mating connectors are customer-supplied.

## GENERAL DESCRIPTION

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

- Repair parts for the internal wiring harness 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 through the vehicle OEM. The OEM is responsible for warranty on these parts.

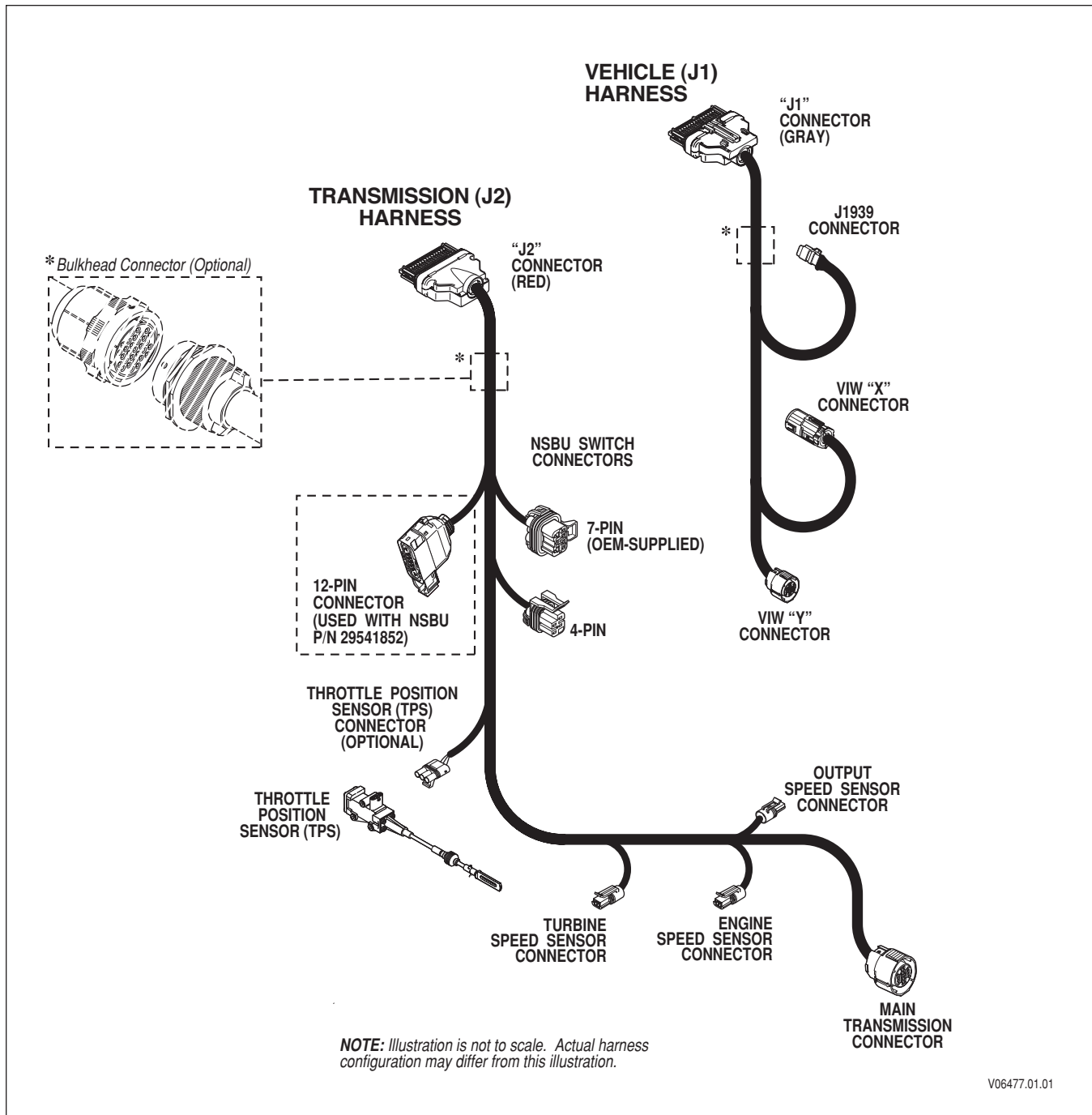


Figure 1-10. Typical External Wiring Harnesses

## GENERAL DESCRIPTION

### B. Internal Wiring Harness (Figure 1-11)

An internal wiring harness connects the shift solenoids, clutch trim solenoids, torque converter clutch solenoid, pressure switch manifold, and temperature sensor to the external harness leading to the TCM.

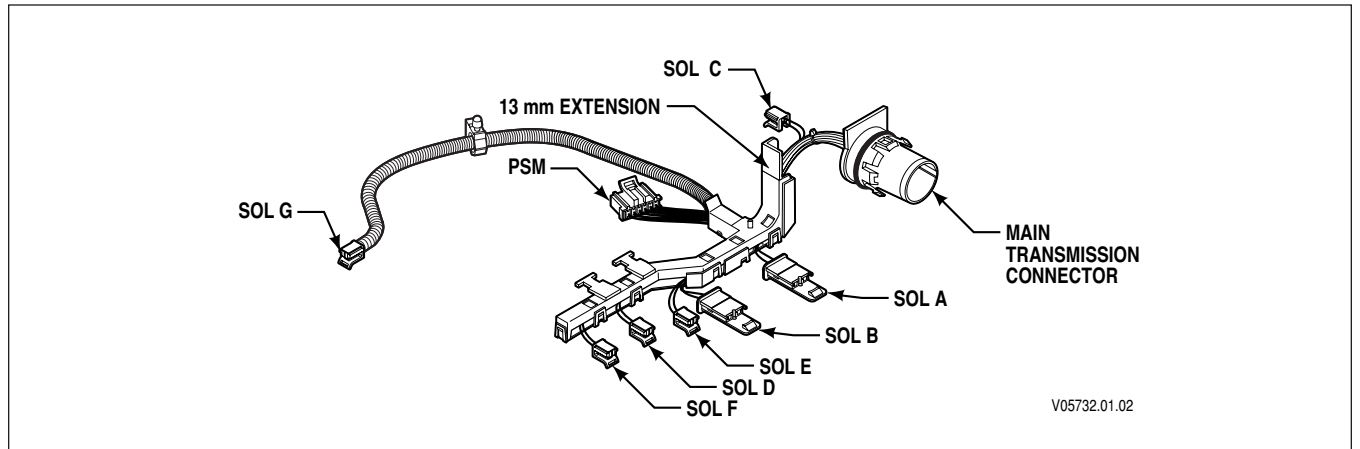


Figure 1-11. Typical Internal Wiring Harness



## GENERAL DESCRIPTION

### NOTES

## SECTION 2—DEFINITIONS AND ABBREVIATIONS

### 2-1. CHECK TRANS LIGHT

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, vehicle, and transmission. To do this, the TCM turns on the **CHECK TRANS** light on the instrument panel, which notifies the operator that a Diagnostic Trouble Code (DTC) has been stored.

Each time the engine is started, the TCM will illuminate the **CHECK TRANS** light, then turn it off after a few seconds. This is a circuit check to verify that the lamp and wiring are in proper working order. Illumination of the **CHECK TRANS** light at any time after start-up indicates that the TCM has set a DTC. The Scan Tool is used to verify that the TCM has set a DTC (see Paragraph 2-5). While the **CHECK TRANS** light is on, upshifts and downshifts may be restricted and direction changes (**D-R**, **R-D**) may not occur. The torque converter clutch is inhibited when transmission shifting is restricted or during any critical transmission malfunction.

The 1000 and 2000 Product Families transmissions DTCs are latching DTCs. When a failure condition is detected, the DTC set by the TCM remains active for the entire time the ignition is on. When the ignition is turned off and then on again, the transmission DTCs will reset and the TCM will recheck for the failure condition. If the failure condition is not present, the previously set DTC will remain in history; the **CHECK TRANS** light will turn off after the circuit check, and the transmission will function normally unless another failure occurs. This feature allows the vehicle to be driven to a service outlet.

### 2-2. SCAN TOOL INHIBITS

The following inhibit information may be displayed on the Allison DOC™ For PC (Scan Tool), depending on the TCM software level. If TCM software does not support one of the inhibits listed below, a N/A will be shown in the information box.

If an inhibit has occurred since the last DTC was cleared, the inhibit state will indicate **ON** and will stay **ON** until the next **manual DTC** clear with the Scan Tool. These inhibits do not turn **OFF** after a specified number ignition cycles.

The range inhibit light will illuminate and/or an inhibited state will be shown on the Scan Tool when the transmission is inhibited to Neutral for the following reasons:

- **Low Main Pressure**

If the transmission pressure switches do not indicate transmission pressurized at start-up, shifts-to-range may be inhibited and the range inhibit light will illuminate. The Scan Tool will indicate an active inhibit.

Common causes are transmission low on fluid, transmission filter has just been changed, or pan has been removed and fluid recently drained.

May produce P0701.

- **Transfer Case Neutral**

If the transfer case is shifted into neutral while the transmission is in drive or reverse at a speed above idle, the transmission will continue to command range until the output speed is reduced to a point where neutral range is commanded. The range inhibit light will illuminate and the Scan Tool will indicate an active inhibit.

- **Diagnostic Active**

This indicates that an active diagnostic code is set and that the **CHECK TRANS** light should be illuminated. In some failure modes, Reverse cannot and will not be commanded. If Reverse is selected during these failure modes a range inhibit light will illuminate in Reverse.

During diagnostic responses, Neutral-to-Range Inhibits and Direction Change Inhibits continue to operate, but they may latch under certain conditions. In these cases, shutting down ignition and waiting for at least 5 seconds before re-starting will clear the inhibit condition. The Scan tool will indicate an active inhibit.

## DEFINITIONS AND ABBREVIATIONS

- **Auto Neutral for PTO**

Neutral-to-Drive and Neutral-to-Reverse shifts will be inhibited to neutral and the Scan Tool will show an inhibited state when TCM detects that auto neutral function input is active.

- **Reverse Enable**

Neutral-to-Reverse shifts will be inhibited to neutral and the Scan Tool will show an inhibited state when no input is detected from dash or floor mounted reverse enable switch when selecting reverse range. The Scan Tool will indicate an active inhibit.

This function is only used in European transit and tour buses applications.

- **Refuse Packer Step Switch**

Transmission operation is limited to only 1st range. Neutral-to-reverse shifts will be inhibited to neutral and the Scan Tool will show an inhibited state when input is detected from a step switch indicating that personnel is present on rear step platform.

- **Auxiliary Function Range Inhibit**

Neutral-to-Drive and Neutral-to-Reverse shifts will be inhibited to neutral and the Scan Tool will show an inhibited state when input is detected from an auxiliary switch or device. This inhibit will remain active until the auxiliary switch input is shut off and range is reselected.

- **PTO Neutral Lockup**

The Scan Tool will show an inhibited state when Neutral Lockup is active and range shifts are being inhibited to neutral. When the selector is moved, lockup is released and the inhibit clears.

- **Engine Speed**

Neutral-to-Drive and Neutral-to-Reverse shifts will be inhibited to neutral and the range inhibit light will illuminate if the Engine Speed is greater than a calibrated value (1400 rpm for medium duty non-emergency vehicles). The Scan Tool will indicate an active inhibit.

- **Output Speed**

Reverse-to-Drive, Drive-to-Reverse, and Neutral-to-Reverse shifts initiated above 300 rpm of output speed will be inhibited to neutral and the range inhibit light will illuminate. The Scan Tool will indicate an active inhibit.

- **Throttle**

Reverse-to-Drive, Drive-to-Reverse, Neutral-to-Drive, and Neutral-to-Reverse shifts where throttle position is greater than 25 percent will be inhibited to neutral and the range inhibit light will illuminate. The Scan Tool will indicate an active inhibit.

- **NSBU Function or Alignment**

Reverse-to-Drive, Drive-to-Reverse, Neutral-to-Drive, and Neutral-to-Reverse shifts will be inhibited to neutral and the range inhibit light will illuminate when a NSBU failure or misalignment is detected. Common cause would be an error in the four-bit NSBU switch input signal that is sent to the TCM. The Scan Tool will indicate an active inhibit.

- **NSBU RPS Disagree**

Reverse-to-Drive, Drive-to-Reverse, Neutral-to-Drive, and Neutral-to-Reverse shifts will be inhibited to neutral and the range inhibit light will illuminate when the reverse pressure switch status is in the incorrect state when compared to the NSBU switch state. The Scan Tool will indicate an active inhibit.

- **MSV Mis-Alignment/Unable to detect ratio after shift to range**

If the range verification test fails to detect turbine speed pull-down or valid gear ratio when shifting to either forward or reverse range from neutral, the transmission will shift back to a neutral condition and the range inhibit light will illuminate.

## DEFINITIONS AND ABBREVIATIONS

Conditions that may cause this include: Attempts to shift the transmission from Neutral-to-Drive or Neutral-to-Reverse with the transfer case in neutral; transmission low on fluid; misadjustment in the NSBU or Selector Linkage; turbine or output speed sensor failure that may prevent the pull down test/ratio test from passing; solenoid A or B hydraulic failures; and possibly failed range clutch (C1 or C5 for 1st, C3 or C5 for Reverse).

The Scan Tool will indicate an active inhibit response.

- **Wheel Spin or Lock**

When the TCM detects that wheel lock or spin is occurring, the TCC is disengaged and a lock-to-range response is commanded for 6 seconds. The Scan Tool will indicate an active inhibit response.

### 2-3. SCAN TOOL (Allison DOC™ For PC) (Figure 2-1)

The current Scan Tool (ST) is the PC Tool Software Allison DOC™ For PC, which is available through Kent-Moore Heavy-Duty Division. When installed on a Windows® PC, the Allison DOC™ For PC transmits and receives data to and from the TCM via the vehicle data communications link, processes the data, and displays appropriate information. Use Allison DOC™ For PC during installation checkout and troubleshooting.

For more details on Allison DOC™ For PC features, see information in Appendix M.

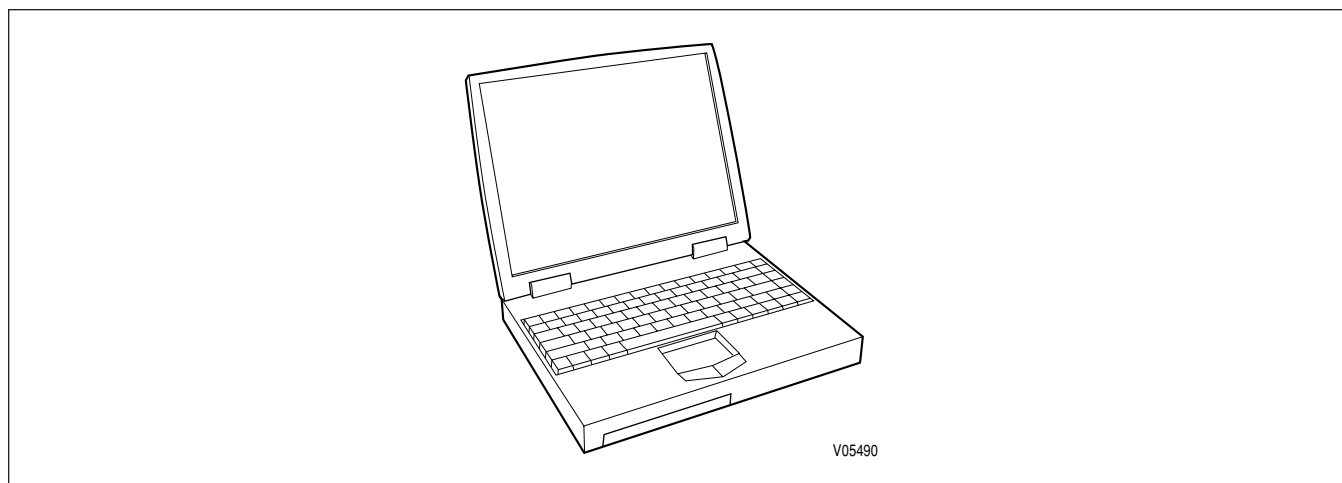


Figure 2-1. Scan Tool