

Troubleshooting Manual

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Allison Transmission **ALLISON 4TH GENERATION CONTROLS**

1000 and 2000 Product Families



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FOREWORD — How to Use This Manual

This manual provides troubleshooting information for Allison Transmission 1000 and 2000 Product Families transmissions. Service Manual SM4006EN, Mechanics Tips MT4007EN, 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. For 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

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1000 and 2000 Product Families Service Literature

Publication Name	Publication No.
Allison DOC™ For PC—Service Tool User Guide	GN3433EN
Automatic Transmission Fluid Technician's Guide	GN2055EN
*Mechanic's Tips	MT4007EN
*In-Chassis Maintenance	GN4008EN
*Emergency Vehicle Series Operator's Manual	OM3761EN
*Highway Series Operator's Manual	OM3757EN
*Rugged Duty Series Operator's Manual	OM3759EN
*Motorhome Series Operator's Manual	OM3364EN
*Pupil Transport/Shuttle Series Operator's Manual	OM3758EN
*Bus Series 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	PO4009EN
Service Manual	SM4006EN
Troubleshooting Manual—Allison 4 th Generation Controls	TS3977EN
* Also Available On The Internet At www.allisontransmission.com	

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SECTION 1—GENERAL DESCRIPTION

1-1. TRANSMISSION

The 1000 and 2000 Product Families Allison 4th Generation 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 up to six forward speeds, neutral, and reverse. The fifth and sixth ranges are overdrive gear ratios. The 1000 and 2000 Product Families incorporates a variety of standard and optional design features.

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

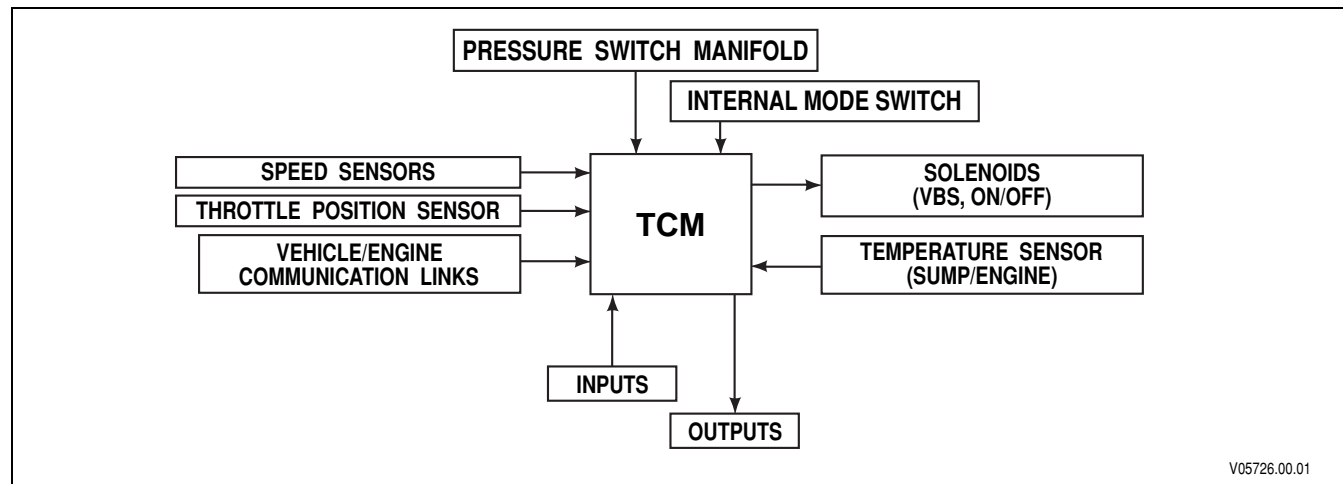


Figure 1-1. Transmission Control Module Block Diagram

Figure 1-2 shows the electronic control components.

Electronic Controls consist of the following elements:

- Remote 12 volts or 24 volts 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)
- Internal Mode Switch (IMS)
- Pressure Switch Manifold (PSM)
- Wiring Harnesses

NOTE: All external harnesses are OEM-supplied.

GENERAL DESCRIPTION

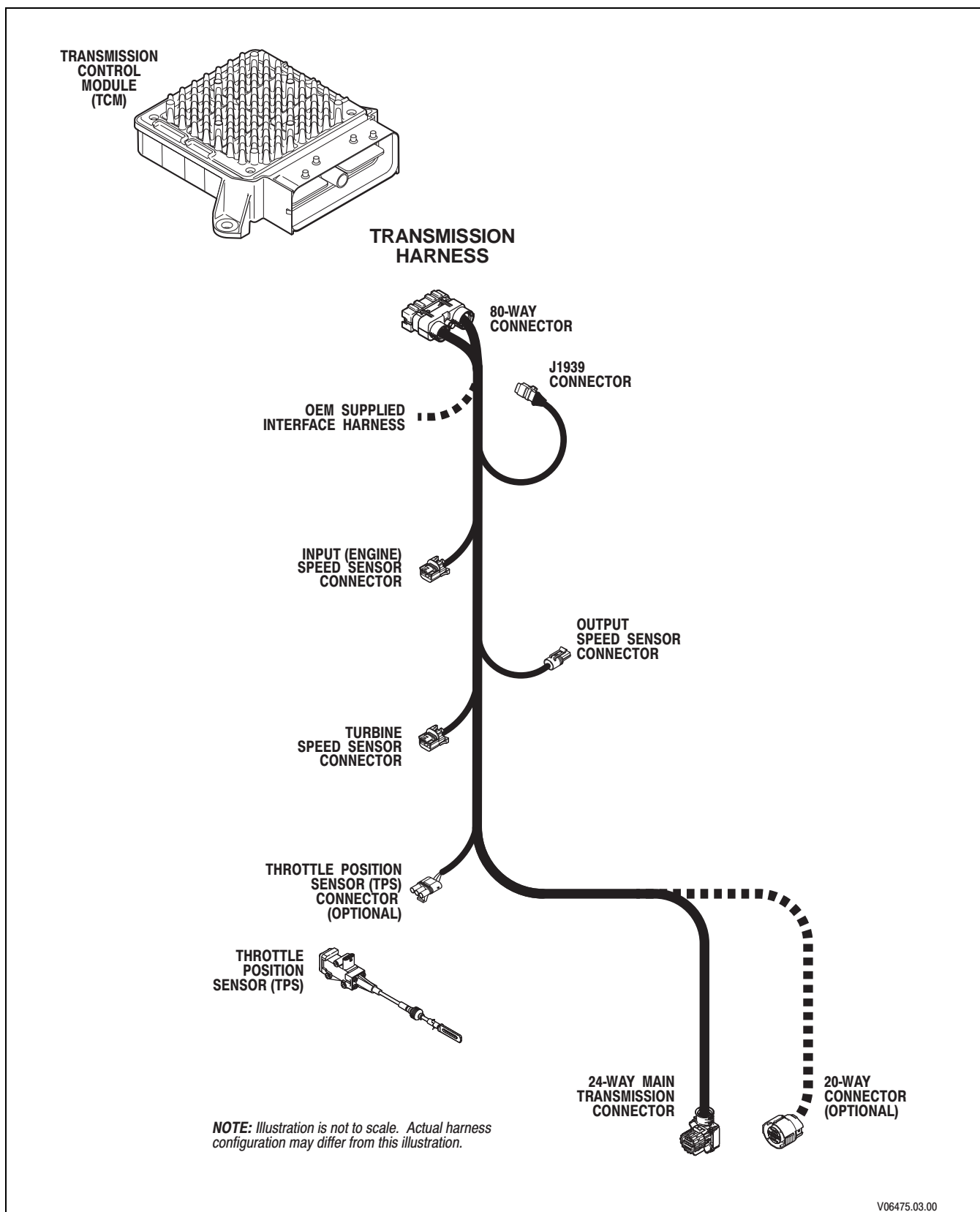


Figure 1–2. Electronic Control Components

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 12 volts and 24 volts configurations to match the configuration of the vehicle electrical system.

The TCM (refer to 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.

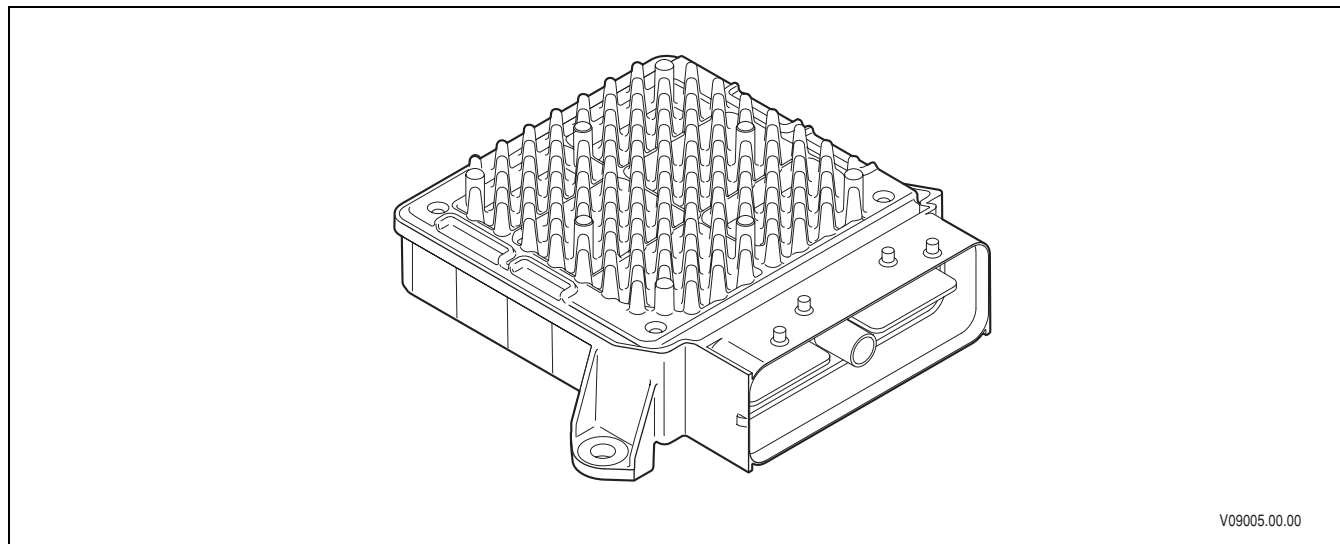


Figure 1–3. Transmission Control Module (TCM)

1–3. SHIFT SELECTOR

The vehicle is equipped with a lever-type shift selector (refer to 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 Internal Mode Switch (IMS) mounted on the selector shaft inside the transmission oil pan. 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 (refer to 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.

GENERAL DESCRIPTION

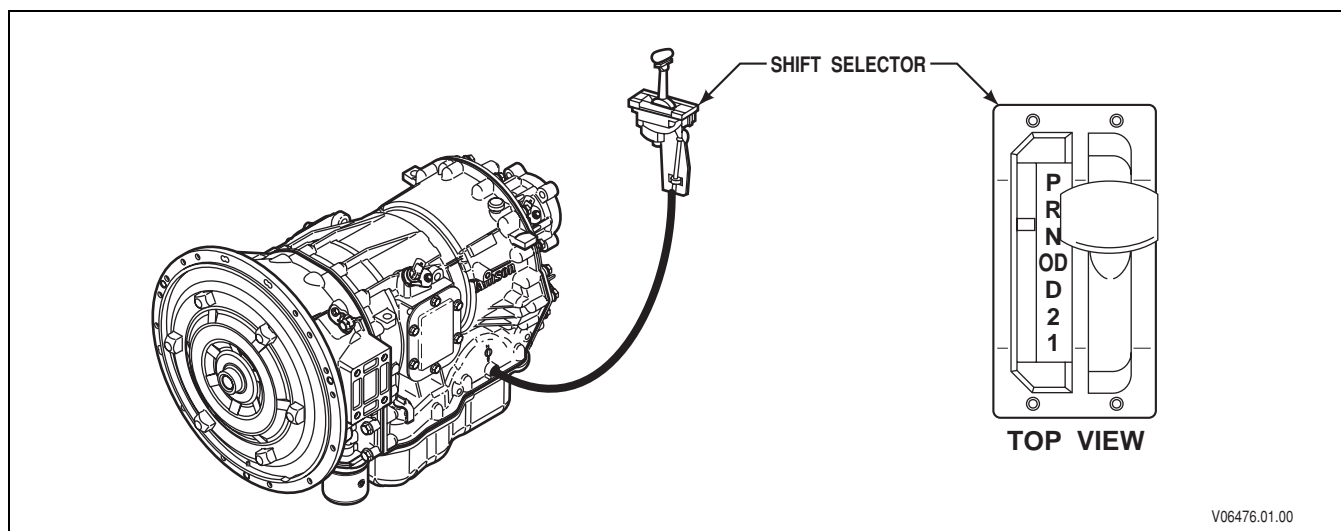


Figure 1-4. Typical Lever-Type Shift Selector

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.

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 (on GM truck applications, a position **M** is used for Tap Up/Tap Down functionality).

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 **P (Park)** position, the selector valve remains in the neutral position when the selector is moved to **P (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 neutral is required.

GENERAL DESCRIPTION

C. Internal Mode Switch (IMS)

An internally-mounted switch, commonly called an Internal Mode Switch or IMS (refer to Figure 1–5), mounts inside the transmission oil pan at the shift selector shaft. The IMS 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 neutral signal output of the IMS is typically used as confirmation that the transmission is in neutral before the engine starter is engaged.

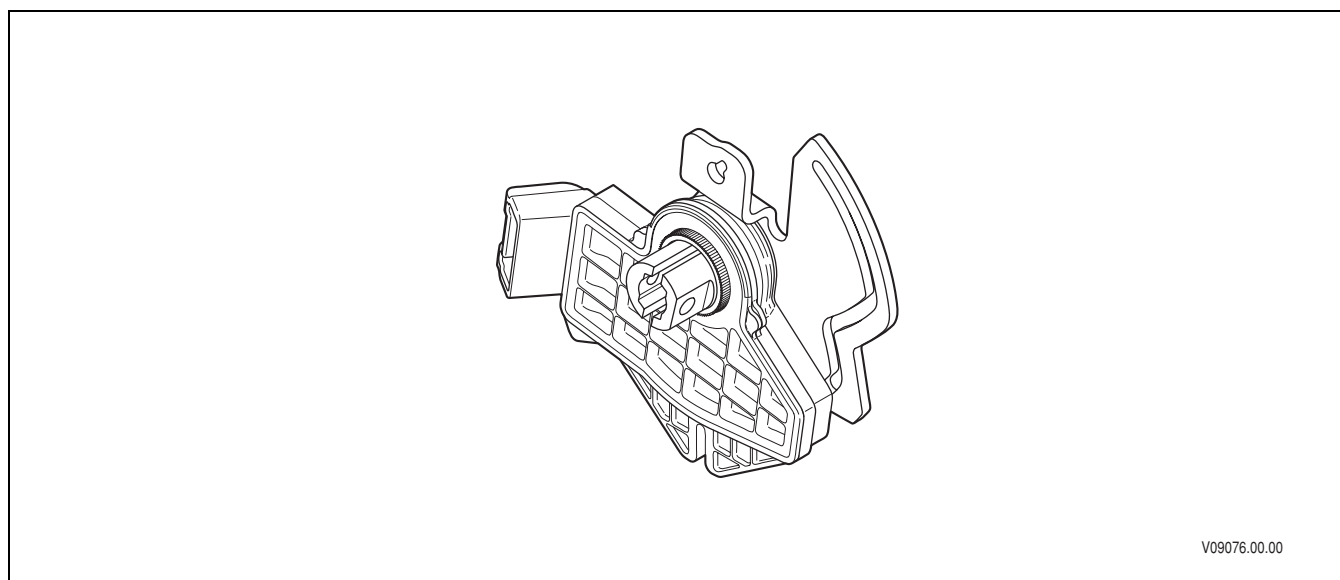


Figure 1–5. Internal Mode Switch (IMS)

1–4. THROTTLE POSITION SENSOR (TPS)

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS (refer to 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.

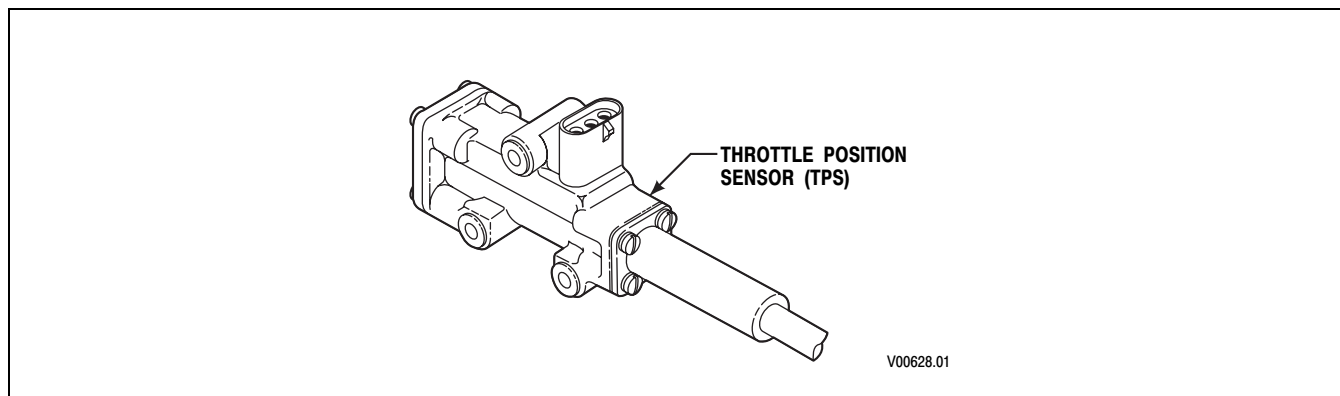


Figure 1–6. Throttle Position Sensor (TPS)

GENERAL DESCRIPTION

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 (refer to 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.

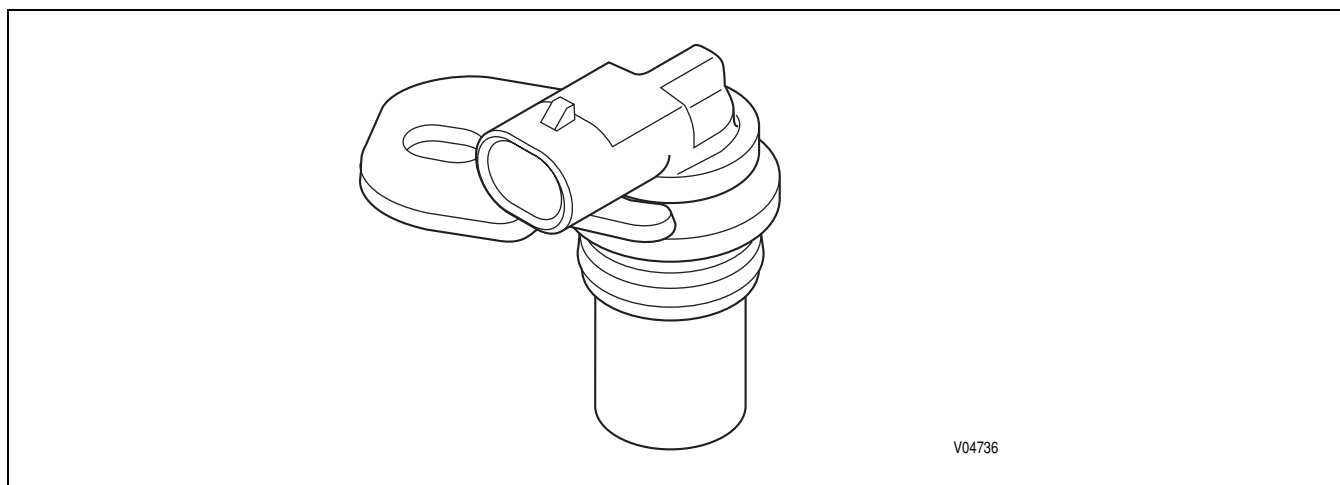


Figure 1-7. Typical Speed Sensor

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 15 volts 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.

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 (refer to 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 (refer to Figure 1-8).

GENERAL DESCRIPTION

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 (refer to Figure 1–8).

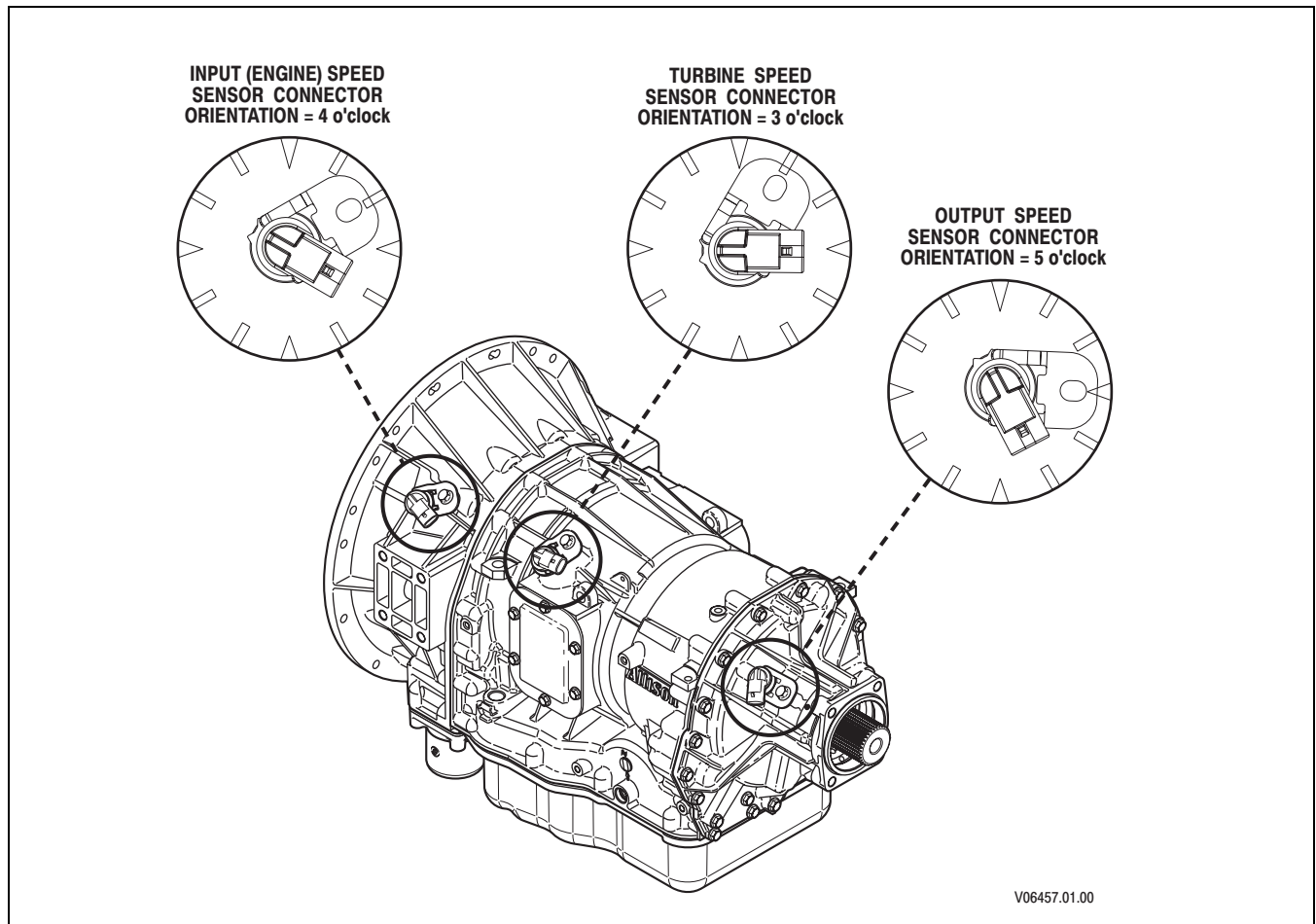


Figure 1–8. Speed Sensor Connector Orientation

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 and the control valve body. The main valve body contains the Pressure Control Valves (PCVs), the Torque Converter Clutch (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 Pressure Switch Manifold (PSM) to the main transmission connector and external wiring harness.

GENERAL DESCRIPTION

A. Main Modulation

Main pressure is reduced by using an on/off Main Mod solenoid that is located in the control valve body assembly. The Main Mod solenoid body is bolted to the 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 coolant flow at low engine speeds.

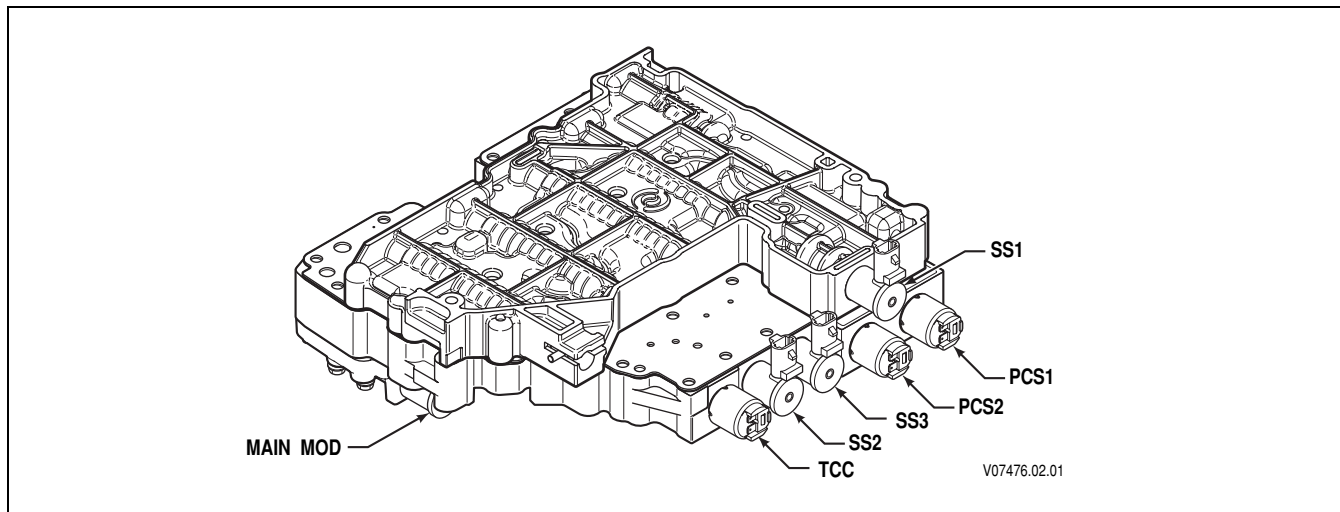


Figure 1–9. Control Valve Assembly

1–7. WIRING HARNESS

A. External Wiring Harness

The external wiring harness (refer to Figure 1–10) requirements are typically met through the use of a single harness with one branch connecting the TCM to the transmission, TPS, IMS, and speed sensors; another branch connecting the TCM to Allison DOC™ For PC–Service Tool and other vehicle interfaces. All wiring harnesses and mating connectors are OEM-supplied.

NOTE: *Repair parts for the external harness and external harness components must be obtained through the vehicle OEM. The OEM is responsible for warranty on these parts.*

GENERAL DESCRIPTION

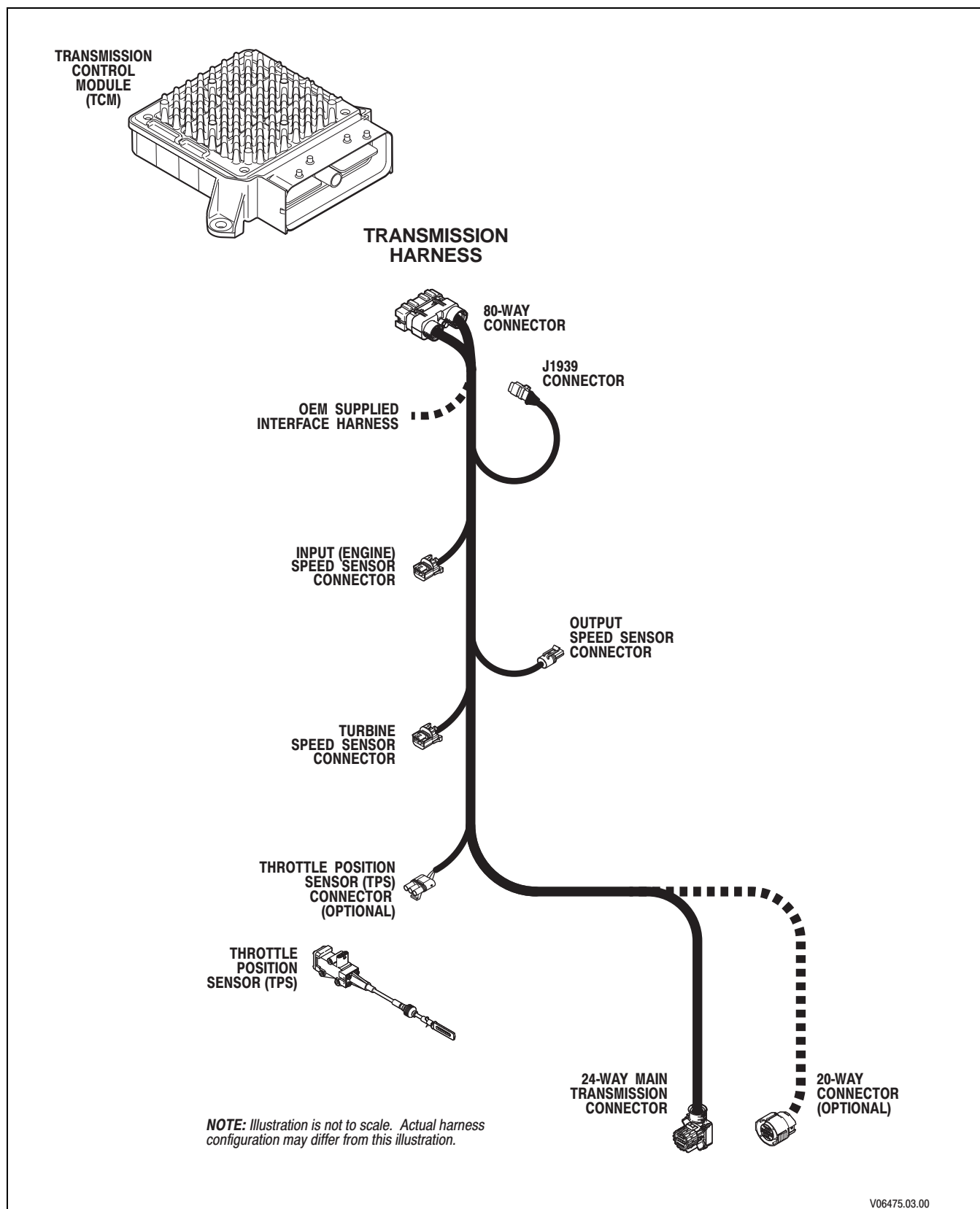


Figure 1-10. Typical External Wiring Harnesses

GENERAL DESCRIPTION

B. Internal Wiring Harness

An internal wiring harness (refer to Figure 1–11 and Figure 1–12) connects the Shift Solenoids (SS1, SS2, SS3), Pressure Control Solenoids (PCS1, PCS2), Torque Converter Clutch (TCC) solenoid, Internal Mode Switch (IMS), Pressure Switch Manifold (PSM), and temperature sensor to the external harness leading to the TCM.

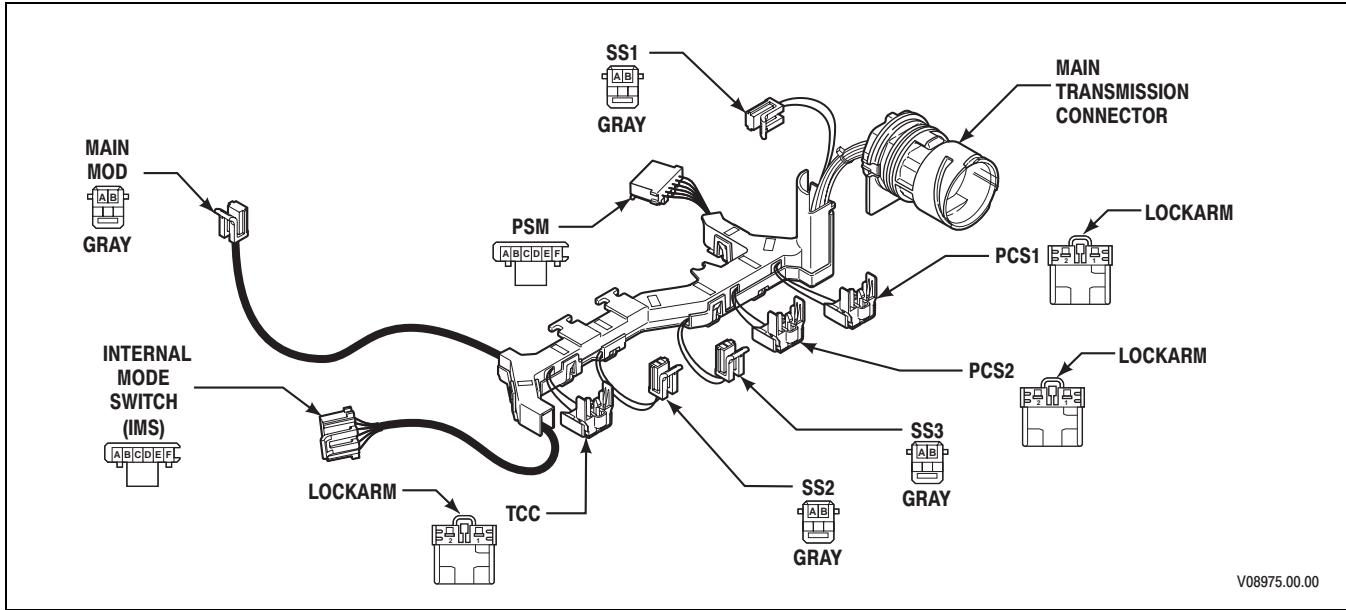


Figure 1–11. Typical Internal Wiring Harness (24-Way Connector)

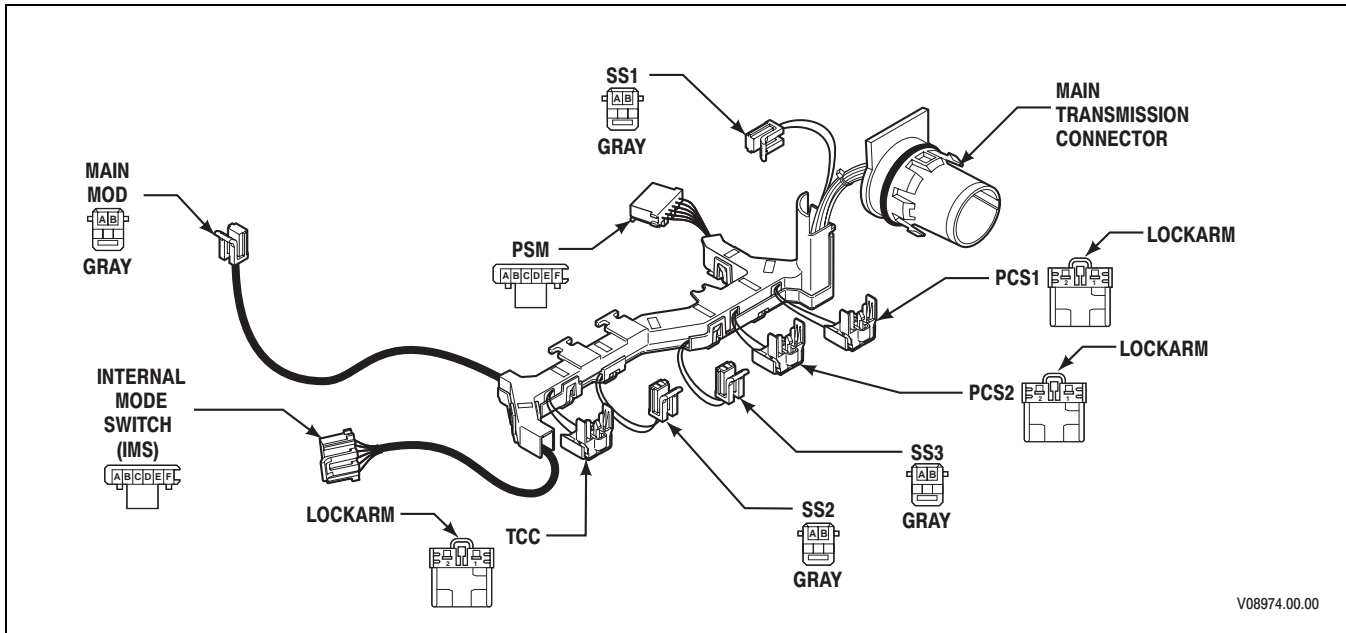



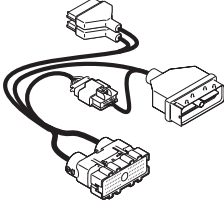
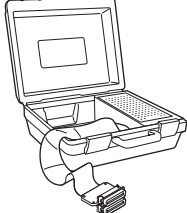
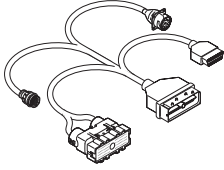
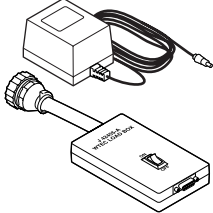
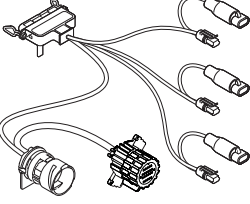
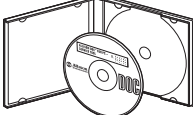
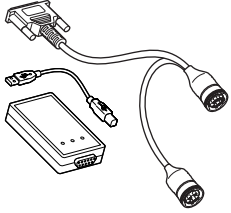
Figure 1–12. Typical Internal Wiring Harness (20-Way Connector for GM Applications Only)

GENERAL DESCRIPTION

1-8. SPECIAL ELECTRONIC/ELECTRICAL TOOLS

All tools listed are essential for overhaul, maintenance, and/or recalibration of the 1000 and 2000 Product Families electronic and electrical systems. The tools listed below are available for purchase from SPX/Kent-Moore.

Table 1-1. Essential Tools

	<p>J-34520-A Digital Volt/Ohmmeter (DVOM)</p>		<p>J-47275 TCM Breakout Harness Adapter <i>NOTE: Used with J-39700. Refer to Figure 5-2.</i></p>
	<p>J-39700 Universal Breakout Box</p>		<p>J-47276 “T” Breakout and TCM Reflashing Harness</p>
	<p>J-42455-A Load Box</p>		<p>J-47278 1000 and 2000 Product Families Breakout Harness <i>NOTE: Used with J-39700. Refer to Figure 5-3.</i></p>
	<p>J-44950 Allison DOC™ For PC-Service Tool <i>NOTE: J-44950 is superseded for each new release of Allison DOC™ For PC-Service Tool.</i></p>		<p>J-47943 - DPA4 USB Translator Device Kit or J-47943-A - DPA4 Plus USB Translator Device Kit <i>NOTE: Support for the J1850 communication protocol is only available on the J-47943-A.</i></p>

GENERAL DESCRIPTION

Table 1-1. Essential Tools (cont'd)

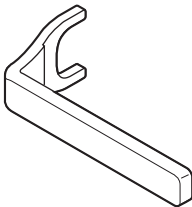
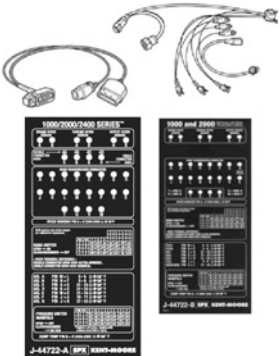
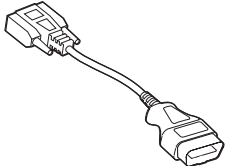
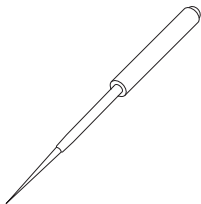

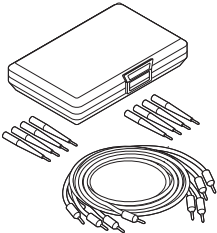
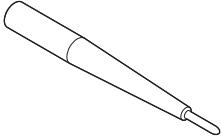
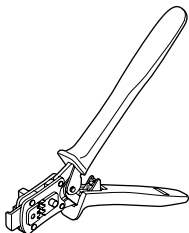
	<p>J-47944 1000 and 2000 Product Families Main Transmission Connector Removal Tool</p>		<p>J-44722-B NOTE: The J-44722-B Kit includes the J-44722-2 Breakout Cable, the J-46971 Single Connector NSBU Breakout Adapter Cable, the J-44722-1B Overlay, and the J-44722-3 Overlay (for pick-up trucks).</p>
	<p>J-47949 or J-47949-A GMLAN Cable</p>		

Table 1-2. Available Tools

	<p>J-38125-12A Terminal Remover (80-way connector) GM P/N: 12094429</p>		<p>J-44722-3 Overlay NOTE: J-44722-3 overlay is for pick-up truck use only. The J-44722-3 is included in the J-44722-B Kit.</p>
	<p>J-39197-A Jumper Kit</p>		<p>J-47277 Terminal Probe NOTE: J-47277 is now included in the J-39197-A Kit.</p>

GENERAL DESCRIPTION

Table 1-2. Available Tools

	<p>Molex PremiumGrade™</p>
	<p>Current</p>
	<p>Molex P/N: 63811-6000 SPX P/N: N/A</p>
	<p>Previous</p>
	<p>Molex P/N: 63811-2700 SPX P/N: J-47139</p>
	<p>Crimper ServiceGrade™</p>
<p>Current</p>	
<p>Molex P/N: 64016-0133 SPX P/N: N/A</p>	
<p>Previous</p>	
<p>Molex P/N: N/A SPX P/N: N/A</p>	

GENERAL DESCRIPTION

NOTES