1999 AUTOMATIC TRANSMISSIONS

Hydra-Matic 4T40-E & 4T45-E Electronic Controls

APPLICATION

4T40-E & 4T45-E TRANSAXLE APPLICATIONS

Vehicle Application (Body Code)	Transaxle Model
2.2L, 2.4L & 3.1L Models	
Alero & Grand Am (N)	4T40-E
Cavalier & Sunfire (J)	4T40-E
Cutlass & Malibu (N)	4T40-E
3.4L Models	
Alero & Grand Am (N)	4T45-E

DESCRIPTION & OPERATION

The Hydra-Matic 4T40-E and 4T45-E use 2 electronic shift solenoids, controlled by Powertrain Control Module (PCM), to control shifting and a pressure control solenoid to control hydraulic pressure. Torque Converter Clutch (TCC) solenoid is a Pulse Width Modulated (PWM) solenoid which controls TCC apply and release. Each solenoid is turned on or off by the PCM. PCM includes on-board self-diagnostics. This helps identify which components or circuits may need further testing.

Each solenoid either holds hydraulic pressure (solenoid on) or releases hydraulic pressure (solenoid off). This action controls shift valves inside valve body. By switching one or both solenoids on or off, different combinations of clutches, sprags and bands are operated. See **SOLENOID POSITIONS** table. Line pressure is increased or decreased by PCM changing the duty cycle on pressure control solenoid.

Line pressure control system compensates for normal wear of transmission components during upshifts in order to maintain optimal shift quality during life of transmission. PCM/VCM uses "adaptive learning" to maintain acceptable upshift times by adjusting line pressure. PCM/VCM compares actual "acceptable" shift time to calibrated desired shift time and calculates difference. An "acceptable" shift is considered valid if no inconsistent vehicle operations (A/C compressor cycling or extreme throttle changes) occurred during upshift. Line pressure is either increased or decreased depending on duration of upshift time.

PRESSURE CONTROL SOLENOID

Transmission Adaptive Pressure (TAP) values may require to be reset if one of the following repairs has been performed:

- Transmission overhaul or replacement.
- Repair or replacement of an apply or release component (band, clutch, piston and/or servo).
- Repair or replacement of a component or assembly which directly affects transmission line pressure.

To reset TAP values, see **CLEARING & RESETTING TAP VALUES** under COMPONENT TESTS.

Pressure control (force motor) solenoid has a spool valve and operates pressure regulator valve. See **Fig. 2**. PCM/VCM sends a frequency signal to pressure control solenoid to regulate hydraulic line pressure. Frequency signal (duty cycle) is measured with a dwell meter or lab scope. When duty cycle is zero, line pressure is at maximum, and pressure control solenoid draws zero amps. When duty cycle is 60 percent, line pressure is at minimum, and pressure control solenoid draws 1.1 amps at 4.5 volts.

PCM

PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. PCM utilizes two 80-pin connectors. See **Fig. 3**, **Fig. 4** and **Fig. 5** . PCM controls ignition, fuel and emission devices related to engine and transaxle upshifts and downshifts.

PCM receives electronic signals from sensors and switches. These signals help PCM determine when to operate various relays and solenoids related to engine and transaxle control.

SENSORS & SWITCHES

PCM controls upshifts and downshifts based on coolant temperature (or transaxle temperature), throttle position, transaxle range switch position, vehicle speed sensor and brake pedal switch. System includes several other switches and sensors which are used for engine control.

SOLENOIDS

Transaxle is shifted up or down by 2 electric solenoids. Both solenoids are located on valve body. Ignition power is supplied to each solenoid by ERLS 10-amp fuse located in instrument panel fuse block. For solenoid positions at each selector lever position, see **SOLENOID POSITIONS** table.

SOLENOID POSITIONS

Selector Lever Position	Solenoid Position (1-2/2-3)
"1" (1st Gear)	ON/OFF
"2" (2nd Gear)	OFF/OFF
"3" (3rd Gear)	OFF/ON
"D" (Overdrive)	ON/ON
"R" (Reverse)	ON/OFF
"N" or "P" (Neutral or Park)	ON/OFF

TORQUE CONVERTER CLUTCH (TCC) CONTROL COMPONENTS

The following component signals are used in TCC operation:

Brake Switch

Power from ignition switch passes through brake switch to TCC solenoid. When brake pedal is depressed with TCC applied, power to TCC solenoid is interrupted, releasing converter clutch and preventing engine from stalling.

Engine Coolant Temperature (ECT) Sensor

This sensor provides PCM with engine coolant temperature information. PCM will not allow TCC operation until signal from this sensor indicates coolant temperature more than 130-150°F (55-65°C).

Powertrain Control Module (PCM)

To determine application of torque converter clutch, PCM receives and processes information from various input devices. These devices may include vehicle speed sensor, engine coolant temperature sensor, throttle position sensor and brake switch. PCM controls application of torque converter clutch by providing a ground circuit for TCC solenoid circuit.

TCC Solenoid

Solenoid is energized by PCM to redirect transaxle fluid to converter clutch apply valve in control valve assembly. TCC solenoid controls apply and release of TCC.

Throttle Position (TP) Sensor

Sensor provides PCM with throttle position information. TCC operation is prevented when throttle position signal is less than a specified value.

Vehicle Speed Sensor (VSS)

This sensor sends vehicle speed information to PCM. Vehicle speed must be more than a certain value before TCC can be applied. A Permanent Magnet (PM) generator type sensor is mounted on transaxle.

NOTE: Diagnostic codes for engine coolant temperature sensor and throttle position sensor may be present while performing TCC electrical diagnosis. For complete diagnostic information for these codes, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

LIMP-IN MODE

If sensor input signals are missing or inadequate for transaxle operation, PCM will output preset operating signals to transaxle. This mode will keep vehicle operational and allow it to be driven with reduced transaxle function and performance, to a repair facility. Malfunction Indicator Light (MIL) will light if malfunction occurs. Vehicle should not be driven for extended periods in limp-in mode.

SELF-DIAGNOSTIC SYSTEM

PCM constantly monitors all electrical circuits. If PCM detects circuit problems or sensors out of range, it will record a Diagnostic Trouble Code (DTC). If problem continues for a predetermined time, Malfunction Indicator Light (MIL) will light.

If MIL is on all the time, DTC(s) are currently being detected. If MIL is off, but PCM had detected a circuit or sensor problem, DTC(s) will be stored in computer memory.

Stored DTCs may be retrieved from PCM memory using a scan tool. DTCs CANNOT be retrieved by grounding 16-pin Data Link Connector (DLC).

NOTE: Faulty engine sensors and actuators may cause transaxle related DTCs or driveability problems. Engine faults and related DTCs must be diagnosed and repaired before transaxle codes are repaired. For additional information on diagnosing and repairing engine related PCM trouble codes, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

CIRCUIT TESTS

TRANSAXLE WIRING HARNESS CHECK

1. Install Jumper Harness (J-39775) on transaxle 20-pin connector (transaxle harness side). Using a DVOM and Connector Test Adapter Kit (J-35616), measure resistance between transaxle 20-pin connector terminals "A" and "E" (1-2 shift solenoid). See **Fig. 1** and **Fig. 2** . If resistance is 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), go to step 3. If resistance is not 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), go to next step.
2. Disconnect transaxle wiring harness connector at 1-2 shift solenoid. See **Fig. 1** and **Fig. 2** . Measure resistance between 1-2 shift solenoid terminals. If resistance is not 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), replace 1-2 shift solenoid. If resistance is 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), go to step 14.
3. Measure resistance between transaxle 20-pin connector terminals "B" and "E" (2-3 shift solenoid). See **Fig. 1** and **Fig. 2** . If resistance is 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), go to step 5. If resistance is not 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), go to next step.
4. Disconnect transaxle wiring harness connector at 2-3 shift solenoid. See **Fig. 1** and **Fig. 2** . Measure resistance between 2-3 shift solenoid terminals. If resistance is not 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), replace 2-3 shift solenoid. If resistance is 24-31 ohms at 212°F (100°C) and 19-24 ohms at 68°F (20°C), go to step 14.
5. Measure resistance between transaxle 20-pin connector terminals "E" and "T" (TCC PWM solenoid). See **Fig. 1** and **Fig. 2** . If resistance is 13-15 ohms at 212°F (100°C) and 10-11 ohms at 68°F (20°C), go to step 7. If resistance is not 13-15 ohms at 212°F (100°C) and 10-11 ohms at 68°F (20°C), go to next step.
6. Disconnect transaxle wiring harness connector at TCC PWM solenoid. See **Fig. 1** and **Fig. 2** . Measure resistance between solenoid terminals. If resistance is not 13-15 ohms at 212°F (100°C) and 10-11 ohms at 68°F (20°C), replace TCC PWM solenoid. If resistance is 13-15 ohms at 212°F (100°C) and 10-11 ohms at 68°F (20°C), go to step 14.
7. Measure resistance between transaxle 20-pin connector terminals "C" and "D" (pressure control solenoid). See **Fig. 1** and **Fig. 2** . If resistance is 3-5 ohms at 212°F (100°C) and 4-7 ohms at 68°F (20°C), go to step 9. If resistance is not 3-5 ohms at 212°F (100°C) and 4-7 ohms at 68°F (20°C), go to next step.
8. Disconnect transaxle wiring harness connector at pressure control solenoid. See **Fig. 1** and **Fig. 2** . Measure resistance between solenoid terminals. If resistance is not 3-5 ohms at 212°F (100°C) and 4-7 ohms at 68°F (20°C), replace pressure control solenoid. If resistance is 3-5 ohms at 212°F (100°C) and 4-7 ohms at 68°F (20°C), go to step 14.
9. Measure resistance between transaxle 20-pin connector terminals "S" and "V" (input speed sensor). See **Fig. 1** and **Fig. 2** . If resistance is 750-835 ohms at 212°F (100°C) and 625-725 ohms at 68°F (20°C), go

to step 11. If resistance is not 750-835 ohms at 212°F (100°C) and 625-725 ohms at 68°F (20°C), go to next step.

10. Disconnect transaxle wiring harness connector at input speed sensor. Measure resistance between sensor terminals. If resistance is not 750-835 ohms at 212°F (100°C) and 625-725 ohms at 68°F (20°C), replace input speed sensor. If resistance is 750-835 ohms at 212°F (100°C) and 625-725 ohms at 68°F (20°C), go to step 14.
11. Measure resistance between transaxle 20-pin connector terminals "L" and "M" (TFT sensor). See **Fig. 1** and **Fig. 2** . If resistance is 750-835 ohms at 212°F (100°C) and 3106-3923 ohms at 68°F (20°C), go to step 13. If resistance is not 750-835 ohms at 212°F (100°C) and 3106-3923 ohms at 68°F (20°C), go to next step.
12. Disconnect transaxle wiring harness connector at TFT sensor. TFT sensor is part of Transmission Fluid Pressure (TFP) manual valve position switch assembly. See **Fig. 1** and **Fig. 2** . Measure resistance between sensor terminals. If resistance is not 750-835 ohms at 212°F (100°C) and 3106-3923 ohms at 68° F (20°C), replace TFT sensor. If resistance is 750-835 ohms at 212°F (100°C) and 3106-3923 ohms at 68° F (20°C), go to step 14.
13. Using a DVOM and Connector Test Adapter Kit (J-35616), measure resistance between transaxle case and transaxle 20-pin connector terminals "A", "B", "C", "D", "E", "L", "M", "S", "T" and "V". See **Fig. 1**. If resistance is more than 250 k/ohms at each terminal, go to next step. If resistance is less than 250 k/ohms at each terminal, replace transaxle wiring harness.
14. Inspect for high resistance. Check transaxle wiring harness for poor electrical connections at 20-pin connector and at each component connector. Look for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Repair as necessary, then go to step 1. If no problem was found with connections and terminals, replace transaxle wiring harness.

NOTE: Pressure Switch Assembly (PSA) is also referred to as Transaxle Fluid Pressure (TFP) manual valve position switch.

TRANSAXLE FLUID PRESSURE (TFP) MANUAL VALVE POSITION SWITCH RESISTANCE CHECK

NOTE: For TFP manual valve position switch terminal identification, see WIRING DIAGRAMS.

1. Install Jumper Harness (J-39775) on transaxle 20-pin connector (transaxle harness side). Using a DVOM and Connector Test Adapter Kit (J-35616), measure resistance between transaxle 20-pin connector terminals "U" and transaxle case. See **Fig. 1**. If resistance is less than 50 ohms, go to step 3. If resistance is more than 50 ohms, go to next step.
2. Disconnect wiring harness connector at Transaxle Fluid Pressure (TFP) manual valve position switch. See **Fig. 2**. Measure resistance between position switch terminal "D" and position switch housing. If resistance is less than 50 ohms, go to step 14. If resistance is more than 50 ohms, replace TFP manual valve position switch.
3. Reconnect TFP manual valve position switch connector. Measure resistance between transaxle 20-pin connector terminal "N" and transaxle case. See **Fig. 1** and **Fig. 2** . If resistance is more than 50 k/ohms, go to step 5. If resistance is less than 50 k/ohms, go to next step.
4. Disconnect wiring harness connector at TFP manual valve position switch. See **Fig. 2**. Measure resistance

between TFP manual valve position switch terminal "A" and TFP manual valve position switch housing. If resistance is more than 50 k/ohms, go to step 14. If resistance is less than 50 k/ohms, replace TFP manual valve position switch.

5. Reconnect TFP manual valve position switch connector. Measure resistance between transaxle 20-pin connector terminal "R" and transaxle case. See **Fig. 1** and **Fig. 2** . If resistance is more than 50 k/ohms, go to step 7. If resistance is less than 50 k/ohms, go to next step.
6. Disconnect wiring harness connector at TFP manual valve position switch. See **Fig. 2**. Measure resistance between TFP manual valve position switch terminal "B" and TFP manual valve position switch housing. If resistance is more than 50 k/ohms, go to step 14. If resistance is less than 50 k/ohms, replace TFP manual valve position switch.
7. Reconnect TFP manual valve position switch connector. Measure resistance between transaxle 20-pin connector terminal "P" and transaxle case. See **Fig. 1** and **Fig. 2** . If resistance is more than 50 k/ohms, go to step 9. If resistance is less than 50 k/ohms, go to next step.
8. Disconnect wiring harness connector at TFP manual valve position switch. See **Fig. 2**. Measure resistance between TFP manual valve position switch terminal "C" and TFP manual valve position switch housing. See **Fig. 1** and **Fig. 2** . If resistance is more than 50 k/ohms, go to step 14. If resistance is less than 50 k/ohms, replace TFP manual valve position switch.
9. Reconnect TFP manual valve position switch connector. Start engine and let idle. Set parking brake. Ensure gear selector is in "P" position. Measure resistance between transaxle 20-pin connector terminal "U" and transaxle case. If resistance is more than 50 k/ohms, go to next step. If resistance is less than 50 k/ohms, replace TFP manual valve position switch.
10. Place gear selector in "R" position. Measure resistance between transaxle 20-pin connector terminal "P" and transaxle case. If resistance is less than 50 ohms, go to next step. If resistance is more than 50 ohms, replace TFP manual valve position switch.
11. Place gear selector in "D" position. Measure resistance between transaxle 20-pin connector terminal "N" and transaxle case. If resistance is less than 50 ohms, measure resistance between transaxle 20-pin connector terminal "R" and transaxle case. If resistance is less than 50 ohms, go to next step. If resistance is more than 50 ohms, replace TFP manual valve position switch.
12. Place gear selector in "1" position. Measure resistance between transaxle 20-pin connector terminal "N" and transaxle case. If resistance is less than 50 ohms, go to next step. If resistance is more than 50 ohms, replace TFP manual valve position switch.
13. Reconnect TFP manual valve position switch connector. Measure resistance between transaxle 20-pin connector terminal "P" and transaxle case. See **Fig. 1**. If resistance is less than 50 ohms, go to next step. If resistance is more than 50 ohms, replace TFP manual valve position switch.
14. Inspect for high resistance. Check transaxle wiring harness for poor electrical connections at 20-pin connector and at TFP manual valve position switch. Look for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Repair as necessary, then go to step 1. If no problem was found with connectors or terminals, replace transaxle wiring harness.

SYMPTOM TESTS

NO MALFUNCTION INDICATOR LIGHT (MIL)

If Malfunction Indicator Light (MIL) does not light, see MIL INOPERATIVE or MIL CIRCUIT CHECK in appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

NO DATA LINK CONNECTOR (DLC) DATA

If scan tool does not display PCM data, see DLC DIAGNOSIS OR NO SCAN TOOL DATA in appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

DIAGNOSIS & TESTING

NOTE: To test electronic control of transaxle solenoids without using self-diagnostics or if self-diagnostics does not function, go to CIRCUIT TESTS and COMPONENT TESTS . After repairs are made, DTCs should be erased from computer memory. See CLEARING DIAGNOSTIC TROUBLE CODES.

NOTE: If no DTCs are present and vehicle is in limp-in mode, check fused power supply circuit to transaxle solenoids. Non-related transaxle component system failure may cause this circuit fuse to fail. Fuses such as ERLS or SHIFT SOL fuse supply power to non-related transaxle components (A/C clutch, EGR, EVAP, or ABS system) which may have caused fuse to fail.

NOTE: Trouble codes will be recorded at various operating times. Some codes require operation of affected sensor or switch for 5 seconds; others may require operation for 5 minutes or longer at normal operating temperature, road speed and load. Therefore, some codes may not set in a service bay operational mode and may require road testing vehicle in order to duplicate condition under which code will set.

ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (2.2L & 2.4L)

NOTE: Check for applicable Technical Service Bulletins (TSBs) before proceeding. DO NOT perform the following procedure if driveability conditions are not present. DO NOT turn ignition off during the following procedure or clear DTCs unless instructed to do so.

NOTE: Use of scan tool is required to perform OBD system check. Perform this test prior to performing any diagnostic procedures in DTC tests. For scan tool data values, refer to scan tool manufacturer owner's manual.

NOTE: Most problems that exist with the MIL or diagnostic system are engine performance or PCM related. Procedures for repairing these systems and circuits may require additional engine performance repair data. This test contains references to additional procedures not found in this publication.

The OBD System Check determines:

- If Malfunction Indicator Light (MIL) works.
- If PCM is operating and can recognize a fault.

- If any codes are stored.

OBD system check is the starting point for utilizing the self-diagnostic system for determining computer-related problems. After performing necessary tests as described in OBD system check, if no codes are indicated and driveability problems still exist, see appropriate TROUBLE SHOOTING - NO CODES article in ENGINE PERFORMANCE.

NOTE: The following steps should be performed first to reduce diagnostic time and prevent replacement of good parts.

1. Connect scan tool. Turn ignition on, with engine off. If scan tool powers up, go to next step. If scan tool does not power up, go to DLC DIAGNOSIS OR NO SCAN TOOL DATA in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
2. If scan tool displays PCM data, go to next step. If scan tool does not display PCM data, go to DLC DIAGNOSIS OR NO SCAN TOOL DATA in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
3. Using scan tool, check for DTCs. If any LAST TEST FAIL, HISTORY or MIL request DTCs are present, go to next step. If no DTCs are present, go to step 5.
4. Using scan tool, record FREEZE FRAME and FAILURE RECORDS information. Identify DTCs. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS**. After identification, diagnose DTCs. See **DIAGNOSTIC TESTS**.
5. Observe MIL. If MIL is illuminated, go to next step. If MIL is not illuminated, go to MIL INOPERATIVE in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
6. Using scan tool, command MIL off. If MIL turns off, go to next step. If MIL does not turn off, go to MIL ON STEADY in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
7. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and then stalls, go to NO START DIAGNOSIS in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
8. Allow engine to idle. During engine warm-up, check ECT, TP, MAP, O2 sensors and IAC valve for proper operation. Compare actual scan tool data with typical scan tool data values. If values are within limits, see appropriate TROUBLE SHOOTING - NO CODES article. If values are not within limits, go to appropriate SYSTEM & COMPONENT TESTING article.

ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK (3.1L & 3.4L)

NOTE: Check for applicable Technical Service Bulletins (TSBs) before proceeding. DO NOT turn ignition off during the following procedure or clear DTCs unless instructed to do so.

NOTE: Most problems that exist with the MIL or diagnostic system are engine performance or PCM related. Procedures for repairing these systems and circuits may require additional engine performance repair data. This test contains references to additional procedures not found in this publication.

The OBD System Check determines:

- If Malfunction Indicator Light (MIL) works.
- If PCM is operating and can recognize a fault.
- If any codes are stored.

OBD system check is the starting point for utilizing the self-diagnostic system for determining computer-related problems. After performing necessary tests as described in OBD system check, if no codes are indicated and driveability problems still exist, see appropriate TROUBLE SHOOTING - NO CODES article in ENGINE PERFORMANCE.

NOTE: The following steps should be performed first to reduce diagnostic time and prevent replacement of good parts.

1. Turn ignition on, with engine off. Observe MIL. If MIL illuminates, go to next step. If MIL does not illuminate, go to MIL INOPERATIVE in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
2. Turn ignition off. Connect scan tool. Turn ignition on. If scan tool displays PCM data, go to next step. If scan tool does not display PCM data, go to DLC DIAGNOSIS OR NO SCAN TOOL DATA in BASIC DIAGNOSTIC PROCEDURES - CARS article in ENGINE PERFORMANCE.
3. Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start, or starts and stalls, go to NO START DIAGNOSIS in appropriate BASIC DIAGNOSTIC PROCEDURES article in ENGINE PERFORMANCE.
4. Using scan tool, display LAST TEST FAIL information. If any DTCs are stored, save freeze frame and failure records information using scan tool CAPTURE INFO feature. If DTCs are indicated as LAST TEST FAILED, diagnose DTCs. See **DIAGNOSTIC TESTS**. If DTCs are not indicated, go to next step.
5. Using scan tool, display DTC FAILURE RECORDS information. If DTC failure records are stored, save freeze frame and failure records information using scan tool CAPTURE INFO feature. If failure records are stored, diagnose DTCs. See **DIAGNOSTIC TESTS**. If failure records are not stored, go to next step.
6. Compare PCM data values displayed on scan tool to typical engine scan data values. If values are within limits, system is okay. If values are not within limits, see appropriate SYSTEM & COMPONENT TESTING article in ENGINE PERFORMANCE.

RETRIEVING DIAGNOSTIC TROUBLE CODES

NOTE: Stored DTCs may be retrieved from PCM memory using a scan tool. DTCs CANNOT be retrieved by grounding 16-pin Data Link Connector (DLC). Plugging scan tool into DLC, located under instrument panel, enables user to read DTCs and check voltages in system on serial data line.

Scan tools may furnish information on status of output devices (solenoids and relays). However, status parameters are only an indication that output signals have been sent to devices by control module; they do not indicate if devices have responded properly to signal. Check for proper response at output device using a voltmeter or test light.

If trouble codes are not present, this is not necessarily an indication a problem does not exist. Driveability related problems with codes displayed occur about 20 percent of the time, while driveability problems without codes occur about 80 percent of the time. Sensors that are out of specification WILL NOT set a trouble code but WILL cause driveability problems. Using scan tool is the easiest method of checking sensor specifications and other data parameters. Scan tool is useful in finding intermittent wiring problems by wiggling wiring harness and connections (key on, engine off) while observing scan tool.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

NOTE: Only transaxle related trouble codes are listed. See DIAGNOSTIC TROUBLE CODE DEFINITIONS table. For engine related DTC definitions, see TROUBLE CODE DEFINITIONS article in APPLICATIONS & IDENTIFICATION. For engine related DTC diagnosis, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will affect transaxle operation and diagnosis.

There are 4 types of DTC categories:

- **Type "A"**

  Emissions related. Illuminates MIL the first time DTC sets.

- **Type "B"**

  Emissions related. Illuminates MIL if fault is active for 2 consecutive driving cycles.

- **Type "C"**

  Non-emissions related. Does not illuminate MIL, but will illuminate SERVICE light.

- **Type "D"**

  Non-emissions related. Does not illuminate MIL or SERVICE light.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DTC	DTC Type	Circuit Affected
P0218	D	Transaxle Fluid Overheating
P0502	B	Vehicle Speed Sensor Circuit (Low Input)
P0503	B	Vehicle Speed Sensor Circuit (Intermittent)
P0711	D	Transaxle Fluid Temperature (TFT) Sensor Performance Malfunction
P0712	D	Transaxle Fluid Temperature (TFT) Sensor Circuit (Low Input)
P0713	D	Transaxle Fluid Temperature (TFT) Sensor Circuit (High Input)

P0716	B	Input Speed Sensor Range Malfunction
P0717	B	Input Speed Sensor Circuit (No Signal)
P0719	D	Brake Switch Circuit Low Input (Switch Stuck On)
P0724	D	Brake Switch Circuit High Input (Switch Stuck Off)
P0730	D	Incorrect Gear Ratio
P0741	B	TCC Circuit Inoperative (Stuck Off)
P0742	A	TCC Circuit Inoperative (Stuck On)
P0748	D	Pressure Control Solenoid Electrical Malfunction
P0751	B	1-2 Shift Solenoid Performance Malfunction
P0753	A	1-2 Shift Solenoid Electrical Malfunction
P0756	A	2-3 Shift Solenoid Performance Malfunction
P0758	A	2-3 Shift Solenoid Electrical Malfunction
P1810	B	Pressure Switch Assembly (PSA) Malfunction
P1811	D	Maximum Adapt & Long Shift
P1860	A	TCC PWM Solenoid Circuit Electrical Malfunction
P1887	B	TCC Release Switch Circuit Malfunction

CLEARING DIAGNOSTIC TROUBLE CODES

DTCs can be cleared using scan tool. If scan tool is not available, turn ignition switch to OFF position. Remove control module fuse from fuse block for 30 seconds. Replace fuse. If fuse cannot be located, disconnect PCM pigtail at battery for 30 seconds. Codes may be cleared by disconnecting negative battery cable. However, this may result in loss of other on-board memory data, such as preset radio tuning. After power to PCM is removed, poor driveability may occur until control module "relearns" operating parameters.

DTCs will be cleared under the following conditions: PCM will turn off MIL after 3 consecutive ignition cycles without a failure reported. PCM will cancel DTC default actions when fault no longer exists and ignition is cycled off long enough to power down PCM. DTC will be cleared when vehicle has achieved 40 warm-up cycles without failure reported.

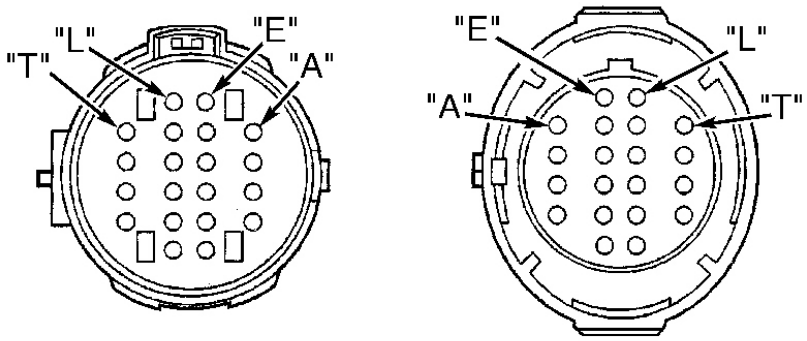
HARD OR INTERMITTENT DIAGNOSTIC TROUBLE CODE DETERMINATION

During any diagnostic procedure, it must be determined if codes are hard failure codes or intermittent failure codes. Diagnostic tests will not usually help analyze intermittent codes. To determine hard codes and intermittent codes, proceed as follows:

1. Enter diagnostic mode. See **RETRIEVING DIAGNOSTIC TROUBLE CODES**. Read and record all stored DTCs. Exit diagnostic mode and clear trouble codes. See **CLEARING DIAGNOSTIC TROUBLE CODES**.
2. Apply parking brake and place transaxle in Neutral or Park. Block drive wheels and start engine. MIL should go out. Run warm engine at specified curb idle for 2 minutes and note MIL.
3. If MIL comes on, enter diagnostic mode. Read and record DTCs. This will reveal hard failure codes. DTCs may require a road test to reset hard failure after clearing DTCs. If MIL does not come on, all stored DTCs were intermittent failures.

CONNECTOR IDENTIFICATION

NOTE: For connector identification, refer to illustrations. See Fig. 1-Fig. 5 .



CAVITY	FUNCTION
A	1-2 SHIFT SOLENOID
B	2-3 SHIFT SOLENOID
C	PRESSURE CONTROL SOLENOID (HIGH)
D	PRESSURE CONTROL SOLENOID (LOW)
E	BOTH SHIFT SOLENOIDS AND TCC PWM SOLENOID
L	TRANSAXLE FLUID TEMPERATURE SENSOR (HIGH)
M	TRANSAXLE FLUID TEMPERATURE SENSOR (LOW)
N	RANGE SIGNAL "A"
P	RANGE SIGNAL "C"
R	RANGE SIGNAL "B"
S	INPUT SPEED SENSOR (HIGH)
T	TCC PWM SOLENOID
U	TCC RELEASE SWITCH
V	INPUT SPEED SENSOR (LOW)

G99D54968

Fig. 1: Identifying Transaxle 20-Pin Connector Terminals
Courtesy of GENERAL MOTORS CORP.

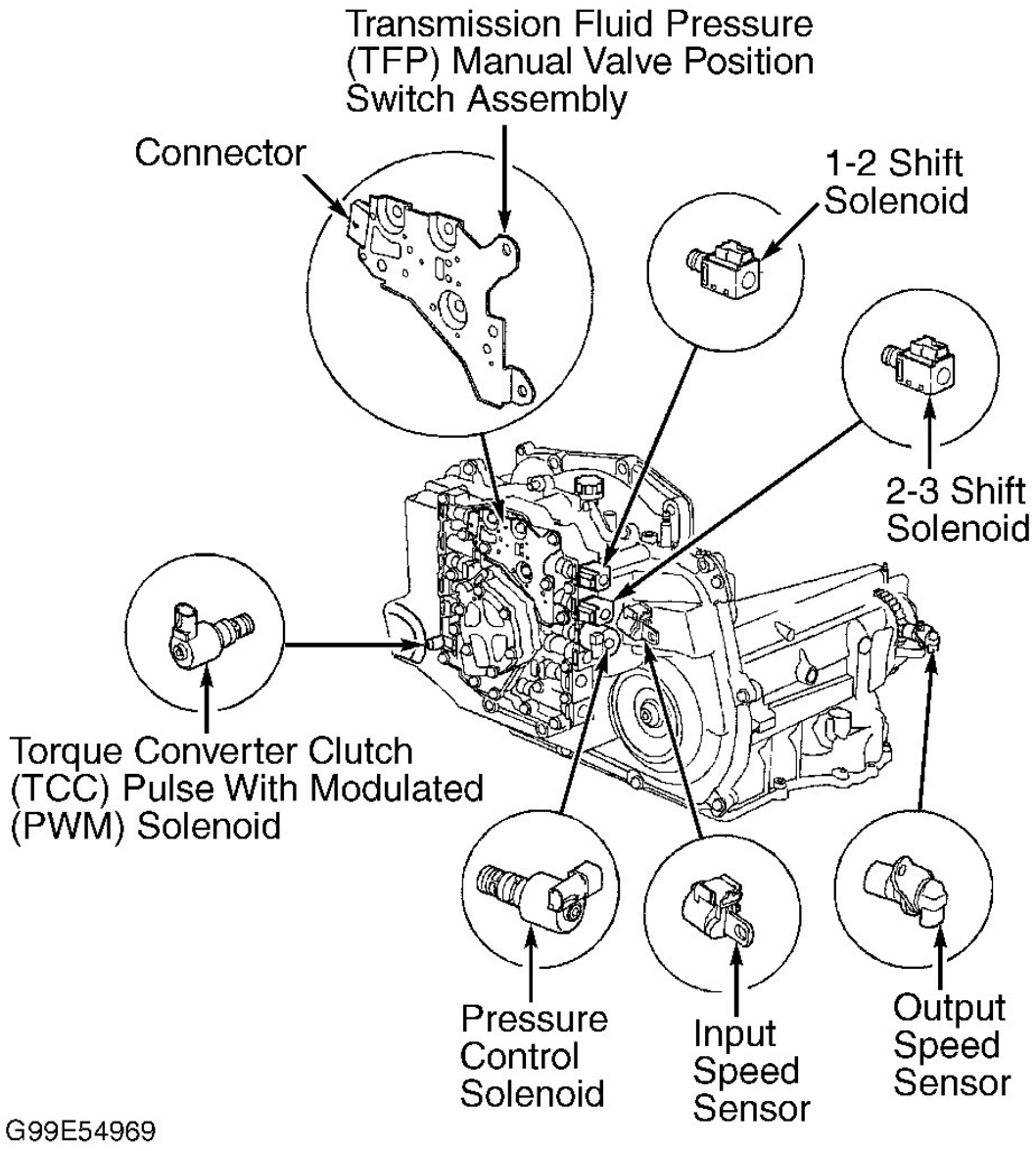


Fig. 2: Identifying Component Locations
Courtesy of GENERAL MOTORS CORP.

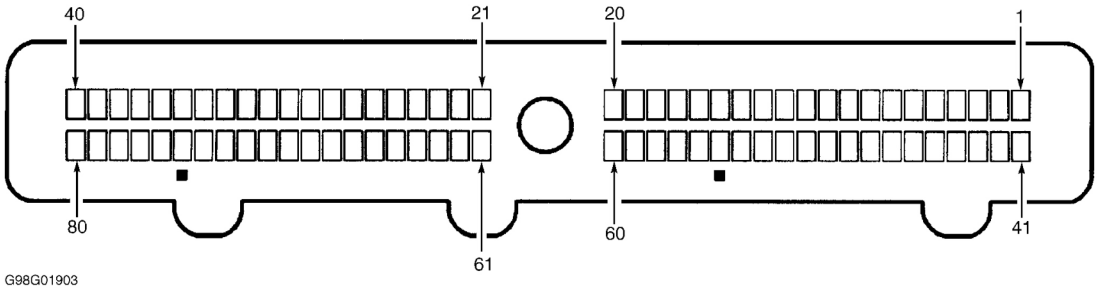


Fig. 3: Identifying PCM 80-Pin Harness Connector Terminals (C1 & C2 - 2.2L & 2.4L)
Courtesy of GENERAL MOTORS CORP.

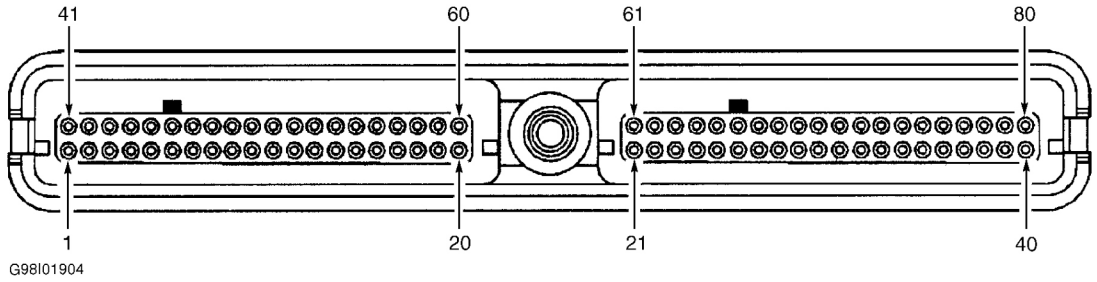


Fig. 4: Identifying PCM 80-Pin Harness Connector Terminals (C1 - 3.1L & 3.4L)
Courtesy of GENERAL MOTORS CORP.

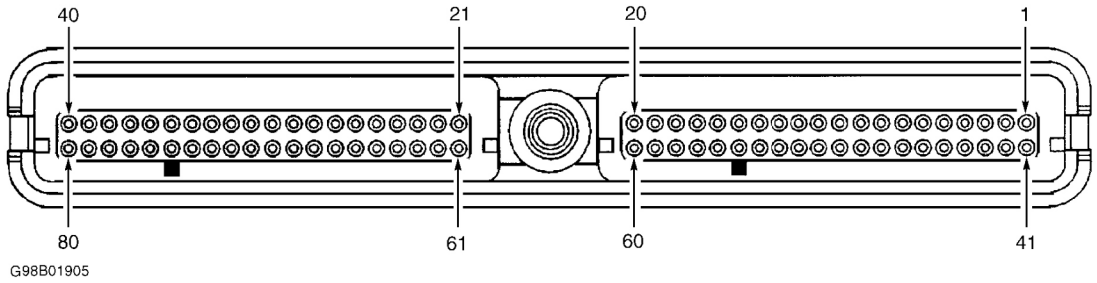


Fig. 5: Identifying PCM 80-Pin Harness Connector Terminals (C2 - 3.1L & 3.4L)
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC TESTS

INTRODUCTION

Diagnostic Tests

Following diagnostic tests are DTC specific. Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under **DIAGNOSIS & TESTING** prior to performing any diagnostic procedure. For PCM

terminal identification, see **Fig. 3**, **Fig. 4** and **Fig. 5** . See **WIRING DIAGRAMS**. For engine related DTCs, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

Diagnostic Aids

Diagnostic aids, located at end of each diagnostic test, are additional tips used to help diagnose trouble codes when diagnostic procedures do not find a problem.

DTC P0218: TRANSAXLE FLUID OVERHEATING

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS. For oil circuit identification, see OIL CIRCUIT DIAGRAMS article.

Circuit Description

Transaxle oil pump is constantly circulating fluid through torque converter. Hot fluid leaving converter flows through transaxle cooler lines to oil cooler, located in radiator. Fluid is then routed back to transaxle.

Lube circuit No. 1 is routed through input shaft to lubricate transaxle components in front of transaxle. Lube circuit No. 2 is fed by line pressure at pressure regulator valve. This fluid is routed through oil feed pipes and into forward clutch support. Lube circuit No. 2 provides lubrication to rear of transaxle. DTC P0218 will set when PCM detects a high transaxle fluid temperature for long period of time.

Conditions For Setting DTC P0218

DTC will set under the following conditions:

- When transaxle temperature is more than 260°F (130°C) for 10 minutes.
- DTCs P0711, P0712 or P0713 (transaxle fluid temperature sensor) are not present.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- Freezes shift adapts from being updated.
- DTC P0218 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Check transaxle fluid level. Fill as necessary. Inspect engine and transaxle cooling system for air flow restrictions or blockage, debris or damaged cooler lines. Repair as necessary, then go to step 4. If no problems are found, go to next step.

3. Check control valve assembly for stuck or leaking pressure regulator valve. Repair as necessary, then go to next step. If valve is okay, inspect oil feed tubes for restriction or leaking seals. Repair as necessary, then go to next step. If tubes are okay, check for torque converter stator damage. Repair as necessary, then go to next step.
4. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0218". Turn ignition switch to ON position for 10 seconds. TFT temperature must be 264°F (129°C) or less for 5 seconds. If DTC P0218 is not present, repair is complete. If DTC P0218 is still present, repeat test.

Diagnostic Aids

Question owner for possible vehicle overloading, exceeding trailer towing limit or towing in overdrive.

DTC P0502: VEHICLE SPEED SENSOR CIRCUIT (LOW INPUT)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Vehicle speed is signaled to PCM by Vehicle Speed Sensor (VSS). Sensor is a Permanent Magnet (PM) generator mounted to transaxle case. PM generator produces an AC voltage as speed sensor rotor teeth pass sensor's magnetic field. AC voltage level increases as speed of vehicle increases. PCM converts AC voltage into digital signal. PCM uses vehicle speed to determine shift timing, TCC apply and release, and gear ratio calculations. DTC P0502 will set when PCM detects a low vehicle output speed when vehicle has high engine speed in drive gear.

Conditions For Setting DTC P0502

DTC will set under the following conditions:

- Transaxle is in Drive.
- DTCs P0107 or P0108 (MAP sensor), P0121, P0122 or P0123 (throttle position sensor) or P1810 (pressure switch assembly) are not present.
- DTCs P0716 or P0717 (input speed sensor) are not present.
- DTC P1644 (engine torque) is not present on 3.1L and 3.4L.
- Throttle position angle is greater than 12 percent.
- MAP is more than 7.3 psi (50 kPa) on 2.2L and 2.4L.
- Input speed is more than 2000 RPM on 2.2L and 2.4L or more than 1500 RPM on 3.1L and 3.4L.
- Output speed is less than 2 MPH on 2.2L and 2.4L or less than 150 RPM for 3 seconds on 3.1L and 3.4L.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with a failure signal.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Calculates output speed from input speed, engine speed and commanded gear.
- DTC P0502 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test. Raise and support vehicle.

CAUTION: To prevent damage to drive axles, support lower control arms in normal horizontal position.

2. Start engine and let idle. Shift gear selector to "D" position. With drive wheels rotating, if transaxle output speed does not increase when wheel speed increases, go to next step. If transaxle output speed increases when wheel speed increases, condition is intermittent. See **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect both PCM 80-pin connectors. On "J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located under left side of instrument panel, near steering column.
4. Connect DVOM between VSS terminals at appropriate PCM connectors (Purple wire and Yellow wire). See **WIRING DIAGRAMS**. Set DVOM to AC scale. Turn ignition switch to ON position. DO NOT start engine. Rotate drive wheels and observe DVOM display. If DVOM displays more than .5 volt, replace PCM, then go to step 7. If DVOM displays less than .5 volt, go to next step.
5. Turn ignition off. Set DVOM to ohms while still connected to VSS terminals at PCM connectors. If resistance is 1530-1870 ohms, repair short to ground in Yellow wire, then go to step 7. If wire is okay, go to next step. If resistance is more than 1870 ohms, repair open in Purple wire or Yellow wire, then go to step 7. If wires are okay, replace speed sensor, then go to step 7. If resistance is less than 1530 ohms, disconnect speed sensor connector at transaxle. If resistance is less than 1530 ohms, check for VSS wires shorted together. Repair as necessary, then go to step 7. If resistance is more than 1530 ohms, replace speed sensor, then go to step 7.
6. Reconnect PCM connector(s). Set DVOM to DC volts. Connect DVOM to VSS connector terminals. Turn ignition switch to ON position. DO NOT start engine. If DVOM displays system voltage, repair short to voltage is Yellow wire, then go to next step. If DVOM does not display system voltage, remove speed sensor from transaxle. Check for incorrect speed sensor, sensor damage, excessive air gap between sensor and rotor, rotor damage or incorrect rotor alignment. Inspect for transaxle case damage. Repair or replace components as necessary, then go to next step.
7. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0502". Operate vehicle at more than 2 MPH for 5 seconds. If DTC P0502 is not present, repair is complete. If DTC P0502 is still present, repeat test.

Diagnostic Aids

Condition may be intermittent. Check for loose speed sensor mounting or poor sensor connection. Check for

bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. Inspect for damaged speed sensor or transaxle rotor teeth. A slipping forward clutch could set DTC P0502.

DTC P0503: VEHICLE SPEED SENSOR CIRCUIT (INTERMITTENT)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Vehicle speed is signaled to PCM by Vehicle Speed Sensor (VSS). Sensor is a Permanent Magnet (PM) generator mounted to transaxle case. PM generator produces an AC voltage as speed sensor rotor teeth pass sensor's magnetic field. AC voltage level increases as speed of vehicle increases. PCM converts AC voltage into digital signal. PCM uses vehicle speed to determine shift timing, TCC apply and release, and gear ratio calculations. DTC P0503 will set when PCM detects a loss of vehicle speed while vehicle is in motion.

Conditions For Setting DTC P0503

DTC will set under the following conditions:

- Engine is running.
- Time since gear selector lever change is more than 6 seconds.
- DTC P1810 (Transaxle Fluid Pressure (TFP) manual valve position switch) is not present.
- Output speed drops more than 1200 RPM within 3 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with a failure signal.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Calculates output speed from input speed, engine speed and commanded gear.
- DTC P0503 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test. Raise and support vehicle.

CAUTION: To prevent damage to drive axles, support lower control arms in normal horizontal position.

2. Start engine and let idle. Shift gear selector to "D" position. With drive wheels rotating, if transaxle output speed does not increase when wheel speed increases, go to next step. If transaxle output speed increases when wheel speed increases, condition is intermittent. See **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect both PCM 80-pin connectors. On "J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located under left side of instrument panel, near steering column.
4. Connect DVOM between VSS terminals at appropriate PCM connectors (Purple wire and Yellow wire). See **WIRING DIAGRAMS**. Set DVOM to AC scale. Turn ignition switch to ON position. DO NOT start engine. Rotate drive wheels and observe DVOM display. If DVOM displays more than .5 volt, replace PCM, then go to step 7. If DVOM displays less than .5 volt, go to next step.
5. Turn ignition off. Set DVOM to ohms while still connected to VSS terminals at PCM connectors. If resistance is 1530-1870 ohms, repair short to ground in Yellow wire, then go to step 7. If wire is okay, go to next step. If resistance is more than 1870 ohms, repair open in Purple wire or Yellow wire, then go to step 7. If wires are okay, replace speed sensor, then go to step 7. If resistance is less than 1530 ohms, disconnect speed sensor connector at transaxle. If resistance is less than 1530 ohms, check for VSS wires shorted together. Repair as necessary, then go to step 7. If resistance is more than 1530 ohms, replace speed sensor, then go to step 7.
6. Reconnect PCM connector(s). Set DVOM to DC volts. Connect DVOM to VSS connector terminals. Turn ignition switch to ON position. DO NOT start engine. If DVOM displays system voltage, repair short to voltage is Yellow wire, then go to next step. If DVOM does not display system voltage, remove speed sensor from transaxle. Check for incorrect speed sensor, sensor damage, excessive air gap between sensor and rotor, rotor damage or incorrect rotor alignment. Inspect for transaxle case damage. Repair or replace components as necessary, then go to next step.
7. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0503". Road test vehicle and ensure speed sensor is operating. If DTC P0503 is not present, repair is complete. If DTC P0503 is still present, repeat test.

Diagnostic Aids

Condition may be intermittent. Check for loose speed sensor mounting or poor sensor connection. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. Inspect for damaged speed sensor or transaxle rotor teeth.

DTC P0711: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT PERFORMANCE MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Transaxle Fluid Temperature (TFT) sensor is a negative coefficient thermistor. When transaxle fluid is cold, sensor resistance is high. As transaxle fluid warms, sensor resistance decreases. PCM monitors TFT sensor circuit. Circuit may be functional but not in normal operating range. DTC P0711 indicates stuck, erratic,

intermittent or skewed values, indicating poor system performance. TFT range is -40 to 305°F (-40 to 151°C). DTC P0711 will set when PCM detects an intermittent voltage or no voltage change in TFT sensor circuit.

Conditions For Setting DTC P0711

DTC will set under the following conditions:

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- DTCs P0716 or P0717 (input speed sensor) are not present.
- Transaxle fluid temperature at start-up is -40 to 70°F (-40 to 21°C).
- System voltage is 8-18 volts.
- Engine run time is more than 5 minutes.
- Vehicle speed is more than 5 MPH for 6 minutes and 49 seconds.
- TCC slip is more than 300 RPM for 6 minutes and 49 seconds.
- Engine coolant temperature is more than 158°F (70°C).
- Engine coolant temperature has changed by more than 90°F (50°C) since start-up.

Conditions For Setting DTC P0711

Change in transaxle fluid temperature is less than 2°F (1.5°C) since start-up for one minute and 20 seconds, or change in transaxle fluid temperature is more than 36°F (20°C) within 200 milliseconds, 14 times within 7 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with failure reported.
- Freezes shift adapts from being updated.
- Will calculate default transaxle temperature based on engine coolant temperature, manifold air temperature and engine run time.
- DTC P0711 will be stored in PCM history.

Diagnostic Procedure

1. Check transaxle fluid level. Fill as needed. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "TFT sensor" on scan tool. Drive vehicle and observe scan tool for one of the following fail conditions: TFT sensor fluid temperature does not change by more than 2.7°F (1.5°C) in 80 seconds since start-up, or TFT sensor fluid temperature changes by more than 36°F (20°C) within 200 milliseconds, 14 times within 7 seconds (unrealistic change). If either fail condition occurs, go to next step. If neither fail conditions occurs, see **DIAGNOSTIC AIDS**.
3. If scan tool displays a condition in which TFT sensor fluid temperature does not change by more than 2.7°F (1.5°C) in 80 seconds since start-up, go to step 7. If scan tool does not display this condition, go to

next step.

4. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) on engine side of transaxle 20-pin connector. Connect a test light between terminals "L" and "M" at transaxle 20-pin connector. See Fig. 1. Turn ignition switch to ON position. DO NOT start engine.
5. While observing scan tool display, wiggle wiring harness between transaxle 20-pin connector and PCM connectors. If TFT sensor fluid temperature changes by more than 36°F (20°C), check for intermittent open or short in wires between transaxle 20-pin connector and PCM. Repair wires as necessary, then go to step 8. If wires are okay, replace PCM, then go to step 8.
6. If TFT sensor fluid temperature does not change by more than 36°F (20°C), check for intermittent open or short in wires between transaxle 20-pin connector and TFT sensor. Repair wires as necessary, then go to step 8. If wires are okay, replace TFT sensor, then go to step 8.
7. Turn ignition off. Disconnect transaxle 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If scan tool displays a condition in which TFT sensor fluid temperature does not change by more than 2.7°F (1.5°C) in 80 seconds since start-up, replace PCM, then go to next step. If scan tool does not display this condition, replace TFT sensor, then go to next step.
8. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0711". Drive vehicle and ensure TFT sensor fluid temperature changes by more than 4° F (2.25°C) for 5 seconds since start-up, and TFT sensor fluid temperature does not change by more than 36°F (20°C) within 200 milliseconds for at least 11 seconds. If DTC P0711 is not present, repair is complete. If DTC P0711 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. Test TFT sensor at various temperature levels to evaluate possibility of a skewed (mis-scaled) sensor. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. Inspect transaxle wiring harness for transaxle fluid.

DTC P0712: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT (LOW INPUT)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Transaxle Fluid Temperature (TFT) sensor is a thermistor which is part of the Transaxle Fluid Pressure (TFP) manual valve position switch. PCM supplies a 5-volt reference signal to sensor on circuit No. 1227 (Yellow/Black wire). When transaxle fluid is cold, sensor resistance is high and PCM will sense a high signal voltage. As transaxle fluid warms, sensor resistance lowers and PCM senses lower voltage. PCM uses TFT sensor readings to control TCC apply and release, line pressure adjustments and temperature compensated shifts. DTC P0712 will set when PCM detects a continuous short to ground in TFT sensor circuit or TFT sensor.

Conditions For Setting DTC P0712

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 8-18 volts.
- TFT sensor voltage is less than .33 volt for 10 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- Freezes shift adapts from being updated.
- Will calculate transaxle temperature based on engine coolant temperature, manifold air temperature and engine run time.
- DTC P0712 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "TFT sensor" on scan tool. If scan tool displays transaxle fluid temperature voltage of less than .33 volts, go to next step. If scan tool does not display transaxle fluid temperature voltage of less than .33 volts, see **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Turn ignition switch to ON position. If scan tool displays transaxle fluid temperature voltage of more than 4.92 volts, go to next step. If scan tool does not display transaxle fluid temperature voltage of more than 4.92 volts, check for short to ground in Yellow/Black wire between transaxle 20-pin connector (PCM side) and PCM. Repair wire as necessary, then go to step 6. If wire is okay, replace PCM, then go to step 6.
4. Install Jumper Harness (J-39775) to transaxle side of 20-pin connector. Connect ohmmeter between terminals "L" and "M" (Yellow/Black wire and Black wire on Cavalier and Sunfire or White/Black wire on all other models) of transaxle 20-pin connector. See **Fig. 1**. If resistance is 3106-3923 ohms at 68°F (20°C) and 164-190 ohms at 212°F (100°C), replace PCM, then go to step 6.
5. If resistance is not 3106-3923 ohms at 68°F (20°C) and 164-190 ohms at 212°F (100°C), check for short to ground in Yellow/Black wire between transaxle 20-pin connector and TFT sensor connector. Repair wire as necessary, then go to next step. If wire is okay, replace TFP manual valve position switch, then go to next step.
6. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0712". Turn ignition switch to ON position for more than 3 seconds. TFT sensor signal voltage must be more than .33 volts. If DTC P0712 is not present, repair is complete. If DTC P0712 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to

bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0713: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT (HIGH INPUT)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Transaxle Fluid Temperature (TFT) sensor is a thermistor which is part of the Transaxle Fluid Pressure (TFP) manual valve position switch. PCM supplies a 5 volt reference signal to sensor on circuit No. 1227 (Yellow/Black wire). When transaxle fluid is cold, sensor resistance is high and PCM will sense a high signal voltage. As transaxle fluid warms, sensor resistance lowers and PCM senses lower voltage. PCM uses TFT sensor readings to control TCC apply and release, line pressure adjustments and temperature compensated shifts. DTC P0713 will set when PCM detects a continuous open or short to voltage in TFT sensor circuit or TFT sensor.

Conditions For Setting DTC P0713

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 8-18 volts.
- TFT sensor voltage is more than 4.9 volts for 6 minutes 40 seconds.
- If vehicle has been exposed to temperatures below -36.4°F (-38°C).

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- Freezes shift adapts from being updated.
- Will calculate transaxle temperature based on engine coolant temperature, manifold air temperature and engine run time.
- DTC P0713 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "TFT sensor" on scan tool. If scan tool displays transaxle fluid temperature voltage of more than 4.92 volts, go to next step. If scan tool does not display transaxle fluid temperature voltage of more than 4.92 volts, see **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect fused jumper between transaxle 20-pin connector terminals "L"

and "M" (Yellow/Black wire and Black wire on Cavalier and Sunfire or White/Black wire on all other models). See **Fig. 1**. Turn ignition switch to ON position. DO NOT start engine.

4. If scan tool does not display transaxle fluid temperature voltage of less than .33 volts, go to next step. If scan tool displays transaxle fluid temperature voltage of less than .33 volts, check for open in Yellow/Black wire or Black wire on Cavalier and Sunfire, or White/Black wire on all other models between transaxle 20-pin connector and TFT sensor connector. Repair wire(s) as necessary, then go to step 7. If wire is okay, replace TFP manual valve position switch, then go to step 7.
5. Connect jumper wire between ground and terminal "L" (Yellow/Black wire) at PCM side of transaxle 20-pin connector. If scan tool displays transaxle fluid temperature voltage of less than .33 volts, go to next step. If scan tool does not display transaxle fluid temperature voltage of less than .33 volts, check for open in Yellow/Black wire between PCM side of transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 7. If wire is okay, replace PCM then go to step 7.
6. Check for open in Black wire on Cavalier and Sunfire, or White/Black wire on all other models between PCM side of transaxle 20-pin connector and PCM. Repair wire as necessary, then go to next step.
7. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0713". Turn ignition switch to ON position for more than 3 seconds. TFT signal voltage must be less than 4.9 volts for one minute. If DTC P0713 is not present, repair is complete. If DTC P0713 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0716: INPUT SPEED SENSOR RANGE MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Transaxle input speed is signaled to PCM by Input Speed Sensor (ISS). Sensor is a Permanent Magnet (PM) generator. Sensor mounts into transaxle case and maintains slight air gap between sensor and drive sprocket. PM generator produces an AC voltage as drive sprocket rotor teeth pass in front of sensor's magnetic field. AC voltage level increases as speed of turbine shaft increases. PCM converts AC voltage into digital signal. This signal is then used by PCM to determine actual turbine shaft speed. PCM uses input speed to calculate torque converter slip speed and gear ratios. DTC P0716 will set when PCM detects an unrealistic change in input speed.

Conditions For Setting DTC P0716

DTC will set under the following conditions:

- Engine is running.

- Input speed change is more than 1300 RPM in .8 seconds.
- DTCs P0717 (input speed sensor), P0121, P0122 or P0123 (throttle position) are not present.
- DTCs P0502 or P0503 (vehicle speed sensor), P0751, P0753 or P0758 (1-2 or 2-3 shift solenoid) are not present.
- Throttle position angle is more than 15 percent.
- Vehicle speed is more than 5 MPH.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with a failure reported.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Inhibits TCC engagement.
- DTC P0716 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Start engine. Select "Trans ISS" on scan tool. If scan tool displays transaxle input speed less than 500 RPM, go to next step. If scan tool displays transaxle input speed more than 500 RPM, see **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to transaxle 20-pin connector. Connect ohmmeter between terminals "S" and "V" of transaxle 20-pin connector. See **Fig. 1**. If resistance is 615-835 ohms, go to step 6. If resistance is not 615-835 ohms, go to next step.
4. Check for open or short to ground in Red/Black wire between transaxle 20-pin connector and input speed sensor. Repair as necessary, then go to step 8. If wire is okay, go to next step.
5. Check for open or short to ground in Blue/White wire between transaxle 20-pin connector and input speed sensor. Repair as necessary, then go to step 8. If wire is okay, replace input speed sensor, then go to step 8.
6. Turn ignition off. Disconnect Jumper Harness (J-39775) from transaxle side of transaxle 20-pin connector. Reconnect transaxle 20-pin connector. Disconnect both PCM 80-pin connectors. On "J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located under left side of instrument panel, near steering column.
7. Connect voltmeter between input speed sensor terminals at appropriate PCM connector(s) (Blue/White wire and Red/Black wire). Set voltmeter to AC scale. Crank engine. If voltmeter displays more than .150 mV (50 Hz), replace PCM, then go to next step. If voltmeter displays less than .150 mV (50 Hz), repair open or short to ground in Red/Black wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to next step. If wire is okay, repair open or short to ground in Blue/White wire between transaxle 20-pin connector and PCM. If wire is okay, replace PCM, then go to next step.
8. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC

and enter DTC "P0716". Shift transaxle to Park and start engine. Transaxle input speed must be more than 50 RPM for .3 seconds without a speed change of more than 300 RPM. If DTC P0716 is not present, repair is complete. If DTC P0716 is still present, repeat test.

Diagnostic Aids

Diagnostic test checks for input speed sensor circuit problem. If engine is running and vehicle is moving above 7 MPH, input speed must be more than zero. Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0717: INPUT SPEED SENSOR CIRCUIT (NO SIGNAL)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Transaxle input speed is signaled to PCM by Input Speed Sensor (ISS). Sensor is a Permanent Magnet (PM) generator. Sensor mounts into transaxle case and maintains slight air gap between sensor and drive sprocket. PM generator produces an AC voltage as drive sprocket rotor teeth pass in front of sensor's magnetic field. AC voltage level increases as speed of turbine shaft increases. PCM converts AC voltage into digital signal. This signal is then used by PCM to determine actual turbine shaft speed. PCM uses input speed to calculate torque converter slip speed and gear ratios. DTC P0717 will set when PCM detects a low input speed when high vehicle speed exists.

Conditions For Setting DTC P0717

DTC will set under the following conditions:

- DTCs P0502 or P0503 (vehicle speed sensor) and P1810 (pressure switch assembly) are not present.
- Engine is running.
- Pressure switch assembly indicates transaxle is not in Park or Neutral.
- Vehicle speed is more than 5 MPH.
- Input speed is less than 100 RPM for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with failure reported.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- DTC P0717 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Start engine. Select "Trans ISS" on scan tool. If scan tool displays transaxle input speed less than 500 RPM, go to next step. If scan tool displays transaxle input speed more than 500 RPM, see **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to transaxle side of transaxle 20-pin connector. Connect ohmmeter to terminals "S" (Red/Black wire) and "V" (Blue/White wire) of transaxle 20-pin connector. If resistance is 615-835 ohms, go to step 8. If resistance is not 615-835 ohms, go to next step.
4. Check for open or short to ground in Red/Black wire between transaxle 20-pin connector and input speed sensor. Repair as necessary, then go to step 8. If wire is okay, go to next step.
5. Check for open or short to ground in Blue/White wire between transaxle 20-pin connector and input speed sensor. Repair as necessary, then go to step 8. If wire is okay, replace input speed sensor, then go to step 8.
6. Turn ignition off. Disconnect Jumper Harness (J-39775) from transaxle side of transaxle 20-pin connector. Reconnect transaxle 20-pin connector. On models with 2.2L and 2.4L engine, disconnect both PCM 80-pin connectors. On models with 3.1L and 3.4L engine, disconnect PCM 80-pin connector C1. On "J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located under left side of instrument panel, near steering column.
7. On all models, connect voltmeter between input speed sensor terminals at appropriate PCM connector(s) (Blue/White wire and Red/Black wire). See **Fig. 3**, **Fig. 4** and **Fig. 5** . Set voltmeter to AC scale. Crank engine. If voltmeter displays more than .150 mV (50 Hz), replace PCM, then go to next step. If voltmeter displays less than .150 mV (50 Hz), repair open or short to ground in Red/Black wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to next step. If wire is okay, repair open or short to ground in Blue/White wire between transaxle 20-pin connector and PCM. If wire is okay, replace PCM, then go to next step.
8. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0717". Shift transaxle into Park and start engine. Transaxle input speed must be more than 120 RPM for 3 seconds. If DTC P0717 is not present, repair is complete. If DTC P0717 is still present, repeat test.

Diagnostic Aids

Diagnostic test checks for input speed sensor circuit problem. If engine is running and vehicle is moving above 7 MPH, input speed must be more than zero. Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0719: BRAKE SWITCH CIRCUIT LOW INPUT (SWITCH STUCK ON)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Torque Converter Clutch (TCC) brake switch is used to indicate brake pedal status to PCM. Normally-closed brake switch supplies battery voltage on circuit No. 420 (Purple wire) to PCM. When brake pedal is applied, brake switch opens, interrupting voltage to PCM. When brake pedal is released, voltage is constant to PCM. When PCM sees zero volts at brake switch input, PCM de-energizes TCC Pulse Width Modulated (PWM) solenoid. DTC P0719 will set when PCM detects an open (stuck on) brake switch during acceleration.

Conditions For Setting DTC P0719

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 8-18 volts.
- PCM detects an open brake switch circuit (zero volts) for 15 minutes and following conditions occur 8 consecutive times.
- Vehicle speed is less than 5 MPH, then vehicle speed is between 5-20 MPH for 3 seconds, then vehicle speed is more than 20 MPH for 6 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- DTC P0719 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "Brake Switch" on scan tool. Disconnect brake switch connector. Connect fused jumper between brake switch connector terminals. If brake switch status on scan tool changes from open to closed, go to step 4.
3. If brake switch status on scan tool does not change from open to closed, on "J" body models, remove and inspect ERLS 10-amp fuse from instrument panel fuse block. On "N" body models, remove and inspect CRUISE fuse from instrument panel fuse block. On all models, replace fuse if necessary and check for short to ground in Pink wire ("J" body) or Brown wire ("N" body) between brake switch and fuse block. If wire is okay, go to step 6. If fuse is okay, go to step 5.
4. Check and adjust brake switch as necessary, then go to step 6. If adjustment is okay, replace brake switch, then go to step 6.
5. Check for open in Purple wire between brake switch connector and PCM. Repair wire as necessary, then go to next step. If wire is okay, replace PCM, then go to next step.

6. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0719". Turn ignition switch to ON position. DO NOT apply brake pedal. PCM must receive 12 volts (brake switch closed) on circuit for 3 seconds or more. If DTC P0719 is not present, repair is complete. If DTC P0719 is still present, repeat test.

Diagnostic Aids

Ask customer about driving habits and/or unusual traffic conditions such as heavy stop and go driving. Check brake switch for proper adjustment. Inspect wiring for poor connections at PCM and at brake switch connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0724: BRAKE SWITCH CIRCUIT HIGH INPUT (SWITCH STUCK OFF)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Torque Converter Clutch (TCC) brake switch is used to indicate brake pedal status to PCM. Normally-closed brake switch supplies battery voltage on circuit No. 420 (Purple wire) to PCM. When brake pedal is applied, brake switch opens, interrupting voltage to PCM. When brake pedal is released, voltage is constant to PCM. When PCM sees zero volts at brake switch input, PCM de-energizes TCC Pulse Width Modulated (PWM) solenoid. DTC P0724 will set when PCM detects a closed (stuck off) brake switch during deceleration.

Conditions For Setting DTC P0724

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 8-18 volts.
- PCM detects a closed brake switch circuit (12 volts) during deceleration and following conditions occur 8 consecutive times.
- Vehicle speed is more than 20 MPH for 6 seconds, then vehicle speed is between 5-20 MPH for 3 seconds, then vehicle speed is less than 5 MPH.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- DTC P0724 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "Brake Switch" on scan tool. Disconnect brake switch connector. If brake switch status on scan tool changes from closed to open, replace brake switch, then go to next step. If brake switch status on scan tool does not change from closed to open, check for short to voltage in Purple wire between brake switch connector and PCM, then go to next step. If wire is okay, replace PCM, then go to next step.
3. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0724". Turn ignition switch to ON position. Apply brake pedal for 3 seconds or more. If DTC P0724 is not present, repair is complete. If DTC P0724 is still present, repeat test.

Diagnostic Aids

Ask customer about driving habits and/or unusual traffic conditions such as heavy stop and go driving. Check brake switch for proper adjustment. Inspect wiring for poor connections at PCM and at brake switch connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0730: INCORRECT GEAR RATIO

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

PCM calculates gear ratio based on transaxle input and output speed sensor readings. PCM compares known transaxle gear ratio to calculated ratio for particular gear range selected. DTC P0730 will set when PCM detects and unknown transaxle gear ratio.

Conditions For Setting DTC P0730

DTC will set under the following conditions:

- DTCs P0121, P0122 and P0123 (throttle position sensor), P0502 and P0503 (vehicle speed sensor) are not present.
- DTCs P0716 or P0717 (input speed sensor) and P1810 (pressure switch assembly) are not present.
- Engine is running.
- Transaxle Fluid Pressure (TFP) manual valve position switch in not in Park or Neutral.
- Vehicle speed is more than 5 MPH.
- Engine torque is more than 18 ft. lbs. (25 N.m) on 3.1L and 3.4L models.
- Throttle position angle is more than 15 percent.
- Transaxle temperature is more than 70°F (21°C).
- 6 seconds has passed since last manual shift change.

One of the following conditions occur for 7 seconds:

- Gear ratio is more than 3.13.
- Gear ratio is 2.23:1-2.87:1.
- Gear ratio is 1.71:1-2.02:1.
- Gear ratio is 1.07:1-1.54:1.
- Gear ratio is .72:1-.91:1.
- Gear ratio is less than .61:1.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- DTC P0730 will be stored in PCM history.

Diagnostic Procedure

1. Visually inspect transaxle cooling system for fluid leaks. Repair as necessary, then go to step 5. If no fluid leaks are found, check transaxle fluid level. Fill as necessary. If fluid level is okay, go to next step.
2. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
3. Select snapshot mode on scan tool to record transaxle gear ratios. Drive vehicle in 1st, 2nd, 3rd and "D" with throttle position angle more than 15 percent and vehicle speed more than 5 MPH. Record each gear ratio. Gear ratios should be 2.02-2.23 in Reverse, 2.87-3.13 in 1st gear, 1.54-1.71 in 2nd gear, .91-1.07 in 3rd gear and .61-.72 in "D". If gear ratios are not as specified, go to next step. If gear ratios are as specified, see **DIAGNOSTIC AIDS**.
4. Perform line pressure test. See HYDRAULIC PRESSURE TESTS in HYDRA-MATIC 4T40-E & 4T45-E OVERHAUL article. If line pressure is as specified, check for clutch slippage and repair as necessary, then go to next step. If line pressure is not as specified, repair component(s) as necessary, then go to next step.
5. Because PCM commands maximum line pressure and does not inhibit TCC engagement for DTC P0730, torque converter may need replacement due to possible "ballooning". Check torque converter for "ballooning" and replace as necessary, then go to next step.
6. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0730". Drive vehicle in "D" with throttle position angle more than 15 percent to obtain any one of the following gear ratios for 7 seconds: 2.02-2.23 in Reverse, 2.87-3.13 in 1st gear, 1.54-1.71 in 2nd gear, .91-1.07 in 3rd gear and .61-.72 in "D". If DTC P0730 is not present, repair is complete. If DTC P0730 is still present, repeat test.

Diagnostic Aids

Check for intermittent input speed sensor or vehicle speed sensor circuit problems, or for possible incorrect calibration.

DTC P0741: TCC CIRCUIT INOPERATIVE (STUCK OFF)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS. For fluid circuit identification, see OIL CIRCUIT DIAGRAMS article.

Circuit Description

Torque Converter Clutch (TCC) solenoid is a Pulse Width Modulated (PWM) solenoid. PCM energizes TCC PWM solenoid by grounding circuit No. 418 (Brown wire). When vehicle operating conditions are appropriate to apply TCC, PCM begins TCC PWM duty cycle at about 42 percent. PCM then increases duty cycle up to 90 percent to achieve full TCC apply pressure.

When TCC PWM is de-energized, solenoid blocks filtered 2-3 drive fluid and allows TCC signal fluid to exhaust. When energized, solenoid modulates fluid into TCC signal fluid circuit. When fully energized, modulation stops and solenoid blocks both 2-3 drive fluid and TCC signal fluid from being exhausted. DTC P0741 will set when PCM detects a high TCC slip speed when TCC is commanded on.

Conditions For Setting DTC P0741

DTC will set under the following conditions:

- DTCs P0121, P0122 or P0123 (throttle position sensor), P0502 or P503 (vehicle speed sensor) are not present.
- DTCs P0742 (TCC stuck on), P1810 (pressure switch assembly) or P1887 (TCC release switch) are not present.
- Throttle position angle is 8-75 percent.
- 6 seconds has passed since last manual shift change.
- Transaxle Fluid Pressure (TFP) manual valve position switch indicates "2", "3" or "D" position.
- Transaxle fluid temperature is 70-266°F (21-130°C).
- PCM commands TCC on for more than 3 seconds.
- Commanded gear is 2nd, 3rd or "D".
- TCC slip speed is 250 RPM or more for 8 seconds 2 consecutive times.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with first failure reported.
- Inhibits TCC engagement.
- Freezes shift adapts from being updated.
- DTC P0741 will be stored in PCM history.

Diagnostic Procedure

1. Ensure transaxle fluid level is correct. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test. If DTCs P0753 and P0758 are present, go to next step. If DTCs P0753 and P0758 are not present, go to step 3.
2. Turn ignition off. Remove and inspect ERLS 10-amp fuse ("J" body) or AUTO TRANS fuse ("N" body) from instrument panel fuse block. Replace fuse if necessary and check for short to ground in Pink wire between transaxle 20-pin connector and fuse block. If fuse is okay, check for open in Pink wire. Repair wire as necessary. If wire is okay, go to step 6.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect test light between ground and terminal "E" (Pink wire) of transaxle 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If test light is on, go to next step. If test light is off, check for open in Pink wire between terminal "E" and splice in wiring harness to PCM, then go to step 9.
4. Connect test light between transaxle 20-pin connector terminals "E" and "T" (Pink wire and Brown wire). Select "TCC Duty Cycle" on scan tool. Command TCC duty cycle to 100 percent, then to zero. If test light is on when TCC duty cycle is commanded to 100 percent and is off at zero, go to step 6.
5. If test light is not on when TCC duty cycle is commanded to 100 percent and is not off at zero, check for open in Brown wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 9. If wire is okay, replace PCM, then go to step 9.
6. Disconnect Jumper Harness (J-39775) from PCM side of transaxle 20-pin connector and install harness on transaxle side of 20-pin connector. Connect ohmmeter between terminals "E" and "T" (Red wire and Tan wire) of transaxle 20-pin connector.
7. If resistance is 10-15 ohms, go to next step. If resistance is not 10-15 ohms, check for open in Red wire or Tan wire between transaxle 20-pin connector and TCC PWM solenoid. Repair wires as necessary, then go to step 9. If wires are okay, replace TCC PWM solenoid, then go to step 9.
8. Repair TCC PWM shift valve circuit. Inspect for the following: Leak at TCC PWM solenoid, TCC regulator apply valve or control valve stuck in release position, or plugged TCC PWM solenoid filter. Repair components as necessary, then go to next step.
9. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0741". Drive vehicle in "D" position with throttle position more than 8 percent to obtain 45 MPH. With TCC commanded on and engaged, slip speed must be less than 250 RPM for 8 seconds. If DTC P0741 is not present, repair is complete. If DTC P0741 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0742: TCC CIRCUIT INOPERATIVE (STUCK ON)

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS. For fluid circuit identification, see OIL CIRCUIT DIAGRAMS article.

Circuit Description

Torque Converter Clutch (TCC) release switch is part of Pressure Switch Assembly (PSA) (also referred to as Transaxle Fluid Pressure (TFP) manual valve position switch), which is mounted to transaxle valve body. Switch is normally-closed. Switch provides signal to PCM when TCC is released. This is accomplished by TCC release fluid pressure acting on switch contact and opening circuit. When voltage is high on circuit No. 657/1804 (Yellow wire and White wire), PCM recognizes TCC is no longer engaged. DTC P0742 will set when PCM detects TCC release switch is closed when TCC is commanded off.

Conditions For Setting DTC P0742

DTC will set under the following conditions:

- DTCs P0121, P0122 or P0123 (throttle position sensor) are not present.
- DTC P1887 (TCC release) is not present.
- Engine is running.
- Throttle position angle is 12-75 percent.
- 6 seconds has passed since last manual shift change.
- TCC is commanded off.
- All conditions are met for 8 seconds 2 consecutive times.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Freezes shift adapts from being updated.
- TCC will be commanded on.
- DTC P0742 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "TCC Release Pressure" on scan tool. If TCC release pressure is present, see **DIAGNOSTIC AIDS**. If TCC release pressure is not present, start engine. If TCC release pressure is not present with engine started, go to step 10. If TCC release pressure is not present with engine started, go to next step.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If TCC release pressure is not present, go to next step. If TCC release pressure is present, go to step 5.
4. Check for short to ground in White wire between transaxle 20-pin connector and PSA. Repair wire as necessary. If wire is okay, go to step 9.
5. Check for short to ground in Yellow wire between transaxle 20-pin connector and PCM. Repair wire as necessary. If wire is okay, replace TCC PWM solenoid, then go to step 11.

6. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect test light between battery voltage and terminal "T" (Brown wire) of transaxle 20-pin connector. If test light is off, go to next step. If test light is on, check for short to ground in Brown wire between transaxle 20-pin connector and PCM. Repair as necessary, then go to step 11. If wire is okay, replace PCM, then go to step 11.
7. Turn ignition off. Disconnect Jumper Harness (J-39775) from PCM side of transaxle 20-pin connector and connect harness to transaxle side of 20-pin connector. Connect test light between battery voltage and terminal "T" (Tan wire) of transaxle 20-pin connector. If test light is off, go to step 10.
8. If test light is on, check for short to ground in Tan wire between transaxle 20-pin connector and TCC PWM solenoid. Repair wire as necessary, then go to step 11. If wire is okay, check TCC PWM solenoid for internal short. Replace solenoid as necessary, then go to step 11.
9. Remove PSA and inspect TCC release switch for cut, damaged or leaking seal, sediment or debris in switch or damaged or stuck switch contacts. Repair or replace TCC release switch as necessary. If switch is okay, replace PSA, then go to step 11.
10. Inspect TCC PWM hydraulic circuit. Check for plugged TCC PWM solenoid exhaust, TCC regulator apply valve or control valve stuck in apply position, TCC feed limit valve stuck, causing no or low TCC feed limit pressure and release pressure or stuck pressure regulator valve. Repair or replace component as necessary, then go to next step.
11. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0742". Drive vehicle in "D" position with throttle position angle at 12-75 percent. TCC release fluid must be present at TCC release switch (switch open) for 6 seconds. If DTC P0742 is not present, repair is complete. If DTC P0742 is still present, repeat test.

Diagnostic Aids

Rapid fluctuation in line pressure could set DTC P0742. Check for pressure regulator malfunction and low or high line pressure. Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. Customer may notice an engine stalling condition. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0748: PRESSURE CONTROL SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

NOTE: Transmission Adaptive Pressure (TAP) values may require to be reset if one of the following repairs has been performed:

- **Transmission overhaul or replacement.**
- **Repair or replacement of an apply or release component (band, clutch, piston and/or servo).**
- **Repair or replacement of a component or assembly which directly affects transmission line pressure.**

To reset TAP values, see CLEARING & RESETTING TAP VALUES under COMPONENT TESTS.

Circuit Description

Pressure Control Solenoid (PCS) is used to regulate transaxle line pressure. PCS consists of an electrical connector, coil, armature, regulating spring and a poppet valve. PCS is attached to upper control valve body. PCM compares TP sensor voltage, fluid temperature, gear status and other inputs to determine line pressure appropriate for given load. PCM will regulate pressure by applying varying amperage to PCS. Applied amperage can vary from .1-1.1 amps. PCM then monitors amperage at return line. DTC P0748 will set when PCM detects a continuous open or short to ground in PCS circuit to PCS solenoid.

Conditions For Setting DTC P0748

DTC will set under the following conditions:

- System voltage is 8-18 volts.
- PC solenoid duty cycle is zero percent or more than 95 percent.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- Freezes shift adapts from being updated.
- Commands maximum line pressure (zero amps).
- DTC P0748 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Start engine. Using scan tool, apply .1-1.0 amp and observe scan tool display. If PCS actual amperage reading is not within .16 amp of desired reference amperage reading, go to next step. If PCS actual amperage reading is within .16 amp of desired reference amperage reading, see **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to transaxle side of 20-pin connector. Connect ohmmeter between terminals "C" and "D" (Red/Black wire and Light Blue/White wire) of transaxle 20-pin connector. If resistance is 3-7 ohms, go to step 6.
4. If resistance is not 3-7 ohms, but resistance is more than 7 ohms, check for open in Red/Black wire and Light Blue/White wire between transaxle 20-pin connector and PCS. Repair wires as necessary, then go to step 12. If wires are okay, replace pressure control solenoid, then go to step 12.
5. If resistance is less than 3 ohms, ensure Red/Black wire and Light Blue/White wire are not shorted together. Repair wires as necessary, then go to step 12. If wires are okay, replace pressure control solenoid, then go to step 12.
6. Connect ohmmeter between ground and terminal "D" (Light Blue/White wire) of transaxle 20-pin

connector. If resistance is more than 1000 ohms, go to next step. If resistance is less than 1000 ohms, check for short to ground in Red/Black wire and Light Blue/White wire between transaxle 20-pin connector and pressure control solenoid. Repair wires as necessary, then go to step 12. If wires are okay, replace pressure control solenoid, then go to step 12.

7. Disconnect jumper harness from transaxle 20-pin connector and install harness on PCM side of transaxle 20-pin connector. Disconnect PCM 80-pin connector C2. See **Fig. 3** and **Fig. 5** . PCM on "J" body models is located forward of right front wheel housing, behind front fascia cavity splash shield. PCM on "N" body models is located below left side of instrument panel, near steering column.
8. Connect ohmmeter between ground and terminal "D" (Light Blue/White wire) of transaxle 20-pin connector. If resistance is more than 10 ohms, go to next step. If resistance is less than 10 ohms, check for short to ground in Light Blue/White wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 12.
9. Connect ohmmeter between terminal "D" of transaxle 20-pin connector and terminal No. 9 on vehicles with 2.2L and 2.4L engine or terminal No. 46 on vehicles with 3.1L and 3.4L engine (Light Blue/White wire) of PCM 80-pin connector C2. See **Fig. 3** and **Fig. 5** . If resistance is less than 10 ohms, go to next step. If resistance is more than 10 ohms, check for open in Light Blue/White wire. Repair wire as necessary, then go to step 12.
10. Connect ohmmeter between ground and terminal "C" (Red/Black wire) of transaxle 20-pin connector. If resistance is more than 10 ohms, go to next step. If resistance is less than 10 ohms, check for short to ground in Red/Black wire. Repair wire as necessary, then go to step 12.
11. Connect ohmmeter between terminal "C" of transaxle 20-pin connector and terminal No. 6 on vehicles with 2.2L and 2.4L engine or terminal No. 45 on vehicles with 3.1L and 3.4L engine (Red/Black wire) of PCM 80-pin connector C2. See **Fig. 3** and **Fig. 5** . If resistance is less than 10 ohms, replace PCM, then go to next step. If resistance is more than 10 ohms, check for open in Red/Black wire. Repair wire as necessary, then go to next step.
12. Because PCM commands maximum line pressure and does not inhibit TCC engagement for DTC P0748, torque converter may need replacement due to possible "ballooning". Check torque converter for "ballooning" and replace as necessary, then go to next step.
13. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0748". Turn ignition switch to ON position. PCS actual return amperage must be .16 amp of commanded amperage. If DTC P0748 is not present, repair is complete. If DTC P0748 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. Extended engine cranking with a weak battery could set DTC P0748. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0751: 1-2 SHIFT SOLENOID PERFORMANCE MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

The 1-2 shift solenoid is a normally-open exhaust valve that is used in conjunction with 2-3 shift solenoid, to allow 4 different shifting combinations. Solenoid is attached to control valve body. Malfunctions will occur when shift solenoid or shift valve is stuck on or off. DTC P0751 will set when PCM detects that commanded gear does not match actual gear ratio for particular gear. See **COMMANDED & ACTUAL GEAR RATIO REFERENCE** table.

Conditions For Setting DTC P0751

DTC will set under the following conditions:

- DTCs P0121, P0122 and P0123 (throttle position sensor), P0502 and P0503 (vehicle speed sensor) are not present.
- DTCs P0716 or P0717 (input speed sensor), P0753 and P0758 (shift solenoid) and P1810 (pressure switch assembly) are not present.
- Engine is running.
- Transaxle Fluid Pressure (TFP) manual valve position switch is not in Park, Reverse or Neutral.
- Vehicle speed is more than 5 MPH.
- Throttle position angle is more than 8 percent.
- Engine torque is 10 ft. lbs. (14 N.m).
- Transaxle temperature is more than 70°F (21°C).

All conditions exist when any one of the following conditions occur:

- PCM commands 1st gear and gear ratio is between 1.54-1.71 (2nd gear) for 2 seconds. This must occur 2 consecutive times.
- PCM commands 2nd gear and gear ratio is between 2.87-3.13 (1st gear) for 4 seconds. This must occur 2 consecutive times.
- PCM commands 3rd gear and gear ratio is between .61-.72 (4th gear) for 5 seconds. This must occur 2 consecutive times.
- PCM commands 4th gear and gear ratio is between .91-1.07 (3rd gear) for 5 seconds. This must occur 2 consecutive times.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Inhibits TCC engagement.
- DTC P0751 will be stored in PCM history.

COMMANDED & ACTUAL GEAR RATIO REFERENCE

Commanded Gear	Actual Gear Ratio
1st	2nd
2nd	1st
3rd	4th
4th	3rd

Diagnostic Procedure

1. Check transaxle fluid level. Fill as needed. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select snapshot mode on scan tool. Record current gear and gear ratio. Drive vehicle in "D" position to obtain 1-2 shift with throttle position angle more than 8 percent and vehicle speed more than 5 MPH for 5 seconds. If current gear is 2nd and gear ratio is within 2.87-3.13, and commanded gear is 3rd and gear ratio is .67-.72, go to next step. If current gear is 1st and gear ratio is 1.54-1.71, and commanded gear is 4th and gear ratio is within .91-1.07, go to step 4.
3. Repair 1-2 shift circuit. Check 1-2 shift circuit for 1-2 shift solenoid mechanically stuck on, or 1-2 shift valve stuck in applied (upshift) position. Repair as necessary, then go to step 5.
4. Repair 1-2 shift circuit. Check 1-2 shift circuit for 1-2 shift solenoid mechanically stuck off, 1-2 shift solenoid "O" ring damage or 1-2 shift valve stuck in released (downshift) position. Repair as necessary, then go to next step.
5. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0751". Drive vehicle in "D" position. Allow transaxle to shift through all gears. Actual gear ratios must match commanded gears for .75 seconds for all gears. See **COMMANDED & ACTUAL GEAR RATIO REFERENCE** table. If DTC P0751 is not present, repair is complete. If DTC P0751 is still present, repeat test.

Diagnostic Aids

Check for stuck throttle position sensor. If DTC P0751 cannot be reset after clearing code, check for possible fluid contamination or plugged or restricted oil circuits.

DTC P0753: 1-2 SHIFT SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

The 1-2 shift solenoid is used to control fluid flow acting on 1-2 shift valve. Solenoid is a normally-open valve that is used in conjunction with 2-3 shift solenoid, to allow 4 different shifting combinations. See **SHIFT SOLENOID COMBINATIONS** table. Solenoid is attached to control valve body. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off by providing a ground path through circuit No. 1222 (Light Green wire). DTC P0753 will set when PCM detects a continuous open, short to ground or short to voltage in 1-2 shift solenoid circuit.

Conditions For Setting DTC P0753

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 8-18 volts.
- PCM commands solenoid on and voltage remains high (B+) for 4.3 seconds.
- PCM commands solenoid off and voltage remains low (zero volts) for 4.3 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Inhibits TCC engagement.
- DTC P0753 will be stored in PCM history.

SHIFT SOLENOID COMBINATIONS

Gear	1-2 Shift Solenoid	2-3 Shift Solenoid
1st	On	Off
2nd	Off	Off
3rd	Off	On
4th	On	On

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. If DTCs P0758 or P1860 are not present, go to step 8. If DTCs P0758 or P1860 are present, go to next step.
3. Remove ERLS 10-amp fuse ("J" body) or AUTO TRANS fuse ("N" body) from instrument panel fuse block and inspect fuse. Replace fuse if necessary. If fuse was open, go to next step. If fuse is okay, go to step 6.
4. Check for short to ground in Pink wire between transaxle 20-pin connector and fuse block. Repair wire as necessary, then go to step 17. If wire is okay, replace transaxle wiring harness, then go to step 17.
5. Check for short to ground in Red wire between transaxle 20-pin connector and 1-2 shift solenoid. Repair wire as necessary, then go to step 17. If wire is okay, replace transaxle wiring harness, then go to step 17.
6. Check for open in Pink wire between transaxle 20-pin connector and fuse block. Repair wire as necessary, then go to step 17. If wire is okay, go to next step.
7. Check for open in Red wire between transaxle 20-pin connector and 1-2 shift solenoid. Repair wire as necessary, then go to step 17. If wire is okay, replace transaxle wiring harness, then go to step 17.

8. Using scan tool, command 1-2 shift solenoid on and off 3 times. Listen at transaxle side cover. If solenoid does not click when commanded on and off, go to next step. If solenoid clicks when commanded on and off, see **DIAGNOSTIC AIDS**.
9. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect test light between terminals "A" and "E" (Light Green wire and Pink wire) of transaxle 20-pin connector. See **Fig. 1**. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, command 1-2 shift solenoid on and off 3 times.
10. If test light cycles on and off 3 times, go to step 14. If test light does not cycle on and off 3 times, and test light is always on, go to next step. If test light is always off, go to step 12.
11. Turn ignition off. Disconnect PCM 80-pin connector C2 on 2.2L and 2.4L models or PCM 80-pin connector C1 on 3.1L and 3.4L models. See **Fig. 3** and **Fig. 4** . On "J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located below left side of instrument panel, near steering column. On all models, turn ignition switch to ON position. Ensure test light is still connected between terminals "A" and "E" (Light Green wire and Pink wire) of transaxle 20-pin connector. If test light is off, replace PCM, then go to step 17. If test light is on, check for short to ground in Light Green wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 17.
12. Check for open in Light Green wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 17. If wire is okay, go to next step.
13. Connect test light between ground and terminal "A" (Light Green wire) of transaxle 20-pin connector. If test light is off, replace PCM, then go to step 17. If test light is on, check for short to battery voltage in Light Green wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 17.
14. Turn ignition off. Disconnect jumper harness from PCM side of transaxle 20-pin connector and install harness to transaxle side of 20-pin connector. Connect ohmmeter between terminals "A" and "E" (Light Green wire and Pink wire) of transaxle 20-pin connector.
15. If resistance is 19-31 ohms, go to next step. If resistance is not 19-31 ohms but is more than 250 ohms, check for open or poor connection in Light Green wire and Pink wire at connector. Repair wire or connector as necessary, then go to step 17. If resistance is not 19-31 ohms but is less than 250 ohms, go to next step.
16. Connect ohmmeter between ground and terminal "A" (Light Green wire) of transaxle 20-pin connector. If resistance is more than 1000 ohms, replace 1-2 shift solenoid, then go to step 17. If resistance is less than 1000 ohms, check for short to ground in Light Green wire between transaxle 20-pin connector and 1-2 shift solenoid. Repair wire as necessary, then go to next step.
17. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0753". Place transaxle in Park and start engine. Allow engine to idle for 5 seconds. If DTC P0753 is not present, repair is complete. If DTC P0753 is still present, repeat test.

Diagnostic Aids

An open in Pink wire between transaxle 20-pin connector and fuse can cause multiple DTCs to set. Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0756: 2-3 SHIFT SOLENOID PERFORMANCE MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

The 2-3 shift solenoid is a normally-open exhaust valve that is used in conjunction with 1-2 shift solenoid, to allow 4 different shifting combinations. Solenoid is attached to control valve body. Malfunctions will occur when shift solenoid or shift valve is stuck on or off.

DTC P0756 will set when PCM detects a 1st gear ratio when commanded gear is 2nd, a 4th gear ratio when commanded gear is 3rd, a 2nd gear ratio when commanded gear is 1st, or a 3rd gear ratio when commanded gear is 4th. See **COMMANDED & ACTUAL GEAR RATIO REFERENCE** table.

Conditions For Setting DTC P0756

DTC will set under the following conditions:

- DTCs P0121, P0122 and P0123 (throttle position sensor) and P0502 or P0503 (vehicle speed sensor) are not present.
- DTCs P0716 or P0717 (input speed sensor), DTC P0753 or P0758 (shift solenoid performance), DTC P1644 (engine torque) and P1810 (pressure switch assembly) are not present.
- Engine is running.
- Transaxle Fluid Pressure (TFP) manual valve position switch indicates D4, D3, D2 or D1.
- Transaxle fluid temperature is more than 70°F (21°C).
- Vehicle speed is more than 5 MPH.
- Throttle position angle is more than 8 percent.

All conditions exist when any one of the following conditions occur:

- PCM commands 1st gear and gear ratio is between .61-.72 (4th gear) for 2 seconds. This must occur 2 consecutive times.
- PCM commands 2nd gear and gear ratio is between .91-1.07 (3rd gear) for 5 seconds. This must occur 2 consecutive times.
- PCM commands 3rd gear and gear ratio is between 1.54-1.71 (2nd gear) for 5 seconds. This must occur 2 consecutive times.
- PCM commands 4th gear and gear ratio is between 2.87-3.13 (1st gear) for 5 seconds. This must occur 2 consecutive times.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.

- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Commands immediate shift to 2nd gear.
- Inhibits TCC engagement.
- DTC P0756 will be stored in PCM history.

Diagnostic Procedure

1. Check transaxle fluid level. Fill as needed. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select snapshot mode on scan tool. Record current gear and gear ratio. Drive vehicle in "D" position to obtain 2-3 shift with throttle position angle more than 8 percent and vehicle speed more than 5 MPH for 5 seconds. If 1st gear ratio is 2.87-3.13, and 4th gear ratio is .61-.72, see **DIAGNOSTIC AIDS**. If 1st gear ratio is not 2.87-3.13, and 4th gear ratio is not .61-.72, go to next step.
3. Determine if engine labors during start off and 3rd gear is indicated when 1st gear is commanded. If engine does not labor during start off and 3rd is not indicated when 1st gear is commanded, go to next step. If engine labors during start off and 3rd gear is indicated when 1st gear is commanded, go to step 5.
4. Repair 2-3 shift circuit. Check 2-3 shift circuit for 2-3 shift solenoid mechanically stuck off, 2-3 shift solenoid "O" ring damage or 2-3 shift valve stuck in released (downshift) position. Repair as necessary, then go to step 6.
5. Repair 2-3 shift circuit. Check 2-3 shift circuit for 2-3 shift solenoid mechanically stuck on, or 2-3 shift valve stuck in applied (upshift) position. Repair as necessary, then go to next step.
6. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0756". Drive vehicle in "D" position. Allow transaxle to shift through all gears. Actual gear ratios must match commanded gears for .75 seconds for all gears. See **COMMANDED & ACTUAL GEAR RATIO REFERENCE** table. If DTC P0756 is not present, repair is complete. If DTC P0756 is still present, repeat test.

Diagnostic Aids

If DTC P0756 cannot be reset after clearing code, check for possible fluid contamination or plugged or restricted oil circuit.

DTC P0758: 2-3 SHIFT SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

The 2-3 shift solenoid is used to control fluid flow acting on 2-3 shift valve. Solenoid is a normally-open valve that is used in conjunction with 1-2 shift solenoid, to allow 4 different shifting combinations. See **SHIFT SOLENOID COMBINATIONS** table. Solenoid is attached to control valve body. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off by providing a ground path

through circuit No. 1223 (Yellow/Black wire). DTC P0758 will set when PCM detects a continuous open, short to ground or short to voltage in 2-3 shift solenoid circuit.

Conditions For Setting DTC P0758

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 8-18 volts.
- PCM commands solenoid on and voltage remains high for 4.3 seconds.
- PCM commands solenoid off and voltage remains low for 4.3 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Commands immediate shift to 2nd gear.
- Inhibits TCC engagement.
- DTC P0758 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. If DTCs P0753 or P1860 are not present, go to step 8. If DTCs P0753 or P1860 are present, go to next step.
3. Remove ERLS 10-amp fuse ("J" body) or AUTO TRANS fuse ("N" body) from instrument panel fuse block and inspect fuse. Replace fuse if necessary. If fuse was open, go to next step. If fuse is okay, go to step 6.
4. Check for short to ground in Pink wire between transaxle 20-pin connector and fuse block. Repair wire as necessary, then go to step 17. If wire is okay, go to next step.
5. Check for short to ground in Red wire between transaxle 20-pin connector and 2-3 shift solenoid. Repair wire as necessary, then go to step 17. If wire is okay, replace transaxle wiring harness, then go to step 17.
6. Check for open in Pink wire between transaxle 20-pin connector and fuse block. Repair wire as necessary, then go to step 17. If wire is okay, go to next step.
7. Check for open in Red wire between transaxle 20-pin connector and 2-3 shift solenoid. Repair wire as necessary, then go to step 17. If wire is okay, replace transaxle wiring harness, then go to step 17.
8. Using scan tool, command 2-3 shift solenoid on and off 3 times. Listen at transaxle side cover. If solenoid does not click when commanded on and off, go to next step. If solenoid clicks when commanded on and off, see **DIAGNOSTIC AIDS**.

9. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect test light between terminals "B" and "E" (Yellow/Black wire and Pink wire) of transaxle 20-pin connector. See **Fig. 1**. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, command 2-3 shift solenoid on and off 3 times.
10. If test light cycles on and off 3 times, go to step 14. If test light does not cycle on and off 3 times, and test light is always on, go to next step. If test light is always off, go to step 12.
11. Turn ignition off. Disconnect PCM 80-pin connector C2 on 2.2L and 2.4L models or PCM 80-pin connector C1 on 3.1L and 3.4L models. See **Fig. 3** and **Fig. 5** . On "J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located below left side of instrument panel, near steering column. On all models, turn ignition switch to ON position. Ensure test light is still connected between terminals "B" and "E" (Yellow/Black wire and Pink wire) of transaxle 20-pin connector. If test light is off, replace PCM, then go to step 17. If test light is on, check for short to ground in Yellow/Black wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 17.
12. Check for open in Yellow/Black wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 17. If wire is okay, go to next step.
13. Connect test light between ground and terminal "B" (Yellow/Black wire) of transaxle 20-pin connector. If test light is off, replace PCM, then go to step 17. If test light is on, check for short to battery voltage in Yellow/Black wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 17.
14. Turn ignition off. Disconnect jumper harness from PCM side of transaxle 20-pin connector and install harness to transaxle side of 20-pin connector. Connect ohmmeter between terminals "B" and "E" (Yellow/Black wire and Pink wire) of transaxle 20-pin connector.
15. If resistance is 19-31 ohms, go to next step. If resistance is not 19-31 ohms but is more than 250 ohms, check for open or poor connection in Yellow/Black wire and Pink wire at connector. Repair wire or connector as necessary, then go to step 17. If resistance is not 19-31 ohms but is less than 250 ohms, go to next step.
16. Connect ohmmeter between ground and terminal "B" (Yellow/Black wire) of transaxle 20-pin connector. If resistance is more than 1000 ohms, replace 2-3 shift solenoid, then go to step 17. If resistance is less than 1000 ohms, check for short to ground in Yellow/Black wire between transaxle 20-pin connector and 2-3 shift solenoid. Repair wire as necessary, then go to next step.
17. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P0753". Place transaxle in Park and start engine. Allow engine to idle for 5 seconds. If DTC P0753 is not present, repair is complete. If DTC P0753 is still present, repeat test.

Diagnostic Aids

An open in Pink wire between shift solenoid and fuse can cause multiple DTCs to set. Check for stuck throttle position sensor. Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1810: PRESSURE SWITCH ASSEMBLY (PSA) MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS. Pressure switch assembly is also referred to as Transaxle Fluid Pressure (TFP) manual valve position switch.

Circuit Description

Transaxle Pressure Switch Assembly (PSA) consists of 6 pressure switches. One switch is normally-closed and is used to detect TCC release fluid pressure. Other switches are normally-open and are used for determining gear range selection. PSA contains Transaxle Fluid Temperature (TFT) sensor. These components are combined into one unit and mounted on control valve body.

PCM provides battery voltage on each range signal. By grounding one or more switches with fluid pressure from manual shift valve, PCM detects selected gear range. When transaxle electrical connector is disconnected and ignition is on, ground potential for 3 range signals from PCM will be removed, and an illegal gear will be indicated. See **PSA LOGIC** table. DTC P1810 will set when PCM detects an invalid gear status, a drive range after start-up or an incorrect gear ratio.

PSA LOGIC

Gear	Signal "A"	Signal "B"	Signal "C"
Park	On	Off	Off
Reverse	On	Off	On
Neutral	On	Off	Off
Drive/OD	On	On	Off
D3/3rd	Off	On	Off
D2/2nd	Off	On	On
D1/Lo	On	On	On
Illegal	Off	Off	Off
Illegal	Off	Off	On

Conditions For Setting DTC P1810

If PCM detects any of following states, DTC will set in required conditions.

- An invalid gear state.
- Any drive range after start-up.
- An incorrect gear ratio.
- Engine is running.
- System voltage is 8-18 volts.

DTC will set under any one of the following 3 conditions occur:

Condition No. 1:

- Gear range is illegal for 60 seconds. See **PSA LOGIC** table.

Condition No. 2:

- D2, D4 or Reverse gear is indicated after start-up for 3 seconds.
- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- Vehicle speed is less than 2 MPH.

Condition No. 3:

- DTCs P0121, P0122 or P0123 (throttle position sensor), P0716 or P0717 (input speed sensor) or P0502 and P0503 (vehicle speed sensor) are not present.
- DTCs P0751, P0753, P0756 or P0758 (1-2 and 2-3 shift solenoid) are not present.
- Engine torque is more than 10 ft. lbs (14 N.m).
- Throttle position angle is equal to or more than 10 percent.
- Vehicle speed is 5 MPH or more.

One of the following 3 conditions must also occur:

- PSA indicates Park/Neutral when gear ratio is less than .72 (4th gear) for 5 seconds.
- PSA indicates Reverse when gear ratio is more than 2.23 or less than 2.02 for 5 seconds.
- PSA indicates gear position other than Park or Neutral when gear ratio indicates Reverse for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with a failure signal.
- Freezes shift adapts from being updated.
- Increases line pressure.
- Assumes "D" shift pattern.
- Inhibits TCC engagement.
- DTC P1810 will be stored in PCM history.

Diagnostic Procedure

1. Check transaxle fluid. Fill as needed. Ensure transaxle shift linkage is adjusted correctly. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Apply parking brake. Start engine and apply brake. Shift transaxle into each gear selector lever position while monitoring scan tool Transaxle Range (TR) switch display. See **PSA LOGIC** table. If each selected lever position does not match scan tool display, go to next step. If each selected lever position matches scan tool display, see **DIAGNOSTIC AIDS**.
3. Turn ignition off. Disconnect transaxle 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. Measure voltage between ground and PCM side of transaxle 20-pin connector terminals, "N", "R" and "P" (range signal circuits). If battery voltage is present on all 3 circuits, go to next step. If

battery voltage is not present on all 3 circuits, go to step 5.

4. Connect fused jumper wire between ground and PCM side of transaxle 20-pin connector terminals "N", "R" and "P". Using scan tool, verify that when any range signal circuit is grounded, other range signal circuits are not affected. If other range signal circuits are affected a short between range signal circuits exist. If range signal circuits are shorted together, repair as necessary. See **WIRING DIAGRAMS**. If range signal circuits are not shorted together, go to **TRANSAXLE FLUID PRESSURE (TFP) MANUAL VALVE POSITION SWITCH RESISTANCE CHECK**.
5. Inspect range signal circuits where battery voltage was not present for open or short to ground. Repair wiring as necessary, then go to next step. If wires are okay, replace PCM, then go to next step.
6. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P1810". Drive vehicle in "D" position with throttle position angle more than 10 percent. Allow transaxle to shift through all gears. If DTC P1810 is not present, repair is complete. If DTC P1810 is still present, repeat test.

Diagnostic Aids

A pressure regulator malfunction could set DTC P1810. Inspect wiring for poor connections at PCM and at transaxle 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1811: MAXIMUM ADAPT & LONG SHIFT

NOTE: Perform OBD system check prior to performing diagnostic procedures. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Transaxle line pressure is modified by PCM through Pressure Control Solenoid (PCS) to control gear shift execution time and shift consistency. PCM monitors various inputs and modifies shift execution and timing by applying a calculated duty cycle to PCS. PCM alters shifting based on driving habits, transaxle load and internal transaxle condition. DTC P1811 will set when PCM detects long shifts that cannot be shortened by shift adapts during same ignition cycle.

Conditions For Setting DTC P1811

DTC will set under the following condition:

- Shift is adaptable.
- Shift adapt is at limit.
- Shift time is more than .65 seconds twice during ignition cycle.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will not light MIL when fault is set.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- DTC P1811 will be stored in PCM history.

Diagnostic Procedure

1. Check transaxle fluid. Fill as needed. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select snapshot on scan tool to record shift times. Drive vehicle in D4 to obtain 1-2, 2-3 and 3-4 upshifts. If all shifts exceeded .65 seconds, perform line pressure test. See HYDRAULIC PRESSURE TEST in HYDRA-MATIC 4T40-E & 4T45-E OVERHAUL article. If line pressure is not within specification, go to next step. If line pressure is within specification, see **DIAGNOSTIC AIDS**. If all shifts did not exceed .65 seconds, go to step 4.
3. Inspect transaxle for low fluid level caused by external leaks, fluid filter clogged or out of position, internal fluid passage leaks, casting porosity or damage, damaged or out of position gaskets or spacer plate. Check for contaminated, stuck or damaged PCS or pressure regulator valve stuck or leaking. Check for torque signal valve stuck or leaking, leaking or damaged oil pump, or inadequate suction or pump cavitation. Repair component(s) as necessary, then go to step 9.
4. If 1-2 shift exceeded .65 seconds, go to next step. If 2-3 shift exceeded .65 seconds, go to step 7. If 3-4 shift exceeded .65 seconds, go to step 8.
5. Repair 1-2 shift circuit. Inspect for leaking, rolled or cut 1-2 accumulator piston or 2nd clutch piston seals. Inspect for burned or damaged 2nd clutch plates, broken or out of position 2nd clutch springs, cracked or damaged 2nd clutch piston, leaking or damaged driven sprocket support seals, internal fluid passage leaks, casting porosity or damage, or damaged or out of position gaskets or spacer plate.
6. Inspect for slipping forward clutch, cracked or damaged driven sprocket support, damaged 2nd roller clutch or sprag clutch or 2nd roller clutch or sprag clutch not holding. Repair or replace components as necessary, then go to step 9.
7. Repair 2-3 shift circuit. Inspect for leaking, rolled or cut 2-3 accumulator or direct clutch piston seals, burned or damaged direct clutch plates, broken or out of position direct clutch springs, cracked or damaged direct clutch piston, leaking or damaged driven sprocket support seals, cracked or damaged driven sprocket support, damaged sprag clutch or sprag clutch not holding. Check for internal fluid passage leaks, casting porosity or damage, or damaged or out of position gaskets or spacer plate. Repair or replace components as necessary, then go to step 9.
8. Repair 3-4 shift circuit. Inspect for leaking, rolled or cut 3-4 accumulator piston or intermediate/4th servo piston seals and burned, damaged, slipping or out of position intermediate/4th band. Check for internal fluid passage leaks, casting porosity or damage, or damaged or out of position gaskets or spacer plate. Inspect direct clutch for slipping, damaged or seized intermediate/4th servo pin, damaged intermediate/4th servo piston or cracked or leaking intermediate/4th servo cover. Repair or replace components as necessary, then go to next step.
9. Because PCM commands maximum line pressure and does not inhibit TCC engagement for DTC P1811, torque converter may need replacement due to possible "ballooning". Check torque converter for "ballooning" and replace as necessary, then go to next step.
10. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC

and enter DTC "P1811". Drive vehicle in D4 to obtain 1-2, 2-3 and 3-4 upshift. Shift times must be less than .65 seconds. If DTC P1811 is not present, repair is complete. If DTC P1811 is still present, repeat test.

Diagnostic Aids

Question owner about vehicle overloading, exceeding trailer towing limit or towing in overdrive. If after several unsuccessful attempts to gain accurate shift times and an adapt can be made, reset adapts and operate vehicle to assure proper shifting.

DTC P1860: TCC PWM SOLENOID CIRCUIT ELECTRICAL MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Torque Converter Clutch (TCC) Pulse Width Modulated (PWM) solenoid is a normally closed solenoid used to control apply and release of converter clutch. PCM operates TCC PWM solenoid with a negative duty cycle. When vehicle operating conditions are appropriate to apply TCC, PCM immediately increases duty cycle to about 42 percent. PCM then increases duty cycle to about 90 percent to achieve full TCC apply pressure. When solenoid is commanded on, PCM will detect high voltage. When solenoid is commanded off, PCM will detect low voltage. DTC P1860 will set when PCM detects a continuous open, short to ground or short to voltage in TCC PWM solenoid circuit.

Conditions For Setting DTC P1860

DTC will set under the following conditions:

- System voltage is 8-18 volts.
- Engine has been running for more than 5 seconds, and is not in fuel shut off mode.
- TCC duty cycle is less than 10 percent or more than 90 percent.
- PCM detects an open, short to ground or short to voltage in TCC PWM solenoid circuit within 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Inhibits TCC engagement.
- Freezes shift adapts from being updated.
- DTC P1860 will be stored in PCM history.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool,

record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test. If DTCs P0753 and P0758 are present, go to next step. If DTCs P0753 and P0758 are not present, go to step 7.

2. Remove ERLS 10-amp fuse ("J" body) or AUTO TRANS fuse ("N" body) from instrument panel fuse block and inspect fuse. Replace fuse if necessary. If fuse was open, go to next step. If fuse is okay, go to step 5.
3. Check for short to ground in Pink wire between transaxle 20-pin connector and fuse block. Repair wire as necessary, then go to step 16. If wire is okay, go to next step.
4. Check for short to ground in Red wire between transaxle 20-pin connector and 2-3 shift solenoid. Repair wire as necessary, then go to step 16. If wire is okay, replace transaxle wiring harness, then go to step 16.
5. Check for open in Pink wire between transaxle 20-pin connector and fuse block. Repair wire as necessary, then go to step 16. If wire is okay, go to next step.
6. Check for open in Red wire between transaxle 20-pin connector and 2-3 shift solenoid. Repair wire as necessary, then go to step 16. If wire is okay, replace transaxle wiring harness, then go to step 16.
7. Turn ignition off. Disconnect transaxle 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect a test light between terminal "E" and "T" (Pink wire and Brown wire) of transaxle 20-pin connector. See **Fig. 1**. Turn ignition switch to ON position. DO NOT start engine. If test light is on, go to next step. If test light is off, go to step 10.
8. Turn ignition off. Disconnect PCM 80-pin connector C2. See **Fig. 3**, **Fig. 4** and **Fig. 5** . On"J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located below left side of instrument panel, near steering column.
9. On all models, turn ignition switch to ON position. Ensure test light is still connected between terminals "E" and "T" (Pink wire and Brown wire) of transaxle 20-pin connector. If test light is off, replace PCM, then go to step 16. If test light is on, check for short to ground in Brown wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 16.
10. Using scan tool, command TCC PWM solenoid on and off 3 times. If test light cycles on and off 3 times, go to step 13. If test light does not cycle on and off 3 times, or test light is always off, go to next step.
11. Check for open in Brown wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 16. If wire is okay, go to next step.
12. Connect test light between ground and terminal "T" (Brown wire) of transaxle 20-pin connector. If test light is off, replace PCM, then go to next step. If test light is on, check for short to battery voltage in Brown wire between transaxle 20-pin connector and TCC PWM solenoid. Repair wire as necessary, then go to step 16.
13. Turn ignition off. Disconnect jumper harness from PCM side of transaxle 20-pin connector and install harness to transaxle side of 20-pin connector. Connect ohmmeter between terminals "E" and "T" (Pink wire and Brown wire) of transaxle 20-pin connector.
14. If resistance is 10-15 ohms, go to next step. If resistance is not 10-15 ohms but is more than 250 ohms, check for open or poor connection in Brown wire and Red wire at connector. Repair wire or connector as necessary, then go to step 16. If resistance is not 10-15 ohms but is less than 250 ohms, go to next step.
15. Connect ohmmeter between ground and terminal "T" (Brown wire) of transaxle 20-pin connector. If resistance is more than 1000 ohms, replace TCC PWM solenoid, then go to next step. If resistance is less than 1000 ohms, check for short to ground in Brown wire between transaxle 20-pin connector and TCC PWM solenoid. Repair wire as necessary, then go to next step.
16. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC

and enter DTC "P1860". Road test vehicle in D4 and increase vehicle speed until TCC applies. Ensure TCC duty cycle is 10-90 percent for more than 5 seconds. If DTC P1860 is not present, repair is complete. If DTC P1860 is still present, repeat test.

Diagnostic Aids

Ensure transaxle fluid level is correct. Inspect PCM, transaxle and PWM solenoid connectors for bent, broken or backed out terminals. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. Check for moisture or corrosion. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1887: TCC RELEASE SWITCH CIRCUIT MALFUNCTION

NOTE: Perform appropriate ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK under DIAGNOSIS & TESTING. For wire terminal locations, see WIRING DIAGRAMS.

Circuit Description

Torque Converter Clutch (TCC) release switch is part of Pressure Switch Assembly (PSA) which is mounted to control valve assembly. Normally-closed switch provides a signal to PCM to indicate when TCC is released. This is accomplished by torque converter release fluid pressure acting on switch contact and opening the circuit. When voltage is high on circuit No. 657 (Yellow wire) or No. 1804 (White wire), PCM recognizes TCC is no longer engaged. DTC P1887 will set when PCM detects TCC release switch is open, indicating TCC is not applied, and TCC slip speed indicates TCC is engaged.

Conditions For Setting DTC P1887

DTC will set under the following conditions:

- DTCs P0716 or P0717 (input speed sensor) and P0741 or P0742 (TCC solenoid) are not present.
- Engine is running.
- Transaxle Fluid Pressure (TFP) manual valve position switch is in D4.
- TCC is commanded on.
- TCC slip speed is between -20 RPM and 40 RPM.
- Engine torque is more than 33 ft. lbs. (45 N.m).
- TCC release pressure is present for 6 seconds twice during same trip.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with a failure signal.
- Freezes shift adapts from being updated.
- Inhibits TCC engagement.
- DTC P1887 will be stored in PCM history after conditions are met during 2 consecutive trips.

Diagnostic Procedure

1. Connect scan tool to DLC. Turn ignition switch to ON position. DO NOT start engine. Using scan tool, record freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Select "TCC Release Switch" on scan tool. If TCC release switch status on scan tool is closed, go to next step. If TCC release switch status on scan tool is open, go to step 5.
3. Start engine. If TCC release switch status on scan tool is open, go to step 10. If TCC release switch status on scan tool is closed, turn ignition off. Disconnect transaxle 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.
4. If TCC release switch status on scan tool is open, go to step 7. If TCC release switch status on scan tool is closed, check for short to ground in Yellow wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 11. If wire is okay, replace PCM, then go to step 11.
5. Install Jumper Harness (J-39775) to PCM side of transaxle 20-pin connector. Connect fused jumper between ground and terminal "U" (Yellow wire) of transaxle 20-pin connector.
6. If TCC release switch status on scan tool is closed, go to next step. If TCC release switch status on scan tool is open, check for open in Yellow wire between transaxle 20-pin connector and PCM. Repair wire as necessary, then go to step 11. If wire is okay, replace PCM, then go to step 11.
7. Disconnect jumper harness from PCM side of transaxle 20-pin connector and install harness on transaxle side of 20-pin connector. Connect ohmmeter between ground and terminal "U" (White wire) of transaxle 20-pin connector.
8. If resistance is more than 50 ohms, check for open in White wire between transaxle 20-pin connector and TCC release switch. Repair wire as necessary, then go to step 11. If wire is okay, replace PSA, then go to step 11. If resistance is less than 50 ohms, start engine. If resistance is more than 50 ohms, check for open in White wire between transaxle 20-pin connector and TCC release switch. Repair wire as necessary, then go to step 11. If wire is okay, replace PSA, then go to step 11.
9. If resistance is less than 50 ohms, check for short to ground in White wire between transaxle 20-pin connector and TCC release switch. Repair wire as necessary, then go to step 11. If wire is okay, replace PSA, then go to step 11.
10. Inspect for leaking or cut torque converter "O" ring, blocked channel plate orificed exhaust passage, leaking, cut or improperly installed oil pump bearing and seal assembly seal, valve body-to-spacer plate gasket misaligned, spacer plate-to-channel plate gasket misaligned, channel plate turbine shaft sleeve installed backward or does not fit, blocked valve body spacer plate release exhaust orifice, or cut or missing turbine shaft-to-sprocket seal. Repair component(s) as necessary, then go to next step.
11. After repair is complete, select DTC on scan tool. Select CLEAR INFO function. Select SPECIFIC DTC and enter DTC "P1887". Drive vehicle in D4 to obtain 45 MPH. With TCC commanded on and engaged, TCC release switch status must be closed (no release oil present at switch) for 8 seconds. If DTC P1887 is not present, repair is complete. If DTC P1887 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transaxle 20-pin connectors. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Inspect for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

COMPONENT TESTS

CLEARING & RESETTING TAP VALUES

Using scan tool, clear and reset TAP values. Follow scan tool manufacturer's instructions. Start engine and allow to reach normal operating temperature with transmission in Park. Ensure all accessories are off. Apply brakes and shift transmission into Drive. Allow engine to idle for 2 minutes. Perform road test for 5-7 miles. Operate vehicle under normal conditions. Avoid extreme acceleration. Once road test is complete, allow engine to return to idle. Place transmission in PARK. Allow engine to idle for 1 minute. Turn engine off.

SHIFT SOLENOID LEAK TEST

Clamp 1/2" rubber hose over fluid inlet end of solenoid. Ground either terminal of solenoid. Apply less than 120 psi to open end of rubber hose. Apply 12 volts to remaining terminal. If air leak exists when solenoid is energized, replace solenoid.

COMPONENT SPECIFICATIONS

TRANSAXLE COMPONENT RESISTANCE SPECIFICATIONS

Component (1)	(2) Transaxle 20-Pin Connector Terminals	Ohms Resistance At 68°F (20°C)	Ohms Resistance At 212°F (100°C)
TCC PWM Solenoid	T & E	10-11	13-15
1-2 Shift Solenoid	A & E	19-24	24-31
2-3 Shift Solenoid	B & E	19-24	24-31
Pressure Control Solenoid	C & D	3-5	4-7
Input Speed Sensor	S & V	625-725	750-835
TFT Sensor	L & M	3106-3923	164-190
Output Speed Sensor	A & B	1500-1750	1750-1900

(1) See **Fig. 2**.

(2) See **Fig. 1**.

REMOVAL & INSTALLATION

POWERTRAIN CONTROL MODULE (PCM)

CAUTION: Electronic components used in control systems are designed to carry very low voltages. As little as a 30-volt charge created by static electricity can cause a total or degrading failure in PCM or other electronic components containing integrated circuits. Before servicing PCM, technician must ground himself and the work area to discharge static electricity.

CAUTION: DO NOT remove part from packaging until ready to install. Ground any static-proof package before opening. DO NOT touch electrical terminals of

components unless properly grounded. DO NOT lay electrical components on car seat, carpeting or dashboard. Use electrostatic protection mat and ground strap whenever possible.

NOTE: Before replacing PCM, carefully inspect all wiring and control components. Failure to test for short circuits may result in repeated PCM failure due to shorts. To prevent internal damage to PCM, ensure ignition switch is in OFF position when connecting or disconnecting PCM connectors or any electrical components.

Transmission Adaptive Pressure (TAP) values may require to be reset if one of the following repairs has been performed:

- Transmission overhaul or replacement.
- Repair or replacement of an apply or release component (band, clutch, piston and/or servo).
- Repair or replacement of a component or assembly which directly affects transmission line pressure.

To reset TAP values, see **CLEARING & RESETTING TAP VALUES**.

Removal & Installation

Turn ignition off. Disconnect negative battery cable. Locate PCM. On"J" body models, PCM is located forward of right front wheel housing, behind front fascia cavity splash shield. On "N" body models, PCM is located below left side of instrument panel, near steering column. Remove any necessary components to gain access to PCM. Disconnect harness connectors from PCM. Remove PCM mounting bolts (if equipped). Remove PCM. To install, reverse removal procedure. Transfer any necessary components (i.e., knock sensor module, EEPROM, etc.) to new PCM before installation. Program replacement PCM using appropriate equipment and latest software. See COMPUTER RELEARN PROCEDURES article in APPLICATION & IDENTIFICATION.

WIRING DIAGRAMS

Fig. 6: 1999 "J" Body - 2.2L & 2.4L (Cavalier & Sunfire) 4T40-E Transaxle System Wiring Diagram

Fig. 7: 1999 "N" Body - 2.4L (Malibu) 4T40-E Transaxle System Wiring Diagram

Fig. 8: 1999 "N" Body - 2.4L (Alero & Grand Am) 4T40-E Transaxle System Wiring Diagram

Fig. 9: 1999 "N" Body - 3.1L (Cutlass & Malibu) 4T40-E Transaxle System Wiring Diagram

Fig. 10: 1999 "N" Body - 3.4L (Alero & Grand Am) 4T45-E Transaxle System Wiring Diagram

