General Motors Corp. - 4L60-E Electronic Controls

DESCRIPTION

The 4L60-E transmission uses 2 electric shift solenoids to control transmission upshifts and downshifts. In addition, a pressure control (force motor) solenoid controls hydraulic line pressure, and a Torque Converter Clutch (TCC) solenoid controls TCC application. A TCC Pulse Width Modulated (PWM) solenoid is used to control fluid acting on converter clutch valve, which then controls TCC apply and release. A 3-2 control solenoid modulates hydraulic pressure for the 2-4 band and 3-4 clutch to improve 3-2 downshift. Solenoids are turned on and off by Powertrain Control Module (PCM).

PCM receives signals from various transmission sensors. Sensors include engine speed and throttle position, transmission speed, hydraulic pressure and transmission fluid temperature. PCM has on-board self-diagnostics to help identify any parts or circuits which may need further testing.

PCM

Passenger cars are equipped with a Powertrain Control Module (PCM). For PCM locations, see **PCM LOCATION** table.

PCM utilizes 2 different colored 80-pin connectors. See **Fig. 3** .

PCM controls TCC, pressure control solenoid, (hydraulic pressure), PWM solenoid and shift solenoids 1-2 and 2-3. In addition, PCM also controls ignition, fuel and emission devices related to engine.

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

PCM LOCATION

Application	Location
Corvette	Right Side Of Engine Compartment, Between
**	Wheelwell & Dash Panel, Below Battery

SENSORS & SWITCHES

PCM controls converter clutch lock-up, upshifts and downshifts based on transmission temperature, system voltage, throttle position, transmission oil pressure switches (5), and transmission output and input (engine) speed sensors. See **Fig. 1** . System includes several other sensors and switches that are used for engine control (gasoline engines). For additional information and testing of engine components, see appropriate article in ENGINE PERFORMANCE.

SOLENOIDS

Shift Solenoids 1-2 & 2-3

Transmission is shifted up or down by 2 electric shift solenoids. Both solenoids are located on valve body. See **Fig. 1** . Ignition power is supplied to each solenoid by transmission fuse. Solenoid 1-2 controls hydraulic pressure to 1-2 shift valve. Solenoid 2-3 controls hydraulic pressure to 2-3 shift valve.

NOTE: The 3-4 shift valve is directly controlled by hydraulic circuits in valve body.

Pressure Control Solenoid

Pressure control (force motor) solenoid has a spool valve and operates pressure regulator valve. See **Fig. 1** . PCM 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.

TCC Solenoid

This solenoid is used to control TCC apply valve. PCM sends a frequency signal to TCC solenoid to gradually apply or release TCC. See **Fig. 1** .

3-2 Control Solenoid

PCM modulates current (duty cycle) to control 3-2 control solenoid. The 3-2 control solenoid is off in first gear. In all other gears, 3-2 control solenoid is 90 percent on. Hydraulic pressure is regulated to smoothly release 3-4 clutch and 2-4 band during 3-2 downshift.

TCC PWM Solenoid

TCC PWM solenoid is used to control fluid acting on converter clutch valve, which then controls TCC apply and release. See **Fig. 1** . TCC PWM solenoid is used to provide smooth engagement of torque converter clutch by operating with a duty cycle on time of less than 50 percent.

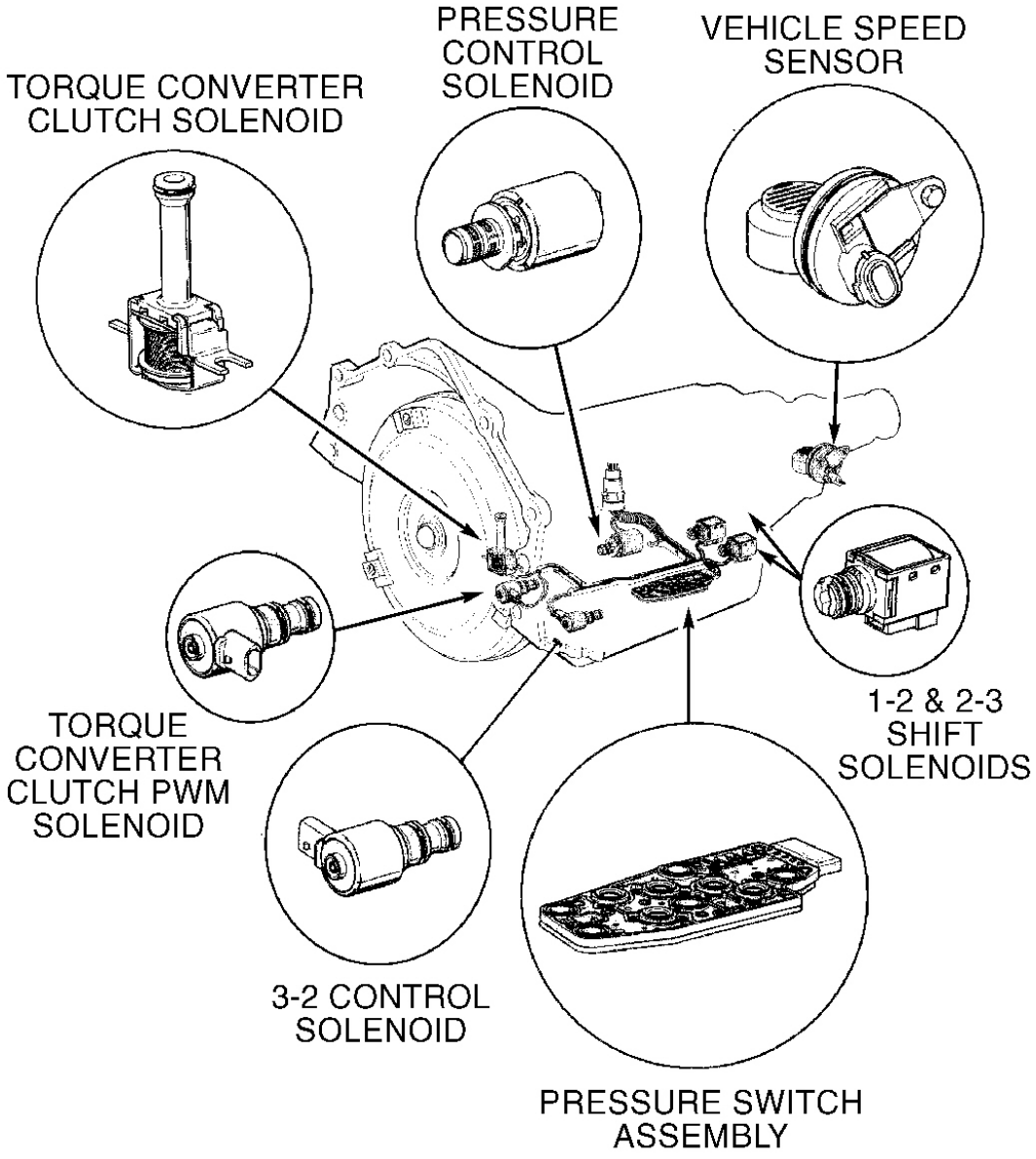


Fig. 1: Locating Transmission Solenoids, Sensors & Switches
Courtesy of GENERAL MOTORS CORP.

SELF-DIAGNOSTICS

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 glow.

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 transmission related DTCs or driveability problems. Engine faults and related DTCs must be diagnosed and repaired before transmission codes are repaired. For additional information on diagnosing and repairing engine related PCM trouble codes, see appropriate article in ENGINE PERFORMANCE.

OPERATION

Shift solenoid 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 **CLUTCH & BAND APPLICATION CHART** under ELECTRONIC TESTING.

LIMP-IN MODE

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

CLUTCH & BAND APPLICATION

CLUTCH & BAND APPLICATION CHART

Selector Lever Position	Shift Solenoid Position	Elements In Use
"D" (Overdrive) First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag & Low Roller Clutch
"D" (Overdrive) Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag & 2-4 Band
"D" (Overdrive) Third Gear	1-2 OFF/2-3 OFF	Forward Clutch, Forward Sprag & 3-4 Clutch
"D" (Overdrive) Overdrive	1-2 ON/2-3 OFF	Forward Clutch, 2-4 Band & 3-4 Clutch
"D" (Drive) First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag & Low Roller Clutch
"D" (Drive) Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag & 2-4 Band
"D" (Drive) Third Gear	1-2 OFF/2-3 OFF	Forward Clutch, Forward Sprag, Overrun Clutch & 3-4 Clutch
"2" (Intermediate) First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag, Low Roller Clutch & Overrun Clutch

"2" (Intermediate) Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band
"1" (Low) First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag, Low Reverse Clutch, Low Roller Clutch & Overrun Clutch
Second Gear (1)	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band
"R" (Reverse)	1-2 ON/2-3 ON	Low Reverse Clutch & Reverse Input Clutch
"P" (Park)	1-2 ON/2-3 ON	Low Reverse Clutch
"N" (Neutral)	1-2 ON/2-3 ON	All Clutches & Bands Released Or Ineffective
(1) Gear is only available above 30-35 MPH.		

SELF-DIAGNOSTIC SYSTEM

NOTE: To test electronic control of transmission solenoids, sensors and pressure switch assembly without using self-diagnostics or if self-diagnostics does not function, go to COMPONENT TESTS under ELECTRONIC TESTING. After repairs are made, DTCs should be erased from computer memory. See CLEARING TROUBLE CODES .

NOTE: If no DTCs are present and vehicle is in limp-in mode, check fused power supply circuit to transmission solenoids. Non-related transmission component system failure may cause this circuit fuse to fail. Fuses such as ERLS or SHIFT SOL fuse supply power to non-related transmission 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.

RETRIEVING CODES

NOTE: Stored DTCs may be retrieved from PCM memory using 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 also 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 also useful in finding intermittent wiring problems by wiggling wiring harness and connections (key on, engine off) while observing scan tool.

DIAGNOSTIC TROUBLE CODE (DTC) DEFINITIONS

NOTE: Only transmission-related trouble codes are listed. For engine-related DTC definitions, see TROUBLE CODE DEFINITIONS article in APPLICATIONS & IDENTIFICATION section. For engine-related DTC diagnosis, see TESTS W/CODES (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 transmission operation and diagnosis.

DIAGNOSTIC TROUBLE CODE (DTC) DEFINITIONS

DTC	Circuit Affected
DTC P0218	Transmission Fluid Overtemp.
DTC P0502	Vehicle Speed Sensor Circuit (Low Input)
DTC P0503	Vehicle Speed Sensor Circuit (Intermittent)
DTC P0560(1)	System Voltage Malfunction
DTC P0711	Trans. Fluid Temp. (TFT) Sensor Circuit (Range/Perf.)
DTC P0712	Trans. Fluid Temp. (TFT) Sensor Circuit (Low Input)
DTC P0713	Trans. Fluid Temp. (TFT) Sensor Circuit (High Input)
DTC P0719	Brake Switch Circuit Low Input (Switch Stuck On)
DTC P0724	Brake Switch Circuit High Input (Switch Stuck Off)
DTC P0740	TCC Solenoid Electrical Malfunction
DTC P0742	TCC Circuit Inoperative (Stuck On)
DTC P0748	Pressure Control Solenoid Electrical Malfunction
DTC P0751	1-2 Shift Solenoid ("A") Performance Malfunction
DTC P0753	1-2 Shift Solenoid ("A") Electrical Malfunction
DTC P0756	2-3 Shift Solenoid ("B") Performance Malfunction
DTC P0758	2-3 Shift Solenoid ("B") Electrical Malfunction
DTC P0785	3-2 Shift Solenoid Electrical Malfunction
DTC P1810	Transmission Fluid Pressure (TFP) Switch Malfunction
DTC P1860	TCC PWM Solenoid Electrical Malfunction
DTC P1870	Transmission Component Slipping

(1) 1997 models only.

HARD OR INTERMITTENT 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 CODES** . Read and record all stored DTCs. Exit diagnostic mode and clear trouble codes. See **CLEARING TROUBLE CODES** .
2. Apply parking brake and place transmission 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.

CLEARING 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 also 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 also 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 a failure reported.

ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

NOTE: Use of scan tool is required to perform OBD system check. Perform this test prior to performing any diagnostic procedures in DTC tests.

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 diagnostic system check, if no codes are indicated and driveability problems still exist, see TESTS W/O CODES article in ENGINE PERFORMANCE.

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

1. Install scan tool and follow scan tool manufacturer's instructions to proceed with test. 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 TESTING article in ENGINE PERFORMANCE.
2. Attempt to start engine. If engine starts and runs, go to next step. If engine does not start or starts and dies, go to NO-START DIAGNOSIS in BASIC TESTING article in ENGINE PERFORMANCE.
3. Using scan tool, select Eng DTC, DTC Info and Last Tst Fail. If any DTCs are present, go to next step. If DTCs are not present, select Eng DTC, DTC Info and History. If any DTCs are present, go to next step. If DTCs are not present, go to step 5).
4. Using scan tool, select "Capture Info", then "Store Info" (this option will only be displayed if there is no previously captured data) or "Refresh Info (to overwrite older data with current info). Then refer to affected DTC to diagnose problem.
5. If DTCs are not present, compare scan tool data with specific component values. If values are not within specified range, check related circuit or component(s). See SYSTEM/COMPONENT TESTS article in ENGINE PERFORMANCE.

DIAGNOSTIC TESTS

DIAGNOSTIC TESTS DESCRIPTION

NOTE: Not all DTCs are applicable to all models.

Diagnostic Tests

Following diagnostic tests are DTC specific. Always perform **ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** prior to performing any diagnostic procedure. For PCM terminal locations, see **Fig. 3** . See **WIRING DIAGRAMS** . For engine-related DTCs, see TESTS W/CODES (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.

USING DIAGNOSTIC TESTS & WIRING DIAGRAMS

PCM connector colors and terminal identification may vary with vehicle model and engine size. When using following diagnostic tests, see appropriate wiring diagram to determine which PCM connector(s) to disconnect during test procedure. Locate component being tested and trace specified wiring circuit to determine PCM connector and terminal related to that component.

DTC P0218: TRANSMISSION FLUID OVERTEMP

NOTE: **Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire terminal locations, see WIRING DIAGRAMS . Transmission Fluid Pressure (TFP) position switch assembly may also be referred to as Pressure Switch Assembly (PSA).**

Circuit Description

Flow of transmission fluid starts in bottom pan and is drawn through filter, control valve body, transmission case and into oil pump assembly. Oil pump assembly pressurizes fluid and directs it to pressure regulator valve, where it becomes the main supply of fluid to various components and hydraulic circuits in transmission. Hot fluid exiting torque converter flows through converter clutch apply valve and into transmission cooler lines to oil cooler and auxiliary cooler, if equipped. From cooler, fluid returns to cool and lubricate front of transmission. In forward drive ranges, "D4" fluid from manual valve is routed through an orificed cup plug in rear of transmission case to feed rear lube fluid circuit. DTC P0218 is set if PCM detects a high transmission fluid temperature for long periods of time.

Conditions For Setting DTC P0218

DTC will set under the following conditions:

- DTCs P0712 or P0713 (TFT sensor) are not present.
- Transmission fluid temperature is more than 266°F (130°C).
- All conditions are met for 10 minutes.

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. Ensure fluid level is correct. 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. If DTC P0711 is also set, see DIAGNOSTIC AIDS. If DTC P0711 is not set, inspect engine and transmission cooling system for restrictions, blockage or debris. Check transmission cooler lines for damage. Repair as necessary, then go to next step. If components are okay, perform line pressure test. See LINE PRESSURE TESTS in AUTO TRANS OVERHAUL - 4L60-E article. If line pressure is within specification, go to next step. If line pressure is not within specification, check torque converter stator for damage. See TORQUE CONVERTER in AUTO TRANS OVERHAUL - 4L60-E article.
3. 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. Scan tool must indicate fluid temperature

less than 264°F (129°C) for at least 5 seconds. If DTC P0218 is not present, repair is complete. If DTC P0218 is still present, repeat test.

Diagnostic Aids

DTC P0218 may set about 10 minutes after DTC P0711 has set. If DTC P0711 is also set, perform diagnostic procedure for that DTC before diagnosing DTC P0218. Repairing condition that caused DTC P0711 will probably eliminate DTC P0218. Verify driver habits such as towing trailer in "D4". Towing should be performed in "D3".

DTC P0502: VEHICLE SPEED SENSOR CIRCUIT (LOW INPUT)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, 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 transmission case extension. PM generator produces an AC voltage as speed sensor rotor teeth pass sensor's magnetic field. PCM converts AC voltage into digital signal. PCM uses vehicle speed to determine shift timing and TCC apply and release. VSS voltage will vary from a minimum of .5 volt AC at 100 RPM to more than 100 volts AC at 8000 RPM. VSS resistance value is 1470-2820 ohms. DTC P0502 is set if 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:

- Transmission is not in Park or Neutral.
- DTCs P0107 and P0108 (MAP sensor), or P0122 and P0123 (throttle position sensor) are not present.
- DTC P1810 (transmission fluid pressure position switch) is not present.
- Engine speed is 3000-4800 RPM.
- Throttle angle is more than 17 percent.
- Output speed is less than 250 RPM.
- All conditions are met for 3 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Commands 2nd gear only.
- Inhibits TCC engagement.
- Freezes shift adapts from being updated.

- Commands maximum line pressure.
- 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.
2. Start engine and let idle. Disable traction control system (if equipped). Shift gear selector to any forward position. Select "Output Speed" on scan tool. With drive wheels rotating, if transmission output speed does not increase when wheel speed increases, go to next step. If transmission output speed increases when wheel speed increases, see DIAGNOSTIC AIDS.
3. Turn ignition off. Disconnect appropriate PCM connector connected to VSS. See **WIRING DIAGRAMS** . Connect voltmeter between VSS terminals at appropriate PCM connector terminals. Rotate drive wheels and observe voltmeter display. If voltage is less than .5 volt, go to next step. If voltage is more than .5 volt, check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to step 7). If terminals and connections are okay, replace PCM, then go to step 7).
4. Using an ohmmeter, measure resistance between VSS terminals at appropriate PCM connector. See **WIRING DIAGRAMS** . If resistance is more than 2820 ohms, check for poor connection or open circuit in VSS wiring. Repair as necessary, then go to step 7). If wiring is okay, go to next step. If resistance is more than 1470 ohms, go to next step. If resistance is less than 1470 ohms, check for short to ground, or for VSS wires shorted together. Repair as necessary, then go to step 7). If wiring is okay, go to next step.
5. Reconnect appropriate PCM connector. Disconnect VSS connector. Measure resistance between VSS terminals. If resistance is not 1470-2820 ohms, go to next step. If resistance is 1470-2820 ohms, check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to step 7). If terminals and connections are okay, replace PCM, then go to step 7).
6. Remove VSS from transmission. Inspect output speed sensor rotor for damage or misalignment. Repair as necessary, then go to next step. If rotor is okay, replace VSS, 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". Test drive vehicle. Ensure transmission output speed is more than 251 RPM for 2 seconds. If DTC P0502 is not present, repair is complete. If DTC P0502 is still present, repeat test.

Diagnostic Aids

DTC P0502 sets when no vehicle speed is detected at start-off. Check for Electromagnetic Interferences (EMI) induced on VSS circuits caused by misrouted wiring harness too near spark plug wires. Check wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out or broken terminals, or misaligned connectors. Inspect for damaged VSS or for damaged output speed sensor rotor teeth. Check for moisture and corrosion. Ensure VSS is aligned correctly and secured to transmission case properly. An incorrect calibration may set DTC P0502. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0503: VEHICLE SPEED SENSOR CIRCUIT (INTERMITTENT)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, 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 transmission case extension. PM generator produces an AC voltage as speed sensor rotor teeth pass sensor's magnetic field. PCM converts AC voltage into digital signal. PCM uses vehicle speed to determine shift timing, TCC apply and release, and gear ratio calculations. VSS voltage will vary from .5 volt AC at 100 RPM to more than 100 volts AC at 8000 RPM. VSS resistance value is 1470-2820 ohms. DTC P0503 is set if PCM detects a large drop in vehicle speed.

Conditions For Setting DTC P0503

DTC will set under the following conditions:

- Transmission is not in Park, Neutral or Reverse.
- DTC P1810 (TFP valve position switch) is not present.
- Engine is not in fuel shut off mode.
- Time since last gear range change is more than 6 seconds.
- Engine speed is more than 450 RPM.
- Transmission output speed does not rise by 500 RPM within 6 seconds.
- Transmission output speed drops by more than 1300 RPM for 3 seconds and is not in Park or Neutral.
- Transmission output speed drops by more than 1600 RPM for 3 seconds in Park or Neutral.
- All conditions are met for 3 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL when fault is set.
- Inhibits TCC engagement.
- Commands maximum line pressure.
- Commands a soft landing to 2nd gear.
- Inhibits 4th gear in hot mode.
- Freezes shift adapts from being updated.
- 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.

2. Start engine and let idle. Disable traction control system, if equipped. Shift gear selector to any forward range. Select "Trans OSS" on scan tool. With drive wheels rotating, if "Trans OSS" RPM does not increase when wheel speed increases, go to step 4). If "Trans OSS" RPM increases when wheel speed increases, go to next step.
3. Use scan tool to check for most current PCM calibration I.D. number. Refer to manufacturer service bulletins if necessary. If I.D. number matches, replace PCM, then go to step 7). If I.D number does not match, update PCM with latest calibration, then go to step 7).
4. Turn ignition off. Disconnect VSS connector. Connect voltmeter between VSS terminals. See **Fig. 1** . Rotate drive wheels and observe voltmeter display. If voltage is less than .5 volt, go to next step. If voltage is more than .5 volt, go to step 6).
5. Connect ohmmeter between VSS terminals. If resistance is not 1470-2820 ohms, replace VSS, then go to step 7). If resistance is 1470-2820 ohms, remove VSS from transmission. Inspect output shaft sensor rotor teeth for damage or misalignment. Repair as necessary, then go to step 7). If rotor teeth are okay, replace VSS, then go to step 7).
6. Check for open, short to ground, short to voltage or VSS wires shorted together. Repair wires as necessary, then go to next step. If wires are okay, check PCM connector for damaged or backed out pins, or weak terminal tension. Repair as necessary, then go to next step. If connector is okay, replace PCM, then go to next step.
7. Install VSS into transmission. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P0503". Test drive vehicle and ensure transmission output speed is more than 600 RPM for 3 seconds and does not drop by more than 500 RPM. If DTC P0503 is not present, repair is complete. If DTC P0503 is still present, repeat test.

Diagnostic Aids

An incorrect VSS calibration may set DTC P0503. Check for Electromagnetic Interferences (EMI) induced on VSS circuits caused by misrouted wires along spark plug wires. Ensure VSS is secured to transmission case extension and correctly aligned. Check for damaged VSS or rotor teeth. Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out or broken terminals, or misaligned connectors. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0560: SYSTEM VOLTAGE MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

PCM monitors fused battery and ignition voltage circuits for low or high system voltage.

Conditions For Setting DTC P0560

DTC will set under the following conditions:

- For low system voltage, engine speed is more than 1000 RPM and system voltage is less than 10 volts at a maximum transmission temperature of 304°F (151°C), or less than 6.7 volts at a minimum transmission temperature of -40°F (-40°C).
- For high system voltage, system voltage is more than 16 volts for 2 seconds.
- All conditions are met for 2 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.
- All transmission output devices are off.
- DTC P0560 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. Using a DVOM, measure and record battery voltage at battery. If voltage is more than 10.5 volts, go to next step. If voltage is less than 10.5 volts, diagnose battery condition and repair or replace as necessary.
3. Start engine and warm to normal operating temperature. If generator (CHECK ENGINE) light on instrument panel is on, diagnose charging system and repair as necessary. If generator (CHECK ENGINE) light is off, increase engine speed to 1000-1500 RPM. Observe scan tool system voltage. If system voltage is 13-15 volts, go to next step. If system voltage is not 13-15 volts, diagnose charging system and repair as necessary.
4. Turn engine off. Disconnect appropriate PCM connector connected to battery positive voltage circuit. See **WIRING DIAGRAMS** . Turn ignition switch to ON position. DO NOT start engine. Using a DVOM, check for battery voltage at battery positive voltage terminals of appropriate PCM connector.
5. If difference between measured battery voltage in step 2) and voltage measured at appropriate PCM connector is less than .5 volt, go to next step. If voltage is more than .5 volt, check for high resistance in battery positive voltage circuits. Repair as necessary, then go to step 7).
6. Disconnect appropriate PCM connector connected to ignition positive voltage circuit. See **WIRING DIAGRAMS** . Using a DVOM, check for ignition voltage at ignition positive voltage terminals of appropriate PCM connector. If difference between measured battery voltage in step 2) and voltage measured at appropriate PCM connector is more than .5 volt, check for high resistance in ignition voltage circuits. Repair as necessary, then go to next step. If voltage is less than .5 volt, check appropriate PCM connector for bent, backed out or damaged connector terminals. Repair as necessary, then go to next step. If connector terminals are okay, replace PCM, 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 "P0560". Start vehicle and warm to normal operating temperature. PCM must detect a system voltage of 10-16 volts. If DTC P0560 is not present, repair is complete. If DTC P0560 is still present, repeat test.

Diagnostic Aids

Charging battery with battery charger or jump starting vehicle could set DTC P0560. If DTC set when accessories are operated, check for poor system connections or excessive current draw. Inspect starter solenoid for faulty connection. Inspect starter solenoid fusible link. Check drive belt for wear or incorrect tension.

DTC P0711: TRANS. FLUID TEMPERATURE (TFT) SENSOR CIRCUIT (RANGE/PERFORMANCE)

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within TFP valve position switch. TFT sensor controls signal voltage from PCM. PCM supplies a 5-volt reference signal to sensor. When transmission fluid temperature is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and detected voltage decreases. At transmission normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. TFT sensor resistance is 3088-3942. DTC P0711 is set if PCM detects a large change in transmission fluid temperature or if PCM detects a TFT value which remains constant for a period of time in which a measurable amount of change is expected for 2 consecutive ignition cycles.

Conditions For Setting DTC P0711

DTC will set under the following conditions:

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- System voltage is 10-16 volts.
- Transmission fluid temperature sensor voltage is .2-4.92 volts.
- Transmission fluid temperature at start-up is -40 to 70 °F (-40 to 21°C).
- DTC P1870 (transmission component slipping) is not present.
- Engine is running for more than 7 minutes.
- Vehicle speed is equal to or more than 5 MPH for 7 minutes or more within a single ignition cycle.
- Transmission fluid temp is equal to or more than 158°F (70°C) and has changed by at least 90°F (50°C) since start-up.
- TCC slip speed is equal to or more than 120 RPM for 7 minutes or more within a single ignition cycle.
- All of the above conditions are met and either of the following failure criteria occur in 2 consecutive ignition cycles:

Failure Criteria (Case No. 1)

Transmission fluid temperature has changed by less than 2.7°F (1.5°C) since start-up and condition is met for 7 minutes or more.

Failure Criteria (Case No. 2)

Transmission fluid temperature has changed by more than 36°F (20°C) within .2 seconds, and condition is met 14 times or more within 7 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.
- DTC P0711 is stored in PCM history.
- Determines a default transmission fluid temperature using the following information:

Default Temperatures

If any ECT DTC (P0117, P0118, P1114 or P1115) is set, PCM substitutes a transmission fluid temperature default value of 275°F (135°C). If ECT is more than 257°F (125 °C), PCM substitutes a transmission fluid temperature value of 275°F (135°C).

If engine run time is less than 5 minutes, and no IAT DTCs (P0112 or P0113) are set and IAT is available, PCM substitutes a transmission fluid temperature value equal to IAT.

If any IAT DTCs (P0112 or P0113) are set, or IAT is not available, PCM substitutes a transmission fluid temperature default value of 194°F (90°C).

If engine run time is more than 5 minutes, no IAT DTCs (P0112 or P0113) are set, IAT is available, ECT is 104-257°F (40-125°C), and IAT at start-up is less than 59°F (15°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 8°F (5°C). If IAT at start-up is more than 95°F (35°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 16°F (10°C). If IAT at start-up is 59-95°F (15-35°C), PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and any IAT DTCs (P0112 or P0113) is set, or IAT is not available, PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and ECT is less than 104°F (40°C), PCM substitutes a transmission fluid temperature default value equal to 140°F (60°C).

Diagnostic Procedure

1. Ensure transmission 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.
2. Select "TFT" on scan tool. Drive vehicle and observe scan tool for either of the following fail conditions: TFT does not change more than 2.7°F (1.5°C) in 7 minutes since start-up, or TFT changes more than 36° F (20°C) in .200 seconds, 14 times within 7 seconds (out of range change). If either of these conditions occurred, go to next step. If neither of these conditions occurred, cause is intermittent. See DIAGNOSTIC AIDS.

3. If scan tool displays a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, go to step 5). If scan tool does not display a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, go to next step.
4. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) on engine side of transmission 20-pin connector. Connect test light between terminals "L" and "M". See **Fig. 2** . Turn ignition switch to ON position. DO NOT start engine. While observing scan tool, wiggle engine wiring harness from appropriate PCM connector to transmission 20-pin connector. If TFT temperature changes by more than 36°F (20°C), go to step 6). If TFT temperature does not change by more than 36°F (20°C), go to step 7).
5. Turn ignition off. Disconnect transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If scan tool displays a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, replace PCM, then go to step 8). If scan tool does not display a condition in which TFT does not change by more than 2.7°F (1.5°C) in 7 minutes since start-up, replace TFT sensor, then go to step 8).
6. Check for intermittent open or short condition in TFT sensor circuits between PCM connector and transmission 20-pin connector. Repair circuit(s) as necessary, then go to step 8). If circuits are okay, replace PCM, then go to step 8).
7. Check for intermittent open or short condition in TFT sensor circuits between transmission 20-pin connector and TFT sensor. Repair circuit(s) as necessary, then go to next step. If circuits are okay, 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". Road test vehicle. Monitor transmission fluid temperature. Ensure that rise in fluid temperature is more than 4°F (2.25°C) within 11 seconds since start-up, and fluid temperature does not change by more than 36°F (20°C) within .200 seconds for a period of at least 11 seconds. If DTC P0711 is not present, repair is complete. If DTC P0711 is still present, repeat test.

Diagnostic Aids

If DTC P0218 (transmission fluid overtemp.) is also set, inspect transmission cooling system for blockage and restrictions. DTC P0218 may set about 10 minutes after DTC P0711 has set. If DTC P0711 is also set, perform diagnostic procedure for that DTC before diagnosing DTC P0218. Repairing condition that caused DTC P0711 will probably eliminate DTC P0218. Verify driver habits such as towing trailer in "D4". Towing should be performed in "D3". Inspect wiring for poor connections at PCM and at transmission 20-pin connector. Check for bent, backed out or broken terminals, or misaligned connectors. Check for weak terminal tension. Check for chafed wire that could short to bare metal or other wiring. Check for broken wire inside insulation. Check for moisture and corrosion. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

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

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within Transmission Fluid Pressure (TFP) position switch. TFP is also referred to as Pressure Switch Assembly (PSA). TFT sensor controls signal voltage from PCM. PCM provides a 5-volt reference to sensor on TFT sensor signal circuit. When transmission fluid is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and voltage decreases. At normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. Check sensor for shifted calibration by using sensor **TEMPERATURE-TO-RESISTANCE VALUES** table. DTC P0712 is set if PCM detects a continuous short to ground in TFT sensor signal circuit or TFT sensor.

Conditions For Setting DTC P0712

DTC will set under the following conditions:

- System voltage is 10-16 volts.
- Ignition switch is in ON position.
- TFT sensor indicates a voltage less than .2 volt.
- All conditions are met for 10 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with failure.
- Defaults transmission temperature to 275°F (135°C).
- Freezes shift adapts from being updated.
- Determines a default transmission fluid temperature using the following information:

Default Temperatures

If any ECT DTC (P0117, P0118, P1114 or P1115) is set, PCM substitutes a transmission fluid temperature default value of 275°F (135°C). If ECT is more than 257°F (125 °C), PCM substitutes a transmission fluid temperature value of 275°F (135°C).

If engine run time is less than 5 minutes, and no IAT DTCs (P0112 or P0113) are set and IAT is available, PCM substitutes a transmission fluid temperature value equal to IAT.

If any IAT DTCs (P0112 or P0113) are set, or IAT is not available, PCM substitutes a transmission fluid temperature default value of 194°F (90°C).

If engine run time is more than 5 minutes, no IAT DTCs (P0112 or P0113) are set, IAT is available, ECT is 104-257°F (40-125°C), and IAT at start-up is less than 59°F (15°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 8°F (5°C). If IAT at start-up is more than 95°F (35°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 16°F (10°C). If IAT at start-up is 59-95°F (15-35°C), PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and any IAT DTCs (P0112 or P0113) is set, or IAT is not available,

PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and ECT is less than 104°F (40°C), PCM substitutes a transmission fluid temperature default value equal to 140°F (60°C).

Diagnostic Procedure

1. Ensure transmission 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.
2. Read TFT sensor signal voltage on scan tool. If TFT sensor signal voltage is less than .2 volt, go to next step. If TFT sensor signal voltage is more than .2 volt, see DIAGNOSTIC AIDS.
3. Turn ignition off. Disconnect transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. If TFT sensor signal voltage is 4.92 volts, go to next step. If TFT sensor signal voltage is not 4.92 volts, check for short to ground in TFT sensor signal circuit. Repair circuit as necessary, then go to step 7). If circuit is okay, go to step 6).
4. Install Jumper Harness (J-39775) on transmission side of 20-pin connector. Using a DVOM, measure resistance of TFT sensor between TFP position switch terminals of jumper harness. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS.
5. If resistance is not 3088-3942 ohms, remove transmission oil pan. Check for short to ground in transmission wiring harness. Repair as necessary. If wiring harness is okay, disconnect TFT sensor connector. Measure resistance between TFT sensor terminals. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS. If resistance is not 3088-3942 ohms, replace TFP position switch, then go to step 7).
6. Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, 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 "P0712". Ensure TFT sensor indicates a voltage more than .2 volt for 10 seconds. 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 transmission 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. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. If DTC P0218 is also set, check transmission cooling system for possible blockage and/or restrictions.

TEMPERATURE-TO-RESISTANCE VALUES (1)

Temperature - °F (°C)	Ohms
212 (100)	177
158 (70)	467
95 (35)	1802
50 (10)	6238

-40 (-40)	110778
(1) Measure resistance across sensor terminals.	

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

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

Transmission Fluid Temperature (TFT) sensor is a negative coefficient thermistor within Transmission Fluid Pressure (TFP) position switch. TFT sensor controls signal voltage from PCM. PCM provides a 5-volt reference to sensor on TFT sensor signal circuit. When transmission fluid is cold, sensor resistance is high, and PCM detects high signal voltage. As transmission fluid temperature increases, sensor resistance decreases and voltage decreases. At normal operating temperature of 212°F (100°C), voltage is about 1.5-2 volts. Check sensor for shifted calibration by using sensor **TEMPERATURE-TO-RESISTANCE VALUES** table. DTC P0713 is set if PCM detects a continuous open or short to voltage in TFT sensor signal circuit or TFT sensor.

Conditions For Setting DTC P0713

DTC will set under the following conditions:

- System voltage is 10-16 volts.
- Ignition switch is in ON position.
- TFT sensor indicates a voltage less than 4.94 volts.
- All conditions are met for 7 minutes.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with failure.
- Defaults transmission temperature to 275°F (135°C).
- Freezes shift adapts from being updated.
- Determines a default transmission fluid temperature using the following information:

Default Temperatures

If any ECT DTC (P0117, P0118, P1114 or P1115) is set, PCM substitutes a transmission fluid temperature default value of 275°F (135°C). If ECT is more than 257°F (125 °C), PCM substitutes a transmission fluid temperature value of 275°F (135°C).

If engine run time is less than 5 minutes, and no IAT DTCs (P0112 or P0113) are set and IAT is available, PCM substitutes a transmission fluid temperature value equal to IAT.

If any IAT DTCs (P0112 or P0113) are set, or IAT is not available, PCM substitutes a transmission fluid temperature default value of 194°F (90°C).

If engine run time is more than 5 minutes, no IAT DTCs (P0112 or P0113) are set, IAT is available, ECT is 104-257°F (40-125°C), and IAT at start-up is less than 59°F (15°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 8°F (5°C). If IAT at start-up is more than 95°F (35°C), PCM substitutes a transmission fluid temperature default value equal to ECT plus 16°F (10°C). If IAT at start-up is 59-95°F (15-35°C), PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and any IAT DTCs (P0112 or P0113) is set, or IAT is not available, PCM substitutes a transmission fluid temperature default value equal to ECT.

If engine run time is more than 5 minutes, and ECT is less than 104°F (40°C), PCM substitutes a transmission fluid temperature default value equal to 140°F (60°C).

Diagnostic Procedure

1. Ensure transmission 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.
2. Read TFT sensor signal voltage on scan tool. If TFT sensor signal voltage is more than 4.92 volts, go to next step. If TFT sensor signal voltage is less than 4.92 volts, see DIAGNOSTIC AIDS.
3. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) on engine side of transmission 20-pin connector. Install fused jumper wire between appropriate PCM connector TFT sensor ground terminal, and appropriate PCM connector TFT sensor signal terminal of jumper harness. See **WIRING DIAGRAMS** . Turn ignition switch to ON position. DO NOT start engine. If TFT sensor signal voltage is less than .2 volt, go to next step. If TFT sensor signal voltage is more than .2 volt, check for open or short to voltage in TFT sensor signal circuit, or for open in TFT ground circuit. Repair circuits as necessary, then go to step 7). If circuits are is okay, go to step 6).
4. Turn ignition off. Remove jumper wire. Disconnect jumper harness from engine side of 20-pin connector. Install jumper harness on transmission side of 20-pin connector. Using a DVOM, measure resistance of TFT sensor harness between TFP position switch terminals of jumper harness. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS.
5. If resistance is not 3088-3942 ohms, remove transmission oil pan. Check for open in transmission wiring harness. Repair as necessary, then go to step 7). If wiring harness is okay, disconnect TFT sensor connector. Measure resistance between TFT sensor terminals. If resistance is 3088-3942 ohms, see DIAGNOSTIC AIDS. If resistance is not 3088-3942 ohms, replace TFP position switch, then go to step 7).
6. Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, 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". Ensure TFT sensor indicates a voltage less than 4.92 volts for 2 seconds. 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 transmission 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. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change. Check engine and transmission harness for open condition.

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

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

Torque Converter Clutch (TCC) brake switch is used to indicate brake pedal status to PCM. PCM de-energizes TCC solenoid when brake pedal is applied. DTC P0719 is set if PCM detects an open (stuck on) brake switch during acceleration.

Conditions For Setting DTC P0719

DTC will set under the following conditions:

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- Vehicle speed is less than 5 MPH.
- Then vehicle speed is 5-20 MPH for 4 seconds, then vehicle speed is more than 20 MPH for 6 seconds.
- All conditions must occur 7 times with brake switch on for more than 15 minutes without PCM detecting voltage input of 2 seconds or more.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after first failure signal.
- Ensures TCC brake switch remains closed with brake pedal released.
- Inhibits TCC engagement.
- Inhibits 4th gear if in hot mode.
- Freezes shift adapts from being updated.
- DTC P0719 is 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. Apply and release brake pedal while observing scan tool. If scan tool displays brake pedal in correct

positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.

3. Connect test light between ground and ignition feed circuit terminal at brake switch. If test light is off, repair open in ignition feed circuit, then go to step 9). If test light is on, connect test light between ground and brake switch signal terminal at brake switch. If test light is off, go to step 5). If test light is on, go to next step.
4. Apply brake pedal. If test light is off, go to step 6). If test light is on, check brake switch signal circuit for short to voltage. Repair circuit as necessary, then go to step 9). If circuit is okay, go to next step.
5. Ensure brake switch assembly is adjusted properly. Adjust brake switch as necessary, then go to step 9). If adjustment is okay, replace brake switch, then go to step 9).
6. Release brake pedal. Turn ignition off. Disconnect appropriate PCM connector connected to brake switch signal circuit. See **WIRING DIAGRAMS** . Turn ignition switch to ON position. DO NOT start engine. Connect test light between ground and brake switch signal terminal of appropriate PCM connector. If test light is on, go to next step. If test light is off, check for open in brake switch signal circuit between brake switch and PCM. Repair as necessary, then go to step 9).
7. Turn ignition off. Reconnect appropriate PCM connector. Turn ignition switch to ON position. DO NOT start engine. Apply and release brake pedal. If scan tool displays brake pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.
8. Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are okay, replace PCM, 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 "P0719". Ensure TCC brake switch signal indicates zero volts for 2 seconds with brake pedal applied. If DTC P0719 is not present, repair is complete. If DTC P0719 is still present, repeat test.

Diagnostic Aids

Check TCC brake switch for proper adjustment. Check PCM calibration for current update. Inspect wiring for poor connections at PCM. 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. Check 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 ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

Torque Converter Clutch (TCC) brake switch is used to indicate brake pedal status to PCM. PCM de-energizes TCC solenoid when brake pedal is applied. DTC P0724 is set if PCM detects a closed (stuck off) brake switch during deceleration.

Conditions For Setting DTC P0724

DTC will set under the following conditions:

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- PCM detects a closed TCC brake switch for 2 seconds and the following events occur 7 consecutive times:
- Vehicle speed is more than 20 MPH for 6 seconds.
- Then vehicle speed is 5-20 MPH for 4 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.
- Freezes shift adapts from being updated.
- 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 freeze frame and failure records for reference. Data will be lost when DTCs are cleared later in this test.
2. Apply and release brake pedal while observing scan tool. If scan tool displays brake pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.
3. Connect test light between ground and ignition feed circuit terminal at brake switch. If test light is off, repair open in ignition feed circuit, then go to step 8). If test light is on, connect test light between ground and brake switch signal terminal at brake switch. If test light is off, go to step 5). If test light is on, go to next step.
4. Apply brake pedal. If test light is off, go to step 6). If test light is on, check brake switch signal circuit for short to voltage. Repair circuit as necessary, then go to step 8). If circuit is okay, go to next step.
5. Ensure brake switch assembly is adjusted properly. Adjust brake switch as necessary, then go to step 8). If adjustment is okay, replace brake switch, then go to step 8).
6. Apply and release brake pedal. If scan tool displays brake pedal in correct positions, see DIAGNOSTIC AIDS. If scan tool does not display brake pedal in correct positions, go to next step.
7. Check PCM connector for damaged or backed out connector terminals, weak terminal tension and poor connections. Repair as necessary, then go to next step. If terminals and connections are 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 "P0724". Ensure TCC brake switch signal indicates 12 volts for 2 seconds with brake pedal released. If DTC P0724 is not present, repair is complete. If DTC P0724 is still present, repeat test.

Diagnostic Aids

Check TCC brake switch for proper adjustment. Check PCM calibration for current update. Inspect wiring for

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

DTC P0740: TCC SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

In conjunction with TCC PWM solenoid, TCC solenoid is used to control fluid flow acting on TCC valve. TCC valve controls apply and release of TCC. Solenoid is a normally-open on/off device. Solenoid is attached to transmission case and extends into oil pump cover. PCM monitors TP voltage, vehicle speed and other input devices in order to determine when to energize TCC solenoid. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. DTC P0740 is set if PCM detects a continuous open or short to ground in TCC solenoid circuit.

Conditions For Setting DTC P0740

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 10-17 volts.
- Engine is not in fuel cutoff mode.
- Engine speed is more than 450 RPM for 8 seconds.
- PCM commands solenoid on and voltage remains high (battery voltage).
- PCM commands solenoid off and voltage remains low (zero volts).
- All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Inhibits TCC engagement.
- Inhibits 4th gear if in hot mode.
- Freezes shift adapts from being updated.
- DTC P0740 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 P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate TCC solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See **WIRING DIAGRAMS** . Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 10). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 10).
3. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and TCC solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.
4. If test light does not light, check for open or short to ground in ignition feed circuit of TCC solenoid. Repair as necessary, then go to step 10). If test light lights, connect test light between TCC solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command TCC solenoid on and off 3 times.
5. If test light cycles on and off, go to next step. If test light does not cycle on and off 3 times, check TCC solenoid ground circuit for open or short to ground. Repair circuit as necessary, then go to step 10). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 10). If connections and terminals are okay, replace PCM, then go to step 10).
6. Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between TCC solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.
7. If resistance is 21-33 ohms, go to next step. If resistance is not 21-33 ohms, disconnect TCC solenoid connector. Measure resistance between TCC solenoid terminals. If resistance is 21-33 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 10). If resistance is not 21-33 ohms, replace TCC solenoid, then go to step 10).
8. Turn ignition off. Connect ohmmeter between ground and TCC solenoid ground circuit, and between ground and TCC solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.
9. Disconnect TCC solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace TCC solenoid, then go to next step.
10. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when TCC solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0740". If DTC P0740 is not present, repair is complete. If DTC P0740 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transmission 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. Check 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 ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS . For fluid circuit ID, see the OIL CIRCUIT DIAGRAMS in the AUTO TRANS DIAGNOSIS section.

Circuit Description

Torque Converter Clutch (TCC) solenoid stops converter signal oil exhaust. PCM commands solenoid on and off through ground circuit. When TCC solenoid is de-energized, solenoid will release fluid and release TCC. DTC P0742 is set if PCM detects a low torque converter slip when TCC is off.

Conditions For Setting DTC P0742

DTC will set under the following conditions:

- DTCs P0107 or P0108 (MAP sensor) are not present.
- DTCs P0122 or P0123 (throttle position sensor) are not present.
- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- DTC P0740 (TCC solenoid) is not present.
- DTC P1810 (TFP position switch) is not present.
- DTC P1860 (TCC PWM solenoid) is not present.
- Throttle position is more than 13 percent.
- Engine speed is more than 450 RPM and less than 5500 RPM for more than 2 seconds.
- Commanded gear is not 1st.
- TCC is commanded off.
- Gear range is D4, D3 or D2.
- TCC slip speed is -20 to 20 RPM for more than 5.6 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.
- 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. Using scan tool, verify TP sensor value is within .6-5.0 volts. If TP sensor voltage is as specified, go to next step. If TP sensor voltage is not as specified, see DIAGNOSTIC AIDS.
3. Drive vehicle in "D4" range in 4th gear under steady acceleration with TP angle more than 25 percent. Select "TCC Solenoid" state on scan tool. If scan tool displays TCC slip speed of -20 to 20 RPM in off state, go to next step. If scan tool does not display TCC slip speed of -20 to 20 RPM in off state, see DIAGNOSTIC AIDS.
4. TCC is mechanically stuck on. Inspect TCC for a clogged exhaust orifice in TCC solenoid, converter clutch apply valve stuck in apply position, misaligned or damaged valve body gasket, or a restricted release passage. Repair component as necessary, then go to next step.
5. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Hold throttle angle at 25 percent. Accelerate vehicle to 55 MPH. If throttle moves more than 3 percent, stop vehicle and start again. Ensure TCC slip speed is between -50 to 2500 RPM for 10 seconds with TCC off. Select "Specific DTC" and enter DTC "P0742". If DTC P0742 is not present, repair is complete. If DTC P0742 is still present, repeat test.

Diagnostic Aids

TCC may mechanically stick on with parking brake applied and any gear range selected. TCC fluid will mechanically apply TCC, which may cause engine to stall. A stuck TP sensor will set DTC P0742.

DTC P0748: PRESSURE CONTROL SOLENOID (PCS) ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

Pressure Control Solenoid (PCS) is used to regulate transmission line pressure. PCM compares TP voltage, engine RPM and other inputs to determine appropriate line pressure for given load. PCM will regulate pressure by applying varying amperage to PCS. Applied amperage can vary from 0.1-1.0 amps. PCM then monitors amperage. DTC P0748 is set if PCM detects a continuous open or short to ground in PCS circuit.

Conditions For Setting DTC P0748

DTC will set under the following conditions:

- System voltage is 10-17 volts.
- PCM recognizes PCS has reached electrical high or low limit.

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 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 0.1-1.0 amp and observe scan tool display. If PCS actual amperage reading is not within 0.16 amps of desired reference amperage reading, go to next step. If PCS actual amperage reading is within 0.16 amps of desired reference amperage reading, see DIAGNOSTIC AIDS.
3. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to transmission side of 20-pin connector. Using an ohmmeter, measure resistance of PCS between PCS terminals of jumper harness. If resistance is 3-7 ohms, go to step 5).
4. If resistance is not 3-7 ohms, remove transmission oil pan. Disconnect PCS connector. Measure resistance between PCS terminals. If resistance is 3-7 ohms, check for open in PCS wiring harness. Repair wiring as necessary, then go to step 6). If resistance is not 3-7 ohms, replace PCS, then go to step 6).
5. Check PCS circuits for poor connection, open or short to ground. Repair circuits as necessary, then go to next step. If circuits are okay, check for damaged or backed out PCM connector terminals. Repair as necessary, then go to next step. If connector terminals are okay, replace PCM, then go to next step.
6. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Ensure duty cycle is not at low or high limit. Select "Specific DTC" and enter DTC "P0748". 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 transmission 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. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0751: 1-2 SHIFT SOLENOID ("A") PERFORMANCE MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

The 1-2 shift solenoid (solenoid "A") is a normally open exhaust valve that is used in conjunction with 2-3 shift solenoid (solenoid "B"), to allow 4 different shifting combinations. Solenoid is attached to control valve body. DTC P0751 is set if PCM detects a 1-1-4-4 or a 2-2-3-3 shift pattern, depending on mechanical failure.

Conditions For Setting DTC P0751

DTC will set under the following conditions:

- DTCs P0122 or P0123 (throttle position sensor) are not present.

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- DTC P0742 (TCC stuck on) is not present.
- DTCs P0753 and P0758 (1-2 and 2-3 shift solenoid electrical) are not present.
- DTC P0785 (3-2 shift solenoid) is not present.
- DTC P1810 (Temperature Fluid Pressure position switch) is not present.
- Gear range is "D4".
- Vehicle speed is more than 5 MPH.
- Transmission fluid temperature is 68-266°F (20-130°C).
- Traction control is not active (if equipped).
- All conditions have been met and any combination of the following conditions occur 3 consecutive times:

Condition No. 1:

- Commanded 1-2 shift.
- Throttle angle is 17-42 percent.
- Throttle angle stays constant within 3 percent.
- Vehicle speed is 5-30 MPH.
- Within 2.5 seconds, engine speed in 2nd gear must be 150 RPM more than last speed in 1st gear.

Condition No. 2:

- Commanded 2-3 shift.
- Throttle angle is 17-32 percent.
- Throttle angle stays constant within 5 percent.
- Vehicle speed is 20-45 MPH.
- Within 1.7 seconds, engine speed in 3rd gear must be 75 RPM less than last speed in 2nd gear.

Condition No. 3:

- Commanded 3-4 shift.
- Throttle angle is 17-30 percent.
- Throttle angle stays constant within 3 percent.
- Vehicle speed is 28-65 MPH.
- Within 3 seconds, engine speed in 4th gear must be 20 RPM more than last speed in 3rd gear.

Condition No. 4:

- Commanded 4th gear.
- TCC is on.
- Throttle angle is 13-26 percent.
- Speed ratio (engine speed divided by output speed) is .85-1.2.

- TCC slip speed is 300-2000 RPM for more than 4 seconds.

Condition No. 5:

- Commanded 4th gear.
- TCC is on.
- Throttle angle is 13-26 percent.
- Speed ratio (engine speed divided by output speed) is .5-.79.
- TCC slip speed is between -20 and 20 RPM for more than 4 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.
- Defaults line pressure to "D2".
- DTC P0751 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 and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, go to next step. If gear position does not match transmission range switch on scan tool, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See **COMPONENT TESTS** .
3. Raise and support vehicle. Shift gear selector into "D4" position. Using scan tool, command 1st, 2nd, 3rd and 4th gears while accelerating vehicle. If a 1-1-4-4 or 2-2-3-3 shift pattern is not detected, see DIAGNOSTIC AIDS. If a 1-1-4-4 or 2-2-3-3 shift pattern is detected, check shift solenoids for damaged seals or internal malfunction. Repair shift solenoids as necessary, then go to next step.
4. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Hold throttle at 20 percent and accelerate vehicle to 55 MPH. If throttle moves more than 3 percent, stop vehicle and start again. Drive vehicle at 55 MPH for 2 miles. Select "Specific DTC" and enter DTC "P0751". If DTC P0751 is not present, repair is complete. If DTC P0751 is still present, repeat test.

Diagnostic Aids

Verify shift speeds are correct. See AUTO TRANS OVERHAUL - 4L60-E article. More than one shift may occur due to other internal transmission failures.

DTC P0753: 1-2 SHIFT SOLENOID ("A") ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

The 1-2 shift solenoid (solenoid "A") is used to control fluid flow acting on 1-2 and 3-4 shift valves. Solenoid is a normally open exhaust valve that is used in conjunction with 2-3 shift solenoid (solenoid "B"), 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 through ground circuit. DTC P0753 is set if PCM detects a continuous open or short to ground in 1-2 shift solenoid circuit.

Conditions For Setting DTC P0753

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 10-17 volts.
- Engine is not in fuel cutoff mode.
- Engine speed is more than 450 RPM for 5 seconds.
- PCM commands solenoid on and voltage remains high (battery voltage).
- PCM commands solenoid off and voltage remains low (zero volts).
- All conditions are met for 5 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.
- Defaults to maximum line pressure.
- DTC P0753 will be stored in PCM history.

SHIFT SOLENOID COMBINATIONS

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

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 P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate 1-2 shift solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See **WIRING DIAGRAMS** . Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 12). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 12).
3. Using scan tool, command 1-2 shift solenoid on and off 3 times while listening at transmission oil pan. If solenoid does not click when commanded on and off, go to next step. If solenoid clicks when commanded on and off, inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, see DIAGNOSTIC AIDS.
4. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and 1-2 shift solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.
5. If test light does not light, check for open or short to ground in ignition feed circuit of 1-2 shift solenoid. Repair as necessary, then go to step 12). If test light lights, connect test light between 1-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command 1-2 shift solenoid on and off 3 times. If test light cycles on and off, go to step 8). 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 7).
6. Check 1-2 shift solenoid ground circuit for short to ground. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).
7. Check for open in 1-2 shift solenoid ignition feed circuit or poor connection at PCM connector. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).
8. Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between 1-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.
9. If resistance is 19-31 ohms, go to next step. If resistance is not 19-31 ohms, disconnect 1-2 shift solenoid connector. Measure resistance between 1-2 shift solenoid terminals. If resistance is 19-31 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 12). If resistance is not 19-31 ohms, replace1-2 shift solenoid, then go to step 12).
10. Turn ignition off. Connect ohmmeter between ground and 1-2 shift solenoid ground circuit, and between ground and 1-2 shift solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.
11. Disconnect 1-2 shift solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace 1-2 shift solenoid, then go to next step.
12. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when 1-2 shift solenoid is commanded on, and voltage increases to battery

voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0753". If DTC P0753 is not present, repair is complete. If DTC P0753 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM. 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. Check 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 ("B") PERFORMANCE MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

The 2-3 shift solenoid (solenoid "B") is a normally open exhaust valve that is used in conjunction with 1-2 shift solenoid (solenoid "A"), to allow 4 different shifting combinations. Solenoid is attached to control valve body. DTC P0756 is set if PCM detects a 1-2-2-1 or a 4-3-3-4 shift pattern, depending on mechanical failure.

Conditions For Setting DTC P0756

DTC will set under the following conditions:

- DTCs P0122 or P0123 (throttle position sensor) are not present.
- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- DTCs P0712 or P0713 (TFT sensor) are not present.
- DTC P0740 (TCC solenoid) is not present.
- DTC P0742 (TCC stuck on) is not present.
- DTCs P0753 and P0758 (1-2 and 2-3 shift solenoid electrical) are not present.
- DTC P0785 (3-2 shift solenoid) is not present.
- DTC P1810 (temperature fluid pressure position switch) is not present.
- DTC P1860 (TCC PWM solenoid) is not present.
- Gear range is "D4".
- TCC is off.
- Vehicle speed is more than 5 MPH.
- Engine is not in fuel cutoff mode.
- Transmission fluid temperature is 68-266°F (20-130°C).
- Engine speed is more than 450 RPM for 2 seconds and less than 5500 RPM.
- All conditions are met and either one of the following fail conditions occurs:
- Solenoid is stuck on and Conditions No. 2 and 3 occur 3 consecutive times.

- Solenoid is stuck off and Conditions No. 1 and 3 occur 3 consecutive times.

Condition No. 1:

- 1st gear is commanded for 2.5 seconds.
- Throttle angle is more than 25 percent.
- Speed ratio (engine speed divided by output speed) is .5-2.59.
- TCC slip speed is between -93 and -2000 RPM for 1.6 seconds.
- Transmission output speed is 400-1500 RPM.

Condition No. 2:

- 3rd gear is commanded for one second.
- Throttle angle is 13-55 percent.
- Throttle angle stays constant within 3 percent.
- 3rd gear speed ratio is more than last 2nd gear speed ratio minus .2.
- 3rd gear TCC slip speed is more than or equal to last 2nd gear TCC slip speed plus 200 RPM for 1.3 seconds.
- Discontinue test if time since shift commanded is more than 5 seconds.

Condition No. 3:

- 4th gear is commanded for one second.
- Throttle angle is more than 18 percent.
- Speed ratio (engine speed divided by output speed) is 2.05-8.00.
- TCC slip speed is 1000-4000 RPM for 3 seconds.
- Transmission output speed is 0-8191 RPM.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Commands 3rd gear.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- DTC P0756 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 and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, go to next step. If gear position does not match transmission range switch on scan tool, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See **COMPONENT TESTS** .
3. Raise and support vehicle. Shift gear selector into "D4" position. Using scan tool, command 1st, 2nd, 3rd and 4th gears while accelerating vehicle. If 1st gear was commanded but not achieved or gear other than 4th gear occurred in 4th gear, check shift solenoids for damaged seals or internal malfunction. Repair shift solenoids as necessary, then go to next step. If all gears commanded were achieved, see DIAGNOSTIC AIDS.
4. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Hold throttle at 50 percent and accelerate vehicle to 55 MPH. If throttle moves more than 3 percent, stop vehicle and start again. Hold throttle at 20 percent and accelerate vehicle to 55 MPH. Select "Specific DTC" and enter DTC "P0756". If DTC P0756 is not present, repair is complete. If DTC P0756 is still present, repeat test.

Diagnostic Aids

Verify shift speeds are correct. See AUTO TRANS OVERHAUL - 4L60-E article. More than one shift may occur due to other internal transmission failures.

DTC P0758: 2-3 SHIFT SOLENOID ("B") ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

The 2-3 shift solenoid (solenoid "B") is used to control fluid flow acting on 2-3 shift valve. Solenoid is a normally open exhaust valve that is used in conjunction with 1-2 shift solenoid (solenoid "A"), 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 through ground circuit. DTC P0758 is set if PCM detects a continuous open or short to ground in 2-3 shift solenoid circuit.

Conditions For Setting DTC P0758

DTC will set under the following conditions:

- Ignition is on.
- System voltage is 10-17 volts.
- PCM commands solenoid on and voltage remains high (battery voltage).
- PCM commands solenoid off and voltage remains low (zero volts).
- All conditions are met for 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.
- Commands maximum line pressure.
- Transmission operates in 3rd gear only.
- 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 P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate 2-3 shift solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See **WIRING DIAGRAMS** . Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 12). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 12).
3. Using scan tool, command 2-3 shift solenoid on and off 3 times while listening at transmission oil pan. If solenoid does not click when commanded on and off, go to next step. If solenoid clicks when commanded on and off, inspect wiring for poor connections at PCM and transmission 20-pin connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, see DIAGNOSTIC AIDS.
4. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and 2-3 shift solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.
5. If test light does not light, check for open or short to ground in ignition feed circuit of 2-3 shift solenoid. Repair as necessary, then go to step 12). If test light lights, connect test light between 2-3 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command 2-3 shift solenoid on and off 3 times. If test light cycles on and off, go to step 8). 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 7).
6. Check 2-3 shift solenoid ground circuit for short to ground. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).
7. Check for open in 2-3 shift solenoid ignition feed circuit or poor connection at PCM connector. Repair circuit as necessary, then go to step 12). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 12). If connections and terminals are okay, replace PCM, then go to step 12).
8. Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install

harness to transmission side of 20-pin connector. Connect ohmmeter between 2-3 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

9. If resistance is 19-31 ohms, go to next step. If resistance is not 19-31 ohms, disconnect 2-3 shift solenoid connector. Measure resistance between 2-3 shift solenoid terminals. If resistance is 19-31 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 12). If resistance is not 19-31 ohms, replace2-3 shift solenoid, then go to step 12).
10. Turn ignition off. Connect ohmmeter between ground and 2-3 shift solenoid ground circuit, and between ground and 2-3 shift solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.
11. Disconnect 2-3 shift solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace 2-3 shift solenoid, then go to next step.
12. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when 2-3 shift solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0758". If DTC P0758 is not present, repair is complete. If DTC P0758 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM. 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. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P0785: 3-2 SHIFT SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

The 3-2 shift solenoid is a normally-closed 3-port on/off device which controls 3-2 downshift. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. During 3-2 downshift, 2-4 band applies as 3-4 clutch releases. PCM varies timing between 3-4 clutch release and 2-4 band apply depending on vehicle speed and throttle position. DTC P0785 is set if PCM detects a continuous open or short to ground in 3-2 shift solenoid circuit.

Conditions For Setting DTC P0785

DTC will set under the following conditions:

- System voltage is 10-17 volts.
- Ignition is on.
- Engine is not in fuel cutoff mode.

- Engine speed is more than 450 RPM for 5 seconds.
- PCM commands solenoid on and voltage remains high (battery voltage).
- PCM commands solenoid off and voltage remains low (zero voltage).
- All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Inhibits TCC engagement.
- Inhibits 4th gear if in hot mode.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- Commands a soft landing to 3rd gear.
- DTC P0785 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 P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate 3-2 shift solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See **WIRING DIAGRAMS** . Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 10). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 10).
3. Using scan tool, command 3-2 shift solenoid on and off 3 times while listening at transmission oil pan. If solenoid cycles, see DIAGNOSTIC AIDS. If solenoid does not cycle, turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and 3-2 shift solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.
4. If test light does not light, check for open or short to ground in ignition feed circuit of 3-2 shift solenoid. Repair as necessary, then go to step 10). If test light lights, connect test light between 3-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command 3-2 shift solenoid on and off 3 times.
5. If test light cycles on and off, go to next step. If test light does not cycle on and off 3 times, check 3-2 shift solenoid ground circuit for open or short to ground. Repair circuit as necessary, then go to step 10). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 10). If connections and terminals are okay, replace PCM, then go to step 10).
6. Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install

harness to transmission side of 20-pin connector. Connect ohmmeter between 3-2 shift solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.

7. If resistance is 20-32 ohms, go to next step. If resistance is not 20-32 ohms, disconnect 3-2 shift solenoid connector. Measure resistance between 3-2 shift solenoid terminals. If resistance is 20-32 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 10). If resistance is not 20-32 ohms, replace3-2 shift solenoid, then go to step 10).
8. Turn ignition off. Connect ohmmeter between ground and 3-2 shift solenoid ground circuit, and between ground and 3-2 shift solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.
9. Disconnect 3-2 shift solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace 3-2 shift solenoid, then go to next step.
10. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when 3-2 shift solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P0785". If DTC P0785 is not present, repair is complete. If DTC P0785 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transmission 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. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1572: TRACTION CONTROL SYSTEM (TCS) LOW VOLTAGE TOO LONG

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire terminal locations, see WIRING DIAGRAMS .

Circuit Description

PCM receives an input signal from Traction Control System (TCS) indicating a traction control event is occurring. Battery positive signal during normal operation becomes zero volts during traction control event. PCM inhibits upshifts, downshifts and TCC operation during event. DTC P1572 is set if PCM detects an active traction control circuit in Park and Neutral.

Conditions For Setting DTC P1572

DTC will set under the following conditions:

- DTC P1810 (TFP position switch) is not present.
- Transmission is in Park or Neutral.
- Traction control is active.
- All conditions are met for 6.4 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- If TCS is active, TCC is turned off.
- Inhibits 4th gear if in hot mode.
- Freezes shift adapts from being updated.
- DTC P1572 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 scan tool does not display traction control as "Active", see DIAGNOSTIC AIDS. If scan tool displays traction control as "Active", turn ignition off. Disconnect appropriate PCM connector connected to traction control system. See **WIRING DIAGRAMS** . Turn ignition switch to ON position. DO NOT start engine. If scan tool does not display traction control "Active", replace PCM, then go to next step. If scan tool displays traction control "Active", diagnose using ANTI-LOCK article or TRACTION CONTROL SYSTEM (TCS) article in the BRAKES.
3. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Ensure traction control is NOT active for 6.4 seconds. Select "Specific DTC" and enter DTC "P1572". If DTC P1572 is not present, repair is complete. If DTC P1572 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and brake switch. Check for bent, backed out, deformed or damaged terminals. Check for weak terminal tension. Check 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: TRANSMISSION FLUID PRESSURE (TFP) POSITION SWITCH ASSEMBLY MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire terminal ID, see WIRING DIAGRAMS . Transmission Fluid Pressure (TFP) position switch assembly may also be referred to as Pressure Switch Assembly (PSA).

Circuit Description

Transmission Fluid Pressure (TFP) position switch assembly consists of 5 pressure switches and a Transmission Fluid Temperature (TFT) sensor. 2 switches are normally-closed. 3 other switches are normally-open. Complete assembly mounts on control valve body.

PCM supplies battery voltage to each range switch. PCM grounds one or more range switch signal circuit through various combinations of pressure switches. PCM monitors combinations in order to detect what manual valve position has been selected. PCM compares actual voltage combination of switches to TFP position switch combination values stored in memory. TFP position switch cannot distinguish between Park and Neutral because monitored valve body pressures are identical. DTC P1810 is set if PCM detects an invalid state of TFP position switch. See TFP LOGIC TABLE.

TFP LOGIC

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

Conditions For Setting DTC P1810

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

Condition No. 1:

This condition detects an illegal switch combination.

- System voltage is 10-17 volts
- Engine is running.
- Engine is not in fuel cutoff mode.
- PCM detects an illegal TFP state.
- All conditions are met for one minute.

Condition No. 2:

This condition detects D2, D4 or Reverse during an engine start.

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- Engine speed is less than 100 RPM for .3 seconds, then engine speed is between 100-600 RPM for .3 seconds, then engine speed is more than 600 RPM for 3 seconds.
- Vehicle speed is less than 4 MPH.
- Detected gear range is D2, D4 or Reverse.
- All conditions are met for 3 seconds.

Condition No. 3:

This condition detect Park or Neutral when vehicle should be in D4.

- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- Engine speed is less than 2000 RPM.
- Speed ratio (engine speed divided by output speed) is .39-.80.
- TCC is locked on.
- Detected gear range is Park or Neutral.
- All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL after 2 consecutive trips with failure.
- Freezes shift adapts from being updated.
- Defaults line pressure to "D2".
- Defaults shift pattern to "D4".
- DTC P1810 will be stored in PCM history.

Diagnostic Procedure

1. Check transmission fluid. Fill as needed. Ensure transmission shift linkage is adjusted correctly. Diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See **COMPONENT TESTS** . 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 and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, see DIAGNOSTIC AIDS. If gear position does not match transmission range switch on scan tool, go to next step.
3. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) on PCM side of transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine. Using a DVOM, measure voltage at range input circuits "A", "B" and "C" at transmission 20-pin connector. See **WIRING DIAGRAMS** . If battery voltage is present at all circuits, go to step 5). If battery voltage is not present at all circuits, go to next step.
4. Check each circuit which did not have battery voltage for open or short to ground. Repair circuit(s) as necessary, then go to step 6). If all circuits are okay, inspect wiring for poor connections at appropriate PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 6). If connections and terminals are okay, replace PCM, then go to step 6).
5. Ensure circuits are not shorted together. Use a fused jumper to separately ground each circuit while monitoring scan tool TFP position switch A/B/C display. Repair circuits as necessary, then go to next step. If all circuits are okay, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See **COMPONENT TESTS** .

6. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Select "Specific DTC" and enter DTC "P1810". Turn ignition switch to ON position for at least 2 seconds. Start vehicle and idle for 5 seconds. Drive vehicle in D4 until TCC locks for 20 seconds. If DTC P1810 is not present, repair is complete. If DTC P1810 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and at transmission 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 P1860: TCC PWM SOLENOID ELECTRICAL MALFUNCTION

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

TCC PWM solenoid is used to control fluid flow acting on converter clutch valve. Solenoid controls TCC apply and release. Solenoid is attached to control valve body. Ignition voltage is supplied directly to solenoid through fused circuit. PCM commands solenoid on or off through ground circuit. TCC PWM solenoid provides a smooth engagement of TCC by operating during duty cycle percent of on time. DTC P1860 is set if PCM detects a continuous open or short to ground in TCC PWM solenoid circuit.

Conditions For Setting DTC P1860

DTC will set under the following conditions:

- 1st gear is commanded.
- Ignition is on.
- DTCs P0751 or P0753 (1-2 shift solenoid) are not present.
- DTCs P0756 or P0758 (2-3 shift solenoid) are not present.
- System voltage is 10-17 volts.
- TCC is at 100 percent duty cycle for more than .1 second.
- TCC is at zero percent duty cycle for more than 5 seconds.
- PCM commands solenoid off and voltage remains low (zero volts).
- All conditions are met for 5 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.

- Inhibits TCC engagement.
- Inhibits 4th gear if in hot mode.
- 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.
2. If DTCs P0740, P0753, P0758, P0785 and P1860 are not present, go to next step. If DTCs P0740, P0753, P0758, P0785 and P1860 are present, remove appropriate TCC PWM solenoid ignition feed circuit fuse from underhood electrical center and inspect fuse. See **WIRING DIAGRAMS** . Replace fuse if necessary, and check for short to ground in wiring harness between transmission 20-pin connector and fuse. Repair wiring as necessary, then go to step 10). If fuse is okay, check for open in wiring harness between transmission 20-way connector and fuse. Repair wire as necessary, then go to step 10).
3. Turn ignition off. Disconnect transmission 20-pin connector. Install Jumper Harness (J-39775) to PCM side of transmission 20-pin connector. Connect test light between ground and TCC PWM solenoid ignition feed circuit at transmission 20-pin connector. Turn ignition switch to ON position. DO NOT start engine.
4. If test light does not light, check for open or short to ground in ignition feed circuit of TCC PWM solenoid. Repair as necessary, then go to step 10). If test light lights, connect test light between TCC PWM solenoid ground circuit and ignition feed circuit at transmission 20-pin connector. Using scan tool, command TCC PWM solenoid on and off 3 times.
5. If test light cycles on and off, go to next step. If test light does not cycle on and off 3 times, check TCC PWM solenoid ground circuit for open or short to ground. Repair circuit as necessary, then go to step 10). If circuit is okay, inspect wiring for poor connections at PCM connector. Check for bent, backed out, deformed or damaged terminals. Repair as necessary, then go to step 10). If connections and terminals are okay, replace PCM, then go to step 10).
6. Turn ignition off. Disconnect jumper harness from PCM side of transmission 20-pin connector and install harness to transmission side of 20-pin connector. Connect ohmmeter between TCC PWM solenoid ground circuit and ignition feed circuit at transmission 20-pin connector.
7. If resistance is 10-15 ohms, go to next step. If resistance is not 10-15 ohms, disconnect TCC PWM solenoid connector. Measure resistance between TCC PWM solenoid terminals. If resistance is 10-15 ohms, check for open circuit in transmission wiring harness. Repair as necessary, then go to step 10). If resistance is not 10-15 ohms, replace TCC PWM solenoid, then go to step 10).
8. Turn ignition off. Connect ohmmeter between ground and TCC PWM solenoid ground circuit, and between ground and TCC PWM solenoid ignition feed circuit at transmission 20-pin connector. If resistance is more than 250 k/ohms, see DIAGNOSTIC AIDS. If resistance is less than 250 k/ohms, go to next step.
9. Disconnect TCC PWM solenoid connector. Measure resistance between ground and each solenoid terminal. If resistance is more than 250 k/ohms, check for short to ground in transmission wiring harness. Repair as necessary, then go to next step. If resistance is less than 250 k/ohms, replace TCC PWM solenoid, then go to next step.

10. After repair is complete, select DTC on scan tool. Select "Clear Info" function. Test drive vehicle. Ensure voltage decreases to zero when TCC PWM solenoid is commanded on, and voltage increases to battery voltage when commanded off. Conditions must be met for 5 seconds. Select "Specific DTC" and enter DTC "P1860". If DTC P1860 is not present, repair is complete. If DTC P1860 is still present, repeat test.

Diagnostic Aids

Inspect wiring for poor connections at PCM and transmission 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. Check for broken wire inside insulation. If diagnosing for intermittent short or open condition, move wiring harness while observing scan tool for value change.

DTC P1870: TRANSMISSION COMPONENT SLIPPING

NOTE: Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK prior to performing diagnostic procedures. For wire circuit ID, see WIRING DIAGRAMS .

Circuit Description

PCM monitors difference between engine speed and transmission output speed. In "D3" with TCC engaged, engine speed should closely match transmission output speed. In "D4" with TCC engaged, TCC slip speed should be -20 to 20 RPM. DTC P1870 is set if PCM detects excessive TCC slip when TCC should be engaged.

Conditions For Setting DTC P1870

DTC will set under the following conditions:

- DTCs P0122 or P0123 (throttle position sensor) are not present.
- DTCs P0502 or P0503 (vehicle speed sensor) are not present.
- DTCs P0712 or P0713 (TFT sensor) are not present.
- DTC P0740 (TCC solenoid) is not present.
- DTCs P0751 or P0753 (1-2 shift solenoid) are not present.
- DTCs P0756 or P0758 (2-3 shift solenoid) are not present.
- DTC P1810 (TFP position switch) is not present.
- DTC P1860 (TCC PWM solenoid) is not present.
- Engine speed is less than 5500 RPM.
- Gear range is "D4".
- Vehicle is not in 1st gear.
- Throttle angle is 13-36 percent.
- Transmission fluid temperature is 68-266°F (20-130°C).
- TCC is on for more than .1 second.
- TCC is at maximum apply for .1 second.
- Shift solenoid performance counter is at zero.

- TCC slip speed is more than 130 RPM for more than 8 seconds.

Action Taken By PCM

PCM performs the following if DTC is set:

- Will light MIL at first failure signal.
- Inhibits TCC engagement.
- Inhibits 4th gear if in hot mode.
- Freezes shift adapts from being updated.
- Commands maximum line pressure.
- DTC P1870 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 and let idle. Apply parking brake. While observing scan tool, shift transmission into each gear position. If gear position matches transmission range switch on scan tool, go to next step. If gear position does not match transmission range switch on scan tool, diagnose Transmission Fluid Pressure (TFP) position switch. Switch is also referred to as Pressure Switch Assembly (PSA). See **COMPONENT TESTS** .
3. Drive vehicle in 4th gear while TCC is engaged. If TCC slip speed is more than 130 RPM for 10 seconds, go to TROUBLE SHOOTING in AUTO TRANS OVERHAUL - 4L60-E article. If TCC slip speed is less than 130 RPM for 10 seconds, see DIAGNOSTIC AIDS.

Diagnostic Aids

A TFP position switch (Pressure Switch Assembly) malfunction could set DTC P1870. Ensure final drive ratio matches PCM calibration. The following mechanical conditions could set DTC P1870:

- Shift solenoids.
- TCC solenoid.
- TCC PWM solenoid.
- Internal transmission failures.
- Engine misfire.
- Transmission range switch DTC.

ELECTRONIC TESTING

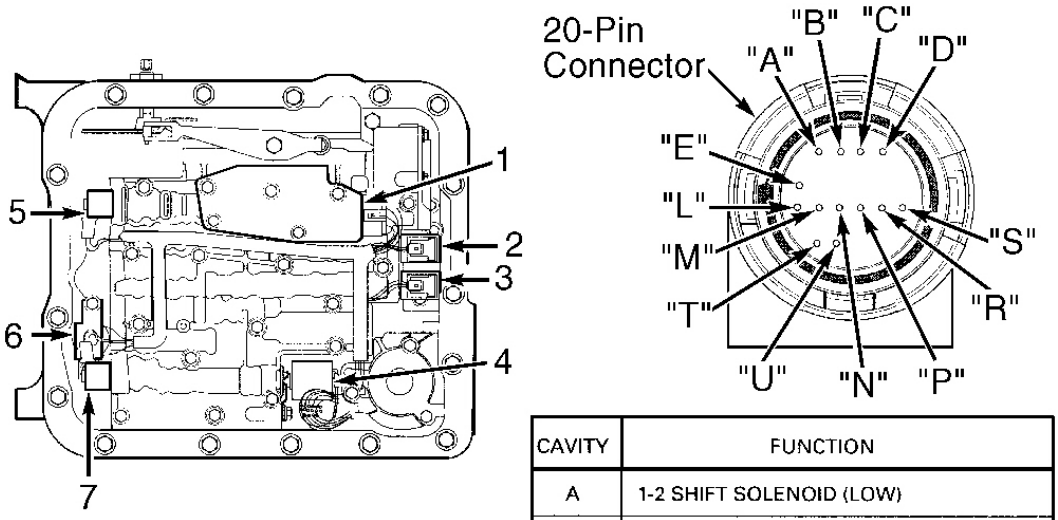
COMPONENT TESTS

Component & Wiring Harness Resistance Check

1. Install Jumper Harness (J-39775) to transmission 20-pin connector. Using an ohmmeter, measure resistance between specified terminals for each component. See **Fig. 2** . Compare resistance reading to known values. See **TRANSMISSION COMPONENT RESISTANCE SPECIFICATIONS** table.
2. If resistance reading is okay, go to next step. If resistance reading is not okay, disconnect wiring harness at component and measure component resistance. Replace component if resistance is not as specified. If resistance is as specified, repair wiring harness between component and 20-pin connector.
3. Measure resistance between ground and each terminal at transmission 20-pin connector. See **Fig. 2** . Resistance should be more than 250 k/ohms for each solenoid and more than 10 megohms for fluid temperature sensor and vehicle speed sensor. Resistance for fluid temperature sensor will vary with temperature. If resistance is within specification, problem is intermittent. If resistance is low, disconnect wiring harness at component.
4. Measure resistance between component terminals and ground. If resistance is low, replace component. If resistance is high, inspect wiring harness for short to ground. Repair as necessary.

TRANSMISSION COMPONENT RESISTANCE SPECIFICATIONS

Component	Ohms
Pressure Control Solenoid	3-7
TCC PWM Solenoid	10-15
TCC Solenoid	21-33
1-2 & 2-3 Shift Solenoids	19-31
3-2 Control Solenoid	20-32
TFT Sensor	
At 68°F (20°C)	3088-3942
At 212°F (100°C)	159-198
Vehicle Speed Sensor	
At 68°F (20°C)	1470-2220
At 212°F (100°C)	1800-2820



1. Pressure Switch Assembly
2. 1-2 Shift Solenoid
3. 2-3 Shift Solenoid
4. Pressure Control Solenoid
5. 3-2 Control Solenoid
6. TCC Solenoid
7. TCC Control Solenoid

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

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

NOTE: Pressure switch assembly is also referred to as Transmission Fluid Pressure (TFP) Valve Position Switch.

Transmission Fluid Pressure (TFP) Valve Position Switch

1. Install Jumper Harness (J39775) to transmission 20-pin connector. Using DVOM, measure resistance between terminal "N" of transmission 20-pin connector and ground. See **Fig. 2** . If resistance is less than

50 k/ohms, go to next step. If resistance is more than 50 k/ohms, go to step 3).

2. Disconnect TFP valve position switch connector. Measure resistance between terminal "C" at TFP valve position switch and ground. See **WIRING DIAGRAMS** . If resistance is more than 50 k/ohms, go to step 16). If resistance is less than 50 k/ohms, replace TFP valve position switch.
3. Measure resistance between terminal "R" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to step 5). If resistance is more than 200 ohms, go to next step.
4. Disconnect TFP valve position switch connector. Measure resistance between terminal "E" at TFP valve position switch and ground. See **WIRING DIAGRAMS** . If resistance is less than 200 ohms, go to step 16). If resistance is more than 200 ohms, replace TFP valve position switch.
5. Measure resistance between terminal "P" of transmission 20-pin connector and ground. See **Fig. 2** . If resistance is less than 50k/ohms, go to next step. If resistance is more than 50 k/ohms, go to step 7).
6. Disconnect TFP valve position switch connector. Measure resistance between terminal "D" at TFP valve position switch and ground. See **WIRING DIAGRAMS** . If resistance is more than 50 k/ohms, go to step 16). If resistance is less than 50 k/ohms, replace TFP valve position switch.
7. Start engine and allow to idle. Set parking brake. Place gear selector in Reverse. Measure resistance between terminal "N" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to next step. If resistance is more than 200 ohms, go to step 16).
8. Place gear selector in "1" (low) position. Measure resistance between terminal "N" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to next step. If resistance is more than 200 ohms, go to step 16).
9. Place gear selector in "3" (3rd gear) position. Measure resistance between terminal "R" of transmission 20-pin connector and ground. If resistance is more than 50 k/ohms, go to next step. If resistance is less than 50 k/ohms, go to step 16).
10. Place gear selector in "D" (overdrive) position. Measure resistance between terminal "P" of transmission 20-pin connector and ground. If resistance is less than 200 ohms, go to next step. If resistance is more than 200 ohms, go to step 16).
11. Place gear selector in "2" (2nd gear) position. Measure resistance between terminal "P" of transmission 20-pin connector and ground. If resistance is more than 50 k/ohms, go to next step. If resistance is less than 50 k/ohms, go to step 16).
12. Turn ignition off. Measure resistance between terminal "L" and terminal "M" at transmission 20-pin connector. If TFT sensor resistance is 3088-3942 ohms at 68°F (20°C) or 159-198 ohms at 212°F (100° C), go to next step. If TFT sensor resistance is not as specified, go to step 14).
13. Measure resistance between terminal "L" of transmission 20-pin connector and ground, and between terminal "M" of transmission 20-pin connector and ground. If both resistance readings are more than 10 megohms, problem is intermittent. Go to step 16). If both resistance readings are less than 10 megohms, go to next step.
14. Disconnect TFP valve position switch connector. Measure resistance between terminal "A" and terminal "B" at TFP valve position switch. If TFT sensor resistance is 3088-3942 ohms at 68°F (20°C) or 159-198 ohms at 212°F (100°C), go to next step. If TFT sensor resistance is not as specified, replace TFP valve position switch.
15. Measure resistance between terminal "A" of TFP valve position switch and ground, and between terminal "B" of TFP position switch and ground. If both resistance readings are more than 10 megohms, go to next step. If both resistance readings are less than 10 megohms, replace TFP valve position switch.

16. Check for short or high resistance in TFP valve position switch circuits. Check for poor connections at transmission 20-pin connector and at TFP valve position switch. Check for bent, backed out or damaged terminals, or poor terminal tension. If diagnosing for intermittent problem, wiggle wiring harness while observing test equipment for change in value. If short or high resistance is found, verify repair, then repeat test procedure. If short or high resistance is not found, check for open or short to ground in circuits between TFP valve position switch and PCM. Replace wiring harness as necessary. If circuits are okay, replace TFP valve position switch.

PCM HARNESS CONNECTOR TERMINALS IDENTIFICATION

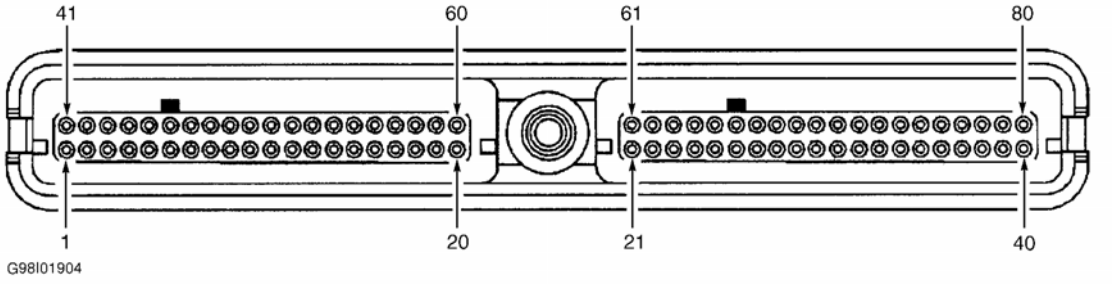

Fig. 3: PCM 80-Pin Harness Connector Terminal ID (C1 - Red & C2 - Blue)
Courtesy of GENERAL MOTORS CORP.

WIRING DIAGRAMS

Fig. 4: Wiring Diagram