MODEL IDENTIFICATION

Vehicle model is identified by fourth character of Vehicle Identification Number (VIN). VIN is stamped on metal pad on top of left end of instrument panel, near windshield.

INTRODUCTION

Before testing separate components or systems, perform all procedures listed in **BASIC TESTING** article. Since many computer-controlled and monitored components will set a diagnostic trouble code if they malfunction, it is also recommended self-diagnosis be performed. See **TESTS W/CODES** article.

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens.

COMPUTERIZED ENGINE CONTROLS

PCM POWER & GROUND CHECK

Ground Circuits

1. Using an ohmmeter, check for continuity to ground at PCM ground terminals. See **POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D.** table. Resistance should be zero ohms. If not, repair open to ground.
2. Using a voltmeter, connect negative lead of voltmeter to a good ground. Backprobe positive lead of voltmeter to each ground terminal. With vehicle running, voltmeter should indicate less than one volt. If voltmeter reading is more than one volt, check for open, short to voltage, corrosion or loose connection on ground circuit.

Power Circuits

1. Using a voltmeter, check for battery voltage between PCM continuous power terminal(s) and ground. See **POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D.** table. If battery voltage is not present, check for blown fuse or open fusible link. If okay, check for open in wire between PCM terminal and power source.
2. Turn ignition switch to RUN position. Using a voltmeter, check for battery voltage between PCM ignition power terminals and ground. If battery voltage is not present, check IGN fuse. If fuse is okay, check for an open in wire between battery and ignition switch, and between ignition switch and PCM terminal. If okay, check for a defective ignition switch.
3. Connect voltmeter between ground and PCM starter (crank) signal terminal. On vehicles with manual

transmission/transaxle, depress clutch pedal. On vehicles with automatic transmission/transaxle, position gear shift lever in Park. On all vehicles, turn ignition switch to START position. Battery voltage should be present only when ignition switch is in START position.

4. If voltage is not present, check CRANK fuse or fusible link between ignition switch and PCM terminal. If fuse or fusible link is okay, check for an open in wire between ignition switch and PCM terminal, or check for a defective ignition switch.

PCM Harness Resistance

Turn ignition switch to LOCK position. Disconnect PCM and appropriate component harness connectors. Check for open or short circuits between PCM harness connector terminal and component harness connector terminal. See **POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D.** table. See **WIRING DIAGRAMS** article. If harness is open or shorted, repair as necessary.

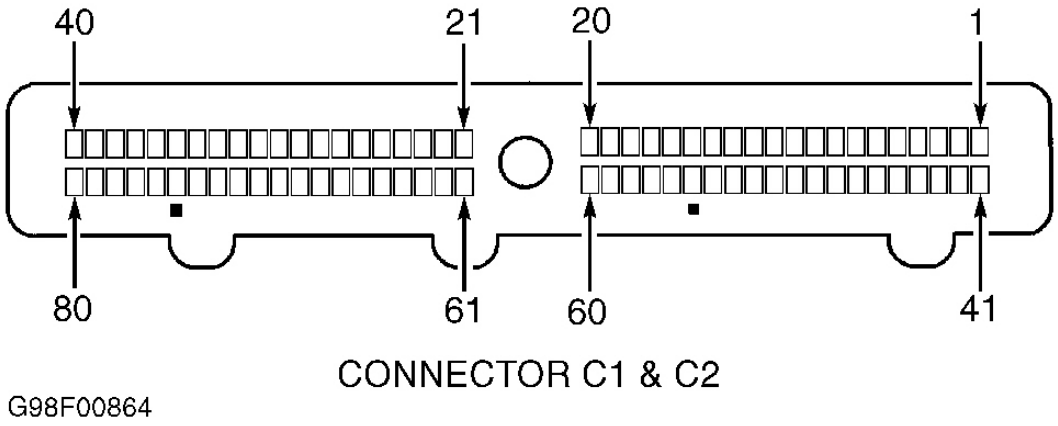

Fig. 1: Identifying Powertrain Control Module (PCM) Harness Connector Terminals
Courtesy of GENERAL MOTORS CORP.

POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D. (1)

Connector	Terminal	Wire Color	Function
C1	1 & 2	*****	Not Used
C1	3	(2) WHT	EVAP Canister Vent Valve Control
C1	4	BRN/WHT	Camshaft Position Sensor Signal
C1	5 & 6	*****	Not Used
C1	7	YEL	Vehicle Speed Sensor High
C1	8	*****	Not Used
C1	9	PNK/BLK	Fuel Injector No. 3 Control
C1	10	*****	Not Used
C1	11	DK BLU	(2) VTD Fuel Enable

C1	12	LT BLU/BLK	Fuel Injector No. 4 Control
C1	13	(3) RED/WHT	Fuel Injector No. 2 Control
C1	14	GK GRN	A/C Clutch Status
C1	15	BLK/WHT	Fuel Injector No. 5 Control
C1	16 & 17	*****	Not Used
C1	18	YEL/BLK	Fuel Injector No. 6 Control
C1	19 & 20	*****	Not Used
C1	21	PPL	Intake Air Temperature Sensor Ground
C1	22	DK BLU	Transmission Range Switch B Signal
C1	23	LT GRN/BLK	Fuel Injector No. 2 Control
C1	24	BLK/WHT	Sensor Ground Jumper
C1	25	PNK	Transmission Range Switch A Signal
C1	26	BLK/WHT	PRND A
C1	27	RED/BLK	Fuel Injector No. 7 Control
C1	28 & 29	*****	Not Used
C1	30	GRY/BLK	(4) Spark Retard Signal
C1	31	DK BLU/WHT	Fuel Injector No 8 Control
C1	32	ORG/BLK	Park Neutral Position Switch Signal
C1	33	BLK	Fuel Injector No. 1 Control
C1	34	GRY	(5) Skip Shift Solenoid Control
C1	35	LT GRN	1-2 Shift Solenoid
C1	36	DK BLU	(2) Fuel Gauge Output Control
C1	37	BRN/WHT	Malfunction Indicator Light Control
C1	38	*****	Not Used
C1	39	DK GRN/WHT	A/C Clutch Relay Control
C1	40	WHT	(6) Skip Shift Light Control (M/T)
C1	41	BRN/WHT	(7) Low Oil Level Indicator Light Control
C1	42	LT GRN	Reverse Inhibit Solenoid Control
C1	43	DK GRN	Coooling Fan Relay No. 1 Control
C1	44	(8) YEL	Crankshaft Position Sensor Signal
C1	45	DK GRN/WHT	EVAP Canister Purge Valve Control
C1	46	ORG/BLK	Desired Torque
C1	47	DK GRN/WHT	A/C Request Signal
C1	48	YEL	Mass Airflow Sensor Signal
C1	49	PPL	Ignition No. 1 Control
C1	50 & 51	*****	Not Used
C1	52	(9) PPL/WHT	Ignition No. 8 Control
C1	53	RED	Ignition No. 7 Control
C1	54	LT BLU/WHT	Ignition No. 6 Control

C1	55	DK GRN/WHT	Vehicle Speed Sensor Signal
C1	56	DK GRN	Ignition No. 5 Control
C1	57	DK GRN/WHT	Ignition No. 4 Control
C1	58	LT BLU	Ignition No. 3 Control
C1	59	BRN/WHT	Ignition Control Reference Low Bank No. 2
C1	60	BRN	Ignition Control Reference Low Bank No. 1
C1	61	RED	Transmission Range C Signal
C1	62	BLK	(2) EGR Pintle Position Ground
C1	63	BLK	A/C Pressure Sensor Ground
C1	64	BLK	Engine Oil Pressure Switch Ground
C1	65	GRY	PRND C
C1	66	YEL	PRND B
C1	67	*****	Not Used
C1	68	GRY	Clutch Switch Signal
C1	69	BRN	EVAP Purge Vacuum Switch Signal
C1	70	*****	Not Used
C1	71	PPL	Vehicle Speed Sensor Signal Low
C1	72	(10) BLK	Powertrain Control Module Ground
C1	73	GRY	Extended Brake Travel Switch Signal
C1	74	*****	Not Used
C1	75	GRY	Fuel Tank Pressure Sensor Ground
C1	76	(10) BLK	Powertrain Control Module Ground
C1	77	PPL	Torque Converter Clutch Brake Switch
C1	78-80	*****	Not Used
C2	1	TAN	Heater Oxygen Sensor Signal Low Bank No. 2; Sensor No. 2)
C2	2	TAN/WHT	Heater Oxygen Sensor Signal Low Bank No. 1; Sensor No. 2)
C2	3	TAN	(2) Serial Data (UART)
C2	4	RED	Camshaft Position Sensor Voltage Supply
C2	5	TAN	Heater Oxygen Sensor Signal Low Bank No. 2; Sensor No. 1)
C2	6	TAN/WHT	Heater Oxygen Sensor Signal Low Bank No. 1; Sensor No. 1)
C2	7	RED/BLK	A/C Pressure Sensor Signal
C2	8	TAN	Intake Air Temperature Sensor Signal
C2	9	BRN	(2) EGR Pintle Position Sensor Siganl
C2	10	(11) PPL	Fuel Level Sensor Signal
C2	11	GRY	Generator Terminal F
C2	12	DK BLU	(12) Throttle Position Sensor Signal
C2	13	YEL/BLK	Transmission Fluid Temperature Sensor Signal
C2	14	ORG/BLK	Transmission Fluid Temperature Sensor Ground
C2	15-18	*****	Not Used

C2	19	PNK	Powertrain Control Module Ignition Voltage
C2	20	ORG	Powertrain Control Module Battery Voltage
C2	21	(10) BLK	Powertrain Control Module Ground
C2	22	YEL/BLK	Crankshaft Position Sensor Ground
C2	23	BLK	(2) Throttle Position Sensor Ground
C2	24	BLK/WHT	Sensor Ground Jumper
C2	25	BRN	Engine Coolant Temperature Ground
C2	26	ORG/BLK	Manifold Absolute Pressure Sensor Ground
C2	27	*****	Not Used
C2	28	DK BLU	Cooling Fan Relays No. 2 & 3 Control
C2	29	*****	Not Used
C2	30	BRN	Air Pump Relay Control
C2	31	PPL	v
C2	32	TAN/BLK	Torque Converter Clutch Solenoid Valve Control
C2	33	BRN	Torque Converter Clutch (PWM) Solenoid Valve Control
C2	34	GRY	(2) EGR Valve Ground
C2	35	WHT	Tachometer Output Signal
C2	36	LT BLU/WHT	Transmission Fluid Pressure Control Solenoid Control Low
C2	37	DK GRN/WHT	Fuel Pump Relay Control
C2	38	LT BLU	(2) EGR Valve Control
C2	39	RED/BLK	Transmission Fluid Pressure Control Solenoid Control High
C2	40	TAN/BLK	Torque Delivered
C2	41	PPL	Heated Oxygen Sensor Signal High (Bank No. 2; Sensor No. 2)
C2	42	PPL/WHT	Heated Oxygen Sensor Signal High (Bank No. 1; Sensor No. 2)
C2	43	GRY	(2) Throttle Position Sensor Reference Voltage
C2	44	GRY	Fuel Level Sensor Reference Voltage
C2	45	GRY	Engine Oil Pressure Sensor Reference Voltage
C2	46	PPL	Heated Oxygen Sensor Signal High (Bank No. 2; Sensor No. 1)
C2	47	PPL/WHT	Heated Oxygen Sensor Signal High (Bank No. 1; Sensor No. 1)
C2	48	LT GRN	Manifold Absolute Pressure Sensor Signal
C2	49	YEL	Engine Coolant Temperature Sensor Signal
C2	50 & 51	*****	Not Used
C2	52	DK GRN	(2) Fuel Tank Pressure Sensor Signal
C2	53	TAN/WHT	Engine Oil Pressure Sensor Signal
C2	54	LT GRN/BLK	(2) Idle Air Control Coil B Low
C2	55	LT BLU/BLK	(2) Idle Air Control Coil A Low
C2	56	LT BLU/WHT	(2) Idle Air Control Coil A High
C2	57	LT GRN/WHT	(2) Idle Air Control Coil B High
C2	58	(13) PPL	Serial Data Class II)

C2	59	*****	Not Used
C2	60	(10) BLK	Powertrain Control Module Ground
C2	61	ORG	Powertrain Control Module Battery Voltage
C2	62	LT GRN	Crankshaft Position Sensor Ignition Voltage
C2	63	*****	Not Used
C2	64	GRY	Manifold Absolute Pressure Reference Voltage
C2	65	GRY	(2) Reference Voltage
C2	66	GRY	A/C Pressure Sensor Reference Voltage
C2	67	GRY	(2) Reference Voltage
C2	68	LT BLU	Rear Knock Sensor Signal
C2	69	DK BLU	Front Knock Sensor Signal
C2	70	PNK/BLK	Camshaft Position Sensor Ground
C2	71-75	TAN	TAC Module Serial Data
C2	71-75	ORG/BLK	TAC Module Serial Data
C2	73-75	*****	Not Used
C2	76	BRN	Oil Level Sensor Signal
C2	77	RED	Generator Terminal L
C2	78-80	*****	Not Used

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

(2) Not used.

(3) Purple/White wire.

(4) Real time damping (Dark Blue wire).

(5) On A/T models, 3-2 shift solenoid (White wire).

(6) Shift solenoid B (Yellow/Black wire) on A/T models.

(7) Powertrain Control Module pitch output Pink/White wire).

(8) Dark Blue/White wire.

(9) Red/White wire.

(10) Black/White wire.

(11) Dark Blue wire.

(12) Fuel level sensor signal.

(13) Dark Green wire.

DIAGNOSTIC TROUBLE CODES

TROUBLE CODE DEFINITION

Code No.	Circuit Affected

P0101	MAF System Performance
P0102	MAF Sensor Circuit-Low Frequency
P0103	MAF Sensor Circuit-High Frequency
P0107	MAP Sensor Circuit-Low Voltage
P0108	MAP Sensor Circuit-High Voltage
P0112	IAT Sensor Circuit-Low Voltage
P0113	IAT Sensor Signal Voltage High
P0117	ECT Sensor Circuit Low Voltage
P0118	ECT Sensor Signal High Voltage
P0125	ECT Excessive Time To Closed Loop
P0131	HO2S Circuit Low Voltage-Bank 1, Sensor 1
P0132	HO2S Circuit High Voltage-Bank 1, Sensor 1
P0133	HO2S Slow Response-Bank 1, Sensor 1
P0134	HO2S Insufficient Activity-Bank 1, Sensor 1
P0135	HO2S Heater Circuit-Bank 1, Sensor 1
P0137	HO2S Circuit Low Voltage-Bank 1, Sensor 2
P0138	HO2S Circuit High Voltage-Bank 1, Sensor 2
P0140	HO2S Insufficient Activity-Bank 1, Sensor 2
P0141	HO2S Heater Circuit-Bank 1, Sensor 2
P0151	HO2S Circuit Voltage Low-Bank 2, Sensor 1
P0152	HO2S Circuit Voltage High-Bank 2, Sensor 1
P0153	HO2S Slow Response-Bank 2, Sensor 1
P0154	HO2S Circuit Insufficient Activity-Bank 2, Sensor 1
P0155	HO2S Heater Circuit-Bank 2, Sensor 1
P0157	HO2S Circuit Voltage Low-Bank 2, Sensor 2
P0158	HO2S Circuit Voltage High-Bank 2, Sensor 2
P0160	HO2S Insufficient Activity-Bank 2, Sensor 2
P0161	HO2S Heater Circuit-Bank 2, Sensor 2
P0171	Fuel Trim System Lean-Bank 1
P0172	Fuel Trim System Rich-Bank 1
P0174	Fuel Trim System Lean-Bank 2
P0175	Fuel Trim System Rich-Bank 2
P0230	Fuel Pump Control Circuit
P0300	Engine Misfire Detected
P0325	Knock Sensor Module Circuit
P0327	Knock Sensor Circuit-Front
P0332	Knock Sensor Circuit
P0335	CKP Sensor Circuit
P0336	CKP Sensor System Performance
P0341	CMP Sensor Circuit Performance
P0342	CMP Sensor Circuit Low Voltage

P0343	CMP Sensor Circuit High Voltage
P0351/P1351	Ignition Control No. 1 Circuit
P0352/P1352	Ignition Control No. 2 Circuit
P0353	Ignition Control No. 3 Circuit
P0354	Ignition Control No. 4 Circuit
P0355	Ignition Control No. 5 Circuit
P0356	Ignition Control No. 6 Circuit
P0357	Ignition Control No. 7 Circuit
P0358	Ignition Control No. 8 Circuit
P0410	AIR System
P0412	AIR Solenoid Relay Control Circuit
P0418	AIR Pump Relay Control Circuit
P0420	TWC System Low Efficiency-Bank 1
P0430	TWC Low Efficiency-Bank 2
P0441	EVAP System-No Flow During Purge
P0443	EVAP Canister Purge Sol. Circuit Fault
P0461	Fuel Level Sensor Circuit Performance
P0462	Fuel Level Sensor Circuit-Voltage Low
P0463	Fuel Level Sensor Circuit-Voltage High
P0480	Cooling Fan Relay No. 1 Control Circuit
P0481	Cooling Fan Relay No. 2 & 3 Control Circuit
P0500	VSS Circuit
P0506	IAC System RPM Low
P0507	Idle Speed High
P0522	Engine Oil Pressure Sensor Circuit-Voltage Low
P0523	Engine Oil Pressure Sensor Circuit-Voltage High
P0530	A/C Refrigerant Pressure Sensor Circuit
P0562	System Voltage Low
P0563	System Voltage High
P0567	Cruise Resume Circuit
P0568	Cruise Set Circuit
P0571	Cruise Brake Switch Circuit
P0601	PCM Memory
P0602	PCM Not Programmed
P0604	PCM RAM Performance
P0606	PCM Internal Comm. Interrupted
P0608	VSS Output Circuit
P0650	MIL Control Circuit
P0654	Engine Speed Output Circuit
P0704	Clutch Switch Circuit
	Trans. Range Switch Circuit

P0705 (1)	
P0705 (1)	Trans. Range Switch Circuit
P0706 (1)	Trans. Range Switch Performance
P0801 (1)	Reverse Inhibit Solenoid Control Circuit
P0803 (1)	1-4 Upshift Solenoid Control Circuit
P0804 (1)	1-4 Upshift Light Control Circuit
P1111	IAT Sensor Circuit Intermittent High Voltage
P1112	IAT Sensor Circuit Intermittent Low Voltage
P1114	ECT Sensor Circuit Intermittent Low Voltage
P1115	ECT Sensor Circuit Intermittent High Voltage
P1125	APP System
P1133	HO2S Insufficient Switching-Bank 1, Sensor 1
P1134	HO2S Transition Time Ratio-Bank 1, Sensor 1
P1153	HO2S Insufficient Switching-Bank 2, Sensor 1
P1154	HO2S Transition Time Ratio-Bank 2, Sensor 1
P1220	TP Sensor No. 2 Circuit
P1221	TP Sensor No. 1 & 2 Performance
P1258	Engine Coolant Overtemp.-Fuel Disabled
P1275	APP Sensor No. 1 Circuit
P1276	APP Sensor No. 1 Performance
P1280	APP Sensor No. 2 Circuit
P1281	APP Sensor No. 2 Performance
P1285	APP Sensor No. 3 Circuit
P1286	APP Sensor No. 3 Performance
P1380	ABS DTC Rough Road Data Unstable
P1381	Misfire Detected, No EBCM/PCM/VCM Serial Data
P1415	AIR System-Bank 1
P1416	AIR System-Bank 2
P1431	Fuel Level Sensor No. 2 Circuit Performance
P1432	Fuel Level Sensor No. 2 Circuit Low Voltage
P1433	Fuel Level Sensor No. 2 Circuit High Voltage
P1441	EVAP System Flow During Non-Purge
P1514	TAC System MAF Performance
P1515	Command Vs. Actual Performance (PCM)
P1516	Command Vs. Actual TP Performance (TAC)
P1517	TAC Module Processor Serial Data Circuit
P1518	PCM-To-TAC Module Serial Data Circuit
P1539	A/C Clutch Status Circuit Voltage High
P1545	A/C Clutch Relay Control Circuit

P1546	A/C Clutch Status Circuit Voltage Low
P1571	ASR Desired Torque Circuit
P1574	Stoplight Control Circuit
P1575	Extended Brake Travel Switch Circuit Voltage High
P1626	Loss Of Serial Communication W/Theft Deterrent Or Theft Deterrent System Fuel Enable Circuit
P1630	Theft Deterrent System-PCM In Learn Mode
P1631	Theft Deterrent System-Password Incorrect
P1635	5-Volt Reference No. 1 Circuit
P1639	5-Volt Reference No. 2 Circuit
P1644	Delivered Torque Output Circuit
P1652	PCM Chassis Pitch Output Circuit
(1) Covered in entirety in **AUTO TRANS DIAGNOSIS** article in the AUTO TRANS DIAGNOSIS section.	

ENGINE SENSORS & SWITCHES

NOTE: For additional sensor testing specifications, see SENSOR RANGE CHARTS article.

Manufacturer does not provide many individual system and component testing. For sensor and switch testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in **TESTS W/CODES** article.

CAUTION: DO NOT remove pressure cap from surge tank while engine is at normal operating temperature.

Engine Oil Level Sensor Diagnosis

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Ensure oil level is okay. Turn ignition switch to RUN position. Disconnect engine oil level sensor harness connector. Measure voltage between ground and engine oil level sensor input circuit (Brown wire) at engine oil level sensor harness connector. If battery voltage exists, go to next step. If battery voltage does not exist, go to step 4).
3. Measure voltage between engine oil level sensor harness connector terminals. If battery voltage exists, go to step 6). If battery voltage does not exist, go to step 7).
4. Turn ignition switch to LOCK position. Disconnect PCM harness connector that contains engine oil level sensor input circuit. Check continuity in engine oil level input circuit (Brown wire) between PCM and engine oil level sensor harness connectors. If continuity exists, go to next step. If continuity does not exist, go to step 8).

5. Using a test light connected to battery voltage, probe engine oil level sensor input circuit (Brown wire) at engine oil level sensor harness connector. If test light illuminates, go to step 9). If test light does not illuminate, go to step 10).
6. Check for poor connection at engine oil level sensor. If poor connection does not exist, go to step 12). If poor connection exists, repair as necessary.
7. Repair open in engine oil level sensor ground circuit.
8. Repair open in engine oil level sensor input circuit.
9. Repair short to ground in engine oil level sensor input circuit.
10. Check for poor connection at PCM. If poor connection does not exist, go to next step. If poor connection exists, repair as necessary.
11. Replace PCM.
12. Replace engine oil level sensor.

Park Neutral Position (PNP) Switch Diagnosis

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Connect scan tool to data link connector. Turn ignition switch to RUN position. Place transmission in Park. Observe PNP switch parameter on scan tool. If P-N--- is displayed, go to next step. If P-N--- is not displayed, go to step 4).
3. Shift transmission into Drive. If -R-OD21--- is displayed, system is okay at this time. If -R-OD21--- is not displayed, go to step 7).
4. Disconnect PNP switch harness connector. Using a fused jumper wire, connect PNP switch signal circuit (Orange/Black wire) and ground circuit (Black/White wire) at PNP switch harness connector. If P-N--- is not displayed, go to next step. If P-N--- is displayed, go to step 10).
5. Using a fused jumper wire, ground signal circuit (Orange/Black wire) at PNP switch harness connector. If P-N--- is not displayed, leave jumper wire connected and go to next step. If P-N--- is displayed, go to step 13).
6. Turn ignition switch to LOCK position. Disconnect PCM harness connector containing PNP switch signal circuit. Using a test light connected to battery voltage, probe PNP signal circuit (Orange/Black wire) at PNP switch harness connector. If test light does not illuminate, go to step 11). If test light illuminates, go to step 9).
7. Disconnect PNP switch harness connector. Observe PNP switch parameter on scan tool. If -R-OD21 is not displayed, go to next step. If -R-OD21 is displayed, go to step 10).
8. Turn ignition switch to lock position. Disconnect PCM harness connector that contains PNP switch signal circuit. Turn ignition switch to RUN position. If -R-OD21 is displayed, go to step 12). If -R-OD21 is not displayed, go to step 15).
9. Check for poor connection at PCM. If poor connection does not exist, go to step 15). If poor connection exists, repair as necessary and go to step 16).
10. Check for poor connection at PNP switch. If poor connection does not exist, go to step 14). If poor connection exists, repair as necessary and go to step 16).
11. Repair open in PNP switch signal circuit (Orange/Black wire) between PCM and PNP switch harness

connectors. After repairs are complete, go to step 16).

12. Repair short to ground in PNP switch signal circuit (Orange/Black wire) between PCM and PNP switch harness connectors. After repairs are complete, go to step 16).
13. Repair open in PNP switch ground circuit (Black/White wire) and go to step 16).
14. Replace PNP switch and go to step 16).
15. Replace PCM and go to next step.
16. Operate vehicle within conditions under which symptom was noted. If system operates properly, system is okay at this time. If system does not operate properly, go to step 2).

MOTORS, RELAYS & SOLENOIDS

Manufacturer does not provide many individual system and component testing. For motor, relay and solenoid testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES under COMPUTERIZED ENGINE CONTROLS. See **TESTS W/CODES** article.

MOTORS

Secondary AIR Elec. Air Pump

Locate secondary AIR electric air pump on left front of engine compartment. Disconnect 3-wire connector from electric air pump. Apply ground to terminal "C" (Black wire) of pump. Apply battery voltage with a fused jumper wire to terminal "A" (Red wire) of pump. Pump should run. If pump does not operate, replace pump.

Idle Air Control (IAC) Motor

See IDLE CONTROL SYSTEM.

RELAYS

A/C Clutch Relay

See **A/C-HEATER SYSTEM** article in AIR CONDITIONING & HEAT section.

Fuel Pump Relay

See **BASIC TESTING** article.

SOLENOIDS

All PCM-controlled solenoids should have at least 20 ohms of resistance when checked with positive ohmmeter lead connected to power supply terminal of solenoid and negative ohmmeter lead connected to ground terminal of solenoid. Some solenoids are equipped with internal diodes. On these solenoids, resistance values will differ if ohmmeter test leads are reversed.

FUEL SYSTEM

NOTE: For fuel system pressure testing, see BASIC TESTING article.

Manufacturer does not provide many individual system and component testing. For fuel system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in **TESTS W/CODES** article.

NOTE: Retrieve DTCs and preform appropriate DTC test before performing FUEL INJECTOR CIRCUIT DIAGNOSIS. See TESTS W/CODES article. Also ensure all mechanical and ignition coil/module circuit malfunctions are repairs before performing FUEL INJECTOR CIRCUIT DIAGNOSIS.

Fuel Injector Circuit Diagnosis

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Connect scan tool to data link connector. Start engine and let idle. Using scan tool, monitor MISFIRE CUR. COUNTERS on MISFIRE DATA LIST. If any MISFIRE CUR. COUNTERS are increasing, go to step 4). If no MISFIRE CUR. COUNTERS are increasing, go to next step.
3. Monitor MISFIRE HIST. COUNTERS on MISFIRE DATA LIST. If any MISFIRE HIST. COUNTERS indicate greater than zero, go to step 17). If all MISFIRE HIST. COUNTERS indicate zero, check for poor connection at fuel injectors and repair as necessary.
4. Check fuel injector ignition feed fuses. If all injector fuses are okay, go to next step. If any fuel injector fuse(s) are blown, go to step 8).
5. Turn ignition switch to LOCK position. Disconnect fuel injector harness connector that MISFIRE CUR COUNTER are increasing. Turn ignition switch to RUN position. Using a test light connected to ground, probe ignition feed circuit (Pink wire) at appropriate fuel injector harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 10).
6. Turn ignition switch to LOCK position. Connect fuel injector test light to fuel injector harness connector. Start engine. If test light blinks, go to next step. If test light does not blink, go to step 11)
7. Check the fuel injector harness terminals for poor connection. If a problem exists, repair as necessary. If a problem does not exist, go to step 15).
8. Turn ignition switch to LOCK position. Disconnect the 4 fuel injector harness connector related to fuse that was blown. Using a test light connected to battery voltage, probe one fuel injector ignition feed circuit. If test light does not illuminate, go to next step. If test light illuminates, go to step 13).
9. Measure resistance of each fuel injector that is powered by blown fuse. If resistance is not 11.4 ohms or less at any fuel injector, go to step 14). If resistance is 11.4 or less ohms at any fuel injector, go to step 15).
10. Repair open in appropriate fuel injector ignition feed circuit (Pink wire).
11. Turn ignition switch to LOCK position. Disconnect PCM harness connector containing fuel injector control circuits. Check fuel injector control circuits for open, between PCM and fuel injector harness connectors. If open exists, go to next step. If open does not exist, go to step 16).
12. Repair open in fuel injector control circuit.

13. Repair short to ground in appropriate fuel injector ignition feed circuit.
14. Repair intermittent short to ground in appropriate fuel injector ignition feed circuit.
15. Replace faulty injector(s) as necessary.
16. Replace PCM.
17. Inspect appropriate injector circuit for the following: poor connection at injector and PCM, intermittent short to ground and intermittent opens. If problem exist, repair as necessary. If problem does not exist, repair by symptom. See **TESTS W/O CODES** article.

NOTE: Allow engine to cool down to avoid irregular readings due to "hot soak" fuel boiling. To prevent flooding, the FUEL INJECTOR BALANCE TEST should not be performed more than once without starting and running engine.

NOTE: If injectors are dirty, they should be cleaned using approved injector cleaning procedure before performing FUEL INJECTOR BALANCE TEST.

Fuel Injector Balance Test

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. If fuel injector coil test has been performed, go to next step. If fuel injector coil test has not been performed, perform fuel injector coil test. See INJECTOR COIL TEST - ECT BETWEEN 50-95°F.
3. If engine coolant temperature is below 201°F (94°C), go to step 5). If engine coolant temperature is above 201°F (94°C), go to next step.
4. Allow engine to cool until coolant temperature is below 210°F (94°C), then go to next step.
5. Install fuel pressure gauge. Turn ignition switch to RUN position then to LOCK position. Bleed air from fuel pressure gauge. Using scan tool, energize fuel pump. If fuel pressure reading is 55-60 psi (3.9-4.2 kg/cm^2), go to next step. If fuel pressure reading is not within specification, perform fuel system diagnosis. See **BASIC TESTING** article.
6. Turn fuel pump off. Observe fuel pressure gauge. If fuel pressure remains constant, go to next step. If fuel system does not remain constant, perform fuel system diagnosis. See **BASIC TESTING** article.

NOTE: Perform step 7) on each injector.

7. Disconnect fuel injectors harness connector. Using appropriate fuel injector adapter, connect Fuel Injector Tester (J-39021) to fuel injector. Connect fuel injector tester power leads to appropriate battery terminals. Set amperage supply selector switch on fuel injector tester to Balance Test 2.5-amp position. Turn ignition switch to RUN position then to LOCK position. Record fuel pressure reading (first reading). Energize injector by depressing PUSH TO START TEST button on injector tester and hold until fuel pressure gauge stabilizes. Record fuel pressure reading (second reading). Subtract first reading from second reading (this result is pressure drop value). Add pressure drop value for each injector together and divide total by total number of injectors. If any injector's drop value is greater or less than average drop value by 1.5 psi, replace faulty injector(s) as necessary. If no injector's drop value is greater or less than

average drop value by 1.5 psi, injector balance test is okay at this time.

WARNING: In order to prevent flooding of cylinder and possible engine damage, relieve fuel pressure before performing injector coil test procedure.

Injector Coil Test ECT Between 50-95°F

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Connect scan tool to data link connector. Using scan tool, check engine coolant temperature. If 50-95°F (10-35°C) is displayed, go to next step. If 50-95°F (10-35°C) is not displayed, perform INJECTOR COIL TEST - ECT NOT BETWEEN 50-95°F test.

NOTE: Perform step 3) on each injector.

3. Turn ignition switch to LOCK position. Relieve fuel pressure. Disconnect fuel injector harness connectors. Using appropriate fuel injector adapter, connect Fuel Injector Tester (J-39021) to fuel injector. Connect fuel injector tester power leads to appropriate battery terminals. Set amperage supply selector switch on fuel injector tester to Coil Test 0.5-amp position. connect DVOM to injector tester. Depress PUSH TO START TEST button. Record lowest voltage reading within first second of test. If any injector has erratic voltage reading or reading not 5.7-6.6 volts, go to next step. If no injector has erratic voltage reading or reading not 5.7-6.6 volts, perform injector balance test. See FUEL INJECTOR BALANCE TEST.
4. Replace faulty injector(s) and perform injector balance test. See FUEL INJECTOR BALANCE TEST.

WARNING: In order to prevent flooding of cylinder and possible engine damage, relieve fuel pressure before performing injector coil test procedure.

Injector Coil Test ECT Not Between 50-95°F

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Connect scan tool to data link connector. Using scan tool, check engine coolant temperature. If 50-95°F (10-35°C) is not displayed, go to next step. If 50-95°F (10-35°C) is displayed, perform INJECTOR COIL TEST - ECT BETWEEN 50-95°F test.

NOTE: Perform step 3) on each injector.

3. Turn ignition switch to LOCK position. Relieve fuel pressure. Disconnect fuel injector harness connectors. Using fuel injector adapter, connect Fuel Injector Tester (J-39021) to fuel injector. Connect fuel injector tester power leads to appropriate battery terminals. Set amperage supply selector switch on fuel injector tester to Coil Test 0.5-amp position. Connect DVOM to injector tester. Depress PUSH TO

START TEST button. Record highest voltage reading other than those greater than 9.5 volts. Subtract any other voltage reading observed from highest voltage reading. If difference is greater than 0.6 volt, go to next step. If difference is not greater than 0.6 volt, perform injector balance test. See FUEL INJECTOR BALANCE TEST.

4. Replace any injector(s) that had any of the following results: initial reading greater than 9.5 volts, erratic reading or difference is greater than 0.6 volt. After repairs are complete, perform injector balance test. See FUEL INJECTOR BALANCE TEST.

IDLE CONTROL SYSTEM

NOTE: Manufacturer does not provide system testing for 5.7L. For idle control system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in TESTS W/CODES article.

IGNITION SYSTEM

NOTE: For basic ignition system checks, see BASIC TESTING article.

For ignition system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in **TESTS W/CODES** article.

EMISSION SYSTEMS & SUB-SYSTEMS

NOTE: For emission and sub-system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in TESTS W/CODES article.

EVAP CONTROL SYSTEM DIAGNOSIS

NOTE: Ensure all vacuum line and EVAP system components are not damaged or missing before proceeding with this test.

AIR INJECTION

AIR Pump (Belt-Driven)

Accelerate engine to approximately 1500 RPM and observe airflow from hoses. If airflow increases as engine is accelerated, pump is working properly. If airflow does not increase, check hoses, pump belt tension, leaky valves or defective air injection pump.

Check Valve

Detach check valve and blow through valve in direction of check valve flow (to cylinder head). Attempt to suck air back. Replace valve if airflow is allowed against the direction of flow.

Electric AIR Pump Relay

1. Start engine. With engine operating in open loop, electric air pump should run and air should be coming out of electric air pump exhaust port.
2. If electric air pump is operating, allow engine to idle for at least 3 minutes. With vehicle in closed loop (or about 3 minutes after start), PCM should de-energize electric air pump relay and electric air pump should stop. If this does not occur, go to next step. If air pump operates as described, relay is functioning properly.
3. Remove air pump relay from fuse/relay block. Air pump should stop. If air pump stops, check or replace faulty relay. If air pump does not stop, check circuit to air pump for a short to battery voltage.

EXHAUST GAS RECIRCULATION

WARNING: Use protective gloves, or allow exhaust system to cool, before work on exhaust system components.

Manufacturer does not provide many individual system and component testing. For EGR system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in **TESTS W/CODES** article.

Exhaust System Check

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Remove heated oxygen sensor. Install exhaust backpressure tester in place of oxygen sensor. Start engine and let idle. If pressure reading is not 1.25 psi or greater, go to next step. If pressure reading is 1.25 psi or greater, go to step 4).
3. Increase engine speed to 2000 RPM. If pressure reading is greater than 3 psi, go to next step. If pressure reading is not greater than 3 psi, go to step 6).
4. Check exhaust system for crushed pipe, internal muffler damage or heat distress. If problem does not exist, go to next step. If problem exists, repair as necessary and go to step 6).
5. Replace catalytic converter and go to next step.
6. Operate vehicle within conditions under which original symptom was noted. If system operate properly, system is okay at this time. If system does not operate properly, go to step 2).

POSITIVE CRANKCASE VENTILATION (PCV)

Required Service

The PCV system may require service for obstructions if any of the following conditions exist:

- Rough idle.
- Stalling or slow idle speed.

- Oil leaks.
- Oil in air cleaner.
- Sludge in engine.

A leaking PCV valve or hose could cause:

- Rough idle.
- Stalling.
- High idle speed.

If engine idles rough, check for clogged PCV valve or plugged or broken hoses BEFORE adjusting idle. Check PCV valve application to ensure correct valve is fitted. Replace PCV valve if required.

Checking PCV Valve Function

1. Remove PCV valve from rocker cover. Run engine at idle. Place thumb over open end of valve to check for vacuum. If there is no vacuum at valve, check for obstruction in manifold port, hoses or PCV valve. Repair or replace as necessary.
2. Turn engine off. Remove PCV valve. Shake valve and listen for rattle of check valve inside. If a clear rattle is not heard, replace PCV valve.
3. Visually inspect valve for varnish or deposits which may make PCV valve operation sticky or restricted, or cause incomplete seating of valve. Replace if necessary.
4. An engine must be sealed for PCV system to function as designed. If leakage, sludging or dilution of oil is noted and PCV system is functioning properly, check engine for cause and repair as required to ensure PCV system will continue to function properly.
5. An engine operating without any crankcase ventilation can be damaged, so it is important to replace PCV valve and air cleaner breather (if equipped) at regular intervals (at least every 30,000 miles). Check all hoses and clamps for failure or deterioration.

MISCELLANEOUS CONTROLS

NOTE: Although some of the controlled devices listed here are not technically engine performance components, they can affect driveability if they malfunction.

TRANSMISSION

NOTE: Computerized transmission controls are also covered in greater detail in TRANSMISSION SERVICING - A/T article in AUTOMATIC TRANS SERVICE section or TRANSMISSION SERVICING - M/T article in MANUAL TRANS SERVICE section manual for domestic vehicles. For component circuit identification, see wiring diagram in WIRING DIAGRAMS article.

Converter Clutch Solenoid

Disconnect harness connector to Torque Converter Clutch (TCC) solenoid. Measure resistance between appropriate TCC solenoid terminals. Solenoid resistance should be greater than 20 ohms.

NOTE: Some solenoids may have an internal pressure switch in series with the solenoid winding and will not show continuity until that pressure switch is applied by transmission hydraulic pressure.

Converter Lock-Up Signal At Transmission

1. Warm engine to operating temperature. Raise vehicle and support drive wheels. Support suspension where necessary to prevent damage to drive axles.
2. Disconnect converter clutch connector at transmission. Connect a test light across appropriate converter clutch harness terminals. Start engine and place transmission in Drive. Accelerate vehicle to 45 MPH and note test light.
3. If test light is off, check solenoid power supply wire of harness for open or short to ground. Check ground circuit for open between harness connector and PCM. If harness is okay, see CONVERTER LOCK-UP SIGNAL FROM PCM.

Converter Lock-Up Signal From PCM

1. Warm engine to operating temperature. Raise vehicle and support drive wheels. Support suspension where necessary to prevent damage to drive axles.
2. Connect a test light to battery voltage. Touch TCC control driver terminal with test light. Accelerate vehicle to 45 MPH and note test light. If test light does not illuminate, problem is a faulty PCM connector or PCM.

1-4 Upshift System Check (Man. Trans.)

A malfunction in the upshift system will set a related diagnostic trouble code. See **TESTS W/CODES** article.

PCM CONTROLLED GENERATOR

1. If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in **TESTS W/CODES** article.
2. Turn ignition switch to RUN position. If charging light illuminates, go to next step. If charging light does not illuminate, go to step 4).
3. Start engine. If charging light does not go out, go to step 5). If charging light goes out, go to step 21).
4. Turn ignition switch to LOCK position. Disconnect generator harness connectors. Turn ignition switch to RUN position. If charging light illuminates, go to step 6). If charging light does not illuminate, go to step 7).
5. Turn ignition switch to LOCK position. Connect scan tool to data link connector. Turn ignition switch to RUN position. Ensure all accessories are off. Observe generator voltage on scan tool. If battery voltage is displayed, go to step 8). If less than battery voltage is displayed, go to step 9).
6. Using a test light connected to ground, probe charging light signal circuit at generator harness connector.

If test light illuminates, go to step 10). If test light does not illuminate, go to step 11).

7. Replace or repair instrument cluster and/or charging light bulb as necessary. After repairs are complete, go to step 21).
8. Using scan tool, check GEN F valve. If 5 percent is displayed, go to step 7). If 5 percent is not displayed, go to step 12).
9. Turn ignition switch to LOCK position. Disconnect generator harness connectors. Turn ignition switch to RUN position. Using a test light connected to battery voltage, probe charging light signal circuit at generator harness connector. If test light illuminates, go to step 13). If test light does not illuminate, go to step 14).
10. Locate and repair short to ground in charging light control signal circuit and go to step 21).
11. Replace generator and go to step 21).
12. Turn ignition switch to LOCK position. Disconnect generator harness connectors. Turn ignition switch to RUN position. Using a test light connected to battery voltage, probe generator field circuit at generator harness connector. If test light illuminates, go to step 15). If test light does not illuminate, go to step 16).
13. Locate and repair short to ground in field circuit and go to step 21).
14. Measure voltage at charging light signal circuit at generator harness connector. If 4.5 volts or greater exists, go to step 17). If 4.5 volts or greater does not exist, go to step 18).
15. Locate and repair short to ground in field circuit. After repairs are complete, go to step 21).
16. Locate and repair poor connection and/or open in field circuit. After repairs are complete, go to step 21).
17. Measure voltage at battery voltage supply circuit at generator harness connector. If battery voltage exist, go to step 11). If battery voltage does not exist, go to step 19).
18. Check for poor connection and/or open in battery voltage supply circuit. If poor connection and/or open does not exist, go to step 20). If poor connection and/or open exists, repair as necessary and go to step 21).
19. Locate and repair poor connection and/or open in battery voltage supply circuit. After repairs are complete, go to step 21).
20. Replace PCM and go to next step.
21. Operate vehicle under condition under which original symptom was noted. If system does not operate properly, go to step 2).

A/C COMPRESSOR CLUTCH CONTROLS

NOTE: For A/C clutch circuit testing, see A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section. See wiring diagram in WIRING DIAGRAMS article for terminal and wire color identification.

To provide improved idle quality, improved Wide Open Throttle (WOT) performance and A/C system protection, the compressor clutch is controlled by PCM.

For proper control of cooling fans, compressor clutch and Idle Air Control (IAC) valve, a refrigerant pressure sensor is used. PCM uses signals provided by sensor to monitor high and low side refrigerant pressures. If PCM detects a fault in refrigerant pressure circuit, compressor clutch will be disabled.

The A/C clutch relay is controlled by PCM. This allows PCM to raise idle speed before engaging compressor clutch, or disable compressor clutch during WOT, high engine RPM, high power steering loads and hot engine restarts. PCM also disables compressor clutch if coolant temperature becomes excessive. To locate A/C clutch relay, see **A/C CLUTCH RELAY LOCATION** table.

A/C CLUTCH RELAY LOCATION

Application	Location
"Y" Body	In Underhood Electrical Center, In Front Of Battery

WARNING: Vehicles may be equipped with a PCM using an Electrically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM, the new PCM must be programmed.

NOTE: To help save diagnostic time, check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary.

ELECTRIC COOLING FAN CONTROL

NOTE: For electric cooling fan circuit testing, see AIR CONDITIONING & HEAT section. See wiring diagram in WIRING DIAGRAMS article for terminal and wire color identification.

All FWD and some RWD vehicles use an electric cooling fan. The electric cooling fan is used for radiator and A/C condenser cooling. Cooling fan operates when A/C is on and when engine coolant temperature exceeds a specific value. One or more cooling fan relays may be used. For cooling fan relay location, see **COOLING FAN RELAY LOCATION** table.

COOLING FAN RELAY LOCATION

Application	Location
"Y" Body	In Underhood Electrical Center, In Front Of Battery

To help save diagnostic time, ALWAYS check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary. For component location and terminal and wire color identification, see wiring diagram in **WIRING DIAGRAMS** article.

WARNING: Vehicles may be equipped with a PCM using an Electrically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM, the new PCM must be programmed.

COMPONENT LOCATIONS

NOTE: Component location illustrations are not available for Corvette.

COMPONENT LOCATIONS (VIN G)

Component	Location
A/C Pressure Sensor	Attached To A/C Evaporative Tube
Body Control Module	Mounted On Toe Board
Cooling Fan Relays	Power Distribution Box, At Right Side Of Engine Compartment, Between Wheelwell & Dash
Data Link Connector	Under Instrument Panel
EGR Valve	At Left Rear Of Engine, On Intake Plenum
Engine Coolant Temperature (ECT) Sensor	Left Side Of Engine, Below Generator
Engine Oil Level Sensor	Left Side Of Oil Pan
EVAP Canister Purge Solenoid	At Left Side Of Engine On Intake Manifold
EVAP Canister Vacuum Switch	At Left Side Of Engine, On Intake Manifold
Fuel Injectors	In Intake Manifold
Ignition Control Modules	On Valve Cover At Top Of Each Cylinder
Intake Air Temperature (IAT) Sensor	Front Center Of Engine, In Air Intake Duct
Knock Sensors	Center Of Engine, Below Intake Manifold
Manifold Absolute Pressure (MAP) Sensor	Rear Of Intake Manifold
Mass Airflow (MAF) Sensor	Top Of Air Cleaner Assembly
Oxygen Sensors (O2S)	In Exhaust Pipes In Front & Rear Of Catalytic Converters
Park/Neutral Position Switch	Left Side Of Transmission
Power Distribution Box	Right Side Of Engine Compartment, Between Wheelwell & Dash Panel
Powertrain Control Module (PCM)	Right Side Of Engine Compartment, Between Wheelwell & Dash Panel, Below Battery
Throttle Actuator Control Module	Mounted On Side Of Powertrain Control Module, Below Battery
Throttle Actuator Motor	Left Side Of Throttle Body
Throttle Position (TP) Sensor	On Throttle Body
Vehicle Speed Sensor	At Top Right Of Differential