Intermittent Diagnostic Techniques

Intermittent diagnostic techniques help find and isolate the root cause of intermittent faults associated with the EEC-V system. The material is organized to help find the fault and perform the repair. There are examples that illustrate the diagnostic techniques. The process of finding and isolating an intermittent, starts with recreating a fault symptom, accumulating PCM data and comparing that data to typical values and analyzing the results.

Before proceeding, be sure that:

- Customary mechanical system tests and inspections do not reveal a problem. (Remember, mechanical component problems can make a PCM system react abnormally.)
- Review Technical Service Bulletins (TSBs) and OASIS messages, if available.
- Quick Test and associated Pinpoint diagnosis have been completed without finding a fault, and the symptom is still occurring.

Recreating the Fault

Recreating the fault is the first step in isolating the cause of the intermittent symptom. If Freeze Frame Data is available, it may help in recreating the conditions at the time of a Malfunction Indicator Lamp Diagnostic Trouble Code (MIL-type DTC). Listed below are some of the conditions for recreating the fault.

CONDITIONS TO RECREATE FAULT

Engine Type Conditions	Non-Engine Type Conditions
Engine Temperature	Ambient Temperature
Engine RPM	Moisture Conditions
Engine Load
Engine idle/accel/decel	Road Conditions (smooth-bumpy)

Accumulating PCM Data

PCM data can be accumulated in a number of ways. Gather as much data as possible when the malfunction is occurring to prevent misdiagnosis. Data should be accumulated during different operating conditions and based on the customer description of the intermittent fault. Reference the known good data values located in Section 6 , Reference Values. This will require recording data in four conditions for comparison: 1) KOEO, 2) HOT IDLE, 3) 30 mph and 4) 55 mph. Acquisition of PCM PID data using a scan tool is one of the easiest ways to gather information. Listed below are instructions for gathering PID data using a New Generation Star (NGS) scan tool.

Selecting and Viewing PIDs

1. Select Vehicle and Engine Selection and enter the proper year, vehicle and engine package from the menu.

2. Select DIAGNOSTIC DATA LINK.

3. Select POWERTRAIN CONTROL MODULE (PCM).

4. Select PID/DATA MONITOR AND RECORD.

5. Select the PIDs from the intermittent symptom chart or the PCM Pinpoint test. The star symbol next to each PID on the screen indicates that PID has been selected.

6. Turn ignition key on or start vehicle.

7. Select the START key and access the PIDs.

Storing PIDs

1. When ready to capture and store the selected PIDs, press the trigger button.

2. Press trigger again when ready to save information.

3. The information is now located in the main recording area. Store to a viewing area before starting another recording or the data will be overwritten.

Recording DVOM Measurements Along with PIDs

1. Select DIGITAL MEASUREMENT SYSTEM.

2. Select one of the meters (i.e., VOLTMETER).

3. Select PIDS.

4. Select PID/DATA MONITOR.

5. Select PCM.

6. Select the PIDs and START to record.

7. Press REC to save digital multimeter function and PID data.

8. Press TRIGGER to save, store and view.

Playback of Stored PIDs

Look for abnormal behavior or values that are clearly incorrect. Inspect the signals for abrupt or unexpected changes. For example, during a steady cruise most of the sensor values should be relatively stable. Sensors such as AP, MAP and RPM that change abruptly when the vehicle is traveling at a constant speed are clues to a possible fault area.

Look for agreement in related signals. For example, if AP is changed during acceleration, a corresponding change should occur in RPM PIDS.

Make sure the signals act in proper sequence. An increase in RPM after the AP is increased is expected. However, if RPM increases without an AP change, then a problem may exist. An RPM increase is normal during extended idle at colder ambient temperatures and during PTO operation.

1. Select VIEW RECORDER AREAS.

2. Select a viewing area.

3. Select up to four PIDs to review in the table format or two PIDs to review in the graph mode.

4. Table Format: Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the values. (Refer to the following AP example or reference the EEC-V charts and graphs in this section.) Notice the major jump in the AP voltage while scrolling through the information. This example would require a smooth and progressive throttle pedal travel during a key ON and engine OFF mode.

5. Graph Format: Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the linear lines showing the transformation of values to the line graph.

Peripheral Inputs

Some signals may require certain peripherals or auxiliary tools to aid in diagnostics. In some cases, these devices can be inserted into the measurement jacks of the scan tool or digital multimeter. The NGS is capable of recording the value from the measurement jacks on the NGS while storing the value from other PIDs.

Comparing PCM Data

After the PCM values have been acquired, it is necessary to determine the fault area. Typically, it will require the comparison of the actual values from the vehicle to the typical values from Reference Value Charts in Section 6 .

Analyzing PCM Data

Once the fault area is identified, the circuit must be checked to determine if the wiring or component is at fault. When making circuit and component measurements, make sure all accessories and dome and hood lights are off. Use any of the following methods to diagnose a suspected PCM wire circuit or device. Some methods are particular to a certain type of PCM device.

- Change Condition to Cause Response by Input
- Change Input and Verify Output Response
- Click Testing/Output Test Mode (Solenoids/Relays)
- Coil Resistance (Solenoids/Relays)
- Harness Opens
- Harness Shorts

Change Conditions to Cause Response by Input

The purpose is to verify the sensor receives and responds to changes.

1. Select, view and record the appropriate sensor PID(s).

2. Create condition or cause condition to change.

3. If reading changes appropriately, then it should be operating OK.

    Examples:
    - EOT should change from a higher voltage (2.6V) for a cold engine, to a lower voltage as the engine warms up (0.6V).
    - Move AP, observe AP PID change.
    - Press brake pedal, watch BOO PID change states.

Change Input and Verify Output Response

The purpose is to verify how the PCM and actuator circuit responds to sensor input.

1. Select, view and record the appropriate sensor PID(s).

2. Create condition to cause input condition to change.

3. Observe change (response) in actuator PID or actuator signal circuit measured by a measuring device.

Click Testing (Solenoids/Relays)

The purpose is to activate a solenoid or relay from the PCM by entering Output Self Test Mode.

1. Key on.

2. Enter Output Self Test Mode.

3. Turn outputs on and then off. The state of the output can be changed by cycling the accelerator pedal.

4. Listen for relays to click on and off. If a breakout box is connected to the PCM, measure the control circuit while turning the outputs on and off. A voltage change of greater than 4 volts should occur during the ON and OFF transition. (NOTE: The glow plug relay will only cycle on for 5 seconds the first time the accelerator pedal is pressed.)

Coil Resistance (Solenoids/Relays)

The purpose is to measure the correct resistance value of a device.

1. Key off.

2. Data Link Connector (DLC) disconnected from any diagnostic tools.

3. Disconnect component from vehicle harness.

4. Using an ohmmeter and referencing the Static Resistance Value Chart in the EEC-V graphs and charts at the end of this section, measure across the component terminals.

Harness Opens

The purpose is to check harness for open circuits.

1. Key off.

2. DLC disconnected from any diagnostic tools.

3. Disconnect component from vehicle harness.

4. Install breakout box.

5. Using an ohmmeter, isolate the circuit in question from the breakout box to the component connector pin.

6. Reading should be less than 5 ohms.

Harness Shorts

The purpose is to check the harness for short circuits (to ground or power).

1. Key off only.

2. DLC disconnected from any diagnostic tools.

3. Disconnect component from vehicle harness.

4. Using a digital multimeter, measure between the signal circuit and signal return circuit or power ground circuit or vehicle power.

5. If reading is less than 10 kohms, then the two circuits may be shorted.

EEC-V Graphs and Charts

Static Resistance Values

Component	Ohm Value
EPC	3 to 5.1 ohms
SS 1	15 to 25 ohms
SS 2	15 to 25 ohms
TCC	0.9 to 1.9 ohms

TEMPERATURE SENSOR GRAPH
(ECT, IAT AND TFT SENSORS)
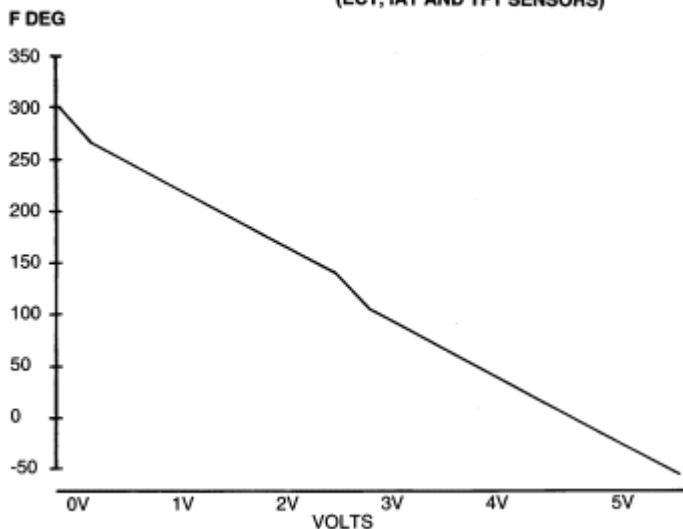
TRANSFORMATION TABLE

TEMPERATURE		VOLTAGE	RESISTANCE
F DEG	C DEG	VOLTS	K OHMS
302	160	0.12	0.54
267	131	0.2	0.8
248	120	0.28	1.18
230	110	0.36	1.55
212	100	0.47	2.07
194	90	0.61	2.8
176	80	0.8	3.84
158	70	1.04	5.37
140	60	1.35	7.6
104	40	2.16	16.15
86	30	2.62	24.27
68	20	3.06	37.3
50	10	3.52	58.75
32	0	3.97	65.849
14	−10	4.422	78.194
−4	−20	4.874	90.539
−22	−30	4.89	102.884
−40	−40	4.91	115.229
−58	−50	5	127.574

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TR SENSOR GRAPH
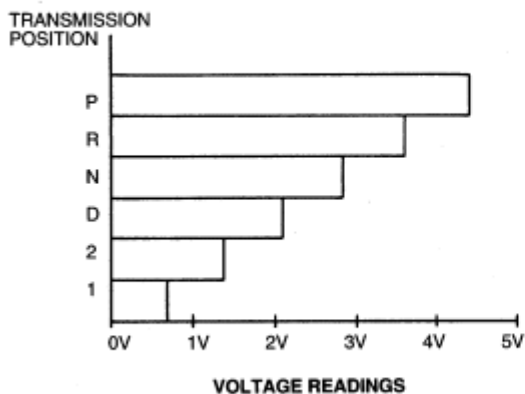
TRANSFORMATION TABLE

TRANSMISSION RANGE POSITION	VOLTAGE VALUE	RESISTANCE OHMS
P	4.41	4.16K
R	3.60	1.44K
N	2.83	733
D	2.09	401
2	1.37	211
1	0.68	81

TR SENSOR DATA:
VOLTAGE VALUES CALCULATED FOR VREF = 5.0V
AND MAY VARY +/- 5%.

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Note: The above illustrations are examples of generic NGS data and are not 7.3L diesel-specific.