

SECTION 7B

EEC Intermittent Fault Diagnosis

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Introduction

Defining Intermittent Driveability Symptoms

The Rotunda EEC-IV Monitor 007-0047F and the Rotunda EEC-IV Monitor Recorder 007-00021 are useful tools for diagnosing intermittent driveability symptoms which are unable to be resolved through the diagnostics in Section 6B Pinpoint Testing. This section supports diagnostic procedures and data using the EEC-IV Monitor and EEC-IV Monitor Recorder in a symptom-oriented manner.

By definition, an "intermittent" symptom is a randomly-occurring drive symptom from which no diagnostic codes (KOEO, KOER) are reported to the Rotunda Super STAR II Tester 007-0041B or other diagnostic equipment. Often, the EEC Quick Test (Section 5B) will result in pass codes while the drive symptom(s) still exist.

Before proceeding with the following procedures, be sure that:

- Customary mechanical system tests and inspections reveal no obvious problems (remember, mechanical component problems can make a good Powertrain Control Module [PCM] system react abnormally).
- EEC Quick Test (Section 5B) and associated EEC Pinpoint Test diagnostics (Section 6B) have been completed, and the symptom is still occurring after all recommended procedures have been performed.
- Review of Ford Technical Service Bulletins (TSBs) and inquiry into On-line Automotive Service Information System (OASIS) indicates no applicable articles.

Purpose of This Section

The Rotunda EEC-IV Monitor 007-0047F functions as a "window" into the EEC system. Through this "window" the user is able to view the same sensor and actuator values the Powertrain Control Module (PCM) uses to make decisions about engine performance. The EEC-IV Monitor displays these values for both static (Key OFF Engine Off, KOEO) and dynamic conditions (Key ON Engine Running, KOER). The advantage of the Rotunda EEC-IV Monitor Recorder 007-00021 is the ability to take a "snapshot" of selected PCM signals which can be stored and reviewed later.

NOTE: Throughout the rest of this section, the Rotunda EEC-IV Monitor 007-0047F and Rotunda EEC-IV Monitor Recorder 007-00021 will be referred to as Monitor and Recorder, respectively.

A basic working knowledge of the EEC system is critical to efficient troubleshooting of the symptom. Since no diagnostic procedure can account for all the possibilities which can be encountered, these diagnostic procedures only attempt to provide basic steps and methods for isolating possible causes.

The diagnostic procedures used in this section are a symptom-based approach for isolating the faulty system, circuit, or sensor. Often a mechanical fault will cause a good EEC system to react abnormally. In those cases, the use of a Monitor with these diagnostic procedures will help to eliminate possible EEC faults and locate mechanical faults.

EEC-IV Monitor — What Is It?

The Rotunda EEC-IV Monitor 007-0047F is an electronic tool which measures the operation of the electronic sensors and actuators of the EEC system. Its main purpose is to let the technician "see" the same information that the processor receives and observe how the processor reacts to the information. The Monitor has other capabilities, such as a built-in wiggle test used to locate intermittent faults in wiring, connections, and other EEC components.

Introduction

Why Is It Useful?

The Monitor is useful in identifying hard to diagnose vehicle problems. Many vehicle failures are hard faults and Pinpoint Tests (Section 6B) make it relatively easy to find the faulty part and fix the problem. But for problems that are intermittent and do not generate codes, the Monitor enables the technician to view sensor and actuator signals to the Powertrain Control Module (PCM). Judgements can be made by comparing the signals to normal operating conditions.

The Monitor readings are also helpful in locating non-electronic failures. By verifying that the electronics are not at fault, unnecessary replacement of a good component can be avoided. The technician can then investigate likely non-electronic systems capable of causing the same symptoms. Using the Monitor to read the electronic sensors associated with a mechanical system provides a check of the non-EEC system.

Rotunda EEC-IV Recorder 007-00021 — What Is It?

Basically, the Recorder works the same as an audio cassette recorder except that up to 8 different channels can be recorded at the same time, and the recording is stored in an electronic memory instead of on a tape cassette.

The Recorder is part of the Rotunda Driveability Test Package 007-0048F. When attached to the Monitor, the Recorder has access to the same sensor and actuator signals that the Powertrain Control Module (PCM) receives.

Why Is It Useful?

The Recorder is useful in helping to isolate intermittent faults and repeatable driveability problems. It does this by recording selected signals during a period of abnormal vehicle behavior. The stored information can be replayed to determine which devices or systems are malfunctioning. The Recorder can also be triggered to automatically record during the Monitor Wiggle Test.

Remember

It is important to perform EEC Quick Test (Section 5B) before proceeding in this section. Diagnostic trouble codes encountered in Quick Test must be recorded before disconnecting the PCM harness from the PCM to install the Monitor, as codes will be lost when the PCM is disconnected.

Questions / Information

In order for a vehicle to be correctly diagnosed it is important to obtain accurate information about the vehicle and the intermittent symptom. Consider the following points and questions:

- Get a full description of the vehicle operating conditions when the symptom occurs - details such as range of speed, engine hot or cold, accelerating or decelerating, heater or A/C on, engine noise, etc.
- Did the symptom occur gradually or suddenly?
- Could it be related to a previous event - such as an accident or part replacement?

Introduction

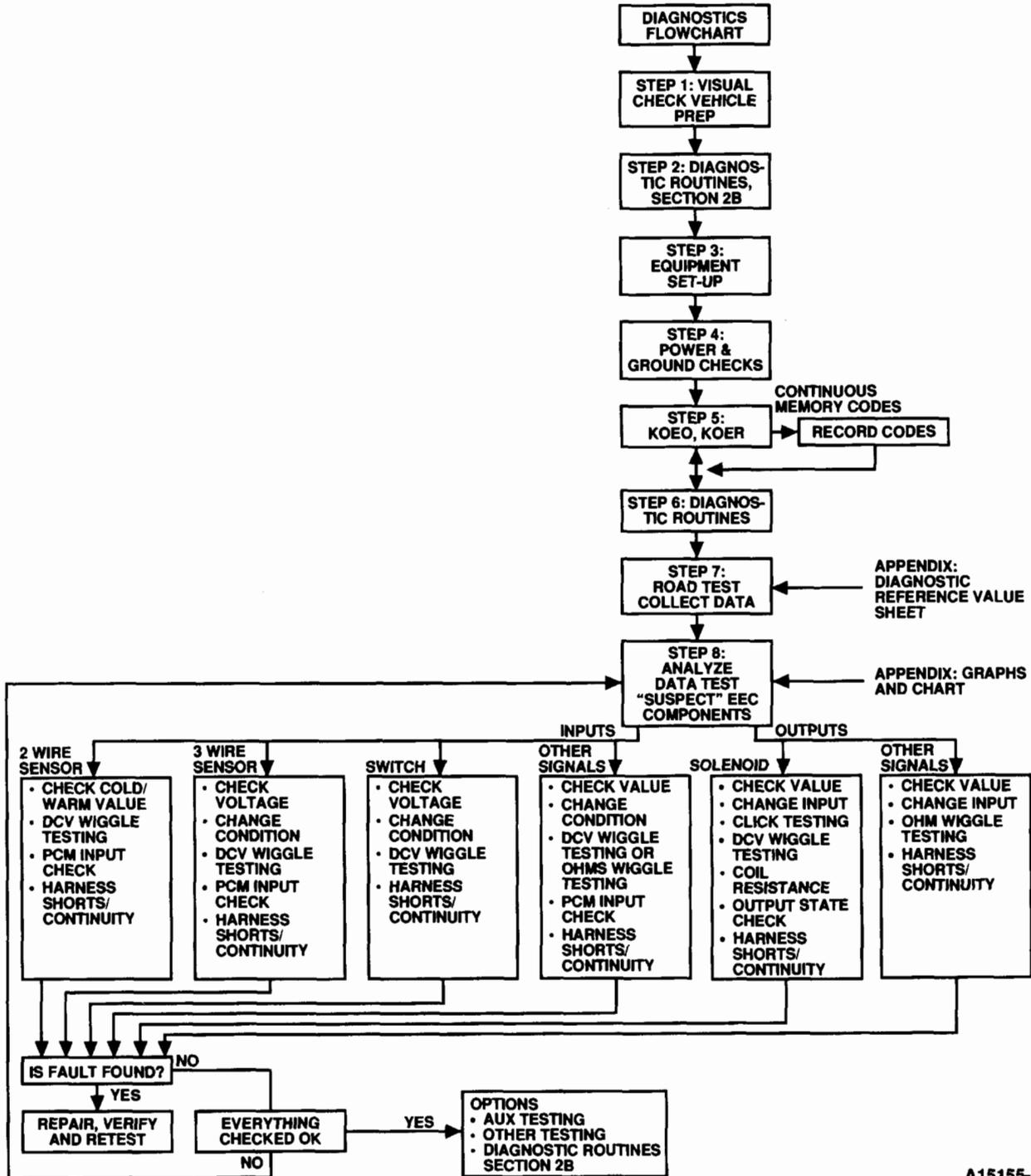
- What is the service history? Has it been serviced in the past in a way that might relate to the present symptom?
- Could the problem be related to the customer's driving habits, improper maintenance or neglect, or use of improper or poor fuels?

The Diagnostic Summary Flowchart

The flowchart on the following page gives an overview of the steps involved in EEC Intermittent Fault diagnosis. The flowchart is meant as a guide, and is not meant as a substitute for the procedures it lists. Detailed descriptions of these procedures follow the flowchart.

Introduction

Diagnostic Summary Flowchart



A15155-F

Step 1: Visual Check, Vehicle Preparation

NOTE: Be careful not to move any components or wiring harnesses while inspecting the vehicle. By doing so you could affect a possible fault and be unable to locate the original problem.

Visual Check

1. Inspect the air cleaner and inlet duct.
2. Check all the engine vacuum hoses for damage, leaks, cracks, blockage, proper routing, etc.
3. Check the EEC system wiring for proper connections, bent or broken pins, corrosion, loose wires, proper routing, etc.
4. Check the Powertrain Control Module (PCM), sensors, and actuators for physical damage.
5. Check the engine coolant for proper level.
6. Check the transaxle fluid level and quality.
7. Make all the necessary repairs before continuing.

Vehicle Preparation

1. Perform all the safety steps required to start and run vehicle tests:
 - Apply the parking brake.
 - Place the selector lever firmly into PARK (ATX) or NEUTRAL (MTX).
 - Block the drive wheels.
2. Turn off **ALL** electrical loads, such as radios, lights, A/C - heater fans, etc.
3. Start the engine and run until the engine is at normal operating temperature.
4. Turn off the engine and proceed with **Equipment Set-up**.

Step 2: Equipment Set-Up

CAUTION

The ignition switch must be turned off (Key OFF) before disconnecting the Powertrain Control Module (PCM) harness cable from the PCM.

Equipment Set-Up

1. Check for diagnostic trouble codes using the Super STAR II Tester or other diagnostic equipment. These codes must be recorded before disconnecting the Powertrain Control Module (PCM) harness, because the codes will be erased.
2. Install the Monitor (refer to the installation procedure below).
3. Select the proper Monitor overlay card for the appropriate engine (refer to Chart 1 on the next page).
4. If a Recorder is available, do not install it at this time.

Special Note

- If for some reason the correct overlay card is not available for the engine being serviced, the Monitor may still be used with a few limitations. In this situation, no overlay card is used and the technician must rely on the pin number label on PIN SELECTOR A and the light array to identify the Powertrain Control Module (PCM) signals. The Monitor can only be used in the MANUAL mode (DCV, OHMS). Do not substitute an incorrect overlay because the readings in the AUTO mode will not be correct. Also, the signal labels on the substitute overlay card may be different from the labels on the proper card.

Description and Installation of Rotunda EEC-IV Monitor 007-0047F

EEC-IV Monitor Installation

1. Record any diagnostic trouble codes obtained during Quick Test before removing the Powertrain Control Module (PCM) harness cable from the PCM; removal of the harness results in loss of Keep Alive Memory Power (KAPWR) and will result in loss of any stored codes.
2. Remove the lid from the Monitor and ensure that the POWER switch is in the OFF position.
3. Turn the ignition switch off (Key OFF) and disconnect the PCM harness cable from the PCM.
4. Inspect the connector for loose or damaged pins, corrosion, or loose wires.
5. Connect the appropriate PCM adapter harness connectors to the PCM (Figure 1). A listing of the monitor adapters and overlays is in Chart 1.

NOTE: For 1.9L and 2.0L, refer to Section 7A of this manual for installation and testing procedures.

Step 2: Equipment Set-Up

Chart 1

Year	Engine	Monitor	
		Adapter	Overlay
1994	1.3L	007-00057	68
1994	1.6L Non-Turbo	007-00038	46
1994	1.6L Turbo	007-00038	47
1994	1.8L MTX	007-00057	36
1994	1.8L 4EAT	T92C-6000-AH	60
1994	2.5L	T92C-6000-AH	62

6. Attach the Monitor connector to the PCM adapter cable and tighten the bolt on the connector with a 10mm socket until snug. Do not over-tighten. Attach the PCM harness to the PCM adapter (Figure 1).

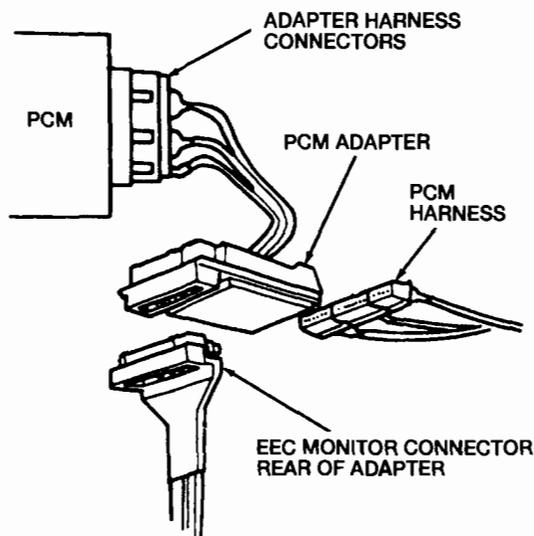


Figure 1.

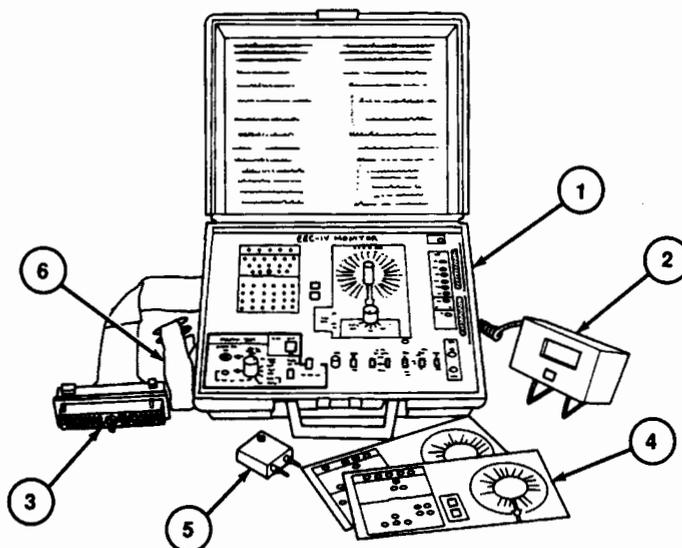
7. Select the correct Monitor overlay card for the vehicle and engine being serviced. Install this overlay on the Monitor's front panel.
8. Position the Monitor where it can be conveniently viewed and operated. If the Monitor is to be operated in the engine compartment, be sure to route the connecting cable away from moving parts, ignition wires, coil, and door or hood ornaments. If the Monitor is to be operated in the passenger compartment, it may be placed on the seat or suspended from the instrument panel.
9. To suspend the Monitor from the instrument panel, use the straps supplied with the Monitor and fasten the hooks into the windshield defroster vents.
10. Place the remote display in a convenient viewing position, either attached to the top or bottom of the Monitor, the passenger visor, or the edge of the dashboard.

Step 2: Equipment Set-Up

11. Check to see that all electrical loads are off (radio, lights, power windows, A/C, rear window defroster, etc.).

Overall Description of Monitor (Figure 2)

Rotunda EEC-IV Monitor 007-0047F



A12813-B

Figure 2.

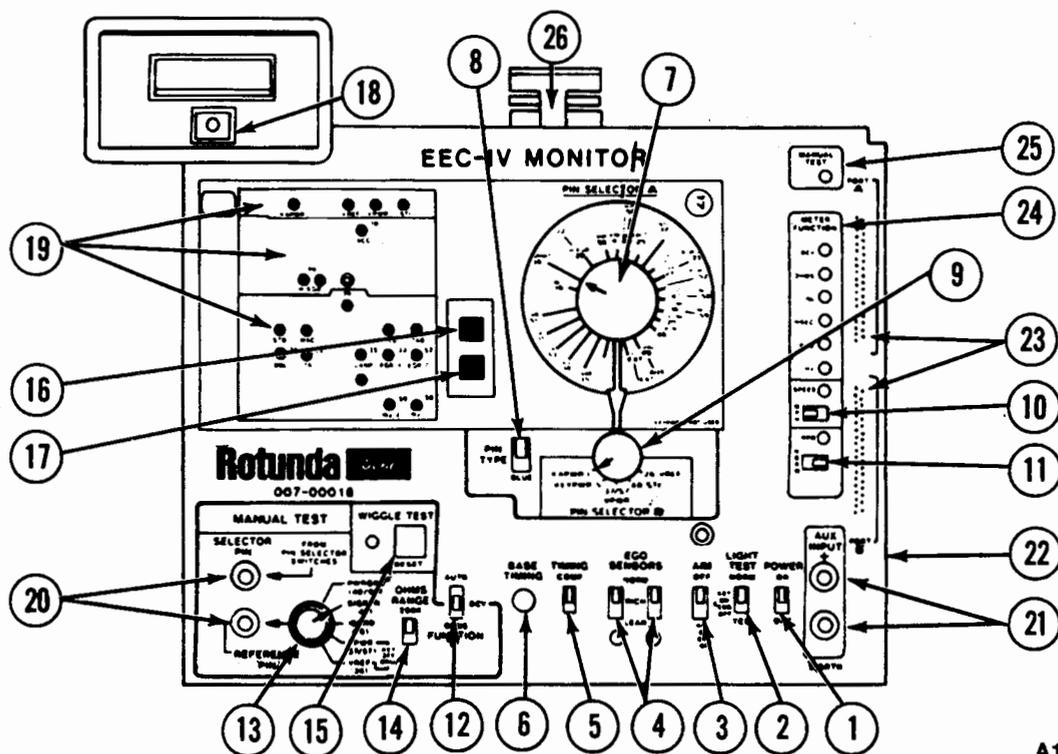
1. **The Main Unit.** This is the brain of the EEC-IV Monitor. It contains all the switches, buttons, and lights that enable the technician to perform diagnostic tests.
2. **Remote Display.** An LCD readout is used to display all Monitor measurements. This display is housed in a small box which is detached from the main unit. Viewing is easy and convenient because the display may be mounted in convenient locations.
3. **T-Connector and Harness.** The T-connector is a special plug which is attached between the Powertrain Control Module (PCM) harness connector and the PCM. The Monitor receives power through this connection as well as access to all electrical signals entering and leaving the PCM.
4. **Overlays.** This item is a plastic card which is installed on the Monitor to program it for use. Each engine family has a unique overlay associated with it. Generally, the sensor input signals are listed in the inner blue circle around PIN SELECTOR A; the outer red circle lists the output actuator signals. The overlay card lists only those signals applicable to the specific vehicle being tested.
5. **Switch Box.** The switch box is a small device which can be plugged into the SELECTOR PIN and REFERENCE PIN JACKS located on the lower left corner of the Monitor. It is useful for testing solenoid and relay operations.

Step 2: Equipment Set-Up

6. **Straps.** These straps snap to the Monitor main unit case and are used to hold the main unit in a convenient place for on-the-road testing.

Monitor Description (Figure 3)

Rotunda EEC-IV Monitor



A12826-A

Figure 3.

1. **POWER.** Monitor ON/OFF switch.
2. **LIGHT TEST.** NORM is operational mode; TEST modes activate all lights and beeps.
3. **AIM.** Audible Intermittent Monitor — 3 positions: OFF, Key ON Engine Off (KOEO) which beeps when Self-Test Output (STO) is at ground, and Key ON Engine Running (KOER) which initiates diagnostic test mode and also beeps when STO is at ground.
4. **EGO SENSORS.** 3 positions: NORM, RICH (applies rich signal to Powertrain Control Module [PCM]), and LEAN (applies lean signal to PCM). Single Heated Oxygen Sensor (HO2S) or Oxygen Sensor (O2S) engines use only NORM position.
5. **TIMING.** Selects COMP (computed) mode, which reads spark advance from the PCM, or DIST (distributor) mode, which allows the Monitor to be calibrated to base timing.

Step 2: Equipment Set-Up

6. **BASE TIMING.** Calibrates base timing when TIMING switch is in DIST mode.
7. **PIN SELECTOR A.** Rotary dial which allows selection of PCM signals.
8. **PIN TYPE.** Selects between 2 modes for PIN SELECTOR A — BLUE (inner) sensors / inputs or RED (outer) actuators / outputs.
9. **PIN SELECTOR B.** Rotary dial which allows selection of PCM power and Self-Test Input (STI) signals.
10. **SPEED.** Selects between MPH and KPH readings for vehicle speed signals.
11. **RPM.** Selects between NORM and x10 scale readings for ignition signals.
12. **FUNCTION.** 3 positions: AUTO (measurements with varied units automatically selected), DC Volts (DCV) [readings in DCV only and uses the REFERENCE PIN dial], and OHMS (resistance readings only and uses the REFERENCE PIN dial). DCV and OHMS will light the MANUAL TEST light.
13. **REFERENCE PIN.** Selects ground or voltage when FUNCTION is in DCV or OHMS.
14. **OHMS RANGE.** Switches between 2K and 200K range readings for OHMS mode.
15. **WIGGLE TEST.** RESET button resets the manual mode wiggle test and turns off the beeper or light if either is on.
16. **EGRV.** Activates the Exhaust Gas Recirculation (EGR) vent solenoid when depressed (special applications).
17. **EGRC.** Activates the EGR control solenoid when depressed (special applications).
18. **PUSH TO TEST.** (Located on remote display.) Display test turns on all digits in readout (should read 1888).
19. **PCM POWER / SIGNAL STATUS INDICATORS.** Grouped into 3 categories: Power, Sensors, and Actuators. Lights show status of signals.
20. **SELECTOR PIN JACKS.** Top (red) jack probes the PIN SELECTOR A / B signal; bottom (black) jack probes the REFERENCE PIN signal.
21. **AUX INPUT.** Jacks used to measure external signals.
22. **AUX POWER.** Jack supplies power for auxiliary input device (located on the side of the monitor).
23. **PORT A / PORT B.** Enables EEC-IV Monitor Recorder to be connected.
24. **METER FUNCTION.** Lights identify measurement unit being used.
25. **MANUAL TEST.** Light blinks when FUNCTION switch is in manual DCV or OHMS, otherwise light remains off.
26. **SUPER STAR II TESTER CONNECTION.** Enables hook-up of Rotunda Super STAR II Tester 007-0041B without using the data link connector.

Step 2: Equipment Set-Up

Auxiliary Equipment for the Monitor

The Monitor, in addition to all of its useful testing, can be used with some very helpful peripheral tools. The **Rotunda Multi-point Auxiliary Adapter 007-00023**, or "Octopus," is a device which inserts into the AUX input jacks. It can be used to measure many different non-PCM electrical signals, such as fuel pump, A/C, and battery. The most useful auxiliary equipment tool used in conjunction with the Monitor is the Recorder, which is described below.

Description and Installation of Rotunda EEC-IV Recorder 007-00021

EEC-IV Recorder Installation

1. The Monitor must be installed first in order to use the Recorder. Make sure that the correct overlay card is installed.
2. Place the Recorder in an appropriate location near the Monitor. Check to ensure that the Recorder power switch is OFF. The lid of the Recorder may be removed if desired.
3. Install the PORT A cable of the Recorder into the PORT A connector on the Monitor; install the PORT B cable of the recorder into the PORT B connector of the monitor. Make sure that the cables are properly oriented before insertion and are firmly seated afterwards. (Figure 4.)

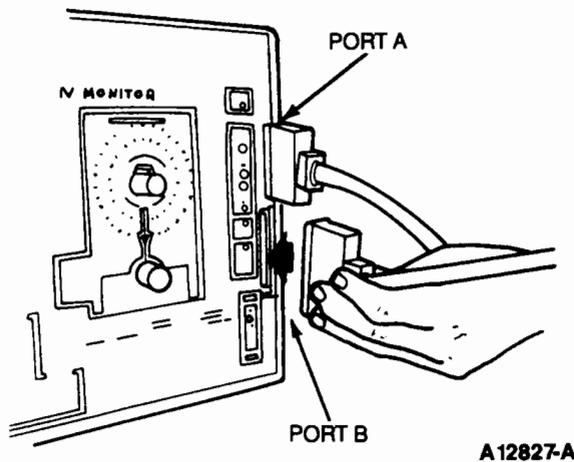


Figure 4.

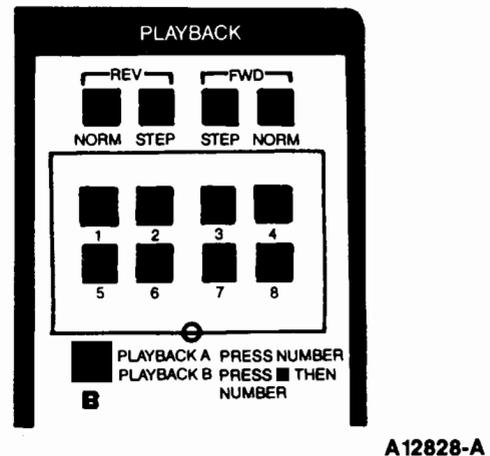


Figure 5.

4. As a final step, install the white overlay card around the eight playback buttons. This card will be used later to keep track of the signal names of the recorded channels. Refer to Figure 5.

Step 2: Equipment Set-Up

Overall Description of the Recorder (Figure 6)

Rotunda EEC-IV Monitor Recorder

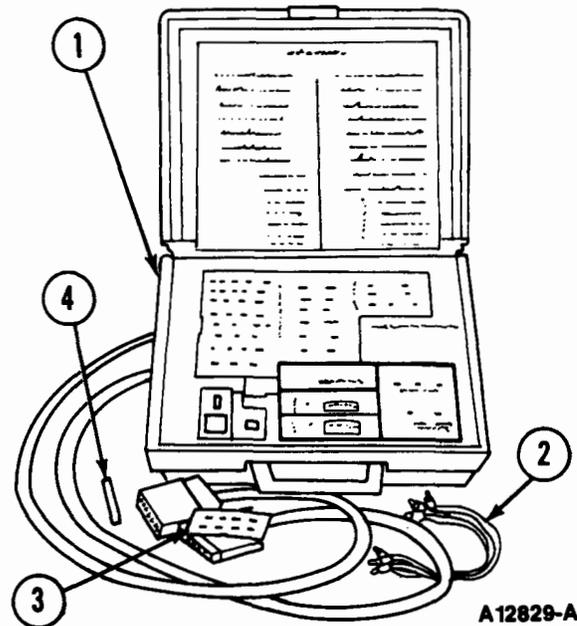


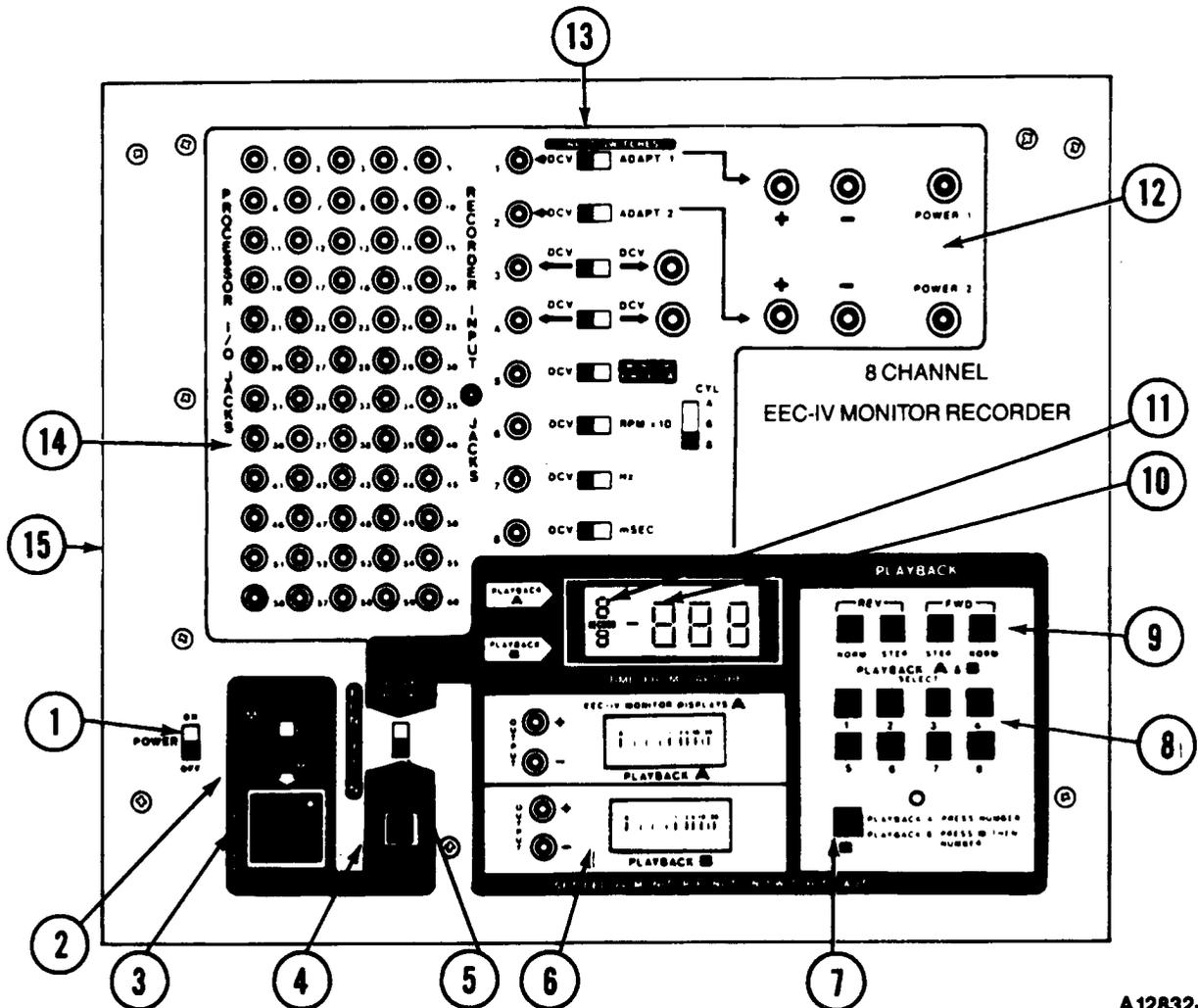
Figure 6.

1. **Main Unit.** This contains all the circuitry necessary for recording operations. It must be connected to a Monitor. All aspects of signal recording and playback are controlled by the front panel switches and buttons.
2. **Selection Cable.** The bundle of jumper leads used to connect the eight recording channel inputs to any of the pins of the Powertrain Control Module (PCM) connector.
3. **Overlay Card.** The white overlay card fits around the playback buttons. The user can mark the signal names being recorded next to the recording channel number.
4. **Marking Pen.** This special felt-tip pen is used to mark the overlay card. The markings can easily be erased with a moist tissue or cloth.

Step 2: Equipment Set-Up

Recorder Description (Figure 7)

Rotunda EEC-IV Monitor Recorder



A12832-A

Figure 7.

1. **ON/OFF.** Recorder power.
2. **MODE.** Select between NORMAL and WIGGLE modes for initiating capture of recorded signals.
3. **CAPTURE.** When activated, the recorder saves the previous 30-second period and continues to record the next 20-second period. A tone will sound and light will flash while recording.
4. **START RECORD.** Operates in the FUNCTION RECORD mode only. Will initiate continuous recording of selected channels. A tone will sound.

Step 2: Equipment Set-Up

5. **FUNCTION.** Selects between the PLAYBACK and RECORD modes.
6. **PLAYBACK METERS.** Shows the dynamic reading from 0-20 volts on respective channels. Output jacks are available for remote readings.
7. **B SELECT.** When pressed before one of channels 1 thru 8, selects PLAYBACK B channel for PLAYBACK mode.
8. **CHANNEL SELECT.** Choice of eight channels to be displayed in PLAYBACK mode.
9. **PLAYBACK DIRECTION.** Choice of the REVERSE or FORWARD directions (range is -30 to 19.9 seconds) and choice of the NORM (continuous) or STEP (0.1 second increments).
10. **TIME.** Display expressed in seconds and designated "+" or "-" for CHANNEL A.
11. **CHANNEL INDICATOR.** Displays CHANNEL A on top; CHANNEL B on bottom.
12. **ADAPTER INPUTS.** Special optional inputs used for CHANNELS 1 and 2 only.
13. **CHANNEL INPUTS.** Channels 1 through 8 selected with switches for optional inputs with non-DCV units.
14. **CHANNEL I/O.** 60 jacks for channels from PCM which can be jumpered to Channels 1 through 8.
15. **REMOTE CAPTURE INPUT.** Allows optional input to activate capture via remote device (located on the side of the recorder).

Auxiliary Equipment

The Recorder allows external auxiliary equipment to be used with it. The Recorder allows up to two auxiliary inputs, which can include the **Rotunda Multi-point Auxiliary Adapter 007-00023** input. For outputs, the Recorder supplies PLAYBACK CHANNELS A AND B jacks for use with a DVOM or a graphic recording device. Finally, the Recorder provides an input jack on its lower left side which allow a remote capture activating device to be used.

Methods of Monitor Measurements

Monitor Light Indicator Values

The light or LED array on the upper left side of the Monitor displays the status of many key Powertrain Control Module (PCM) signals. By observing these lights, one can easily gain information about the condition of dynamic PCM signals.

Preliminary: Light Test. Prior to operation of the Monitor it is a good practice to verify that all the lights are functional. Turn on the Monitor. When the LIGHT TEST switch is set to TEST mode, all the lights (or LEDs) should light and the beeper should sound. The red O2S or HO2S light will be dim. Return the switch back to NORM when the test is completed.

Step 2: Equipment Set-Up

Power Indicators. The top group of indicators display power and STI signals. When the appropriate voltage is present the light will be lit. For example, at Key ON, the KEYPWR (optional), VREF and VPWR lights should all be visible. The STI light is on when the signal is 0 volts (Key OFF) and off when 5 volts is present at Key ON.

Input Signal Indicators. The second group of indicators are selected input signals. They are lit when their voltage is above 2.5 volts, and off when their voltage is below 2.5 volts. There are two exceptions to this manner of operation — the knock sensor and the O2S (HO2S). The knock sensor lights when the signal is above 1.0 volt. The O2S (HO2S) has two lights; the green light for lean (below +0.45 volts) and the red light for rich (above +0.45 volts). During certain engine run conditions the O2S (HO2S) can be seen switching back and forth between green (lean) and red (rich).

Output Signal Indicators. The bottom group of indicators are output signals such as solenoids, relays, and injectors. These signals are lit when their value is below 6.0 volts and off when above 6.0 volts. For example, this means that most solenoids will be lit when they are activated because they are controlled by ground. Injectors will be blinking on and off in proportion to their on times.

Meter Function Indicators. The far right column of indicators display the type of units for the value on the remote display unit. During manual DCV or OHMS, the MANUAL TEST indicator will blink and the appropriate DCV or OHMS indicator will light. In AUTO mode the correct unit indicator will light automatically. Listed in the following chart are examples of the types of AUTO units which apply for the various PCM signals.

AUTO MODE UNITS	
Signal	Units
IDM, TACH	RPM
IAC	Duty Cycle %
Injectors	MSEC
All Others	DCV

Auto Measurements

AUX — Rotunda Multi-point Auxiliary Adapter (Octopus) 007-00023

1. Key ON Engine Off (KOEO) / Key ON Engine Running (KOER).
2. Select PIN SELECTOR A AUX (red).
3. Insert a jumper from the device into the AUX input jack.
4. Read the value in DCV (DCV light on).

Change Condition to Cause Response by Input

1. KOEO or KOER.
2. Select the sensor on PIN SELECTOR A.

Step 2: Equipment Set-Up

3. Create the condition or the change in condition.
4. Observe the change in the sensor value; verify with the **EEC Graphs and Charts**.
5. Examples:
 - Move the throttle; observe the TP increase.
 - Warm up the engine; observe the ECT decrease.
 - Press the brake pedal; observe the BOO light.

Change Input and Verify Output Response

1. KOEO or KOER.
2. Select the actuator on PIN SELECTOR A.
3. Create the change for the input device with the switch box or vehicle operation.
4. Observe the change (response) in the actuator signal, observe the light.
5. Examples:
 - Increase the throttle (TP); observe the Spark Output (SPOUT) increase.
 - Move the EGO switch to LEAN; observe the SPOUT increase.
 - Turn on the A/C at WOT; observe the WAC light on and grounded.

Check Value

1. KOEO/KOER.
2. Select the signal from PIN SELECTOR A or B.
3. Various units are used, refer to the METER FUNCTION light.

Click Testing (Relays/Solenoids)

1. KOEO only.
2. Can also be done in the manual DCV Function mode.
3. Select the relay or solenoid signal on PIN SELECTOR A and the correct ground on the REFERENCE PIN selector.
4. Insert the switch box into the SELECTOR PIN jacks.
5. Push the small red button to turn on the relay or solenoid.

Step 2: Equipment Set-Up

6. Listen for "click" of the device turning on, observe the signal light turn on and the device energizing.

PCM Input Check (STO)

1. KOEO.
2. Select the sensor from PIN SELECTOR A.
3. Set the REFERENCE PIN selector to SIG RTN.
4. Insert the switch box into the SELECTOR PIN jacks.
5. Move the AIM switch to the KEY ON ENG OFF position.
6. Push the small red button on the switch box and observe the STO light turn on and the beeper sound as long as the button is pressed.
7. Return the AIM switch to the OFF position.

Output State Check (Solenoids/Relays)

1. KOEO.
2. Move the AIM switch to the KEY ON ENG ON position and wait for the output codes (beeps) to end.
3. Completely depress and release the throttle — observe the signal light turn on.
4. Completely depress and release the throttle — the light should turn off.
5. Return the AIM switch to the OFF position.

Step 2: Equipment Set-Up

Manual Ohms Measurement

External Ohms

1. Key OFF.
2. Select EXT on PIN SELECTOR A.
3. Select the correct ground on REFERENCE PIN selector.
4. Select the OHMS RANGE switch.
5. Verify that resistance to be measured is not connected to the vehicle.
6. Connect jumper wires from the SELECTOR PIN jacks to the device to be measured.
7. Read the value of resistance.

Harness Continuity

1. Key OFF.
2. Select the signal from PIN SELECTOR A.
3. Disconnect the sensor / actuator where signal is to be checked.
4. Connect a jumper wire from the REFERENCE PIN jack (black) to the signal pin on the harness to be tested.
5. Check for continuity — 0 ohms.

Harness Shorts

1. Key OFF.
2. Select the signal from PIN SELECTOR A.
3. Set the OHMS RANGE switch to 200K.
4. Disconnect the sensor / actuator to be tested.
5. Disconnect the PCM.
6. Select the various power or ground signals from the REFERENCE PIN selector for which the device is being tested. Example: VREF, SIG RTN, PWR GND.
7. Read resistance: 0 ohms or a low resistance reading indicates a short; 10K ohms or higher indicates an open.

Step 2: Equipment Set-Up

Ohms Value (Coil Resistance)

1. Key OFF.
2. Select the signal from PIN SELECTOR A and PIN TYPE.
3. Select the correct ground from the REFERENCE PIN selector.
4. Select the OHMS RANGE switch.
5. The WIGGLE TEST light will illuminate and sound; press the WIGGLE TEST RESET button.
6. The MANUAL TEST light should be blinking; value in ohms units.

OHMS Wiggle Testing

1. Key OFF.
2. Select the signal from PIN SELECTOR A and PIN TYPE.
3. Select the correct ground from the REFERENCE PIN selector.
4. Tap the components, flex the harness and connectors.
5. The WIGGLE TEST light and beeper will activate when the change sensed.
6. The OHMS Wiggle Test is less sensitive than the DCV Wiggle Test.
7. Criteria for using the OHMS Wiggle Test as opposed to DCV Wiggle Test:
 - a. All sensors which do not use DCV units in the AUTO mode.
 - b. Example: PIP, SPOUT, CKP.

Power/Ground Harness Continuity

1. Key OFF.
2. Select EXT on PIN SELECTOR A.
3. Select the desired power / ground signal on the REFERENCE PIN selector.
4. Disconnect the sensor / actuator where the power / ground signal is to be checked.
5. Connect a jumper wire from the SELECTOR PIN jack (red) to the ground / power signal pin on the harness to be tested.
6. Check for continuity — 0 ohms.

Step 2: Equipment Set-Up

Manual DCV Measurements

DCV Wiggle Testing

1. Key On Engine Off (KOEO) / Key On Engine Running (KOER).
2. Select the signal from PIN SELECTOR A or B.
3. Select the correct ground from the REFERENCE PIN selector.
4. Tap the component, flex the harness and connectors.
5. The WIGGLE TEST light and beeper will activate when the change is sensed.
6. The DCV Wiggle Test is more sensitive and more commonly used than the OHMS Wiggle Test.
7. Criteria for using the DCV Wiggle Test as opposed to the OHMS Wiggle Test:
 - All actuators (red zone).
 - All power and grounds.
 - All sensors which use DCV units in AUTO mode.
 - Cannot use KOER Wiggle testing for switching-type signals such as injectors.

Manual DCV

1. KOEO / KOER.
2. Select the signal from PIN SELECTOR A or B.
3. Select the correct ground from the REFERENCE PIN selector.
4. The WIGGLE TEST will light and sound; reset the WIGGLE TEST RESET button.
5. The MANUAL TEST light should be blinking; value in DCV units.

Recorder — Additional Measurements

Recorder AUX Inputs

1. Key On Engine Running (KOER).
2. Monitor set up in the desired operation.

Step 2: Equipment Set-Up

3. Device (e.g., Multi-point Auxiliary Adapter) inserted into ADAPT1 or ADAPT2 of Recorder.
4. Recorder input switch set toward the auxiliary device.
5. Recorder operation performed as normal.

Recorder DCV Wiggle Capture

1. KOER.
2. Monitor set up for manual DCV Wiggle.
3. Recorder CHANNELS 1-4, 6-8 selected with PCM signals.
4. Select Recorder CHANNEL 5 for the signal to trigger the Recorder CAPTURE, switch is set to DCV (same signal is selected on Monitor on PIN SELECTOR A).
5. Optional: STO (17) could be selected so the PCM wiggle mode would trigger capture.
6. The Recorder MODE switch set to NORM, the FUNCTION switch to RECORD.
7. Start the vehicle, press the WIGGLE TEST RESET on the Monitor, set the Recorder MODE switch to WIGGLE.
8. Press the START RECORD button on the Recorder (CAPTURE light should blink).
9. Operate the vehicle until the symptom occurs — the Monitor Wiggle alarm will sound and the Recorder CAPTURE function will engage. If the symptom does not trigger the wiggle alarm on the Monitor, the signals can still be saved by pressing the CAPTURE button.

NOTE: SELECTOR PIN jack (red) is connected to SELECTOR PIN A/B signal at all times: AUTO, DCV and OHMS. REFERENCE PIN jack (black) is connected to REFERENCE PIN selector signal at all times: AUTO, DCV and OHMS.

Step 3: Power and Ground Tests

Strategy for Locating Power and Ground Faults

If the value of a ground or power circuit is out of range or a signal is suspected to be faulty, then use the following methods to determine the fault. (Refer to Methods of Monitor Measurements.)

- Inspect circuit wires for visible breaks or shorts, loose connectors, bent or pushed out connector pins, or corrosion.
- Test vehicle battery for low voltage and current (refer to the appropriate Service Manual, Section 14-01).
- Perform the Monitor Wiggle Test on the problem circuit. A beep will sound if an intermittent short or open is present.
- Perform the Click Test for those signals which activate relays or solenoids. Using the switch box in the selector pin jacks allows relays and solenoids to be activated.

TEST STEP		RESULT	ACTION TO TAKE
PG1	TEST EQUIPMENT POWER		
	<ul style="list-style-type: none"> ● Key OFF. ● Turn the Monitor power ON. ● Check the green KAPWR LED. ● Is the LED on? 	Yes No	► GO to PG2 . ► REPAIR the KAPWR circuit to the battery. REFER to Pinpoint Test PGC in Section 6B.
PG2	TEST MONITOR LED		
	<ul style="list-style-type: none"> ● Key OFF. ● Turn the Monitor power ON. ● Place the light test switch to the test position. ● Check all the LEDs on the Monitor including the six yellow LEDs in the remote display. ● Did all the LEDs illuminate and did the beep sound? 	Yes No	► GO to PG3 . ► The Monitor is faulty and requires REPAIR.
PG3	TEST MONITOR REMOTE DISPLAY		
	<ul style="list-style-type: none"> ● Key OFF. ● Turn the Monitor power ON. ● Depress the remote display button. ● Does the display indicate "1888"? <p>NOTE: Temperature extremes above 70°C (158°F) will result in a black display and cold temperature extremes will cause the display to run slow. The display will return to normal during normal ambient temperatures.</p>	Yes No	► GO to PG4 . ► The Monitor is faulty and requires REPAIR.

Step 3: Power and Ground Tests

	TEST STEP	RESULT	ACTION TO TAKE																		
PG4	CHECK POWER VOLTAGE LEVEL <ul style="list-style-type: none"> ● Key ON, engine off. ● Turn the Monitor power ON. ● Place Pin Selector A to select Pin Selector B. ● Verify the voltages in the following chart: <table border="1" style="margin-left: 20px; border-collapse: collapse; width: 150px;"> <thead> <tr> <th>Signal</th> <th>Value (volts)</th> </tr> </thead> <tbody> <tr> <td>VPWR</td> <td>Greater than 10.5</td> </tr> <tr> <td>KAPWR</td> <td>Greater than 10.5</td> </tr> <tr> <td>VREF</td> <td>4.5-5.5</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Did all the voltage levels correspond to the chart? 	Signal	Value (volts)	VPWR	Greater than 10.5	KAPWR	Greater than 10.5	VREF	4.5-5.5	Yes No (VPWR) No (KAPWR) No (VREF)	<ul style="list-style-type: none"> ▶ GO to PG5. ▶ INSPECT/ SERVICE PCM harness, power relay, battery, ignition switch, or cables. ▶ INSPECT/ SERVICE PCM harness or battery. ▶ INSPECT/ SERVICE PCM harness or PCM. 										
Signal	Value (volts)																				
VPWR	Greater than 10.5																				
KAPWR	Greater than 10.5																				
VREF	4.5-5.5																				
PG5	CHECK GROUND VOLTAGE LEVELS <ul style="list-style-type: none"> ● Key ON, engine off. ● Turn the Monitor power ON. ● Verify the voltages in the chart below: <table border="1" style="margin-left: 20px; border-collapse: collapse; width: 200px;"> <thead> <tr> <th>Signal</th> <th>Value (volts)</th> <th>Application</th> </tr> </thead> <tbody> <tr> <td>PWRGND</td> <td>0 - 0.5</td> <td>All Engines</td> </tr> <tr> <td>SIGRTN</td> <td>0 - 0.5</td> <td>All Engines</td> </tr> <tr> <td>CAN/CAL</td> <td>0 + 0.5</td> <td>1.8L California</td> </tr> <tr> <td>GND</td> <td>0 + 0.5</td> <td>1.3L MTX</td> </tr> <tr> <td>CKPRTN</td> <td>0 - 0.5</td> <td>2.5L</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Do all the voltage levels correspond to the chart? 	Signal	Value (volts)	Application	PWRGND	0 - 0.5	All Engines	SIGRTN	0 - 0.5	All Engines	CAN/CAL	0 + 0.5	1.8L California	GND	0 + 0.5	1.3L MTX	CKPRTN	0 - 0.5	2.5L	Yes No	<ul style="list-style-type: none"> ▶ GO to PG6. ▶ REPAIR the circuit(s) at fault.
Signal	Value (volts)	Application																			
PWRGND	0 - 0.5	All Engines																			
SIGRTN	0 - 0.5	All Engines																			
CAN/CAL	0 + 0.5	1.8L California																			
GND	0 + 0.5	1.3L MTX																			
CKPRTN	0 - 0.5	2.5L																			
PG6	CHECK OTHER POWER <ul style="list-style-type: none"> ● Key ON, engine off. ● Turn the Monitor power ON. ● Verify the voltage in the chart below: <table border="1" style="margin-left: 20px; border-collapse: collapse; width: 200px;"> <thead> <tr> <th>Signal</th> <th>Value (volts)</th> <th>Application</th> </tr> </thead> <tbody> <tr> <td>VMREF</td> <td>7-9</td> <td>1.6L</td> </tr> <tr> <td>CAN/CAL</td> <td>10-14</td> <td>1.8L Canada</td> </tr> <tr> <td>MT/AT</td> <td>10-14</td> <td>1.8L 4EAT</td> </tr> <tr> <td>VST</td> <td>10-14</td> <td>2.5L</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Does the voltage correspond to the chart? 	Signal	Value (volts)	Application	VMREF	7-9	1.6L	CAN/CAL	10-14	1.8L Canada	MT/AT	10-14	1.8L 4EAT	VST	10-14	2.5L	Yes No	<ul style="list-style-type: none"> ▶ GO to Step 4, EEC-IV Monitor Symptom Analysis. ▶ REPAIR the circuit(s) at fault. 			
Signal	Value (volts)	Application																			
VMREF	7-9	1.6L																			
CAN/CAL	10-14	1.8L Canada																			
MT/AT	10-14	1.8L 4EAT																			
VST	10-14	2.5L																			

Step 4: Symptom Analysis

Purpose of This Step

When an intermittent symptom occurs, get a full description of the symptom and the driving mode during which it occurs.

Finding Probable Causes

- Refer to Section 3B and list the sensors and actuators that could cause the symptom.
- Refer to the EEC Graphs and Charts and the Diagnostic Reference Values in this section.
- **REMEMBER:** The conditions and driving mode can provide clues to the cause of the symptom.

Example: A hard start symptom with engine cold could indicate an Engine Coolant Temperature (ECT) sensor malfunction.

Check the Basics

- Always make sure things like fluid levels and quality, maintenance schedules, and proper vehicle use are okay. Old, clogged fuel filters can cause intermittent problems, as can low coolant levels and poor oil quality.
- Good power and ground connections, and good harness condition are **VERY** important. Poor grounds and powers (to injectors, for example) can cause intermittent symptoms.

Step 5: Road Test

Re-Creating the Symptom

In order to diagnose an intermittent symptom, one must re-create the symptom and collect information on how the EEC system is sensing and reacting. After visual and non-EEC checks are completed and satisfied, the EEC portion is diagnosed. Through the use of the Monitor and Recorder, these signal lines can be inspected for shorts, opens, component failures, or erratic behavior. In addition, the information received from the Monitor and Recorder can reveal the presence of mechanical problems.

Optional

If a Recorder unit is available, install it at this time — refer to EEC-IV Recorder Installation in this section.

Road Test Set-Up

1. Place the Monitor (Recorder also, if installed) in a convenient location inside the vehicle. Secure any cables that are attached from the engine compartment to the Monitor or Recorder inside the vehicle.
2. Check to see that the proper overlay card is inserted on the Monitor. Refer to the note in Step 2, Equipment Set-Up, if the correct overlay is not available.
3. List the Powertrain Control Module (PCM) sensors and actuators that could cause the condition. Refer to Section 3B. These signals will be monitored during the road test.
4. If a Recorder is used, select the first eight signals that could cause the condition for Channels 1 to 8. Connect the jumpers from the Input / Output (I/O) jacks to the appropriate channels. Refer to Step 2, Equipment Set-Up, if needed.
5. Select the proper **Diagnostic Reference Value Chart** after Step 6. These sheets list PCM sensor and actuator values at various operating conditions. The values given in these charts are "ballpark" references only.
6. In order for a road test to be performed, another person must accompany the driver. This is a safety issue because the driver should not divert his attention from the road to the operation of this test equipment. The accompanying person can select signals, observe changes, and record data.

Use of Auxiliary Equipment Inputs

Some useful signals may require auxiliary equipment. These devices can be inserted into the AUX input jacks of the Monitor or the ADAPT 1 / ADAPT 2 input jacks of the Recorder. Two types of peripherals are available. An example of a peripheral and the signals it receives is listed.

- Multi-point Auxiliary Adapter — A/C, Fuel Pump

Road Test Reminders

The purpose of the road test is to re-create the problem symptom by duplicating the conditions that caused it to occur.

Step 5: Road Test

Alternatives. In some cases it may not be necessary or desirable to perform an actual road test. The symptom may occur at starting, idle, or high idle speed conditions. If this situation applies, proceed with the **Road Test Procedure** by using the operating condition that applies the most to your situation.

Legality/Liability. The **Road Test Procedure** is a suggested, but optional, part of this section. The liability of this operation is left to the individual who chooses to use it.

Safety. It is important that the road test is performed with safety issues in mind. Use the vehicle seat belts and operate the vehicle in a safe manner.

Road Test Observations

During the road test, various Powertrain Control Module (PCM) signals are chosen and their values shown. In addition, there is other important information that can be viewed during the road test, including:

- **PCM Values.** Compare road test values at various operating conditions with those listed in the **Diagnostic Reference Value Charts**. Refer to the **EEC Graphs and Charts** for further detail.
- **Monitor Lights.** The Monitor lights give quick information about the condition of many PCM signals. These lights can quickly reveal the general status of many signals and tell whether a solenoid or switch is activated. Optional signals are identified in yellow labels.
- **Wiggle Testing.** By using the Monitor Wiggle Test in Key ON Engine Running (KOER), often an intermittent device or wire will trigger the alarm. The DCV Wiggle mode in particular is very sensitive to sudden, erratic changes in a PCM harness or component.

Road Test Procedure

1. Select the first listed PCM sensor or actuator on Monitor PIN SELECTOR A.
2. Turn on the Monitor and the Recorder if used. Start and drive the vehicle.
3. If the Recorder is installed put the FUNCTION switch in the RECORD mode and press the START RECORD button.
4. Drive the vehicle to create conditions so that the symptom occurs.
5. When the symptom occurs, the accompanying passenger should observe changes in the selected PCM signal. Information should be recorded onto paper with other specific notes about the symptom, device, or operating conditions. If the Recorder is used, the CAPTURE button should be pressed.
6. If the Monitor is used without the Recorder, the next PCM signal on the list can be selected on PIN SELECTOR A. The drive symptom should then be re-created and recorded as in the previous step. This step is to be re-created until the cause of the problem is found or enough data is collected to return and analyze.
7. If the Recorder is used, the accompanying passenger may wish to write down the data from the Recorder channels onto paper. The drive symptom can be created and recorded again for confirmation. Otherwise, the road test is completed and you can return to analyze the results.

Step 6: Analyzing Data

Analyzing Data

Once the road test is completed, the results need to be analyzed to find and repair the exact fault which caused the symptom. The notes taken during the road test can now be analyzed, discussed, and compared with reference data.

Insights from the Recorder

The use of the Recorder greatly enhances the view of the PCM operation during the presence of the symptom and allows a systems approach to the problem. By setting the FUNCTION switch to PLAYBACK mode and inspecting the recorded channels, you can begin to evaluate the results.

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 Throttle Position (TP) and Mass Air Flow (MAF) changing abruptly when the vehicle is traveling at a constant speed are clues.

Look for agreement in related signals. For example, if the TP is changed during a gentle acceleration a corresponding change should occur in MAF. Compare the signals by selecting different channels at a certain time range. The PLAYBACK meters can also be viewed for quick comparisons.

Make sure the signals act in proper sequence. An increase in rpm after the TP is increased is valid. However, if the rpm increases without a TP change, then a problem exists.

Analyzing Methods

Use any of the following methods to further troubleshoot a suspected Powertrain Control Module (PCM) signal. Some methods are unique to a certain type of PCM device. Follow the given strategy listed for each unique device on the successive pages. Refer to **Methods of Monitor Measurement** in this section.

- Change condition to cause response by input.
- Change input and verify output response.
- Click testing (solenoids / relays).
- Coil resistance (solenoids / relays).
- PCM input / output check.
- Harness continuity.
- Harness shorts.
- Output state check (solenoids / relays).
- Wiggle Testing (DCV or OHMS).

Step 6: Analyzing Data

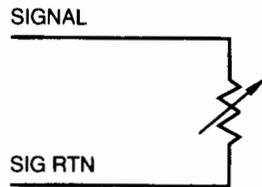
Analyzing Strategies for Sensors/Inputs

2 Wire Sensors

Device:

ECT
IAT
EGRT

Typical Schematic:



Strategy:

Check Cold Value
Check Warm Value
DCV Wiggle Testing
PCM Input Check
Harness Shorts
Harness Continuity

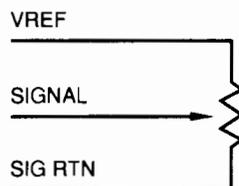
A14089-D

3 Wire Sensors

Device:

EVP
TP
MC-VAF
VAF

Typical Schematic:



Strategy:

Check Sensor Voltage Value
Change Condition
DCV Wiggle Testing
PCM Input Check
Harness Shorts
Harness Continuity

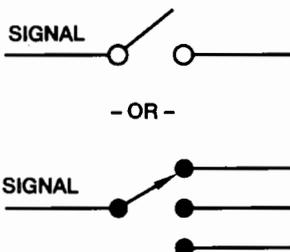
A14090-E

Switches

DEVICE:

ACS	PSP	MLP
BOO	BLMT	MLPD
IDL	HDLP	MLP1
CPP	VST	MLP2
PNP	HPS	MLPR
ECTS	CCPS	SCPP
MMS	FAN	ODS
DRL	DEF	WOT
		MLPOD
		MLPL

TYPICAL SCHEMATIC:



STRATEGY:

CHECK SENSOR VOLTAGE VALUE
CHANGE CONDITION
DCV WIGGLE TESTING
HARNESS SHORTS
HARNESS CONTINUITY

A14091-G

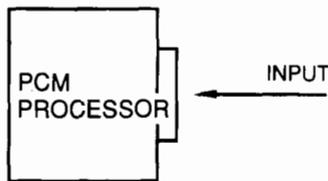
Step 6: Analyzing Data

Other Input Signals

Device:

CID	PIP	CKP1
KS	STI	BARO
IDM	VSS	MAF
VST	RTS2	O2S
TRS	HO2S	CKP
PNP	RHO2S	DSS
RTS1	LHO2S	MTX/ATX
VMREF	PSG	TCS
CAN/CAL	CIDREF	TCS RET

Typical Schematic:



Strategy:

- Check Sensor Voltage Value
- Change Operational Condition
- DCV Wiggle Testing
- or
- Ohms Wiggle Testing
- PCM Input Check
- Harness Shorts
- Harness Continuity

A14092-F

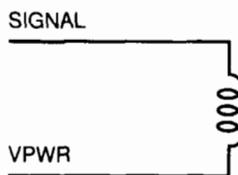
Analyzing Strategies for Actuators/Outputs

Solenoids/Relays

Device:

INJ	SS1	HSF
CANP	SS2	BOOST
VRIS1	SS3	
EGRC	ACR	
EGRV	FPR	
LFAN	DRL	
HFAN	FPRC	
EVR	LPS	
DSS	TCC	
IAC	CFAN	
DEF	WAC	
VRIS2	HSIA	

Typical Schematic:



Strategy:

- Check Solenoid/Relay Voltage Value
- Change Input
- Click Testing
- DCV Wiggle Testing
- Coil Resistance
- Output State Check
- Harness Shorts
- Harness Continuity

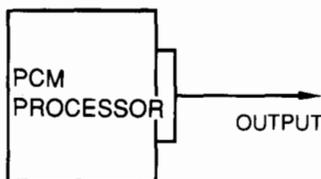
A14093-E

Other Output Signals

Device:

SML	BARO
MIL	ODL
STO	MSL
SPOUT	KCU
ICM	OBI

Typical Schematic:



Strategy:

- Check Sensor Voltage Value
- Change Input
- Ohm Wiggle Testing
- Harness Shorts
- Harness Continuity

A14094-E

Step 6: Analyzing Data

Optional Diagnostic Tools

By using the suggested strategies for the "suspect" PCM components, the source of the fault can be found. If a fault is not found after following the given methods, a few options still remain.

Follow-up Diagnosis. The Monitor and Recorder can be used to troubleshoot PCM signals other than those in the list. By conducting a thorough investigation of all the PCM signals, the source of the problem can likely be found. Available for auxiliary (AUX) input is the **Rotunda Multi-point Auxiliary Adapter 007-00023**.

Other Diagnostic Tools. If needed, there are other specialized tools that could aid in troubleshooting.

One useful tool is the **Rotunda Gas Check 014-00335** used in checking for water in fuel, alcohol percentage, fuel vapor pressure, and lead.

Section 2B. The **Diagnostic Routines, Section 2B** of this volume, lists various symptoms and reference possible systems. Also referenced in this section are other volumes and group numbers.

Verification

After the vehicle fault has been located and repaired, a verification test needs to be performed. This may require a road test to verify that the symptom is no longer present. It is also important to remember that if any diagnostic trouble codes were present before the symptom was repaired, those codes must be cleared. Refer to **Section 5B Appendix — Erasing Diagnostic Trouble Codes**.

Diagnostic Reference Values

Notes

1. **Diagnostic Reference Values** are based on engine at normal operating temperature (between 82°-104°C [180°-220°F] / ECT = 0.8 to 0.5v).
2. KOEO and Hot Idle test measurements are taken with the vehicle in the PARK position.
3. Reference values shown in the charts may differ substantially between vehicles due to various factors such as component tolerance, driving conditions, weather, etc. The values recorded on these sheets were obtained at approximately 600 ft. altitude above sea level with ambient temperatures of 10° to 21°C (50° to 70°F).
4. The WAC and FP reference values do not correspond to Section 6B values due to differences in the way these signals are measured. The monitor measures these signals with reference to PWR GND (40 / 60).
5. O2S in switching mode ranges from 0.2 to 0.9 DCV.
6. Refer to the Glossary (Section 22B) for a definition or a description of all acronyms listed in the diagnostic reference charts.
7. The 1.3L PCM is not fully compatible with the EEC-IV Monitor. Because of this, some inputs and outputs register inaccurate readings and cannot be used. These pins read NA (Not Applicable) in the reference value columns. These pins can be monitored using a Rotunda Breakout Box 007-00033.

Diagnostic Reference Values

1.3L Diagnostic Reference Values

NOTE: For tests involving switches the values will be: switch OFF (released) / switch ON (depressed).

NOTE: The 1.3L PCM is not fully compatible with the EEC-IV Monitor. Because of this, some inputs and outputs register faulty readings. These pins read NA (Not Applicable) for reference values. These pins may be monitored using a Breakout Box.

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
BLMT ¹	1R	PWRGND	12/0	DCV	14/0	14/0	14/0	DCV
BOO	1O	PWRGND	0/12	DCV	0/14	0	0	DCV
CCPS (A/C Only) ²	1Q	PWRGND	12	DCV	14/0	14/0	14/0	DCV
CID	2G	PWRGND	NA	NA	NA	NA	NA	NA
CKP	2E	PWRGND	NA	DCV	700	1800/2400 ₃	3000	RPM
CPP/PNP (MTX)	1V	PWRGND	0/12 ⁴	RPM	0/14 ⁴	14	14	DCV
PNP (ATX)	1V	PWRGND	0/12 ⁵	DCV	0/14 ⁵	14	14	DCV
DEF	1L	PWRGND	0/12	DCV ⁶	0/14	0/14	0/14	DCV ⁶
DRL (Canada Only)	1I	PWRGND	0/12	DCV	0/14	0/14	0/14	DCV
ECT	2H	SIGRTN	2.7-4.4 ⁷	DCV	.75	.75	.70	DCV
EVP	2J	PWRGND	.66	DCV	.67	1.32/.63 ³	2.1/.72 ³	DCV
HDLR	1U	PWRGND	0/12	DCV	0/14	0/14	0/14	DCV
HPS (A/C Only) ²	2I	PWRGND	12	DCV	14/0	14/0	14/0	DCV
IAT	2L	SIGRTN	2.5 ⁷	DCV	2.83	3.21	3.50	DCV
IDL	1N	PWRGND	0/12 ⁸	DCV	0	14	14	DCV
MAF	2O	PWRGND	1-1.5	DCV	2.0	2.6	2.8	DCV
O2S	2N	PWRGND	0	DCV	.2-.8	.2-.65	.2-.6	DCV
PSP (ATX)	1P	PWRGND	12	DCV	14	14	14	DCV
STI	1K	PWRGND	12	DCV	14	14	14	DCV
TP	2M	PWRGND	.5-4.2 ⁹	DCV	.52	.72	1.12/.55 ³	DCV
VSS	1M	PWRGND	NA ¹⁰	DCV	NA ¹⁰	NA ¹⁰	NA ¹⁰	DCV

(Continued)

Diagnostic Reference Values

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
VST	1C	PWRGND	0/10 ¹¹	DCV	0	0	0	DCV

- 1 0V in blower motor switch positions OFF and 1, 12-14V in blower motor switch positions 2 and 3.
- 2 0V with A/C OFF, 12-14V with A/C ON and blower motor switch in position 2 or 3.
- 3 ATX/MTX.
- 4 0V while in NEUTRAL or clutch pedal depressed, 12-14V while in gear or clutch pedal released.
- 5 0.5V in PARK or NEUTRAL, 12V for all other selector lever positions.
- 6 Use manual DCV setting.
- 7 At 20°C (68°F)
- 8 0.5V with accelerator pedal released, 12V with accelerator pedal depressed.
- 9 0.5V with accelerator pedal released, 12V with accelerator pedal fully depressed.
- 10 Though this pin does not register MPH (vehicle speed), it will register an alternating voltage (0-5V) as the vehicle is slowly rolled forward or backwards.
- 11 0V key in RUN, 10V with engine cranking.

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
ACR (A/C Only) ¹	1J	PWRGND	12	DCV	14/0	14/0	14/0	DCV
CANP	2X	PWRGND	12	DCV	14	9.5	4.4	DCV
CFAN (A/C Only)	2P	PWRGND	12	DCV	14	14	14	DCV
CFR	1S	PWRGND	12	DCV	14	14	14	DCV
EGRC	2S	PWRGND	12	DCV	14	14	14	DCV
EGRV	2R	PWRGND	12	DCV ²	14	14	14	DCV ²
FPR	1H	PWRGND	12	DCV	0	0	0	DCV
IAC	2W	PWRGND	9	DCV	10.25	6.80	6.65	DCV
ICM	2F	PWRGND	0	DCV	.20	.31	.49	DCV
INJ1	2U	PWRGND	NA	mSEC	4.5	6.3/4.8 ³	8.2/7.0 ³	mSEC
INJ2	2V	PWRGND	NA	mSEC	4.5	6.3/4.8 ³	8.2/7.0 ³	mSEC
INJ3	2Y	PWRGND	NA	NA	NA	NA	NA	NA
INJ4	2Z	PWRGND	NA	NA	NA	NA	NA	NA
MIL	1E	PWRGND	0/12 ⁴	DCV	14	14	14	DCV
SIL (MTX)	1T	PWRGND	12	DCV	14	0/14 ⁵	0/14 ⁵	DCV
SML	1D	PWRGND	12	DCV	0/14 ⁶	0/14 ⁶	0/14 ⁶	DCV
STO	1F	PWRGND	12	DCV	14	14	14	DCV
VREF	2K	PWRGND	5	DCV	5	5	5	DCV

- 1 0V with A/C OFF, 12-14V with A/C ON and blower motor switch in position 2 or 3.
- 2 Use manual DCV setting.
- 3 ATX/MTX.
- 4 0V while MIL illuminated, 12V with MIL not illuminated.
- 5 0V while shift indicator lamp illuminated, 12V with SIL not illuminated.
- 6 0V when illuminated, 14V when not illuminated.

Diagnostic Reference Values

1.6L Non-Turbo Diagnostic Reference Values

NOTE: For tests involving switches, the values will be: switch OFF (released)/switch ON (depressed).

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
TP	2G	SIGRTN	0.5	DCV	0.5	0.6	0.8	DCV
VAF	2E	SIGRTN	1.8	DCV	6.7	8	8.2	DCV
ECT	2I	SIGRTN	2.5	DCV	0.4	0.5	0.5	DCV
BARO	2H	SIGRTN	3.9	DCV	3.9	3.9	3.8	DCV
IAT	2J	PWRGND	2.4	DCV	3	3	3	DCV
IDL	1E	PWRGND	0	DCV	0	12.6	12.4	DCV
PNP/ CPP	1G	PWRGND	12	DCV	14	14	14	DCV
BOO	1J	PWRGND	0/12 ¹	DCV ¹	0/12	0	0	DCV ¹
PSP	1K	PWRGND	12	DCV	14	14	14	DCV
IDM	1M	PWRGND	N/A	RPM	850-1050	2650-2700	3125-3175	RPM
O2S	2D	PWRGND	N/A	DCV	0.8	0.5	0.6	DCV

1 12 volts with brake pedal depressed, 0 volts with brake pedal released.

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
BANK 1	3E	PWRGND	N/A	mSEC	3.9	5.8	7.1	mSEC
BANK 2	3C	PWRGND	N/A	mSEC	3.9	5.9	7.1	mSEC
CANP	2P	PWRGND	12	DCV ¹	14.3 ²	14 ²	14 ²	DCV ¹
IAC	2Q	PWRGND	7	DCV	10	9.7	9.8	DCV
FPRC	2K	PWRGND	12	DCV	14	14.3	14	DCV
STO	1B	PWRGND	0.7	DCV	14	14	13.8	DCV
MIL	1A	PWRGND	1.6	DCV	13.2	14	13.8	DCV

1 Test in manual DCV.

2 Voltage may be lower while purging occurs.

NOTE: Reference values shown may vary approximately ± 20 percent depending on operating conditions and other factors.

Diagnostic Reference Values

1.6L Turbo Diagnostic Reference Values

NOTE: For tests involving switches, the values will be: switch OFF (released) / switch ON (depressed).

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
TP	2G	SIGRTN	0.4	DCV	0.36	0.5	0.67	DCV
VAF	2E	SIGRTN	2	DCV	5.5	7.4	8.1	DCV
ECT	2I	SIGRTN	2.5	DCV	0.4	0.5	0.5	DCV
BARO	2H	SIGRTN	3.9	DCV	3.8	3.8	3.8	DCV
IAT	2J	PWRGND	2.2	DCV	2.3	2.6	2.7	DCV
IDL	1E	PWRGND	0	DCV	0	13.9	13.9	DCV
PNP/PPP	1G	PWRGND	12	DCV	14	14	14	DCV
BOO	1J	PWRGND	0/12	DCV ¹	0/12	0	0	DCV ¹
PSP	1K	PWRGND	12	DCV	13.6	13.7	13.7	DCV
KCU	2M	PWRGND	12	DCV	12	12	12	DCV
IDM	1M	PWRGND	N/A	RPM	800-900	2640-2680	3120-3160	RPM
O2S	2D	PWRGND	N/A	DCV	0	0.5	0.5	DCV

1 12 volts with the brake pedal depressed, 0 volts with brake pedal released.

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
BANK 1	3E	PWRGND	N/A	mSEC	3.4	3.5	4.3	mSEC
BANK 2	3C	PWRGND	N/A	mSEC	3.4	3.5	3.5	mSEC
CANP	2P	PWRGND	12	DCV ¹	14.3 ²	14 ²	14 ²	DCV ¹
IAC	2Q	PWRGND	7.5	DCV	7.6	9.4	9.6	DCV
FPRC	2K	PWRGND	12	DCV	14	14	14	DCV
STO	1B	PWRGND	0.71	DCV	13.5	13.5	13.5	DCV
MIL	1A	PWRGND	1.6	DCV	13.6	13.7	13.6	DCV

1 Test in manual DCV.

2 Voltage may be lower while purging occurs.

NOTE: Reference values shown may vary approximately ± 20 percent depending on operating conditions and other factors.

Diagnostic Reference Values

1.8L 4EAT Diagnostic Reference Values

NOTE: For tests involving switches, the values will be: switch OFF (released)/switch ON (depressed).

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
TP	2F	SIGRTN	0.45	DCV	0.45	0.65	0.7	DCV
VAF	2B	SIGRTN	3.88	DCV	2.8	1.31	1.26	DCV
ECT	2E	SIGRTN	2.0	DCV	0.45	0.42	0.43	DCV
IAT	2K	PWRGND	0-3	DCV	2.7	2.4	2.5	DCV
IDL	1T	PWRGND	0	DCV	0	12	12	DCV
MLP	1R	PWRGND	0	DCV	0	12-14	12-14	DCV
BOO	1Q	PWRGND	0/12	DCV ¹	0/12	0	0	DCV ¹
PSP	1N	PWRGND	12	DCV	14	14	14	DCV
CKP	2A	PWRGND	0	RPM	730-900	1750-1800	2100-2300	RPM
HDLP	1H	PWRGND	0/12	DCV	0/12	0/12	0/12	DCV
BLMT	1P	PWRGND	12 ²	DCV	14 ²	14 ²	14 ²	DCV
STI	1I	PWRGND	12	DCV	14	14	14	DCV
O2S	2C	PWRGND	N/A	DCV	0-1	0-1	0-1	DCV

1 12 volts with brake pedal depressed, 0 volts with brake pedal released.

2 A/C on, blower off or in position 1; 0 volts with blower in position 2 or more.

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
BANK 1	3U	PWRGND	N/A	mSEC	3.6	4.2	6.2	mSEC
BANK 2	3V	PWRGND	N/A	mSEC	3.6	4.2	6.2	mSEC
CANP	2O	PWRGND	12	DCV	12	11-14	3.9-13	DCV
IAC	3Q	PWRGND	3.3	DCV	9	9	8.6	DCV
FPRC	3M	PWRGND	12	DCV	14	14	14	DCV
STO	1F	PWRGND	0	DCV	12	12	12	DCV
WAC	1L	PWRGND	12	DCV	14	14	14	DCV
SPOUT	1G	PWRGND	0	RPM	730-900	1750-1800	2100-2300	RPM
MIL	1E	PWRGND	2	DCV	14	14	14	DCV

NOTE: Reference values shown may vary approximately ± 20 percent depending on operating conditions and other factors.

Diagnostic Reference Values

1.8L MTX Diagnostic Reference Values

NOTE: For tests involving switches, the values will be: switch OFF (released)/ switch ON (depressed).

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
TP	2M	SIGRTN	0.45	DCV	0.45	0.65	0.7	DCV
VAF	2O	SIGRTN	3.88	DCV	2.8	1.31	1.26	DCV
ECT	2Q	SIGRTN	2.0	DCV	0.45	0.42	0.43	DCV
IAT	2P	PWRGND	0-3	DCV	2.7	2.4	2.5	DCV
IDL	1N	PWRGND	0	DCV	0	12	12	DCV
PNP/CPP	1V	PWRGND	0	DCV	0	12	12	DCV
BOO	1O	PWRGND	0/12	DCV ¹	0/12	0	0	DCV ¹
PSP	1P	PWRGND	12	DCV	14	14	14	DCV
CKP	2E	PWRGND	0	RPM	730-900	1750-1800	2100-2300	RPM
WOT	2L	PWRGND	5	DCV	5	5	5	DCV
HDLP	1U	PWRGND	0/12	DCV	0/12	0/12	0/12	DCV
BLMT	1S	PWRGND	12 ²	DCV	14 ²	14 ²	14 ²	DCV
STI	1K	PWRGND	12	DCV	14	14	14	DCV
O2S	2N	PWRGND	N/A	DCV	0-1	0-1	0-1	DCV

1 12 volts with brake pedal depressed, 0 volts with brake pedal released.

2 A/C on, blower off or in position 1; 0 volts with blower in position 2 or more.

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
BANK 1	2U	PWRGND	N/A	mSEC	3.6	4.2	6.2	mSEC
BANK 2	2V	PWRGND	N/A	mSEC	3.6	4.2	6.2	mSEC
CANP	2X	PWRGND	12	DCV	12	11-14	3.9-13	DCV
IAC	2W	PWRGND	3.3	DCV	9	9	8.6	DCV
FPRC	2T	PWRGND	12	DCV	14	14	14	DCV
STO	1F	PWRGND	0	DCV	0	0	0	DCV
WAC	1J	PWRGND	12	DCV	14	14	14	DCV
SPOUT	1G	PWRGND	0	RPM	730-900	1750-1800	2100-2300	RPM
MIL	1E	PWRGND	2	DCV	14	14	14	DCV

NOTE: Reference values shown may vary approximately ± 20 percent depending on operating conditions and other factors.

Diagnostic Reference Values

2.5L 4EAT Diagnostic Reference Values

NOTE: For tests involving switches, the values will be: switch OFF (released)/switch ON (depressed).

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
CCPS ¹	1O	PWRGND	12/0.5	DCV	14/0	14/0	14/0	DCV
BLMT ²	1P	PWRGND	12	DCV	14	14	14	DCV
BOO	1Q	PWRGND	0.5/12 ³	DCV	0/13.5 ³	0	0	DCV
CKP1	3E	PWRGND	N/A	RPM	675	1250	2180	RPM
CKP2	3H	PWRGND	N/A	RPM	1320	2580	4320	RPM
DEF	1J	PWRGND	12/0.5	DCV	14/1	14/1	14/1	DCV
DRL	2L	PWRGND	12/0.5	DCV	14	14	14	DCV
ECT	2E	SIGRTN	0.3 ⁴	DCV	0.33	0.35	0.36	DCV
EVP	2J	PWRGND	0.8	DCV	0.73	1.47	3.42	DCV
HDLP	1H	PWRGND	0.5/12	DCV	0/14	0/14	0/14	DCV
IAT	2K	SIGRTN	0.9 ⁴	DCV	2.5	2.5	3.0	DCV
IDL	1T	PWRGND	0/12	DCV	13.7	12.5	12.5	DCV
KS	2M	PWRGND	2.4	DCV	2.34	2.34	2.35	DCV
LHO2S	2D	PWRGND	0.5	DCV	0.8	0.6	0.5	DCV
MC-VAF	2B	PWRGND	4	DCV	3.06	1.50	1.62	DCV
PNPS ⁵	1R	PWRGND	0	DCV	0.5	13	13	DCV
PSP	1N	PWRGND	12	DCV	13.5	13.5	13.5	DCV
RHO2S	2C	PWRGND	0.5	DCV	0.8	0.43	0.5	DCV
RTS1	1S	PWRGND	2.5	DCV	13	13	13	DCV
RTS2	1V	PWRGND	12	DCV	13	13	13	DCV
STI	1I	PWRGND	12	DCV	13.5	13.5	13.5	DCV
TP	2F	SIGRTN	.5/3.7	DCV	0.54	0.67	0.76	DCV
TRS/ECTS	1K	PWRGND	10.5	DCV	13	13	13	DCV
VSS	1M	PWRGND	N/A	MPH	4	17	30	MPH
VST	1C	PWRGND	0.5	DCV	0	0	0	DCV

1 Switch is ON with A/C ON, blower ON.

2 0 volts in position 3 or more.

3 12 volts with brake pedal depressed, 0 volts with brake pedal released.

4 At 20°C (68°F).

5 0 volts in P or N position; 12 volts in R, D, 1 or 2.

Diagnostic Reference Values

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
ACR ¹	1L	PWRGND	12/1	DCV	13.3/1	13.3/1	13.3/1	DCV
BARO	2A	PWRGND	3.9	DCV	3.9	3.9	3.9	DCV
CANP	2O	PWRGND	12	DCV	1.13	10.2	5.3	DCV
CFAN	3N	PWRGND	12	DCV	13.5	13.5	13.5	DCV
EGRC	3P	PWRGND	12	DCV	13.6	13.5	13.5	DCV
EGRV	3O	PWRGND	12	DCV	13.6	1.5	1.45	DCV
FPR	3T	PWRGND	12	DCV	0.5	0.5	0.5	DCV
FPRC	3M	PWRGND	12	DCV	13.5	13.5	13.5	DCV
HFAN	2P	PWRGND	12	DCV	13.6	13.6	13.6	DCV
VRIS1	3I	PWRGND	12	DCV	1.12	1.14	1.22	DCV
VRIS2	3J	PWRGND	12	DCV	13.64	13.48	13.48	DCV
IAC	3Q	PWRGND	6	DCV	9.2	8.5	8.03	DCV
ICM	1G	PWRGND	N/A	RPM	660	1200	2190	RPM
INJ1	2U	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ2	3V	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ3	3W	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ4	3X	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ5	3Y	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ6	3Z	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
LFAN	3L	PWRGND	12/1	DCV	13.5/1	13.5	13.5	DCV
MIL	1E	PWRGND	0.5	DCV	13.6	13.5	.513	DCV
SML	1D	PWRGND	0.5	DCV	0-13 ²	0-13 ²	0-13 ²	DCV
STO	1F	PWRGND	0.5	DCV	13.5	13.5	13.5	DCV

1 Switch is ON with A/C ON, blower ON.

2 Value switches between 1 volt and 13 volts.

NOTE: Reference values shown may vary approximately ± 20 percent depending on operating conditions and other factors.

Diagnostic Reference Values

2.5L MTX Diagnostic Reference Values

NOTE: For tests involving switches, the values will be: switch OFF (released)/ switch ON (depressed).

Inputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
CCPS ¹	1O	PWRGND	12/0	DCV	14/0	14/0	14/0	DCV
BLMT ²	1P	PWRGND	12	DCV	14	14	14	DCV
BOO	1Q	PWRGND	0/12 ³	DCV	0/13.5 ³	0	0	DCV
CKP1	3E	PWRGND	N/A	RPM	675	1450	2630	RPM
CKP2	3H	PWRGND	N/A	RPM	1320	2950	5320	RPM
DEF	1J	PWRGND	12/0.5	DCV	14/1	14/1	14/1	DCV
DRL	2L	PWRGND	12/0.5	DCV	14	14	14	DCV
ECT	2E	SIGRTN	0.3 ⁴	DCV	0.33	0.35	0.36	DCV
EVP	2J	PWRGND	0.8	DCV	0.73	1.47	1.87	DCV
HDLP	1H	PWRGND	0-1/12	DCV	0/14	0/14	0/14	DCV
IAT	2K	SIGRTN	0.9 ⁴	DCV	2.5	2.5	3.0	DCV
IDL	1T	PWRGND	0/12	DCV	0	12.5	12.5	DCV
KS	2M	PWRGND	2.4	DCV	2.34	2.34	2.35	DCV
LHO2S	2D	PWRGND	0-1	DCV	0.8	0.6	0.5	DCV
MC-VAF	2B	PWRGND	4	DCV	3.06	1.50	1.62	DCV
PNP/PPP	1R	PWRGND	12/0	DCV	0	13.5	13.5	DCV
PSP	1N	PWRGND	12	DCV	13.5	13.5	13.5	DCV
RHO2S	2C	PWRGND	0-1	DCV	0.8	0.43	0.5	DCV
STI	1I	PWRGND	12	DCV	13.5	13.5	13.5	DCV
TP	2F	SIGRTN	.5/3.7	DCV	0.54	0.67	0.76	DCV
VSS	1M	PWRGND	N/A	MPH	4	17	30	MPH
VST	1C	PWRGND	0	DCV	0	0	0	DCV

1 Switch is ON with A/C ON, blower ON.

2 0 volts in position 3 or more.

3 12 volts with brake pedal depressed, 0 volts with brake pedal released.

4 At 20°C (68°F).

Diagnostic Reference Values

Outputs	SIG Pin #	REF. Pin #	KOEO	Units	Hot Idle	30 MPH	55 MPH	Units
ACR ¹	1L	PWRGND	12	DCV	13.3/1	13.3/1	13.3/1	DCV
CANP	2O	PWRGND	12	DCV	1.13	10.2	5.3	DCV
CFAN	3N	PWRGND	12	DCV	13.5	13.5	13.5	DCV
EGRC	3P	PWRGND	12	DCV ²	13.6	13.5	13.5	DCV ²
EGRV	3O	PWRGND	12	DCV ²	13.6	1.5	1.45	DCV ²
FPR	3T	PWRGND	12	DCV ²	0.5	0.5	0.5	DCV ²
FPRC	3M	PWRGND	12	DCV	13.5	13.5	13.5	DCV
HFAN	2P	PWRGND	12	DCV	13.6	13.6	13.6	DCV
VRIS1	3I	PWRGND	12	DCV ²	1.12	1.14	1.22	DCV ²
VRIS2	3J	PWRGND	12	DCV	13.6	13.4	13.4	DCV
IAC	3Q	PWRGND	6	DCV	9.2	8.5	8.03	DCV
ICM	1G	PWRGND	N/A	RPM	660	1468	2650	RPM
INJ1	3U	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ2	3V	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ3	3W	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ4	3Z	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ5	3Y	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
INJ6	3Z	PWRGND	N/A	mSEC	4.0	4.8	5.0	mSEC
LFAN	3L	PWRGND	12/1	DCV	13.5/1	13.5	13.5	DCV
MIL	1E	PWRGND	0-1	DCV	13.6	13.6	13.6	DCV
SML	1D	PWRGND	0-1	DCV	0-13	0-13	0-13	DCV
STO	1F	PWRGND	0-1	DCV	13.5	13.5	13.5	DCV

1 Switch is ON with A/C ON, blower ON.

2 Use manual DC volts when making measurements.

NOTE: Reference values shown may vary approximately ± 20 percent depending on operating conditions and other factors.

Diagnostic Reference Values

Static Resistance Values

Engine	Actuator	PCM Pin	Reference	Resistance (ohms)
1.3L	CANP	2X	VPWR	30
	EGRC	2S	VPWR	34
	EGRV	2R	VPNR	35
	IAC	2W	VPWR	13
	INJ1	2U	VPWR	17
	INJ2	2V	VPWR	17
1.6L	BANK1	3E	VPWR	14
	BANK2	3C	VPWR	14
	CANP	2P	VPWR	20
	IAC	2Q	VPWR	20
	FPRC	2K	VPWR	20
1.8L MTX	BANK1	2U	VPWR	9.0
	BANK2	2V	VPWR	9.0
	CANP	2X	VPWR	30
	VICS	2S	VPWR	50
	IAC	2W	VPWR	16
	FPRC	2T	VPWR	50
1.8L 4EAT	BANK1	3U	VPWR	9.0
	BANK2	3V	VPWR	9.0
	CANP	2O	VPWR	30
	VICS	3I	VPWR	50
	IAC	3Q	VPWR	16
	FPRC	3M	VPWR	50
2.5L	CANP	2O	VPWR	30-34
	EGRC	3P	VPWR	30-34
	EGRV	3O	VPWR	30-34
	FPRC	3M	VPWR	30-34
	VRIS1	3I	VPWR	33-39
	VRIS2	3J	VPWR	33-39
	IAC	3Q	VPWR	10.7-12.3
	INJ1	3U	VPWR	12-16
	INJ2	3V	VPWR	12-16
	INJ3	3W	VPWR	12-16
	INJ4	3X	VPWR	12-16
	INJ5	3Y	VPWR	12-16
	INJ6	3Z	VPWR	12-16

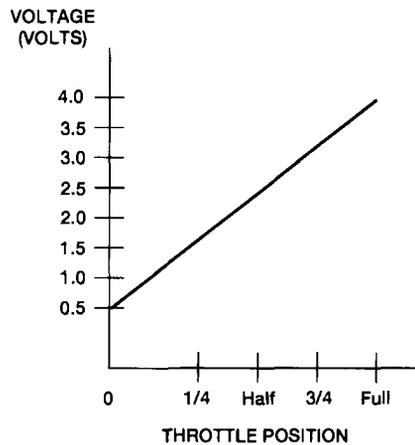
NOTE: All tests made with monitor in manual ohms, key OFF, and PCM disconnected.

EEC Graphs and Charts

Fuel Pressure Specifications

Engine	1.3L	1.6L	1.8L	2.5L
Engine Running	210-260 kPa 30-38 psi	189-231 kPa 27-34 psi	206-255 kPa 30-37 psi	207-248 kPa 30-36 psi
Key ON, Engine Off (Test Connector Jumped, Pump Running)	265-320 kPa 38-46 psi	255-289 kPa 37-42 psi	265-314 kPa 38-46 psi	270-310 kPa 39-45 psi

Throttle Position Sensor Graph (All Engines)



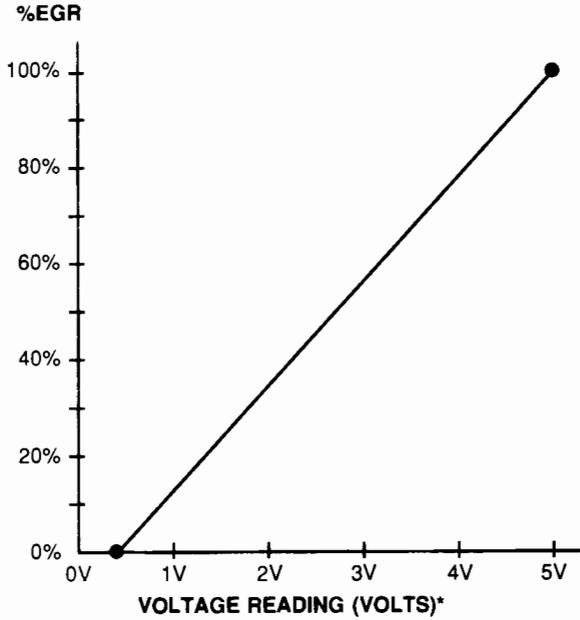
Throttle Position	Voltage (Volts)
0	0.5
1/4	1.3
Half	2.2
3/4	2.9
Full	3.7

NOTE: Voltage Values May Vary $\pm 15\%$.

A16834-B

Exhaust Gas Recirculation Valve Position (EVP) Sensor Graph (1.3L, 2.5L Only)

EEC Graphs and Charts

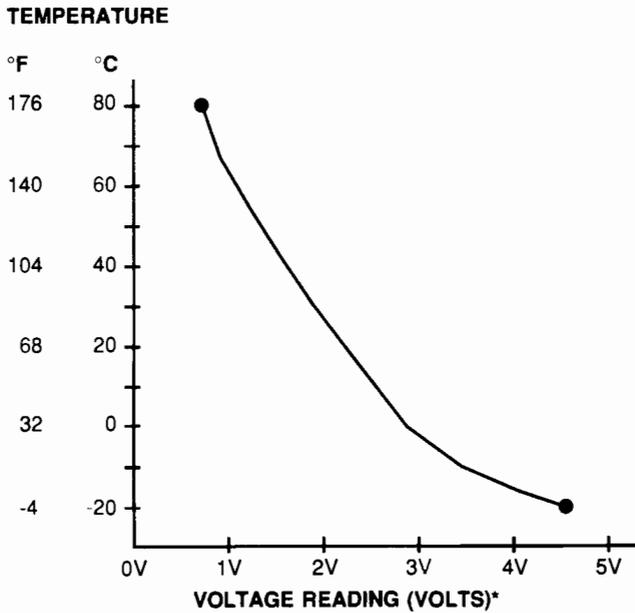


%EGR	Voltage*
0	0.4-0.8
10	0.7-1.1
20	1.1-1.5
30	1.4-1.8
40	1.8-2.2
50	2.1-2.5
60	2.5-2.9
70	2.8-3.2
80	3.2-3.6
90	3.5-3.9
100	3.9-4.3

EVP SENSOR DATA * Voltage values calculated for VREF = 5.0V (These values may vary ± 15% due to sensor and VREF variations.)

CA14104-C

Engine Coolant Temperature (ECT) Sensor Graph (All Engines)



Temperature °F	Temperature °C	Voltage* Volts
-4	-20	4.7
32	0	3.4
68	20	2.5
104	40	2.0
140	60	1.2
176	80	0.7
194	90	0.45
203	95	0.33
212	100	0.2

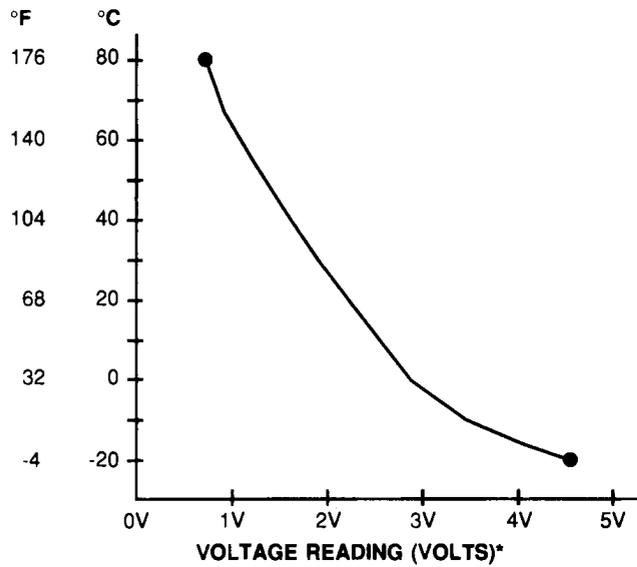
ECT SENSOR DATA * Voltage values calculated for VREF = 5.0V (These values may vary ± 15% due to sensor and VREF variations.)

CA14105-D

EEC Graphs and Charts

Intake Air Temperature (IAT) Sensor Graph (All Engines)

TEMPERATURE

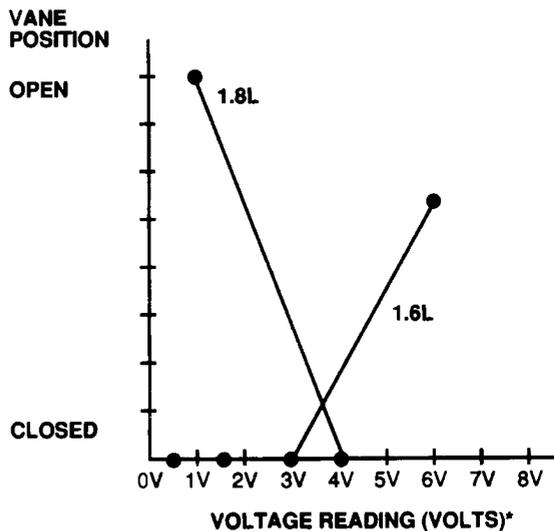


Temperature °F	Temperature °C	Voltage* Volts
-4	-20	4.7
32	0	3.4
68	20	2.5
104	40	2.0
140	60	1.2
176	80	0.7

IAT SENSOR DATA * Voltage values calculated for VREF = 5.0V (These values may vary ± 15% due to sensor and VREF variations).

CA14107-D

Volume Air Flow (VAF) Sensor Graph (1.6L, 1.8L Only)

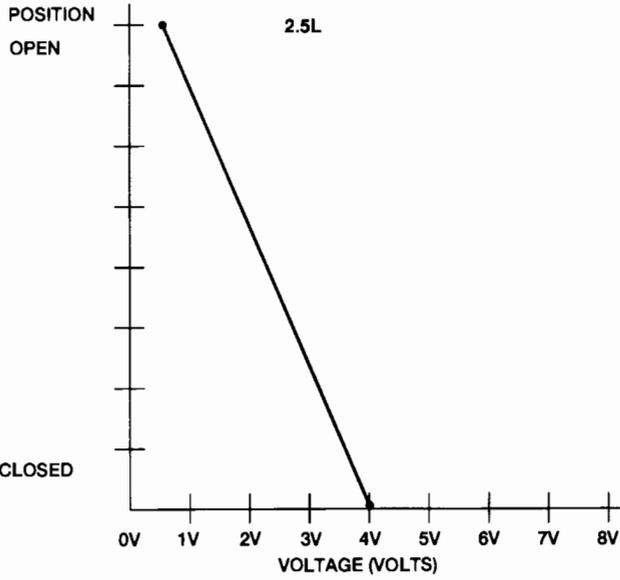


VANE POSITION	VOLTAGE* VOLTS	
	1.8L	1.6L
Vane Closed	4.5-5V	3-3.3V
Vane Open	0.5-1.5V	7-8V

CA14106-F

Measuring Core-Volume Air Flow (MC-VAF) Sensor Graph (2.5L Only)

EEC Graphs and Charts



Core Position	Voltage
Closed	4V
Open	0.35V

A16835-A

Specifications/Special Service Tools

Special Service Tools/Equipment

ROTUNDA EQUIPMENT

Model	Description
007-0047F	EEC-IV Monitor
007-00021	EEC-IV Recorder
007-00023	Multi-Point Auxiliary Adapter
007-0041B	Super STAR II Tester
007-0048F	Driveability Test Package
014-00335	Gas Check
007-00057	PCM Adapter
007-00038	PCM Adapter
T92C-6000-AH	PCM Adapter
007-00033	Breakout Box