

# I - SYSTEM/COMPONENT TESTS

## 1993 Mitsubishi Montero

1993 ENGINE PERFORMANCE  
Chrysler Corp./Mitsubishi System & Component Testing

Dodge; Ram-50  
Mitsubishi; Montero, Pickup

### INTRODUCTION

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

Before testing separate components or systems, perform procedures in F - BASIC TESTING article in this section. Since many computer-controlled and monitored components set a trouble code if they malfunction, also perform procedures in G - TESTS W/CODES article in this section.

### COMPUTERIZED ENGINE CONTROLS

#### CONTROL UNIT

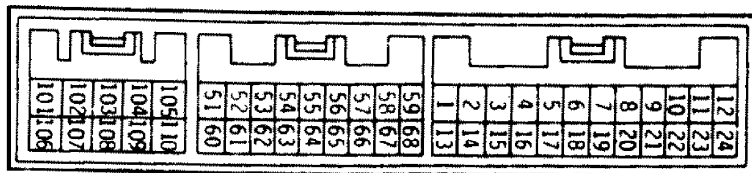
**NOTE:** For Engine Control Module (ECM) location, see ENGINE CONTROL MODULE (ECM) LOCATION table. To identify ECM power and ground circuits, see appropriate L - WIRING DIAGRAMS article in this section.

##### Ground Circuits

- 1) Turn ignition off. Using an ohmmeter, check continuity between chassis ground and ECM ground terminals. See GROUND TERMINAL ID table. Ohmmeter should indicate zero ohms. If reading is not zero ohms, check and repair open circuit between ECM connector and ground.
- 2) Connect voltmeter negative lead to chassis ground. Connect positive lead to ECM ground terminals. See GROUND TERMINAL ID table. See Fig. 1. With engine running, voltmeter should indicate less than one volt. If voltmeter reading is greater than one volt, check for open, corrosion or loose connection in ground circuit.

##### Power Circuits

Turn ignition on. Check for battery voltage on ECM power terminals. See POWER TERMINAL ID table. If battery voltage is not present, check operation of MPI control relay. See RELAYS under MOTORS, RELAYS & SOLENOIDS.



93J78252

Fig. 1: ECM Connectors ID

#### GROUND TERMINAL ID TABLE

Application

ECM Terminals

All Models ..... 101 & 106

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POWER TERMINAL ID TABLE

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Application ..... ECM Terminals

All Models ..... 102 & 107

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ENGINE CONTROL MODULE (ECM) LOCATION TABLE

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Application ..... Location

All Models ..... Near Right Kick Panel

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## **ENGINE SENSORS & SWITCHES**

### **BAROMETRIC PRESSURE SENSOR**

Sensor is a part of airflow sensor assembly. See G - TESTS W/CODES article in this section.

### **CAMSHAFT POSITION SENSOR**

See G - TESTS W/CODES article in this section.

### **CLOSED THROTTLE POSITION SWITCH**

See THROTTLE POSITION SENSOR in G - TESTS W/CODES article in this section.

### **COOLANT TEMPERATURE SENSOR**

See G - TESTS W/CODES article in this section.

### **CRANKSHAFT POSITION SENSOR**

See G - TESTS W/CODES article in this section.

### **EGR TEMPERATURE SENSOR (CALIFORNIA)**

See G - TESTS W/CODES article in this section.

### **IDLE POSITION SWITCH**

See THROTTLE POSITION SENSOR in G - TESTS W/CODES article in this section.

### **INHIBITOR SWITCH (A/T MODELS)**

1) Switch is mounted to automatic transaxle, near shift lever mechanism. Ensure switch is adjusted properly. Switch output can be affected by improper adjustment. Using DVOM, measure resistance between selected terminals to ensure continuity between ignition switch and ECM when shift selector lever is in Park or Neutral position. See INHIBITOR SWITCH CONTINUITY CHECK table.

2) Using DVOM, measure power supply voltage of switch. Disconnect ECM connector. Disconnect inhibitor switch connector. Turn

ignition switch to START position. Measure voltage between inhibitor switch and vehicle ground. On Pickup 2.4L and Ram-50 2.4L, inhibitor switch wire color is Black/White. on all other models, inhibitor switch wire color is Black/Yellow;. Supply voltage should be battery voltage. If voltage is within specification, go to step 3. If voltage is less than battery voltage, check and repair power supply circuit.

3) Using DVOM, measure inhibitor switch terminal input voltage. Connect ECM connector. Ensure inhibitor switch connector is disconnected. Turn ignition switch to ON position. Measure voltage between inhibitor switch and vehicle ground. Input voltage should be battery voltage. If voltage is within specification, go to step 4. If voltage is less than battery voltage, check and repair circuit.

4) Using DVOM, measure input voltage of ECM. Disconnect ECM connector. Connect inhibitor switch connector. Ensure shift selector lever is in "P" position. Turn ignition switch to ON position. Measure voltage between ECM connector and vehicle ground. See ECM TERMINAL ID table. ECM input voltage should be 8 volts or greater. If voltage is within specification, system is okay. If voltage is less than 8 volts, replace ECM.

#### INHIBITOR SWITCH CONTINUITY CHECK TABLE

Application	(1) Wire Color	(2) Wire Color
All Models	Black/Yellow	Black/Blue

(1) - Ignition switch to inhibitor switch circuit.

(2) - Inhibitor switch to ECM circuit.

#### ECM TERMINAL ID TABLE

Application	(1) Terminal Number
All Models	104

(1) - See Fig. 1.

### INTAKE AIR TEMPERATURE SENSOR

See G - TESTS W/CODES article in this section.

### OXYGEN (O2) SENSOR

See G - TESTS W/CODES article in this section.

### POWER STEERING OIL PRESSURE SWITCH

1) Disconnect switch connector at pump. Using DVOM, check continuity between switch and vehicle ground. Continuity should not exist with wheels straight ahead and engine idling. Continuity should be present when wheels are turned.

2) Check continuity of circuit between switch and ECM. Disconnect power steering oil pressure switch connector and ECM connector. Connect jumper wire between ECM terminal and vehicle ground. See POWER STEERING PRESSURE SWITCH ECM TERMINAL NUMBER table. Using DVOM, check for continuity between switch harness connector and vehicle ground. Check and repair circuit if no continuity exists. Go to step 3 if continuity exists.

3) Connect ECM connector. Turn ignition on. Using DVOM, measure voltage at switch harness connector. System is okay if battery voltage exists. Replace ECM if voltage does not exist.

POWER STEERING PRESSURE SWITCH ECM TERMINAL NUMBER TABLE

Application	(1) Terminal Number
All Models .....	5

(1) - See Fig. 1.

**THROTTLE POSITION SENSOR**

See G - TESTS W/CODES article in this section.

**VEHICLE SPEED SENSOR**

See G - TESTS W/CODES article in this section.

**MOTORS, RELAYS & SOLENOIDS**

**MOTORS**

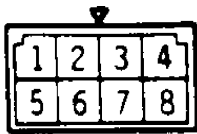
IAC Motor  
See IDLE CONTROL SYSTEM.

**RELAYS**

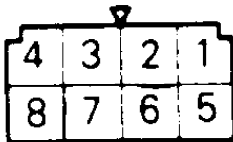
For MPI control relay location, see MPI CONTROL RELAY LOCATION table.

MPI CONTROL RELAY LOCATION TABLE

Application	Location
Montero .....	Under right corner of dash.
Pickup & Ram-50 .....	Behind kick panel.



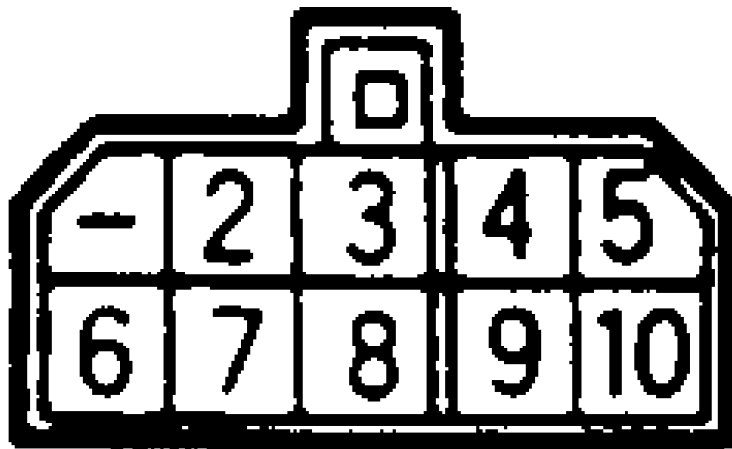
COMPONENT CONNECTOR



HARNESS CONNECTOR

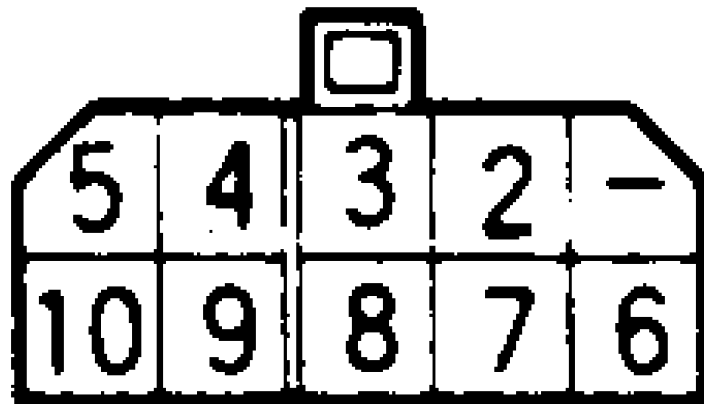
93C78453

Fig. 2: MPI Control Relay Connector ID (2.4L 4 Cylinder)  
Courtesy of Mitsubishi Motor Sales of America.



## COMPONENT CONNECTOR

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## HARNESS CONNECTOR

**93D78454**

Fig. 3: MPI Control Relay Connector ID (V6)  
 Courtesy of Mitsubishi Motor Sales of America.

MPI Control Relay (2.4L)

1) This step checks ignition switch supply voltage of control relay. Disconnect control relay connector. Turn ignition on. Using

DVOM, measure voltage between terminal No. 8 of relay harness connector and vehicle ground. See Fig. 2. If voltage is battery voltage, go to step 2. If voltage is not battery voltage, check and repair circuit between ignition switch and control relay.

2) This step checks continuity of control relay ground circuit. Turn ignition off. Using DVOM, check continuity between control relay harness connector terminal No. 6 and vehicle ground. If continuity exists, go to step 3. If continuity does not exist, check and repair circuit between control relay and vehicle ground.

3) This step checks battery supply voltage of control relay. Using DVOM, measure voltage between terminal No. 4 of relay harness connector and vehicle ground. If voltage is battery voltage, go to step 4. If voltage is not battery voltage, check and repair circuit between battery and control relay.

4) This step checks continuity of circuit between control relay and ECM. Disconnect ECM connector. Using DVOM, check continuity between control relay harness connector terminal No. 3 and ECM connector terminals No. 12 and 25. See Figs. 1 and 2. If continuity exists, go to step 5. If continuity does not exist, check and repair circuits between control relay harness connector and ECM.

5) This step checks supply voltage to control relay actuator. Connect ECM and MPI control relay connectors. Using DVOM, backprobe control relay terminal No. 2. With engine cranking, voltage should be 8 volts or greater. Start engine and run at 2500 RPM or greater. If voltage is battery voltage, harness is okay. If voltage is not battery voltage, go to step 6.

6) If control relay tests okay in steps 6 through 8, replace ECM. Removal of relay may assist in testing. Continuity should exist between terminals No. 5 and 7. Measure resistance between terminals No. 6 and 8. Continuity should exist in only one direction. Replace control relay if continuity is not as specified.

7) Connect 12-volt power source between relay terminals No. 5 and 7. Connect positive lead to terminal No. 7. With relay energized, battery voltage should exist between terminals No. 1 and 5. With power source removed, voltage should not exist.

8) Move 12-volt power source to relay terminals No. 6 and 8. Connect positive lead to terminal No. 8. With relay energized, continuity should exist between terminals No. 2 and 4 and between terminals No. 3 and 4. With power source removed, continuity should not exist. Replace control relay if measurements are not as specified.

#### MPI Control Relay (3.0L)

1) This step checks ignition supply voltage to ECM. Disconnect ECM harness connector. Turn ignition on. Measure voltage between ECM harness connector terminal No. 110 and vehicle ground. See Fig. 1. If voltage is battery voltage, go to step 2. If voltage is not battery voltage, repair circuit between ignition switch and ECM harness connector.

2) This step checks battery supply voltage of control relay. Measure voltage between terminal No. 10 of relay harness connector and vehicle ground. See Fig. 3. If voltage is battery voltage, go to step 3. If voltage is not battery voltage, check and repair circuit between battery and control relay.

3) This step checks continuity of circuit between control relay and ECM. Disconnect ECM connector. Check continuity between control relay harness connector terminal No. 8 and ECM connectors No. 63 and 66. If continuity exists, go to step 4. If continuity does not exist, check and repair circuits between control relay harness connector and ECM.

4) This step checks continuity of circuit between control relay and ECM. Check continuity between control relay harness connector terminal No. 4 and ECM harness connector terminals No. 102 and 107. If continuity exists, go to step 5. If continuity does not

exist, check and repair circuits between control relay harness connector and ECM.

5) Connect 12-volt power source between relay terminals No. 8 and 10. Connect positive lead to terminal No. 10. With relay energized, battery voltage should exist between terminals No. 4 and 8 and between terminals No. 5 and 8. With power source removed, voltage should not exist.

6) Move 12-volt power source to relay terminals No. 6 and 9. Connect positive lead to terminal No. 6. With relay energized, continuity should exist between terminals No. 2 and 3. With power source removed, continuity should not exist.

7) Move 12-volt power source to relay terminals No. 3 and 7. Connect positive lead to terminal No. 3. With relay energized, voltage should exist between terminals No. 2 and 7. With power source removed, voltage should not exist. Replace control relay if any measurements are not as specified.

## **FUEL SYSTEM**

### **FUEL DELIVERY**

NOTE: For fuel system pressure testing, see F - BASIC TESTING article in this section.

### **FUEL CONTROL**

Fuel Injectors

See G - TESTS W/CODES article in this section.

## **IDLE CONTROL SYSTEM**

### **ELECTRICAL LOAD SWITCH**

### **IDLE AIR CONTROL (IAC) MOTOR**

CAUTION: DO NOT apply more than 6 volts to IAC motor.

NOTE: For diagnosis and testing information concerning IAC motor position sensor, see G - TESTS W/CODES article in this section.

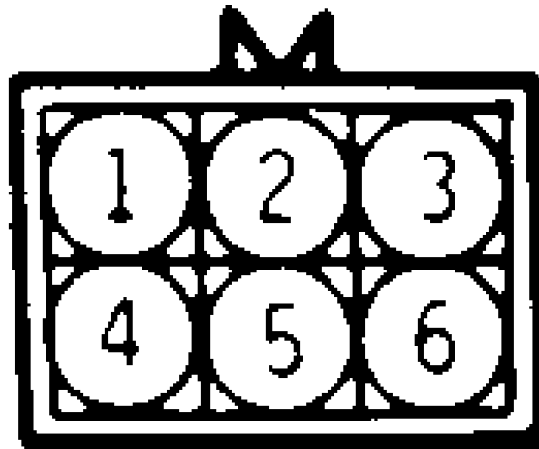
2.4L

1) Using a stethoscope, listen for operating sound of IAC motor when ignition switch is placed in ON position. If no operating sound can be heard, proceed with following tests.

2) This step checks for continuity between IAC motor and ECM. Disconnect IAC motor harness connector and ECM harness connector. Connect a jumper wire between ECM harness connector terminal No. 4 and vehicle ground. See Fig. 1. Using DVOM, check continuity between IAC harness connector No. 5 and vehicle ground. See Fig. 4.

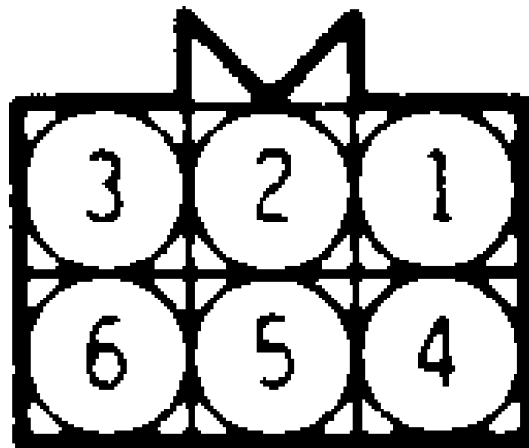
3) Move jumper wire to ECM harness connector terminal No. 17 and vehicle ground. Using DVOM, check continuity between IAC harness connector No. 6 and vehicle ground. If continuity does not exist, check and repair appropriate circuit. If continuity exists, go to step 4.

4) If preceding tests do not show any system or component malfunction and ECM is suspected, replace ECM and retest system.



## COMPONENT CONNECTOR

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## HARNESS CONNECTOR

**93G78473**

Fig. 4: IAC Motor Connector ID (2.4L)  
Courtesy of Mitsubishi Motor Sales of America.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. Go to step 10 for test procedures using oscilloscope.



3.0L

1) Using a stethoscope, listen for operating sound of IAC motor when ignition switch is placed in ON position. If no operating sound can be heard, proceed with following tests.

2) Disconnect IAC harness connector. Install Test Harness (MD998463-01) if necessary to aid testing. Using DVOM, measure resistance between IAC terminals No. 1 and 2 and between terminals No. 1 and 3. See Fig. 5. Resistance should be 28-33 ohms.



COMPONENT CONNECTOR



HARNESS CONNECTOR

93178475

Fig. 5: Identifying IAC Motor Connectors (V6)  
Courtesy of Mitsubishi Motor Sales of America.

3) Measure resistance between terminals No. 4 and 5 and between terminals No. 5 and 6. Resistance should be 28-33 ohms. If resistance measurements are not within specification, replace IAC motor. Go to step 4 if IAC motor is within specification.

4) Remove throttle body. See N - REMOVE/INSTALL/OHAUL article in this section. Remove stepper motor from throttle body. Connect Test Harness (MD998463-01) to IAC motor.

5) Hold IAC motor in hand. Place thumb on top of plunger. Connect positive lead of 6-volt power source to White and Green clips of test harness. Individually connect, then disconnect, negative lead of power source to Red and Black clips, Blue and Black clips, Blue and Yellow clips, and Red and Yellow clips. Finish by connecting negative lead to Red and Black clips again.

6) Connect negative lead to test leads in reverse sequence of step 5. Stepper motor should vibrate with each connection. Replace IAC motor if vibration is not felt with each connection.

7) Ensure MPI control relay is functioning properly. See RELAYS under MOTORS, RELAYS & SOLENOIDS. Disconnect IAC motor harness connector. Turn ignition on. Using DVOM, check for battery voltage between terminal No. 2 and vehicle ground and terminal No. 5 and vehicle ground. If voltage is not battery voltage, check and repair circuits between MPI control relay and IAC motor. If battery voltage exists, go to step 8.

8) This step checks for continuity between MPI control relay and IAC motor. Check for continuity between MPI control relay terminals No. 4 and 5 and IAC motor terminals No. 2 and 5. See Figs. 3 and 6. If continuity exists, go to step 9. If continuity does not exist, check and repair circuits.

9) This step checks for continuity between ECM and IAC motor. Disconnect ECM harness connector. Check continuity of specified circuits. See Figs. 1 and 5. See IAC TO ECM CIRCUIT CONTINUITY CHECK table. Check and repair any circuits without continuity.

IAC TO ECM CIRCUIT CONTINUITY CHECK TABLE

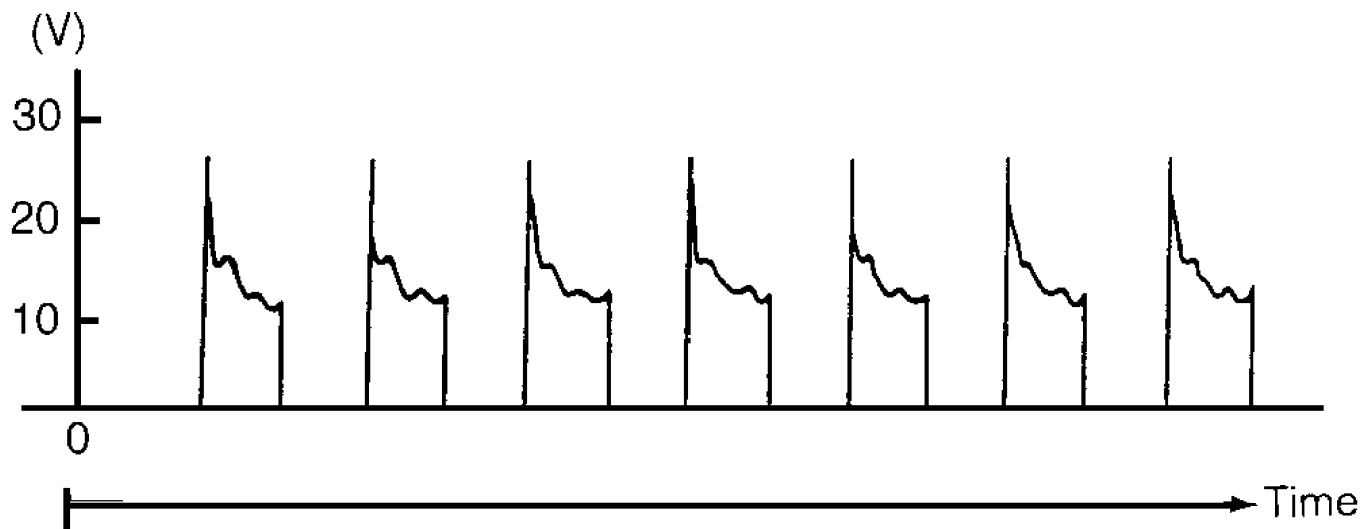
IAC Terminal Number	ECM Terminal Number
All Models	
1	58
3	59

4	.....	68
6	.....	67

10) Connect ECM harness connector. Install harness connector and Test Harness (MB998463-01). Using engine analyzer with oscilloscope capability, connect special patterns probe to selected leads of test harness. Leads used are Red, Green, Black and Yellow clips.

11) Start engine, and allow it to idle. Connect special patterns probe to one test lead. Turn A/C on. When IAC motor operates to increase engine speed to compensate for A/C system, a waveform should be displayed. Conduct test with each remaining test lead and compare pattern to illustration. See Fig. 6.

12) If waveform is different, replace IAC motor. If all preceding tests do not show any system or component malfunction and ECM is suspected, replace ECM and retest system.



93H78474

Fig. 6: Good IAC Motor Waveform ID  
 Courtesy of Mitsubishi Motor Sales of America.

### IDLE SPEED CONTROL MOTOR

NOTE: For diagnosis and testing information concerning ISC motor position sensor, see G - TESTS W/CODES article in this section.

### IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC DIAGNOSTIC TESTING article in this section.

### TIMING CONTROL SYSTEMS

Camshaft Position Sensor  
 See G - TESTS W/CODES article in this section.

Crankshaft Position Sensor  
 See G - TESTS W/CODES article in this section.

Knock Sensor

See G - TESTS W/CODES article in this section.

## EMISSION SYSTEMS & SUB-SYSTEMS

### EXHAUST GAS RECIRCULATION (EGR)

See G - TESTS W/CODES article in this section.

### FUEL EVAPORATION

Purge Control Solenoid Valve (3.0L)

1) Label and disconnect both vacuum hoses from solenoid valve. Disconnect electrical connector. Connect hand vacuum pump to solenoid valve nipple where Red-striped hose was connected. Apply vacuum to solenoid valve. Vacuum should hold.

2) Apply battery voltage to terminals of solenoid valve. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across solenoid valve terminals. Reading should be 36-44 ohms at 68°F (20°C). If reading is not within specification, replace valve.

3) This step checks voltage at purge solenoid. Disconnect purge solenoid harness connector. Turn ignition on. Using DVOM, measure voltage at harness connector terminal No. 1 (horizontal terminal). If voltage is battery voltage, go to step 4. If voltage is not battery voltage, check and repair circuit between purge solenoid and MPI control relay.

4) This step checks continuity between ECM and purge solenoid. Disconnect ECM harness connector. Connect jumper wire between ECM terminal No. 9 (No. 62 on Montero, Pickup and Ram-50) and vehicle ground.

5) Using DVOM, check for continuity between purge solenoid harness connector terminal No. 2 (vertical terminal) and vehicle ground. If continuity exists, harness is good. If continuity does not exist, check and repair circuit.

6) If preceding tests do not show any system or component malfunction and ECM is suspected, replace ECM and retest system.

#### ECM TERMINAL ID TABLE

Application	Terminal Number
All Models .....	9

### POSITIVE CRANKCASE VENTILATION (PCV)

PCV Valve

Remove PCV valve. Shake valve by hand. Valve should rattle if moving freely. Apply air pressure to valve. Air should flow in one direction only. Connect PCV valve to vacuum hose and start engine. Ensure vacuum is flowing through valve.

## MISCELLANEOUS CONTROLS

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

A/C Switch & Compressor Clutch Relay

Using DVOM, measure power supply voltage of ECM. Disconnect ECM connector. Turn A/C switch and ignition switch to ON positions.

Measure voltage between specified ECM terminals and vehicle ground. See A/C POWER ECM TERMINAL LOCATION table. Voltage should be 6 volts or greater. If voltage is not battery voltage, check and repair circuit.

A/C POWER ECM TERMINAL LOCATION TABLE

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Application	Wire Color	(1) Terminal No.
Montero .....	Green/Blue .....	7
	Green/White .....	65
Pickup & Ram-50 .....	Green/Red .....	7
	Blue .....	65

(1) - See Fig. 1.

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