AMERICAN MOTORS
COMPUTERIZED EMISSION CONTROL (CEC) SYSTEM

DESCRIPTION

The Computerized Emission Control (CEC) system is used on all 258" 6 cylinder engines (except Eagle). This system consists of a Micro Computer Unit (MCU), an oxygen sensor, a ported vacuum switch, 2 manifold vacuum switches, a coolant temperature sensor and a catalytic converter. This system is used in conjunction with the Carter model BBD carburetor equipped with electronically controlled main metering air bleeds. See *FUEL SYSTEMS section.*

OPERATION

The CEC system operates in the following 3 modes:

- INITIALIZATION
- OPEN LOOP
- CLOSED LOOP

INITIALIZATION

The initialization function occurs when ignition switch is turned to "ON" position. This sets initial air bleed metering rod position by signaling the stepper motor to drive them first to a full rich position (fully toward front of vehicle) and then, by a preprogrammed number of steps, in lean direction (toward rear of vehicle). This serves as a starting point of mixture control operation.

OPEN LOOP OPERATION

Engine is in Open Loop Operation mode whenever engine operating conditions do not meet programmed criteria for Closed Loop mode. At this time, air/fuel ratio is determined by engine operation rather than exhaust gas composition. Oxygen sensor data is not accepted in this mode. The following conditions keep the system in Open Loop:

- Engine Starting
- Engine Temperature Too Low
- Oxygen Sensor Temperature Too Low
- Engine at Idle Speed
- Wide Open Throttle Position
- Insufficient Battery Voltage

CLOSED LOOP OPERATION

When all input data, on engine operation, meets programmed criteria (Open Loop conditions do not exist), the system switches to Closed Loop Operation mode. This then allows oxygen sensor input to MCU to determine proper air/fuel ratio. In this mode, all sensors supply engine operating conditions and demands to MCU. The sensor signals are computed and modified by oxygen sensor signal for optium air/fuel mixture.

OXYGEN SENSOR

The oxygen sensor is mounted in the exhaust pipe and is used to measure oxygen content of exhaust gases. As more oxygen is sensed (showing a leaner mixture), the electrical signal generated by the switch drops in voltage. A lower oxygen content (richer mixture) causes an increase in the voltage signal.

MICRO COMPUTER UNIT (MCU)

The MCU, mounted beneath right side dash panel, monitors the system's sensors and switches and, based upon mode of operation, generates a control signal to the main air bleed stepper motor mounted in carburetor. The MCU also receives a voltage signal from negative side of coil. Until voltage equivalent to a predetermined RPM is received, the system will remain in Open Loop mode.

When the system is in Open Loop mode, the air/fuel mixture will be based on a predetermined ratio dependent upon engine RPM and input signals from engine sensors. When system is switched to Closed Loop mode, the MCU monitors oxygen sensor and engine sensor input to determine proper air-/fuel mixture.

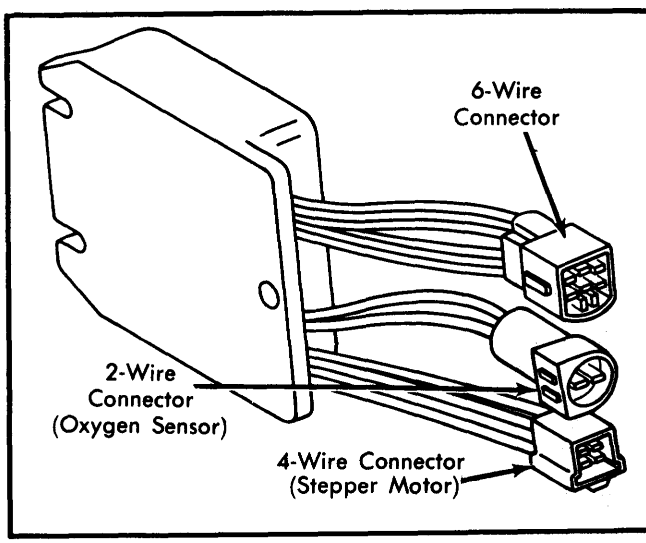

Fig. 1 Micro Computer Unit (MCU)

VACUUM SWITCHES

Two vacuum switches are used to determine throttle position. A ported vacuum switch is used in conjunction with a manifold vacuum switch. The Open Loop-3 (at idle) vacuum switch (red) has normally closed electrical contacts which are opened by 3±.5 in. Hg vacuum. The Open Loop-2 (wide open throttle) manifold vacuum switch (blue) has normally closed electrical contacts which are opened by 4±.5 in. Hg vacuum.

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A second manifold vacuum switch is used in conjunction with a coolant temperature override (CTO) switch to signal engine starting position or cold operation. The Open Loop-1 (cold operation/engine starting) manifold vacuum switch (yellow) has normally open contacts which are closed by 3±.5 in. Hg vacuum. All vacuum switches are mounted together on left inner fender panel.

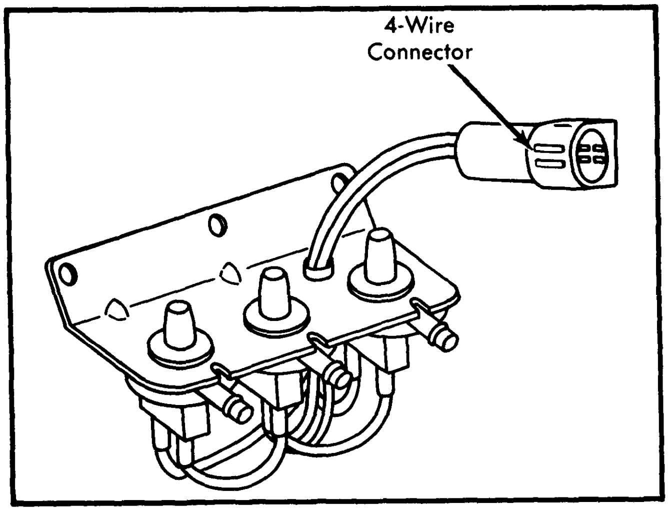

Fig. 2 Vacuum Switch Assembly

DIAGNOSIS

PRE-DIAGNOSTIC CHECKS

Before starting diagnostic checks, make the following general checks first: Check all vacuum hoses for proper routing and connections. Check for kinked, cracked or plugged hoses. Inspect all wiring for frayed or broken wires and cracked or corroded connections.

DIAGNOSTIC CHECKS

Follow each Diagnostic Check in order given to systematically evaluate each componenet. The results of these checks will refer to proper Diagnostic Test to determine cause of operational problem. Equipment needed for checks and tests are a tachometer, a hand vacuum pump and a digital volt/ohmmeter with a minimum impedance of 10 meg-ohms per volt. Also, using air cleaner cover as a template, cut a piece of clear acrylic plastic (Minimum 1/4" thick) and secure with wing nut to air cleaner (after air cleaner cover has been removed). This allows observation of air bleed metering needles in carburetor.

NOTE – *After completing any repair, repeat Diagnostic Check to ensure the problem is solved.*

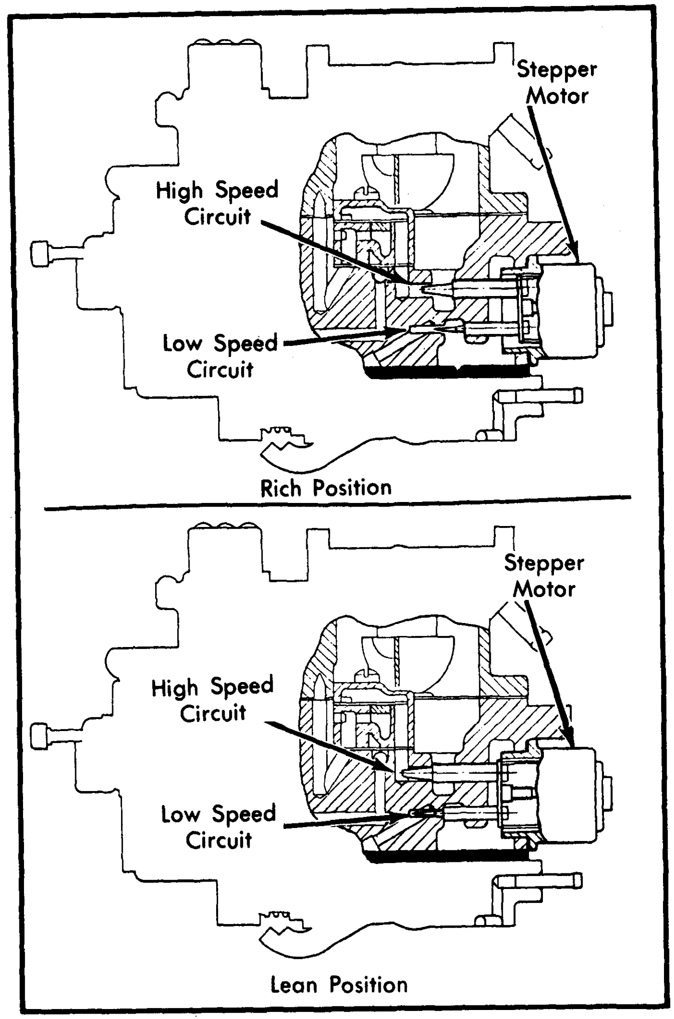

Fig. 3 Feedback Carburetor Stepper Motor

INITIALIZATION CHECK

1) While observing metering pins, have helper turn ignition switch to "ON" position. Metering pins should move fully toward front to vehicle, reverse direction and move partially toward rear of vehicle. They should then stop for approximately 40 seconds and then move in either direction.

NOTE – *Metering needles work in tandem. Only 1 needle will be visible in carburetor.*

2) If pins do not move after 40 seconds, check vacuum hose routing or replace CTO and continue diagnostic checks. If pins fail to move at all, perform Initialization Test sequence.

NOTE – *Switch colors refered to in Checks and Tests are color of switches lead wire.*

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OPEN LOOP-1 CHECK

1) Coolant temperature should be below 100° F. If not, remove vacuum hose from yellow vacuum switch and apply 5 to 10 in. Hg vacuum to switch and proceed.

2) Start engine and run at 1500 RPM. At the end of initialization period (approximately 40 seconds, but may vary if engine is hot) metering pins should not move.

3) Release vacuum to yellow vacuum switch and pins should now move. If system works properly, continue with diagnostic checks. If not, perform Open Loop-1 Test sequence.

OPEN LOOP-2 CHECK

1) With engine idling below 800 RPM and no vacuum to yellow vacuum switch, observe metering pins while disconnecting vacuum hose connected to blue vacuum switch.

2) Metering pins should move fully toward front of vehicle and stop. If system works properly, reconnect vacuum hose to blue switch and continue with diagnostic checks. If not, reconnect vacuum hose to blue switch and perform Open Loop-2 Test sequence.

OPEN LOOP-3 CHECK

1) Turn engine "OFF". Have helper restart engine and idle below 800 RPM while observing metering pins.

2) After initialization, metering pins should move fully toward front of vehicle and stop. If system works properly, continue with diagnostic checks. If not, perform Open Loop-3 Test sequence.

CLOSED LOOP CHECK

1) With no vacuum applied to yellow vacuum switch, slowly increase engine speed to 2000 RPM and maintain speed while observing metering pins. Metering pins should start moving and continue in incremental steps.

2) If metering pins do not move at all, perform Open Loop-3 Test sequence. If metering pins move fully to either end and remain stationary, perform Closed Loop Test sequence. If system operates properly, CEC is functioning normally; turn engine "OFF", reconnect all vacuum hoses and reinstall air cleaner cover.

TESTING

DIAGNOSTIC TESTS

NOTE — *After performing a repair or replacement of a component, repeat the related Diagnostic Check to ensure system is repaired and functioning properly.*

INITIALIZATION TEST

1) Disconnect 6-wire connector at MCU and check for battery voltage at harness side terminal 12. If battery voltage is not present, inspect and repair voltage supply circuit.

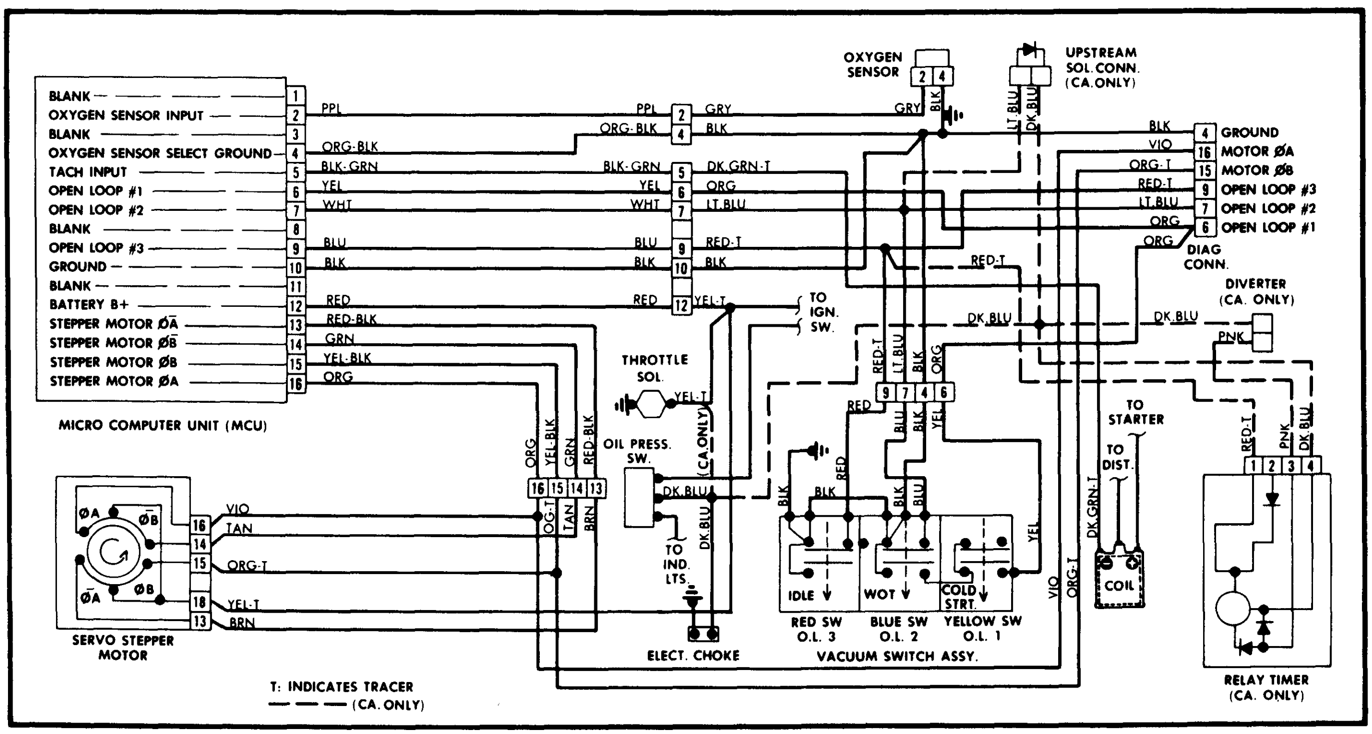

Fig. 4 Wiring Diagram for American Motors CEC System

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2) Test harness side terminal 10 for continuity to ground. If not continuous, repair open in ground circuit 10.

3) Disconnect 4-wire connector and measure resistance between harness side terminal 12 and each of harness side terminals of 4-wire connector. All 4 indications should be nearly equal and be between 50 and 95 ohms. If okay, proceed to step **6)**. If not okay, continue to step **4)**.

4) Disconnect 5-wire stepper motor connector and measure resistance between stepper motor side terminal 18 and stepper motor housing. Resistance should be infinite.

5) Measure resistance between terminal 18 and other 4 terminals of motor side connector. Resistance should be nearly equal and be between 53 and 85 ohms for all four. If steps **4)** and **5)** show stepper motor to be okay, repair wiring harness between stepper motor and MCU. If not okay, replace stepper motor.

6) With ignition "ON", check for battery voltage at harness side terminal 18 (5-wire connector). If battery voltage is present, continue to step **7)**. If not, repair voltage supply circuit.

7) With ignition "OFF", remove stepper motor and push metering pins fully into motor. Reinstall motor and carefully reconnect 5-wire connector. Observe pins while ignition is turned to "ON" position. If pins move, replace stepper motor. If pins do not move, replace MCU.

OPEN LOOP-1 TEST

NOTE – *If alternate source of vacuum was used for Open Loop-1 Check, begin test with second step.*

1) Measure vacuum at hose leading to yellow vacuum switch with engine running and coolant temperature below 100°, F. A vacuum of 5 in. Hg or more should be indicated. If vacuum is below 5 in. Hg, repair vacuum leak or replace CTO switch.

2) With ignition "OFF", disconnect 6-wire connector from MCU and measure resistance from harness side terminal 6 to ground. It should have infinite resistance. If okay, proceed to step **4)**. If not, continue to step **3)**

3) Disconnect vacuum switch electrical connector and measure resistance from terminal 6 (vacuum switch side of connector) to ground. If resistance is infinite, repair short in harness. If continuity is indicated, replace shorted vacuum switch assembly and reconnect harness.

4) Apply and hold 5 to 10 in. Hg vacuum to yellow vacuum switch. Perform continuity test from harness side terminal 6 to ground. There should be continuity. If okay, replace MCU. If not okay, continue to step **5)**.

5) Disconnect 4-wire connector and test switch side of terminal 6 for continuity to ground. If there is continuity to ground, repair open in harness between 4-wire connector and 6-wire connector. If not, replace vacuum switch assembly and reconnect harness connectors.

OPEN LOOP-2 TEST

1) With engine idling, disconnect 6-wire connector at MCU and test harness side terminal 7 for continuity to ground. There should be no continuity. If okay, proceed to Step **3)**. If not okay, continue to step **2)**.

2) Disconnect 4-wire connector at vacuum switch assembly and test switch side terminal 7 for continuity to ground. There should be no continuity. If okay, repair short in harness between vacuum switch assembly and MCU. If not okay, proceed to step **4)**.

3) Disconnect vacuum hose leading to blue switch and retest harness side terminal 7 for continuity to ground. There should be continuity. If okay, replace MCU. If not okay, disconnect 4-wire connector at vacuum switch assembly and test switch side terminal 7 for continuity to ground. There should be continuity. If okay, repair open in harness. If not okay, replace vacuum switch assembly.

4) Disconnect vacuum hose leading to blue switch and check for vacuum. With engine at idle, there should be vacuum present. If okay, replace vacuum switch assembly. If not okay, repair vacuum leak or remove obstruction from hose.

OPEN LOOP-3 TEST

1) Disconnect 6-wire connector at MCU and measure voltage at harness side terminal 5. Voltage should be 7±2 volts. If okay, continue to step **2)**. If not okay, repair harness wiring to coil.

2) With engine at idle, test harness side terminal 9 for continuity to ground. There should be continuity. If okay, proceed to step **5)**. If not okay, continue to step **3)**.

3) Disconnect vacuum hose leading to red switch and check for vacuum at idle. No vacuum should be present. If okay, continue to step **4)**. If not okay, correct vacuum hose routing or idle speed.

4) Disconnect 4-wire connector at vacuum switch assembly and test switch side terminal 9 for continuity to ground. There should be continuity. If okay, repair open circuit in harness between MCU and vacuum switch assembly. If not okay, replace vacuum switch assembly and reconnect harness.

5) Increase engine speed to 1500 RPM and recheck continuity. There should be no continuity. If okay, return engine to idle and replace MCU. If not okay, continue to step **6)**.

6) With engine at 1500 RPM, measure vacuum to red switch. There should be 5 in. or more Hg vacuum. If okay, continue to step **7)**. If not okay, return engine to idle and repair routing or restriction of vacuum hose.

7) Reconnect vacuum hose to red switch and disconnect 4-wire connector at vacuum switch assembly. With engine at 1500 RPM, test switch side terminal 9 for continuity to ground. There should be no continuity. If okay, repair shorted circuit in harness between MCU and vacuum switch assembly. If not okay, replace vacuum switch assembly and reconnect vacuum hoses and harness connectors.

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CLOSED LOOP TEST

NOTE – *Voltmeter used in tests must have a minimum impedance of 10 meg-ohms per volt.*

1) With engine "OFF", remove air cleaner and plug vacuum hoses. Turn ignition "ON" for 4 seconds, then turn "OFF". Disconnect stepper motor and oxygen sensor connectors.

2) Connect positive lead of voltmeter to terminal 2 and negative lead to terminal 4 of oxygen sensor connector (sensor side). Set voltmeter to 1 volt scale.

3) Start engine and warm for 4 minutes. Increase engine speed to 1200 RPM while closing choke valve. Run engine, with valve closed, for 1 minute. While choke is closed, voltmeter should indicate a minimum of 0.6 volts. Turn ignition switch "OFF". If okay, replace MCU and proceed to step **5)**. If not okay, continue to step **4)**.

4) Disconnect and plug hose leading to air distribution check valve at exhaust manifold. Repeat step **3)**. If okay, replace air distribution check valve and continue. If not okay, replace the oxygen sensor and continue.

5) Unplug and reconnect air distribution check valve hose. Remove voltmeter and reconnect harness connectors. Install air cleaner.

NOTE – *If after completing Closed Loop Check and Test, the problem still exists, recheck for other engine malfunctions that can effect air/fuel mixture, combustion efficiency and exhaust gas composition.*