

## CHRYSLER CORP. ELECTRONIC FUEL CONTROL

Aries  
Horizon  
LeBaron (2.2L Engine Only)  
Omni

Rampage  
Reliant  
400 (2.2L Engine Only)

### DESCRIPTION

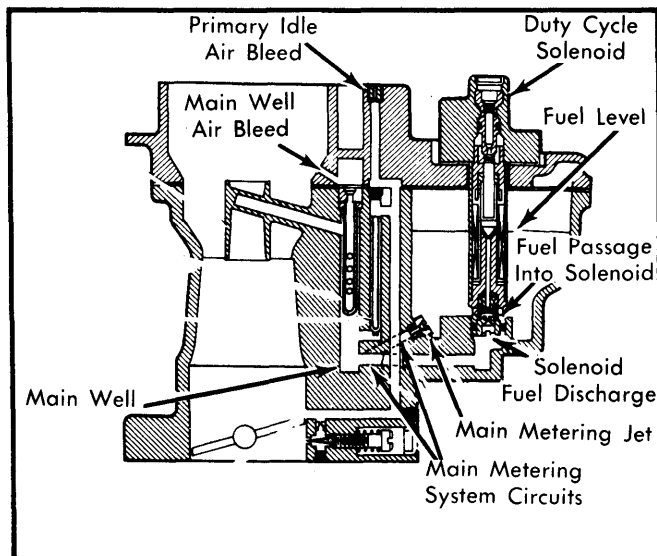
The Electronic Fuel Control system (EFC) is an electronically controlled system that closely controls air/fuel ratio and ignition timing. The Spark Control Computer (SCC) is the heart of the system. The Spark Control Computer is fed information from various different sensors to control air/fuel mixture and ignition timing. This provides the capability of igniting a lean air/fuel mixture according to different modes of engine operation. During closed loop operation, the computer maintains the air/fuel mixture close to the ideal ratio of 14.7:1.

### OPERATION

The EFC system consists of 5 sub-systems: Fuel control, spark control, data sensors, Spark Control Computer (SCC) and catalytic converter.

#### FUEL CONTROL

All models are equipped with feedback carburetors which contain an electronically operated duty cycle solenoid. This solenoid meters the main fuel system of carburetor and operates in parallel with the conventional fixed main metering jets. The computer controls the operation of the solenoid with electrical signals, in response to signals received from data sensors. See Fig. 1.



**Fig. 1 Sectional View of Feedback Carburetor With Duty Cycle Solenoid**

When the solenoid is de-energized by the computer, the solenoid valve spring pushes upward through main system fuel valve. When de-energized, the solenoid main metering orifice is fully uncovered, providing the richest mixture for any given air flow.

When the solenoid is energized by the computer, the solenoid main metering orifice is fully sealed. This solenoid position of-

fers the leanest mixture within the carburetor for any given air flow.

The main fuel system may be regulated between richest and leanest mixture conditions by controlling the amount of time that the solenoid is energized. The computer controls the duration of time that the solenoid is energized in comparison to total time of solenoid operation. This is controlled by engine operating conditions and/or oxygen sensor signals. In this manner, the ideal air/fuel ratio can be constantly maintained.

#### SPARK CONTROL

Spark control allows the computer to determine the exact instant that ignition is required; then signals ignition coil to produce electrical impulses which fire the spark plugs. The computer eliminates the need for either vacuum advance units or centrifugal advance weights. Spark control operates in 1 of the following modes:

- **Start Mode** – During cranking, an electrical signal from the distributor is fed into the computer, which causes the computer to fire the spark plugs at a fixed amount of advance.
- **Run Mode** – Once the engine starts and is operating normally, the timing will be controlled by the computer, based upon information received by the data sensors.

Spark timing and dwell cannot be adjusted in the run mode. If the computer fails, the system will go into the start mode. This enables the vehicle to be driven in for repair; but performance and fuel economy will be poor. If the start mode fails, the engine will not start or run.

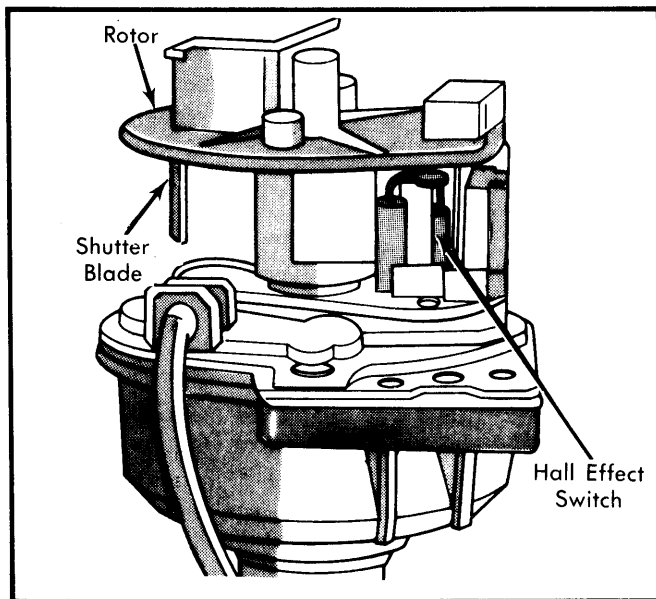
The amount of spark advance is determined by engine speed and engine vacuum. However, where it happens depends upon the following conditions:

- **Advance From Vacuum** – Advance based upon engine vacuum is allowed by the computer when the carburetor switch is open. The amount of advance is programmed into the computer and is proportionate to the amount of vacuum and engine RPM.
- **Advance From Speed** – Advance based upon engine speed (RPM) is allowed by the computer when the carburetor switch is open and advance from vacuum will not happen quickly. This advance from speed is programmed into the computer and is controlled by engine RPM. Advance from speed will build at a slow rate. If carburetor switch closes, advance from speed will be cancelled.

#### DATA SENSORS

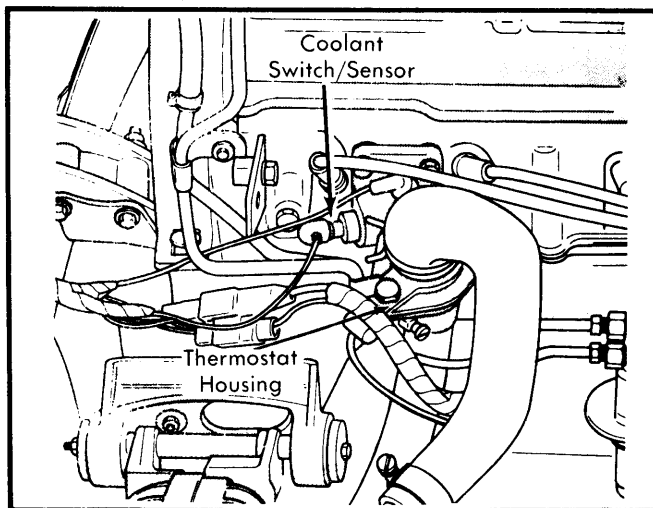
**Hall Effect Pick-Up Assembly** – This device is located in the distributor to supply basic timing signal to the computer. From this signal, the computer can determine engine speed (RPM), when each piston is coming up on its compression stroke or when engine is in the start mode. See Fig. 2.

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**Fig. 2** Location of Hall Effect Pick-Up Assembly in Distributor

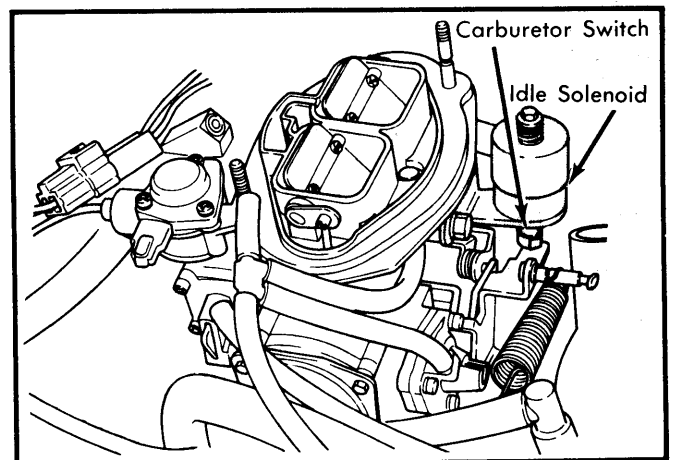
**Coolant Switch** — The coolant switch is located in the thermostat housing. This switch supplies a signal to the computer when engine coolant temperature reaches a predetermined temperature. This information is required to prevent changing of the air/fuel ratio until the engine reaches normal operating temperature. The computer also controls the amount of spark advance with a cold engine.



**Fig. 3** Location of Coolant Switch/Sensor

**Vacuum Transducer** — The vacuum transducer is mounted on the computer. It provides the computer with a signal for the amount of engine vacuum. Engine vacuum is used by the computer to determine how much to advance or retard ignition timing and to change the air/fuel ratio.

**Carburetor Switch** — This switch is located on the end of the idle stop to signal the computer when the engine is at idle. When the carburetor switch contacts the throttle lever ground, there will be a cancellation of spark advance and idle control of the air/fuel mixture. See Fig. 4.



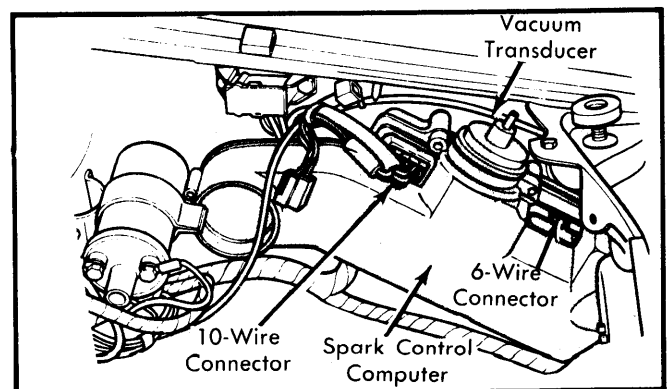
**Fig. 4** Location of Carburetor Switch

**Oxygen Sensor** — The oxygen sensor is located in the exhaust manifold. This sensor sends a signal to the computer. The voltage output of the oxygen sensor is proportional to the oxygen content of the exhaust gases. The computer will adjust the air/fuel mixture to a level which will maintain operating efficiency of the 3-way catalyst system and engine.

### SPARK CONTROL COMPUTER

The computer is located on the left inner fenderwell, near the battery. The computer consists of 1 electronic printed circuit board which simultaneously receives signals from all data sensors and analyzes these signals to determine correct ignition timing and air/fuel mixture. After determining spark advance, the computer will operate the engine in 1 of the following modes:

- **Open Loop Mode** — During cold engine operation, the air/fuel ratio is controlled by information programmed into the computer by the manufacturer. Until normal operating temperature is reached, the air/fuel mixture will be fixed at a rich level to allow proper engine warm-up. During this mode of operation, air from the AIR pump is injected "upstream" in the exhaust manifold to assist in heating up the oxygen sensor.
- **Closed Loop Mode** — Once normal engine operating temperature is achieved, the air/fuel ratio is controlled by the computer based upon information received from the oxygen sensor.



**Fig. 5** Location of Spark Control Computer

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CATALYTIC CONVERTER

Proper emission control is accomplished with the special catalytic converter system used with the EFC system. All models use a front converter with air injection line and a second (main) catalytic converter placed behind the front converter.

**NOTE** — Similarities exist between external characteristics of each converter system. However, extreme care must be exercised during replacement of converters due to internal design differences.

TESTING

A malfunction in the EFC system may result in engine surge, hesitation, rough idle and/or poor fuel economy. Before making any tests, check all vacuum and electrical wiring for proper routing and connections, and check for exhaust and intake manifold leaks. If these are in order, testing may begin.

**NOTE** — The Spark Control Computer controls ignition timing as well as air/fuel mixture. Before testing EFC system, perform spark control tests first.

ELECTRONIC SPARK CONTROL SYSTEM TESTS

**Ignition System Starting Test** — 1) Remove coil wire from distributor cap. Hold end of wire 1/4" away from good engine ground. Have assistant crank engine, while you watch for spark at secondary wire. Spark should be constant and bright blue.

2) If there is a good spark, continue cranking engine while slowly moving secondary wire away from ground. Look for arcing at coil tower. If arcing occurs, replace coil. If spark is weak or not constant, or if there is no spark, proceed to "Failure to Start Test".

3) If spark is good and there is no arcing at the coil tower, secondary voltage is satisfactory. Make sure it is reaching spark plugs by checking distributor rotor, cap, spark plug wires and spark plugs.

4) If all of these components check okay, ignition system is not at fault. Check fuel system or mechanical engine damage.

**CAUTION** — Perform "Ignition System Starting Test" first. Failure to do so may result in lost diagnostic time or incorrect test results.

**Failure to Start Test** — 1) Measure and record battery voltage. Check battery specific gravity, which must be 1.220 (temperature corrected) to deliver proper voltage to ignition system.

2) Remove coil secondary wire from distributor cap and hold 1/4" from a good ground. Prepare a special jumper wire assembly as shown in Fig. 6. With ignition switch on, momentarily touch special jumper wire to ground and coil negative terminal. A spark should be obtained at secondary wire.

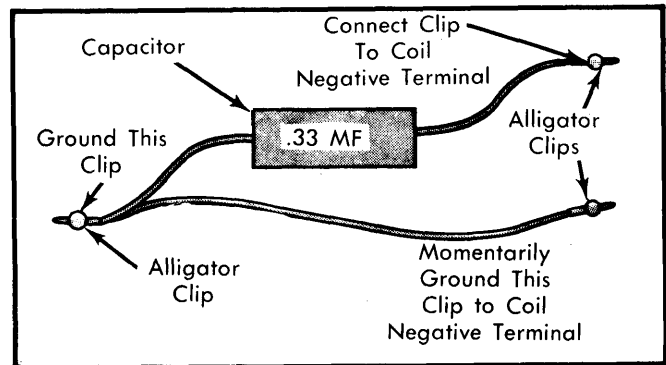


Fig. 6 Special Jumper Wire Assembly for Grounding Coil Negative Terminal

3) If spark was obtained, proceed to step 6). If no spark resulted, turn ignition off and disconnect 10-wire harness connector from computer. See Fig. 7. Turn ignition back on and again, using special jumper wire, connect negative terminal momentarily to ground. Spark should be obtained.

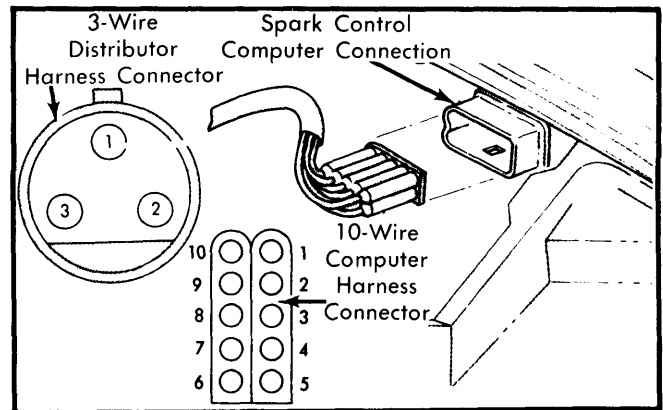


Fig. 7 Distributor and Computer Harness Connectors Used in Testing ESA System

4) If spark was obtained, but engine will not start, computer output is shorted. Replace computer. If no spark resulted in step 3), connect positive lead of voltmeter to coil positive terminal and negative lead to a good ground. Reading should be within 1 volt of battery voltage. If not, check wiring between battery and coil positive terminal.

5) If correct voltage was recorded in step 4), measure voltage between ground and coil negative terminal. Again, it should be within 1 volt of battery voltage. Replace ignition coil if there is either no voltage present, or if voltage is present but no spark results when shorting negative coil terminal.

6) If no spark was obtained in step 2) or if in step 5) spark was obtained but engine would not start, hold carburetor switch open with a thin cardboard insulator. Measure voltage between carburetor switch and ground. Reading should be at least 5 volts. If so, proceed to step 10).

7) If voltage was not at least 5 volts in step 6), turn ignition off and disconnect 10-wire harness connector from computer. Turn ignition on. Connect positive lead of voltmeter to cavity 2 of connector and negative lead to ground. Reading should be within 1 volt of battery voltage.

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8) If no battery voltage is present, check wire from battery to ignition switch to cavity 2. Use an ohmmeter if necessary to check continuity of wires. Correct problem and repeat step 7). If voltage was present in step 7), turn ignition off and connect ohmmeter leads to carburetor switch terminal and cavity 7 of 10-wire connector.

9) If no continuity is found, check for open wire between cavity 7 and carburetor switch. If continuity was indicated, connect ohmmeter leads to cavity 10 and to a good ground. If continuity exists, replace computer, as correct power is entering computer, but not leaving it. Repeat step 6). If no continuity existed between cavity 10 and ground, check for an open wire in the ground system.

10) Reconnect 10-wire harness connector to computer. Turn ignition on and hold secondary coil wire 1/4" from a good ground. Disconnect 3-wire distributor connector from distributor. Attach jumper wire between cavities 2 and 3 of harness connector. A good spark should jump from coil wire to ground.

11) If spark resulted, but engine will not start, replace Hall Effect Pick-Up. Before replacing, however, always be sure rotor shutterblades are grounded. Connect 1 ohmmeter lead to a good ground and touch other lead to shutterblade. See Fig. 2. If no continuity, push down on rotor to seat against shaft. If still no continuity, replace rotor. If shutterblade is grounded, then proceed to replace Hall Effect Pick-Up.

12) If no spark resulted in step 10), connect voltmeter positive lead to distributor harness connector cavity 1 and negative lead to ground. Reading should be within 1 volt of battery voltage. If no battery voltage is present, proceed to step 15). If voltage was correct, turn ignition off and disconnect 10-wire harness connector from computer.

13) Connect ohmmeter leads between cavity 2 (Black/Light Blue wires) of distributor harness connector and cavity 9 of 10-wire connector. Then connect leads to cavity 3 (Gray wire) of distributor harness connector and cavity 5 of 10-wire connector.

14) If no continuity is present, repair open wires. If continuity exists, replace computer (power going into computer, but not coming out). Repeat step 10).

15) If there was no battery voltage in step 12), turn ignition off, disconnect the 10-wire connector and connect ohmmeter leads to cavity 1 of distributor harness and cavity 3 of 10-wire connector. If no continuity exists, repair wire and repeat procedure in step 10).

16) If continuity existed in step 15), turn ignition on and check for battery voltage with voltmeter positive lead in cavity 2 of 10-wire connector and negative lead in cavity 10. If battery voltage is present, but vehicle will not start, replace computer and repeat step 10). If no battery voltage is present, check ground wire and repeat step 10).

**Spark Control Computer Spark Test - 1)** Warm engine to normal operating temperature. Disconnect carburetor switch or unground it. Be sure coolant temperature switch/sensor is connected and working properly.

2) Remove and plug vacuum hose at vacuum transducer. Connect an auxiliary vacuum supply to vacuum transducer and apply 16 in. Hg. Increase engine speed to 2000 RPM and wait 1 minute before checking specifications. Advance specifications are in addition to basic advance. See *Spark Advance Test Specifications table*.

3) If computer fails to obtain settings, replace computer.

### Spark Advance Test Specifications

Computer Part No.	Spark Advance <sup>①</sup>
5213437 .....	51-59°
5213438 .....	46-54°
5213480 .....	41-49°
5213481 .....	43-51°
5213482 .....	41-49°
5213483 .....	41-49°
5213486 .....	40-48°
5213542 .....	51-59°
5213544 .....	46-54°
5213546 .....	39-47°
5213546 <sup>②</sup> .....	27-35°
5213594 .....	33-41°

① - With engine speed at 2000 RPM and 16 in. Hg vacuum applied.

② - High Altitude.

### ELECTRONIC FUEL CONTROL SYSTEM TESTS

**NOTE** - The "Spark Control Computer Spark Test" should be tested prior to beginning any test on EFC system. The following tests **MUST** be performed in the sequence given.

**Air Switching System Diagnosis (Vacuum Supply) - 1)** Remove vacuum hose for air switching/diverter valve and connect a vacuum gauge to hose. Set parking brake. Start engine and observe gauge reading.

2) On a cold engine, engine vacuum should be present until engine coolant temperature reaches 125°F (2.2L engine) or 150°F (1.7L engine). When temperature is reached, vacuum should drop to 0. If no vacuum is present on gauge, check the vacuum supply and Coolant Controlled Engine Vacuum Switch (CCEVS).

3) On a warm engine, no vacuum should be present. If vacuum is present, check Coolant Controlled Engine Vacuum Switch (CCEVS).

**Air Switching System Diagnosis (Air Switching Valve) - 1)** Remove air supply hose from air switching valve. Remove vacuum hose from valve and install an auxiliary vacuum supply.

2) Set parking brake. Start engine. Air should blow out of side port. Apply vacuum to valve. Air should blow out bottom port. If valve does not operate as previously described, replace valve.

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**Coolant Switch Test** – 1) Turn ignition off and disconnect wire connector from switch. Connect 1 ohmmeter lead to a good ground and other lead to switch terminal.

2) A cold engine should show continuity. If not, replace switch. A hot engine should show no continuity. If so replace switch.

**Carburetor Duty Cycle Solenoid Test** – 1) Remove and plug vacuum hose at vacuum transducer. Connect a tachometer. Connect an auxiliary vacuum supply to vacuum transducer and apply 16 in. Hg. Set parking brake and start engine. Allow engine to reach normal operating temperature. DO NOT ground carburetor switch. Run engine at 2000 RPM.

2) On A/C equipped models, disconnect duty cycle solenoid connector. On all other models, disconnect or remove Green wire only. DO NOT disconnect idle solenoid. Average engine speed should increase at least 50 RPM.

3) Reconnect solenoid connector. Engine speed should slowly return to 2000 RPM. Disconnect the 6-pin connector at the computer. Connect a ground to harness connector pin 15. Engine speed should decrease at least 50 RPM. If engine speed does not change as outlined, service carburetor (check for air leaks).

**Electronic Fuel Control Computer Test** – 1) Connect a tachometer and set parking brake. Start engine, warm to normal operating temperature and maintain engine speed of 2000 RPM. DO NOT ground carburetor switch. Connect a voltmeter to duty cycle solenoid output wire going to carburetor (green wire).

**NOTE** – Do not separate the connector from the wiring harness.

2) Disconnect electrical connector at oxygen sensor and connect a jumper wire to the harness end. Connect the other end of the jumper to a good ground. Engine speed should increase at least 50 RPM and voltmeter should indicate more than 9 volts.

3) Hold jumper wire with one hand and with the other hand, touch the battery positive terminal. DO NOT connect jumper wire directly to battery. Engine speed should decrease at least 50 RPM and voltmeter should indicate less than 3 volts. If computer fails both tests, it must be replaced. Reconnect oxygen sensor harness.

**CAUTION** – Before performing the next test, the fuel control computer must be operating properly.

**Oxygen Sensor Test** – 1) Set parking brake and connect tachometer. Run engine at 2000 RPM and connect voltmeter to solenoid-to-carburetor Green output wire. DO NOT ground carburetor switch. Hold choke blade closed. During the next 10 seconds, the voltage should decrease to 3 volts or less and maintain that level. If engine does not respond, go to step 2).

2) Disconnect PCV system. During the next 10 seconds, the voltage should increase to 9 volts or greater and maintain that level until vacuum hose is reconnected. If sensor fails both tests, replace it. Reconnect all hoses and wires.

**NOTE** – This test should not be performed for more than 90 seconds.

### POOR PERFORMANCE TESTS

**NOTE** – Be sure basic timing and hot curb idle speed are set to specifications before performing these tests.

**Carburetor Switch Test** – 1) Turn ignition off and disconnect 10-wire connector from computer. With throttle completely closed, check continuity with ohmmeter leads connected to cavity 7 and ground.

**NOTE** – Grounding carburetor switch eliminates all spark advance on most systems.

2) If no continuity is read, check wire from cavity 7 to carburetor switch terminal. Also check carburetor switch for proper operation.

3) Open throttle and again check for continuity from cavity 7 to ground. There should be no continuity. If readings are not as previously described, replace carburetor switch.

**NOTE** – After performing carburetor switch test, perform tests on the spark control system and fuel control system.

### MAINTENANCE

The EFC system does not require periodic maintenance. However, when vehicle is raised for other services, check condition of catalytic converter, oxygen sensor and exhaust system.

### REMOVAL & INSTALLATION

#### SPARK CONTROL COMPUTER

**NOTE** – Do not remove grease from 10-wire or 6-wire harness connectors or connector cavities in the computer. The grease is used in order to prevent moisture from corroding the terminals. If there is not at least 1/4" of grease on bottom of computer connector cavities, apply a liberal amount of Mopar multi-purpose grease No. 2932524 (or equivalent) over entire end of connector plug before reinstalling.

**Removal & Installation** – 1) Remove battery. Disconnect 10-wire and 6-wire connectors from computer. Remove outside air duct from computer. Disconnect vacuum hose from vacuum transducer.

2) Remove 3 mounting screws that hold computer to fenderwell and remove computer. To install, reverse removal procedure.

**NOTE** – Computer is not serviceable. Do not attempt to take it apart for any reason. Also, if the vacuum transducer becomes defective, entire computer must be replaced.

#### COOLANT SWITCH/SENSOR

**Removal & Installation** – Disconnect electrical connector and remove switch/sensor. To install, coat with anti-seize compound and reverse removal procedure.

# 1982 Computerized Engine Controls<sub>1a-35</sub>

## CHRYSLER CORP. ELECTRONIC FUEL CONTROL (Cont.)

### HALL EFFECT PICK-UP ASSEMBLY

**NOTE** — Replacement of Hall Effect Pick-Up Assembly requires overhaul of distributor.

### CARBURETOR SWITCH

**Removal & Installation** — Remove bracket and idle solenoid assembly from carburetor. Disconnect electrical connector. To install, reverse removal procedure and adjust if necessary.

### DUTY CYCLE SOLENOID

**Removal** — 1) Remove 2 duty cycle solenoid retaining screws and gently lift solenoid from air horn. See Fig. 8. Remove anti-rattle spring, 2 retaining screws and idle solenoid from carburetor.

2) Remove 2 wide open throttle cut-out switch mounting screws (if equipped). Mark location for proper assembly. Remove harness mounting screws and open retaining clip. Remove wires from connector and thread through clip.

**Installation** — 1) Install idle solenoid and anti-rattle spring. Install wide open throttle cut-out switch (if equipped). Adjust switch so air conditioning clutch circuit is open in throttle position of 10° before wide open throttle.

2) Install new duty cycle solenoid gasket on air horn and install new "O" ring on duty cycle solenoid tip. Lightly lubricate solenoid with petroleum jelly and carefully install solenoid into carburetor. Install and tighten mounting screws. Route wiring through clamp and connect to harness. Install and tighten harness mounting screw.

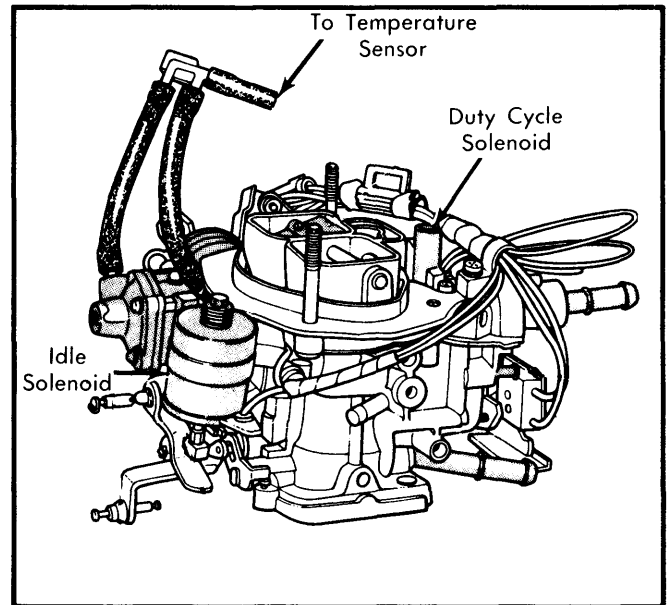


Fig. 8 Replacing Duty Cycle Solenoid

### OXYGEN SENSOR

**Removal** — Disconnect battery cable and remove air cleaner. Disconnect electrical lead at sensor. Remove sensor.

**Installation** — Coat threads of new sensor with nickel-based anti-seize compound. Do not use graphite or other compounds. Start sensor by hand, then tighten to 35 ft. lbs. Install air cleaner and connect battery cable.

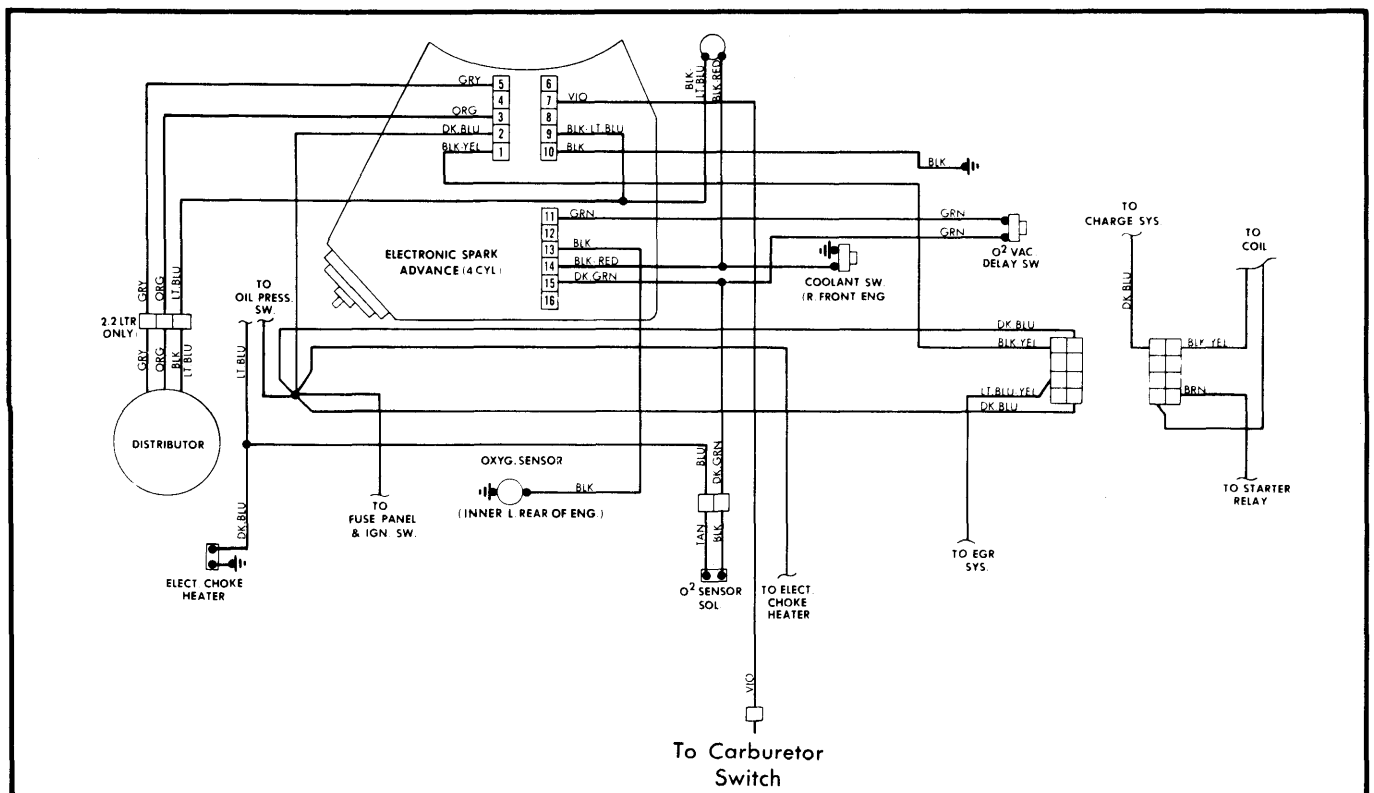


Fig. 9 Wiring Diagram for 1.7L and 2.2L EFC System