CHRYSLER CORP. HALL EFFECT ELECTRONIC SPARK CONTROL SYSTEM

Chrysler Corp.
Aries & Reliant (2.2L Only)
Horizon & Omni

DESCRIPTION

The Electronic Spark Control system used on Chrysler Corp. front wheel drive vehicles with 1.7L and 2.2L engines features a Hall Effect distributor and a spark control computer. *See Fig. 1.*

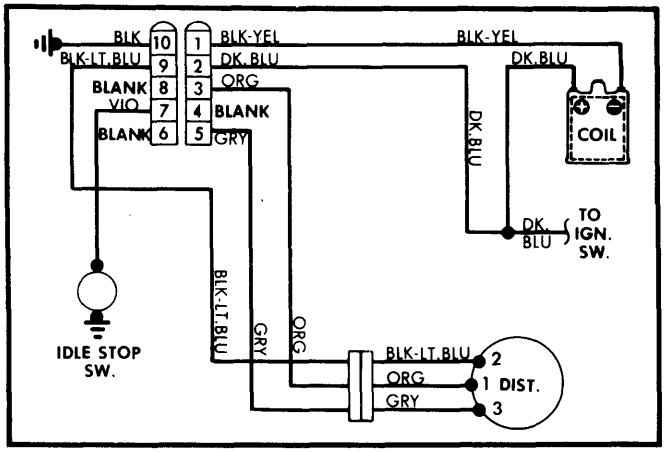

Fig. 1 Wiring Diagram of Chrysler Corp. Hall Effect Electronic Spark Control System

The computer is really the heart of the system, providing capability of igniting a lean air/fuel mixture according to different modes of engine operation. It provides an infinite number of variable advance curves. The computer contains an electronic printed circuit board, which simultaneously receives signals from various engine sensors, analyzes them to determine how the engine is operating and then advances or retards ignition timing.

The computer determines the exact instant when ignition is required, and then signals the ignition coil to produce the electrical impulses to fire the spark plugs. The computer is located on the fenderwell, near the battery.

The computer is connected to other fuel/ignition components by a 10-wire dual connector. Five engine sensors feed information to the computer. These include a vacuum transducer, mounted on the computer housing, the Hall Effect pick-up assembly in the distributor, an engine coolant temperature sensor, a carburetor switch, and an oxygen sensor.

The computer used with the spark control system eliminates need for either vacuum advance units or centrifugal advance weights. The Hall Effect distributor is connected to the rest of the system by a 3-terminal connector. *See Fig. 2.* It sends small alternating current signals to the computer as rotor shutter blades enter and leave the gap in the Hall Effect switching unit pick-up assembly.

The carburetor switch reports when the engine is at idle. The coolant temperature switch or sensor keeps the computer posted on engine operating temperatures. The vacuum transducer informs the computer of engine manifold vacuum.

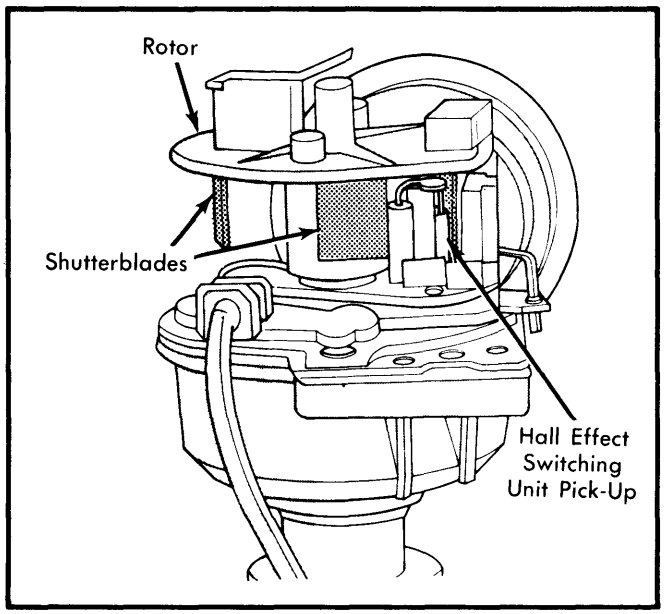

Fig. 2 Components of Hall Effect Distributor for Electronic Spark Control System

OPERATION

The computer has 2 functional modes, the start and run modes. The start mode functions only during engine cranking and starting. A fixed amount of spark advance is provided, based on distributor position. The run mode only functions when the engine starts and is operating normally. The Hall Effect pick-up assembly and the other 4 sensors provide information to the computer, which then varies spark advance to match engine operating conditions. Spark timing and dwell cannot be adjusted in the run mode.

Engine sensors work together. If engine temperature drops below a predetermined temperature, the coolant temperature switch signals the computer to prevent additional advance from the vacuum transducer signal. As temperatures rise, vacuum increases, and additional advance is called for. For maximum advance, the carburetor switch must remain open. During the time when advance will not occur quickly, vacuum advance is controlled by engine RPM and will build up at a slow rate. If the carburetor switch closes, this build up of advance will be cancelled.

The Hall Effect pick-up signal is a reference signal, providing maximum amount of advance, based on sensor input. At the proper time, the computer shuts off current to the ignition coil primary circuit. As the magnetic field there collapses, a high voltage surge occurs in the secondary, firing the spark plugs.

If the computer fails, the system will go into the start mode. This enables the vehicle to be driven in for repair. Performance and fuel ecomomy will be poor, however. If the Hall Effect pick-up or the start mode of the computer fails, the engine will not start or run.

ADJUSTMENTS

NOTE — *No adjustments can be made to the Hall Effect pick-up unit. Dwell and spark timing cannot be adjusted in the run mode. Fixed timing (start mode) can be adjusted by changing distributor position.*

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TESTING

IGNITION SYSTEM STARTING TEST

1) Remove coil wire from distributor cap. Hold end of wire ¼" 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 these components check okay, ignition system is not at fault. Check fuel system or mechanical engine damage.

FAILURE TO START TEST

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

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 ¼" from a good ground. Prepare a special jumper wire assembly as shown in *Fig. 3*. With ignition switch turned on, momentarily touch special jumper wire to ground and coil negative terminal. A spark should be obtained at secondary wire.

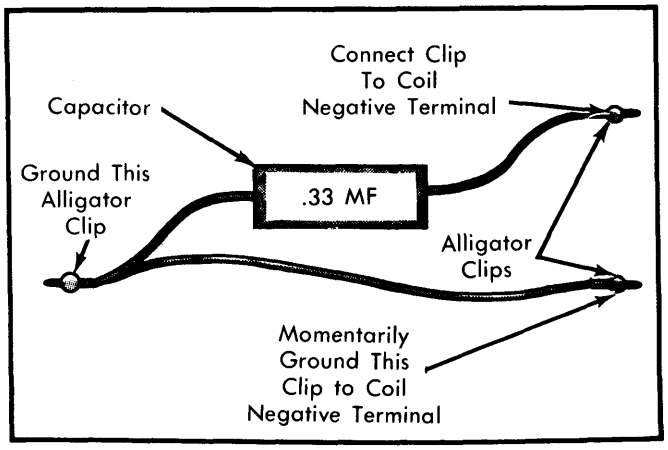

Fig. 3 Special Jumper Wire Assembly for Grounding Coil Negative Terminal

3) If spark was obtained, proceed to step **6)**. If no spark resulted, turn ignition switch off and disconnect 10-wire harness connector from computer. See *Fig. 4*. Turn ignition switch back on and again, using special jumper, connect negative terminal momentarily to ground. Spark should be obtained.

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.

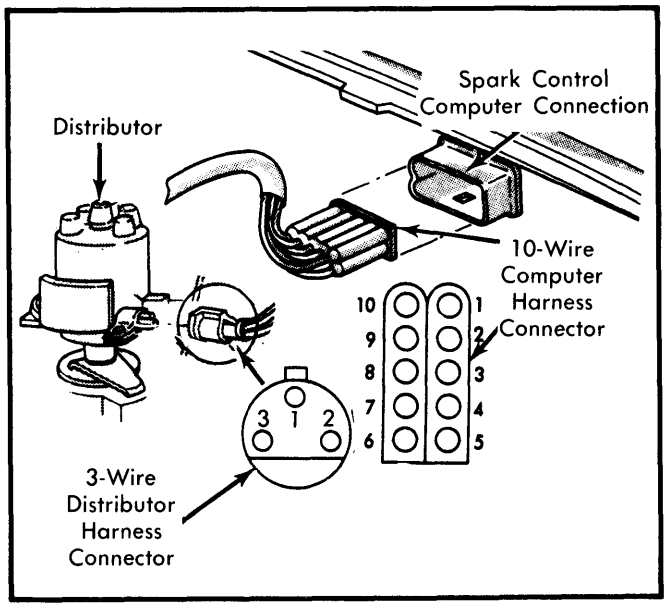

Fig. 4 Distributor and Computer Harness Connectors Used in Testing ESC System

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)** voltage was obtained but engine would not start, hold carburetor switch open with a thin cardboard insulator. See *Fig. 5*. Measure voltage between carburetor switch and ground. Reading should be at least 5 volts. If so, proceed to step **10)**.

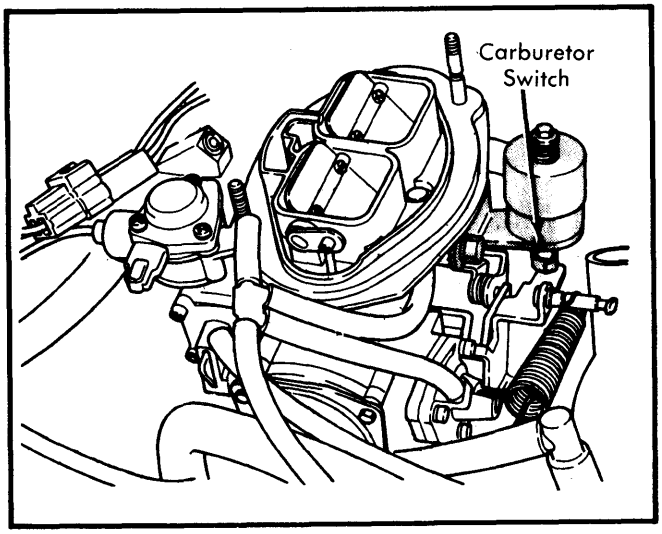

Fig. 5 Location of Carburetor Switch

7) If voltage was not at least 5 volts in step **6)**, turn ignition switch off and disconnect 10-wire harness connector from computer. Turn ignition switch on. Connect positive lead of

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voltmeter to cavity 2 of connector and negative lead to ground. Reading should be within 1 volt of battery voltage.

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 switch 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 switch on and hold secondary coil wire ¼" from a good ground. Disconnect 3-wire distributor connector from distributor. Attach jumper wire between cavities 2 and 3 of distributor 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 pick-up, however, always be sure rotor shutterblades are grounded. Connect one ohmmeter lead to a good ground and touch other lead to shutterblade. See *Fig. 2*. If no continuity is indicated, 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 (Orange wire) 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 off ignition switch and disconnect 10-wire harness connector from computer.

13) Connect ohmmeter leads between cavity 2 (Black-Light Blue wire) 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. Continuity should be indicated.

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 switch off, disconnect 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 step **10)**.

16) If continuity existed in step **15)**, turn ignition switch 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 read, check ground wire and repeat step **10)**.

POOR PERFORMANCE TESTS

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

Carburetor Switch – 1) Turn ignition switch 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 none.

Coolant Switch – 1) Turn ignition switch off and disconnect wire connecter from coolant switch. Connect one ohmmeter lead to a good ground and other lead to coolant switch terminal.

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

Coolant Sensor – Turn ignition switch off and disconnect wire connector from sensor. Connect ohmmeter leads to sensor terminals. With engine cold and ambient temperature below 90° F, resistance should read 500-1000 ohms. With a hot engine, resistance should be greater than 1300 ohms.

NOTE – *The coolant sensor resistance will continually change with changes in engine temperature. It is not a switch.*

Basic Advance Timing – 1) Connect an adjustable timing light to engine so that total timing advance can be checked. Connect jumper wire between carburetor switch and a good ground.

2) On vehicles with manual transaxles, unscrew large plastic plug in clutch housing to view timing marks on flywheel. After vehicle starts, adjust timing light so pointer on clutch housing is aligned with specified mark on flyweel.

3) On vehicles with automatic transaxles, look through window in converter housing for notch in torque converter. After vehicle starts, adjust timing light so notch in torque converter is aligned with mark on converter housing.

4) The meter on timing light should show amount of advance shown on emission control label.

Computer Spark Advance – 1) Warm engine to normal operating temperature. Disconnect carburetor switch or unground it. Be sure coolant temperature sensor is working properly and is connected.

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

NOTE – *On systems with an accumulator, the specified time must be reached with the carburetor switch ungrounded before checking for specified spark advance schedule.*

3) If computer fails to obtain settings shown on emission control label, replace computer.

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OVERHAUL

Disassembly – **1)** Remove distributor from vehicle. Lightly clamp distributor in soft jaws of vise. Remove distributor cap and rotor from shaft. Remove screw holding pick-up lead on 1.7L engines; remove pick-up connector on 2.2L engines.

NOTE – *When removing spark plug wires from distributor cap, do not pull on wires. Positive-locking wires must be released from inside cap. See Fig. 6.*

2) Remove Hall Effect pick-up assembly lock springs (or clips) and lift out pick-up assembly. Remove 2 screws holding splash shield to distributor housing. Mark drive gear (or distributor drive) position on distributor shaft. Using a pin punch, drive roll pin from shaft.

NOTE – *Hall Effect pick-up assembly may be replaced without removing distributor from engine.*

3) Remove drive gear (or distributor drive) and remove shaft from housing. If equipped, remove thrust washers, nylon spacers and block seals.

Reassembly – To reassemble, reverse disassembly procedure. Correct rotor has "E.S.A." stamped in its top. Check rotor for proper grounding of shutterblades.

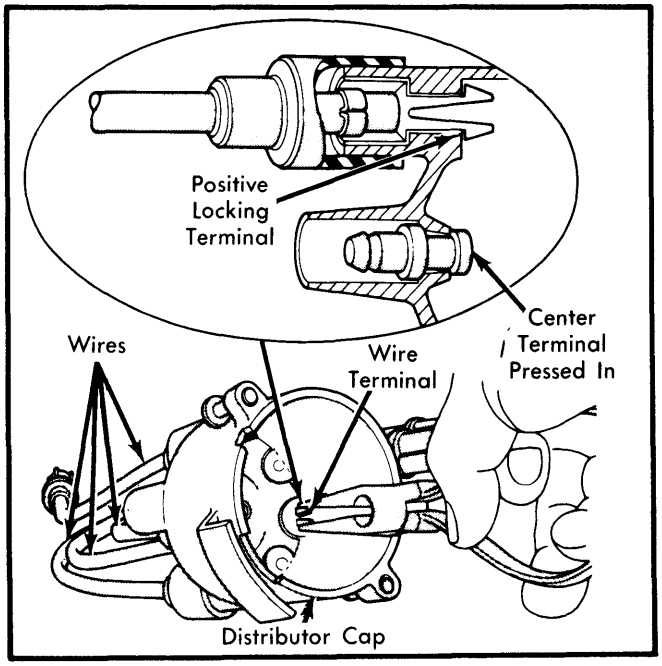

Fig. 6 Use Pliers to Release Positive-Locking Spark Plug Wire Terminals