CHRYSLER ELECTRONIC FUEL INJECTION

DESCRIPTION

The Chrysler Electronic Fuel Injection System is used on the 5.2L (318") engine in Imperial models only. The system includes several main sub-systems: air induction, fuel delivery, fuel control, emission control, and computer control.

The air induction system includes a heated air system, an air flow meter, air cleaner, throttle body, throttle position potentiometer, throttle switch, and Automatic Idle Speed (AIS) motor.

The fuel delivery system provides fuel from the pump to (and from) the fuel control system. It is composed of an in-tank fuel pump, 2 fuel filters, check valve, pressure regulator, by-pass orifice, return line, and return check valve.

Fuel control does the actual delivery of fuel into the engine. This job is done using a variable flow pump mounted on a support plate under the air cleaner and above the throttle body. In addition to the pump, the system includes a fuel flowmeter and temperature sensor, fuel pressure switch, and fuel injector assembly. A power module provides the power to operate the control pump.

Emission controls are directly controlled by the fuel injection computer, but are not unique to the injection engine. These controls include EGR, air injection management and switching, evaporative emission control, and crankcase ventilation.

A computer controls the fuel injection system and regulates the air/fuel ratio. In addition, the computer controls ignition and emission systems. Various engine sensors are used to provide input to the computer. Two other modules assist the computer in controlling the fuel injection system: the Automatic Shut-Down Module and the Power Module.

OPERATION

GENERAL

The Electronic Fuel Injection system is unique in that it actually measures the volume of both fuel and air entering the engine. The air flow meter measures the volume of air entering the air cleaner, and the computer signals the control motor to add enough fuel to achieve the desired 14.7:1 air/fuel ratio. Finally, the oxygen sensor and other engine sensors help the computer to fine-tune the mixture to accomodate various driving conditions that require a richer or leaner mixture.

AIR INDUCTION

The air induction system conditions and measures the amount of air entering the engine. A standard air temperature system heats incoming air and maintains it at a chosen temperature. A temperature sensing valve, check valve, and vacuum motor control the heating functions.

A special duct on the air cleaner is used to swirl the incoming air. A special sensor then determines the quantity of air entering, and feeds a control signal to the computer. When the engine is cranking, not enough air flows for the sensor to work, so air flow is estimated by the computer.

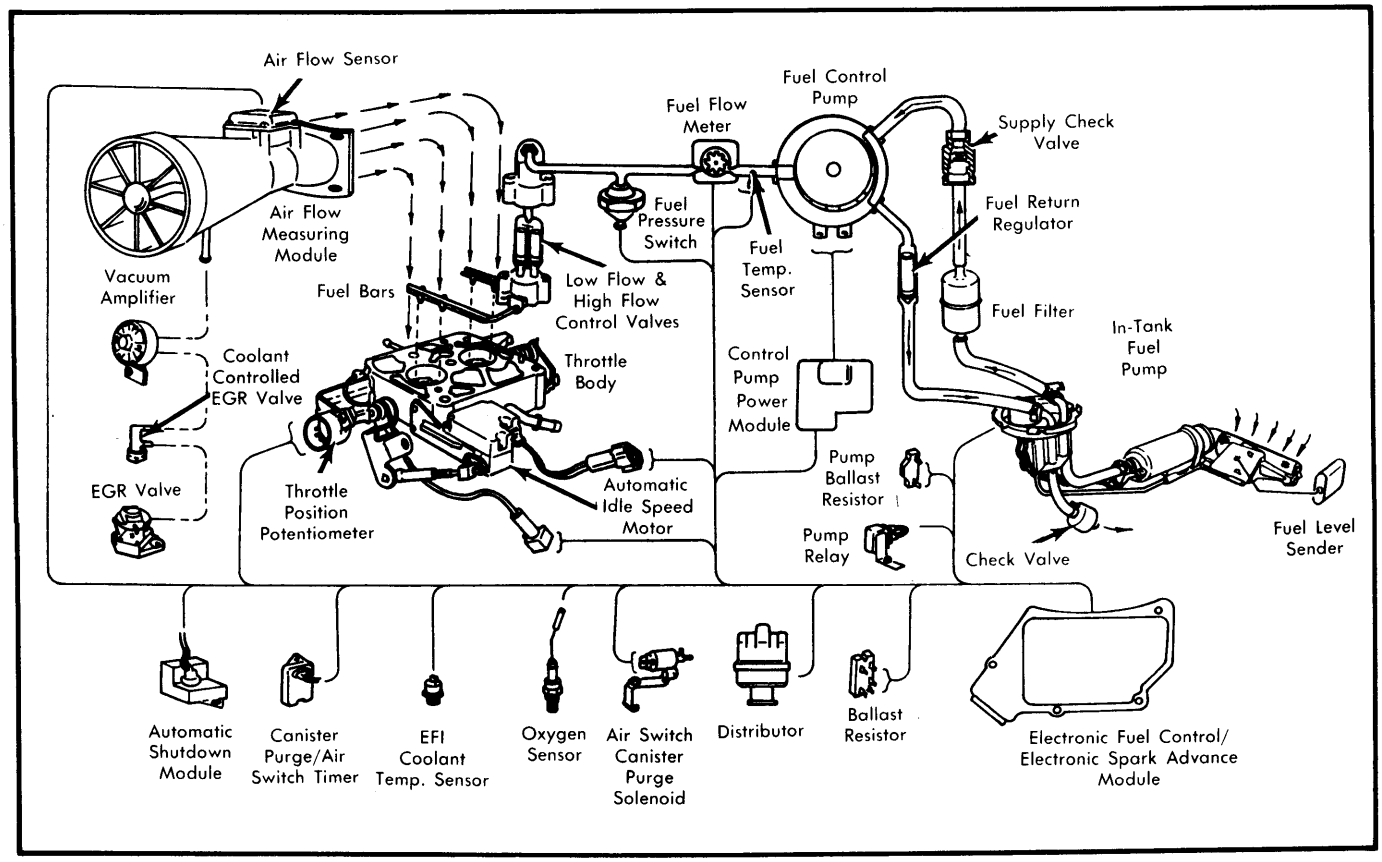

Fig. 1 Electronic Fuel Injection System Schematic

CHRYSLER ELECTRONIC FUEL INJECTION (Cont.)

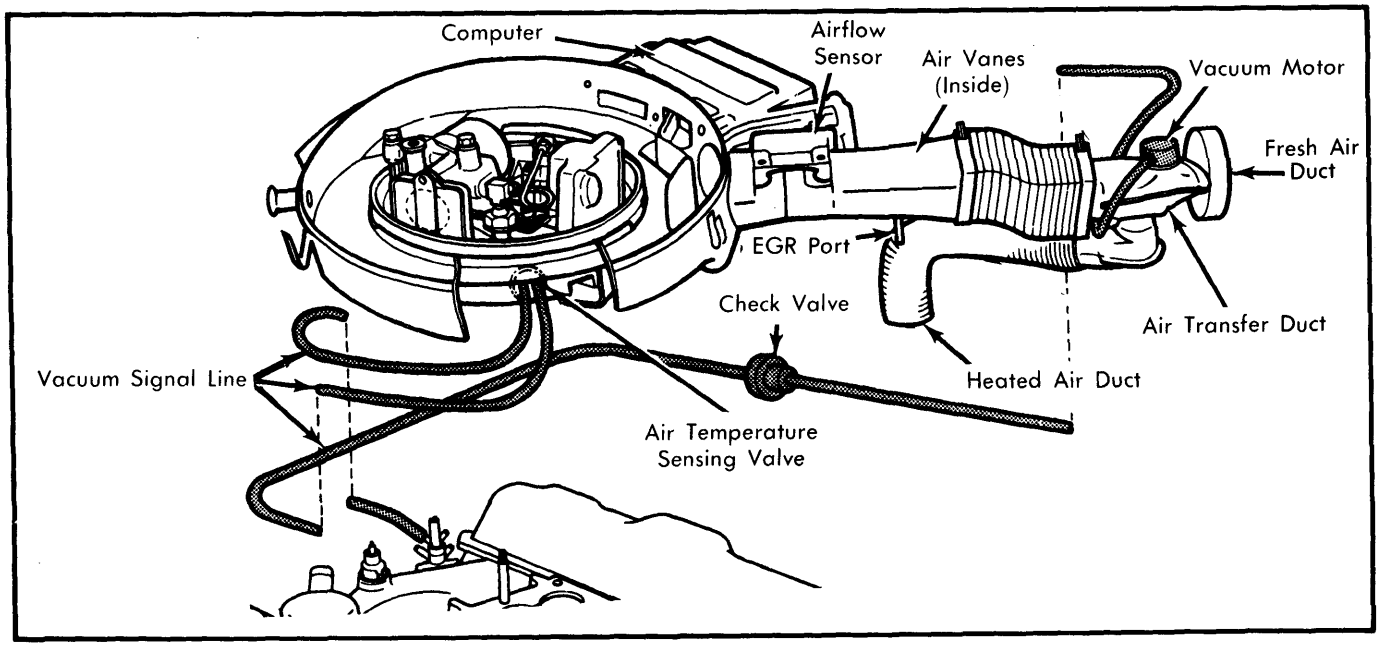

Fig. 2 EFI Air Induction System Components

The final component in the air induction system is the throttle body. It is located on top of the intake manifold and contains the throttle blades, several vacuum ports, and the Automatic Idle Speed (AIS) motor. In addition, a throttle switch and throttle position sensor are used to inform the computer of throttle position and engine load. When the throttle is closed, the AIS controls idle speed by moving the throttle linkage stop. When the throttle is open, the position sensor enables the computer to vary enrichment. If the throttle is floored and the engine is not running, no fuel will flow (to help prevent flooding).

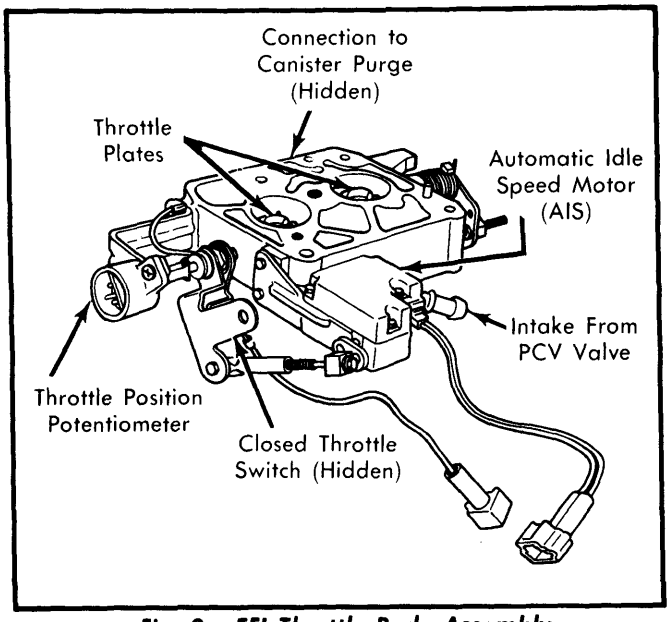

Fig. 3 EFI Throttle Body Assembly

FUEL DELIVERY

The fuel delivery system begins with a 2-speed electric pump in the fuel tank. When the engine is cranking, battery voltage is applied to the pump to produce high pressure and volume, to minimize cranking times. When the engine starts, current flows through a ballast resistor, lowering pump pressure and volume and extending pump life.

Fuel flows through a pair of filters located near the tank, then on to the control pump reservoir (like a float bowl). Fuel not used returns to the tank through a regulator and check valve. A small orifice allows vapors to return to the tank when the engine is not running.

FUEL CONTROL

The fuel control system uses a small electric pump to provide fuel at varying pressure to the injectors. Unlike other EFI systems (GM and Ford), the injectors spray constantly. The Chrysler system controls the amount of fuel flowing, rather than the time the injectors are open. The entire fuel control system is mounted on the fuel support plate, above the throttle body.

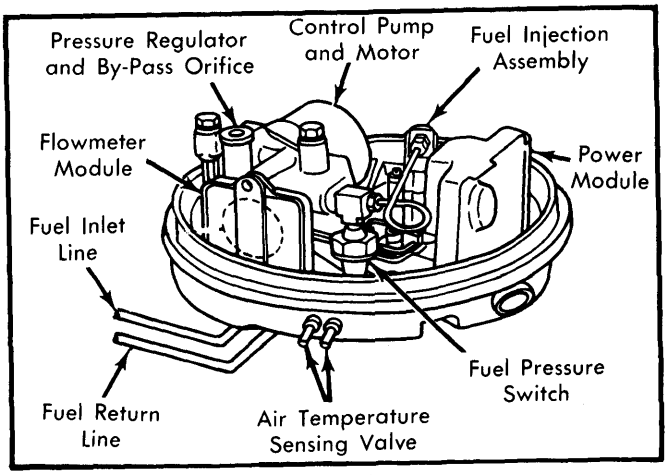

Fig. 4 EFI Fuel Control Support Plate Assembly

CHRYSLER ELECTRONIC FUEL INJECTION (Cont.)

A flowmeter and temperature sender enable the computer to calculate the amount and density of fuel going to the injectors. The pressure switch is normally open when the engine is running. However, during cranking, pressure is low, so the switch closes and drives the control pump at full speed until the pressure is up to normal. This ensures quick starting.

The injection assembly contains 2 valves. The Light Load valve opens above 21 psi and allows fuel to flow through 4 holes in the light load bars. Fuel is sprayed into the throttle body and atomized further by ridges on the throttle blades. When fuel pressure exceeds 34 psi, the Power valve opens and allows fuel to spray through the power bars. This normally occurs only during starting and full-throttle operation.

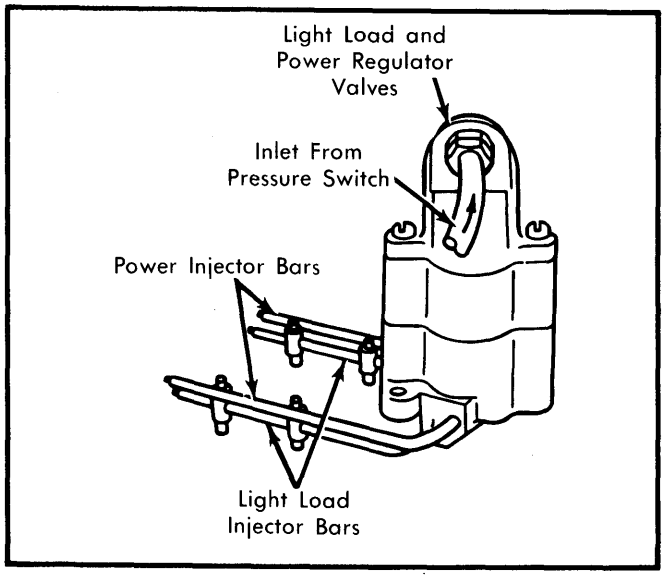

Fig. 5 EFI Fuel Injection Assembly

ENGINE SENSORS

The computer needs information to determine engine operating conditions and requirements. The air flowmeter, fuel flowmeter, fuel pressure switch, fuel temperature switch and throttle sensors are described in air and fuel sections. Other sensors include oxygen sensor, engine coolant temperature (used to compute warm-up enrichment), and a back-up closed throttle switch. This switch is actually a brake switch in parallel with the idle stop switch. It ensures that the engine idle is controlled when the brake is depressed.

The computer also calculates engine speed from distributor signals, engine load by dividing airflow and speed, and A/C operation by compressor clutch voltage. These inputs are used to modify spark timing and fuel injection. In addition, emission systems like canister purge and air injection are controlled.

COMPUTER OPERATION

The computer controls 4 circuits: EFI fuel control, the air/fuel mixture fine-tuning (using oxygen sensor), electronic spark advance, and idle speed control.

In open-loop operation, the air flowmeter and the fuel flowmeter are used to determine mixture strength. This occurs when the engine is cold or when acceleration is needed. When the oxygen sensor is hot and cruising operation occurs, the system enters closed-loop operation.

In closed-loop, the oxygen sensor reports the amount of unburned oxygen in the exhaust to the computer. The computer then drives the control pump faster or slower to adjust mixture.

Three other sub-systems are involved in computer operation. The idle speed is controlled by a motor on the throttle body, which adjusts the throttle stop to maintain idle in cold operation or with A/C on. A Power Module inside the air cleaner near the injectors provides 23-volt current for operating the EFI system. Finally, an Automatic Shut-Down Module terminates power to the fuel pumps whenever the ignition key is on, but no signal is received from the distributor. During cranking, the ASD allows the pumps to operate, but if the fuel pressure switch does not close in 10-20 seconds, the pumps stop. This prevents flooding if the injectors are leaking.

TROUBLE SHOOTING

CAUTION – *All voltage checks should be made with a digital, high-impedance volt-ohmmeter. Do not use a conventional needle-type meter.*

NOTE – *A Chrysler EFI tester is required to fully test or adjust the EFI system. However, many operational checks can be made with normal shop equipment. These trouble shooting procedures cover the fuel injection system only. For information on the ignition or emission functions, see appropriate articles in ELECTRICAL or COMPUTERIZED ENGINE CONTROLS Sections.*

SYSTEM VISUAL CHECK

Inside Air Cleaner – 1) Proper wires connected to control pump, fuel pressure switch, and fuel flowmeter. See *Fig. 6* (wiring diagram) for identification.

2) Power module ground wire connected to support plate screw. Fuel lines and pressure switch connected tight and not leaking.

3) No wires are cut or chafed by clips or hardware. Air cleaner cover tightly sealed.

NOTE – *The EFI system measures air to calculate fuel flow and will not operate if the air cleaner cover is removed. Ensure that cover is sealed except when observing fuel flow during cranking.*

Outside Air Cleaner – 1) All electrical connections are tight and wires are in good condition. All electrical component mounting screws must be clean and tight to ensure a good ground connection.

2) Vacuum hoses connected between PCV valve and front throttle body port; charcoal canister and rear throttle body port. All other vacuum lines connected and in good condition.

3) Check fuses for EFI and in-tank pump. Check connection from in-tank pump to body harness near tank.

NO-START CHECKS

1) Remove air cleaner. Disconnect coil secondary wire and connect it to ground. Crank engine and check for fuel flow at injectors. If flow is okay, check ignition system.

CAUTION – *Coil secondary wire must be grounded if not connected to cap while engine is being cranked. Otherwise, damage to computer may occur.*

CHRYSLER ELECTRONIC FUEL INJECTION (Cont.)

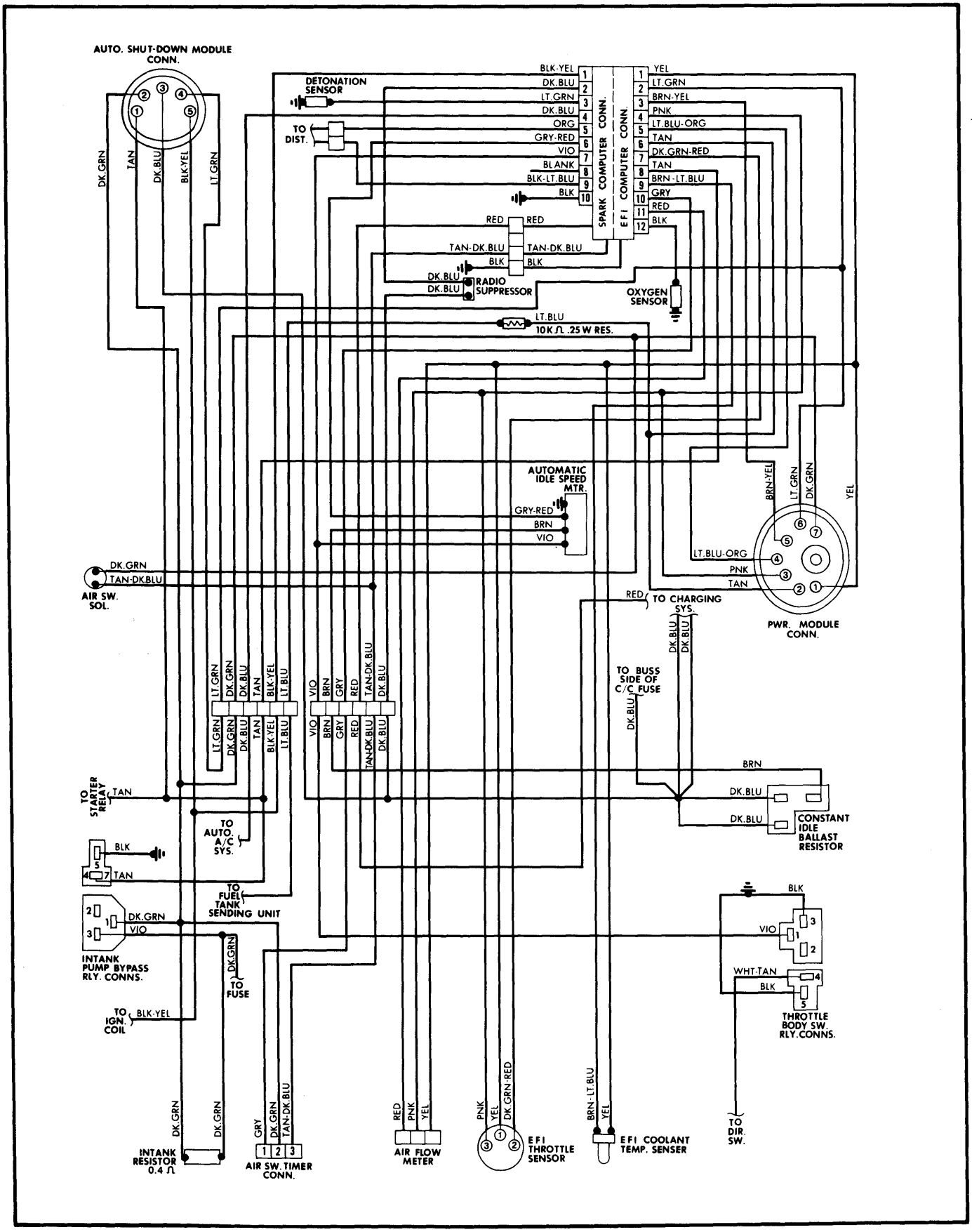

Fig. 6 EFI Wiring Diagram

CHRYSLER ELECTRONIC FUEL INJECTION (Cont.)

2) If no fuel is seen, perform "In-Tank Pump Test". If fuel flow is minimal, perform "Fuel Pressure Test". If fuel flow is excessive or evidence of flooding is seen, perform "Excessive Fuel Flow" test.

In-Tank Pump Test – 1) Check continuity and resistance of in-tank pump ballast resistor. Resistor is at right top of cowl and should have 0.4 ohms resistance.

2) Continuity should be present between one side of ballast resistor and pin 3 of pump relay connector (right fender well). Continuity should exist between other side of resistor and pin 1 in connector. Pin 5 should be grounded.

3) Insert positive voltmeter probe into rear of relay connector at pin 3 while connector is hooked up. Connect other probe to ground and crank engine. Voltmeter should indicate 8-10 volts. Insert probe at pin 4 and crank engine. Voltmeter should indicate 9 volts. If not, check battery and supply to pump relay.

4) If voltage is present, check continuity between pin 3 of relay connector and Dark Green wire at pump (fuel tank).

Fuel Pressure Test – 1) Check battery for at least 12 volts. Connect pressure gauge to "T" at fuel supply fitting on fuel plate. Crank engine.

2) Fuel pressure should be at least 8 psi. If not, check fuel pick-up, fuel filters, fuel lines or blocked vent lines.

Excessive Fuel Flow – 1) With air cleaner cover removed, turn key on. If fuel flows continuously from injectors, disconnect control pump connector.

2) If fuel continues to flow, replace fuel control plate (pump, injectors, flowmeter).

3) If fuel flow stops, problem is in computer. Substitute good computer and retest. If original proves defective, replace computer.

STARTS, THEN STALLS CHECKS

AIS Motor – 1) Turn ignition on but do not start engine. Visually check position of throttle arm at AIS motor. Arm should be pointing downward and toward rear of engine.

2) If throttle arm is in correct position, check ballast resistor. With ignition on, measure voltage between pin "A" and ground, then between pin "B" and ground. Voltage at "A" should be 6 volts, at "B", 10 volts. If not, check wiring harness.

3) Resistance (with connectors removed) between pins "C" and "D" should be 9-11 ohms, and between "D" and "E" should be 4-6 ohms. If not correct, replace ballast resistor.

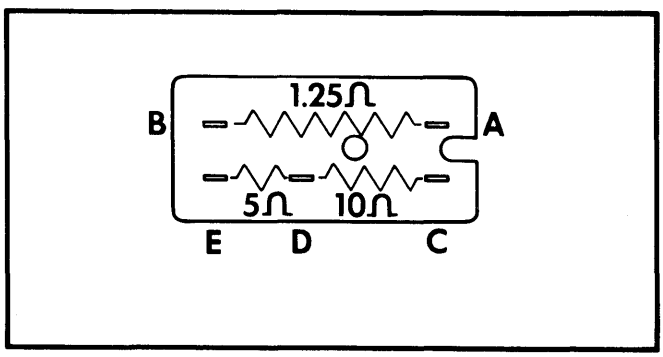

Fig. 7 Ignition/AIS Motor Ballast Resistor Connections

4) If arm at motor was in correct position, disconnect 10-pin connector at computer. Connect a voltmeter between pin 6 of connector and ground. At least 8 volts should be present. If not, check wiring harness. If harness is okay, replace AIS motor.

5) If 8 volts were measured at pin 6, computer must be replaced.

Fuel Supply – Perform test under "No-Start Checks" and inspect fuel flow, fuel pressure, and voltage to pump.

Computer Supply – 1) Disconnect 12-pin EFI connector from module inside computer on air cleaner housing. Connect a voltmeter between pin 8 of connector and ground, then crank engine.

2) Voltmeter should indicate at least 9 volts. If not, reconnect connector and check wiring harness to starter relay. If voltage is correct, replace computer.

ADJUSTMENT

THROTTLE POSITION POTENTIOMETER

NOTE – *Throttle position potentiometer is mounted with break-off screws. Screws must be drilled and removed, then replaced before adjustment is possible.*

1) Connect EFI tester to vehicle. Place toggle switch to EFI position and rotary switch to throttle position, then turn ignition on. Move diagnostic aid switch to manual position, then move AIS control switch down and hold until AIS motor stops.

2) Depress AIS by-pass button and read TPP voltage. Adjust switch position to obtain 4.0-5.0 volts. Tighten break-off screws until heads snap off.

AUTOMATIC IDLE SPEED MOTOR

1) Turn ignition on. Motor should move arm rearward and open throttle blades. When vehicle is started, idle should be 580 RPM in "D" and should remain constant. If not, adjustment may be necessary.

2) Connect EFI tester with diagnostic aid. Connect tachometer pick-up to No. 1 spark plug lead, battery leads to battery, and place diagnostic aid switch to normal position.

3) Start engine and run until warm. Move diagnostic aid switch to manual and depress control switch until engine speed no longer decreases. Place transmission selector in "D".

4) Idle speed should be 530-630 RPM. If not, adjust to 580 RPM by turning screw on end of AIS motor linkage. One turn of screw will change idle speed 50 RPM.

AUTO-CALIBRATION

NOTE – *Whenever computer is replaced, auto-calibration procedure must be performed to allow computer to adjust to vehicle conditions.*

1) Start and run engine until normal operating temperature is reached. If engine is already warm, idle for at least 90 seconds to allow timer to run out.

2) Increase speed to 2000-2500 RPM and hold constant for at least 90 seconds. Reduce engine speed to idle and allow to idle for at least 150 seconds.

3) Repeat step **2)** once more so computer can verify initial calibration. Procedure is now complete.

CHRYSLER ELECTRONIC FUEL INJECTION (Cont.)

CALIBRATION VERIFICATION

NOTE – *This procedure can be used to verify that the computer is operating properly. Engine must be at normal temperature.*

1) Air cleaner cover must be tight and exhaust system must be checked to ensure no leaks or holes exist. Connect EFI tester to system and connect a CO meter to tailpipe.

2) Remove air pump hose from downstream air injection tube and plug tube. Connect diagnostic aid to AIS motor. Start engine, leave transmission selector in "P", and place speed control switch in manual position. Idle for at least 90 seconds.

3) Disconnect oxygen sensor wire and ground wiring harness side of connector. Increase engine speed to 2000-2500 RPM and hold it constant with diagnostic aid control.

4) CO reading must be between 0.5-3.5%. If higher than 3.5%, replace computer.

5) Remove test equipment and reconnect air injection tube.