DATSUN ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM

280ZX Turbo

DESCRIPTION

The Electronic Concentrated Engine Control System (ECCS) is a computerized emission, ignition and fuel control system. A single control unit monitors a variety of sensors, including the following:

- Crankshaft Angle Sensor
- Throttle Valve Switch
- Air Flow Meter
- Air Temperature Sensor
- Cylinder Head Temperature Sensor
- Barometric Pressure Sensor
- Oxygen Sensor
- Detonation Sensor
- Vehicle Speed Sensor
- Park/Neutral Switch
- Air Conditioning Switch

The computer processes information from these sensors and controls these engine functions:

- Ignition Timing and Dwell
- Fuel Injectors
- Fuel Pump Operation
- Engine Idle Speed
- EGR Operation

NOTE – *For component location and identification, see Fig. 1.*

OPERATION

ECCS CONTROL UNIT

The control unit is located on the driver's side kick panel. It is not serviceable and should not be opened. A monitor lamp is provided in the lower side of the unit so system operation can be checked. The control unit contains memory and locic circuits that enable it to interpret sensor inputs and control the different engine systems.

ENGINE SENSORS

Crankshaft Angle Sensor – The crankshaft pulley has a disc attached to it which has 90 teeth spaced at 4° intervals. It also has 3 projections at 120° intervals. The crankshaft angle sensor uses magnetic pick-ups (3) to sense the position of these teeth and send a signal to the control unit. Two of the pick-ups work together to ganerate 1 pulse for every 1° of crankshaft rotation. This signal is used for timing and engine speed information. The other pick-up generates a pulse every 120° of rotation and this signal is used to determine piston location (TDC).

Throttle Valve Switch – The throttle valve switch is open when the throttle is being moved and closed when the engine is idling. The switch also contains a set of full-throttle contacts, but these are not used in this system.

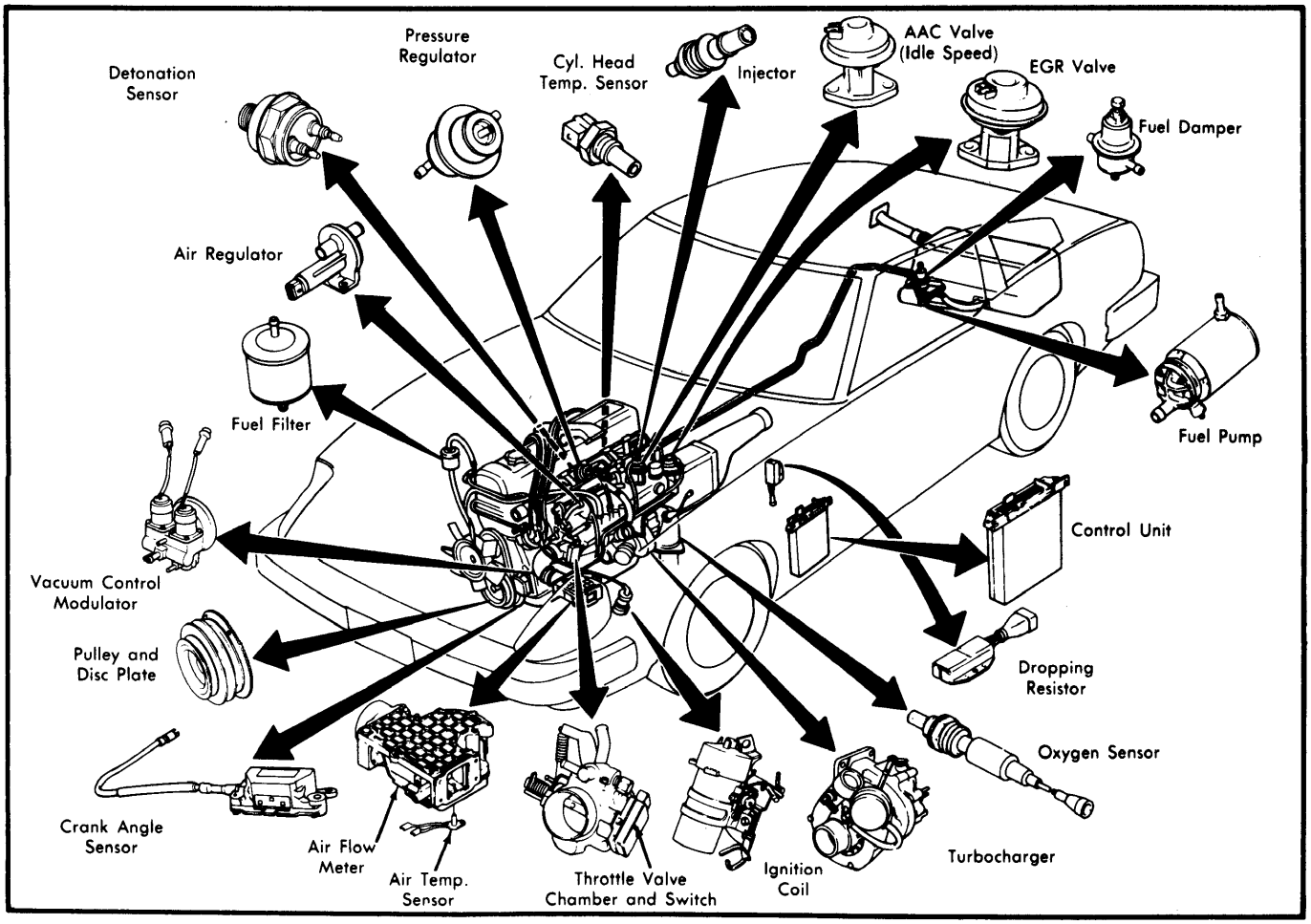

Fig. 1 ECCS Component Locations

DATSUN ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM (Cont.)

Air Flow Meter and Temperature Sensor – The air flow meter measures incoming air so fuel mixture can be determined and injection time controlled by the ECCS control unit. It is a standard AFC flow meter, but incorporates a temperature sensor which is also used for ECCS input. The sensor cannot be serviced separately.

Cylinder Head Temperature Sensor – The cylinder head sensor is located in the right rear corner of the head and provides a varying resistance measurement as cylinder head temperature changes.

Barometric Pressure Sensor – This sensor is built into the ECCS control unit and cannot be serviced separately. It allows the control unit to compensate for altitude changes.

Oxygen Sensor – This component measures the amount of unburned oxygen in the exhaust and provides a voltage signal which is used to adjust fuel mixture (amount of injection time).

Detonation Sensor – The detonation sensor is located near the oil dipstick and sends a signal when "knocking" occurs. The control unit modifies ignition timing to reduce detonation.

ENGINE CONTROLS

Fuel Injection – The control unit determines how long voltage is provided to each injector. The injection time will determine how much fuel is injected. *For more information, see the appropriate Bosch AFC Fuel Injection article in FUEL SYSTEMS Section.*

Fuel Pump – The ECCS control unit operates the electric fuel pump. When the ignition is turned to "ON" or "START" position, the fuel pump operates. If the ignition is on and no signal is received from the crank sensor 120° pick-up for more than 1 second, the fuel pump stops. It will operate for 5 seconds before the engine is cranked, and will then stop if the engine is not cranked over at 20 RPM or more.

Ignition Timing – The control unit uses sensor input to determine the correct timing. It sends a signal to a power transistor located on the coil, which permits current to flow through the coil. Timing is advanced and retarded by the control unit based on sensor input, built-in programming and detonation sensor signals.

EGR Operation – Exhaust gas recirculation is controlled by the ECCS. A signal is sent to the vacuum control modulator, which provides a regulated vacuum supply to open the EGR valve. EGR operation is affected by cylinder head temperature, throttle valve position and ignition switch position. Recirculation takes place only when the engine is operating above idle with cylinder head temperature between 135-240° F (57-115° C).

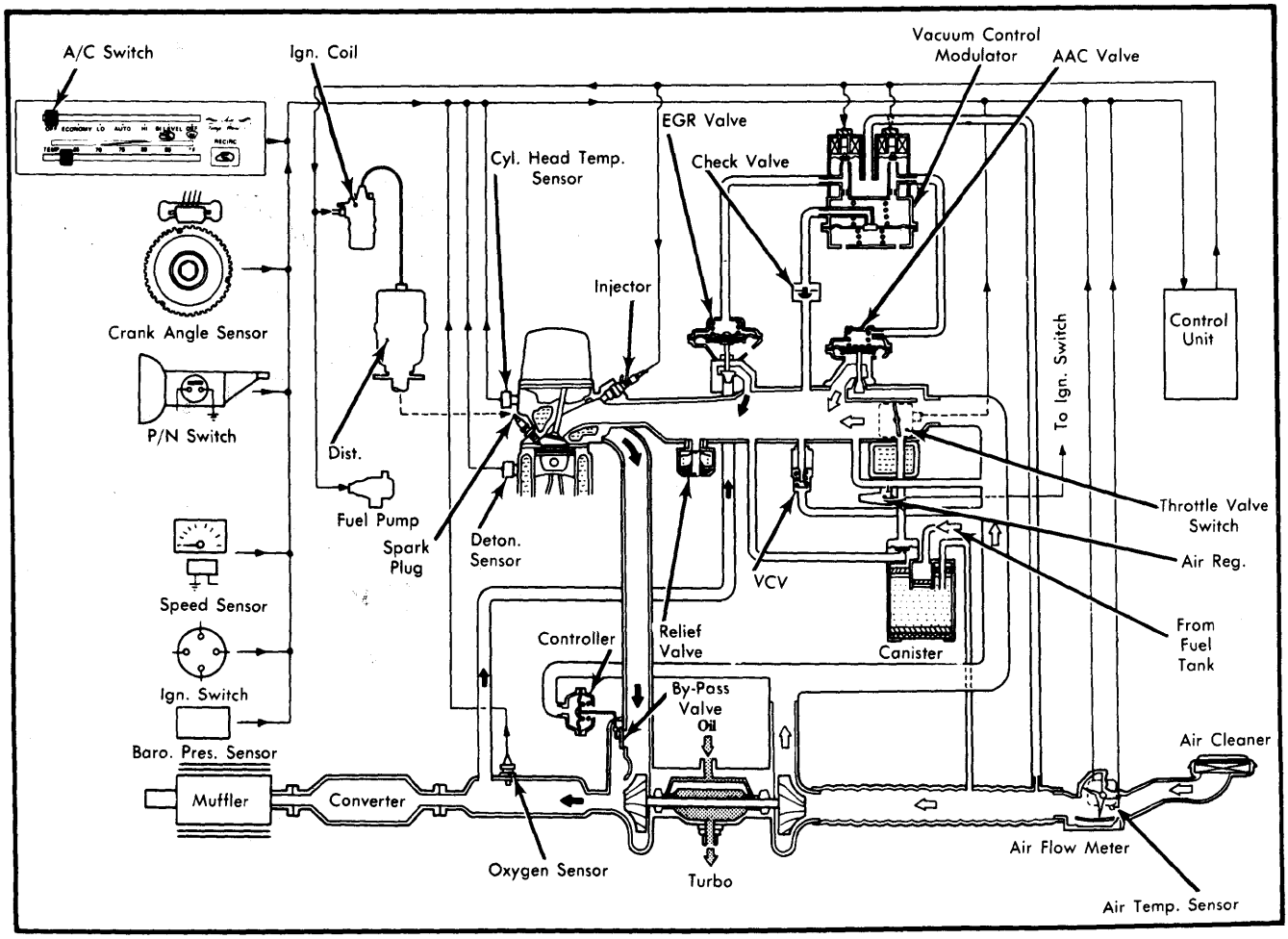

Fig. 2 ECCS Schematic and Vacuum Diagram

DATSUN ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM (Cont.)

Idle Speed Control – The Auxiliary Air Control (AAC) valve is used to control idle speed. The valve is operated by a vacuum signal from the vacuum control modulator and wrks much like an EGR valve does. It allows extra air into the throttle chamber, which increases idle speed. The control unit monitors speed with the crankshaft angle sensor and continually corrects idle speed by operating the vacuum control modulator.

TESTING

NOTE – *The Datsun ECCS system requires a special tester (Datsun ECCS Analyzer) to be fully diagnosed. However, some checks of individual components may be made using regular shop test equipment.*

CAUTION – *Be sure ignition switch is off when disconnecting connectors from control unit. While testing, be careful not to bend any pins and do not touch more than 1 pin at a time with meter lead as meter or control unit could be damaged.*

PREPARATION FOR TESTING

1) Turn ignition off. Disconnect battery ground cable and disconnect wire from terminal "S" at starter motor.

2) Remove air cleaner and position air flow meter so flap can be moved by hand from air cleaner side. Disconnect all 3 connectors at control unit.

COMPONENT TESTING

Throttle Valve Switch – 1) Connect ohmmeter across pins 18 and 25 in control unit connectors. With throttle depressed, no continuity should be present. With throttle released, continuity should be present. If not correct, adjust throttle switch. See *Adjustments in this article.*

2) Connect ohmmeter to terminal 18 and ground, then 25 and ground. See *Fig. 5.* No continuity should be present in either position. If present, repair short to ground in harness, or replace throttle valve switch.

Air Flow Meter – 1) Connect ohmmeter across pins 33 and 26 in connectors. Resistance should be 280-400 ohms. If not, check resistance at meter. If not correct, repair harness or replace air flow meter. See *Fig. 4.*

2) Connect ohmmeter across pins 33 and 31 at connector. Resistance should measure any value between infinity and zero. If not, check resistance at meter. If okay at meter, repair harness. If not, replace air flow meter.

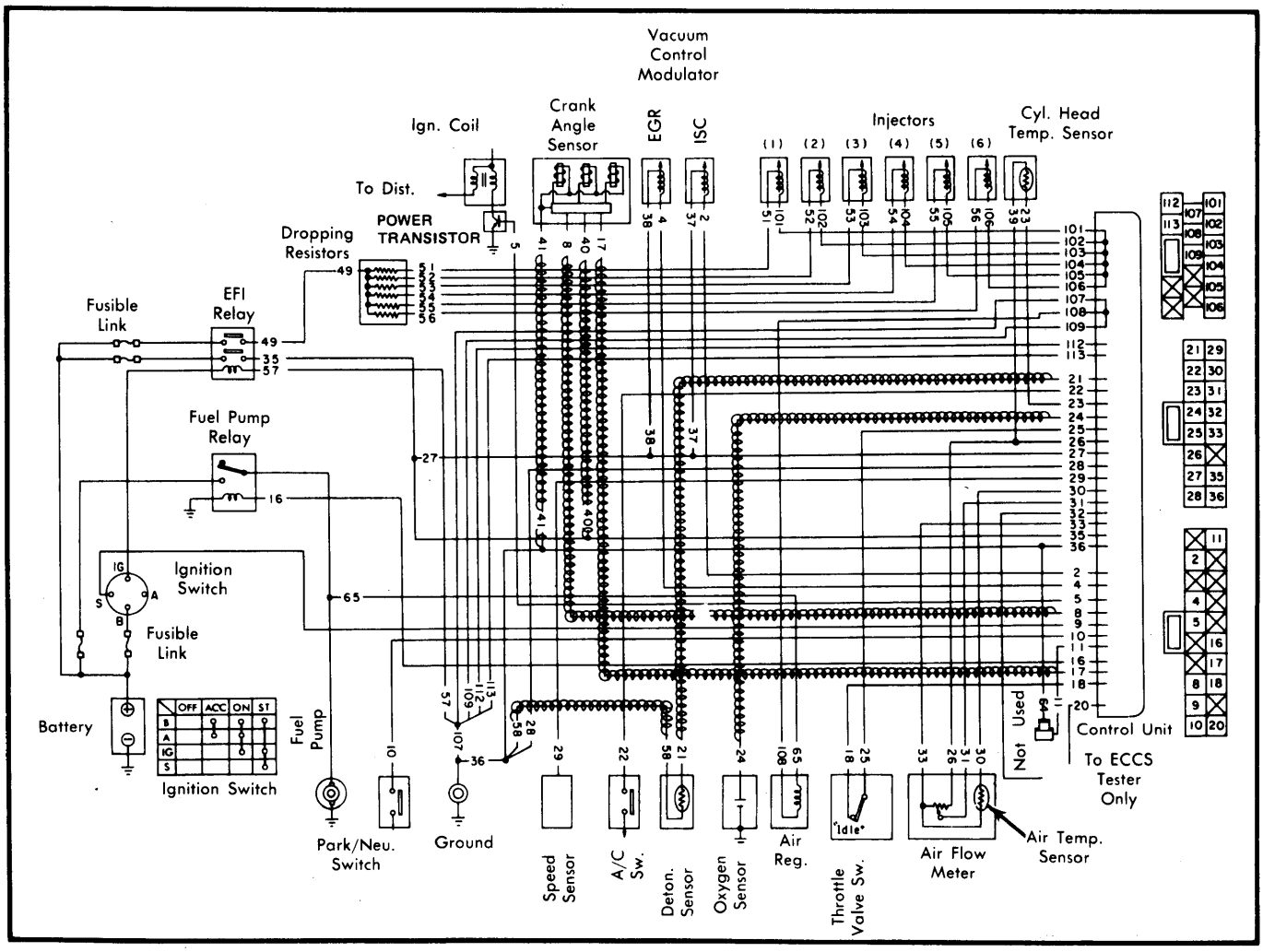

Fig. 3 Datsun ECCS Wiring Diagram

DATSUN ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM (Cont.)

3) Connect 1 lead to ground and the other lead of ohmmeter to connector pin 26, then 31, then 33. Infinite resistance should be shown in all cases. If not, repeat check at connector pins or air flow meter. Repair harness or replace meter as necessary.

4) Operate air flow meter flap by hand to ensure it moves smoothly without binding. If okay, meter is functioning properly. If not, replace air flow meter.

Air Temperature Sensor – **1)** Connect ohmmeter across pins 30 and 33 in control unit connector. With air temperature at 68° F (20° C), resistance should be 2100-2900 ohms. If not correct, repeat test at air flow meter terminals. Repair harness or replace meter as necessary. See *Fig. 4*.

2) Connect ohmmeter between ground and pin 30 at connector. No continuity should be present. Repeat check at air flow meter terminal and body. Repair harness or replace meter as necessary.

Cylinder Head Temperature Sensor – Remove sensor from head and dip end of sensor into water at 68° F (20° C). Resistance should be 2100-2900 ohms across sensor terminals. Connect harness to sensor and measure between control unit connector pin 23 and ground. Resistance should be the same as before. If not, repair harness.

Oxygen Sensor – **1)** Connect all wiring and battery cables. Start engine and warm to normal operating temperature. Open hood and run engine at 2000 RPM for 5 minutes. If engine does not run smoothly, check air flow meter, cylinder head temperature sensor and air temperature sensor.

2) Accelerate engine several times, then check idle. If not 600-700 RPM in "D", check vacuum control modulator and idle speed control system.

NOTE – *Special ECCS tester is required for idle speed system check.*

3) Check timing. If not 17-23° BTDC, adjust to 20° BTDC with adjustment screw on crankshaft sensor bracket (loosen sensor bolts first).

4) Using a mirror, check that inspection lamp on bottom of control unit goes on and off more than 5 times in 10 seconds with engine running at 2000 RPM in "N". If so, sensor is okay.

5) If not, check oxygen sensor harness. If harness is okay, replace oxygen sensor.

Oxygen Sensor Harness – Disconnect harness from sensor in exhaust pipe and connect to ground with jumper wire. Measure resistance between ground and pin 24 in control unit connector. Zero resistance should be measured. If not present, repair harness.

Control Unit Ground Circuits – Measure resistance between ground and the following control unit connector terminals: 28, 36, 107, 108, 109, 112 and 113. Continuity should be present in all cases. If not, repair harness.

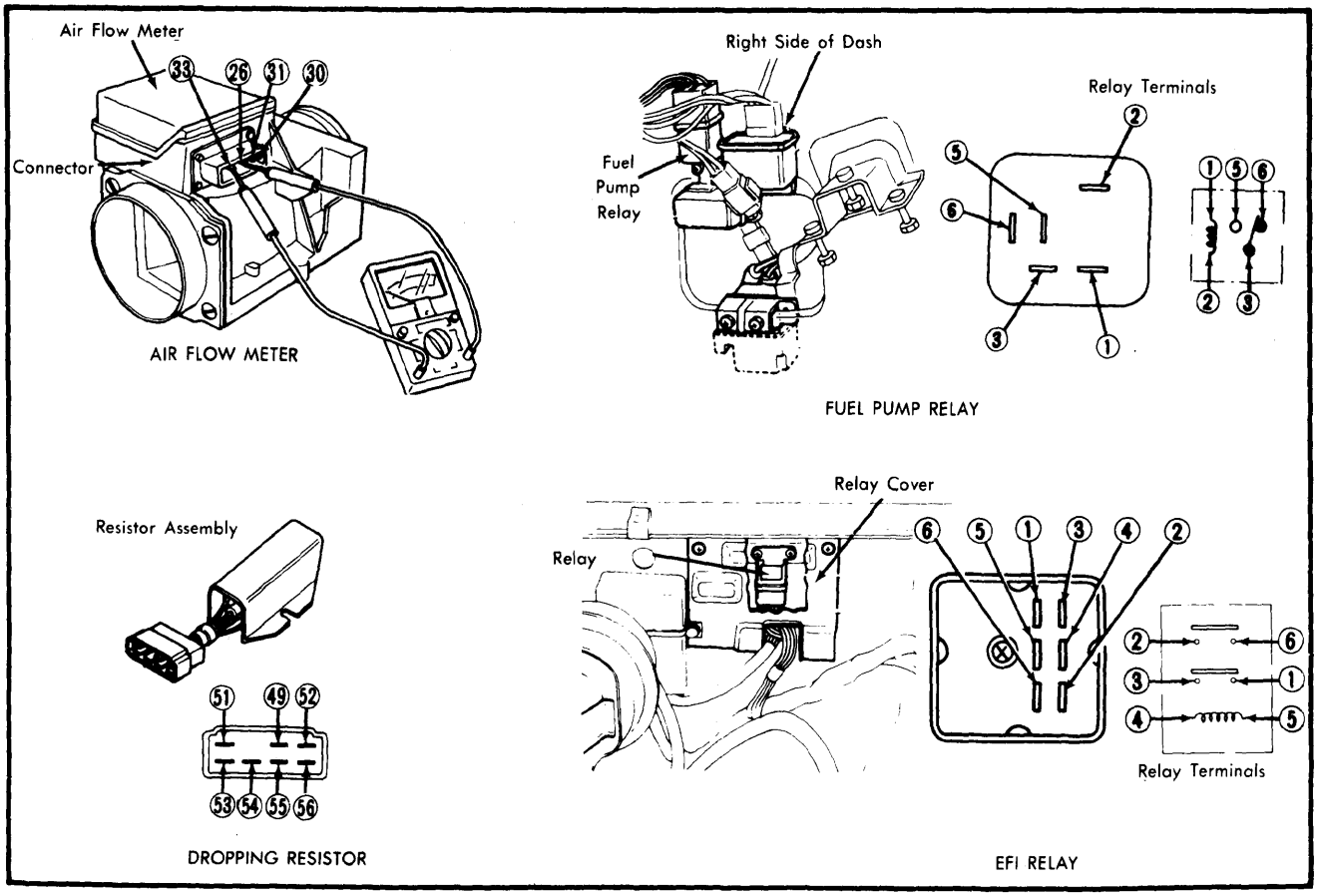

Fig. 4 Datsun ECCS Component Testing Locations

DATSUN ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM (Cont.)

Air Regulator – 1) Connect ohmmeter between pin 108 in control unit connector and ground. Resistance should be 25-90 ohms.

2) Connect battery ground cable and leave starter "S" wire disconnected. Turn ignition to "START" position. Using a voltmeter, measure between terminals 108 in control unit connector and ground. Battery voltage should be present. If not, go to next step.

3) Fuel pump should operate for 5 seconds with ignition on and engine not running. If pump is not heard, check pump relay. If pump is heard, go to next step.

4) Start engine and pinch hose between throttle chamber and air regulator. Engine speed should decrease during warm-up but not when engine is at operating temperature. Disconnect hoses from both ends of regulator and see if flap opens. It should move smoothly. Check resistance across terminals on regulator. If continuity exists, regulator is good. If not, replace regulator.

Fuel Pump Relay – Fuel pump relay is mounted on right side of dashboard. Remove relay and check continuity. It should be present between terminals 1 and 2, and terminals 3 and 6. With 12 volts applied to terminals 1 and 2, continuity should be present across terminals 3 and 5. If test is okay, check harness. If not okay, replace relay. See *Fig. 4.*

Injectors – 1) Connect battery ground cable and turn ignition on. Use a voltmeter to measure between ground and the following terminals at control unit connector: 101, 102, 103, 104, 105 and 106. Battery voltage should be present at all terminals. If so, go to step **3)**. If not, go to next step.

2) If battery voltage was not present at terminal, check the appropriate injector. Disconnect battery ground cable and remove connectors at injector. Continuity should exist across terminals on injector. If not, replace injector.

NOTE – *Injector circuits are numbered according to cylinder number. For example, injector power circuit 103 goes to cylinder 3, and dropping resistor circuit 53 goes to cylinder 3.*

3) Check dropping resistor by disconnecting connector at dropping resistor unit and measuring between terminal 49 and all other terminals. Resistance should be about 6 ohms. Replace resistor if any circuit is defective.

EFI Relay – 1) With battery cables connected and ignition on, measure voltage between control unit connector pin 35 and ground. Battery voltage should be present. If not, check EFI relay operation. Relay is located under a cover in engine compartment. See *Fig. 4.*

2) Continuity should exist across terminals 4 and 5. With battery voltage applied to 4 and terminal 5 grounded, continuity should exist across 1 and 3, and 2 and 6. If not, replace relay.

Ignition Signal Circuit – Disconnect starter motor "S" terminal and connect battery ground cable. Turn ignition switch to "START". Measure voltage between control unit connector pin 9 and ground. If battery voltage is not present, check harness and ignition coil.

Vacuum Control Modulator – 1) Connect battery ground cable and turn ignition on. Measure voltage between control unit connector terminal 2 and ground. Battery voltage should be present.

2) Check for battery voltage between terminal 4 and ground. If voltage is present in both checks, modulator solenoid valves are okay. If not, disconnect both connectors at modulator.

3) Check resistance between terminals for each solenoid valve on modulator. Resistance should be 40 ohms for each valve. If not, replace vacuum control modulator.

Park/Neutral Switch – Connect battery ground cable and turn ignition on. Connect voltmeter between control unit connector pin 10 and ground. With transmission lever in "P" or "N", battery voltage should be present. If not, check harness or replace switch.

Air Conditioning Switch – Connect ohmmeter between control unit connector terminal 22 and ground. With switch on, zero resistance should be measured, and with switch off, infinity should be measured. If not correct, check harness or replace switch.

ADJUSTMENTS

THROTTLE VALVE SWITCH

Disconnect throttle valve switch connector. Connect ohmmeter across terminals 18 and 25, ensuring that continuity exists. Allow engine to run at idle and adjust switch so continuity is lost at about 750 RPM.

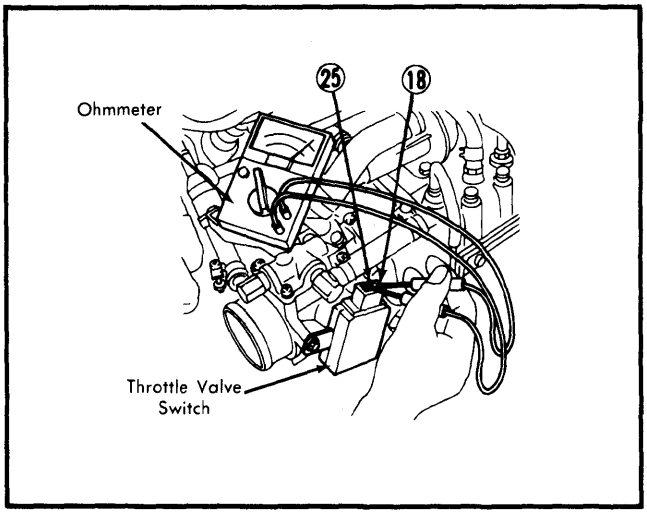

Fig. 5 Adjusting Throttle Valve Switch

CRANKSHAFT ANGLE SENSOR

NOTE – *Remove cover under engine compartment and adjust sensor from beneath vehicle.*

Crankshaft Angle Sensor Clearance – 1) To adjust radial clearance, loosen 2 adjuster mounting bolts (at extreme ends of bracket). Insert feeler gauge between sensor and disc, then press sensor against gauge while tightening bolts. See *Fig. 6.*

DATSUN ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM (Cont.)

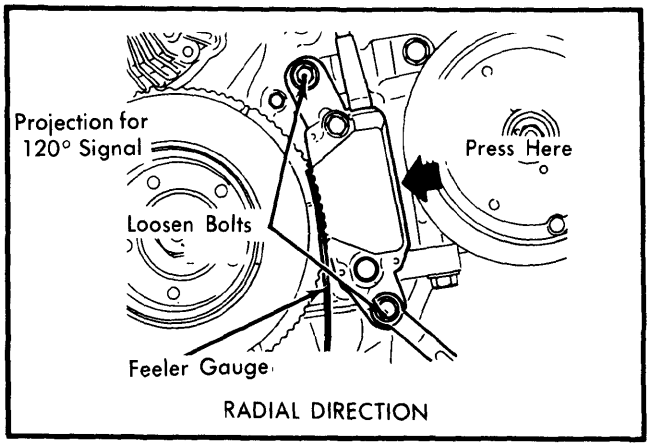

Fig. 6 Adjusting Crankshaft Angle Sensor Radial Clearance

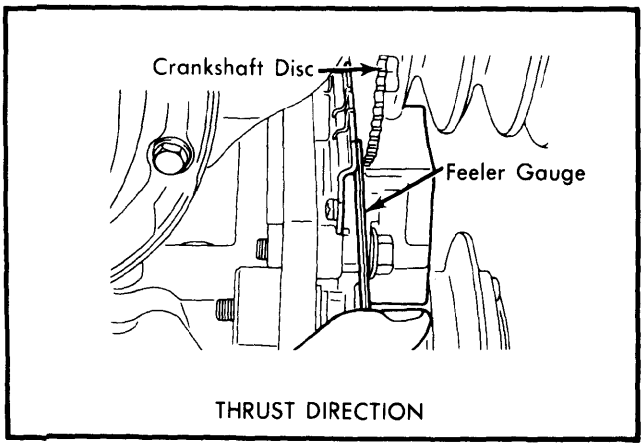

Fig. 7 Adjusting Crankshaft Angle Sensor Thrust Clearance

2) To adjust thrust clearance, loosen 4 air conditioning compressor bracket mounting bolts. Insert a feeler gauge between disc and sensor, then tighten bolts. *See Fig. 7.*

Crankshaft Sensor Clearance Specifications

Application	Checking In. (mm)	Adjustment In. (mm)
Radial	.039-.055 (1.0-1.4)	.047 (1.2)
Thrust	.039-.052 (1.0-1.4)	.047 (1.2)

NOTE – *Ignition timing cannot be adjusted by rotating the distributor. The crankshaft angle sensor must be adjusted to change idle speed timing.*

Ignition Timing – 1) Check ignition timing at idle speed using a timing light. If timing is not 20±3° BTDC, remove cover under engine compartment. Loosen crankshaft angle sensor bolts (2 bolts retaining sensor to adjuster).

2) To advance ignition timing, tighten adjusting screw. This will move crankshaft angle sensor upward. To retard ignition timing, loosen adjusting screw, this will move crankshaft angle sensor downward. *See Fig. 8.*

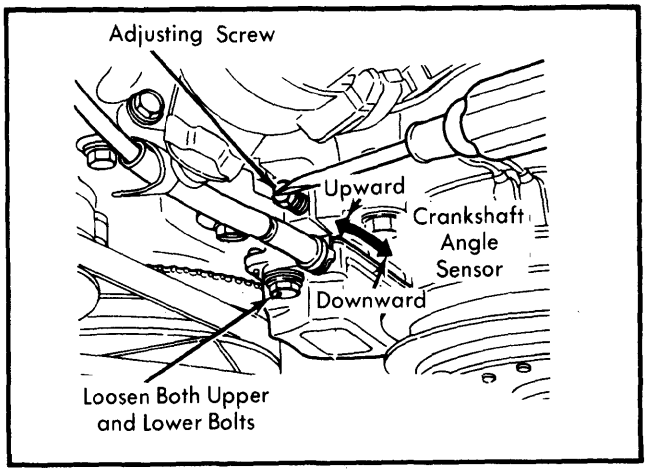

Fig. 8 Adjusting Ignition Timing by Turning Crankshaft Angle Sensor Adjusting Screw

3) After adjusting ignition timing, recheck crankshaft angle sensor radial and thrust clearances. Correct if necessary.