



## DESCRIPTION

### Hot Wire Multiport Fuel Injection

The 'Hot Wire' Multiport fuel injection system derives its name from the mass air flow sensor which uses one cold wire and one electrically heated wire to measure the volume of air entering the engine.

The function of the system is to supply the exact amount of fuel directly into the intake manifold according to the prevailing engine operating conditions.

To monitor these conditions, various sensors are fitted to the engine to measure engine parameters. Data from the sensors is received by the Engine control module (ECM), the ECM will then determine the exact amount of fuel required at any condition.

The ECM having received data from the sensors produces pulses, the length of which will determine the simultaneous open time of each bank of injectors in turn, which will govern the amount of fuel injected.

### Engine control module - ECM

The Multiport fuel injection system is controlled by the 14 CUX Engine Control Module comprising of a microprocessor with integrated circuits and components mounted on printed circuit boards. The ECM is connected to the main harness by a 40 pin plug.

### Injectors

The eight fuel injectors are fitted between the pressurized fuel rail and inlet manifold. Each injector comprises a solenoid operated needle valve with a movable plunger rigidly attached to the nozzle valve. When the solenoid is energized the plunger is attracted off its seat and allows pressurized fuel into the intake manifold.

### Engine coolant temperature sensor

The engine coolant temperature sensor is located in the front of the thermostat housing. The sensor provides engine coolant information to the ECM. The ECM increases the injector opening time when cold to provide improved driveability, and reduces the opening time as the engine reaches normal operating temperature.

### Engine fuel temperature sensor

The engine fuel temperature sensor is located in the rail on the RH side of the ram housing. The sensor sends fuel temperature data to the ECM, the ECM on receiving the data will adjust the injector open time accordingly to produce good hot starting in high ambient temperatures.

### Idle air control valve

The idle air control valve is screwed into a housing attached to the rear of the plenum chamber, between the plenum chamber and bulkhead. The idle air control valve has two windings which enable the motor to be energised in both directions thus opening or closing the air valve as required by the ECM. The idle air control valve will open and allow extra air into the plenum chamber to maintain engine idle speed when the engine is under increased (Electrical and Mechanical) loads. The idle air control valve will control engine idle speed when the vehicle is stationary.

### Heated oxygen sensors (O<sub>2</sub> sensors) - Catalyst vehicles

The two heated oxygen sensors are located forward of the catalysts mounted in the exhaust downpipes. The sensors monitor the oxygen content of the exhaust gases and provide feedback information of the air/fuel ratio to the ECM. Each sensor is heated by an electrical element to improve its response time when the ignition is switched on.

## Fuel pressure regulator

The fuel pressure regulator is mounted in the fuel rail at the rear of the plenum chamber. The regulator is a mechanical device controlled by plenum chamber vacuum, it ensures that fuel rail pressure is maintained at a constant pressure difference of 2.5 bar above that of the manifold.

When pressure exceeds the regulator setting excess fuel is returned to the fuel tank.

## Fuel pump

The electric fuel pump is located in the fuel tank, and is a self priming 'wet' pump, the motor is immersed in the fuel within the tank.

## Air flow sensor

The hot-wire air flow sensor is mounted on a bracket attached to the left hand valance, rigidly connected to the air cleaner and by hose to the plenum chamber inlet neck.

The air flow sensor consists of a cast alloy body through which air flows. A proportion of this air flows through a bypass in which two wire elements are situated: one is a sensing wire and the other is a compensating wire. Under the control of an electronic module which is mounted on the air flow sensor body, a small current is passed through the sensing wire to produce a heating effect. The compensating wire is also connected to the module but is not heated, but reacts to the temperature of the air taken in, as engine intake air passes over the wires a cooling effect takes place.

The electronic module monitors the reaction of the wires in proportion to the air stream and provides output signals in proportion to the air mass flow rate which are compatible with the requirements of the ECM.

## Throttle position sensor

The throttle position sensor is mounted on the side of the plenum chamber inlet neck and is directly coupled to the throttle butterfly shaft.

The throttle position sensor is a resistive device supplied with a voltage from the ECM. Movement of the accelerator pedal causes the throttle valve to open, thus rotating the wiper arm within the throttle position sensor which in turn varies the resistance in proportion to the valve position. The ECM lengthens the injector open time when it detects a change in output voltage (rising) from the throttle position sensor.

In addition the ECM will weaken the mixture when it detects the throttle position sensor output voltage is decreasing under deceleration and will shorten the length of time the injectors are open.

When the throttle is fully open, the ECM will detect the corresponding throttle position sensor voltage and will apply full load enrichment. This is a fixed percentage and is independent of temperature. Full load enrichment is also achieved by adjusting the length of the injector open time.

When the throttle is closed, overrun fuel cut off or idle speed control may be facilitated dependant on other inputs to the ECM.

The throttle position sensor is 'self adaptive', which means that adjustment is not possible. It also means the throttle position sensor setting is not lost, for example, when throttle stop wear occurs.



**CAUTION: Do not attempt to adjust throttle position sensor.**



### Tune select resistor -

To suit individual market requirements a tune select resistor is connected across pins 5 and 27 of the ECM.

It is located adjacent to the ECM, and strapped to the MFI cable assembly. The value of the resistor is dependent on the market application:

Red wire, 180 ohms, Australia, Rest of world.

Green wire, 470 Ohms, UK and Europe - non catalyst.

Yellow wire 910 Ohms, Saudi non catalyst.

White wire, 3K9 Ohms, European catalyst

### Condenser fans

It should be noted that under high coolant temperatures, when the engine is switched off, the condenser fans will be activated and will run for approximately ten minutes.

### Vehicle speed sensor

The vehicle speed sensor is located on the side of the Transfer box adjacent to the parking brake. The sensor provides road speed data to the ECM. The ECM in turn detects vehicle movement from the road speed input and ensures that idle air control mode is disengaged. Should the vehicle speed sensor fail in service the ECM idle air control would become erratic.

The sensor also provides road speed data to the electric speedometer and cruise control ECU.

### Inertia fuel shutoff switch

The inertia fuel shutoff switch is a mechanically operated switch, located on the bulkhead adjacent to the washer reservoir under bonnet [hood].

The switch is normally closed and is in line with the fuel pump. In the event of a sudden impact the switch opens, and disconnects the electrical feed to the fuel pump. The switch is reset by pressing down the button.



**WARNING: Check the integrity of the fuel system before the inertia switch is reset.**

### Relay modules

The two multiport fuel injection relays are located in the RH footwell area behind the 'A' post panel. The main relay module is energized via the ECM when the ignition is switched on and supplies current to the multiport fuel injection system. The fuel pump relay module is energized by the ECM which in turn operates the fuel pump to pressurize the fuel system.