

■ ENGINE CONTROL SYSTEM

1. General

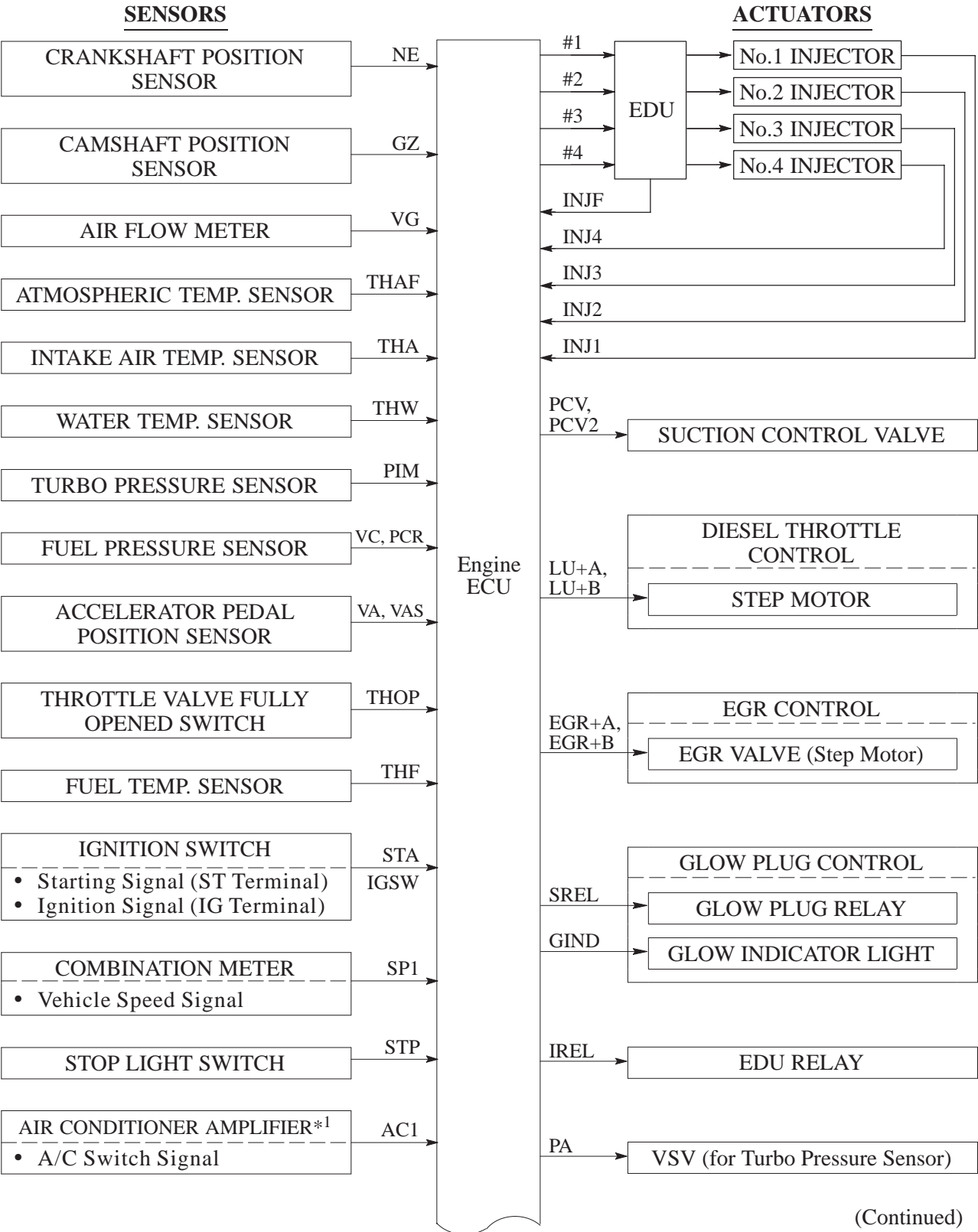
► System Comparison List ◀

System	Outline	Avensis Verso/ Picnic	Avensis	Previa
Fuel Injection Volume Control (See page EG-76)	Based on the signals received from the sensors, the engine ECU determines the fuel injection volume in accordance with the engine condition.	○	○	○
Fuel Injection Timing Control (See page EG-76)	Based on the signals received from the sensors, the engine ECU determines the fuel injection timing in accordance with the engine condition.	○	○	○
Fuel Pressure Control (See page EG-77)	Based on the signals received from the sensors, the engine ECU determines fuel pressure in accordance with engine condition.	○	○	○
Pilot Injection Control (See page EG-77)	Based on the signals received from the sensors, the engine ECU determines pilot injection volume/timing, and interval (between pilot injection and main injection) in accordance with the engine condition.	○	○	○
Idle Speed Control (See page EG-78)	The engine ECU determines the idle speed in accordance with the engine condition, and controls the fuel injection volume in order to maintain the target idle speed.	○	○	○
Glow Plug Control	Controls the length of time when the current is applied to the glow plugs, in accordance with engine coolant temperature.	○	○	○
EGR Control (See page EG-78)	Based on the signals received from the sensors, the engine ECU determines the EGR volume via EGR valve and throttle valve in accordance with the engine condition.	○	○	○
Turbo Pressure Control (See page EG-79)	Based on the signals received from the sensors, the engine ECU controls the actuator via VRV in accordance with the engine condition.	○	—	○
Diesel Throttle Control	Fully close the throttle in order to reduce the vibration when the engine is stopped.	○	○	○
Air Conditioner Cut-off Control*	By controlling the air conditioner compressor ON or OFF in accordance with the engine condition, drivability is maintained.	○	○	○
Engine Immobiliser	Prohibits fuel injection if an attempt is made to start the engine with an invalid ignition key.	○	○	○
Diagnosis (See page EG-79)	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.	○	○	○
Fail-safe (See page EG-80)	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.	○	○	○

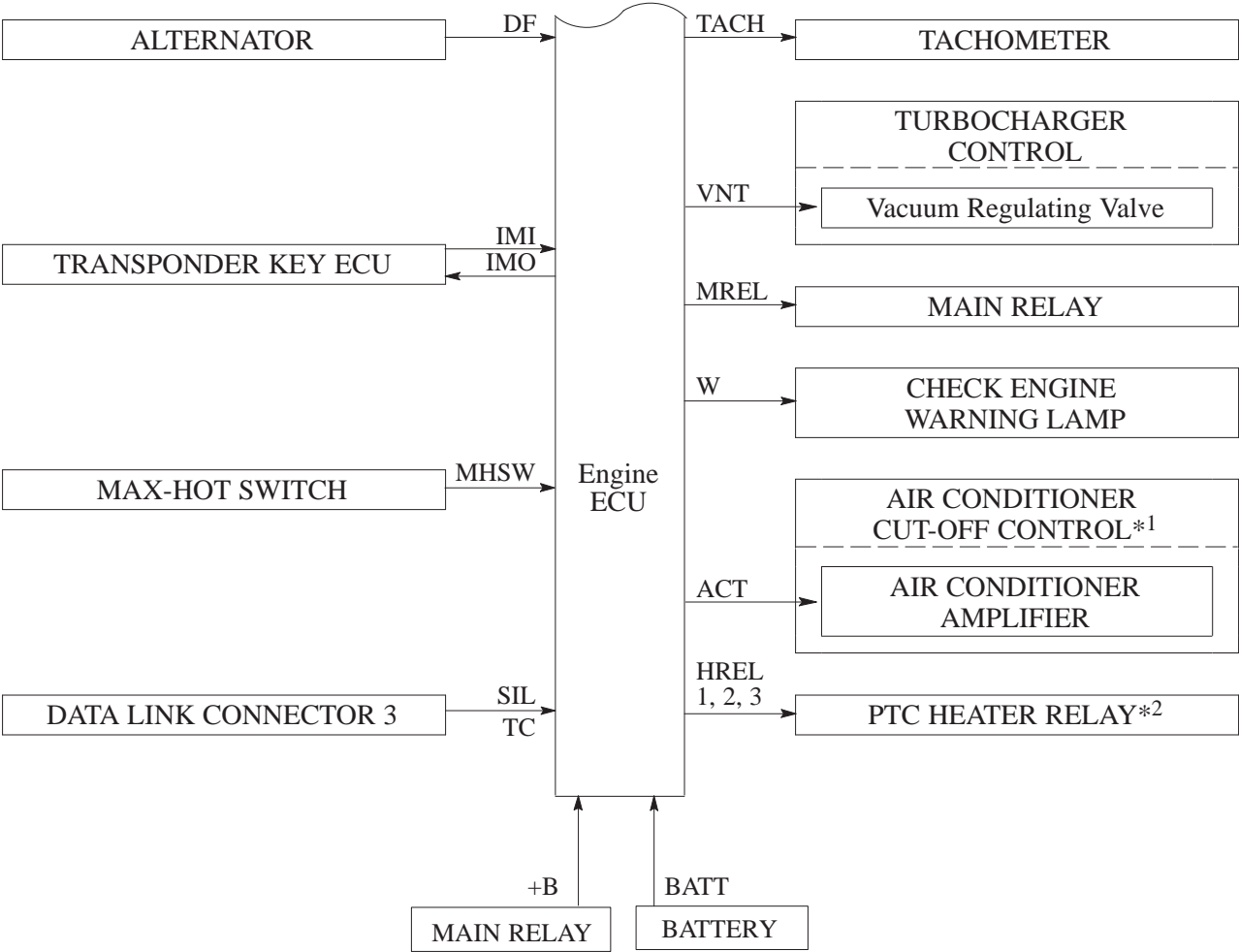
*: with Air Conditioner System

2. Construction

The configuration of the engine control system in the 1CD-FTV engine is shown in the following chart.



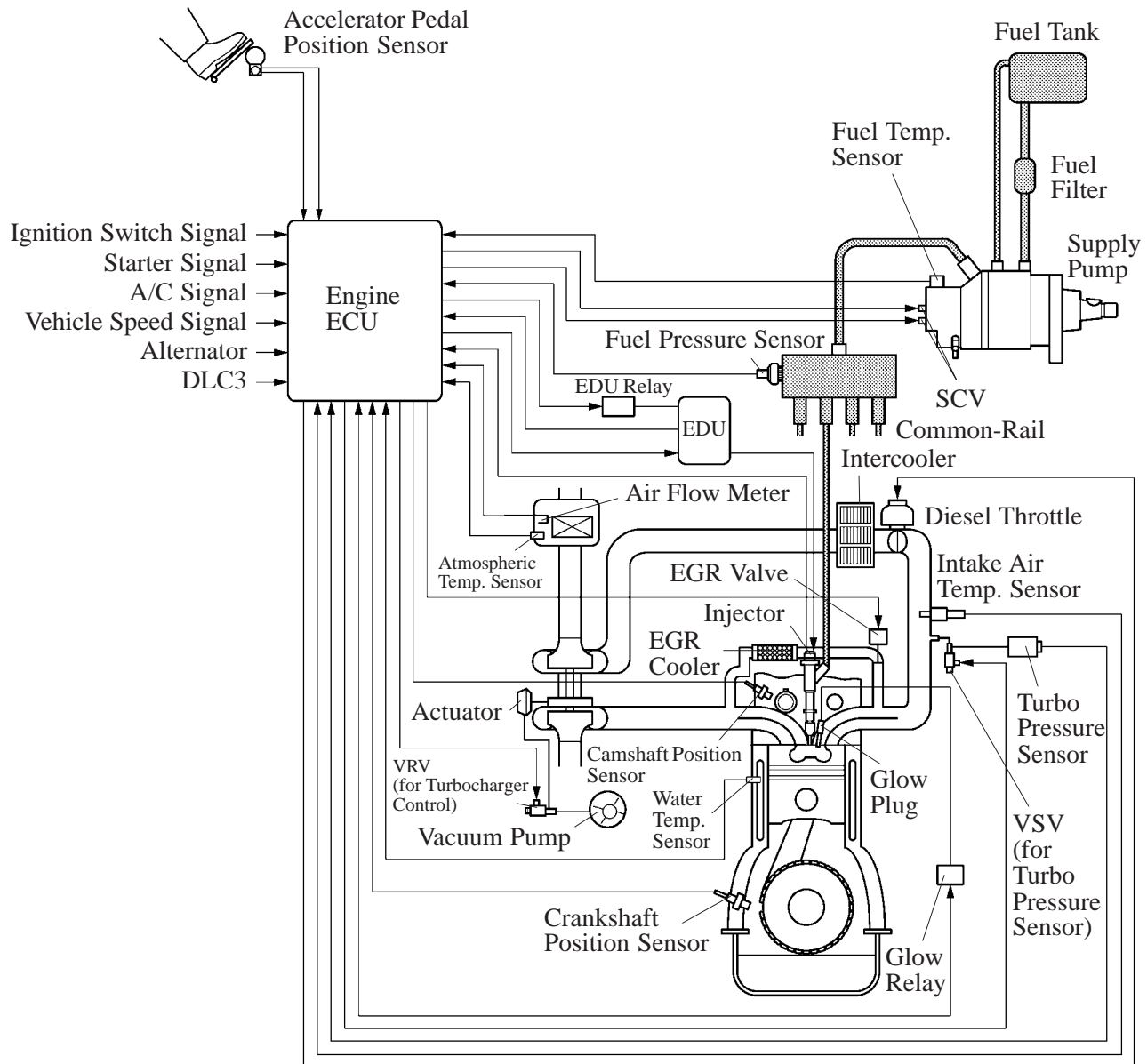
*1: with Air Conditioner System



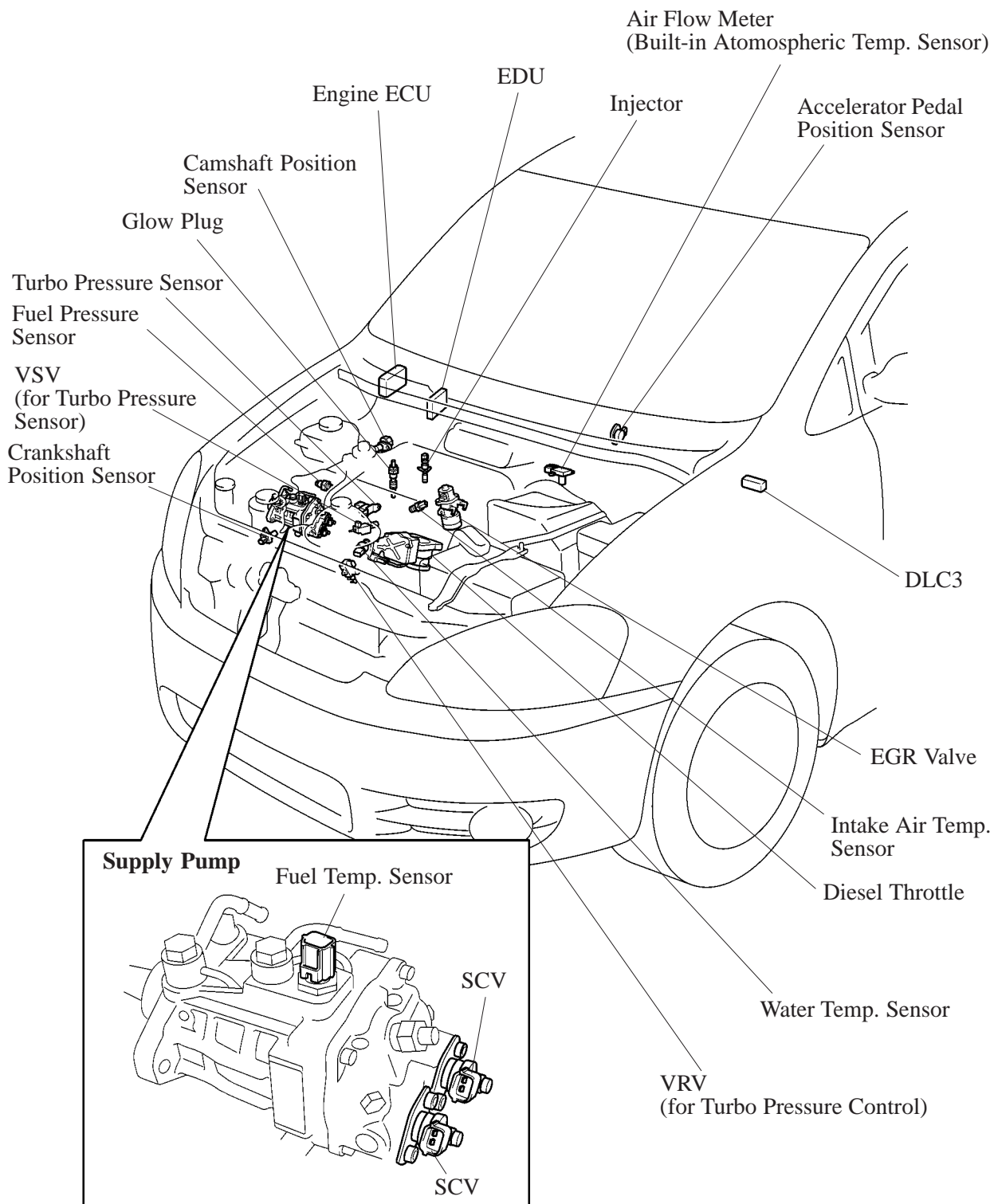
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*1: with Air Conditioner System
*2: with PTC Heater

3. Engine Control System Diagram



4. Layout of Main Components



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5. Main Component of Engine Control System

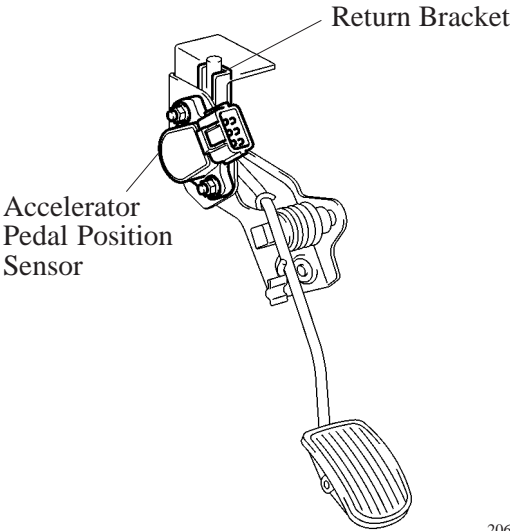
General

The main components of the 1CD-FTV engine control system are as follows:

Components	Outline	Quantity
Air Flow Meter	Hot-wire Type	1
Crankshaft Position Sensor (Rotor Teeth)	Pick-up Coil Type (36-2)	1
Camshaft Position Sensor (Rotor Teeth)	Pick-up Coil Type (1)	1
Accelerator Pedal Position Sensor	Linear Type	2 (Main, Sub)
EDU	DC/DC Converter	1

— Changes (from Avensis) —

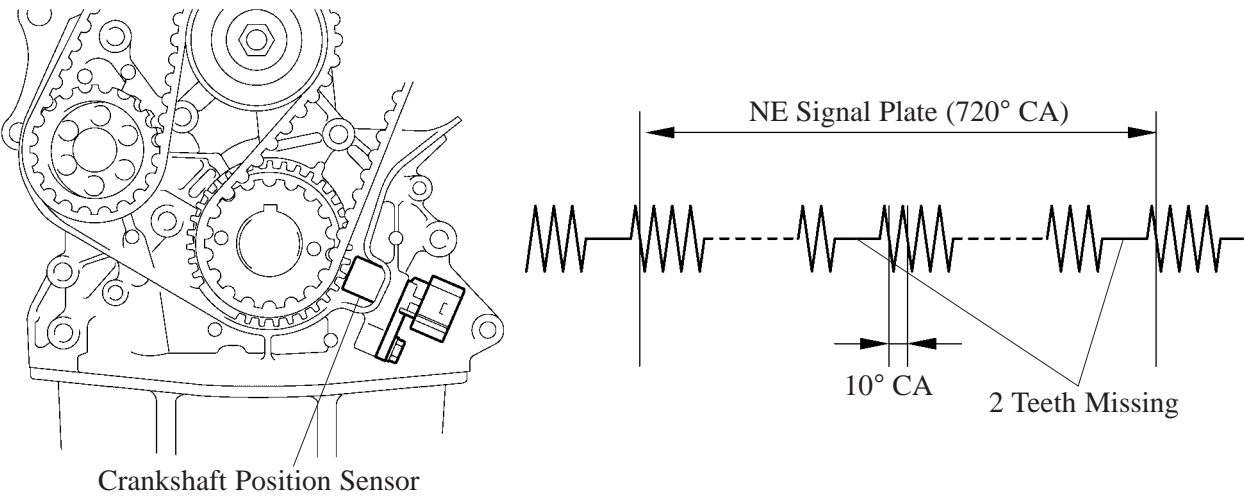
A return bracket has been provided on the accelerator pedal position sensor, and in order to forcefully return the sensor lever to the fully closed position, the accelerator pedal switch has been discontinued.



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Crankshaft Position Sensor

The timing rotor of the crankshaft consists of 34 teeth, with 2 teeth missing. The crankshaft position sensor outputs the crankshaft rotation signals every 10°, and the missing teeth are used to determine the top-dead-center.



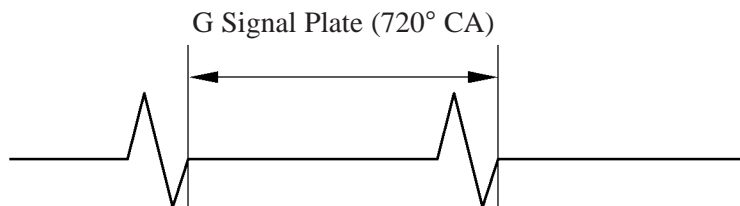
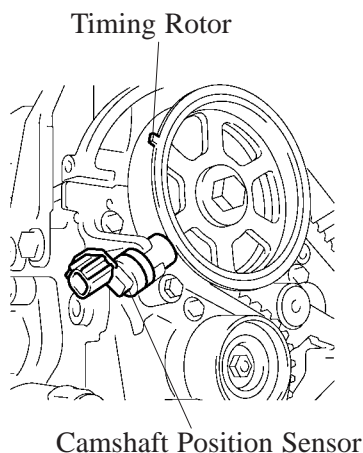
Crankshaft Position Sensor

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Camshaft Position Sensor

To detect the camshaft position, a protrusion that is provided on the timing pulley is used to generate 1 pulse for every 2 revolution of the crankshaft.

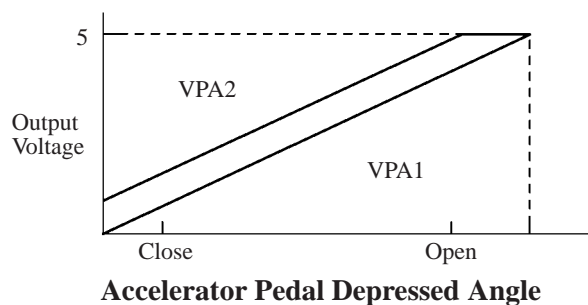
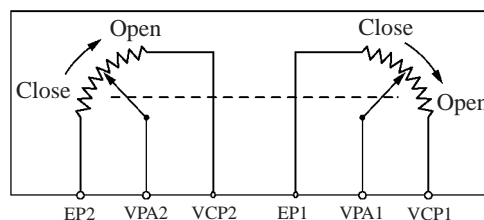
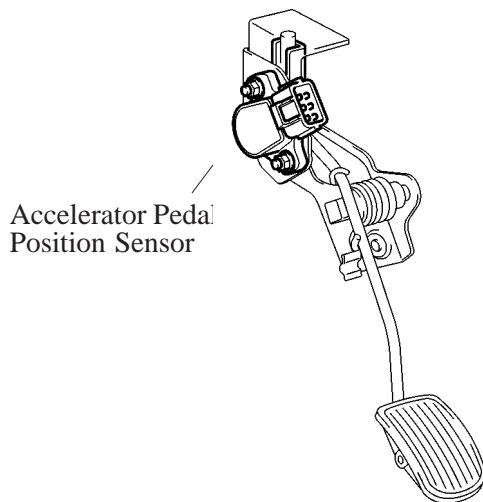


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Accelerator Pedal Position Sensor

This sensor converts the accelerator pedal depressed angles into electric signals with two differing characteristics and outputs them to the engine ECU. One is the VPA1 signal that linearly outputs the voltage along the entire range of the accelerator pedal depressed angle. The other is the VPA2 signal that outputs on offset voltage.

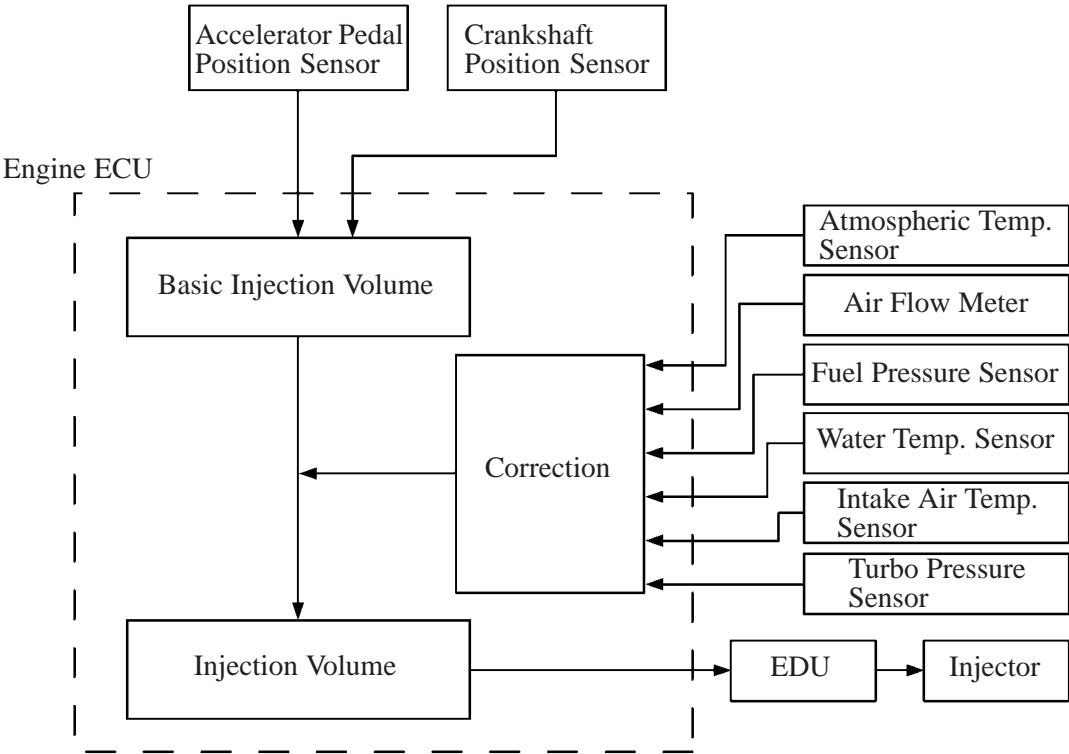


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6. Fuel Injection Volume Control

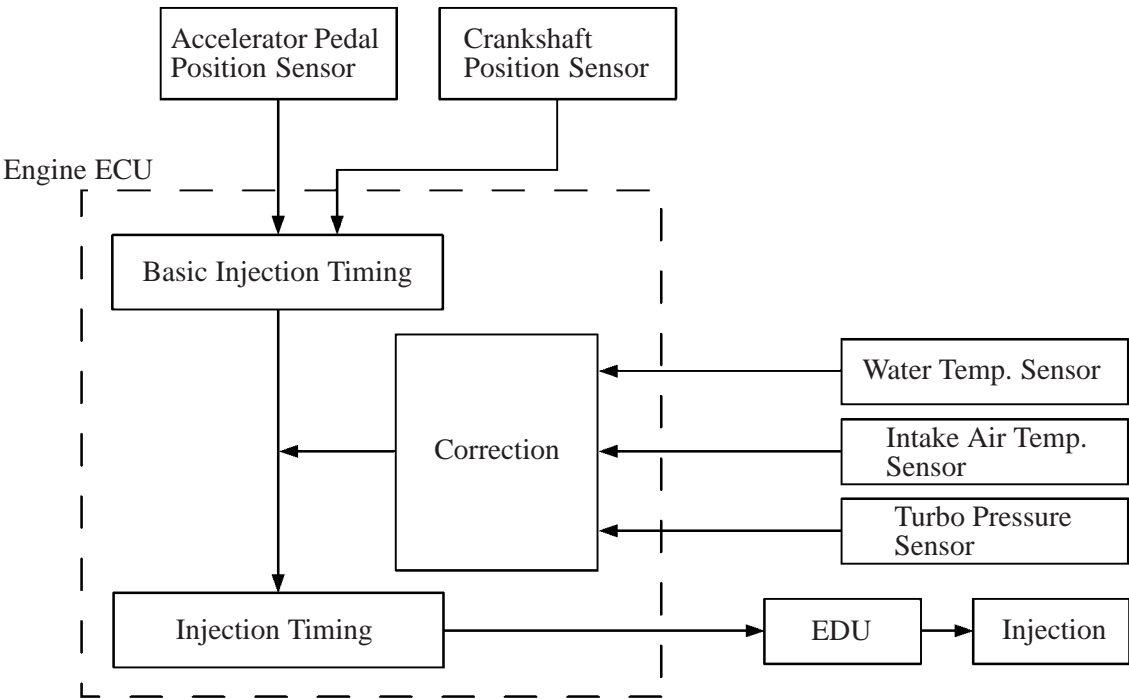
Fuel injection volume is controlled as shown below.



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7. Fuel Injection Timing Control

Fuel injection timing is controlled as shown below.



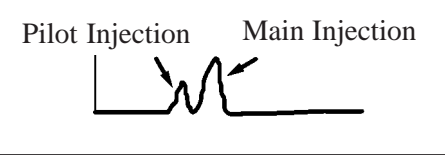
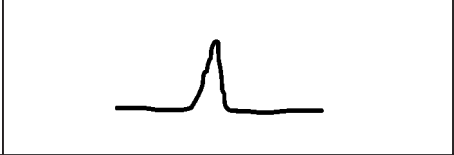
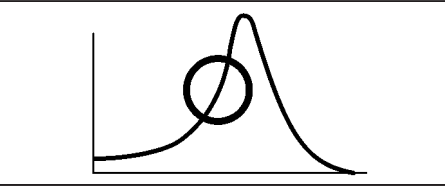
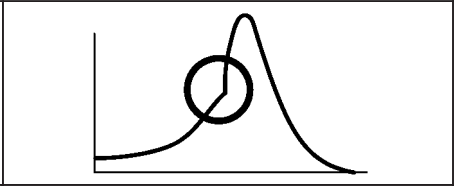
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8. Fuel Pressure Control

The target injection pressure is calculated based on the signals from the accelerator pedal position sensor and the crankshaft position sensor. To control fuel pressure, signals are sent to the SCV of the supply pump in order to regulate the pumping volume so that the pressure detected by the fuel pressure sensor matches the target injection pressure.

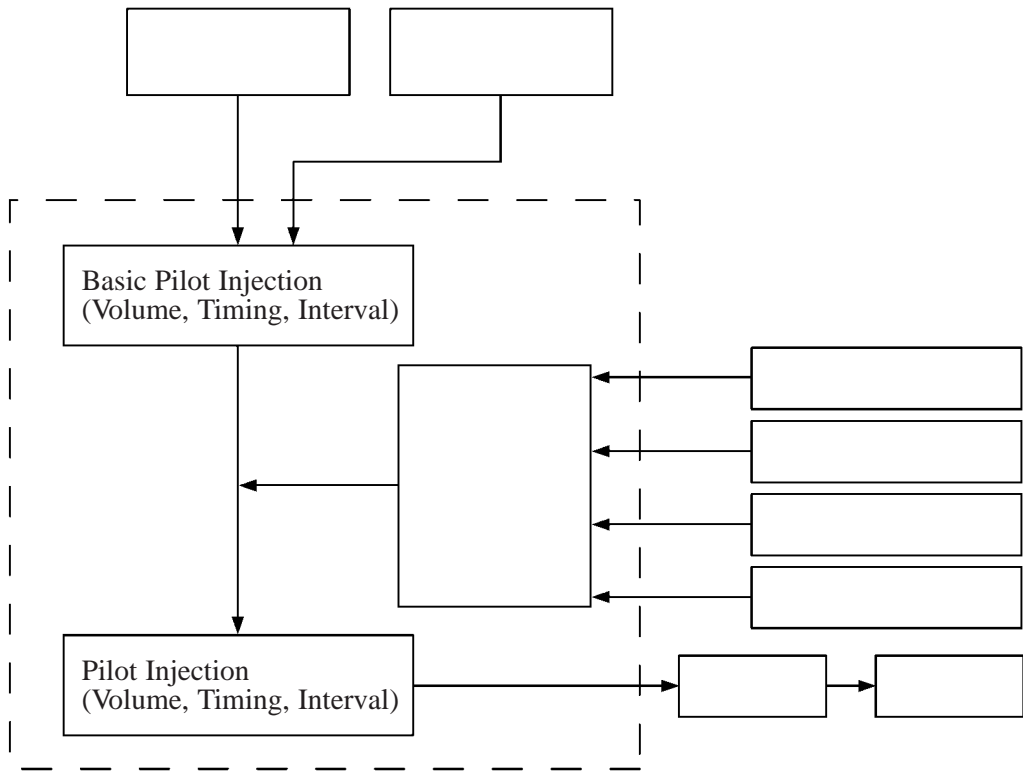
9. Pilot Injection Control

- Pilot injection is a method that provides an auxiliary fuel injection before the main fuel injection takes place. The purpose of pilot injection is to gently start the combustion of the fuel of the main injection in order to reduce vibration and noise.

State	Pilot Injection	Ordinarily Injection
Fuel Injection		
Combustion Pressure		

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- During pilot injection, the pilot injection volume, timing, and interval (between pilot injection and main injection) are controlled as shown below.



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10. Idle Speed Control

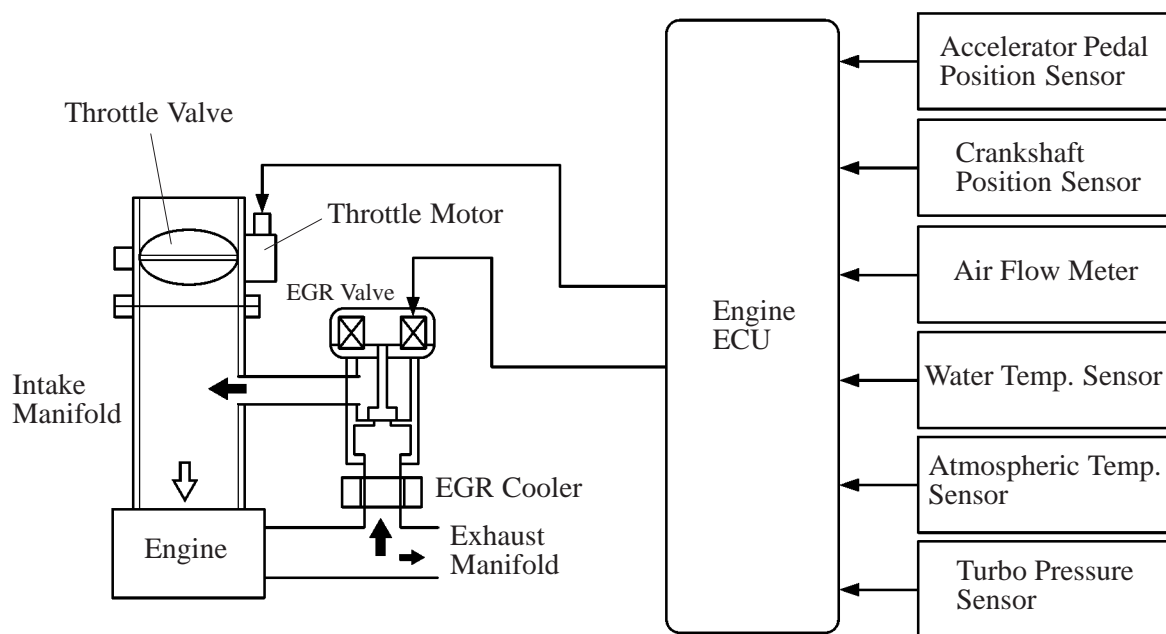
- In this system, the engine ECU calculates the target engine speed in accordance with the engine condition, and determines the fuel injection volume, thus controlling the idle speed rpm.
- During cold operation, the idle is increased by turning ON the idle up switch, thus improving the heating performance of the heater.

11. EGR Control

By sensing the engine driving conditions, the control unit electrically operates EGR valve and throttle opening position with step motor and the amount of recirculating exhaust gas is regulated.

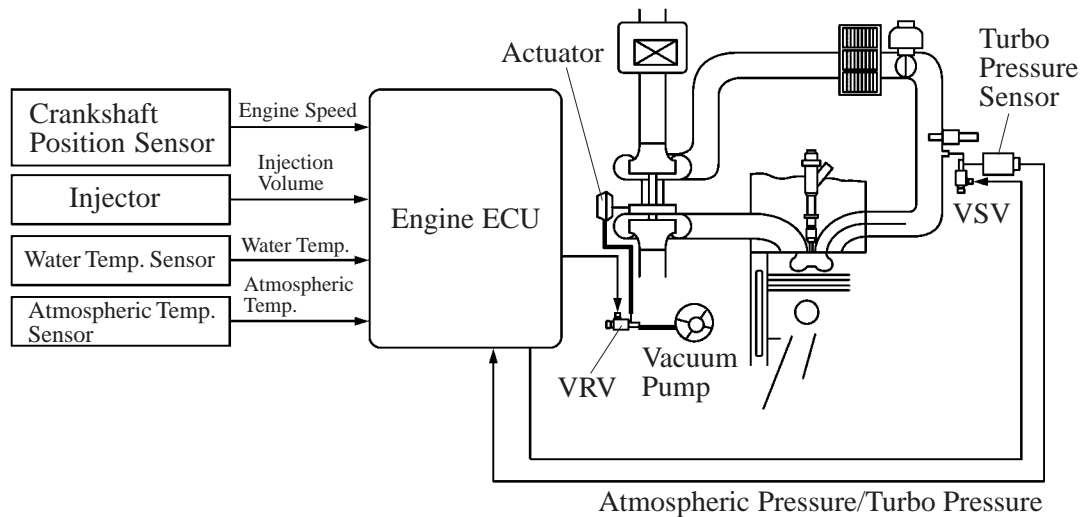
— Change (from Avensis) —

The VRV (Vacuum Regulating Valve) for EGR and the VSV (for cutoff) have been discontinued.



12. Turbo Pressure Control

- The turbo pressure (intake manifold pressure) is controlled by the variable nozzle vane located in the turbine area. This nozzle is actuated by the actuator that is directly connected to it. This actuator is actuated by the vacuum pressure that has been regulated by the VRV (Vacuum Regulating Valve) in accordance with the signals from the engine ECU.
- The engine ECU calculates an optimal turbo pressure in accordance with the driving conditions (engine speed, injection volume, atmospheric pressure, and water temperature). It controls the variable nozzle so that the turbo pressure detected by the turbo pressure sensor matches the calculated turbo pressure.
- The turbo pressure sensor detects the atmospheric pressure and the turbo pressure by switching the VSV (Vacuum Switching Valve). This switching is effected by the engine ECU when no fuel is injected during idle or deceleration.



13. Diagnosis

When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorizes the failed section. Furthermore, check engine warning lamp in the combination meter illuminates or blinks to inform the driver. The engine will also store the DTCs (Diagnosis Trouble Codes) of the malfunctions.

The DTCs can be accessed by connecting the SST (09843-18040) to the DLC3 terminals Tc and CG, and reading the blinking of the check engine warning lamp. They can also be accessed by connecting a hand-held tester.

— Change (from Avensis) —

The DTCs listed below have been added or discontinued.

► Added DTC ◀

DTC No.	Detection Item
34 (2)	Turbocharger System Malfunction
34 (3)	Turbocharger Stick Detected (Close)
34 (4)	Turbocharger Stick Detected (Open)
51	Stop Light Switch Malfunction
71	Exhaust Gas Recirculation Control Circuit Malfunction (Open)
89	Interior IC Malfunction

► Discontinued DTC ◀

DTC No.	Detection Item
19 (3)	Accelerator Pedal Switch Circuit Malfunction (Short)
19 (4)	Accelerator Pedal Switch Circuit Malfunction (Open)

14. Fail Safe

When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.

► Fail-Safe Control List ◀

Location of Malfunction	Description of Control
Accelerator Pedal Position Sensor	<p>The accelerator pedal position sensor comprises two (main, sub) circuits.</p> <ul style="list-style-type: none"> If a malfunction occurs in either one of the sensor circuits, the engine ECU detects, the abnormal signal voltage difference between these two sensor circuits and switches to the limp mode. In the limp mode, the remaining circuits is used to calculate the injection control, in order to operate the vehicle under limp mode control. If both systems malfunction, the engine ECU considers that the accelerator pedal is fully closed.
Water Temp. Sensor	In case of a signal malfunction, the engine ECU fixes the uses the constant values of 120°C (248.0°F) water temperature to perform the calculation. However, in case that the fuel temperature is less than 15°C (59.0°F), a fuel temperature sensor controls as a substitute for a water temperature sensor.
Intake Air Temp. Sensor	In case of a signal malfunction, the engine ECU fixes the uses the constant values of 90°C (194.0°F) intake air temperature to perform the calculation.
Fuel Temp. Sensor	In case of a signal malfunction, the engine ECU fixes the uses the constant values of 40°C (104.0°F) fuel temperature to perform the calculation.
Turbo Pressure Sensor	In case of a signal malfunction, the engine ECU calculates the injection volume limited by the turbo pressure fixed value and continues effecting injection control.