Print Exit

6AR-FSE ENGINE CONTROL SFI SYSTEM CONTROL ENGINE CONTROL

FUNCTION OF MAIN COMPONENTS

a. The main components of the engine control system are as follows:

Component		Outline	Quantity	Function
ECM		VFOREST + VFOREST	1	The ECM optimally controls the SFI, ESA and ETCS-i to suit the operating conditions of the engine in accordance with the signals provided by the sensors.
Mass Air Flow Meter Sub-assembly	Mass Air Flow Meter	Silicon Chip Type	1	This sensor has a built-in silicon chip to directly detect the intake air mass.
	Intake Air Temperature Sensor	Thermistor Type	1	This sensor detects the intake air temperature by means of an internal thermistor.
Engine Coolant Temperature Sensor		Thermistor Type	1	This sensor detects the engine coolant temperature.
Temperature Sensor		Thermistor Type	1	This sensor detects the engine oil temperature.
Fuel Pressure Sensor		Semiconductor Type	1	The sensor senses the fuel pressure in the fuel delivery pipe sub-assembly (for direct injection).
Oil Pressure Sender Gauge Assembly		Semiconductor Type	1	This gauge detects the engine oil pressure.
Crankshaft Position Sensor [No. of Rotor Teeth]		Magneto-Resistance Element (MRE) [36 - 2]	1	This sensor detects the engine speed and crankshaft angle.
Camshaft Position Sensor (Intake Camshaft) [No. of Rotor Teeth]		Magneto-Resistance Element (MRE) Type [3]	1	· This sensor performs cylinder identification. · This sensor is used to detect the intake camshaft position.
Camshaft Position Sensor (Exhaust Camshaft) [No. of Rotor Teeth]		Magneto-Resistance Element (MRE) Type [3]	1	· This sensor performs cylinder identification. · This sensor is used to detect the exhaust camshaft position.
Manifold Absolute Pressure Sensor		Semiconductor Silicon Chip Type	1	This sensor detects the pressure in the intake manifold and sends signals to the ECM.
Throttle Body with Motor Assembly	Throttle Position Sensor	Linear (Non-contact) Type	1	This sensor detects the throttle valve opening angle.
	Throttle Control Motor	DC Motor	1	This motor regulates the opening of the throttle valve in accordance with signals from the ECM.
Knock Control Sensor		Built-in Piezoelectric Type (Non-resonant Type/Flat Type)	1	This sensor detects engine knocking indirectly through the vibration of the cylinder block caused by engine knocking.
Air Fuel Ratio Sensor		Heated Type (Planar Type)	1	As with the heated oxygen sensor, this sensor detects the oxygen concentration in the exhaust gas. However, it detects the oxygen concentration in the exhaust gas linearly.
Heated Oxygen Sensor		Heated Type (Cup Type)	1	This sensor detects the oxygen concentration in the exhaust gas by measuring the electromotive force which is generated in the sensor itself.

Component		Outline	Quantity	Function
Camshaft Timing Oil Control Valve Assembly		Solenoid Type	1	This solenoid changes the oil passage to the camshaft timing exhaust gear assembly in response to signals from the ECM.
Cam Timing Oil Control Solenoid Assembly		Solenoid Type	1	This solenoid controls the intake camshaft phase to achieve the optimal valve timing by moving the oil control valve.
Fuel Injector Assembly	For Port Injection	12-hole Type	4	The injector is an electromagnetically-operated nozzle which injects fuel in accordance with signals from the ECM.
	For Direct Injection	High Pressure Single Slit Nozzle Type	4	This injector contains a high-pressure electromagnetically-operated nozzle to inject fuel directly into the cylinder.
Ignition Coil Assembly		Type with Igniter	4	This ignition coil assembly incorporates an igniter and provides high voltage necessary for ignition in accordance with signals from the ECM.
Spark Plug		Iridium-tipped Type	4	This spark plug produces a spark inside the cylinder using high voltage electricity delivered from the ignition coil assembly.
EGR Valve Assembly		Step Motor Type	1	This valve opens and closes based on signals from the ECM and controls the flow rate of the exhaust gas in the EGR bypass.

SYSTEM CONTROL

a. The engine control system of the 6AR-FSE engine has the following features:

System		Outline
Direct Injection 4-stroke Gasoline Engine Superior Version Sequential Multiport Fuel Injection (D-4S SFI)		· This is an L-type SFI system. It directly detects the intake air volume with a silicon chip type mass air flow mater sub-assembly. · The D-4S SFI system is a fuel injection system which combines direct injection injectors and port injection injectors. · Based on signals from each sensor, the ECM controls the injection volume and timing of each type of injector (direct and port injection types) in accordance with the engine speed and engine load in order to optimize combustion conditions.
Electronic Spark Advance (ESA)		· Ignition timing is determined by the ECM based on signals from various sensors. The ECM corrects ignition timing in response to engine knocking. · This system determines the optimal ignition timing in accordance with the signals received from the sensors and sends ignition (IGT) signals to the igniters.
Electronic Throttle Control System-intelligent (ETCS-i)		Optimally controls the opening angle of the throttle valve in accordance with the accelerator pedal input and the engine and vehicle operating conditions.
Variable Valve Timing-intelligent Wide (VVT-iW)		Regulates operation of the intake camshaft to ensure an optimal valve timing in accordance with the engine operating conditions.
Variable Valve Timing-intelligent (VVT-i)		Regulates operation of the exhaust camshaft to ensure an optimal valve timing in accordance with the engine operating conditions.
Fuel Pump Control	For High-pressure Pump	Regulates the fuel pressure within a range of 2.75 to 20 MPa in accordance with driving conditions.
	For Low-pressure Pump	· Fuel pump operation is controlled by signals from the fuel pump control ECU assembly. · The fuel pump is stopped when an SRS airbag is deployed in a frontal collision.

System	Outline
Cooling Fan Control	Controls the radiator cooling fan operation in accordance with signals from the ECM based on the engine coolant temperature sensor signal and the operating condition of the air conditioning.
Cranking Hold Function (Starter Control)	Once the engine switch is pushed, this control operates the starter until the engine starts.
Air Fuel Ratio Sensor and Heated Oxygen Sensor Heater Control	Maintains the temperature of the air fuel ratio sensor or heated oxygen sensor at an appropriate level to increase the ability of each sensor to accurately detect the concentration of oxygen.
EGR Control	Based on the signals received from the sensors, the ECM determines the EGR volume in accordance with the engine operating conditions.
Evaporative Emission Control	The ECM controls the purge flow of evaporative emissions (HC) from the canister in accordance with the engine operating conditions.
Brake Override System	The driving torque is restricted when both the accelerator and brake pedals are depressed. (For the Activation Conditions and Inspection Method, refer to the repair manual)
Fail-safe	When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in memory.
Diagnosis	When the ECM detects a malfunction, the ECM records the malfunction and information that relates to the fault.

FAIL-SAFE

a. When a malfunction of any of the sensors is detected, there is a possibility of an engine or other malfunction occurring if the ECM were to continue normal control. To prevent such a problem, the fail-safe function of the ECM either relies on the data stored in memory to allow the engine control system to continue operating, or stops the engine if a hazard is anticipated. For details, refer to the Repair Manual.

DIAGNOSIS

a. When the ECM detects a malfunction, the ECM records information related to the fault. Furthermore, the Malfunction Indicator Lamp (MIL) in the combination meter assembly illuminates or blinks to inform the driver.

b. The ECM also stores Diagnostic Trouble Codes (DTCs) for malfunctions it has detected. The DTCs can be accessed by using the Global TechStream (GTS).

c. For details, refer to the Repair Manual.