

■ ENGINE CONTROL SYSTEM

1. General

The engine control system of the 2UZ-FE engine has the following features.

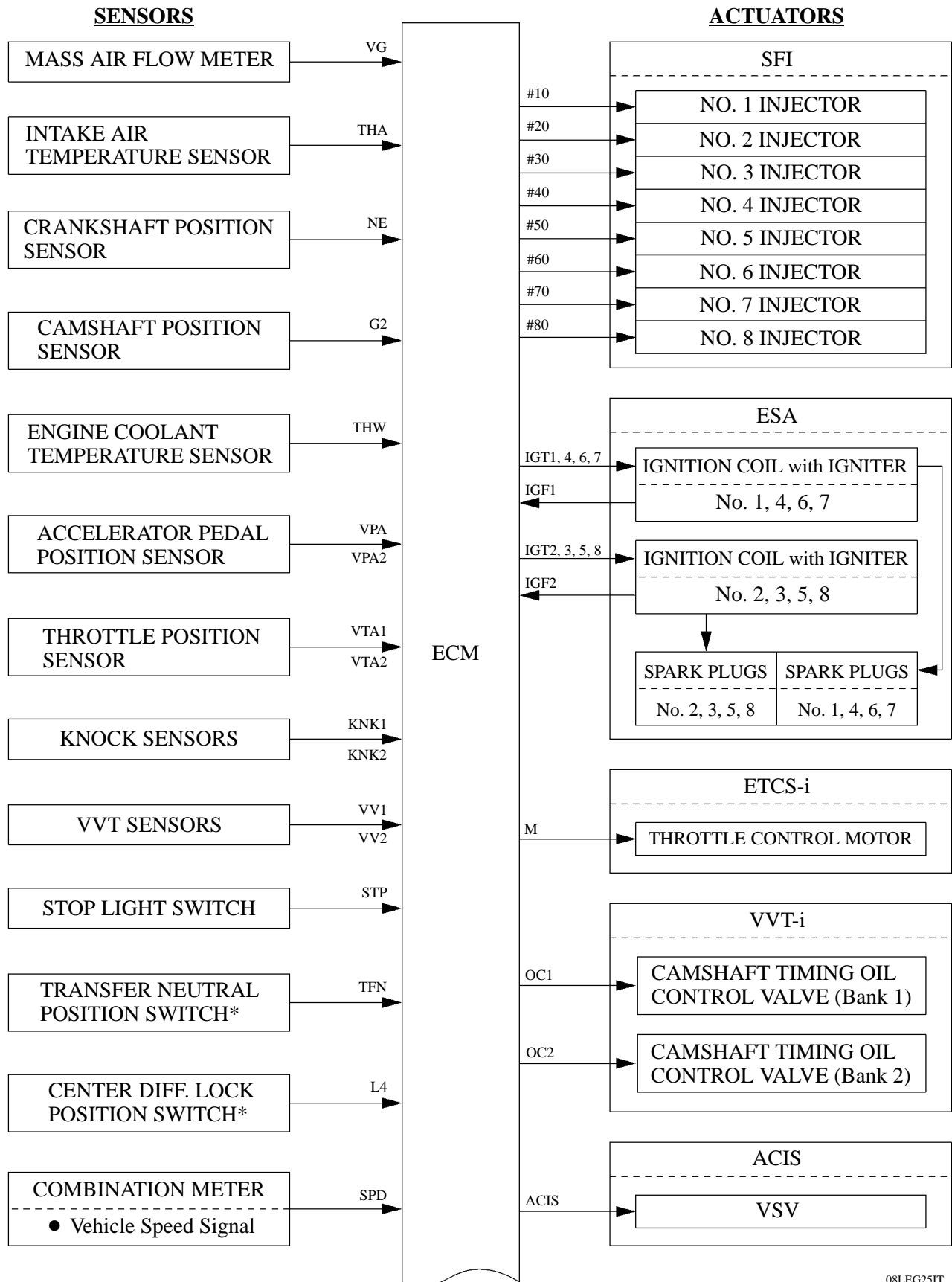
System	Outline
SFI (Sequential Multiport Fuel Injection)	<ul style="list-style-type: none"> ● An L-type SFI system directly detects the intake air mass using a hot wire type air flow meter. ● An independent injection system (in which fuel is injected once into each intake port for each two revolutions of the crankshaft) is used. ● Fuel injection takes two forms: <ul style="list-style-type: none"> – Synchronous injection, in which injection always occurs at the same timing relative to the firing order. – Non-synchronous injection in which injection is effected regardless of the crankshaft angle.
ESA (Electronic Spark Advance)	<ul style="list-style-type: none"> ● 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 selects the optimal ignition timing in accordance with the signals received from the sensors and sends the (IGT) ignition signal to the igniter.
ETCS-i (Electronic Throttle Control System-intelligent) [See page EG-49]	Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.
VVT-i (Variable Valve Timing-intelligent) [See page EG-54]	Controls the intake camshaft to optimal valve timing in accordance with the engine condition.
ACIS (Acoustic Control Induction System) [See page EG-58]	The intake air passages are switched according to the engine speed and throttle valve opening angle to provided high performance in all speed ranges.
Fuel Pump Control [See page EG-60]	<ul style="list-style-type: none"> ● Based on signals from the ECM, the fuel pump ECU controls the fuel pump to 3 stages. ● The fuel pump is stopped when the SRS airbag is deployed in a frontal, side, or side rear collision.
Air Injection Control [See page EG-62]	The ECM controls the air injection time based on the signals from the crankshaft position sensor, engine coolant temperature sensor, mass air flow meter and air pressure sensor.
Starter Control (Cranking Hold Function) [See page EG-66]	Once the ignition switch is turned ON, this control continues to operate the starter until the engine started.

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System	Outline
Air-fuel Ratio Sensor and Oxygen Sensor Heater Control	Maintains the temperature of the air-fuel ratio sensors or oxygen sensors at an appropriate level to increase the detection accuracy of the exhaust gas oxygen concentration.
Air Conditioning Cut-off Control	By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Evaporative Emission Control [See page EG-68]	<ul style="list-style-type: none"> ● The ECM controls the purge flow of evaporative emission (HC) in the canister in accordance with the engine conditions. ● Approximately five hours after the ignition switch has been turned OFF, the ECM operates the pump module to detect any evaporative emission leakage occurring between the fuel tank and the canister through changes in the fuel tank pressure.
Engine Immobilizer	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid key.
Diagnosis [See page EG-80]	When the ECM detects a malfunction, the ECM records the malfunction and memorizes information related to the fault.
Fail-safe [See page EG-80]	When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.

2. Construction

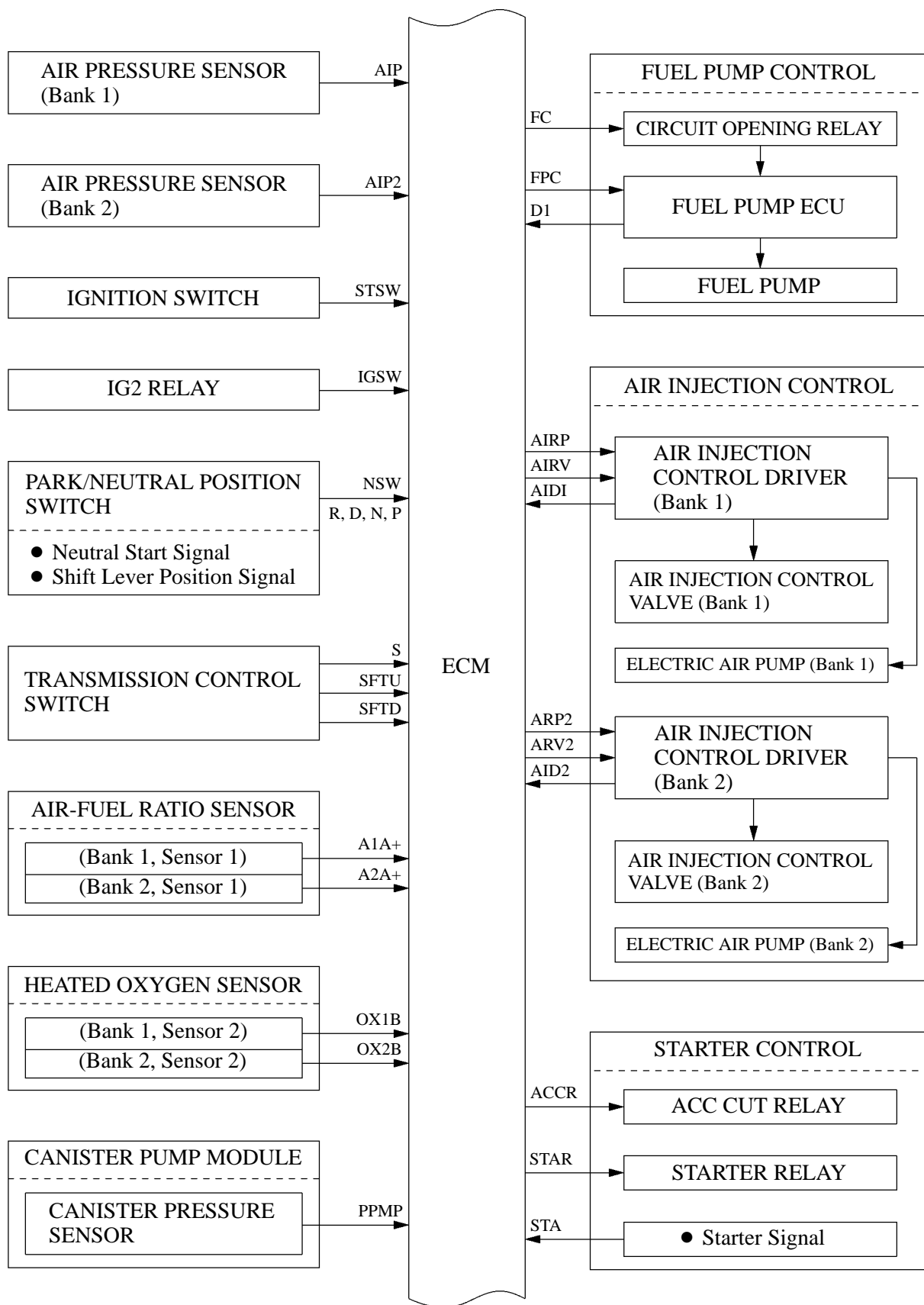
The configuration of the engine control system in the 2UZ-FE engine is as shown in the following chart.



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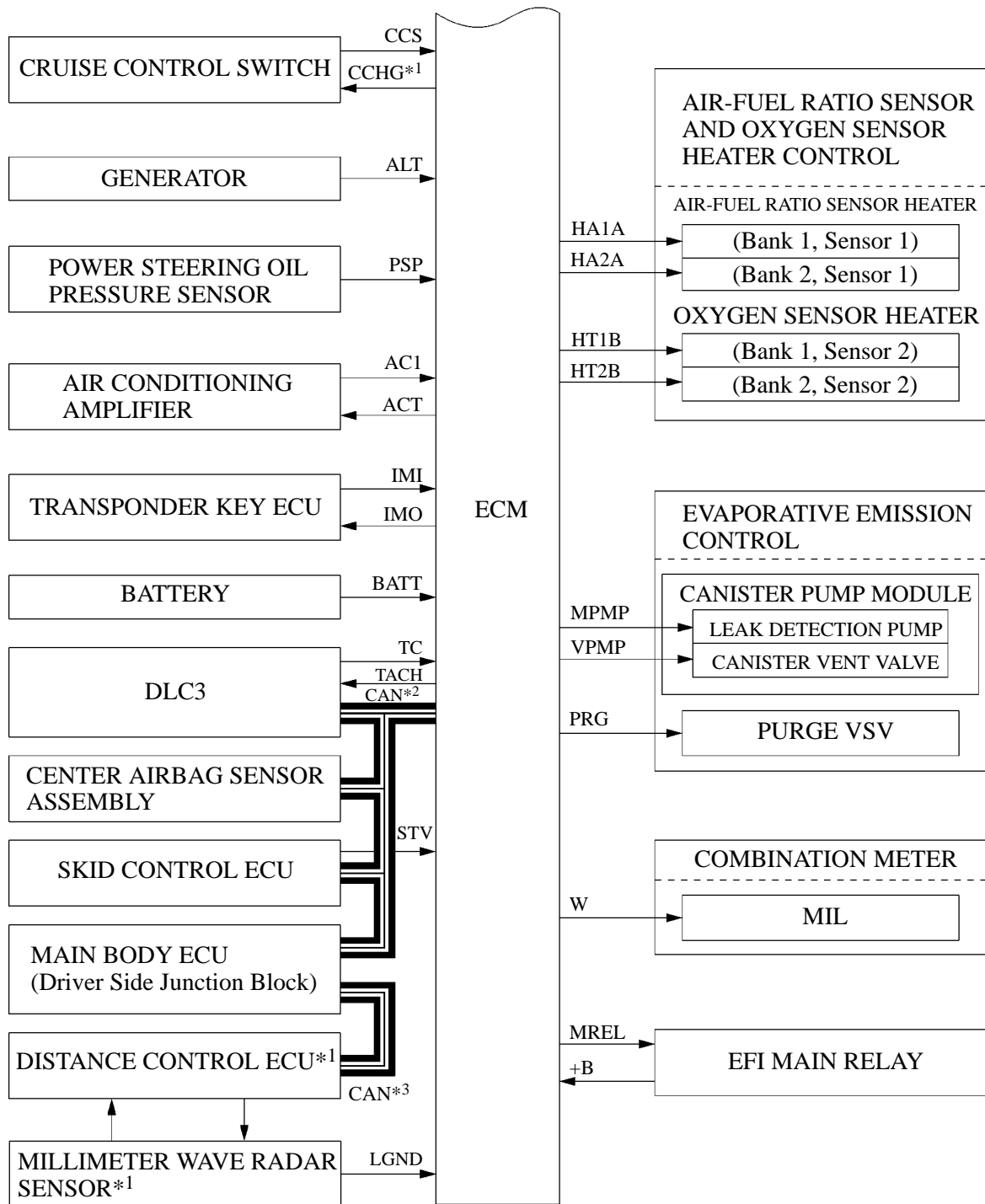
*: 4WD Models

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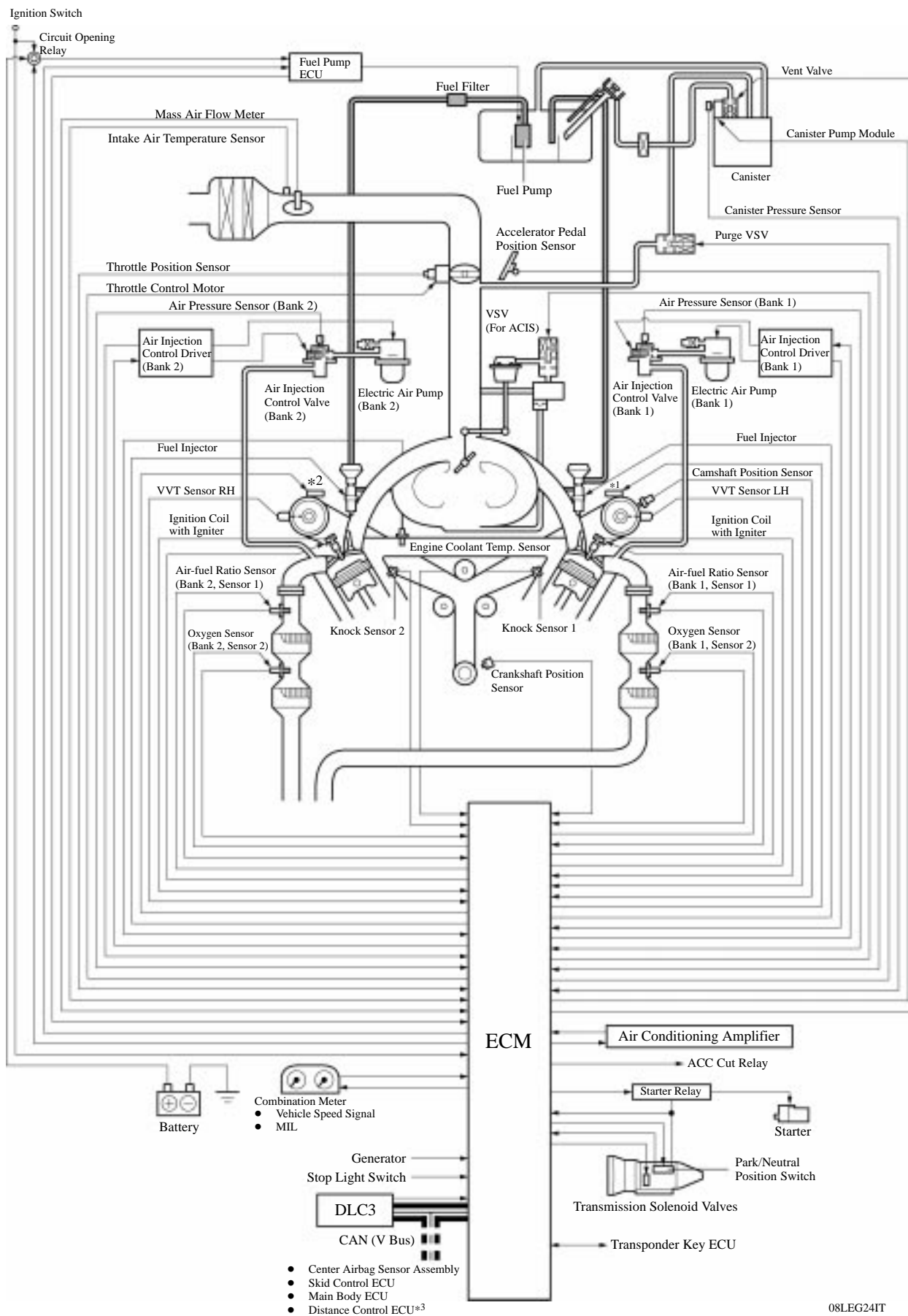
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*1: Models with Dynamic Laser Cruise Control System

*2: V Bus

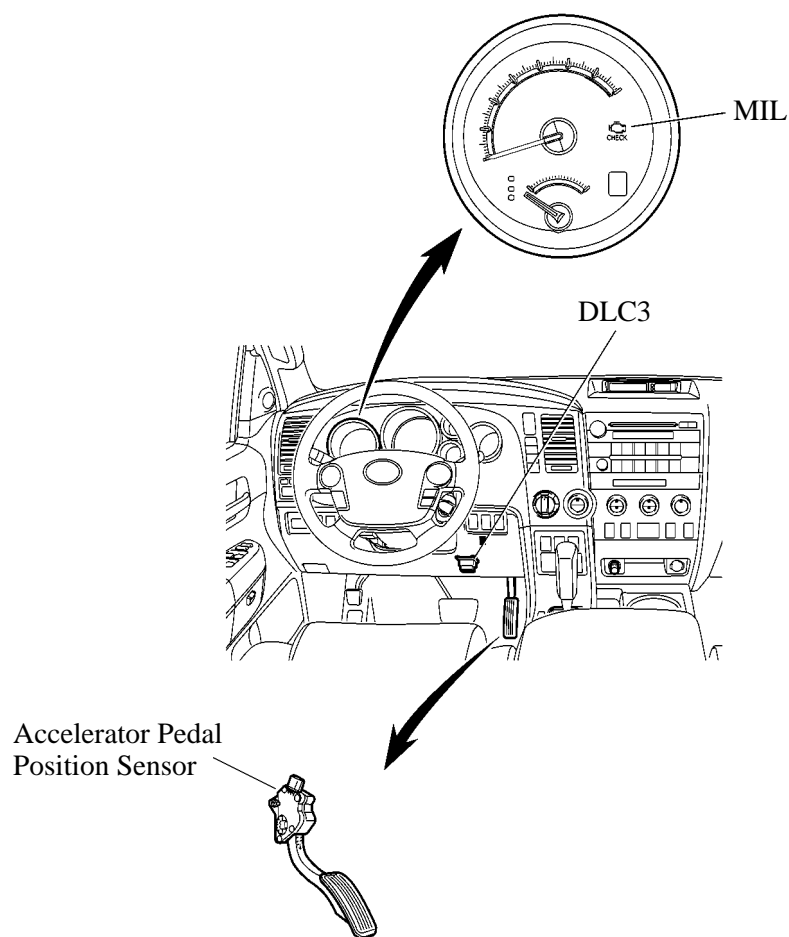
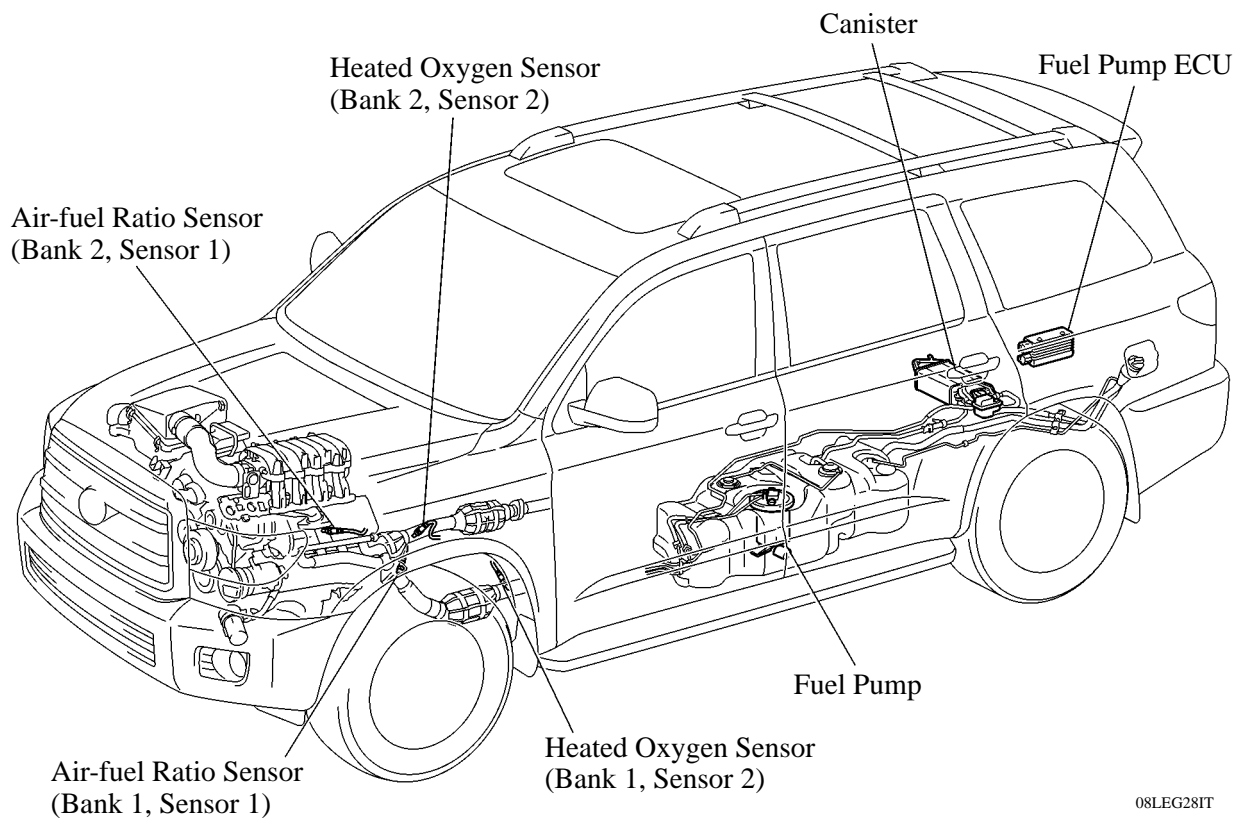
*3: MS Bus

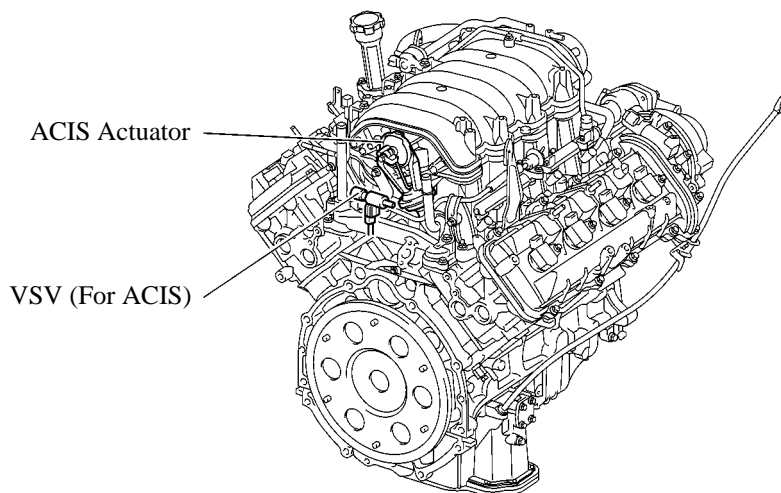
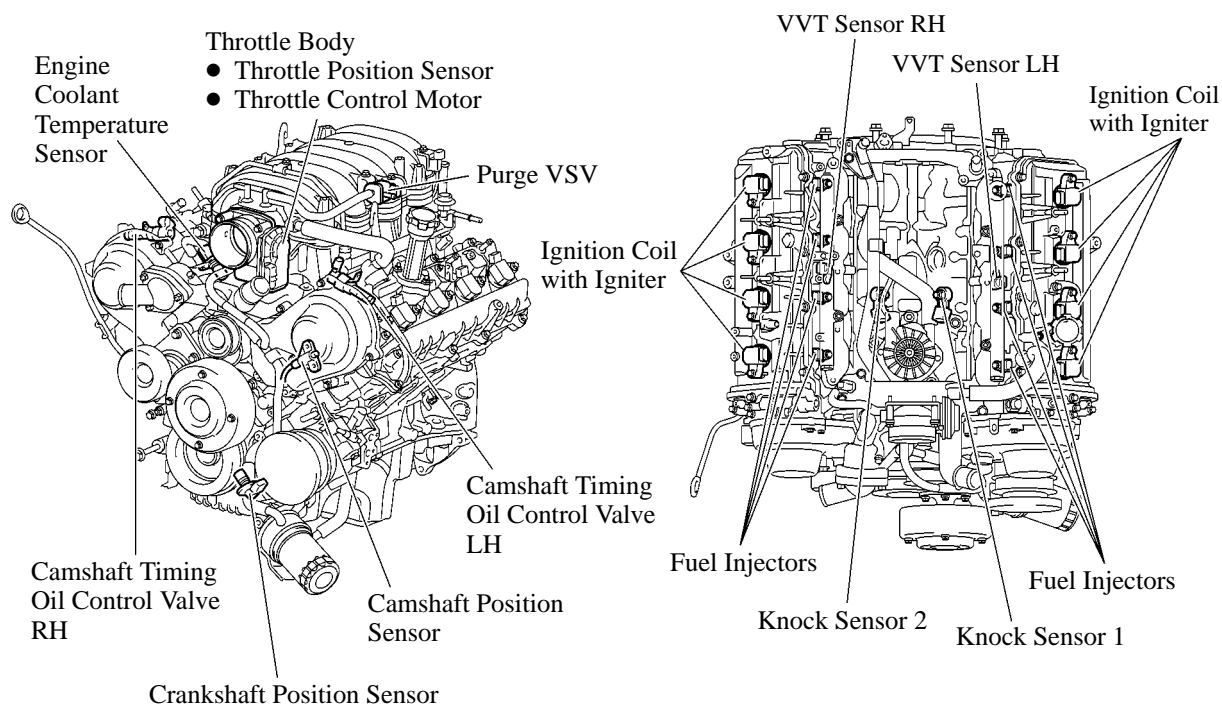
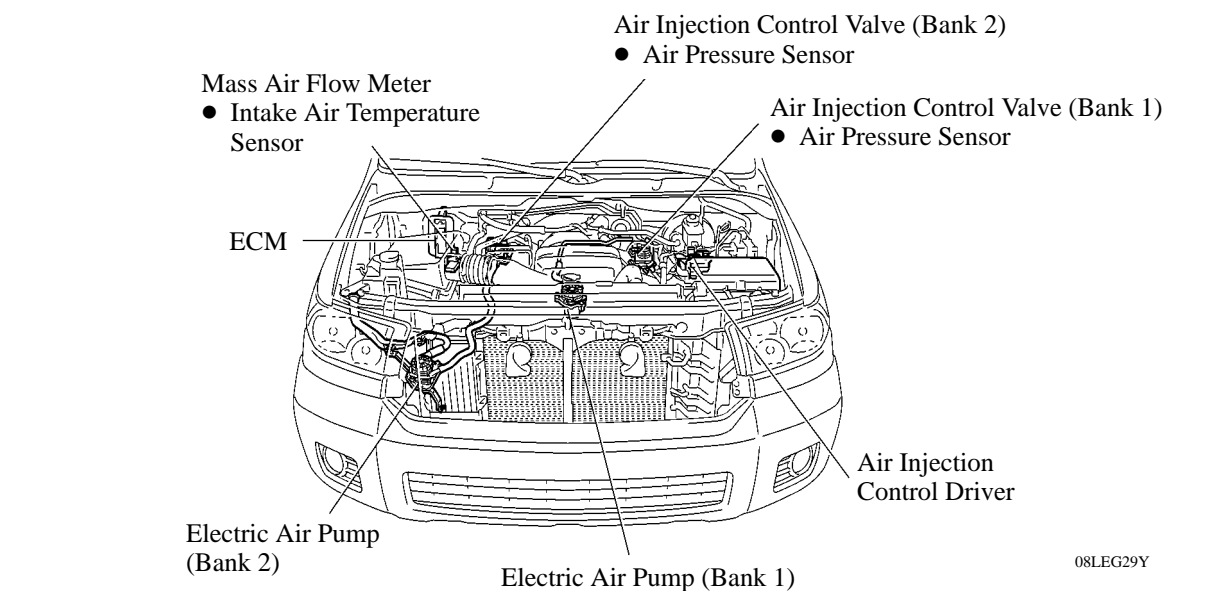
3. Engine Control System Diagram



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4. Layout of Main Components





5. Main Components of Engine Control System

General

The main components of the 2UZ-FE engine control system are as follows:

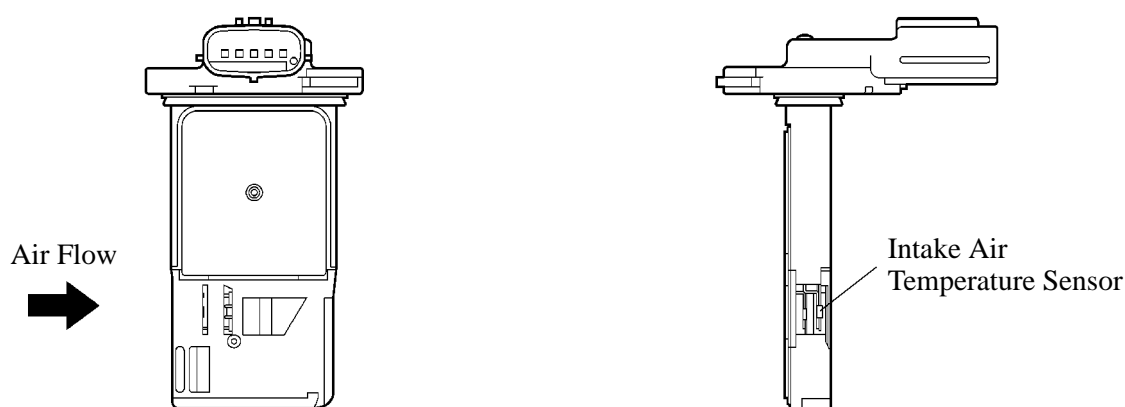
Components	Outline	Quantity	Function
ECM	32-bit CPU (DENSO)	1	The ECM optimally controls the engine control system to suit the operating conditions of the engine in accordance with the signals provided by the sensors.
Mass Air Flow Meter [See page EG-40]	Hot-wire Type	1	This sensor has a built-in hot-wire to directly detect the intake air mass and flow rate.
Intake Air Temperature Sensor	Thermistor Type	1	This sensor detects the intake air temperature by means of an internal thermistor.
Crankshaft Position Sensor [See page EG-40]	Pick-up Coil Type (Rotor Teeth/36-2)	1	This sensor detects the engine speed and the crankshaft position.
Camshaft Position Sensor [See page EG-41]	MRE Type (Rotor Teeth/3)	1	This sensor detects the camshaft position and performs the cylinder identification.
VVT Sensor [See page EG-42]	Pick-up Coil Type (Rotor Teeth/3)	1 each bank	This sensor detects the actual valve timing.
Accelerator Pedal Position Sensor [See page EG-43]	Non-contact Type	1	This sensor detects the amount of pedal effort applied to the accelerator pedal.
Throttle Position Sensor [See page EG-44]	Non-contact Type	1	This sensor detects the throttle valve opening angle.
Knock Sensor [See page EG-45]	Built-in Piezoelectric Type (Flat Type)	1 each bank	This sensor detects an occurrence of the engine knocking indirectly from the vibration of the cylinder block caused by the occurrence of engine knocking.
Heated Oxygen Sensor [See page EG-47]	Cup Type with Heater	1 each bank	This sensor detects the oxygen concentration in the exhaust gas by measuring the electromotive force which is generated in the sensor itself.
Air-fuel Ratio Sensor [See page EG-47]	Planar Type with Heater	1 each bank	As with the oxygen sensor, this sensor detects the oxygen concentration in the exhaust gas. However, it detects the oxygen concentration in the exhaust gas linearly.
Engine Coolant Temperature Sensor	Thermistor Type	1	This sensor detects the engine coolant temperature by means of an internal thermistor.
Fuel Injector	4-hole Type	8	This fuel injector contains an electro-magnetically operated nozzle to inject fuel into the intake port.

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Components	Outline	Quantity	Function
Camshaft Timing Oil Control Valve [See page EG-56]	Electro-magnetic Coil Type	2 each bank	The camshaft timing oil control valve changes the valve timing by switching the oil passage that acts on the VVT-i controller in accordance with the signals received from the ECM.

Mass Air Flow Meter

- This mass air flow meter, which is a slot-in type, allows a portion of the intake air to flow through the detection area. By directly measuring the mass and the flow rate of the intake air, the detection precision is improved and the intake air resistance is reduced.
- This mass air flow meter has a built-in intake air temperature sensor.

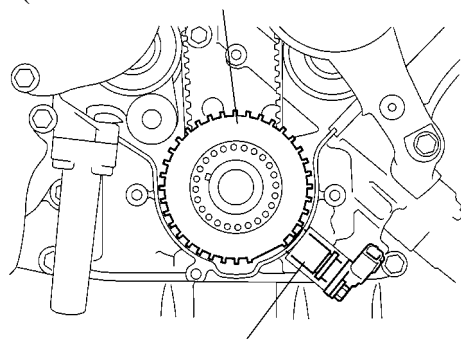


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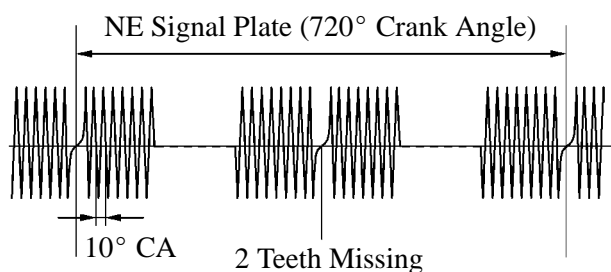
Crankshaft Position Sensor

The timing rotor of the crankshaft consists of a 34-tooth plate with 2 teeth missing. The crankshaft position sensor outputs a crankshaft rotation signal every 10° of crankshaft rotation, and the change of the signal due to the missing teeth is used to determine top-dead-center.

Timing Rotor
(No. 1 Crankshaft Position Sensor Plate)



Crankshaft Position Sensor



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