■ ENGINE CONTROL SYSTEM

1. General

The engine control system of the 3UR-FE engine has the following features.

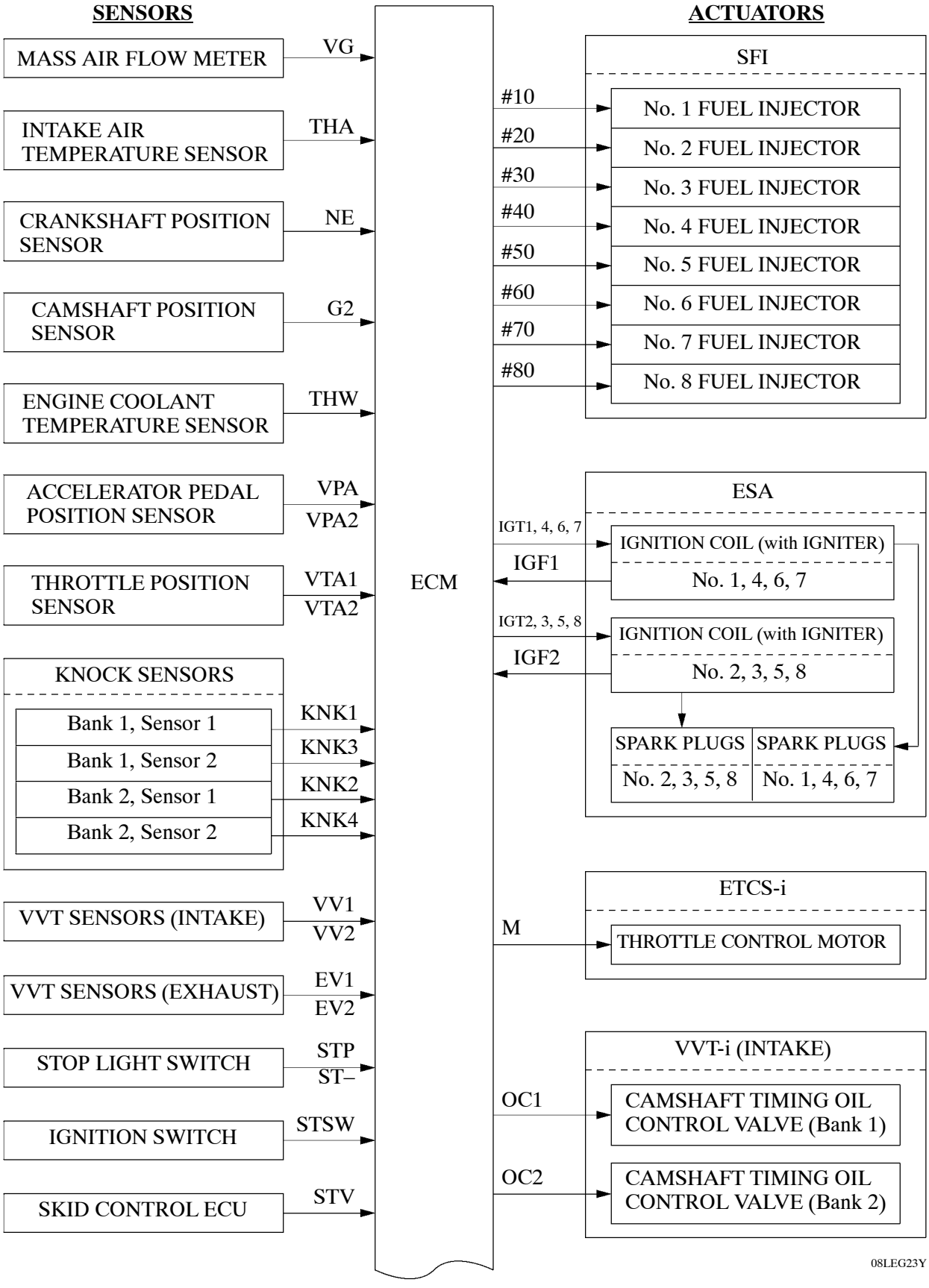
System	Outline
SFI (Sequential Multiport Fuel Injection)	● An L-type SFI system directly detects the intake air mass using a hot wire type air flow meter. ● An independent injection system (in which fuel is injected once into each intake port for each two revolutions of the crankshaft) is used. ● Fuel injection takes two forms: – 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. ● Synchronous injection is further divided into group injection during a cold start, and independent injection after the engine is started.
ESA (Electronic Spark Advance)	● 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-135]	Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.
Dual VVT-i (Variable Valve Timing-intelligent) [See page EG-140]	Controls the intake and exhaust camshafts to optimal valve timing in accordance with the engine operating conditions.
ACIS (Acoustic Control Induction System) [See page EG-146]	The intake air passages are switched based on engine speed and throttle valve opening angle to provide high performance in all engine speed ranges.
Fuel Pump Control	● 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. ● The basic construction and operation of this system are the same as the 2UZ-FE engine. For details, see page EG-60.
Air Injection Control [See page EG-148]	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)	● Once the ignition switch is turned ON while the brake pedal is depressed, this control continues to operate the starter until the engine started. ● The basic construction and operation of this system are the same as the 2UZ-FE engine. For details, see page EG-66.

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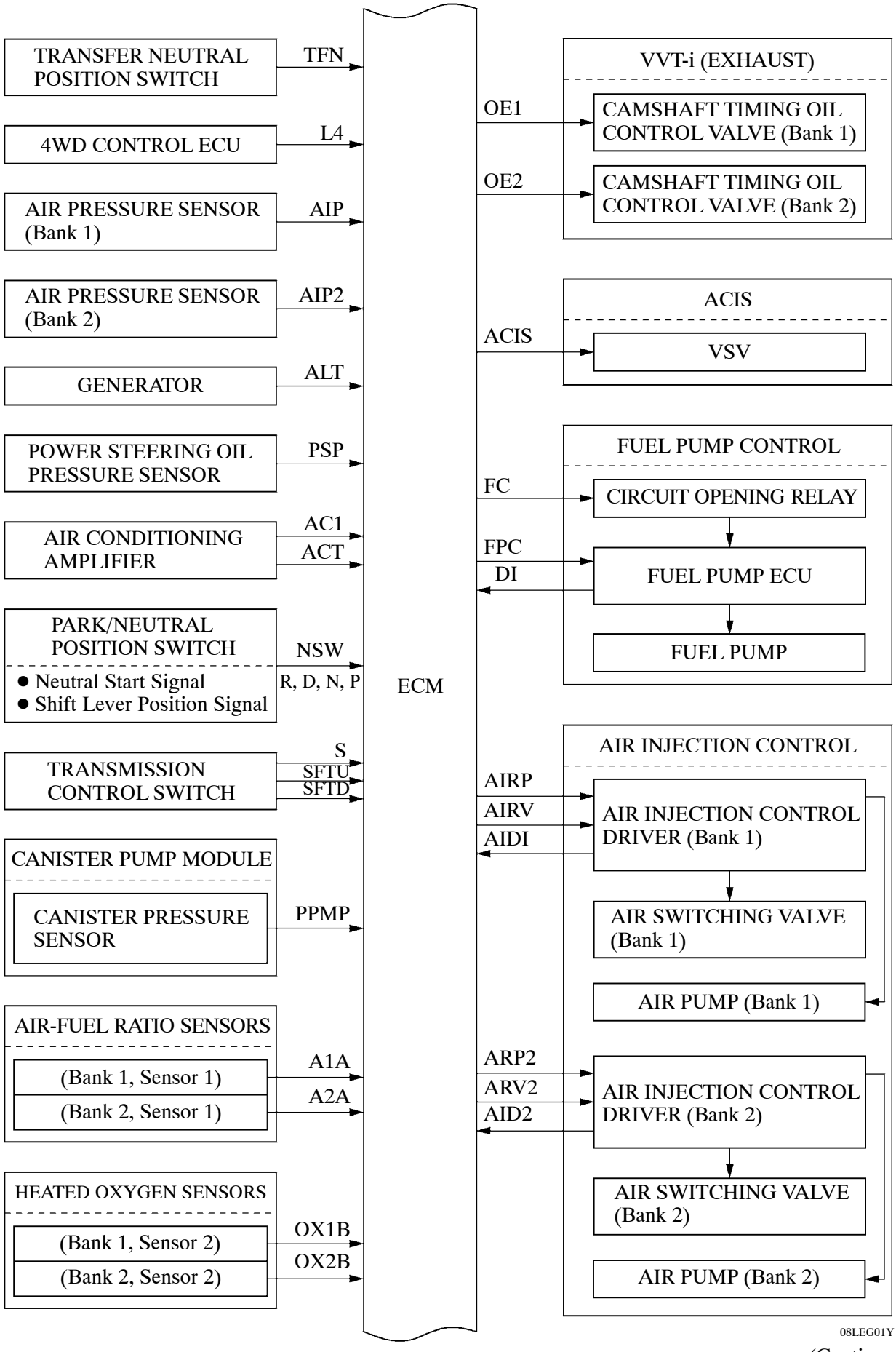
System	Outline
Air-fuel Ratio Sensor and Heated Oxygen Sensor Heater Control	Maintains the temperature of the air-fuel ratio sensors or heated oxygen sensors at an appropriate level to increase the detection accuracy of the exhaust gas oxygen concentration.
Air Conditioning Cut-off Control	By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Evaporative Emission Control [See page EG-152]	● 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-153]	When the ECM detects a malfunction, the ECM records the malfunction and memorizes information related to the fault.
Fail-safe [See page EG-153]	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 is as shown in the following chart.



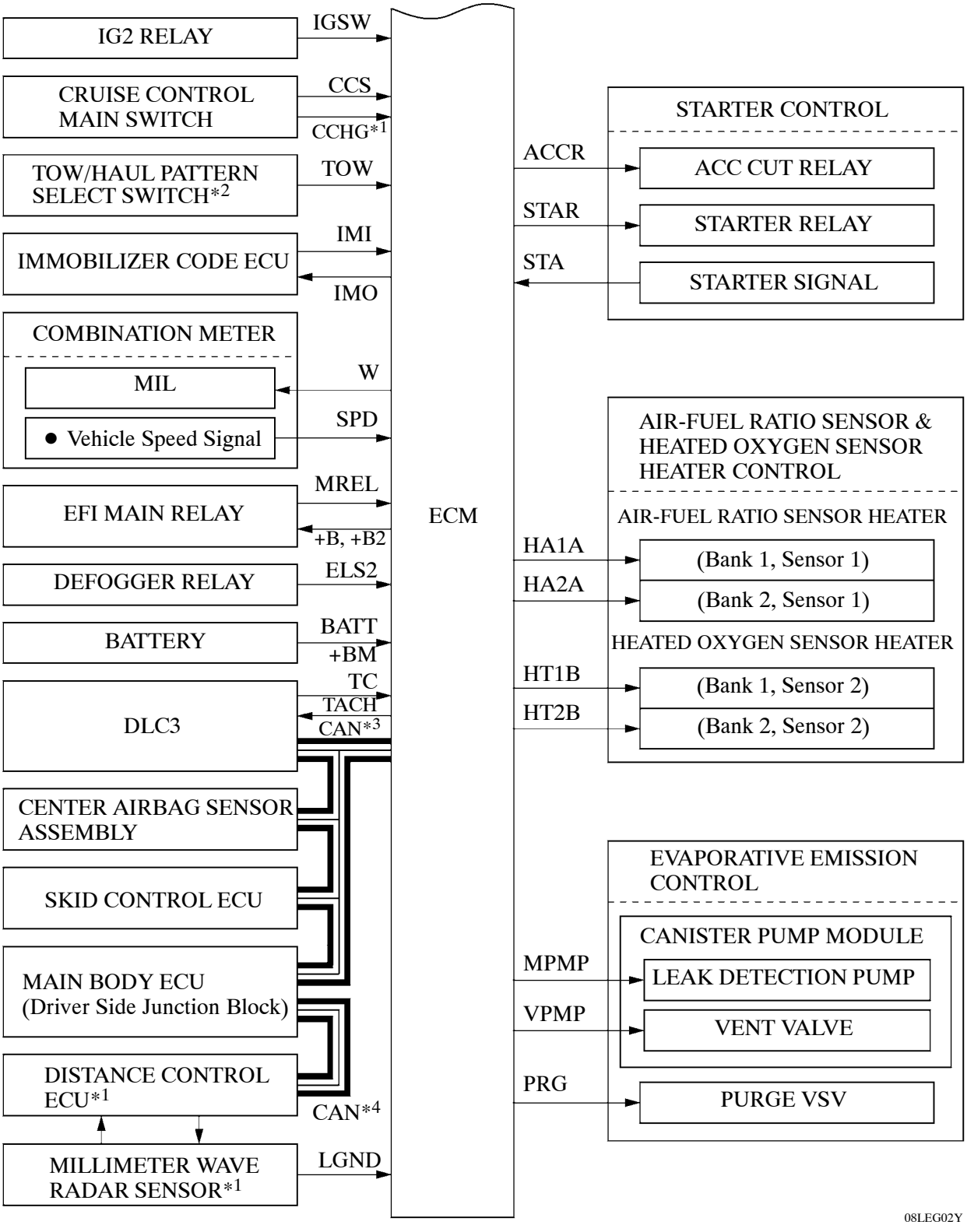
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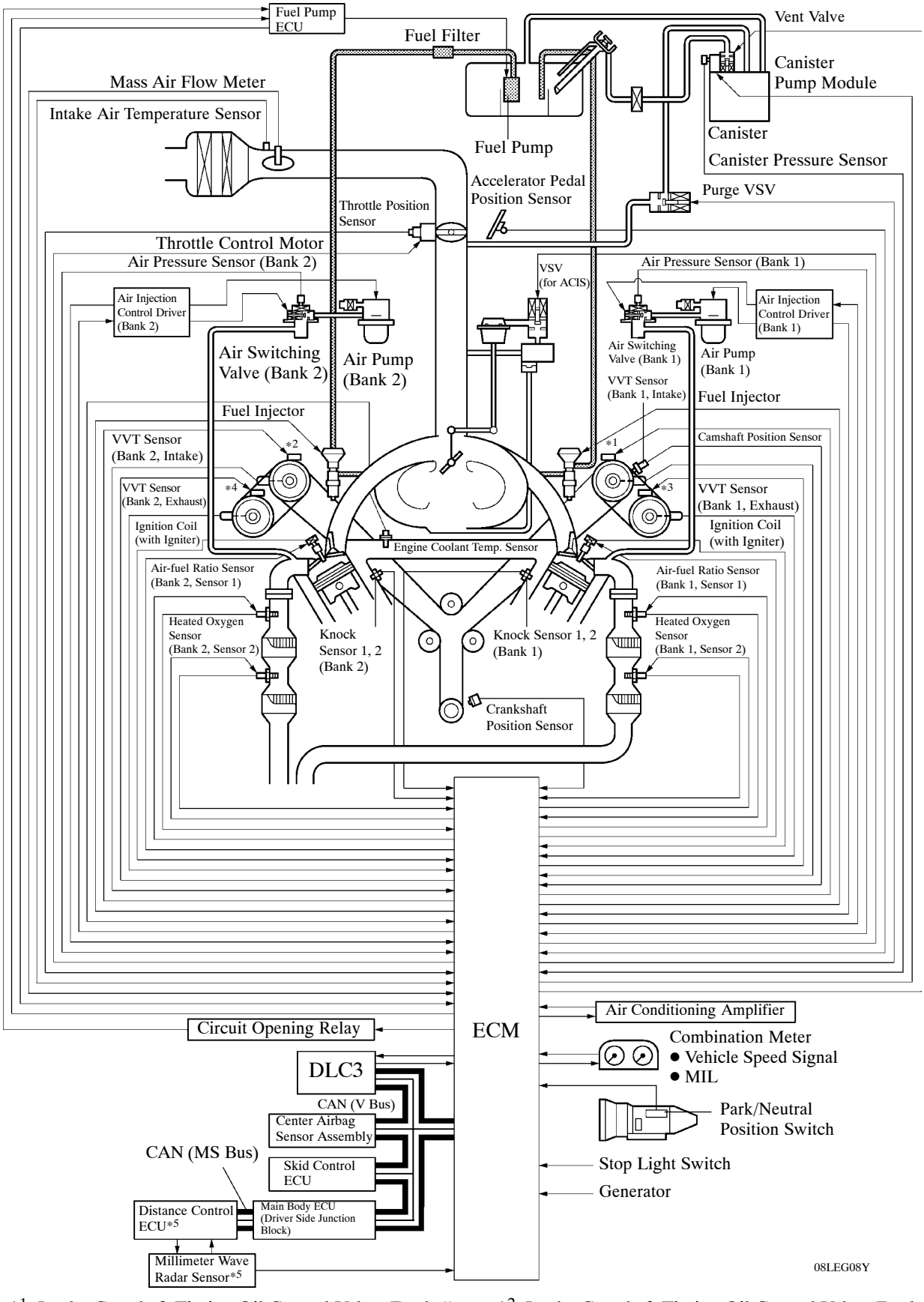
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EG



*1: Models with Dynamic Laser Cruise Control System
*2: Models with Towing Package
*3: V Bus
*4: MS Bus

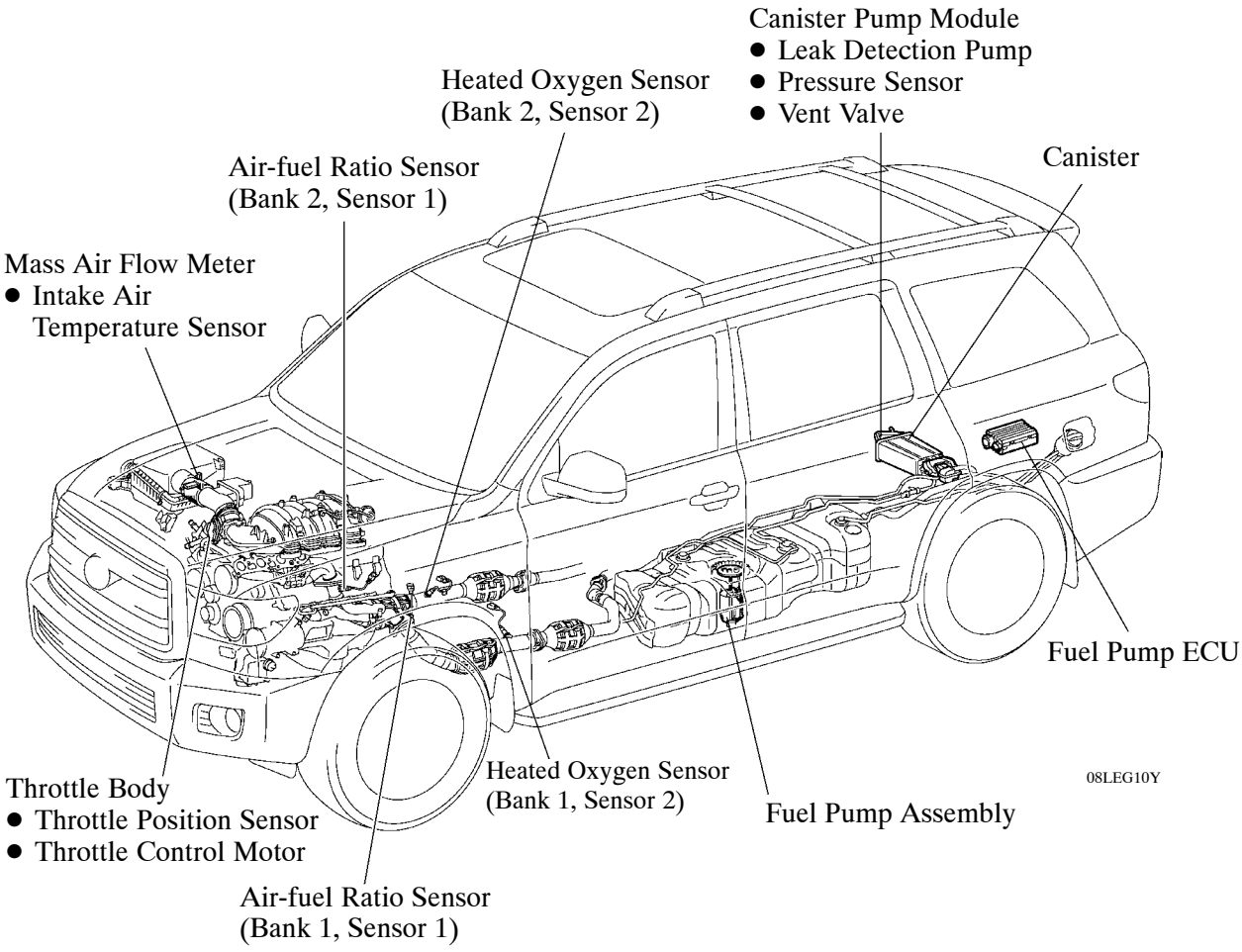
3. Engine Control System Diagram

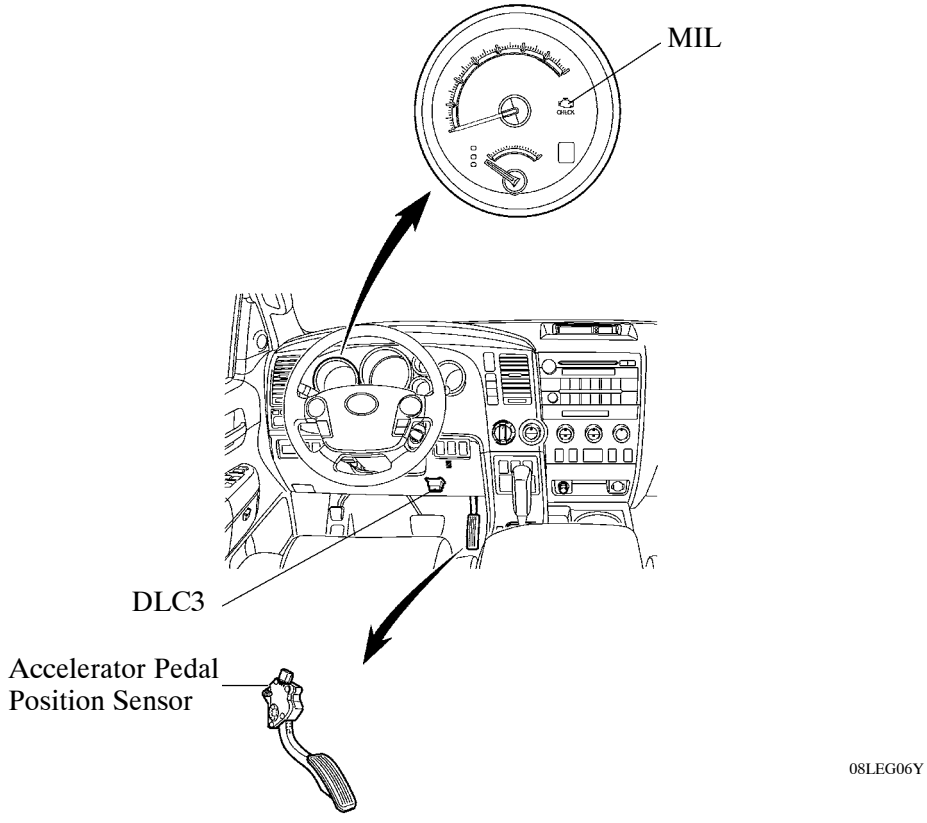


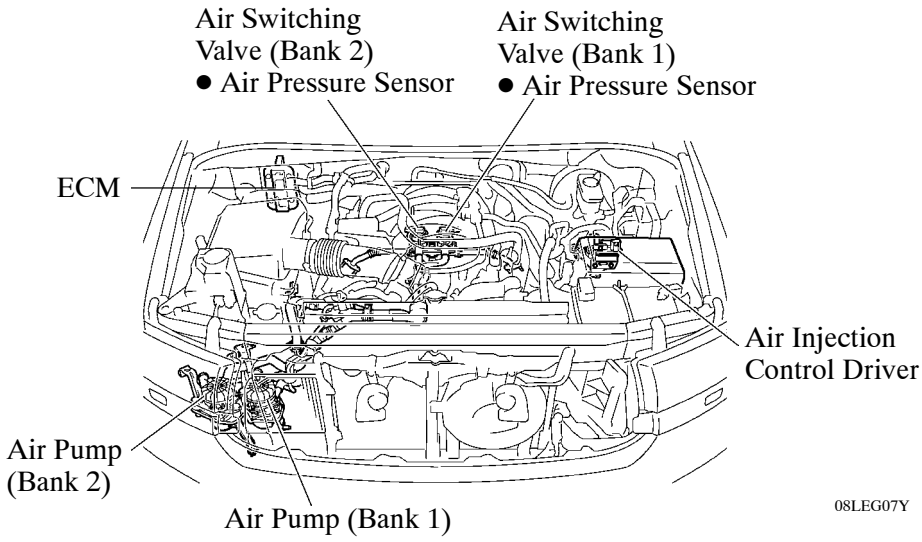
*1: Intake Camshaft Timing Oil Control Valve (Bank 1)
*2: Intake Camshaft Timing Oil Control Valve (Bank 2)
*3: Exhaust Camshaft Timing Oil Control Valve (Bank 1)
*4: Exhaust Camshaft Timing Oil Control Valve (Bank 2)
*5: Models with Dynamic Laser Cruise Control System

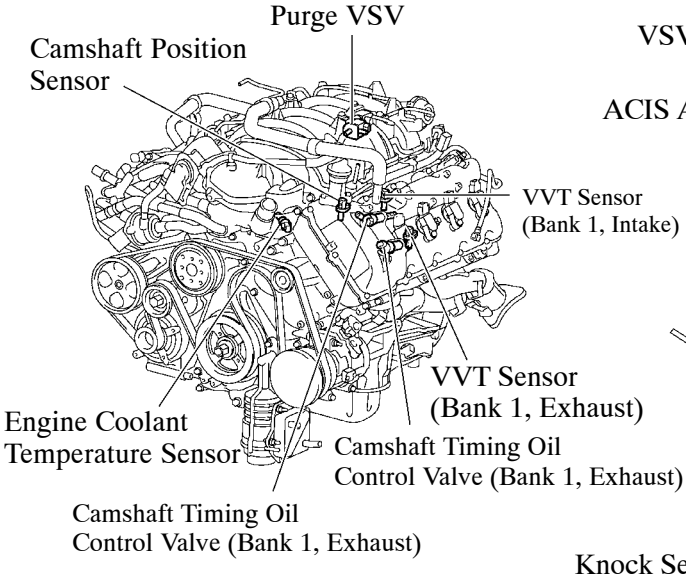
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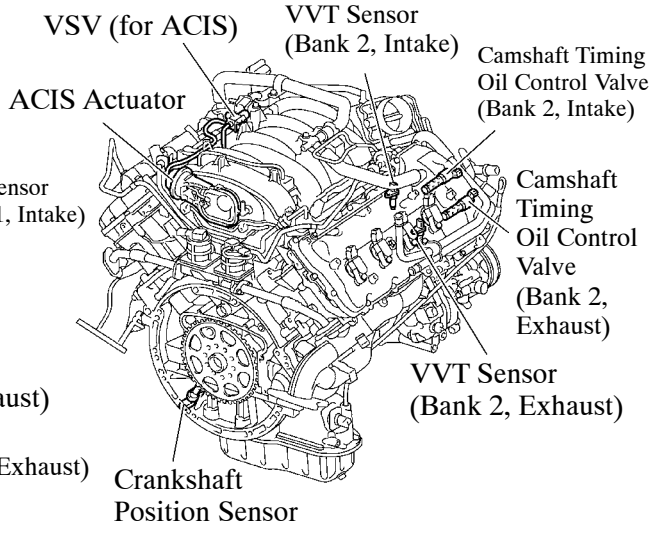
4. Layout of Main Components

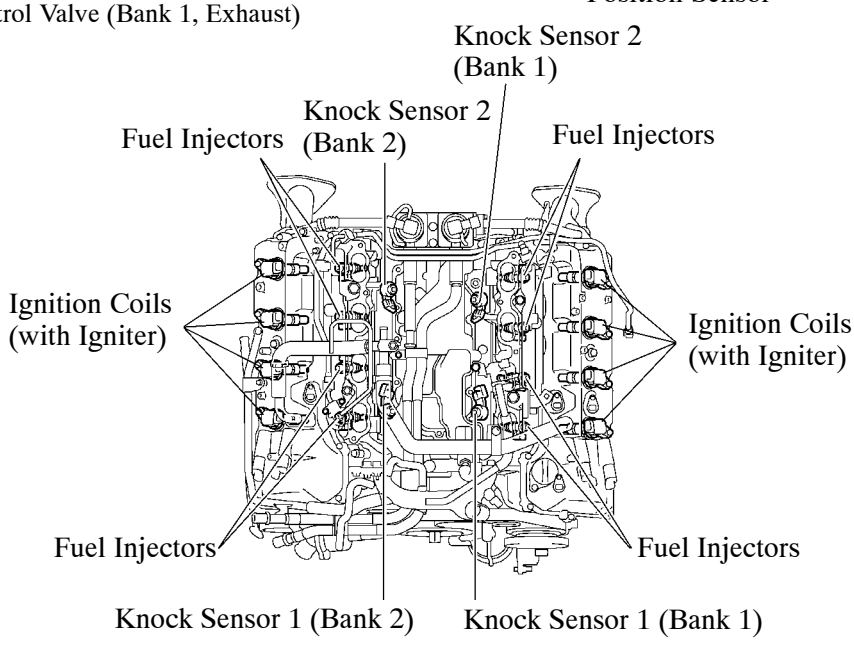





Air Switching
Valve (Bank 2)
● Air Pressure Sensor
Air Switching
Valve (Bank 1)
● Air Pressure Sensor
ECM
Air Injection
Control Driver
Air Pump
(Bank 2)
Air Pump (Bank 1)
08LEG07Y


Purge VSV
Camshaft Position
Sensor
VVT Sensor
(Bank 1, Intake)
VVT Sensor
(Bank 1, Exhaust)
Engine Coolant
Temperature Sensor
Camshaft Timing Oil
Control Valve (Bank 1, Exhaust)
Camshaft Timing Oil
Control Valve (Bank 1, Exhaust)


VSV (for ACIS)
VVT Sensor
(Bank 2, Intake)
Camshaft Timing
Oil Control Valve
(Bank 2, Intake)
ACIS Actuator
Camshaft
Timing
Oil Control
Valve
(Bank 2,
Exhaust)
VVT Sensor
(Bank 2, Exhaust)
Crankshaft
Position Sensor


Knock Sensor 2
(Bank 1)
Knock Sensor 2
(Bank 2)
Fuel Injectors
Fuel Injectors
Ignition Coils
(with Igniter)
Ignition Coils
(with Igniter)
Fuel Injectors
Fuel Injectors
Knock Sensor 1 (Bank 2)
Knock Sensor 1 (Bank 1)
080EG26S

5. Main Component of Engine Control System

General

The main components of the 3UR-FE engine control system are as follows:

Components	Outline	Quantity	Function
ECM	32-bit CPU (DENSO)	1	The ECM optimally controls the SFI, ESA and ISC to suit the operating conditions of the engine in accordance with the signals provided by the sensors.
Mass Air Flow Meter	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.
Accelerator Pedal Position Sensor	Hall IC Type (Non-contact Type)	1	This sensor detects the amount of pedal effort applied to the accelerator pedal.
Throttle Position Sensor	Hall IC Type (Non-contact Type)	1	This sensor detects the throttle valve opening angle.
Crankshaft Position Sensor	MRE Type (Rotor Teeth/36-2)	1	This sensor detects the engine speed and the crankshaft position.
Camshaft Position Sensor	MRE Type (Rotor Teeth/3)	1	This sensor detects the camshaft position and performs the cylinder identification.
VVT Sensor (Intake)	MRE Type (Rotor Teeth/3)	1 each bank	This sensor detects the actual valve timing.
VVT Sensor (Exhaust)	MRE Type (Rotor Teeth/3)	1 each bank	This sensor detects the actual valve timing.
Knock Sensor	Built-in Piezoelectric Element (Flat Type)	2 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	Cup Type with Heater	1 each bank	This sensor detects the oxygen concentration in the exhaust emission by measuring the electromotive force which is generated in the sensor itself.
Air-fuel Ratio Sensor	Planar Type with Heater	1 each bank	As with the heated oxygen sensor, this sensor detects the oxygen concentration in the exhaust emission. However, it detects the oxygen concentration in the exhaust emission linearly.
Engine Coolant Temperature Sensor	Thermistor Type	1	This sensor detects the engine coolant temperature by means of an internal thermistor.
Fuel Injector	12-hole Type	8	This fuel injector contains an electro-magnetically operated nozzle to inject fuel into the intake port.
Camshaft Timing Oil Control Valve	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

The mass air flow meter which is the same type as that of the 2UZ-FE engine is used. For details, see page EG-40.

Accelerator Pedal Position Sensor

The accelerator pedal position sensor which is the same type as that of the 2UZ-FE engine is used. For details, see page EG-43.

Throttle position Sensor

The throttle position sensor which is the same type as that of the 2UZ-FE engine is used. For details, see page EG-44.

Knock Sensor (Flat Type)

The knock sensor which is the same type as that of the 2UZ-FE engine is used. For details, see page EG-45.

Service Tip

These knock sensors are mounted in specific directions at specific angles. To prevent the right and left bank wiring connectors from being interchanged, make sure to install each sensor in its prescribed direction. For details, refer to the 2008 Sequoia Repair Manual (Pub. No. RM08L0U).

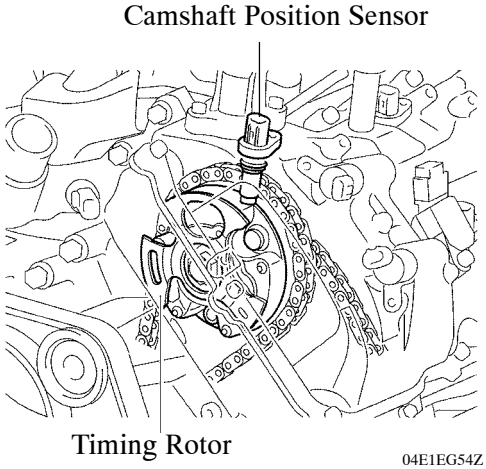
Air-fuel Ratio Sensor and Heated Oxygen Sensor

The air-fuel ratio sensor and the heated oxygen sensor which are the same type as that of the 2UZ-FE engine are used. For details, see page EG-47.

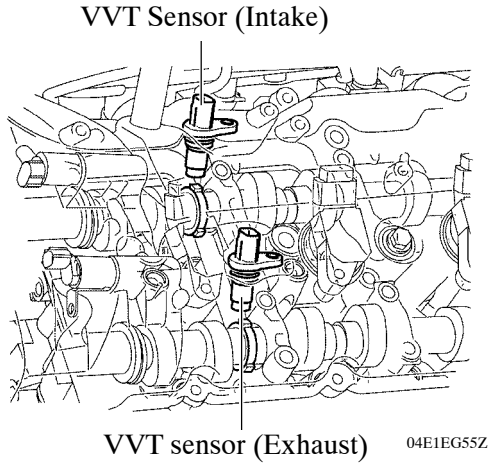
Crankshaft Position, Camshaft Position and VVT Sensors

1) General

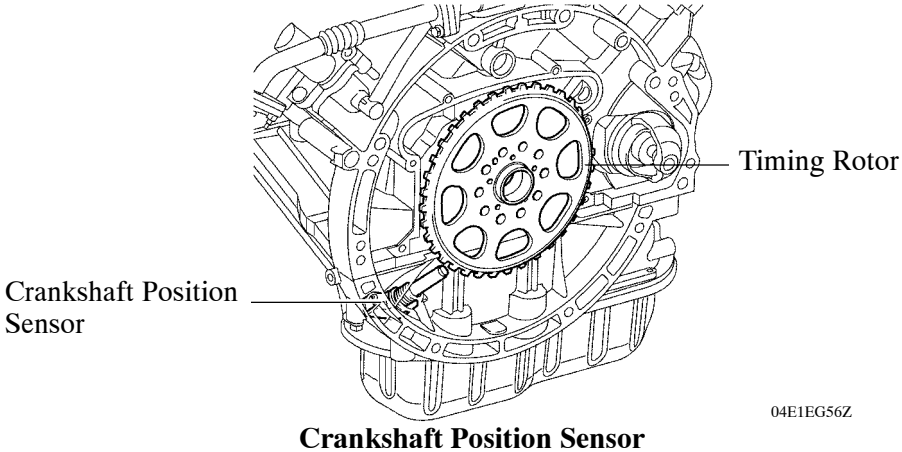
- MRE (Magnetic Resistance Element) sensors are used for the crankshaft position, camshaft position, and VVT sensors.
- The timing rotor for the crankshaft position sensor is installed on the back end of the crankshaft. The timing rotor has 34 teeth, with 2 teeth missing, at 10° intervals. Based on these teeth, the crankshaft position sensor transmits crankshaft position signals (NE signal) consisting of 33 Hi/Lo output pulses every 10° per revolution of the crankshaft, and 1 Hi/Lo output pulse every 30°. The ECM uses the NE signal for detecting the crankshaft position as well as for detecting the engine speed. It uses the missing teeth signal for determining the top-dead-center.
- The camshaft position sensor uses a timing rotor that is installed on the front end of the intake camshaft sprocket of the left bank. Based on the timing rotor, the sensor outputs camshaft position signals (G2 signal) consisting of 3 (3 Hi output, 3 Lo output) pulses for every 2 revolutions of the crankshaft. The ECM compares the G2 and NE signals to detect the camshaft position and identify the cylinder.
- The VVT sensors (intake and exhaust) use timing rotors that are installed on the intake and exhaust camshafts of each bank. Based on the timing rotors, the sensors output VVT position signals consisting of 3 (3 Hi output, 3 Lo output) pulses for every 2 revolutions of the crankshaft. The ECM compares these VVT position signals and the NE signal to detect the actual valve timing.



Camshaft Position Sensor

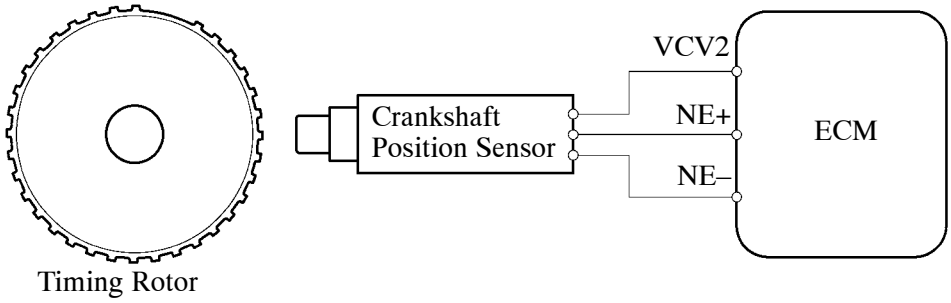


VVT Sensor (Bank 1)



Crankshaft Position Sensor

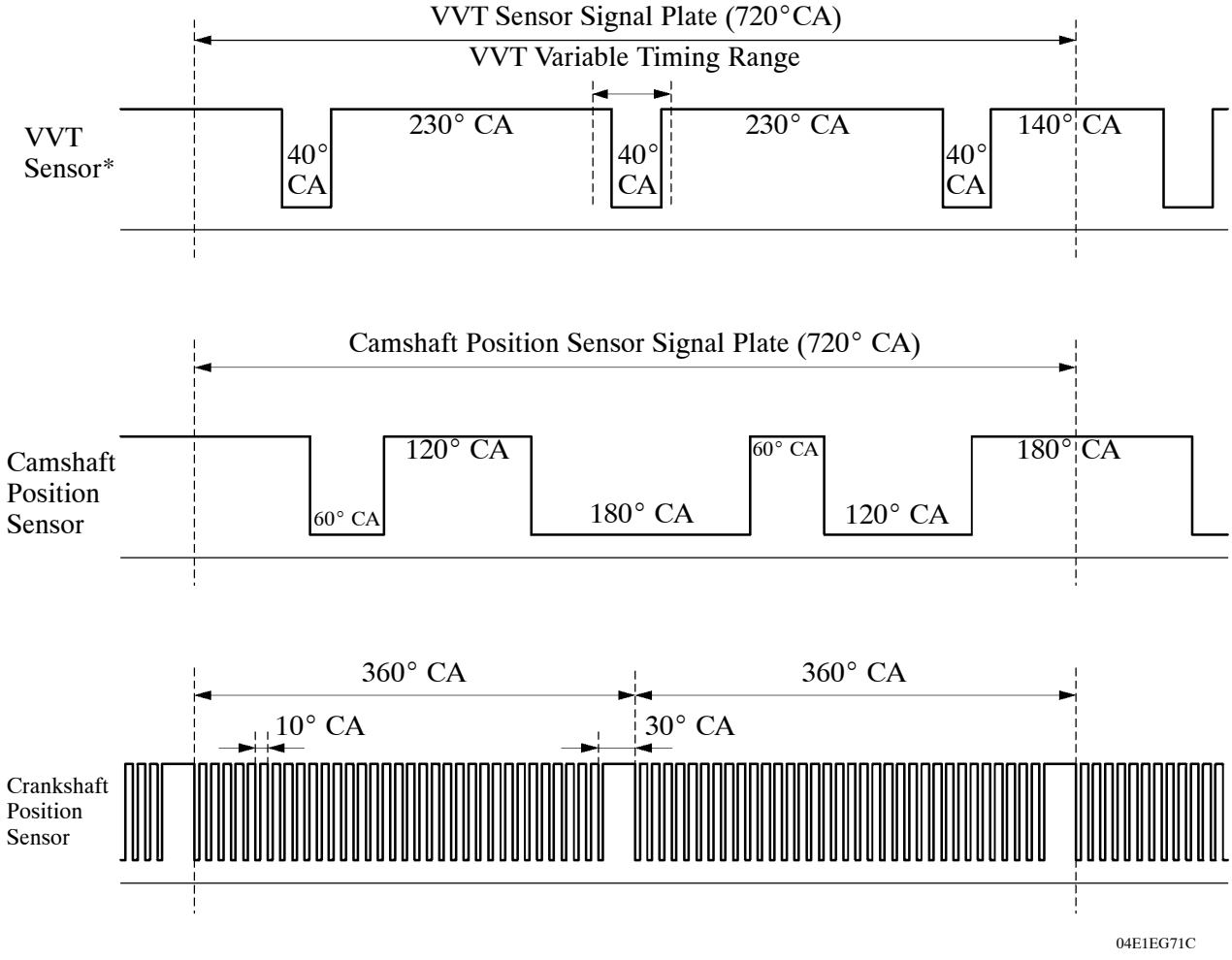
▶ Wiring Diagram ◀



Crankshaft Position Sensor Circuit

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▶ Sensor Output Waveforms ◀



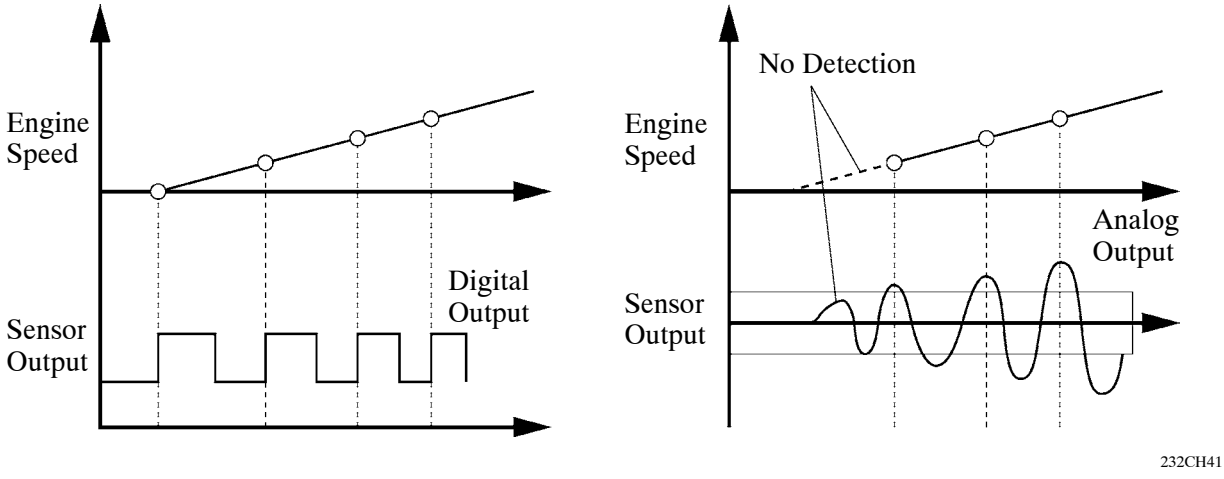
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*: This is an example of an output waveform of the VVT sensor (bank 1, intake).

2) MRE Type Sensor

- The MRE type sensor consists of an MRE, a magnet and a sensor.
- The direction of the magnetic field changes due to the profile (protruding and non-protruding portions) of the timing rotor, which passes by the sensor. As a result, the resistance of the MRE changes, and the output voltage to the ECM changes to Hi or Lo. The ECM detects the crankshaft and camshaft positions based on this output voltage.
- The differences between the MRE type sensor and the pick-up coil type sensor used on a conventional model are as follows.
  - An MRE type sensor outputs a constant level of Hi/Lo digital signals regardless of the engine speed. Therefore, an MRE type sensor can detect the positions of the crankshaft and camshaft at an early stage of cranking.
  - A pick-up coil type sensor outputs analog signals with levels that change with the engine speed.

▶ MRE Type and Pick-up Coil Type Output Waveform Image Comparison ◀



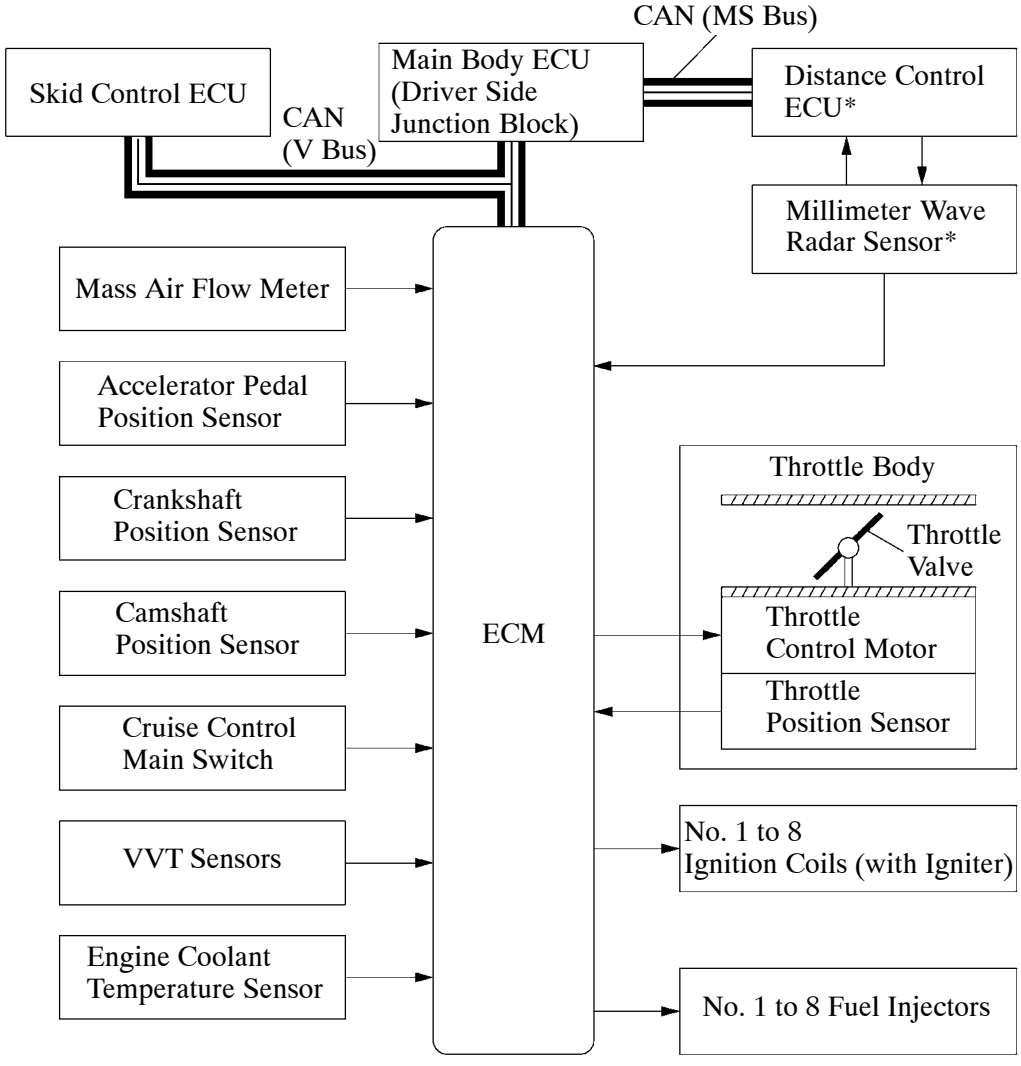
MRE Type **Pick-up Coil Type**

6. ETCS-i (Electronic Throttle Control System-intelligent)

General

- In the conventional throttle body, the throttle valve angle is determined invariably by the amount of the accelerator pedal effort. In contrast, ETCS-i uses the ECM to calculate the optimal throttle valve angle that is appropriate for the respective driving condition and uses a throttle control motor to control the angle.
- In case of an abnormal condition, this system transfers to the fail-safe mode.

▶ System Diagram ◀



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*: Models with Dynamic Laser Cruise Control System

Control

1) General

The ETCS-i consists of the following functions:

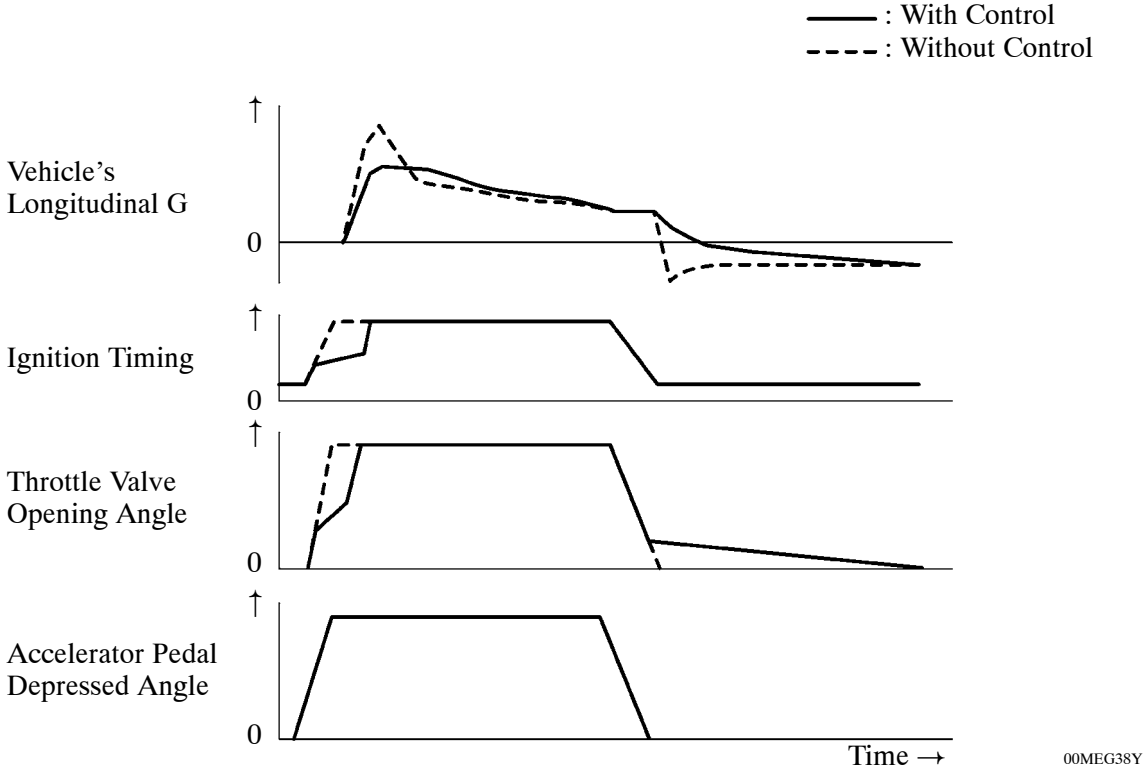
- Normal Throttle Control (non-linear control)
- ISC (Idle Speed Control)
- TRAC/A-TRAC (Active Traction Control)*1
- VSC (Vehicle Stability Control) Coordination Control
- Cruise Control
- Dynamic Laser Cruise Control*2
- TOW/HAUL Control*3

*1: 4WD Models
*2: Models with Dynamic Laser Cruise Control System
*3: Models with Towing Package

2) Normal Throttle Control (Non-linear Control)

Controls the throttle to an optimal throttle valve angle that is appropriate for the driving condition such as the amount of the accelerator pedal effort and the engine speed in order to realize excellent throttle control and comfort in all operating ranges.

▶ Conceptual Diagrams of Engine Control During Acceleration and Deceleration ◀



3) Idle Speed Control

The ECM controls the throttle valve in order to constantly maintain an ideal idle speed.

4) TRAC/A-TRAC*1

As part of the A-TRAC, the throttle valve opening angle is reduced by a demand signal sent from the skid control ECU to the ECM. This demand signal will be sent if an excessive amount of slippage occurs at a drive wheel, thus ensuring vehicle stability and applying appropriate amount of power to the road.

5) VSC Coordination Control

In order to bring the effectiveness of the VSC into full play, the throttle valve angle is regulated through a coordination control with the skid control ECU.

6) Cruise Control

The ECM directly actuates the throttle valve for operation of the cruise control.

7) Dynamic Laser Cruise Control*2

The dynamic laser cruise control uses a millimeter wave radar sensor and distance control ECU to determine the distance, direction, and relative speed to a vehicle ahead. Thus, the system can effect deceleration control, follow-up control, constant speed control, and acceleration control. To make these controls possible, the ECM controls the throttle valve.

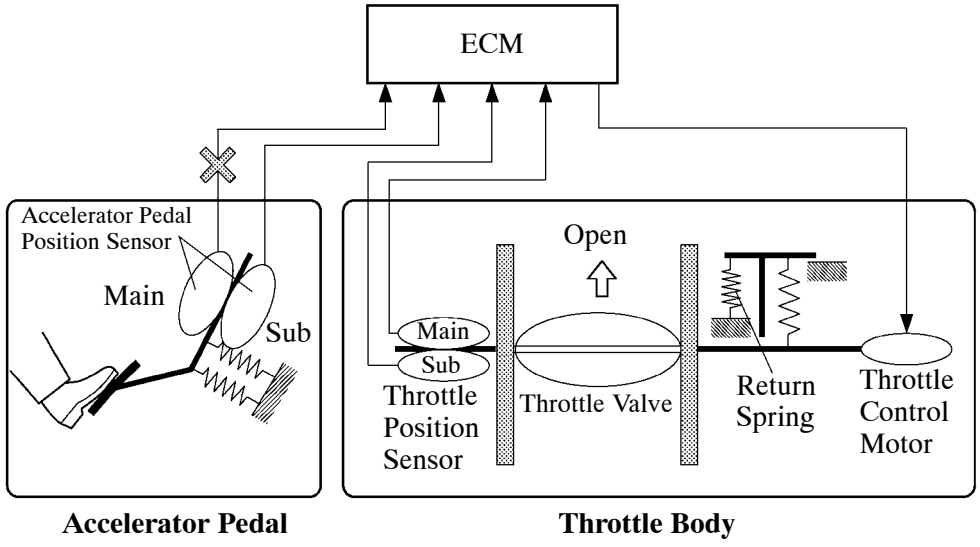
8) TOW/HAUL Control*3

When tow/haul control is operating, the throttle valve opening angle relationship to the accelerator pedal angle is increased. As a result, during tow/haul control, acceleration performance is ensured.

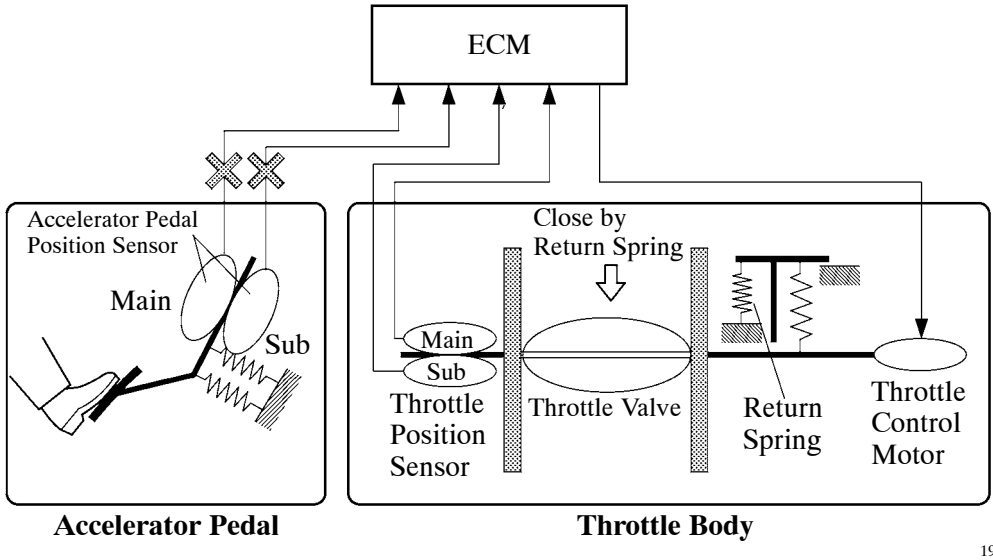
*1: 4WD Models
*2: Models with Dynamic Laser Cruise Control System
*3: Models with Towing Package

Fail-safe Operation due to Accelerator Pedal Position Sensor Trouble

- The accelerator pedal position sensor comprises two (main, sub) sensor circuits.
- If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between these two sensor circuits and switches into a fail-safe mode. In this fail-safe mode, the remaining circuit is used to calculate the accelerator pedal opening, in order to operate the vehicle under fail-safe mode control.

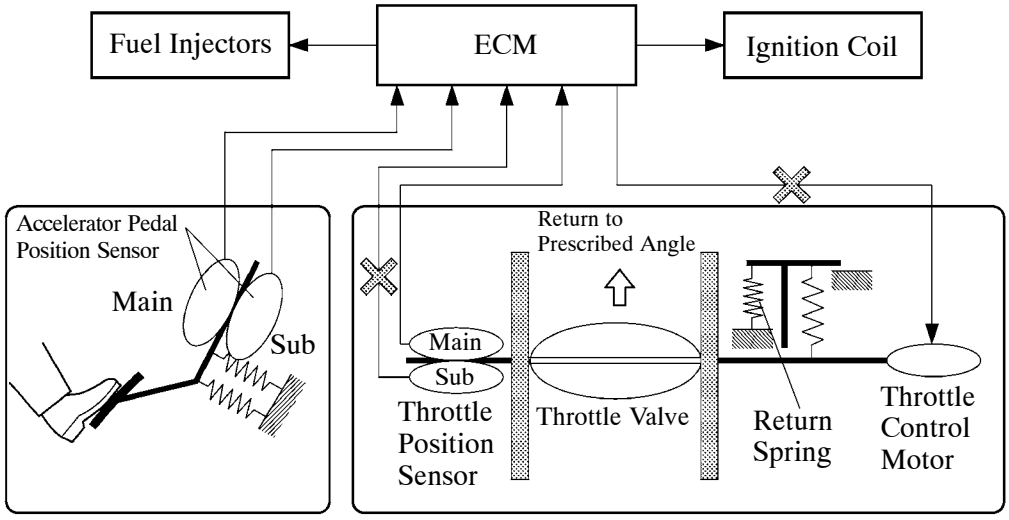


- If both circuits malfunction, the ECM detects the abnormal signal voltage from these two sensor circuits and discontinues the throttle control. At this time, the vehicle can be driven within its idling range.



Fail-safe Operation due to Throttle Position Sensor Trouble

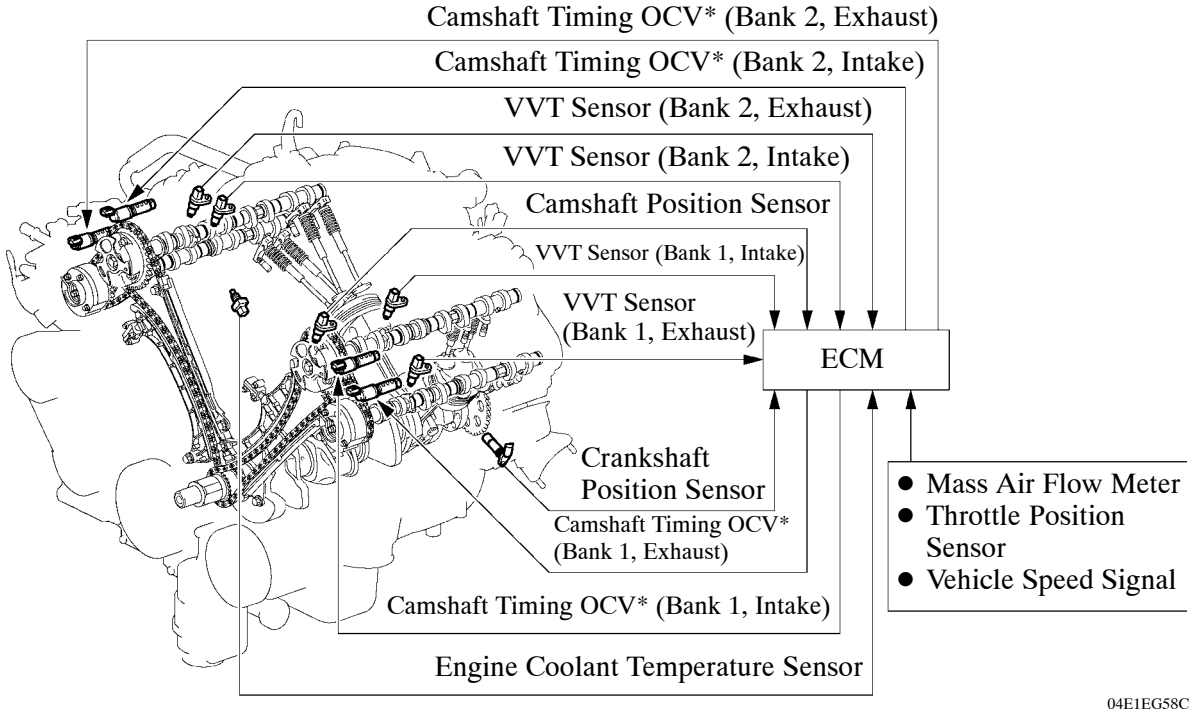
- The throttle position sensor comprises two (main, sub) sensor circuits.
- If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between these two sensor circuits, cuts off the current to the throttle control motor, and switches to a fail-safe mode.
- Then, the force of the return spring causes the throttle valve to return and stay at the prescribed base opening position. At this time, the vehicle can be driven in the fail-safe mode while the engine output is regulated through control of the fuel injection and ignition timing in accordance with the accelerator pedal position.
- The same control as above is effected if the ECM detects a malfunction in the throttle control motor system.



7. Dual VVT-i (Variable Valve Timing-intelligent) System

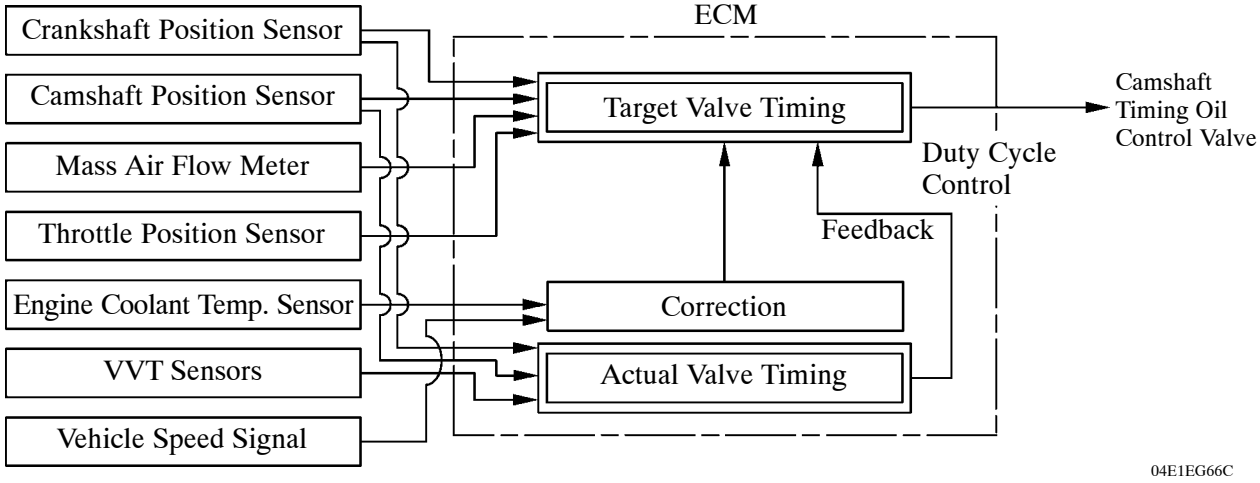
General

- The Dual VVT-i system is designed to control the intake and exhaust camshafts within a range of 60° and 30° respectively (of Crankshaft Angle) to provide valve timing that is optimally suited to the engine operating conditions. This improves torque in all the speed ranges as well as increasing fuel economy, and reducing exhaust emissions.

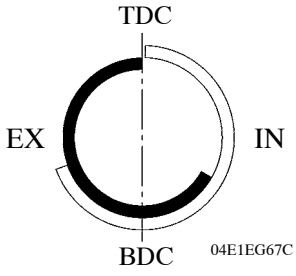
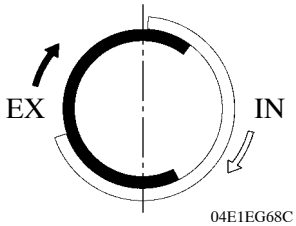
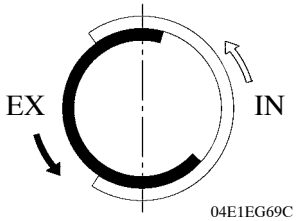
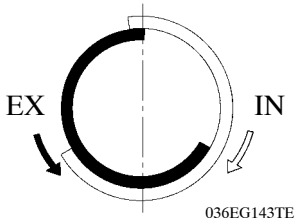
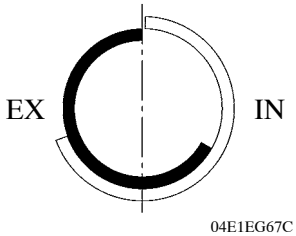
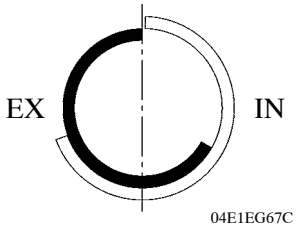


*: Oil Control Valve

- By using the engine speed, intake air mass, throttle position and engine coolant temperature, the ECM calculates optimal valve timing for each driving condition and controls the camshaft timing oil control valves. In addition, the ECM uses signals from the intake and exhaust VVT sensors for each bank and the crankshaft position sensor to detect the actual valve timing, thus providing feedback control to achieve the target valve timing.



Effectiveness of Dual VVT-i System

Condition	Operation		Timing/ Position	Objective	Effect
During Idling		IN	Most Retarded Position	Eliminating overlap to reduce blow back to the intake side.	● Stabilized idle speed ● Better fuel economy
		EX	Most Advanced Position		
In Low Speed Range with Light to Medium Load		IN	Retarded	Retarding the intake valve close timing and reducing pumping loss. Increasing overlap and increasing internal EGR.	● Better fuel economy ● Improved emission control
		EX	Retarded		
In Low to Medium Speed Range with Heavy Load		IN	Advanced	Advancing the intake valve close timing, reducing intake air blow back to the intake side, and improving volumetric efficiency.	Improved torque in low to medium speed range
		EX	Advanced		
In High Speed Range with Heavy Load		IN	Retarded	Retarding the intake valve close timing and improving volumetric efficiency using the inertia force of the intake air.	Improved output
		EX	Advanced		
At Low Temperatures		IN	Most Retarded Position	Eliminating overlap to reduce blow back to the intake side. Fixing valve timing at extremely low temperatures and increasing the control range as the temperature rises.	● Stabilized fast idle speed ● Better fuel economy
		EX	Most Advanced Position		
● Upon Starting ● Stopping the Engine		IN	Most Retarded Position	Controlling valve timing and fixing it to the optimal timing for engine start.	Improved startability
		EX	Most Advanced Position		

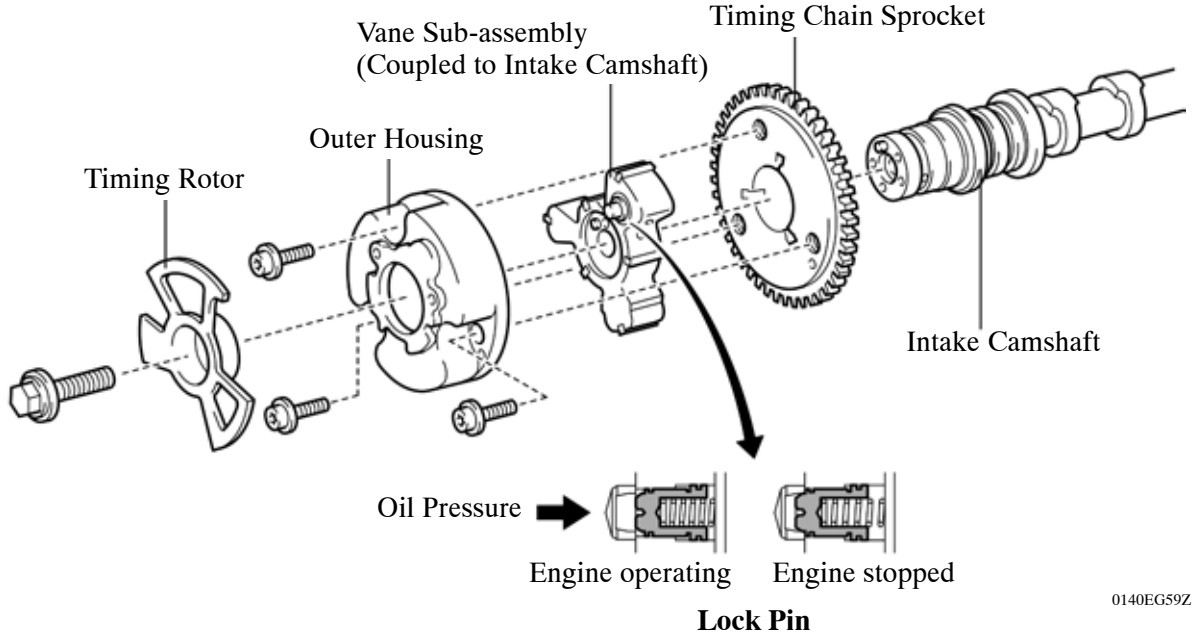
EG

Construction

1) VVT-i Controller

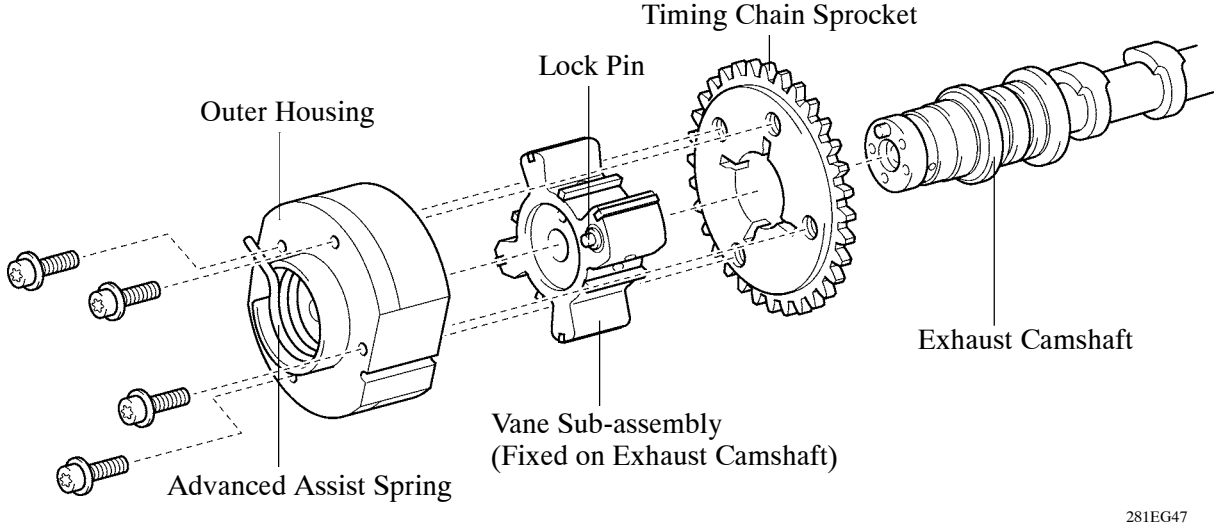
- This controller consists of an outer housing that is driven by the timing chain sprocket, and a vane sub-assembly that is coupled to each camshaft.
- The intake side uses a VVT-i controller with 3 vanes, and the exhaust side uses one with 4 vanes.
- When the engine stops, the intake side VVT-i controller is locked at the most retarded angle by its lock pin, and the exhaust side controller is locked at the most advanced angle. This ensures excellent engine startability.
- The oil pressure sent from the advance or retard side passages of the intake and exhaust camshafts causes rotation of the VVT-i controller vane sub-assembly relative to the timing chain sprocket, to vary the valve timing continuously.
- An advance assist spring is provided on the exhaust side VVT-i controller. This helps to apply torque in the advanced angle direction so that the vane lock pin securely engages with the housing when the engine stops.

▶ Intake Side VVT-i Controller ◀



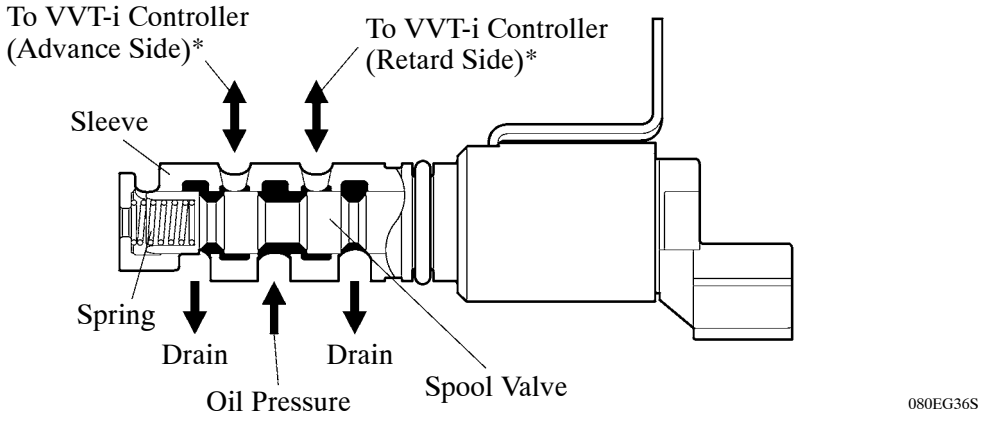
Lock Pin

▶ Exhaust Side VVT-i Controller ◀



2) Camshaft Timing Oil Control Valve

This camshaft timing oil control valve controls the spool valve using duty cycle control from the ECM. This allows hydraulic pressure to be applied to the VVT-i controller advance or retard side. When the engine is stopped, the camshaft timing oil control valve (intake) will move to the retard position, and the camshaft timing oil control valve (exhaust) will move to the advance position.



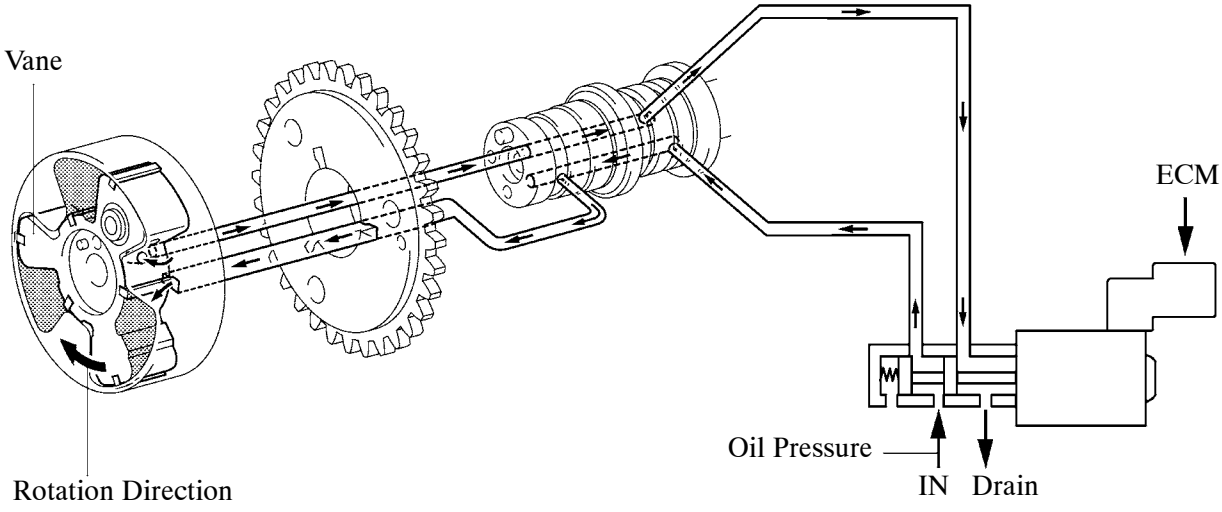
*: On the exhaust side oil control valve, the advance and retard sides are reversed.

Operation

1) Advance

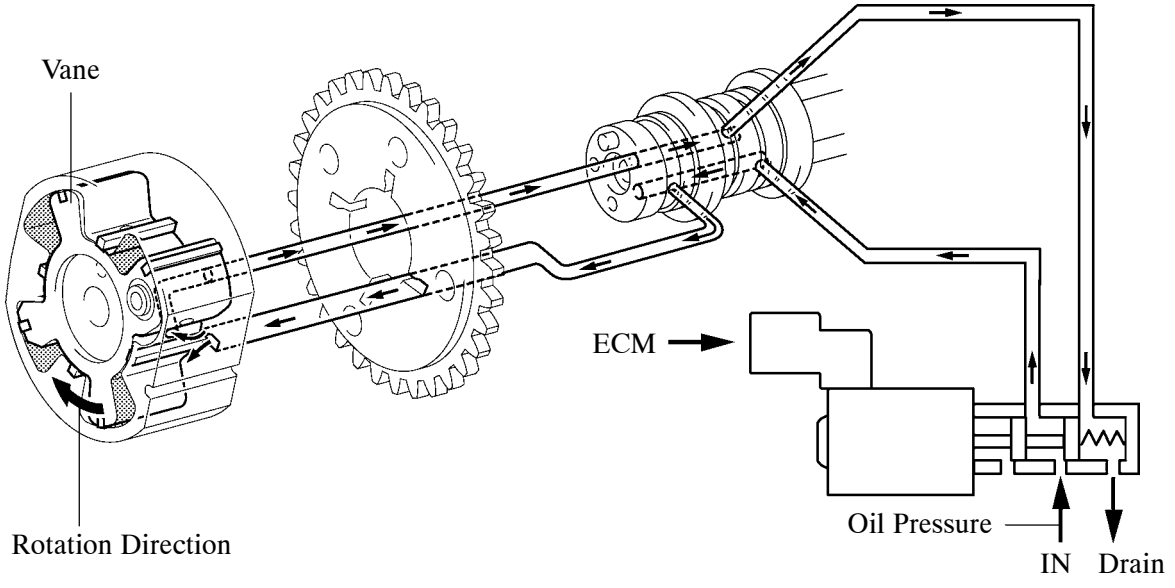
When the camshaft timing oil control valve is positioned as illustrated below by the advance signals from the ECM, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.

▶ Intake Side ◀



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▶ Exhaust Side ◀

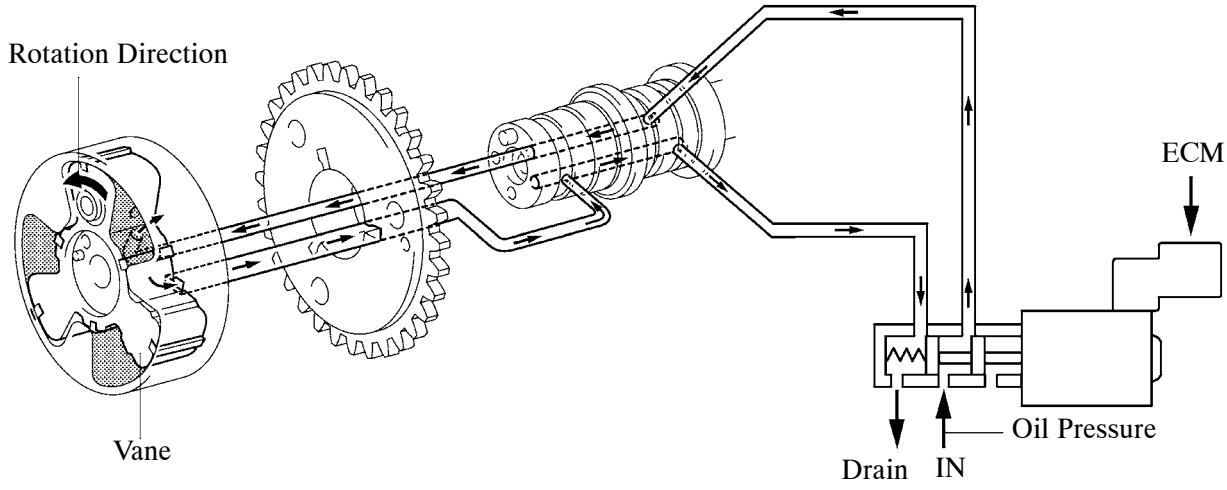


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2) Retard

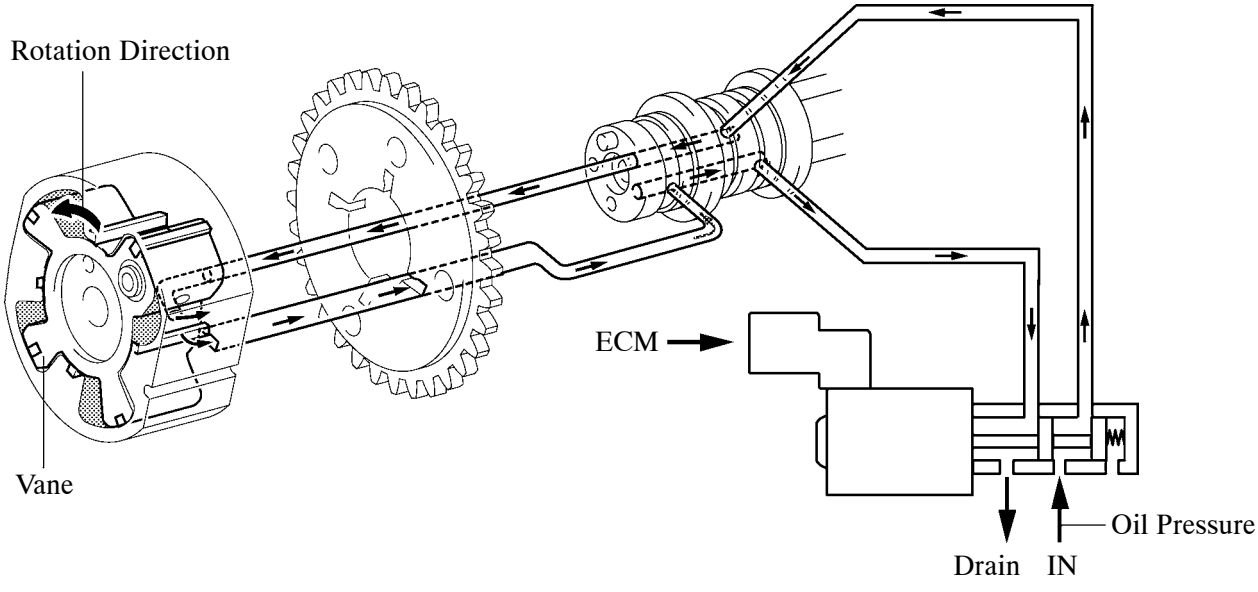
When the camshaft timing oil control valve is positioned as illustrated below by the retard signals from the ECM, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.

▶ Intake Side ◀



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▶ Exhaust Side ◀



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3) Hold

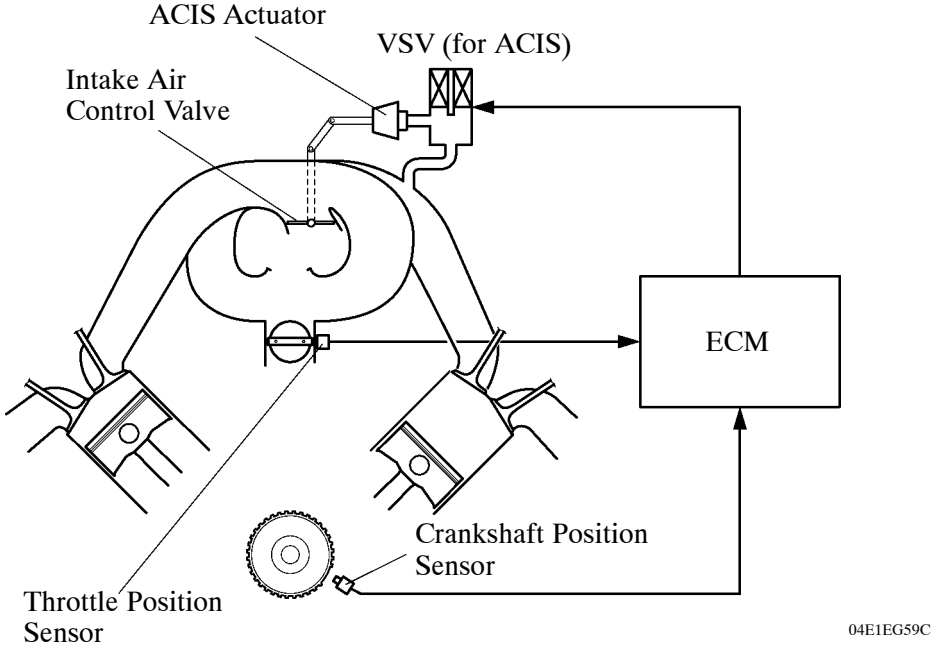
After reaching the target timing, the engine valve timing is maintained by keeping the camshaft timing oil control valve in the neutral position unless the engine operating conditions change.
This maintains the engine valve timing at the desired target position by preventing the engine oil from running out of the oil control valve.

8. ACIS (Acoustic Control Induction System)

General

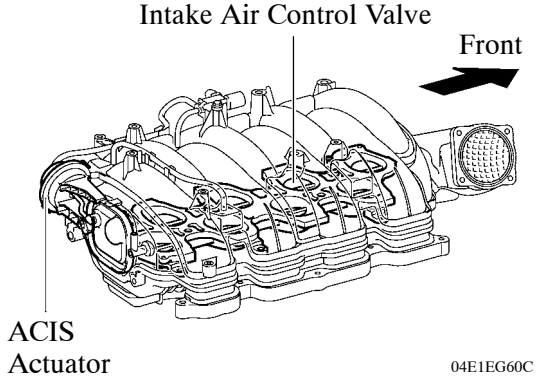
The ACIS is realized by using a bulkhead to divide the intake manifold into two stages, with an intake air control valve in the bulkhead being opened and closed to vary the effective length of the intake manifold in accordance with the engine speed and throttle valve opening angle. This increases the power output in all ranges from low to high speed.

▶ System Diagram ◀



Intake Air Control Valve and ACIS Actuator

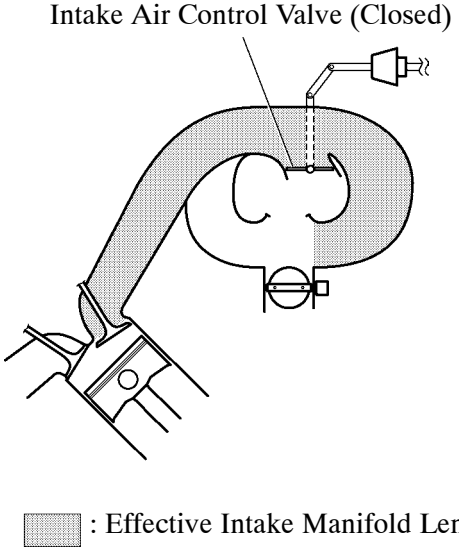
The intake air control valve and ACIS actuator are integrated with the intake manifold. This valve opens and closes to change the effective length of the intake manifold in two stages.



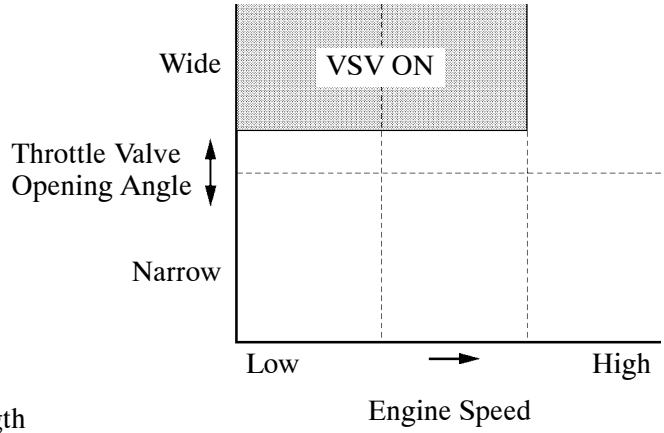
Operation

1) When the Intake Control Valve Closes (VSV ON)

The ECM activates the VSV so that the negative pressure acts on the diaphragm chamber of the actuator. This closes the control valve to match the longer pulsation cycle. As a result, the effective length of the intake manifold is lengthened and the intake efficiency in the low-to-medium engine speed range under heavy load is improved due to the dynamic effect of the intake air, thereby increasing the power output.



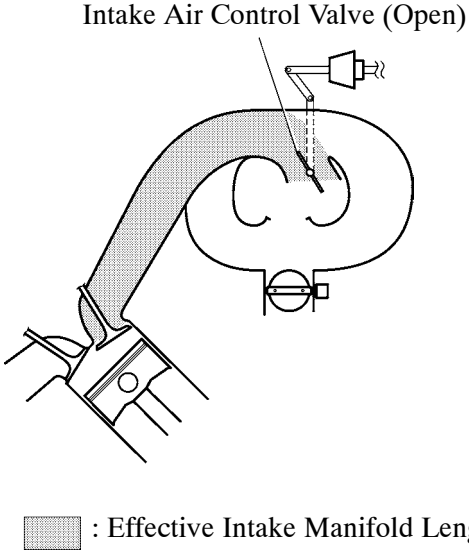
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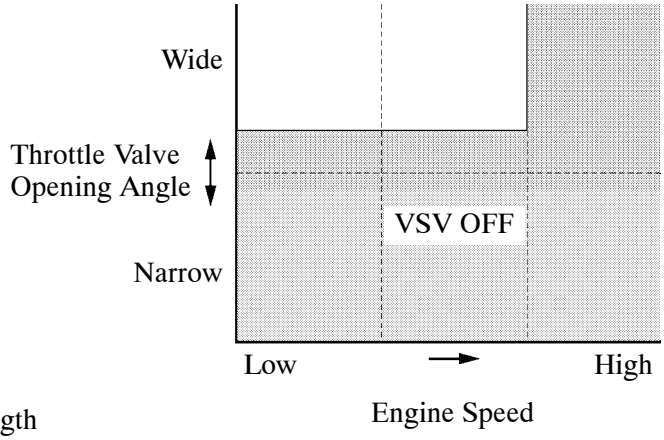
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2) When the Intake Control Valve Opens (VSV OFF)

The ECM deactivates the VSV so that atmospheric air is led into the diaphragm chamber of the actuator. This opens the control valve to match the shorter pulsation cycle. When the control valve is open, the effective length of the intake manifold is shortened and peak intake efficiency is shifted. This benefits the low, medium and high engine speed ranges at low loads and the high engine speed range under heavy load, thus providing greater output at high engine speeds.



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9. Air Injection System

General

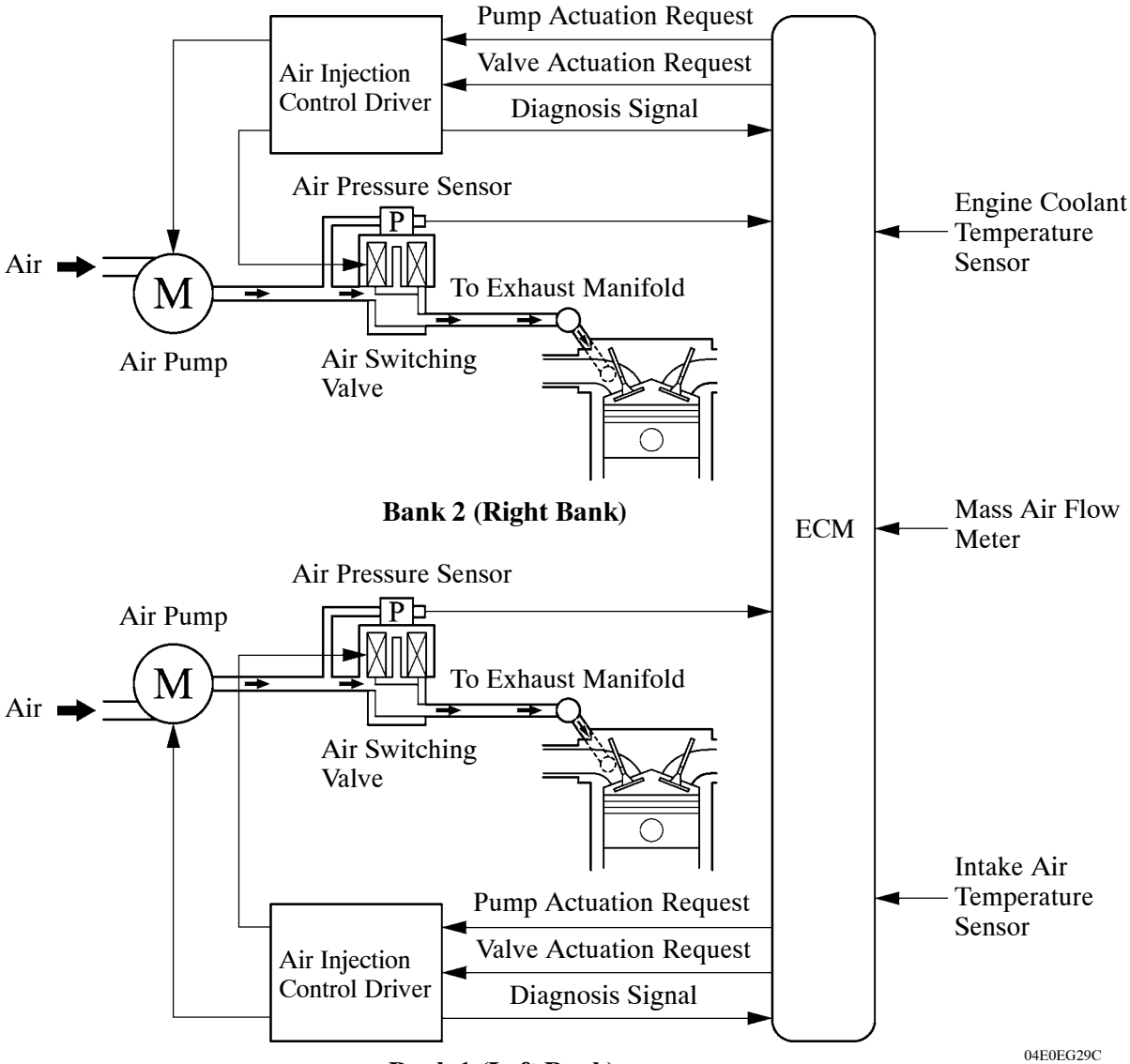
To ensure the proper warm-up performance of the TWCs (Three-Way Catalytic converters) after starting a cold engine, an air injection system is used.

- For this system each of, the bank 2 (right bank) and bank 1 (left bank) has an air pump, air injection control driver, air switching valve, and air pressure sensor. Control of the right bank and left bank is performed independently. Two pumps are used to increase the amount of air supplied, shortening the catalyst warm-up time.
- The ECM estimates the amount of air injected to the TWCs based on signals from the mass air flow meter in order to regulate the air injection time.
- Air is injected under the following conditions.

▶ Operation Conditions ◀

Engine Coolant Temperature	5 to 45°C (41 to 113°F)
Intake Air Temperature	5°C (41°F) or more

▶ System Diagram ◀

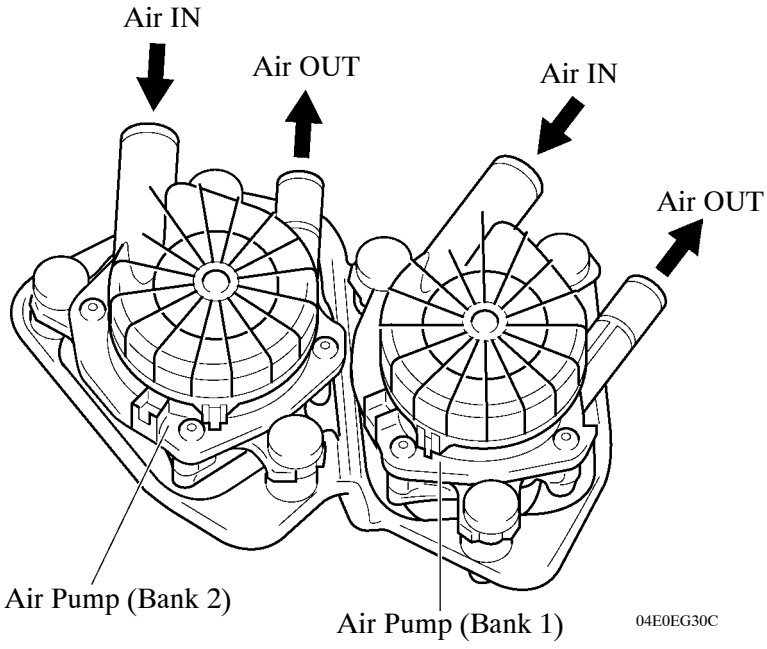


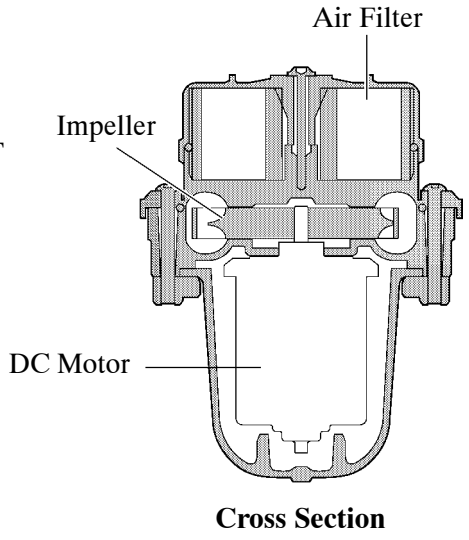
Construction and Operation

1) Air Pump

Each air pump consists of a DC motor, an impeller and an air filter.

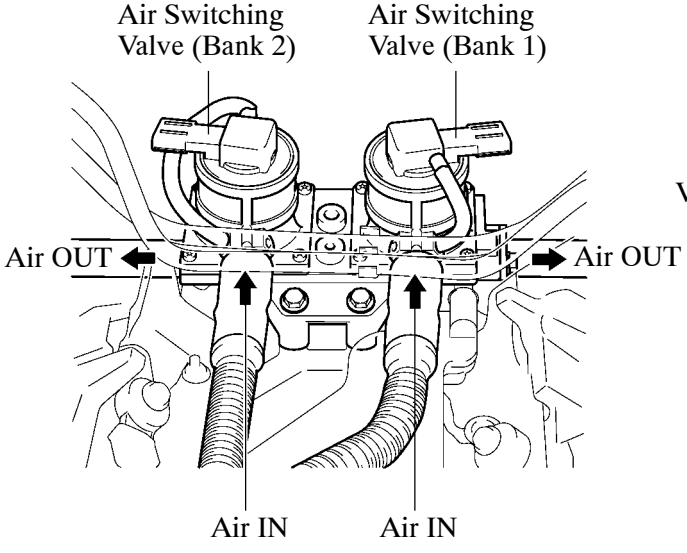
- The air pump supplies air into an air injection control valve using its impeller.
- The air filter is maintenance-free.
- The structure and function of the air pumps for the bank 1 and bank 2 are basically the same.

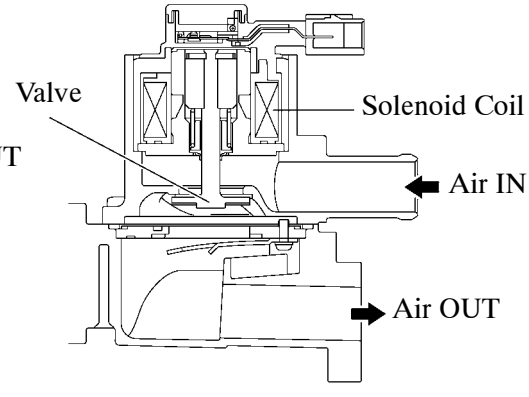




2) Air Switching Valve

- The air switching valve is operated by a solenoid coil to control air injection and prevent back-flow of exhaust gas. Opening timing of the valve is synchronized with the operation timing of the air pump.
- An air pressure sensor is built into the corresponding air switching valve.
- The structure and function of the air switching valves for the bank 1 and bank 2 are basically the same.

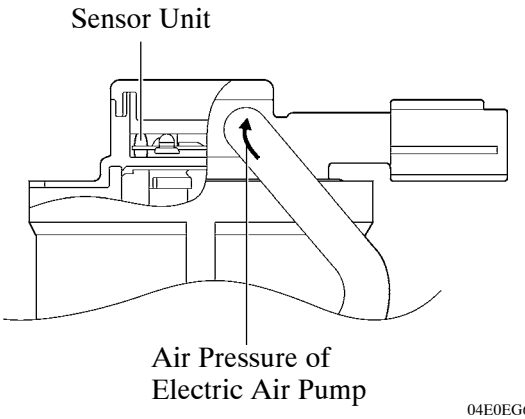


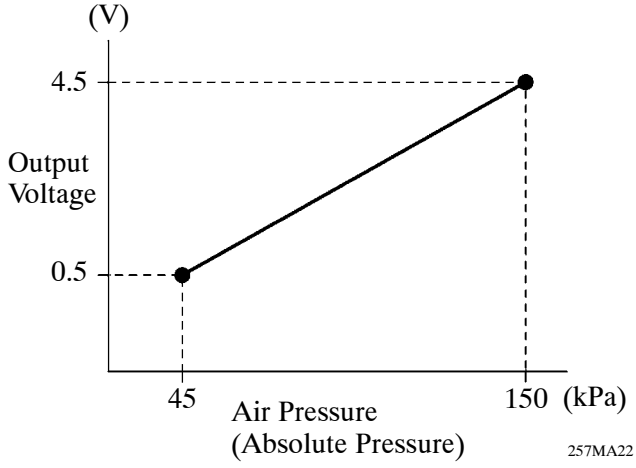


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3) Air Pressure Sensor

- The air pressure sensor consists of a semiconductor, which has a silicon chip that changes its electrical resistance when pressure is applied to it. The sensor converts the pressure into an electrical signal, and sends it to the ECM in an amplified form.
- The structure and function of the air pressure sensors for the bank 1 and bank 2 are basically the same.

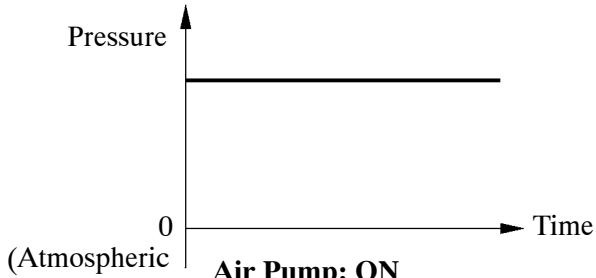




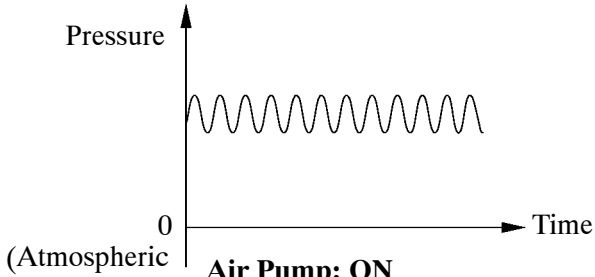
The ECM detects operation of the air injection system based on signals from the air pressure sensor as follows:

1) When the air pump is ON and the air switching valve is closed, the pressure is stable.
2) When the air pump is ON and the air switching valve is open, the pressure drops slightly and becomes unstable because of exhaust pulses.
3) When the air pump is OFF and the air switching valve is closed, the pressure remains at atmospheric pressure.
4) When the air pump is OFF and air switching valve is open, the pressure drops below atmospheric pressure and becomes unstable because of exhaust pulses.

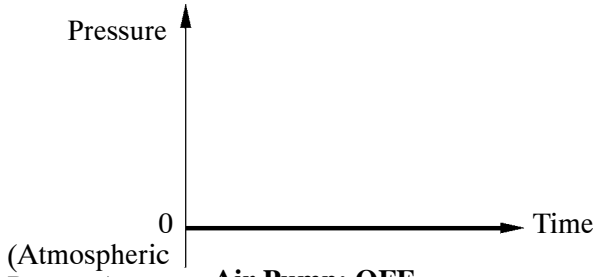
Example: 1



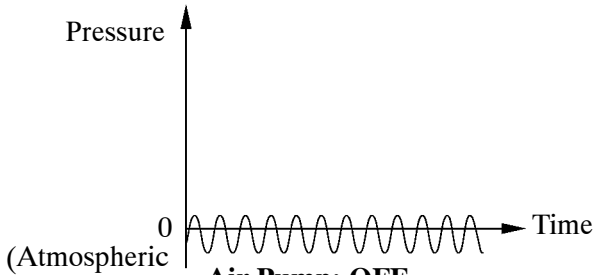
Example: 2



Example: 3



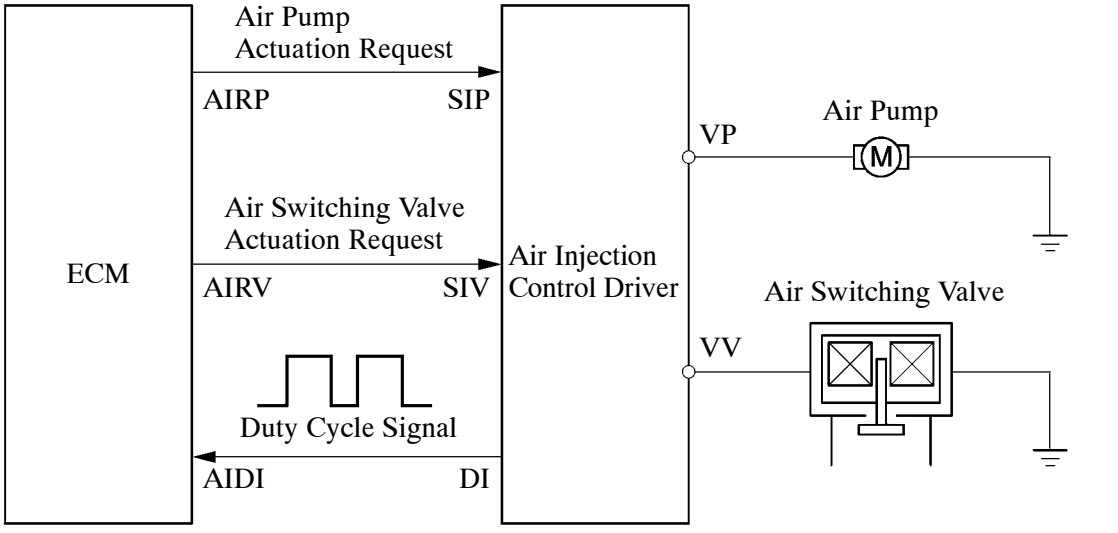
Example: 4



273GX81

4) Air Injection Control Driver

- A semiconductor type air injection control driver is used. Activated by the ECM, this driver actuates the air pump and the air switching valve.
- The air injection control driver also detects failures in the input and output circuits of the air injection driver and transmits the failure status to the ECM via duty cycle signals.
- The basic functions of the air injection control drivers for the bank 1 and bank 2 are the same. The following system chart shows the bank 1 (left bank).



▶ DI Terminal Output ◀

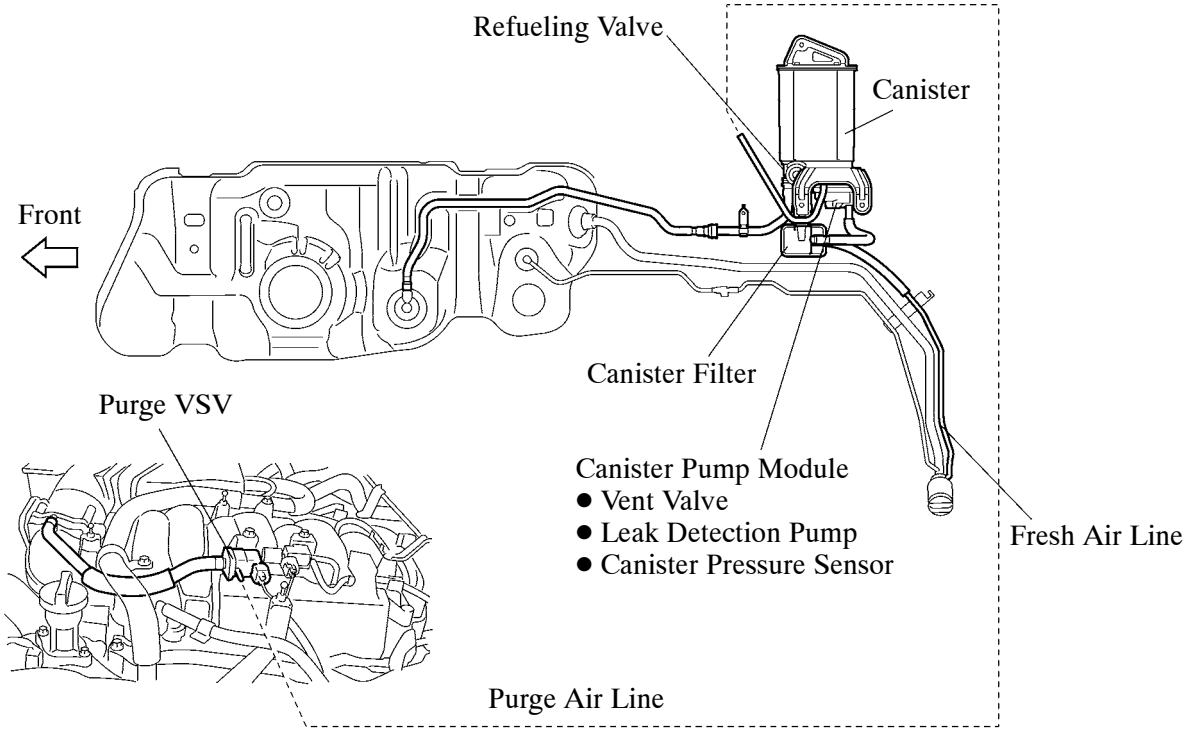
Condition	AIRP	AIRV	Output (Duty Cycle Signal)
Open circuit in line between AIDI and DI terminals.	—	—	GND 273GX28
Failure in line between ECM terminals and air injection control driver.	—	—	GND 273GX29
Output failure at air injection control driver. (Failure in air pump actuation circuit)	—	—	200 ms GND 273GX30
Output failure at air injection control driver. (Failure in air switching valve actuation circuit)	—	—	GND 273GX31
Overheat failure of air injection control driver.	—	—	GND 273GX32
Normal	ON	ON	GND 273GX33
	OFF	OFF	GND 273GX29
	ON	OFF	
	OFF	ON	

10. Evaporative Emission Control System

General

The basic construction and operation of this system are the same as the 2UZ-FE engine. For details, see page EG-68.

Layout of Main Components



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11. Diagnosis

- When the ECM detects a malfunction, the ECM makes a diagnosis and memorizes the failed section. Furthermore, the MIL (Malfunction Indicator Lamp) in the combination meter illuminates or blinks to inform the driver.
- The ECM will also store the DTC (Diagnostic Trouble Code) of the malfunctions. The DTC can be accessed by using the Techstream.
- For details, refer to the 2008 Sequoia Repair Manual (Pub. No. RM08L0U).

Service Tip

To clear the DTC that is stored in the ECM, use the Techstream, disconnect the battery terminal or remove the EFI MAIN fuse and ETCS fuse for 1 minute or longer.

12. Fail-safe

When a malfunction is detected at any of the sensors, there is a possibility of an engine or other malfunction occurring if the ECM were to continue to control the engine control system in the normal way. 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 2008 Sequoia Repair Manual (Pub. No. RM08L0U).