■ENGINE CONTROL SYSTEM

1. General

The engine control systems for the 1AZ-FE and 2AZ-FE engines have following features.

System	Outline
EFI Electronic Fuel Injection	• An L-type EFI system directly detects the intake air volume with a hot-wire type air flow meter. • The fuel injection system is a sequential multiport fuel injection system.
ESA Electronic Spark Advance	Ignition timing is determined by the engine ECU based on signals from various sensors. The engine ECU corrects ignition timing in response to engine knocking.
ETCS-i Electronic Throttle Control System-intelligent (See page EG-44)	Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.
	• A linkless-type is used, without an accelerator cable. • An accelerator pedal position sensor is provided on the accelerator pedal. • A non-contact type throttle position sensor and accelerator pedal position sensor are used.
VVT-i Variable Valve Timing-intelligent (See page EG-49)	Controls the intake camshaft to an optimal valve timing in accordance with the engine condition.
Air-fuel Ratio Sensor, Oxygen Sensor Heater Control	Maintains the temperature of the air-fuel ratio sensor and oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.
Air Conditioner Cut-off Control*1	By turning the air conditioner compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Cooling Fan Control (See page EG-53)	Radiator cooling fan operation is controlled by signals from engine ECU based on the water temperature sensor signal (THW) and the condition of the air conditioner operation.
Fuel Pump Control (See page EG-54)	• Fuel pump operation is controlled by signal from the engine ECU. • The fuel pump is stopped when the SRS driver's and front passenger's airbags are deployed.
Starting Control*2 Cranking Hold Function (See page EG-55)	Once the engine switch is pushed, this control continues to operate the starter until the engine is started.

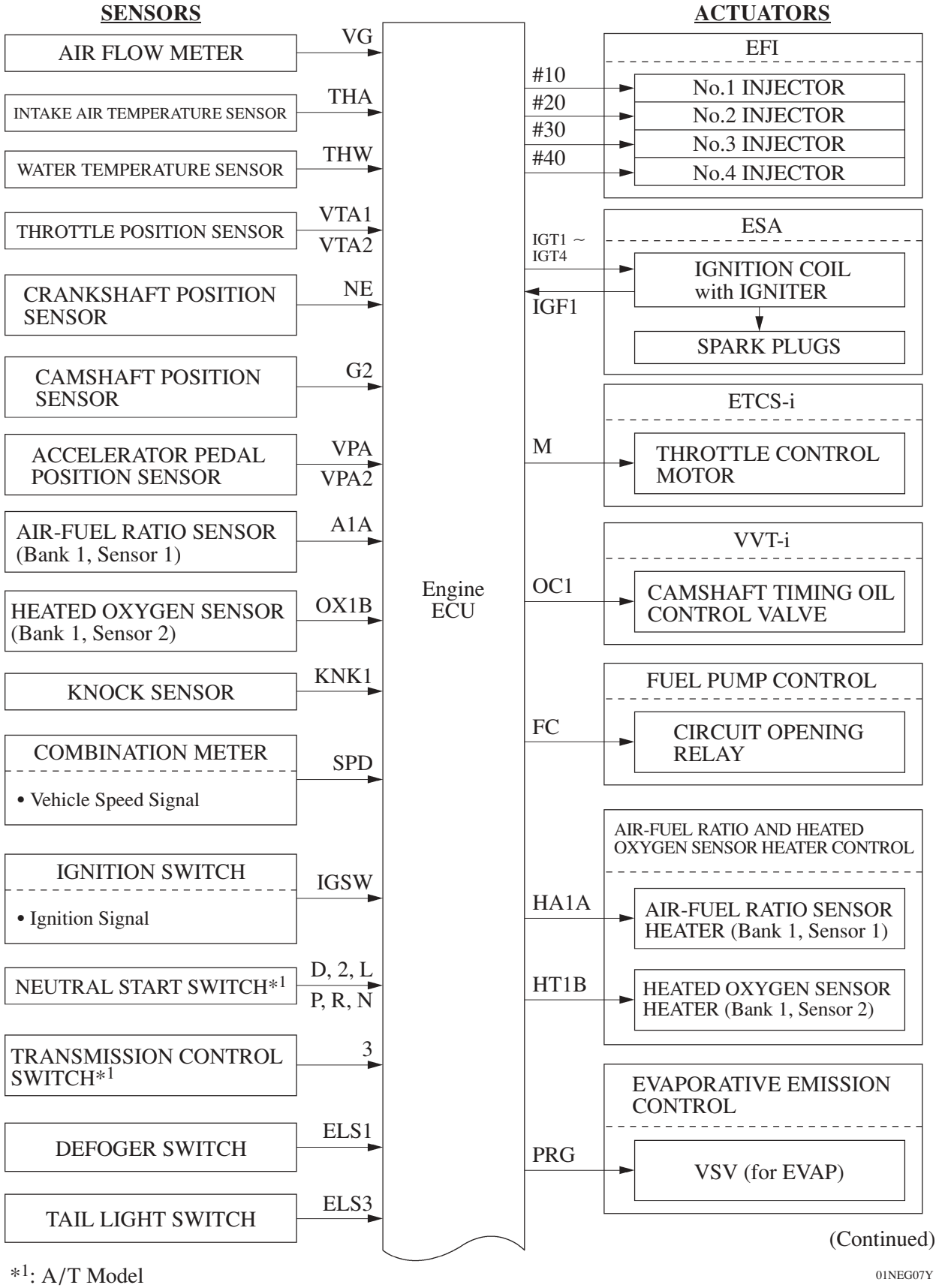
*1: Models with Air Conditioner System (Continued)
*2: Models with Smart Entry & Start System

System	Outline
Charging Control (See page EG-57)	The engine ECU regulates the charging voltage of the alternator in accordance with the driving conditions and the charging state of the battery.
Engine Immobilizer*3	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.
Diagnosis (See page EG-59)	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.
Fail-safe (See page EG-59)	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in memory.

*3: Models with Engine Immobilizer System

2. Construction

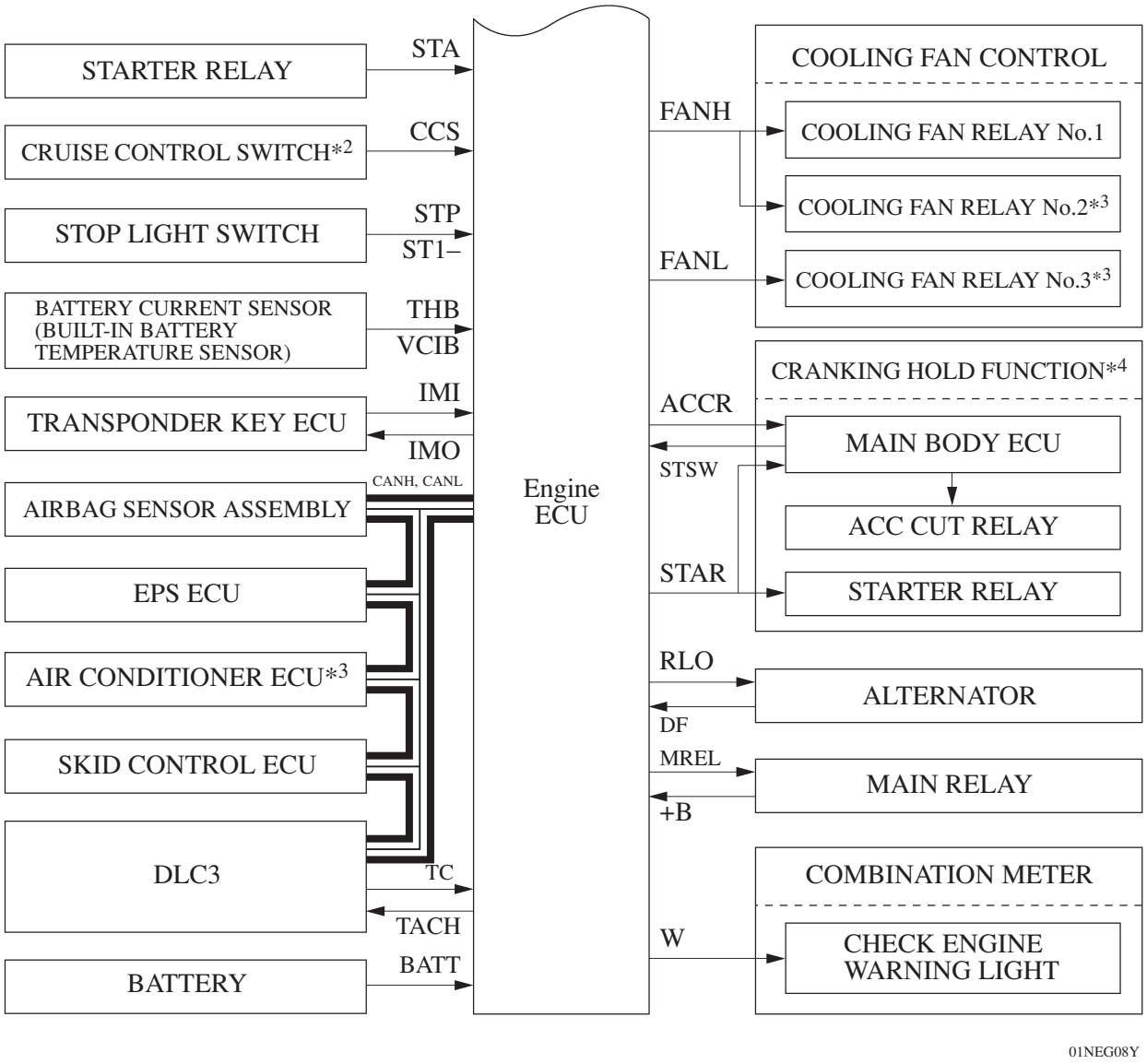
The configuration of the engine control system in the 1AZ-FE and 2AZ-FE engines are shown in the following chart.



(Continued)

*1: A/T Model

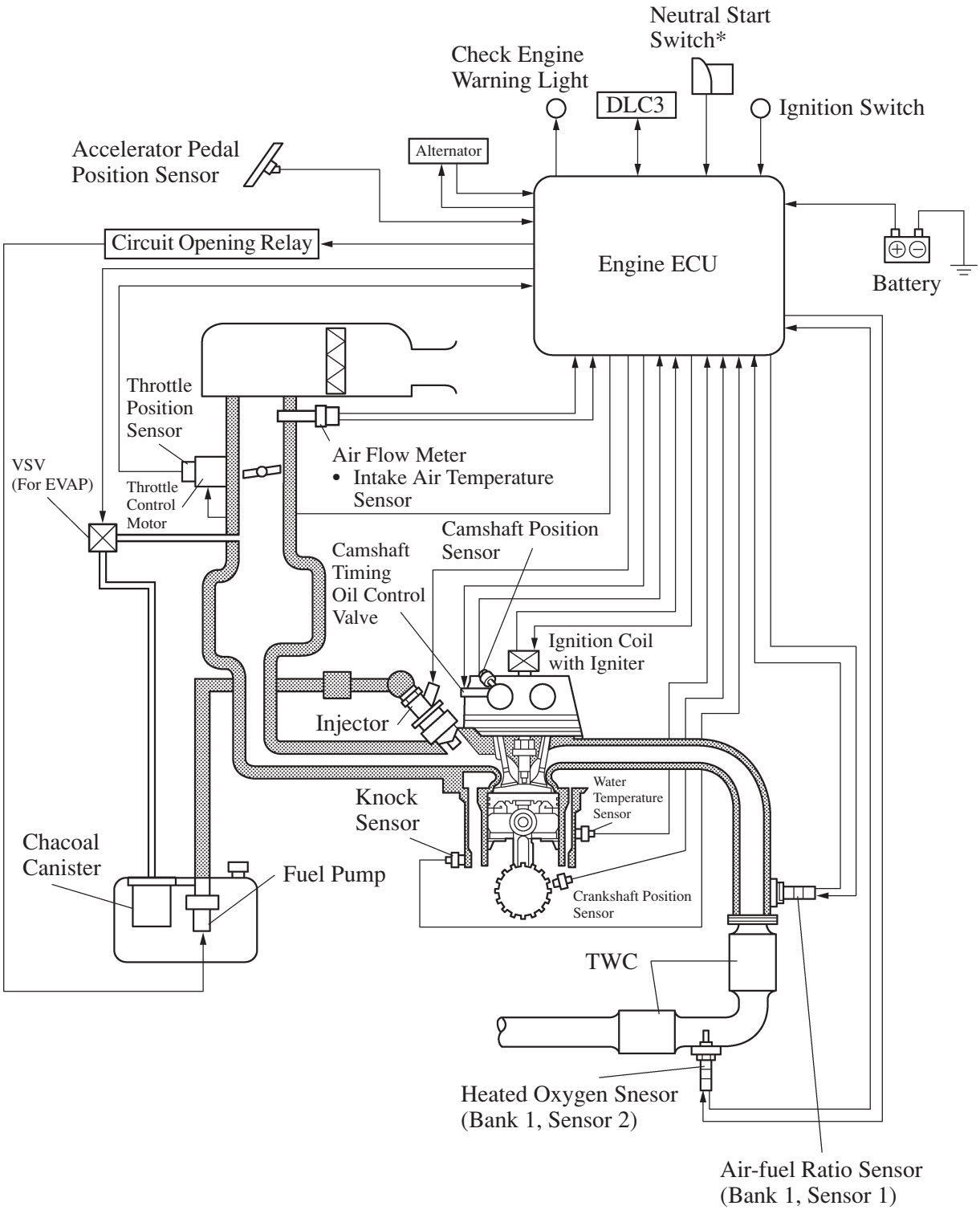
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*2: Models with Cruise Control System
*3: Models with Air Conditioner System
*4: Models with Smart Entry & Start System

3. Engine Control System Diagram

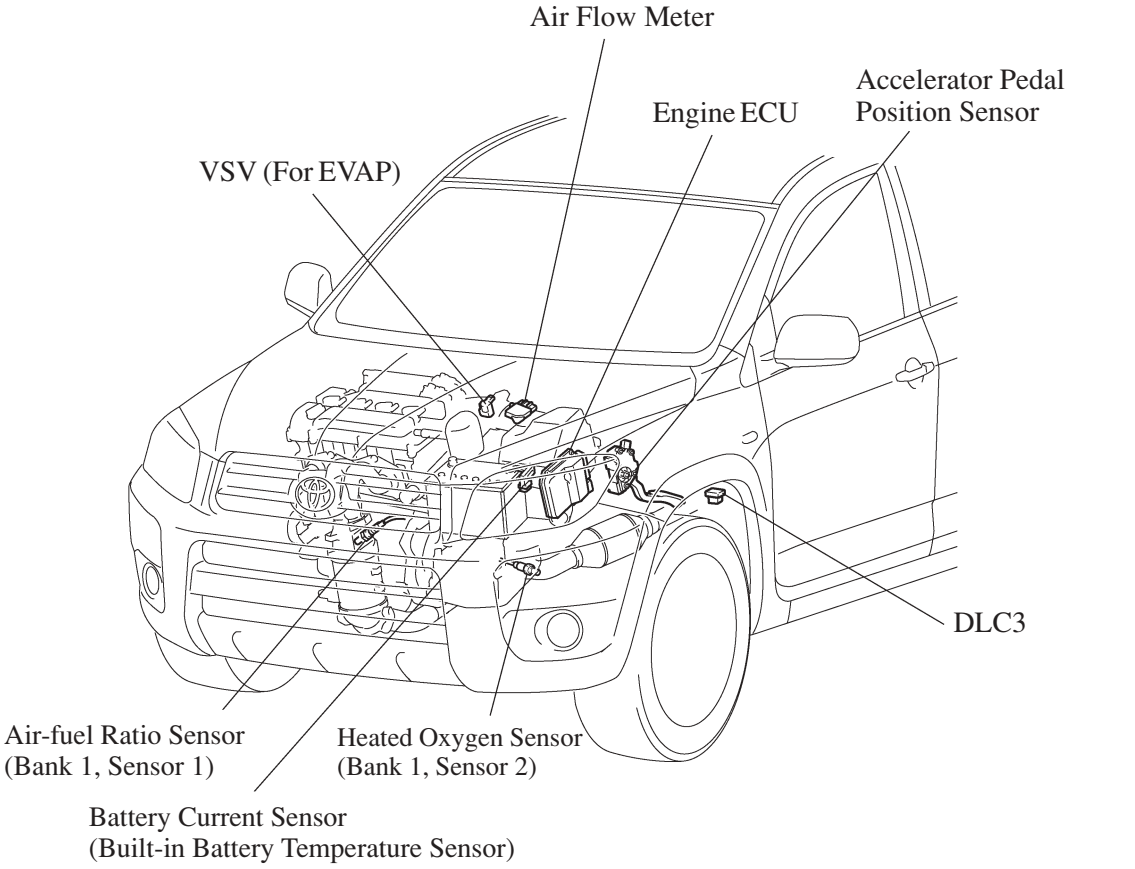


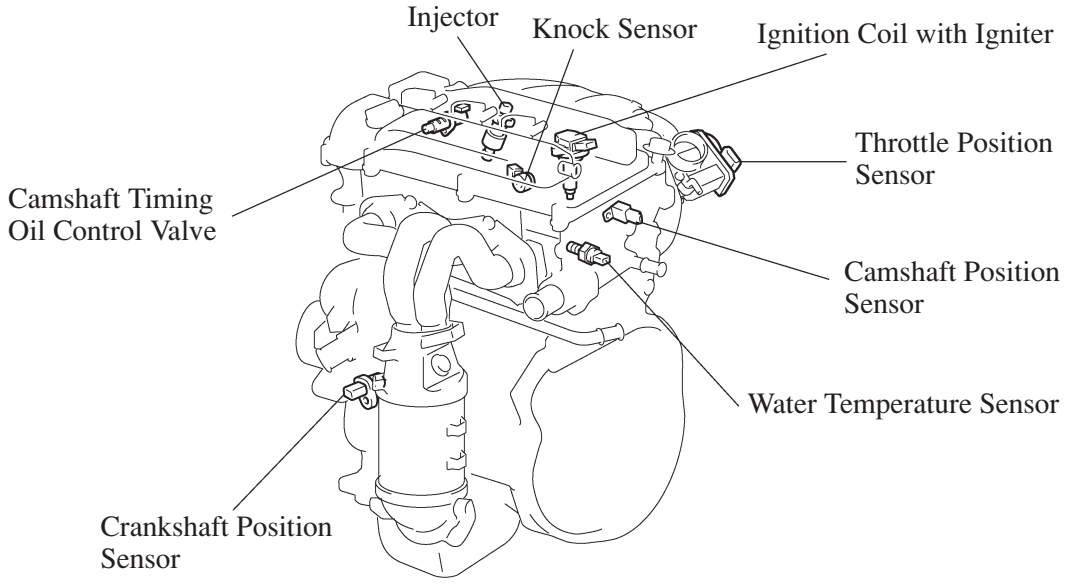
*1: A/T Model

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4. Layout of Main Components





5. Main Components of Engine Control System

General

The main components of the 1AZ-FE and 2AZ-FE engine control systems are as follows:

Components	Outline	Quantity
Engine ECU	32-bit	1
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 (3)	1
Throttle Position Sensor	Non-contact Type	1
Accelerator Pedal Position Sensor	Non-contact Type	1
Knock Sensor	Built-in Piezoelectric Element Type (Flat Type)	1
Air-fuel Ratio Sensor (Bank 1, Sensor 1)	Type with Heater (Planar Type)	1
Heated Oxygen Sensor (Bank 1, Sensor 2)	Type with Heater (Cup Type)	1
Injector	12-hole Type	4

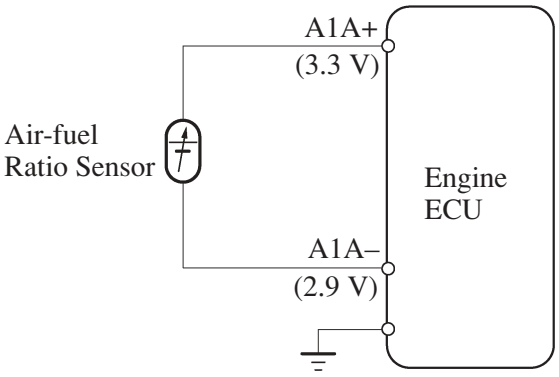
Engine ECU

The 32-bit CPU of the engine ECU is used to increase the speed for processing the signals.

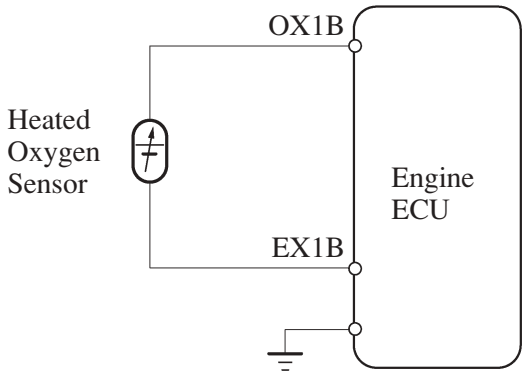
Air-fuel Ratio Sensor and Heated Oxygen Sensor

1) General

- The air-fuel ratio sensor and heated oxygen sensor differ in output characteristics.
- Approximately 0.4V is constantly applied to the air-fuel ratio sensor, which outputs an amperage that varies in accordance with the oxygen concentration in the exhaust emission. The engine ECU converts the changes in the output amperage into voltage in order to linearly detect the present air-fuel ratio. The air-fuel ratio sensor data is read out by an intelligent tester II.
- The output voltage of the heated oxygen sensor changes in accordance with the oxygen concentration in the exhaust emission. The engine ECU uses this output voltage to determine whether the present air-fuel ratio is richer or leaner than the stoichiometric air-fuel ratio.

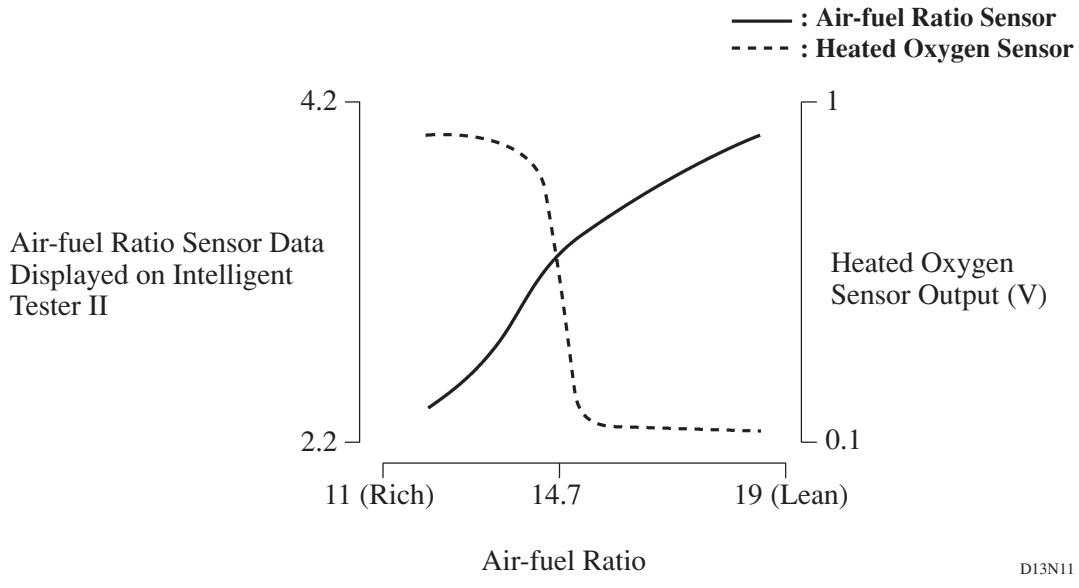


Air-fuel Ratio Sensor Circuit



Heated Oxygen Sensor

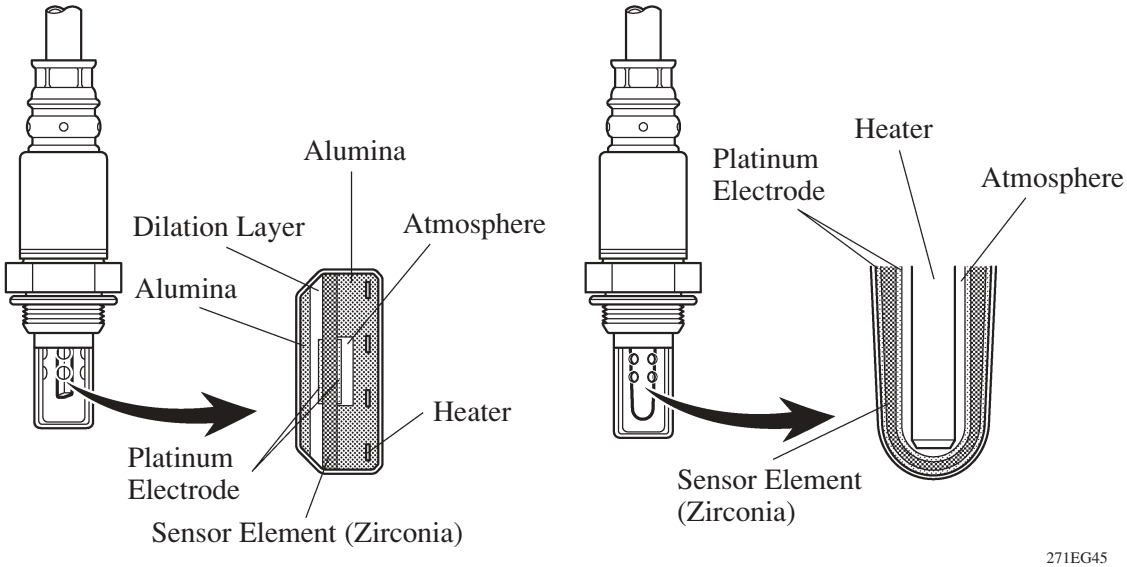
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2) Construction

- The basic construction of the air-fuel ratio sensor and heated oxygen sensor is the same. However, they are divided into the cup type and the planar type, according to the different types of heater construction that are used.
- The cup type sensor contains a sensor element that surrounds a heater.
- The planar type sensor uses alumina, which excels in heat conductivity and insulation, to integrate a sensor element with a heater, thus realizing the excellent warm-up performance of the sensor.



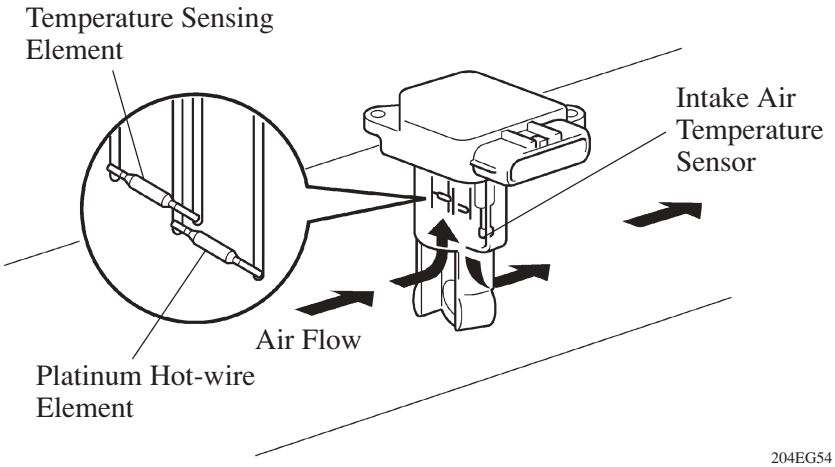
Planar Type Air-fuel Ratio Sensor **Cup Type Heated Oxygen Sensor**

▶ Warm-up Specification ◀

Sensor Type	Planar Type	Cup Type
Warm-up Time	Approx. 10 sec.	Approx. 30 sec.

Air Flow Meter

- The compact and lightweight air flow meter, which is a plug-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 high detection precision is achieved and the intake air resistance is reduced.
- This air flow meter has a built-in intake air temperature sensor.

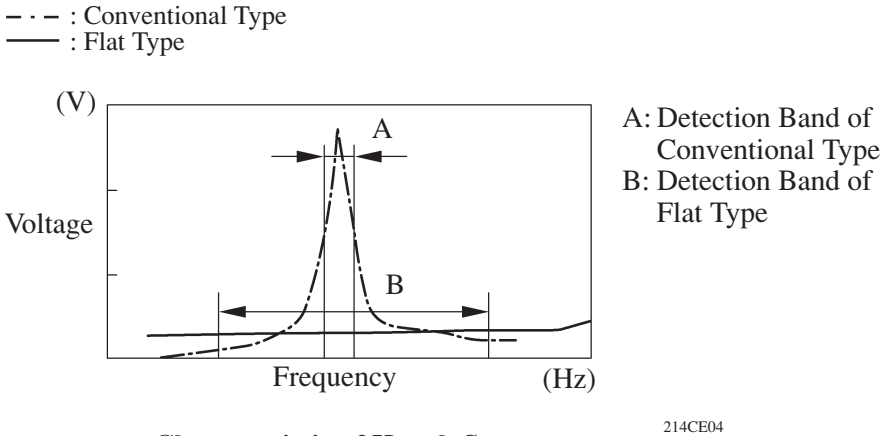


Knock Sensor (Flat Type)

1) General

In the conventional type knock sensor (resonant type), a vibration plate which has the same resonance point as the knocking frequency of the engine is built in and can detect the vibration in this frequency band.
On the other hand, a flat type knock sensor (non-resonant type) has the ability to detect vibration in a wider frequency band from about 6 kHz to 15 kHz, and has the following features.

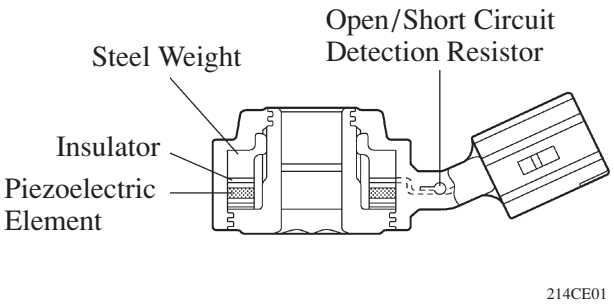
- The engine knocking frequency will change a bit depending on the engine speed. The flat type knock sensor can detect the vibration even when the engine knocking frequency is changed. Thus the vibration detection ability is increased compared to the conventional type knock sensor, and a more precise ignition timing control is possible.



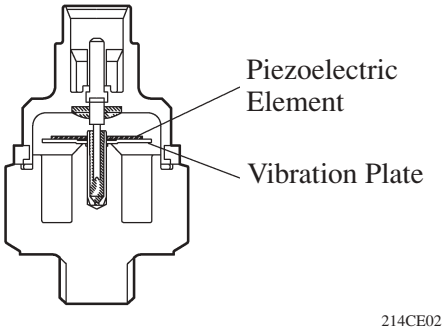
Characteristic of Knock Sensor

2) Construction

- The flat type knock sensor is installed on the engine through the stud bolt installed on the cylinder block. For this reason, a hole for the stud bolt is running through the center of the sensor.
- Inside of the sensor, a steel weight is located on the upper portion and a piezoelectric element is located under the weight through the insulator.
- The open/short circuit detection resistor is integrated.



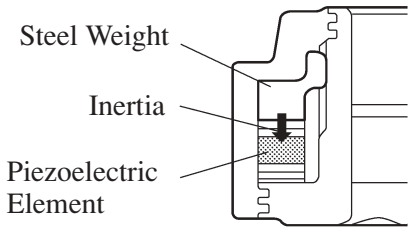
Flat Type Knock Sensor (Non-resonant Type)



Conventional Type Knock Sensor (Resonant Type)

3) Operation

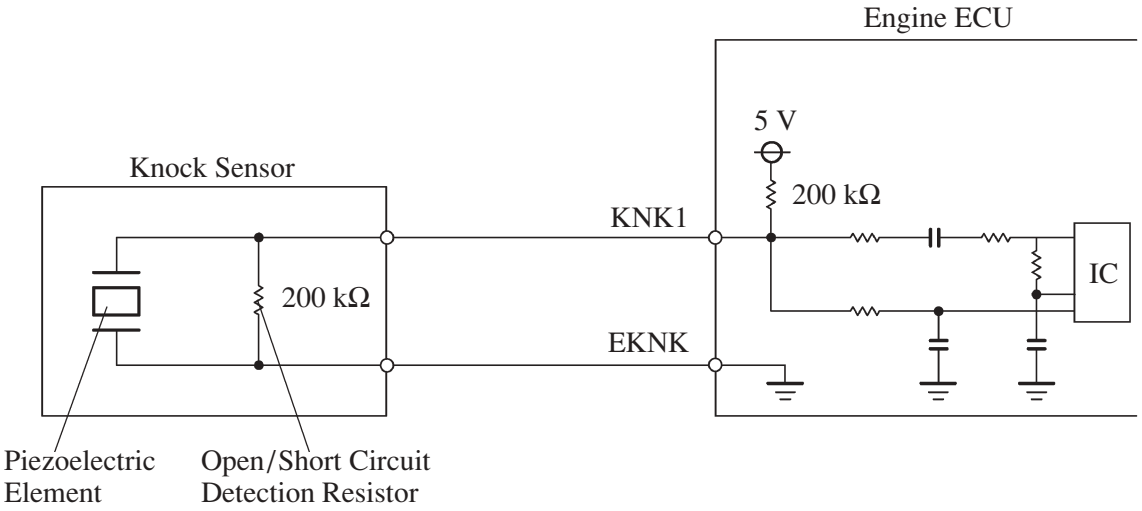
The knocking vibration is transmitted to the steel weight and its inertia applies pressure to the piezoelectric element. The action generates electromotive force.



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4) Open/Short Circuit Detection Resistor

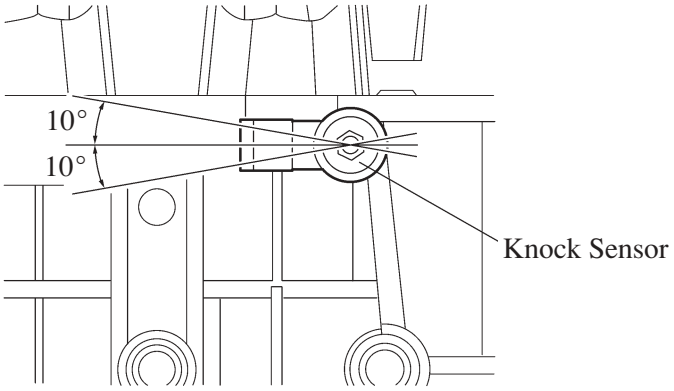
While the ignition is ON, the open/short circuit detection resistor in the knock sensor and the resistor in the engine ECU keep constant the voltage at the terminal KNK1 of engine.
An IC (Integrated Circuit) in the engine ECU is always monitoring the voltage of the terminal KNK1. If the open/short circuit occurs between the knock sensor and the engine ECU, the voltage of the terminal KNK1 will change and the engine ECU detects the open/short circuit and stores DTC (Diagnostic Trouble Code).



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Service Tip

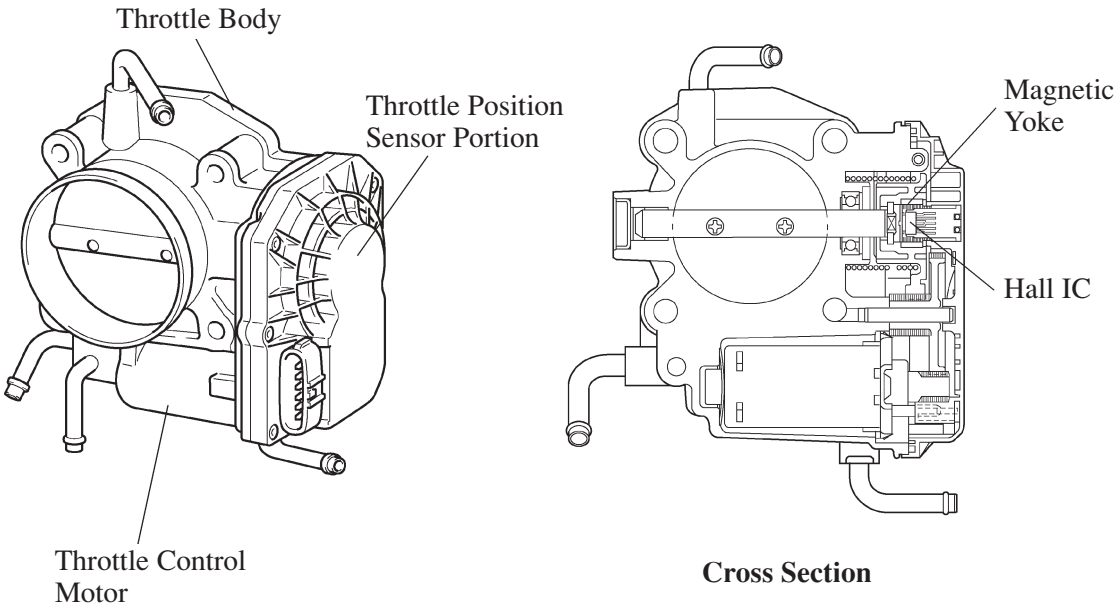
- In accordance with the adoption of an open/short circuit detection resistor, the inspection method for the sensor has been changed. For details, refer to the RAV4 Repair Manual (Pub. No. RM01N0E).
- To prevent the water accumulation in the connecter, make sure to install the flat type knock sensor in the position as shown in the following illustration.

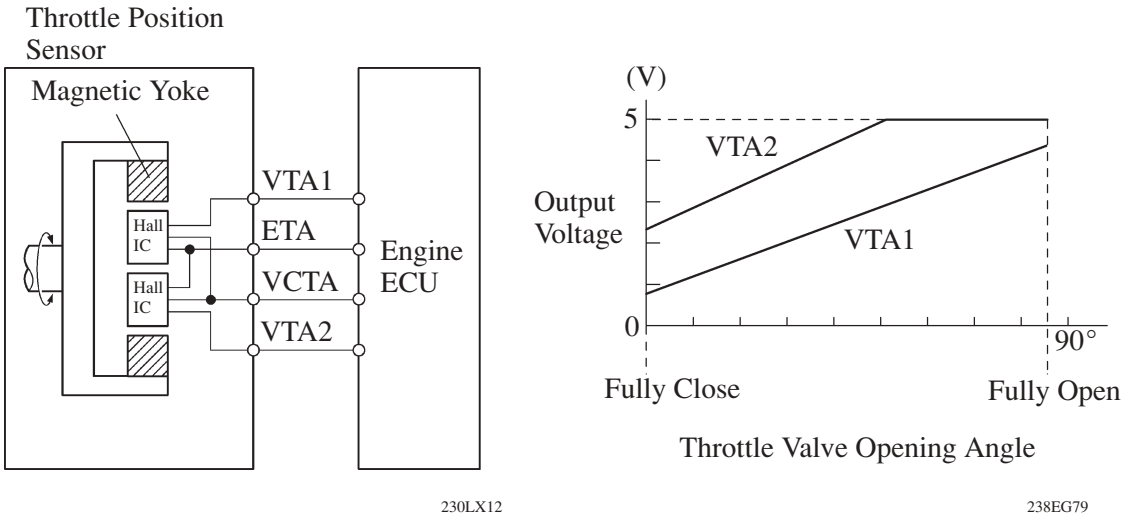


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Throttle Position Sensor

The throttle position sensor is mounted on the throttle body to detect the opening angle of the throttle valve. The throttle position sensor converts the magnetic flux density that changes when the magnetic yoke (located on the same axis as the throttle shaft) rotates around the Hall IC into electric signals to operate the throttle control motor.





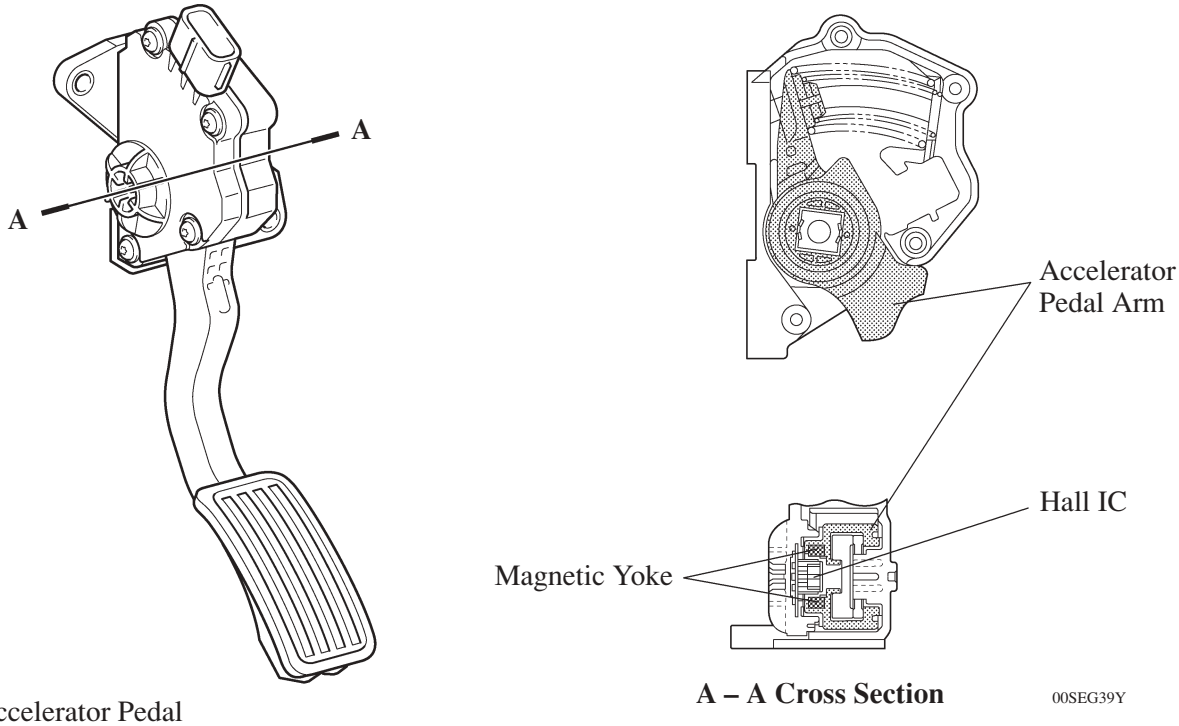
Service Tip

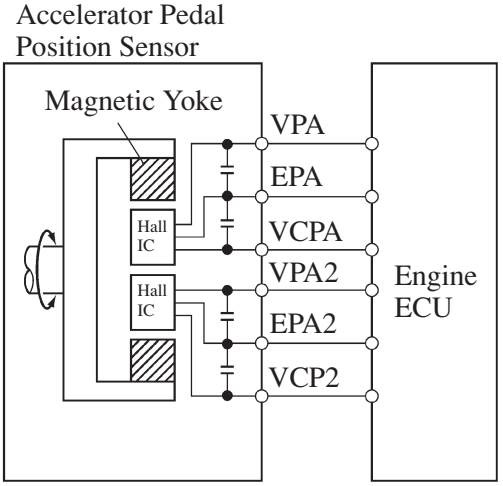
The inspection method differs from the conventional contact type throttle position sensor because this non-contact type sensor uses a Hall IC.
For details, refer to the RAV4 Repair Manual (Pub. No. RM01N0E).

Accelerator Pedal Position Sensor

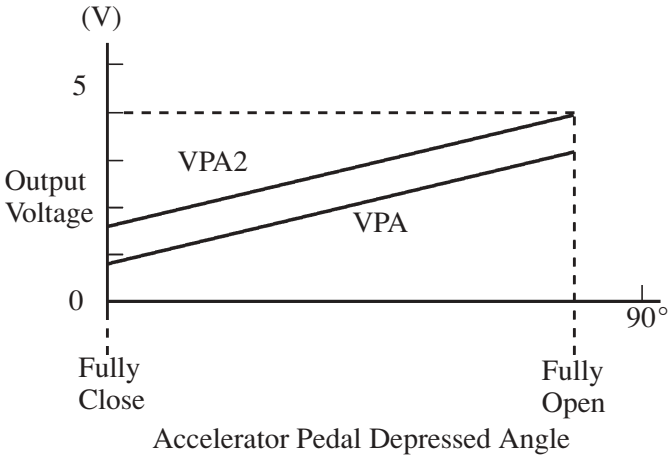
The non-contact type accelerator pedal position sensor uses a Hall IC.

- The magnetic yoke that is mounted at the accelerator pedal arm rotates around the Hall IC in accordance with the amount of effort that is applied to the accelerator pedal. The Hall IC converts the changes in the magnetic flux at that time into electrical signals, and outputs them as accelerator pedal effort to the engine ECU.
- The Hall IC contains circuits for the main and sub signals. It converts the accelerator pedal depressed angles into electric signals with two differing characteristics and outputs them to the engine ECU.





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Service Tip

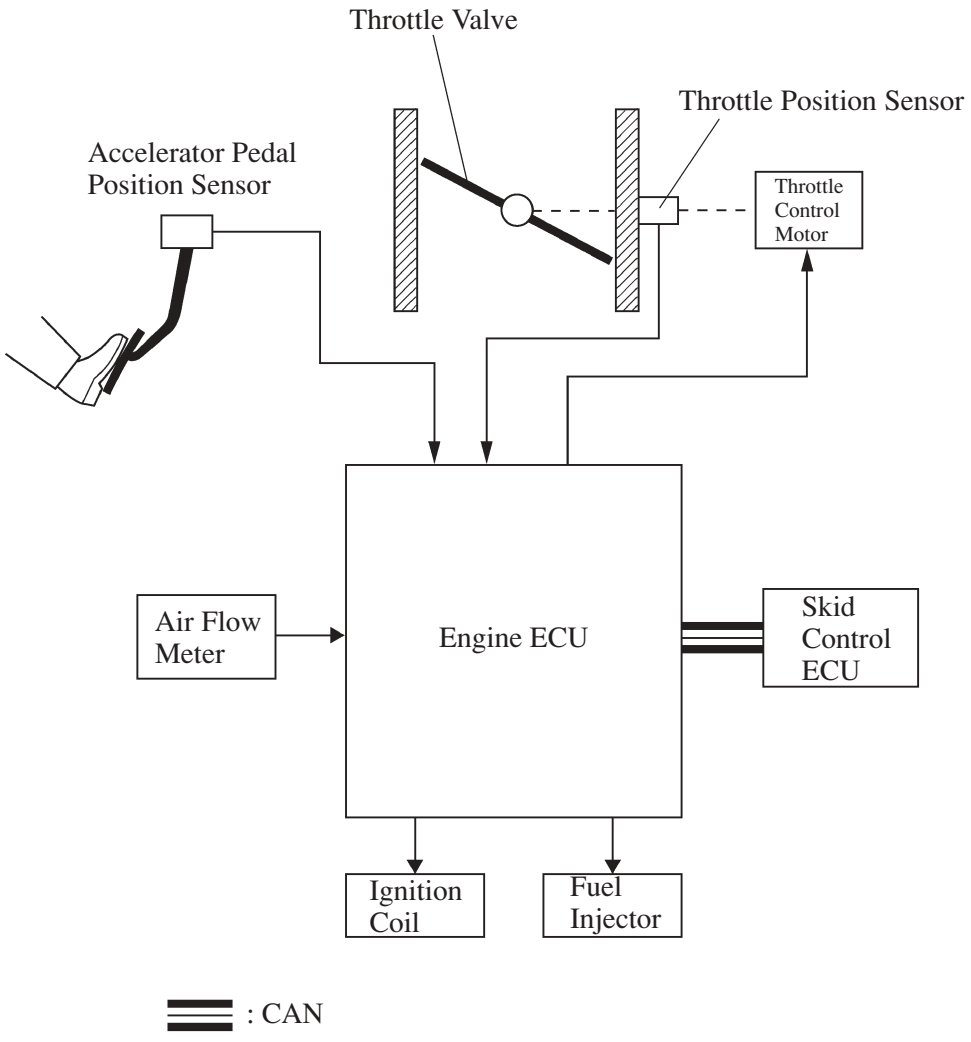
The inspection method differs from the conventional contact type accelerator pedal position sensor because this non-contact type sensor uses a Hall IC.
For details, refer to the RAV4 Repair Manual (Pab. No. RM01N0E).

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

General

- The ETCS-i is used, providing excellent throttle control in all the operating ranges. In the 1AZ-FE and 2AZ-FE engines, the accelerator cable has been discontinued, and an accelerator pedal position sensor has been provided on the accelerator pedal.
- In the conventional throttle body, the throttle valve opening is determined by the amount of the accelerator pedal effort. In contrast, the ETCS-i uses the engine ECU to calculate the optimal throttle valve opening that is appropriate for the respective driving condition and uses a throttle control motor to control the opening.
- The ETCS-i controls the ISC (Idle Speed Control) system, the TRC*1 (Traction Control), VSC*2 (Vehicle Skid Control) system and curise control system*3.
- In case of an abnormal condition, this system switches to the limp mode.

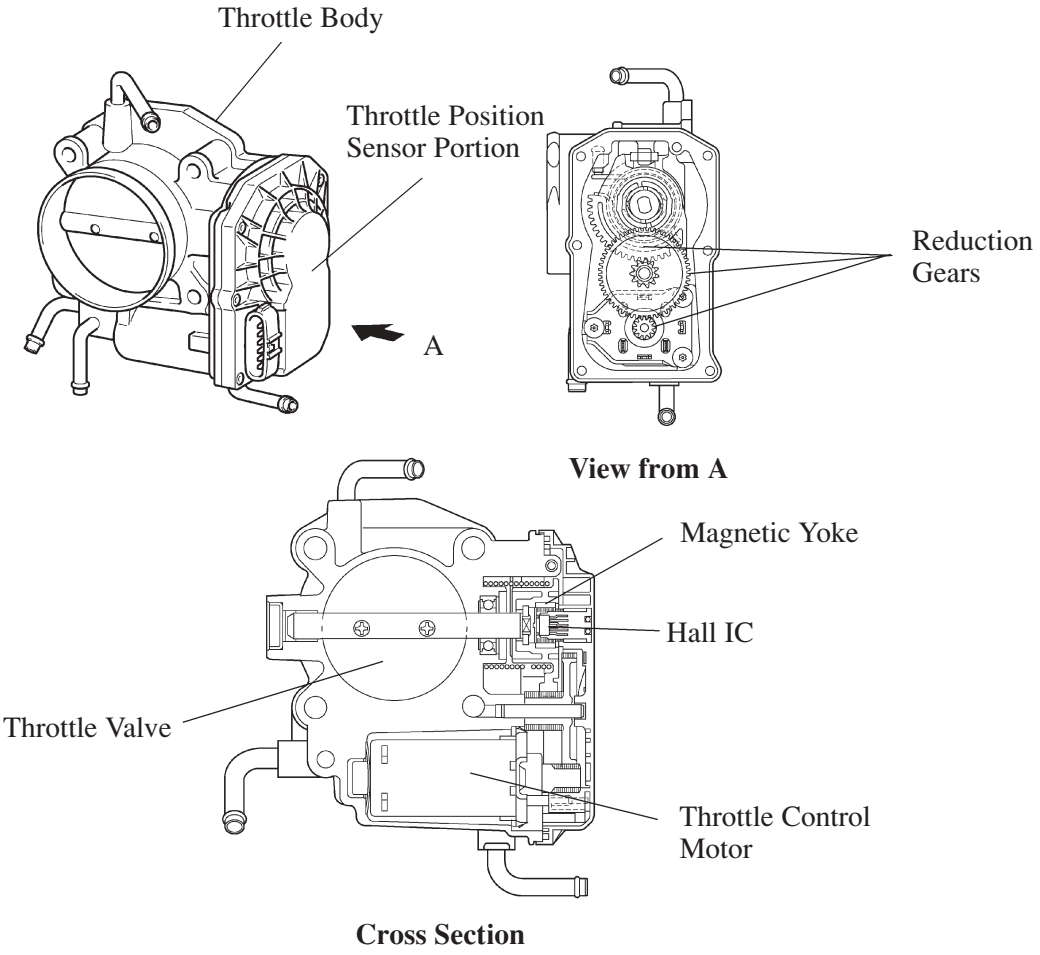
▶ System Diagram ◀



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*1: Models with TRC System
*2: Models with VSC System
*3: Models with Curise Control System

Construction



1) Throttle Position Sensor

The throttle position sensor is mounted on the throttle body, to detect the opening angle of the throttle valve.

2) Throttle Control Motor

A DC motor with excellent response and minimal power consumption is used for the throttle control motor. The engine ECU performs the duty ratio control of the direction and the amperage of the current that flows to the throttle control motor in order to regulate the opening of the throttle valve.

Operation

1) General

The engine ECU drives the throttle control motor by determining the target throttle valve opening in accordance with the respective operating condition.

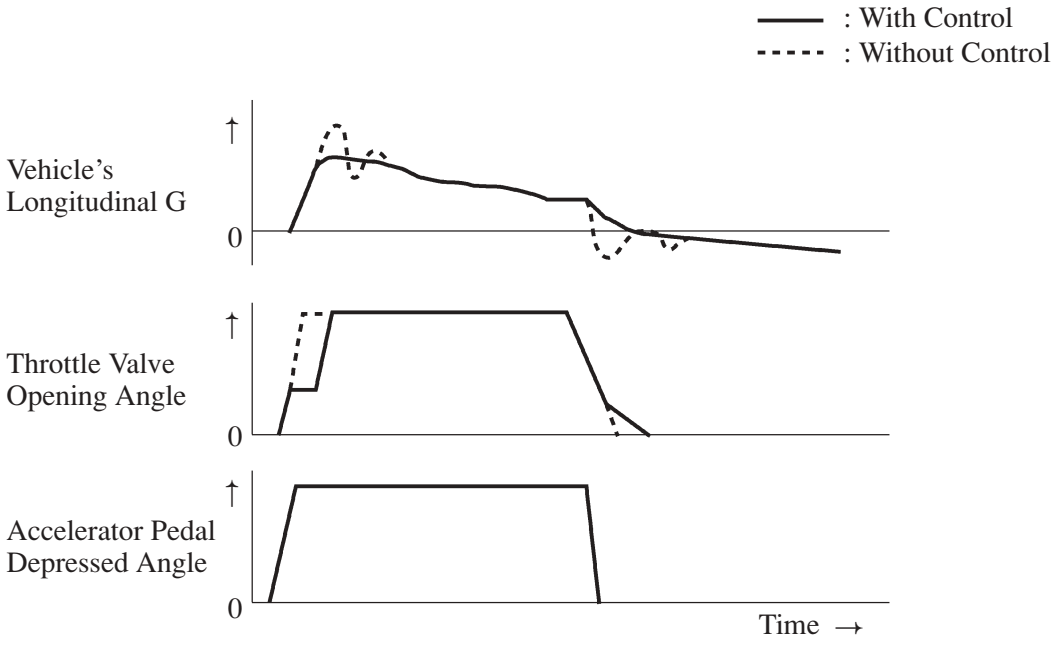
- Non-linear Control
- Idle Speed Control
- TRC Throttle Control
- VSC Coordination Control
- Cruise Control

EG

2) Non-linear Control

It controls the throttle to an optimal throttle valve opening 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.

▶ Control Examples During Acceleration and Deceleration ◀



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3) Idle Speed Control

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

4) TRC Throttle Control

As part of the TRC system, the throttle valve is closed by a demand signal from the skid control ECU if an excessive amount of slippage is created at a driving wheel, thus facilitating the vehicle in providing excellent stability and driving force.

5) VSC Coordination Control

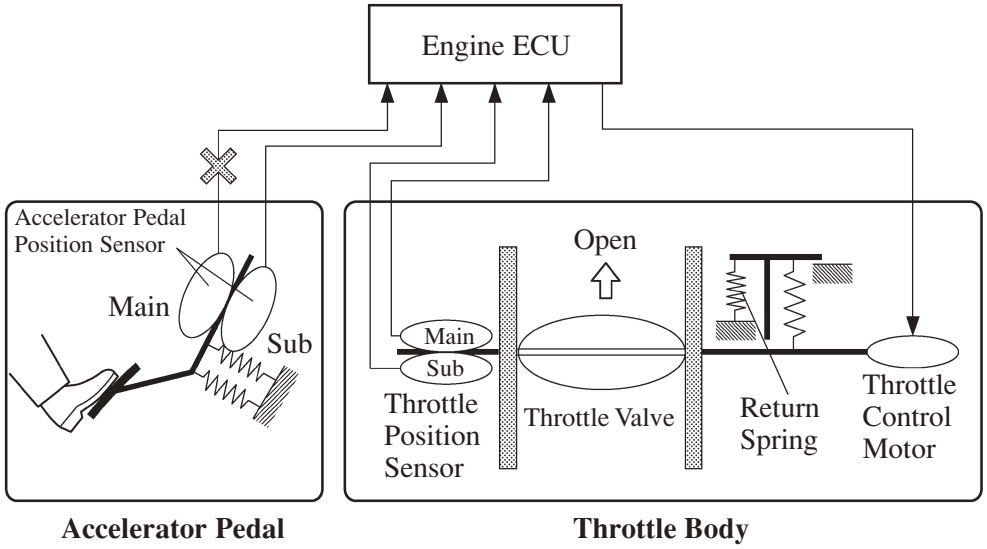
In order to bring the effectiveness of the VSC system control into full play, the throttle valve opening angle is controlled by effecting a coordination control with the skid control ECU.

6) Cruise Control

An engine ECU with an integrated cruise control ECU directly actuates the throttle valve for operation of the cruise control.

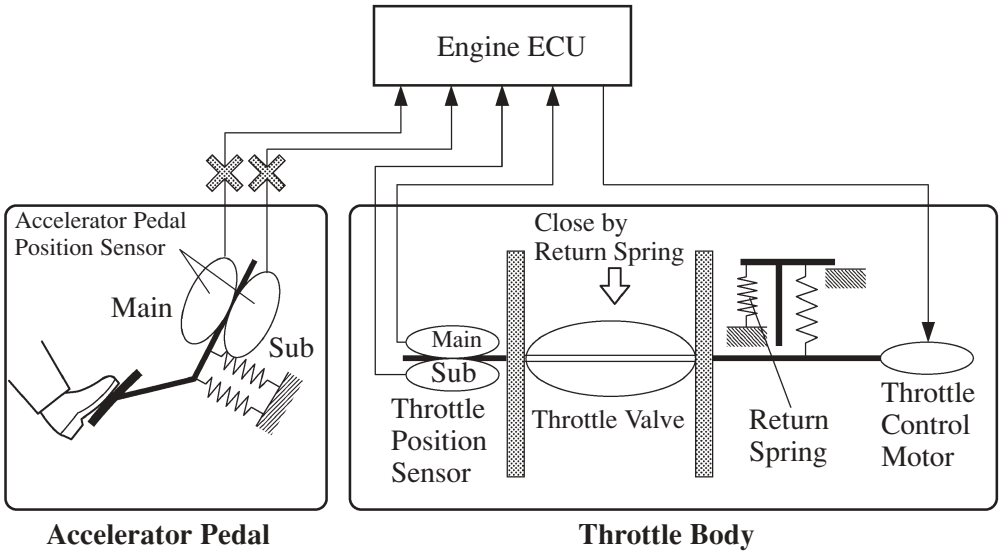
Fail-safe of Accelerator Pedal Position Sensor

- The accelerator pedal position sensor is comprised of two (main, sub) sensor circuits. 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 circuit is used to calculate the accelerator pedal depressed angle, in order to operate the vehicle under the limp mode control.



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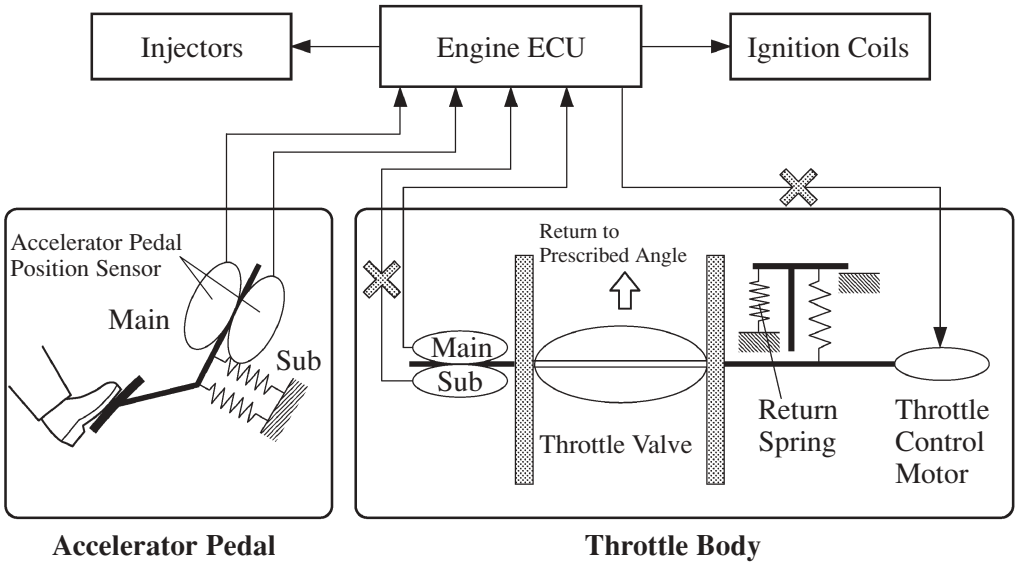
- If both circuits have a malfunction, the engine ECU detects the abnormal signal voltage from these two sensor circuits and stops the throttle control. At this time, the vehicle can be driven within its idling range.



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Fail-safe of Throttle Position Sensor

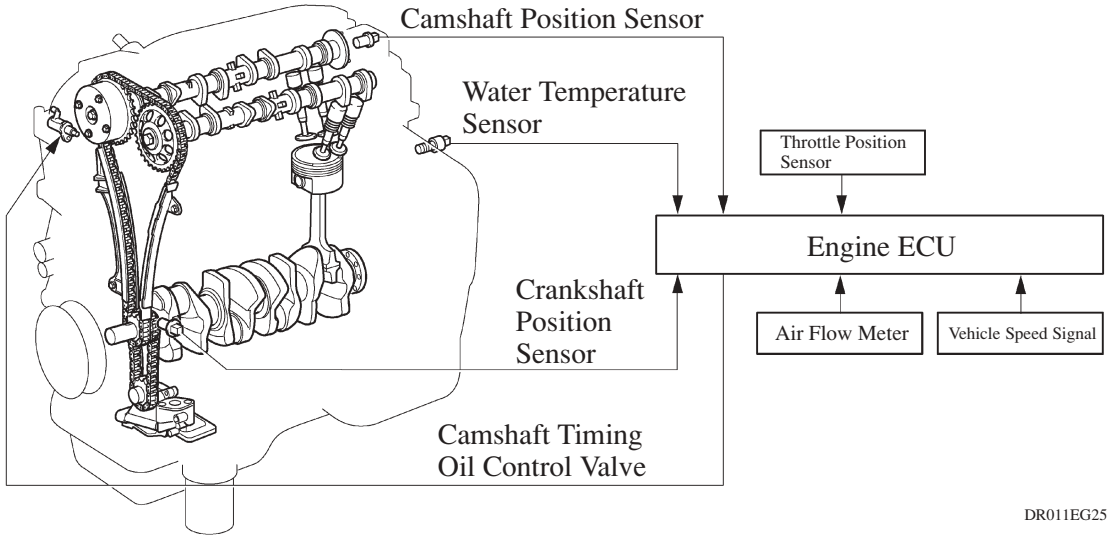
- The throttle position sensor is comprised of two (main, sub) sensor circuits. If a malfunction occurs in either one or both of the sensor circuits, the engine ECU detects the abnormal signal voltage difference between these two sensor circuits, cuts off the current to the throttle control motor, and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



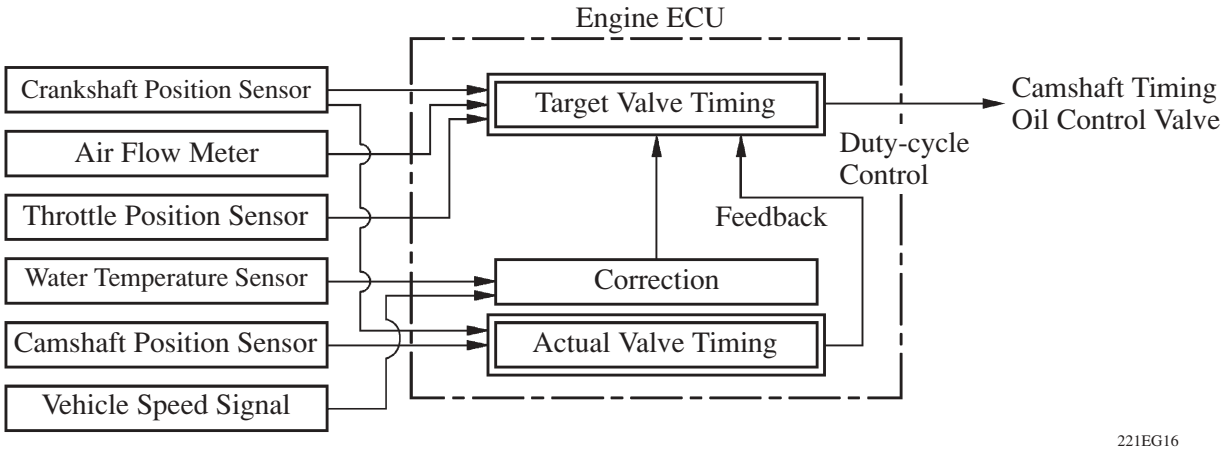
7. VVT-i (Variable Valve Timing-intelligent) System

General

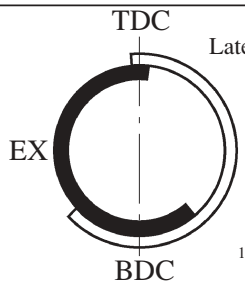
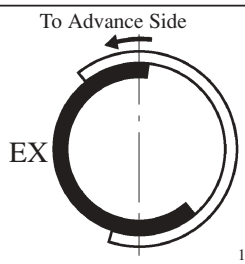
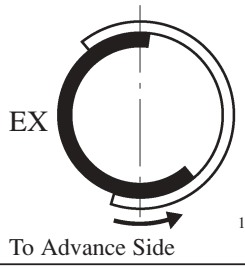
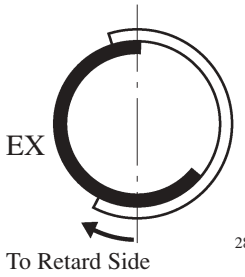
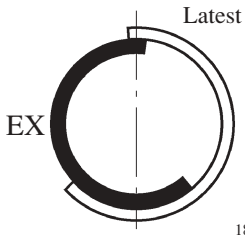
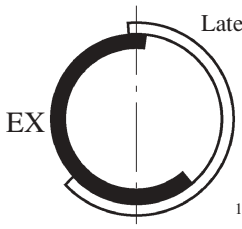
- The VVT-i system is designed to control the intake camshaft within a range of 40° (of Crankshaft Angle) to provide valve timing that is optimally suited to the engine condition. This realizes proper torque in all the speed ranges as well as increasing fuel economy, and reducing exhaust emissions.



- Using the engine speed signal, vehicle speed signal, and the signals from air flow meter, throttle position sensor and water temperature sensor, the engine ECU can calculate optimal valve timing for each driving condition and controls the camshaft timing oil control valve. In addition, the engine ECU uses signals from the camshaft position sensor and crankshaft position sensor to detect the actual valve timing, thus providing feedback control to achieve the target valve timing.



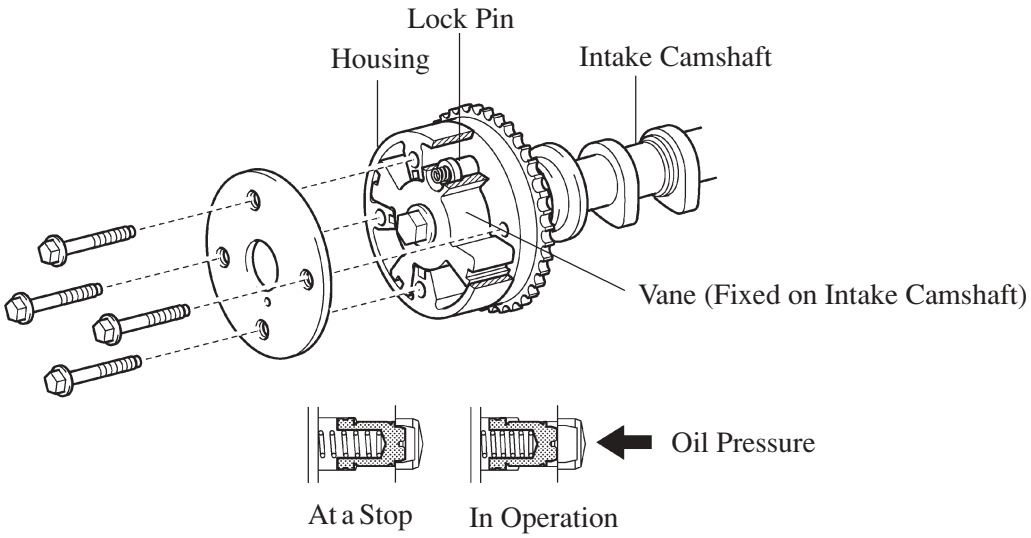
Effectiveness of the VVT-i System

Operation State	Objective	Effect
• During Idling • At Light Load	 Minimizing overlap to reduce blowback to the intake side	• Stabilized idling rpm • Better fuel economy
At Medium Load	 Increasing overlap increases internal EGR, reducing pumping loss	• Better fuel economy • Improved emission control
In Low to Medium Speed Range with Heavy Load	 Advancing the intake valve close timing for volumetric efficiency improvement	Improved torque in low to medium speed range
In High Speed Range with Heavy Load	 Retarding the intake valve close timing for volumetric efficiency improvement	Improved output
At Low Temperature	 Minimizing overlap to prevent blowback to the intake side leads to the lean burning condition, and stabilizes the idling speed at fast idle	• Stabilized fast idle rpm • Better fuel economy
• Upon Starting • Stopping the Engine	 Minimizing overlap to minimize blowback to the intake side	Improved startability

Construction

1) VVT-i Controller

This controller consists of the housing driven by the timing chain and the vane Fixed on the intake camshaft.
The oil pressure sent from the advance or retard side path at the intake camshaft causes rotation in the VVT-i controller vane circumferential direction to vary the intake valve timing continuously.
When the engine is stopped, the intake camshaft will be in the most retarded state to ensure startability.
When hydraulic pressure is not applied to the VVT-i controller immediately after the engine has been started, the lock pin locks the movement of the VVT-i controller to prevent a knocking noise.

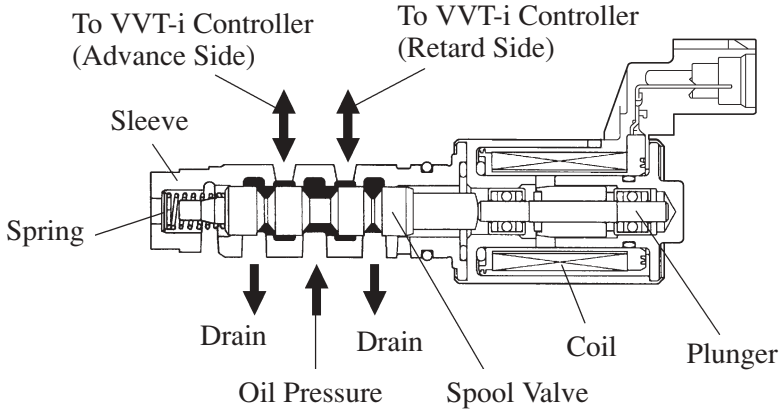


Lock Pin

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2) Camshaft Timing Oil Control Valve

The camshaft timing oil control valve controls the spool valve position in accordance with the duty control from the engine ECU, thus allocating the hydraulic pressure that is applied to the VVT-i controller to the advance and the retard sides. When the engine is stopped, the camshaft timing oil control valve is in the most retarded state.

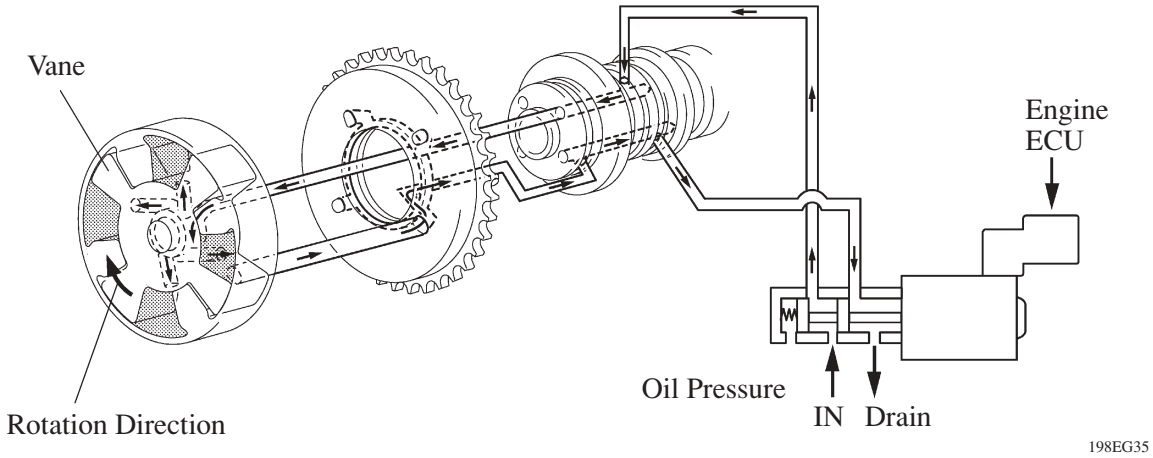


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Operation

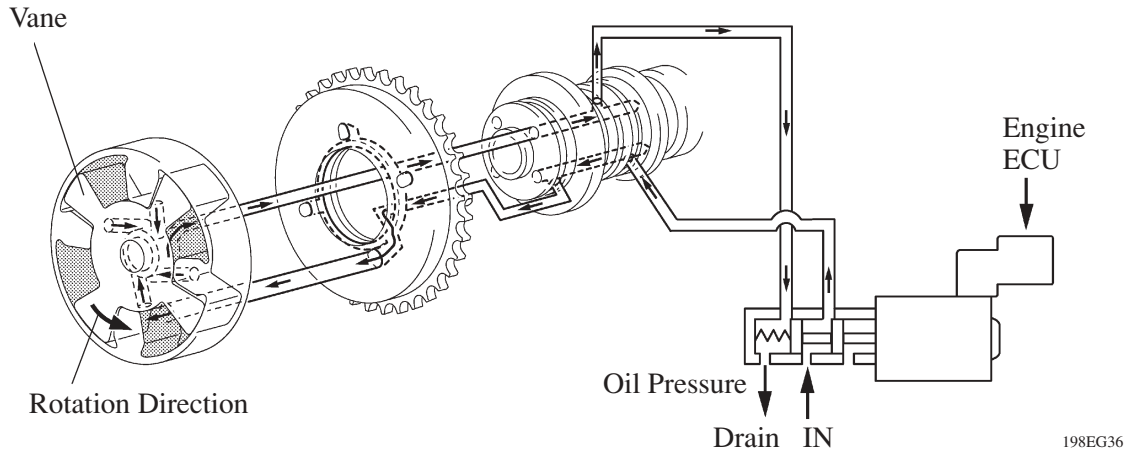
1) Advance

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



2) Retard

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



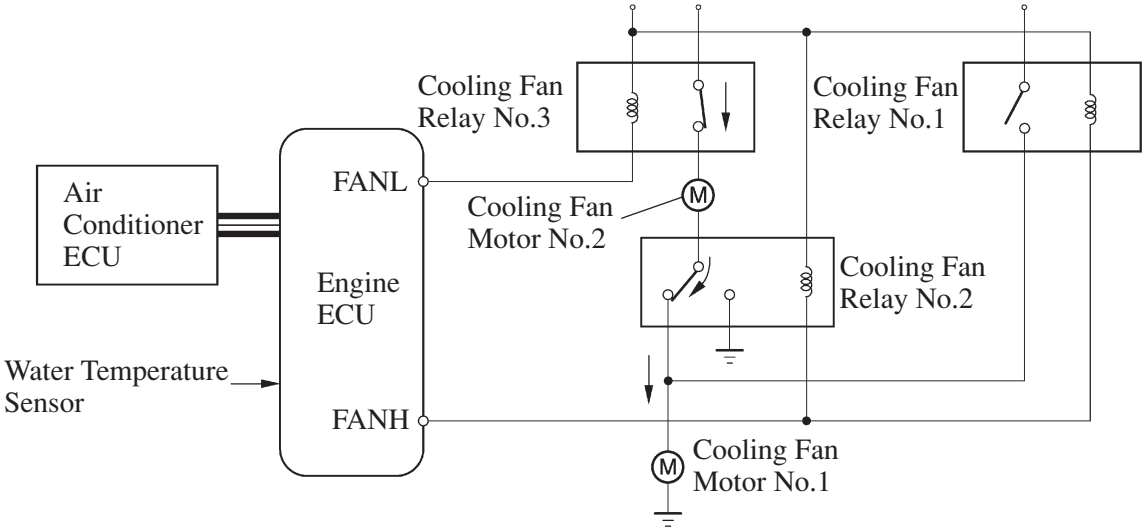
3) Hold

After reaching the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the traveling state changes.
This adjusts the valve timing at the desired target position and prevents the engine oil from running out when it is unnecessary.

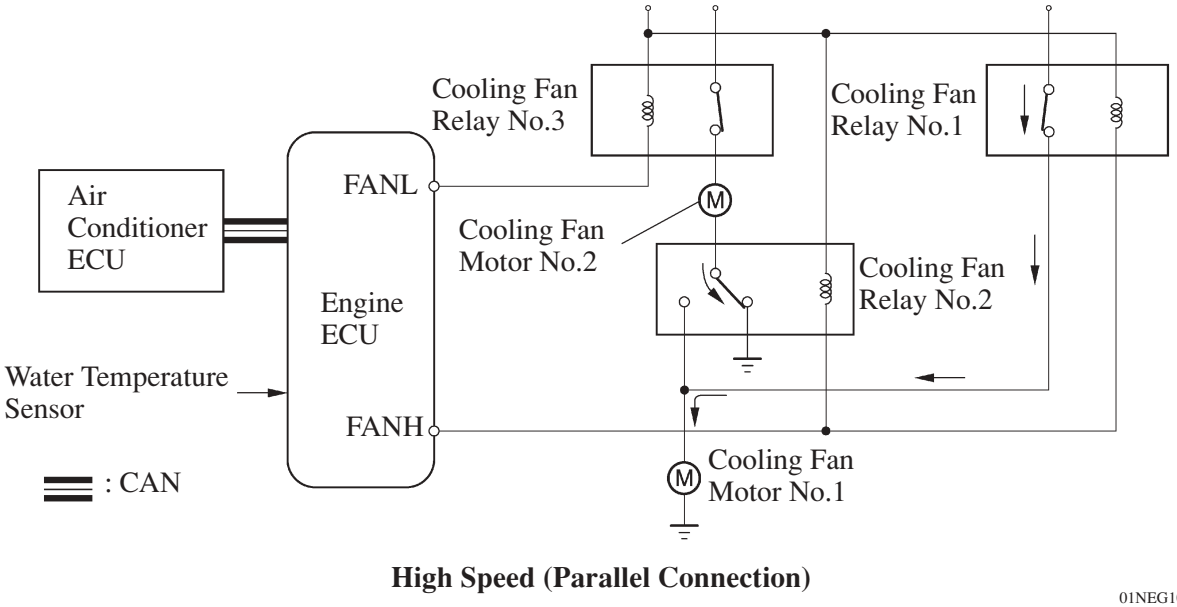
8. Cooling Fan Control

- On the models with air conditioner, the engine ECU controls the operation of the cooling fan in two speeds (Low and High) based on the water temperature sensor signal and the air conditioner ECU signal. This control is accomplished by operating the 2 fan motors in 2 stages through low speed (series connection) and high speed (parallel connection).

▶ Wiring Diagram ◀



Low Speed (Series Connection)



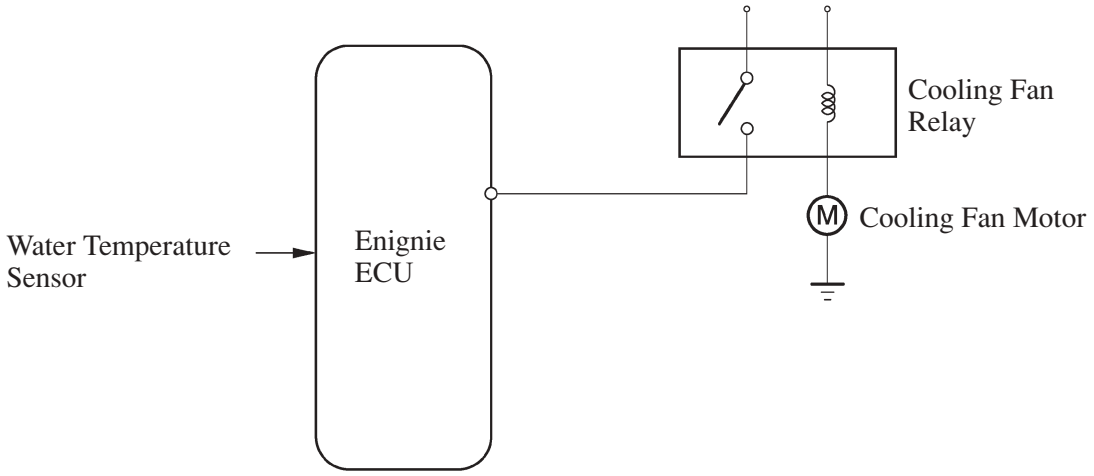
High Speed (Parallel Connection)

▶ Cooling Fan Operation ◀

Air Conditioner Condition		Water Temperature°C (°F)	
A/C Compressor	Refrigerant Pressure	94.5 (202.1) or lower	96 (204.8) or higher
OFF	1.2 MPa (12.5 kgf/cm^2, 178 psi) or lower	OFF	High
ON	1.2 MPa (12.5 kgf/cm^2, 178 psi) or lower	Low	High
	1.2 MPa (12.5 kgf/cm^2, 178 psi) or higher	High	High

- On the models without air conditioner, the engine ECU controls the operation of the cooling fan based on the water temperature sensor signal.

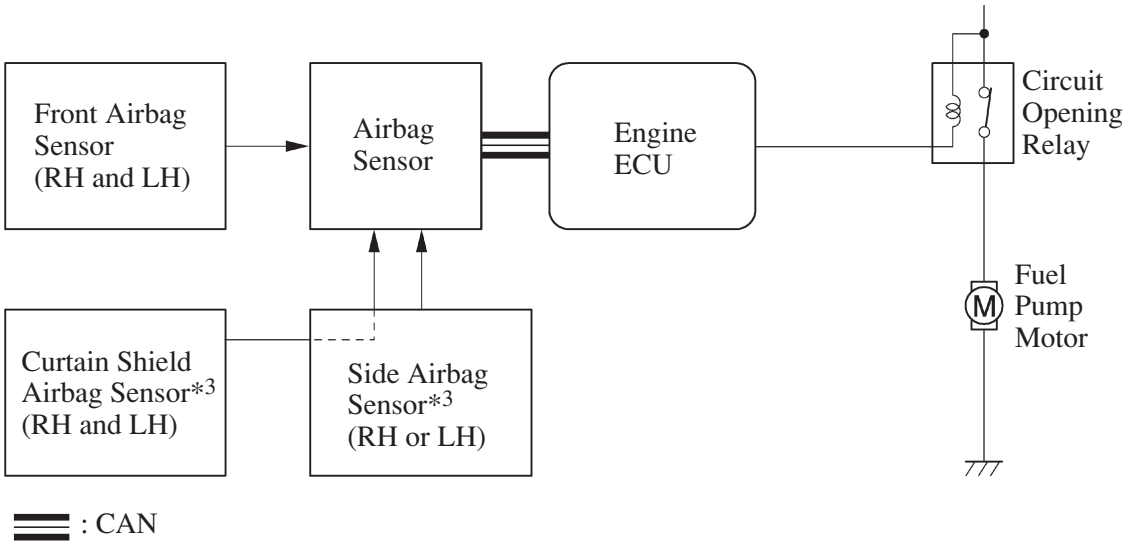
▶ Wiring Diagram ◀



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9. Fuel Pump Control

A fuel cut control is used to stop the fuel pump when the SRS airbag is deployed at the front collision. In this system, the airbag deployment signal from the airbag sensor is detected by the engine ECU, which turns OFF the circuit opening relay.
After the fuel cut control has been activated, turning the ignition switch from OFF to ON*1 (selecting the engine switch from the OFF to IG-ON mode*2) cancels the fuel cut control, and the engine can be restarted.



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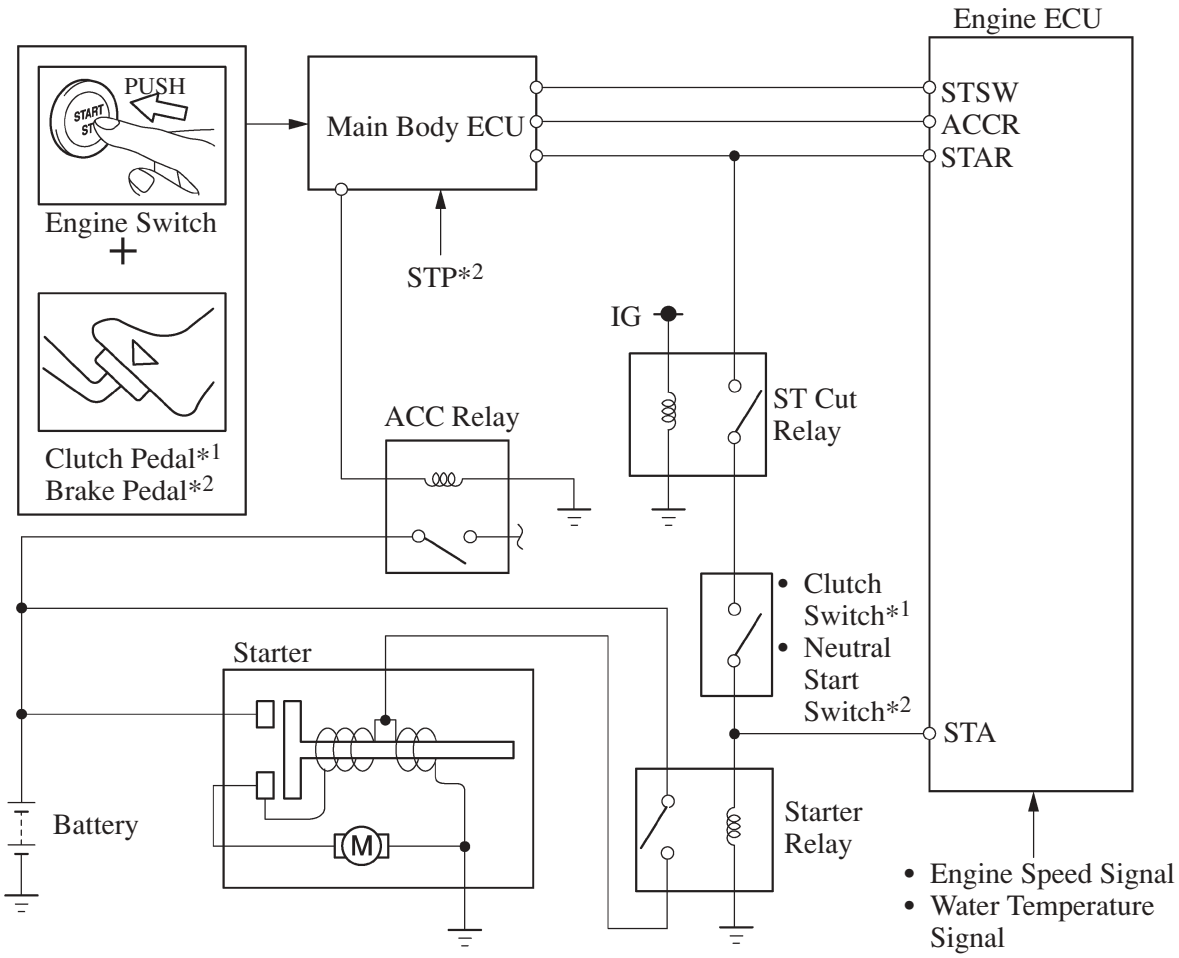
*1: Models without Smart Entry & Start System
*2: Models with Smart Entry & Start System
*3: Models with SRS Driver, Front Passenger, Side and Curtain Shield Airbags

10. Cranking Hold Function

General

- Once the engine switch is pushed, this function continues to operate the starter until the engine starts, provided that the brake pedal on the automatic transaxle models or clutch pedal on the manual transaxle models is depressed. This prevents starting failures and the engine from being cranked after the engine has started.
- When the engine ECU detects a start signal from the main body ECU, this system monitors the engine speed (NE) signal and continues to operate the starter until it determines that the engine has started. Furthermore, even if the engine ECU detects a start signal from the main body ECU, this system will not operate the starter if the engine ECU has determined that the engine has already started.

▶ System Diagram ◀



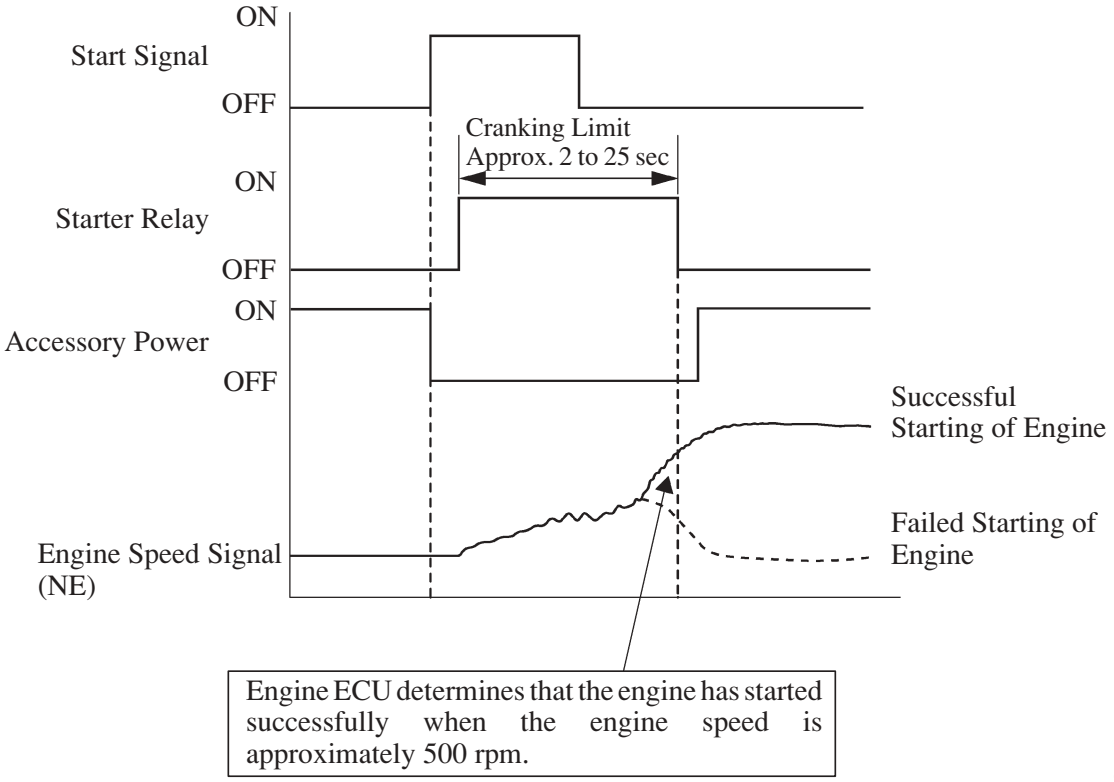
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*1: M/T Models
*2: A/T Models

Operation

- As indicated in the following timing chart, when the engine ECU detects a start signal (STSW) from the main body ECU, the engine ECU outputs the STAR and ACCR signals to the main body ECU. Upon detecting the STAR and ACCR signals from the engine ECU, the main body ECU energizes the starter relay to operate the starter. If the engine is already running, the engine ECU stops the output of the STAR and ACCR signals to the main body ECU. Thus, the main body ECU will not energize the starter relay.
- After the starter operates and the engine speed becomes higher than approximately 500 rpm, the engine ECU determines that the engine has started and stops the output of the STAR and ACCR signals to the main body ECU. Thus, the main body ECU will stop the operation of the starter.
- If the engine has any failure and does not work, the starter operates as long as its maximum continuous operation time and stops automatically. The maximum continuous operation time is approximately 2 seconds through 25 seconds depending on the engine water temperature condition. When the engine water temperature is extremely low, it is approximately 25 seconds and when the engine is warmed up sufficiently, it is approximately 2 seconds.
- This system cuts off the current that powers the accessories while the engine is cranking to prevent the accessory illumination from operating intermittently due to the unstable voltage that is associated with the cranking of the engine.
- This system has the following protections.
  - While the engine is running normally, the starter does not operate.
  - In case the driver keeps pressing the engine switch and the engine successfully started, the engine ECU stops the output of the STAR and ACCR signals when the engine speed becomes higher than 1,200 rpm. Thus, the main body ECU will stop the operation of the starter.
  - In case the driver keeps pressing the engine switch and the engine does not start, the engine ECU stops the output of the STAR and ACCR signals after 30 seconds have elapsed. Thus, the main body ECU will stop the operation of the starter.
  - In case the engine ECU cannot detect an engine speed signal while the starter is operating, the engine ECU will immediately stop the output of the STAR and ACCR signals. Thus, the main body ECU will stop the operation of the starter.

▶ Timing Chart ◀



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11. Charging Control

General

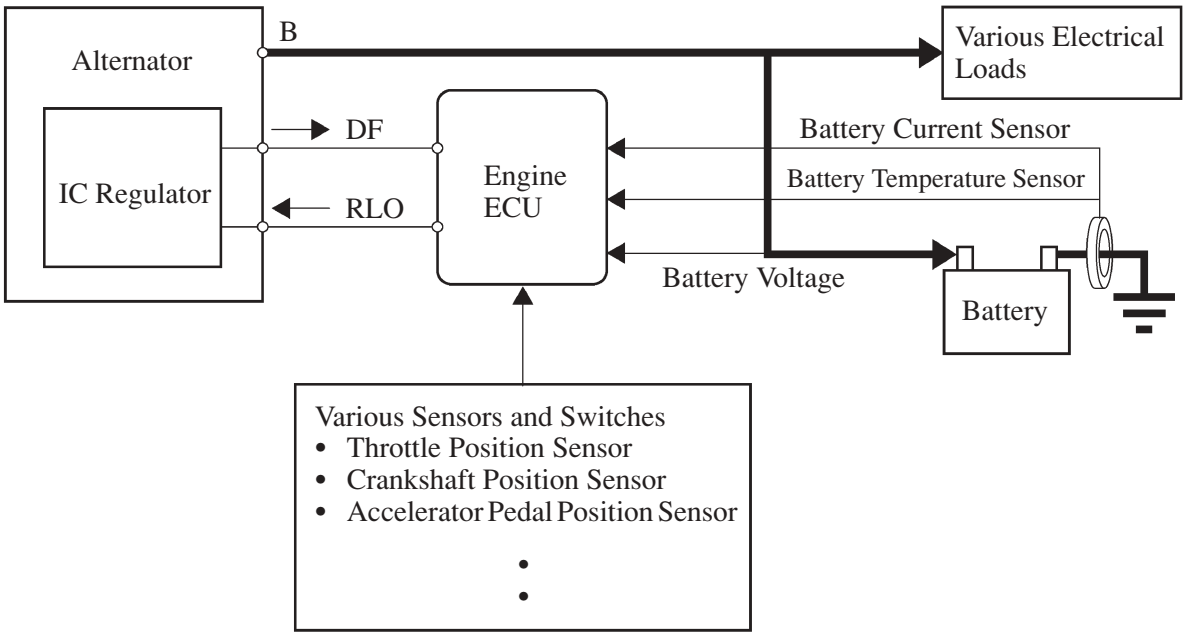
This system lowers the generated voltage when the vehicle is idling or is being driven at a constant speed, and raises the generated voltage when the vehicle is decelerating. This reduces the load on the engine as a result of the electric generation of the alternator, thus contributing to the fuel economy of the engine. During acceleration, this system regulates the generated voltage in order to place the amperage estimation value close to the target value.

- This control consists of the engine ECU, battery current sensor with a built-in battery temperature sensor, alternator, and various sensors and switches.
- The engine ECU detects driving condition based on signals from various sensors and switches, and detects charging condition based on signals from the alternator, battery current sensor and battery temperature sensor. Then the engine ECU outputs signals to the IC regulator to control the genetated voltage of the alternator.

The engine ECU stops the charging control and the alternator switches to normal power generation mode under the following conditions:

- Low battery capacity
- Low or high battery temperature
- Wipers operating or blower motor operating with tail lamp relay ON

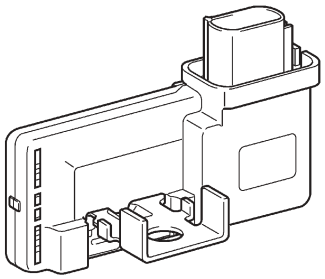
▶ System Diagram ◀



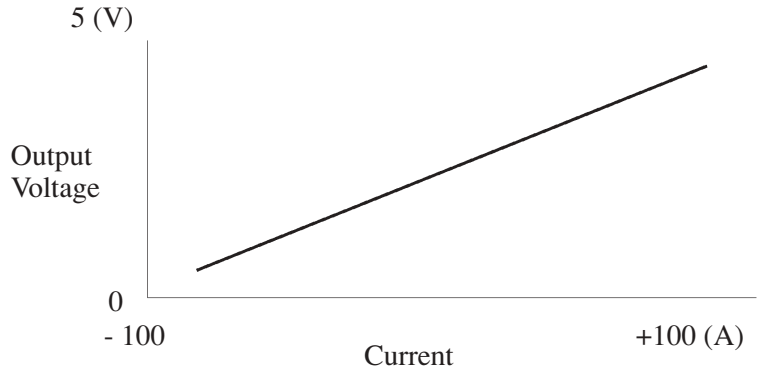
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Battery Current Sensor

Installed on the negative terminal of the battery, this sensor detects the amount of charging and discharging amperage of the battery and sends signal to the engine ECU. Based on this signal, the engine ECU calculates the battery capacity. A Hall IC is used for detecting the amount of charging and discharging amperage. The changes that occur in the magnetic flux density in the core as a result of the charging and amperage of the battery are converted and output as voltage.



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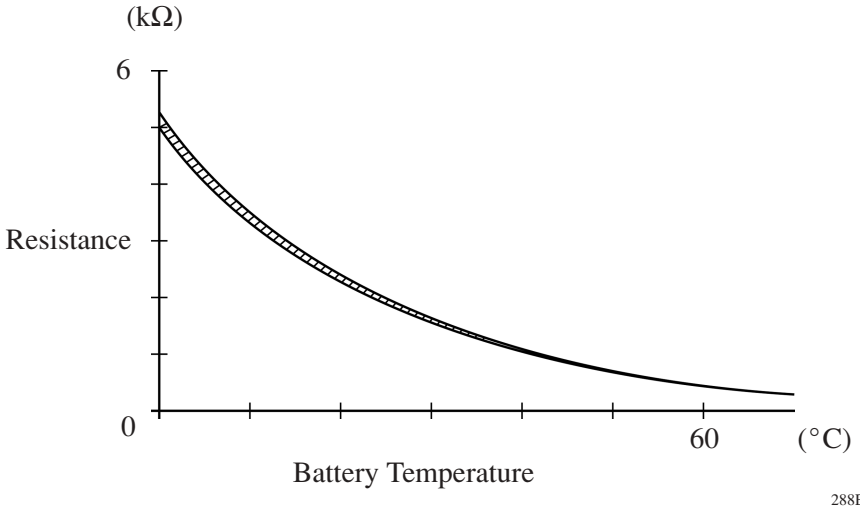


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Characteristic of Current Sensor

Battery Temperature Sensor

- The battery temperature sensor is built into the battery current sensor.
- The battery characteristic (battery internal resistance) of taking in current for charging varies according to battery electrolyte temperature. If the electrolyte temperature is too low or too high, the battery internal resistance will increase, resulting in early deterioration. To prevent this, the battery temperature sensor changes its resistance as shown below to detect the temperature.



288EG61C

Fail-safe

Due to a failure in the battery current sensor or battery temperature sensor, the engine ECU may determine the necessity of performing a fail-safe operation. Then, the engine ECU stops the charging control and the alternator switches to the normal power generation mode.
When the engine ECU detects a malfunction in a sensor, the engine ECU memorizes the DTC (Diagnostic Trouble Code). The check engine warning light does not illuminate.

▶ DTC Chart ◀

DTC No.	Detection Item	DTC No.	Detection Item
P0516	Battery Temperature Sensor Circuit Low	P1551	Battery Current Sensor Circuit Low
P0517	Battery Temperature Sensor Circuit High	P1552	Battery Current Sensor Circuit High
P0560	System Voltage	P1602	Detection of Battery
P1550	Battery Current Sensor Circuit		

12. Diagnosis

- When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorizes the failed section. Furthermore, the check engine warning light in the combination meter illuminates or blinks to inform the driver.
- By using the intelligent tester II, the 5-digit DTCs (Diagnostic Trouble Codes) and ECU data can be read out. Moreover, the ACTIVE TEST can be used to drive the actuator by means of the intelligent tester II.
- The engine ECU can output freeze-frame data to the intelligent tester II. This data is stored in the engine ECU at the very moment when the engine ECU detects its last data of malfunction.
- All the DTCs have been made to correspond to the SAE controlled codes. Some of the DTCs have been further divided into smaller detection areas than in the past, and new DTCs have been assigned to them. For details, refer to the RAV4 Repair Manual (Pub. No. RM01N0E).

Service Tip

To clear the DTC that is stored in the engine ECU, use the intelligent tester II, and disconnect the battery terminal or remove the EFI fuse for 1 minute or longer.

13. Fail-safe

When a malfunction is detected by any of the sensors, there is a possibility of an engine or another malfunction occurring if the ECU were to continue to control the engine control system in the normal way. To prevent such a problem, the fail-safe function of the ECU 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 RAV4 Repair Manual (Pub. No. RM01N0E).