

## ■ ENGINE CONTROL SYSTEM

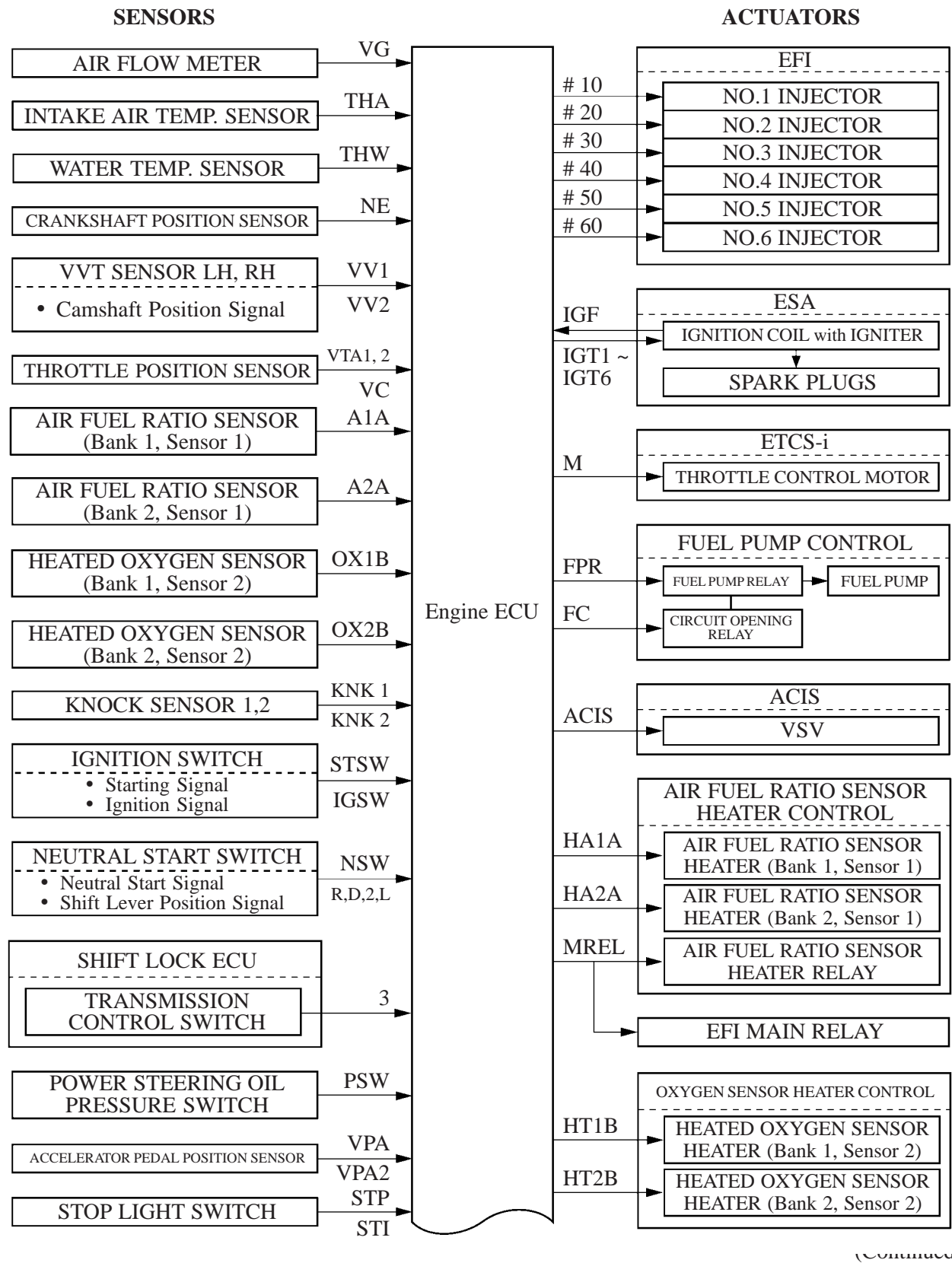
### 1. General

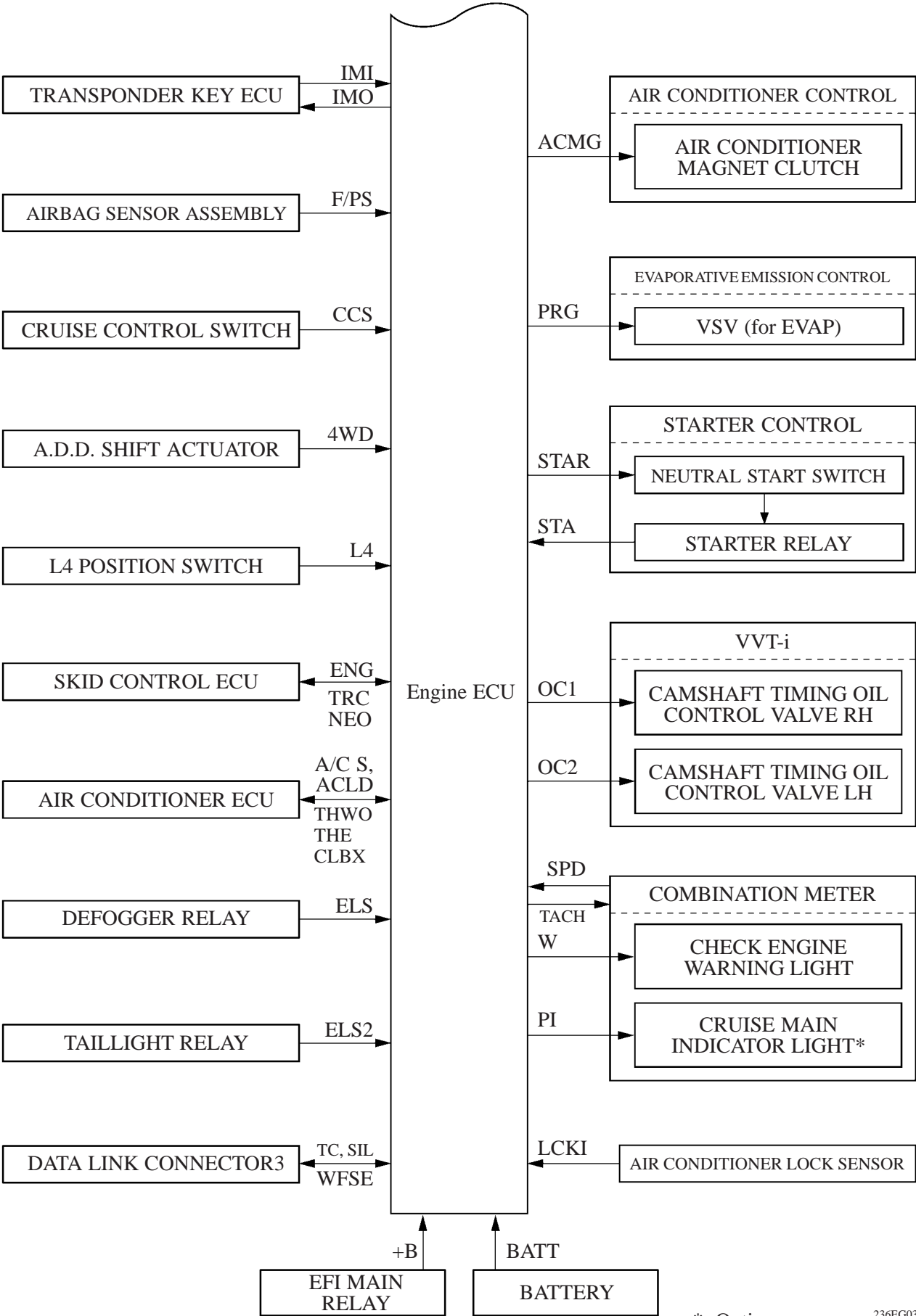
The engine control system for the 1GR-FE engine has following system.

System	Outline
EFI (Electronic Fuel Injection) (See page 47)	An L-type EFI system directly detects the intake air mass with a hot wire type air flow meter.
ESA (Electronic Spark Advance)	<ul style="list-style-type: none"> <li>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.</li> <li>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. The default ignition timing is set to 10° BTDC.</li> </ul>
ETCS-i (Electronic Throttle Control System-intelligent) (See page 48)	<p>Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.</p> <ul style="list-style-type: none"> <li>A link-less type is used, without an accelerator cable.</li> <li>An accelerator pedal position sensor is provided on the accelerator pedal.</li> <li>A no-contact type throttle position sensor and accelerator pedal position sensor are used.</li> </ul>
VVT-i (Variable Valve Timing-intelligent) (See page 53)	Controls the intake camshaft to an optimal valve timing in accordance with the engine condition.
ACIS (Acoustic Control Induction System) (See page 57)	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 60)	<p>The fuel pump speed is controlled by the fuel pump relay and the fuel pump resistor.</p> <p>A fuel cut control is adopted to stop the fuel pump when the airbag is deployed during front or side collision.</p>
Air Fuel Ratio Sensor, Oxygen Sensor Heater Control	Maintains the temperature of the air fuel ratio sensor or 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 emission (HC) in the charcoal canister in accordance with engine conditions.
Air Conditioner Cut-off Control	By turning the air conditioner compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.
Starter Control (Cranking Hold Function) (See page 61)	Once the ignition switch is turned to the START position, this control continues to operate the starter until the engine started.
Diagnosis (See page 63)	<p>When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.</p> <p>All the DTCs (Diagnostic Trouble Codes) have been made to correspond to the SAE controlled codes.</p>
Fail-Safe (See page 63)	When the engine ECU detects a malfunction, the engine ECU 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 1GR-FE engine is shown in the following chart.

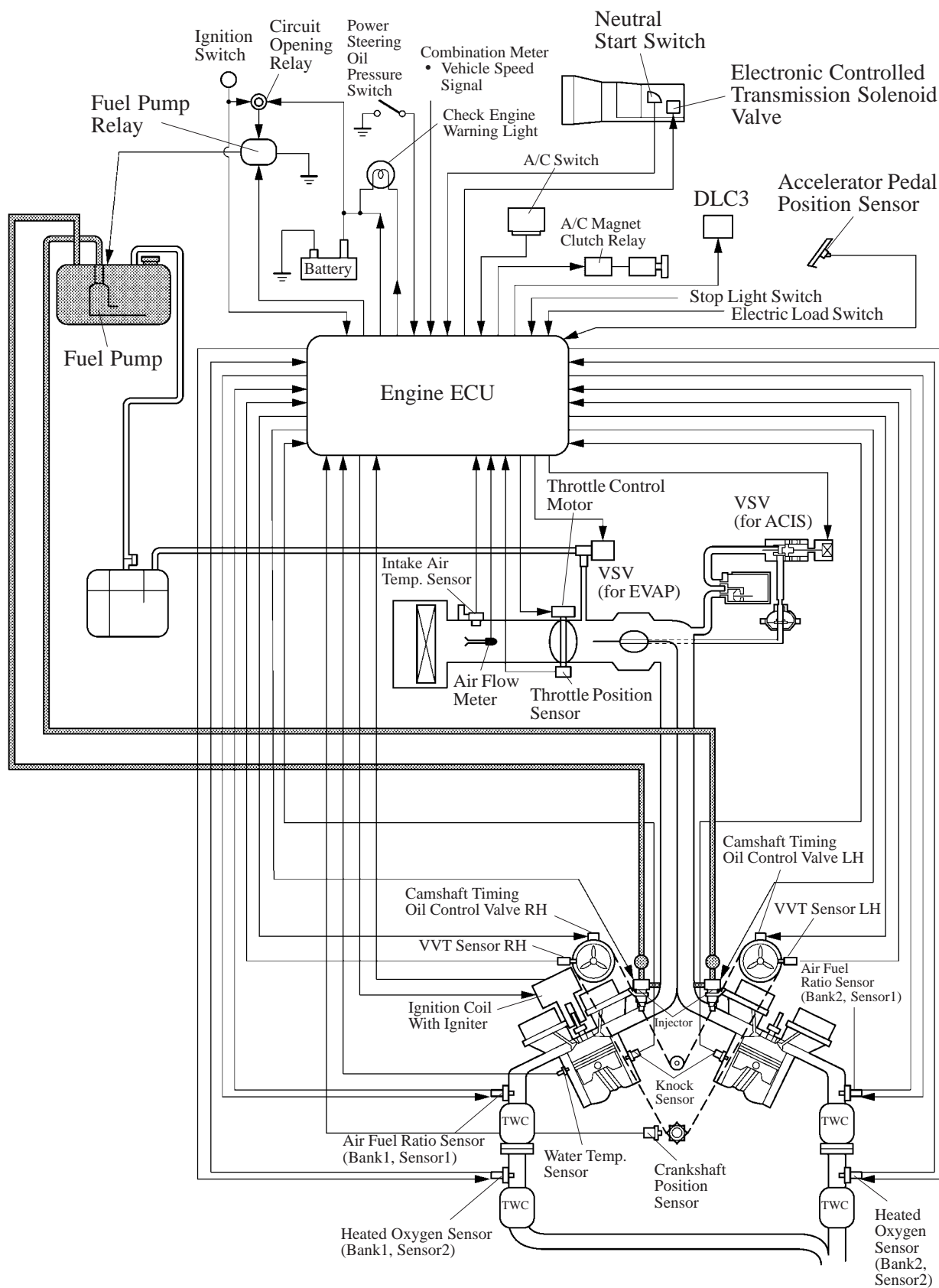




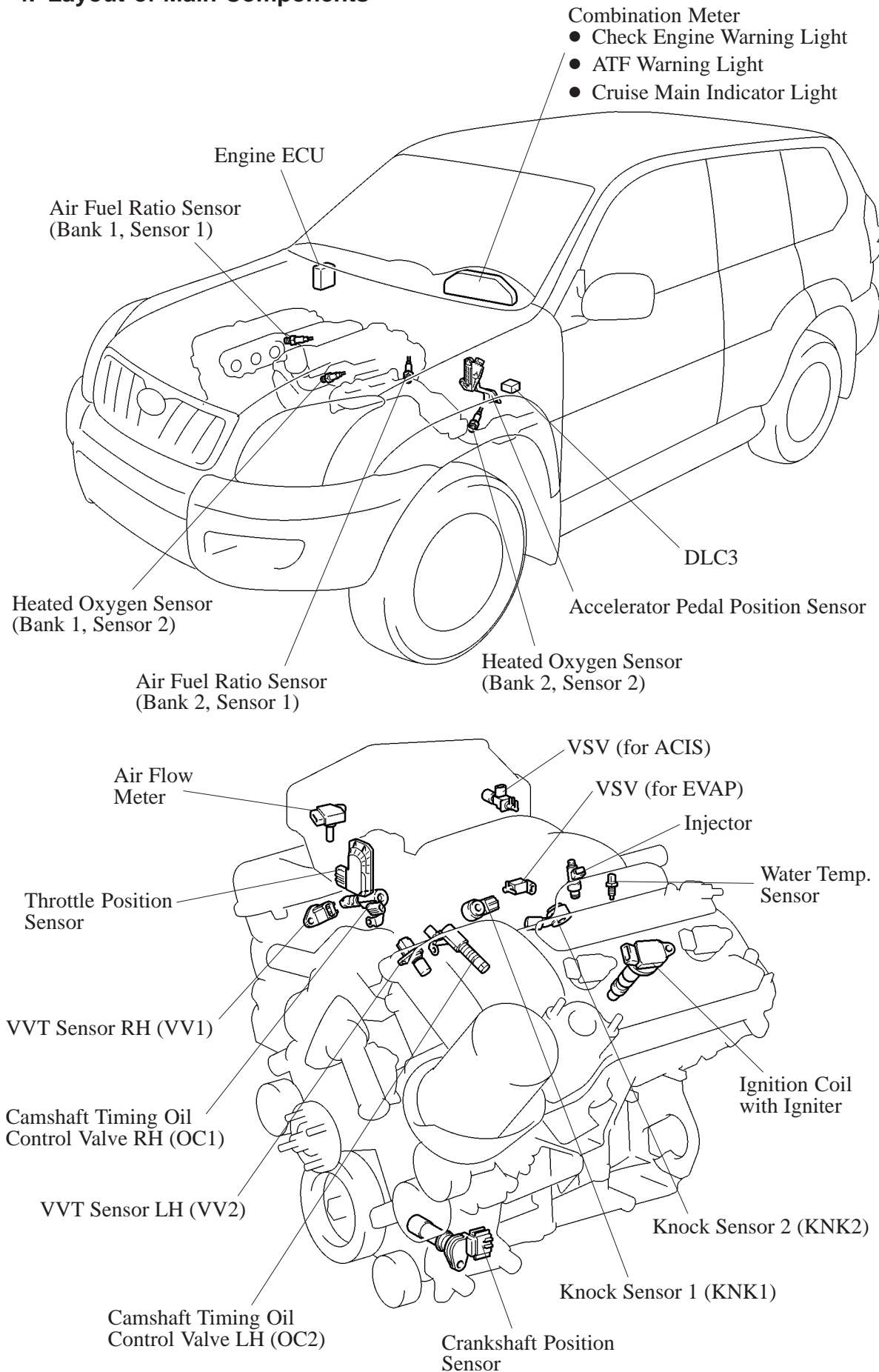
NF

\*: Option

### 3. Engine Control System Diagram



#### 4. Layout of Main Components



NF

## 5. Main Components of Engine Control System

### General

The main components of the 1GR-FE engine control system are as follows:

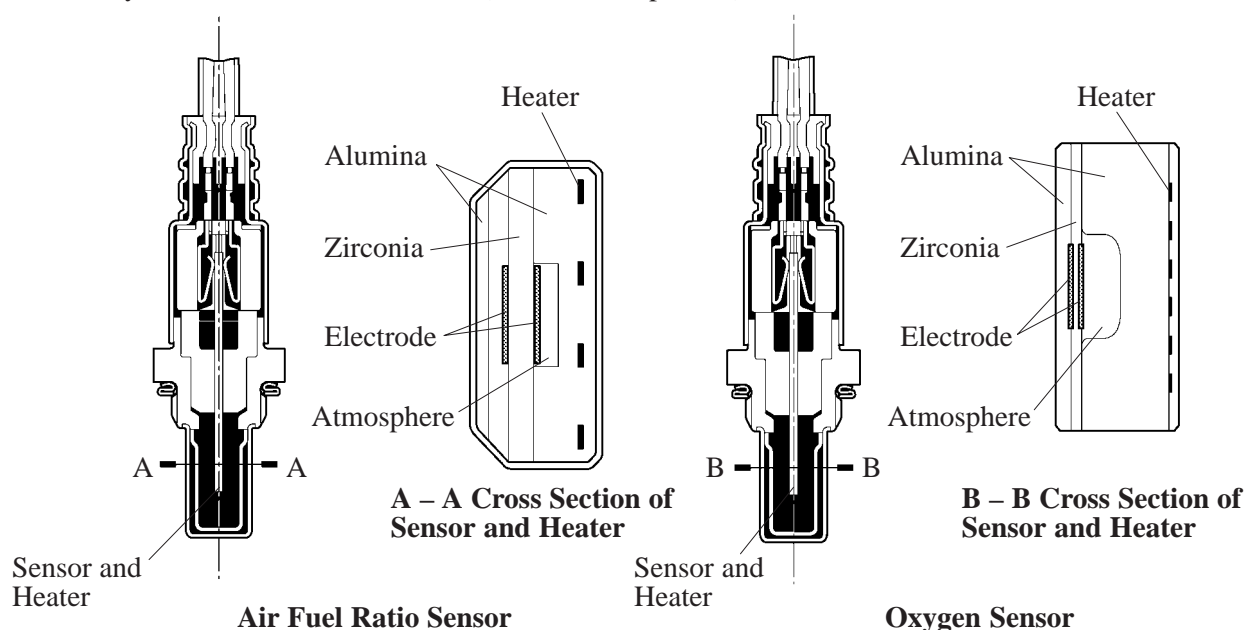
Component	Outline	Quantity
Engine ECU	32-bit CPU	1
Air Fuel Ratio Sensor (Bank 1, Sensor 1) (Bank 2, Sensor 1)	with Heater Type (Planar Type)	2
Oxygen Sensor (Bank 1, Sensor 2) (Bank 2, Sensor 2)	with Heater Type (Planar Type)	2
Air Flow Meter	Hot-wire Type	1
Crankshaft Position Sensor (Rotor Teeth)	Pick-up Coil Type (36-2)	1
VVT Sensor LH, RH (Rotor Teeth)	Pick-up Coil Type (3)	2
Knock Sensor 1, 2	Built-in Piezoelectric Type (Flat Type)	2
Accelerator Pedal Position Sensor	No-contact Type (Mounted on Accelerator Pedal)	1
Throttle Position Sensor	No-contact Type	1
Injector	12-Hole Type	6

### Engine ECU

The 32-bit CPU of the engine ECU has been adopted to increase the speed for processing the signals.

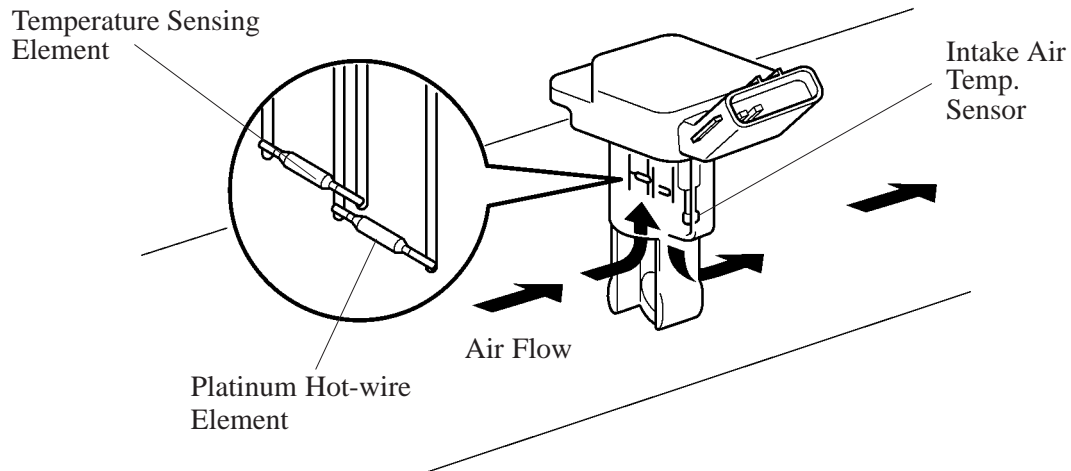
### Oxygen Sensor and Air Fuel Ratio Sensor

Both the oxygen sensor and the air-fuel ratio sensor are the planar type. Compared to the conventional type, the sensor and heater portions of the planar type are narrower overall. Because the heat of the heater acts directly on the alumina and zirconia (of the sensor portion) it accelerates the activation of the sensor.



## Air Flow Meter

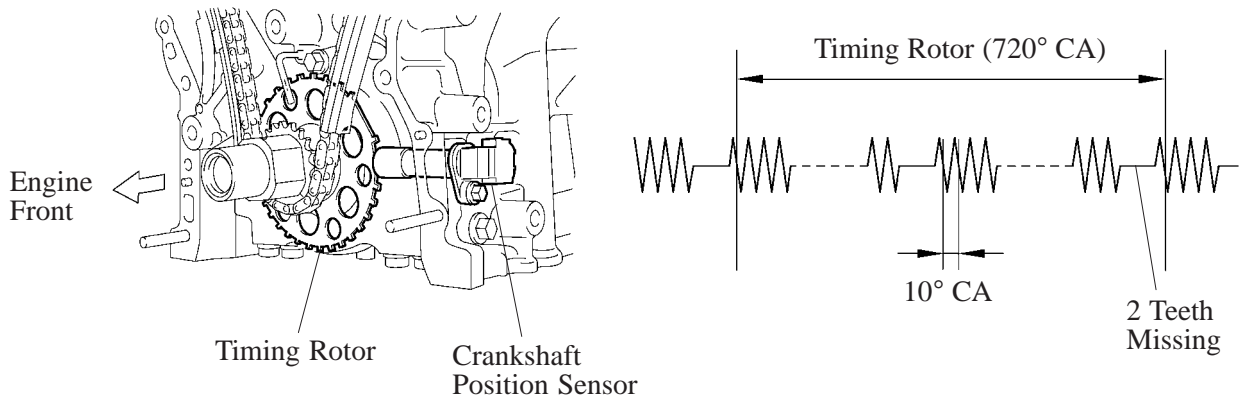
- This air flow meter, which is a plug-in type, allows a portion of the intake air to flow through the detection area. By directly measuring the mass and the flow rate of the intake air, the detection precision has been improved and the intake air resistance has been reduced.
- This air flow meter has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



199EG35

## Crankshaft Position Sensor

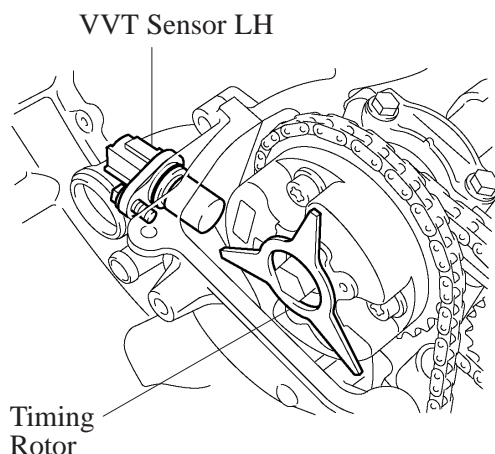
The timing rotor of the crankshaft consists of 34 teeth, with 2 teeth missing. The crankshaft position sensor outputs the crankshaft rotation signals every  $10^\circ$ , and the missing teeth are used to determine the top-dead-center.



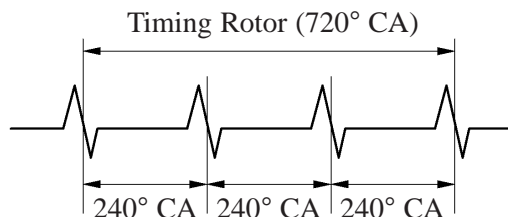
238EG56

## VVT Sensor

The VVT sensors are mounted on the right and left banks of the cylinder heads. To detect the camshaft position, these sensors pick up the protrusion of the timing rotor that is secured to the camshaft in front of the VVT controller. In addition, each sensor generates 3 pulses for every 2 revolutions of the crankshaft.



**Left Bank**



238EG57

## Knock Sensor (Flat Type)

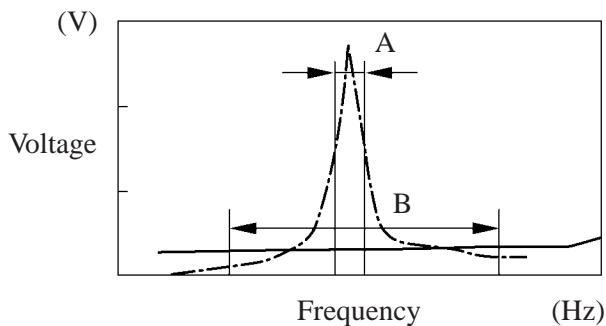
### 1) General

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.

— · — : Resonance Characteristic of Conventional Type

———— : Resonance Characteristic of Flat Type



A: Detection Band of Conventional Type  
B: Detection Band of Flat Type

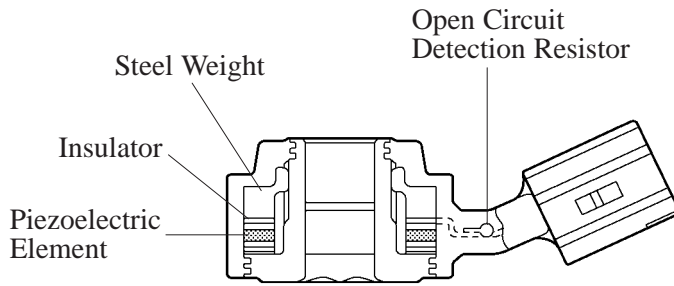
**Characteristic of Knock Sensor**

214CE04



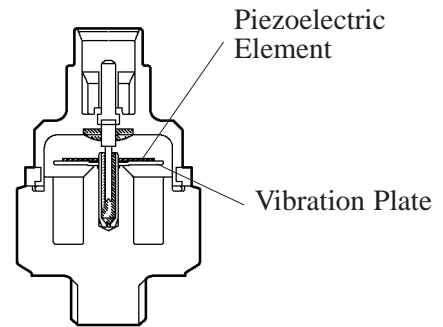
## 2) Construction

- 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 in 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)**

214CE01

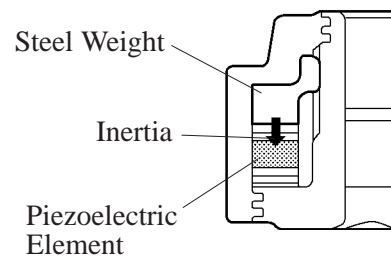


**Conventional Type Knock Sensor  
(Resonant Type)**

214CE02

## 3) Operation

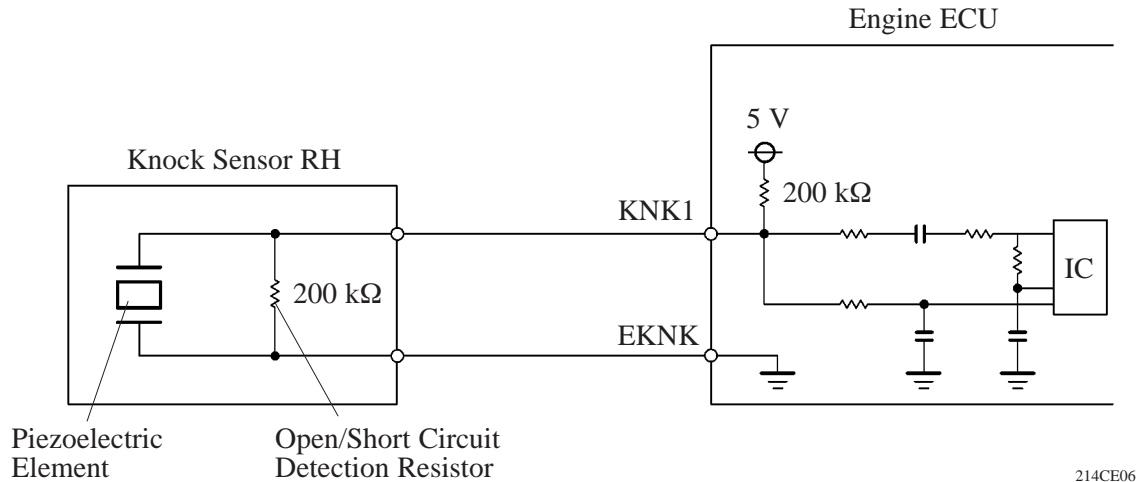
The knocking vibration is transmitted to the steel weight and its inertia applies pressure to the piezoelectric element. The action generates electromotive force.



214CE08

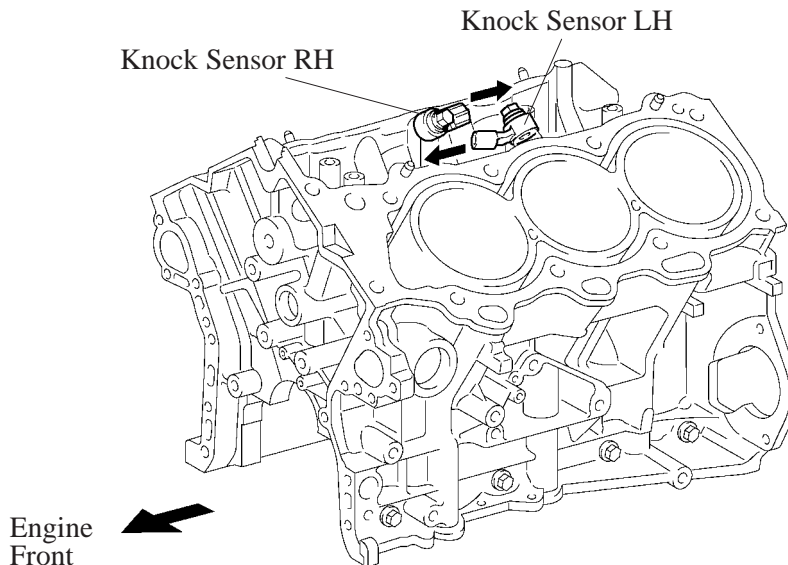
#### 4) Open/Short Circuit Detection Resistor

During the ignition is ON, the open/short circuit detection resistor in the knock sensor and the resistor in the engine ECU keep the voltage at the terminal KNK1 of engine constant. 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).



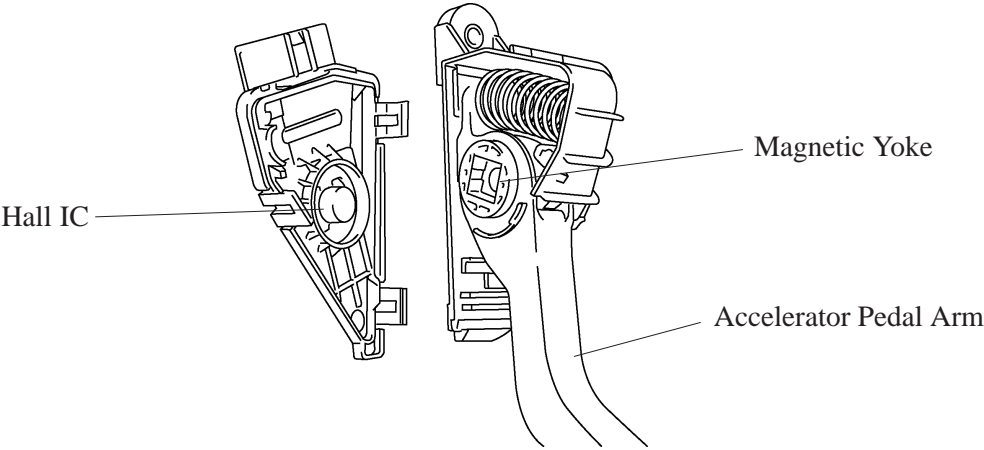
#### Service Tip

- In accordance with the adoption of open/short circuit detection resistor, the inspection method for the sensor has been changed. For details, refer to the Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM1017E).
- These knock sensors are mounted in the specific directions and angles as illustrated. To prevent the right and left bank connectors from being interchanged, make sure to install each sensor in its prescribed direction.

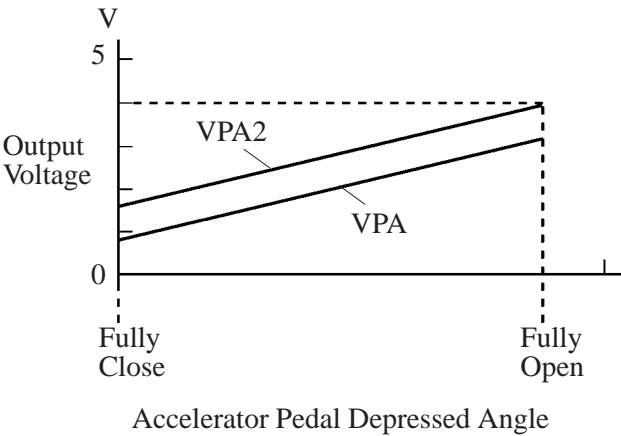
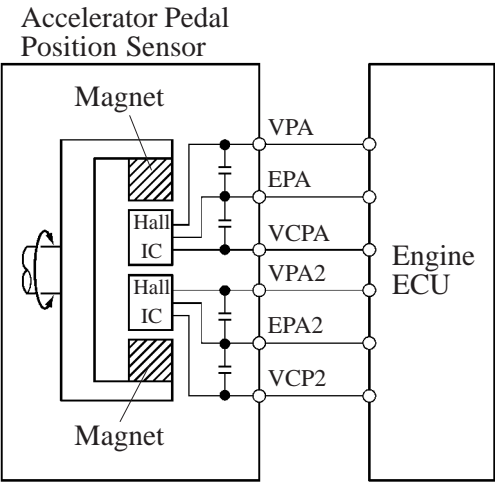


Accelerator Pedal Position Sensor

The magnetic yoke that is mounted at the base of 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 that occur at that time into electrical signals, and outputs them in the form of accelerator pedal effort to the engine ECU.



228TU23



228TU24

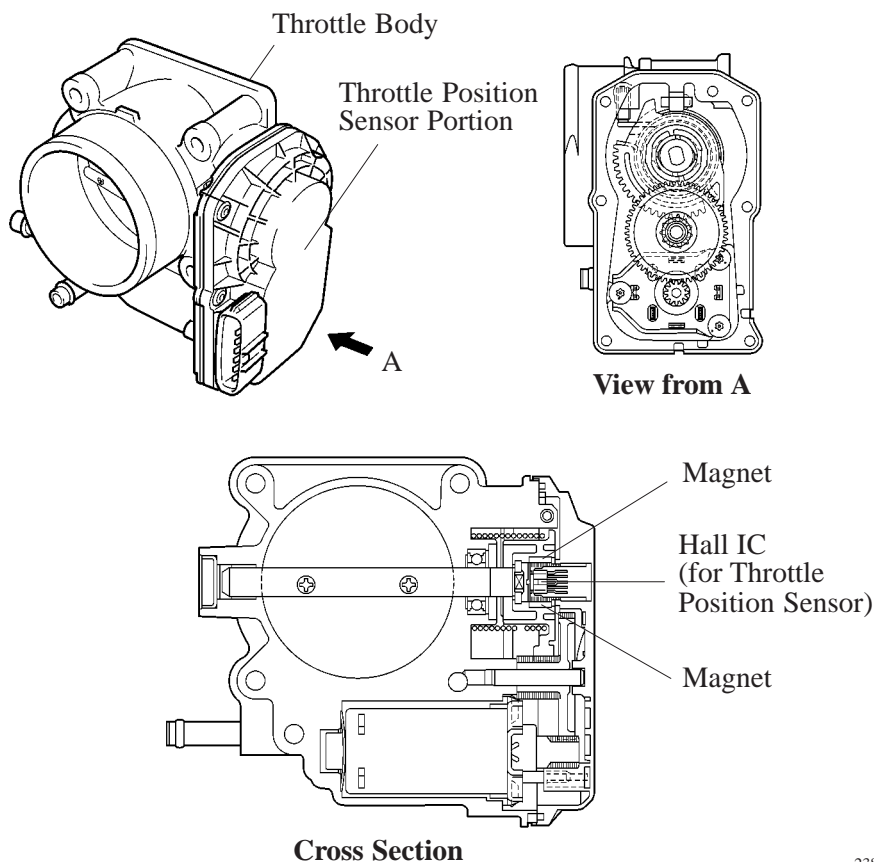
228TU25

Service Tip

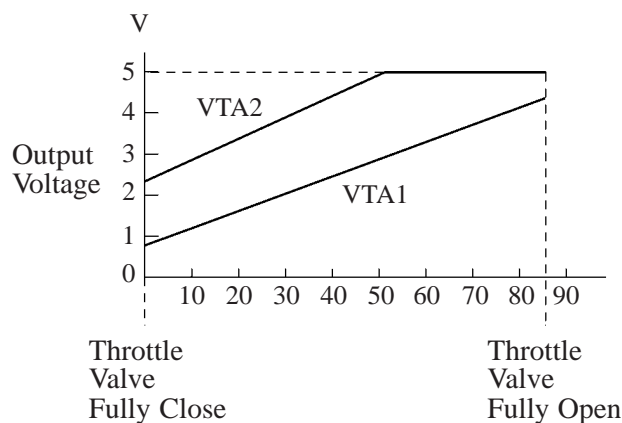
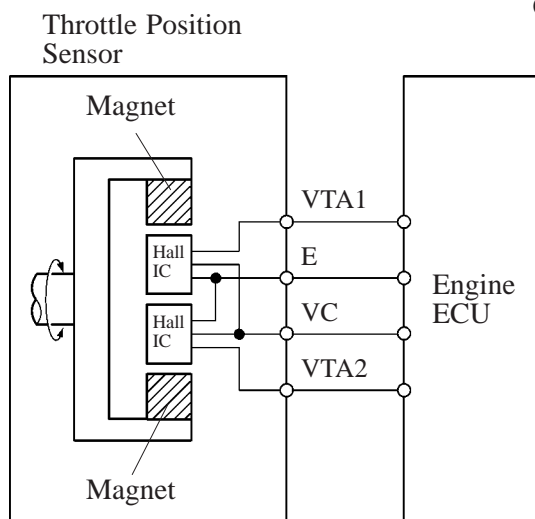
The inspection method differs from the conventional accelerator pedal position sensor because this sensor uses a hall IC. For details, refer to the Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM1017E).

## 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.



238EG59



Throttle Valve Opening Angle

230LX12

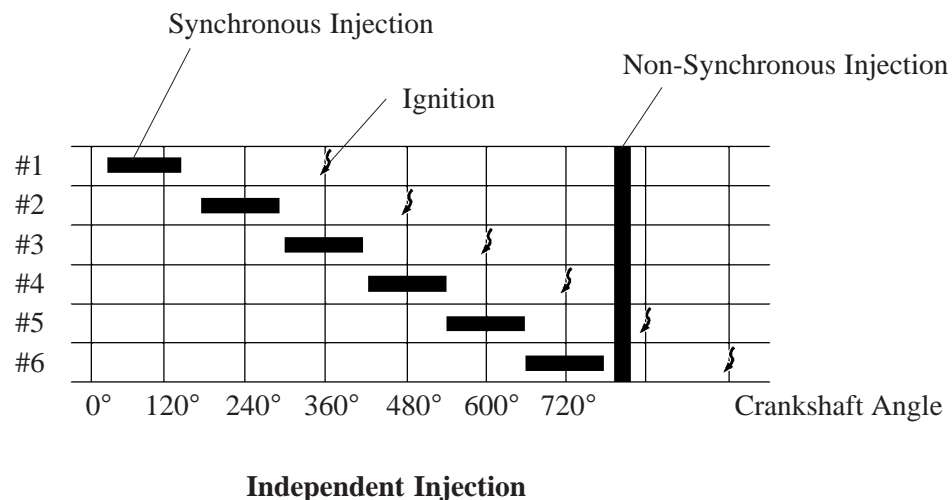
238EG79

### Service Tip

The inspection method differs from the conventional throttle position sensor because this sensor uses a hall IC. For details, refer to the Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM1017E).

## 6. EFI (Electronic Fuel Injection) System

- An L-type EFI system directly detects the intake air mass with a hot wire type air flow meter.
- An independent injection system (in which fuel is injected once into each cylinder for each two revolution of the crankshaft) has been adopted.
- There are two types of fuel injection:
  - a) One is synchronous injection in which corrections based on the signals from the sensors are added to the basic injection duration so that injection occurs always at the same timing.
  - b) The other is non-synchronous injection in which injection is effected by detecting the requests from the signals of the sensors regardless of the crankshaft angle. Furthermore, to protect the engine and improve fuel economy, the system effects fuel cutoff in which the injection of fuel is stopped temporarily in accordance with the driving conditions.
- This system performs group injection when the water temperature is extremely low and the engine is operating at a low speed.



238EG70

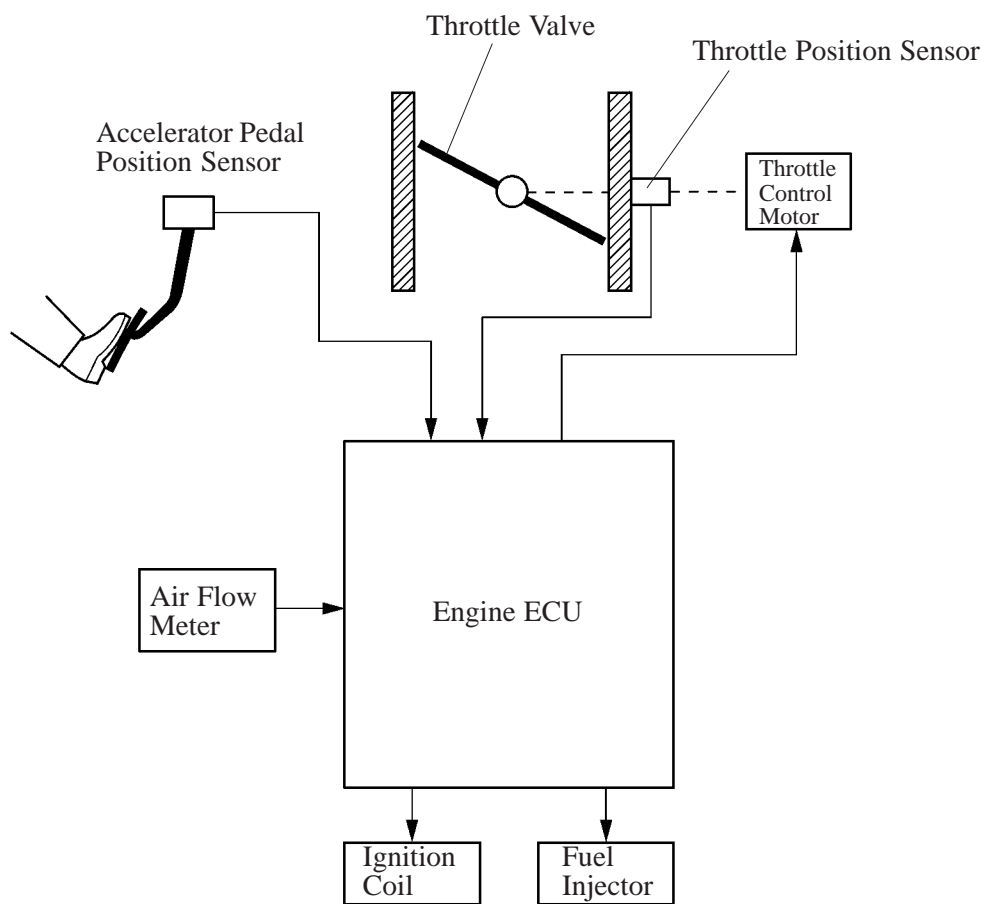
## 7. ETCS-i (Electronic Throttle Control System-intelligent)

### General

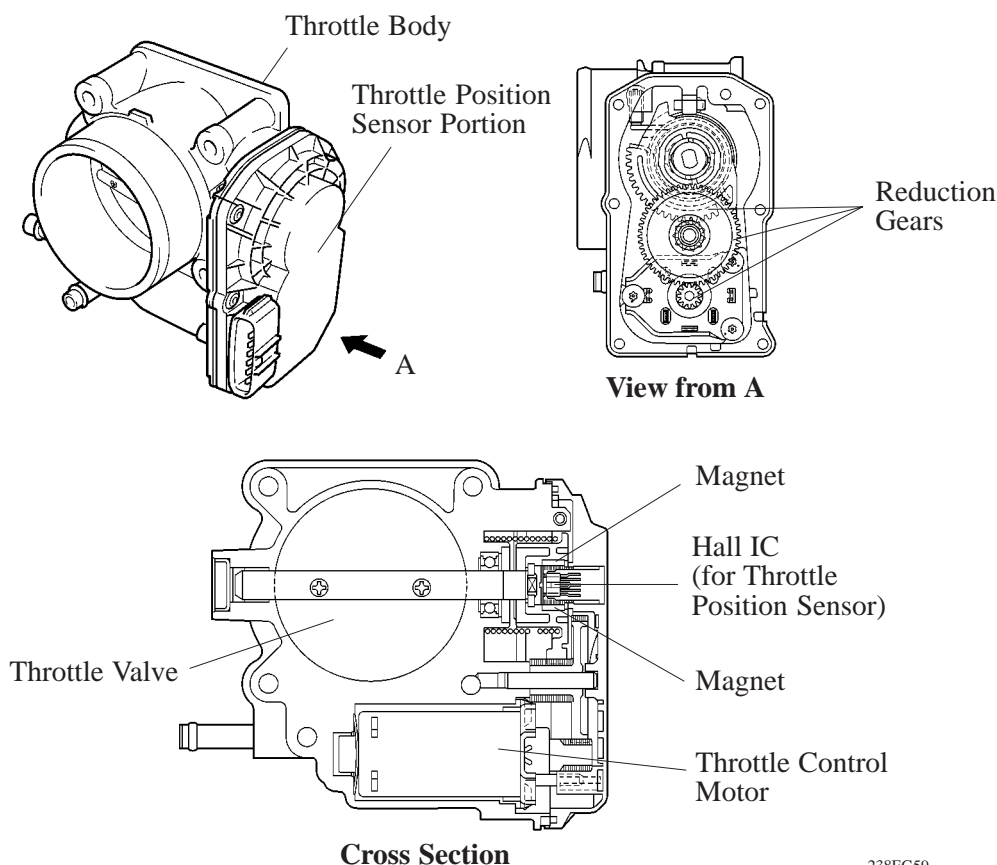
- The ETCS-i is used, providing excellent throttle control in all the operating ranges. In the new 1GR-FE engine, the accelerator cable has been discontinued, and an accelerator position sensor has been provided on the accelerator pedal.
- In the conventional throttle body, the throttle valve opening 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 and the cruise control system, the A-TRC\*(Active-Traction Control), and the VSC\*(Vehicle Stability Control) system.
- In case of an abnormal condition, this system transfers to the limp mode.

\*: Optional Equipment

### ► System Diagram ◀



## Construction



NF

238EG59

### 1) Throttle Position Sensor

The throttle position sensor is mounted on the throttle body, to detect the opening angle of the throttle valve. For details, refer to Main Components of Engine Control System section on [page 46](#).

### 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.

- 1) Non-Linear Control
- 2) Idle Speed Control
- 3) A-TRC\*<sup>1</sup> Throttle Control
- 4) VSC\*<sup>1</sup> Coordination Control
- 5) Cruise Control\*<sup>2</sup>

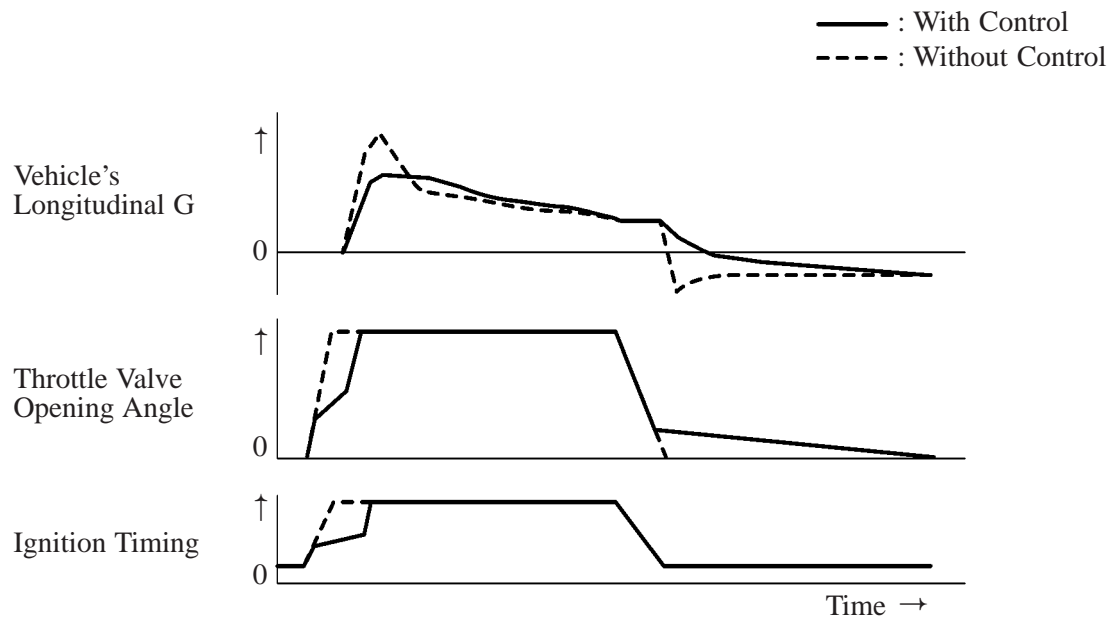
\*<sup>1</sup>: With VSC and A-TRC System

\*<sup>2</sup>: With Cruise Control System

## 2) Non-Linear Control

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 ◀



150EG37

## 3) Idle Speed Control

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

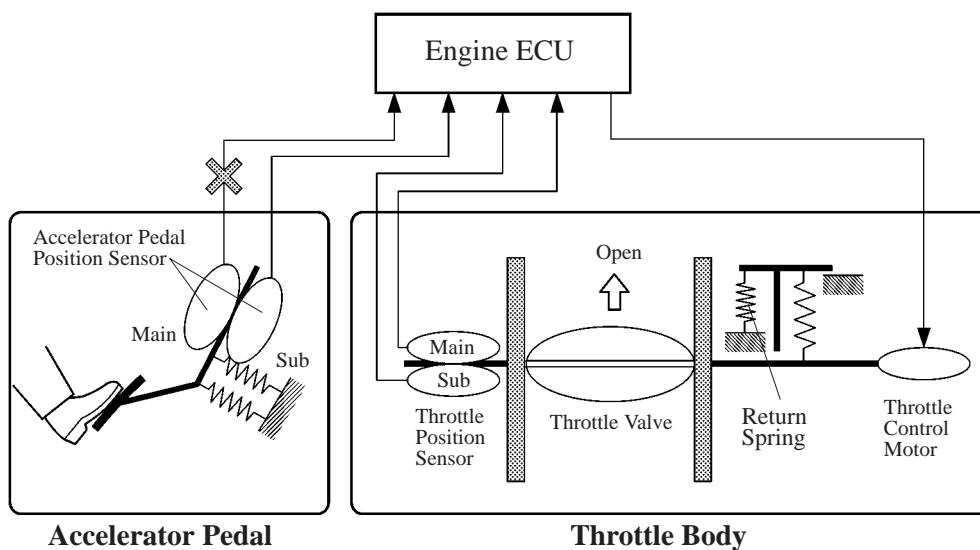
## 4) Cruise Control

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



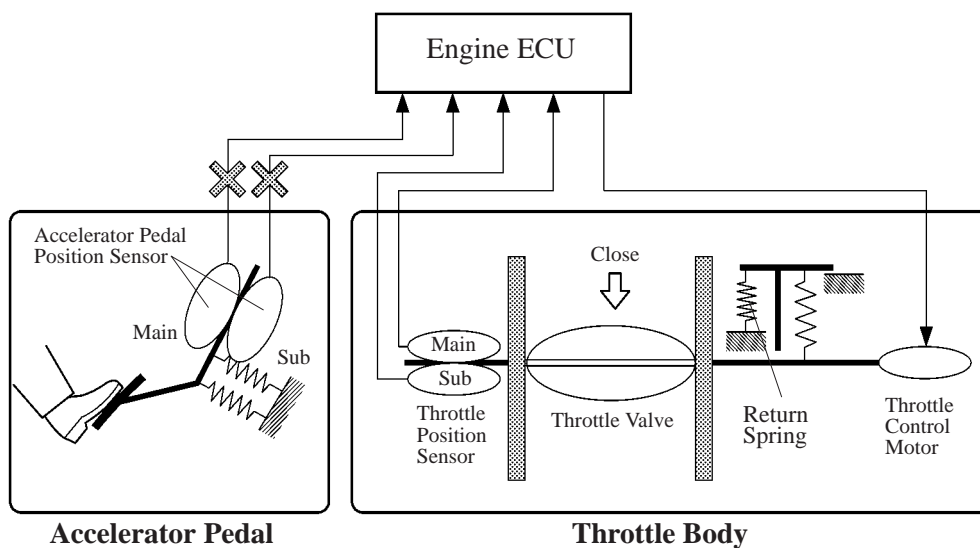
## Fail-Safe of Accelerator Pedal Position Sensor

- The accelerator pedal position sensor comprises 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 circuit and switches to the limp mode. In the limp mode, the remaining circuit is used to calculate the accelerator pedal opening, in order to operate the vehicle under limp mode control.



199EG45

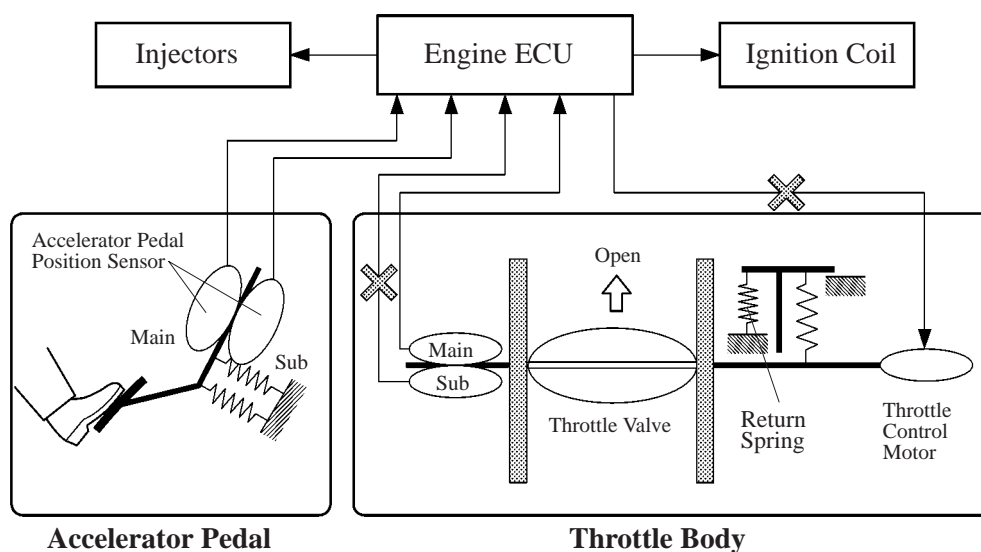
- If both circuits malfunction, the engine ECU detects the abnormal signal voltage between these two sensor circuits and regards that the opening angle of the accelerator pedal is fully closed and then continues the throttle control. At this time, the vehicle can be driven within its idling range.



199EG46

### Fail-Safe of Throttle Position Sensor

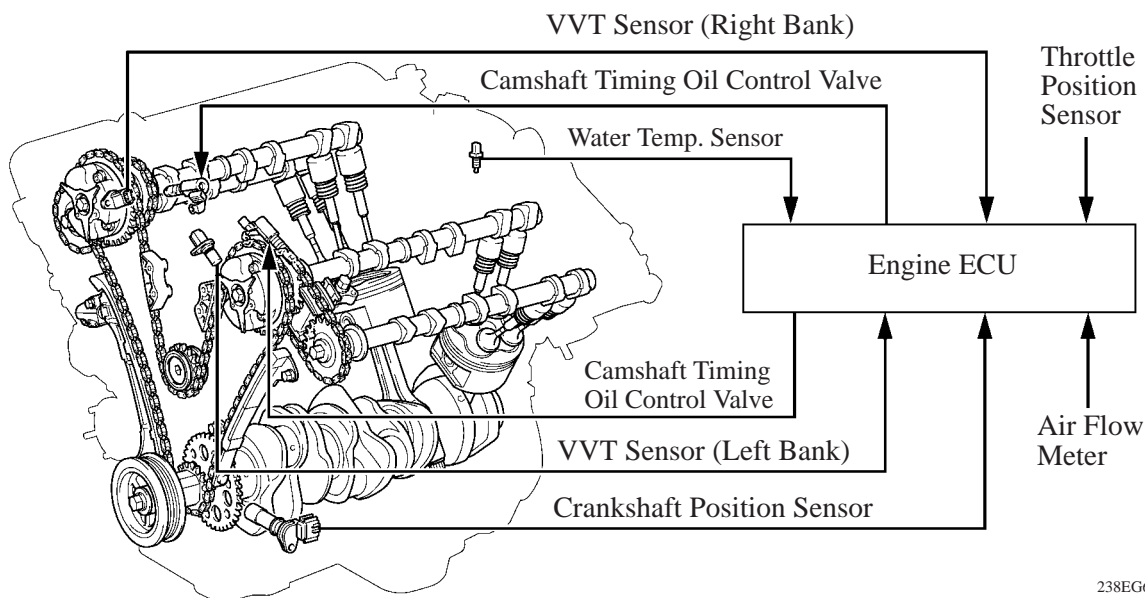
- The throttle position sensor comprises two (main, sub) sensor circuits. If a malfunction occurs in either one of the sensor circuits, the engine ECU detects the abnormal signal voltage difference between these two sensor circuits, cuts off the current to the throttle control motor, and switches to 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 and ignition timing in accordance with the accelerator opening.
- The same control as above is effected if the engine ECU detects a malfunction in the throttle control motor system.



## 8. VVT-i (Variable Valve Timing-intelligent) System

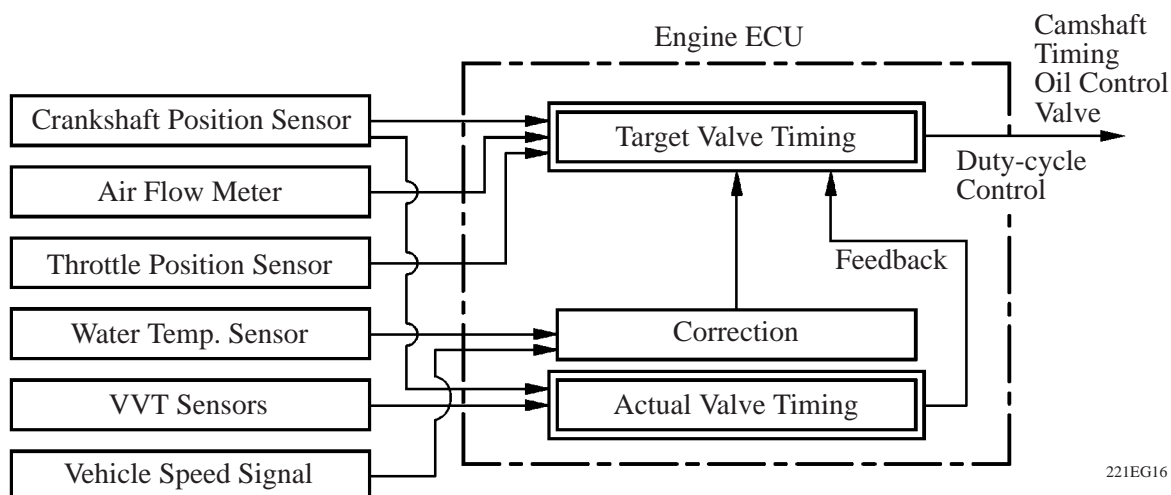
### General

- The VVT-i system is designed to control the intake camshaft within a range of  $50^\circ$  (of Crankshaft Angle) to provide valve timing that is optimally suited to the engine condition. This improves torque in all the speed ranges as well as increasing fuel economy, and reducing exhaust emissions.



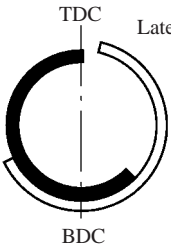
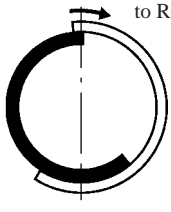
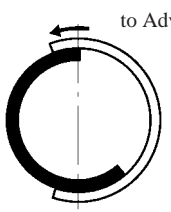
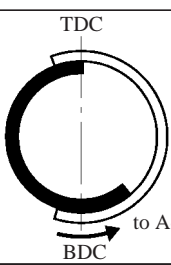
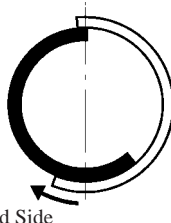
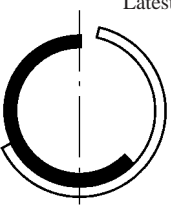
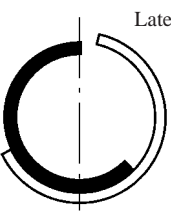
238EG60

- Using the engine speed, intake air volume, throttle position and engine coolant temperature, 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 the crankshaft position sensor to detect the actual valve timing, thus providing feedback control to achieve the target valve timing.



221EG16

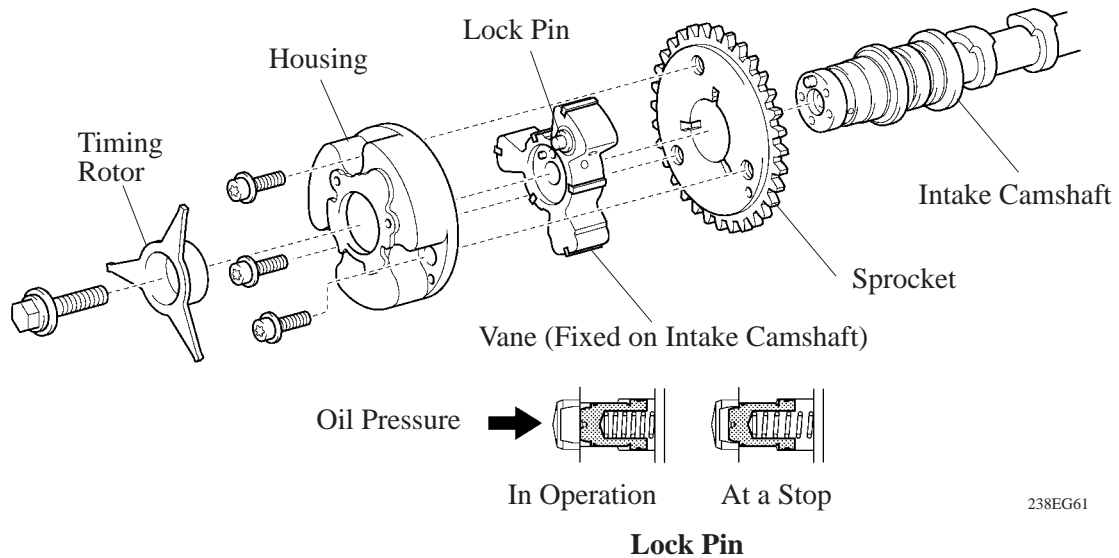
## Effectiveness of the VVT-i System

Operation State	Objective		Effect
During Idling	EX	 <p>Latest Timing</p> <p>IN</p> <p>188EG51</p>	<p>Eliminating overlap to reduce blow back to the intake side</p> <ul style="list-style-type: none"> <li>• Stabilized idling rpm</li> <li>• Better fuel economy</li> </ul>
At Light Load	EX	 <p>to Retard Side</p> <p>IN</p> <p>188EG64</p>	<p>Decreasing overlap to eliminate blow back to the intake side.</p> <p>Ensured engine stability</p>
At Medium Load	EX	 <p>to Advance Side</p> <p>IN</p> <p>188EG65</p>	<p>Increasing overlap to increase internal EGR to reduce pumping loss</p> <ul style="list-style-type: none"> <li>• Better fuel economy</li> <li>• Improved emission control</li> </ul>
In Low to Medium Speed Range with Heavy Load	EX	 <p>Latest Timing</p> <p>IN</p> <p>188EG66</p>	<p>Advancing the intake valve close timing for volumetric efficiency improvement</p> <p>Improved torque in low to medium speed range</p>
In High Speed Range with Heavy Load	EX	 <p>to Retard Side</p> <p>IN</p> <p>188EG67</p>	<p>Retarding the intake valve close timing for volumetric efficiency improvement</p> <p>Improved output</p>
At Low Temperatures	EX	 <p>Latest Timing</p> <p>IN</p> <p>188EG53</p>	<p>Eliminating overlap to prevent blow back to the intake side leads to the lean burning condition, and stabilizes the idling speed at fast idle</p> <ul style="list-style-type: none"> <li>• Stabilized fast idle rpm</li> <li>• Better fuel economy</li> </ul>
<ul style="list-style-type: none"> <li>• Upon Starting</li> <li>• Stopping the Engine</li> </ul>	EX	 <p>Latest Timing</p> <p>IN</p> <p>188EG53</p>	<p>Eliminating overlap to minimize blow back to the intake side</p> <p>Improved startability</p>

## Construction

### 1) VVT-i Controller

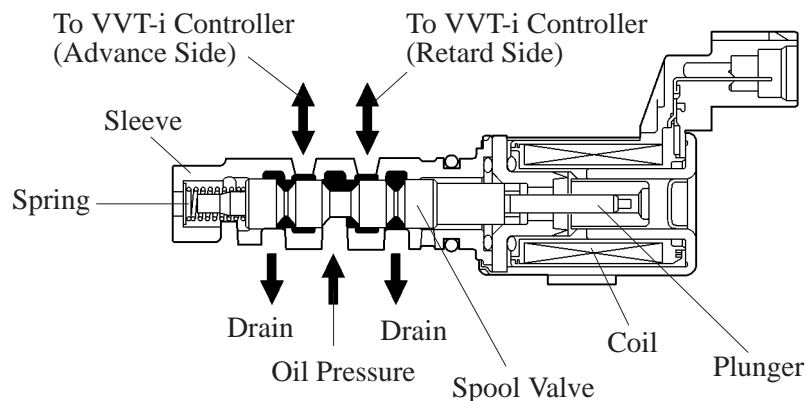
This controller consists of the housing driven from the timing chain and the vane coupled with the intake camshaft. The oil pressure sent from the advance or retard side path at the intake camshaft causes rotation in the VVT-i controller vane circumferential direction to vary the intake valve timing continuously. When the engine is stopped, the intake camshaft will be in the most retarded state to ensure start ability. 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.



NF

### 2) Camshaft Timing Oil Control Valve

This camshaft timing oil control valve controls the spool valve position in accordance with the duty-cycle control from the engine ECU. 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 is in the most retarded state.

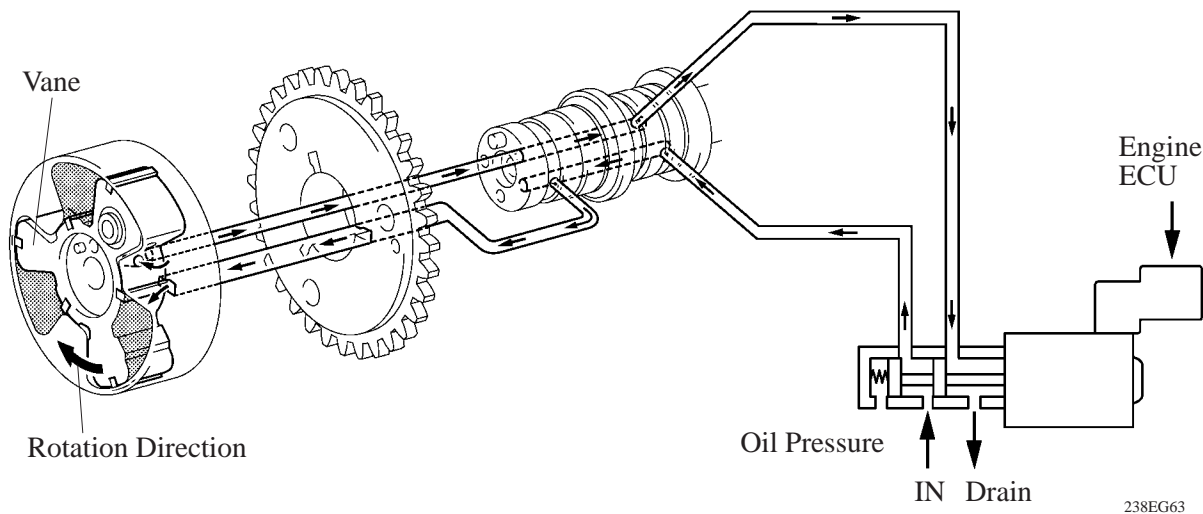


238EG62

## Operation

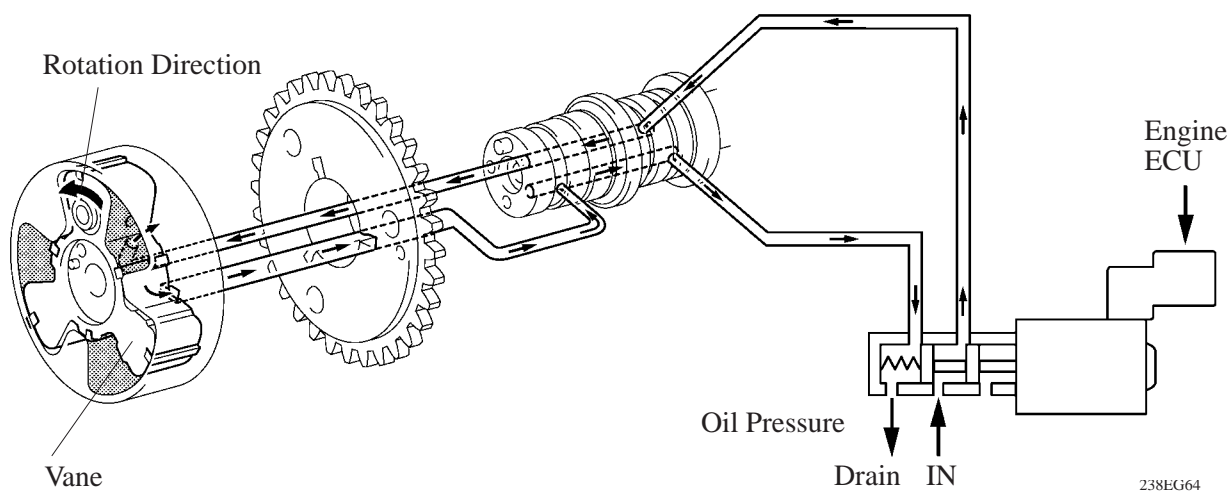
### 1) Advance

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



### 2) Retard

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



### 3) Hold

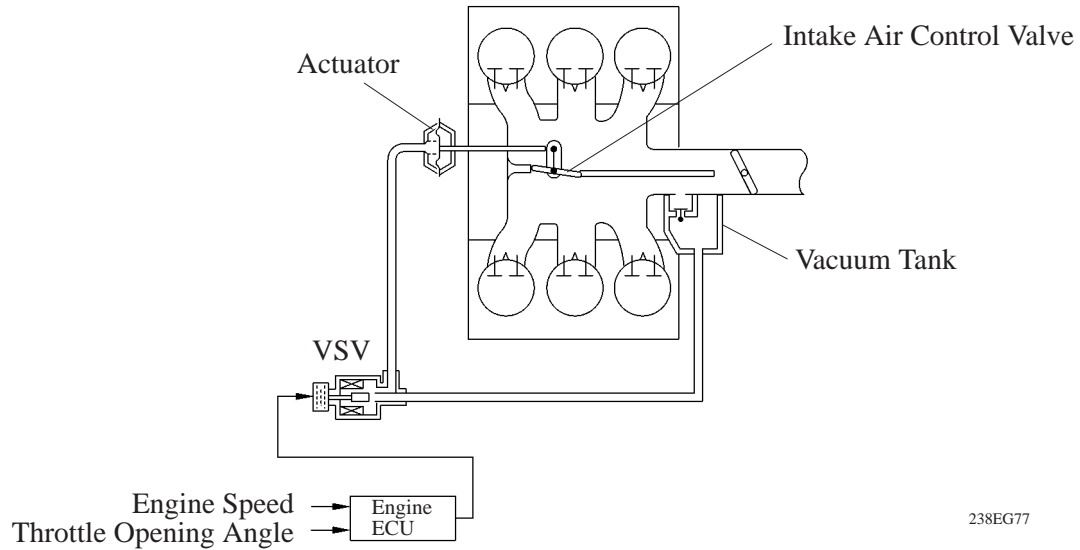
After reaching the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the traveling state changes. This adjusts the valve timing at the desired target position and prevents the engine oil from running out when it is unnecessary.

## 9. ACIS (Acoustic Control Induction System)

### General

The ACIS is realized by using a bulkhead to divide the intake manifold into 2 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 ◀



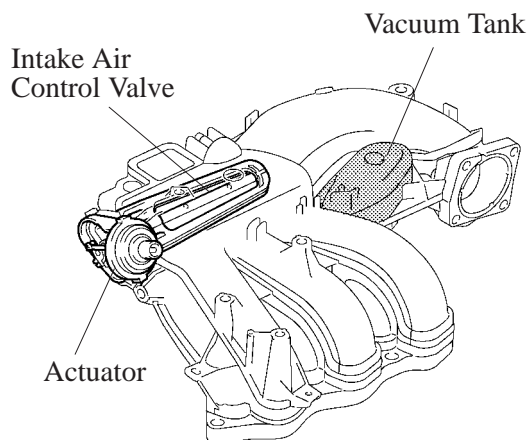
## Construction

### 1) Intake Air Control Valve

The intake air control valve, integrated in the intake air chamber, open and close to change the effective length of the intake manifold in two stages.

### 2) Vacuum Tank

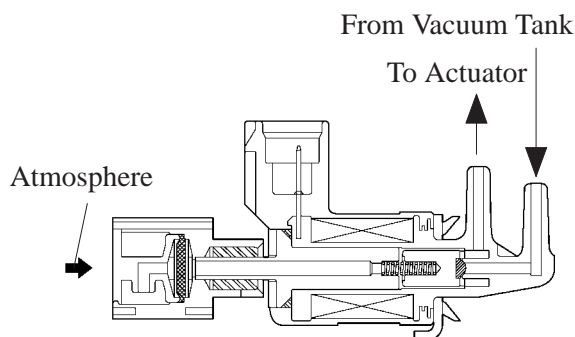
Equipped with an internal check valve, the vacuum tank stores the vacuum that is applied to the actuator in order to maintain the intake air control valve fully closed even during low-vacuum conditions.



238EG65

### 3) VSV (Vacuum Switching Valve)

Controls the vacuum that is applied to the actuator by way of the signal (ACIS) that is output by the engine ECU.



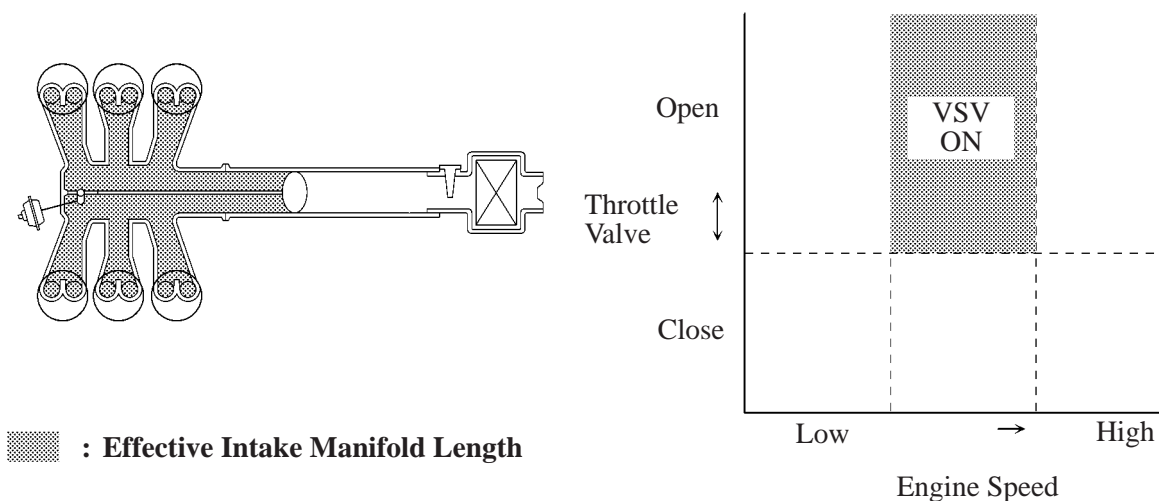
238EG78



## Operation

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

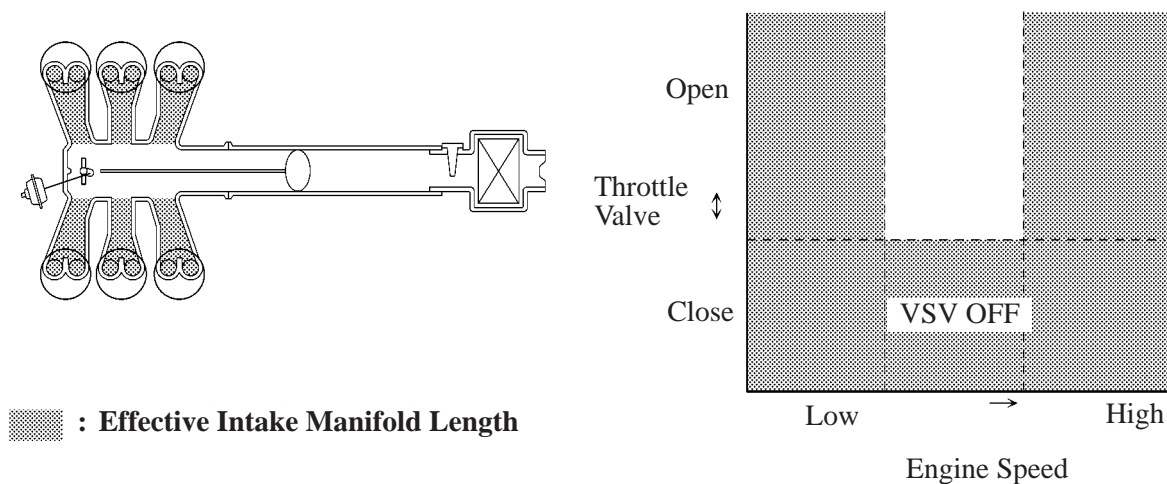
The engine ECU activates the VSV to match the longer pulsation cycle so that the negative pressure acts on the diaphragm chamber of the actuator. This closes the control valve. As a result, the effective length of the intake manifold is lengthened and the intake efficiency in the medium speed range is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



238EG71

### 2) When the Intake Control Valve Open (VSV OFF)

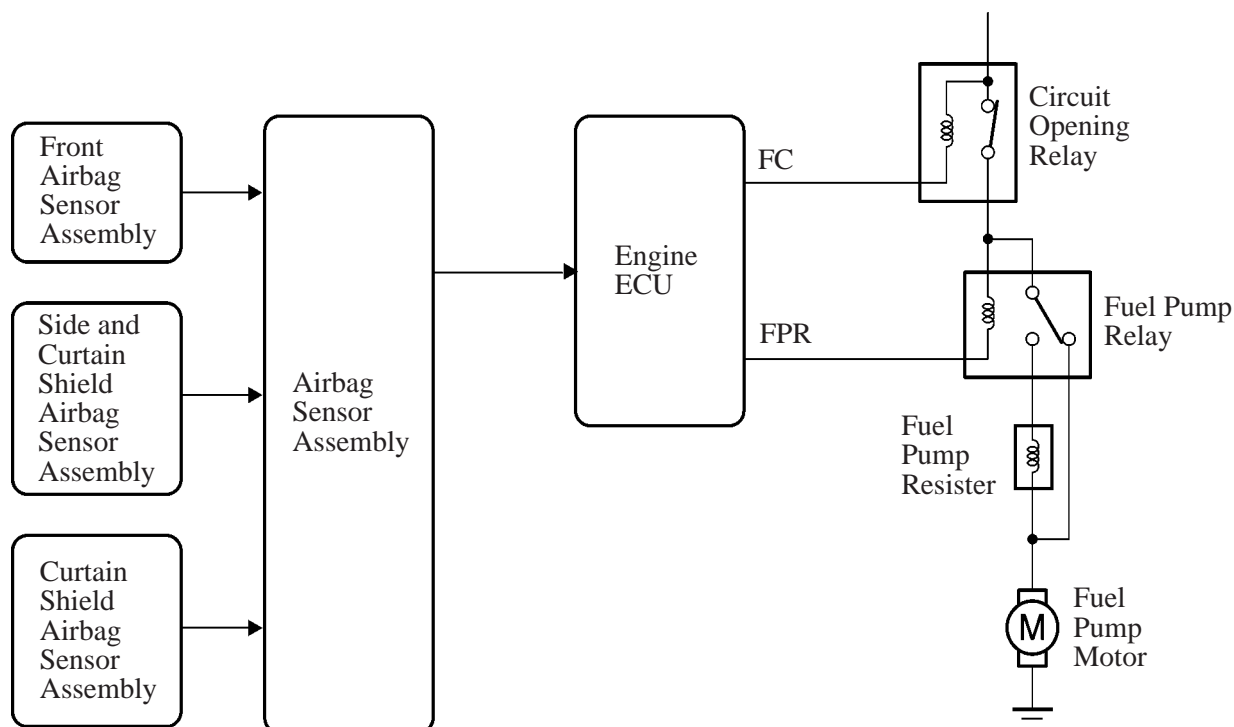
The engine ECU deactivates the VSV to match the shorter pulsation cycle so that atmospheric air is led into the diaphragm chamber of the actuator and opens the control valve. When the control valve is open, the effective length of the intake air chamber is shortened and peak intake efficiency is shifted to the low-to-high engine speed range, thus providing greater output at low-to-high engine speeds.



238EG66

## 10. Fuel Pump Control

- A fuel pump speed is controlled by the fuel pump relay and the fuel pump resister.
- A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision. In this system, the airbag deployment signal from the airbag sensor assembly 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 cancels the fuel cut control, and the engine can be restarted.

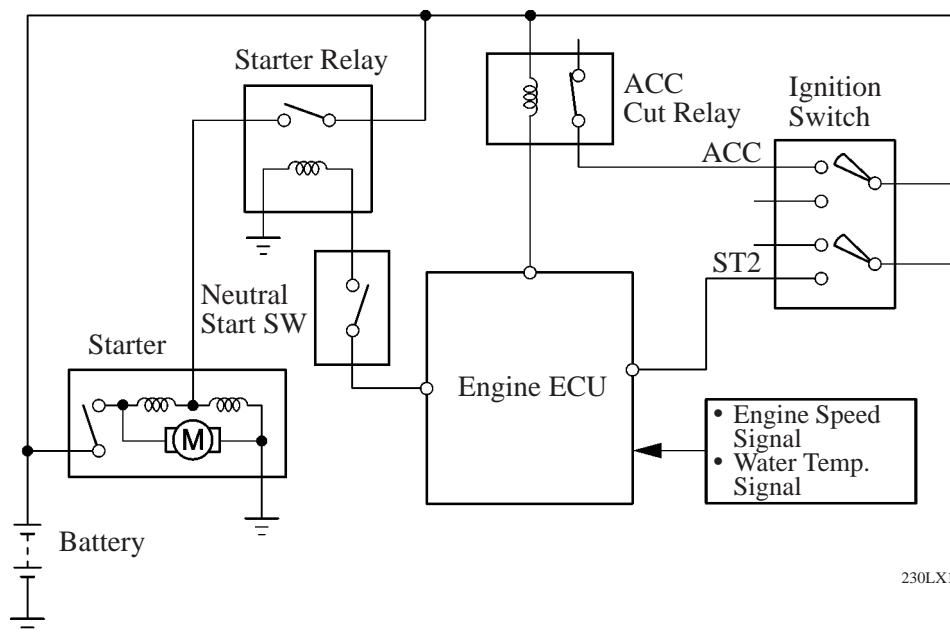


## 11. Cranking Hold Function

### General

- The new Land Cruiser/ Land Cruiser Prado with automatic transmission has adopted cranking hold function. Once the ignition switch is turned to the START position, this control continues to operate the starter until the engine starts, without having to hold the ignition switch in the START position. This prevents starting failures and the engine from being cranked after it has started.
- When the engine ECU detects a start signal from the ignition switch, this system monitors the engine speed (NE) signal and continues to operate the starter until it has determined that the engine has started. Furthermore, even if the engine ECU detects a start signal from the ignition switch, it will not operate the starter if it has determined that the engine has already started.

### ► System Diagram ◀

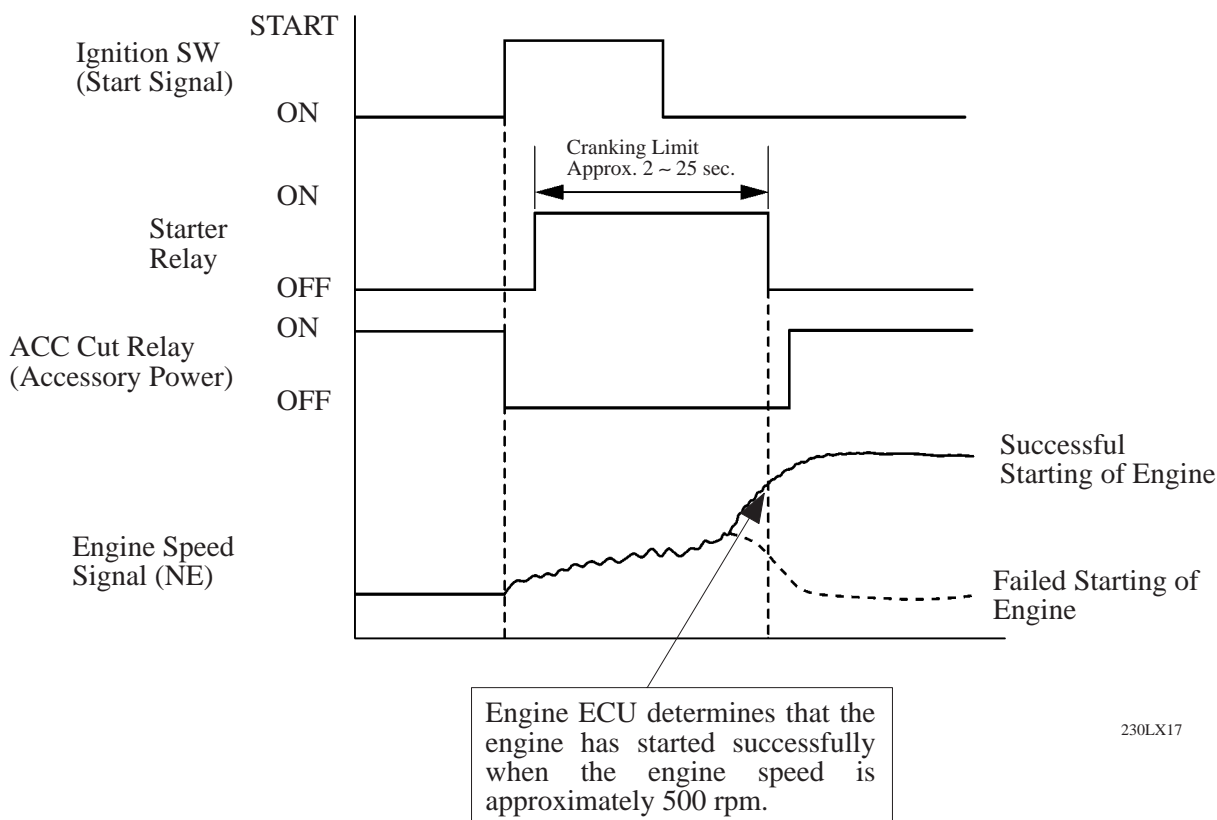


230LX16

## Operation

- As indicated in the timing chart shown below, when the engine ECU detects a start signal from the ignition switch, it energizes the starter relay to operate the starter. If the engine is already running, the engine 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 operation of the starter.
- If the engine has any failure and will 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 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 following protection.
  - While the engine is running normally, even if turning the ignition switch to START position, the starter will not operate.
  - In case that the driver keep holding the ignition switch in START position and the engine starts half way, the engine ECU will stop the starter operation when the engine speed has become approximately 1200 rpm or more.
  - In case that the driver keep holding the ignition switch in START position and the engine will not start, the engine ECU will stop the starter operation when approximately 30 seconds have been passed.
  - In case that the starter begins to operate, but cannot detect the engine speed signal, the engine ECU will stop the starter operation immediately.

### ► Timing Chart ◀



## 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.
- The engine ECU will also store the DTCs of the malfunctions.
- The DTCs can be accessed by connecting the SST (09843-18040) to the DLC3 terminals Tc and CG, and reading the blinking of the check engine warning light. They can also be accessed by connecting a hand-held tester.
- All the DTCs (Diagnostic Trouble Codes) 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 Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM1017E).

### Service Tip

To clear the DTC that is stored in the engine ECU, use a hand-held tester or disconnect the battery terminal or remove the EFI fuse for 1 minute or longer.

## 13. Fail-Safe

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

### ► Fail-Safe Chart ◀

DTC No.	Fail-Safe Operation	Fail-Safe Deactivation Conditions
P0031/28, P0032/28, P0051/21, P0052/21, P0037*, P0038* P0057*, P0058*	The heater circuit in which an abnormality is detected is turned off.	Ignition switch OFF.
P0100/31, P0102/31, P0103/31	Ignition timing is calculated from an engine speed and a throttle angle.	If the ECM "Pass" condition, the ECM will return to "normal mode".
P0110/24, P0112/24, P0113/24	Intake air temp. is fixed at 20°C (68°F).	If the ECM "Pass" condition, the ECM will return to "normal mode".
P0115/22, P0117/22, P0118/22	Water temp. is fixed at 80°C (176°F).	If the ECM "Pass" condition, the ECM will return to "normal mode".
P0120/41, P0122/41, P0123/41, P0220/41, P0222/41, P0223/41, P2135/41	VTA is fixed at about 16% and fuel cut intermittently.	If the ECM "Pass" condition, the ECM will return to "normal mode", and ignition switch OFF.
P0121/41	VTA is fixed at about 16% and fuel cut intermittently.	If the ECM "Pass" condition, the ECM will return to "normal mode", and ignition switch OFF.
P0325/55, P0327/55 P0328/55, P0330/52 P0332/52, P0333/52	Max. timing retardation.	Ignition switch OFF.
P0351/14, P0352/15, P0353/15, P0354/14, P0355/14, P0356/15	Fuel cut.	If the ECM "Pass" condition, the ECM will return to "normal mode".
P2102/41, P2103/41	VTA is fixed at about 16% and fuel cut intermittently.	If the ECM "Pass" condition, the ECM will return to "normal mode", and ignition switch OFF.
P2111/41, P2112/41	VTA is fixed at about 16% and fuel cut intermittently.	
P2119/89	VTA is fixed at about 16% and fuel cut intermittently.	

\*: Europe model