

### 13. Engine Control System

#### General

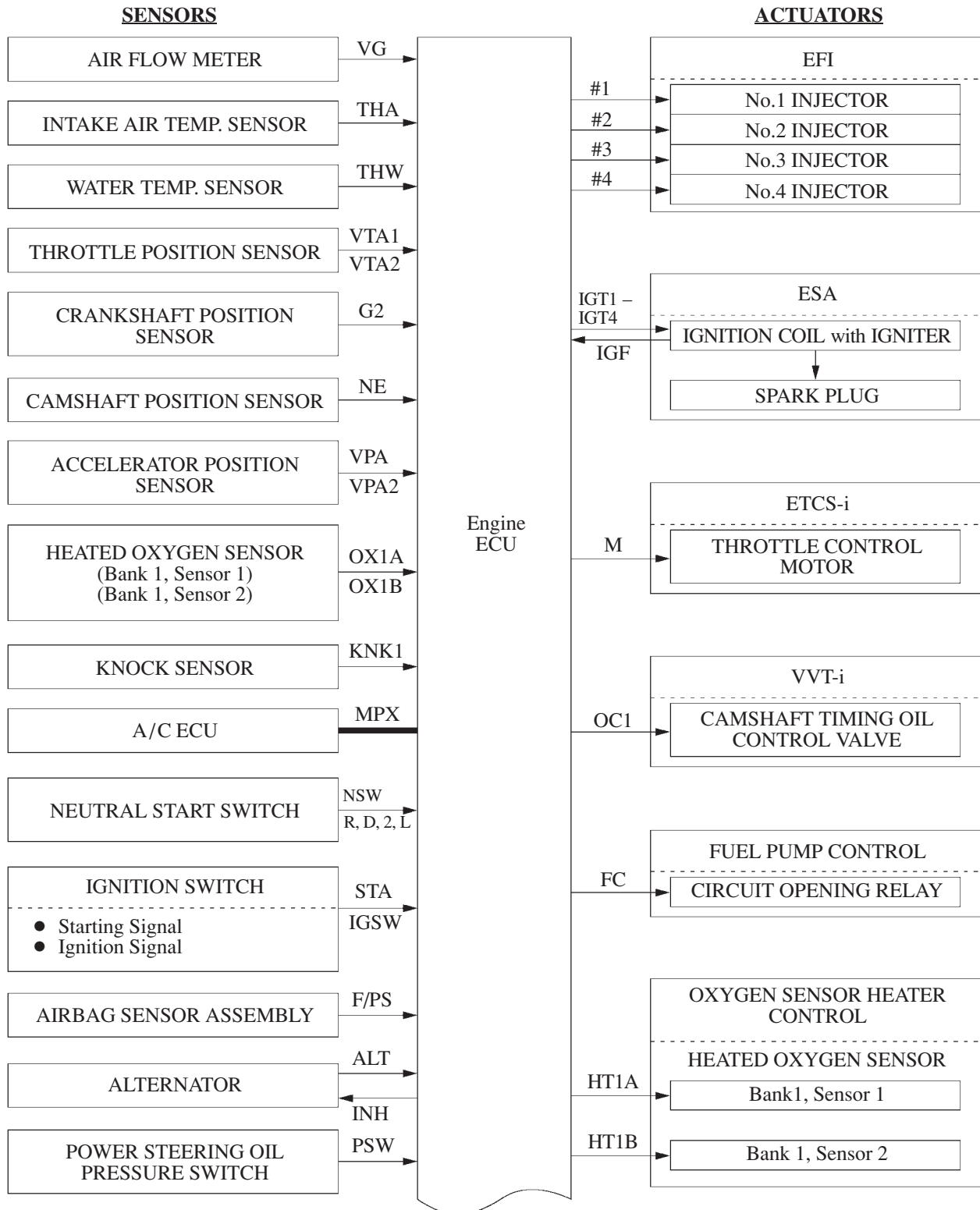
The engine control system of the 2AZ-FE engine has following system.

System	Outline	New 2AZ-FE	Previous 1AZ-FE
EFI ( Electronic Fuel Injection )	An L-type EFI system directly detects the intake air mass with a hot wire type air flow meter.	○	○
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 174)	<ul style="list-style-type: none"> <li>● Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.</li> <li>● A link-less type is used, without an accelerator cable.</li> <li>● A contact type accelerator pedal position sensor is provided on the accelerator pedal.</li> <li>● A no-contact type throttle position sensor is used.</li> <li>● Controls the fast idle and idle speed.</li> </ul>	○	—
VVT-i ( Variable Valve Timing-intelligent ) (See page 212)	Controls the intake camshaft to an optimal valve timing in accordance with the engine condition.	○	○
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	○	○
Air Conditioner Cut-off Control*	By turning the air conditioner compressor ON or OFF in accordance with the engine condition, drivability is maintained.	○	○
Cooling Fan Control (See page 213)	Radiator cooling fan operation is controlled by water temperature sensor signal (THW) and the condition of the air conditioner operation.	○	○
Charging Control (See page 214)	The engine ECU regulates the charging voltage of the alternator in accordance with the driving conditions and the battery's state of charge.	○	—
Fuel Pump Control	Fuel pump operation is controlled by signal from the engine ECU.	○	○
	A fuel cut control is adopted to stop the fuel pump when any airbag is deployed during front or side collision.	○	○
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emission (HC) in the charcoal canister in accordance with engine conditions.	○	○
Engine Immobilizer	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.	○	○
	The ID code stored in the transponder key ECU is compared with that of the transponder tip in the ignition key.	○	—
Diagnosis (See page 216)	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorized the failed section.	○	○
	All the DTCs (Diagnostic Trouble Codes) have been made to correspond to the SAE controlled codes.	○	—
Fail-Safe (See page 216)	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.	○	○

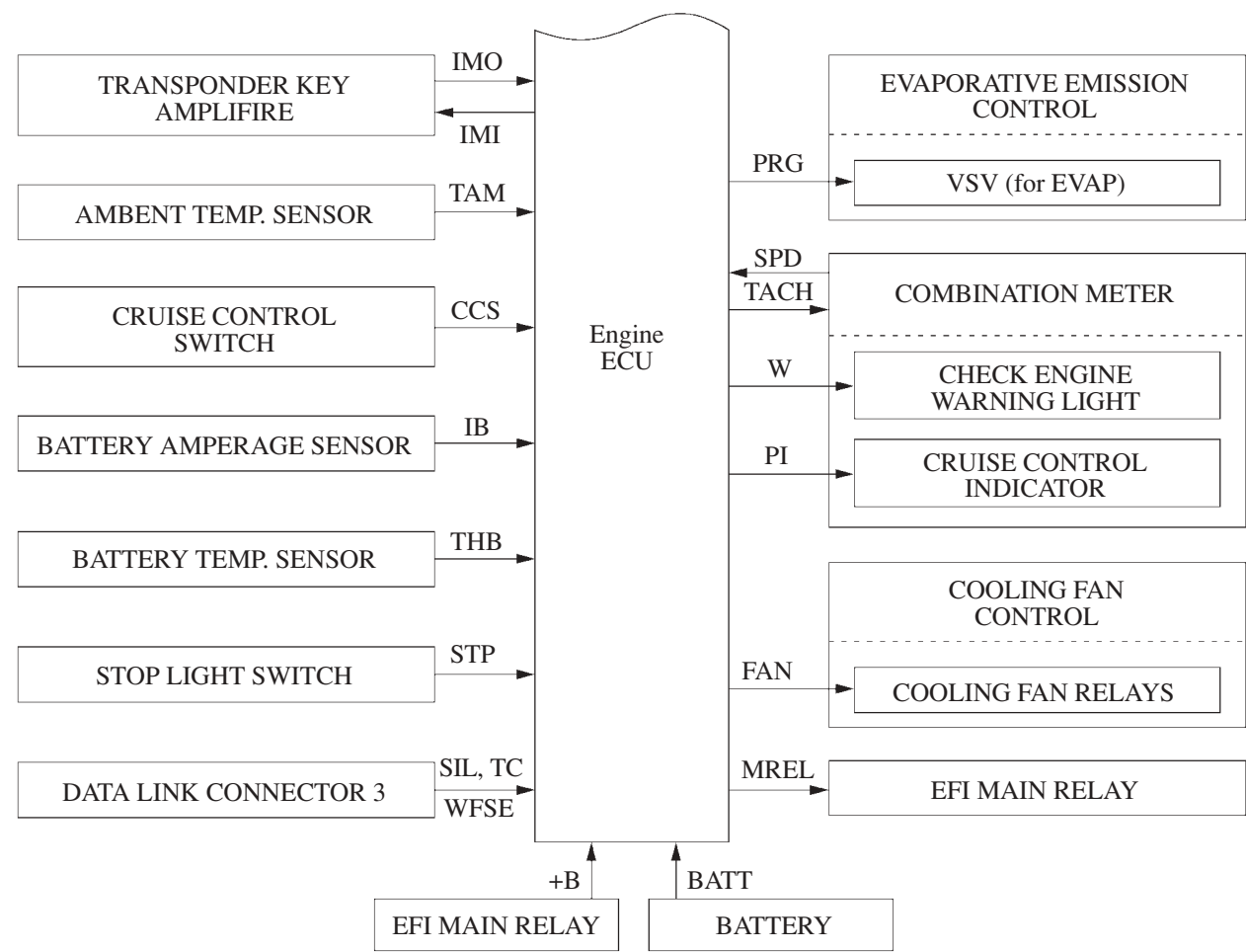
\*: With Air Conditioner Model

# Construction

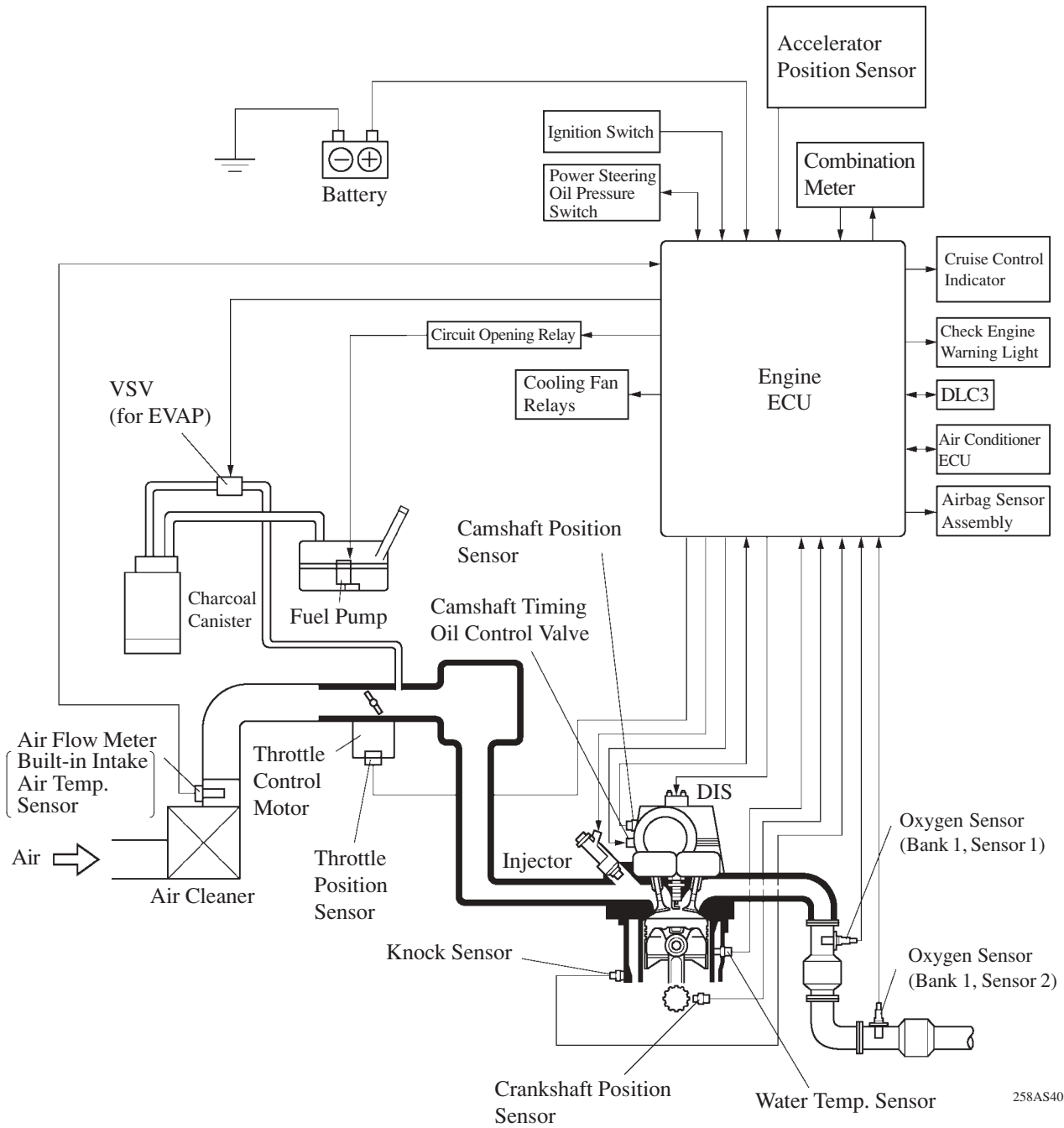
The configuration of the engine control system in the 2AZ-FE engine in the new Avensis Verso is as shown in the following chart.



(Continued)

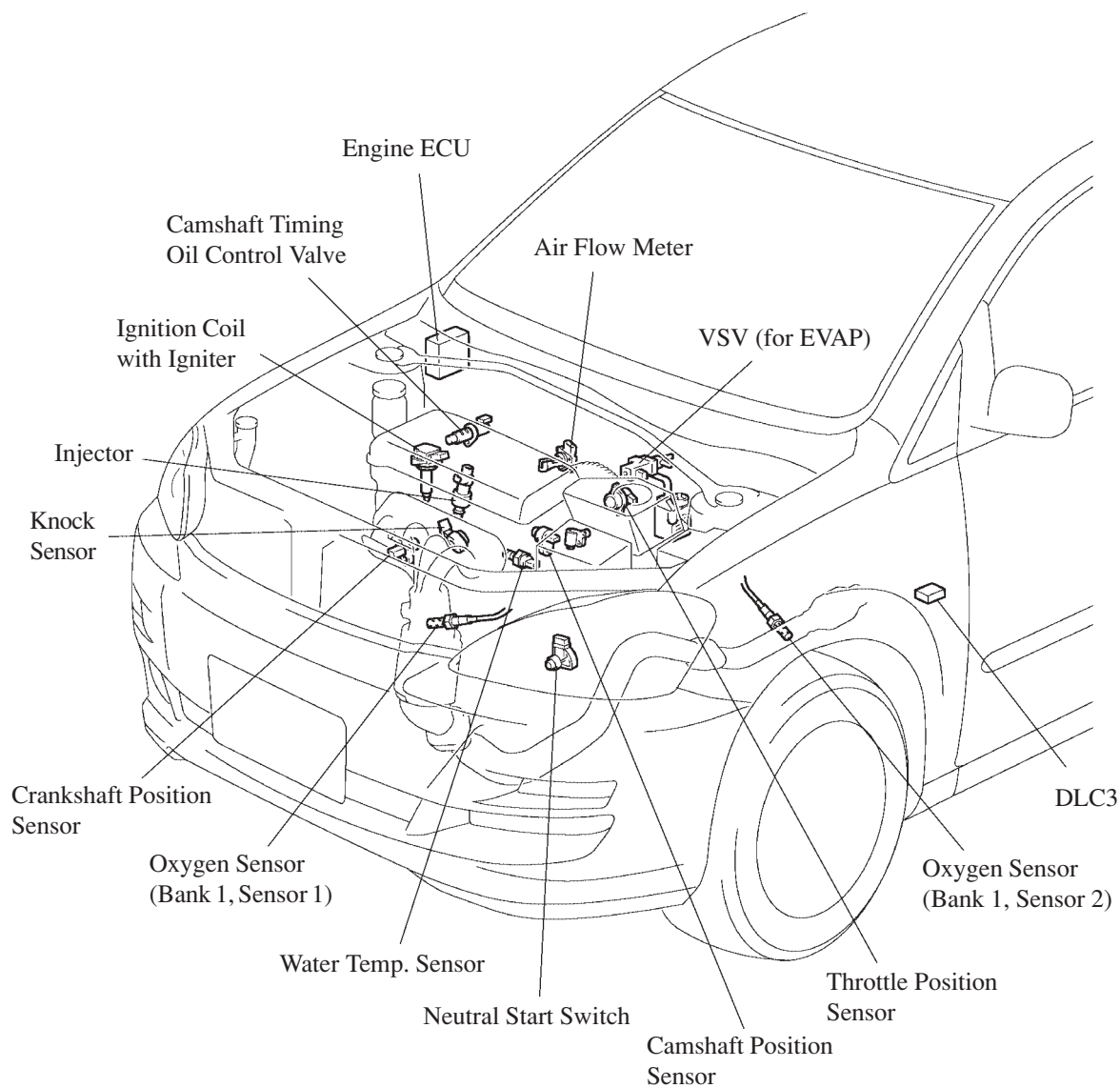


# Engine Control System Diagram



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## Layout of Main Components



## Main Components of Engine Control System

### 1) General

The following table shows the main components.

Components	New (2AZ-FE)		Previous (1AZ-FE)	
	Outline	Quantity	Outline	Quantity
Engine ECU	32-bit CPU	1	←	1
Air Fuel Ratio Sensor (Bank 1, Sensor 1)	—		with Heater Type (Cup type)	2
Oxygen Sensor (Bank 1, Sensor 1)	with Heater Type (Cup type)	1	—	
Oxygen Sensor (Bank 1, Sensor 2)	with Heater Type (Cup type)	1	←	2
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	←	
Knock Sensor	Built-in Piezoelectric Element Type (Flat Type)	1	Built-in Piezoelectric Element Type (Resonant Type)	1
Accelerator Pedal Position Sensor	Contact Type	1	—	
Throttle Position Sensor	No-contact Type	1	Contact Type	1

### 2) Knock Sensor (Flat type)

The same knock sensor as the 1AZ-FE engine has been adopted. For details, [see page 169](#).

### 3) Accelerator Pedal Position Sensor (Contact type)

The same accelerator pedal position sensor as the 1AZ-FE engine has been adopted. For details, [see page 172](#).

### 4) Throttle Position Sensor (No-contact type)

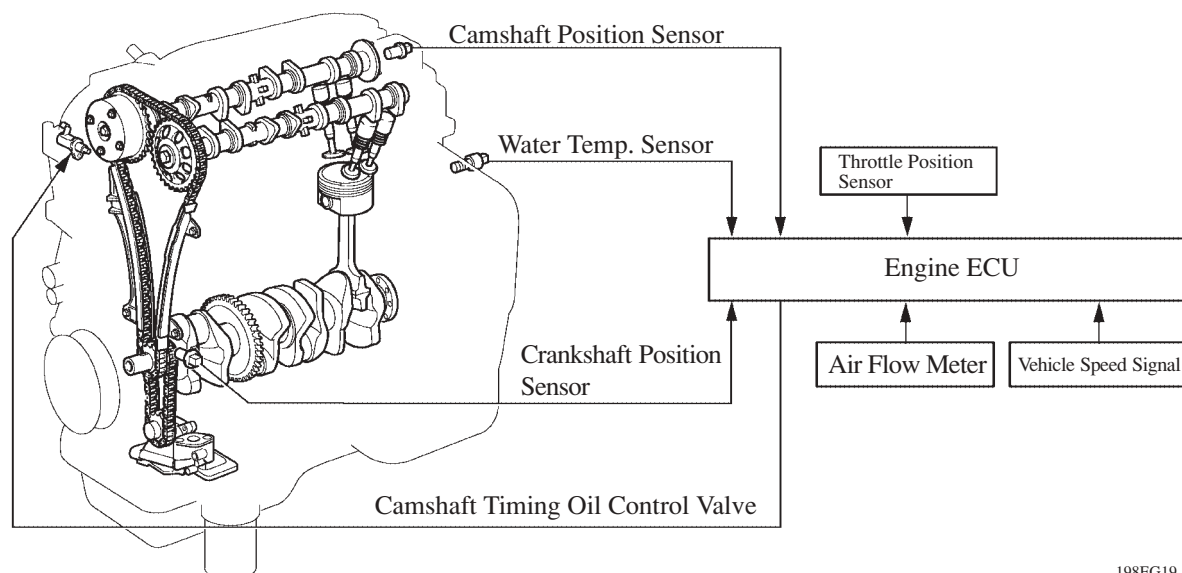
The same throttle position sensor as the 1AZ-FE engine has been adopted. For details, [see page 173](#).

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

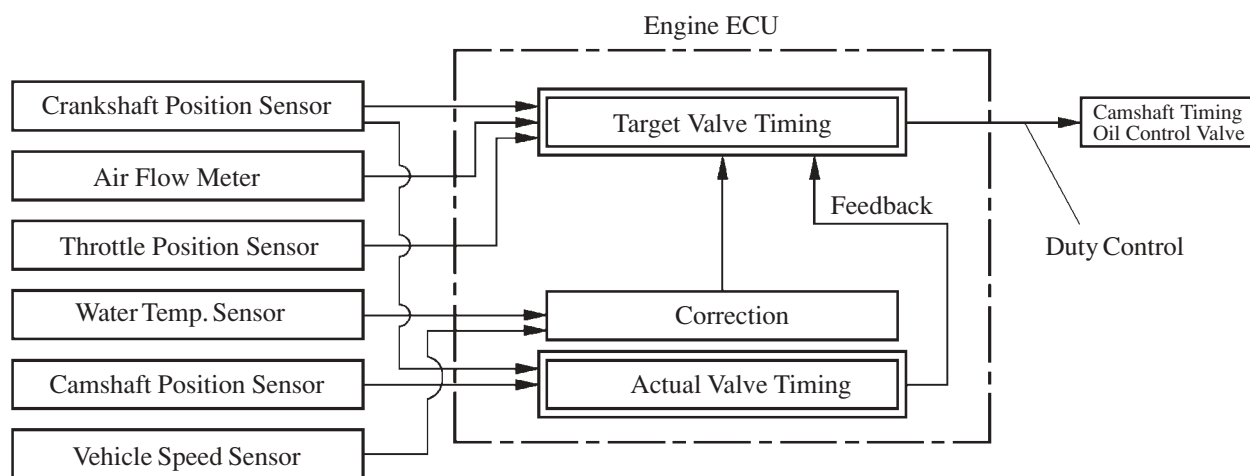
The same ETCS-i control as the 1AZ-FE engine has been adopted. For details, [see page 174](#).

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

The VVT-i system designed to control the intake camshaft within a wide range of 50° (of crankshaft angle) to provide a valve timing that is optimally suited to the engine condition, thus realizing improved torque in all the speed ranges and fuel economy, and reduce exhaust emission. The actual intake valve timing is feedback by means of the camshaft position sensor for constant control to the target valve timing.



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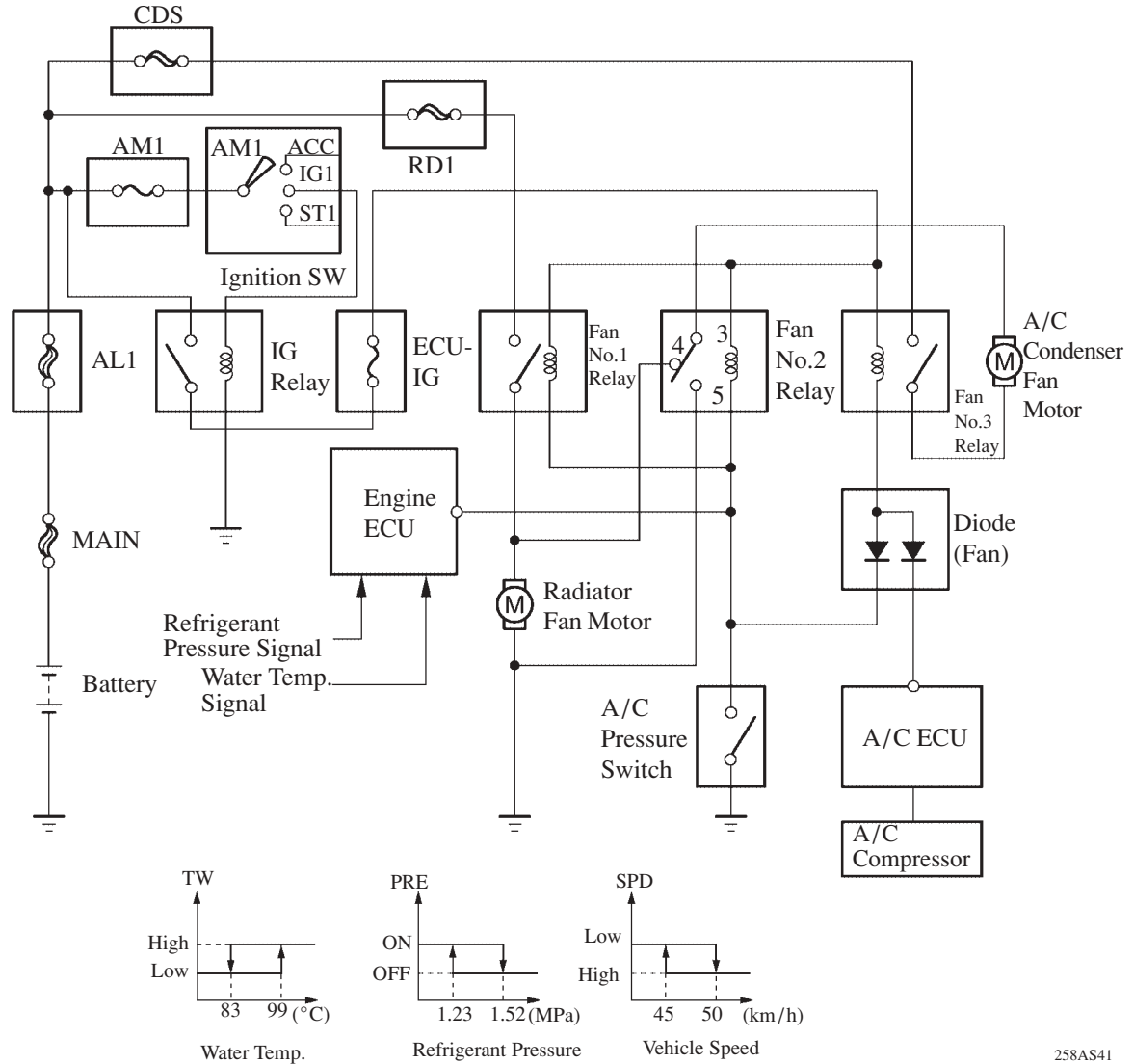
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## Cooling Fan Control

A cooling fan system in which the engine ECU controls the cooling fan speed in accordance with the signals from the water temperature sensor, etc. has been adopted.

The engine ECU controls the cooling fan speeds in accordance with the water temperature and the operating conditions of the A/C compressor, A/C pressure switch. 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 ◀



258AS41

### ► Cooling Fan Operation ◀

A/C Compressor	Water Temperature	A/C Pressure Switch	Vehicle Speed	Relay Operation			Cooling Fan Operation	Cooling Fan Motor Connection
				No.1	No.2	No.3		
OFF	High	—	—	ON	3 to 5	ON	High	Parallel
	Low	—	—	OFF	3 to 4	OFF	OFF	OFF
ON	High	—	—	ON	3 to 5	ON	High	Parallel
	Low	ON	—	ON	3 to 5	ON	High	Parallel
		OFF	Low	OFF	3 to 4	ON	Low	Series
			High	OFF	3 to 4	OFF	OFF	OFF

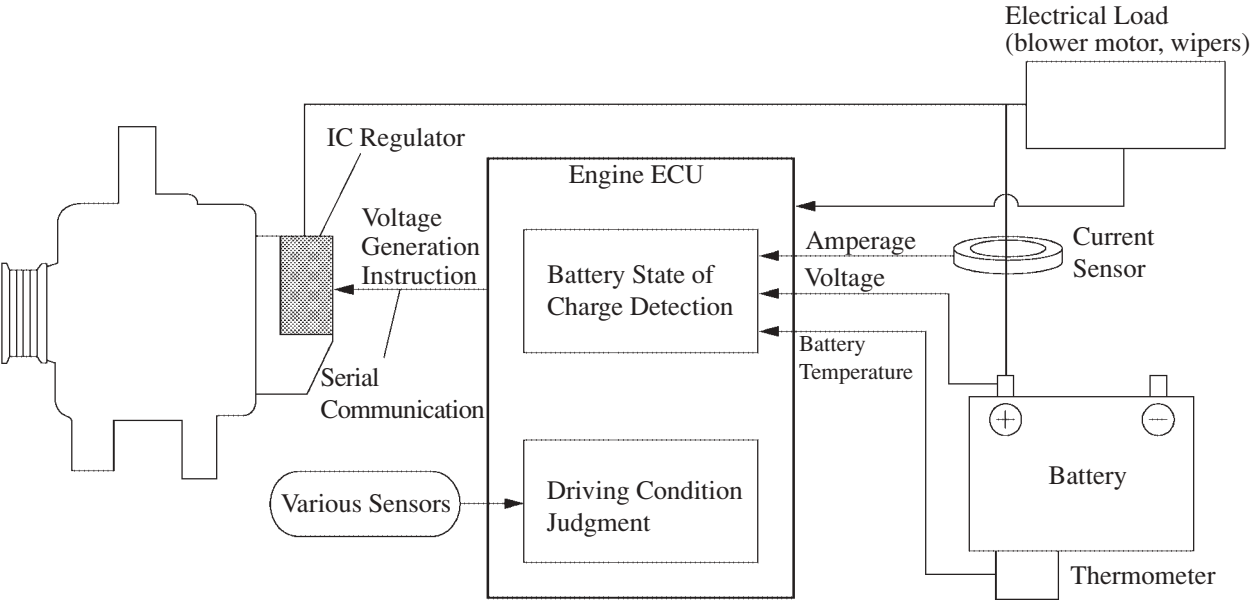


Charging Control

1) General

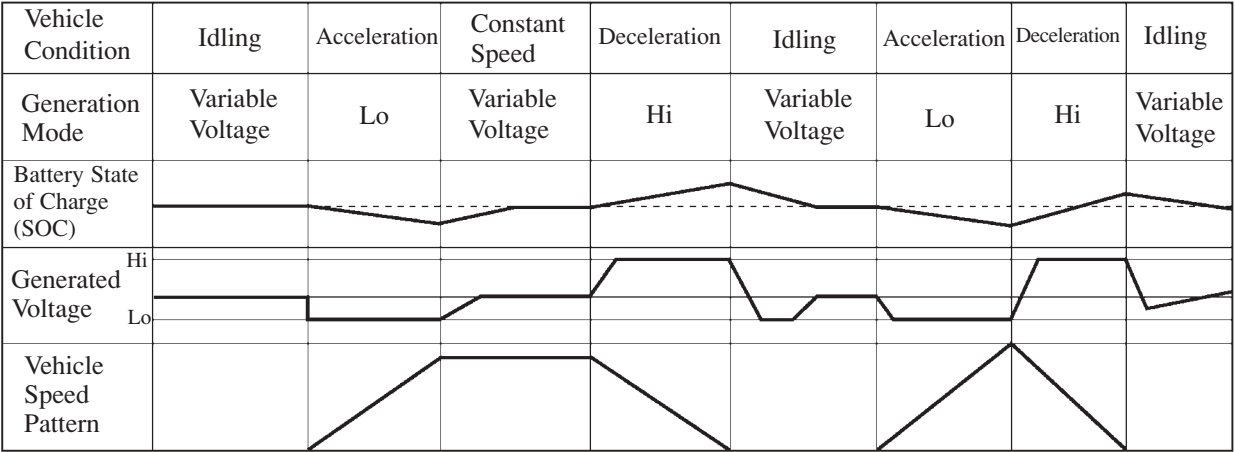
The engine ECU decreases the voltage generated by the alternator during acceleration of the vehicle, and increases the generated voltage during deceleration. This control reduces the load imposed on the engine by the alternator during generation, in order to promote the fuel economy of the engine.

During idling and constant-speed driving, the engine ECU regulates the generated voltage. This is performed in accordance with the battery input and output amperage values, which are detected by the current sensor and tallied by the engine ECU.



258AS29

Charging Control Operation Example:



258AS30

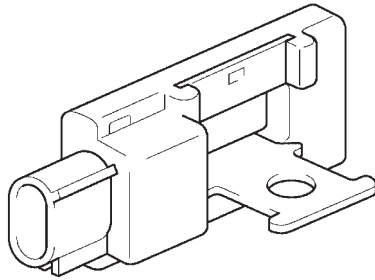
► Function of Main Components ◀

Item	Outline
Engine ECU	Controls the generated voltage of the alternator according to the battery condition and vehicle driving condition.
Current Sensor	Measures the input and output current, and outputs to the engine ECU.
Thermometer	Measures the battery temperature by thermistor, and outputs to the engine ECU.

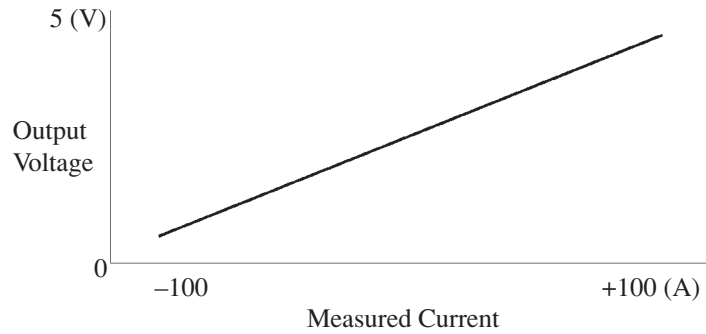
## 2) Current Sensor

The Current Sensor installed in the positive terminal of battery measures the battery input and output current.

The battery input and output current is used to judge the battery state of charge by engine ECU.



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**Characteristic of Current Sensor**

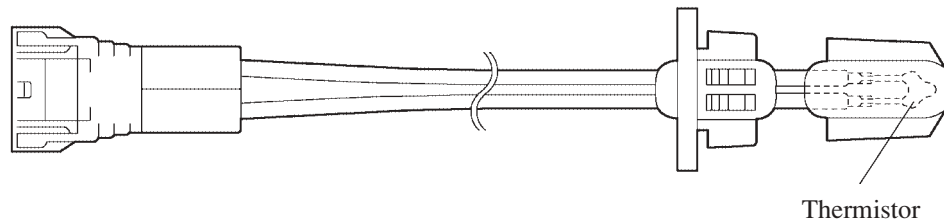
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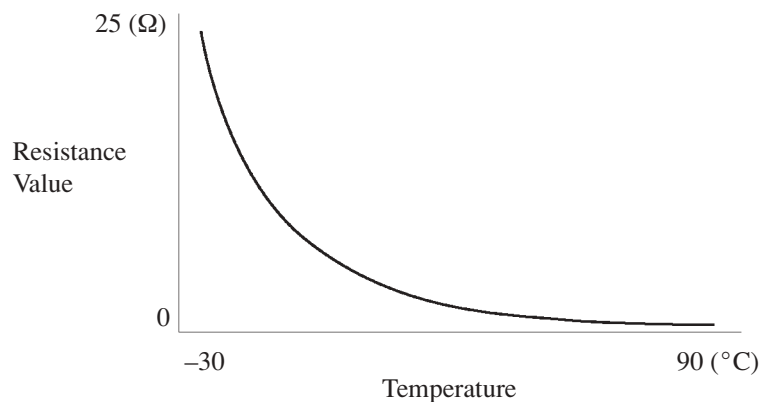
## 3) Thermometer

The Thermometer is installed on the battery tray. The thermistor on the sensor measures the battery temperature. Thermistor is thermally sensitive resistor which varies a resistance value significantly in accordance with temperature changing.

Battery temperature is used to judge the battery state of charge by engine ECU.



258AS59



**Characteristic of Battery Thermometer**

258AS60

## Diagnosis

- When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorizes the failed section.  
Furthermore, the check warning light in the combination meter illuminates or blinks to inform the driver.
- The engine ECU will also store the DTCs (Diagnostic Trouble Codes) of the malfunctions.
- The DTCs can be accessed the use of the hand-held tester.
- All the DTCs have been made to correspond to the SAE controlled codes. For details, refer to the Avensis Verso Repair Manual (Pub. No. RM1032E).

### 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.

## 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
P0100, P0102, P0103	Ignition timing is calculated from engine speed and a throttle angle.	Return to normal condition.
P0110, P0112, P0113	Intake air temp. is fixed at 20°C (68°F).	Return to normal condition.
P0115, P0117, P0118	Water temp. is fixed at 80°C (176°F).	Return to normal condition.
P0120, P0122, P0123, P0220, P0222, P0223, P2135	Fuel cut intermittently when idle.	Return to normal condition and ignition switch OFF.
P0325, P0327, P0328	Max. timing retardation.	Ignition switch OFF.
P0351, P0352, P0353, P0354	Fuel cut.	Return to normal condition.
P0516, P0517, P1550, P1551, P1552, P1602	Charging Control is stopped.	Return to normal condition.
P0604, P0606, P0607, P0657	Fuel cut intermittently when idle.	Return to normal condition and ignition switch OFF.
P2102, P2103	Fuel cut intermittently when idle.	Return to normal condition and ignition switch OFF.
P2111, P2112	Fuel cut intermittently when idle.	Return to normal condition and ignition switch OFF.
P2118, P2119	Fuel cut intermittently when idle.	Return to normal condition and ignition switch OFF.