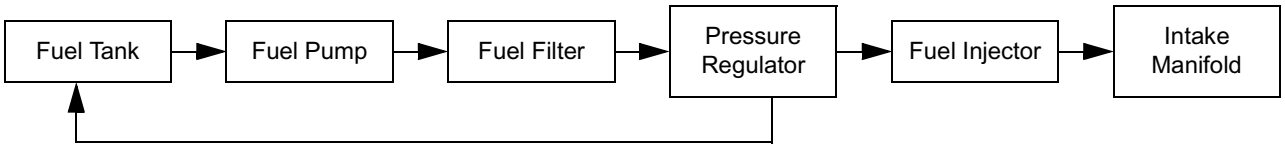
## 5. Three major flow

### 1) FUEL FLOW SYSTEM

All ECCS models have the same basic fuel flow system, as shown in the schematic below. A fuel pump pulls fuel from fuel tank, moves it through the fuel lines (including a fuel filter) and eventually supplies it to the engine through the fuel injectors. A pressure device maintains specified fuel pressure throughout the system.

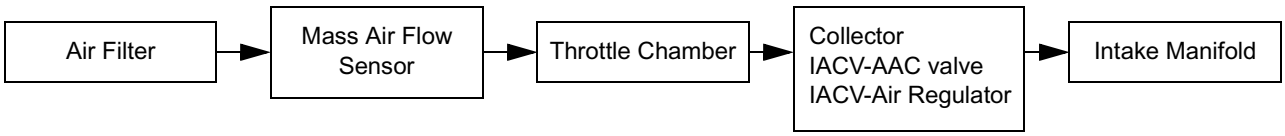
**Typical fuel flow system**




### 2) AIR FLOW SYSTEM

As with the fuel flow system, ECCS Air Flow Systems are basically the same from model to model. Since the quantity of air mixed with fuel (Mixture ratio) is key to engine performance, the control of intake air is extremely important.

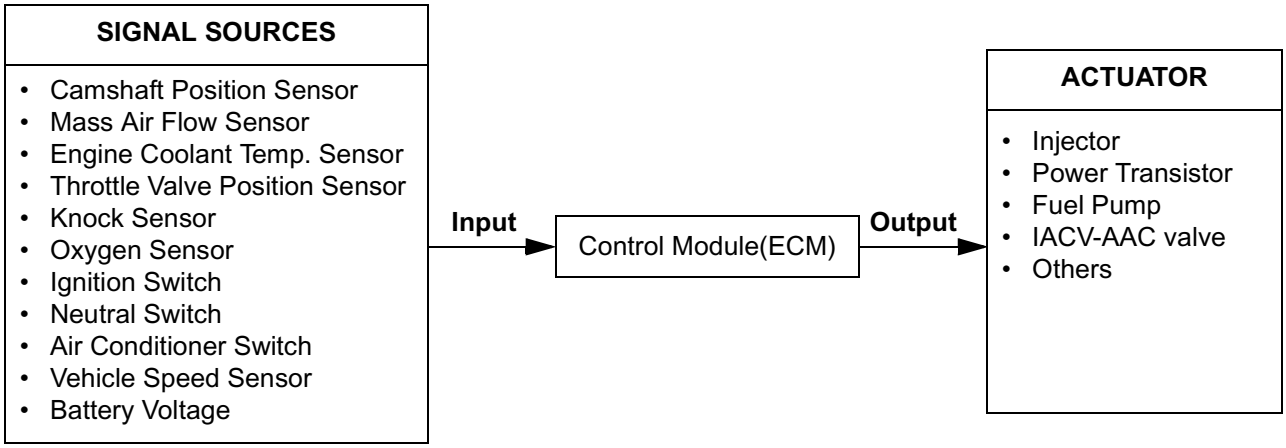
**Typical air flow system**




### 3) ELECTRICAL FLOW SYSTEM

The 3rd Nissan ECCS flow system is for electrical current. In this system, signals are input to the ECM, primarily from the Camshaft Position Sensor (indicating engine speed and piston position) and the Mass Air Flow Sensor (indicating mass air intake). The ECM then processes these signals and send the resulting signals to the injectors and power transistor to control engine operation.

**Typical electrical flow**

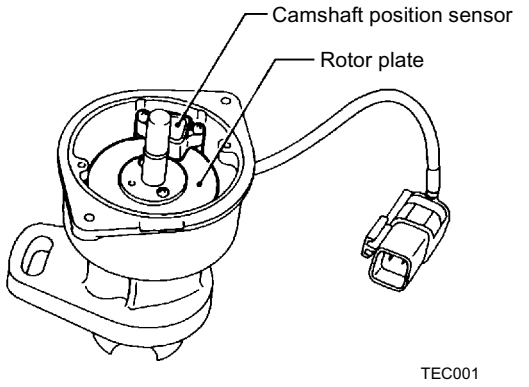


## 6. Function of component parts

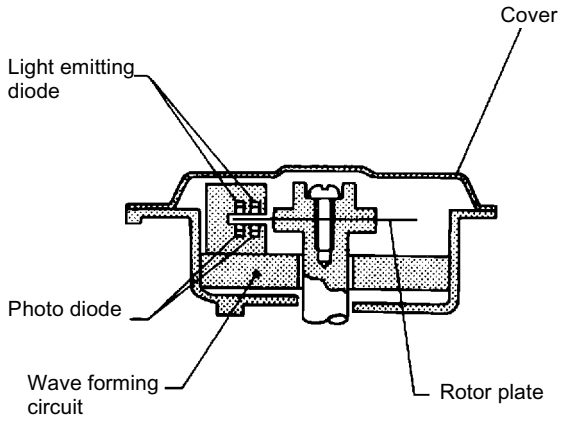
### 1) Camshaft Position Sensor (Crank Angle Sensor)

This is a key component of the ECCS. The CPS monitors engine speed and piston position by reading light signals passing through 2 sets of slits cut in a rotor plate. (Except the New EGI system) The set of 1 degree slits read engine speed and the set of 120 degree (6 cylinder)/ 180 degree (4 cylinder) slits read piston position. A pulse input signal is then sent to the ECM to control:

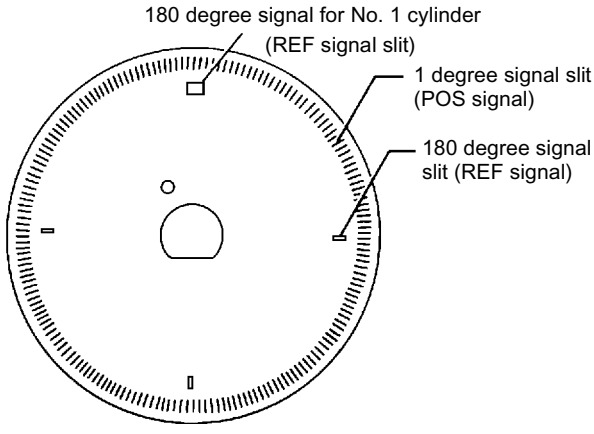
* Fuel injection timing
* Fuel-cut control
* Ignition timing
* Basic fuel injection quantity
* Various enrichment corrections



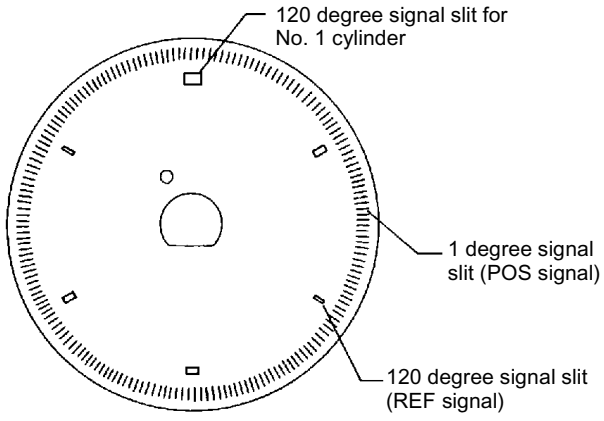

TEC001




TEC002




TEC003

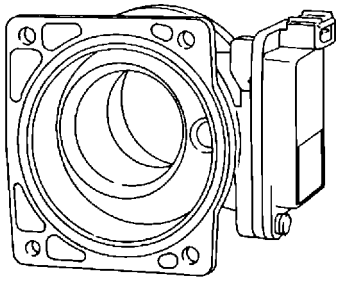



TEC004

**Note:** REF signal ⟶ Reference signal
POS signal ⟶ Position signal

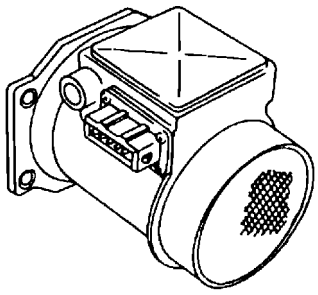
## 2) Mass Air Flow Sensor (Air Flow Meter)

A key component for basic fuel injection control that measures intake air flow rate and density, then sends these signals to the ECM. These signals vary, based on the amount of heat emitting from the hot film place in the intake air stream.



TEC005

By-pass flow type

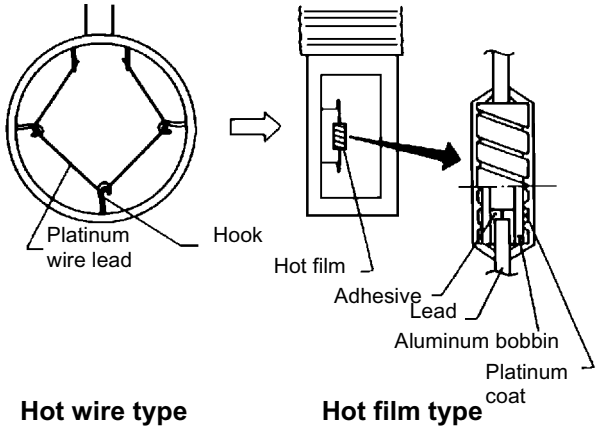


TEC006

Full flow type

Three kinds of Mass Air Flow Sensors have been used in Nissan vehicles:

* Flap type
* Hot wire type
* Hot film type

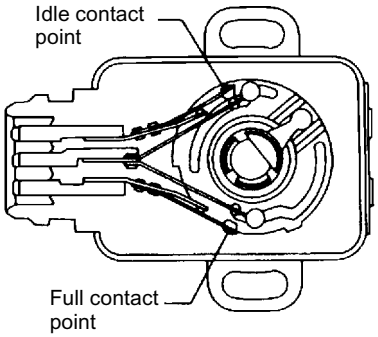



**Hot wire type** **Hot film type**

TEC007

## 3) Throttle Position Switch (Throttle Valve Switch)

Throttle position switch detects full open or full closed position. This is the input signal for the idle engine-speed, idle mixture, idle ignition controls to start operating.

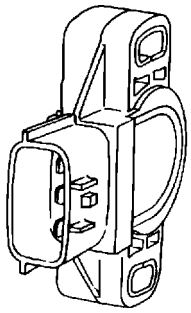



TEC008

**Throttle Position Switch**

### 4) Throttle Position Sensor (Throttle Sensor)

The throttle position sensor detects opening of throttle valve and rate of opening and it provides input for additional fuel injection at acceleration. The throttle position sensor also incorporates the throttle position function.

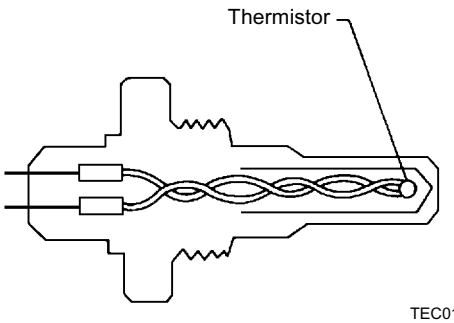


TEC009

**Throttle Position Sensor**

### 5) Engine Coolant Temperature Sensor (Water Temperature Sensor)

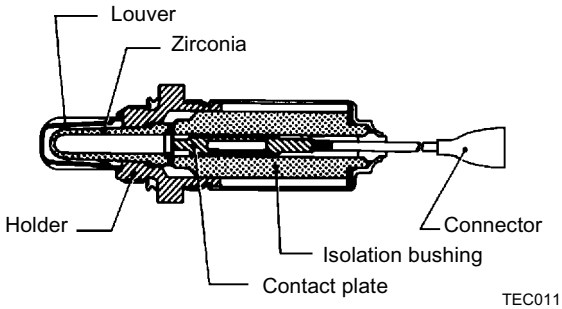
It detects the cooling water temperature and it senses to compensate fuel injection quantity to meet cooling water temperature condition. It also senses an input signal to set the idle engine speed in relation to the cooling water temperature.




TEC010

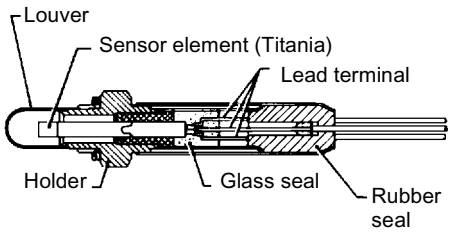
### 6) Oxygen Sensor (Exhaust Gas Sensor)

The oxygen sensor detects oxygen density in exhaust gas and it detects air-fuel ratio.




TEC011

**ZIRCONIA TYPE**

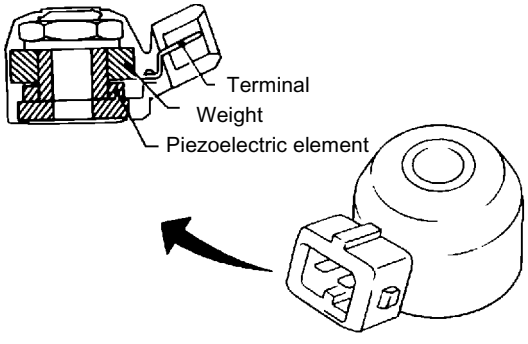



TEC012

**TITANIA TYPE**

### 7) Knock Sensor

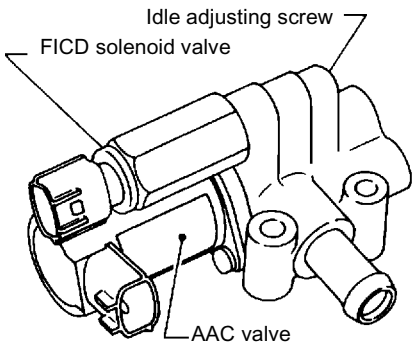
It detects engine knocking and it delays ignition timing when knocking occurred.




TEC013

## 8) IACV-AAC Valve (AAC Valve)

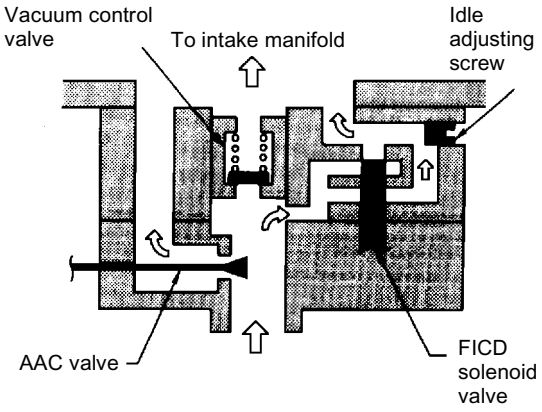
In relation to the actual engine idle speed and the programmed value, the IACV-AAC valve receives a signal from the ECM to adjust the air quantity in the bypass gallery.




TEC014

As shown, air flows through the AAC valve. This solenoid valve is repeatedly energized at a frequency of 160Hz. The quantity of air passing through the AAC valve is adjusted by changing the ratio of energizing periperiod.

The idle adjusting screw must not be turned unless required. If it is turned excessively, idle speed feedback control may not function.

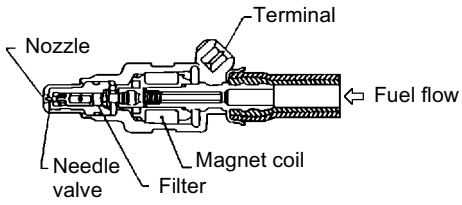



TEC015

## 9) Fuel Injector

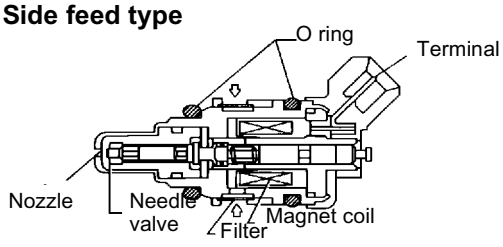
Fuel injectors are installed for each cylinder. The fuel injector is a small, elaborate solenoid valve. As the ECM sends injection signals to the injector, the coil in the injector pulls the needle valve back and fuel is released into the intake port through the nozzle. The injected fuel is controlled by the ECM in terms of injection pulse duration.

**Top feed type**




TEC016

**Side feed type**




TEC017

## GENERAL DESCRIPTION OF NEW EGI ENGINES

## FEATURES OF NEW-EGI ENGINES

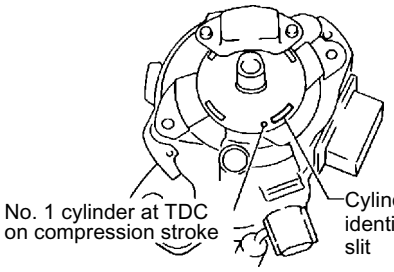
In contrast to the conventional ECCS, the multi-functional throttle chamber has been adopted by integrating the mass air flow sensor, IACV-FICD, IACV-AAC valve and FIX (First Idle cam Wax type).

The mass air flow sensor is installed in the throttle chamber to reduce the distance to the combustion chamber, thereby improving engine response and startability.

## SYSTEM COMPONENTS

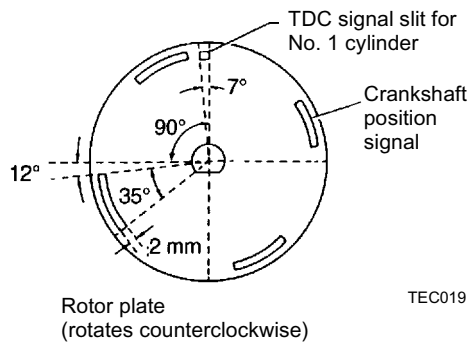
### 1. Camshaft Position Sensor

The camshaft position sensor has been changed from the conventional dual signal system with V signal (crank angle detection) and 180' signal (cylinder identification) to the single signal system, that is, the time control system. The cylinder identification signal uses the position signal of No. 1 cylinder only, and the crankshaft position (angle) signal is detected according to the slit passage time.

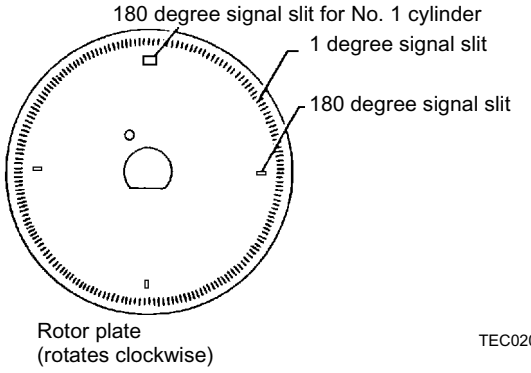



TEC018

**For NEW EGI Engine**



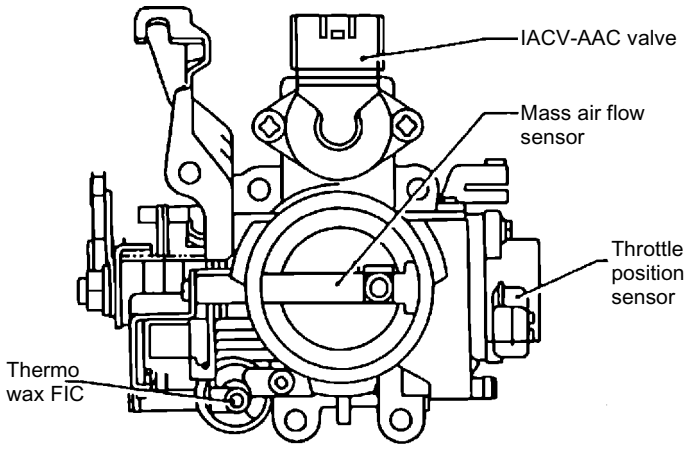

TEC019



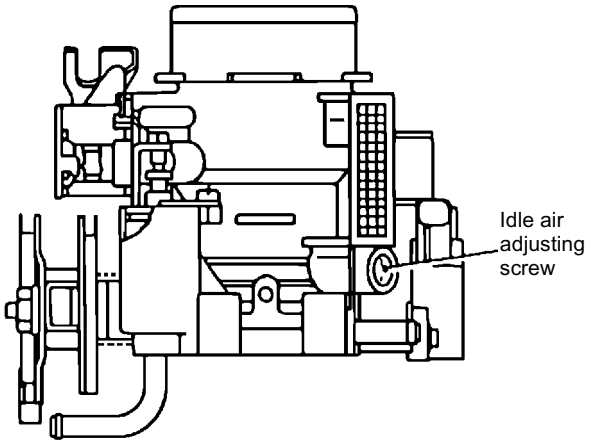

TEC020

## 2. Throttle Body

As mentioned above, the mass air flow sensor, IACV-FICD, IACV-AAC valve, throttle sensor and IACV-FIC are integrated into a single unit forming the multi-functional throttle body. The mass air flow sensor uses a bypass type hot wire. The wax type FIC is used to adjust the auxiliary air quantity when the engine coolant temperature is low.



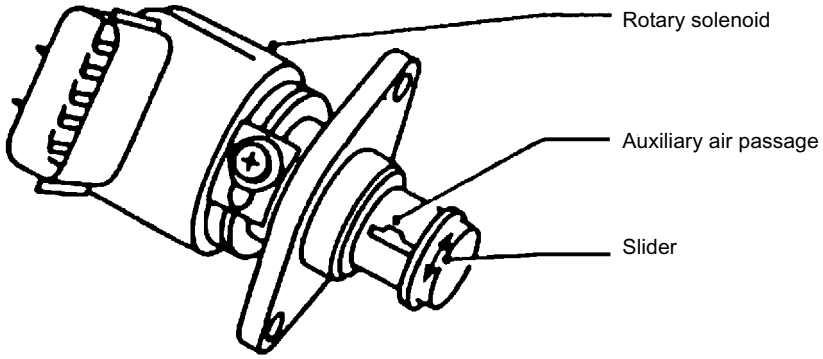

TEC021




TEC022

## 3. IACV-AAC Valve

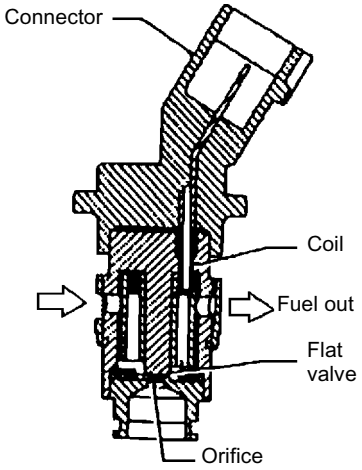
The AAC valve of a rotary solenoid type is used. This rotary solenoid has a rotary magnet which rotates a slider to open or close the flow control hole provided in the slider housing, thus controlling the flow rate of air.



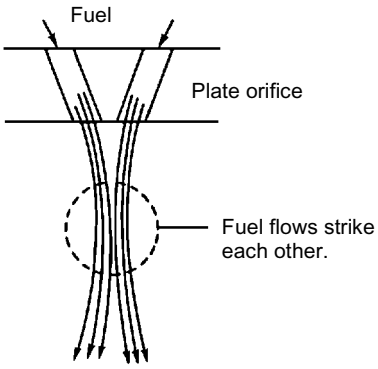

TEC023

## 4. Fuel Injector

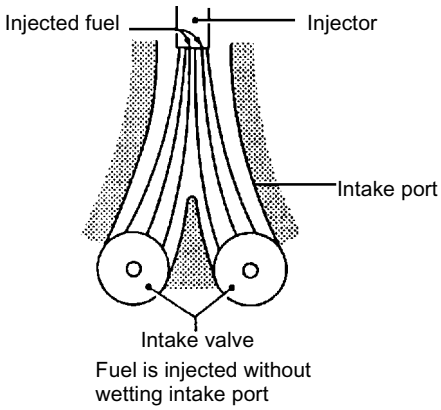
The side feed type injector is used. The nozzle uses a plate orifice type to improve atomization and to prevent deposit.




TEC024



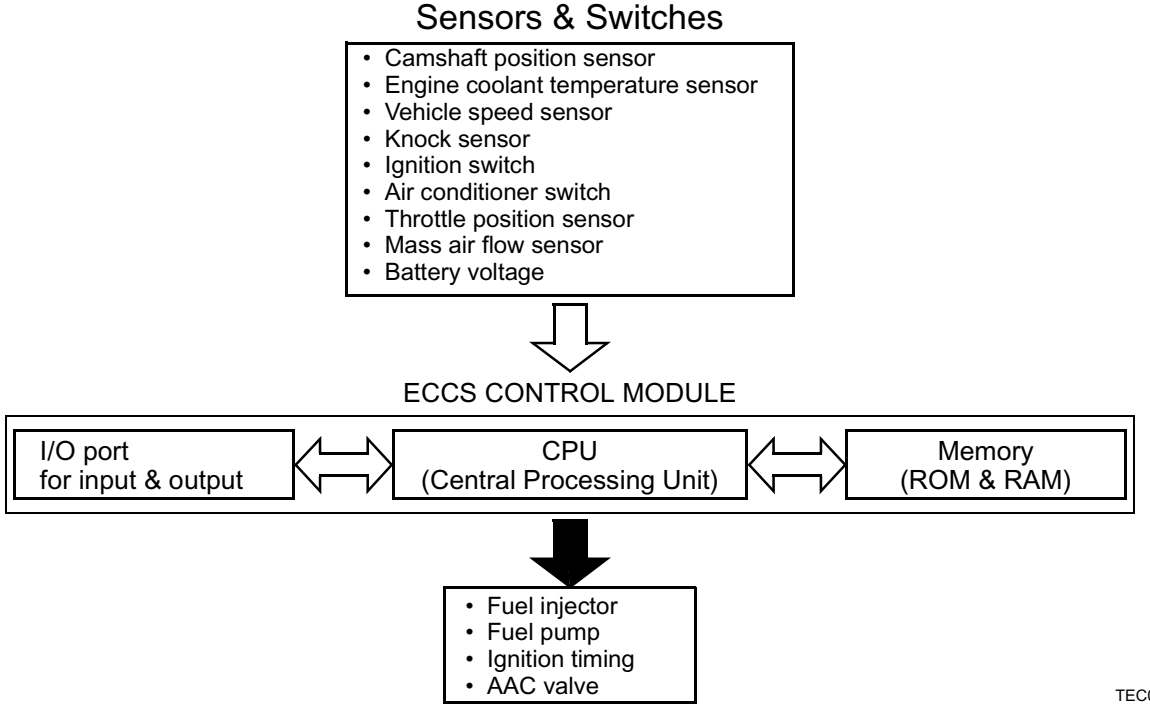

TEC025




TEC026

## ECCS CONTROL MODULE

The control module is sometimes called “ECM”, or simply “computer”. The control module receives signals from various sensors and switches, performs computations, and compares the results with data stored in the memory, and outputs optimum signals to the actuators. This module is the core of the ECCS system.




## CAUTION

- Disassembly of the control module is not allowed for the following reasons.
  - Disassembly allows dirt to enter the control module, resulting in poor contact of connections or rust formation on parts.
  - Static electric charge in the human body may damage the electronic parts such as the IC (Integrated Circuit) or LSI (Large Scale Integrated Circuit), etc.
  - Condition of electronic parts cannot be judged from their appearance.
- Internal wiring may be damaged.
- When connecting or disconnecting the harness connector to or from the control module, be sure to turn the power OFF. Otherwise, the control module may be damaged by a spark discharge, short-circuit, or generation of surge voltage, etc. caused by such operation.
- Do not allow the control module to get wet as this may cause short-circuit or leakage and result in damage to the control module.
- Do not drop the control module. This may cause the PC (printed circuit) board to crack, resulting in malfunction of the control module.
- Store the control module in a place that is clean and dry and where ambient temperatures are somewhat low and do not change drastically.

## NEW ECCS COMPONENT PARTS

### 1. HALL IC (ELEMENT) TYPE CRANKSHAFT ANGLE SENSOR

Hall IC (element) type crankshaft angle sensor consists of two sensors, POS (position) sensor and PHASE sensor. The combination of these two sensors is generally called crankshaft angle sensor.

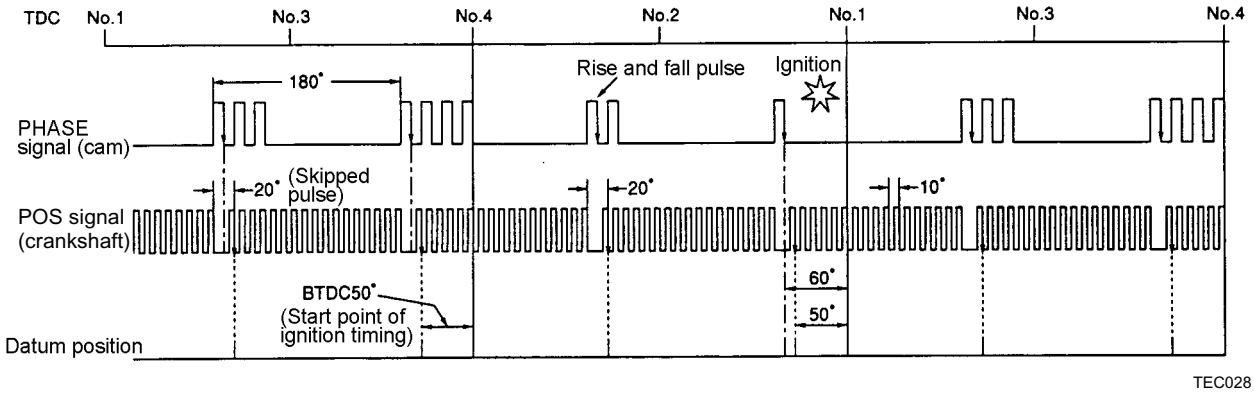
The POS sensor is used for detecting crankshaft position and obtains the POS signals by means of a signal plate installed on the No. 6 counterweight of the crankshaft. The PHASE sensor is used for detecting camshaft position and obtains the PHASE signal by means of projections provided on the exhaust cam sprocket.

Basically, these two sensors function in the same manner as the conventional photoelectric crankshaft angle sensor.

Reference: Hall IC (element) means a semi-conductor element which detects magnetic field by utilizing Hall effects.
Hall IC (element) type crankshaft angle sensor applies the principle of Hall effect. This element is provided with excellent features including less susceptibility to magnetic field than magnetic type crankshaft angle sensor and is capable of high precision ignition timing control.

Functions of each sensor and schematic diagram of the signals are as follows.

| Sensor name | | Function | |
|---|---|---|---|
| Hall IC (element) type crankshaft angle sensor | POS sensor | Detection of crankshaft angle | Engine speed and start positions of each cylinder are detected by two signals. (start points of injection and ignition timings) |
| | PHASE sensor | Identification of cylinders | |
| (Reference) Photo-electric crankshaft angle sensor | REF signal | Identification of cylinders and detection of datum positions (start point of injection and ignition timings) | Engine speed detection differs with engine. |
| | POS signal | 1°signal (crankshaft angle) detection | |

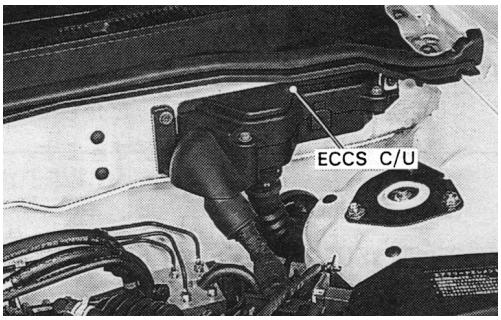



- Procedure for detecting datum position of each cylinder
  The datum position of each cylinder is calculated based on PHASE signal and POS signal. (BTDC 50° )

- Ignition procedure (example of No. 1 cylinder)
  POS signals are counted by using BTDC 50° of No. 1 cylinder as the basic datum. Then, ignition is carried out at the position where the advance angle indicated by ignition timing control is obtained. Here, 10° intervals of POS signals and the angle of skipped pulses are compensated by time measurement.

## 1) ECCS CONTROL UNIT

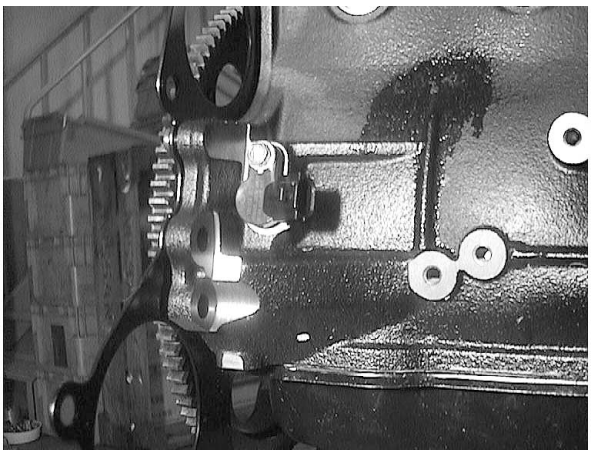
Small-sized ECCS control unit is adopted.
The connector shape is new SMJ81pins, lever-type.
The mounting position is in the right-hand side of engine room on the back of dash panel.



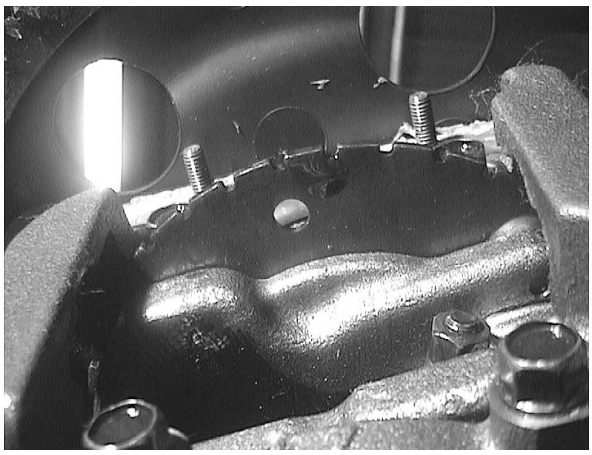

TEC029

## 2) POS (POSITION) SENSOR

POS sensor of hall IC (element) type is adopted.
POS sensor detects crankshaft angle by signalplate mounted to No. 6 counteweight of crankshaft for setting ignition timing and injection timing.
Engine speed is detected by two signals from POS and PHASE sensors.
The mounting position is at the rear right-hand side of cylinder block.



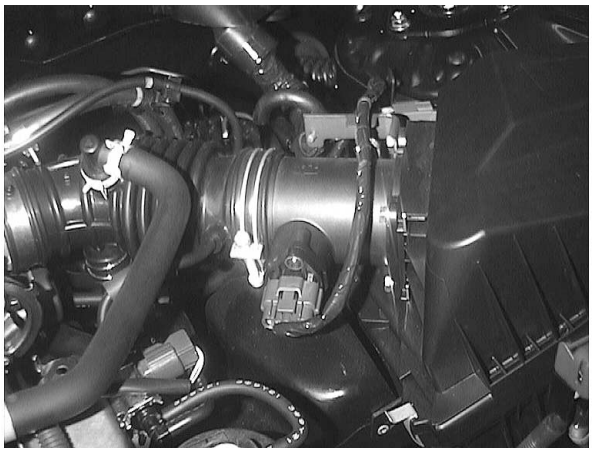
TEC030



TEC031

## 3) Mass AIR FLOW SENSOR

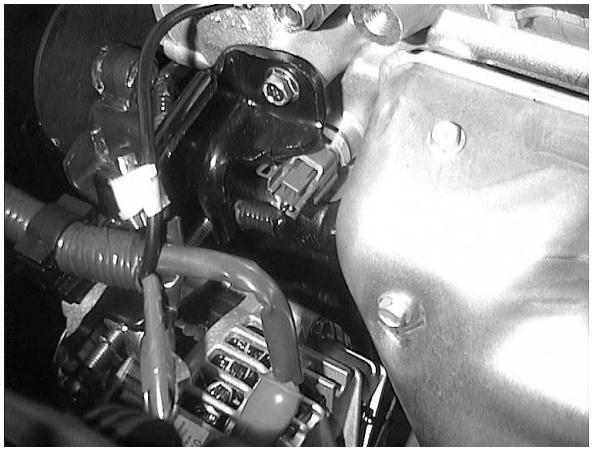
Hot-wire type air flow sensor is adopted.
Accuracy in intake air flow measurement after starting is improved in comparison with the conventional type.
The case is resin-made and signals of output voltage corresponding to intake air flow are issued.



TEC032

## 4) COOLANT TEMPERATURE SENSOR

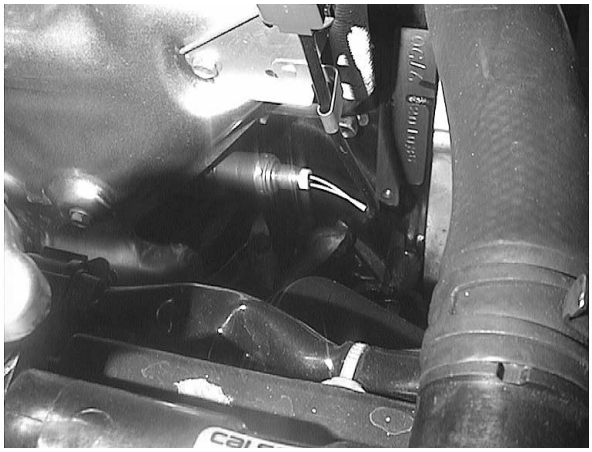
Thermister-type sensor is adopted.
The higher coolant temperature rises, the lower thermister resistance value becomes and so the output voltage is.
The mounting position is at the front left-hand side of cylinder head.



TEC033

## 5) $O_2$ SENSOR

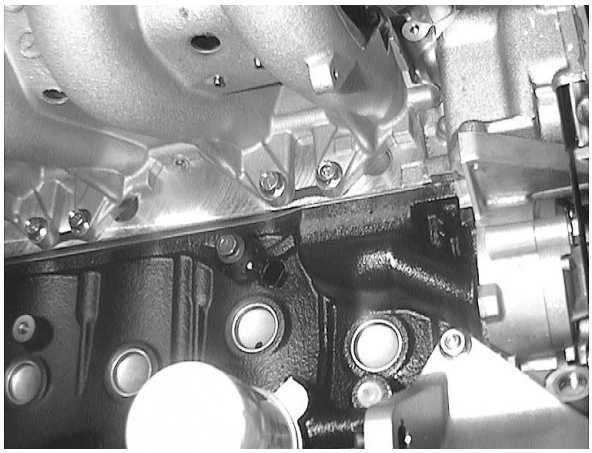
Water-proof zirconia $O_2$ sensor with heater is adopted.
The mounting position is at exhaust manifold.



TEC034

## 6) KNOCK SENSOR

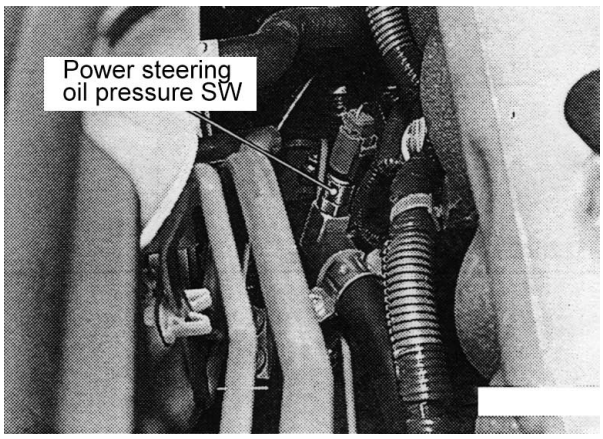
Small-sized piezoelectric knock sensor is adopted.
The mounting position is at the right-hand side of cylinder block (No.2 cylinder).



TEC035

## 7) POWER STEERING OIL PRESSURE SW

This is mounted on power steering oil piping and turned OFF while power steering is not operated and turned ON while it is operated.
The mounting position is at the rear lower side of intake manifold.




TEC036

## 8) THROTTLE SENSOR AND THROTTLE VALVE SW

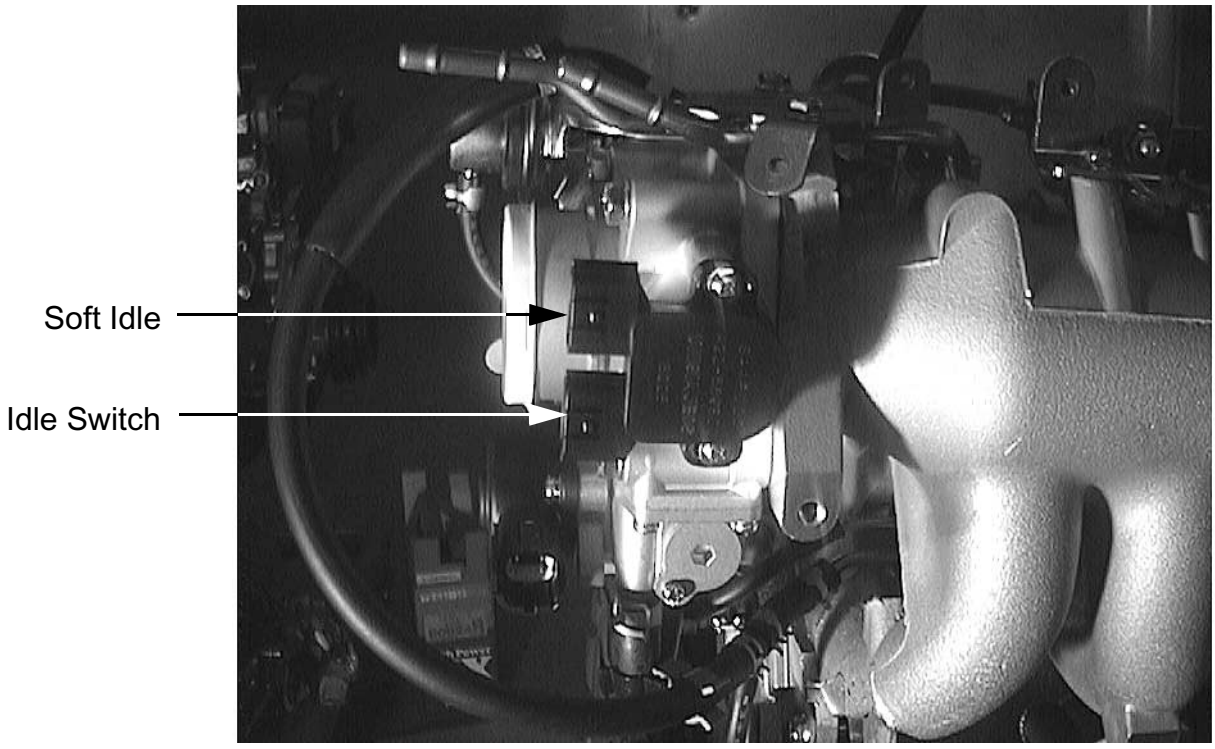
Throttle sensor detects signals according to throttle opening to perform idle judgment through the software, and setting of fuel injection quantity for acceleration/deceleration.

Throttle valve SW is used as a fail-safe device for the electronically controlled A/T by detecting idling and full-throttle signals. It is also used for idle judgment in the event of failure of both throttle sensor and air flow sensor.

Function of soft idle SW

This function memorizes the minimum value of throttle sensor output in operation as the learned value (learned as idling range) to determine engine condition as idle or not by comparing the throttle sensor output while operating with said learned value.

Here, it is necessary to rewrite the learned value when idle judgment is not turned ON at idling when (and after) adjusting the throttle sensor output.

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