5. Main Components of Engine Control System

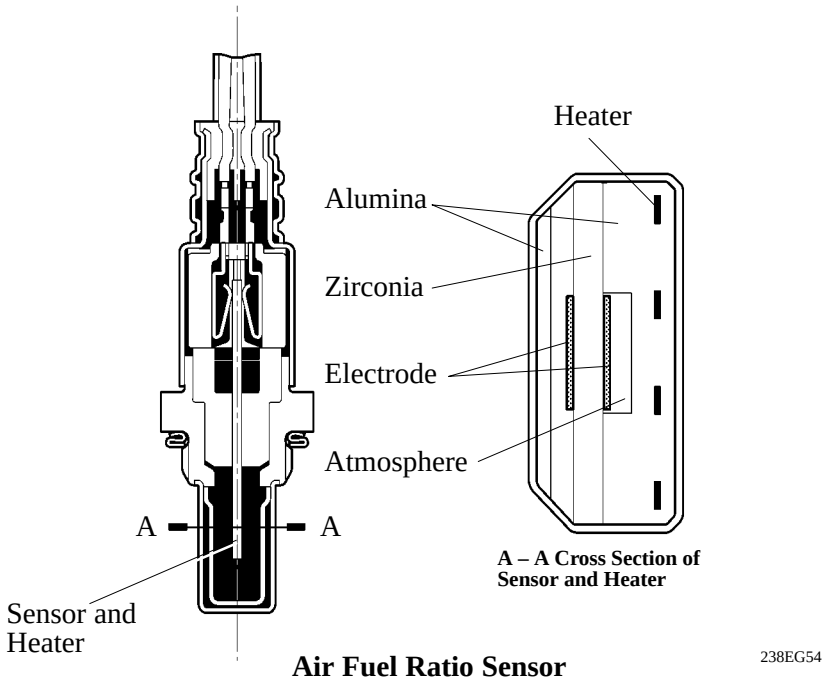
General

The following table compares the main components.

Components	3MZ-FE		1MZ-FE	
	Outline	Quantity	Outline	Quantity
ECM	32-bit CPU	1	16-bit CPU	1
Air Fuel Ratio Sensor (Bank 1, Sensor 1) (Bank 2, Sensor 1)	with Heater Type (Planar Type)	2	with Heater Type (Cup Type)	2
Oxygen Sensor (Bank 1, Sensor 2) (Bank 2, Sensor 2)	with Heater Type	2	←	
Mass 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	Built-in Piezoelectric Type (Flat Type)	2	Built-in Piezoelectric Type (Conventional Type)	2
Accelerator Pedal Position Sensor	No-contact Type (Mounted on Accelerator Pedal)	1	—	
Throttle Position Sensor	No-contact Type	1	Linear Type	
Injector	12-Hole Type	6	4-Hole Type with Air Assist	6

Air Fuel Ratio Sensor

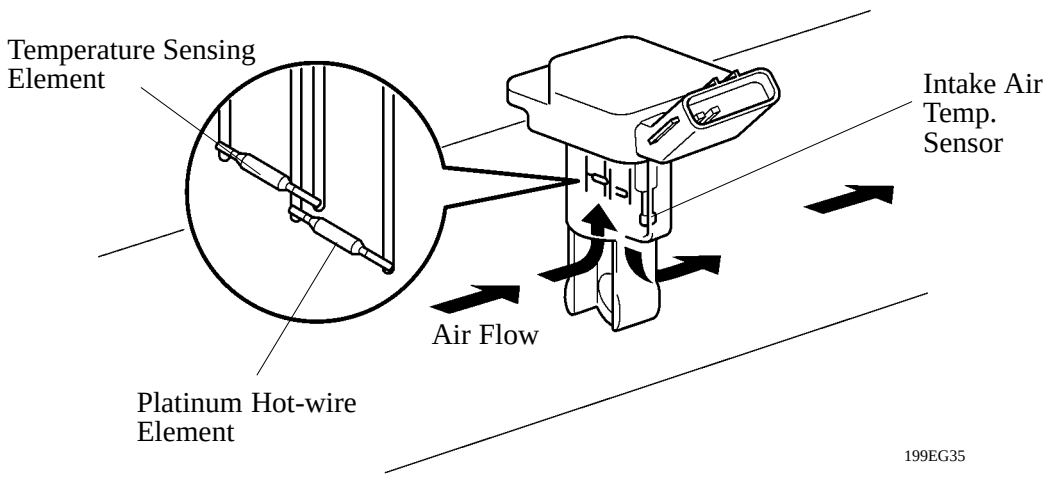
The air-fuel ratio sensor is the planar type. Compared to the conventional type, the sensor and heater portions of the planar type are narrower overall. Because the heat of the heater acts directly on the alumina and zirconia (of the sensor portion) it accelerates the activation of the sensor.



Air Fuel Ratio Sensor

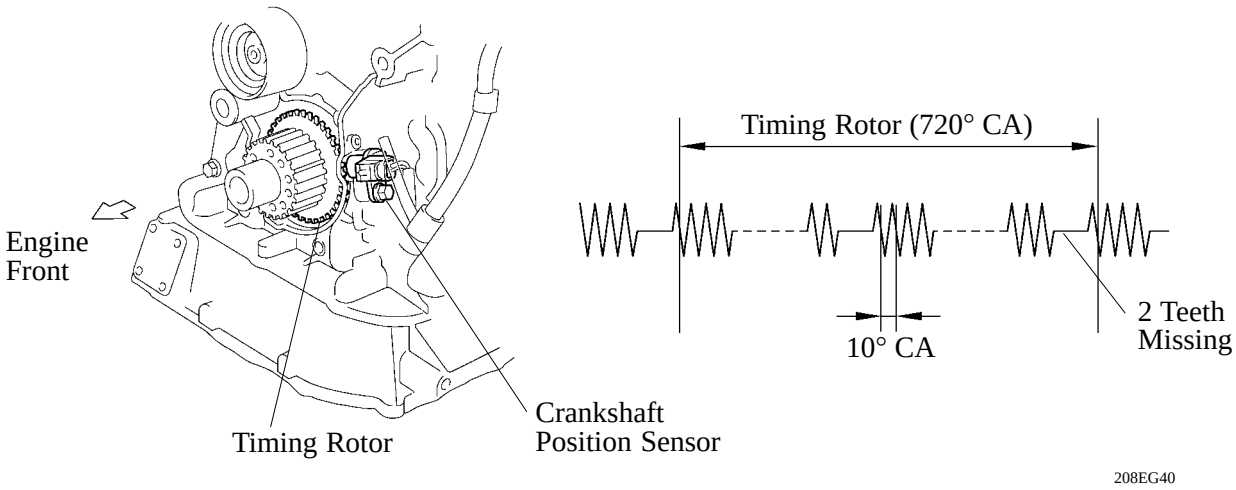
Mass Air Flow Meter

- This mass 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 mass air flow meter has a built-in intake air temperature sensor.



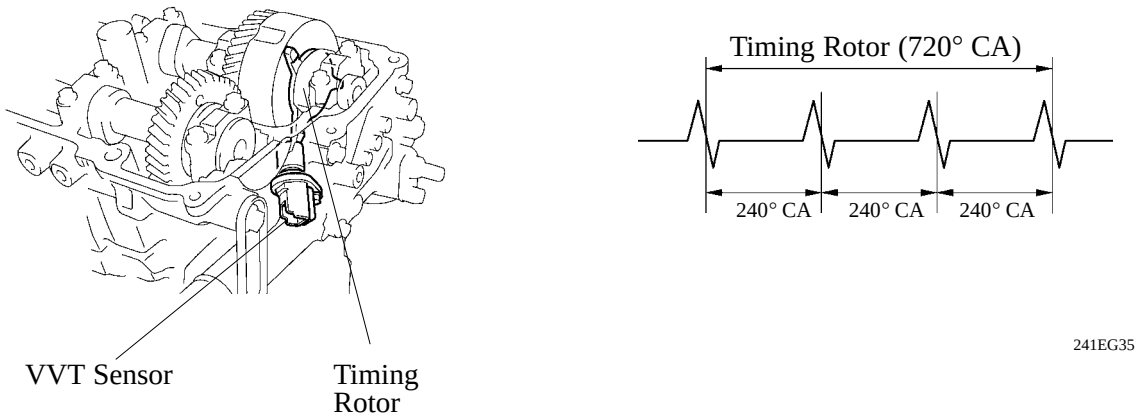
Crankshaft Position Sensor

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°, and the missing teeth are used to determine the top-dead-center.



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.



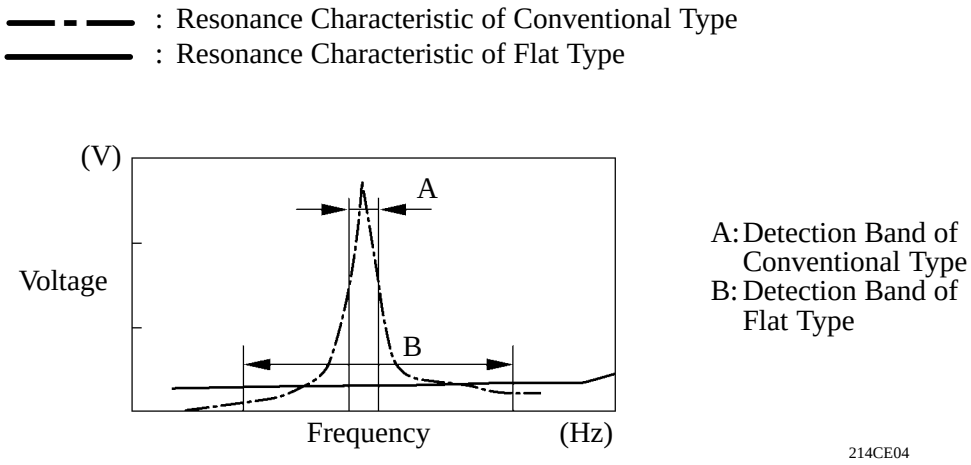
Left Bank

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.

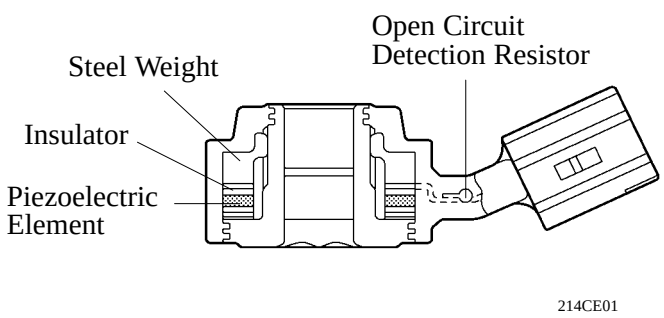
- The engine knocking frequency will change a bit depending on the engine speed. The flat type knock sensor can detect the vibration even when the engine knocking frequency is changed. Thus the vibration detection ability is increased compared to the conventional type knock sensor, and a more precise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



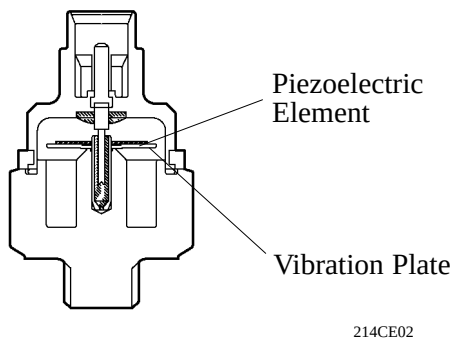
Characteristic of Knock Sensor

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 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.



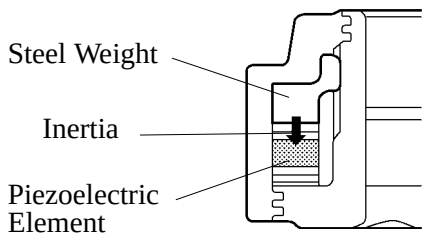
**Flat Type Knock Sensor
(Non-Resonant Type)**



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

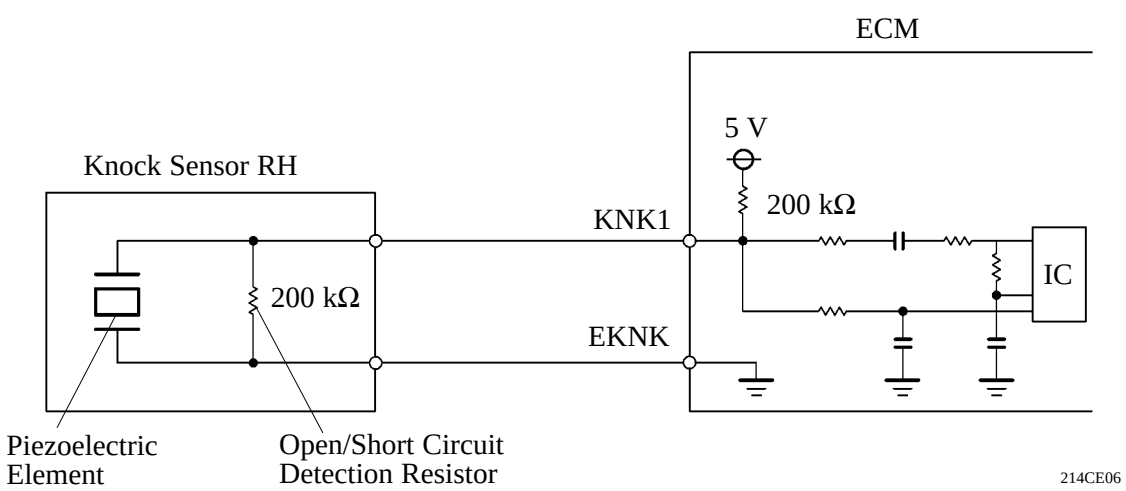
3) Operation

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



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

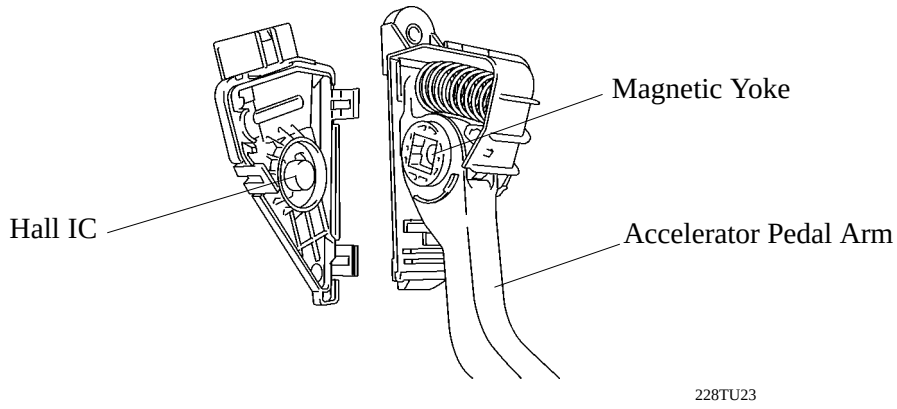


Service Tip

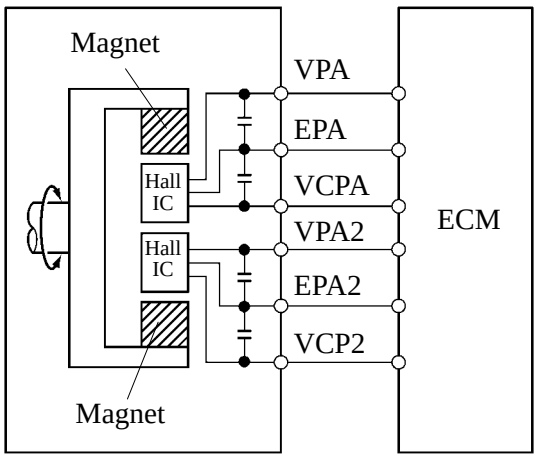
In accordance with the adoption of open/short circuit detection resistor, the inspection method for the sensor has been changed. For details, refer to 2004 LEXUS RX330 Repair Manual (Pub. No. RM1027U).

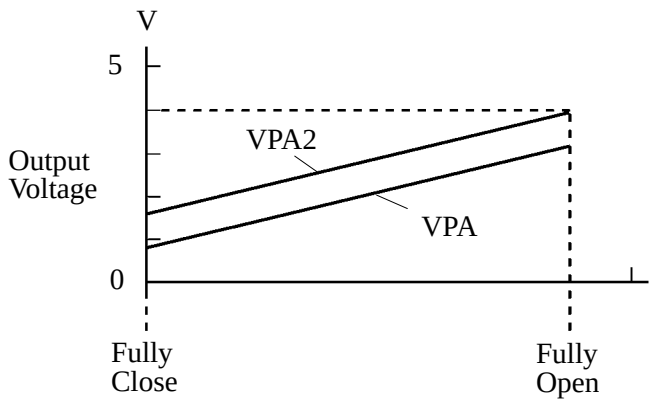
Accelerator Pedal Position Sensor

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 ECM.



Accelerator Pedal Position Sensor



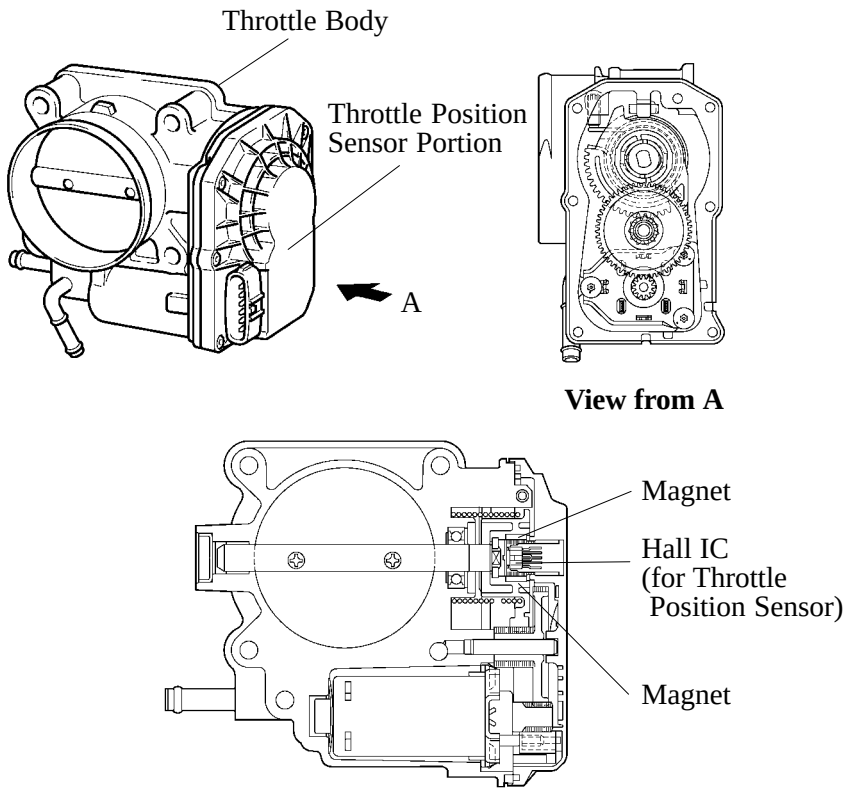


Service Tip

The inspection method differs from the conventional accelerator pedal position sensor because this sensor uses a hall IC. For details, refer to the 2004 LEXUS RX330 Repair Manual (Pub. No. RM1027U.)

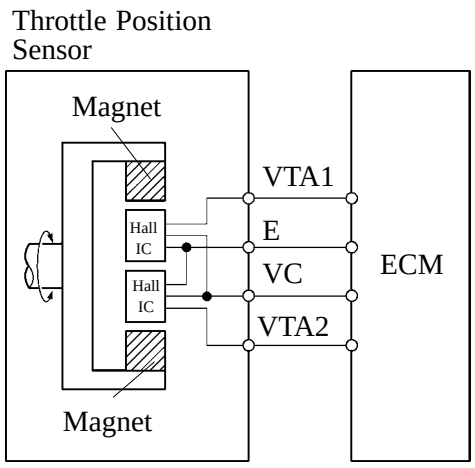
Throttle Position Sensor

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.

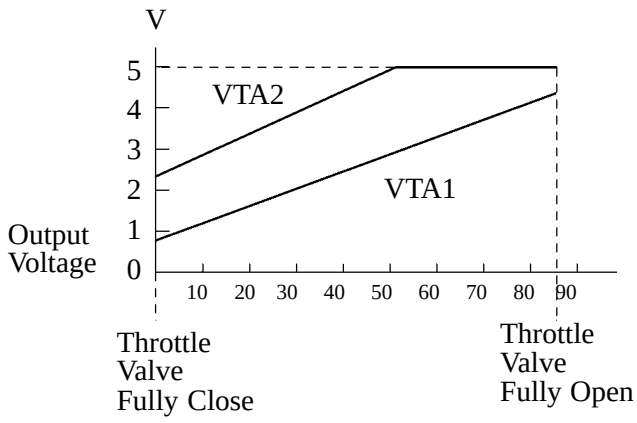


Cross Section

241EG28



230LX12



Throttle Valve Opening Angle

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 2004 LEXUS RX330 Repair Manual (Pub. No. RM1027U).