

### 5. Main Components of Engine Control System

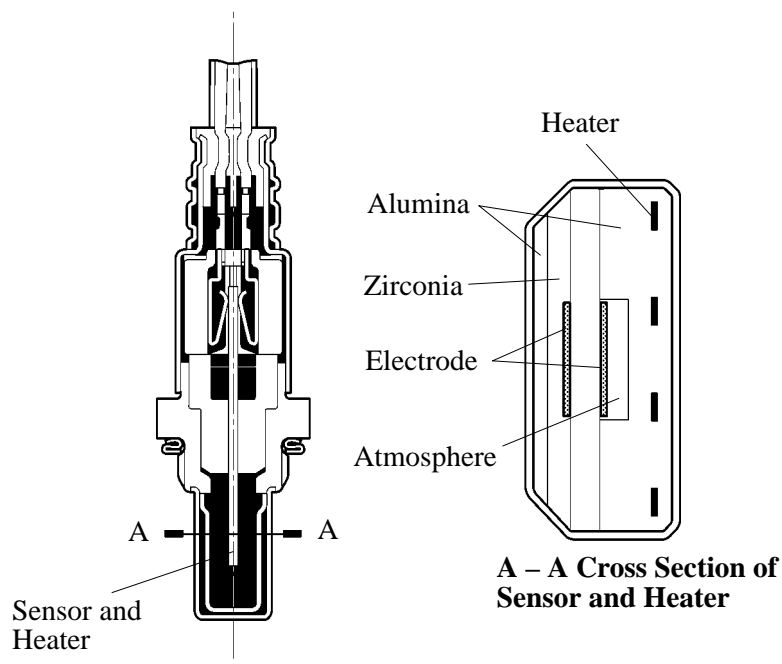
#### General

The following table compares the main components.

Components	'04 Prius		'03 Prius	
	Outline	Quantity	Outline	Quantity
ECM	32-bit CPU	1	16-bit CPU	1
Air Fuel Ratio Sensor	with Heater Type (Planar Type)	1	—	
Oxygen Sensor	with Heater Type (Cup Type)	1	with Heater Type (Cup Type)	2
Mass 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)	2	←	
Knock Sensor	Built-in Piezoelectric Type (Flat Type)	1	Built-in Piezoelectric Type (Conventional Type)	1
Throttle Position Sensor	Linear Type	1	←	
Injector	12-Hole Type	4	←	

#### Air Fuel Ratio Sensor

The air-fuel ratio sensor is the planar type. Compared to the conventional type (cup 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**

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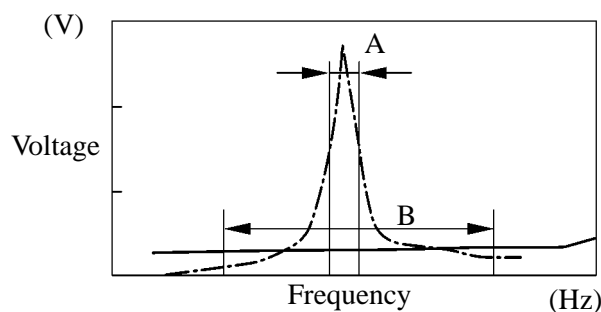
**Knock Sensor (Flat Type)**

**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



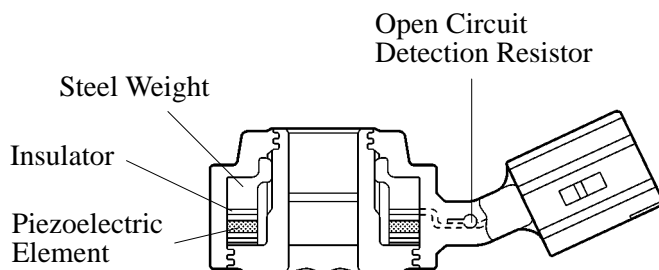
A: Detection Band of Conventional Type  
 B: Detection Band of Flat Type

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**Characteristic of Knock Sensor**

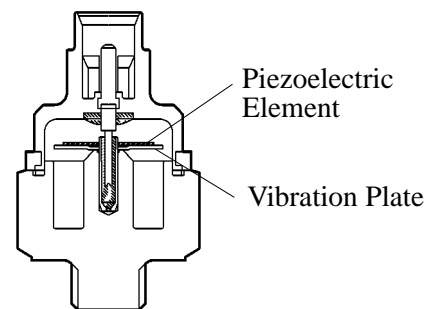
**2) Construction**

- 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)**

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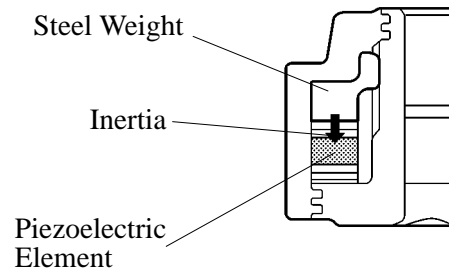


**Conventional Type Knock Sensor (Resonant Type)**

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**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.

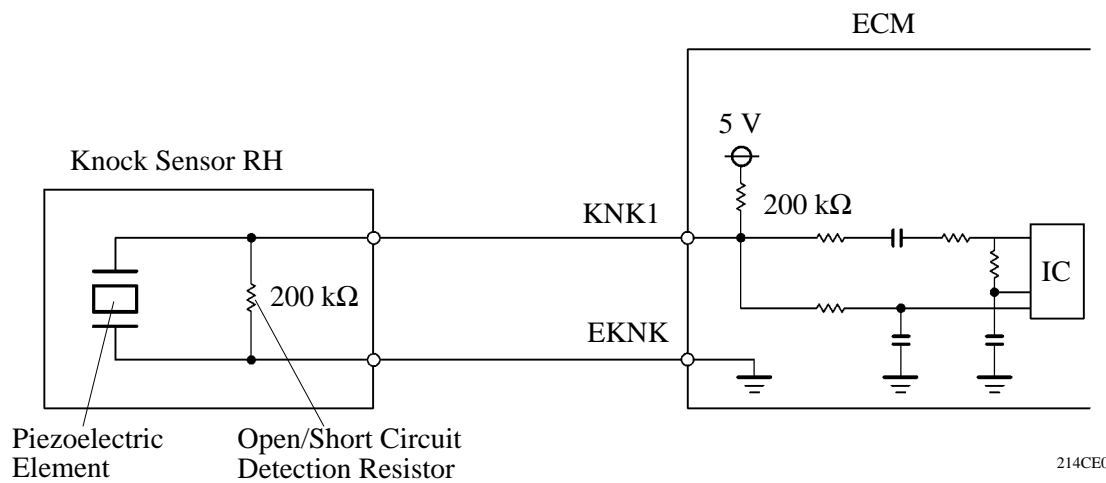


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**4) Open/Short Circuit Detection Resistor**

When 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).



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**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 Prius Repair Manual (Pub. No. RM1075U).