5. Main Component of Engine Control System

General

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

: Change

Components	Outline	Quantity
ECM	32-bit	1
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)	1
Throttle Position Sensor	Linear Type	1
Knock Sensor	Built-in Piezoelectric Element Type (Flat Type)	1
Oxygen Sensor (Bank 1, Sensor 1 and 2)	with Heater	2
Injector	12-Hole Type	4
IAC Valve	Rotary Solenoid Type (1-coil Type)	1

ECM

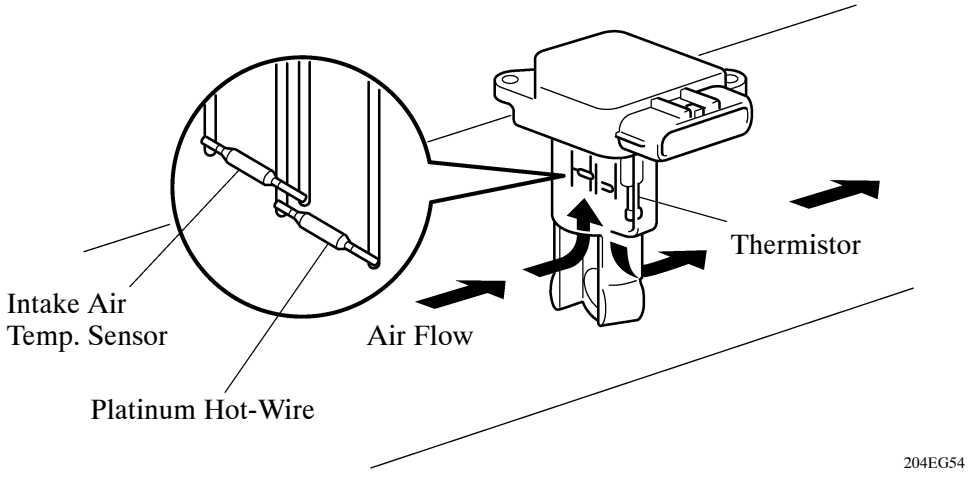
- The 32-bit CPU of the ECM has been changed from the 16-bit CPU to increase the speed for processing the signals.
- This ECM has a built-in air conditioning amplifier.

Service Tip

- The length of time to clear the DTC via the battery terminal has been changed from the previous 10 seconds to 1 minute.
- The automatic transaxle model comes with an ECM that is made either by DENSO or Delphi Delco. These ECMs are compatible with respect to their connector pin layout, connector quantity, and software. However, they are not interchangeable because of their different sizes. When the ECM must be replaced, make sure to check its manufacturer (parts No.) before proceeding with the operation.

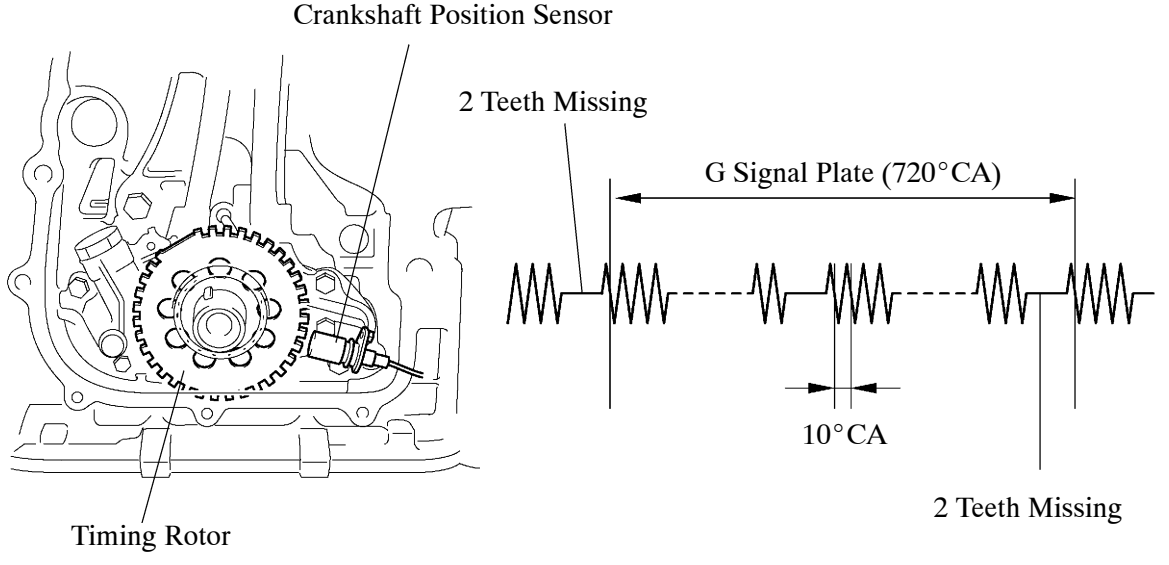
Mass Air Flow Meter

- This compact and lightweight 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 is improved and the intake air resistance has been reduced.
- This mass air flow meter has a built-in intake air temperature sensor.



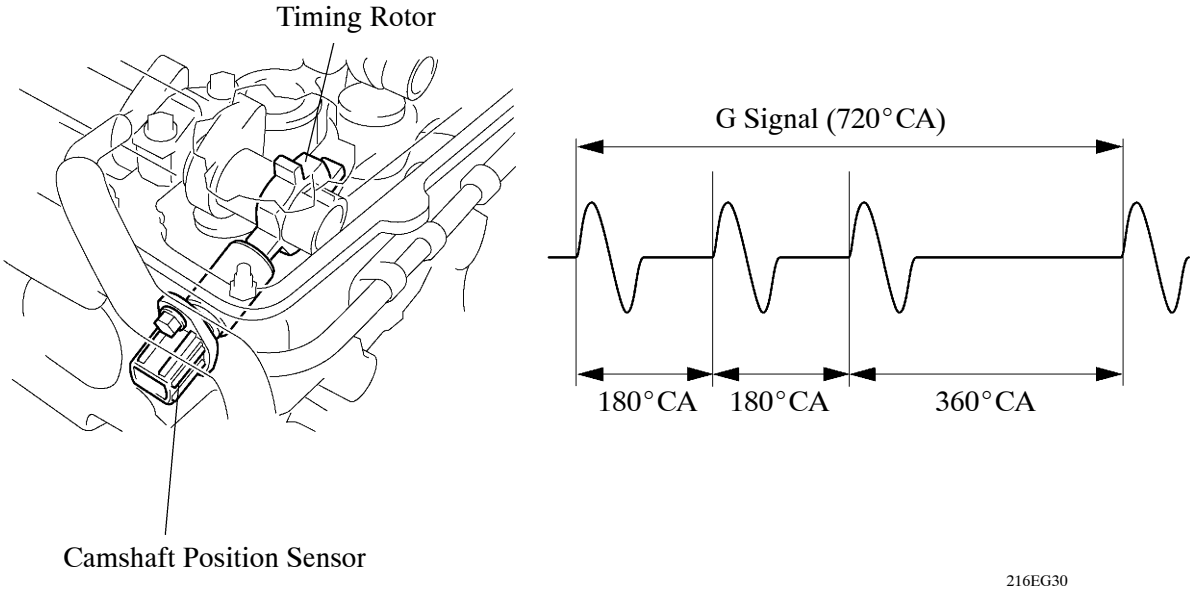
Crankshaft Position Sensor

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.



Camshaft Position Sensor

To detect the camshaft position, a timing rotor on the intake camshaft is used to generate 3 pulses for every 2 revolutions of the crankshaft.



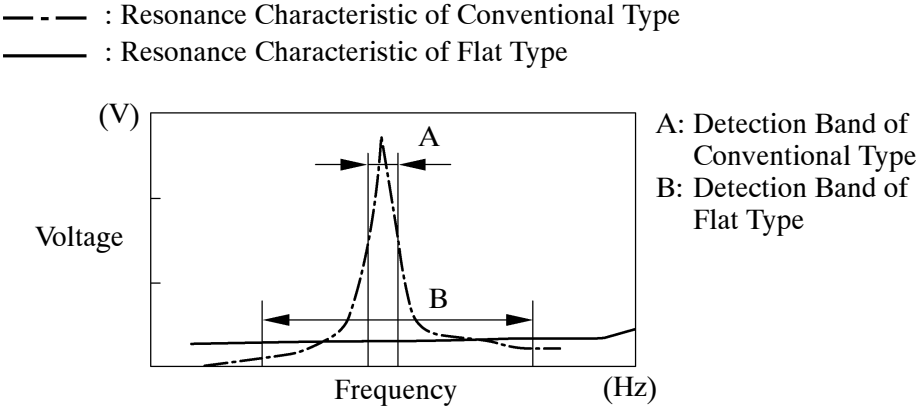
Knock Sensor (Flat Type)

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.

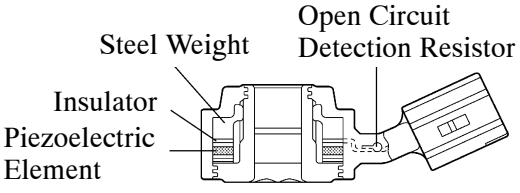
- The engine knocking frequency will change a bit depending on the engine speed. The flat type knock sensor can detect the vibration even when the engine knocking frequency is changed. Thus the vibration detection ability is increased compared to the conventional type knock sensor, and a more precise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



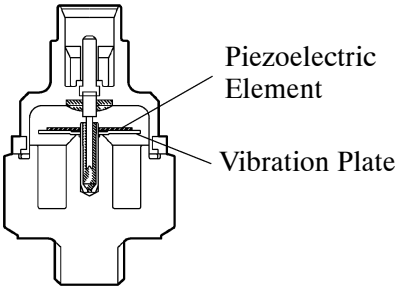
Characteristic of Knock Sensor

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.



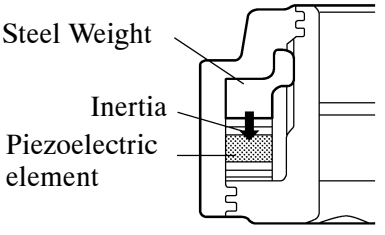
Flat Type Knock Sensor (Non-Resonant Type) 214CE01



Conventional Type Knock Sensor (Resonant Type) 214CE02

3) Operation

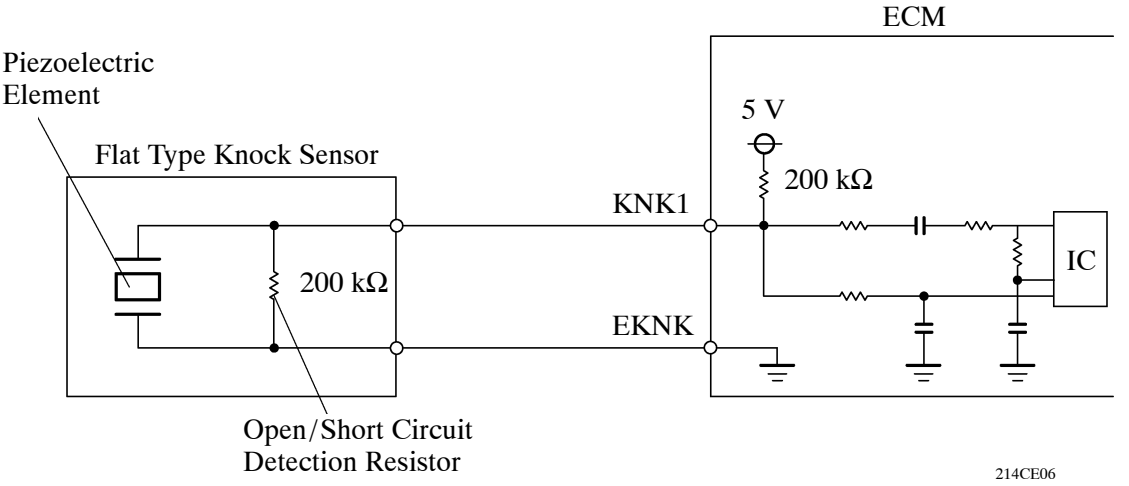
The knocking vibration is transmitted to the steel weight and its inertia applies pressure to the piezoelectric element.
The action generates electromotive force.



214CE08

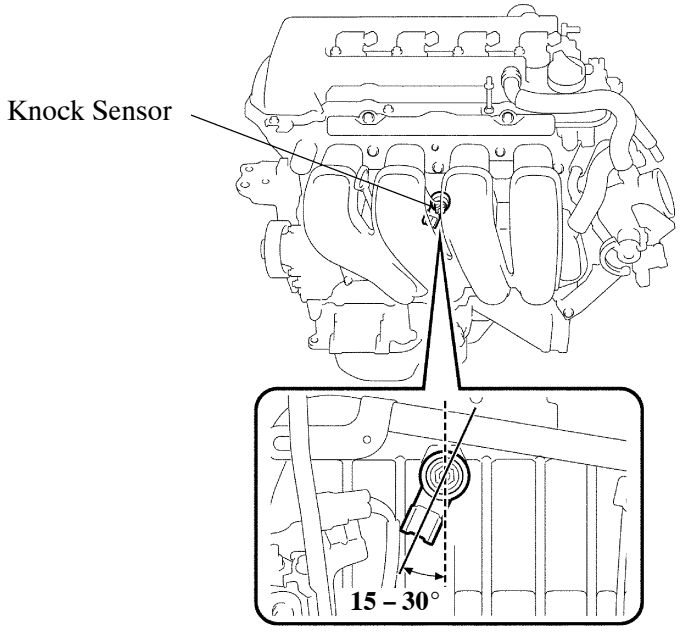
4) Open/Short Circuit Detection Resistor

During the ignition is ON, the open/short circuit detection resistor in the knock sensor and the resistor in the ECM keep the voltage at the terminal KNK1 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) P0325.



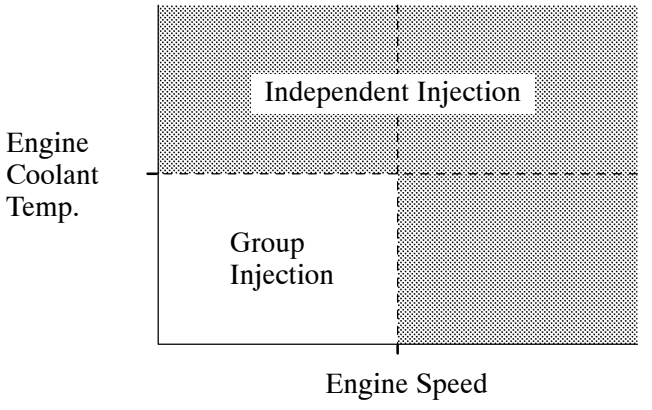
Service Tip

- In accordance with the adoption of an open/short circuit detection resistor, the inspection method for the sensor has been changed. For details, refer to 2003 Corolla Repair Manual (Pub. No. RM938U).
- To prevent the water accumulation in the connecter, make sure to install the flat type knock sensor in the position as shown in the following illustration.



6. SFI (Sequential Multiport Fuel Injection) System

- An L-type SFI system directly detects the intake air mass with a hot wire type mass air flow meter.
- An independent injection system (in which fuel is injected once into each cylinder for each two revolutions of the crankshaft) has been adopted.
  Also, when the engine is starting, a group injection (in which fuel is injected once into two cylinders for each one revolution of the crankshaft) is used. This changes to an independent injection when the engine speed or the engine coolant temperature become higher than a prescribed value.



- There are two (synchronous and non-synchronous) injections:
  a) The synchronous injection in which corrections based on the signals from the sensors are added to the basic injection time so that injection occurs always at the same position.
  b) The 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 achieve lower fuel consumption, the system uses a fuel cutoff in which the injection of fuel is stopped temporarily in accordance with the driving conditions.