■ENGINE CONTROL SYSTEM

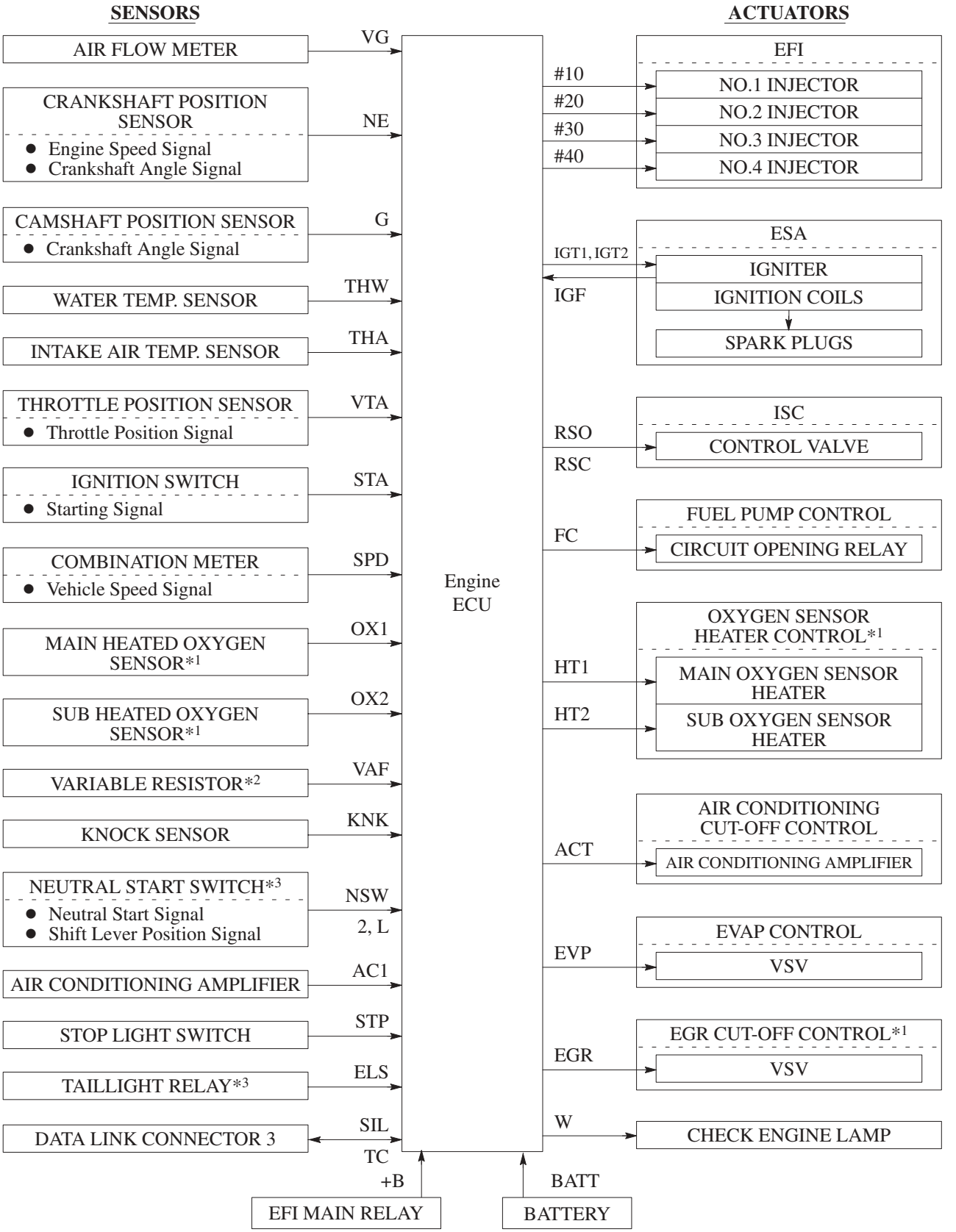
1. General

The sequential multiport fuel injection system which uses hot-wire type air flow meter and the idle speed control system which uses a rotary solenoid type ISC valve are adopted in the engine control system for the 2RZ-FE and 3RZ-FE engines. In addition, the M-OBD (Multiplex On-Board Diagnostic) is adopted.
The engine control system for the 2RZ-FE and 3RZ-FE engines has the following system.

System	Outline	2RZ-FE	3RZ-FE
EFI (Electronic Fuel Injection)	An L-type EFI system directly detects the intake air mass with a hot-wire type air flow meter.	○	○
	The fuel injection system is a sequential multipoint fuel injection system.	○	○
ESA (Electronic Spark Advance)	Ignition timing is determined by the ECU based on signals from various sensors.	○	○
	It retards ignition timing to suppress knocking when it occurs.	○	○
	In vehicles equipped with automatic transmission, torque control correction during gear shifting has been used to minimize the shift shock.	–	○
ISC (Idle Speed Control)	A rotary solenoid type ISC system is used to control the fast idle and idle speeds.	○	○
Fuel Pump Control	Fuel pump operation is controlled by signals from the ECU based on the engine speed signal (NE).	○	○
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensors at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	○	–
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.	○	○
EGR Cut-Off Control	Cuts off EGR according to the engine condition to maintain drivability of the vehicle and durability of the EGR components.	○	–
Air Conditioner Cut-Off Control	By controlling the air conditioner compressor in accordance with the throttle valve opening angle and the vehicle speed, driveability is maintained.	○	○
Diagnosis	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.	○	○
	A newly developed diagnostic system which utilizes a high speed bi-directional communication line to provide extended diagnostic capabilities and features	○	○
Fail-Safe	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in memory.	○	○

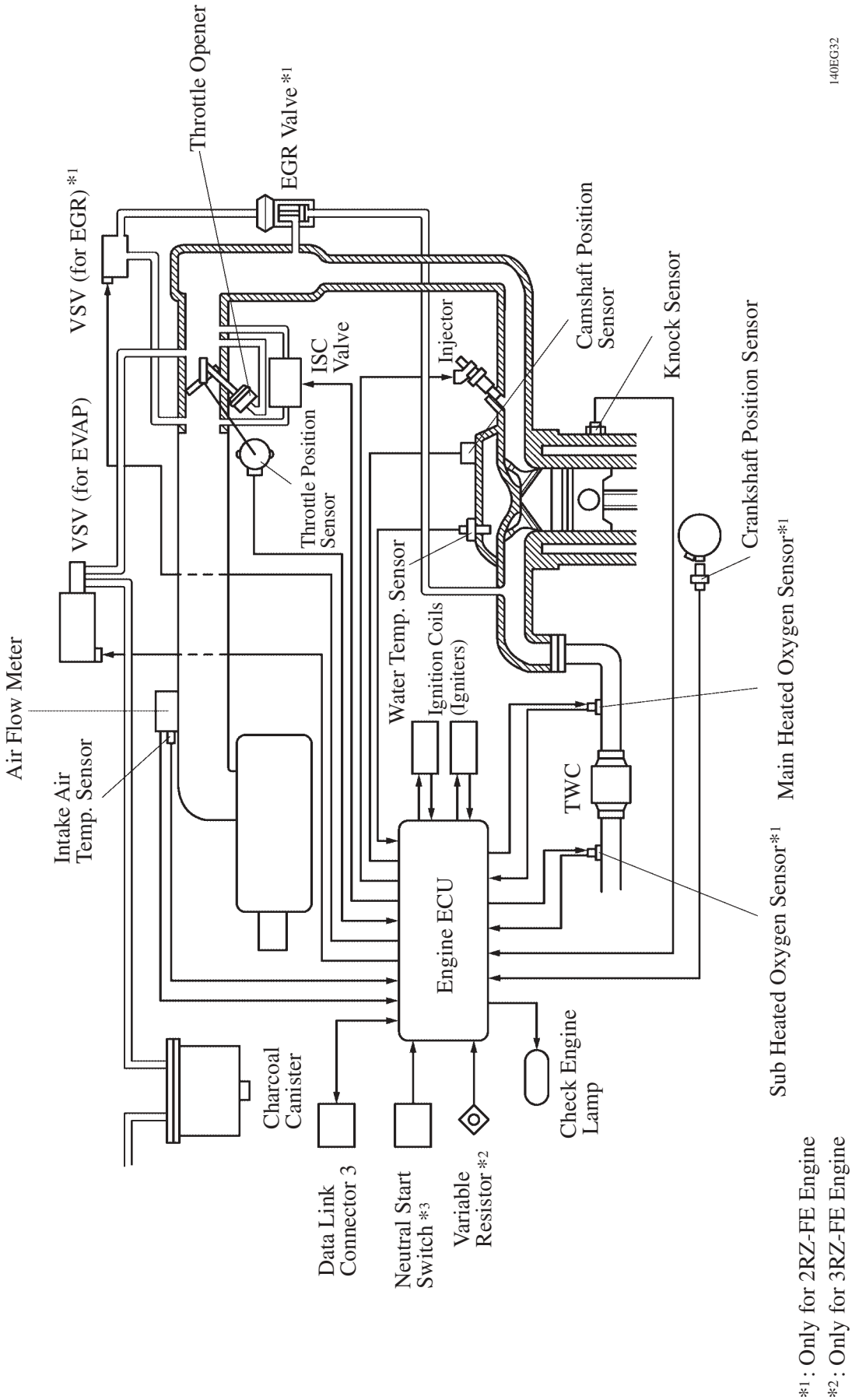
2. Construction

The configuration of the engine control system in the 2RZ-FE and 3RZ-FE engines are as shown in the following chart.



*1: Only for 2RZ-FE Engine
*2: Only for 3RZ-FE Engine
*3: Only for Automatic Transmission Model

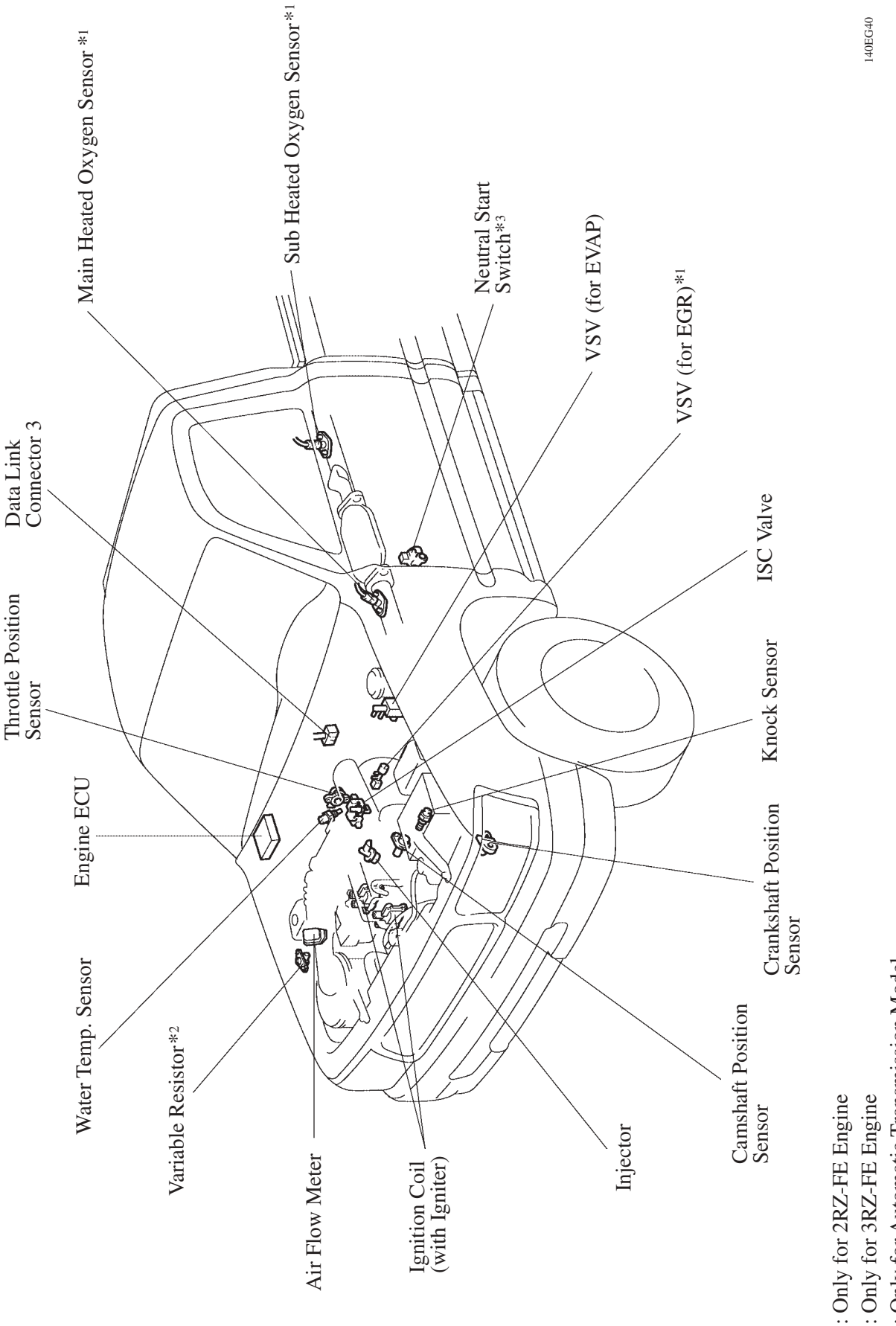
3. Engine Control System Diagram



*1 : Only for 2RZ-FE Engine
*2 : Only for 3RZ-FE Engine
*3 : Only for Automatic Transmission Model.

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4. Layout of Components



*1 : Only for 2RZ-FE Engine
*2 : Only for 3RZ-FE Engine
*3 : Only for Automatic Transmission Model.

5. Main Components of Engine Control System

General

The following table compares the main components of the 2RZ-FE and 3RZ-FE engines.

Components \ Engine		2RZ-FE	3RZ-FE
Air Flow Meter		Hot-Wire Type	←
Crankshaft Position Sensor		Pick-Up Coil Type, 1	←
Camshaft Position Sensors		Pick-Up Coil Type, 1	←
Throttle Position Sensor		Linear Type	←
Knock Sensor		Built-In-Piezoeletric Type, 1	←
Oxygen Sensor	Main	With Heater Type	–
	Sub	With Heater Type	–
Injector		2-Hole Type	←
ISC Valve		Rotary Solenoid Type	←

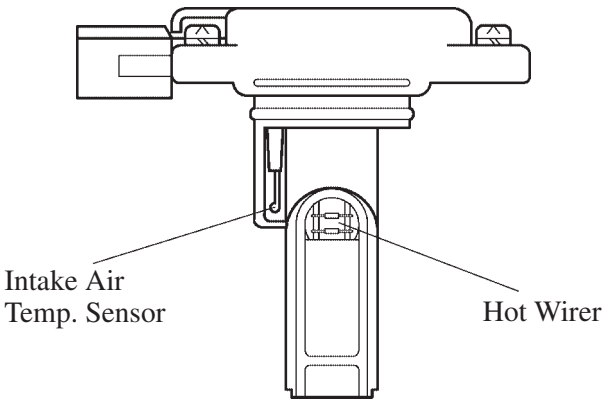
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Air Flow Meter

The 2RZ-FE and 3RZ-FE engines adopts the hot-wire type air flow meter designed for direct electrical measurement of the intake air mass flow.

This air flow meter offers superior measuring precision and its plastic housing is shaped for minimal flow resistance. It has the following features:

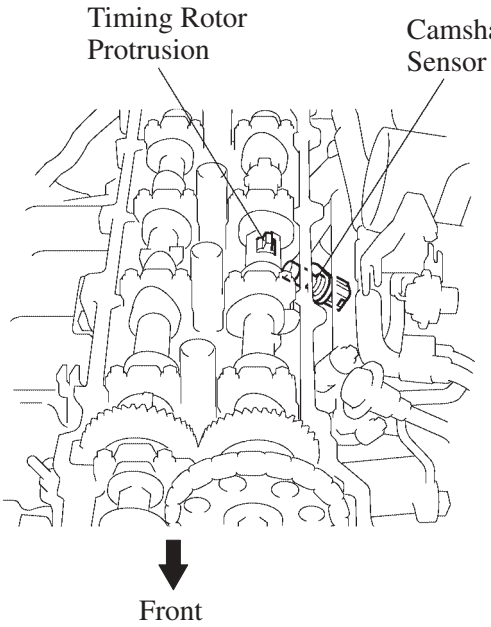
- Compact and lightweight
  The pressure loss caused by this sensor is small and offers only slight intake air flow resistance.
- Superior response and measuring accuracy
- Ability to measure a wide airflow range
- Having no mechanical functions, it offers a superior durability.



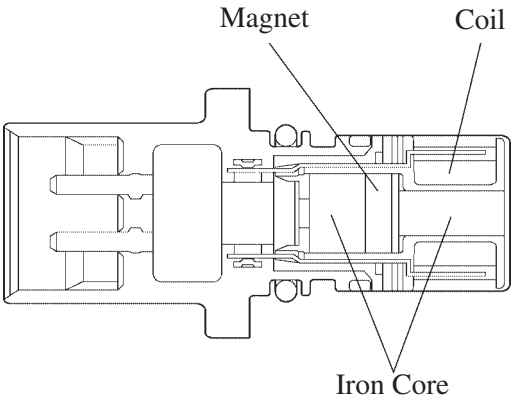
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Camshaft Position Sensor

The camshaft position sensor consists of a magnet, coil and iron core, and mounted onto the intake side of the cylinder head. The timing rotor is integrated with the intake camshaft.
Each time when the camshaft rotates, the air gap between the camshaft position sensor and the protrusion integrated onto the camshaft is varied. This causes the magnetic flux passing through the pickup coil to increase and decrease, generating an electromotive force. Since the voltage generated when the camshaft protrusion approaches the pickup coil is the opposite of when it departs, an alternating electrical current is produced.



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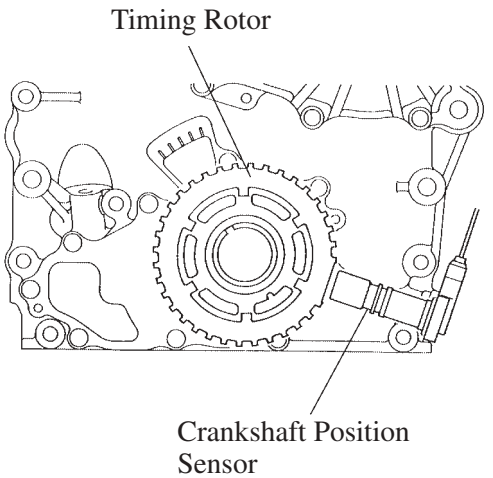


Camshaft Position Sensor Cross Section

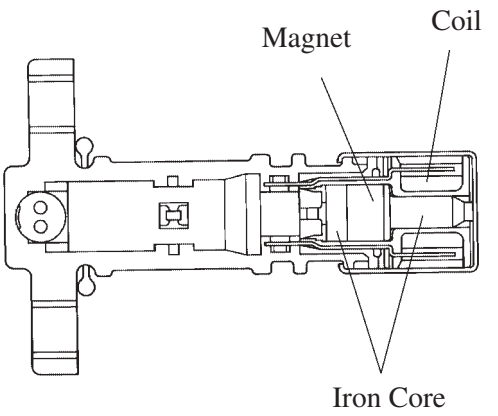
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Crankshaft Position Sensor

The crankshaft position sensor also consists of a magnet, coil and iron core, and is mounted on the timing chain cover as illustrated below.
The timing rotor is integrated with the crankshaft pulley. The rotor's teeth are spaced 10° apart, according to crankshaft angle, but since there are 2 teeth missing, as illustrated below, there is a total of 34 teeth. Accordingly, the engine ECU can detect the crankshaft angle in addition to the crankshaft speed.



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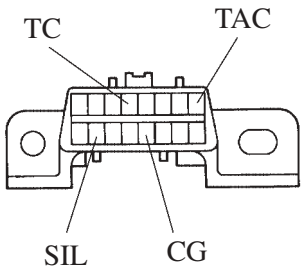
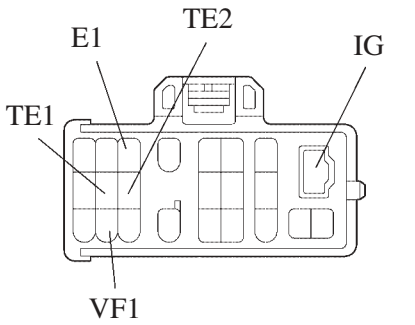


Crankshaft Position Sensor Cross Section

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6. Diagnosis System

The M-OBD (Multiplex On-Board Diagnostic) system that has been adopted in the 2RZ-FE and 3RZ-FE engines is the system that has been improved upon the previous diagnostic system in order to perform trouble-shooting in a more efficient and accurate manner.
The functions of the M-OBD system can be fully utilized through the use of a hand-held tester.
The following table compares the M-OBD system and previous diagnostic system.

System / Item	M-OBD	Previous Diagnostic
Check Connector and Data Link Connector	The DLC3 (Data Link Connector 3) has been newly provided. In addition, the check connector terminals TE1, TE2, and IG have been discontinued. ▶ **DLC3** ◀  140EG127 CG: Chassis Ground SIL: Provides communication between the engine ECU and the hand-held tester. TAC: Outputs the engine speed signal. TC: Provides the same function as the previous TE1 terminal.	The check connector is provided. ▶ **Check Connector** ◀  140EG39
Diagnostic Trouble Code Check Method	After connecting terminals TC and CG of the DLC3, displays the code on CHECK Engine Lamp in the combination meter.	After connecting terminals TE1 and E1 of the check connector, displays the code on CHECK Engine Lamp in the combination meter.
Output Engine ECU Date	The engine ECU's control data can be output by connecting the hand-held tester to the DLC3. Output Date Speed: 9.6 kbps	The engine ECU's control data can be output by connecting the hand-held tester to the check connector. Output Date Speed: 125 bps

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Furthermore, on the M-OBD system, the functions listed below can be utilized by connecting the hand-held tester to the DLC3.

Function	Details
Diagnostic Trouble Code	The system can output 5-digit diagnostic trouble codes to the tester, which are more detailed than the previous 2-digit diagnostic trouble codes, thus making it easier to identify the location of the problem. Example: Code 28 (Oxygen Sensor) → P0130 (Oxygen Sensor) → P0135 (Oxygen Sensor Heater)
Freeze-Frame Data	The system can output freeze-frame data to the tester. This data (which depicts the condition of the engine control system and the vehicle) is stored in the engine ECU at the very moment when the engine ECU has detected its last data of malfunction.
Active Test	Through the use of the tester, the actuators (VSV, fuel pump, ISC valve, etc.) can be activated to a desired state.
Trouble Code Clear	Through the use of the tester, trouble codes stored in the engine ECU can be cleared.

- For details of the diagnostic trouble codes, active test, etc. described above, refer to the 1RZ, 1RZ-E/2RZ, 3RZ-F, 3RZ-FE Engine Repair Manual Supplement (Pub. No. RM584E).
- For details of the hand-held tester, refer to the Hand-Held Tester Operator's Manual.