■ENGINE IMMOBILISER SYSTEM

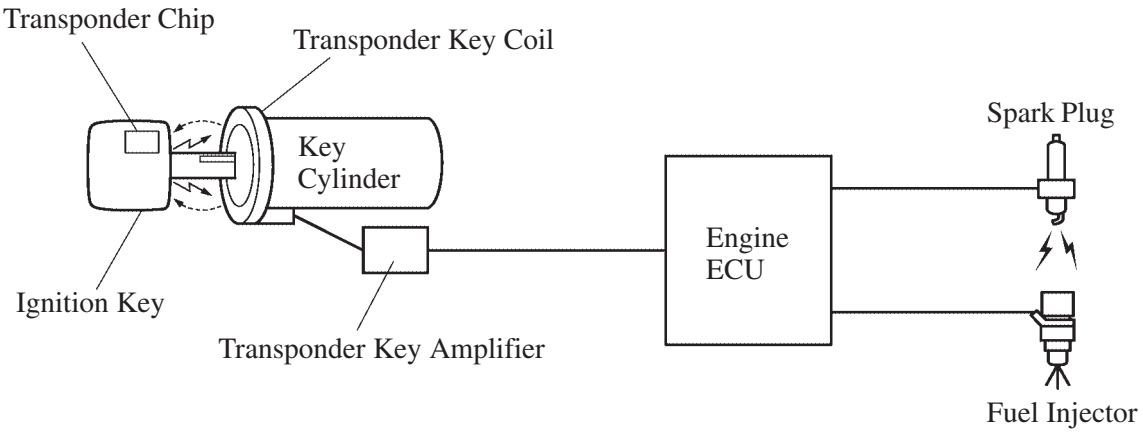
1. General

The engine immobiliser system is a theft-deterrent system which disables the engine from starting using the ignition key with an ID code that matches with the pre-registered code in the vehicle.

2. System Outline

The engine immobiliser system compares the ID code that is registered in the transponder key computer with the ID code of the transponder chip that is embedded in the ignition key. The immobiliser system unsets if these ID codes match. Thus, on the 2UZ-FE, 1FZ-FE, and 1HD-FTE engine models, the transponder key computer and the engine ECU communicate with each other to authorize fuel injection and ignition, enabling the engine to start. On the 1HZ and 1HD-T engine models, the transponder key computer and FCVC (Fuel Cutoff Valve Control) communicate with each other to authorize the delivery of fuel, enabling the engine to start.

On the 2UZ-FE engine model, the transponder key computer and the engine ECU are integrated.



2UZ-FE Engine Model

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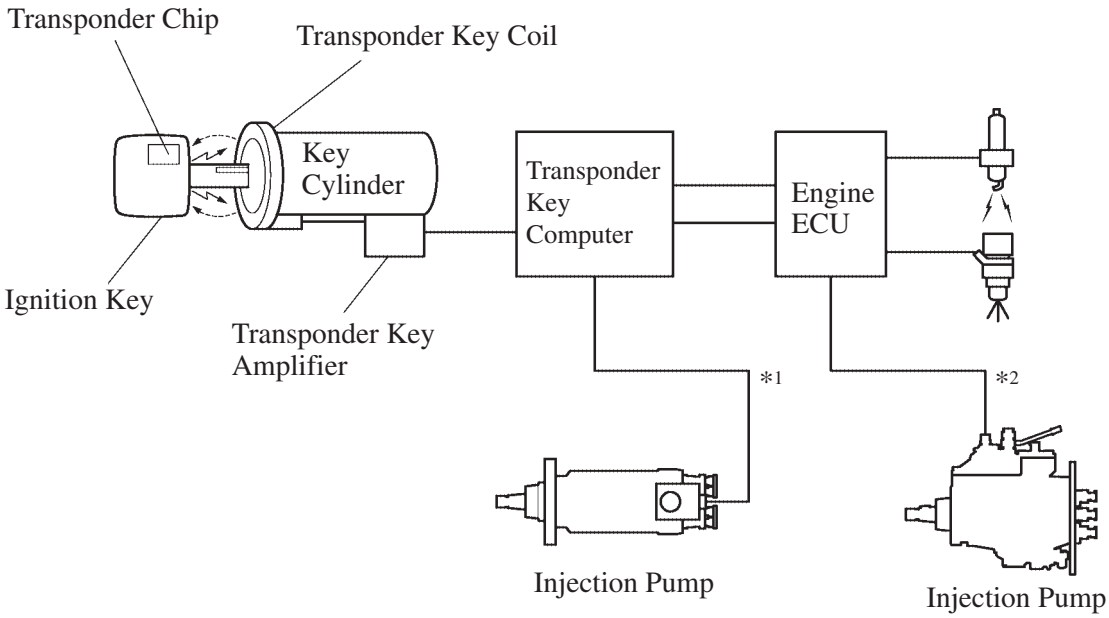

Diesel Engine Model

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*1: 1HZ and 1HD-T Engines Model
*2: 1HD-FTE Engine Model

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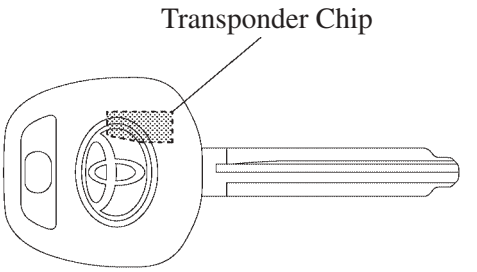
3. Construction

The engine immobiliser system consists of the transponder key (ignition key), transponder key coil, transponder key amplifier, engine ECU (2UZ-FE engine model) and transponder key computer (except 2UZ-FE engine model).

Transponder Key (Ignition Key)

A transponder chip is embedded in the grip of the ignition key. Each transponder chip contains an individual transponder key code (ID code). The key does not need an internal battery to transmit a key code.



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Transponder Key Coil and Transponder Key Amplifier

The transponder key coil is a ring-shaped coil installed around the ignition key cylinder. The transponder key amplifier is installed in the back of the ignition cylinder.
On the 2UZ-FE engine model, in conjunction with the integration of the transponder key computer with the engine ECU, the power circuit for the electricity to be supplied to the transponder key coil has been enclosed in the amplifier.

Engine ECU (2UZ-FE Engine Model)

The transponder key computer has been integrated with the engine ECU. As a result, the wiring of the system has been reduced. Also, the engine starting time has been reduced when the transponder key code did not match, thus improving the vehicle's theft deterrent performance.
A maximum of 10 different transponder key codes (master key: 7 types, sub key: 3 types) can be registered in the engine ECU.

Transponder Key Computer (Except 2UZ-FE Engine Model)

The transponder key computer is mounted inside the passenger side instrument panel.
A maximum of 6 different transponder key codes (master key: 4 types, sub key: 2 types) can be registered in the key computer.

4. Operation

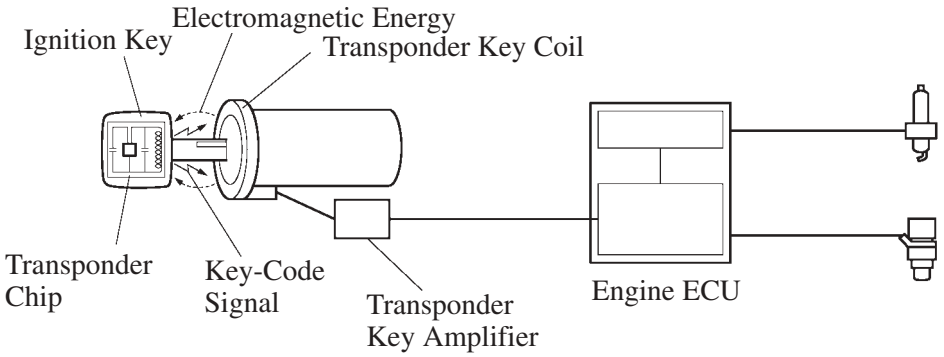
Setting the Engine Immobiliser System

When the ignition key is removed from the key cylinder, the engine immobiliser system will be set.

Unsetting the Engine Immobiliser System

1) Gasoline Engine Model (2UZ-FE Engine Model)

(1) When the ignition key is inserted in the key cylinder, the engine ECU instructs the transponder key coil to supply the electromagnetic energy that enables the transponder chip to transmit a key-code signal. The condenser in the transponder chip converts and stores this energy as electrical energy. The transponder chip then uses this electrical energy to transmit a key-code signal.



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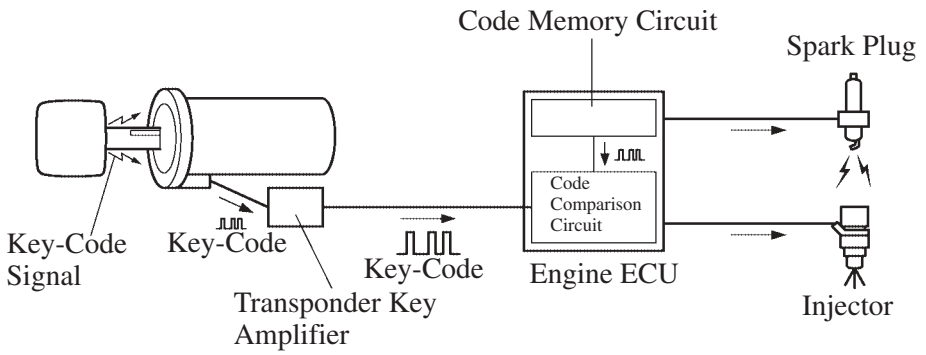
(2) The key code signal that has been received at the coil is amplified by the transponder key amplifier and sent to the engine ECU. The key code that has been received by the engine ECU is then compared to the key code that is stored in the engine ECU. The code comparison process takes place, and if the codes match in a row, the engine ECU unsets the immobiliser system. As a result, the engine will be able to start.



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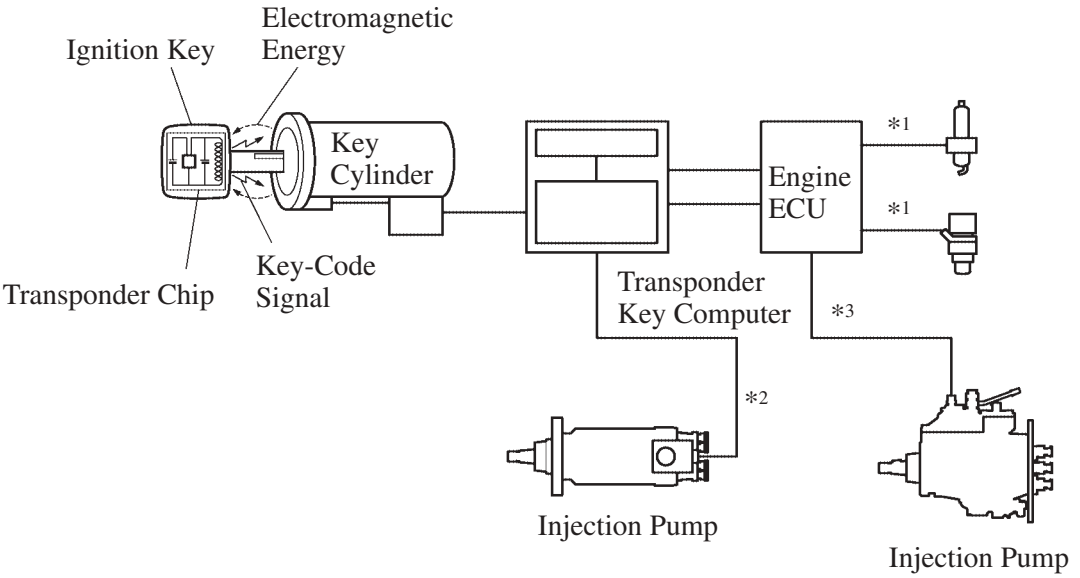
2) Gasoline Engine Model (Except 2UZ-FE Engine Model) and Diesel Engine Model

① When the ignition key is inserted in the key cylinder, the transponder key computer instructs the transponder key coil to supply the electromagnetic energy that enables the transponder chip to transmit a key-code signal. The condensor in the transponder chip converts and stores this energy as electrical energy. The transponder chip then uses this electrical energy to transmit a key-code signal.



*1: 1FZ-FE Engine Model
*2: 1HZ and 1HD-T Engine Model
*3: 1HD-FTE Engine Model

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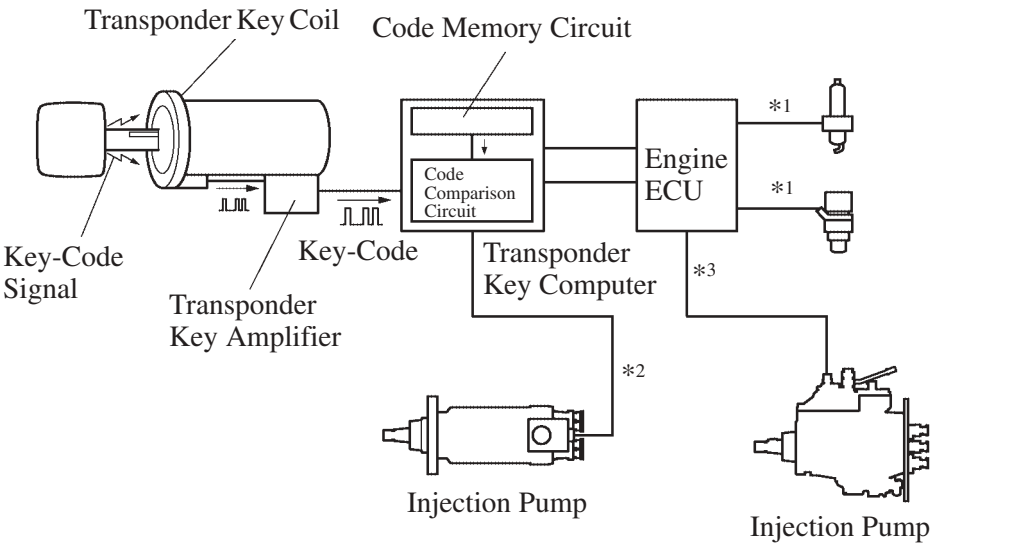
② The key code signal that has been received at the coil is amplified by the transponder key complifier and sent to the computer. The key code that has been received by the computer is then compared to the key code that is stored in the computer. The code comparison process takes place twice, and if the codes match twice in a row, the computer unsets the immobiliser system.



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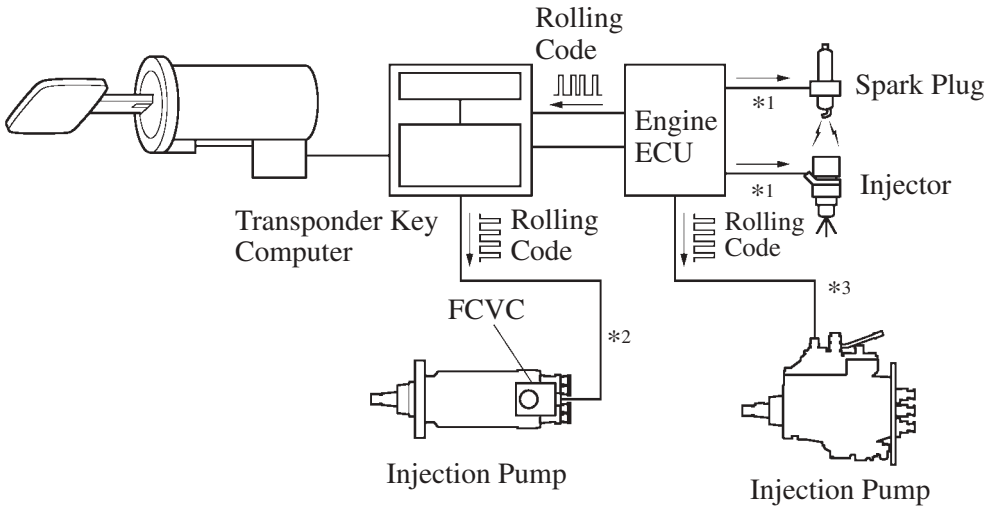
*1: 1FZ-FE Engine Model
*2: 1HZ and 1HD-T Engine Model
*3: 1HD-FTE Engine Model

③ If the immobiliser system is unset, on the gasoline engine model, the engine ECU allows the current to flow to the injectors and to the spark plugs to enable fuel delivery and ignition. On the diesel engine model, the ECU allows the current to flow to the FCVC, thus enabling the injection pump to inject fuel. As a result, the engine can be started.
Then the engine ECU generates a rolling code based on certain parameters and sends it to the computer.



*1: 1FZ-FE Engine Model
*2: 1HZ and 1HD-T Engine Model
*3: 1HD-FTE Engine Model

④ Upon receiving the rolling code from the engine ECU, the computer converts the rolling code according to certain parameters and sends it to the engine ECU. This communication between the computer and the engine ECU will take place for a few seconds until the correct signal is sent by the computer to the engine ECU. Within this time, if the correct signal is sent from the computer to the engine ECU, the engine will continue to operate. However, if the correct signal is not sent by the computer within this period, the engine ECU will prohibit fuel delivery and ignition (gasoline engine model only), thus disabling the engine.

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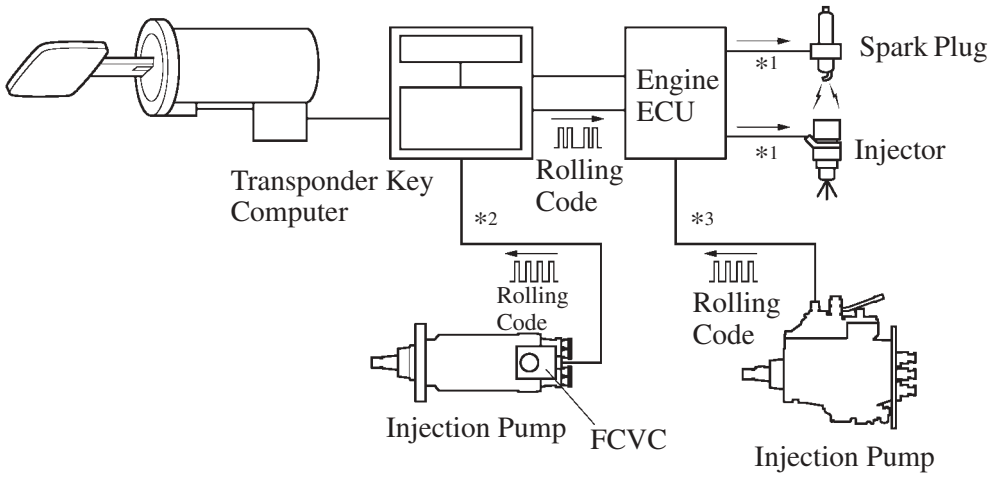

*1: 1FZ-FE Engine Model
*2: 1HZ and 1HD-T Engine Model
*3: 1HD-FTE Engine Model

5. Functions

The engine immobiliser system provides the following functions:

Immobiliser Cancel Function

The immobiliser system is cancelled when the following condition is met, thus permitting authorized operation of the engine:

- The ignition key has been inserted in the key cylinder (after the transponder key computer reads the key code of the transponder chip and that code matches the pre-registered key code).

New Transponder Key Code Registration Function

This function allows the registration of the key code of a new master or sub key to the transponder key computer or engine ECU. On the 2UZ-FE engine model, a maximum of 10 different transponder key codes (7 for master keys and 3 for sub keys) can be registered in the engine ECU. On the other model, a maximum of 6 different transponder key codes (4 for master keys and 2 for sub keys) can be registered in the transponder key computer. This function is used if the transponder key computer is replaced with a new one.

Additional Transponder Key Code Registration Function

This function enables the registration of the key code for a new master key or sub key, while retaining the key codes that are already registered. This function is used for the purpose of adding a new master or sub key.

Transponder Key Code Delete Function

This function deletes all the transponder key codes that are registered in the transponder key computer except for the key code of the master key that was used to execute the delete function.