

7. Engine Control System

General

The following list shows engine control comparison between the 1KD-FTV engine of the new Land Cruiser/Land Cruiser Prado and the 1KD-FTV engine of the previous Land Cruiser/Land Cruiser Prado.

System	Outline	New Land Cruiser /Land Cruiser Prado	Previous Land Cruiser /Land Cruiser Prado
Fuel Injection Volume Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection volume in accordance with the engine condition.	○	○
Fuel Injection Timing Control	Based on the signals received from the sensors, the engine ECU determines the fuel injection timing in accordance with the engine condition.	○	○
Fuel Pressure Control	Based on the signals received from the sensors, the engine ECU controls fuel pressure using the SCV (Suction Control Valve) and pressure discharge valve according to the engine condition.	○	○
Pilot Injection Control	Based on the signals received from the various sensors, the engine ECU determines pilot injection volume, timing, and interval (between pilot injection and main injection) in accordance with the engine condition.	○	○
Idle Speed Control	The engine ECU determines the idle speed in accordance with the engine condition, and controls the fuel injection volume in order to maintain the target idle speed.	○	○
Glow Plug Control	Controls the length of time when the current is applied to the glow plugs in accordance with water temperature.	○	○
EGR Control System (See page 28)	Based on the signals received from the sensors, the engine ECU determines the EGR volume via EGR valve, EGR cooler bypass switching valve and throttle valve in accordance with the engine condition.	○	—
	Based on the signals received from the sensors, the engine ECU determines the EGR volume via EGR valve and throttle valve in accordance with the engine condition.	—	○
Intake Throttle Control (See page 29)	Based on the signals received from the various sensors, the engine ECU determines throttle valve position in accordance with the engine condition.	○	—
	Fully closes the throttle valve in order to reduce the vibration when the engine is stopped.	○	○

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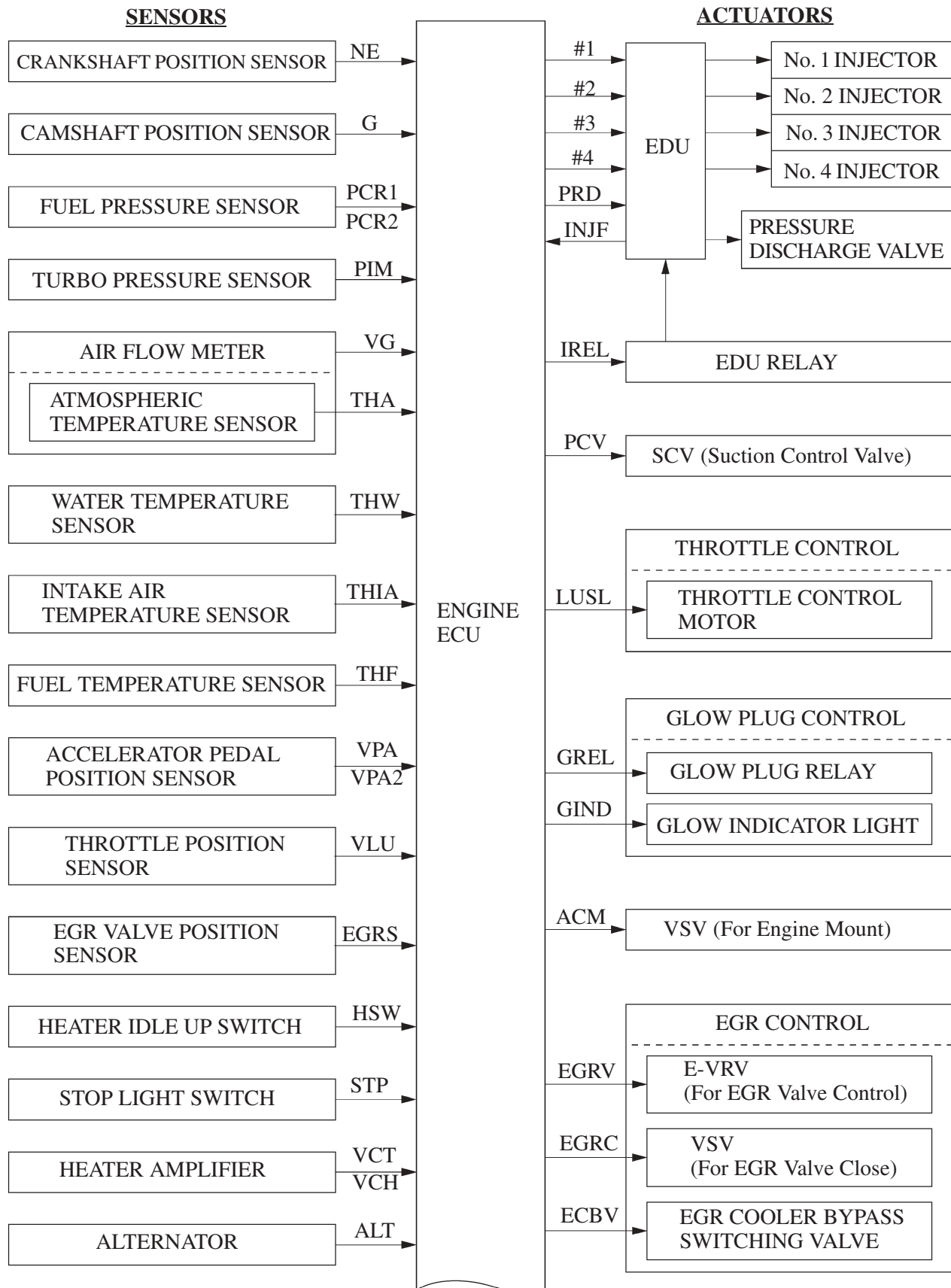
System	Outline	New Land Cruiser /Land Cruiser Prado	Previous Land Cruiser /Land Cruiser Prado
Swirl Control Valve Control (See page 29)	Based on the signals received from the sensors, the engine ECU controls the vacuum that is directed to the actuator via the VSVs, in order to open and close the valve.	○	○
Engine Immobilizer	Prohibits fuel injection if an attempt is made to start the engine with an invalid key.	○	○
Fuel Pump Control*1 (See page 30)	The engine ECU operates the fuel pump to optimally control the transfer of the fuel in the fuel tank.	○	—
Oil Maintenance Management System*2 (See page 31)	When the engine ECU determines engine oil and oil filter deterioration, the engine oil change reminder light turns ON to inform the driver.	○	—
Diagnosis (See page 33)	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.	○	○
Fail-safe (See page 33)	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.	○	○

*1: Only for Dual Tank Models

*2: Europe Models

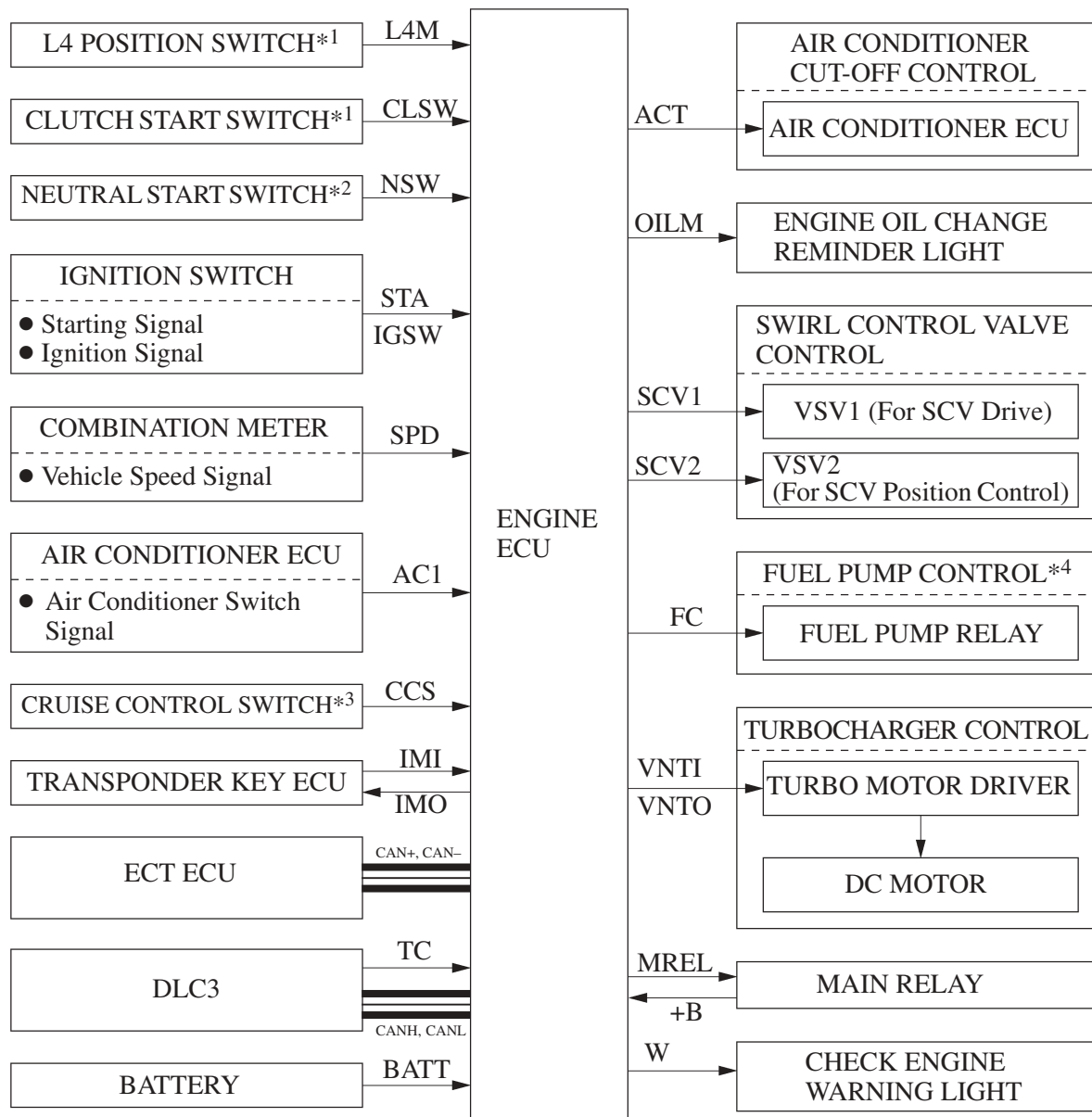
Construction

The configuration of the engine control system is as shown in the following chart.



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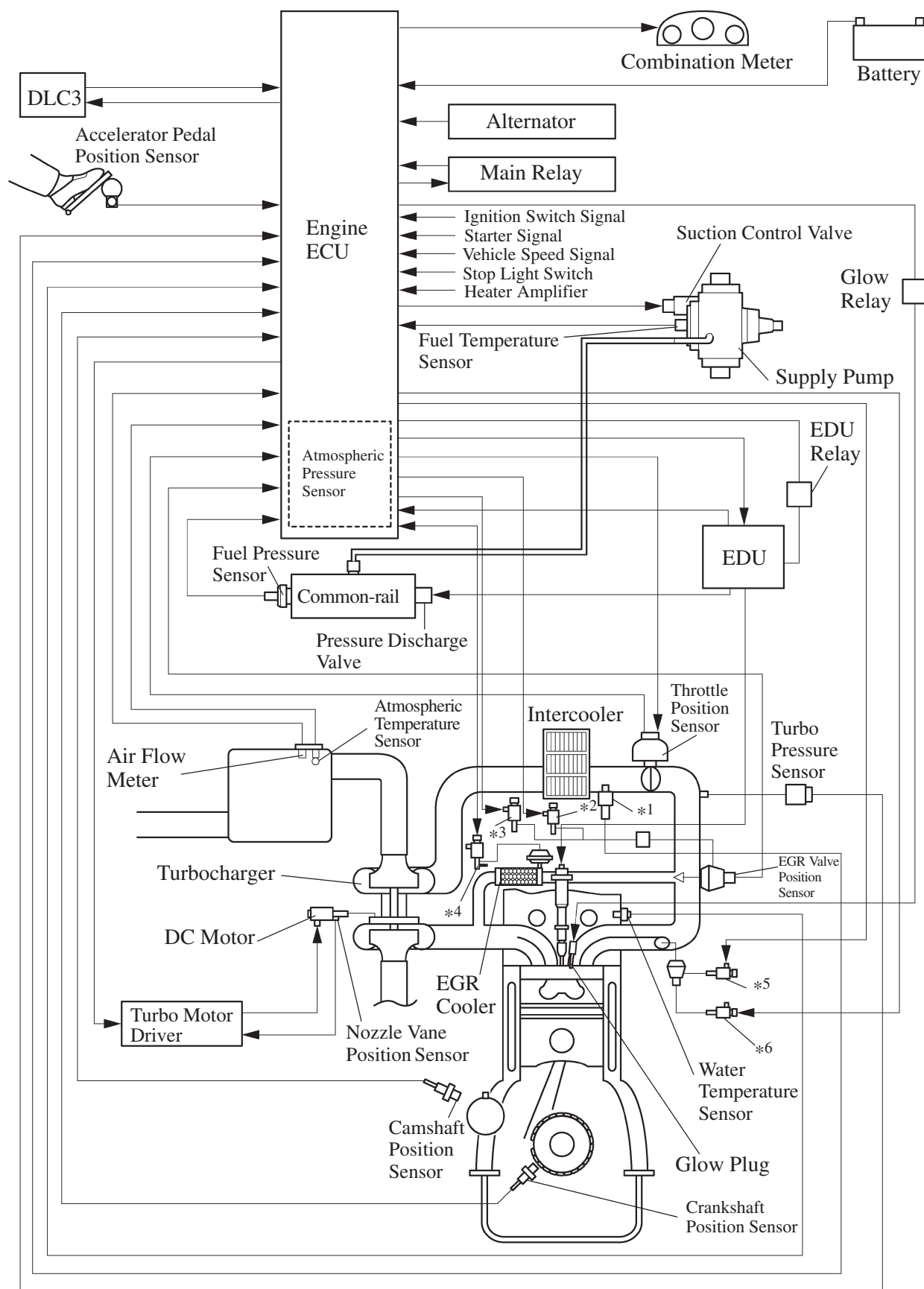
*1: Only for M/T Models

*2: Only for A/T Models

*3: Models with Cruise Control System

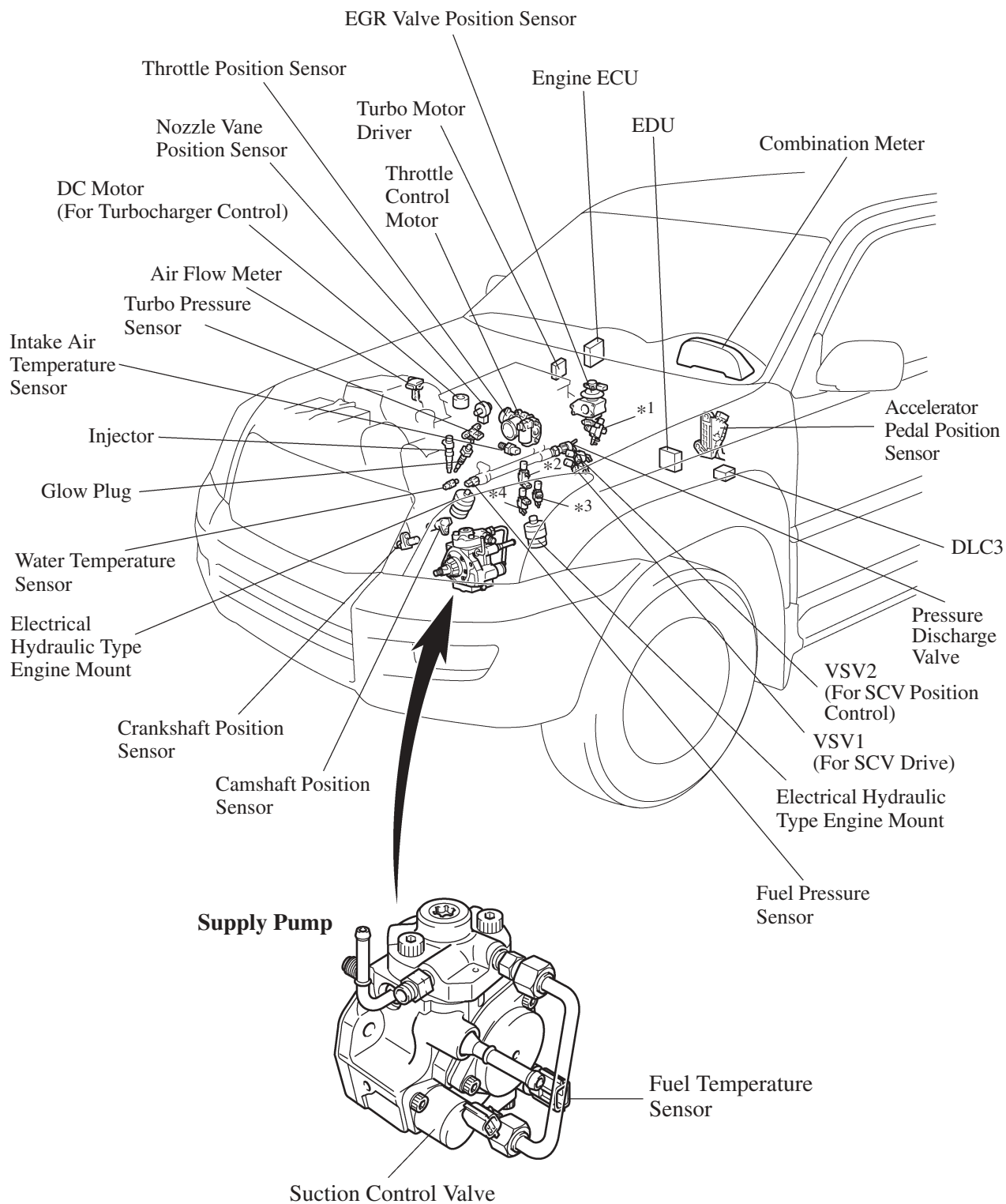
*4: Only for Dual Tank Models

Engine Control System Diagram



- *1: Intake Air Temperature Sensor *2: VSV (For EGR Valve Close)
 *3: E-VRV (For EGR Valve Control) *4: VSV (EGR Cooler Bypass Switching Valve)
 *5: VSV1 (For SCV Drive) *6: VSV2 (For SCV Position Control)

Layout of Main Components



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- *1: E-VRV (For EGR Valve Control) *2: VSV (For EGR Valve Close)
 *3: VSV (For EGR Cooler Bypass Valve) *4: VSV (For Engine Mount)

Main Components of Engine Control System

1) General

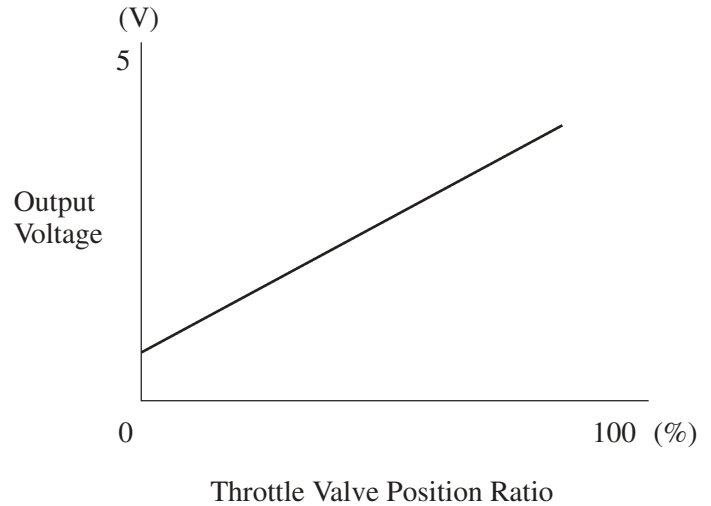
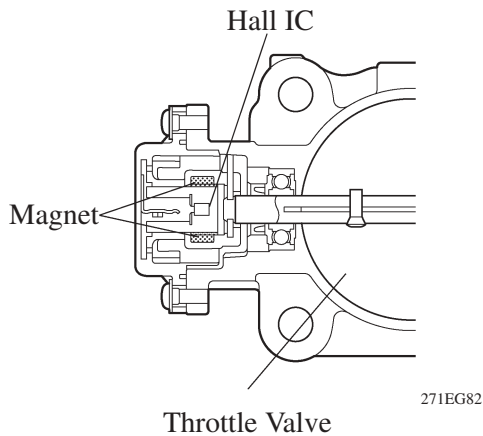
The main components of the 1KD-FTV engine control system are as follows:

Model	New Land Cruiser/Land Cruiser Prado		Previous Land Cruiser/Land Cruiser Prado	
Components	Outline	Quantity	Outline	Quantity
Engine ECU	32-bit CPU	1	←	←
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 (5)	1	←	←
Accelerator Pedal Position Sensor	Linear Type	2 (Main and Sub)	←	←
EDU	Including a Built-in DC/DC Converter	1	←	←
Fuel Pressure Sensor	Semiconductor Strain Gauge Type (Single Circuit)	1	←	←
Throttle Position Sensor	Non-contact Type	1	—	

2) Throttle Position Sensor

The non-contact type 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 that of the throttle valve shaft) rotates around the Hall IC into electric signals to operate the throttle control motor.

► Output Characteristic ◀



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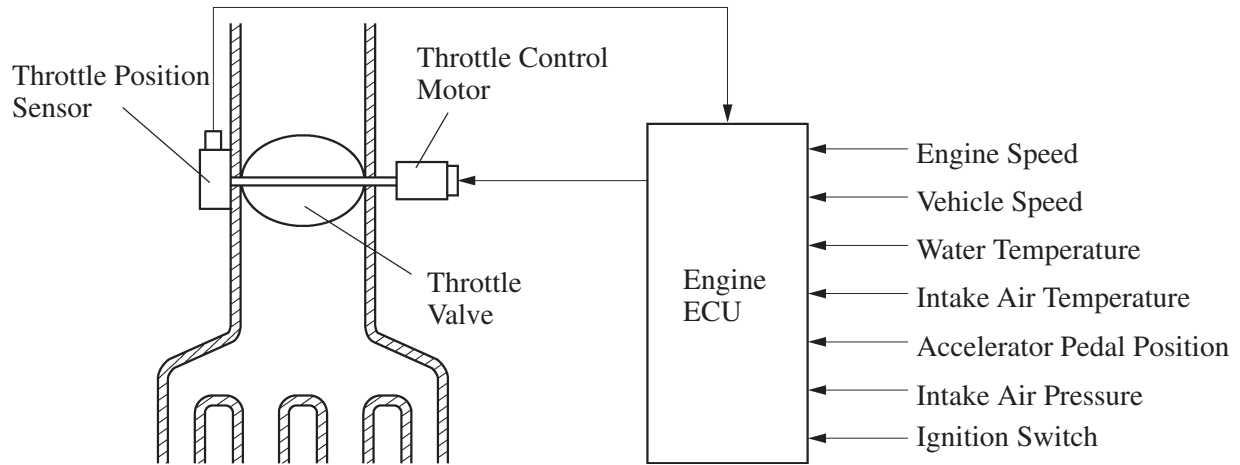
Service Tip

The inspection method differs from that of the contact type throttle position sensor because this sensor uses a Hall IC. For details, refer to the Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM00W1).

Throttle Control

The opening of the throttle valve that is installed on the throttle body is controlled by the engine ECU in accordance with engine conditions.

As a result, the noise that is generated during idling and deceleration, as well as the noise and vibration that are generated when the engine is stopped, has been reduced.

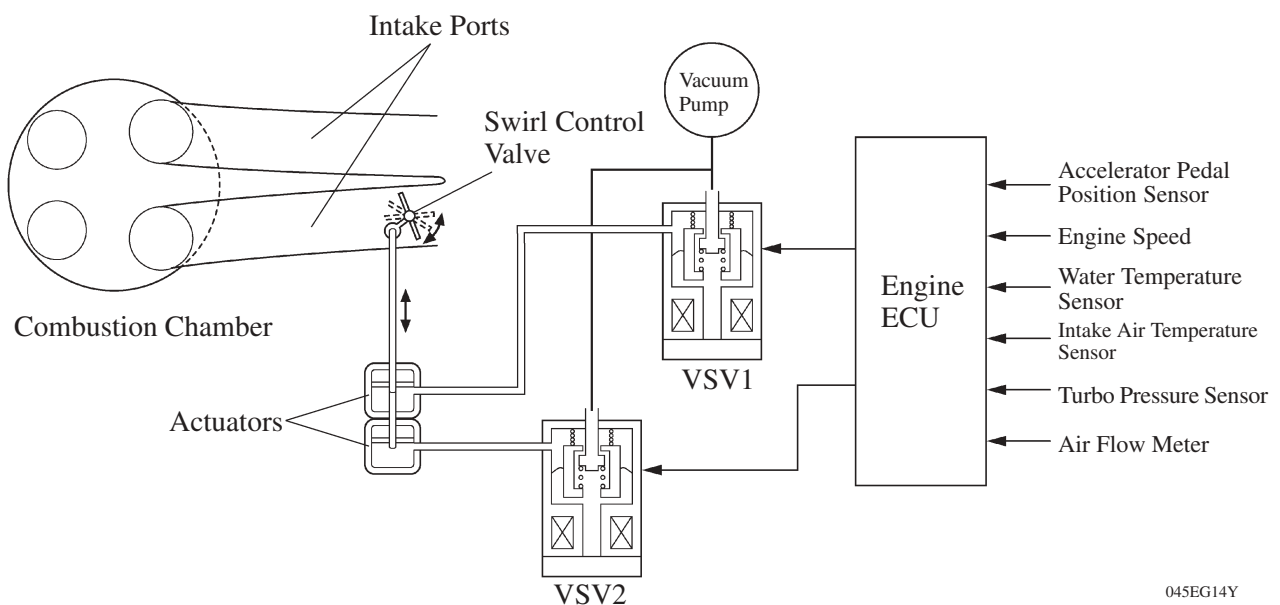


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Swirl Control Valve Control

The engine ECU determines the swirl control valve position based on the engine conditions (engine speed and accelerator pedal position). Then, it switches the vacuum that is applied to the actuator diaphragm via the VSVs, in order to open and close the swirl control valve.

In the low engine speed range, the engine ECU closes the swirl control valve to strengthen the swirl in the combustion chamber, thus promoting the mixture of fuel and air and stabilizing combustion. The engine ECU opens the swirl control valve half way when the engine is running in the mid-speed range, and opens it fully in the high-speed range. On a cold engine, the engine ECU fully opens the swirl control valve to reduce the amount of white smoke emissions.



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Fuel Pump Control

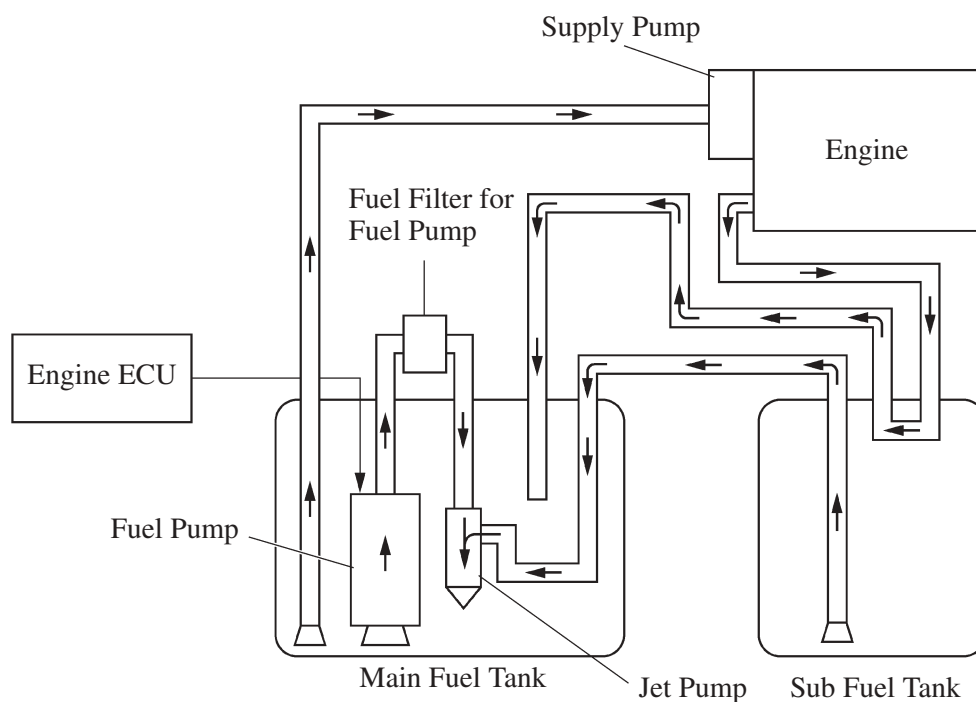
1) General

The fuel pump control system transfers fuel from the sub fuel tank to the main fuel tank.

- The engine ECU operates the fuel pump located in the fuel tank to transfer fuel within the fuel tank.

2) Construction and Operation

The supply pump delivers fuel from the main fuel tank to the engine. Therefore, fuel in sub fuel tank needs to be transferred to main fuel tank. In this system, the Engine ECU operates the fuel pump to transfer the fuel from sub fuel tank to main fuel tank using the jet pump built into the fuel pump.



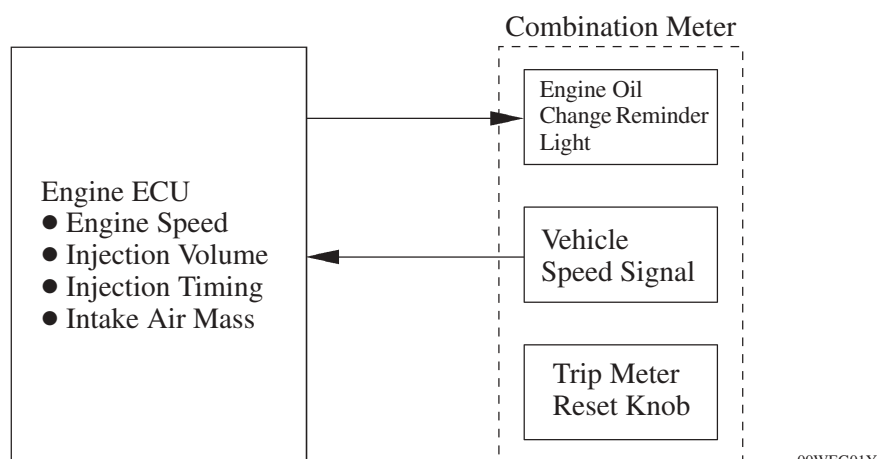
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Oil Maintenance Management System

1) General

- An oil maintenance management system (OMMS) is used. This system determines the deterioration conditions of the engine oil and oil filter, and illuminates an engine oil change reminder light to inform the driver when the engine oil and the oil filter must be changed. Accordingly, the maintenance intervals (30,000 km maximum) that correspond to the actual deterioration conditions of the engine oil have been realized.
- This system indirectly determines the deterioration of the engine oil and oil filter based on the information provided by the engine ECU.

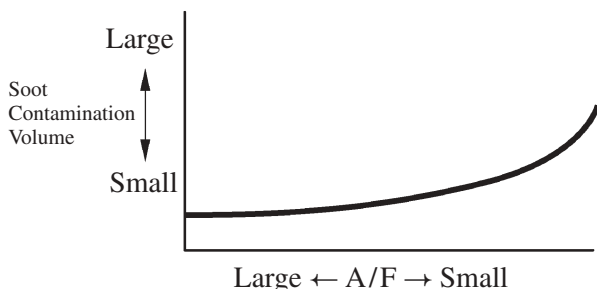
2) System Diagram



3) System Operation

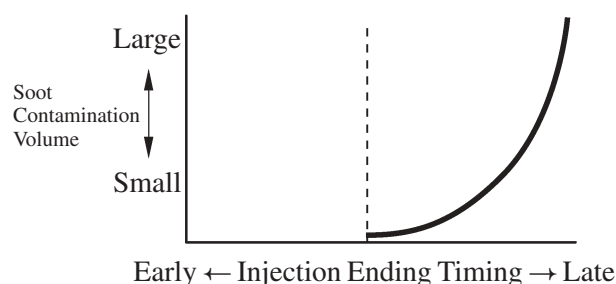
This system determines the deterioration of the engine oil and oil filter in accordance with the soot volume in the engine oil and oil filter. The engine ECU calculates the soot volume in the engine oil and oil filter in accordance with the vehicle speed, engine speed, injection timing, injection volume, and intake air mass. When the calculated value of the soot volume exceeds a predetermined value, the engine ECU will illuminate the engine oil change reminder light. Thus, this system informs the driver that the engine oil and the oil filter must be changed.

► Soot Generation Conditions ◀



Relationship to Air-fuel Ratio

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Relationship to Injection Ending Timing

224EG36

- In addition to controlling the illumination of the engine oil change reminder light by counting the soot volume, the engine ECU illuminates the engine oil change reminder light when the vehicle's driven distance reaches 30,000 km. Thus, this function enhances the reliability of the system.

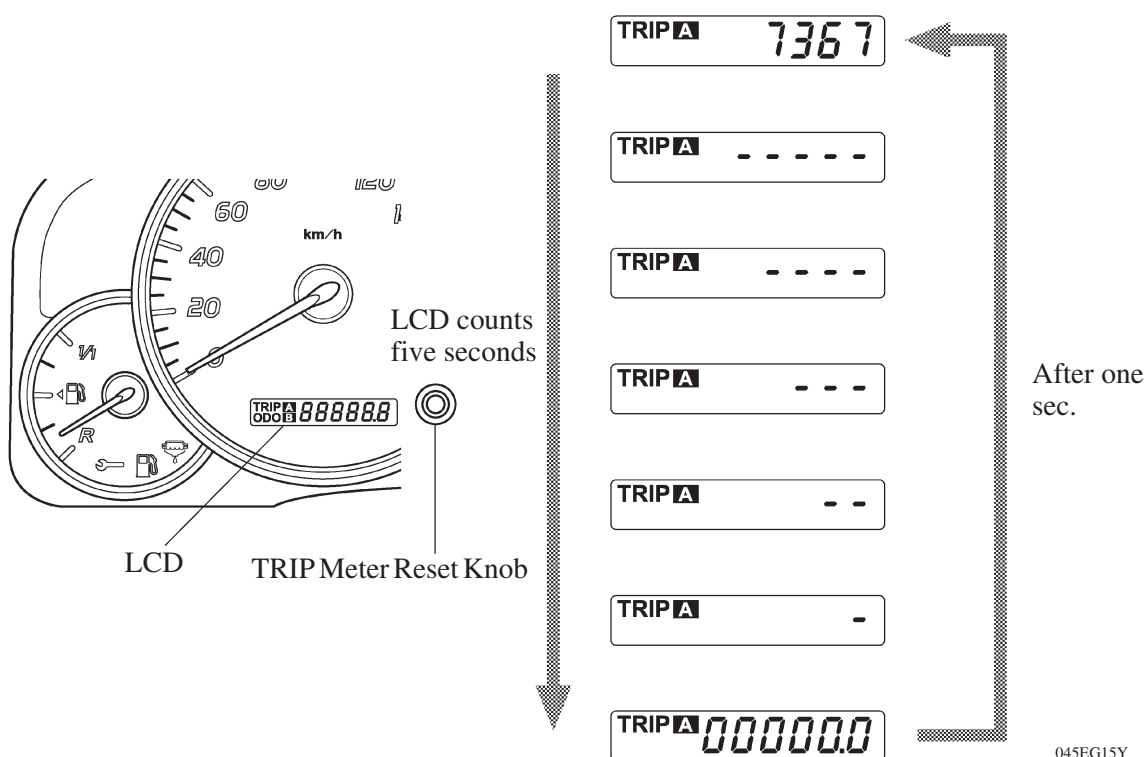
NOTICE

This system does not determine the deterioration of the engine oil based on the elapsed time. Even if the engine oil change reminder light does not illuminate, the engine oil and oil filter should be changed at 2-year intervals at the maximum.

4) Counter Reset

The accumulated soot volume memorized in engine ECU can be reset by the following procedures.

- 1) Ignition switch is ON and make sure that the LCD displays the trip meter A.
- 2) Ignition switch is OFF. Then, while pushing the “TRIP” meter reset knob, ignition switch is ON.
- 3) Until the resetting is completed for at least five seconds and the LCD counts as shown below. Release the “TRIP” meter reset knob when the resetting is completed.
- 4) After the resetting is completed, the LCD displays as follows for one second. Then, the LCD displays the trip meter A mileage.



Diagnosis

- When the engine ECU detects a malfunction, the engine ECU makes DTCs (Diagnostic Trouble Codes) and memorizes the failed section. Furthermore, the check engine warning light in the combination meter illuminates to inform the driver.
- The engine ECU will also store the DTCs (Diagnostic Trouble Codes) of the malfunctions. The DTC can be accessed by using the intelligent tester II.
- For details, refer to the Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM00W1).

Service Tip

To clear the DTC that is stored in the engine ECU, use an intelligent tester II, disconnect the battery terminal or remove the EFI fuse for 1 minute or longer.

Fail-safe

When a malfunction is detected by any of the sensors, there is a possibility of an engine or other malfunction occurring if the engine ECU were to continue to control the engine control system in the normal way. To prevent such a problem, the fail-safe function of the engine ECU either relies on the data stored in memory to allow the engine control system to continue operating, or stops the engine if a hazard is anticipated. For details, refer to the Land Cruiser/Land Cruiser Prado Repair Manual Supplement (Pub. No. RM00W1).