■ENGINE CONTROL SYSTEM

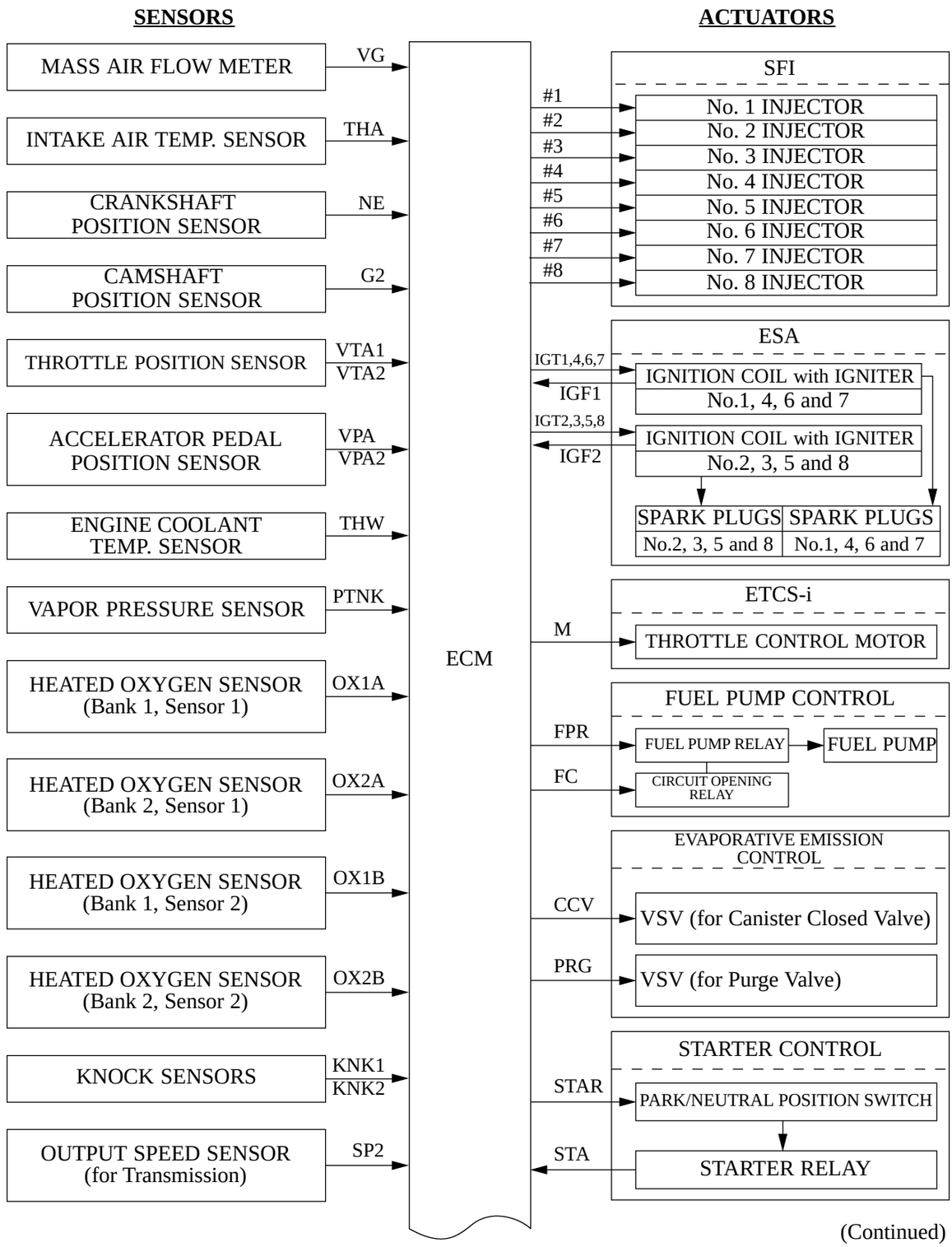
1. General

The engine control system for the 2UZ-FE engine has following system.

System	Outline
SFI (Sequential Multiport Fuel Injection)	An L-type SFI system directly detects the intake air mass with a hot wire type mass air flow meter.
ESA (Electronic Spark Advance)	Ignition timing is determined by the ECM based on signals from various sensors. The ECM corrects ignition timing in response to engine knocking.
ETCS-i (Electronic Throttle Control System-intelligent) (See page EG-35)	Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle
	• A link-less type is used, without an accelerator cable. • An accelerator pedal position sensor is provided on the accelerator pedal. • A no-contact type throttle position sensor and accelerator pedal position sensor are used.
Fuel Pump Control (See page EG-38)	The fuel pump speed is controlled by the fuel pump relay and the fuel pump resistor.
	A fuel cut control is adopted to stop the fuel pump when the airbag is deployed during front or side collision.
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.
Evaporative Emission Control (See page EG-39)	The ECM controls the purge flow of evaporative emission (HC) in the charcoal canister in accordance with engine conditions.
	A pressure gauge is attached to the service port, which is provided between the charcoal canister and the VSV (for purge valve), in order to detect an evaporative emission leakage.
	System construction and control logic have been made to comply with LEV-II evaporative emission regulation.
Air Conditioning Cut-off Control	By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.
Starter Control (Cranking Hold Function) (See page EG-49)	Once the ignition switch is turned to the START position, this control continues to operate the starter until the engine started.
Diagnosis (See page EG-51)	When the ECM detects a malfunction, the ECM diagnoses and memorizes the failed section.
	All the DTCs (Diagnostic Trouble Codes) have been made to correspond to the SAE controlled codes.
Fail-Safe (See page EG-51)	When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.

2. Construction

The configuration of the engine control system in the 2UZ-FE engine is shown in the following chart.



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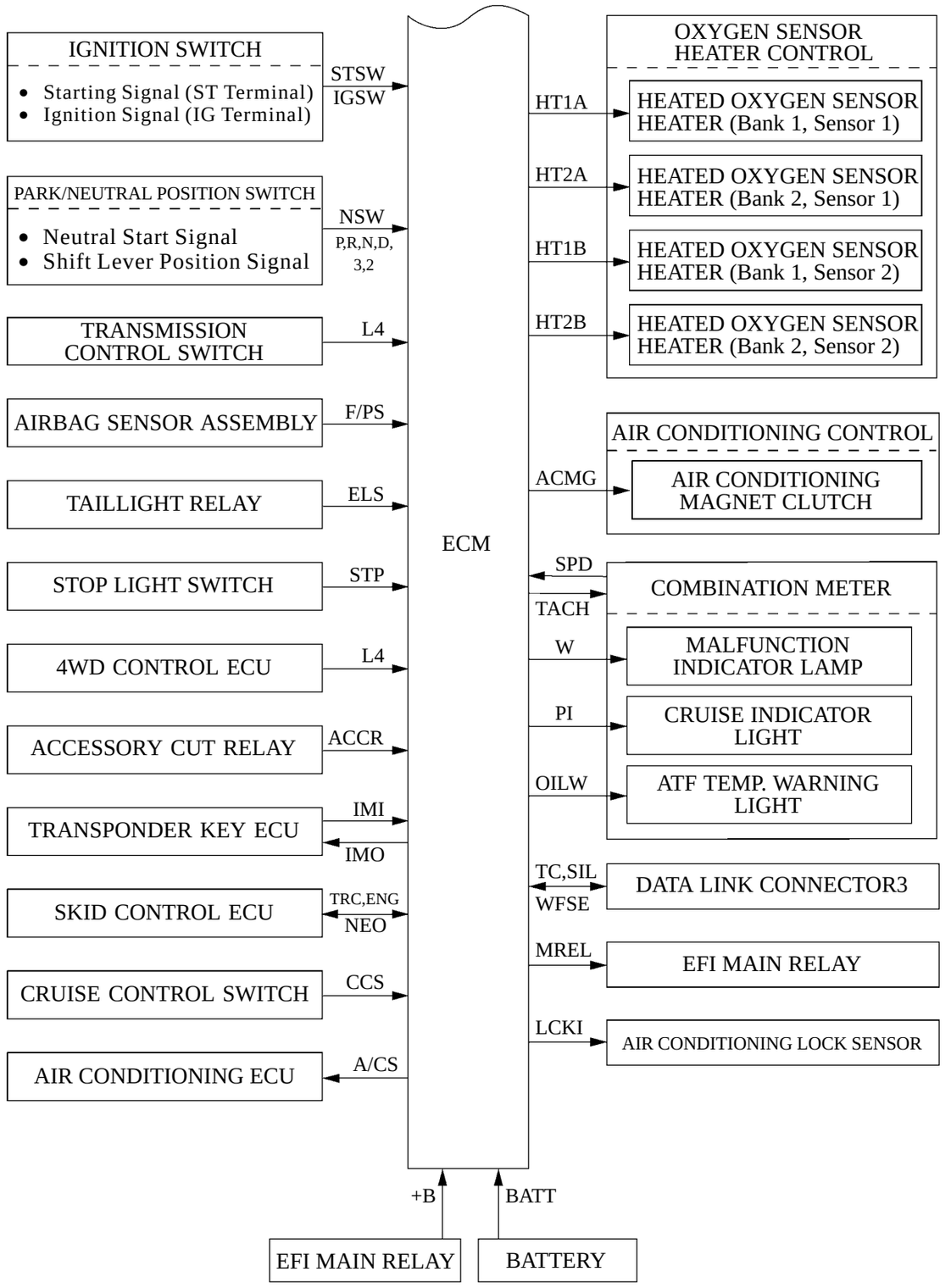
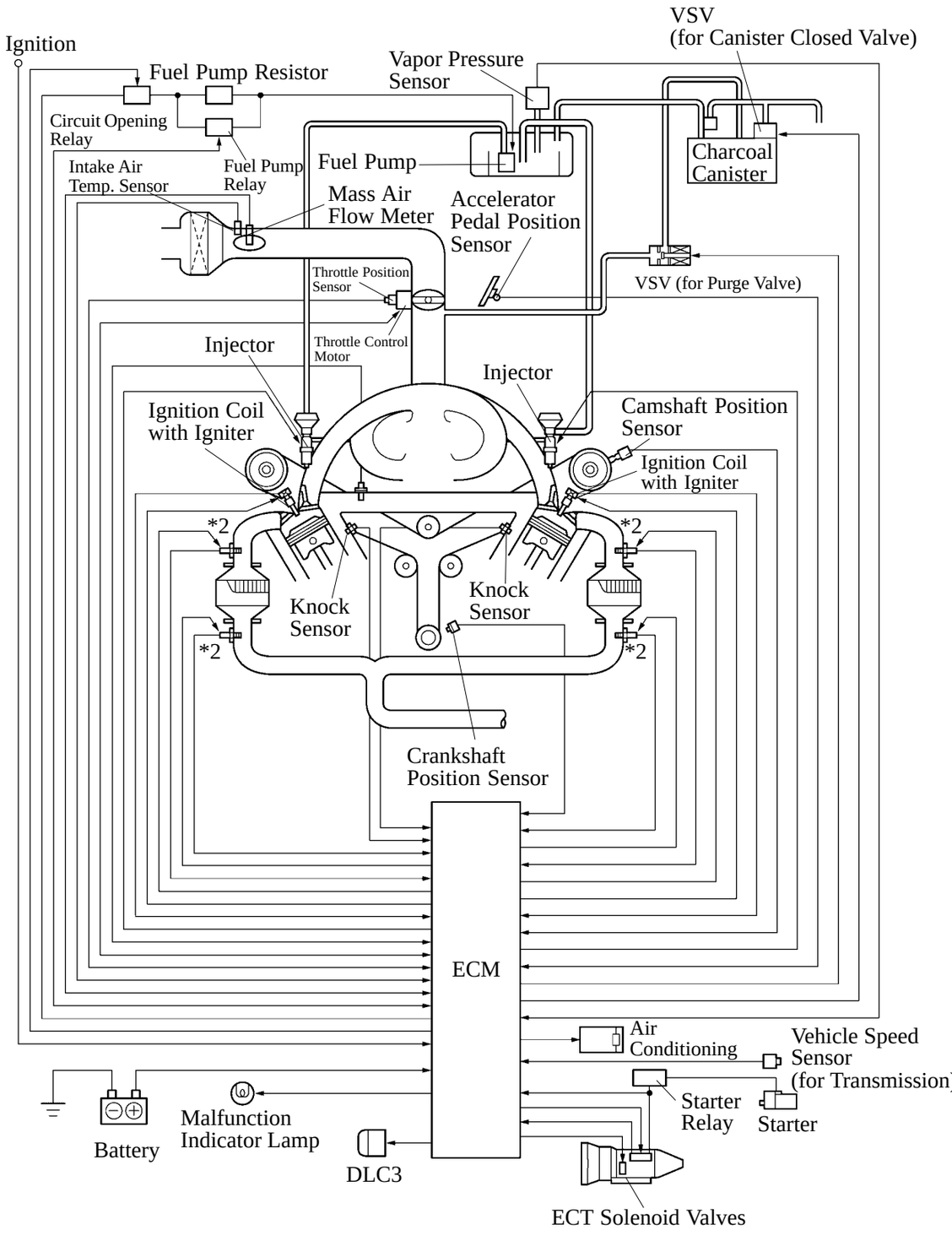
232EG08


IGNITION SWITCH
• Starting Signal (ST Terminal)
• Ignition Signal (IG Terminal)
STSW
IGSW
PARK/NEUTRAL POSITION SWITCH
• Neutral Start Signal
• Shift Lever Position Signal
NSW
P,R,N,D,
3,2
TRANSMISSION CONTROL SWITCH
L4
AIRBAG SENSOR ASSEMBLY
F/PS
TAILLIGHT RELAY
ELS
STOP LIGHT SWITCH
STP
4WD CONTROL ECU
L4
ACCESSORY CUT RELAY
ACCR
TRANSPONDER KEY ECU
IMI
IMO
SKID CONTROL ECU
TRC,ENG
NEO
CRUISE CONTROL SWITCH
CCS
AIR CONDITIONING ECU
A/CS
ECM
+B
BATT
EFI MAIN RELAY
BATTERY
OXYGEN SENSOR HEATER CONTROL
HT1A
HEATED OXYGEN SENSOR HEATER (Bank 1, Sensor 1)
HT2A
HEATED OXYGEN SENSOR HEATER (Bank 2, Sensor 1)
HT1B
HEATED OXYGEN SENSOR HEATER (Bank 1, Sensor 2)
HT2B
HEATED OXYGEN SENSOR HEATER (Bank 2, Sensor 2)
AIR CONDITIONING CONTROL
ACMG
AIR CONDITIONING MAGNET CLUTCH
SPD
TACH
COMBINATION METER
W
MALFUNCTION INDICATOR LAMP
PI
CRUISE INDICATOR LIGHT
OILW
ATF TEMP. WARNING LIGHT
TC,SIL
WFSE
DATA LINK CONNECTOR3
MREL
EFI MAIN RELAY
LCKI
AIR CONDITIONING LOCK SENSOR

232EG09

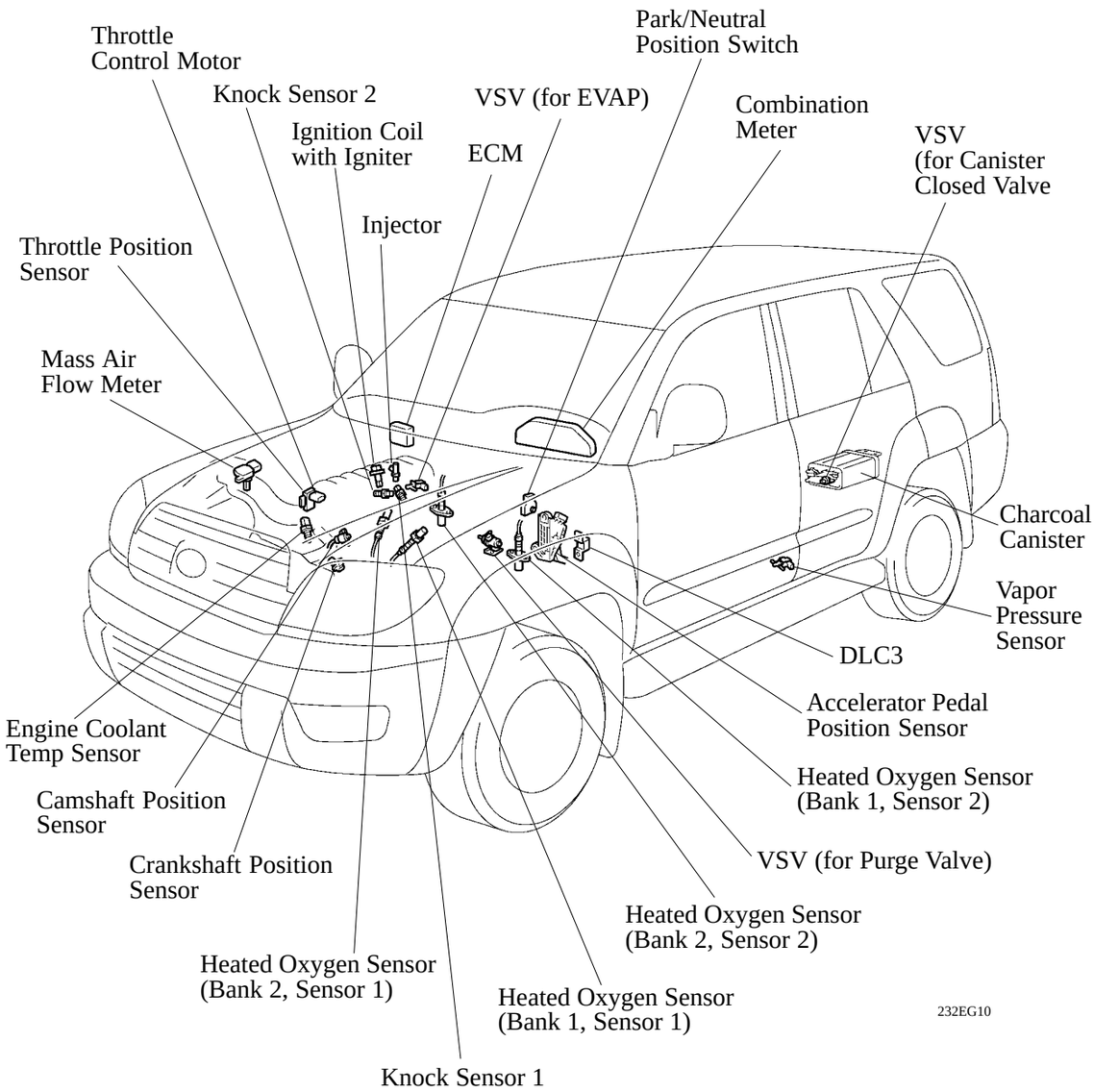
3. Engine Control System Diagram



228TU22

*1: Engine Coolant Temp. Sensor
*2: Heated Oxygen Sensor

4. Layout of Main Components



5. Main Components of Engine Control System

General

The following table compares the main components.

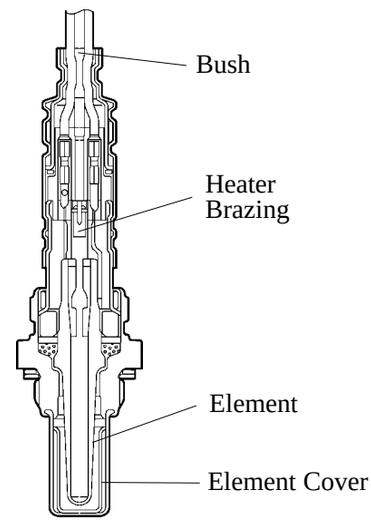
Component		Outline	Quantity
ECM		32-bit CPU	1
Mass Air Flow Meter		Hot-wire Type	1
Crankshaft Position Sensor (Rotor Teeth)		Pick-up Coil Type (36-2)	1
Camshaft Position Sensor (Rotor Teeth)		Pick-up Coil Type (1)	1
Accelerator Pedal Position Sensor		No-contact Type (Mounted on Accelerator Pedal)	1
Throttle Position Sensor		No-contact Type	1
Knock Sensor		Built-in Piezoelectric Type	2
Oxygen Sensor	(Bank 1, Sensor 1) (Bank 2, Sensor 1)	with Heater (Ultra-high temperature resistant type)	2
	(Bank 1, Sensor 2) (Bank 2, Sensor 2)	with Heater (High temperature resistant type)	2
Injector		4-Hole Type	8

ECM

The 32-bit CPU of the ECM has been adopted to increase the speed for processing the signals.

Oxygen Sensor

- An ultra-high temperature resistant oxygen sensor has been adopted for the bank 1/sensor 1 and bank 2/ sensor 1.
- In contrast to the oxygen sensor on the ’02 model, this sensor uses ultra-high temperature resistant materials in the following areas: the element, element cover, heater brazing, and bushing.

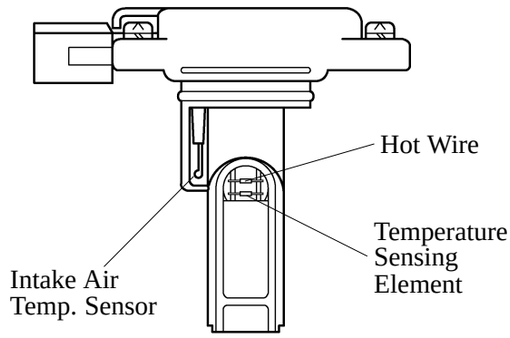


230LX09

Mass Air Flow Meter

The 2UZ-FE engine uses the hot-wire type mass air flow meter designed for direct electrical measurement of the intake air flow.
This mass air flow meter offers superior measuring precision and its plastic housing is shaped for minimal flow resistance. It has the following features:

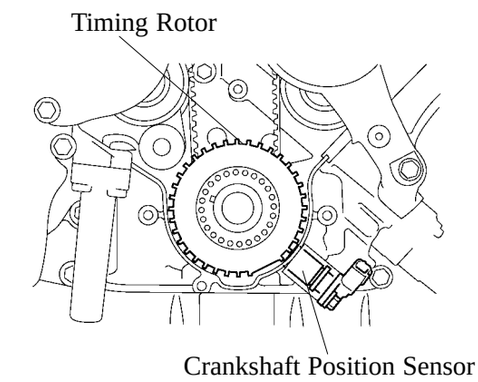
- Compact and lightweight
  The pressure loss caused by this sensor is small and offers only slight intake air flow resistance.
- Superior response and measuring accuracy.
- Ability to measure a wide airflow range.
- Having no mechanical functions, it offers superior durability.



140EG45

Crankshaft Position Sensor

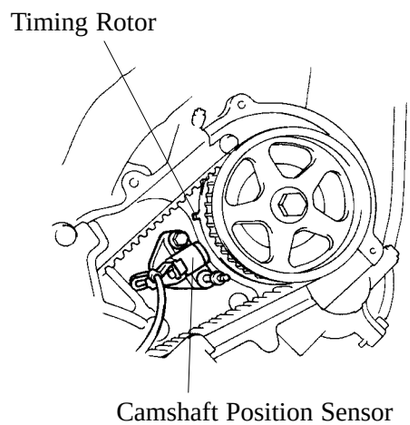
The crankshaft position sensor is mounted on the oil pump body as illustrated below.
The rotor's teeth are spaced 10° apart, according to crankshaft angle, but since there are 2 teeth missing, as illustrated below, there is a total of 34 teeth.
Accordingly, the ECM can detect the crankshaft angle in addition to the crankshaft speed.



151EG18

Camshaft Position Sensor

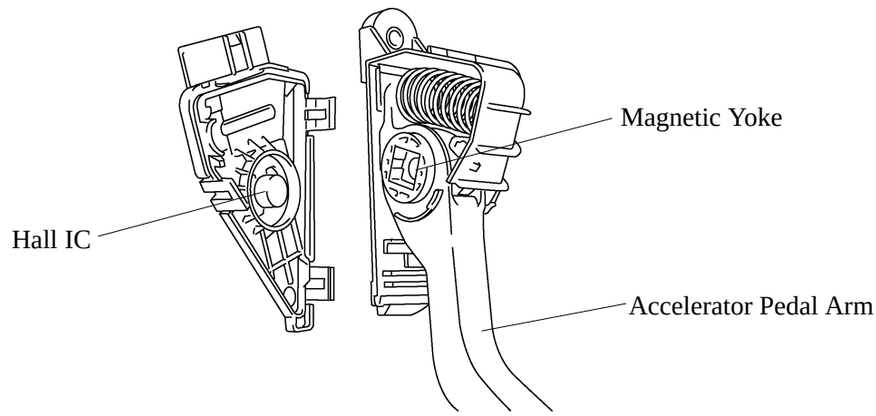
The camshaft position sensor is mounted on the left bank cylinder head. To detect the camshaft position, a protrusion that is provided on the timing pulley is used to generate 1 pulse for every 2 revolutions of the camshaft.



156EG26

Accelerator Pedal Position Sensor

The magnetic yoke that is mounted at the base of the accelerator pedal arm rotates around the Hall IC in accordance with the amount of effort that is applied to the accelerator pedal. The Hall IC converts the changes in the magnetic flux that occur at that time into electrical signals, and outputs them in the form of accelerator pedal position to the ECM.



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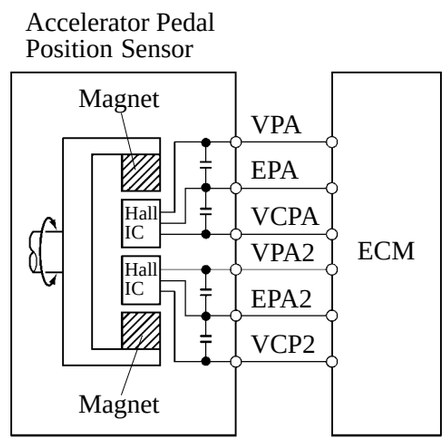
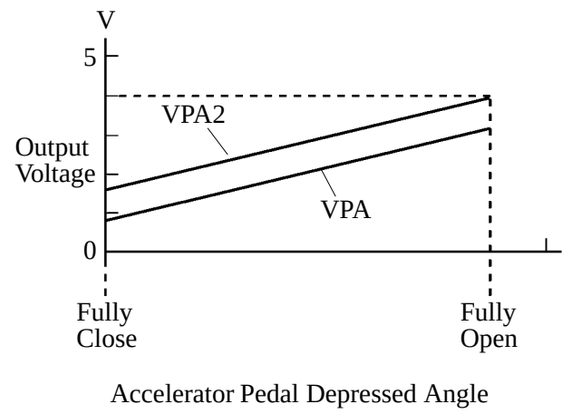


228TU24



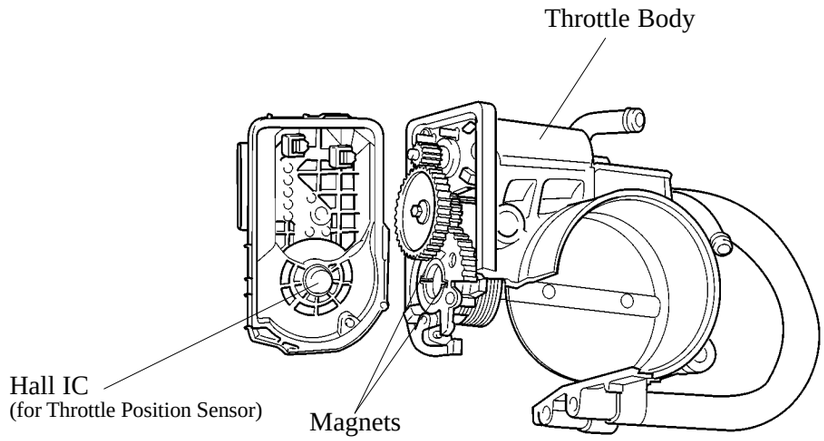
228TU25

Service Tip

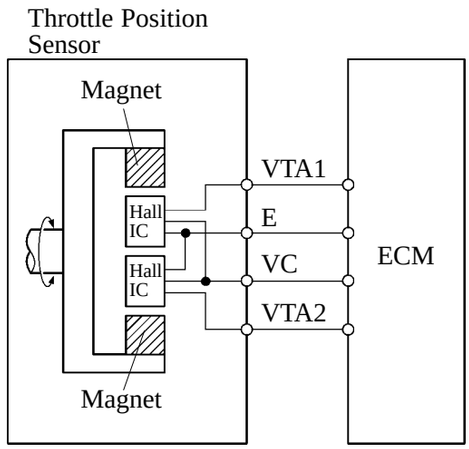
The inspection method differs from the conventional accelerator pedal position sensor because this sensor uses a hall IC. For details, refer to the 2003 4Runner Repair Manual (Pub. No. RM1001U.)

Throttle Position Sensor

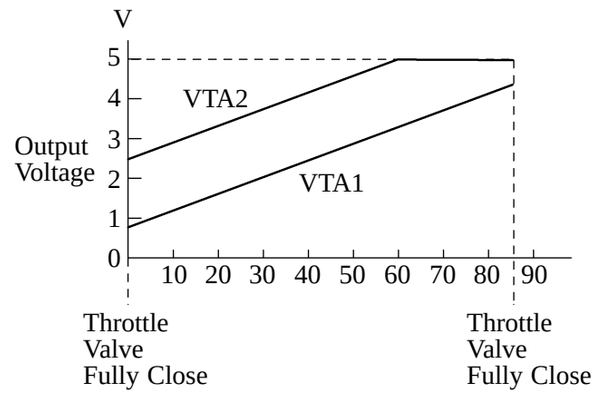
The throttle position sensor is mounted on the throttle body, to detect the opening angle of the throttle valve, the throttle position sensor converts the magnetic flux density that changes when the magnetic yoke (located on the same axis as the throttle shaft) rotates around the Hall IC into electric signals to operate the throttle control motor.



229LC108



230LX12



230LX13

Throttle Valve Opening Angle

Service Tip

The inspection method differs from the conventional throttle position sensor because this sensor uses a Hall IC. For details, refer to the 2003 4Runner Repair Manual (Pub. No. RM1001U.)

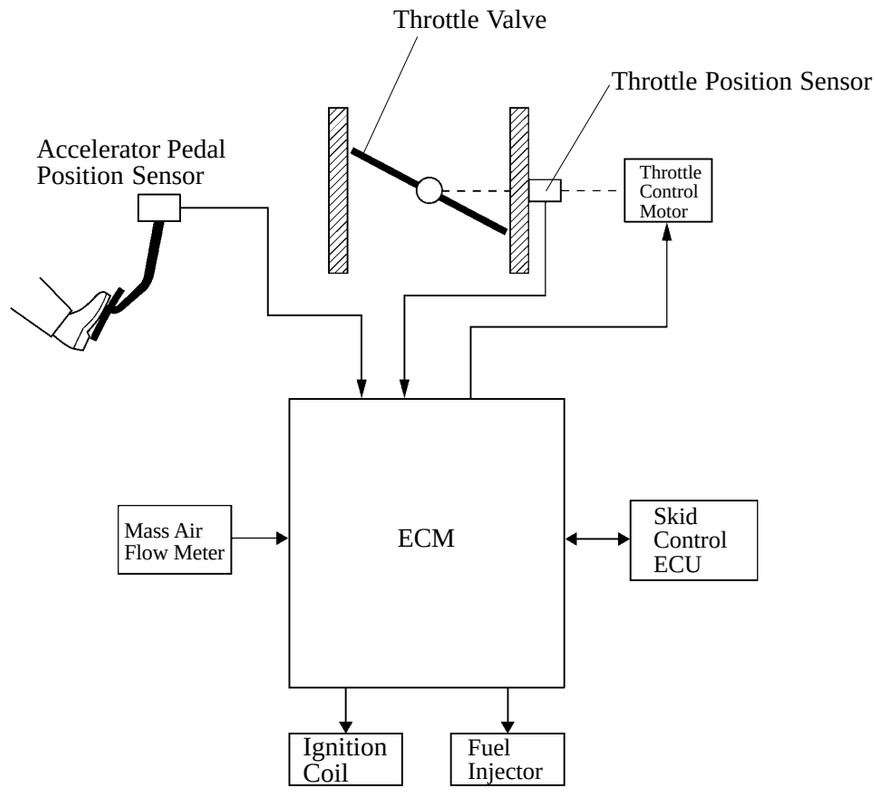
6. ETCS-i (Electronic Throttle Control System-intelligent)

General

- The ETCS-i is used, providing excellent throttle control in all the operating ranges.
  In the new 2UZ-FE engine, the accelerator cable has been discontinued, and an accelerator position sensor has been provided on the accelerator pedal.
- In the conventional throttle body, the throttle valve opening is determined by the amount of the accelerator pedal effort. In contrast, the ETCS-i uses the ECM to calculate the optimal throttle valve opening that is appropriate for the respective driving condition and uses a throttle control motor to control the opening.
- The ETCS-i controls the ISC (Idle Speed Control) system, the cruise control system, the TRAC*1 (Traction Control) / A-TRAC*2 (Active-Traction Control), and the VSC (Vehicle Skid Control) system.
- In case of an abnormal condition, this system transfers to the limp mode. For details, refer to the Fail-Safe section on page EG-51.

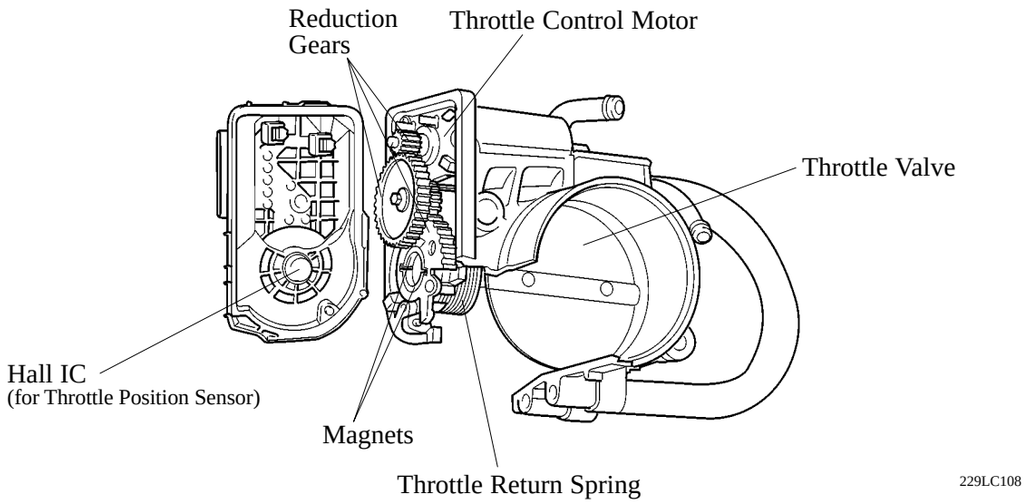
*1: Only for the 2WD model
*2: Only for the 4WD model

▶ System Diagram ◀



208EG44

Construction



1) Throttle Position Sensor

The throttle position sensor is mounted on the throttle body, to detect the opening angle of the throttle valve. For details, refer to Main Components of Engine Control System section on page EG-34.

2) Throttle Control Motor

A DC motor with excellent response and minimal power consumption is used for the throttle control motor. The ECM performs the duty ratio control of the direction and the amperage of the current that flows to the throttle control motor in order to regulate the opening of the throttle valve.

Operation

1) General

The ECM drivers the throttle control motor by determining the target throttle valve opening in accordance with the respective operating condition.

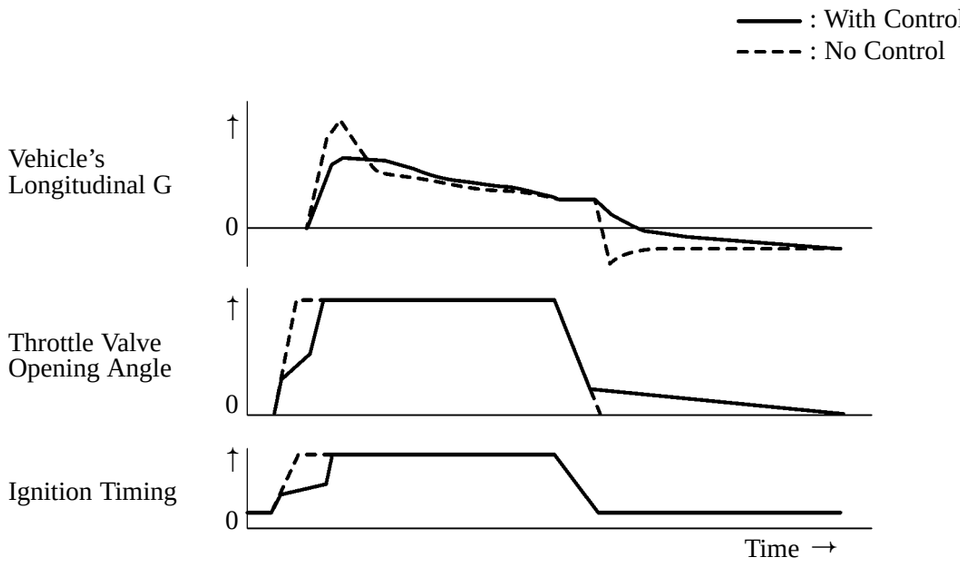
1) Non-Linear Control
2) Idle Speed Control
3) TRAC or A-TRAC* Throttle Control
4) VSC Coordination Control
5) Cruise Control

*: with A-TRAC system (4WD model)

2) Non-Linear Control

Controls the throttle to an optimal throttle valve opening that is appropriate for the driving condition such as the amount of the accelerator pedal effort and the engine speed in order to realize excellent throttle control and comfort in all operating ranges.

▶ Control Examples During Acceleration and Deceleration ◀



150EG37

3) Idle Speed Control

The ECM controls the throttle valve in order to constantly maintain an ideal idle speed.

4) TRAC or A-TRAC* Control

As part of the TRAC or A-TRAC* system, the throttle valve is closed by a demand signal from the skid control ECU if an excessive amount of slippage is created at a driving wheel, thus facilitating the vehicle in ensuring stability and driving force.

* : with A-TRAC system (4WD model)

5) VSC Coordination Control

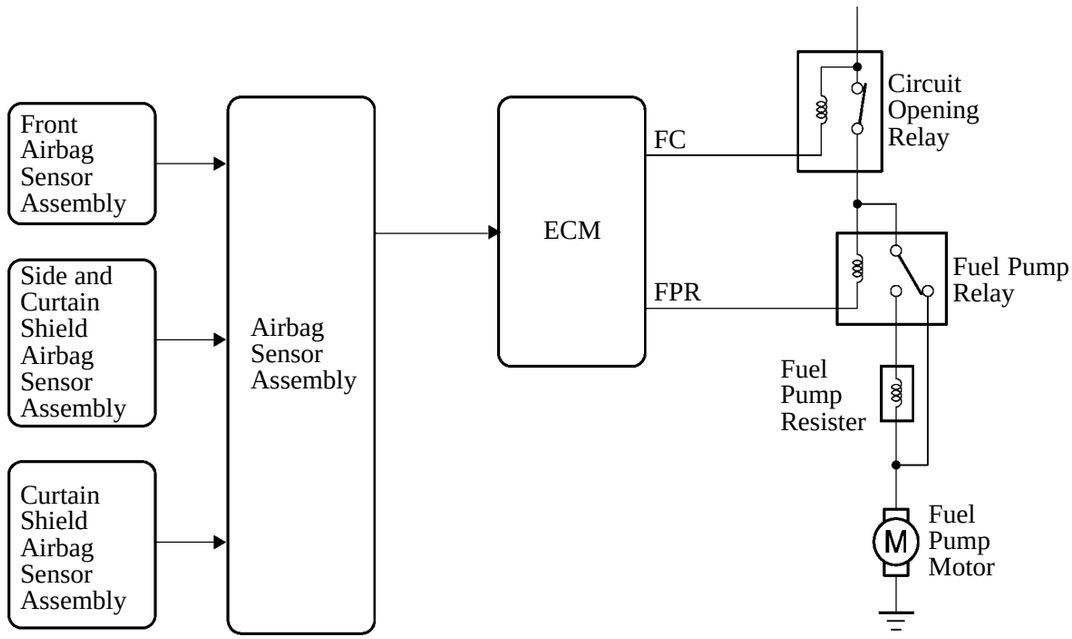
In order to bring the effectiveness of the VSC system control into full play, the throttle valve opening angle is controlled by effecting a coordination control with the skid control ECU.

6) Cruise Control

An ECM with an integrated cruise control ECU directly actuates the throttle valve for operation of the cruise control.

7. Fuel Pump Control

- A fuel pump speed is controlled by the fuel pump relay and the fuel pump resister.
- A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision. In this system, the airbag deployment signal from the airbag sensor assembly is detected by the ECM, which turns OFF the circuit opening relay.
  After the fuel cut control has been activated, turning the ignition switch from OFF to ON cancels the fuel cut control, and the engine can be restarted.



232EG11

8. Evaporative Emission Control System

General

- The construction of the evaporative emission control system has been changed to comply with the LEV-II (Low Emission Vehicle-II) CARB (California Air Resources Board) evaporative emission regulation. Along with this change, the amount of vapor gas that is discharged outside of the vehicle while the vehicle is parked has been reduced considerably. Because of this construction, which is simpler than the previous, the reliability of the system has been improved.
- This system consists primarily of a canister closed valve, purge valve, charcoal canister, vapor pressure sensor, refueling valve, and ECM.
- In this system, the ECM monitors the system for malfunctions and outputs DTCs (Diagnostic Trouble Codes) in the event of a malfunction. The detection method is basically the same as the conventional vacuum type that is used on other models. A vacuum is introduced into the system, and the amount of increase in the internal pressure of the fuel tank is monitored in order to detect any leakage in the system.
- Listed below are the construction differences between this system and the conventional vacuum type:

  1) The air drain valve has been discontinued. The air that has been cleaned through the charcoal canister is discharged through the fresh air line. Accordingly, the fresh air inlet has been moved from the air cleaner to a location near the fuel inlet. Furthermore, the pipe diameter of the fresh air line and the flow rate of the canister closed valve have been increased.

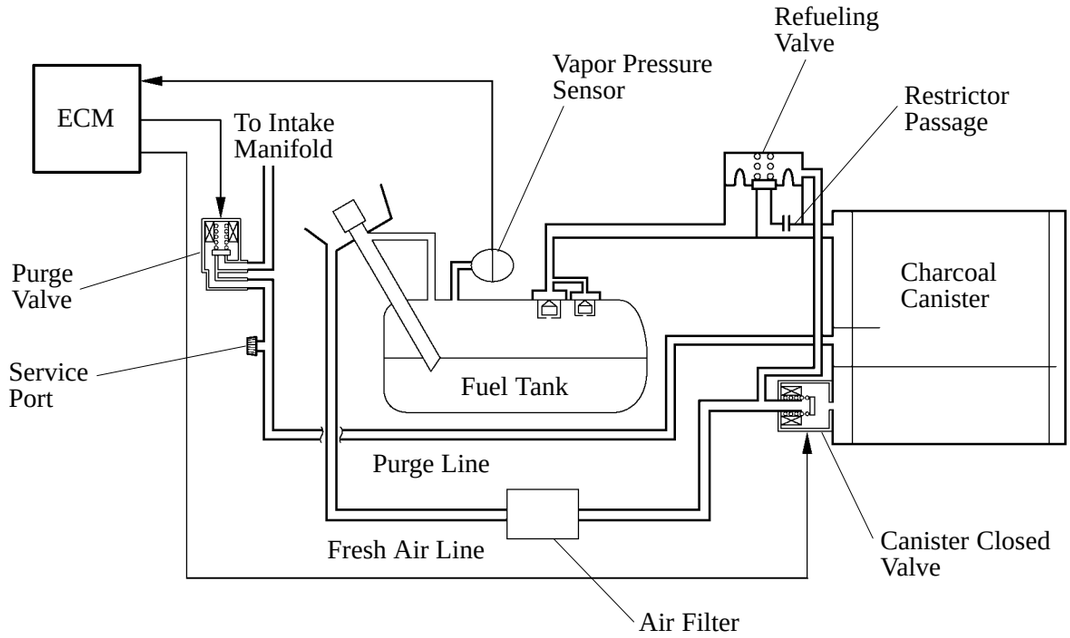
  2) An ORVR (Onboard Refueling Vapor Recovery) function has been provided in the refueling valve.

  3) A restrictor passage has been provided in the refueling valve to prevent the large amount of vacuum during purge operation or system monitoring operation from affecting the pressure in the fuel tank. As a result of this construction, the pressure switching valve has been discontinued.

  4) An air filter* has been added to the fresh air line.

*: The air filter is maintenance-free. If the filter becomes clogged, the ECM will illuminate the MIL (Malfunction Indicator Lamp) and record the DTC number P0446 in its memory.

▶ System Diagram ◀



'03 4Runner

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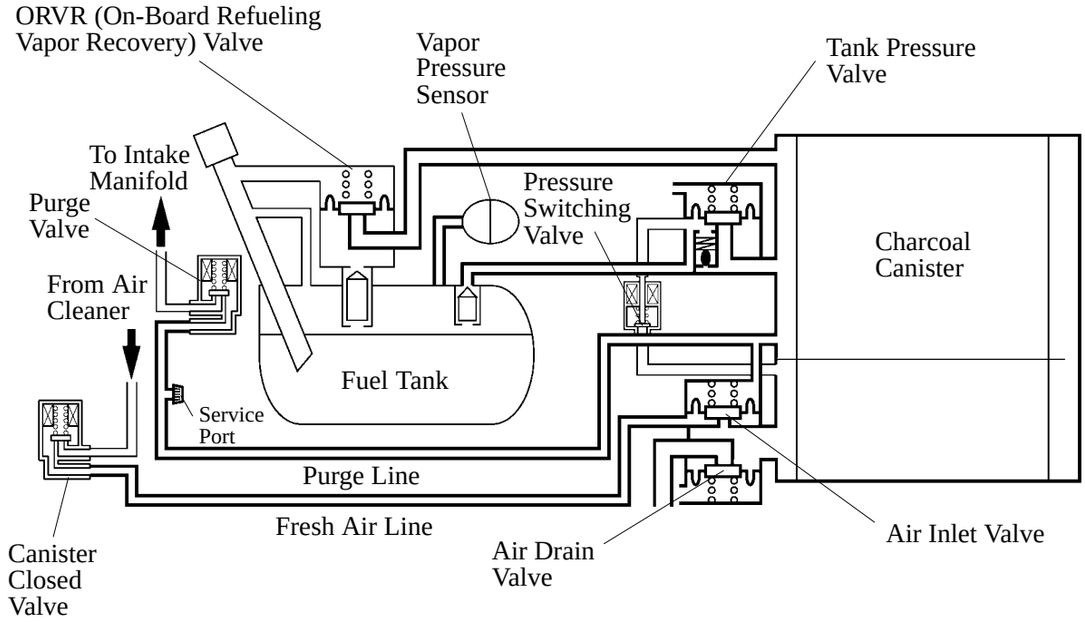
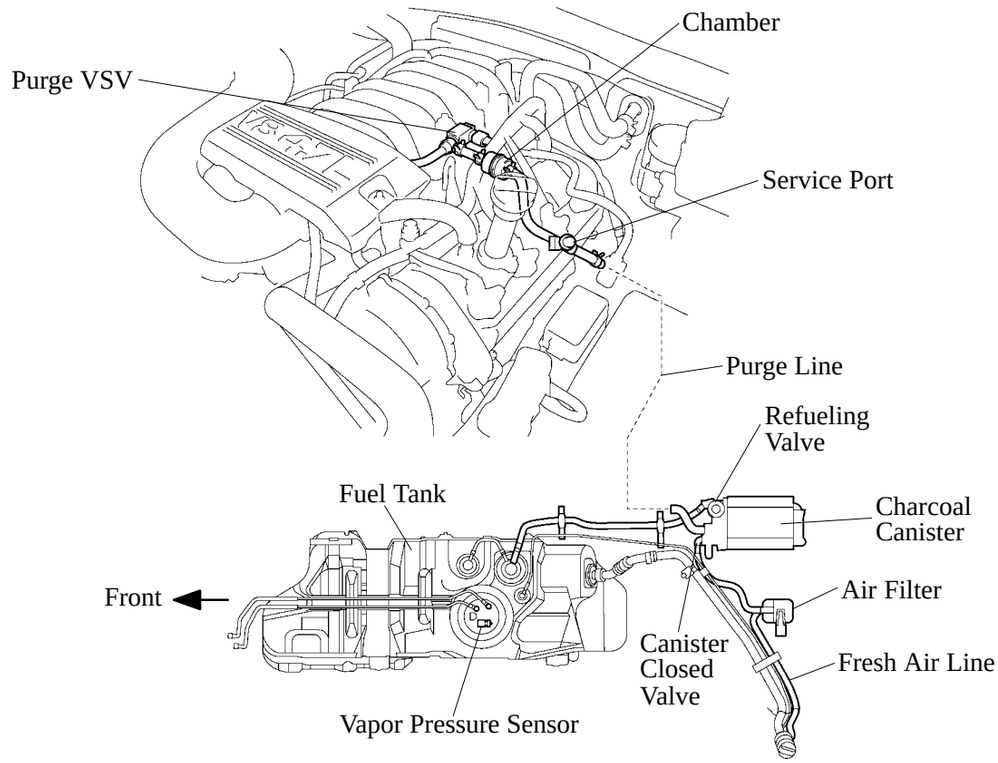


Conventional Vacuum Type

189EG31

Layout of Main Component



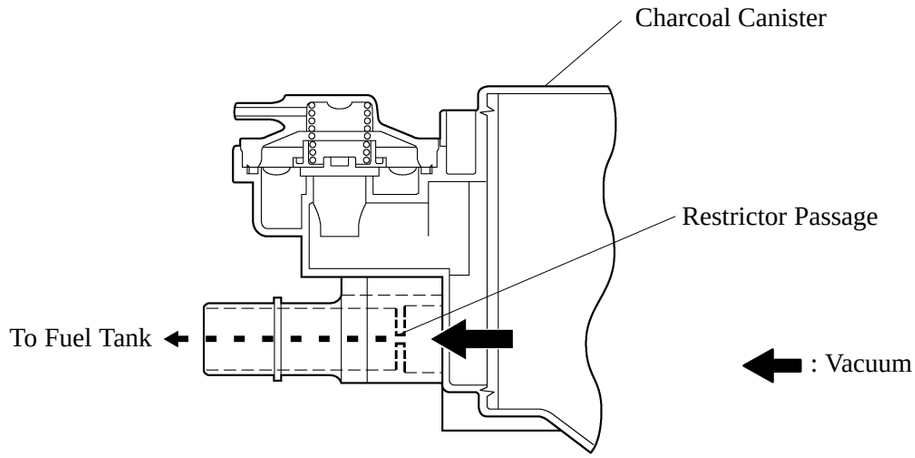
Function of Main Component

Components	Function
Canister Closed Valve	Opens and closes the fresh air line in accordance with the signals from the ECM in order to introduce fresh air and control the pressure relief if the internal pressure in the fuel tank increases.
Purge Valve	Opens in accordance with the signals from the ECM when the system is purging, in order to send the vapor gas that was absorbed by the charcoal canister into the intake manifold. During the system monitoring mode, this valve controls the introduction of the vacuum into the fuel tank.
Charcoal Canister	Contains activated charcoal to absorb the vapor gas that is created in the fuel tank.
Vapor Pressure Sensor	Detects the pressure in the fuel tank and sends the signals to the ECM.
Refueling Valve	Controls the flow rate of the vapor gas from the fuel tank to the charcoal canister when the system is purging or during refueling.
Air Filter	Prevents dust and debris in the fresh air from entering the system.
Service Port	This port is used for connecting a vacuum gauge for inspecting the system.
ECM	Controls the canister closed valve and the purge valve in accordance with the signals from various sensors, in order to achieve a purge volume that suits the driving conditions. In addition, the ECM monitors the system for any leakage and outputs a DTC if a malfunction is found.

Construction and Operation

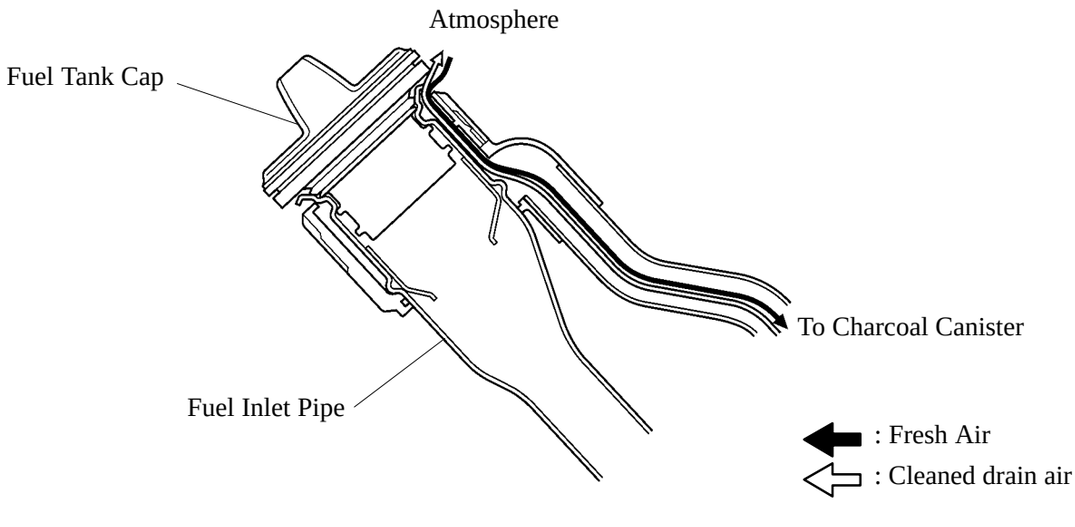
1) Refueling Valve

A restrictor passage has been provided in the tank pressure valve. The restrictor passage prevents the large amount of vacuum that is created during purge operation or system monitoring operation from entering the fuel tank, and limits the flow of the vapor gas from the fuel tank to the charcoal canister. If a large volume of vapor gas recirculates into the intake manifold, it will affect the air-fuel ratio control of the engine. Therefore, the role of the restrictor passage is to prevent this from occurring.



2) Fuel Inlet (Fresh Air Inlet)

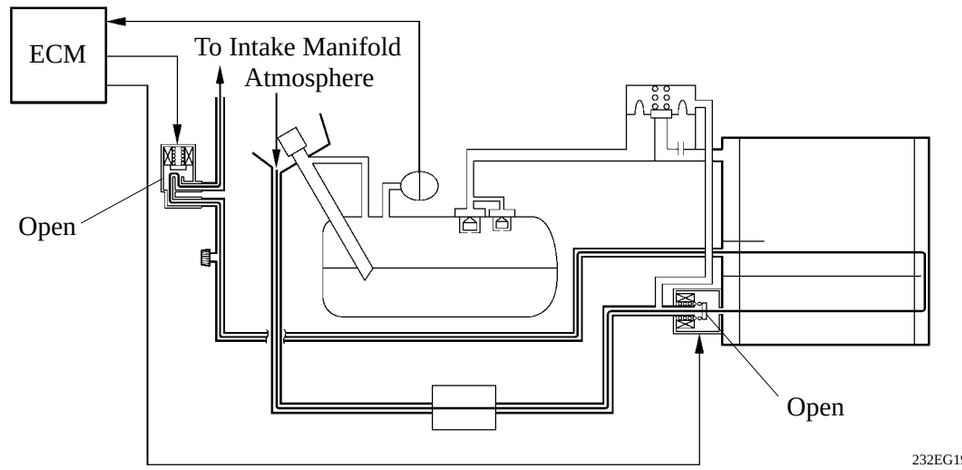
In accordance with the change of structure of the evaporative emission control system, the location of a fresh air line inlet has been changed from the air cleaner section to near the fuel inlet. The fresh air from the atmosphere and drain air cleaned by the charcoal canister will go in and out to the system through the passage shown below.



System Operation

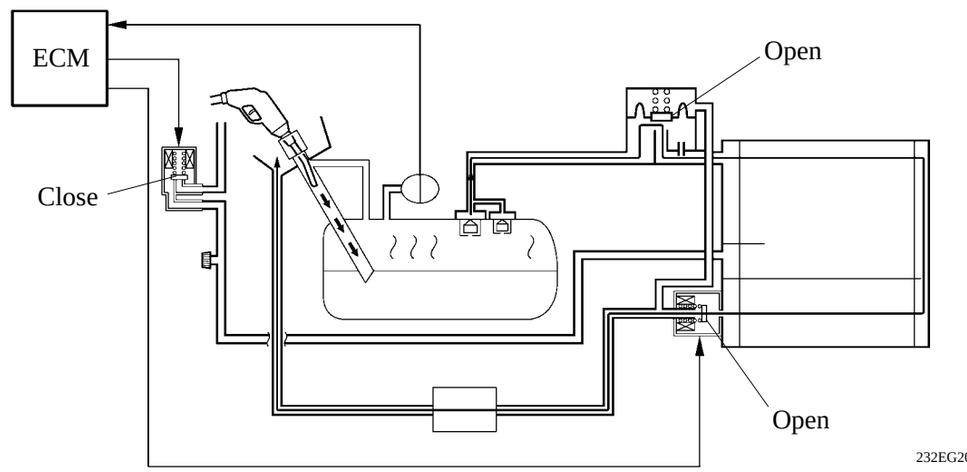
1) Purge Flow Control

When the engine has reached predetermined parameters (closed loop, engine coolant temp. above 75°C (167°F) , etc), stored fuel vapors are purged from the charcoal canister whenever the purge valve is opened by the ECM.
The ECM will change the duty ratio cycle of the purge valve thus controlling purge flow volume. Purge flow volume is determined by intake manifold pressure and the duty ratio cycle of the purge valve.
Atmospheric pressure is allowed into the charcoal canister to ensure that purge flow is constantly maintained whenever purge vacuum is applied to the charcoal canister.



2) ORVR (On-Board Refueling Vapor Recovery)

When the internal pressure of the fuel tank increases during refueling, this pressure causes the diaphragm in the refueling valve to lift up, allowing the fuel vapors to enter the charcoal canister. Because the canister closed valve is always open (even when the engine is stopped) when the system is in a mode other than the monitoring mode, the air that has been cleaned through the charcoal canister is discharged outside of the vehicle via the fresh air line. If the vehicle is refueled during the system monitoring mode, the ECM will recognize the refueling by way of the vapor pressure sensor, which detects the sudden pressure increase in the fuel tank, and will open the canister closed valve.

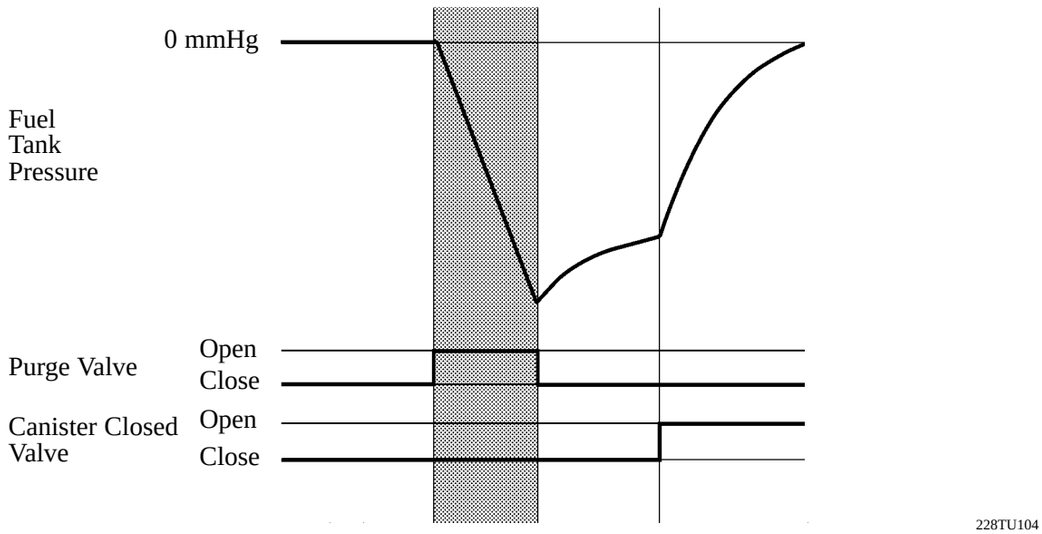


3) System Monitoring

When the initial conditions {low engine temperature (low engine coolant temperature and, engine coolant temperature and intake air temperature being nearly the same) at the engine starting, constant vehicle speed (including idling), and so on.} are met, the ECM introduces a vacuum into the system and monitors the amount of pressure increase in the fuel tank in order to determine if there is any leakage in the system. At the same time, the ECM determines if there is any malfunction in the canister closed valve and the purge valve.

a. Step1

The ECM opens the purge valve and introduces a vacuum into the fuel tank.



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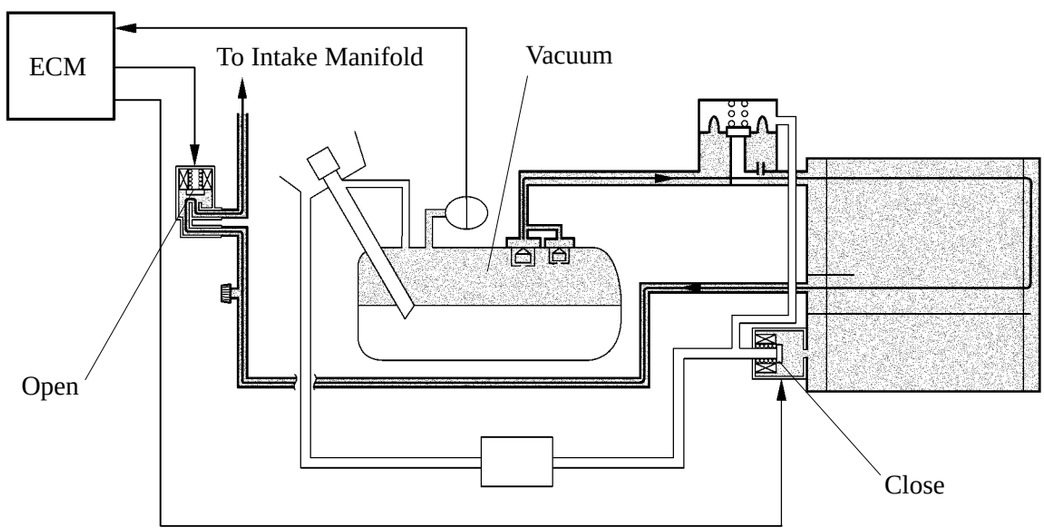
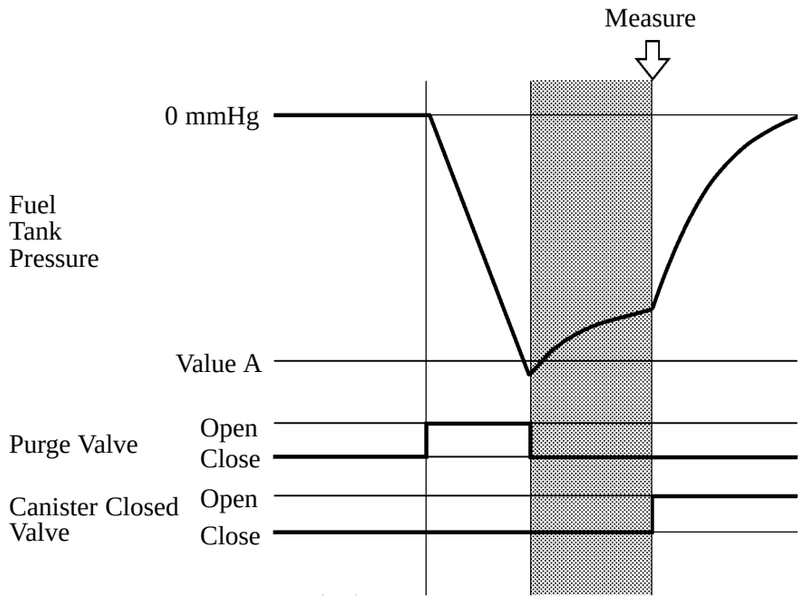


232EG21

b. Step2

When the pressure in the fuel tank decreases below value A, the ECM closes the purge valve again. The ECM measures the amount of pressure increase in the tank.



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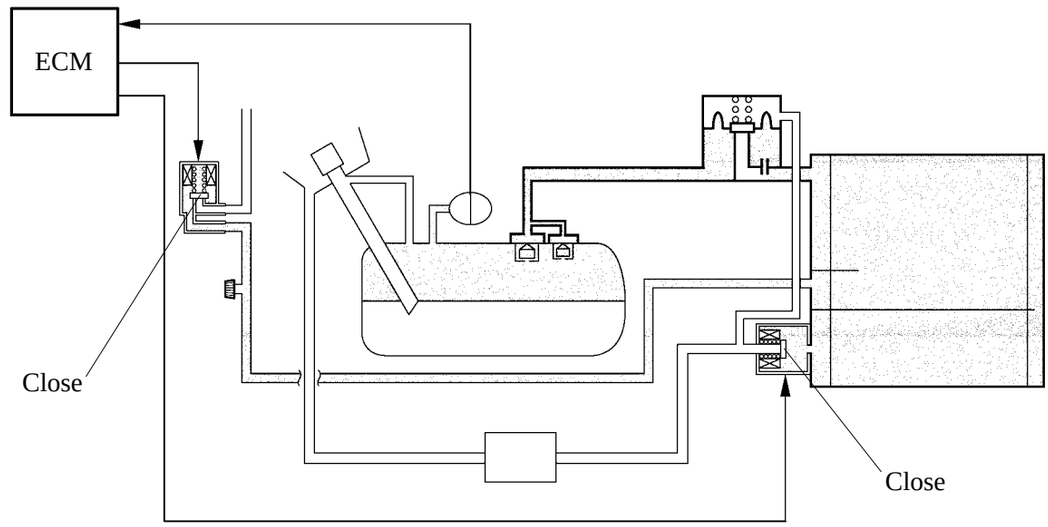
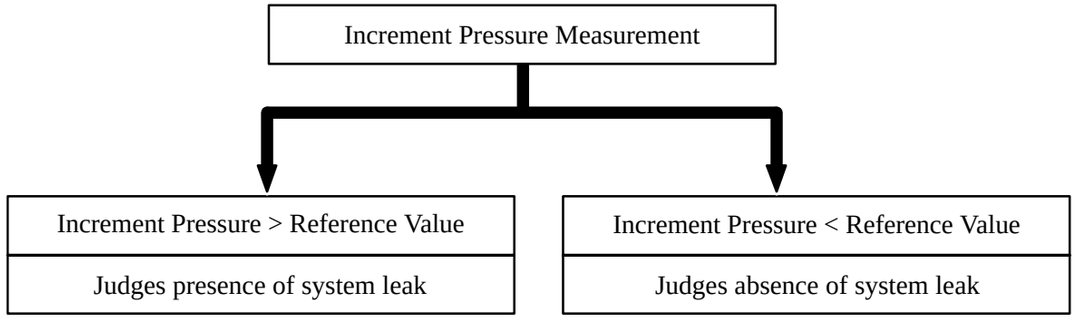


232EG22

c. System Leak Judgment

The ECM determines whether there is a leakage in the system by the increment amount of fuel tank pressure at Step2 in the previous page. If the increment amount of the fuel tank pressure is greater than the reference value, the ECM judges that there is a system leak.



- If the ECM judges that there is no system leak, it ends the system monitoring mode and transfers to the normal system control. (Both the purge valve and canister closed valve are opened.)
- If the ECM determines that there is a system leak, it illuminates the MIL and stores the following DTCs in its memory:

Level of Leak	DTC
Small or medium leak	P0442
Large leak	P0441, P0442 and P0446

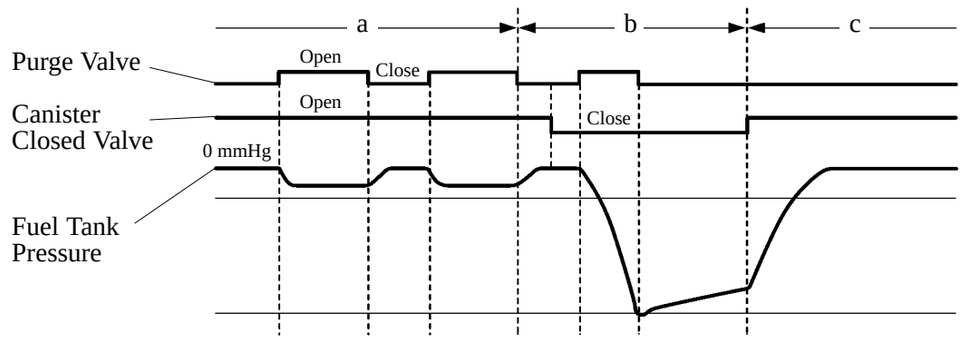
d. VSV (Vacuum Switching Valve) Monitoring

i) Normal Condition

a. During purging, the ECM opens the purge valve, and this creates a slight vacuum in the fuel tank.

b. During the system monitoring mode, the ECM opens the purge valve and closes the canister closed valve to introduce a vacuum into the fuel tank.

c. After the ECM has performed a system leak judgment, it opens the canister closed valve to introduce fresh air into the system. As a result, the atmospheric pressure is reinstated rapidly in the fuel tank.



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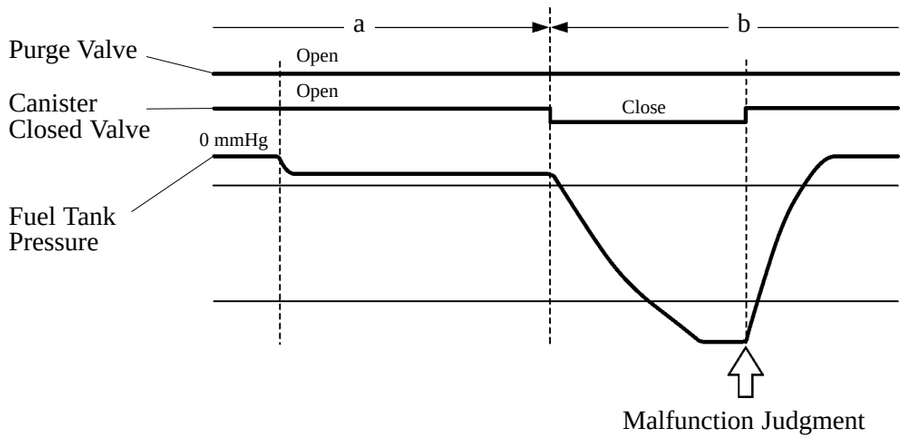
ii) Purge Valve Open Malfunction

a. The fuel tank remains in a constant, slight vacuum state regardless of whether the ECM sends an open or close signal to the purge valve.

b. The pressure in the fuel tank drops rapidly regardless of the close signal that the ECM is sending to the purge valve.

When the ECM detects an open malfunction of the purge valve, it illuminates the MIL and stores the DTC number P0441 in its memory.

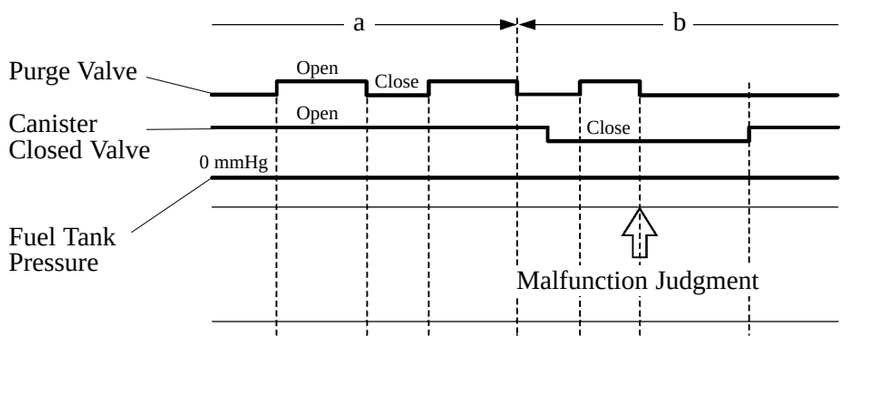


iii) Purge Valve Close Malfunction

a. The pressure in the fuel tank does not change regardless of whether the ECM sends an open or close signal to the purge valve.

b. Even if the ECM closes the canister closed valve in order to transfer to the system monitoring mode, no vacuum is introduced into the fuel tank.

When the ECM detects a close malfunction of the purge valve, it illuminates the MIL and stores the DTC numbers P0441, P0442, and P0446 in its memory.

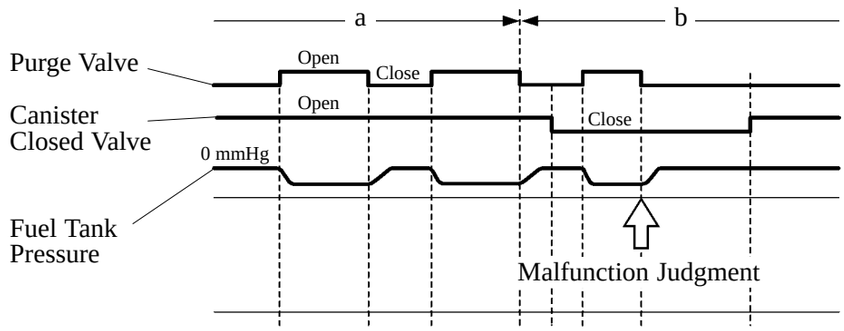


iv) Canister Closed Valve Open Malfunction

a. As the ECM opens the purge valve, a slight vacuum is created in the fuel tank.

b. Even if the ECM sends a close signal to the canister closed valve in order to transfer to the system monitoring mode, it is not possible to completely introduce a vacuum into the fuel tank.

When the ECM detects an open malfunction of the canister close valve, it illuminates the MIL and stores the DTC numbers P0441, P0442, and P0446 in its memory.



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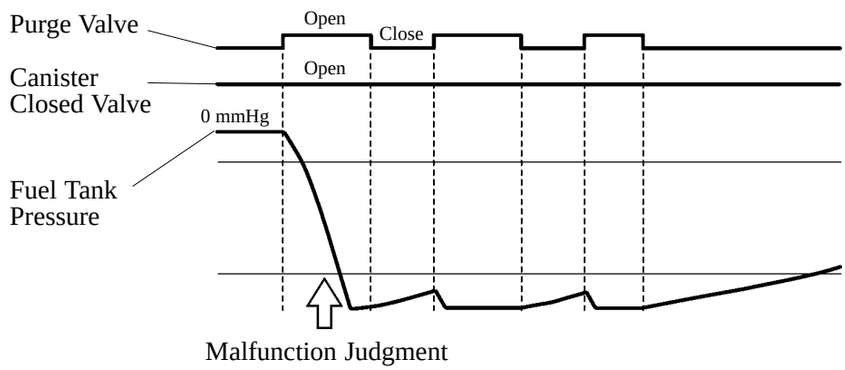
v) Canister Closed Valve Close Malfunction

During purging, a large amount of vacuum is introduced into the fuel tank regardless of the open signal that the ECM sends to the canister closed valve. Even if the purge valve closes, the atmospheric pressure is not reinstated in the fuel tank.

When the ECM detects a close malfunction of the canister close valve, it illuminates the MIL and stores the DTC number P0446 in its memory.



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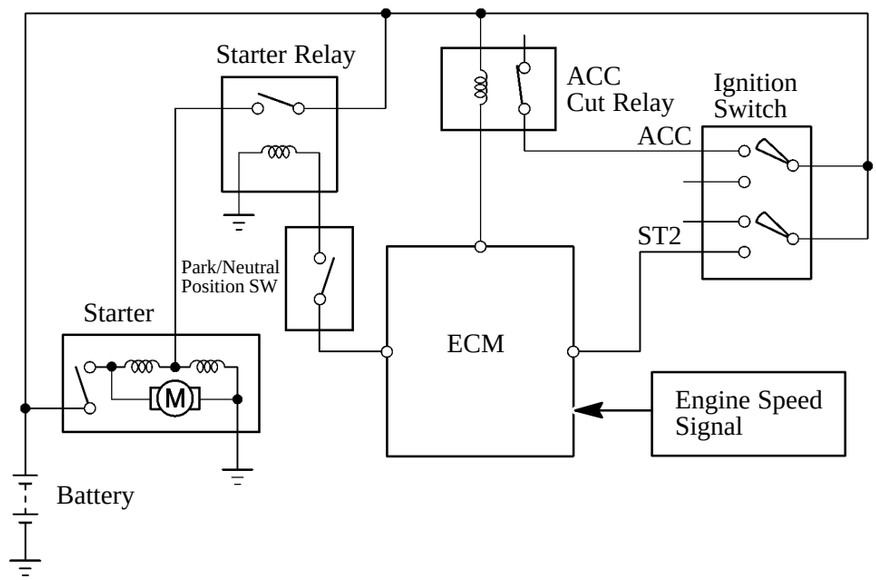
9. Cranking Hold Function

General

- The ’03 4Runner has adopted cranking hold function. Once the ignition switch is turned to the START position, this control continues to operate the starter until the engine starts, without having to hold the ignition switch in the START position. This prevents starting failures and the engine from being cranked after it has started.
- When the ECM detects a start signal from the ignition switch, this system monitors the engine speed (NE) signal and continues to operate the starter until it has determined that the engine has started. Furthermore, even if the ECM detects a start signal from the ignition switch, it will not operate the starter if it has determined that the engine has already started.

▶ System Diagram ◀



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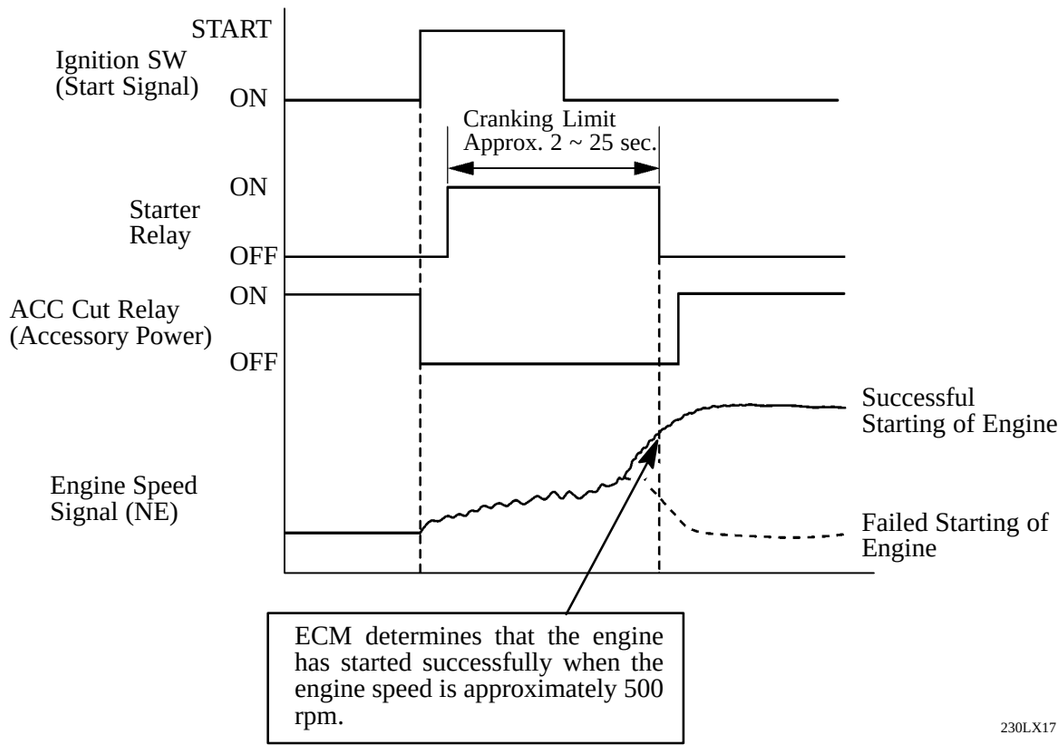
Operation

- As indicated in the timing chart shown below, when the ECM detects a start signal from the ignition switch, it energizes the starter relay to operate the starter. If the engine is already running, the ECM will not energize the starter relay.
- After the starter operates and the engine speed becomes higher than approximately 500 rpm, the ECM determines that the engine has started and stops the operation of the starter.
- If the engine has any failure and will not work, the starter operates as long as its maximum continuous operation time and stops automatically. The maximum continuous operation time is approximately 2 seconds through 25 seconds depending on the engine coolant temperature condition. When the engine coolant temperature is extremely low, it is approximately 25 seconds and when the engine is warmed up sufficiently, it is approximately 2 seconds.
- This system cuts off the current that powers the accessories while the engine is cranking to prevent the accessory illumination from operating intermittently due to the unstable voltage that is associated with the cranking of the engine.

▶ Timing Chart ◀



10. Diagnosis

- When the ECM detects a malfunction, the ECM makes a diagnosis and memorizes the failed section. Furthermore, the MIL (Malfunction Indicator Lamp) in the combination meter illuminates or blinks to inform the driver.
- The ECM will also store the DTCs of the malfunctions.
- The DTCs can be accessed the use of the hand-held tester.
- To comply with the OBD-II regulations, all the DTCs (Diagnostic Trouble Codes) have been made to correspond to the SAE controlled codes. Some of the DTCs have been further divided into smaller detection areas than in the past, and new DTCs have been assigned to them.
  For details, refer to the 2003 4Runner Repair Manual (Pub. No. RM1001U).

Service Tip

To clear the DTC that is stored in the ECM, use a hand-held tester or disconnect the battery terminal or remove the EFI fuse for 1 minute or longer.

11. Fail-Safe

General

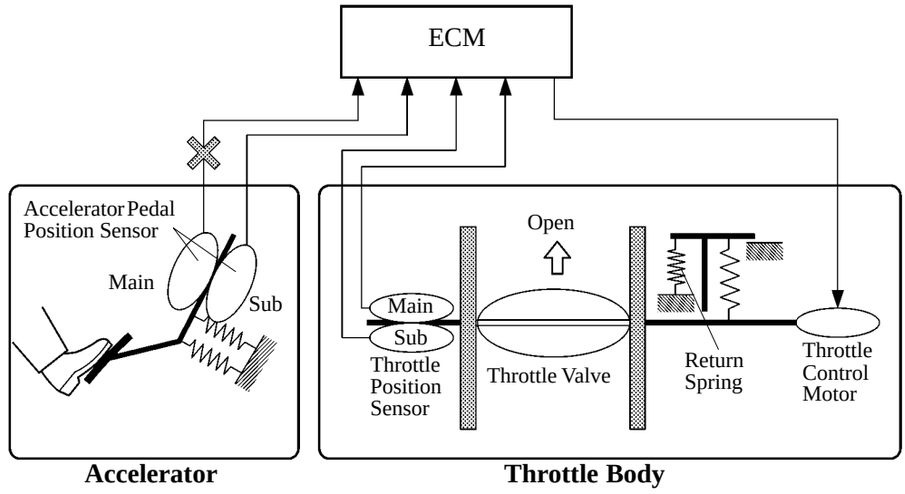
When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.

▶ Fail-Safe Control List ◀

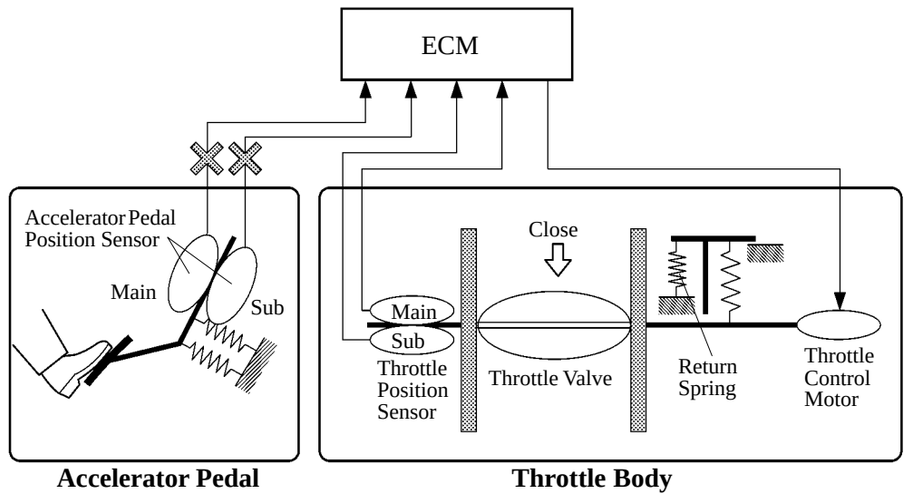
Location on Malfunction	Description Control
Mass Air Flow Meter	In case of a signal malfunction, the engine could operate poorly or the catalyst could overheat if the engine continues to be controlled with the signals from the sensors. Therefore, the ECM effects control by using the values in the ECM or stops the engine.
Accelerator Pedal Position Sensor (See page EG-52)	In case of a signal malfunction, the ECM calculates the accelerator pedal opening angle that is limited by the dual system sensor value and continues effecting throttle valve control. If both system malfunction, the ECM considers that the accelerator pedal is fully closed.
Throttle Position Sensor (See page EG-53)	In case of a signal malfunction, the ECM cuts off the current to the throttle control motor. The throttle valve returns to the prescribed opening by the force of the return spring. The ECM then adjusts the engine output by controlling the fuel injection and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue driving.
Engine Coolant Temp. Sensor and Intake Air Temp. Sensor	In case of a signal malfunction, the use of the values from the sensors will make the air-fuel ratio become too rich or too lean, which could causes the engine to stall or to run poorly during cold operation. Therefore, the ECM fixes the air-fuel ratio to the stoichiometric ratio and uses the constant values of 80°C engine coolant temperature and 20°C intake air temperature to perform the calculation.
Knock Sensor	In case of a malfunction in the knock sensor or in the knocking signal system (open or short circuit), the engine could become damaged if the timing is advanced despite the presence of knocking. Therefore, if a malfunction is detected in the knock sensor system, the ECM turns the timing retard correction of the knock sensor into the maximum retard value.
Ignition Coil (with Igniter)	In case of a malfunction in the ignition system, such as an open circuit in the ignition coil, the catalyst could be become overheated due to engine misfire. Therefore, if the (IGF) ignition signal is not input twice or more in a row, the ECM determines that a malfunction occurred in the ignition system and stops only the injection of fuel into the cylinder with the malfunction.

Fail-Safe of Accelerator Pedal Position Sensor

- The accelerator pedal position sensor comprises two (main, sub) sensor circuits. If a malfunction occurs in either one of the sensor circuits, the ECM detects the abnormal signal voltage difference between these two sensor circuit and switches to the limp mode. In the limp mode, the remaining circuit is used to calculate the accelerator pedal opening, in order to operate the vehicle under limp mode control.



- If both systems malfunction, the ECM detects the abnormal signal voltage between these two sensor circuits and regards that the opening angle of the accelerator pedal is fully opened and then continues the throttle control. At this time, the vehicle can be driven within its idling range.



Fail-Safe of Throttle Position Sensor

- The throttle position sensor comprises two (main, sub) sensor circuits. If a malfunction occurs in either one of the sensor circuits, the ECM detects the abnormal signal voltage difference between these two sensor circuits, cuts off the current to the throttle control motor, and switches to the limp mode. Then, the force of the return spring causes the throttle valve to return and stay at the prescribed opening. At this time, the vehicle can be driven in the limp mode while the engine output is regulated through the control of the fuel injection and ignition timing in accordance with the accelerator opening.
- The same control as above is effected if the ECM detects a malfunction in the throttle control motor system.