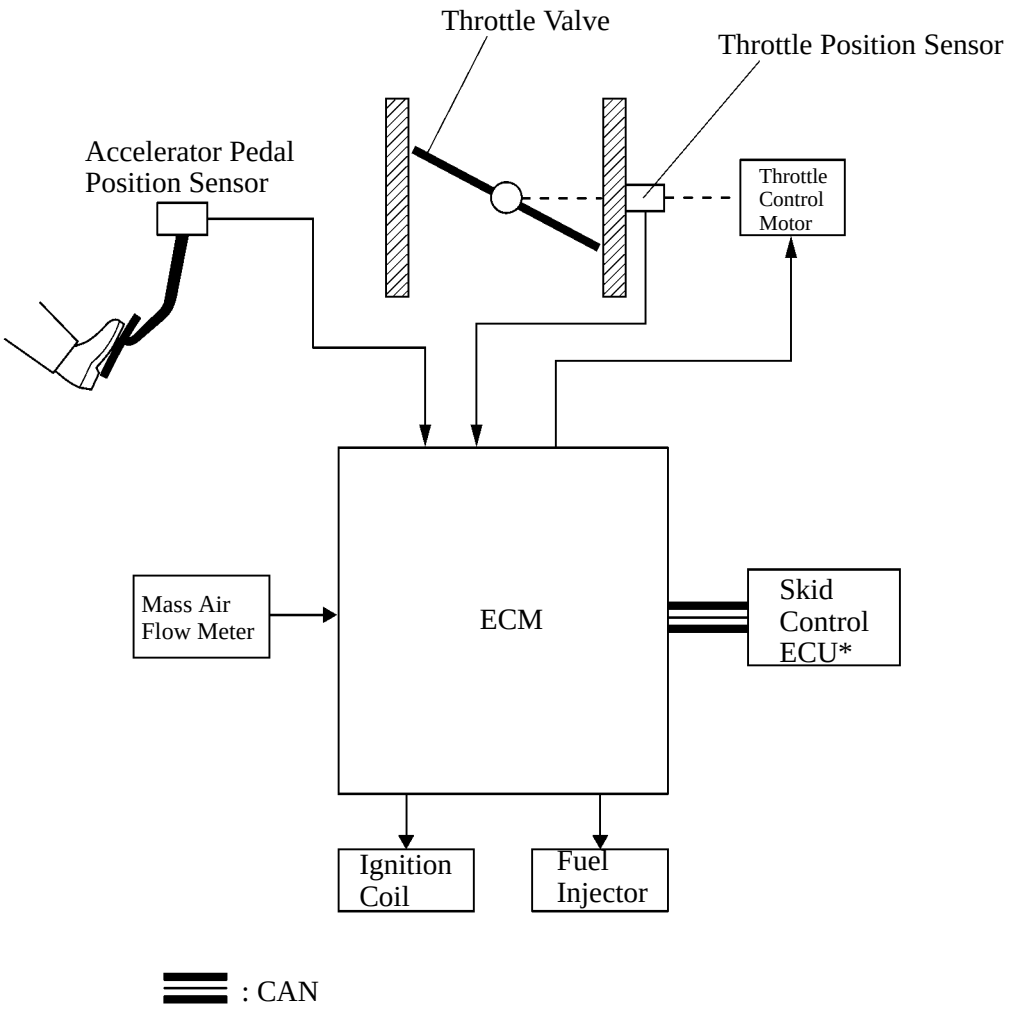
6. ETCS-i (Electronic Throttle Control System-i)

General

- The ETCS-i is used, providing excellent throttle control in all the operating ranges.
- The accelerator cable has been discontinued, and an accelerator pedal position sensor has been provided on the accelerator pedal.
- In the conventional throttle body, the throttle valve opening is determined invariably 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 IAC (Idle Air Control) system and cruise control system.
- In case of an abnormal condition, this system switches to the limp mode.

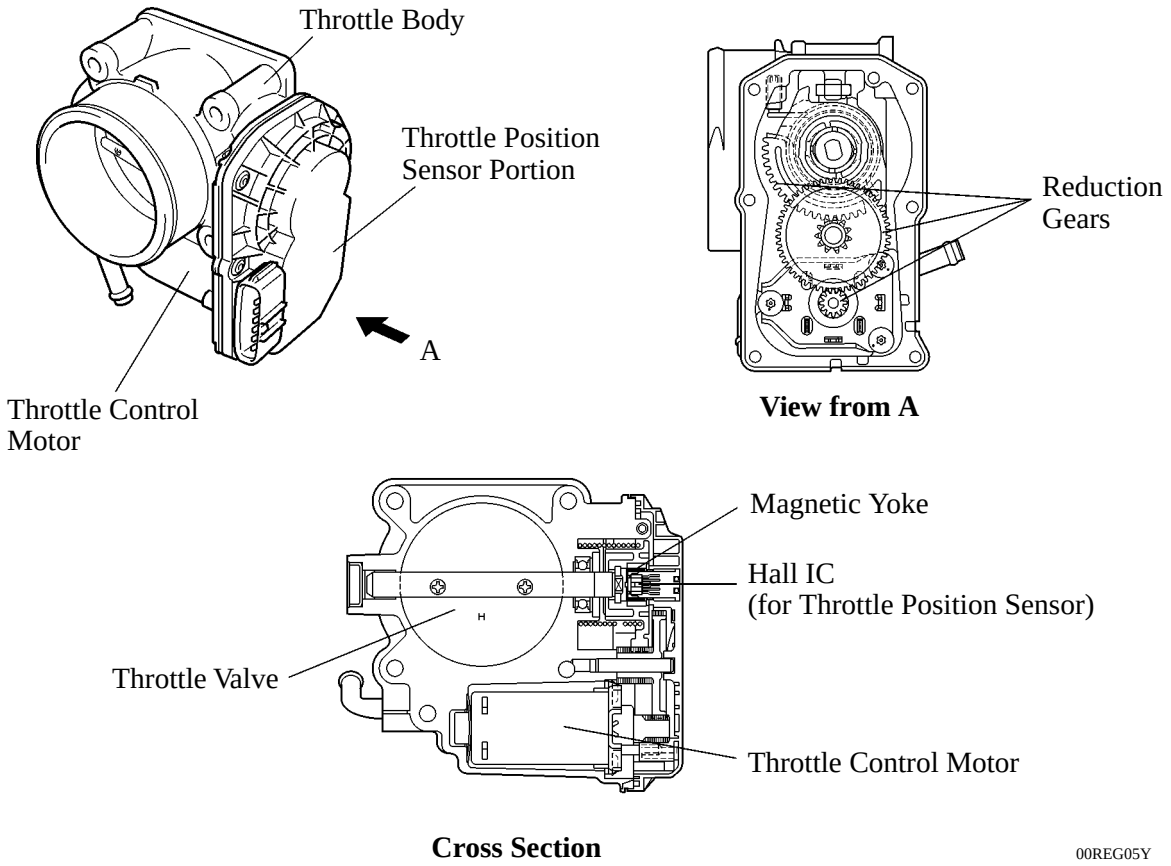
▶ System Diagram ◀



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*: for ABS Models

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

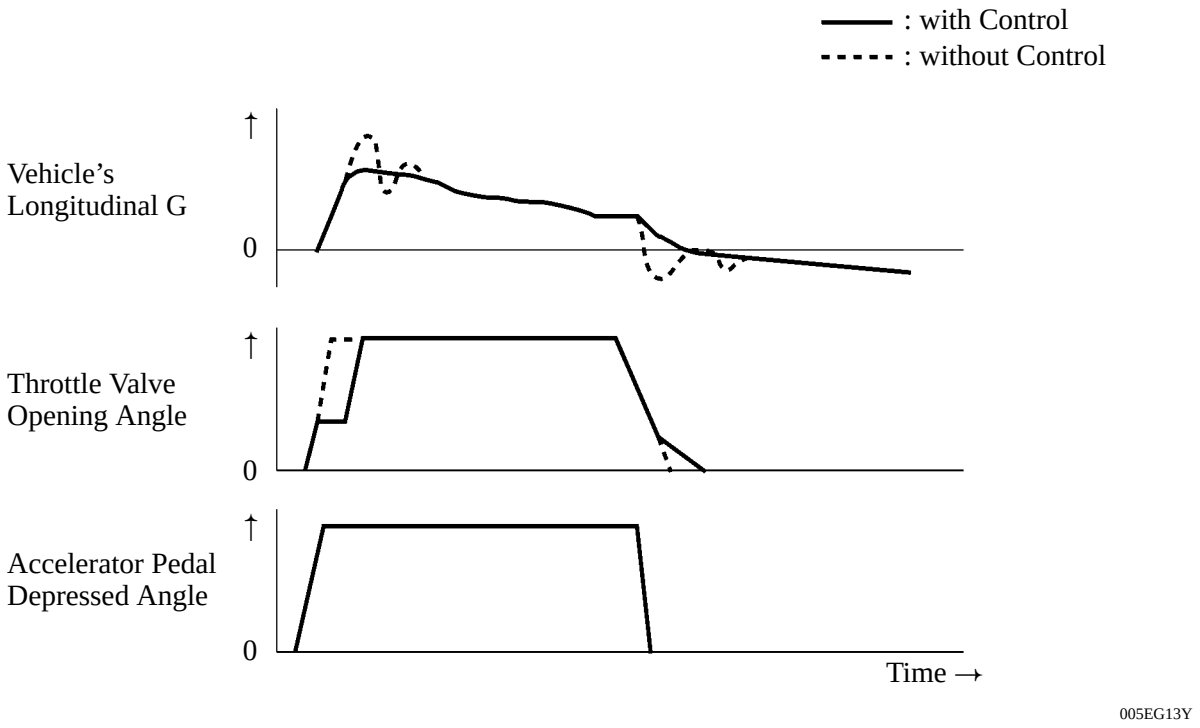
The ECM drives the throttle control motor by determining the target throttle valve opening in accordance with the respective operating condition.

- Non-Linear Control
- Idle Air Control

2) Non-Linear Control

It 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 ◀



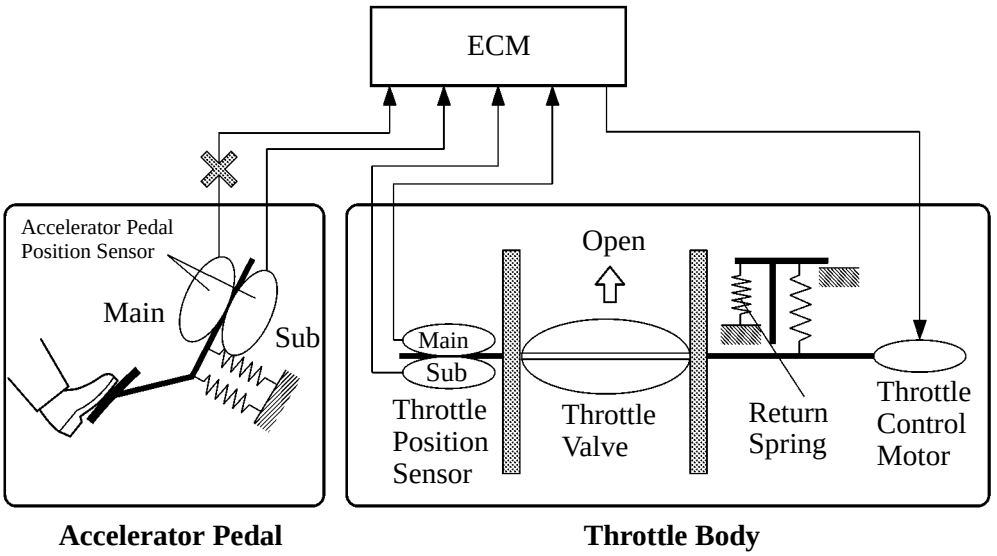
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3) Idle Air Control

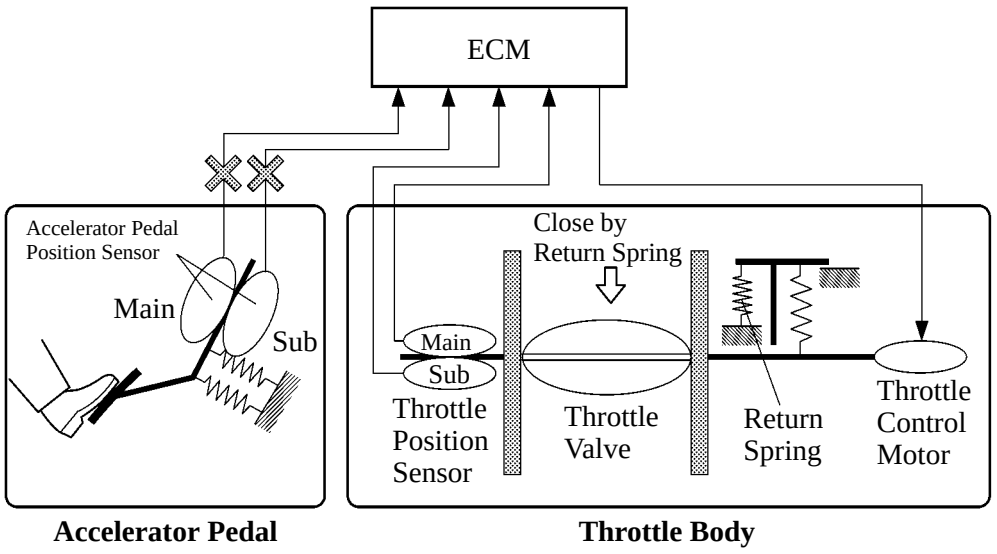
The ECM controls the throttle valve in order to constantly maintain an ideal idle speed.

Fail-Safe of Accelerator Pedal Position Sensor

- The accelerator pedal position sensor is comprised of 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 and switches to the limp mode. In the limp mode, the remaining circuit is used to calculate the accelerator pedal depressed angle, in order to operate the vehicle under limp mode control.



- If both circuits have malfunctions, the ECM detects the abnormal signal voltage from these two sensor circuits and discontinues 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 is comprised of two (main, sub) sensor circuits. If a malfunction occurs in either one or both 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 angle. 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 (intermittent fuel-cut) 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.

