

CRUISE CONTROL SYSTEM

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1. Cruise Control

A: OPERATION

- The cruise control system automatically controls the vehicle speed. It allows the vehicle to run at a constant speed without need for the driver to keep the accelerator pedal depressed.
- The cruise control system is controlled by the engine control module (ECM).
- When the driver has activated the system and made a desired speed setting, the engine control module (ECM) compares the actual vehicle speed detected by the speed sensor with the preset speed in the engine control module (ECM) memory, and then generates a signal according to the difference between the two speeds.

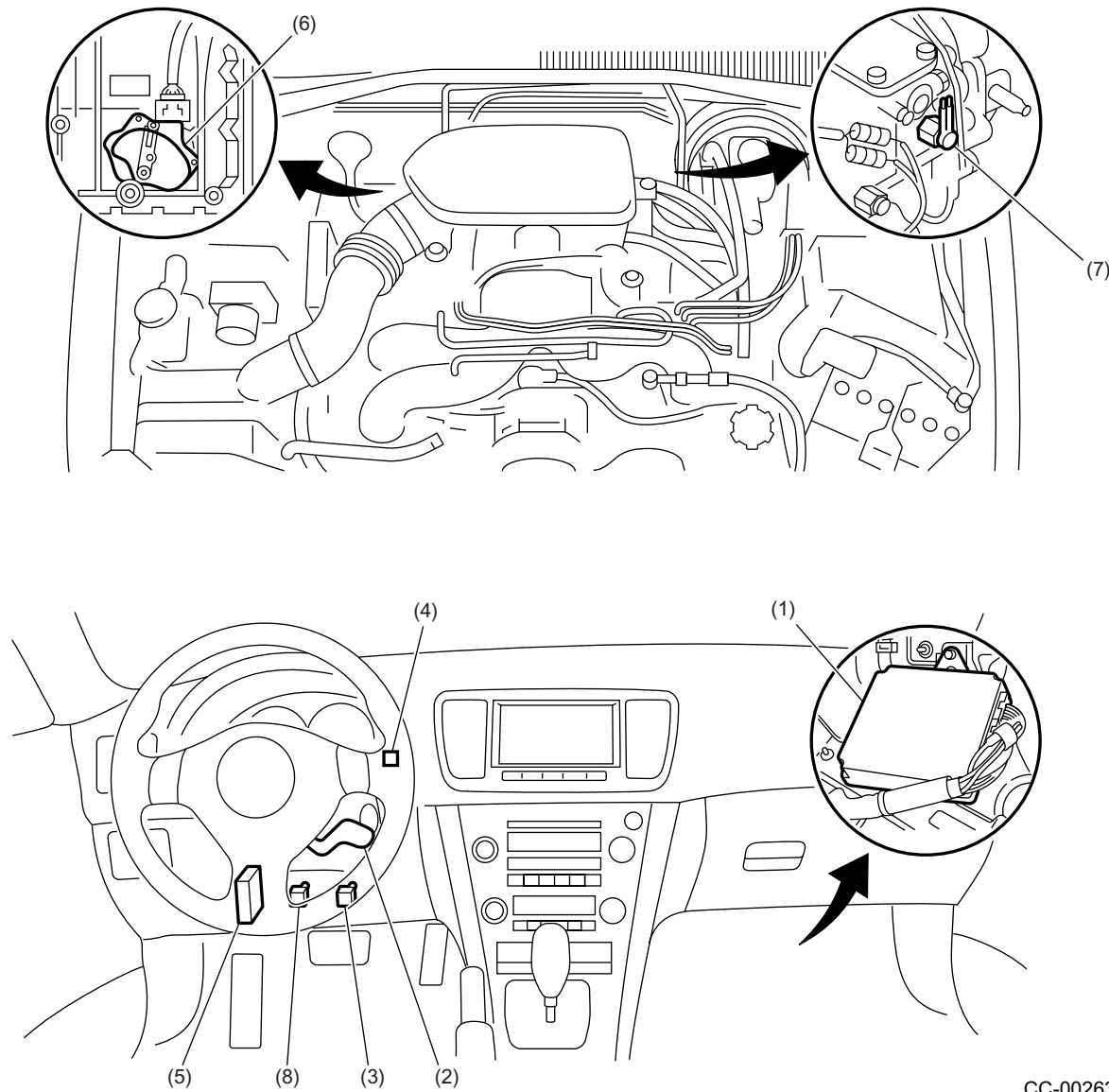
This signal is transmitted to the electronic control throttle.

The electronic control throttle operates the throttle valve as necessary to keep the preset vehicle speed.

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B: LOCATION OF COMPONENTS



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- (1) Engine control module (ECM)
- (2) Cruise control command switch (with built-in MAIN switch)
- (3) Stop light and brake switch
- (4) Cruise indicator light and cruise set indicator light
- (5) Transmission control module (TCM) (AT)
- (6) Inhibitor switch (AT)
- (7) Neutral position switch (MT)
- (8) Clutch switch (MT)

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C: CONTROL AND OPERATION

Vehicle speed control	When the actual vehicle speed is higher than the set speed, the throttle valve of the electronic control throttle moves in the closing direction by the amount corresponding to the difference between the two speeds. When the actual vehicle speed is lower than the set speed, the throttle valve of the electronic control throttle moves in the opening direction by the amount corresponding to the difference between the two speeds.
Speed set function (SET function)	When the SET/COAST switch is pressed while the vehicle is running at a speed greater than 40 km/h (25 MPH) and the MAIN switch is ON, the cruise control is set at the current vehicle speed (this speed becomes the "memorized speed") and the vehicle maintains this speed thereafter.
Resume control function (RESUME function)	When the RESUME/ACCEL switch is turned ON after the cruise control is temporarily cancelled, the vehicle speed returns to the memorized speed, which was stored just before the cruise control was cancelled. This occurs only when the vehicle is running at a speed greater than 32 km/h (20 MPH). In the following cases, however, the memorized speed is cleared. (1) Ignition switch is turned OFF (2) MAIN switch is turned OFF (3) Abnormality in the system is detected
Deceleration control function (1) (COASTING function)	When the SET/COAST switch is pressed for a prolonged time while the vehicle is governed by the cruise control, the memorized vehicle speed of the cruise control is changed to the vehicle speed value reached at the moment the switch is released after slowing down. However, the cruise control is cancelled when the vehicle speed becomes lower than the lower limit of the speed setting range.
Deceleration control function (2) (TAP DOWN function)	When the SET/COAST switch is pressed for a short time while the vehicle is governed by the cruise control, the cruise control subtracts a certain amount from the memorized speed to obtain a new value. However, when the actual vehicle speed largely differs from the memorized speed, the actual speed becomes the new memorized speed of the cruise control.
Acceleration control function (1) (ACCELERATING function)	When the RESUME/ACCEL switch is pressed for a prolonged time while the vehicle is governed by the cruise control, the memorized speed of the cruise control is changed to the vehicle speed value reached at the moment the switch is released after accelerating. However, when the vehicle speed is higher than the upper limit of the speed setting range, the upper limit becomes the memorized speed of the cruise control.
Acceleration control function (2) (TAP UP function)	When the RESUME/ACCEL switch is pressed for a short time while the vehicle is governed by the cruise control, the cruise control adds a certain amount to the memorized speed to obtain a new value. However, when the actual vehicle speed largely differs from the memorized speed, the cruise control maintains the former memorized speed.
Cruise control cancel function	When any of the following conditions is met, the cruise control is cancelled. (1) Stop light switch ON (brake pedal depressed) (2) Brake switch OFF (brake pedal depressed) (3) Clutch switch ON (clutch pedal depressed) (4) Neutral switch ON (shift lever moved to neutral) (5) CANCEL switch ON (command switch pulled) (6) Ignition switch OFF (7) MAIN switch OFF (8) Transmission gear in 1st or reverse (9) Actual vehicle speed drops below 32 km/h (20 MPH) (10) Abnormality in the system is detected

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MEMO

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The diagram illustrates a control system with the following components and connections:

- (1)**: A switch and a motor, connected to a power source.
- (2)**: A battery or power source, connected to the system.
- (3)** and **(4)**: Two solenoid coils, connected to the power source.
- (5)**: A relay or switch, connected to the solenoids.
- (6)**: An output signal or control line, connected to the relay.
- (7)** and **(8)**: Mechanical components, possibly actuators or sensors, connected to the system.
- (9)** and **(10)**: Two rectangular blocks, connected by a bidirectional arrow labeled **(11)**.
- (12)**: A control line, connected from block **(10)** to block **(16)**.
- (13)**: Two output signals or control lines, connected from block **(16)**.
- (14)** and **(15)**: A control line, connected from block **(15)** to block **(16)**.
- (16)**: A large rectangular block, the central control unit, connected to various components.
- (17)** and **(18)**: Control lines, connected from block **(16)** to block **(19)**.
- (19)**: A mechanical component, possibly a valve or actuator, connected to the control lines.
- (20)**: A ground connection, connected to block **(16)**.
- (21)** and **(22)**: A control line, connected from block **(21)** to block **(16)**.
- (23)** and **(24)**: Two switches, connected to the power source and ground.
- (25)** and **(26)**: Mechanical components, possibly actuators or sensors, connected to the system.

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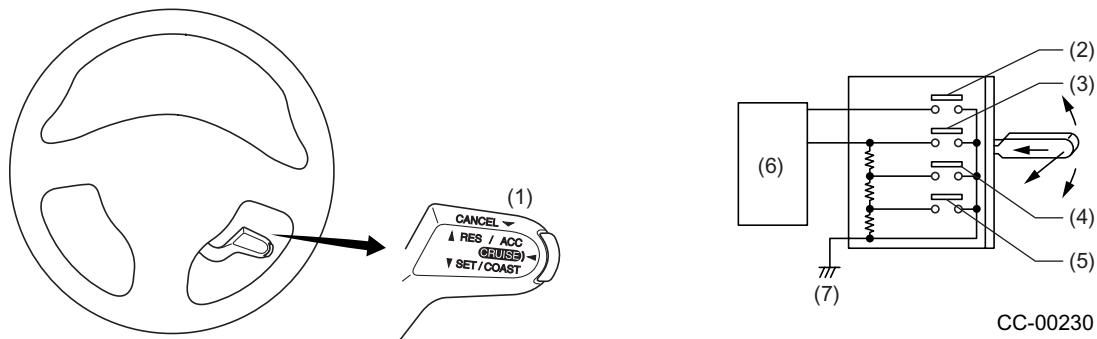
- | | |
|--------------------------------------|--|
| (1) Battery | (14) Vehicle speed signal |
| (2) Ignition switch | (15) ABS control module/vehicle dynamic control (VDC) control module |
| (3) Cruise indicator light | (16) Engine control module (ECM) |
| (4) Cruise set indicator light | (17) MAIN switch signal |
| (5) Main relay | (18) RESUME/ACCEL switch signal
CANCEL switch signal
SET/COAST switch signal |
| (6) Starter | (19) Cruise control command switch |
| (7) Stop light and brake switch | (20) Ground |
| (8) Brake pedal | (21) AT control module (5AT) |
| (9) Combination meter microprocessor | (22) Neutral signal |
| (10) Body integrated unit | (23) Inhibitor switch (4AT) |
| (11) Low speed CAN communication | (24) Neutral position switch (MT) |
| (12) High speed CAN communication | (25) Clutch switch (MT) |
| (13) Electronic control throttle | (26) Clutch pedal (MT) |

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E: COMMAND SWITCH (CRUISE CONTROL LEVER)

- When the vehicle is driven with the cruise control activated, the command switch controls its operation. It inputs MAIN signal, SET/COAST signal, RESUME/ ACCEL signal or CANCEL signal to the engine control module (ECM).
- When the cruise control MAIN switch is turned ON, the cruise indicator light in the combination meter illuminates. Also, when the cruise control is set, the cruise set indicator light in the combination meter illuminates.



(1) Command switch

(2) MAIN

(3) CANCEL

(4) SET/COAST

(5) RESUME/ACCEL

(6) Engine control module (ECM)

(7) Ground

- The command switch is located on the right side of the steering wheel, so the driver can operate it without releasing hands from the steering wheel.
- The command switch is a self-returning lever type.

1. MAIN SWITCH

When the switch is pushed once the cruise control system turns ON and becomes ready to set the cruise control. When the switch is pushed again the cruise control turns OFF.

2. CANCEL, RESUME/ACCEL AND SET/COAST SWITCH

Each switch contact is held closed as long as the lever is kept pressed in the relevant direction (except the CANCEL switch which should be pulled), and resulting current is applied as a signal to the engine control module (ECM).

F: CANCEL SIGNAL

A cancel signal deactivates the cruise control function. Operating any of the following switches results in generation of a cancel signal. On receiving a signal, the engine control module (ECM) cancels the cruise control function.

- Stop light switch
- Brake switch
- Clutch switch (MT)
- Inhibitor switch (AT)
- Neutral position switch (MT)
- MAIN switch (OFF operation)
- Command switch (CANCEL position)
- Ignition switch (OFF operation)

G: VEHICLE SPEED SIGNAL

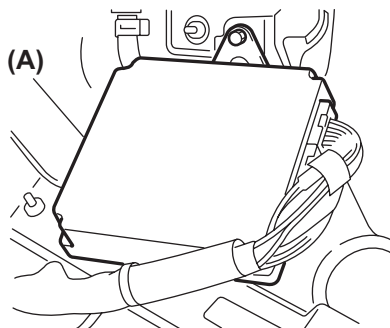
Vehicle speed signals are sent from the ABS control module or vehicle dynamic control (VDC) control module to the engine control module (ECM), which uses the signals in controlling the cruise control function.

H: ENGINE CONTROL MODULE (ECM)

- Based on signals from the related switches and sensors, the engine control module (ECM) controls all the following control functions:

Constant speed control; speed setting control; deceleration control; acceleration control; resume control; manual cancel control; low speed limit control; electronic control throttle control

- The engine control module (ECM) (A) is located at the legroom of the front passenger's seat.



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I: FAIL-SAFE FUNCTION

The cruise control system has a fail-safe function that cancels the cruise control operation when any of the following conditions occurs.

1. CONFLICT BETWEEN CRUISE CONTROL SWITCHES AND CANCELLATION SIGNAL GENERATING SWITCHES

- The cruise control system is deactivated if any of the cruise control switches (SET/COAST, RESUME/ACCEL, and CANCEL switches) is turned ON while any of the cancellation signal generating switches (brake, stop light, clutch, neutral position and inhibitor switches) is activated. The system is re-activated when the cruise control switch is turned OFF and then turn ON again after the cancellation signal generating switch has been returned to its released position.
- When the ignition switch is turned ON while any of the command switches is in the ON position, the cruise control system is deactivated. The system deactivating function is retained until the ignition switch is turned OFF.

2. ABNORMALITIES IN ELECTRIC CIRCUITS

The cruise control system is deactivated and the set speed is also canceled if any of the following abnormalities occurs in the system electric circuits. The system deactivation function is retained until the ignition switch is turned OFF.

- Abnormality of the command switch is detected.
- Abnormality of the stop light switch and brake switch is detected.
- Abnormality of the inhibitor switch is detected. (AT)
- Abnormality of the neutral position switch is detected. (MT)
- Abnormality of the ignition switch is detected.
- Change in vehicle speed signal is detected.
- Abnormality in any of the engine related sensors is detected.
- Abnormality of the brake switch input circuit in the engine control module (ECM) is detected.
- The MAIN switch and command switch were already ON when the ignition switch is turned ON.

3. CRUISE CONTROL CANCEL FUNCTION

When any of the following conditions is met, the cruise control is cancelled.

To set the cruise control again, the vehicle speed must be returned to within the speed setting range and necessary conditions must be met.

- Abnormal engine speed acceleration is detected.
- The vehicle speed has dropped below the lower control limit during cruise control driving.
- The vehicle has been running at speed higher than the set speed for an abnormally long time during cruise controlled driving.
- The set speed became impossible to be maintained for some reason (steep upgrade, hand brake operation, abnormal engine power drop, etc.).