

MAJOR TECHNICAL SPECIFICATIONS

Item		Area		U.S.A.	
Body Type				Sedan	
Vehicle Grade				—	
Model Code				GSV40L-BETGKA	
Major Dimensions & Vehicle Weights	Overall	Length	mm (in.)	4855 (191.1)	5
		Width	mm (in.)	1820 (71.7)	
		Height	mm (in.)	1450 (57.1)	
	Wheel Base		mm (in.)	2775 (109.3)	
	Tread	Front	mm (in.)	1575 (62.0)	
		Rear	mm (in.)	1565 (61.6)	10
	Effective Head Room	Front	mm (in.)	950 (37.4), 960 (37.8)* ²	
		Rear	mm (in.)	935 (36.8), 940 (37.0)* ²	
	Effective Leg Room	Front	mm (in.)	1071 (42.2)	
		Rear	mm (in.)	911 (35.9)	
	Shoulder Room	Front	mm (in.)	1455 (57.3)	15
		Rear	mm (in.)	1430 (56.3)	
	Overhang	Front	mm (in.)	970 (38.2)	
		Rear	mm (in.)	1110 (43.7)	
	Min. Running Ground Clearance		mm (in.)	140 (5.5)	
	Angle of Approach		degrees	13.0	20
	Angle of Departure		degrees	14.2	
	Curb Weight	Front	kg (lb)	994 (2191)	
		Rear	kg (lb)	630 (1389)	
		Total	kg (lb)	1624 (3580)	
Performance	Gross Vehicle Weight (GVWR)	Front	kg (lb)	1123 (2476)	25
		Rear	kg (lb)	999 (2203)	
		Total	kg (lb)	2122 (4679)	
	Fuel Tank Capacity		ℓ (US.gal., Imp.gal)	70 (18.5, 15.5)	
	Luggage Capacity (SAE)		m ³ (cu.ft.)	0.418 (14.76)	
	Max. Speed		km / h (mph)	220 (137)	30
	Max. Cruising Speed		km / h (mph)	184 (114)	
	Acceleration	0 to 60 mph	sec.	6.8	
		0 to 400 m	sec.	15.0	
	Max. Permissible Speed	1st Gear	km / h (mph)	60 (37)	35
		2nd Gear	km / h (mph)	104 (64)	
		3rd Gear	km / h (mph)	140 (87)	
		4th Gear	km / h (mph)	199 (123)	
		5th Gear	km / h (mph)	—	
	Turning Diameter (Outside Front)	Wall to Wall	m (ft.)	11.8 (38.7)	40
		Curb to Curb	m (ft.)	11.2 (36.7)	
Engine	Engine Type		2GR-FE		
	Valve Mechanism		24-valve, DOHC with Dual VVT-i		
	Bore x Stroke		mm (in.) 94.0 x 83.0 (3.70 x 3.27)		
	Displacement		cm ³ (cu.in.) 3456 (210.9)		
	Compression Ratio		10.8 : 1		45
	Carburetor Type		SFI		
	Octane Rating		91 or more		
	Max. Output (SAE-NET)		kW / rpm (HP@rpm) 203 / 6200 (272@6200)		
	Max. Torque (SAE-NET)		N·m / rpm (ft-lbf@rpm) 344 / 4700 (254@4700)		
Engine Electrical	Battery Capacity (5HR)		Voltage & Amp. hr.		50
	Alternator Output		Watts		1200
	Starter Output		kW		1.7
Chassis	Clutch Type		—		
	Transmission Type		U660E		
	Gear Ratio	In First	3.300		55
		In Second	1.900		
		In Third	1.420		
		In Fourth	1.000		
		In Fifth	0.713		60
		In Sixth	0.608		
		In Reverse	4.148		
	Differential Gear Ratio*		3.685		
	Brake Type	Front	Ventilated Disc		
		Rear	Solid Disc		
	Parking Brake Type		Duo-servo		65
	Brake Booster Type and Size		Single, 10"		
	Proportioning Valve Type		—		
	Suspension Type	Front	MacPherson Strut		
		Rear	MacPherson Strut		
	Stabilizer Bar	Front	Standard		70
		Rear	Standard		
	Steering Gear Type		Rack & Pinion		
	Power Steering Type		Hydraulic Type		

*1: Counter gear ratio included

*2: Models with panorama moonroof

■ PERFORMANCE AND SPECIFICATION

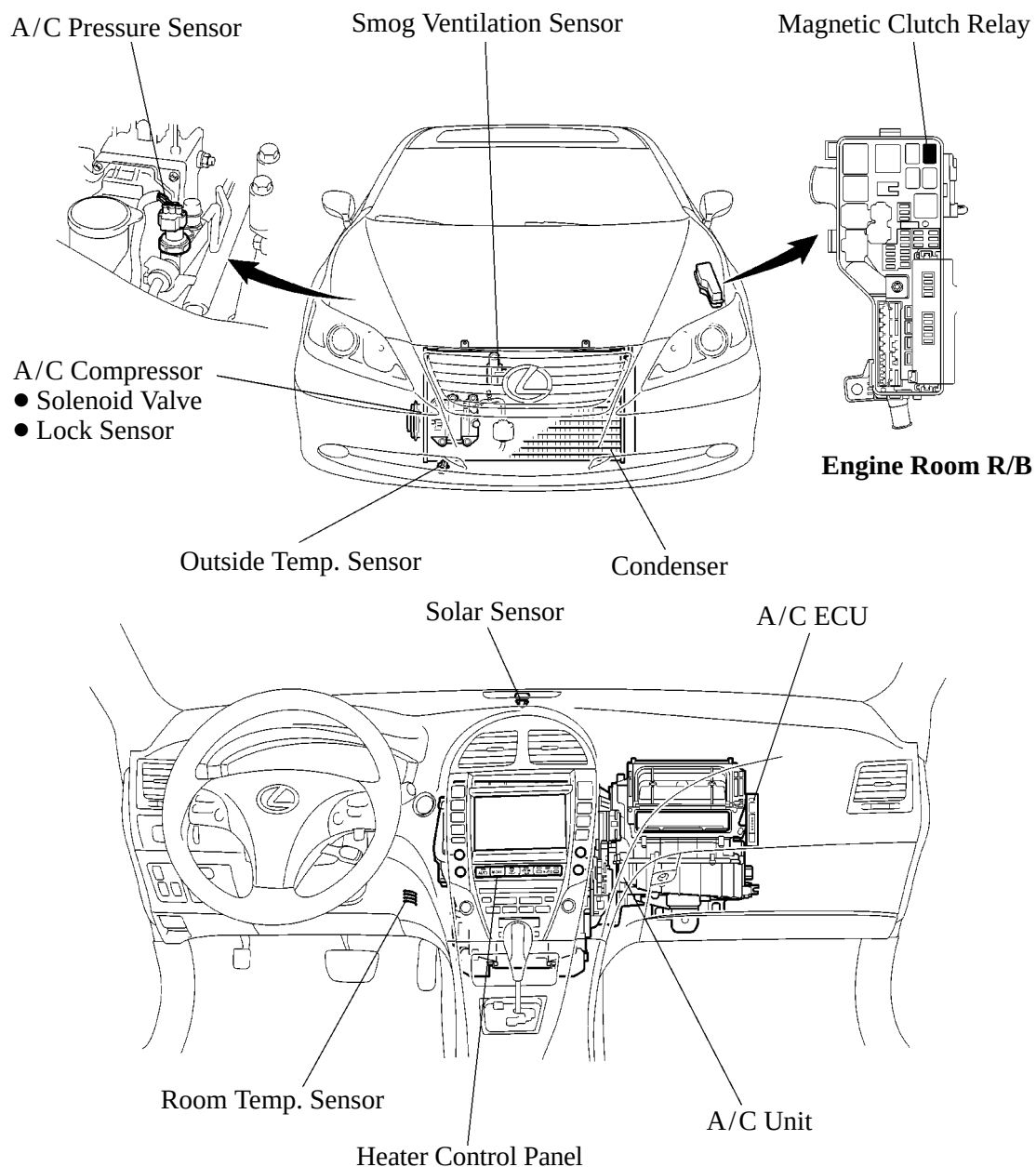
1. Performance

Heater	Heat Output	W	6000
	Air Flow Volume	m ³ /h	360
	Power Consumption	W	210
Air Conditioner	Cooling Capacity	W	6100
	Air Flow Volume	m ³ /h	530
	Power Consumption	W	260

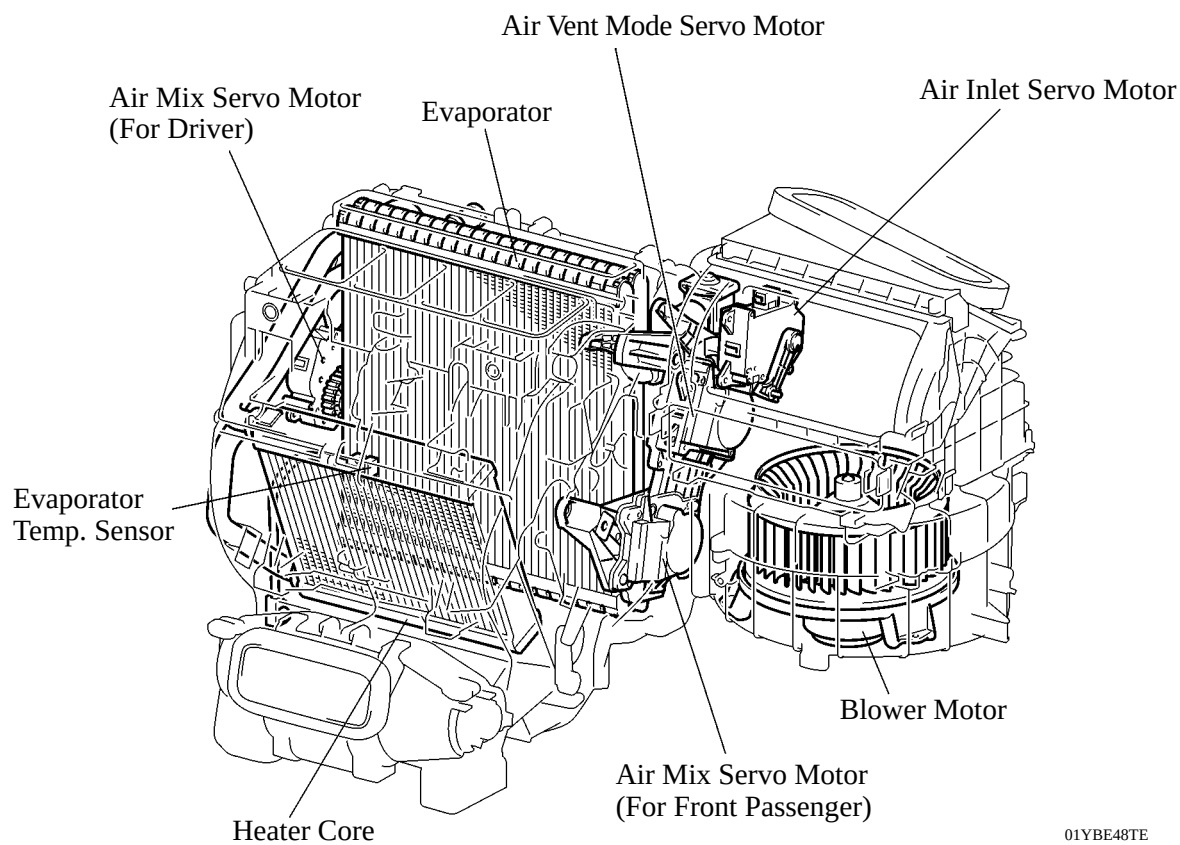
2. Specification

Ventilation and Heater Core	Heater Core	Type	SFA (Straight Flow Aluminum)-II
		Size W x H x L mm (in.)	201.5 x 150 x 27 (7.9 x 5.9 x 1.1)
		Fin Pitch mm (in.)	1.5 (0.06)
	Blower	Motor Type	K70 BMM
		Fan Type	Semi Sirocco
		Fan Size Dia. x H mm (in.)	165 x 70 (6.5 x 2.8)
Air Conditioner	Condenser	Type	MF (Multi-Flow)-IV
		Size W x H x L mm (in.)	720 x 370.2 x 16 (28.3 x 14.6 x 0.6)
		Fin Pitch mm (in.)	3.15 (0.12)
	Evaporator	Type	RS (Revolutionary super-slim Structure)
		Size W x H x L mm (in.)	266.3 x 251 x 38 (10.5 x 9.9 x 1.5)
		Fin Pitch mm (in.)	2.6 (0.1)
	Compressor	Type	7SBH17
		Pulley	Steel with Magnetic Clutch
	Refrigerant	Type	HFC 134a
		Charge Volume g	450 to 550

■ LAYOUT OF MAIN COMPONENTS



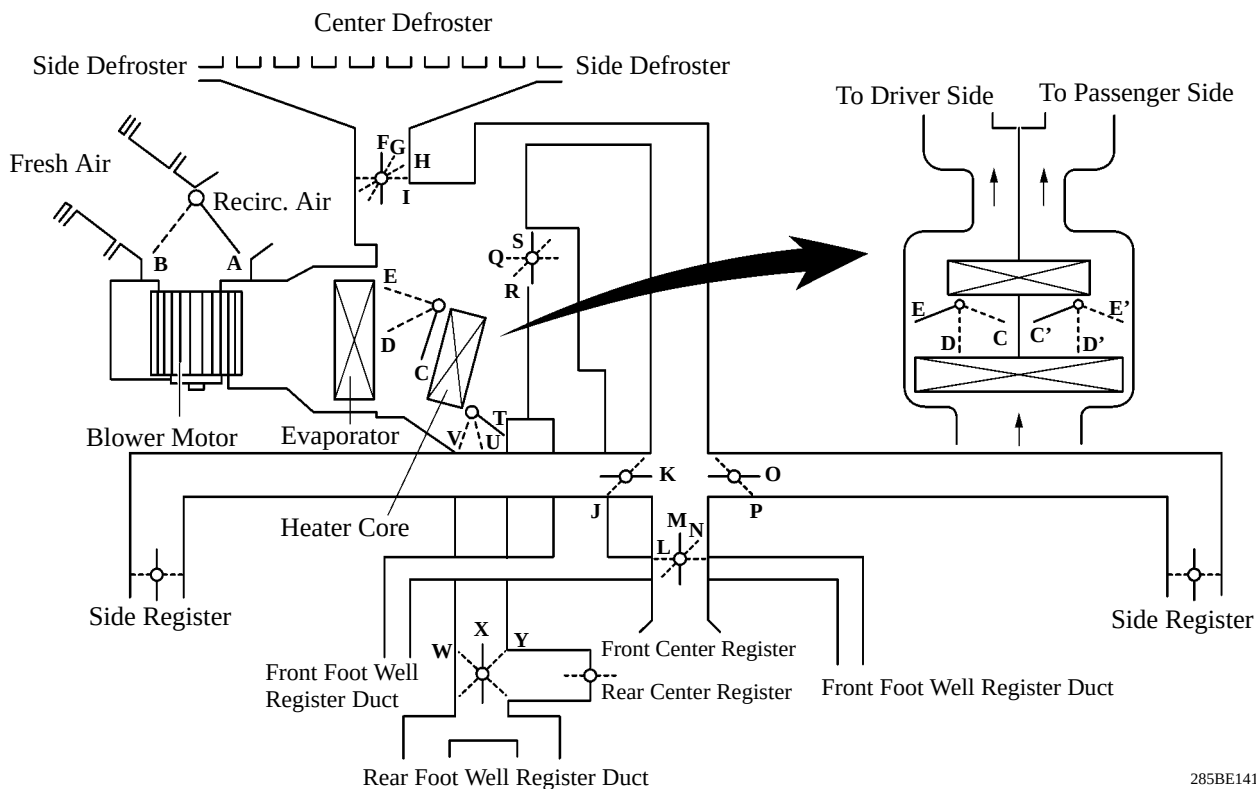
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A/C Unit

■ MODE POSITION AND DAMPER OPERATION

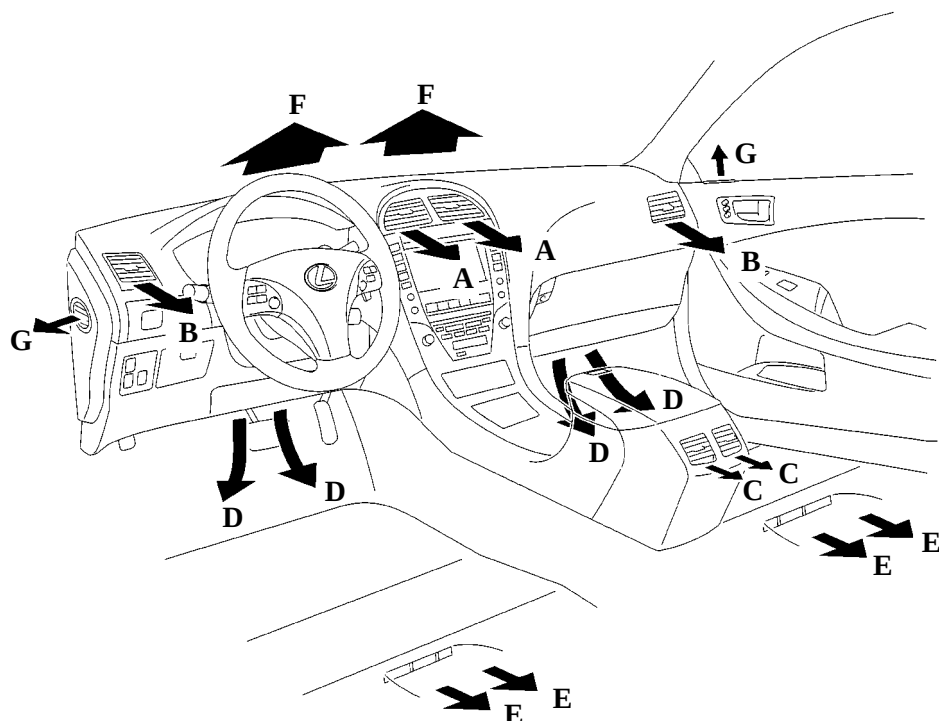


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► Function of Main Damper ◀

Control Damper	Operation Position	Damper Position	Operation
Air Inlet Control Damper	FRESH	A	Brings in fresh air.
	RECIRC	B	Recirculates internal air.
Air Mix Control Damper	MAX COLD to MAX HOT Temp. Setting	C - D - E (C' - D' - E') T - U - V	Varies the mixture ratio of the fresh air and the recirculation air in order to regulate the temperature continuously from HOT to COLD.
Mode Control Damper	DEF 187BE28	F, J, L, P, S, Y	Defrosts the windshield through the center defroster, side defroster, and side register.
	FOOT/DEF 187BE27	G, J, L, P, Q, X	Defrosts the windshield through the center defroster, side defroster, side register, and rear center register, while air is also blown out from the front and rear foot well register ducts.
	FOOT 187BE26	H, J, L, P, Q, X	Air blows out of the foot well register dust, and side register. In addition, air blows out slightly from the center defroster and side defroster.
	BI-LEVEL 187BE25	I, K, N, O, R, X	Air blows out of the front and rear center registers, side register and front and rear foot well register ducts.
	FACE 187BE24	I, K, M, O, S, W	Air blows out of the front and rear center registers, and side register.

■ AIR OUTLETS AND AIRFLOW VOLUME



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INDICATION	MODE	SELECTION		FACE			FOOT		DEF	
				CTR	SIDE	RR	FR	RR	CTR	SIDE
		AUTO	MANUAL	A	B	C	D	E	F	G
 187BE24	FACE	○	○	○	○	○	—	—	—	—
 187BE25	B/L-U*1	○	○	○	○	○	○	○	—	—
	B/L-L*2	○	—	○	○	○	○	○	—	—
 187BE26	FOOT-F*3	○	—	—	○	○	○	○	○	○
	FOOT-R*4	○	○	—	○	○	○	○	○	○
	FOOT-D*5	○	—	—	○	○	○	○	○	○
 187BE27	F/D	○	○	—	○	○	○	○	○	○
 187BE28	DEF	○	○	—	○	—	—	—	○	○

The size of the circle ○ indicates the proportion of airflow volume.

*1: Greater airflow volume at the upper area.

*2: Greater airflow volume at the lower area.

*3: Greater airflow volume at the front.

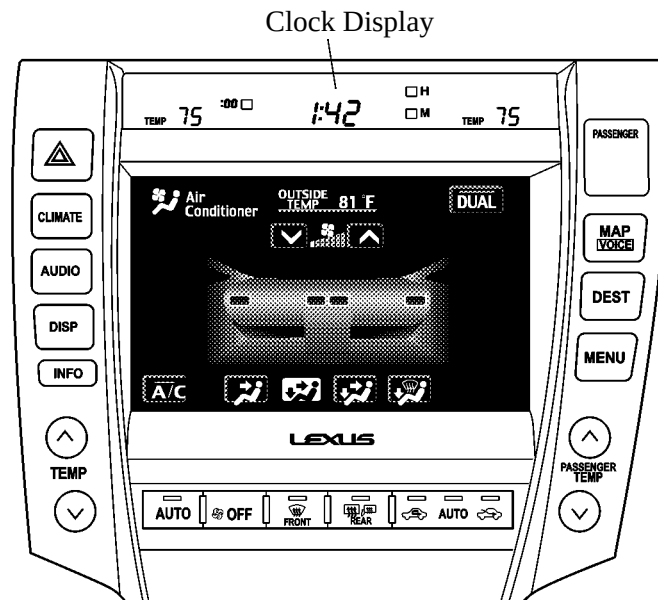
*4: Greater airflow volume at the rear.

*5: Greater airflow volume at the defroster.

■ CONSTRUCTION AND OPERATION

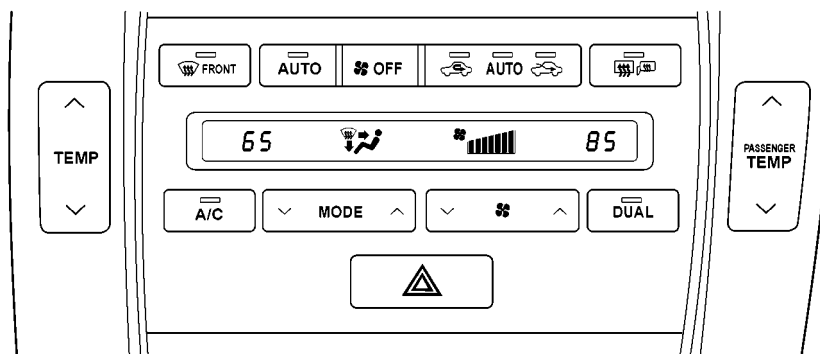
1. Heater Control Panel

- A push-button type center cluster panel is used. There are two types of control panels, one with and one without the multi display.
- On models without the multi display, the air conditioning status is displayed on an LCD (Liquid Crystal Display) panel.
- On models with the multi display, the air conditioning status is indicated on the multi display. However, the set temperatures for the driver seat and the front passenger seat are displayed on the clock display located in the upper portion of the multi display.
- Along with the use of the right/left independent temperature control, the temperature control switches for the driver and the front passenger have been located closer to the respective seats to enhance their ease of use.



Models with Multi Display

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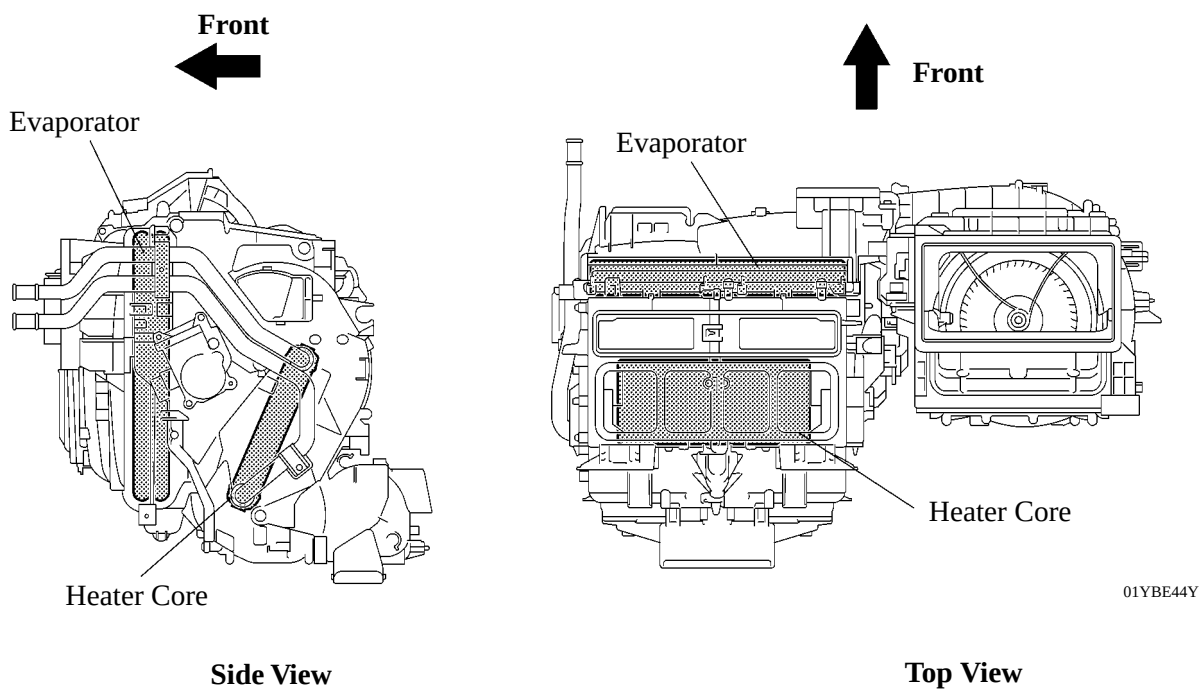
Models without Multi Display

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2. Air Conditioning Unit

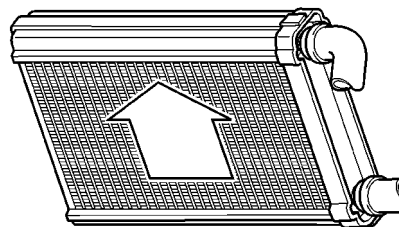
General

A semi-center location air conditioning unit, in which the evaporator and heater core are placed in the vehicle's longitudinal direction, is used. As a result, the air conditioning unit has been made compact and lightweight.



Heater Core

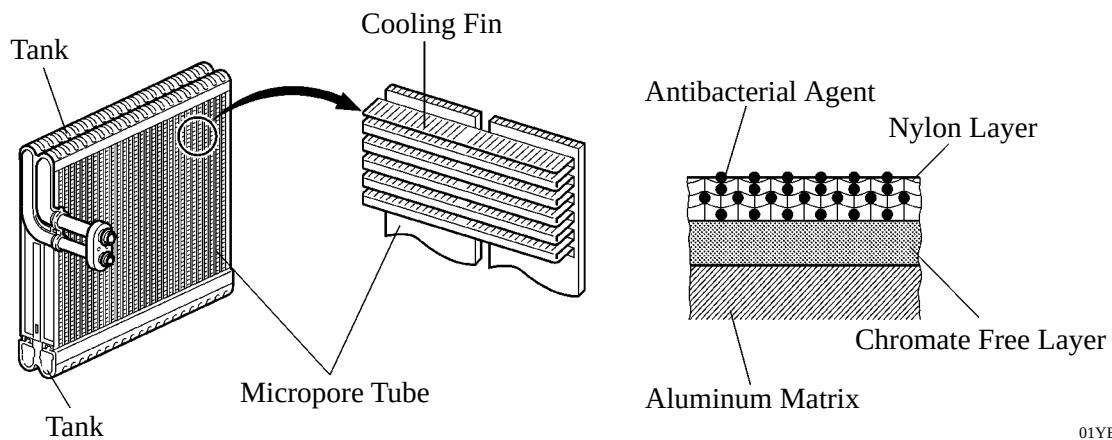
A compact, lightweight, and highly efficient SFA (Straight Flow Aluminum)-II type heater core is used.



Evaporator

A semi-center location air conditioning unit, in which the evaporator and heater core are placed in the vehicle's longitudinal direction, is used. As a result, the air conditioning unit has been made compact and lightweight.

- A revolutionary super-slim structure evaporator is used.
- By placing the tanks at the top and the bottom of the evaporator unit and adopting a micropore tube construction, the following effects have been realized:
 - a) The heat exchanging efficiency has been improved.
 - b) The temperature distribution has been made more uniform.
 - c) The evaporator has been made thinner. 58 mm (2.3 in.) → 38 mm (1.5 in.)
- The evaporator body has been coated with a type of resin that contains an antibacterial agent in order to minimize the source of foul odor and the propagation of bacteria. The substrate below this coating consists of a chromate-free layer to help protect the environment.



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Evaporator Temp. Sensor

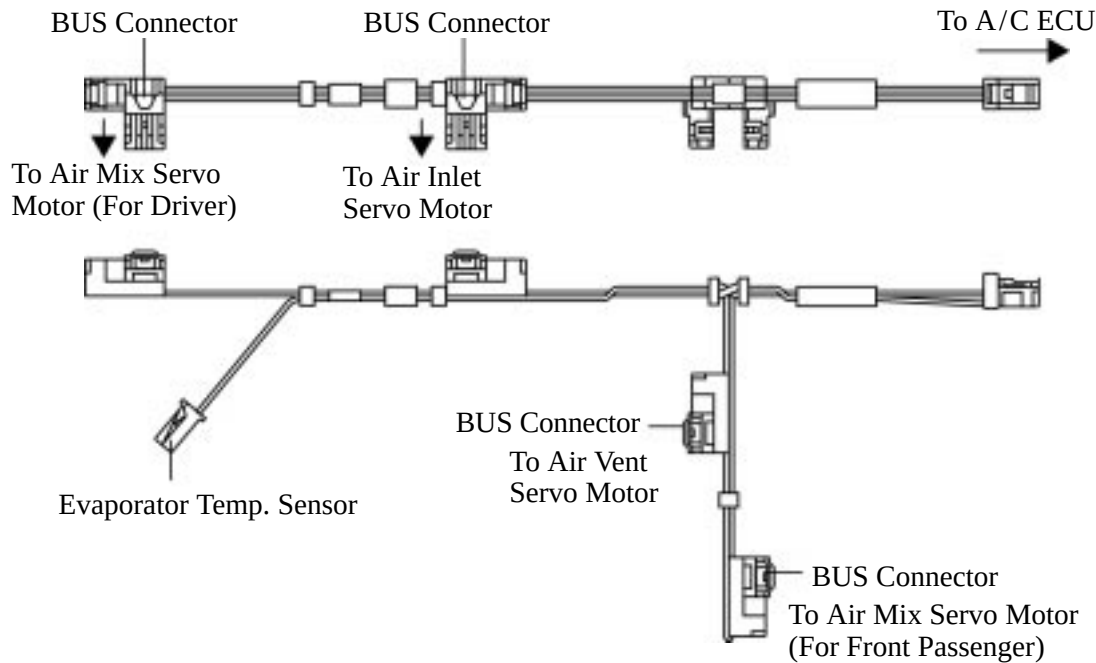
Evaporator temp. sensor detects the temperature of the cool air immediately past the evaporator in the form of resistance changes, and outputs it to the A/C ECU.

Blower Motor

The blower motor has an in-built blower controller, and is controlled with the duty control from the A/C ECU.

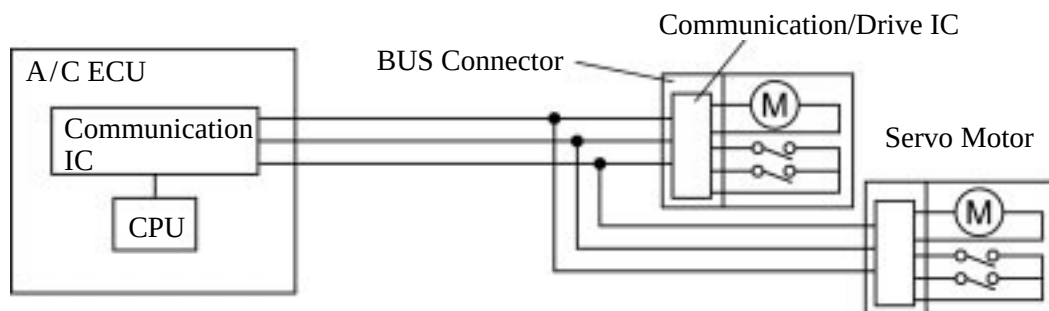
BUS Connector

- A BUS connector is used in the wire harness connection that connects the servo motor from the A/C ECU.



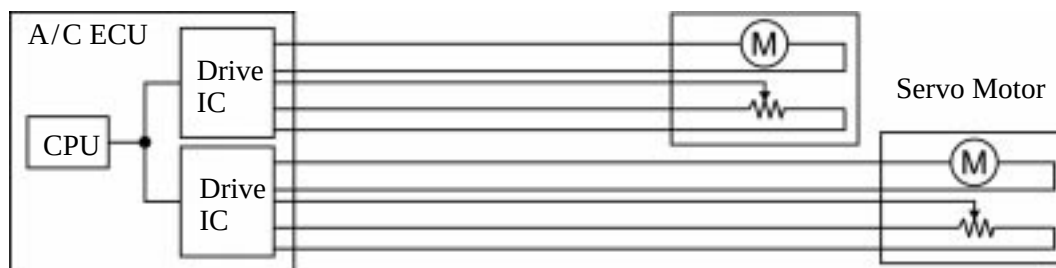
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- The BUS connector has a built-in communication/drive IC which communicates with each servo motor connector, actuates the servo motor, and has a position detection function. This enables bus communication for the servo motor wire harness, for a more lightweight construction and a reduced number of wires.



With BUS Connector

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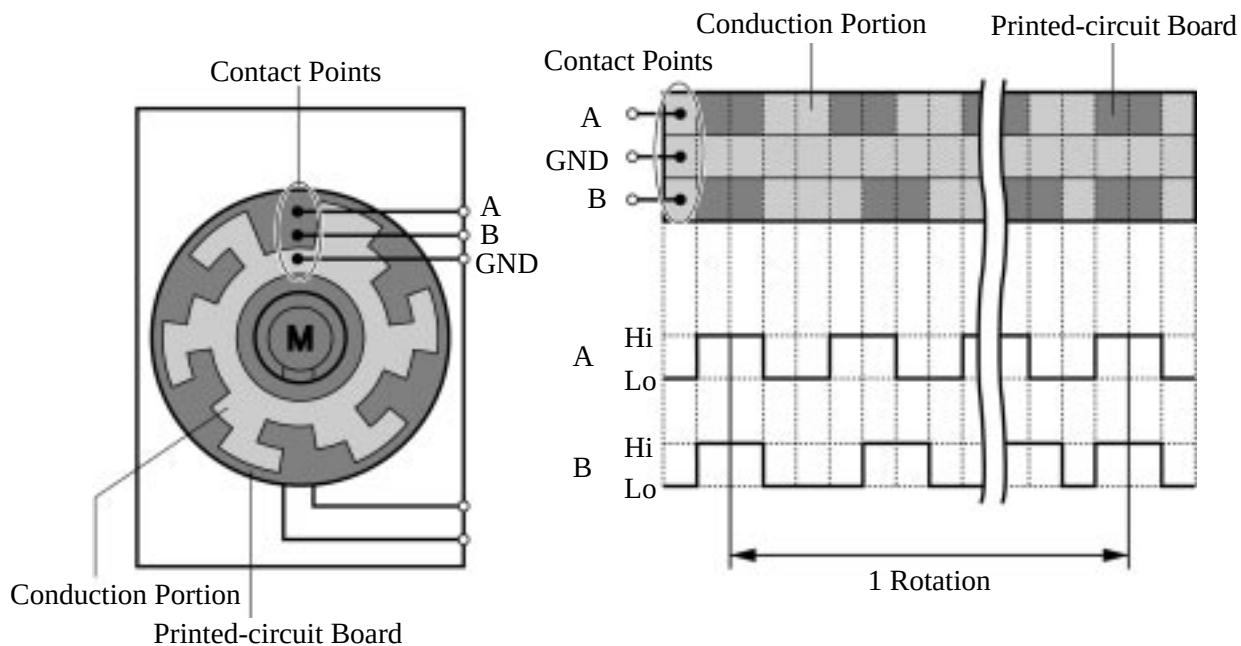


Without BUS Connector

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Servo Motor

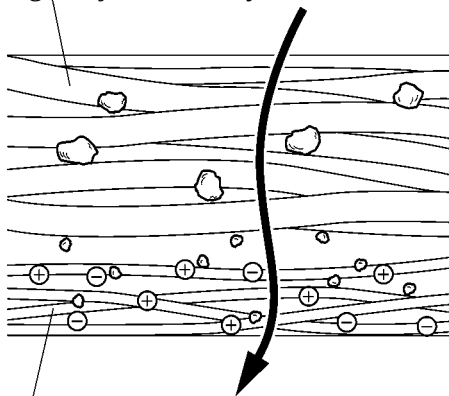
The pulse pattern type servo motor consists of a printed circuit board and servo motor. The printed circuit board has three contact points, and transmits to the A/C ECU two ON-OFF signals for the difference of the pulse phase. The smart connector detects the damper position and movement direction with this signal.



Clean Air Filter

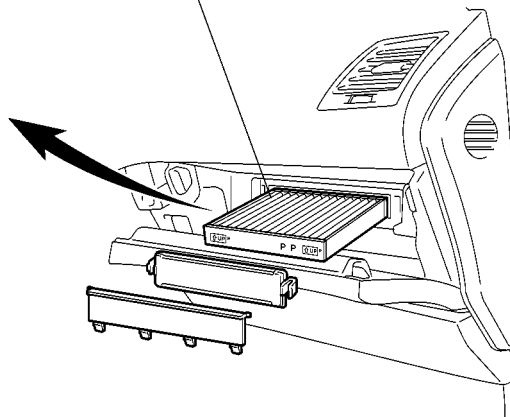
A micro dust and pollen filter is used. This filter excels in the removal of dust and pollen. The filter is made of polyester. Thus, it can be disposed of easily as a non hazardous combustible material, a feature that is provided in consideration of the environment.

Large Foreign Object Filter Layer



Electret Layer
(Microscopic foreign object filtration)

Clean Air Filter



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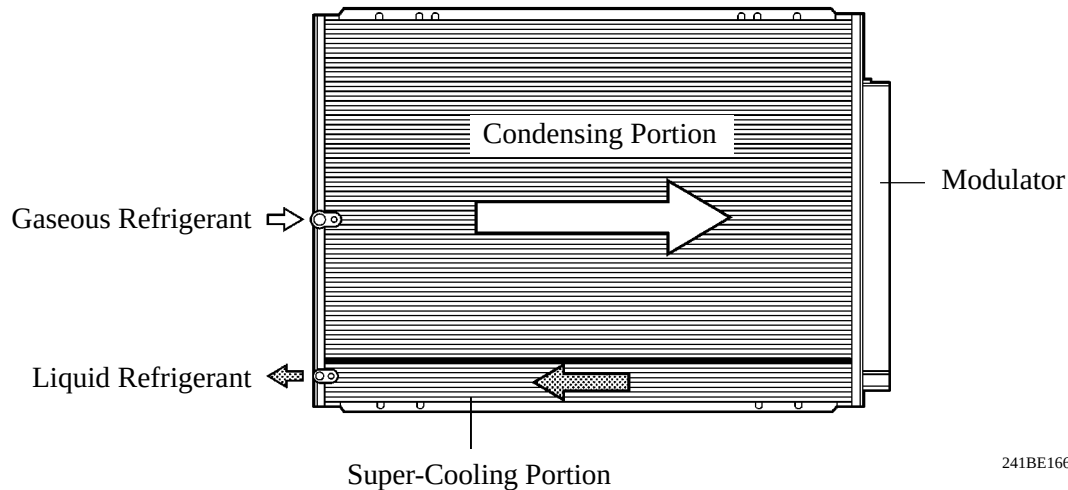
Service Tip

- The filter used on U.S.A. models should be changed at 30,000 miles (cleaning interval: 15,000 miles).
- The filter used on Canadian package models should be changed at 16,000 km (cleaning interval: 8,000 km).
- The filter used on other destination package models should be changed at 30,000 km under normal conditions (cleaning interval: 10,000 km). Under dusty conditions, the filter should be changed at 15,000 km (cleaning interval: 5,000 km).

However, observation of these guidelines should depend on the usage conditions (or environment).

3. Condenser

- A MF (Multi-Flow) type condenser is used. The condenser consists of two cooling portions: a condensing portion and a super-cooling portion, and gas-liquid separator (modulator) are integrated together. This condenser uses a sub-cool cycle that offers excellent heat-exchange performance.
- In the sub-cool cycle, after the refrigerant passes through the condensing portion of the condenser, both the liquid refrigerant and the gaseous refrigerant that could not be liquefied are cooled again in the super-cooling portion. Thus, the refrigerant is sent to the evaporator in an almost completely liquefied state.

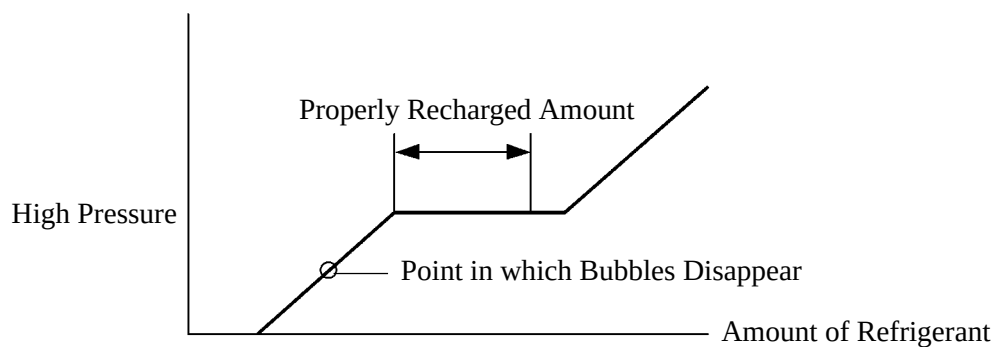


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Service Tip

The point at which the air bubbles disappear in the refrigerant of the sub-cool cycle is lower than the proper amount of refrigerant with which the system must be filled. Therefore, if the system recharged with refrigerant based on the point at which the air bubbles disappear, the amount of refrigerant would be insufficient. As a result, the cooling performance of the system will be affected. If the system is overcharged with refrigerant, this will also lead to a reduced performance.

For the proper method of verifying the amount of the refrigerant and for instructions on how to recharge the system with refrigerant, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

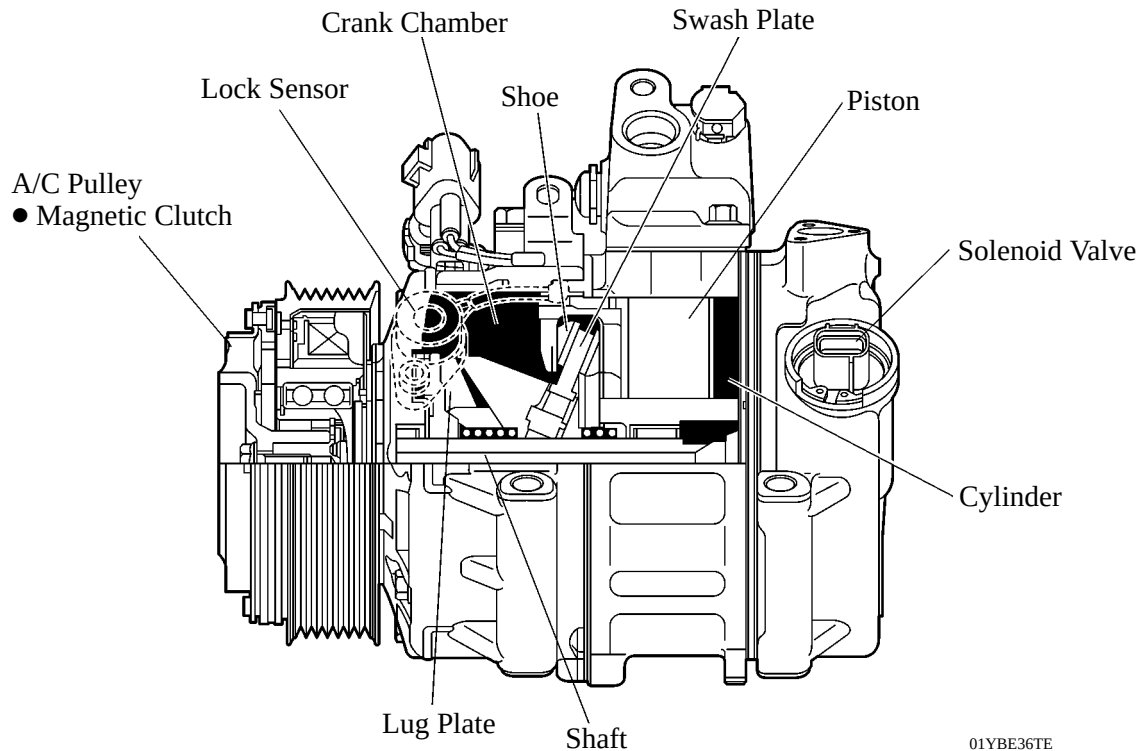


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4. A/C Compressor

General

- The A/C compressor is a continuously variable capacity type in which its capacity can be varied in accordance with the cooling load of the air conditioning.
- This compressor consists of the A/C pulley, shaft, lug plate, swash plate, piston, shoe, crank chamber, cylinder, and solenoid valve.
- A solenoid valve that adjusts the suction pressure so that the compressor capacity can be controlled as desired is provided.

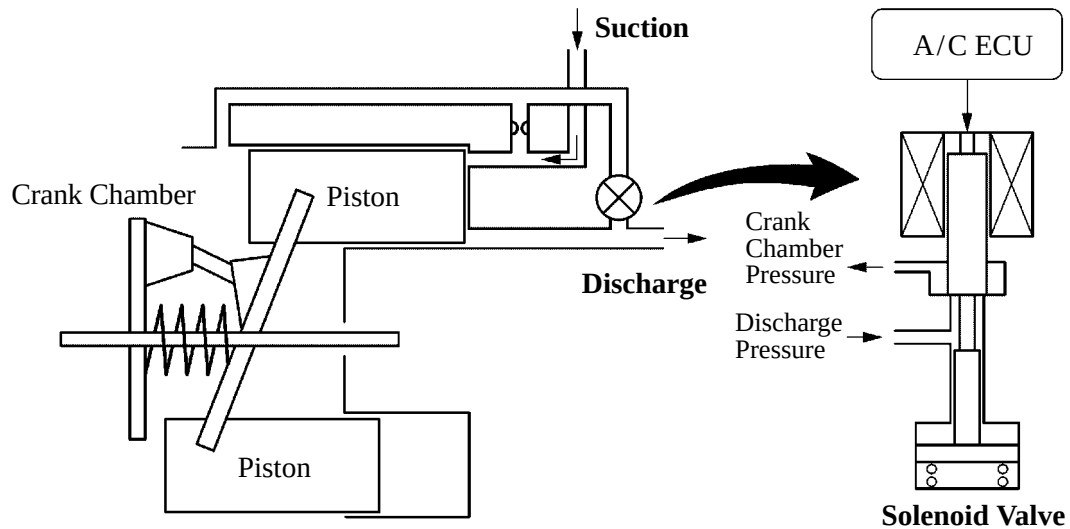


Lock Sensor

The lock sensor sends A/C pulley speed signals to the A/C ECU. The A/C ECU determines whether the magnetic clutch is locked or not by using those signals and engine speed signals.

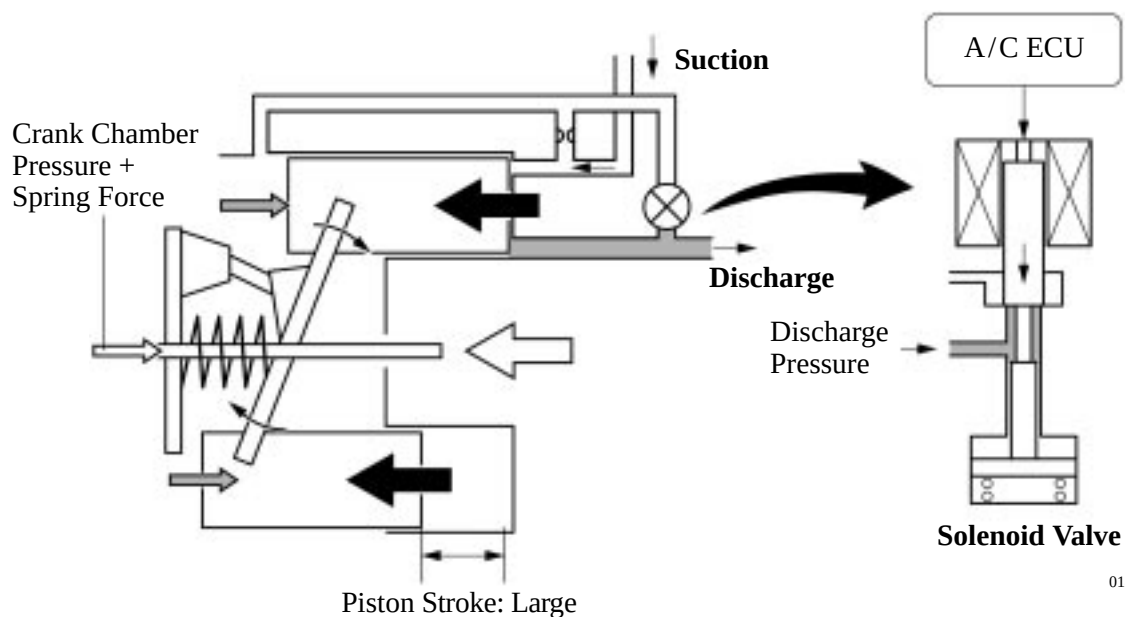
Operation

- The crank chamber is connected to the suction passage. A solenoid valve is provided between the suction passage (LO pressure) and the discharge passage (HI pressure).
- The solenoid valve operates under duty cycle control in accordance with the signals from A/C ECU.



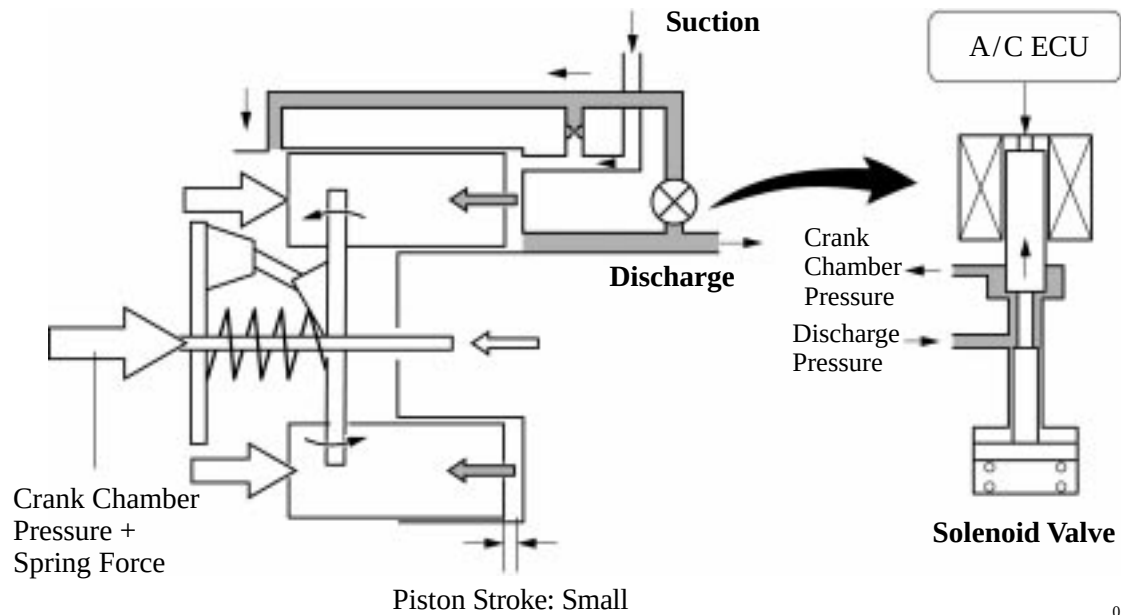
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- When the solenoid valve closes (solenoid coil is energized), a difference in pressure is created and the pressure in the crank chamber decreases. Then, the pressure that is applied to the right side of the piston becomes greater than the pressure that is applied to the left side of the piston. This compresses the spring and tilts the swash plate. As a result, the piston stroke increases and the discharge capacity increases.



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- When the solenoid valve opens (solenoid coil is not energized), the difference in pressure disappears. Then, the pressure that is applied to the left side of the piston becomes the same as the pressure that is applied to the right side of the piston. Thus, the spring elongates and eliminates the tilt of the swash plate. As a result, there is no piston stroke and the discharge capacity is reduced.



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5. A/C Pressure Sensor

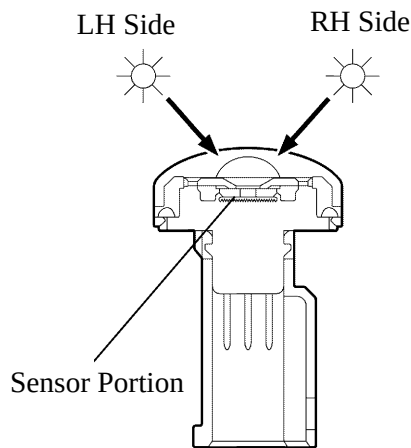
A/C pressure sensor detects the refrigerant pressure and outputs it to the A/C ECU in the form of voltage changes.

6. Room Temp. Sensor and Outside Temp. Sensor

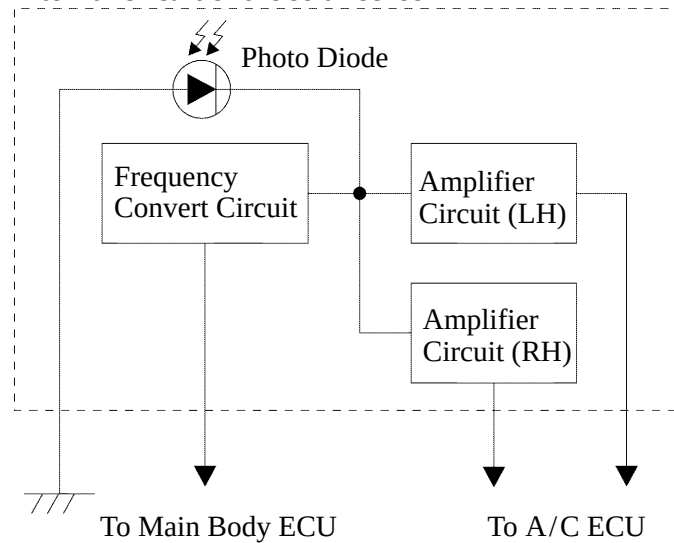
- The room temperature sensor detects the room temperature based on changes in the resistance of its built-in thermistor and sends a signal to the A/C ECU.
- The outside temperature sensor detects the outside temperature based on changes in the resistance of its built-in thermistor and sends a signal to the A/C ECU.

7. Solar Sensor

- The solar sensor consists of a photo diode, two amplifier circuits for the solar sensor, and frequency converter circuit for the light control sensor.
- A solar sensor detects (in the form of changes in the current that flows through the built-in photo diode) the changes in the amount of sunlight from the LH and RH sides (2 directions) and outputs these sunlight strength signals to the A/C ECU.



Internal circuit of the solar sensor



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8. Smog Ventilation Sensor

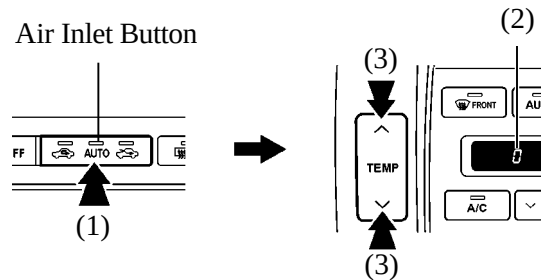
- The smog ventilation sensor detects harmful elements such as CO, HC, and NOx, which are present in the air outside of the vehicle. The sensor outputs it to the A/C ECU.
- The sensitivity of the smog ventilation sensor can be adjusted. Adjustment can be done using the heater control panel or multi display.

Service Tip

Sensitivity Adjust Method of Smog Ventilation Sensor

a) Heater Control Panel Type

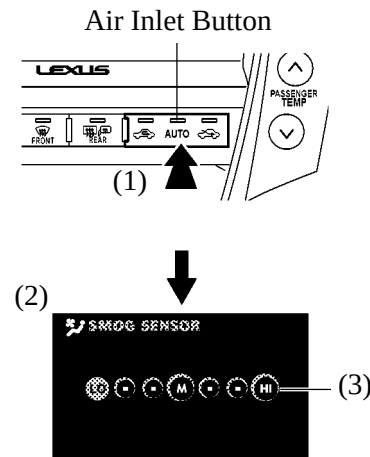
- (1) Press and hold the air inlet button for 2 seconds or more.
- (2) The current sensitivity level is displayed on the LCD on the heater control panel.
- (3) The sensitivity level can be adjusted between -3 and 3 by operating the TEMP switch.
- (4) Pressing the air inlet button again or pressing another switch ends the setting adjustment mode.



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b) Multi Display Type

- (1) Press and hold the air inlet button for 2 seconds or more.
- (2) The sensitivity level adjustment screen appears on the multi display.
- (3) The sensitivity level can be adjusted to seven different levels from HI to LO by touching the screen.
- (4) Pressing the air inlet button again or pressing another switch ends the setting adjustment mode.



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■ SYSTEM CONTROL

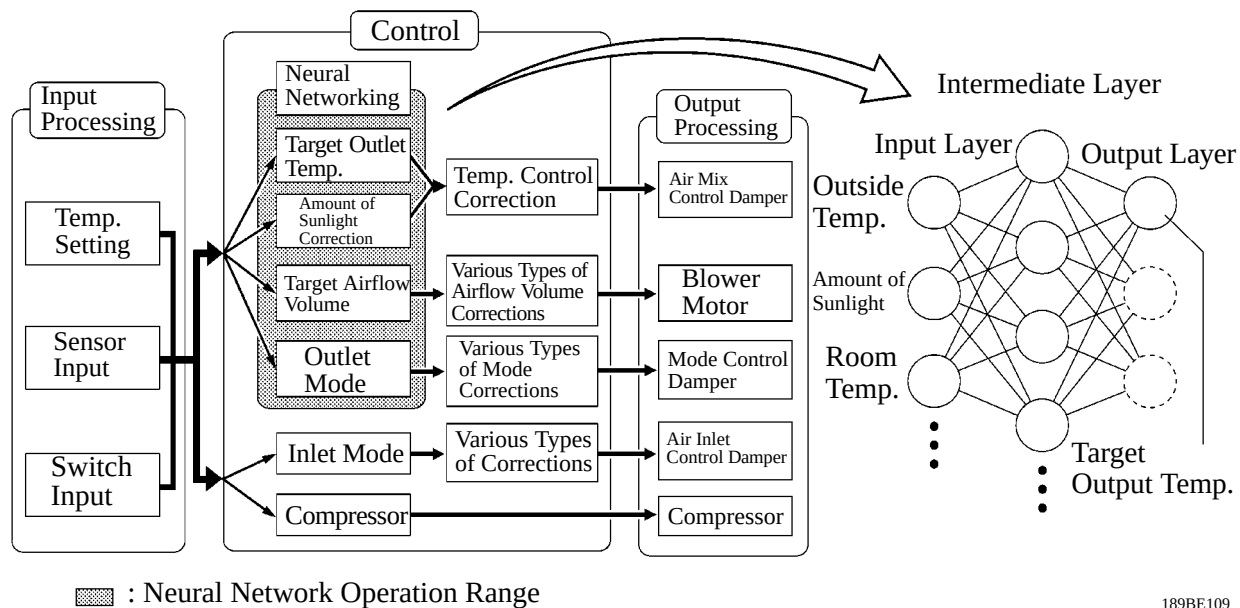
1. General

The air conditioning system has the following controls.

Control	Outline
Neural Network Control [See page BE-80]	This control is capable of effecting complex control by artificially simulating the information processing method of the nervous system of living organisms in order to establish a complex input/output relationship that is similar to a human brain.
Automatic Recirculation Control [See page BE-81]	Automatically changes the air inlet mode to fresh air or recirculation air mode in accordance with the level of harmful elements in the outside air, the cabin temperature, and outside temperature.
Outlet Air Temp. Control	Based on the temperature set at the temperature control switch, the neural network control calculates the outlet air temperature based on the input signals from various sensors.
	The temperature settings for the driver and front passenger are controlled independently in order to provide separate vehicle interior temperatures for the right and left sides of the cabin. Thus, air conditioning that accommodates the occupants' preferences has been realized.
Blower Control	Controls the blower motor in accordance with the airflow volume that has been calculated by the neural network control based on the input signals from various sensors.
Air Outlet Control	Automatically switches the air outlets in accordance with the outlet mode that has been calculated by the neural network control based on the input signals from various sensors.
	In accordance with the engine coolant temperature, outside air temperature, amount of sunlight, required blower, outlet temperature, and vehicle speed conditions, this control automatically switches the blower outlet to FOOT/DEF mode to prevent the windows from becoming fogged when the outside air temperature is low.
Air Inlet Control	Automatically controls the air inlet control damper to achieve the calculated required outlet air temperature.
	Drives the servo motor (for air inlet) according to the operation of the air inlet control switch and moves the dampers to the FRESH or RECIRC position.
Compressor Control	Through the calculation of the target evaporator temperature based on various sensor signals, the A/C ECU optimally controls the discharge capacity by regulating the opening extent of the A/C compressor solenoid valve.
	The A/C ECU compares the A/C pulley speed signals, which are transmitted by the lock sensor located on the A/C compressor, with the engine speed signals, which are transmitted by the ECM (crankshaft position sensor). When the A/C ECU determines that the A/C pulley is locked, it turns off the magnetic clutch.
Rear Window Defogger Control [See page BE-256]	Switches the rear defogger and outside rear view mirror heaters on for 15 minutes when the rear defogger button is pressed. Switches them off if the button is pressed again while they are operating.
Ventilated Seat Control [See page BE-252]	The A/C ECU drives the blower unit provided in the seatback and seat cushion in accordance with the operation of the heated and ventilated seat system switch.
Outside Temperature Indication Control	Calculates the outside temperature using signals transmitted by the outside temperature sensor. Calculated values are corrected by the A/C ECU and then indicated on the multi-information display.
Self-Diagnosis [See page BE-82]	A DTC (Diagnostic Trouble Code) is stored in the memory when the A/C ECU detects a problem with the air conditioning system.

2. Neural Network Control

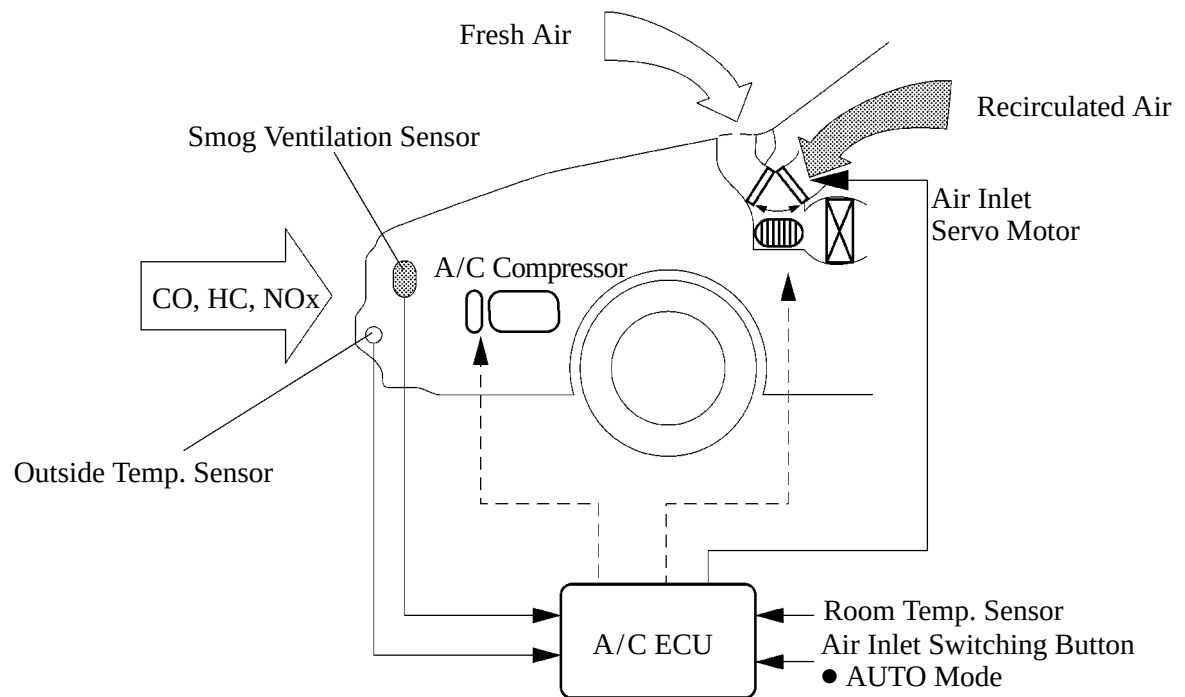
- In previous automatic air conditioning systems, the A/C ECU determined the required outlet air temperature and blower air volume in accordance with the calculation formula that has been obtained based on information received from the sensors. However, because the senses of a person are rather complex, a given temperature is sensed differently, depending on the environment in which the person is situated. For example, a given amount of solar radiation can feel comfortably warm in a cold climate, or extremely uncomfortable in a hot climate. Therefore, as a technique for effecting a higher level of control, a neural network is used in the automatic air conditioning system. With this technique, the data that has been collected under varying environmental conditions is stored in the A/C ECU. The A/C ECU can then effect control to provide enhanced air conditioning comfort.
- The neural network control consists of neurons in the input layer, intermediate layer, and output layer. The input layer neurons process the input data of the outside temperature, the amount of sunlight, and the room temperature based on the outputs of the switches and sensors, and output them to the intermediate layer neurons. Based on this data, the intermediate layer neurons adjust the strength of the links among the neurons. The sum of these is then calculated by the output layer neurons in the form of the required outlet temperature, solar correction, target airflow volume, and outlet mode control volume. Accordingly, the A/C ECU controls the servo motors and blower motor in accordance with the control volumes that have been calculated by the neural network control.



3. Automatic Recirculation Control

When the automatic recirculation control is operating, the A/C ECU automatically changes the air inlet mode to the fresh air or recirculate air mode based on signals from the smog ventilation sensor, outside temperature, and room temperature sensors when the AUTO air inlet mode is selected.

- The A/C ECU detects harmful elements (CO, HC, and NO_x) based on smog ventilation sensor signals and automatically switches the air inlet mode to the recirculate air mode to prevent such harmful elements from entering the cabin.
- The A/C ECU detects room temperature based on a room temperature sensor signal and automatically switches the air inlet mode to the recirculate air mode to prevent the room temperature from becoming too high.
- The A/C ECU detects the outside temperature based on an outside temperature sensor signal and automatically switches the air inlet mode to the fresh air mode to prevent the windshield from fogging up.



01YBE173P

NOTE: The smog ventilation sensor cannot detect elements such as the smoke from a bonfire or factory exhaust, foul or animal odors, and dirt or dust particles. Therefore, the air inlet modes are not switched in accordance with those elements.

4. Self-Diagnosis

- The A/C ECU has a self-diagnosis function. It stores any operation failures in the air conditioning system memory in the form of DTC (Diagnostic Trouble Code).
- There are two methods for reading DTC. One is to use a hand-held tester, and the other is to read DTC indicated on the heater control panel display (or on the clock display if the vehicle is equipped with the multi display).
- For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

Service Tip

The A/C ECU uses the CAN protocol for diagnostic communication. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

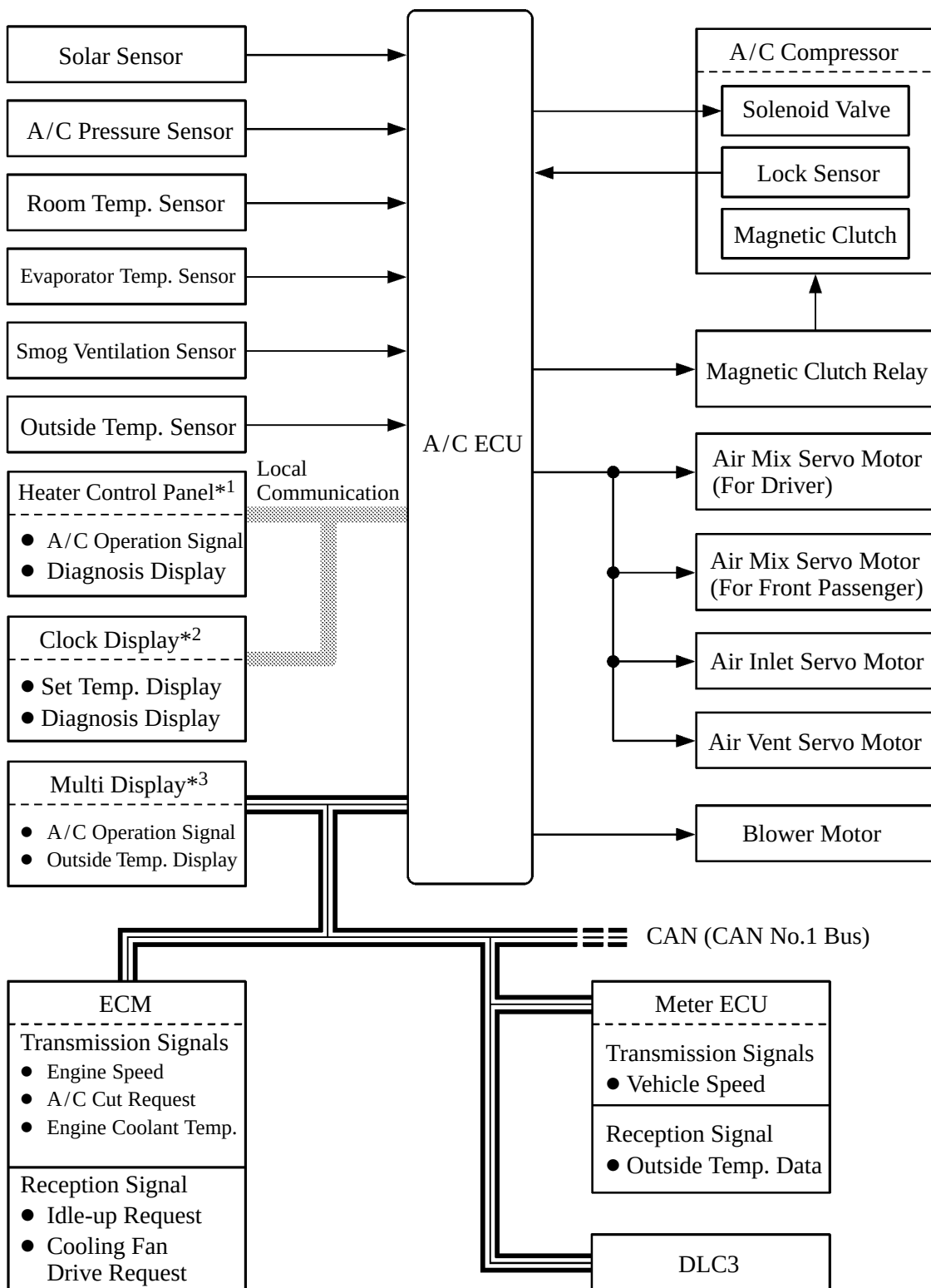
AIR CONDITIONING

■ DESCRIPTION

Automatic air conditioning using left/right independent temperature control and neural network control is standard equipment on all models. It has the following features:

High Performance	● Neural network control is used so passengers can control the air conditioning accurately for maximum comfort. ● FACE mode for the rear seat is installed to blow warm air and ensure excellent heating performance. ● A micro dust and pollen filter, which removes pollen, is used as the clean air filter. ● The blower control has seven levels for precise control. ● Automatic recirculation control is used to help prevent harmful elements such as CO, HC, and NOx from entering the cabin.
Lightweight	A BUS connector with a built-in IC is used in a lightweight wire harness design with a reduced number of wires. The use of this connector means that pulse pattern type servo motors are used.
Compact	A blower motor with a built-in blower motor controller is used in a compact construction.
Others	The following parts are used to ensure high cooling performance while realizing a compact and lightweight construction. ● Semi-center Location A/C Unit ● RS (Revolutionary super-slim Structure) Evaporator ● SFA (Straight Flow Aluminum)-II Heater Core ● MF (Multi-Flow)-IV Sub -cool Condenser ● Continuously Variable Capacity Type Compressor (7SBH17 type)

SYSTEM DIAGRAM



*1: Models without multi display

*2: Models with multi display

*3: Optional equipment

BLUETOOTH HANDS-FREE SYSTEM

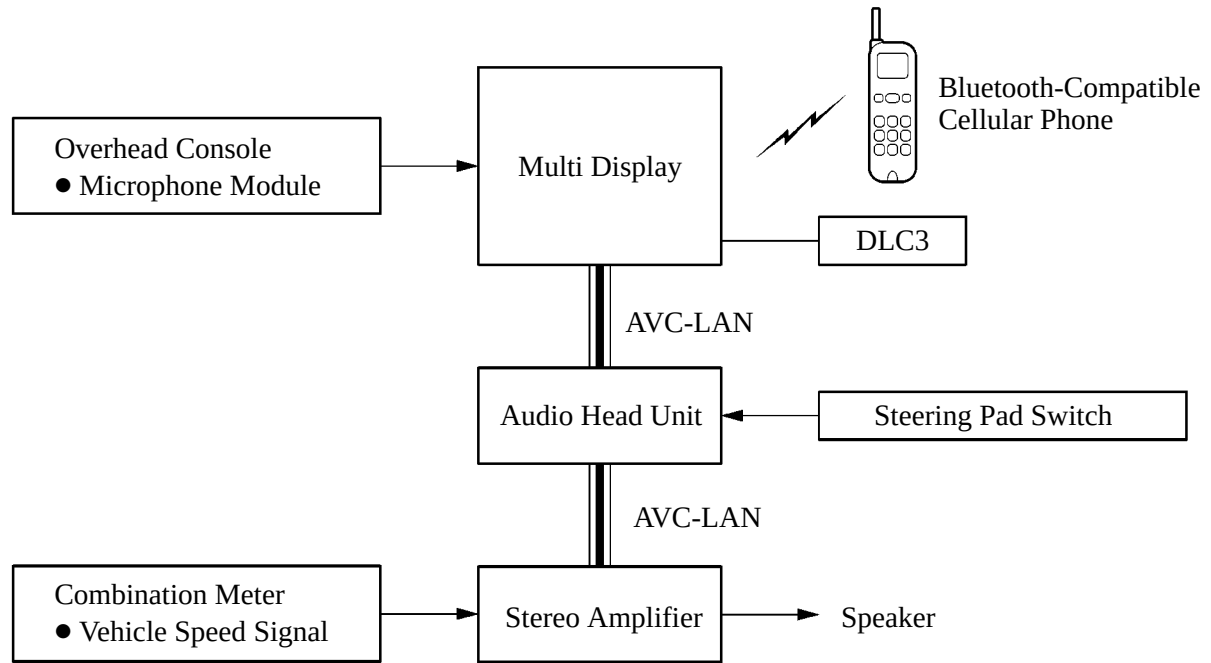
■ DESCRIPTION

- Bluetooth is a short-distance, high-speed wireless data communication system that uses the 2.4 GHz frequency band prescribed by the Bluetooth SIG (Special Interest Group).
- This system enables drivers to place or receive phone calls using a cellular phone without releasing their hands from the steering wheel.
- The Bluetooth hands free system is installed on both the '07 ES350 without the multi display and the '07 ES350 with the multi display as optional equipment.
- The Bluetooth hands free system of the '07 ES350 with the multi display can be operated by touching icons indicated on the multi display.
- The Bluetooth hands free system of the '07 ES350 without the multi display can be operated by turning or pressing the control knob of the audio head unit.
- The major difference between the model with the multi display and the model with the audio system is described in the following table:

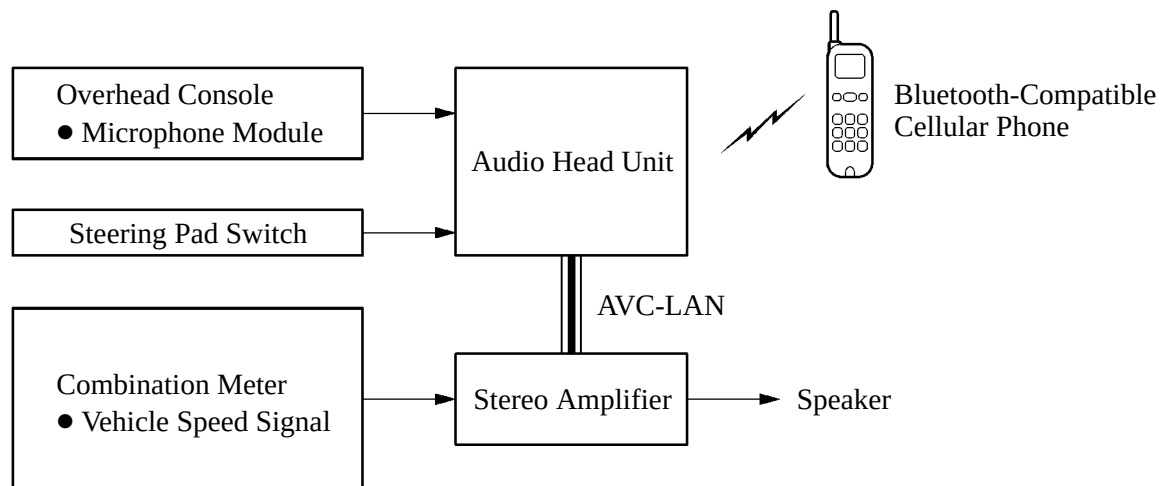
► Major Difference ◀

Function		With Multi Display (Maximum number of data entry)	Without Multi Display (Maximum number of data entry)
Call with Bluetooth phone	By dial	○	—
	By dialed numbers	○(5)	○(5)
	By received calls	○(5)	○(5)
	By phone book	○(1,000)	○(20)
	By voice recognition	○	○
	By speed dial	○	○
	By POI (Point of Interest) call	○	—
Registering phonebook		○(1,000)	○(20)
Registering voice recognition		○(20)	○(20)
Registering speed dial		○(17)	○(6)
Registering speed tone		○(6)	—
Registering group		○(20)	—
Automatic volume setting		○	○

► System Diagram ◀

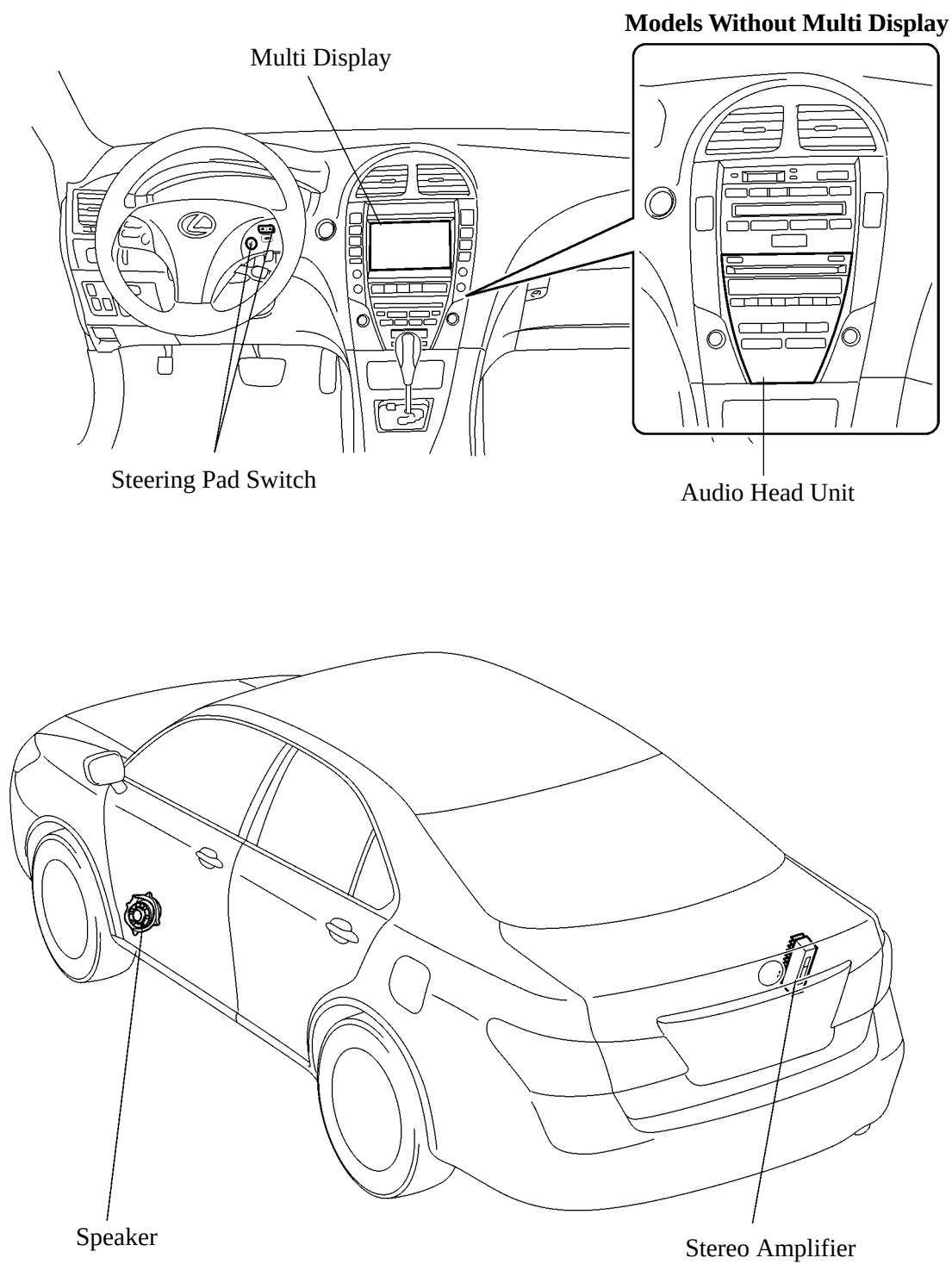


01YBE171TE

Models With Multi Display

01YBE172TE

Models Without Multi Display

■ LAYOUT OF MAIN COMPONENTS

■ HANDS-FREE FUNCTIONS (Models with Multi Display)

The Bluetooth hands-free system installed on the models with the multi display has the following functions. However, for safety, some functions may not be selectable when the vehicle is being driven.

Function		Outline
Call with Bluetooth phone	By dial	The user can call by inputting a telephone number.
	By phonebook	The user can call by using the phonebook data that have been transferred from the user's cellular phone. The user can register up to 1000 numbers in the phonebook.
	By dialed numbers	The user can call by selecting a previously dialed number. The system remembers up to five dialed numbers. If more than five numbers have been dialed, the oldest number will no longer be remembered.
	By received calls	The user can call by selecting the telephone number of a received call. When a call is received, the system will remember the last five numbers. If more than five calls have been received, the oldest number will no longer be remembered.
	By speed dial*	The user can call by using registered telephone numbers that the user selected from the phonebook, dialed numbers or received calls.
	By voice recognition (Dialing by name)	The user can call by giving a name registered in the phonebook.
	By voice recognition (Dialing by phone number)	The user can call by giving a desired number.
	By POI (Point of Interest) call	The user can call by operating a switch when “Call” is displayed on the screen of the navigation system.
Receive with Bluetooth phone		When a call is received, the receive screen is displayed with an audio signal.
Talk on the Bluetooth phone		While the user is talking on the phone, the talking screen is displayed.
Change the settings of the Bluetooth phone	Registering the speed dial	The user can register the desired telephone number from the phonebook, dialed numbers or received calls. Up to 17 speed dial numbers can be registered.
	Registering the speed tone	The user can register desired tone numbers. Up to 6 speed tone numbers can be registered.
	Setting the volume	The user can set the volume.
		Automatic volume settings for high speed: The user can set the volume one step up when the speed is over 80 km/h (50 mph).
		Initializing the settings: The user can initialize the settings.
	Setting the screen	Receiving call display: The user can select the method of the receiving call display.
		Auto answer: When a call is received, the display automatically changes to the talking screen and the user can start to talk on the phone (without touching any switch) after a preset time.
		The Bluetooth connection status at startup: When the user turns the power source to ACC or IG-ON and the Bluetooth is automatically connected, the connection check is displayed.
Initializing the settings: The user can initialize the settings.		

*: The user can operate it while driving.

(Continued)

Function		Outline
Change the setting of the Bluetooth phone	Setting the phonebook	Registering phone number: The user can register phone numbers in the phonebook.
		Transferring a telephone number: The user can transfer the telephone numbers from the user's Bluetooth phone to the system. Up to 1,000 data (up to 2 numbers per entry) can be registered in the phonebook.
		Registering the phonebook data: The user can register the phonebook data.
		Editing the name: If no name has been inputted, the number is displayed.
		Editing the phone number: The user can register a phone number in "TEL1" and "TEL2" separately. Up to 2 numbers per phonebook entry can be registered.
		Selecting the group: The user can set a group for a contact. It will then be easier for the user to find this contact when needed, by using the grouping display.
		Setting the voice recognition: The user can set the voice recognition. Up to 20 numbers can be registered to allow voice recognition.
		Adding data to the phonebook: The user can add data to the phonebook.
		Editing the data: The user can edit the registered data.
		Deleting the data: The user can delete the data.
		Deleting all the phone data: The user can delete all the phone data.
		Registering a group name: The user can register 20 groups
		Selecting a group icon: The user can select the desired icon.
		Editing a group name: The user can input the name with the software keyboard.
		Deleting a group name: The user can delete the group names individually or all at once.
		Deleting the log data: The user can delete the log data individually or all at once.
Change the settings of the Bluetooth phone	Setting the security	By setting the security, the user can prevent people from using some functions of the hands-free system. It is useful when the user leave their car with a hotel or valet parking or the user doesn't want others to see the data that the user has registered.
		Changing the security code: The security code is 4 digits and the default is "0000". Choose a new code that is hard for other people to guess.
		Phone book lock: The user sets the phonebook lock.
		Initializing the security code: The user can initialize the settings.

(Continued)

Function		Outline
Set a Bluetooth phone	Enter the Bluetooth phone	In order to use hands-free function of a Bluetooth phone, it is necessary to register it in the multi display. Once a phone is registered, the hands-free function becomes available automatically. The user can register up to 6 the Bluetooth phones.
	Select the Bluetooth phone	When two or more registered Bluetooth phones are in the cabin, it is necessary to select which phone to use to prevent the lines from being crossed. Only the selected phone is available for use as a hands-free phone. The phone registered last is automatically selected.
	Indicate and change Bluetooth information	The user can set, change and initialize the information of the Bluetooth phone displayed on the screen.
	Deleting a Bluetooth phone	A registered Bluetooth phone can be unregistered from the multi display.
	Displaying the information of the Bluetooth phone user delete	The user can display the information of the Bluetooth phone before he/she deletes it and he/she can ensure that the telephone that he/she will delete is correct one.

■ HANDS-FREE FUNCTIONS (Models without Multi Display)

The Bluetooth hands-free system installed on the models without display has the following functions. However, for safety, some functions may not be selectable when the vehicle is being driven.

Function		Outline
Call with Bluetooth phone	By phonebook	The user can call by using the phonebook data that have been transferred from the user's cellular phone.
	By dialed numbers	The user can call by selecting a previously dialed number. The system remembers up to 5 dialed numbers. If more than 5 numbers have been dialed, the oldest number will no longer be remembered.
	By received calls	The user can call by selecting the telephone number of a received call. When a call is received, the system will remember the last five numbers. If more than five calls have been received, the oldest number will no longer be remembered.
	By speed dial*	The user can call using the registered phone number by pressing the function buttons (1 to 6) of the audio head unit.
	By voice recognition (Dialing by name)	The user can call by giving a name registered in the phonebook.
	By voice recognition (Dialing by phone number)	The user can call by giving a desired number.
Receive with Bluetooth phone		When a call is received, the caller name or phone number is displayed on the audio head unit LCD with an audio signal.
Talk on the Bluetooth phone		While the user is talking on the phone, the caller name or phone number is displayed on the audio head unit LCD.
Change the settings of the Bluetooth phone	Setting the phonebook	Transferring a telephone number: The user can transfer the telephone numbers from the user's Bluetooth phone to the system.
		Editing the name: If no name has been inputted, the number is displayed.
		Registering phone number: The user can register phone numbers using the following methods - Voice recognition - Using dialed numbers and received calls - Inputting phone numbers using the control knob of the audio head unit Up to 20 data can be registered in the phonebook.
		Add entry: The user can register voice recognition data for a maximum 20 registered phone numbers. The user can initialize the settings.
		Change Name: The user can change the registered phone numbers and their voice recognition data.
		Delete entry: The user can delete the registered phone numbers and their voice recognition data.
		Delete speed dial: The user can delete the speed dials registered to the function buttons (1 to 6) of the audio head unit.
		List Names: The user can change or delete the voice recognition data, or can call using certain voice recognition data by selecting that data while the system is reading it out.

*: The user can operate it while driving.

(Continued)

Function		Outline
Change the settings of the Bluetooth phone	Registering the speed dial	The user can register a maximum of 6 speed dials to the function buttons (1 to 6) of the audio head unit by selecting the desired phone numbers from the voice recognition registration. Also, the user can initialize the settings.
	Setting the volume	The user can set the volume.
		Automatic volume settings for high speed: The user can set the volume one step up when the speed is over 80 km/h (50 mph).
		The user can initialize the settings.
	Setting the security	By setting the security, the user can prevent people from using some functions of the Hands-free system. It is useful when the user leaves their car with a hotel or valet parking or the user doesn't want others to see the data that the user has registered.
		Changing the security code: The security code is 4 digits. Choose a new code that is hard for other people to guess.
		Phone book lock: The user sets the phonebook lock.
Set a Bluetooth phone	Enter the Bluetooth phone	In order to use hands-free function of a Bluetooth phone, it is necessary to register it in the audio head unit. Once a phone is registered, the hands-free function becomes available automatically. The user can register up to 6 Bluetooth phones from a maximum of 6 numbers.
	Select the Bluetooth phone	When two or more registered Bluetooth phones are in the cabin, it is necessary to select which phone to use to prevent the lines from being crossed. Only selected phone is available for use as a hands-free phone. The phone registered last is automatically selected.
	Indicate Bluetooth information	The user can check the information of the Bluetooth phone on the audio head unit LCD.
	Change the passkey	The user can change the pass key on the audio head unit LCD.
	Deleting a Bluetooth phone	The user can delete the registered Bluetooth phone.

METER

■ COMBINATION METER

1. General

- An optitron display type combination meter is used. The optitron display type meter realizes excellent visibility through the use of smoke acrylic in the protective panel, and bright LEDs (Light Emitting Diodes) that have high contrast to illuminate the indicator and the dial.
- A multi-information display has been provided in the center of the combination meter.
- A meter ECU and buzzer are enclosed in the combination meter. This ECU maintains communication with other ECUs through the CAN (Controller Area Network).
- Illumination control, which turns on the combination meter illumination at different time intervals when the power source is switched to IG-ON, has been provided.
- A step-motor type movement is used to actuate the indicators of the speedometer, the fuel gauge, the engine coolant temperature gauge and the tachometer.



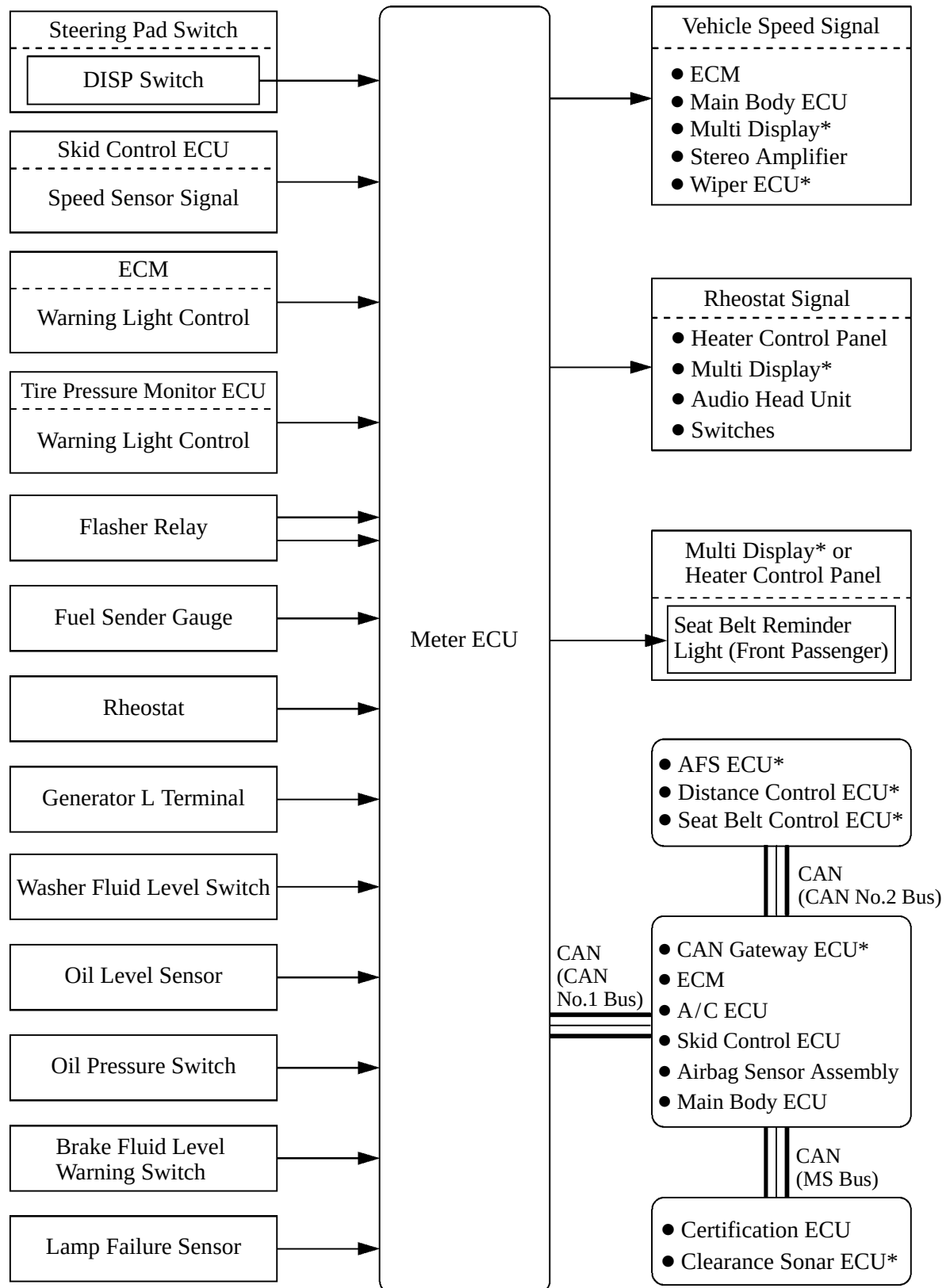
U.S.A. Model

01YBE25Y

Service Tip

If the LEDs malfunction, the entire combination meter assembly must be replaced. Refer to the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

2. System Diagram



*: Optional equipment

► Input and output communication signals of the combination meter ◀

Protocol	ECU	Input Signal	Output Signal
CAN (CAN No.1 Bus)	ECM	● Engine speed ● Engine coolant temperature ● Fuel injection volume ● Starter condition ● Shift position ● S mode indicator ● Current range position ● Buzzer sounding request ● Indicator light control ● Diagnosis (Cruise) ● Engine type information	—
	A/C ECU	Outside temperature	Vehicle speed
	Airbag Sensor Assembly	● Warning light control ● Seat belt remainder control (D, P) ● Diagnosis	Vehicle speed
	Skid Control ECU	● Warning light control ● Indicator light control ● Diagnosis	—
	Main Body ECU	● Lighting status ● Parking brake switch ● Courtesy switch ● Buzzer sounding request ● Auto dimmer signal ● Warning display control ● Diagnosis	—
CAN (CAN No.2 Bus)	AFS ECU*1	● Indicator light control ● Warning display control*2 ● Buzzer sounding request*2	—
	Seat Belt Control ECU*1	● Warning display control ● Buzzer sounding request ● Diagnosis	—
	Distance Control ECU*1	● Warning display control ● Buzzer sounding request ● Cruise control status indication ● Diagnosis	—
CAN (MS Bus)	Certification ECU	● Warning display control ● Buzzer sounding request	—
	Clearance Sonar ECU*1	● Warning display control ● Buzzer sounding request ● Intuitive parking assist status indication	Vehicle speed

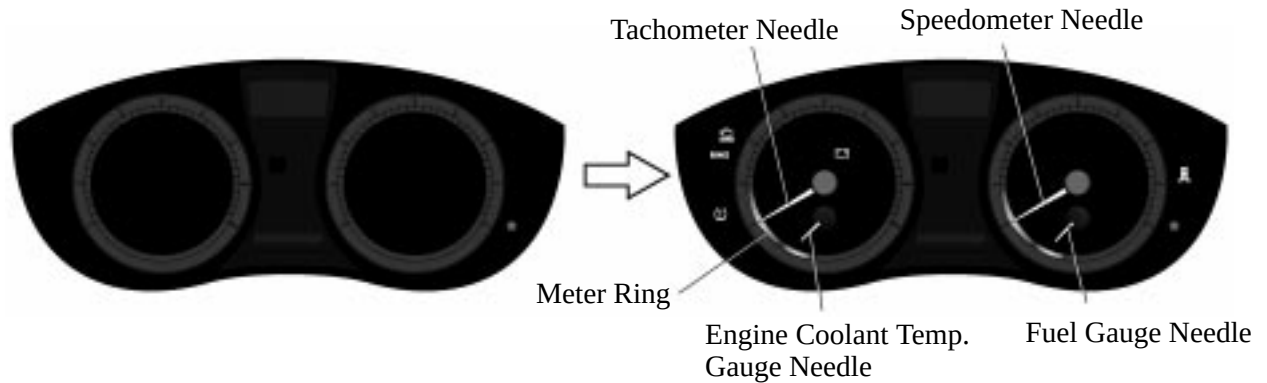
*1: Optional equipment

*2: Only for Korean package models

3. Illumination Control

When the power source is switched to IG-ON, the illumination control operates as follows. However, all illuminations turn off while cranking the engine.

- 1) Illuminates the needles of the speedometer, tachometer, fuel gauge and engine coolant temperature gauge. In addition, the meter ring is illuminated by the point illuminations provided on the tips of each needle.



01YBE27Y

- 2) Illuminates the indicator lights and warning lights, and fades in the LCD (Liquid Crystal Display), shift position indicator light, shift range indicator light and meter illumination.



01YBE28Y

4. Multi-information Display

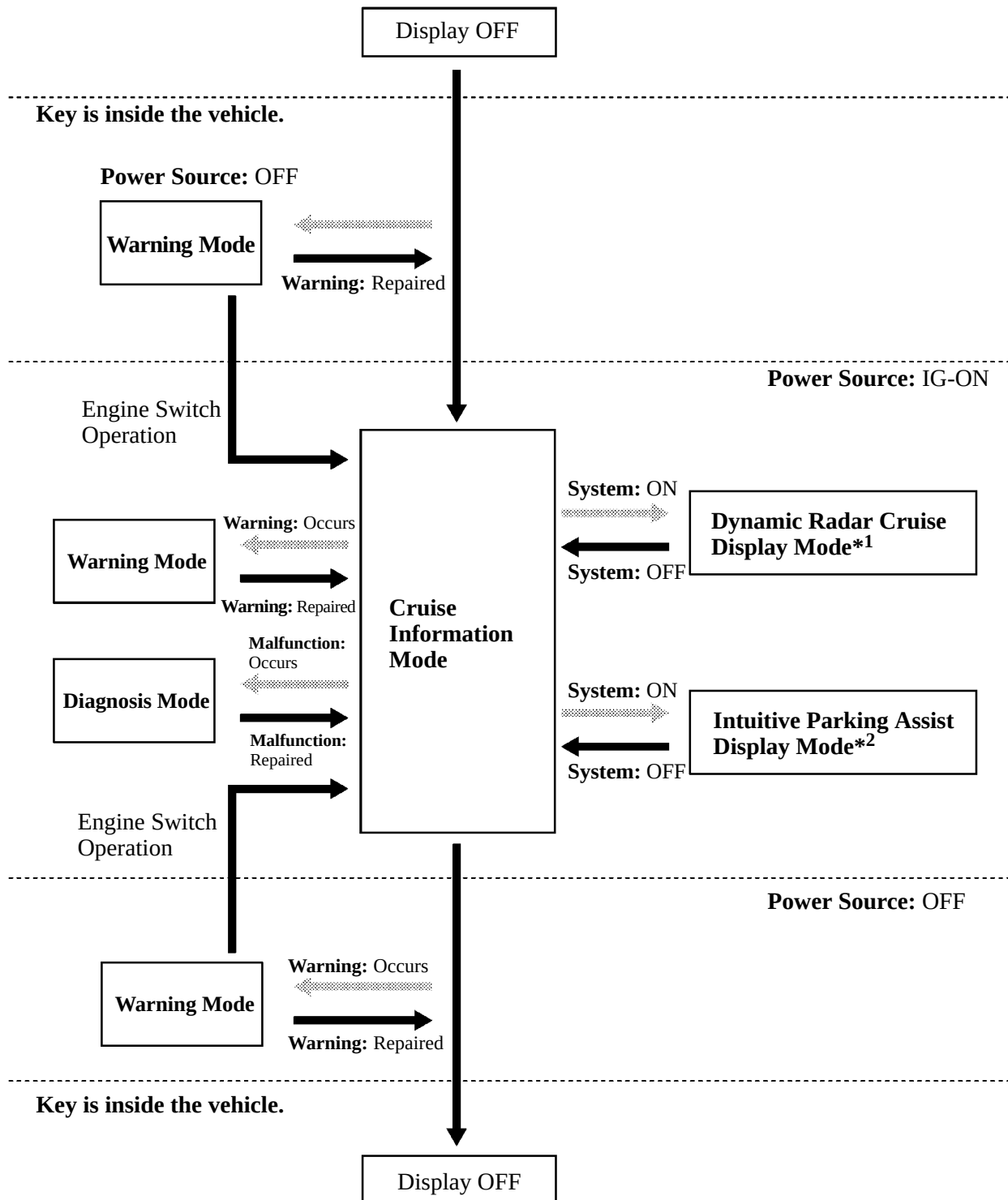
General

- The multi-information display has five modes:

Mode	Outline
Cruise Information (See page BE-50)	• Six types of information (outside temperature, driving range, average fuel consumption, average fuel consumption after refueling, current fuel consumption and average speed) can be displayed. • The display can be switched by using the DISP switch.
Warning (See page BE-51)	Interrupts the multi-information display immediately when a warning occurs.
Dynamic Radar Cruise Display (See page BE-231)	Displays the operating condition of the dynamic radar cruise control.
Intuitive Parking Assist Display (See page BE-110)	Displays the location of an obstacle and the approximate distance between the vehicle and the obstacle and displays malfunction warning messages about frozen sensors or the presence of dirt on the sensors.
Diagnosis (See page CH-82)	DTC (Diagnostic Trouble Code) for the brake control system (TRAC and VSC) can be displayed.

- The multi-information display modes can be switched as shown in the flow chart below:

Key is not inside the vehicle.

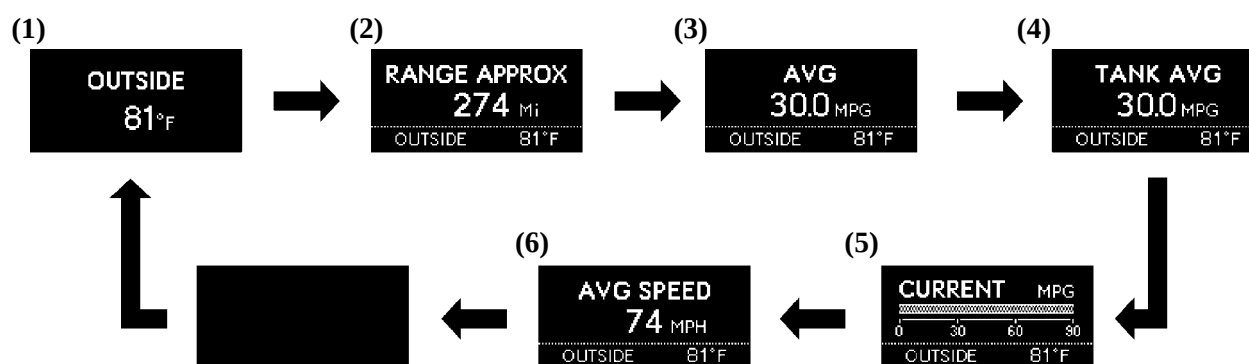


*1: For details, see page BE-231.

*2: For details, see page BE-110.

Cruise Information Mode

The cruise information is displayed in the following order each time the DISP switch is pressed.



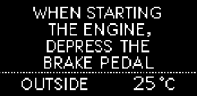
01YBE30P

Information		Outline
(1)	Outside Temperature	Displays the outside temperature in accordance with the outside temperature sensor signal from the A/C ECU.
(2)	Driving Range	- Displays the range, calculated by the combination meter which continuously monitors and stores fuel consumption data and the residual fuel volume when IG-ON has been selected. - Updated every 1 mile (U.S.A. model) or 1 km (except U.S.A. model [package option]).
(3)	Average Fuel Consumption	- Displays the value, calculated by the combination meter, which is based on the distance driven and the volume of fuel consumed (fuel injection signals from the No.1 cylinder) - Updated every 10 seconds.
(4)	Average Fuel Consumption After Refueling	- Displays the value, calculated by the combination meter, which is based on the distance driven since refueling and the fuel consumption volume (fuel injection signals from the No. 1 injector). - The combination meter determines the vehicle has been refueled through the signal from the fuel sender gauge. - Updated every 10 seconds.
(5)	Current Fuel Consumption	- Displays the value, calculated by the combination meter in accordance with the distance driven and the volume of fuel consumed (fuel injection signals from the No.1 injector) when IG-ON has been selected. - Updated every 0.5 seconds.
(6)	Average Speed	- Displays the average speed, which is calculated by the combination meter based on the length of time and the driven distance since IG-ON was selected or the DISP switch was pressed for 0.8 seconds or longer. - Updated every 10 seconds.

Warning Mode

1) General

- When a warning is necessary, the warning display interrupts the multi-information display.
- The master warning light may illuminate or flash and the buzzer may sound depending on the item in the multi-information display.

Warning	Detail	Warning	Detail
 : Flash Buzzer: Sound 01YBE174P	The key is not inside the vehicle.	 : Flash Buzzer: Sound 01YBE175P	The driver door is opened with the shift lever in any position other than P.
 : Flash 01YBE176P	Steering lock has not been released.	 : Flash 01YBE177P	Steering lock is malfunctioning.
 Buzzer: Sound 01YBE178P	The power source is switched from OFF to ACC twice with the brake pedal released.	 : Illuminate 01YBE191P	TRAC and VSC are malfunctioning.
 : Flash Buzzer: Sound 01YBE179P	Key battery is low.	 : Flash Buzzer: Sound 01YBE185P	Parking brake is still engaged with the vehicle having reached a speed of 5 km/h (3 mph).
    : Flash* : Illuminate Buzzer: Sound* 01YBE181P	Any door is open. *: The vehicle having reached a speed of 5 km/h (3 mph).	 : Flash* Buzzer: Sound* 01YBE182P	Engine hood is open. *: The vehicle having reached a speed of 5 km/h (3 mph).
		 : Flash* : Illuminate Buzzer: Sound* 01YBE183P	Luggage compartment door is open. *: The vehicle having reached a speed of 5 km/h (3 mph).

Warning	Detail	Warning	Detail
 : Flash Buzzer: Sound 01YBE184P	Engine oil pressure is low.	 : Illuminate Buzzer: Sound 01YBE192P	Engine oil level is low.
 : Illuminate Buzzer: Sound 01YBE198P	Washer fluid level is low.	 Displayed for 8 sec. : Flash Buzzer: Sound 01YBE180P	The sliding roof is open and the driver door is open.
 : Illuminate Buzzer: Sound 01YBE186P	Intuitive parking assist is dirty or covered with ice. (Optional Equipment)	 : Illuminate Buzzer: Sound 01YBE187P	Intuitive parking assist is malfunctioning. (Optional Equipment)
 CRUISE : Flash : Illuminate Buzzer: Sound 01YBE190P	Dynamic radar cruise control system is malfunctioning. (Optional Equipment)	 CRUISE : Flash : Illuminate Buzzer: Sound 01YBE189P	Dynamic radar cruise control system is unable to judge vehicle-to-vehicle distance. (Optional Equipment)
 CRUISE : Flash : Illuminate Buzzer: Sound 01YBE188P	Millimeter wave radar sensor is dirty or covered with ice. (Optional Equipment)	 : Illuminate Buzzer: Sound 01YBE195P	Automatic headlight beam level control system is malfunctioning. (Only for Korean package model)
 PCS : Illuminate Buzzer: Sound 01YBE193P	Pre-collision system is not currently functional. (Optional Equipment)	 PCS : Illuminate Buzzer: Sound 01YBE194P	Pre-collision system is malfunctioning. (Optional Equipment)
 : Illuminate Buzzer: Sound 01YBE196P	Comes on approximately 4500 miles after the engine oil is changed. (Only for U.S.A. models)	 : Illuminate Buzzer: Sound 01YBE197P	Comes on approximately 5000 miles after the engine oil has been changed. (Only for U.S.A. models)

2) Oil Replacement Reminder

- The oil replacement reminder appears to remind the driver to change the engine oil in accordance with the vehicle driving distance. This reminder is not provided on models equipped with destination package options (reminder provided only on U.S.A. models).
- The meter ECU calculates the vehicle driving distance based on the signals from the skid control ECU.
- There are two types of warnings: one is displayed when the vehicle driving distance has reached 4,500 miles or more since the last time the system was reset, and the other is displayed when the driving distance has reached 5,000 miles or more.
- The “OIL MAINT REQD SOON” warning appears for approximately 15 seconds after the power source is changed to IG-ON, and then goes off.
- The “OIL MAINT REQD” warning remains on while the power source is IG-ON.



4,500 miles or more



5,000 miles or more

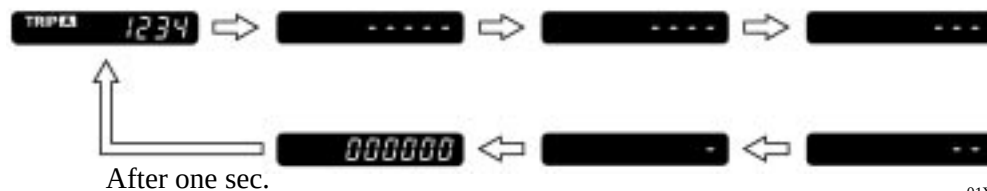
01YBE31P

- After the engine oil has been changed, the accumulated vehicle driving distance is memorized in the meter ECU and should be reset through the operation of the “TRIP” meter reset knob. At this point, the accumulated vehicle driving distance is reset to zero.

Service Tip

The accumulated vehicle driving distance is memorized in the meter ECU and can be reset using the following procedure.

- 1) Switches the power source to IG-ON and make sure that the LCD of the tripmeter (TRIP A) is on.
- 2) Switch the power source to OFF. While pushing the “TRIP” meter reset knob, switch the power source to IG-ON.
- 3) With the power source in the IG ON mode, keep holding the “TRIP” meter reset knob (for at least five seconds) with the LCD counting down as shown below. Release the “TRIP” meter reset knob when the resetting is complete.
- 4) When the resetting is complete, the LCD will display “000000” for one second. Then, the LCD will display the odometer.



01YBE32Y

5. Buzzer

The table below shows the warning and reminder functions of the buzzer.

Function	Item
Warning	● Multi-information Display Warning Mode Indication (See page BE-51) ● Shift Down Warning (See page CH-38)
Reminder	● Key Reminder (See page BE-155) ● Seat Belt Reminder (See page BE-199)

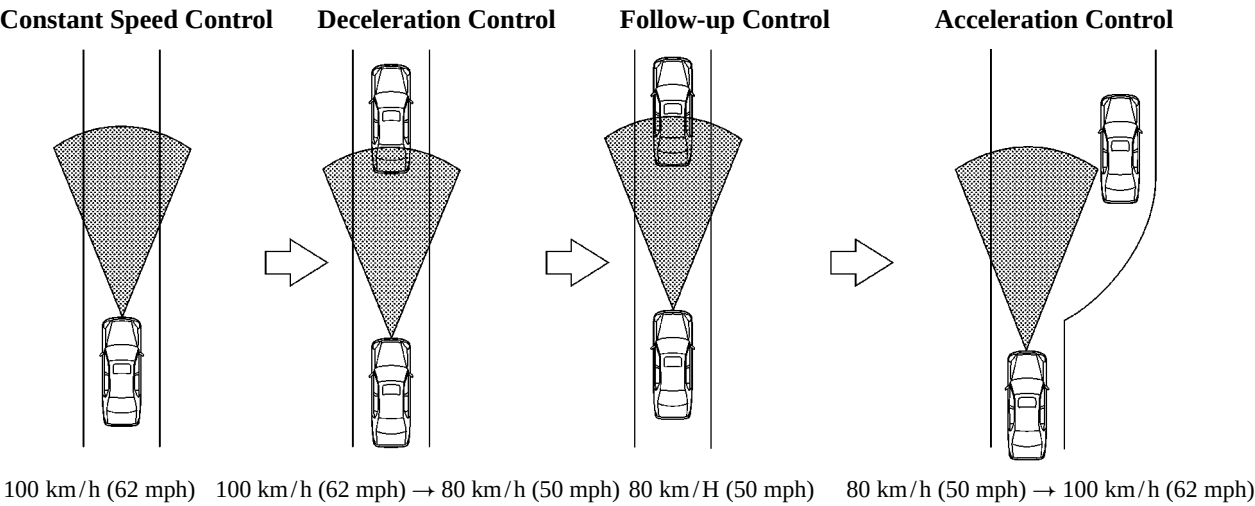
■ DYNAMIC RADAR TYPE CRUISE CONTROL SYSTEM

1. General

The dynamic radar cruise control system has two cruise control modes: Constant speed control mode, and vehicle-to-vehicle distance control mode.

- The cruise control switch is used for switching between the two modes. The mode in which the cruise control system starts is the vehicle-to-vehicle distance control mode.
- The distance control ECU, millimeter wave radar sensor and ECM control this system.
- The combination meter informs the driver of the control conditions.

Mode	Outline
Constant Speed Control Mode	The constant speed control mode is the same as in the conventional type cruise control system. However, differences are as follows: • Set speed: 40 km/h (25 mph) → 45 km/h (27 mph)
Vehicle-to-Vehicle Distance Control Mode	In the vehicle-to-vehicle distance control mode, the system recognizes and determines the lane in which the driver's own vehicle and the vehicle ahead are traveling. Thus, the system is able to maintain the proper vehicle-to-vehicle distance in accordance with the vehicle speed, and allows the vehicle to be driven under follow-up control. • The driver can operate the distance control switch on the steering wheel to select the vehicle-to-vehicle distance in three stages: long, middle, and short. • This mode consists mainly of four controls: constant speed control, deceleration control, follow-up control, and acceleration control. • The illustrations below show control examples while the driver's own vehicle is operating at 100 km/h (62 mph), and the vehicle ahead is operating at 80 km/h (50 mph). • Throttle control and brake control achieve smooth deceleration.

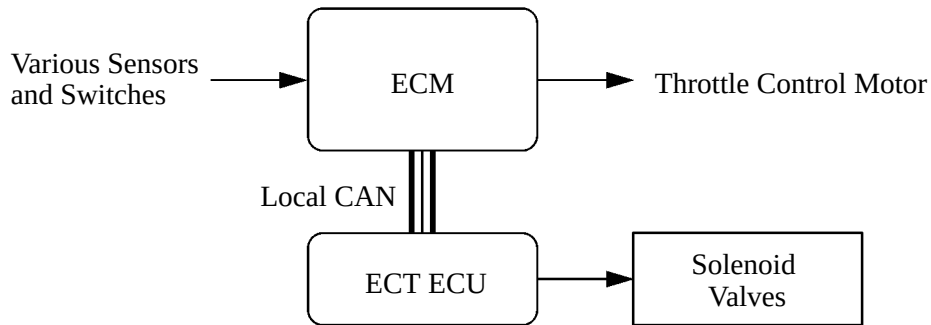


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Service Tip

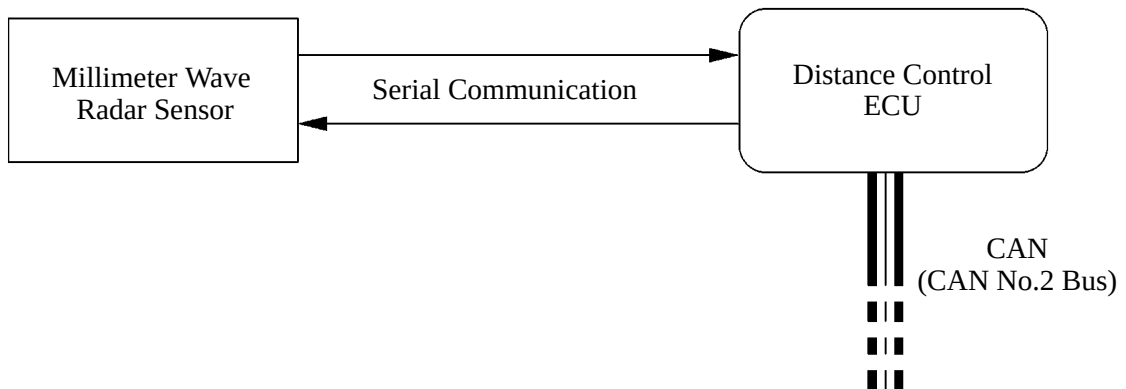
An SST is used if radar axis adjustment is needed. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

- As in the conventional type cruise control system, the constant speed control mode is controlled by the ECM, which outputs signals to the actuators and the ECM.



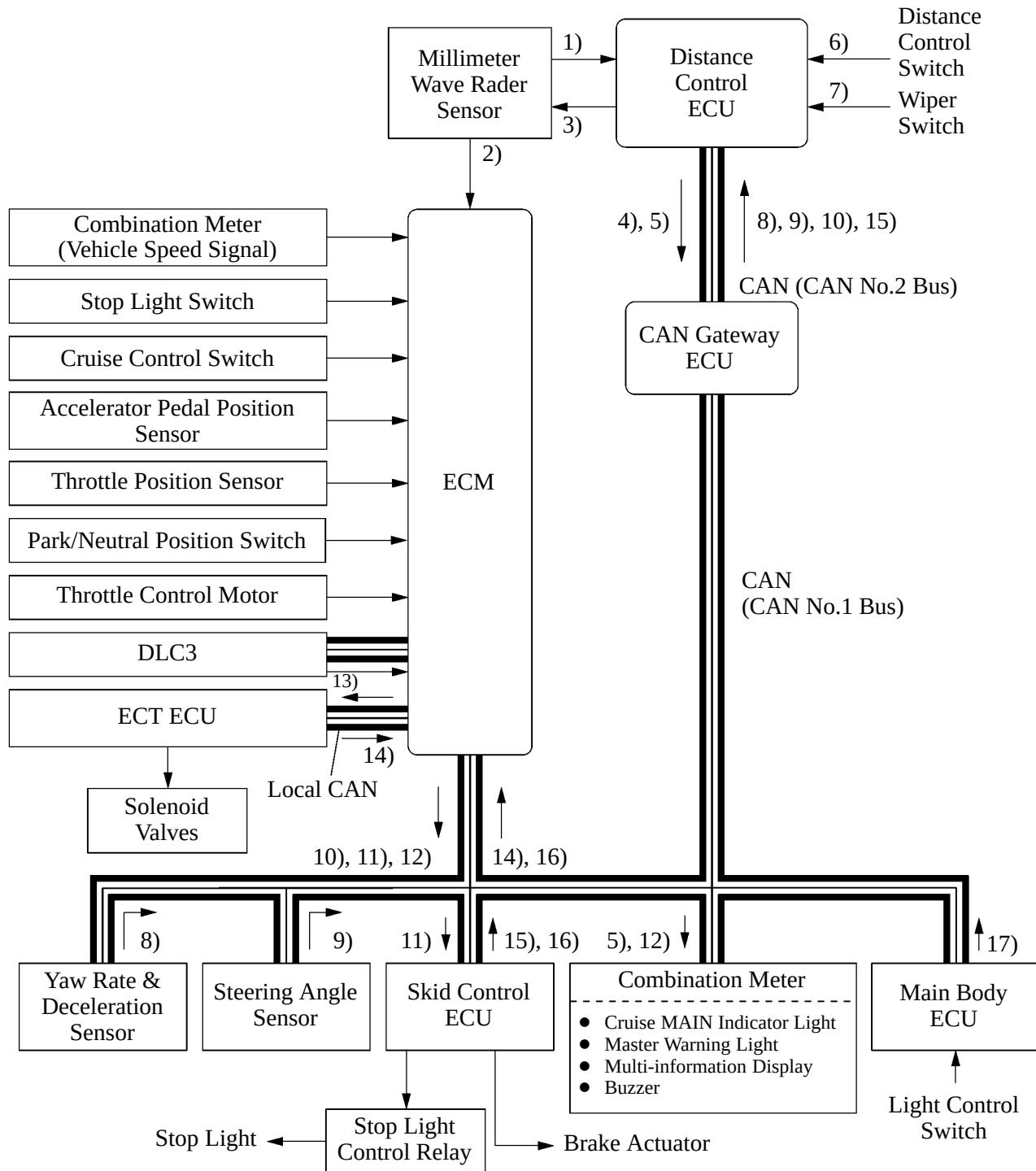
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- The vehicle-to-vehicle distance control mode is controlled by the millimeter wave radar sensor and distance control ECU. Thus, the signals are output to the actuators and the ECU while exchanging data as indicated below.



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2. System Diagram

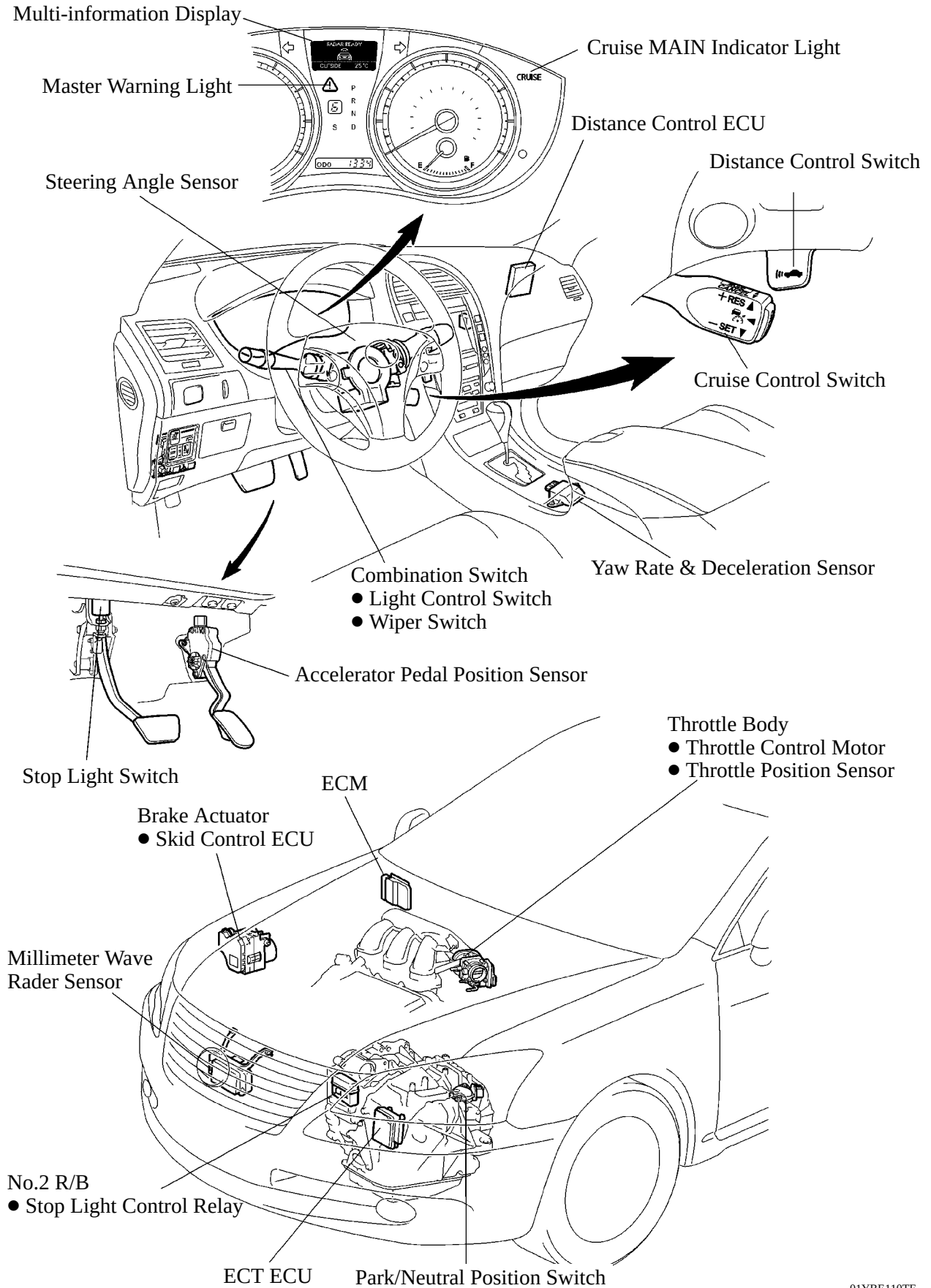


No.	Transmit	Receive	Data List	Communication
1)	Millimeter Wave Radar Sensor	Distance Control ECU	● Vehicle-to-Vehicle Distance ● Presence of Vehicle Ahead ● Relative Acceleration Rate ● Relative Vehicle Speed ● Width and Position of Object Ahead ● Diagnostic Data	Serial
2)		ECM	Millimeter Wave Radar Sensor Operation Signal	Wire
3)	Distance Control ECU	Millimeter Wave Radar Sensor	● Actual Vehicle Speed ● Estimated Curve Radius ● Wiper Condition ● Light Control Switch ● Set Distance ● Beam Axis Adjustment Data	Serial
4)		ECM	● Target Acceleration Rate ● Target Deceleration Rate ● Vehicle-to-Vehicle Distance ● Presence of Vehicle Ahead ● Brake Request ● Beam Axis Deviation ● Millimeter Wave Radar Sensor Dirtiness Detection ● Poor Weather Detection ● Proximity Warning ● Gear Request ● Diagnosis Data	CAN
5)		Combination Meter	● Display Data ● Warning	CAN
6)	Distance Control	Distance Control ECU	Distance Control Switch	Wire
7)	Wiper Switch		Wiper Switch	
8)	Yaw Rate & Deceleration Sensor		Yaw Rate	CAN
9)	Steering Angle Sensor		Steering Angle	
10)	ECM		● Set Vehicle Speed ● Actual Vehicle Speed ● Cruise Control Switch (MAIN Switch) ● Set Distance ● Brake Request Response ● Accelerator Pedal Idle ● Stop Light Signal ● Transmission Information	
11)		Skid Control ECU	● Target Deceleration Rate ● Target Deceleration Rate Gradient ● Brake Request	CAN
12)		Combination Meter	Cruise Control Switch	

(Continued)

No.	Transmit	Receive	Data List	Communication
13)	ECM	ECT ECU	Shift Up Request Signal	CAN
14)	ECT ECU	ECM	Shift Up Response	CAN
15)	Skid Control ECU	Distance Control ECU	Zero Point Information of Yaw Rate	CAN
16)		ECM	● Cruise Control Cancel Request ● Brake Request Response ● Brake Control Operation (VSC)	
17)	Combination Switch	Distance Control ECU	Light Control Switch	CAN

3. Layout of Main Components



4. Function of Main Components

Item		Outline
Cruise Control Switch	ON-OFF Button	Turns ON/OFF the power to the cruise control system.
	MODE Switch	Switches the control mode, between the constant speed control mode and vehicle-to-vehicle distance mode.
	CANCEL Switch	A cancel signal can be output to the ECM through the operation of this switch.
	RES/+ Switch	The accelerate function and resumption of a preset speed can be performed by operating this switch. A signal is output to the ECM when this switch is operated.
	SET/- Switch	The decelerate function and vehicle speed setting resume signals are output to the ECM due to operation of this switch.
Distance Control Switch		While the system is in the vehicle-to-vehicle distance control mode, the driver can operate the distance control switch to select the vehicle-to-vehicle distance in three stages: long, middle, and short.
Stop Light Switch		Detects the pressing of the brake pedal and transmits a signal to the ECM.
Combination Switch	Wiper Switch	Transmits wiper switch information to the distance control ECU.
	Light Control Switch	Switches to the beam axis adjustment mode for the millimeter wave radar sensor.
Millimeter Wave Radar Sensor		Radiates radar waves forward, uses the reflected waves to detect the presence of a vehicle being driven ahead, the vehicle-to-vehicle distance, and the relative speed, and transmits this information to the distance control ECU.
Distance Control ECU		While the system is in the vehicle-to-vehicle distance control mode, the distance control ECU detects the vehicle being followed based on signals from the millimeter wave radar sensor. Then, the distance control ECU calculates the acceleration or deceleration rate required in order to attain the target vehicle-to-vehicle distance, and outputs a request signal to the ECM and or skid control ECU.
Combination Meter		Transmits the vehicle speed signal to the ECM.
	Cruise MAIN Indicator Light	● Illuminates when the ON-OFF button on the cruise control switch has been pressed to turn the system on. ● If the distance control ECU detects a malfunction, this light flashes to warn the driver.
	Master Warning Light	Illuminates when there is a malfunction in the system.
	Buzzer	If the ECM or distance control ECU detects automatic cancel or warning signals while the vehicle is operating under cruise control, this buzzer sounds to inform the driver.
Combination Meter	Multi-information Display	During the dynamic radar cruise control, the multi-information display receives signals from distance control ECU, in order to display the system conditions.
Steering Angle Sensor		Detects the angle and direction of steering and transmits signals to the skid control ECU and distance control ECU.

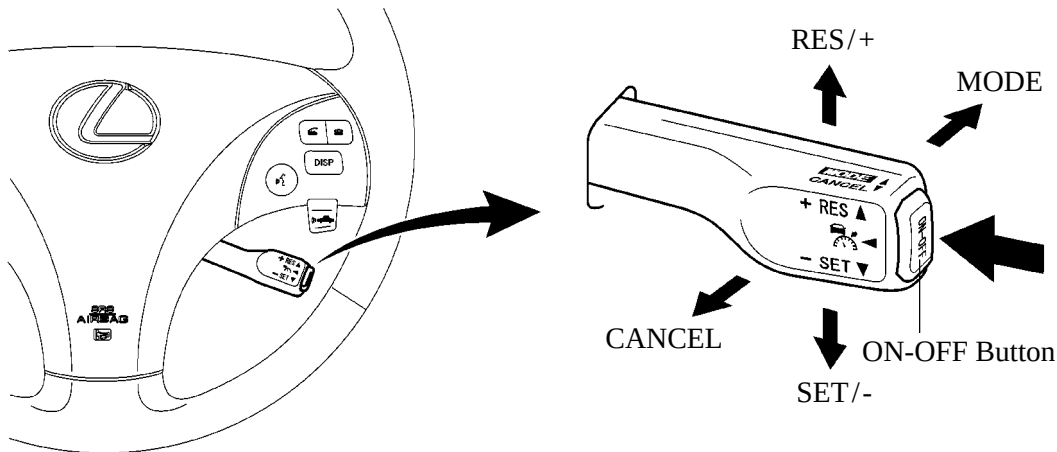
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Item	Outline
Yaw Rate & Deceleration Sensor	Detects the yaw rate of the vehicle and transmits signals to skid control ECU and distance control ECU.
Skid Control ECU	While the system is operating in vehicle-to-vehicle distance control mode, the skid control ECU actuates the brake actuator in accordance with the brake request signal received from the distance control ECU.
Brake Actuator	Actuates the brakes in accordance with the signals from the skid control ECU.
Stop Light Control Relay	Illuminates the stop light in accordance with the stop light illumination request signal from the skid control ECU.
ECM	● Controls the cruise control system in accordance with signals from the switches, sensors, skid control ECU and distance control ECU. ● If the ECM detects a malfunction in the cruise control system, it will store DTC (Diagnostic Trouble Code).

5. Construction and Operation

Cruise Control Switch

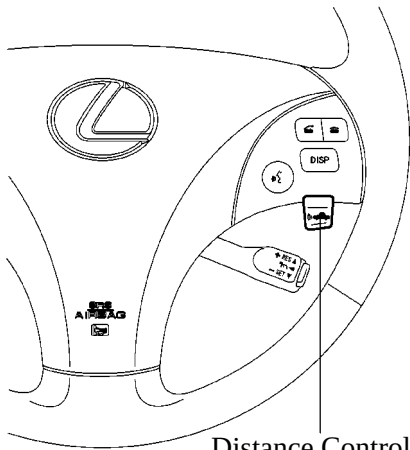
- Cruise control switch consists of the ON-OFF button, RES/+, MODE, SET/- and CANCEL switches. RES/+, MODE, SET/- and CANCEL switches are a lever that operates in four directions.
- The cruise control switch is an automatic reset (normally open) type that turns ON only when the switch is being operated and turns OFF as soon as the driver releases the switch. Furthermore, the functions of the control switch are active only when the cruise control system has been turned on using the ON-OFF button on the cruise control switch.



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Distance Control Switch

- While the vehicle is being driven in vehicle-to-vehicle distance control mode, the vehicle-to-vehicle distance setting can be changed each time the distance control switch is pressed, as follows; long → middle → short.
- If the power source is switched OFF and back to IG ON, the system will default to “long”.
- The vehicle-to-vehicle distance is set as follows:



Distance Control Switch

Mode	Vehicle-to-Vehicle Distance*
Long	Approx. 75 m (246 ft)
Middle	Approx. 50 m (164 ft)
Short	Approx. 30 m (98 ft)

*: While driving at a vehicle speed of 80 km/h (50 mph).

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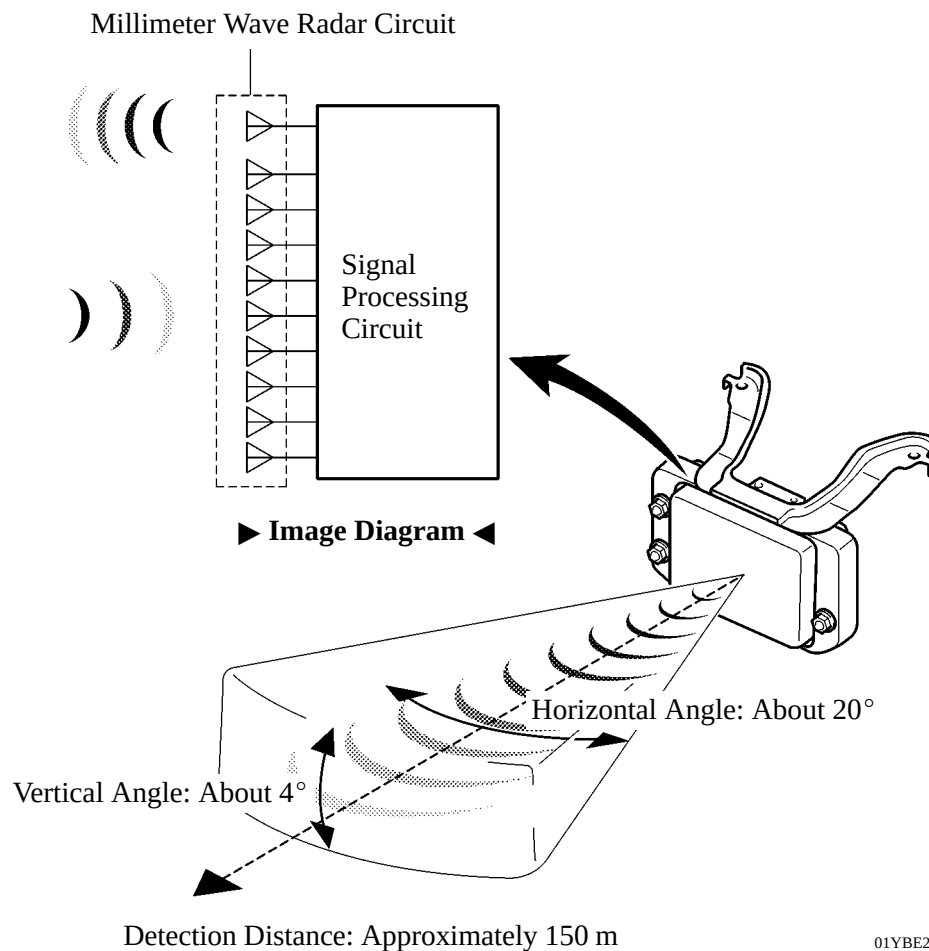
Millimeter Wave Radar Sensor

1) General

The millimeter wave radar sensor consists of a millimeter wave radar circuit, signal processing circuit, and CPU.

- The millimeter wave radar circuit consists of one transmission antenna and nine reception antennas.
- The millimeter wave radar outputs waves when the vehicle speed is above 0, and not when the vehicle speed is at 0. The millimeter wave radar uses frequencies in the 76 GHz band.
- The reception antennas receive the millimeter wave radar waves that have been reflected.
- The signal processing circuit detects the distance, relative speed, and the direction of the object by generating millimeter wave radar waves and calculating the signals received by the reception antennas.

Then, it transmits this information to the distance control ECU.

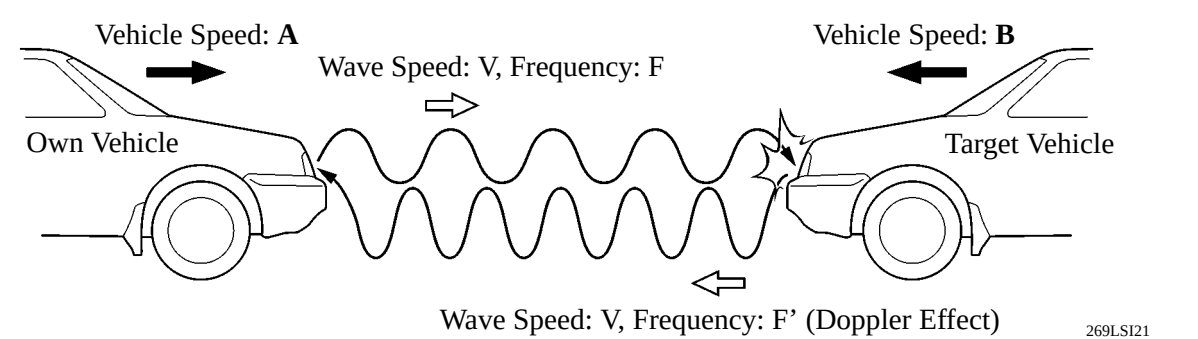


2) Calculation Method

The distance to the object, azimuth (horizontal angle), and relative speed are calculated from the information that is provided by the reflection millimeter wave radar as described below.

Distance	Calculated from the length of time that elapse the waves of the millimeter wave radar are emitted, until the waves reflected by the millimeter wave radar are received.
Azimuth	Calculated from the angle of the waves reflected by the millimeter wave radar that are received.
Relative Speed	Calculated by utilizing the changes (Doppler effect*) that occur in the frequencies of the reflected millimeter wave radar waves.

*: The Doppler effect causes the observer to perceive the radio waves emitted by a moving object to be at higher frequencies as it approaches, and to be at lower frequencies at it recedes. This phenomenon is created because when an object is located far away, the radio waves are perceived at higher frequencies than they are at the radio source.

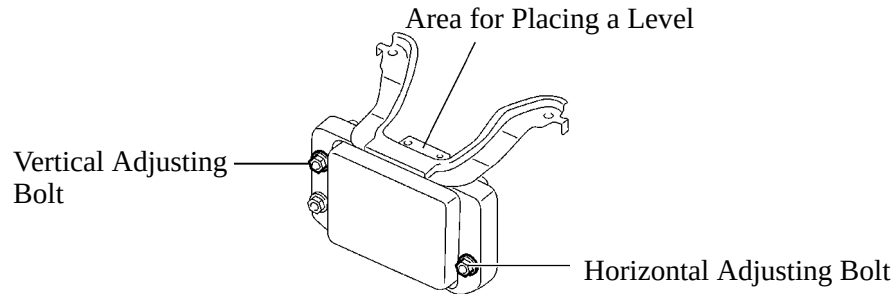


By applying the following formula, the vehicle speed **B** of the target vehicle can be calculated.

Doppler Effect: $F' = \frac{V + B}{V - A} F$

Service Tip

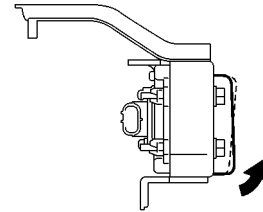
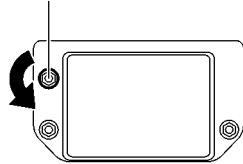
After a millimeter wave radar sensor has been replaced or removed and reinstalled, the SST (09870-60000) and a hand-held tester must be used to adjust the sensor angle. To ensure the proper precision, the sensor must be adjusted in the horizontal state. For this reason, the sensor is provided with an area for placing a level, as well as a horizontal adjusting bolt and a vertical adjusting bolt. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).



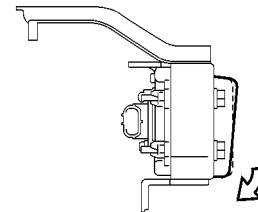
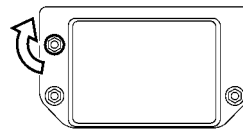
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- Turn vertical adjusting bolt to adjust the vertical direction of the millimeter wave radar sensor.
Reference: One turn of the bolt moves the sensor by approximately 1.0° .

Adjusting Bolt



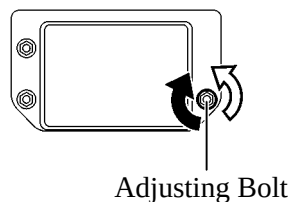
01YBE204TE



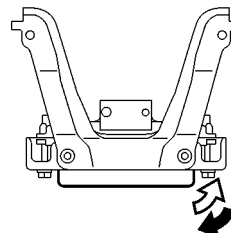
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- Turn the horizontal adjusting bolt to adjust the horizontal direction of the millimeter wave radar sensor.

Reference: One turn of the bolt moves the sensor by approximately 0.33° .



Adjusting Bolt



01YBE206TE

Combination Meter

The combination meter provides a master warning light, cruise MAIN indicator light, buzzer, and multi-information display to warn and indicate in the dynamic radar cruise control system.

- The multi-information display displays the set vehicle speed, constant speed mode mark, vehicle-to-vehicle distance mark, vehicle ahead mark, and warning message.
- Examples of the illumination or display of each indicator light, warning light or multi-information display are shown below.

Mode	Condition	Multi-information Display	 01YBE168P	 0150BE35C	Buzzer
Constant Speed Control	Being Controlled	 01YBE114TE	Illuminate	—	—
Vehicle-to-Vehicle Distance Control	Set Standby	 01YBE146TE	Illuminate	—	—
	Under Constant Speed Control (No Vehicle Ahead)	 01YBE115TE	Illuminate	—	—
	Under Follow-up Control (Vehicle Ahead)	 01YBE147TE	Illuminate	—	—
	Deceleration Control (Vehicle Ahead)	 01YBE148TE The vehicles in the display are highlighted at 0.5-second intervals.	Illuminate	—	Sounds Continuously
System Failure	Millimeter wave radar sensor is dirty.	 01YBE116TE	Flash	Illuminate	Sound Once
	Poor Weather Condition	 01YBE117TE	Flash	Illuminate	Sound Once
	System Check*	 01YBE118TE	Flash	Illuminate	Sound Once
Beam Axis Adjustment		 01YBE119TE	Flash	—	—

*: When a DTC (Diagnostic Trouble Code) is memorized.

6. System Control

General

The control of the dynamic radar cruise control system varies depending on the mode:

A: Constant Speed Control Mode

B: Vehicle-to-vehicle Distance Control Mode.

Control	Outline	Mode	
		A	B
Constant Speed Control [See page BE-234]	The ECM compares the actual vehicle speed and the set speed and if the vehicle speed is higher than the set speed, it uses the throttle control motor to decrease the throttle opening. If the actual vehicle speed is lower than the set speed, it uses the throttle control motor to increase the throttle opening.	○	○
Deceleration Control [See page BE-235]	Effects throttle control and brake control in order to decelerate the vehicle so that the vehicle-to-vehicle distance between this vehicle and the vehicle ahead equals the set distance.	—	○
Follow-up Control [See page BE-236]	After effecting deceleration control, the vehicle follows the vehicle ahead in order to maintain the proper vehicle-to-vehicle distance in accordance with the vehicle speed.	—	○
Acceleration Control [See page BE-237]	Accelerates the vehicle in order to attain the set vehicle speed if the vehicle ahead or this vehicle has changed lanes.	—	○
Set Control	While this system fulfils the following conditions, and the cruise control switch is pressed to the SET/- side and released when the ON-OFF button on the cruise control switch has been pressed to turn the system on, the ECM stores the vehicle speed and maintains the vehicle constantly at that speed. ● The shift lever is in D position ● The shift lever is shifted in the S mode, and shift range is 4th, 5th or 6th.	○	○
	The vehicle is running above a speed of: ● U.S.A.: About 27 mph or more ● Canada: About 43 km/h or more	○	—
	The vehicle is running within a vehicle speed range. ● U.S.A.: About 27 to 85 mph ● Canada: About 43 to 137 km/h	—	○
Low Speed Limit Control	The low speed limit is the lowest speed that cruise control can be set at and it is designed to be approx. "25 mph (40 km/h)". The cruise control cannot be set below that speed. If the vehicle speed drops below that speed while running in the cruise control, the cruise control will be cancelled automatically. However, the set vehicle speed in the memory is kept.	○	○

(Continued)

Control	Outline	Mode	
		A	B
COAST Switch Control	While the cruise control switch is held to the SET/- side, the vehicle speed and the vehicle setting speed changes as follows, according to the mode:	○	○
	- The vehicle decelerates constantly. - The vehicle setting speed changes to the speed at which the switch was turned OFF.	○	—
	- The vehicle setting speed decreases in increments 5 km/h or 5 mph. [Example: 103 → 100 → 95 km/h, 62 → 60 → 55 mph] - The vehicle decelerates rapidly due to ETCS-i.	—	○
Tap Down Control	When the cruise control switch is pushed momentarily (approx. 0.6 sec) to the SET/- side, the vehicle speed and the vehicle setting speed change as follows, according to the mode: - The vehicle will decelerate in increments of approximately 1 mph (1.6 km/h) for each time the switch was pressed. - However, if the difference between the actual vehicle speed and the vehicle setting speed is greater than 5 km/h or 5 mph, the set vehicle speed will change to the speed at which the vehicle was being driven at the time the switch was operated.	○	—
ACC Switch Control	When the cruise control switch is pushed to the RES/+ side and held, the vehicle speed and the vehicle setting speed change as follows, according to the mode:	○	○
	- The vehicle will accelerate constantly. - The vehicle setting speed changes to the speed at which the switch was turned OFF.	○	—
	- The vehicle setting speed increases in increments 5 km/h or 5 mph. [Example: 93 → 95 → 100 km/h, 52 → 55 → 60 mph] - The vehicle will accelerate to the speed that is set at the time the switch is released. However, only the vehicle setting speed will change during follow-up control.	—	○
RES Switch Control	If the vehicle speed is above the low speed limit, the cruise control resumes operation (subsequently pushes the cruise control switch to the RES/+ side) to reach the vehicle speed that was set at the time the driver canceled cruise control.	○	○
	Even if the vehicle speed drops below the low speed limit, resume can be performed when the vehicle speed increases to above the low speed limit.	○	○
	If the vehicle ahead changes driving lanes during follow-up control, the vehicle speed is gradually increased to the set vehicle speed. At this time, the vehicle speed can be increased promptly by pushing the cruise control switch to the RES/+ side.	—	○
Tap Up Control	When the cruise control switch is pushed momentarily (approx. 0.6 sec.) to the RES/+ side, the vehicle speed and the vehicle setting speed change as follows. - The vehicle will accelerate in increments of approx. 1.6 km/h (1 mph) for each time the switch was pressed. - However, if the difference between the actual vehicle speed and the vehicle setting speed is greater than 5 km/h or 5 mph, the vehicle setting speed changes to the speed as which the vehicle was being driven at the time the switch was operated.	○	—

(Continued)

Control	Outline	Mode	
		A	B
Shift Down Control	When the vehicle is cruising uphill, shift-down control may be performed by the ECT (Electronic Control Transmission). The ECM transmits the shift up request signal to the ECT ECU when the ECM judges the end of cruising uphill based on the throttle valve angle.	○	○
Manual Cancel Control	If any of the following signals are sent to the ECM, the cruise control is cancelled accordingly. ● Stop light switch ON signal/brake pedal depressed. ● Shift lever is shifted from D to N. ● When 1st, 2nd and 3rd range is selected in S mode position. ● CANCEL switch ON signal (cruise control switch moved to CANCEL side) ● Cruise control switch (ON-OFF button) OFF signal ● VSC operation signal	○	○
Automatic Cancel Control [See page BE-238]	When an automatic cancel signal is sent to the ECM, the cruise control operation is canceled. At this time, the style of the warning to the driver and the control resumption condition varies according to the cancel signal.	○	○
Mode Switching Control	The following operations switch the modes: 1) ON-OFF button on the cruise control switch is ON. (Starts in the vehicle-to-vehicle distance control mode) 2) Cruise control switch is held to the MODE side. (Approx. 1 second or more) If the switch is pushed to any other side before switching modes, switch the cruise control system OFF; then, perform steps 1) and 2) again.	○	○
Diagnosis [See page BE-239]	If a malfunction occurs in the dynamic radar cruise control system during cruise control operation, the ECM cancels cruise control and diagnoses and memorizes the faults related to the malfunction.	○	○

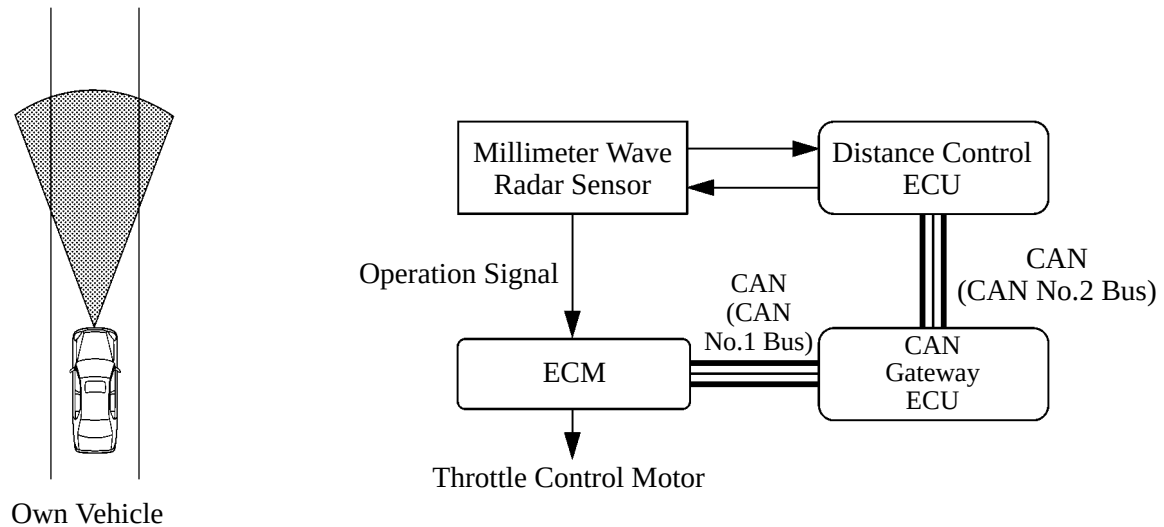
Constant Speed Control

1) General

- In the constant speed control mode, the constant speed control is effected by the ECM in the same way as the conventional cruise control.
- In the vehicle-to-vehicle distance control mode, the constant speed control is effected by the millimeter wave radar sensor and distance control ECU.

2) Constant Speed Control in Vehicle-to-Vehicle Distance Control Mode

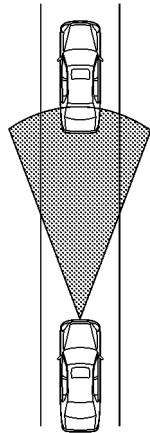
The millimeter wave radar sensor transmits the information about the vehicle ahead to the distance control ECU and also transmits a millimeter wave radar sensor operation signal to the ECM. The distance control ECU transmits this signal to the ECM. The ECM compares the vehicle setting speed and the actual vehicle speed, and effects constant speed control by regulating the throttle control in order to attain the set vehicle speed.



Deceleration Control

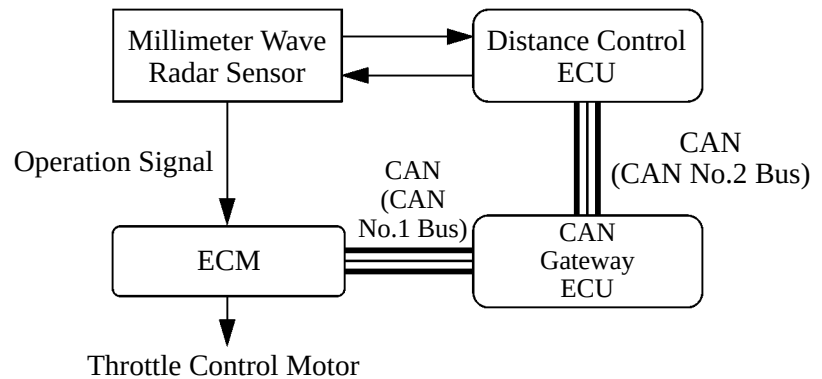
- The distance control ECU calculates the target deceleration rate in accordance with signals from the millimeter wave radar sensor, and transmits a deceleration request signal to the ECM. Upon receiving this signal, the ECM closes the throttle valve in order to cause the vehicle to decelerate.
- This control is not effected in the presence of a parked vehicle or object, or below the settable vehicle speed range.

Vehicle Ahead



Own Vehicle

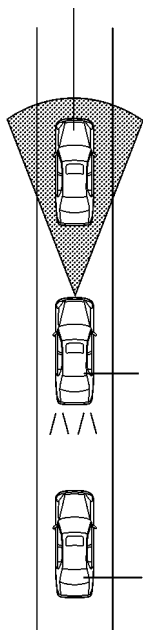
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- If distance control ECU determines that further deceleration is necessary, it transmits a brake request signal to the ECM. Upon receiving this signal, the ECM transmits a brake request signal to skid control ECU. Skid control ECU then controls the brake actuator to apply the brakes.
- At this time, if the deceleration rate is higher than a predetermined value, the skid control ECU outputs a stop light illumination request signal to the stop light control relay, in order to inform anyone who might be following the vehicle.

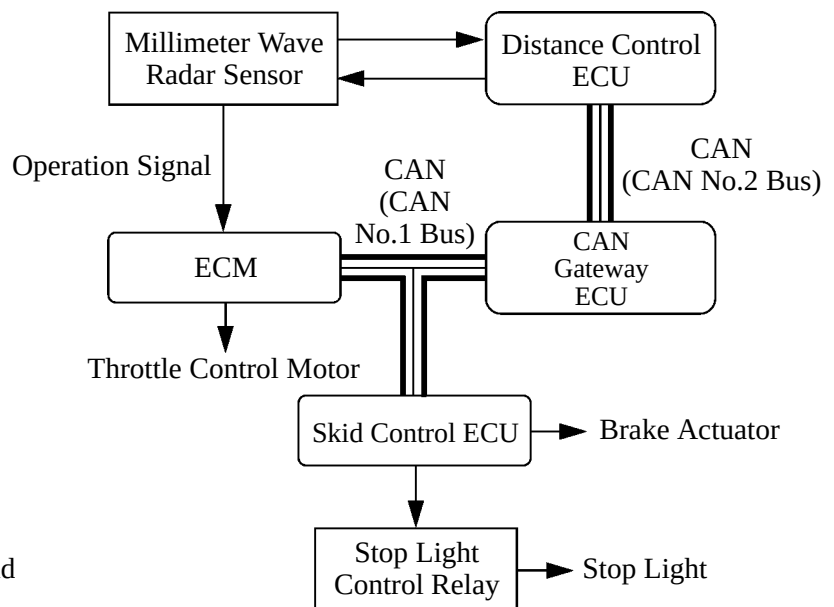
Vehicle Ahead



Own Vehicle

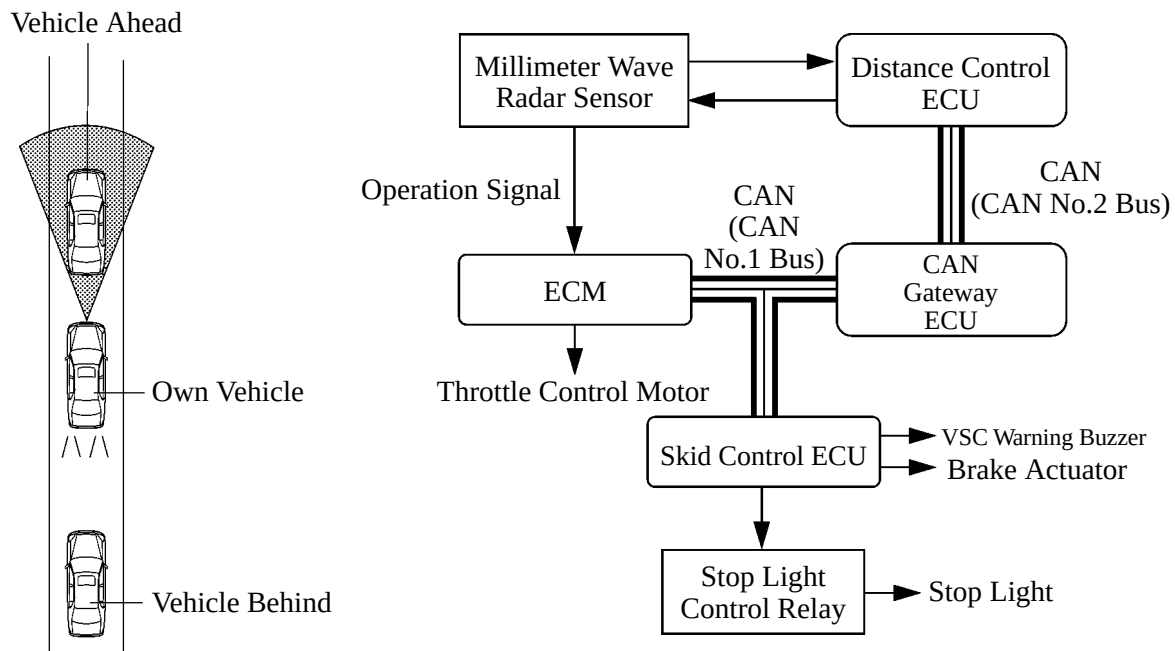
Vehicle Behind

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- If further deceleration is necessary after the stop light is illuminated, the skid control ECU sounds the VSC warning buzzer based on the request signal from the distance control ECU to urge the driver to depress the brake pedal.

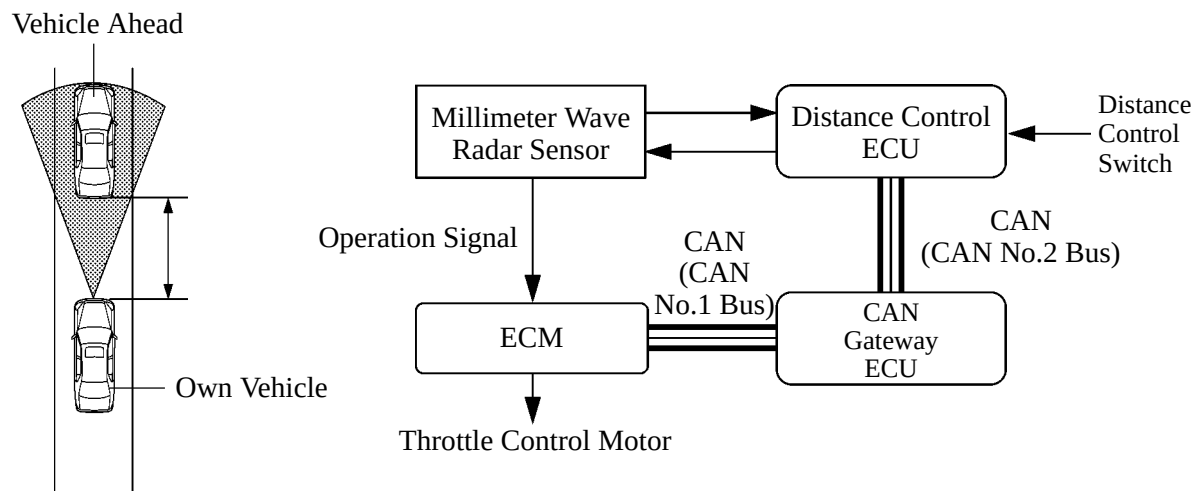


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Follow-up Control

- After effecting deceleration control, distance control ECU transmits a request signal to the ECM so that the vehicle can follow the vehicle ahead while maintaining the proper vehicle-to-vehicle distance according to the vehicle speed. Upon receiving this signal, the ECM regulates the throttle in order to effect follow-up control.
- Three stages (long, middle, and short) of vehicle-to-vehicle distance can be selected by operating the distance control switch.

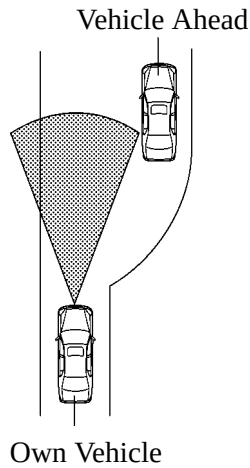


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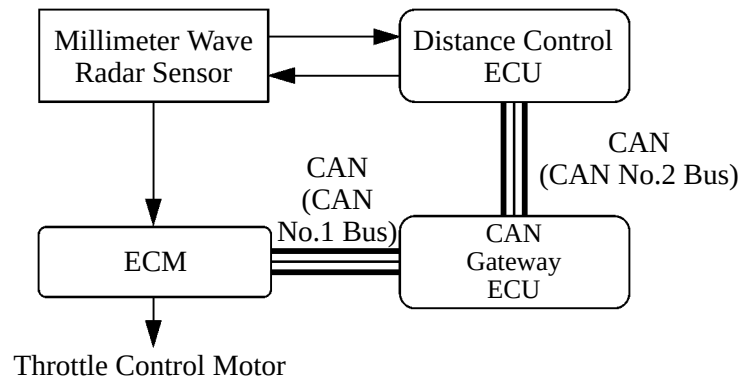
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Acceleration Control

If the distance control ECU detects (based on the millimeter wave radar sensor) that either the vehicle ahead or own vehicle has changed lanes, an acceleration request signal is transmitted to the ECM in order to attain the set vehicle speed. Upon receiving this signal, the ECM regulates the throttle in order to effect acceleration control.



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Automatic Cancel Control

If any of the conditions listed below occur while the vehicle is in cruise control (A: constant speed control mode; B: vehicle-to-vehicle distance control mode), the cruise control will be canceled. Then, the following warning items will appear for the driver.

- 1) Warning message is displayed on the multi-information display.
- 2) Master warning light illuminates.
- 3) Buzzer sounds.
- 4) Cruise MAIN indicator light flashes.

Mode	Description of Malfunction	Warning
A and B	If any of the conditions listed below occur, the ECM clears the vehicle setting speed and cancels the cruise control. ● Malfunction of the vehicle speed signal. ● Malfunction in the ETCS-i. ● An open or short circuit in the stop light switch. The cruise control is prohibited until the conditions are remedied or the cruise control system is turned off and back on again using the ON-OFF button on the cruise control switch.	1) “CHECK CRUISE SYSTEM” 2) Illuminate 3) Sound Once 4) Flash
	If any of the conditions listed below occur, the ECM cancels the cruise control while retaining the vehicle setting speed in its memory. ● The vehicle speed drops below low speed limit [approx. 40 km/h (25 mph)].	1) — 2) — 3) — 4) —
A	If any of the conditions listed below occur, the ECM cancels the cruise control. ● The vehicle speed drops more than 16 km/h (10 mph) below the vehicle setting speed.	1) — 2) — 3) — 4) —
B	If any of the conditions listed below occur, the ECM clears the vehicle setting speed and cancels the cruise control. ● Malfunction of the millimeter wave radar sensor. ● Displacement of the axis of the millimeter wave radar sensor. ● Malfunction in the dynamic radar cruise control system other than those given above. The cruise control is prohibited until the engine switch is turned on again.	1) “CHECK CRUISE SYSTEM” 2) Illuminate 3) Sound Once 4) Flash
	If any of the conditions listed below occur, the ECM cancels the cruise control while retaining the setting vehicle speed in its memory. ● The millimeter wave radar sensor is dirty. The cruise control is prohibited until the conditions are remedied or the ON-OFF button on the cruise control switch is turned on again.	1) “CLEAN RADAR SENSOR” 2) Illuminate 3) Sound Once 4) Flash
	If any of the conditions listed below occur, the ECM cancels the cruise control while retaining the set vehicle speed in its memory. ● The wipers operate at HI speed (including AUTO mode). ● The measurement becomes extremely unstable due to poor weather conditions. The cruise control is prohibited until the conditions are remedied or the cruise control system is turned off and back on again using the ON-OFF button on the cruise control switch.	1) “CRUISE NOT AVAILABLE” 2) Illuminate 3) Sound Once 4) Flash

Diagnosis

If a malfunction occurs in the dynamic radar cruise control system during cruise control, the ECM cancels the cruise control, flashes the cruise MAIN indicator light and the master warning light, and sounds the buzzer to inform the driver of the malfunction. At the same time, the malfunction is stored in memory as a DTC (Diagnostic Trouble Code).

- When a hand-held tester connects to DLC3 or SST (09843-18040) is connected between the Tc and CG terminals of DLC3, DTC can be read.
- A hand-held tester can be used to read the 5-digit codes. If the SST is used, 2-digit codes can be read based on the number of blinks of the cruise MAIN indicator light.

Service Tip

When using a hand-held tester, a dedicated adapter [CAN VIM (Vehicle Interface Module)] must be connected between the DLC3 and the hand-held tester. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

CRUISE CONTROL SYSTEM

DESCRIPTION

There are two cruise control systems, a conventional type and a dynamic radar type.

- The conventional type is standard equipment. It maintains the vehicle speed set by the driver. For details, see page BE-213.
- The dynamic radar type is the set option with pre-collision system. In addition to the conventional type of constant speed control, it uses vehicle-to-vehicle distance control. For details, see page BE-218.

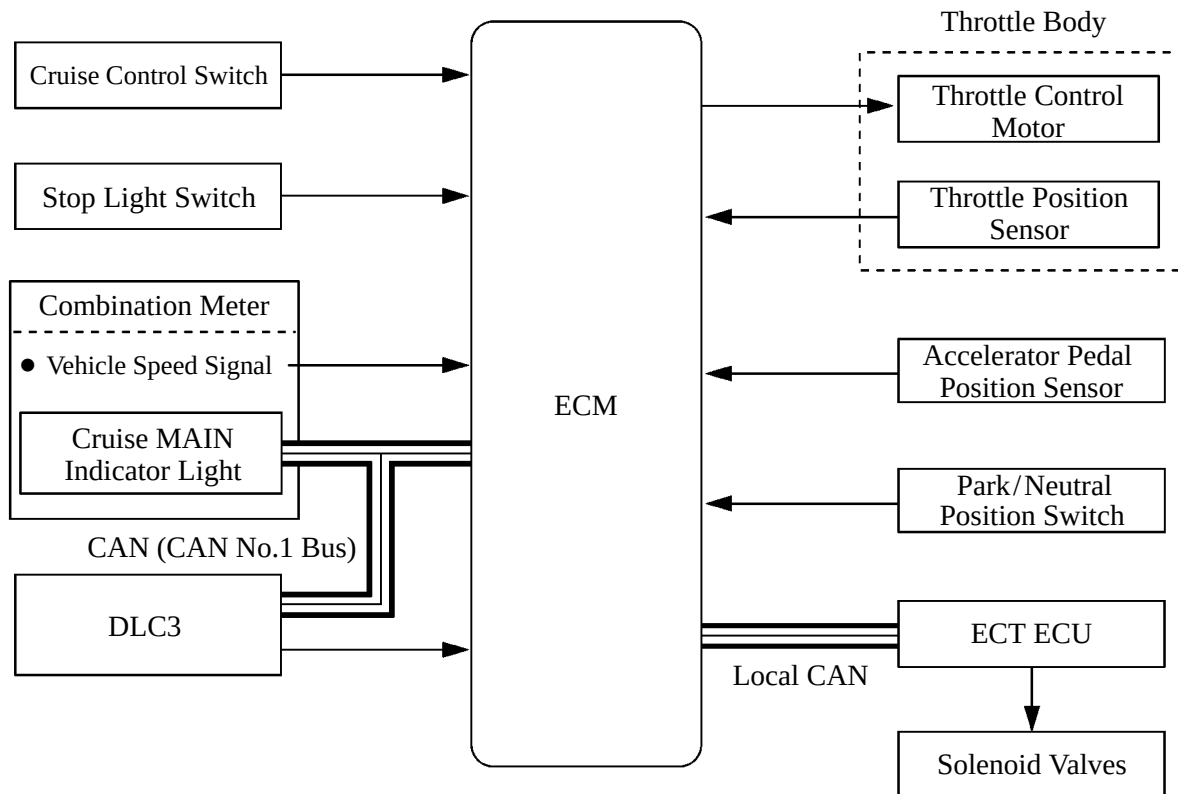
CONVENTIONAL TYPE CRUISE CONTROL SYSTEM

1. General

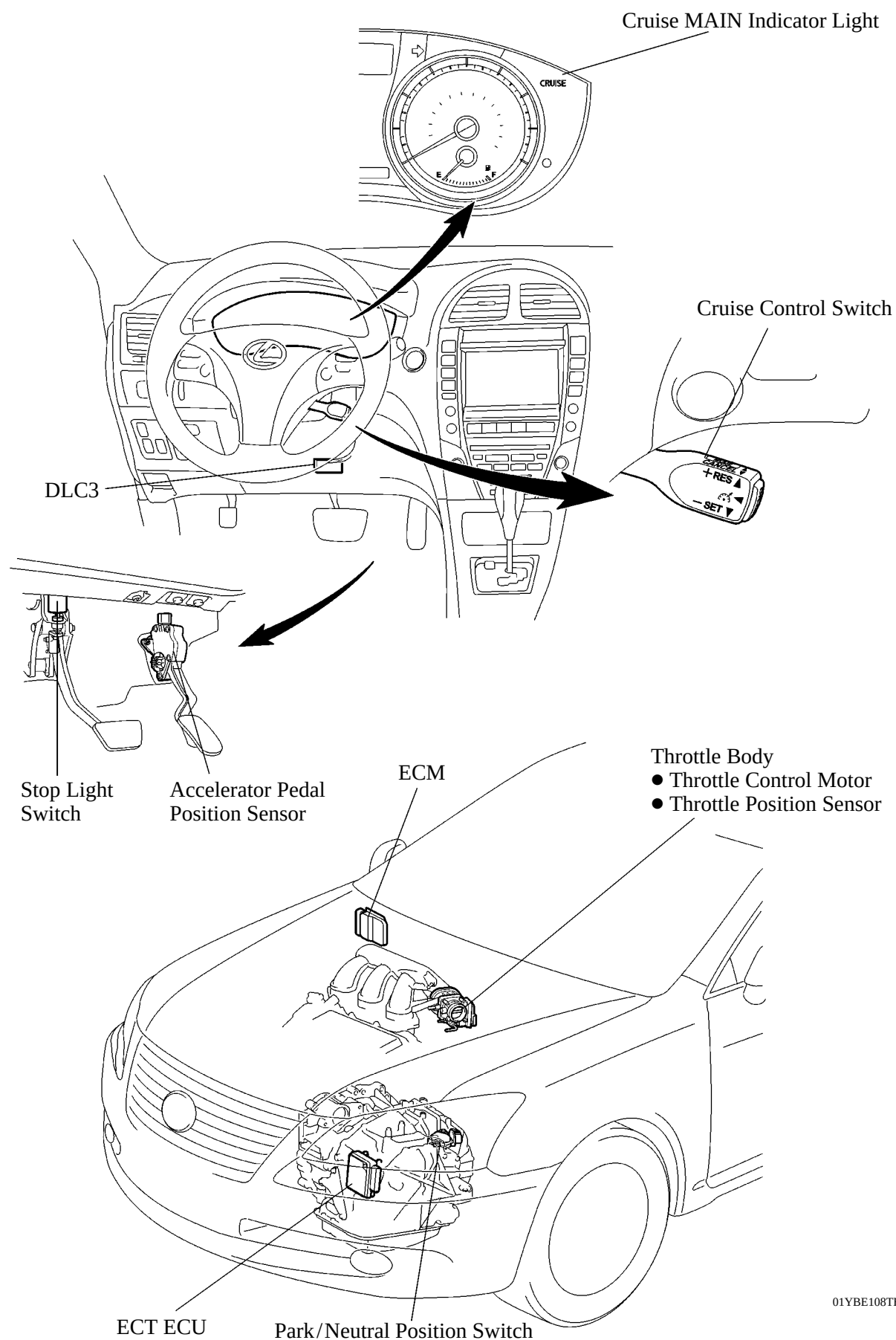
When the system is set to a desired vehicle speed, the throttle valve position is adjusted automatically to maintain the vehicle speed without the driver having to depress the accelerator pedal.

This system effects control through the ETCS-i (Electronic Throttle Control System-intelligent).

► System Diagram ◀



2. Layout of Main Components



3. System Control

General

The cruise control has the following control.

Control	Outline
Constant Speed Control	The ECM compares the actual vehicle speed and the set speed and if the vehicle speed is higher than the set speed, it uses the throttle control motor to decrease the throttle opening. If the actual vehicle speed is lower than the set speed, it uses the throttle control motor to increase the throttle opening.
Set Control	While this system fulfils the following conditions, and the cruise control switch is pressed to the SET/- side and released when the ON-OFF button on the cruise control switch has been pressed to turn the system on, the ECM stores the vehicle speed and maintains the vehicle constantly at that speed. • The vehicle is running at a vehicle speed of about 40 km/h (25 mph) or more.
Low Speed Limit Control	The low speed limit is the lowest speed that cruise control can be set at and it is designed to be approx. 40 km/h (25 mph). The cruise control cannot be set below that speed. If the vehicle speed drops below that speed while running in the cruise control, the cruise control will be cancelled automatically. However the set speed in the memory is kept.
COAST Switch Control	While the cruise control switch is held to the SET/- side, the vehicle speed and the set vehicle speed change as follows. • The vehicle decelerates constantly. • The set vehicle speed changes to the speed that the vehicle is traveling at when the COAST switch is released.
Tap Down Control	When the cruise control switch is pushed momentarily (approx. 0.6 sec.) to the SET/- side, the vehicle speed and the vehicle setting speed change as follows. • The vehicle will decelerate in increments of approx. 1.6 km/h (1 mph) for each time the switch was pressed. • However, if the difference between the actual vehicle speed and the vehicle setting speed is greater than 5 km/h (3.1 mph), the vehicle setting speed will change to the speed at which the vehicle was being driven at the time the switch was operated.
ACC Switch Control	When the cruise control switch is pushed to the RES/+ side and held, the vehicle speed and the vehicle setting speed change as follows. • The vehicle accelerates constantly. • The set vehicle speed changes to the speed as which the switch is releases.
Tap Up Control	When the cruise control switch is pushed momentarily (approx. 0.6 sec.) to the RES/+ side, the vehicle speed and the vehicle setting speed change as follows. • The vehicle accelerates in increments of approx. 1.6 km/h (1 mph) for each time the switch was pressed. • However, if the difference between the actual vehicle speed and the vehicle setting speed is greater than 5 km/h (3.1 mph), the vehicle setting speed does not change.
RES Switch Control	If cruise control is canceled for any reason other than a malfunction or main switch operation and vehicle speed is more than the low speed limit, the vehicle speed is returned to the speed before the cancellation of cruise operation by setting the cruise control switch to the RES/+ side. The cruise control mode can be resumed even if the vehicle speed drops below the low speed limit, because the speed in the memory is not cleared.

(Continued)

Control	Outline
Shift Down Control	When the vehicle is cruising uphill, shift-down control may be performed by the ECT (Electronic Control Transmission). The ECM transmits the shift up request signal to the ECT ECU when the ECM judges the end of cruising uphill based on the throttle valve angle. If shift-down control is performed during ACC or RES switch control, the ECM transmits the shift up request signal to the ECT ECU after ACC or RES switch control is completed.
Manual Cancel Control	If any of the following signals is sent to the ECM, the cruise control is cancelled accordingly. ● Stop light switch ON signal/Depress the brake pedal ● Shift lever is shifted from D to N. ● When 1st, 2nd or 3rd range is selected in S mode position. ● CANCEL switch ON signal (cruise control switch moved to CANCEL side) ● Cruise control switch (ON-OFF button) OFF signal.
Automatic Cancel Control	When any of the following conditions occur during cruise control operation, the speed that is set in the memory is cleared and the cruise control is cancelled. ● Stop light switch open or short circuit ● The vehicle speed signal is not input for a predetermined period of time. ● ETCS-i malfunction Furthermore, the cruise MAIN indicator light will blink until the ON-OFF button on the cruise control switch is used to turn the system off, and the operation of the cruise control will be disabled until the ON-OFF button is turned ON again.
	When any of the following conditions occur during cruise control driving, the speed that is set in the memory is cleared and the cruise control is cancelled. ● Stop light switch input signal is abnormal. ● Cruise control switch input signal is abnormal. Furthermore, the cruise MAIN indicator light will blink until the ON-OFF button on the cruise control switch is used to turn the system off, and the operation of the cruise control will be disabled until the power source is turned IG-ON again.
	When any of the following conditions occur during cruise control driving, the cruise control is cancelled. ● Vehicle speed is below the low speed limit [approx. 40 km/h (25 mph)] or less. ● Vehicle speed decreases by 16 km/h (10 mph) or more below the speed at which the cruise control was set.
Diagnosis	When the ECM does not receive a vehicle speed signal for a predetermined period of time during cruising, or when cruise control is cancelled (automatic cancel) due to a malfunction of the cruise control, stop light switch or vehicle speed signal, the ECM immediately blinks the cruise MAN indicator light due to the malfunction. The contents relating to the malfunction will be stored in the ECM.

Diagnosis

If a malfunction occurs in the cruise control system, during cruise control operation, the ECM actuates the automatic cancel control and blinks the cruise MAIN indicator light to inform the driver of a malfunction. At this time, the ECM memorizes the malfunction in the form of 5-digit and 2-digit DTCs (Diagnostic Trouble Code).

- The 5-digit DTC can be read by connecting a hand-held tester to the DLC3.
- The 2-digit DTC is output to the cruise MAIN indicator light when the Tc and CG terminals of the DLC3 connector are connected through the use of the SST (09843-18040). Thus, these DTCs can be obtained by counting the number of blinks of the cruise MAIN indicator light.

Service Tip

When using a hand-held tester, a dedicated adapter [CAN VIM (Vehicle Interface Module)] must be connected between the DLC3 and the hand-held tester. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

DOOR LOCK CONTROL SYSTEM

■ DESCRIPTION

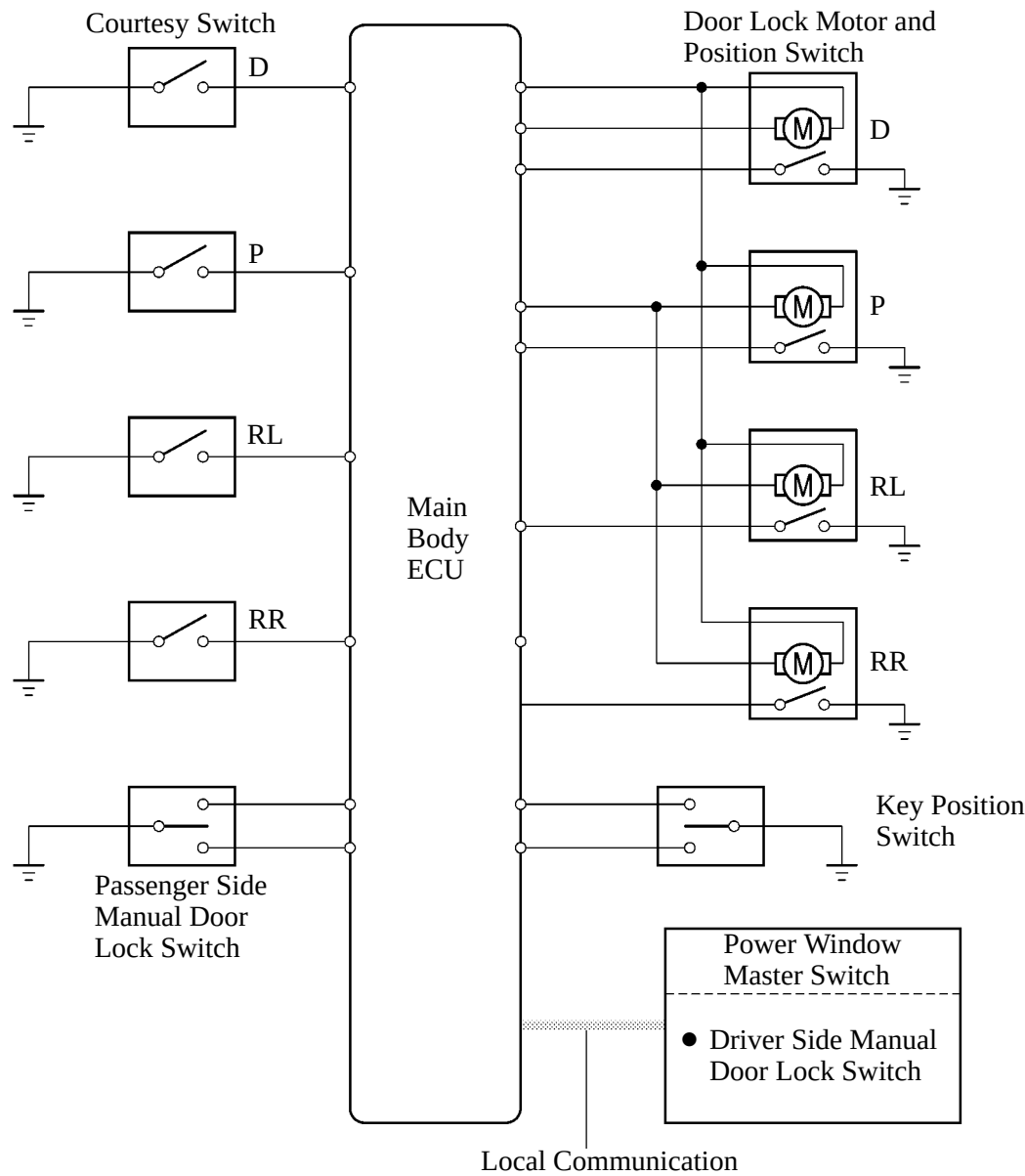
The door lock control system has the following functions:

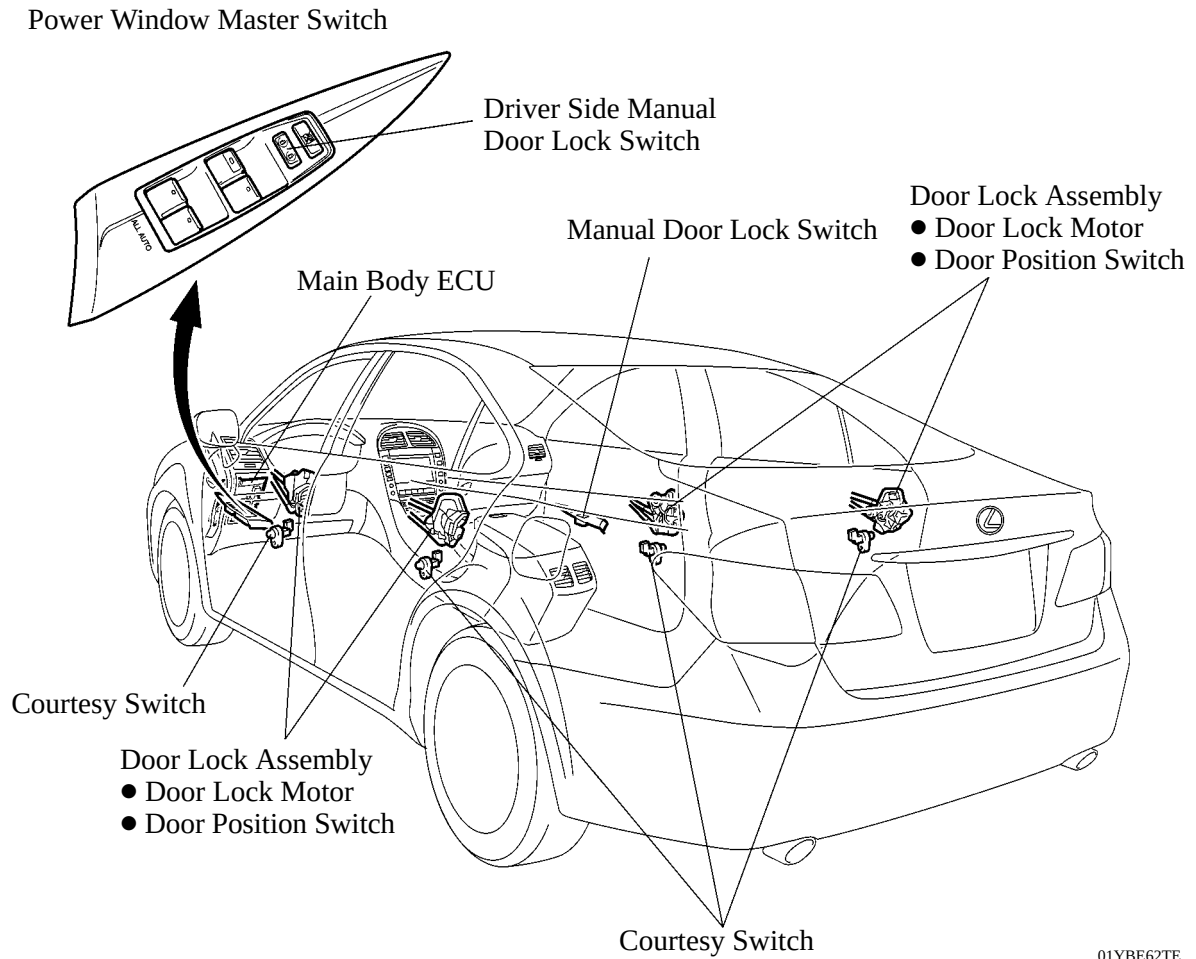
Function	Outline
Manual unlock prohibition function	Performing the door lock operation with a transmitter (wireless remote) or a key will prohibit the unlock operation by the door lock control switch (door mounted interior lock switch).
One-motion open	When the door is locked, this function enables the door to be unlocked by merely pulling the inside handle lever of the door.
Key-linked lock and unlock function	This function, which is linked with the door key cylinder, can lock or unlock all the doors when a lock or unlock operation is effected using the mechanical key.
Key confine prevention function	When the key is in the interior detection area with the driver's door open and if you perform the door lock operation, all the doors will be unlocked.
2-step unlock function* ¹	This function is provided to unlock the driver's door when the key is turned in the door lock cylinder the first time, and to unlock the remaining doors when it is turned the second time.
Shift-linked automatic door lock* ^{1,2}	When the conditions listed below are met, this function causes all the doors to be automatically locked. ● The power source is changed from "ACC" or "OFF" to the "IG-ON". ● All doors are closed. ● The shift lever is moved out of P position. ● Any of the in an unlocked state.
Speed-sensitive automatic door lock* ^{1,2}	When the conditions listed below are met, this function causes all the doors to be automatically locked. ● Vehicle speed is higher than approximately 20 km/h (13 mph). ● All doors are closed. ● The shift lever position is out of P and N position. ● Any one of the doors in an unlocked state.
Shift-linked automatic door unlock* ^{1,2}	When the power source is "ON" and the shift lever is moved to P position from a position other than P, all of the doors will be automatically unlocked.
Opening driver's door-linked automatic door unlock* ^{1,2}	All doors are unlocked automatically when the driver's door is opened within 10 seconds after the power source is changed from "IG-ON" to the "ACC" or "OFF".

*¹: The setting function can be changed using the customized body electronics system. For details, refer to Customized Body Electronics System section on page BE-14.

*²: Except Taiwanese Package Models

► System Diagram ◀



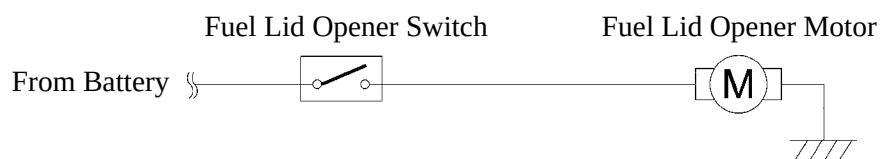
■ LAYOUT OF MAIN COMPONENTS

FUEL LID OPENER

DESCRIPTION

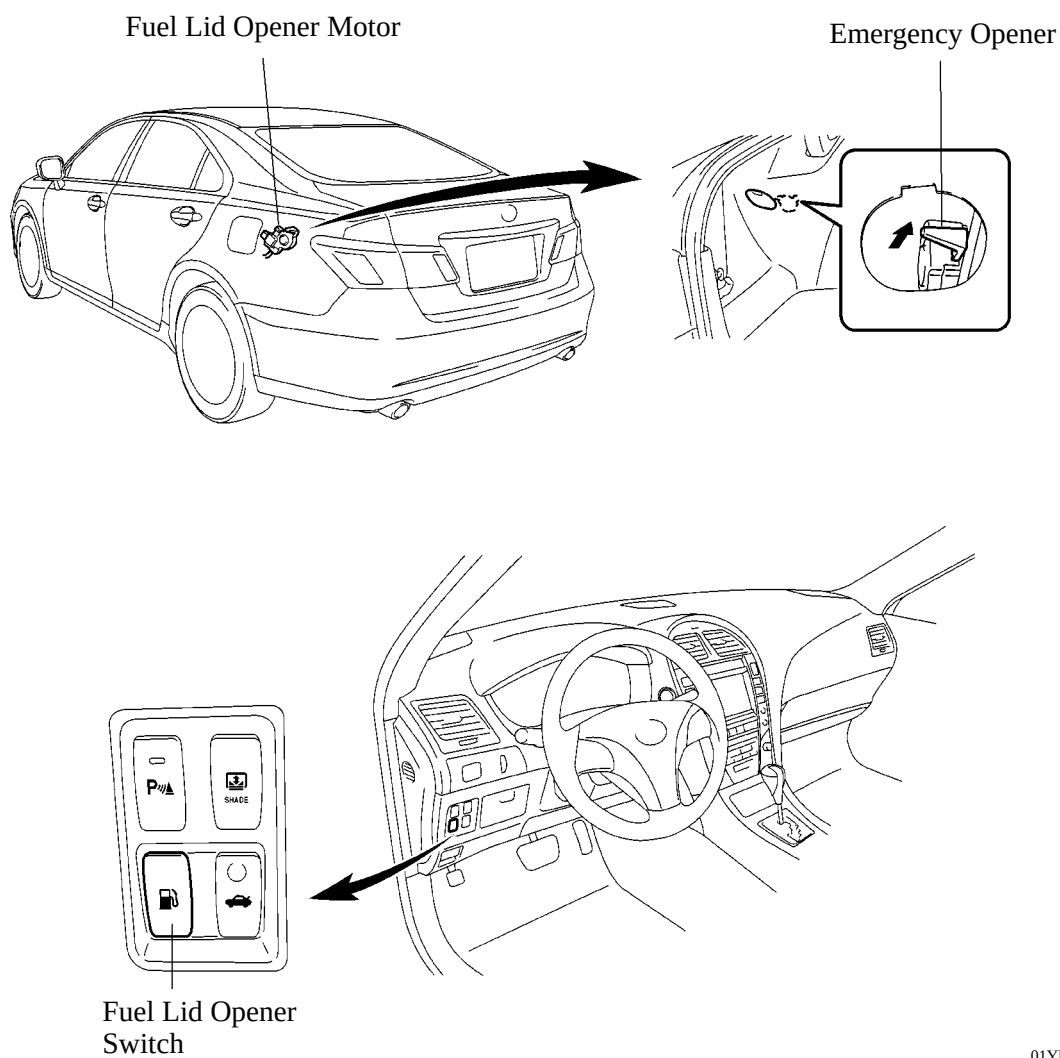
- The fuel lid opener is an electric type.
- An emergency opener has been provided in case the system does not operate due to a discharged battery or other malfunctions.

► System Diagram ◀



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LAYOUT OF MAIN COMPONENTS



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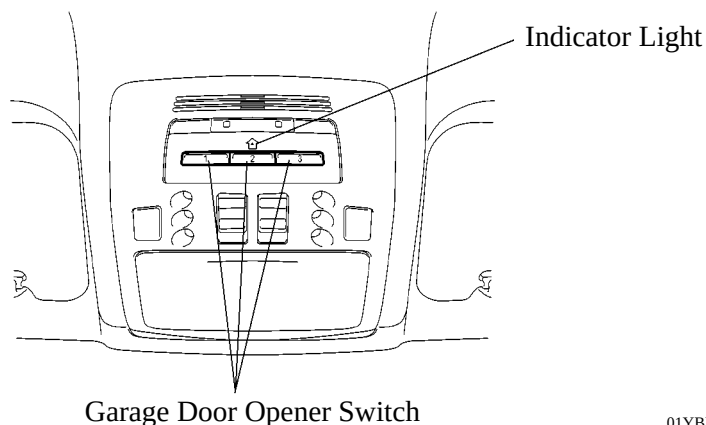
GARAGE DOOR OPENER

DESCRIPTION

The garage door opener system is standard equipment. However, it is not provided on certain models depending on the destination.

This system enables the garage door to be opened or closed from inside the vehicle by operating the switch. This system provides the features listed below.

- Up to three types of transmitter codes can be registered in the garage door opener.
- The garage door opener switch is provided in the overhead console where it is easily accessible.
- An indicator light is provided to enable the operator to verify the operation mode of the garage door opener.
- A rolling code function is used, which changes the transmitter code each time the garage door opener switch is pressed.



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FUNCTION

The following table shows the garage door opener functions and the indicator light operation in each of the modes.

Function	Outline	Indicator Light
Transmission Mode	While the switch is being pressed, the garage door opener transmits the code that was previously registered. Even if the button is pressed continuously, the transmission stops after 20 seconds.	Flash → On (Rolling Code) ON (Except Rolling Code)
Learning Mode	When the button is pressed continuously for 20 seconds, the mode changes to learning mode in which a transmitter code can be registered. Or an existing code can be overwritten. If no codes are registered within 90 seconds of entering learning mode, the mode changes to low power mode.	Slow flashing (during learning mode) Quick flashing (registration completed)
All Delete Mode	When the 2 outside buttons are pressed simultaneously for 20 seconds, all the transmitter codes that are registered in the button are cleared. When the buttons are released within 10 seconds of clearing the codes, the mode changes to learning mode. When the buttons are pressed for longer than 10 seconds after clearing the codes, all the buttons will be registered with a code for operation verification.	Quick flashing (code clearing completed)
Low Power Mode	If the button remains pressed for longer than 100 seconds, such as in the case in which the pressed button gets caught, the mode changes to low power mode to reduce power consumption.	OFF

■ TRANSMITTER CODE REGISTRATION PROCEDURE

The garage door opener contains an EEPROM in which the maximum of 3 types of transmitter recognition codes can be registered. A transmitter code is registered into the EEPROM of the garage door opener according to the following steps.

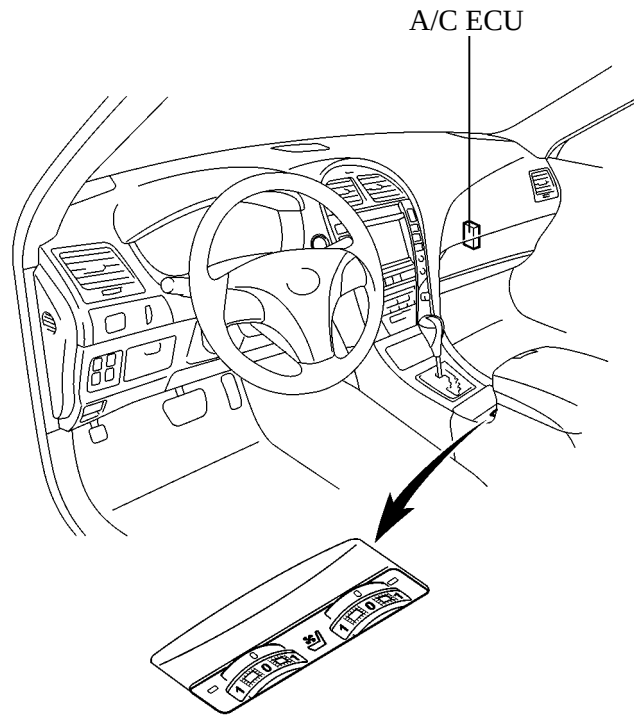
- A: Press the button for registering transmitter codes continuously until the indicator light flashes slowly.
- B: While keeping the garage door opener's button pressed, place the transmitter for while you wish to register the code within about 25 mm (1 in.) of the garage door opener and press the transmitter's button.
- C: After the flashing of the indicator light changes from slow to quick flashing, the registration of the transmitter code has been completed. Then, release your fingers from the buttons of the garage door opener and the transmitter.
- D: To register the code of another transmitter, repeat the operation starting with step "A". To register a new code to the button that already has a code registered to it, select the button to which you wish to register the new code and start the operation starting with step "A".

CAUTION

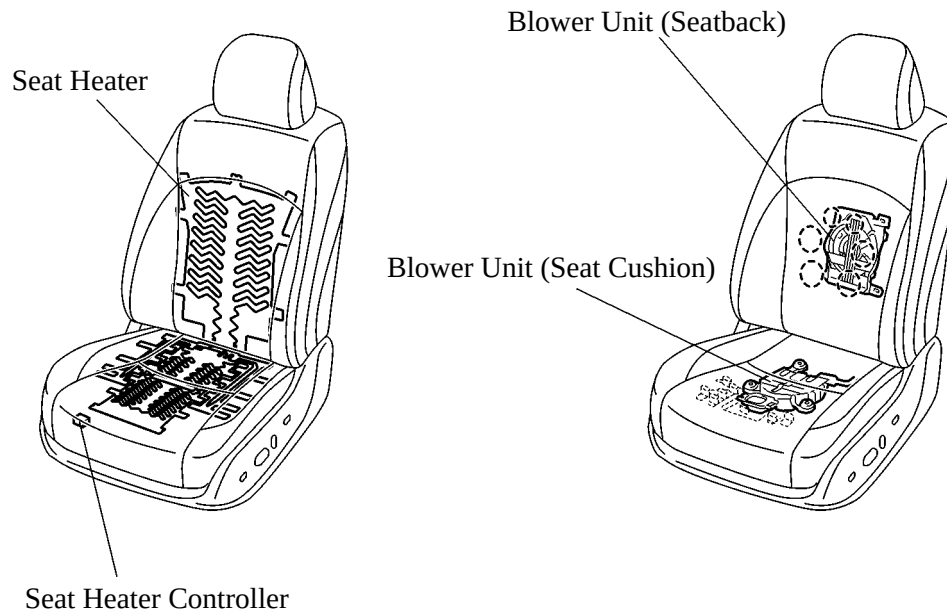
The garage door or the gate could operate unintentionally while registering a transmitter code. Therefore, make sure that there are no people near the garage door or the gate before carrying out this operation.

- NOTE:**
- Before performing a transmitter code registration, stop the engine.
 - The transmitter code of a garage door opener manufactured before 1982 cannot be registered in this system.

For details of procedures of transmitter code registration, refer to the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U) to register the codes correctly.

■ LAYOUT OF MAIN COMPONENTS

Switch for Heated & Ventilated Seats



HEATED & VENTILATED SEAT SYSTEM

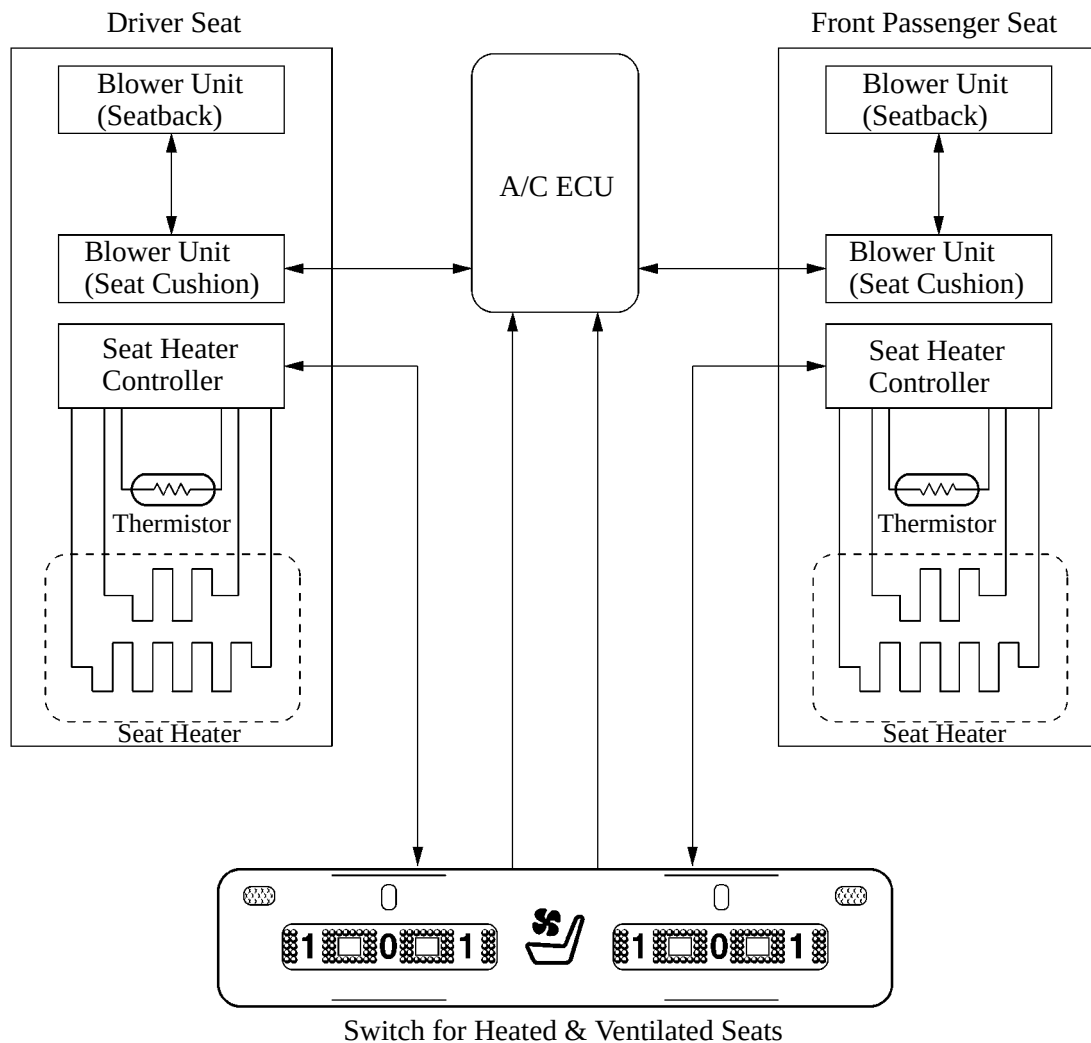
DESCRIPTION

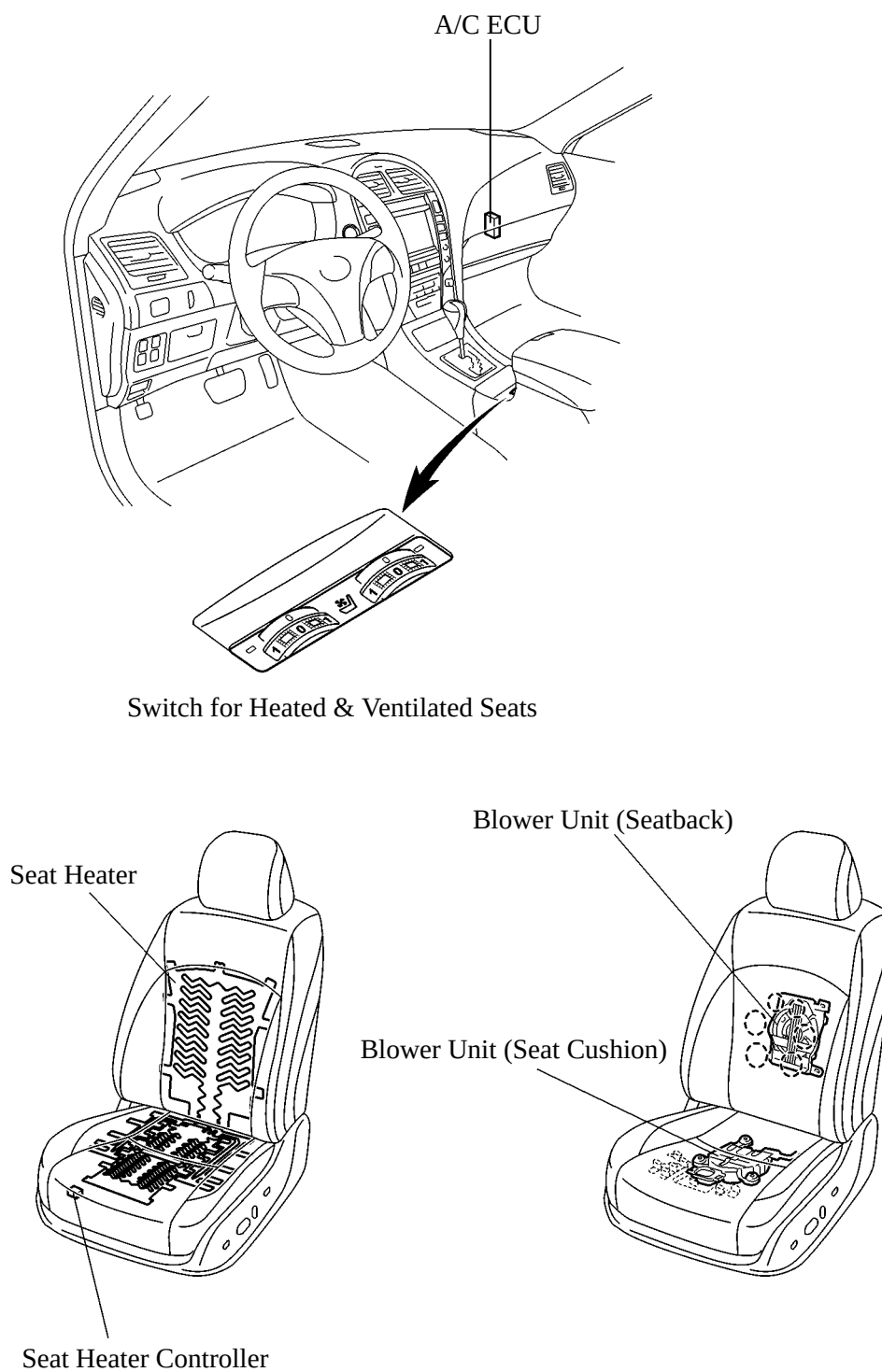
The heated and ventilated seat system has a heating function and ventilation function, in addition to the blower units in the conventional seat ventilation system. This creates a very comfortable seat.

- The heating function and the ventilation function cannot be operated at the same time.
- For the ventilation function, only air in the cabin is used and hot or cold air is not blown.
- The A/C ECU controls the ventilation function.
- The seat heater controllers in each seat control the heating functions individually.
- This system is optional equipment for the driver and front passenger seats.

SYSTEM DIAGRAM

The system consists of the seat heater element, two fan units, a switch for the heated & ventilated seats, seat heater controller, and A/C ECU.



■ LAYOUT OF MAIN COMPONENTS

■ SYSTEM CONTROL

1. Seat Heated Control

- When the user turns the front seat heater switch ON, the seat heater controller detects the temperature that is set at the front seat heater switch.
- At the same time, the seat heater controller detects the temperature of the seat cover by way of the thermister*¹ that is provided in the seat cushion.
- Then, the seat heater controller applies an electrical current in accordance with the circumstances in order to adjust the seat cover temperature to the set temperature.
- When the seat cover temperature reaches approximately 40°C (104°F), the thermostat*² in the seat cushion heater cuts off the current to the seat heaters (and restores the current when the seat cover temperature reaches approximately 30°C (86°F)).

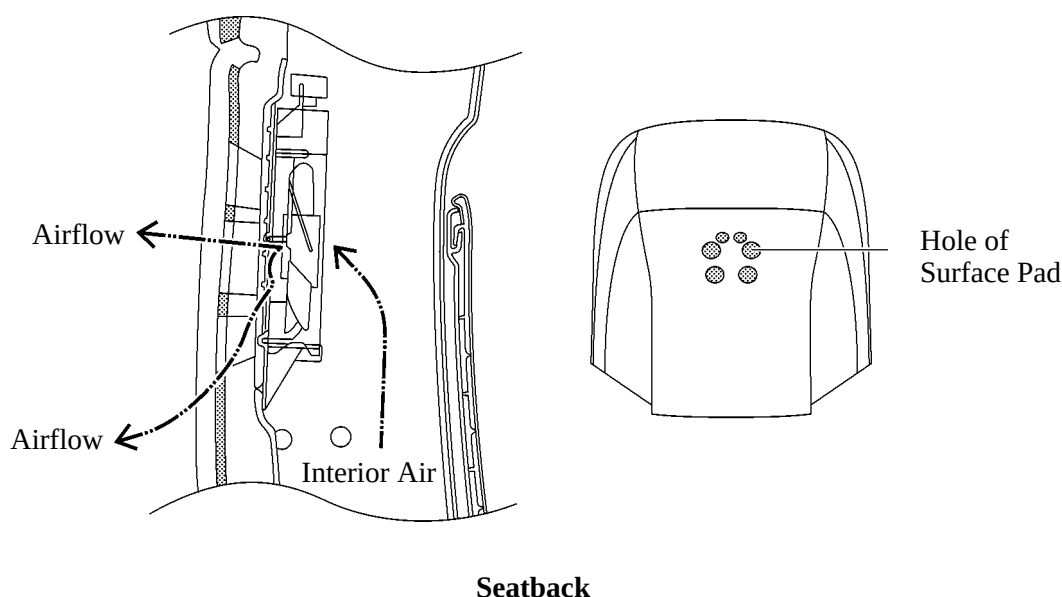
*¹: An element that uses a semiconductor (with properties in which the resistance is high at normal temperatures and gets lower as the temperature rises) in which the electrical resistance changes considerably with slight changes in temperature.

*²: A temperature adjustment device that automatically controls the heat source through the use of a switch that utilizes a bimetal strip or the expansion of mercury.

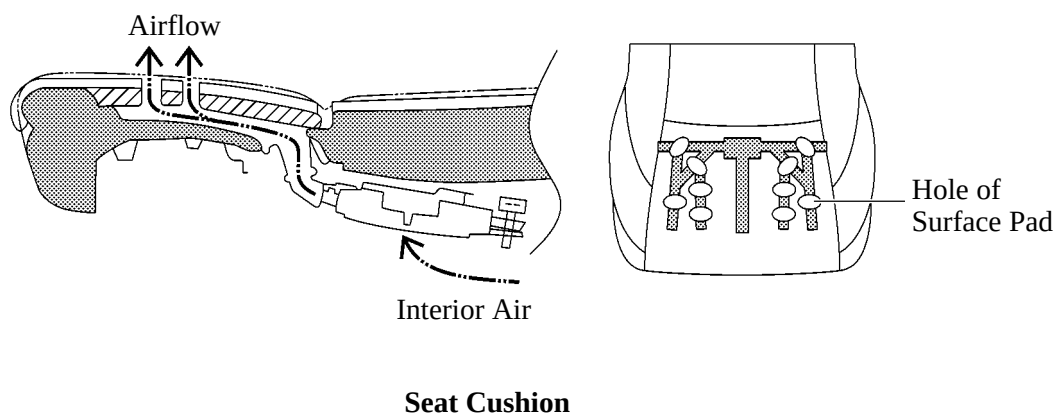
2. Seat Ventilated Control

- By turning the seat heater & ventilation volume switch counterclockwise from OFF in the center position, the ventilation volume can be adjusted to three levels. The indicator light illuminates green to indicate that the ventilation function is operating.
- When the user operates the seat heater & ventilation volume switch located forward of the console box, the blower motor in the seat back/seat cushion climate control blower operates to direct the air that is drawn in from behind the climate control blower to both the seatback and seat cushion pads.
- After the air is directed to both the seatback and seat cushion pads, it travels throughout the pads along the grooves that are provided in the pads. Then, it spreads to the entire seat along the slab urethane layer, and becomes discharged through the perforations in the genuine leather seat cover.

► Ventilation Function ◄

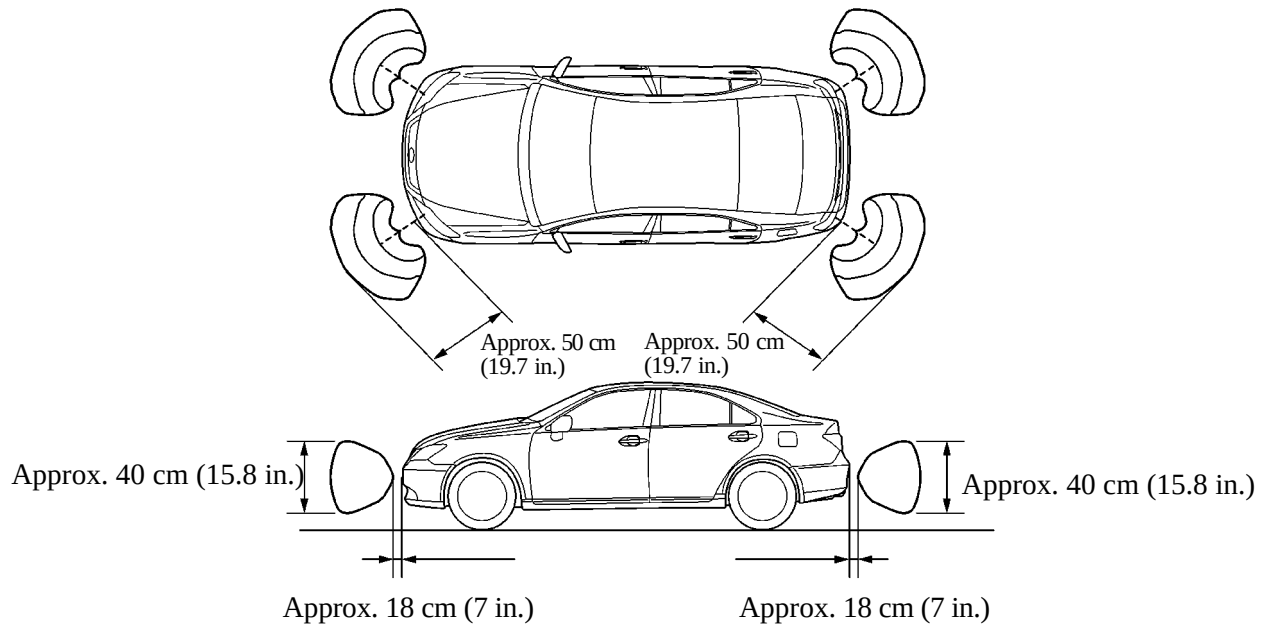


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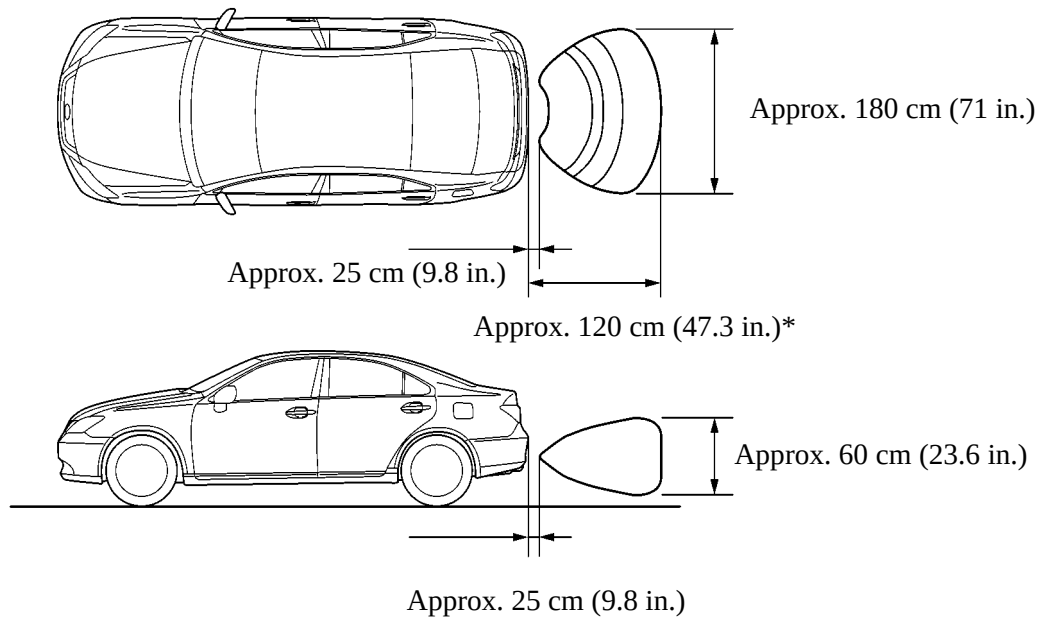
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■ DETECTION AREA



Corner Area

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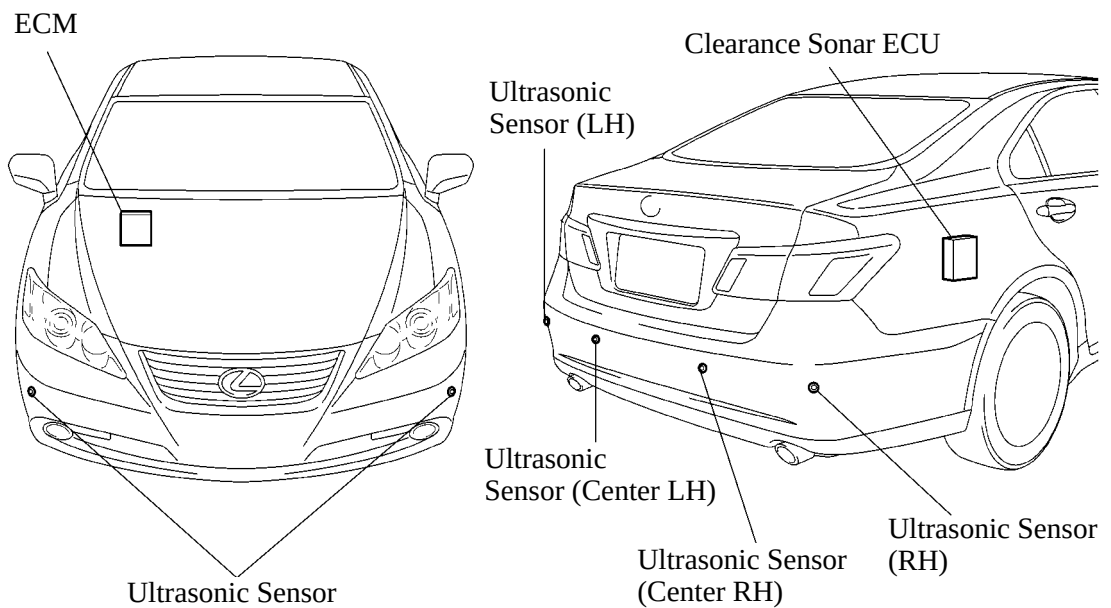


Rear Center Area

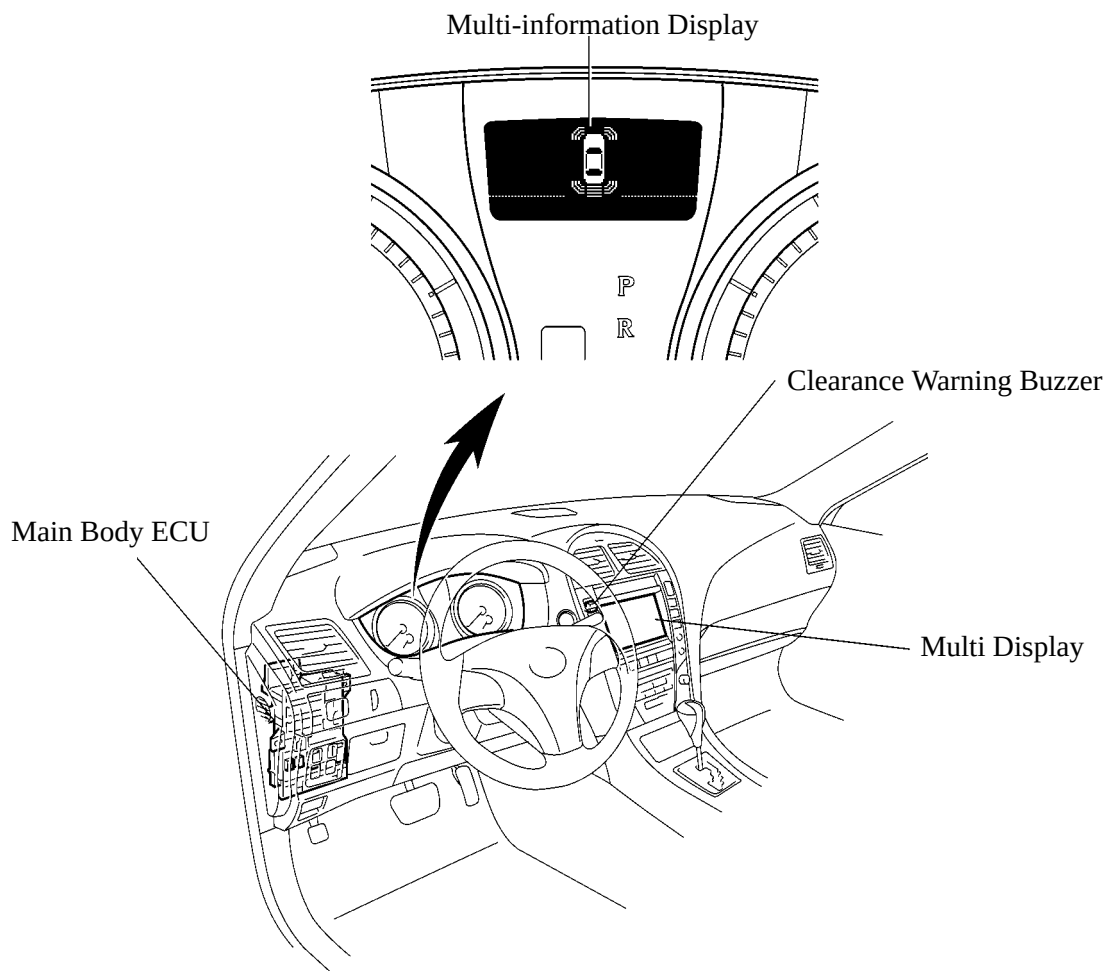
01YBE52Y

*: A pole with a diameter of approximately 6 cm (2.4 in.) can be detected within this detection area. If there is a cylinder-shaped object with a diameter of approximately 40 cm (16 in.), the detection area expands to approximately 150 cm (59 in.).

■ LAYOUT OF MAIN COMPONENTS



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■ FUNCTION OF MAIN COMPONENTS

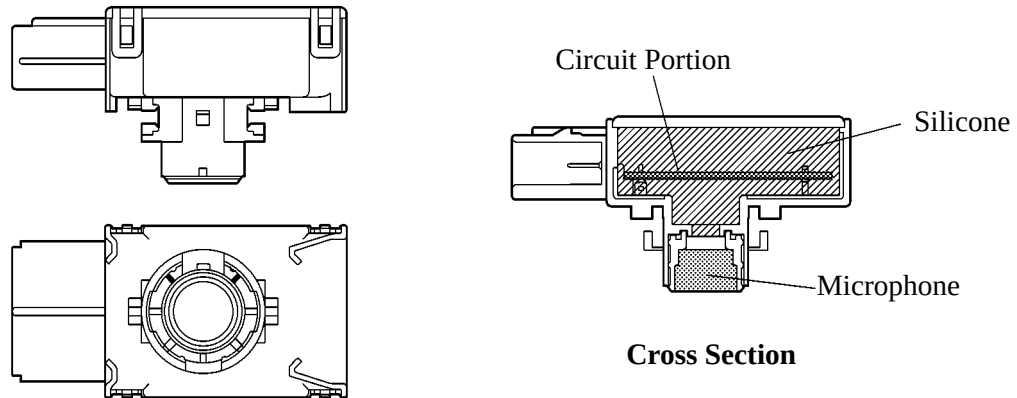
Component		Function
Ultrasonic Sensor (6)		Detects the distance between the vehicle and the obstacle.
Clearance Warning Buzzer		Sounds a buzzer to inform the driver according to the distance to the obstacle.
Combination Meter		Transmits the vehicle speed signal to the clearance sonar ECU.
	Multi-information Display	● Displays the location of the obstacle and the approximate distance between the vehicle and the obstacle. ● Informs the driver if the ultrasonic sensors malfunction, or if they freeze or become dirty.
	Master Warning Light	Illuminates when the multi-information display indicates that the ultrasonic sensors are malfunctioning or frozen.
Clearance Sonar Main Switch		Operating this switch allows the operation of LEXUS parking assist-sensor to be enabled or disabled.
Multi Display*		● Displays the location of the obstacle and the approximate distance between the vehicle and the obstacle. ● The sound volume, distance required to sound the buzzer and distance required to trigger the display can be chosen on the setup screen for the intuitive parking assist.
Clearance Sonar ECU		● Judges the approximate distance between the vehicle and an obstacle based on signals from the ultrasonic sensors. Output signals are sent to the multi-information display and/or multi display. ● Sounds the clearance warning buzzer.
Main Body ECU		Transmits the request signal to the clearance sonar ECU to reduce the illumination of the intuitive parking assist indicator light.
ECM		Transmits the shift position signal to the clearance sonar ECU.

*: Option

■ CONSTRUCTION AND OPERATION

1. Ultrasonic Sensor

- The ultrasonic sensor consists of the microphone that transmits and receives ultrasonic wave and circuit portion.
- The circuit portion is filled with silicone to prevent water from entering.
- Corner sensors and rear center sensors use the same structural parts.



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2. Clearance Warning Buzzer

- Depending on the detection distance and the detection area, the sound pattern of the clearance warning buzzer will vary.

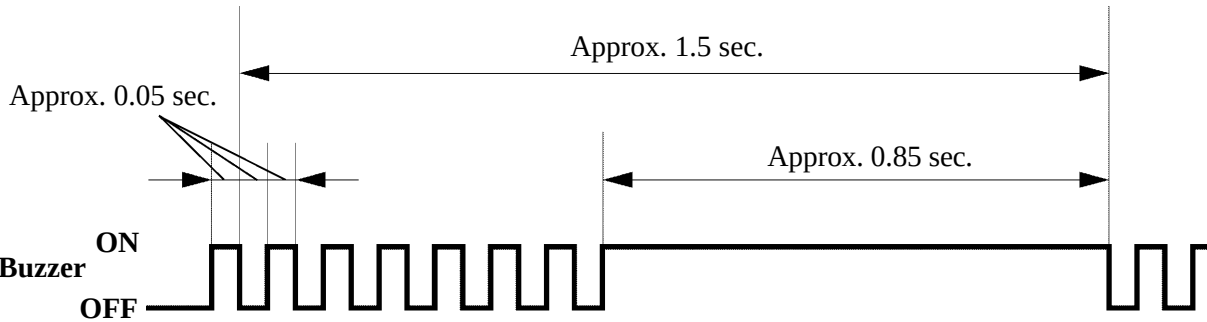
Detection Area	Detection Distance cm (in.)		Buzzer Sound Pattern ON/OFF Time (msec.)
Corner	Long	50 ± 5 to 37.5 ± 5 (19.7 ± 2 to 14.8 ± 2)	150/150
	Middle	37.5 ± 5 to 25 ± 5 (14.8 ± 2 to 9.8 ± 2)	75/75
	Short	25 ± 5 or less (9.8 ± 2 or less)	Continuous Sound/0
Rear Center	Longest	150 ± 15 to 60 ± 6 (59 ± 5.9 to 23.6 ± 2.4)	150/650
	Long	60 ± 6 to 45 ± 5 (23.6 ± 2.4 to 17.7 ± 2)	150/150
	Middle	45 ± 5 to 35 ± 5 (17.7 ± 2 to 13.8 ± 2)	75/75
	Short	35 ± 5 or less (13.8 ± 2 or less)	Continuous Sound/0

- When the front and rear sensors detect obstacles at the same time, the buzzer sounds as follows:

ON/OFF Time (msec.)

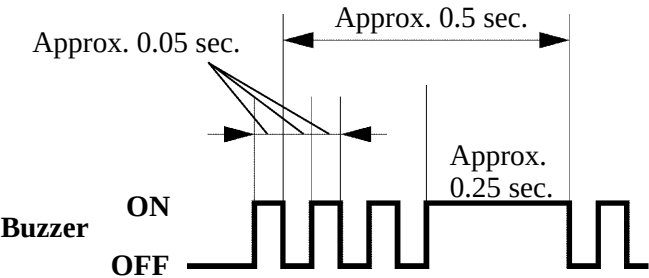
Front \ Rear	Short	Middle	Long	Not detected
Short	Buzzer Timing 2	Buzzer Timing 1	Buzzer Timing 1	Continuous Sound/0
Middle	Buzzer Timing 1	75/75	75/75	75/75
Long	Buzzer Timing 1	75/75	150/150	150/150
Longest	Buzzer Timing 1	75/75	150/150	150/650
Not detected	Continuous Sound/0	75/75	150/150	None

► Buzzer Timing 1 ◀



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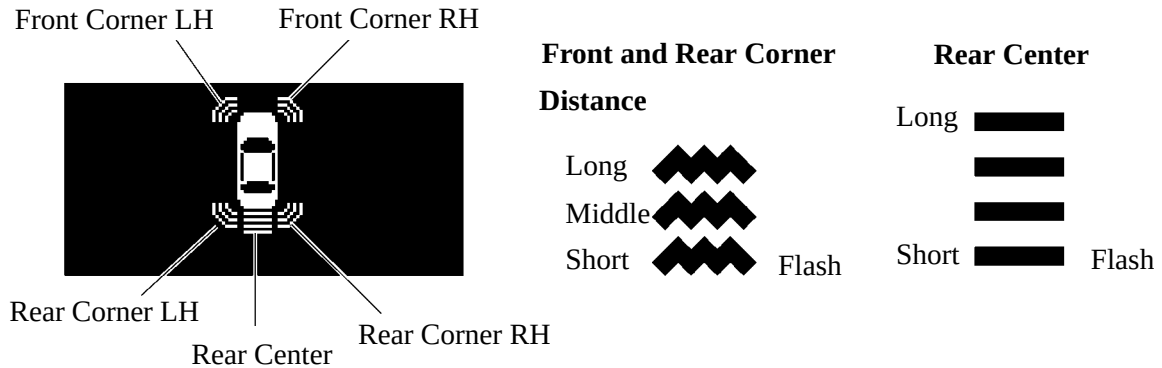
► Buzzer Timing 2 ◀



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3. Multi-information Display

- The items displayed by the multi-information display are the location of the obstacle, the approximate distance between the vehicle and the obstacle, and warning messages relating to sensor malfunction, sensor freezing, or presence of dirt on the sensor. When any warning messages are displayed, the master warning light illuminates and the clearance warning buzzer sounds.
- The number of lines shown on the display changes based on the actual distance and flashes when the distance is short.



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► Warning Message ◀



Ultrasonic Sensor Malfunction Warning

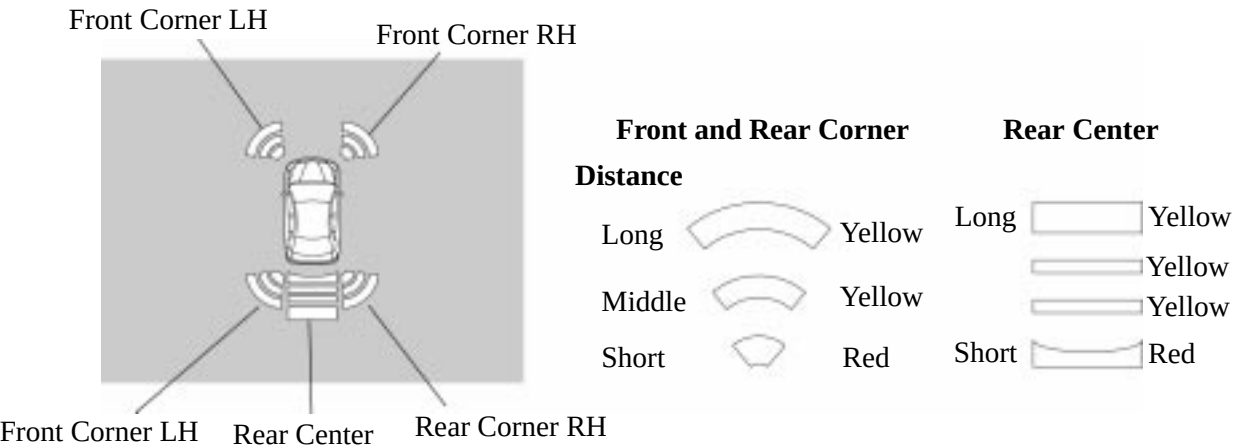


Ultrasonic Sensor Freeze/Contamination Warning

01YBE57TE

4. Multi Display

- The items displayed by the multi display are the location of the obstacle and the approximate distance between the vehicle and the obstacle, warning messages relating to sensor malfunction, sensor freezing, or presence of dirt on the sensor. When any warning messages are displayed, the master warning light illuminates and the clearance warning buzzer sounds.
- The distance is displayed by the number of lines and color based on the actual distance. The display usually illuminates in yellow. When the distance is short, it illuminates in red.



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► Warning Message ◀



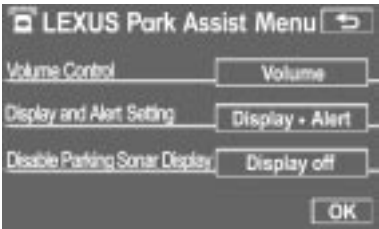
Ultrasonic Sensor Malfunction Warning



Ultrasonic Sensor Freeze/Contamination Warning

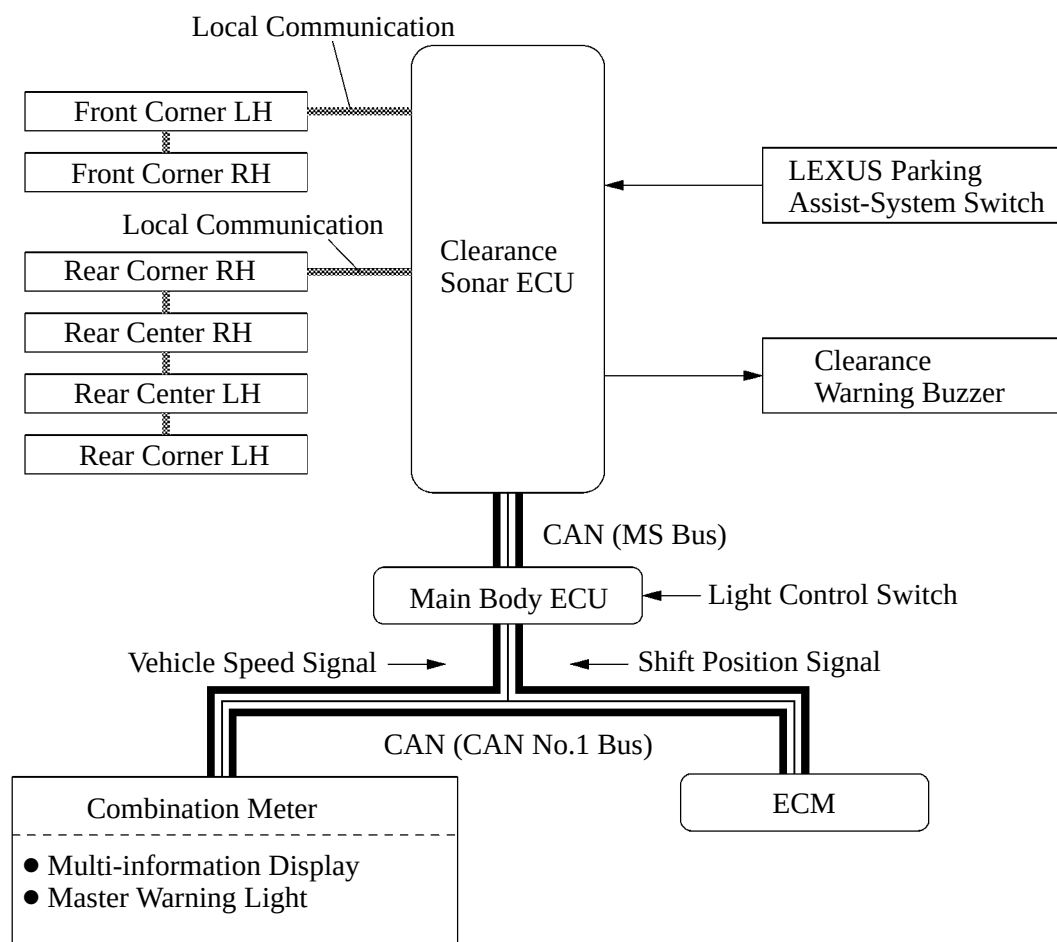
0140BE119C

- The display timing and detection distance on the multi display can be customized.



0140BE120C

SYSTEM DIAGRAM



INTUITIVE PARKING ASSIST

■ DESCRIPTION

The intuitive parking assist uses ultrasonic sensors to detect any obstacles at the corners, at the front, or the rear of the vehicle.

- The intuitive parking assist then informs the driver of the approximate distance between the sensors and the obstacles as well as their positions by displaying them on the multi-information display in the combination meter or on the multi display and by sounding a buzzer.
- '07 ES350 uses local communication lines among the ultrasonic sensors and the clearance sonar ECU, reducing the number of wire harnesses.
- The intuitive parking assist is optional equipment.
- The operating condition of each intuitive parking assist differs according to its installed position as shown in the table below:

Installation Position	Operating Condition
Front Corner	● Power source is IG-ON. ● Intuitive Parking Assist System switch is ON. ● Shift position is except P. ● Vehicle speed is approx. 10 km/h (9 mph) or less. The sensor stops operating when the vehicle speed exceeds 15 km/h (9 mph), and starts operating when the vehicle speed decreases to below 10 km/h (6 mph).
Rear Corner	● Power source is IG-ON. ● Intuitive Parking Assist System switch is ON. ● Shift position is R. ● Vehicle speed is approx. 10 km/h (9 mph) or less. The sensor stops operating when the vehicle speed exceeds 15 km/h (9 mph), and starts operating when the vehicle speed decreases to below 10 km/h (6 mph).
Rear Center	● Power source is IG-ON. ● Intuitive Parking Assist System switch is ON. ● Shift position is R.

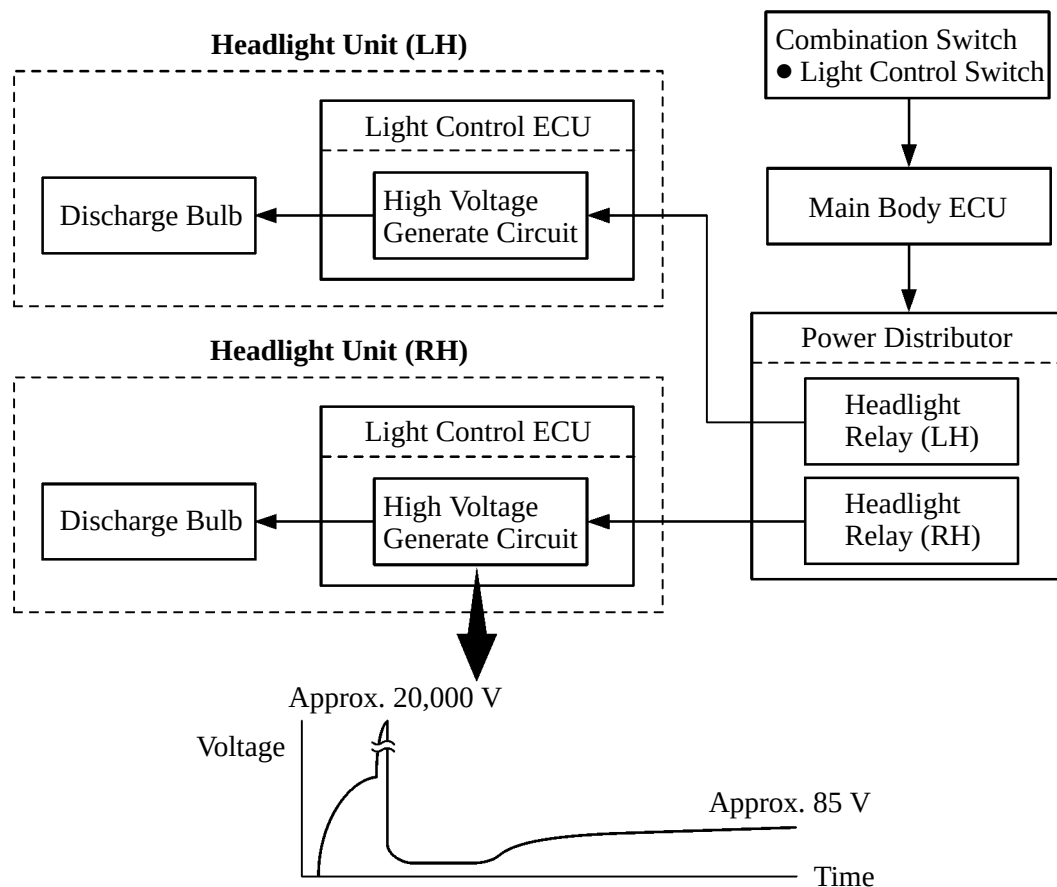
■ HID HEADLIGHT SYSTEM

1. General

The HID (High Intensity Discharge) headlight system uses a discharge bulb as its light source for the Lo beam. Discharge bulbs are superior to halogen bulbs.

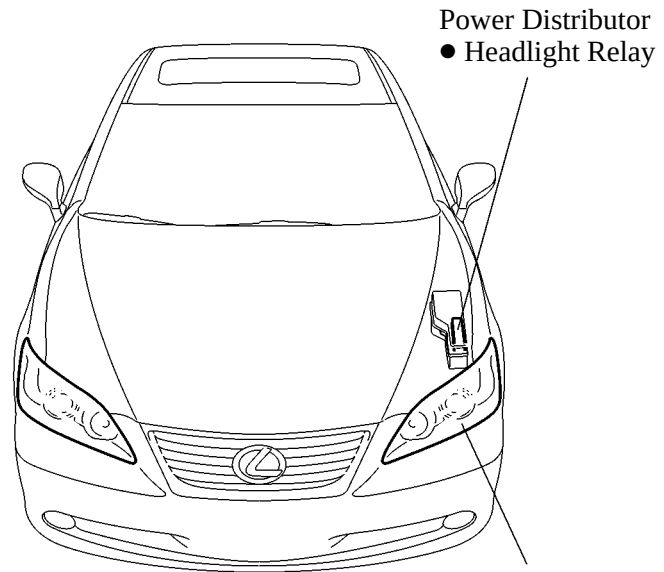
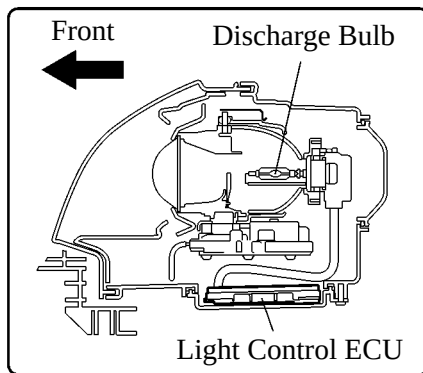
- Discharge bulbs have the following features.
 - The light emitted by the bulb is close in color to sunlight. The light shines ahead over a broader area and further forward, increasing the area visible to the driver.
 - Less power is consumed.
- This system consists of discharge bulbs and light control ECUs.
- Light control ECU transforms the voltage that is input from the battery to a high voltage of up to 20,000V and applies it to the discharge bulbs in order to illuminate them.
- A fail-safe function is provided as a countermeasure against the high voltage that is generated in case that a problem occurs in the headlight system.

► System Diagram ◀

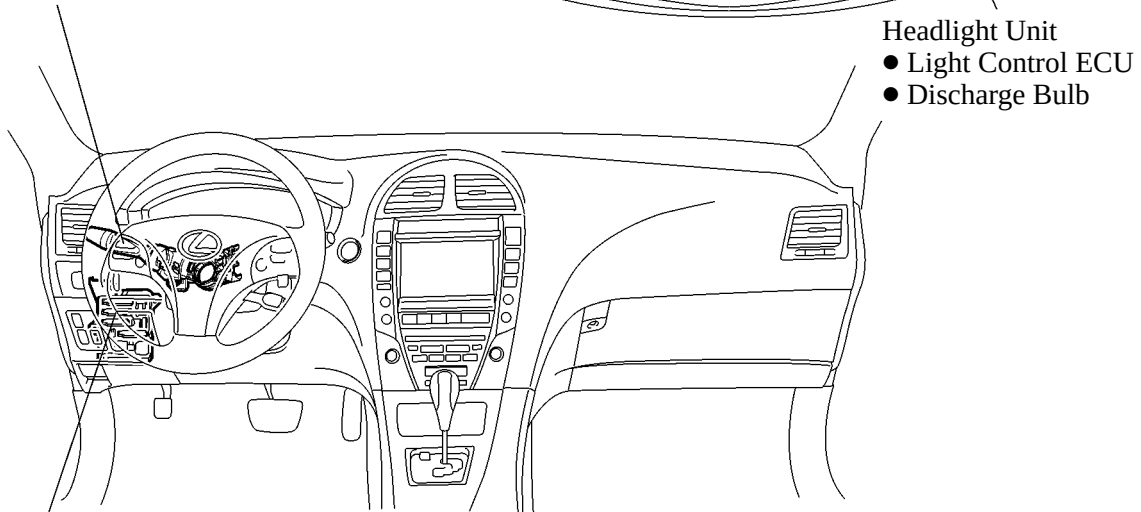


2. Layout of Main Components

Headlight Unit Cross Section



Combination Switch
● Light Control Switch

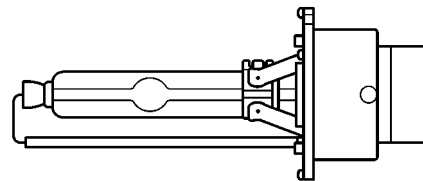


Main Body ECU

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3. Discharge Bulb

Instead of the filament contained in an incandescent bulb, a discharge bulb contains an arc tube, which is filled with xenon gas, and metal halide.



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4. Fail-Safe Function

The light control ECU executes the fail-safe actions listed below in accordance with the problem that has been detected.

Problem	Outline
Detection of Abnormal Input Voltage	If the voltage that is input to light control ECU deviates from the normal operating voltage (9 - 16 volts), the light control ECU stops illuminating the headlights. It resumes illuminating the headlights once the voltage reverts to the operating voltage range. However, if the input voltage decreases after the headlights have illuminated, the headlights will remain illuminated until the input voltage is insufficient to light the bulbs.
Detection of Abnormal Output (Open Circuit or Short Circuit) or Flashing Bulb	If an abnormal condition (open or short) occurs in the voltage that is output by light control ECU, or if the bulb flashes, the light control ECU stops illuminating the headlights and will maintain this state until the power is reinstated. Power is reinstated by turning the headlight control switch from OFF to ON.
Detection of Bulb Open	If a bulb is not inserted in its socket, the light control ECU stops generating high voltage until the bulb is inserted correctly and the power is reinstated. Power is reinstated by turning the headlight control switch from OFF to ON or turning the power source from OFF to IG-ON.

5. Precautions for HID Headlight System

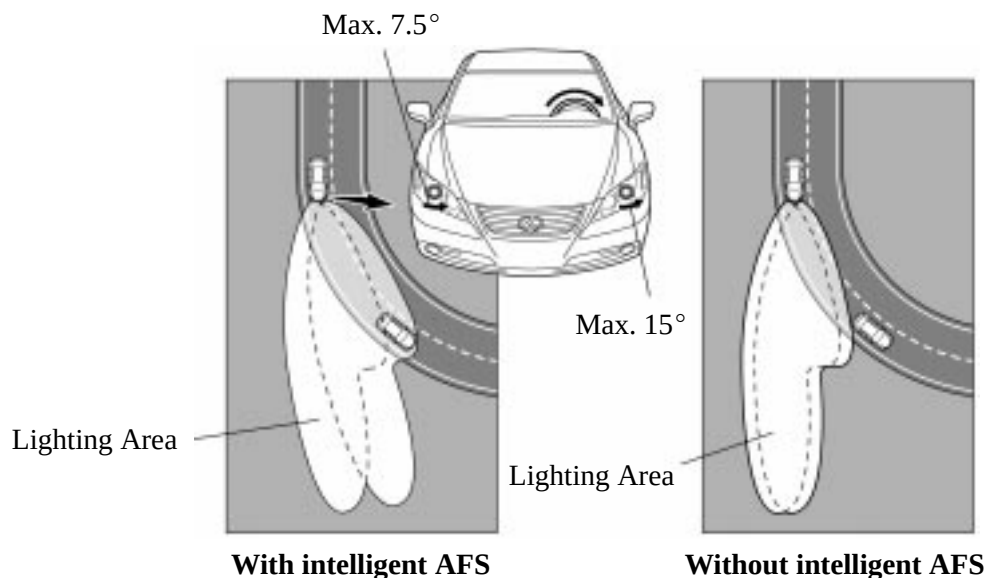
- When the HID headlights illuminate, a high voltage (approximately 20,000V) is applied momentarily to the bulb sockets, which could lead to a serious accident. Never connect the tester to the high voltage socket of HID headlight for measurement, as this may lead to a serious accident because of high voltage.
- Whenever inspecting the HID headlight system, make sure water or rain is not present in order to prevent electric shock, the light control switch is OFF, the battery terminal is removed, and the connector of the light control ECU is disconnected.
- Whenever operating the HID headlight, make sure it is only after assembly has been completed and never operate without bulbs installed.
- Do not operate the HID headlight using a power source other than the vehicle's.
- When there is a defect in the HID headlight or any shock has been applied to it, replace the bulb with a new one.
- A discharge bulb reaches a high temperature when it is illuminated. For this reason, the life of the bulb could be shortened if any oil comes in contact with the glass portion of the bulb. Do not touch the glass portion of a bulb with bare hands.

■ INTELLIGENT AFS (Adaptive Front-lighting System)

1. General

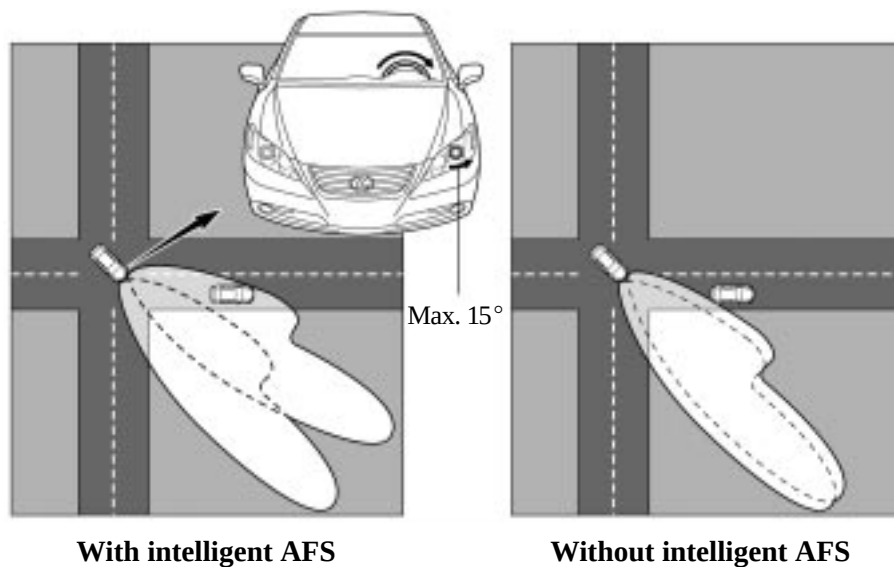
- An intelligent AFS (Adaptive Front-lighting System) is used in order to ensure a wide Lo beam lighting area and realize excellent visibility during turns by moving the Lo beam.
- The intelligent AFS of the '07 ES350 uses medium-to-high speed control and low speed control. In the medium-to-high speed control, the system calculates the target lighting angle based on the steering angle and vehicle speed and changes the swivel angle of the low-beam headlights individually. During the low speed control, the system calculates the target lighting angle based on the steering angle and changes the swivel angle of the low-beam headlight on the side facing into the turn.

► Medium-to-High Speed Control ◀



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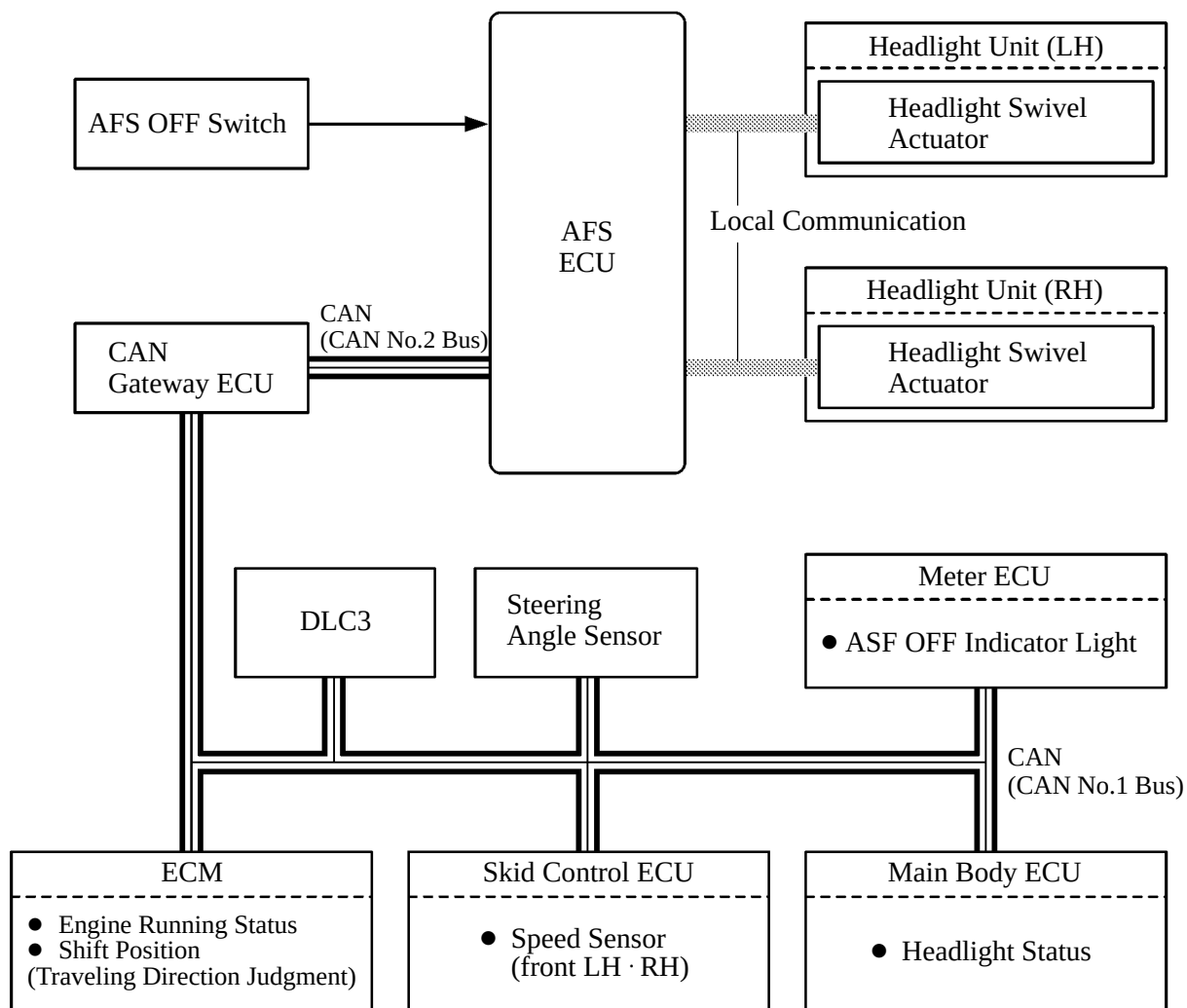
► Low Speed Control ◀



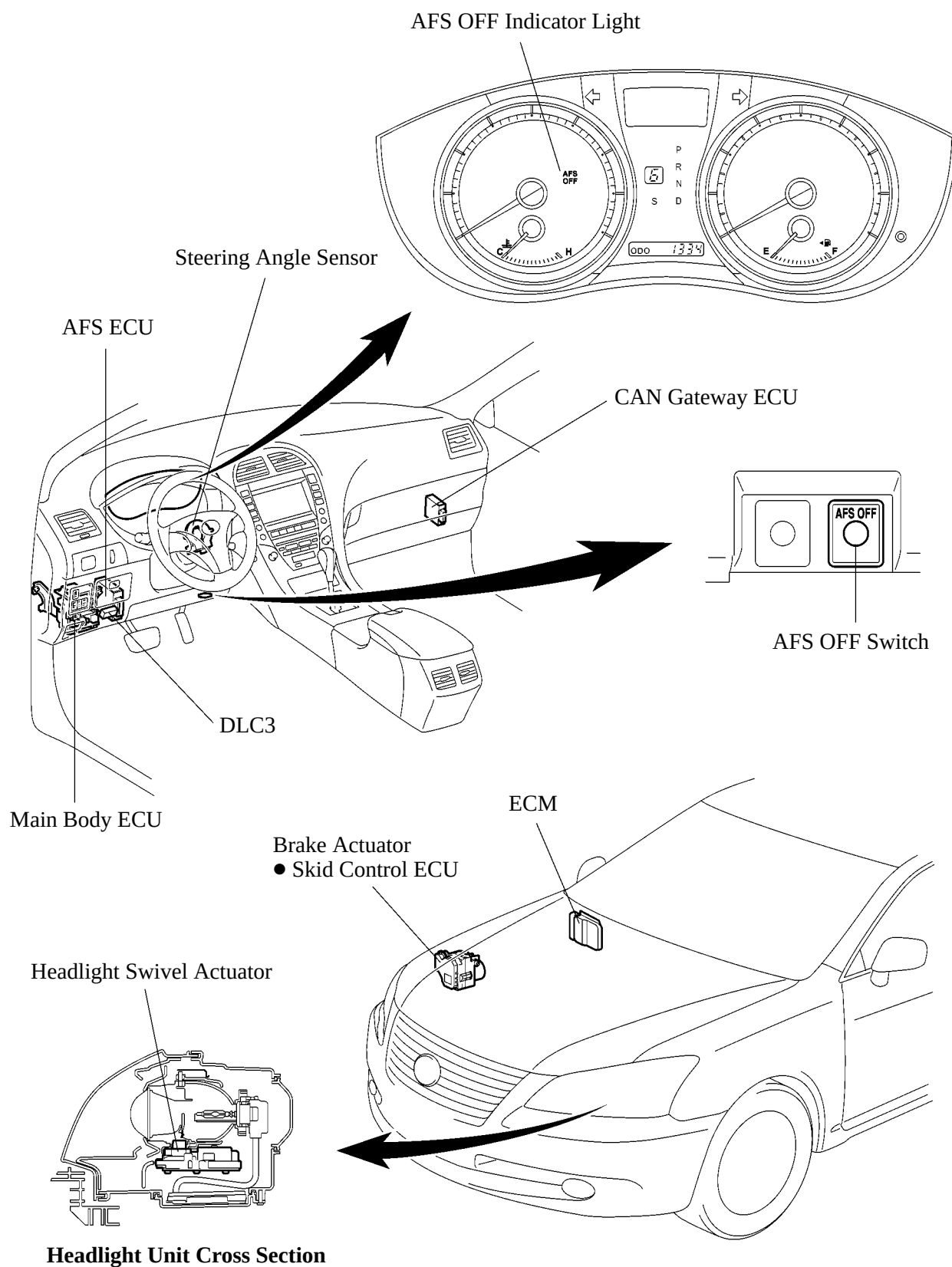
01YBE02Y

2. System Diagram

- This system consists of two headlight units (for Lo beam), the AFS ECU, two headlight swivel actuators, the steering angle sensor and the front speed sensors. The AFS ECU controls this system.
- The AFS ECU also controls the automatic headlight beam level control system. For details, see page BE-26.



3. Layout of Main Components



4. Function of Main Components

Component		Outline
AFS ECU		The AFS ECU receives various signals, calculates the target lighting angle, and actuates the headlight swivel actuator.
Headlight Unit	Head Light Swivel Actuator	• Driven by the AFS ECU, the actuator moves the Lo beam left or right to the angle calculated by the AFS ECU. • A step motor is used for the headlight swivel actuator. The AFS ECU determines the Lo beam angle based on the number of steps (position) of the step motor.
Steering Angle Sensor		Detects the steering angle and direction and outputs this signal to the AFS ECU.
AFS OFF Switch		Pressing this switch, disables the operation of the intelligent AFS.
Skid Control ECU		Transmits the speed sensor signal (Front LH and RH) to the AFS ECU.
ECM		• Transmits the engine running status signal to the AFS ECU. • Transmits the shift position signal to the AFS ECU. The AFS ECU determines whether the vehicle is moving forward or backward from this signal.
Main Body ECU		Transmits the headlight status signal.
Combination Meter (Meter ECU)	AFS OFF Indicator Light	• When the system malfunctions, the meter ECU flashes the AFS OFF indicator light based on the signal from the AFS ECU to alert the driver. • When the AFS OFF switch is off, the AFS ECU illuminates the AFS OFF indicator light to inform the driver that the system does not operate.

5. System Control

General

- The AFS ECU calculates the target lighting angle of the Lo beam by receiving the steering angle and the vehicle speed. Then, it actuates the headlight swivel actuator in order to attain the target lighting angle.
- The operation angle of the headlights is detected through the position (number of steps) of the step motor in the headlight swivel actuator.
- On the '07 ES350, the swivel angle control is switched between the medium-to-high speed and the low speed controls in accordance with the steering angle and vehicle speed.

Low Speed Control

- The AFS ECU performs the low speed control when all the following conditions are fulfilled.
 - Engine is running.
 - Vehicle is moving forward at a speed of 10 km/h (6 mph) or more.
 - Steering angle is 6° or more.
 - Headlight Lo beam is operating (except when the daytime running light system is operating).
 - AFS ON/OFF condition is ON.
- The AFS ECU calculates the swivel angle from the steering angle and drives the headlight swivel actuator on the side facing into the turn to illuminate the road ahead during cornering.

► Swivel Angle Range ◀

Driving Condition	Headlight Unit	
	Left	Right
Right Turn	0° Fixed	0° to 10° to Right
Left Turn	0° to 15° to Left	0° Fixed

Medium-to-High Speed Control

- The AFS ECU performs the medium-to-high speed control when all the following conditions are fulfilled.
 - Engine is running.
 - Vehicle is moving forward at a speed of 30 km/h (19 mph) or more.
 - Steering angle is 7.5° or more.
 - Headlight Lo beam is operating (except when the daytime running light system is operating).
 - AFS ON/OFF condition is ON.
- Based on the steering angle and vehicle speed, the AFS ECU calculates the swivel angle of the Lo beam headlights so that the headlights can illuminate the position which the vehicle will reach after 3 seconds, and drives both headlight swivel actuators to illuminate the road ahead during cornering.

► Swivel Angle Range ◀

Driving Condition	Headlight Unit	
	Left	Right
Right Turn	0° to 5° to Right	0° to 10° to Right
Left Turn	0° to 15° to Left	0° to 7.5° Fixed

Initial Set Control

When the engine is started, the AFS ECU drives the headlight swivel actuator, moves the projector headlight to the operation limit in the direction toward the vehicle center and returns it to the proper position. The AFS ECU thus assesses the position of the headlight for reference control.

Fail-Safe

If the AFS ECU detects a malfunction in the intelligent AFS or automatic headlight beam level control system, it will take the actions indicated in the table below.

Trouble Area	Condition (Fail-Safe Control for Intelligent AFS)	AFS OFF Indicator Light
Headlight Swivel Actuator Malfunction	Normal Side Headlight Swivel Actuator: ● Stops operating after returning to the initial position.	Flash
	Abnormal Side Headlight Swivel Actuator: ● Stops in its current position.	
Steering Angle Sensor Signal Malfunction	Stops operating after returning to the initial position.	Flash
Speed Sensor Signal Malfunction	Stops operating after returning to the initial position.	Flash
Height Control Sensor Signal Malfunction	Stops operating after returning to the initial position.	Flash
Headlight Level Actuator Malfunction	Stops operating after returning to the initial position.	Flash
Communication Signal Malfunction	Main Body ECU: ● Stops operating after returning to the initial position.	Flash
	ECM: ● Stops operating after returning to the initial position.	Flash
	Skid Control ECU: ● Stops operating after returning to the initial position.	Flash
	Steering Angle Sensor: ● Stops operating after returning to the initial position.	Flash

Diagnosis

If the AFS ECU detects a malfunction in the intelligent AFS, the AFS ECU flashes the AFS OFF indicator light in order to alert the driver. At the same time, the DTC (Diagnostic Trouble Codes) are stored in the memory. The DTC can be read by using the hand-held tester. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

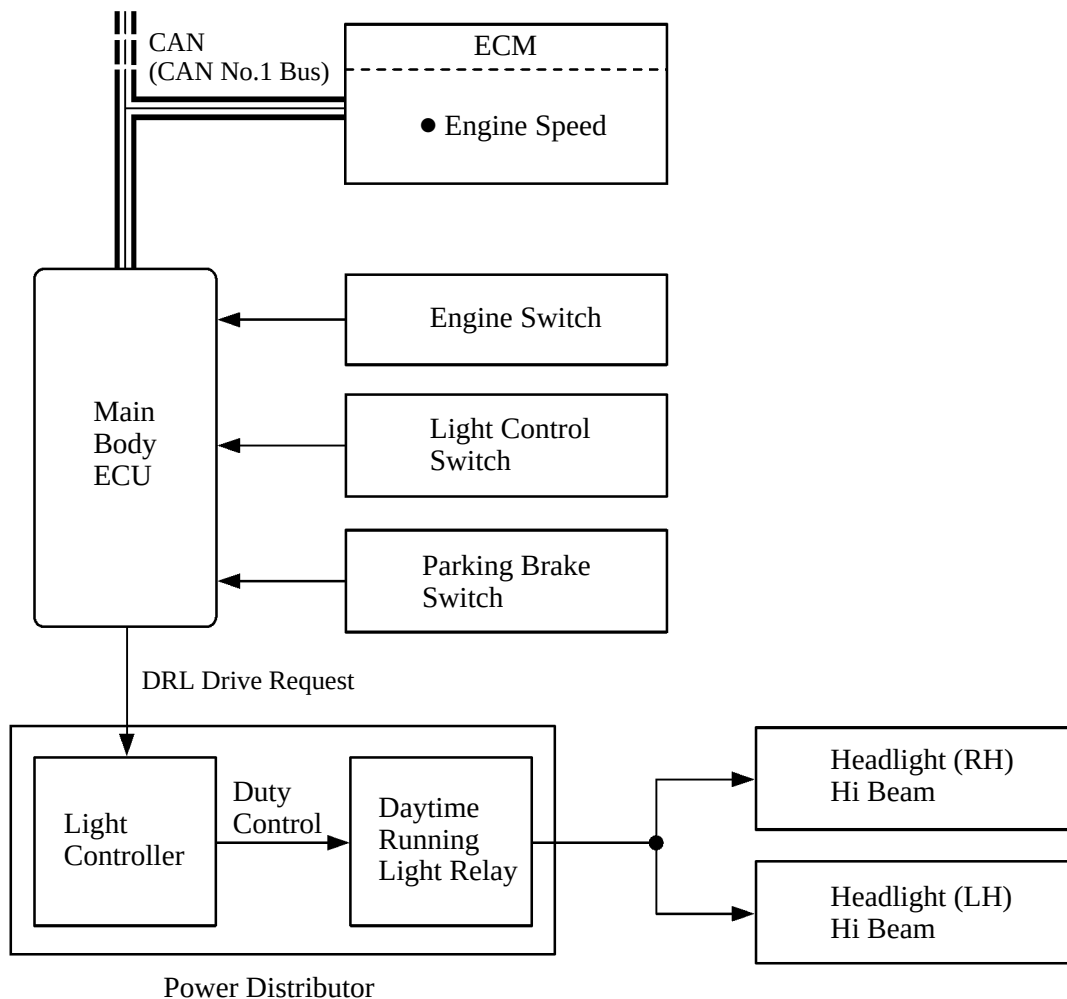
Service Tip

The diagnostic communication uses the CAN protocol. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

■ DAYTIME RUNNING LIGHT SYSTEM

- A daytime running light system is designed to automatically illuminate the headlights (dimmed Hi beam) during the daytime to keep the car highly visible to other vehicles.
- The main body ECU and power distributor control this system. The main body ECU transmits a turn ON signal to the power distributor, and the power distributor illuminates and dims the Hi beam with the duty control.
- This system is enabled when the conditions given below are met:
 - Power Source: IG-ON
 - Engine Speed Signal Input (Engine Running Condition)
 - Light Control Switch OFF, TAIL, or AUTO position (if headlight-on control is not being performed by the automatic light control.)
 - Parking Brake Switch: OFF

► System Diagram ◀

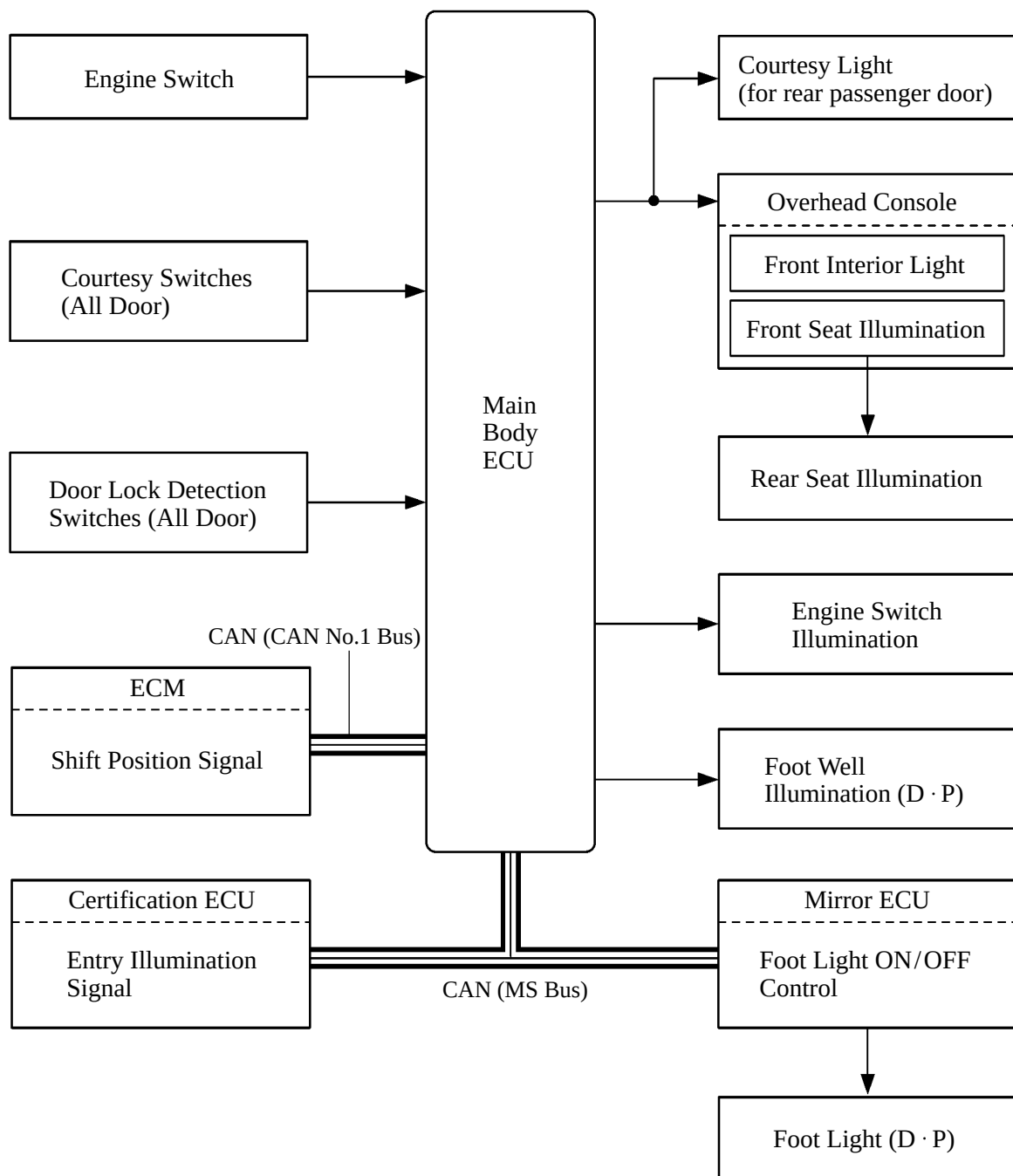


■ ILLUMINATED ENTRY SYSTEM

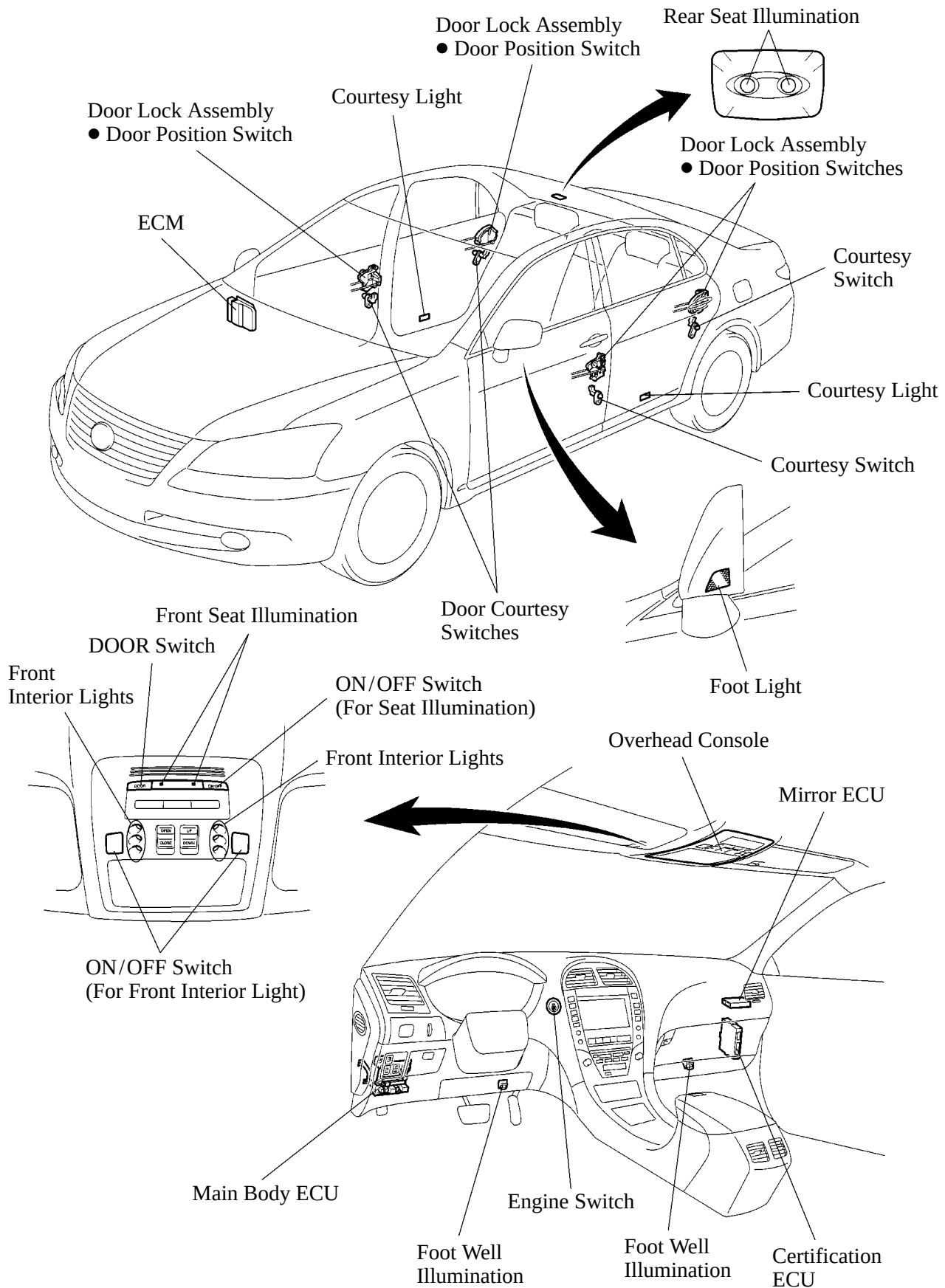
1. General

- The illuminated entry system of the '07 ES350 controls 6 kinds of light: seat illumination (front, rear), front interior light, courtesy light (for rear passenger door) engine switch illumination, foot well illumination and foot light.
- The illuminated entry system controls the front interior light and seat illumination when each light switch is OFF and the DOOR switch is ON.

► System Diagram ◀

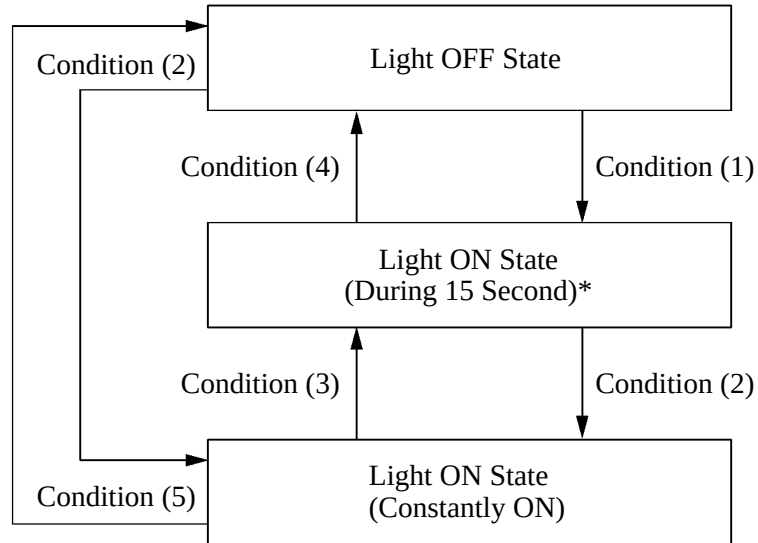


2. Layout of Main Components



3. Interior Light Control

- The interior light control (front interior light, seat illumination, courtesy light [for rear passenger door] and engine switch illumination) consists primarily of the fade-in/fade-out function and timer illumination function.
- The interior light control activates as described in the diagram below when one of items is in the respective state.
- This control is controlled by the main body ECU.



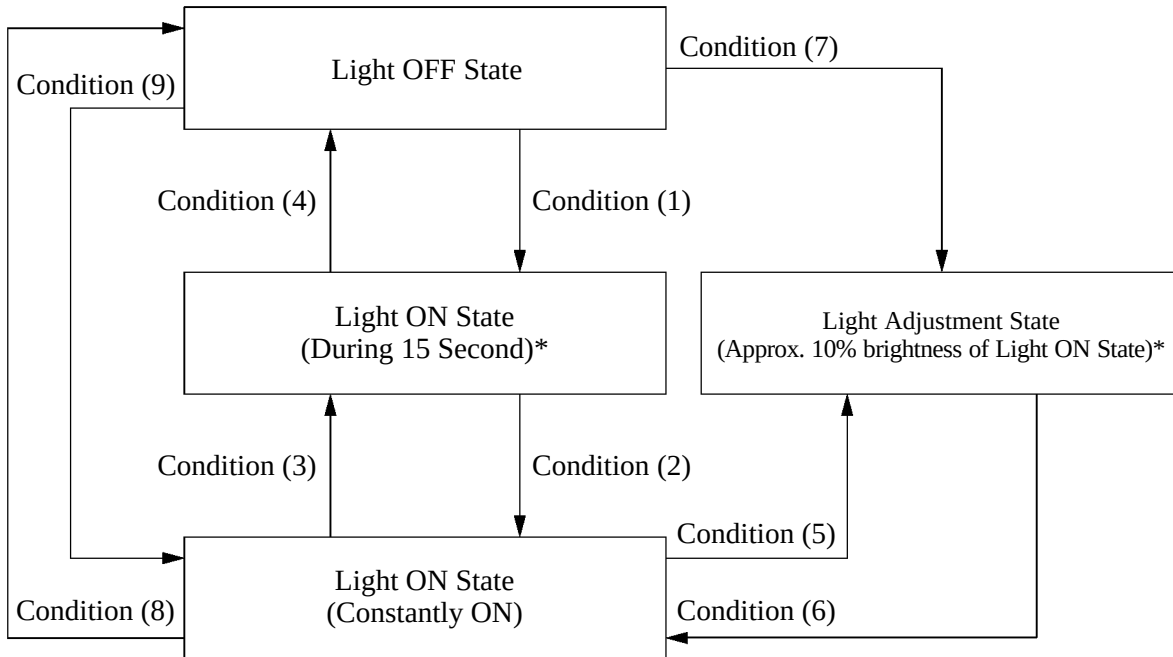
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Condition	Item
Condition (1)	• With power source OFF and all doors closed, any door is unlocked. • With all doors closed, power source is changed from ACC to OFF. • With power source OFF and all doors closed, key enters any actuation area around the doors.
Condition (2)	• Any door is open.
Condition (3)	• With power source OFF, all doors are closed.
Condition (4)	• Power source is ACC or ON. • More than 15 seconds have elapsed since the Light ON State (15 second duration)*. • With power source OFF and all doors closed, all doors are locked.
Condition (5)	• With power source ACC or ON, all doors are closed. • With power source OFF and all doors closed, all doors are locked.

*: The function setting can be changed using the customized body electronics system. For details, refer to Customized Body Electronics System section on page BE-14.

4. Foot Well Illumination Control

- The foot well illumination control consists primarily of the fade-in/fade-out function and timer illumination function.
- The foot well illumination control activates as described in the diagram below when one of items place in the respective state.
- This control is controlled by the main body ECU.



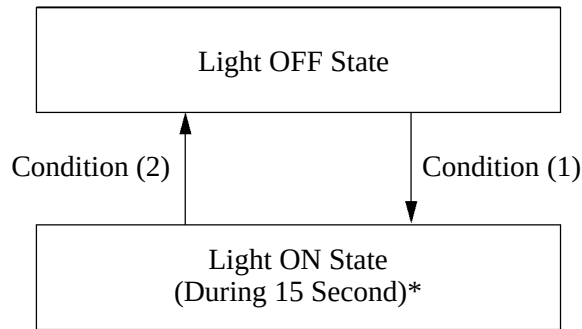
241BE33

Condition	Item
Condition (1)	• With power source OFF and all doors closed, any door is unlocked.
Condition (2)	• Any door is open. • With shift lever at P position, power source is changed from OFF to ON.
Condition (3)	• With power source OFF, all doors are closed. • With all doors closed, power source is changed from ON to OFF.
Condition (4)	• More than 15 seconds have elapsed since start of the Light ON State (15 seconds duration)*. • With power source OFF and all doors closed, all doors are locked.
Condition (5)	• Shift lever is put into other than P position with power source ON.
Condition (6)	• With power source ON, shift lever is put into P position.
Condition (7)	• With shift lever in other than P position, power source is changed from OFF to ON.
Condition (8)	• With power source OFF and all doors locked, all doors are closed.
Condition (9)	• Any door is open. • With shift lever in P position, power source is changed from OFF to ON.

*: The function setting can be changed using the customized body electronics system. For details, refer to Customized Body Electronics System section on page BE-14.

5. Foot Light Control

- The foot light control consists primarily of the fade-in/fade-out function and timer illumination function.
- The foot light control activates as described in the diagram below when one of items is in the respective state.
- This control is controlled by the mirror ECU.



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Condition	Item
Condition (1)	• With shift lever in P position, any door is unlocked. • With power source OFF and all doors closed, key enters any actuation area around the doors. • With foot well illumination ON, any door (driver or front passenger) is opened.
Condition (2)	• With foot well illumination ON, all doors are locked. • Shift lever is put into other than P position with power source ON and foot well illumination ON.

*: The function setting can be changed using the customized body electronics system. For details, refer to Customized Body Electronics System section on page BE-14.

6. Battery Saving Control

When the following two conditions have been met, battery saving control turns off the lights illuminated by the illuminated entry controls (interior light control and foot well illumination control). Battery saving control is controlled by the main body ECU.

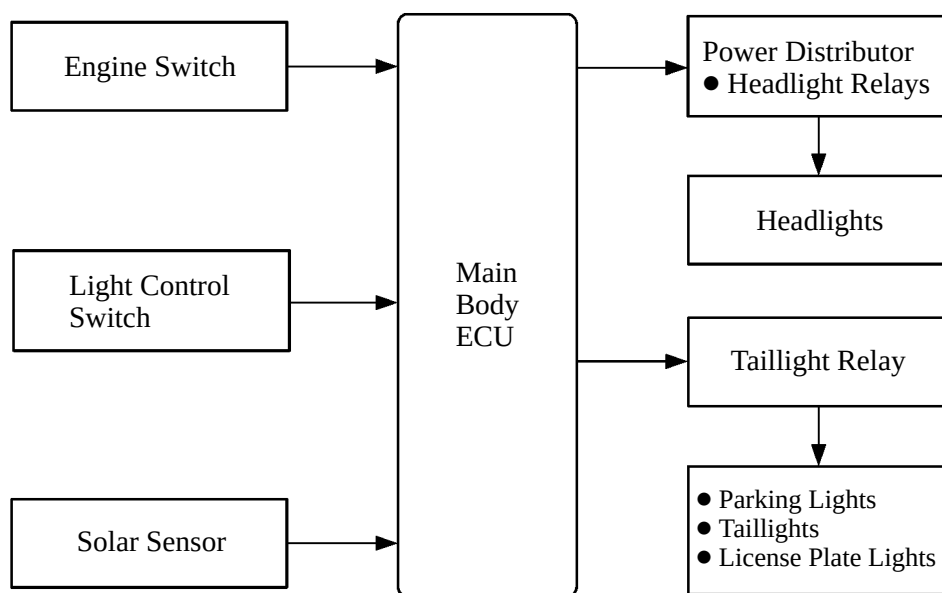
- The key is not in the actuation area.
- There is no change in the condition of the doors for 20 minutes.

■ AUTOMATIC LIGHT CONTROL SYSTEM

- When the light control switch is in the AUTO position, the automatic light control system detects ambient light levels and controls the headlights and taillights (parking lights, taillights and license plate lights) or only the taillights*.
- Ambient light levels are detected by the light control sensor that is integrated in the air conditioning system's solar sensor.
- The main body ECU controls this system.

*: Except U.S.A. and Canadian package models

► System Diagram ◀



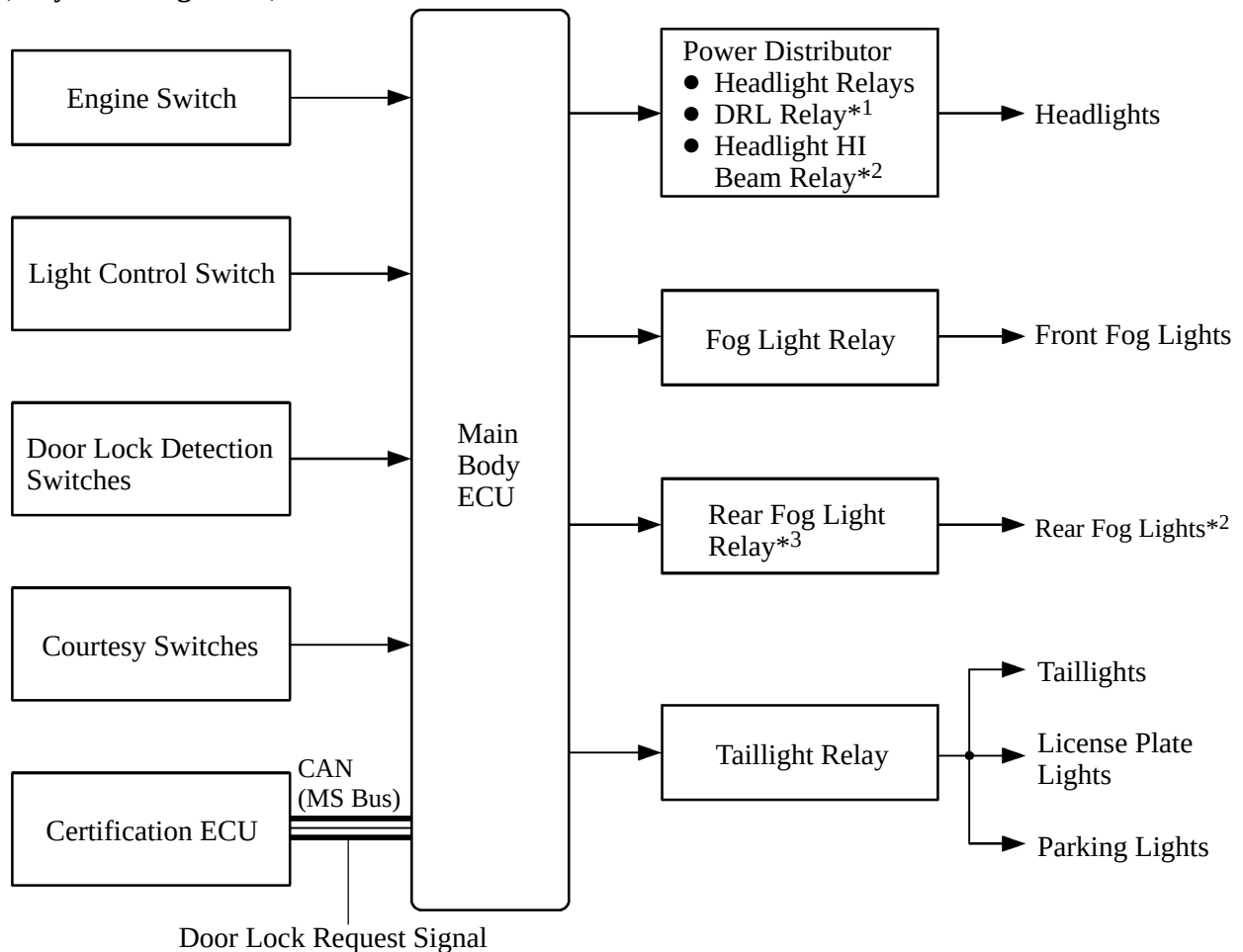
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■ LIGHT TURN-OFF SYSTEM

- The light turn-off system is used to prevent the driver from leaving the vehicle with the headlights, fog lights, parking lights, taillights, or license plate lights on.
- This system has the following functions:

Function	Outline
Delay [Only for U.S.A. and Canadian package models]	When 30 seconds elapse after all of the following conditions are met, the exterior lights turn off. • Power source changes from ACC, or IG-ON to OFF. • The light control switch is in any position except OFF. • The fog light switch is ON. (Only for fog lights) • All doors are closed after any of the doors are opened.
Turn-off	When all of the following conditions are met, the exterior lights turn off. • Power source changes from ACC, or IG-ON to OFF. • The light control switch is in any position except OFF. • The fog light switch is ON. (Only for fog lights) • Delay time elapses or before the delay time elapses, all doors are locked again using the wireless door lock remote control system with all the doors locked. (Only for U.S.A. and Canadian package models) • Any door is opened after all doors have been closed. (except U.S.A. and Canadian package models)

► System Diagram ◀



*1: Only for U.S.A. and Canadian package models

*2: Except U.S.A. and Canadian package models

*3: Only for Taiwanese package models

LIGHTING

■ DESCRIPTION

1. General

The lighting system includes the following equipment:

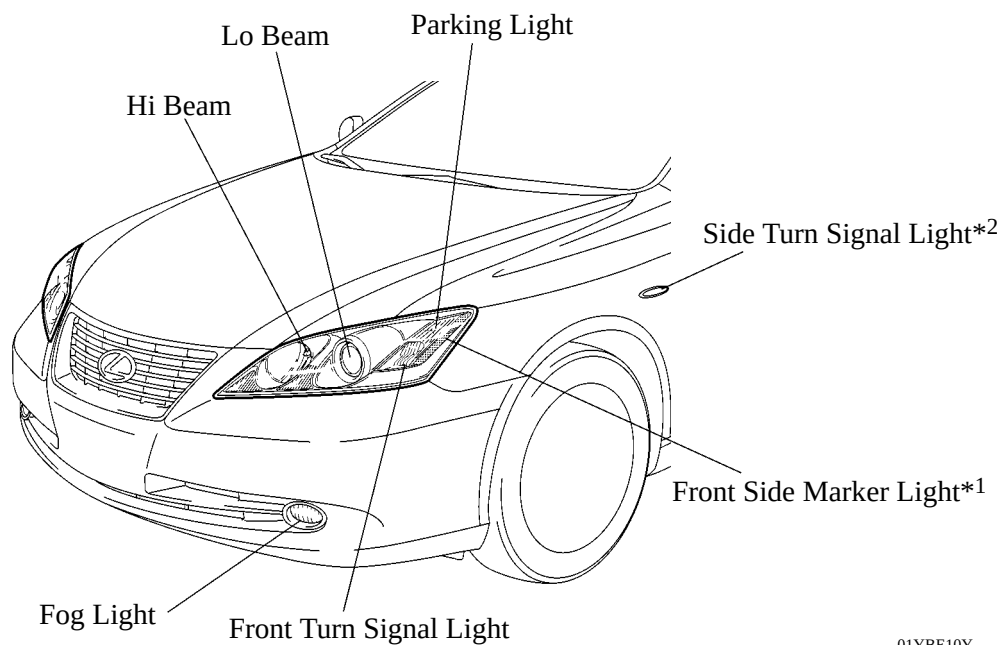
Item		Equipment
Front Fog Light		Standard
Rear Fog Light		Standard* ¹
Headlight	Halogen	Standard* ²
	HID	Option* ²
Automatic Headlight Beam Level Control		Option* ²
Intelligent AFS		Option* ²
Daytime Running Light		Standard* ³
Automatic Light Control System		Standard
Illuminated Entry		Standard
Light Turn-OFF System (With Delay Function* ³)		Standard

*¹: Only for Taiwanese package models

*²: Optional settings vary depending on the package options. For details, see the equipment list in Model Outline.

*³: Only for U.S.A. and Canadian package models

2. Front Exterior Light



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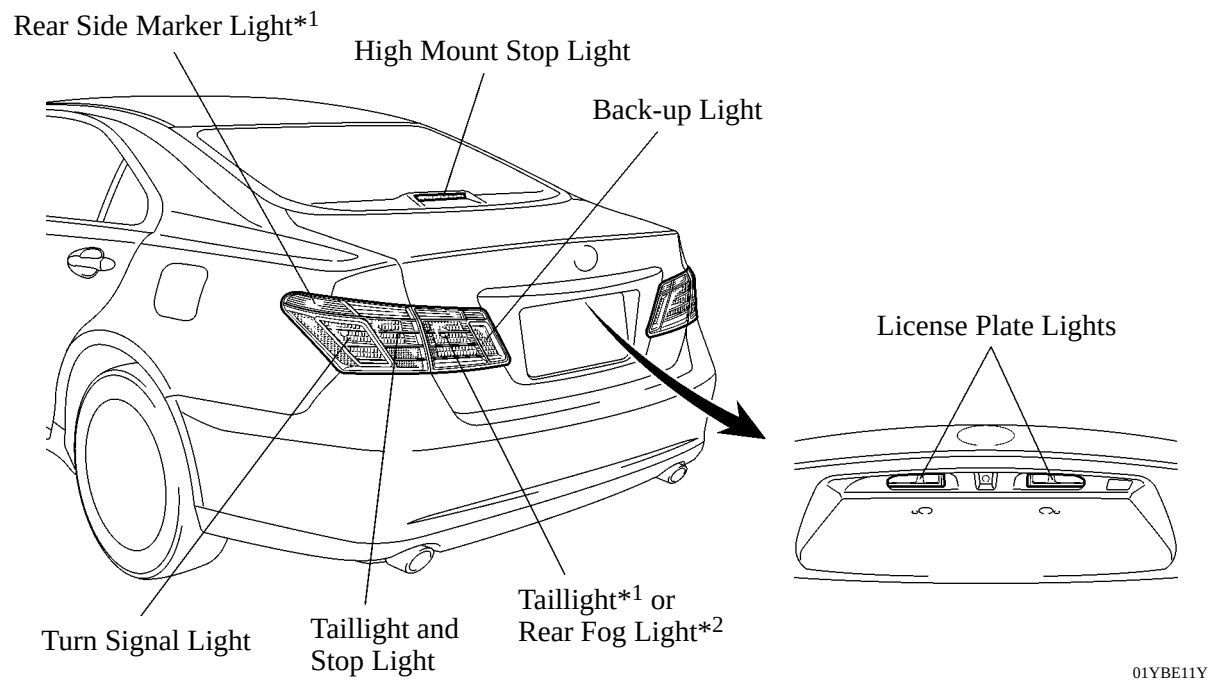
► Specifications ◀

Light		Type	W
Headlight Unit	Hi Beam	Halogen Bulb	60
	Lo Beam (Projector Type)	Halogen Bulb (Standard)	55
		Discharge Bulb (Option)	35
	Front Turn Signal Light	Wedge Base Bulb (Amber)	21
	Parking Light	Wedge Base Bulb (Clear)	5
	Front Side Marker Light*1	Wedge Base Bulb (Clear)	5
Side Turn Signal Light*2		Assembly Unit (Amber)	5
Fog Light		Halogen Bulb	51

*1: Except Taiwanese package models

*2: Only for Korean and Taiwanese package models

3. Rear Exterior Light



► Specifications ◀

Light		Type	W
Combination Light	Taillight & Stop Light	Wedge Base Bulb (Clear)	5/21
	Taillight*1	Wedge Base Bulb (Clear)	5
	Rear Fog Light*2	Wedge Base Bulb (Clear)	21
	Turn Signal Light	Wedge Base Bulb (Amber)	21
	Rear Side Marker Light*1	Wedge Base Bulb (Clear)	3.8
	Back-up Light	Wedge Base Bulb (Clear)	18*1, 16*2
License Plate Lights		LED x 2	0.8
High Mount Stop Light		LED x 32	3.2

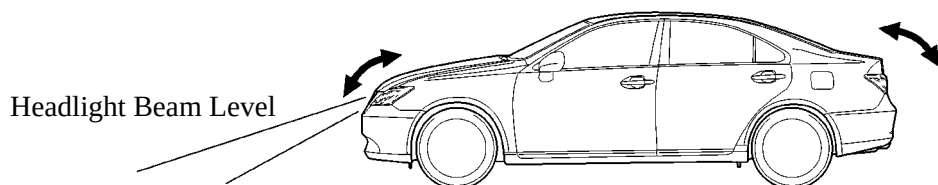
*1: Except Taiwanese package model

*2: Only for Taiwanese package model

■ AUTOMATIC HEADLIGHT BEAM LEVEL CONTROL SYSTEM

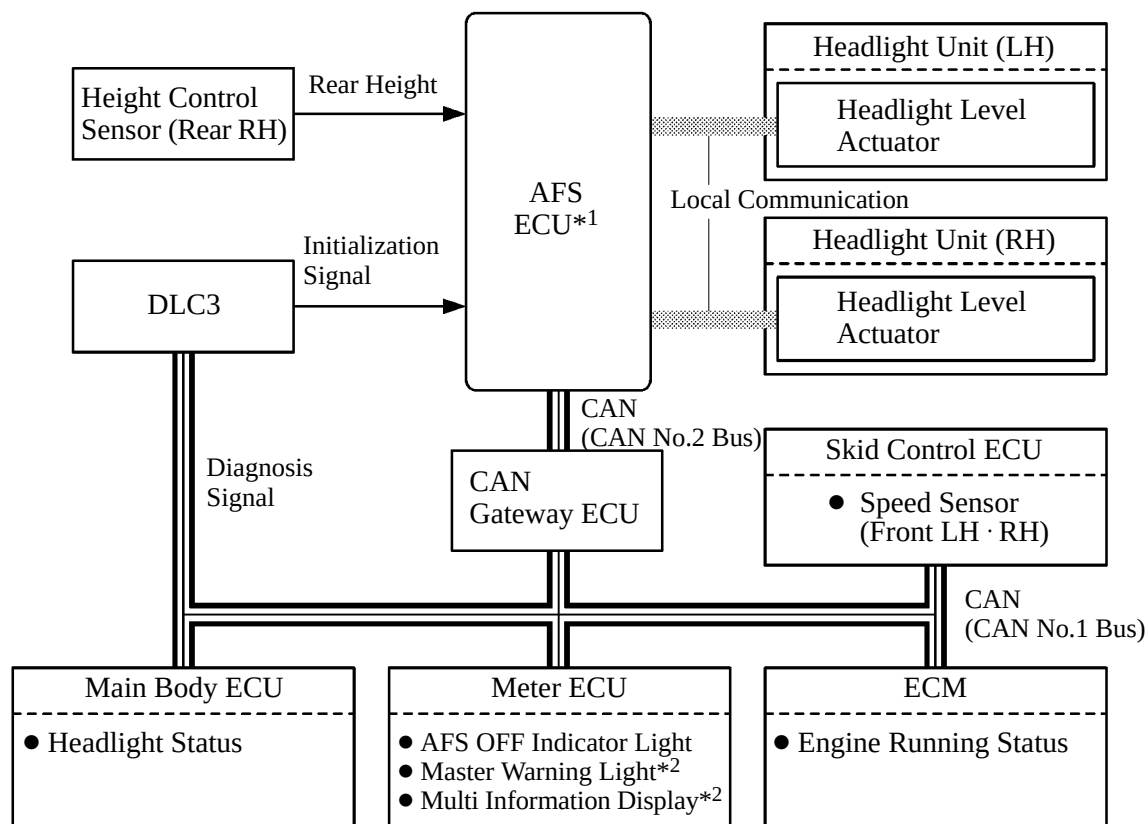
1. General

- When the headlights are on, the automatic headlight beam level control system operates the headlight level actuator in accordance with movement of the vehicle.
- The automatic headlight beam level control system mainly consists of the AFS ECU, rear height control sensor, and two headlight level actuators. The AFS ECU controls the system.
- The AFS ECU calculates changes in the vehicle posture based on signals from the height control sensor (rear RH) and each ECU.
- The ECU then controls the headlight level actuator based on this information, in order to change the headlight reflector angle.



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► System Diagram ◀



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*1: The AFS ECU is used as the master control device on vehicles without the intelligent AFS (Korean package models)

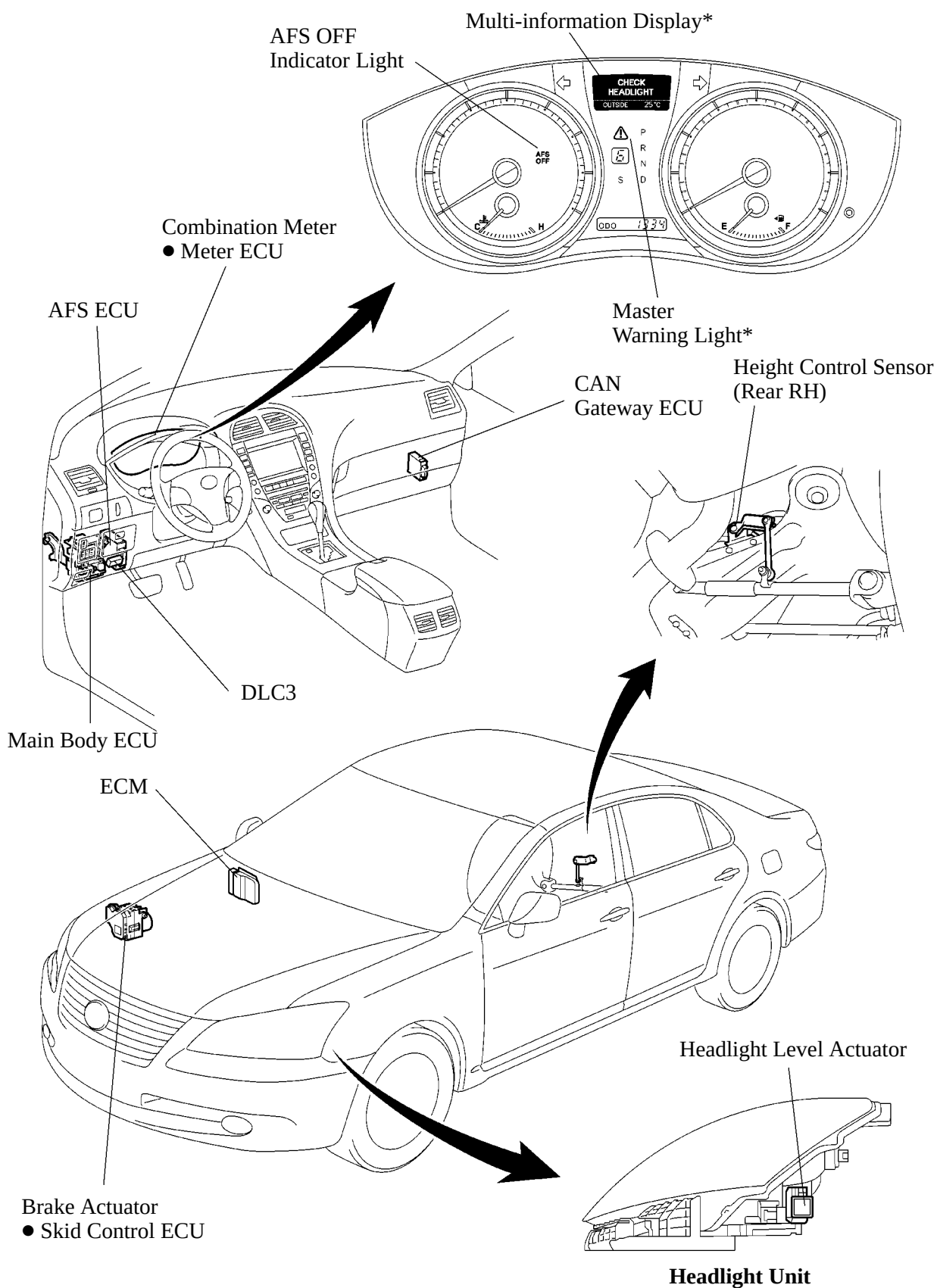
*2: Only for models without the intelligent AFS

Service Tip

If the AFS ECU is replaced, or the rear height control sensor is removed, the AFS ECU must be initialized.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

2. Layout of Main Components



*: Only for models without the intelligent AFS (Korean package models)

3. Function of Main Components

Component		Outline
AFS ECU		● Calculates changes in the vehicle posture based on the signals from the height control sensor and each ECU. ● Outputs control signal to the headlight leveling actuator, based on the detected value. ● Provides initial set control, fail-safe function and diagnosis function.
Headlight Unit	Headlight Level Actuator	● Based on the signals received from the AFS ECU, the actuators move the reflectors in the headlights to vary the Lo beam. ● Uses a step motor to precisely regulate the angle of the reflectors.
Height Control Sensor (Rear RH)		Detects the height of the rear of the vehicle.
Skid Control ECU		Transmits the speed sensor signal (Front LH and RH) to the AFS ECU.
ECM		Transmits the engine running status signal to the AFS ECU.
Main Body ECU		Transmits the headlight status signal.
Combination Meter (Meter ECU)	AFS OFF Indicator Light	When the system malfunctions, the meter ECU alerts the driver by flashing the AFS OFF indicator light in accordance with the signal from the AFS ECU.
	Multi-information Display*	When the system malfunctions, the meter ECU illuminates the master warning light based on the signal from the AFS ECU, and indicates the warning message on the multi-information display to alert the driver.

*: Only for models without the intelligent AFS (Korean package models)

4. Initial Set Control

When the engine is started, the AFS ECU drives the headlight level actuator, moves the headlight reflector to the lower limit position and returns it to the proper position. The AFS ECU thus assesses the position of the headlight for reference control.

5. Fail-Safe

If the AFS ECU detects a malfunction in the automatic headlight beam level control system or intelligent AFS, it will take the actions indicated in the table below.

Trouble Area	Condition (Fail-Safe Control for Automatic Headlight Beam Level Control)	Warning*
Headlight Swivel Actuator Malfunction	Continues to control until a position of 0.65° less than the current position is reached.	Display
Steering Angle Sensor Signal Malfunction	Continues to control	Display
Speed Sensor Signal Malfunction	- Continues to control using the normal speed sensor signal if one signal fails. - Judges that the vehicle speed is 0 km/h and continues to control if both speed sensor signals fail.	Display
Height Control Sensor Signal Malfunction	- Stops the operation after returning to initial position (Fail at higher than initial position). - Stops the operation in current condition (Fail at lower than initial position).	Display
Headlight Level Actuator Malfunction	Normal Side Headlight Level Actuator: - Stops the operation after returning to initial position (Fail at higher than initial position). - Stops in current condition (Fail at lower than initial position).	Display
	Abnormal Side Headlight Level Actuator: Stops in its current position.	
Communication Signal Malfunction	Skid Control ECU: Judges that the vehicle speed is 0 km/h and continues to control.	Display
	Steering Angle Sensor: Normally controls the system	Display

*: On models with the intelligent AFS, the AFS OFF indicator light flashes. On models without the intelligent AFS, the master warning light illuminates and “CHECK HEADLIGHT” is displayed on the multi-information display.

6. Diagnosis

If the AFS ECU detects a malfunction in the automatic headlight beam level control system, the AFS ECU flashes the AFS OFF indicator light (For models without the intelligent AFS, the AFS ECU illuminates the master warning light and indicates the warning message on the multi-information display.). At the same time, the DTC (Diagnostic Trouble Codes) are stored in memory. The DTC can be read by use of the hand-held tester. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

Service Tip

The diagnostic communication uses the CAN protocol. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

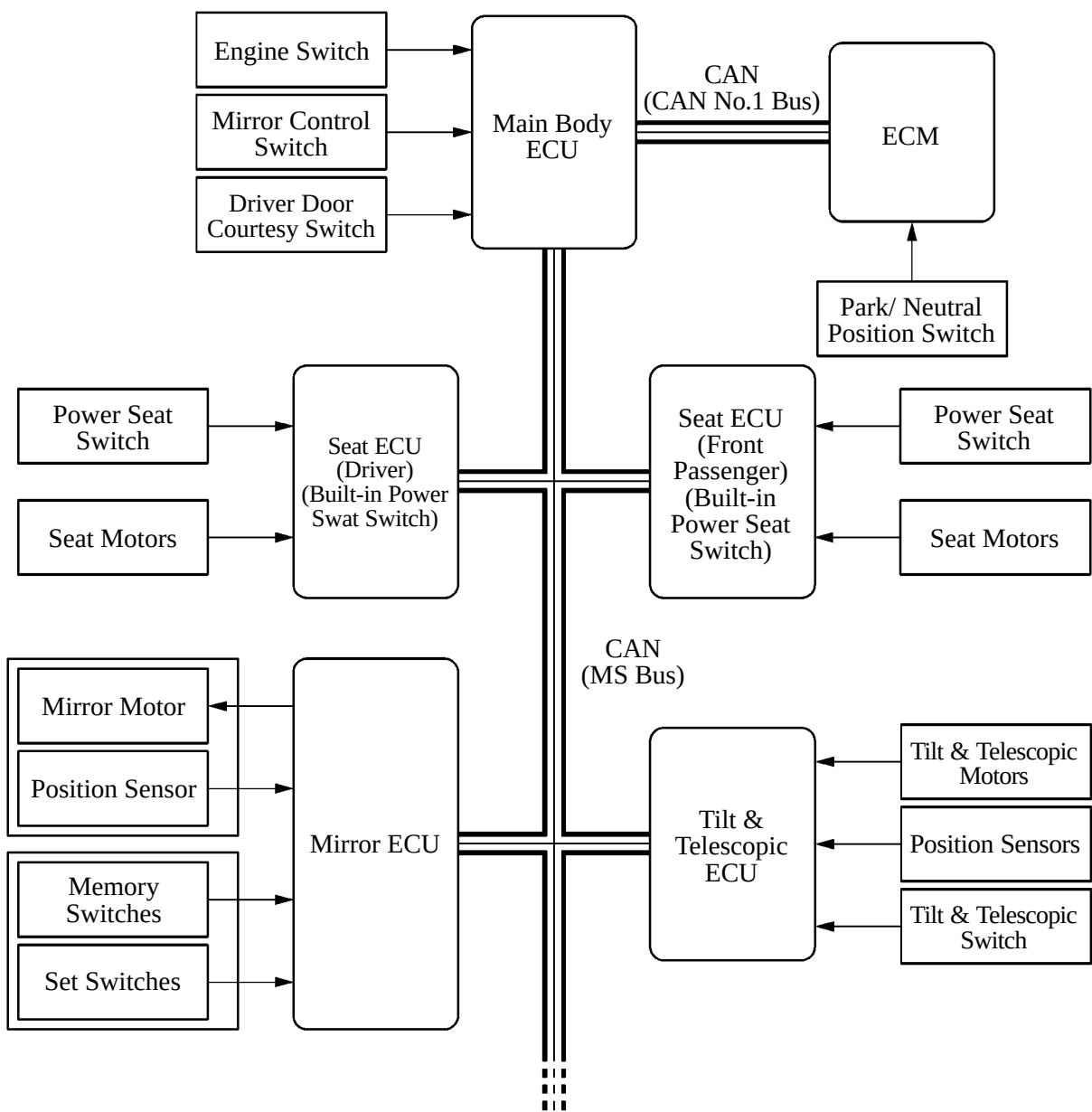
MEMORY SYSTEM

■ DESCRIPTION

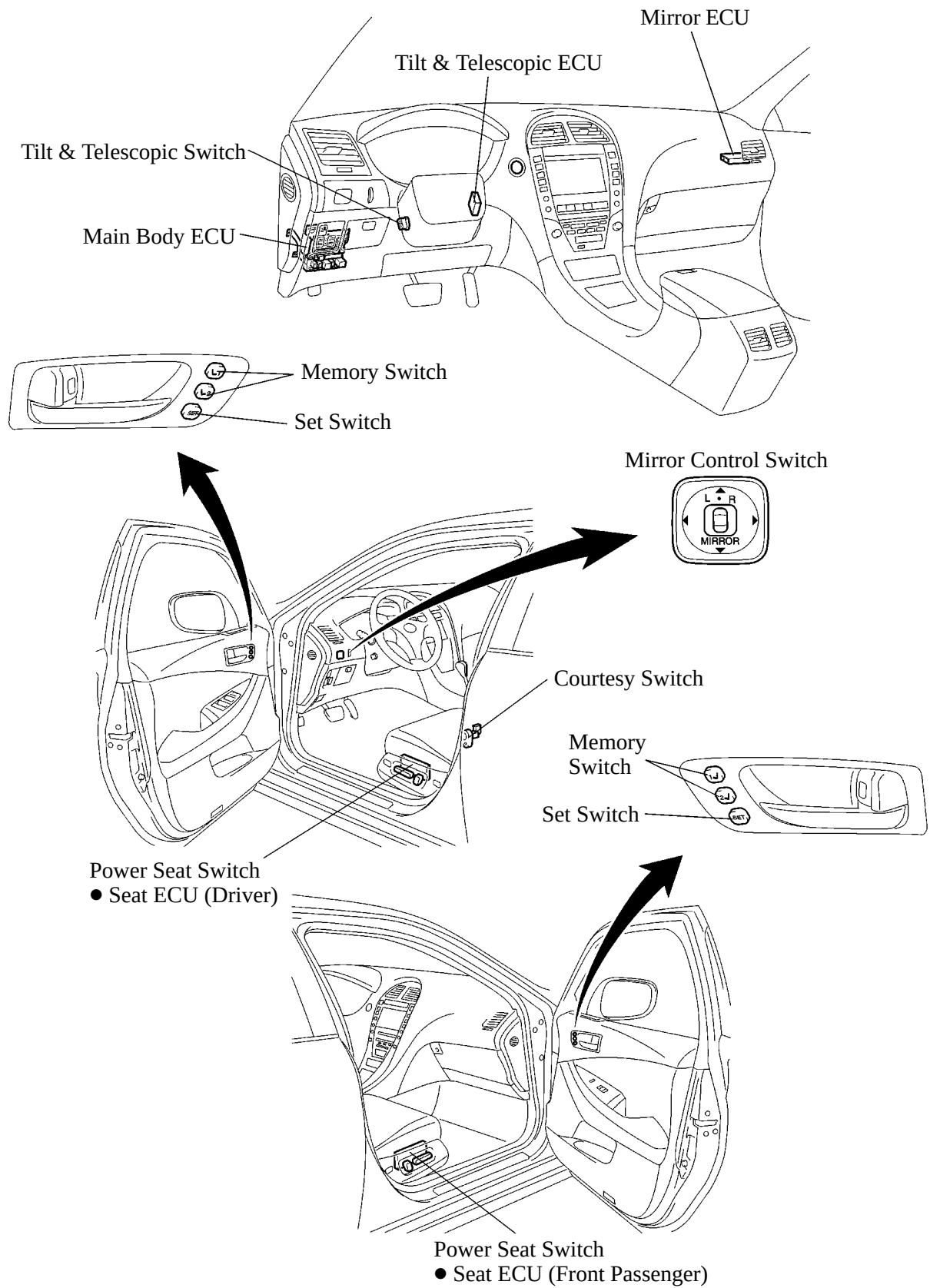
- On the '07 ES350, a memory system is provided for the driver and front passenger seat as an optional equipment.
- The memory system can store 2 positions for the driver seat, front passenger seat, outside rear view mirror, and tilt & telescopic respectively.
- Each seat ECU stores seat slide, front vertical, rear vertical and reclining positions in its memory. The seat ECU is built in to the power seat switch.
- The seat ECU (driver) stores the outside rear view mirror position and tilt & telescopic position in its memory.
- The seat ECU (driver) outputs a reproduction signal to each ECU.
- The memory and recall conditions of this system are as follows.

Function	Condition
Memory	Stores the positions when all conditions below have been met and button 1 or 2 is pushed while the “SET” button is pushed. ● Power source is “IG-ON”. ● Shift position is “P”. When the memory setting is completed, the buzzer will sound for 0.5 seconds.
Recall	If button 1 or 2 is pressed when all conditions have been met, the system operates to adjust the positions. ● Power source is “IG-ON”. ● Shift position is “P”. If button 1 or 2 is pressed when all conditions have been met and within 30 seconds, the system operates to adjust the positions. ● Power source is “IG-OFF”. ● Driver door is opened.

► System Diagram ◀



■ LAYOUT OF MAIN COMPONENTS

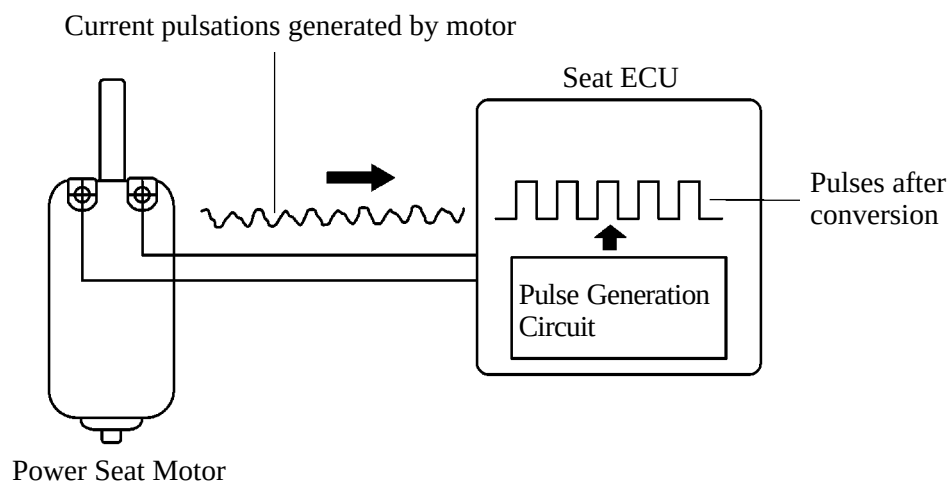


■ DRIVER SEAT ECU

- The seat ECU (driver) effects the main control of the memory system in order to memorize and recall the driver seat position. In addition, the seat ECU (driver) instructs the seat ECU (front passenger), tilt & telescopic ECU, mirror ECU to start memorizing or recalling their respective positions.
- The driver seat position, front passenger seat position, tilt & telescopic steering, and the outside rear view mirror position, are memorized by their respective ECUs.
- The ECUs exchange the information that is necessary for memory control via the CAN.

■ SEAT POSITION DETECTION METHOD

A pulse generation circuit in seat ECU (driver and front passenger) converts the driving current pulsations that are generated by the rotation of the motor into pulse signals. These signals are then picked up in order to detect the seat position.



■ FUNCTION

1. General

The main functions of the multi display are shown below.

Main Function		Outline
Navigation Screen (See page BE-87)		Through the use of the GPS (Global Positioning System) and map data which is stored on a DVD, the navigation system analyzes the position of the vehicle and indicates that position on the map that is displayed on this screen.
Audio/Video System		Displays the following three operations: ● Radio Operation ● Cassette Player Operation ● CD Changer Operation ● DVD Changer Operation (Different optional setting)
Air Conditioning		The operation and control of the air conditioning system can be effected through the use of the automatic air conditioning display of the multi display and the touch switch that appears on the display.
Rear View Monitor System		Displays the rear view of the vehicle has been captured by the television camera mounted on the luggage compartment door when the shift lever is moved to the reverse position. For details, see page BE-98.
Intuitive Parking Assist (Different optional setting)		Detects obstacles and displays the information on the multi display to inform the driver. For details, see page BE-102.
Others	Hands-Free (See page BE-91)	When a Bluetooth-compatible cellular telephone is registered to the multi display, the user can make and receive calls or talk hands-free on the cellular telephone by operating the switches on the screen or the steering pad.
	Maintenance Information	Can be used to inform the driver of inspection or replacement timing of the following items based on the calendar function and vehicle speed signal. Engine Oil: Replace engine oil Oil Filter: Replace engine oil filter Rotation: Rotate tires Tires: Replace tires Battery: Replace battery Brake Pad: Replace brake linings Wipers: Replace wiper blades LLC: Replace engine coolant Brake Oil: Replace brake fluid ATF: Replace ATF Service: Scheduled maintenance Air Filter: Replace air filter Personal: New information items can be created separately from provided ones.
	Calendar with Memo	It is possible to enter memos for particular dates on the calendar.
	Speech Command System	Operates the navigation, audio, and air conditioning systems based on voice commands. However, only English can be recognized by this function.
	Help Screen	Help screen can see the command list and operation guide on it.
	Screen Adjustment	The brightness or contrast of the screen can be adjusted to suit the brightness of surroundings.

(Continued)

Main Function		Outline
Others	Screen Setting	The following screen settings are available: Automatic transition: It enables automatic return to the navigation screen from the audio screen or A/C screen. Switch Color: Color of touch-screen button can selected.
	Beep Setting	Beep sound off.
	Select Language	The language used for the touch-screen buttons, pop-up messages and voice guidance can be changed. English, French, and Spanish are available.
	Delete Personal Data	The following personal data can be deleted or returned to their default settings: ● Maintenance conditions ● Maintenance information “off” setting ● Memory points ● Areas to avoid ● Previous points ● Route trace ● User selection settings ● Phonebook data ● Dialed numbers and received calls ● Speed dial ● Bluetooth phone data ● Security code
Diagnosis		This contains the following four items: ● Service Check Menu ● Display Check ● Navigation Check ● Bluetooth TEL Check

2. Navigation Screen

The navigation ECU calculates the present position, direction of travel, and distance the vehicle has driven based on the following information sources. This information is displayed on the multi display.

- DVD map data
- GPS (Global Positioning System) Satellites
- Built-in Gyro Sensor
- Vehicle Speed Signal

The functions of the navigation screen display are shown below.

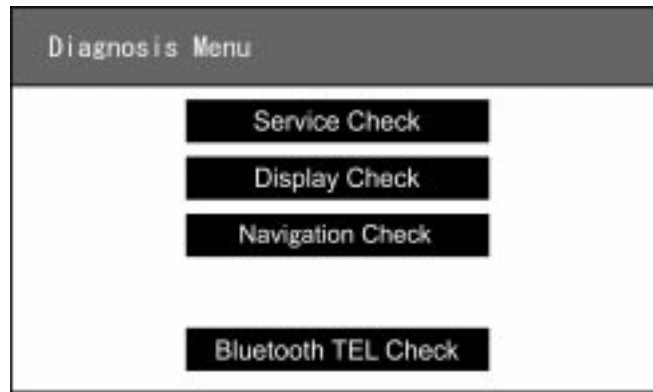
	Item	Function
Map Display	Linear Touch Scroll	Enables smooth scrolling by connecting the touch points on the screen.
	On-route Scroll	Scrolls the center of the cursor forward and reverse constantly along the route.
	Heading Up	• Displays the map so that the direction of the route progression heading faces up during route guidance. • Displays a map in the direction of travel of the vehicle in an enlarged form.
	Step-less Scale Display	Changes the scale of the map from the basic 13 steps to an even finer display.
	Direct Scale Change	Directly selects and displays the map scale.
	Multi-step Scale Display	Changes and displays the map scale in 13 stages.
	Split-view Display	Displays different modes on a screen that is split into two views.
	Points-of-Interest Display	Displays selected types of points of interest as marks on the map.
	Taillight-interlocked Map Color Change	Changes the color on the map screen that is displayed when the taillights are turned ON.
	Road Number Sign Board Display	Displays the road number on the map.
	Compass Mode Screen	Displays the direction of travel and detailed data of the present location.
	Map Coverage Information Display	Displays the map area that is recorded on DVD.
	Street Name Indication on Scrolled Map	Displays the street name and the city name even when the map screen is being scrolled.
	Footprint Map	Displays a map on scale of 75 feet (25 m). (for specific areas in the following cities: Detroit, Chicago, New York, and Los Angeles.)
Destination Search	Last Destination Memory	Stores 20 locations of coordinates, names and times that have been set as destinations in the past.
	Hybrid Points-of-interest Search	Narrows the search by names of the points-of-interest, category, and areas.
	Points-of-interest Pinpoint Display	Pinpoints and displays the position of the point-of-interest.
	House Number Search	Searches for a house number.
	Special Memory Point	Sets a pre-registered point as a destination point while driving.
	Nearest Point-of-interest Search List Display	Searches nearest points-of-interest and displays a list.

(Continued)

Item		Function
Destination Search	Intersection Search	By specifying two streets, the point at which they intersection is set as the destination point.
	Emergency Search	Performs a specific search for hospitals, police stations and dealers.
	Freeway Entrance or Exit Search	Searches for the destination by the name of the street that connects to a freeway entrance or exit.
	Coordinate Search	Searches for a destination by latitude and longitude.
	Telephone Number Search	Searches for a facility by its telephone number.
	POI, brand icon indication	Displays an icon for point of interest.
Route Search	Multiple Destination Setting	Sets multiple destinations. It can also rearrange the sequence of the destinations.
	Route Search	Searches for routes that do not cross the border between the U.S.A. and Canada.
	Search Condition Designation	Searches for the recommended, shortest, and other routes.
	Regulated Road Consideration	Performs search which considers regulated roads.
	Avoidance Area	Searches for a route that avoids a designated area.
	Street Address Search	The user can set up the destination by voice input of the city or street name.
Guidance	Destination Direction Arrow Display	Function to display the direction from the current position to the destination in case of being off the route during the guidance.
	Off-Route Arrow Display	Function to display the route ahead on the route guidance line in case of being off the route during the guidance.
	Rotary Guidance	To guide with a special voice phrase in the rotary.
	Right or Left Turn Guidance	Voice guidance to instruct the direction of travel to be taken.
	Freeway Direction of Travel Guidance	Voice guidance to instruct the direction of travel to take on the freeway.
	Distance Display Destination	Displays the distance from the present location to the destination.
	Freeway Branch Type Specimen Guidance	Type specimen for guidance to a freeway branch.
	Intersection Zoom-in Display	Zoom-in display when approaching an intersection.
	Estimated Arrival Time Display	Displays estimated arrival time to a user.
	Route Trace Display	Displays route trace.
	Turn List Display	Displays a turn list on the right side of the two-screen display when approaching an intersection.
	Freeway Mode Screen	Displays the distance to the next junction and exit, or POIs in the vicinity of the freeway exit.
Others	Voice Recognition	Recognize pre-programmed system commands voiced by the user to operate the navigation system.
	Help	This function explains a user what operation can be performed when a “?” on the display is pushed.

3. Diagnosis

The following check menus are included in the diagnosis screen.



0140BE236C

Check Mode	Detail
Service Check Menu	Performs a system check and gathers DTC (Diagnostic Trouble Codes) in memory, and, based on their results, shows the past and present inspection results of the connected devices.
Display Check	Shows a screen for checking a specific portion of the display.
Navigation Check	Shows a screen for checking a specific portion of navigation ECU.
Bluetooth TEL Check	Shows a screen for setting the voice quality for a Bluetooth-enabled hands-free phone system.

For details on the procedure required to enter the diagnosis menu screen, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

■ DIFFERENCES BETWEEN CAN, AVC-LAN AND BEAN

1. General

- The protocols, which are the rules for establishing data communication, differ between the CAN, AVC-LAN and BEAN*. If the ECUs in the networks use different frameworks for their data, such as communication speed, communication wire, and signals, they will be unable to understand each other. Therefore, protocols (rules) must be established among them.
- Compared to the AVC-LAN and BEAN*, the CAN features high-speed data transmission. Therefore, the CAN is able to transmit larger amounts of data faster than other protocols. This feature makes it possible to transmit data accurately in the power train and chassis control system, which requires large amounts of data to be transmitted in short periods of time.

*: The BEAN is used in the body electrical system of the '06 ES330 and some other LEXUS models, but is not used on the '07 ES350.

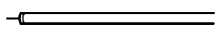
Protocol	CAN (ISO Standard)	AVC-LAN (TOYOTA Original)	BEAN (TOYOTA Original)
Communication Speed	500 kbps*/HS-CAN 250 kbps*/MS-CAN (Max. 1 M bps)	Max. 17.8 kbps*	Max. 10 kbps*
Communication Wire	Twisted-pair Wire	Twisted-pair Wire	AV Single Wire
Drive Type	Differential Voltage Drive	Differential Voltage Drive	Single Wire Voltage Drive
Data Length	1-8 Byte (Variable)	0-32 Byte (Variable)	1-11 Byte (Variable)

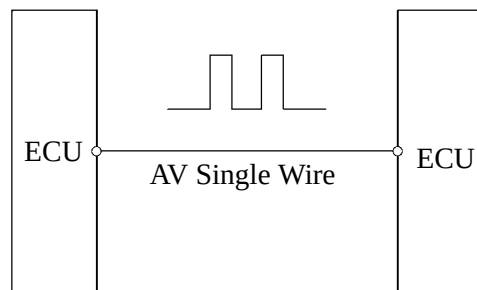
*: bps: abbreviation for “Bits Per Second”, indicating the number of bits that can be transmitted per second.

2. Communication Wire

A twisted-pair wire is used for CAN and AVC-LAN communication. A single, AV (Automobile Vinyl) wire is used for BEAN* communication.

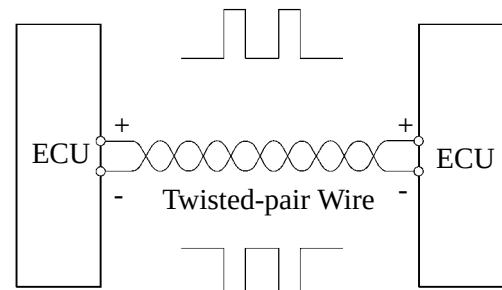
*: The BEAN is used in the body electrical system of the '06 ES330 and some other LEXUS models, but is not used on the '07 ES350.

Communication Wire	Outline
Twisted-pair Wire for CAN  241BE168	This communication wire is a pair of twisted lines. Communication is driven by applying 1.5 to 2.5 V and 2.5 to 3.5 V of voltage to the two lines in order to send a single signal. This system, which is called a "Differential Voltage Drive", reduces noise.
Twisted-pair Wire for AVC-LAN  241BE168	This communication wire is a pair of twisted lines. Communication is driven by applying positive (+) and negative (-) voltages to the two lines in order to send a single signal. This system, which is called a "Differential Voltage Drive", reduces noise.
AV Single Wire  240BE09	This is a lightweight single communication wire that consists of a single core line surrounded by insulation. Voltage is applied to this line in order to drive communication, and this system is called a "Single Wire Voltage Drive".



240BE11

Single Wire Voltage Drive



240BE12

Differential Voltage Drive

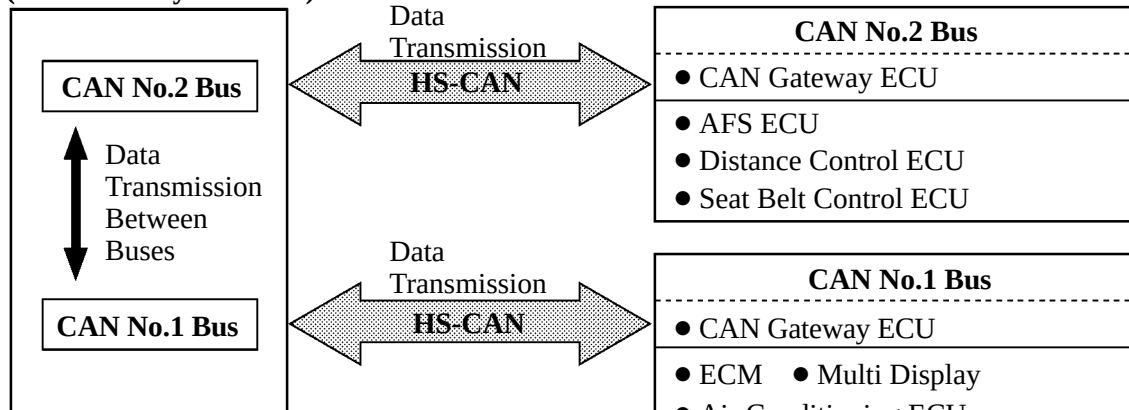
■ CAN

1. General

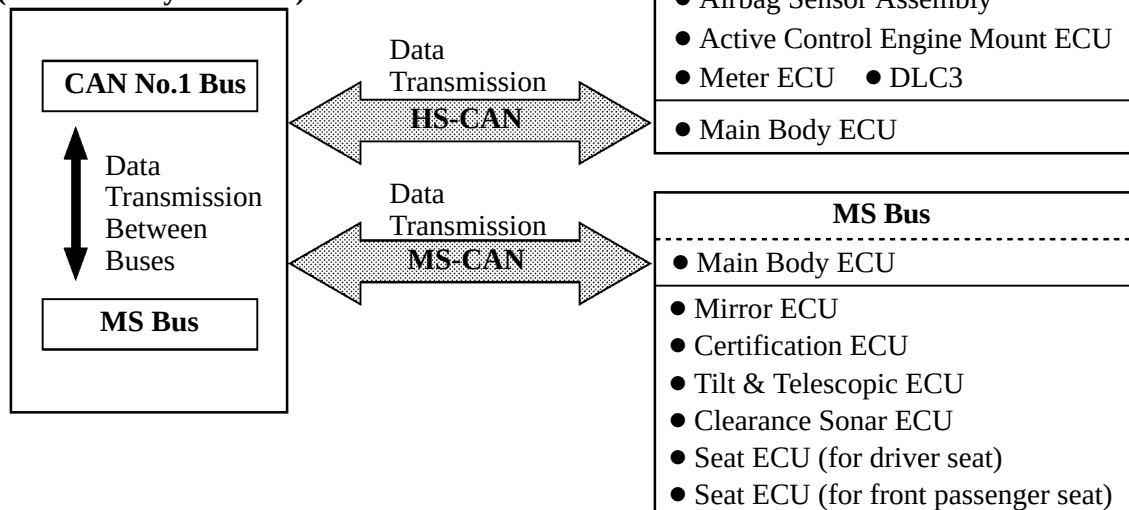
- The '07 ES350 uses two types of CAN that have different communication speeds: HS-CAN (500 kbps) and MS-CAN (250 kbps).
- The HS-CAN consists of the CAN No.1 bus and CAN No.2 bus. The terminating resistors of the CAN No.1 bus are built into the ECM and meter ECU, and those of CAN No.2 bus are built into the CAN gateway ECU and junction connector (rear RH).
- The MS-CAN consists of the MS bus. The terminating resistors of the MS bus are built into the main body ECU and certification ECU.
- ECUs with the gateway functions are used to transmit data between buses (the CAN gateway ECU is used for data transmission between the CAN No.1 bus and the CAN No.2 bus, and the main body ECU is used between the CAN No.1 bus and the MS bus).

► Image of Data Transmission between Buses ◀

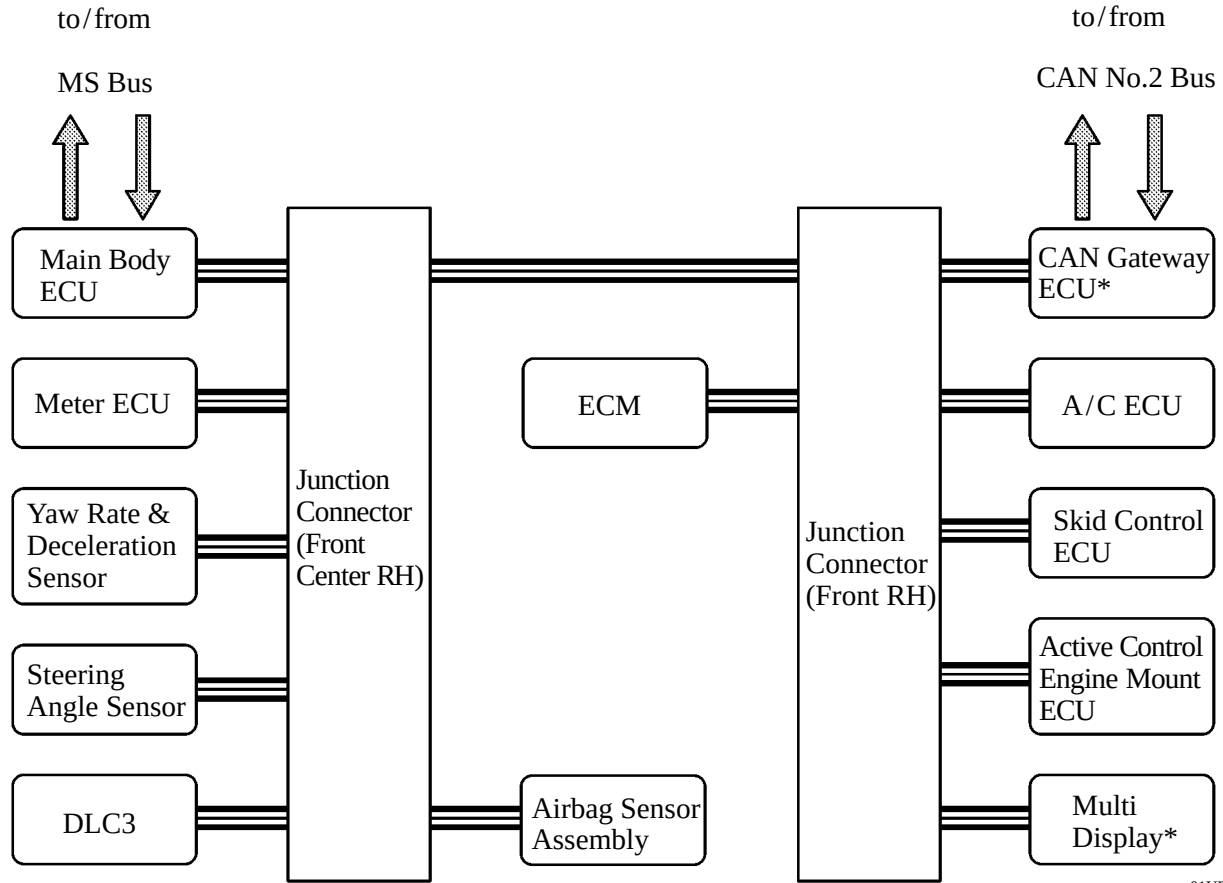
CAN Gateway ECU (with Gateway Function)



Main Body ECU (with Gateway Function)



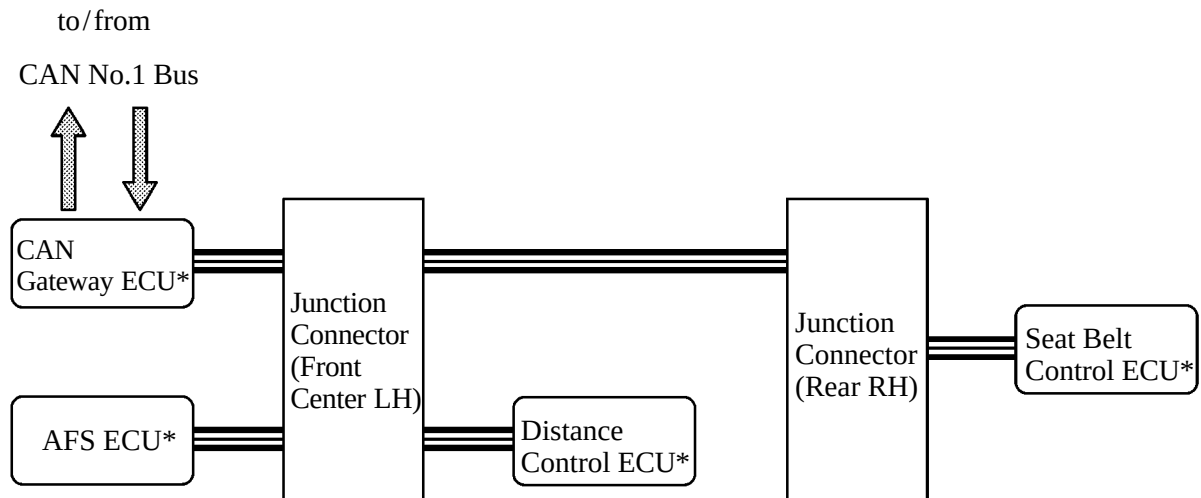
► CAN No.1 Bus ◀



01YBE05P

*: Optional equipment

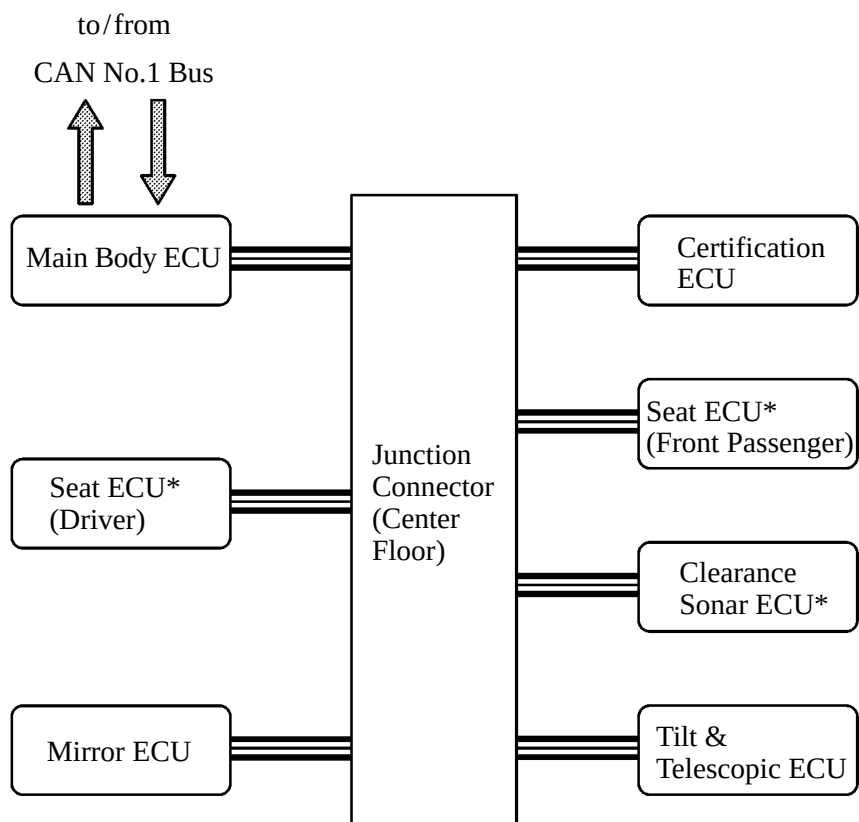
► CAN No.2 Bus ◀



01YBE06P

*: Optional equipment

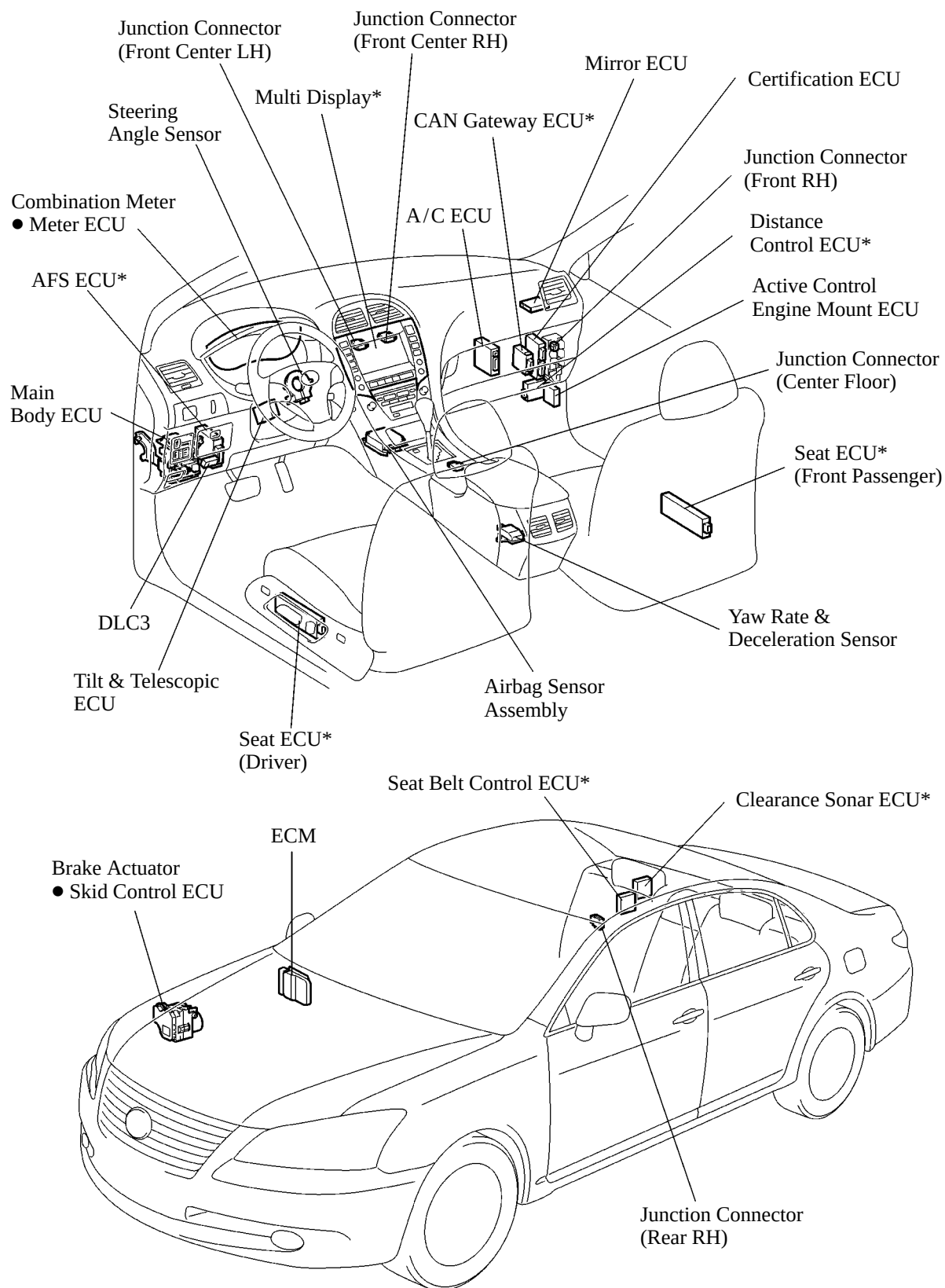
► MS Bus ◀



01YBE07P

*: Optional equipment

2. Layout of Main Components



01YBE08TE

*: Optional equipment

3. Diagnosis

- If a malfunction occurs on the CAN communication line, the ECU that is connected to the CAN communication line stores the DTC (Diagnostic Trouble Code) in its memory.
- The 5-digit DTC can be read by connecting a hand-held tester to the DLC3.
- The DLC3 is equipped with CAN-H and CAN-L terminals for CAN diagnosis. It is possible to determine if there is an open or short in the main wire of the CAN No.1 bus by measuring the resistance value between these terminals.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

Service Tip

The diagnostic communication uses the CAN protocol. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

■ AVC-LAN

1. General

The AVC-LAN is used among the multi display (optional equipment), audio head unit and stereo amplifier.

► System Diagram ◀

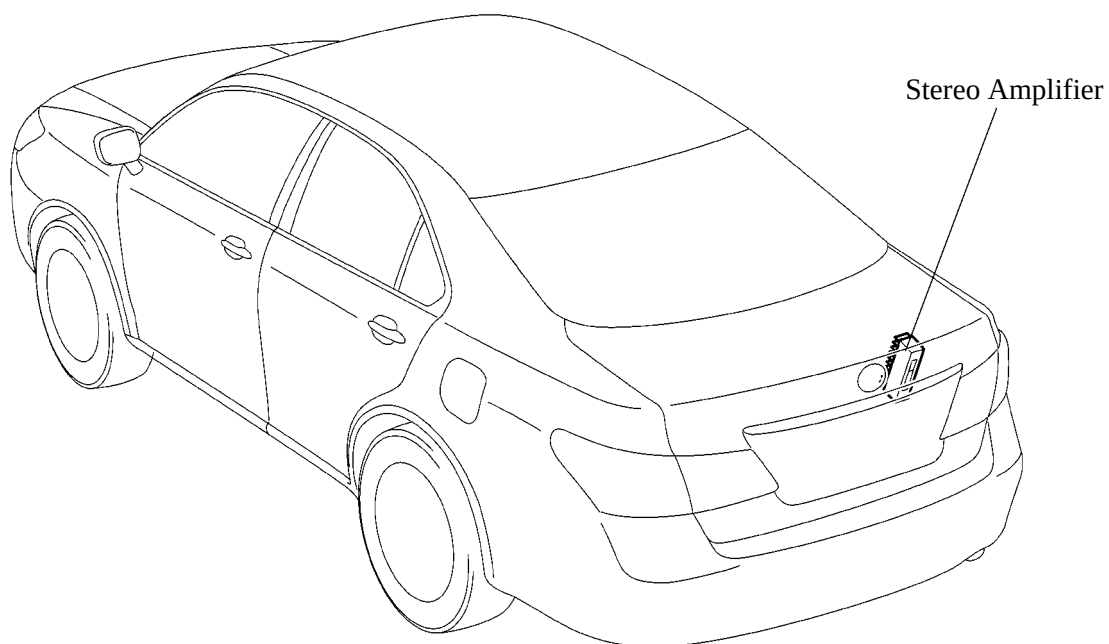
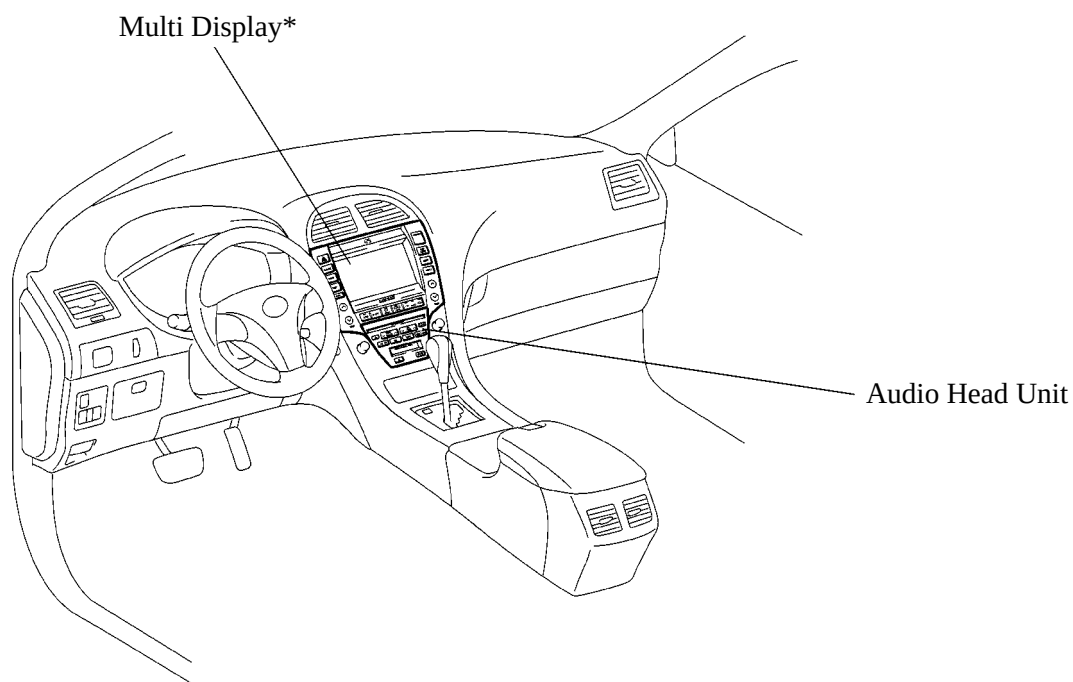
≡ : AVC-LAN



01YBE37P

*: Optional equipment

2. Layout of Main Components



01YBE38TE

*: Optional equipment

3. Diagnosis

If a malfunction occurs in the AVC-LAN communication line, the multi display (models with the multi display) or audio head unit (models without the multi display) stores the DTC (Diagnostic Trouble Code) in its memory.

- The DTC of models with the multi display can be read on the diagnosis menu on the multi display.
- The DTC of models without the multi display can be read on the LCD of the audio head unit.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

■ CUSTOMIZED BODY ELECTRONICS SYSTEM

A hand-held tester can be used to customize the system settings.

System	Hand-Held Tester Display Content	Contents	Default Setting	Available Setting
Wireless Door Lock	TRUNK LID OPER (Trunk lid open function type)	To change the operation method of opening the trunk by the transmitter.	0.8s PR	1 TIME/ 2 TIMES/ 0.8s PR/ OFF
	WIRELESS OPER (Wireless door lock control function)	Function to turn ON/OFF of the wireless door lock.	ON	ON/OFF
	HAZARD ANS BACK (Hazard answer back of the wireless)	Function to turn ON/OFF of the hazard answer back of the wireless door lock.	ON	ON/OFF
	OPEN DOOR WARN (Open Door Warning)	Function to make the buzzer sound for 10 seconds if the door is open when locking with the wireless door lock.	ON	ON/OFF
	AUTO LOCK DELAY (Auto lock time)	Function to change the time until re-locking after unlocking with the wireless door lock.	30 sec* ¹ / 60 sec* ²	30 sec/ 60 sec
	UNLOCK/2 OPER (2 times operation wireless unlock)	Function to unlock the driver's door by pressing the unlock button of the transmitter once and to unlock all the doors by pressing it twice. In the OFF setting, pressing one time makes all the doors unlocked.	ON	ON/OFF
Door Lock	UNLK/KEY TWICE (Unlock w/2 times D key operation)	Function to unlock only the driver's door by doing the key operation once and to unlock all the doors by doing it twice. In the OFF setting, operating the key "UNLOCK" once makes all the doors unlocked.	ON	ON/OFF
	AUTO LOCK/SHIFT* ³ (Automatic door lock linked shift)	Function to lock the doors when shifting the lever from P range to the range other than P.	ON	ON/OFF
	AUTO LOCK* ³ (Auto lock)	Function to lock the doors when the vehicle reaches a certain speed.	OFF	ON/OFF
	AUTO UNLK/SHIFT* ³ (Automatic door unlock linked shift)	Function to unlock the doors by shifting the lever to P range from other than P range when power source is ON.	ON	ON/OFF
	ALL UNLK/OPN-CL* ³ (All Unlock w/D door open-close)	Function to unlock all the other doors when opening the driver's door within 10 seconds after turning the power source to OFF from ON.	OFF	ON/OFF

(Continued)

System	Hand-Held Tester Display Content	Contents	Default Setting	Available Setting
Power Window	UP/DOOR KEY (Door Key P/W UP)	Function to make all the door windows up manually by holding the driver's side door key to the lock side for 1.5 seconds when power source is OFF.	ON	ON/OFF
	DOWN/DOOR KEY (Door Key P/W DOWN)	Function to make all the door windows down manually by holding the driver's side door key to the unlock side for 1.5 seconds when power source is OFF.	ON	ON/OFF
	UP/WIRELESS* ¹ (P/W Up W/Transmit)	Function to make all the door windows up manually by pressing on the transmitter lock button for 2.5 seconds when power source is OFF.	ON	ON/OFF
	DOWN/WIRELESS (P/W DOWN W/Transmit)	Function to make all the door windows down manually by pressing on the transmitter unlock button for 2.5 seconds when power source is OFF.	ON	ON/OFF
	UP/SMART (P/W Up W/Smart)	Function to make all the door windows up manually by pressing on the smart lock button for 2.5 seconds when power source is OFF.	ON	ON/OFF
Illuminated Entry	ILLUMI SYSTEM (Illumination System)	Function to light up the interior lights (foot well illumination) when one of the following occurs; power source turn ON, door unlocked or door open.	ON	ON/OFF
	LIGHT CONTROL (Light Control)	Function to light up the interior lights (foot well illumination) when power source is ON and the shift position is not P.	ON	ON/OFF
	LIGHTING TIME (Lighting time)	Function to change the lighting time after closing the door. (It will quickly fade out in the event the power source is turned ON.)	15 sec	7.5 sec/ 15 sec/ 30 sec
	I/L ON/ACC OFF (I/L when ACC OFF)	Function to light up the interior lights when power source is turned from "ACC" to "OFF".	ON	ON/OFF
	I/L ON/UNLOCK (I/L ON W/Door Key Unlock)	Function to light up the interior lights when unlocking with the door key cylinder.	ON	ON/OFF

(Continued)

System	Hand-Held Tester Display Content	Contents	Default Setting	Available Setting
Warning	KEY LOW-BATT WRN (Warn when the key battery becomes weak)	Setting a warning function for the first time when a key battery becomes weak.	ON	ON/OFF
	SEAT BELT WARN (Seat belt warning buzzer)	Function to change the seat-belt warning buzzer.	D/P ON	D/P ON/ D ON/ P ON/ D/P OFF
	RR BUZ RANGE (Rear buzzer onset range)	Function to set a range which Rear Buzzer starts to sound.	Wide	Narrow/ Wide
	KEEP SENSE BUZ (Keep sense status buzzer)	Function to make buzzer sound when distance between vehicle and obstacle does not change for more than 3seconds.	ON	ON/OFF
	F&R BUZZER VOLM (Front & rear buzzer volume)	Function to change volume of front and rear buzzer.	M2	L/M1/M2 /M3/H
Light Control	LIGHT OFF DELAY*2 (Light auto OFF delay)	Function to keep on lighting the headlight for a certain period of time after closing all the doors with the power source turned OFF from ON under the condition that the light control switch is at HEAD or AUTO with the headlight ON.	30 sec	OFF/ 30 sec/ 60 sec/ 90 sec
	SENSITIVITY (Turn ON luminous intensity)	To adjust the sensitivity of the lighting illumination.	NORMAL	LIGHT 2/ LIGHT 1/ NORMAL/ DARK 1/ DARK 2
	RESPONSE TIME*1 (Response time)	To change the delay timing of lighting the taillight when going into the tunnel in case that the light control switch is at AUTO position.	0.15 sec	1.0 sec/ 0.15sec
	DISP EX ON SEN (Display extinction luminous intensity)	To change the brightness of lowering the lights such as the indicator light of the combination meter, A/C indicator light, clock.	NORMAL	LIGHT 2/ LIGHT 1/ NORMAL/ DARK 1/ DARK 2
	DISP EX OFF SEN (Display extinction release luminous intensity)	To change the brightness of canceling the lowering the lights such as the indicator light of the combination meter, A/C indicator light, clock.	NORMAL	LIGHT 2/ LIGHT 1/ NORMAL/ DARK 1/ DARK 2
	DRL FUNCTION*4 (DRL function)	ON/OFF of the DRL function.	ON	ON/OFF
	FOOT LIGHT T (Foot lamp set up)	Function to set how long the foot light stays on.	15 sec	OFF/ 7.5 sec/ 15 sec/ 30 sec

(Continued)

System	Hand-Held Tester Display Content	Contents	Default Setting	Available Setting
Tilt & Telescopic	AUTO TILT AWAY (Autoaway/Return function)	ON/OFF of the Auto away/return function.	ON	ON/OFF
Slide Roof*5	OPEN/DOOR KEY (Door key related OPEN)	Function to open the sliding roof manually linking with the power window if holding the driver side door key for 1.5 seconds or more to the unlock side when the power source is OFF.	ON	ON/OFF
	CLOSE/DOOR KEY (Door key related CLOSE)	Function to close the sliding roof manually linking with the power window if holding the driver side door key for 1.5 seconds or more to the lock side when the power source is OFF.	ON	ON/OFF
	OPEN/WIRELESS (Wireless key related OPEN)	Function to open the sliding roof manually linking with the power window if pressing on the transmitter unlock button for 1.5 seconds or more when the power source is OFF.	ON	ON/OFF
	CLOSE/WIRELESS*1 (Wireless key related CLOSE)	Function to close the sliding roof manually linking with the power window if pressing on the transmitter lock button for 1.5 seconds or more when the power source is OFF.	ON	ON/OFF
	DOOR KEY OPER (Door key related operation)	Function to select the opening direction of the manual opening of the sliding roof linking with the power window if holding the driver side door key for 1.5 seconds or more to the unlock side when the power source is OFF.	SLIDE	TILT/SLIDE
	WIRELESS OPER (Wireless key related operation)	Function to select the opening direction of the manual opening of the sliding roof linking with the power window if pressing on the transmitter unlock button for 1.5 seconds or more when the power source is OFF.	SLIDE	TILT/SLIDE
A/C	SET TEMP SHIFT (Set Temperature Shift)	To control with the shifted temperature against the display temperature.	NORMAL	+2°C/ +1°C/ NORMAL/ -1°C/ -2°C
	AIR INLET MODE (Air Inlet Mode)	In case of turning the A/C ON when you desire to make the compartment cool down quickly, this is the function to change the mode automatically to RECIRCULATED mode.	AUTO	MANUAL/ AUTO
	COMPRESSOR MODE (Compressor Mode)	Function to turn the A/C ON automatically by pressing the AUTO button when the blower is ON and the A/C is OFF.	AUTO	MANUAL/ AUTO
	COMPRS/DEF OPER (Compressor/Air Inlet DEF operation)	Function to turn the A/C ON automatically linking with the FRONT DEF button when A/C OFF.	LINK	NORMAL/ LINK
	EVAP CTRL (Evaporator Control)	Function to set the evaporator control to the AUTOMATIC position (AUTO) to save power or to the coldest position (MANUAL) to dehumidify the air and to prevent the windows fogging up.	AUTO	MANUAL/ AUTO

(Continued)

System	Hand-Held Tester Display Content	Contents	Default Setting	Available Setting
A/C	GAS SENS SHIFT (Emission Gas Sensor Shift)	Function to change the sensitivity of the exhaust gas sensor.	NORMAL	MU MORE/ MORE/ LI MORE/ NORMAL/ LI LESS/ LESS/ MU LESS
	BUTTON PRS BUZ (Button press buzzer)	Function to sound a buzzer when a button is pressed.	ON	OFF/ON
	FOOT/DEF MODE (Foot/DEF auto mode)	Function to turn the air flow from FOOT/DEF ON automatically when AUTO MODE is ON.	ON	OFF/ON
	AUTO BLOW UP (Foot/DEF automatic blow up function)	Function to switch the blower level automatically when the defroster is ON.	ON	OFF/ON
	AMBIENT TMP SFT (Ambient Temperature Shift)	To control with the shifted ambient temperature against the display ambient temperature.	NORMAL	+3°C/ +2°C/ +1°C/ NORMAL/ -1°C/ -2°C/ -3°C
Intuitive Parking Assist	SENSOR COND/N (Sensor condition N range)	Function to make sensors available when shift position is N.	OFF	OFF/ON
	DISPLAY MODE (Display mode)	Function to change Display Mode.	Guide	All/ Guide/ Undisp
Smart Access System with Push-button Start	WARNING 7 (Select IG ON available area)	Function to choose the available area for the key to start E/G and cancel the Steering Lock.	ALL	FRONT/ ALL
	PARK WAIT TIME (Wait time to permit opening door after locking)	Setting a wait time to permit opening a door after it being locked.	3.0 sec	1.0 sec/ 2.0 sec/ 3.0 sec/ 5.5 sec
	TRUNK OPEN MODE (Trunk open mode when vehicle is locked)	Function to permit opening a trunk with the key.	ON	ON/OFF
Rear Sunshade	R-SHADE DELAY T (Reverse Signal Time for Rear Sun shade)	To change the delay time between shifting to the R range and automatically lowering the Rear-Shade.	0.7 sec	0 sec/ 0.7 sec/ 0.9 sec/ 1.2 sec
	R-POS TO SUN-S (Reverse gear to Rear Sun Shade connection)	This item indicates if Reverse Gear to Rear Sun Shade connection is on, that is if entering reverse gear provokes Sun Shade to pull down.	ON	ON/OFF

*1: Except U.S.A. and Canadian package models

*2: Only for U.S.A. and Canadian package models

*3: Except Taiwanese package models

*4: Except Destination package models

*5: Except models with panorama moon roof system

MULTI DISPLAY

DESCRIPTION

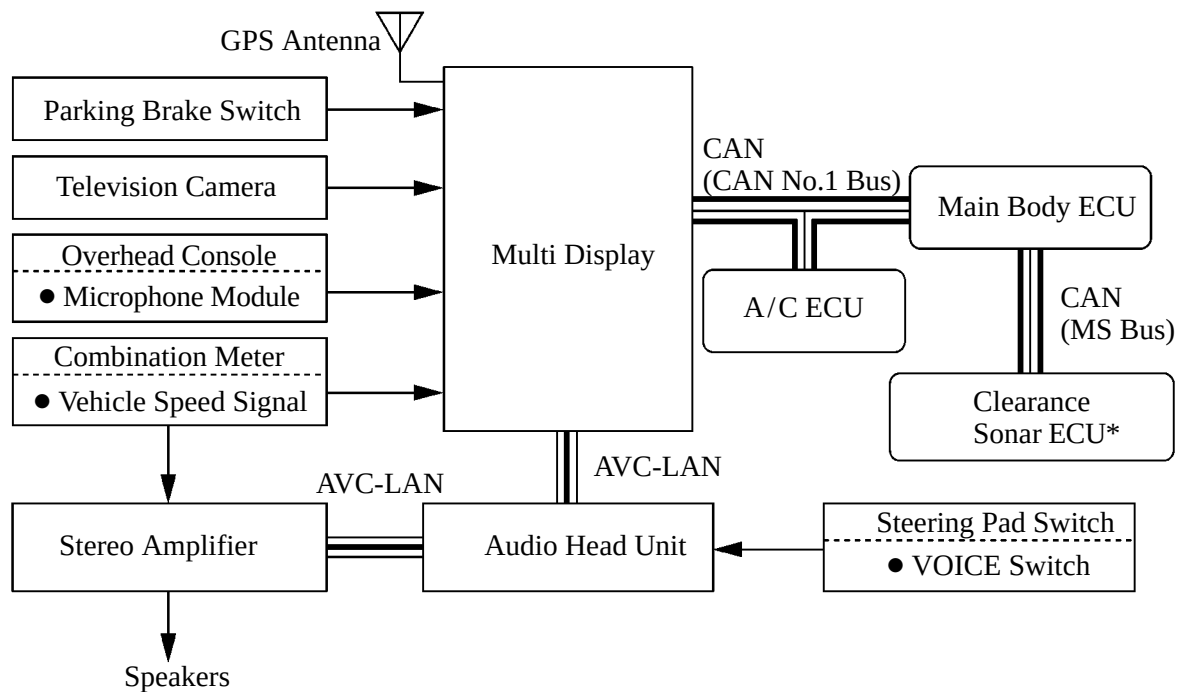
A multi display has been provided on the center cluster panel as optional equipment. The display, which consists of a wide 7.0-inch LCD (Liquid Crystal Display) screen with a pressure sensitive touch panel, offers improved ease of use.

- English is used in the speech command system (voice recognition function).
- The language of the touch-screen buttons, pop-up messages and voice guidance can be selected from English, French and Spanish.
- A hands-free function for a Bluetooth-compatible cellular telephone is used.



Bluetooth is a trademark owned by Bluetooth SIG, Inc.

System Diagram

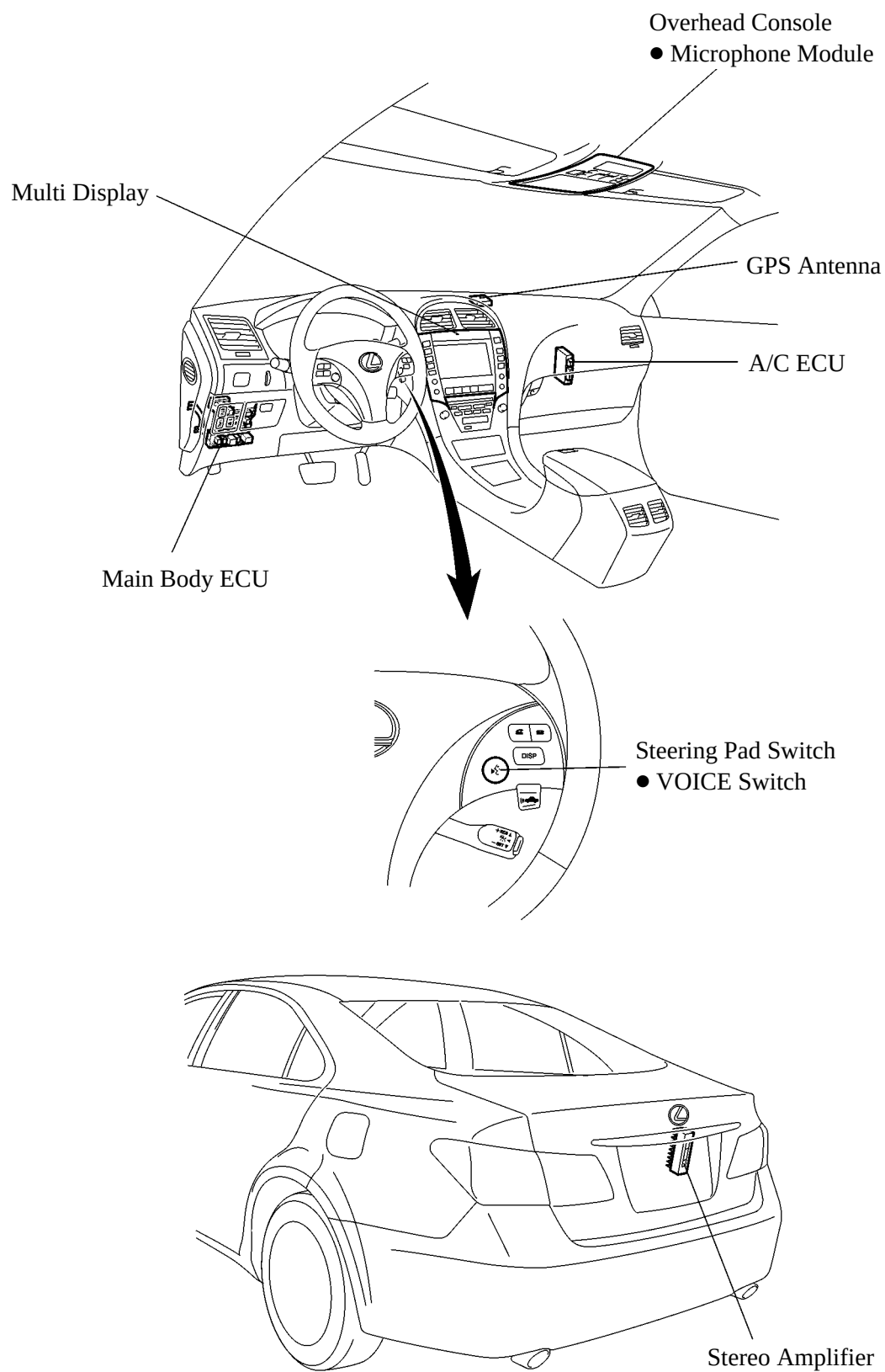


01YBE137P

*: With Intuitive Parking

Specification

Component		Outline
Multi Display		• 7.0 inch wide LCD • FUJITSU TEN
	Navigation ECU	DENSO
	Gyro Sensor	Piezoelectric Ceramic Piece
Map Data Media		DVD (Digital Versatile Disc)

■ LAYOUT OF MAIN COMPONENTS

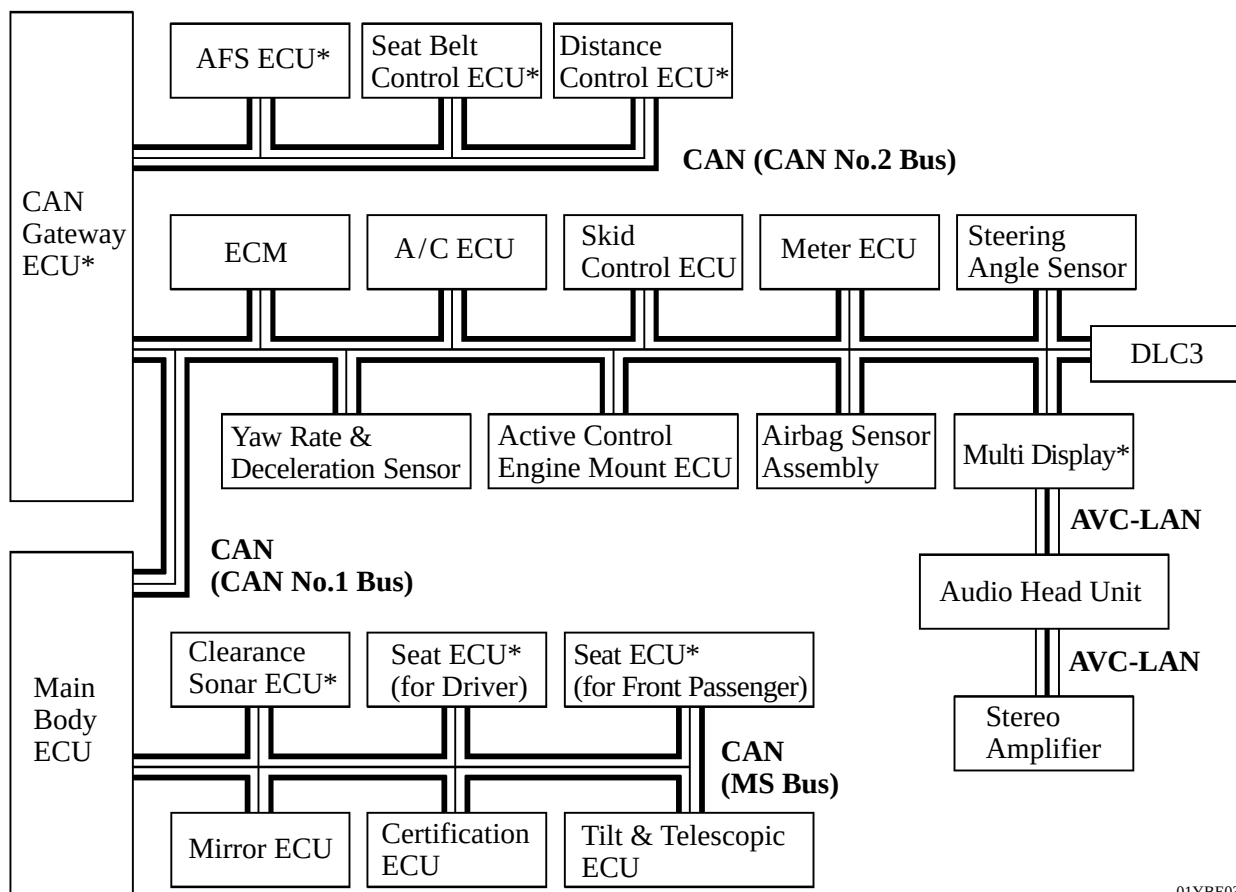
BODY ELECTRICAL

MULTIPLEX COMMUNICATION

■ DESCRIPTION

- The multiplex communication system of the '07 ES350 uses the 2 communication protocols described below in order to achieve a streamlined wiring harness configuration.
 - CAN (Controller Area Network): Classified into two types according to communication speed, the HS (High Speed)-CAN is used for the power train, chassis and body electrical systems, and the MS (Medium Speed)-CAN is used for the body electrical system.
 - AVC-LAN (Audio Visual Communication - Local Area Network): Used for communication only between the audio-visual systems.
- The HS-CAN consists of two busses (the CAN No.1 bus and CAN No.2 bus) and the MS-CAN consists of one bus (MS bus). ECUs with gateway functions (the CAN gateway ECU and main body ECU) are used to transmit data between the busses.
- Due to the introduction of the CAN system for the power train, chassis and body electrical systems, the BEAN (Body Electronics Area Network) that is used for the body electrical system on some conventional models is not used on this model.
- A customized body electronics system is used, enabling the control functions of the ECUs to be set using a hand-held tester. For details, see page BE-14.

► System Diagram ◀



01YBE03P

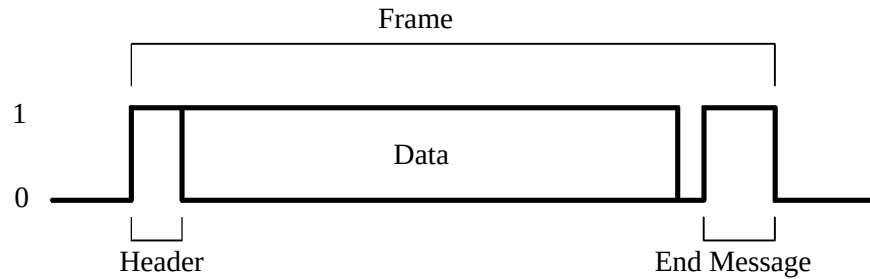
*: Optional equipment

— REFERENCE —

MPX communication uses serial communication data that consists of bits and frames in order to exchange information among the various ECUs. This allows a reduction of the amount of wiring on the vehicle.

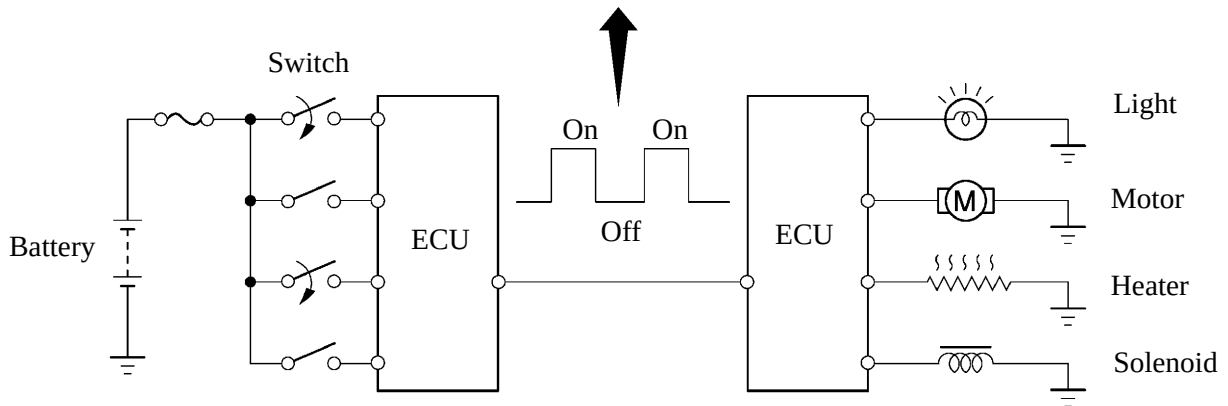
- A bit is the basic unit of communication that is used to represent the information. A bit is represented by binary values of “0” or “1”.
- A frame is a body of data that is transmitted together. A frame contains a header that indicates the beginning, and an end message that indicates the end.

► Conceptual Drawing ◀



240BE05

Serial Communication Data



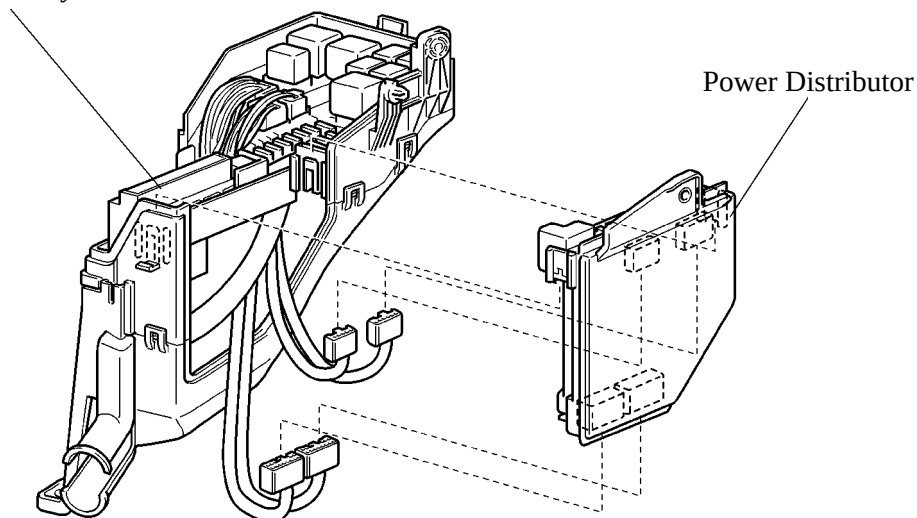
240BE03

POWER DISTRIBUTOR

DESCRIPTION

- The power distributor is built into the engine room relay block, and uses a small mechanical relay and semiconductor relay for a compact and lightweight design.
- The power distributor has a headlight control function. This function dims the headlights (Hi beam) in accordance with operation signals from the main body ECU while the daytime running light system is operating. For details, see page BE-36.

Engine Room Relay Block



01YBE09Y

- The components of the power distributor are shown below.

Component	Relay
Mechanical Relay	• Horn Relay • A/F Relay • Security Horn Relay • EFI Relay • Circuit Opening Relay • Headlight Relay (RH)*¹ • Headlight Relay (LH)*¹
Semiconductor Relay	• Daytime Running Light Relay (Headlight HI Beam Relay) • Headlight Relay (RH)*² • Headlight Relay (LH)*²

*1: Models with halogen type headlight

*2: Models with HID type headlight

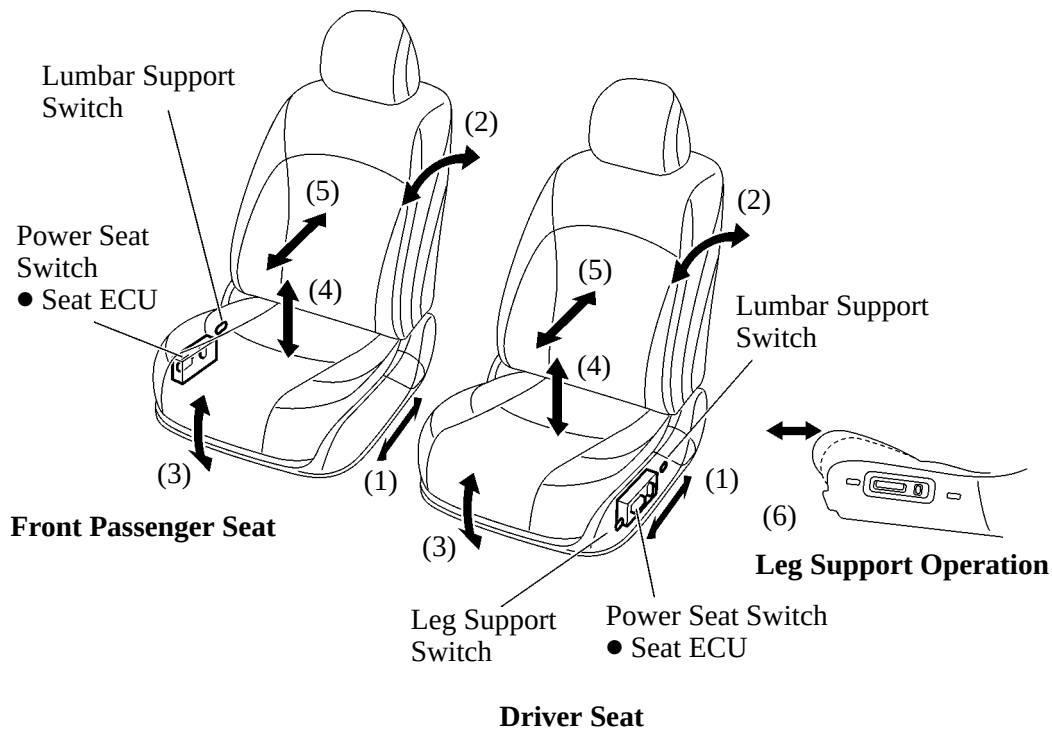
POWER SEAT SYSTEM

DESCRIPTION

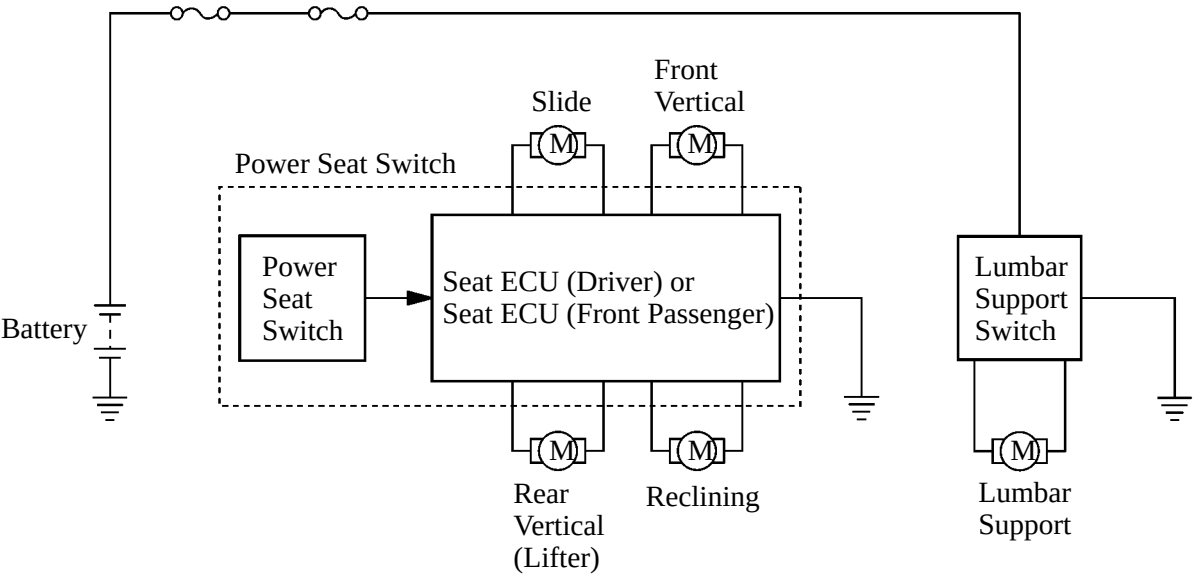
- A power seat with a memory system is used for driver and front passenger seats on all models as optional equipment.
- The memory system, the control of the front power seat (forward-and-rearward slide, reclining, front vertical, rear vertical, and reclining) is effected by the seat ECUs, which is integrated with the power seat switch.
- A leg support adjustment function is provided in order to deal with a wide rang of driver heights. The length of the cushion pad front edge can be adjusted.
- The power seat system for front seat has a function with following equipment:

○: Optional

Function		Memory	Stroke
(1)	Seat Slide	○	260 (10.2) mm (in.)
(2)	Reclining	○	50 degrees
(3)	Front Vertical	○	25.4 (1.0) mm (in.)
(4)	Rear Vertical (Lifter)	○	58 (2.3) mm (in.)
(5)	Lumbar Support	—	34.8 (1.4) mm (in.)
(6)	Leg Support	—	18 mm (in.)

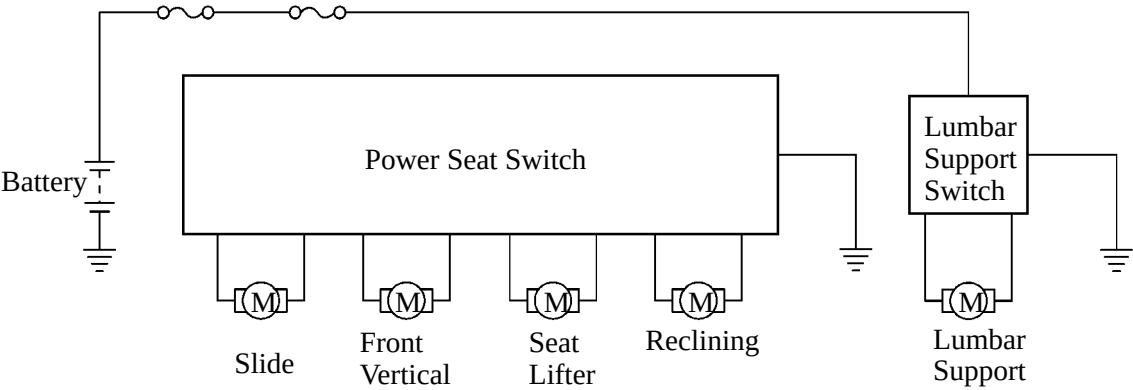


► System Diagram ◀



with Memory System

01YBE207P



without Memory System

01YBE208P

POWER WINDOW SYSTEM

DESCRIPTION

- The power window motor of the '07 ES350 contains an ECU. The ECU effects power window control. The power window system has the following functions:

Function	Outline
Manual up-and-down (All Doors)	This function causes the window to open or close while the power window switch is being pulled halfway up or pushed halfway down. The window stops as soon as the switch is released.
One-touch auto up-and-down (All Doors)	The one-touch auto up-and-down function enables the window to be fully opened or closed with a single touch of the power window switch.
Jam Protection (All Doors)	A jam protection function automatically stops the power window and moves it downward if a foreign object gets jammed in the window during one-touch auto-up operation or manual up operation.
Remote Control (All Doors)	The power window master switch can control the up-and-down operations of the windows.
Window Lock	Power window operation of the 3 passenger windows is disabled when the window lock switch is pressed.
Key Off Operation	This function makes it possible to operate the power windows for approximately 43 seconds after the power source is turned to OFF, if the driver's door is not opened.
Key-linked up-and-down function*1	When the key is not in the interior detection area, the driver's door is locked, and the key in the driver's door is turned and maintained in the lock direction for 1.5 seconds or more, the main body ECU activates the power window motor to raise all door windows while the key is turned. Similarly, when the driver's door is unlocked, turning and maintaining the driver's door key in the unlock direction for 1.5 seconds or more will cause all door windows to be lowered.
Transmitter-linked up-and-down function*1,2	When a lock/unlock signal is transmitted by the transmitter for longer than 2.5 seconds to the certification ECU, the certification ECU transmits the window close/open signal to the main body ECU. Power window ECUs activate all the power window motors in accordance with the signals from the main body ECU to open or close all the windows.
Lock switch-linked up function	All the windows are closed when the lock switch on the outside door handle is pressed for 3 seconds or more with the key in the detection area and all the doors locked. This function can be performed using the door lock switch of any door.
Diagnosis	When any power window ECU detects the following conditions, the self-diagnosis function switches the ECU to failsafe mode. The power window switch illumination (LED) flashes to inform the user. - An abnormality in the Hall IC that detects the position, speed and direction of the window. - An error in the window detection position and the upper limit position recorded in the power window ECU.
Fail-Safe	If the Hall IC in the power window motor malfunctions, some power window functions will be prohibited by the failsafe mode: - Power windows can be operated using the power window switches within 40 seconds of failsafe mode being entered. - Each power window operates when the corresponding power window switch is fully pushed down or pulled up and held in that position.

*1: The setting function can be changed using the customized body electronics system. For details, refer to Customized Body Electronics System section on page BE-14.

*2: Only the down function is available on U.S.A. and Canadian package models.

Service Tip

The power window motor assembly stores the initial position of each door window. The memory is not cleared if battery terminals, fuses or power window motor assembly connectors are disconnected. However, after the power window motor assembly and power window regulator assembly are replaced, the stored initial position data must be cleared and the initialization of the power window motor assembly must be performed. When necessary, perform the initialization as follows:

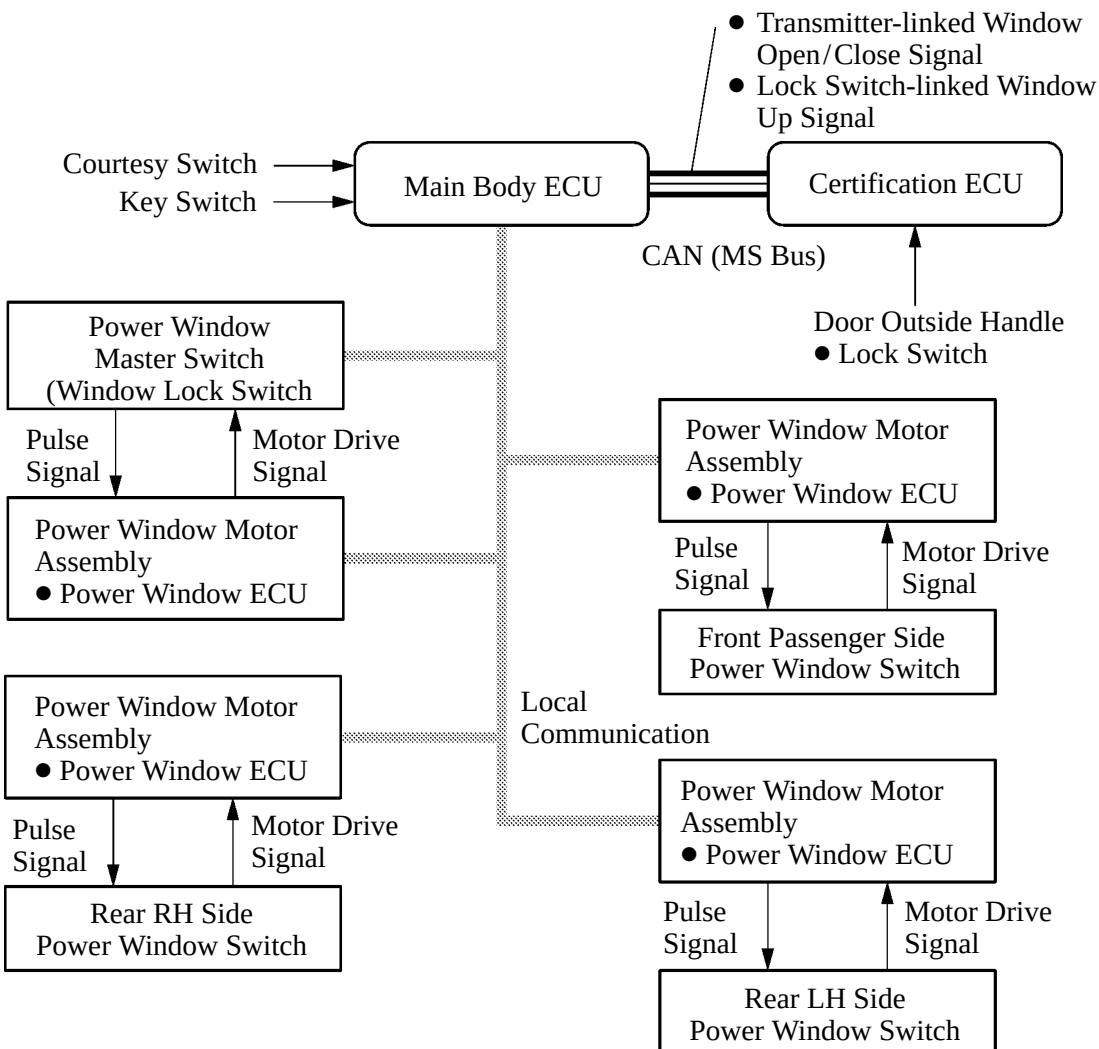
Initial Position Memory Erasure Procedure

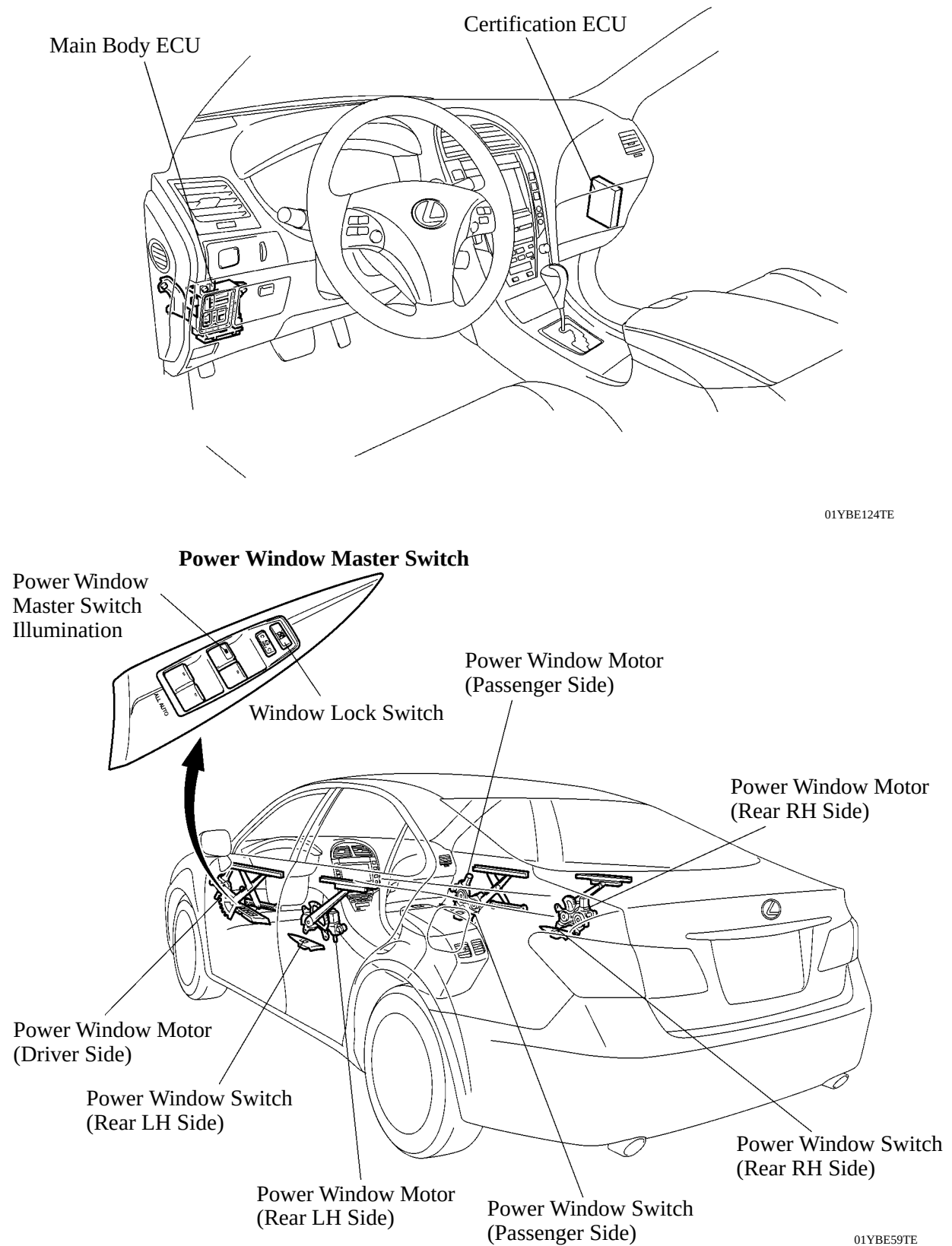
- Turn the power supply off (for example, remove a power window motor assembly connector or fuse) while the power window motor is operating.
- Check that the power window switch illumination blinks after the power source is turned on.

Initialization procedure

- Pull up the power window switch to the AUTO UP position and hold it until the window is fully closed.
- Hold the power window switch in the AUTO UP position for at least 1 second after the window is fully closed.
- Make sure that the window opens and closes automatically using the one touch function.

For details, see the 2007 LEXUS ES350 Repair Manual (RM01Y0U).

► System Diagram ◀

■ LAYOUT OF MAIN COMPONENTS

01YBE124TE

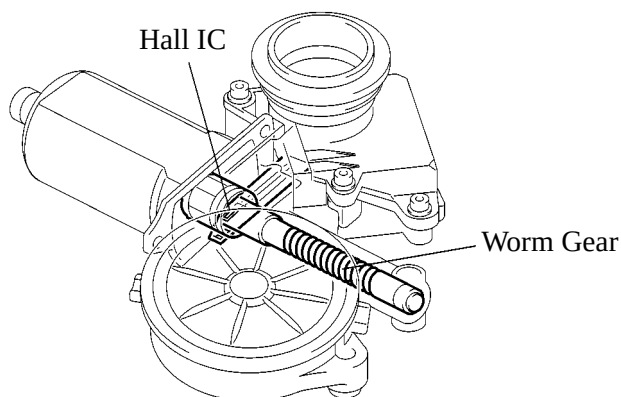
01YBE59TE

■ JAM PROTECTION FUNCTION

- A jam protection function automatically stops the power window and moves it downward if a foreign object gets jammed in the door window during one-touch auto up operation.
- The operation of the jam protection function is described below.

Door window distance from fully closed position	Operation
200 mm (7.87 in.) or more	Down operation of 50 mm (1.97 in.) or one second.
200 mm (7.87 in.) or less	Down operation until door window operation of 200 mm (7.87 in.) is reached or five seconds.

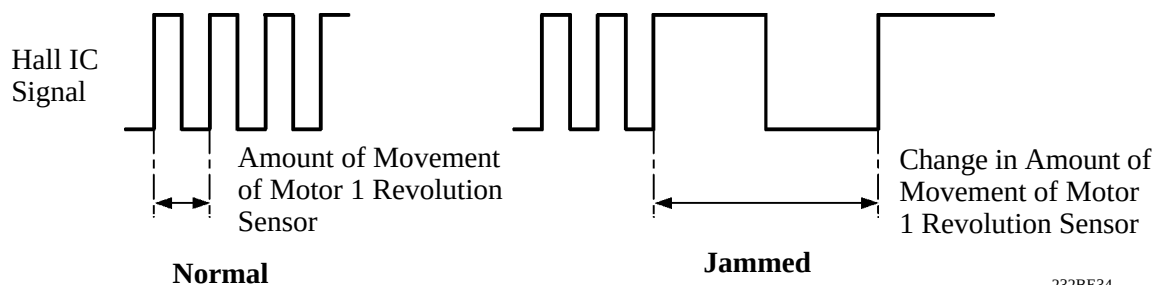
- The worm gear and Hall IC in the power window motor assembly are used to enable the power window jam protection.



01YBE60TE

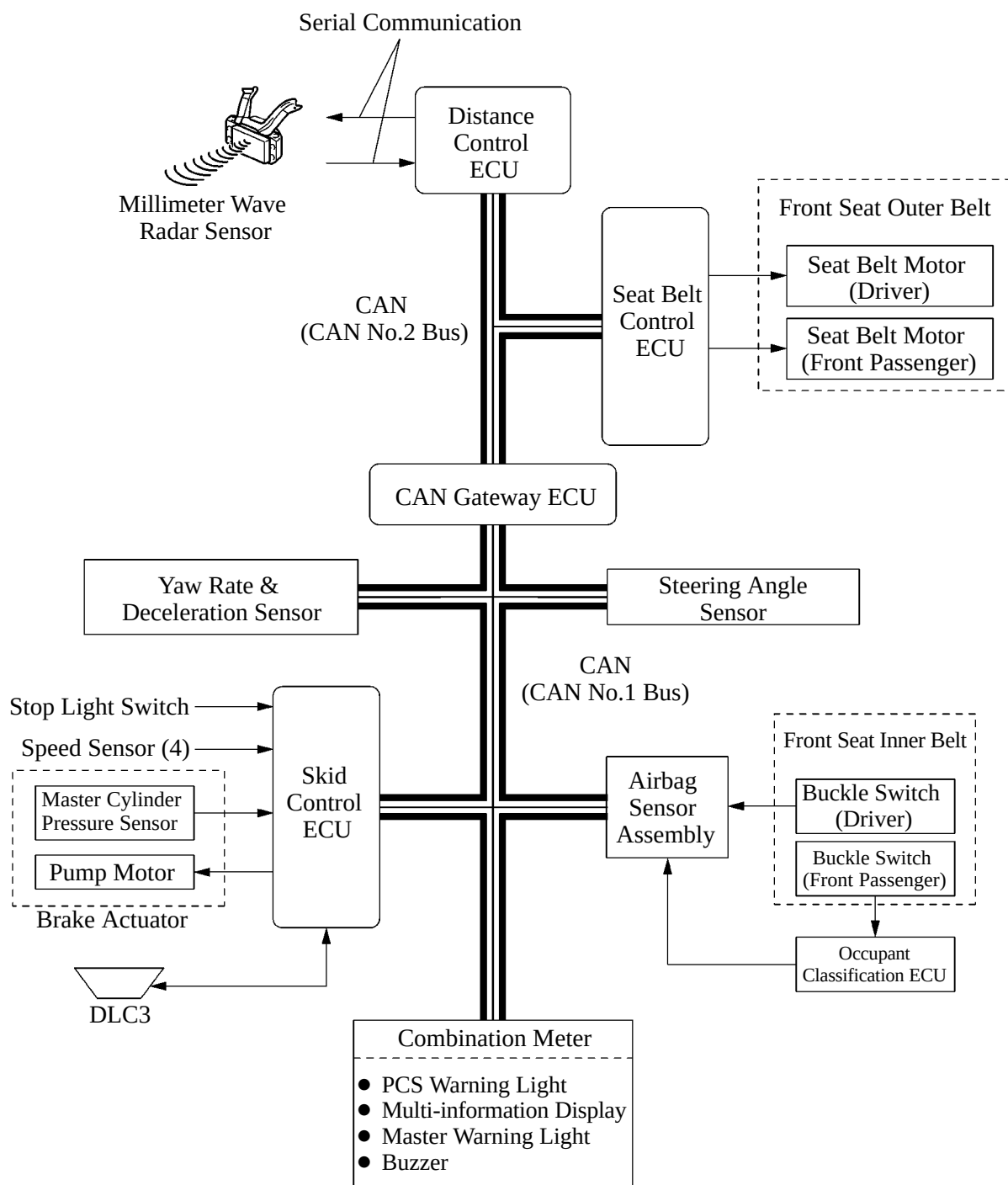
- The Hall IC converts the changes in the magnetic flux that occur through the rotation of the worm gear into pulse signals and outputs them to the power window master switch or power window switch.
- To control the jam protection function, these switches determine the amount of movement and jamming of the window glass based on the pulse signals from the Hall IC.

► Judgment of Movement and Jamming ◀



232BE34

SYSTEM DIAGRAM



■ FUNCTION OF MAIN COMPONENTS

Item		Function
Combination Meter	PCS Warning Light	Illuminates or flashes to warn the driver in accordance with signals from the seat belt control ECU.
	Multi-information Display	Displays a warning message to inform or warn the driver of the system condition in accordance with signals from the seat belt control ECU.
	Master Warning Light	Illuminates to warn the driver in accordance with signals from the seat belt control ECU.
	Buzzer	Sounds on to warn the driver in accordance with signals from the seat belt control ECU.
Millimeter Wave Radar Sensor (See page BE-227)		Radiates millimeter radio wave radar to forward, uses the reflected millimeter radio wave for detecting the presence of a vehicle being driven ahead, the vehicle-to-vehicle distance, and the relative speed, and transmits these pieces of information to the distance control ECU.
Front Seat Outer Belt		Retracts the seat belt in accordance with signals received from the seat belt control ECU.
	Seat Belt Motor	
Front Seat Inner Belt (Driver)		Detects the condition (verifies use of belt) of the driver seat belt and transmits a signal to the airbag sensor assembly.
	Seat Belt Buckle Switch	
Front Seat Inner Belt (Front Passenger)		Detects the condition (verifies use of belt) of the front passenger seat belt and transmits a signal to the airbag sensor assembly.
	Seat Belt Buckle Switch	
Airbag Sensor Assembly		Transmits the condition (fastened or unfastened) of the driver seat belt to the seat belt control ECU.
Distance Control ECU		Makes a judgment that a collision is unavoidable based on the information received from the millimeter wave radar sensor. It then outputs a seat belt operation signal and brake assist standby request signal.
Seat Belt Control ECU		● Receives a seat belt operation request signal from the distance control ECU or skid control ECU and operates the seat belts. ● If the seat belt control ECU detects a malfunction in the pre-collision system, it will store DTC (Diagnostic Trouble Code).
Skid Control ECU		● Receives a brake assist standby request signal from the distance control ECU and switches the brake assist to the standby mode. When a stop light switch signal is input, it operates the brake assist. ● Determines that the brakes have been applied suddenly through a signal received from the master pressure sensor, and outputs a seat belt operation signal to the seat belt control ECU. ● Determines the presence of a front wheel skid tendency or rear wheel skid tendency, and outputs a seat belt operation signal to the seat belt control ECU. ● Transmits a vehicle speed signal to the distance control ECU.
Brake Actuator	Master Cylinder Pressure Sensor	Detects the master cylinder pressure and transmits a signal to the skid control ECU.
	Pump Motor	Receives an actuate signal from the skid control ECU and generates hydraulic pressure for brake assist.

(Continued)

Item	Function
Stop Light Switch	Detects if the brake pedal is pressed and transmits a signal to the skid control ECU.
Speed Sensor (4)	Detects the wheel speed signal and transmits the signal to the skid control ECU.
Yaw Rate & Deceleration Sensor	Detects the yaw rate and lateral/longitude deceleration of the vehicle and transmits the signal to the skid control ECU and the distance control ECU.
Steering Angle Sensor	Detects the angle and direction of steering and transmits a signal to the skid control ECU and the distance control ECU.

Service Tip

When the seat belt control ECU is replaced, active test of the seat belt motor must be performed in accordance with the following procedure to check that the motor operates properly.

- (1) Power source is IG-ON.
- (2) Monitor the PCS warning light for at least 3 seconds after turning the power source to IG-ON.
Make sure that the warning light does not remain on.
- (3) Connect the hand-held tester to the DLC3 and enter the select active test mode.
- (4) Perform active test of the seat belt motor and check that the motor operates properly.

For details, see page 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

■ CONSTRUCTION AND OPERATION

Combination Meter

- The master warning light, PCS warning light, warning message of the multi-information display and buzzer in the combination meter warns the driver of the abnormal or poor conditions of the pre-collision system.
- Two types of warning messages are used for the pre-collision system, as described below. The pre-collision system will not operate when these messages appear in the combination meter.

Warning Message	Detail	 0150BE35C	 01YBE200P	Buzzer	DTC
 01YBE150TE	This message appears when the seat belt control ECU detects a system malfunction.	Illuminate	Illuminate	Sounds once	○
 01YBE158TE	This message appears when the seat belt control ECU determines the following conditions: • Dirty millimeter wave radar sensor • Poor weather condition • Overheated seat belt control ECU After these conditions have been resolved, the system will operate normally.	Illuminate	Flash	Sounds once	X

○: Repair is required/DTC are output

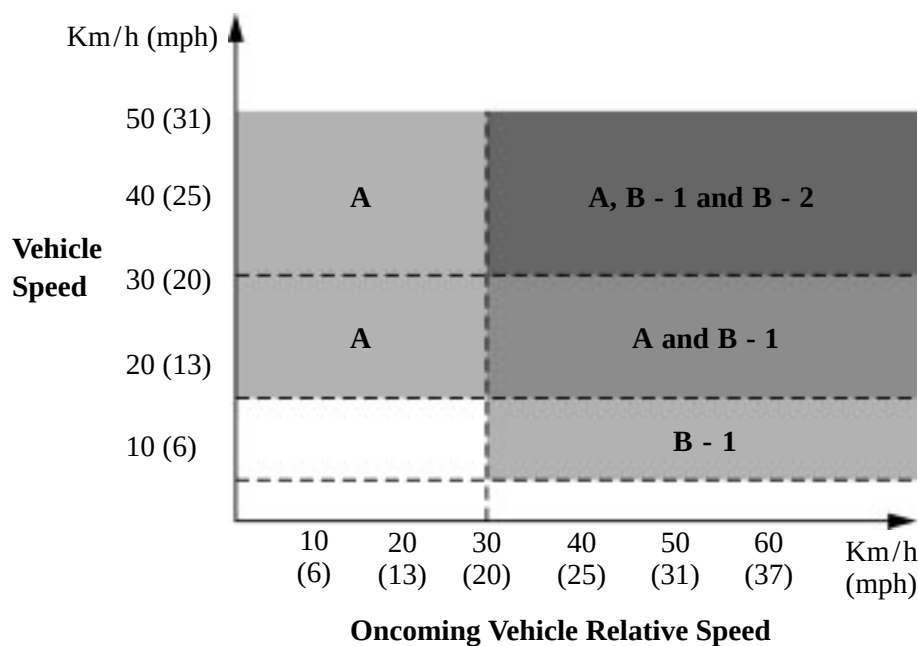
X: Repair is not required/DTC are not output

SYSTEM OPERATION

1. General

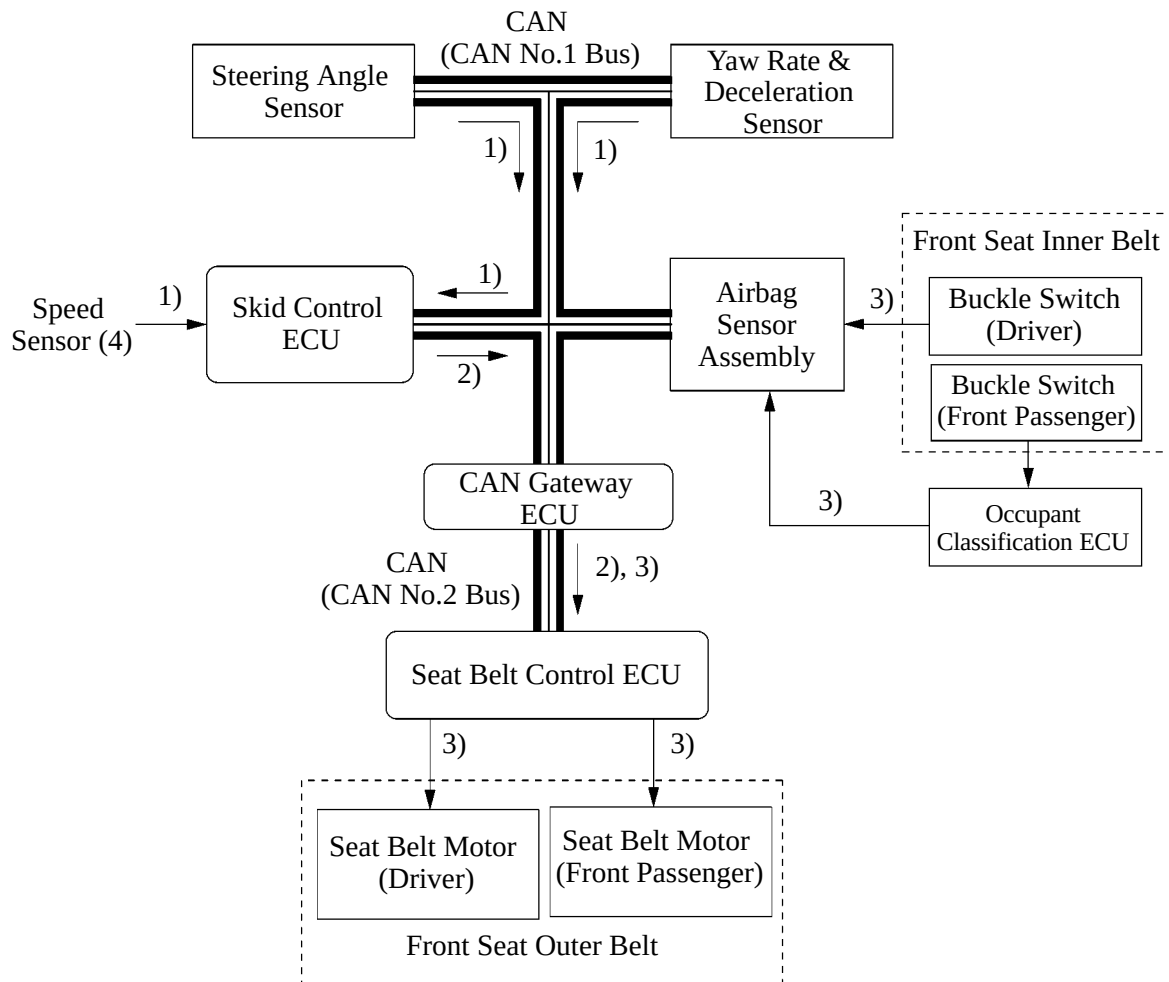
The pre-collision system consists of the following three operations: a pre-collision (unavoidable collision) operation, front or rear wheel skid tendency operation and sudden braking operation. The impact dampening components consists of the operation ranges indicated below.

Range	Operation	Operation Condition	Impact Dampening Component
A	Front or Rear Wheel Skid Tendency Operation	- Power source is IG-ON. - Seat belt is buckled. - Vehicle speed is approx. 15 km/h (10 mph) or above.	Seat Belt Retracting Operation
	Sudden Braking Operation		- Seat Belt Retracting Operation - Brake Assist Standby Condition
B - 1	Pre-collision Operation	- Power source is IG-ON. - Seat belt is buckled. - Vehicle Speed is approx. 5 km/h (3 mph) or above. - Oncoming vehicle relative speed is approx. 30 km/h (20 mph) or above.	Seat Belt Retracting Operation
B - 2		- Power source is IG-ON. - Seat belt is buckled. - Vehicle Speed is approx. 30 km/h (20 mph) or above. - Oncoming vehicle relative speed is approx. 30 km/h (20 mph) or above.	- Seat Belt Retracting Operation - Brake Assist Standby Condition



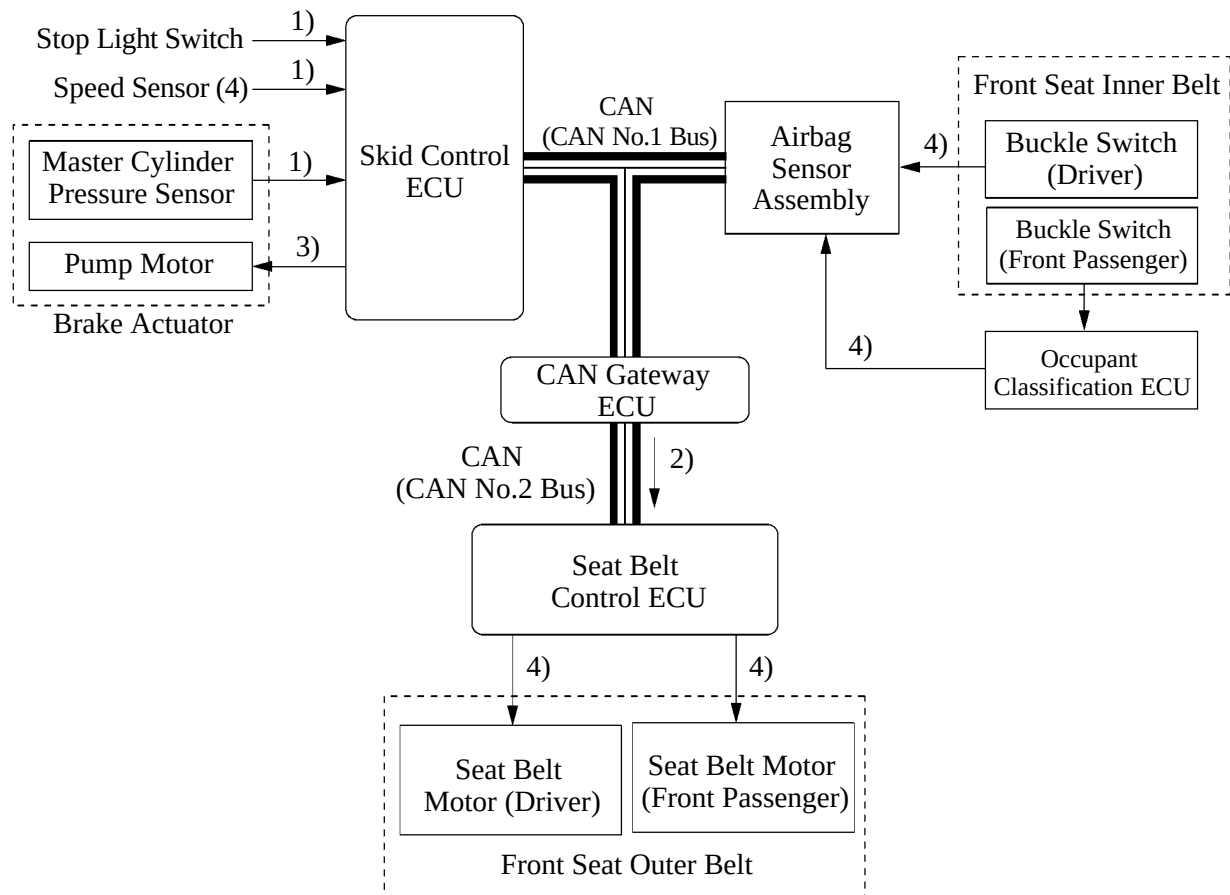
2. Front or Rear Wheel Skid Tendency Operation

- 1) While the vehicle is traveling at approx. 15 km/h (10 mph) or above, the skid control ECU determines the front or rear wheel skid tendency condition based on the signals from the steering angle sensor, yaw rate & deceleration sensor and speed sensors.
- 2) The skid control ECU outputs a seat belt operation request signal to the seat belt control ECU.
- 3) The seat belt control ECU determines the seat belt motor operation conditions based on this signal and the seat belt buckle switch signal. Then, it retracts slack in the seat belts by operating the seat belt motors.
- 4) The seat belts return to a normal state when the relevant conditions of the vehicle have stabilized.



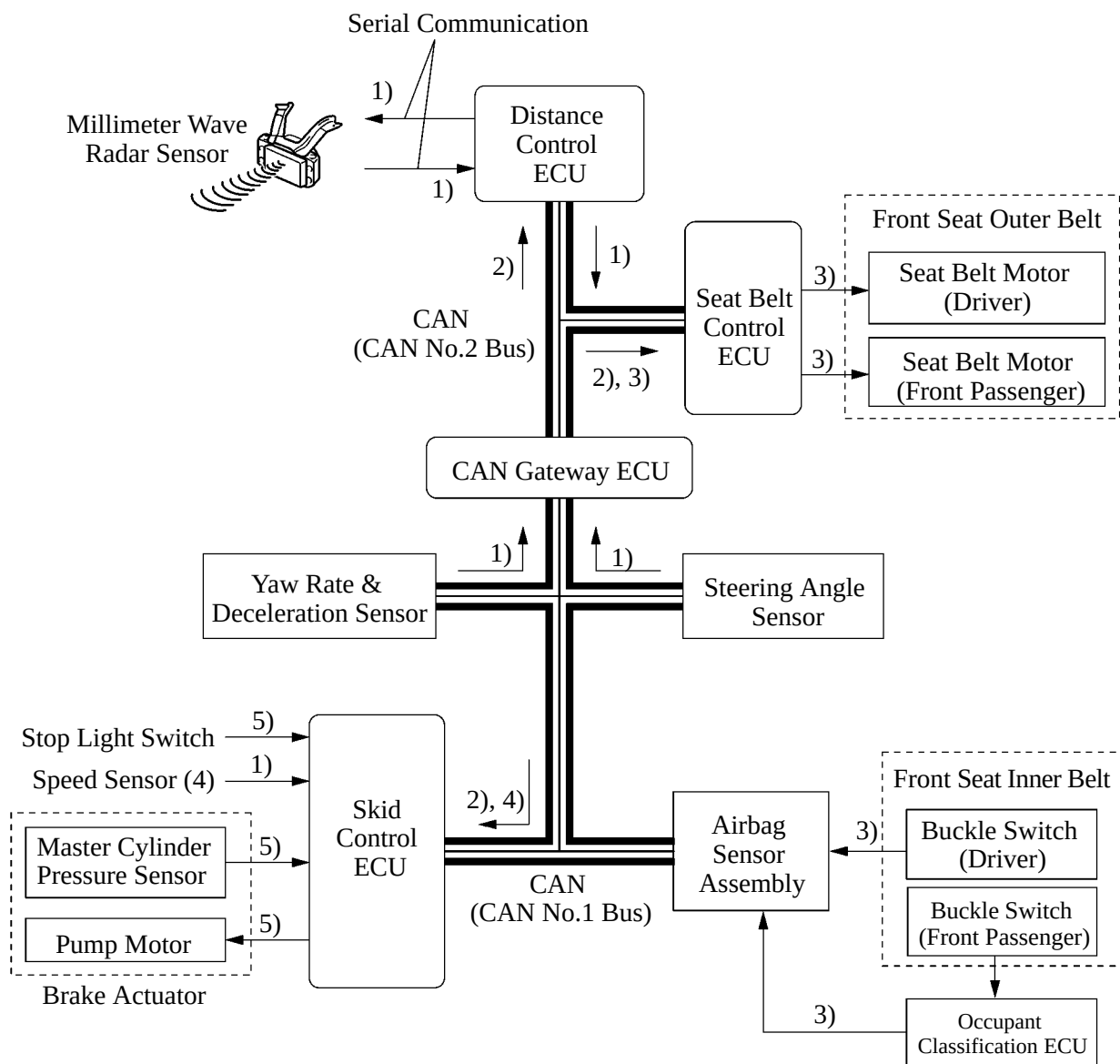
3. Sudden Braking Operation

- 1) While the vehicle is traveling at approx. 15 km/h (10 mph) or above, the skid control ECU can determine a sudden braking condition based on the signals from the master cylinder pressure sensor, stop light switch and speed sensors.
- 2) At this time, the skid control ECU outputs a seat belt operation request signal to the seat belt control ECU.
- 3) Brake assist control enters standby mode according to the determination of the skid control ECU.
- 4) The seat belt control ECU determines the seat belt motor operation conditions based on this signal and the seat belt buckle switch signal. Then, it retracts slack in the seat belts by operating the seat belt motors.
- 5) The seat belts return to a normal state when the brake pedal is released.



4. Pre-collision Operation

- 1) The distance control ECU determines that an unavoidable collision condition exists based on the signals received from the millimeter wave radar sensor, speed sensor, steering angle sensor, and yaw rate & deceleration sensor.
- 2) At this time, the distance control ECU outputs a seat belt operation request signal to the seat belt control ECU, a brake assist standby request signal to the skid control ECU.
- 3) The seat belt control ECU determines the seat belt motor operation condition based on this signal and the seat belt buckle switch signal, and retracts the slack in the seat belts by operating the seat belt motors.
- 4) Upon receiving this signal, the skid control ECU switches the brake assist to the standby mode.
- 5) When the brake assist is in the standby mode and the stop light switch ON signal is input into the skid control ECU, this ECU operates the brake assist based on the master cylinder pressure sensor signal.
- 6) If no collision occurs, the seat belts and the brake assist will return to their normal states.



■ DIAGNOSIS

1. General

The diagnosis circuit of the pre-collision system is integrated in the seat belt control ECU. This ECU detects malfunctions that may occur in the system in accordance with the signals provided by the ECUs and the sensors. The diagnosis function consists of an initial check, monitor, and DTC output functions.

2. Initial Check

The seat belt control ECU performs an initial check on the system for approximately 3 seconds after the power source has been turned IG-ON.

3. Monitor Function

After completing the initial check, the pre-collision system becomes ready to operate. During this time, the seat belt control ECU periodically monitors the system for any malfunctions.

4. DTC Output

- If the seat belt control ECU detects a malfunction in the pre-collision system, it stores 5-digit DTC (Diagnostic Trouble Code) in memory.
- The 5-digit DTC can be read by connecting a hand-held tester to the DLC3.

■ PRECAUTION FOR PRE-COLLISION SYSTEM OPERATION

- When the millimeter wave radar sensor detects an object in front under the conditions described below, the distance control ECU may determine that a collision is unavoidable, and operate the pre-collision system. However, this is not abnormal.

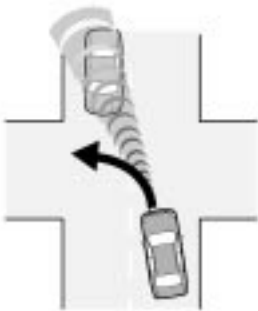
Object on road surface at corner entrance
(Guard Rail, Street Light, Sign, Signboard)



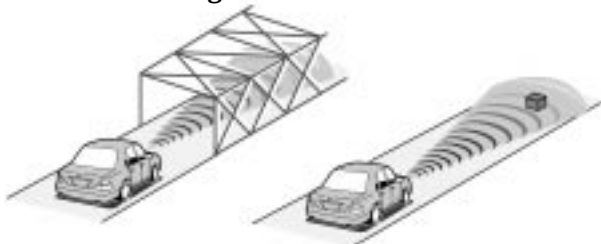
Opposing traffic vehicle during cornering



Opposing traffic at intersection



Narrow Iron Bridge



Metal object, steel plate, or bump on road surface

269LS116

- The millimeter wave radar sensor might not be able to detect the following objects as collision objects:

Objects that cannot be detected	Plastic items (Safety Cones, etc.), etc.
Objects that cannot be detected in a stable manner	People, Bicycles, Motorcycles, Trees, Animals, Snow Fence, etc.

PRE-COLLISION SYSTEM

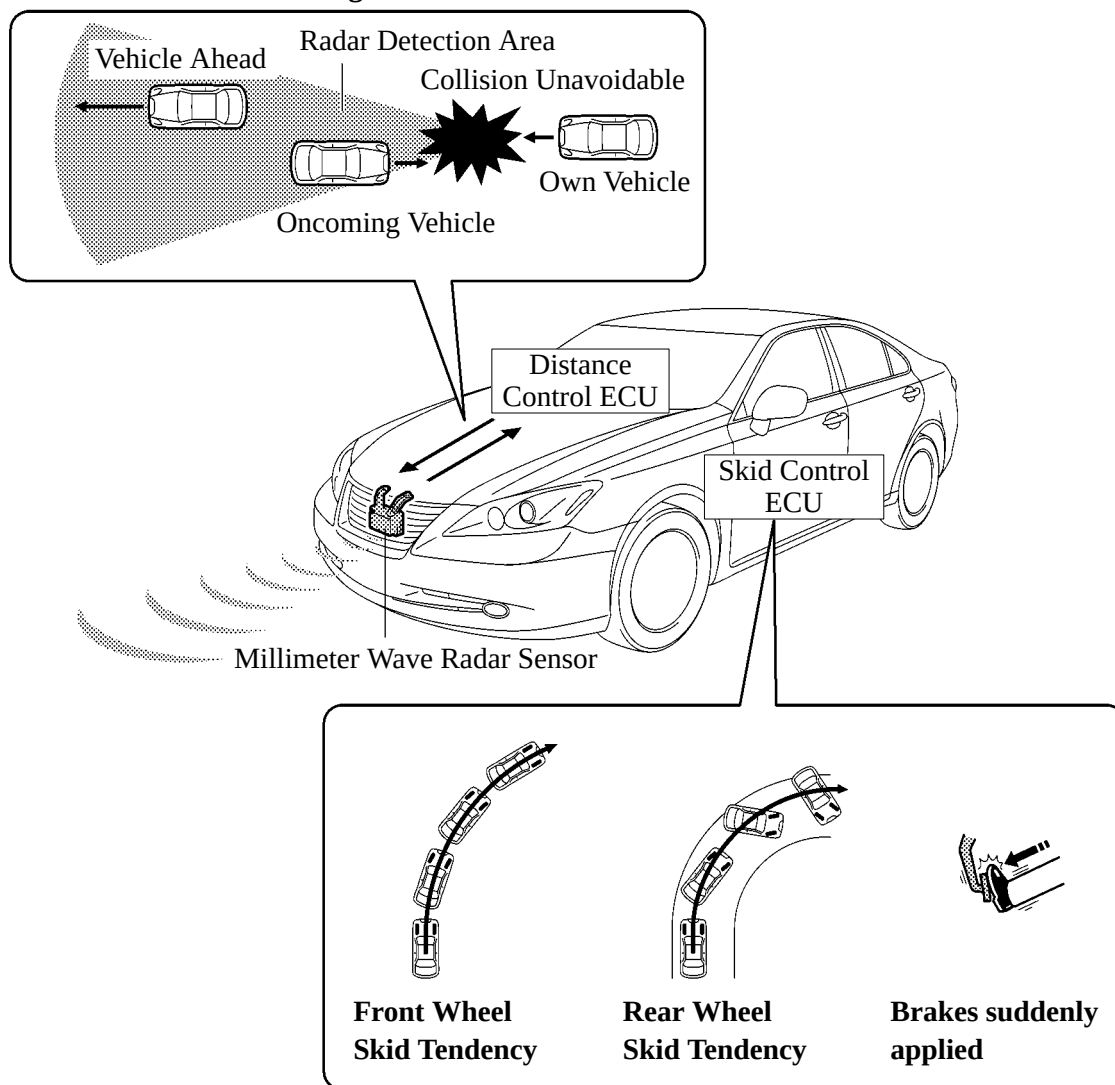
DESCRIPTION

The pre-collision system retracts the slack in the front seatbelts and brings the brake control system to the brake assist standby condition when the conditions below are present before a collision to reduce injury to the driver and front passenger.

Operating Condition	• When a collision with an obstacle in front of the vehicle or a collision with the vehicle ahead is determined to be unavoidable. • When the brakes are suddenly applied. • When the front wheels lose grip in relation to the rear wheels (front wheel skid tendency). • When the rear wheels lose grip in relation to the front wheels (rear wheel skid tendency).
---------------------	--

- The pre-collision system is available as optional equipment.
- The millimeter wave radar sensor and distance control ECU determine whether a collision with an obstacle in front of the vehicle or a collision with the vehicle ahead is unavoidable.
- The millimeter wave radar sensor and distance control ECU make this determination based on the vehicle speed relative to the speed of an oncoming vehicle or based on the speed with which an object is being approached.
- The skid control ECU determines emergency braking, front wheel skid tendency and rear wheel skid tendency. (For details, see page CH-62)

Unavoidable Collision Judgment



- The pre-collision system will not operate under the following conditions.

Non-Operating Condition	1) Oncoming vehicle relative speed is approx. 30 km/h (20 mph) or less. 2) Vehicle speed is approx. 5 km/h (3 mph) or less. 3) The seat belt is not buckled. 4) Collision objects that cannot be detected by the millimeter wave radar sensor: • Objects that cannot be detected: plastic items (Safety Cones, etc.), etc. • Objects that cannot be detected in a stable manner: people, bicycles, motorcycles, trees, animals, snow fence, etc. 5) Power source is OFF or ACC. 6) Multi-information display in the combination meter displays “CHECK PCS SYSTEM” and “PCS NOT AVAILABLE NOW” warning messages. 7) The vehicle collides with an object located outside the detection area of the millimeter wave radar sensor.
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— **Reference** —

Millimeter Wave Radar:

Millimeter wave radar uses an extremely high frequency band between 30 GHz and 300 GHz, with an extremely short wavelength between 1 and 10 mm (0.04 to 0.40 in.) in a vacuum. The millimeter wave radar sensor of the pre-collision system uses frequencies in the 76 GHz band.

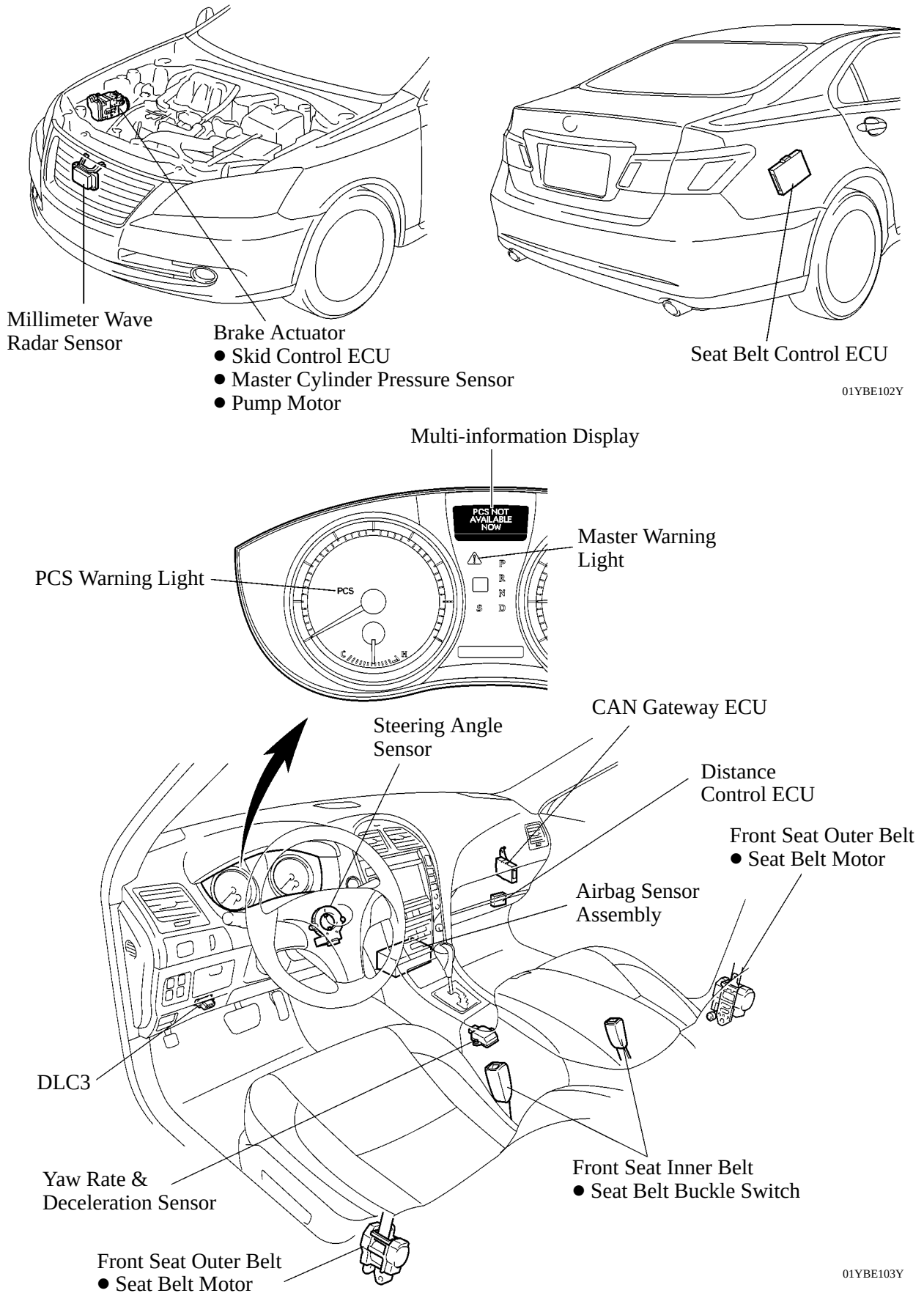
The millimeter wave radar is less affected by weather conditions such as rain, fog, or snow, and provides excellent characteristics for recognizing objects. Therefore, it is well suited to the pre-collision system and the dynamic radar cruise control system.

Frequency	200 kHz	2 MHz	25 MHz	300 MHz	2 GHz	30 GHz	300 GHz
Type	Long Wave		Short Wave			Micro Wave	Millimeter Wave
Example	AM: 1 MHz		FM: 80 MHz		Cellular Mobile Phone: 800 MHz		Millimeter Radar Sensor: 76 GHz

269LSI02

Main Wave Types and Frequencies

■ LAYOUT OF MAIN COMPONENTS



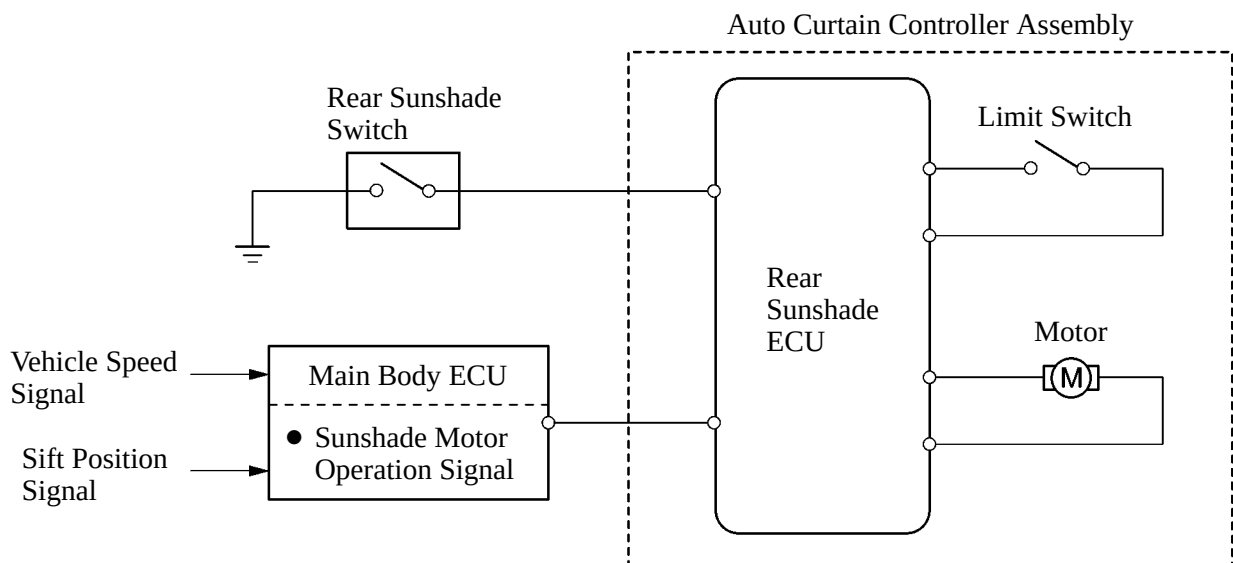
REAR SUNSHADE SYSTEM

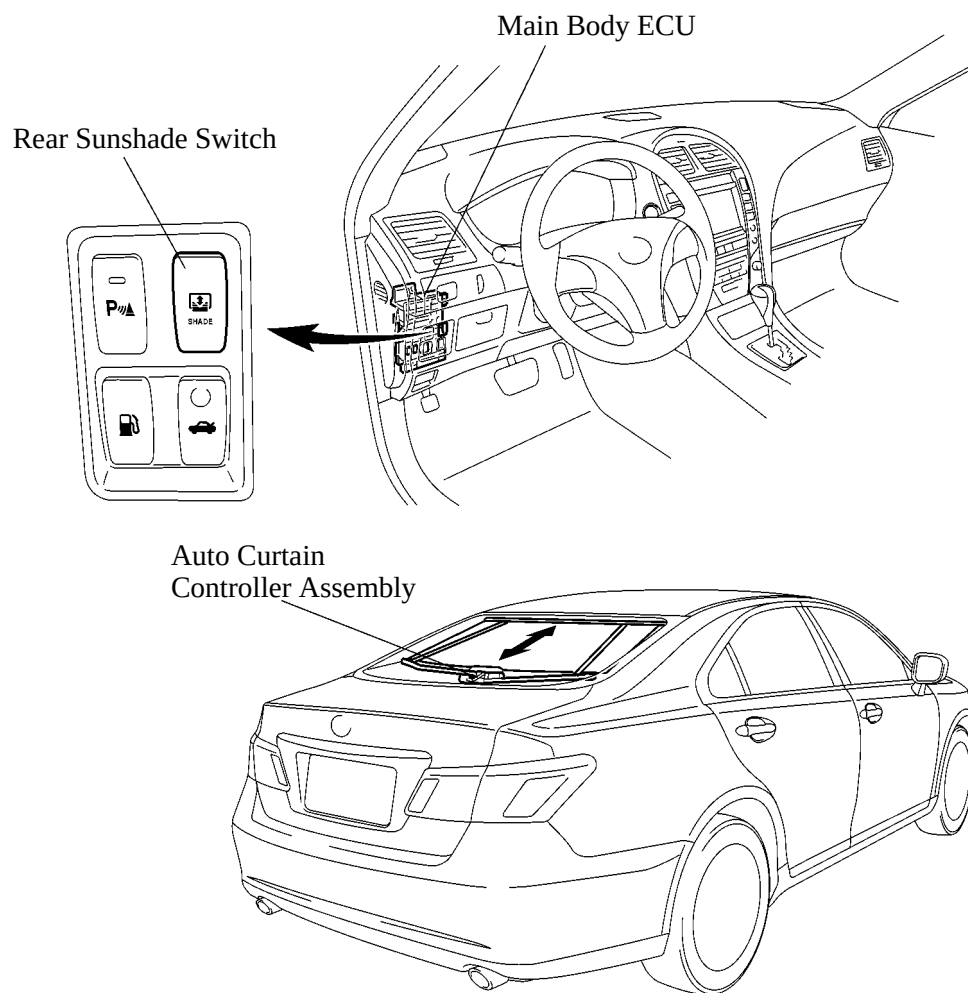
DESCRIPTION

An electrically-operated rear sunshade system blocks direct sunlight from entering through the rear window in order to ensure the comfort of the rear seat passengers.

- This system is provided as an option depending on the destination and grade of the vehicle (refer to Equipment List on page MO-26).
- The built-in ECU of the auto curtain controller assembly controls this system.
- This system has the following functions.

Function	Outline
Manual Up/Down	Moves the rear sunshade up or down in accordance with the rear sunshade switch operation.
Reverse-linked Auto-down	Moves the rear sunshade down automatically in accordance with the reverse signal.
Speed-linked Auto-up	Moves the rear sunshade up when the shift lever is in the D or S position while driving at 15 km/h (9 mph) or more. This function operates only after the reverse linked auto-down function operates.



■ LAYOUT OF MAIN COMPONENTS

REAR VIEW MIRROR

■ DESCRIPTION

The rear view mirrors have the following functions:

Mirror	Function		Equipment
Inside Rear View Mirror	Compass Display		Standard
	Automatic Glare-Resistant EC (Electrochromic) Mirror		Standard
	Shift Illumination		Standard
Outside Rear View Mirror	Mirror Heater (See page BE-255)		Standard
	Foot Light (See page BE-37)		Standard
	Electric Remote Control Mirror	With Reverse-linked Function	Option*
	Automatic Glare-Resistance EC		Standard
	Memory System (See page BE-247)		Option
	Electrical Remote Control Mirror		Standard*

*: Set using the memory system

*: Only for Korean, Taiwanese, Brazilian package models

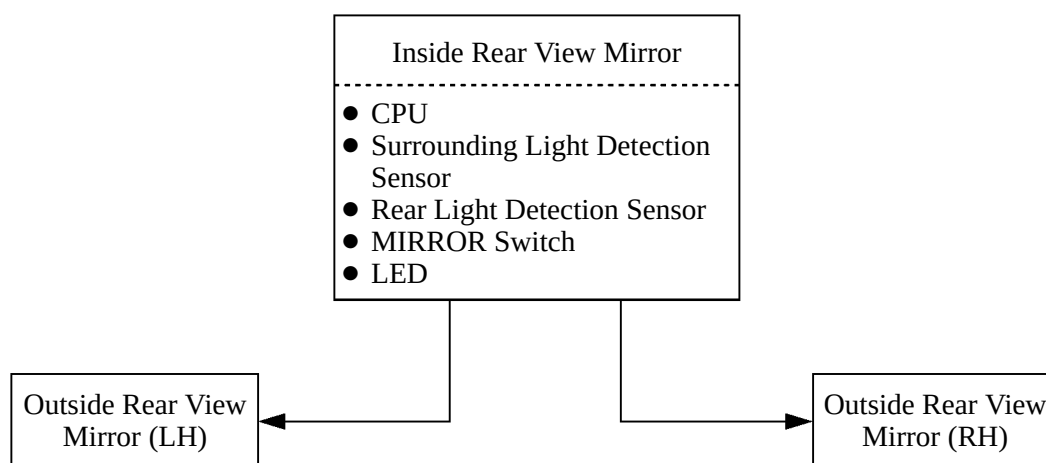
■ AUTOMATIC GLARE-RESISTANT EC MIRROR

1. General

During nighttime driving, if a large difference in intensity exists between the surrounding light and the light reflected off the inside rear view mirror from the headlights behind, an automatic glare-resistant EC (Electrochromic) mirror automatically reduces the reflection rate of the inside or outside rear view mirrors and thus dampens the glare from the mirror.

- This system uses 2 sensors (surrounding light detection sensor, rear light detection sensor) that are present in the inside rear view mirror to detect the difference between the intensity of light in the environment, and the light that the inside rear view mirror receives from the rear of the vehicle.
- When the power source is changed from OFF to IG-ON, this system defaults to AUTO mode.

► System Diagram ◄



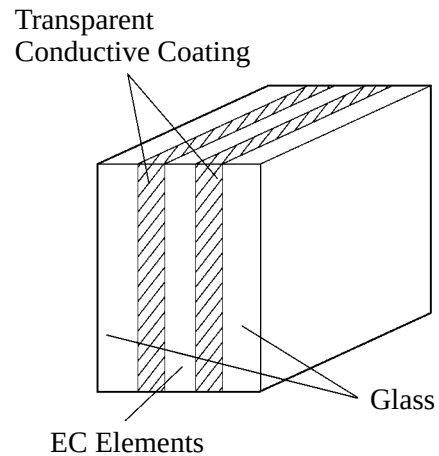
01YBE209P

2. Function of Components

Component	Function
Surrounding Light Detection Sensor	Detects the intensity of the light surrounding the vehicle.
Rear Light Detection Sensor	Detects the intensity of the light that strikes the inside rear view mirror from behind the vehicle.
LED	Turns on to inform the driver while the AUTO mode is operating.
MIRROR Switch	Mirror modes can be selected and compass settings can be performed by pressing the MIRROR switch for a given length of time as follows: ● 0 to 3 seconds: AUTO mode/AUTO OFF mode ● 3 to 6 seconds: Compass display/compass clear ● 6 to 9 seconds: Compass region setting ● 9 seconds or more: Compass system calibration
EC Mirror Cell	Varies the reflection rate of the mirror using the EC element.
CPU	Controls the reflection rate in accordance with the signals from the 2 sensors.

EC Mirror Cell

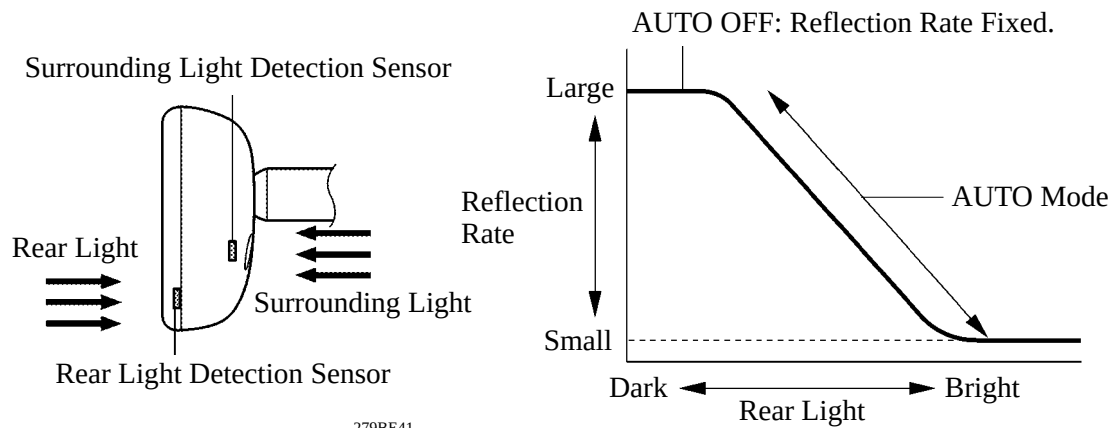
The gel type EC elements are placed between 2 layers of transparent conductive coating, which are placed between 2 sheets of glass. The EC elements have color changing characteristics. These characteristics are utilized to electronically vary the mirror reflection rate through a electro-chemical oxidation reduction reaction.



199BE108

3. Reflection Rate Control

This CPU detects the surrounding light using its surrounding light detection sensor and the rear light using its rear light detection sensor, and determines whether it is day or night based on the intensity of the surrounding light. At the same time, the intensity of the glare from the rear is determined through the difference in intensity between the surrounding and rear light. In accordance with the intensity of the rear light, the reflection rate is varied steplessly.

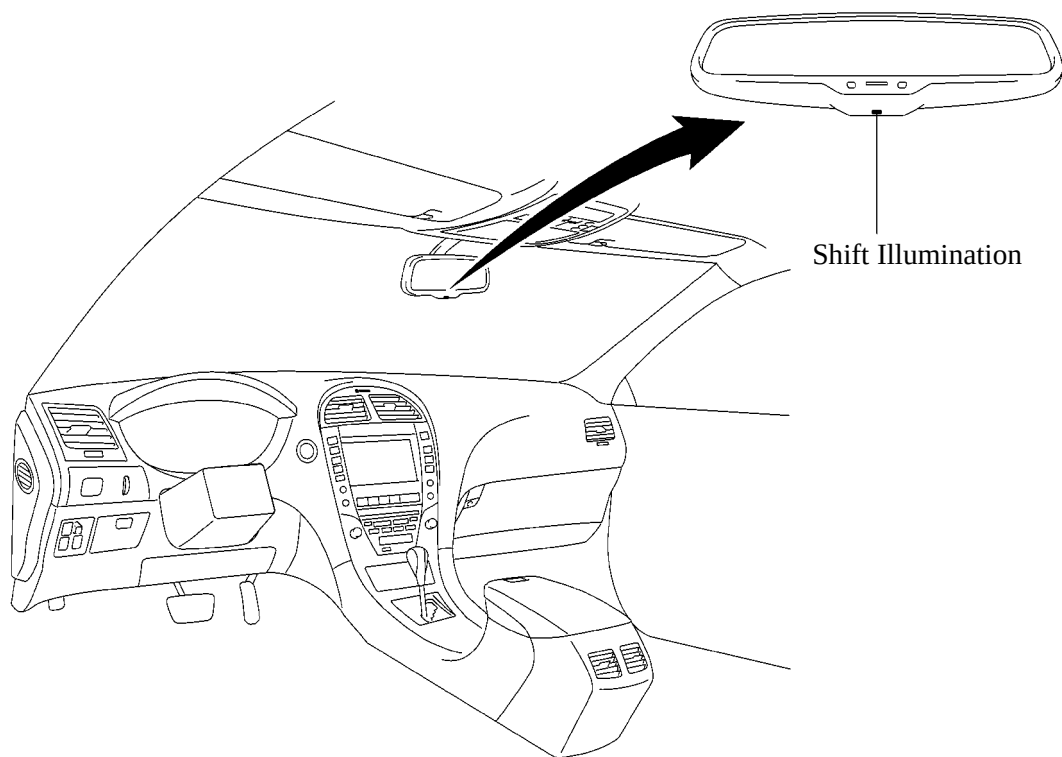


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■ SHIFT ILLUMINATION

- The shift illumination is mounted on the lower part of the inside rear view mirror to illuminate around the shift lever during nighttime driving, thus providing comfortable interior lighting.
- The shift illumination comes on when the following conditions are fulfilled:
 - The power source is IG ON or ACC.
 - The surrounding light detection sensor determines it is night.



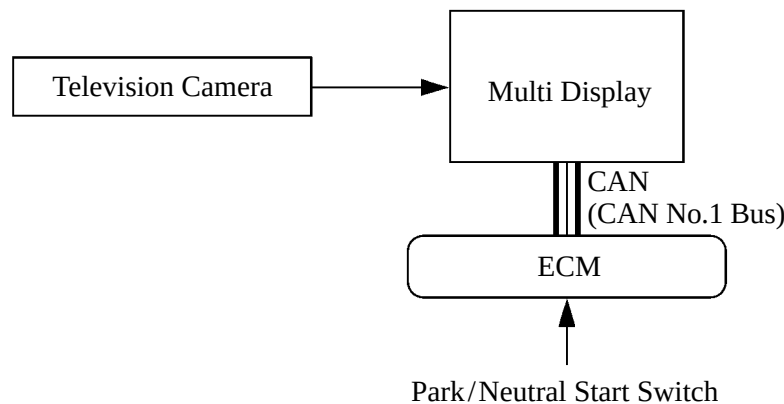
REAR VIEW MONITOR SYSTEM

■ DESCRIPTION

To assist the driver in parking the vehicle by monitoring the rear view, the rear view monitor system has a television camera mounted on the luggage compartment door to display a view of the area behind the vehicle on the multi display.

- A package consisting of the rear view monitor system and the multi display is available.
- This system consists of the television camera and multi display.
- This system operates when all the conditions given below have been met.
 - Power source is IG-ON.
 - The shift lever is shifted to reverse.
- If the driver moves the shift lever to a position other than reverse, or switches the modes on the multi display, the rear view display will stop and change to the display of another mode.

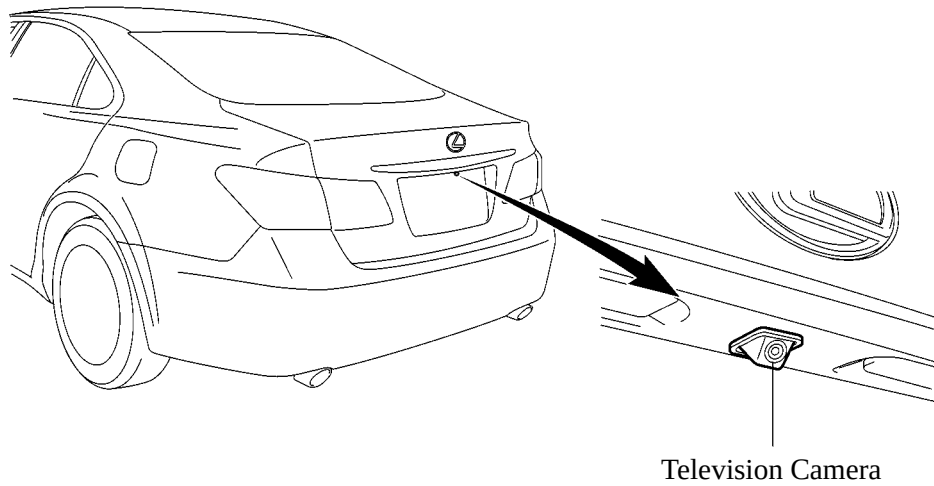
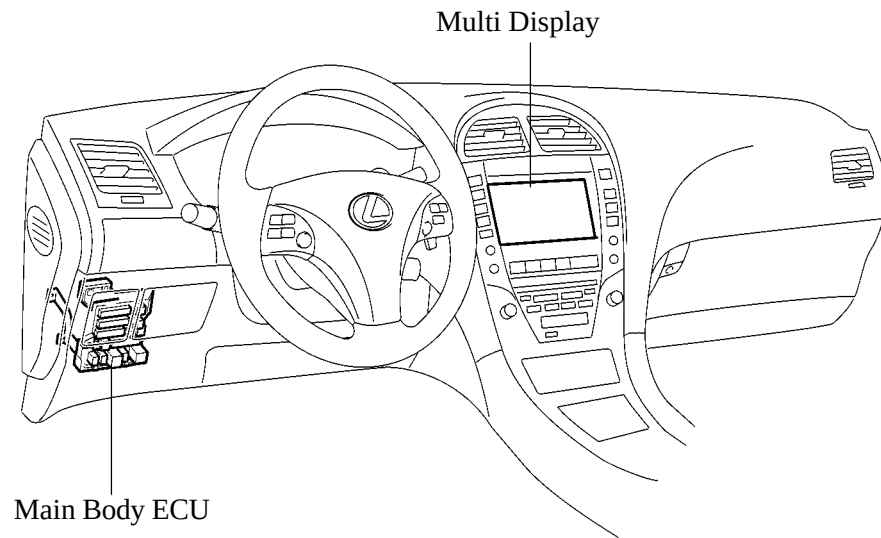
► System Diagram ◀



01YBE126P

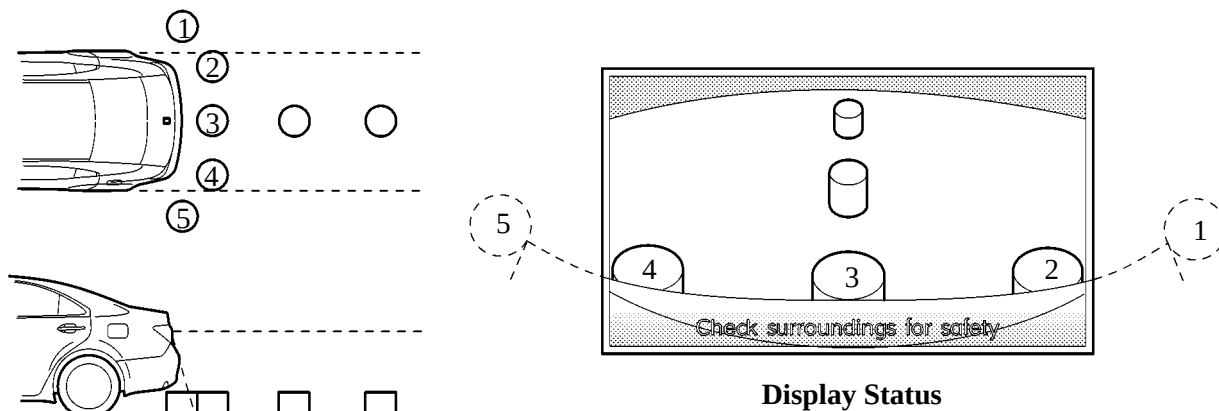
CAUTION

- Do not rely entirely on the rear view monitor system. Use caution, just as you would when backing up any vehicle.
- Never back up while looking only at the screen. The image on the screen may differ from the actual conditions. If you back up while looking only at the screen, you may hit an object or have an accident. When backing up, be sure to check by looking behind and all around the vehicle, both directly and using the mirrors, before proceeding.

■ LAYOUT OF MAIN COMPONENTS

■ AREA DISPLAYED ON SCREEN

- On the multi display, objects on the right of the vehicle appear on the right side of the display panel, and objects on the left of the vehicle appear on the left side of the display panel.
- The television camera uses a wide-angle lens. The perceived distance from images that appear on the screen differs from the actual distance.



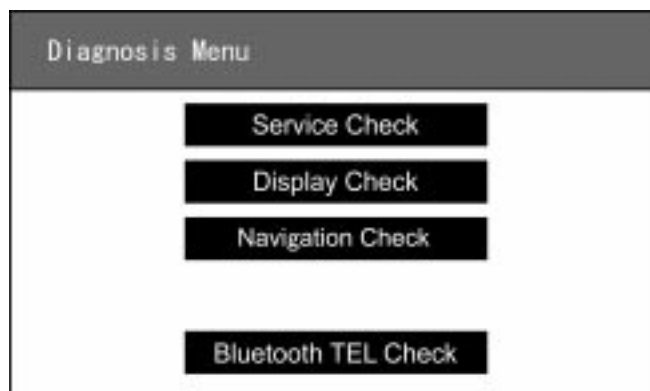
01YBE128TE

NOTE:

- The area displayed on screen may vary according to vehicle status or road conditions.
- The area covered by the television camera is limited. The television camera does not show objects close to either corner of the bumper or show the area under the bumper.

■ DIAGNOSIS

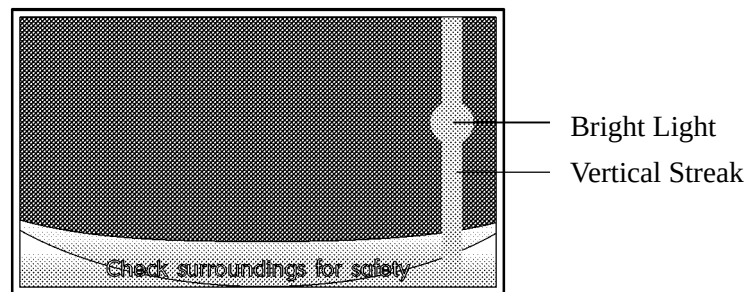
The rear view monitor system is equipped with a diagnosis function which can display the diagnosis menus. The method for entering the diagnosis menu screen is the same as the method used for the multi display. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).



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■ PRECAUTION FOR REAR VIEW MONITOR SYSTEM OPERATION

- In the following cases, it may become difficult to see items in the image on the screen, but this does not indicate a malfunction.
 - In the dark (for example, at night)
 - When the temperature near the lens is very high or low
 - When water droplets are present on the television camera, or when humidity is high. (for example, when it rains)
 - When foreign matter (for example, mud or salt) is present on the television camera lens
 - When the sun or the beam of headlights shines directly into the television camera lens
- If a bright light (for example, sunlight reflected off the vehicle body) is picked up by the television camera, the smear effect*, a phenomenon experienced by a CCD camera, may occur.

**Smear Effect**

01YBE174TE

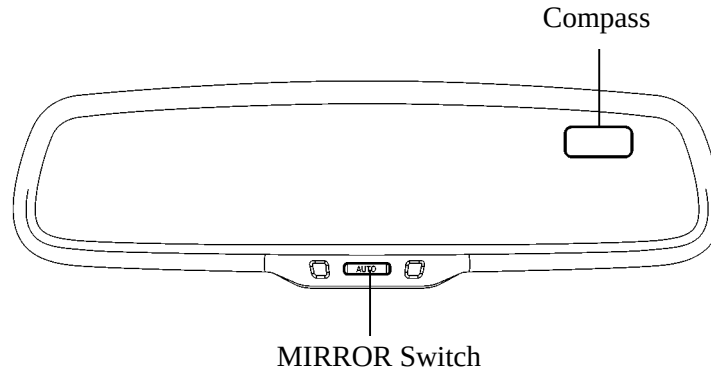
- REFERENCE -

*: Smear effect

A phenomenon that occurs when a bright light is received up by the television camera; and transmitted to the screen, the light source will appear to have a vertical streak above and below it.

■ COMPASS DISPLAY

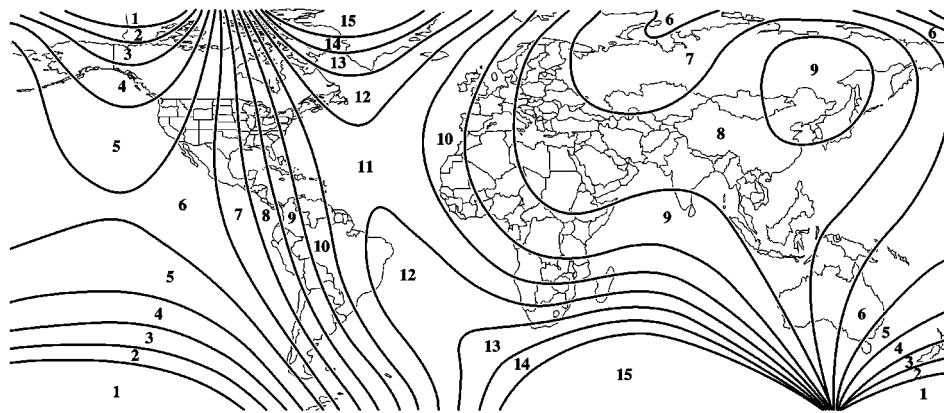
- A sensor that detects the earth's magnetic field is built inside the inside rear view mirror. This sensor is not influenced by the magnetization of the vehicle.
- The compass indicates north as 0° and the forward direction of the vehicle using 8 azimuths. (N, NE, E, SE, S, SW, W, and NW)
- Press the MIRROR switch for 3 to 6 seconds to display the compass.



01YBE131TE

Service Tip

To ensure an accurate compass reading, it is necessary to perform a magnetic variation (declination) adjustment in order to set the number that identifies the region that the vehicle will be used in. The numbers that identify the regions are shown in the illustration below.



01YBE132TE

As the compass system needs to store the vehicle's marked magnetic field, it is necessary to perform calibration for each vehicle. Once calibration has been completed, it is not necessary to perform calibration unless a sudden magnetic field change occurs. In case of occurrence of a sudden magnetic field change, C will be displayed in the compass display and it will be necessary to perform calibration again.

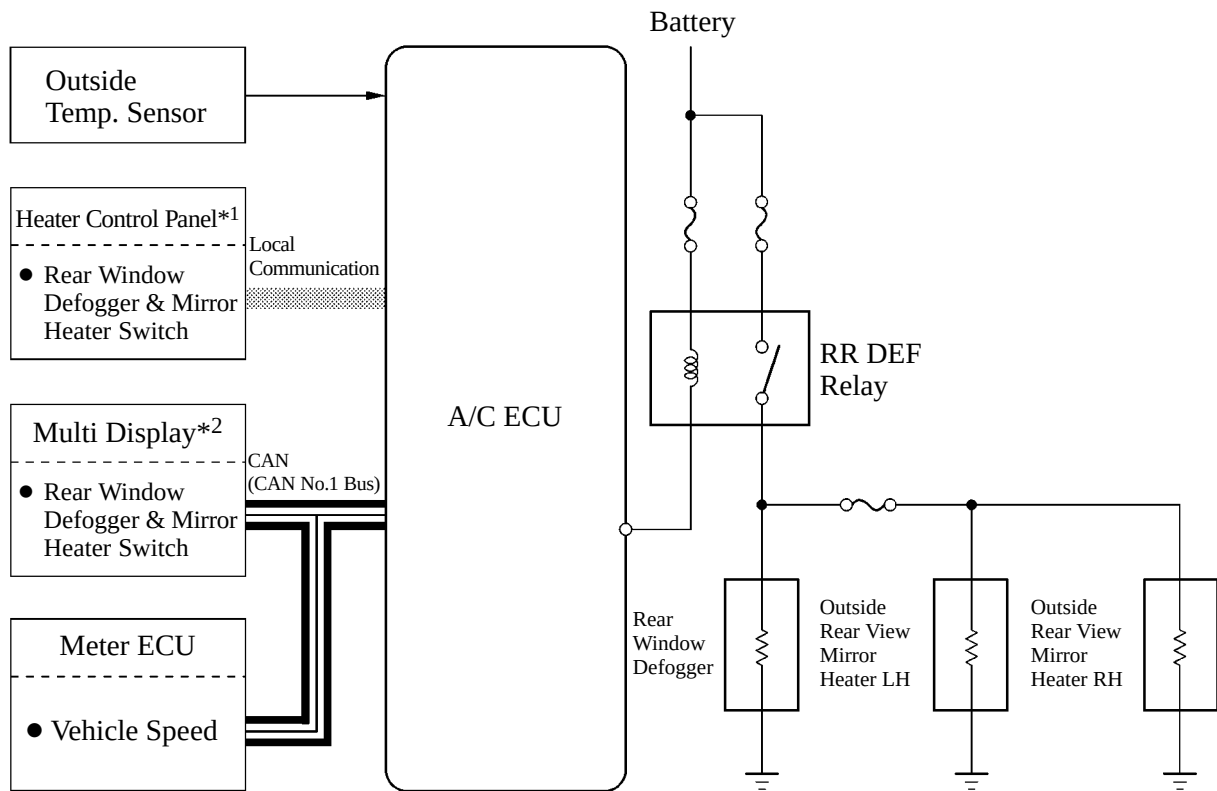
For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

REAR WINDOW DEFOGGER SYSTEM

DESCRIPTION

- The rear window defogger system uses the heater wire on the rear window glass to defog the rear window glass.
- This system is standard equipment on all models.
- The rear window defogger system operates at the same time as the heater function of the outside rear view mirror.
- This system is activated when the engine switch is turned on and the rear window defogger switch is pushed. This switch is provided with a timer function to turn off the defogger and mirror heater after approx. 15 minutes. The operation period of the timer may extend to approx. 45 minutes depending on the circumstances of the outside air temperature and vehicle speed.

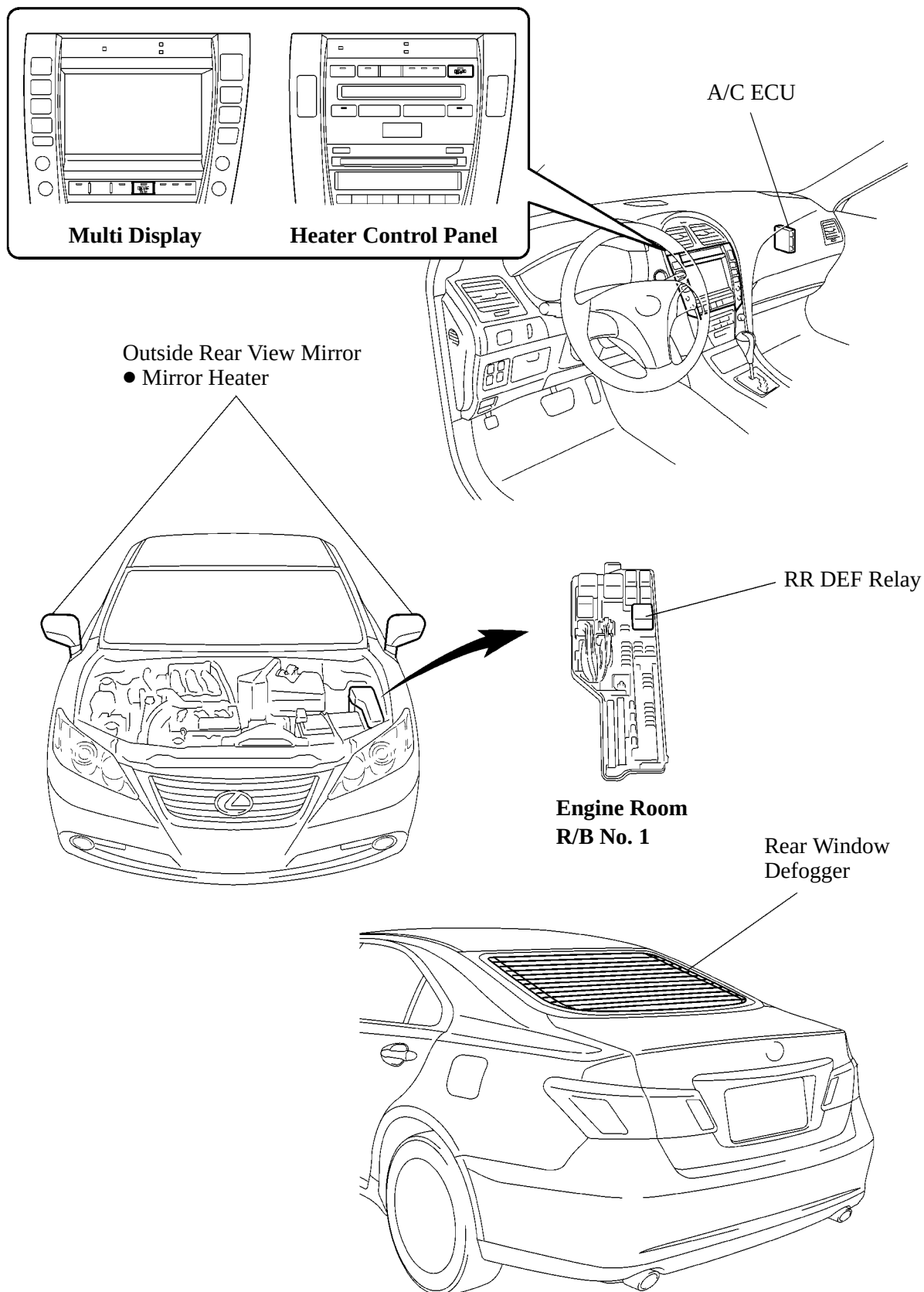
► System Diagram ◀



01YBE157Y

*1: Without multi display

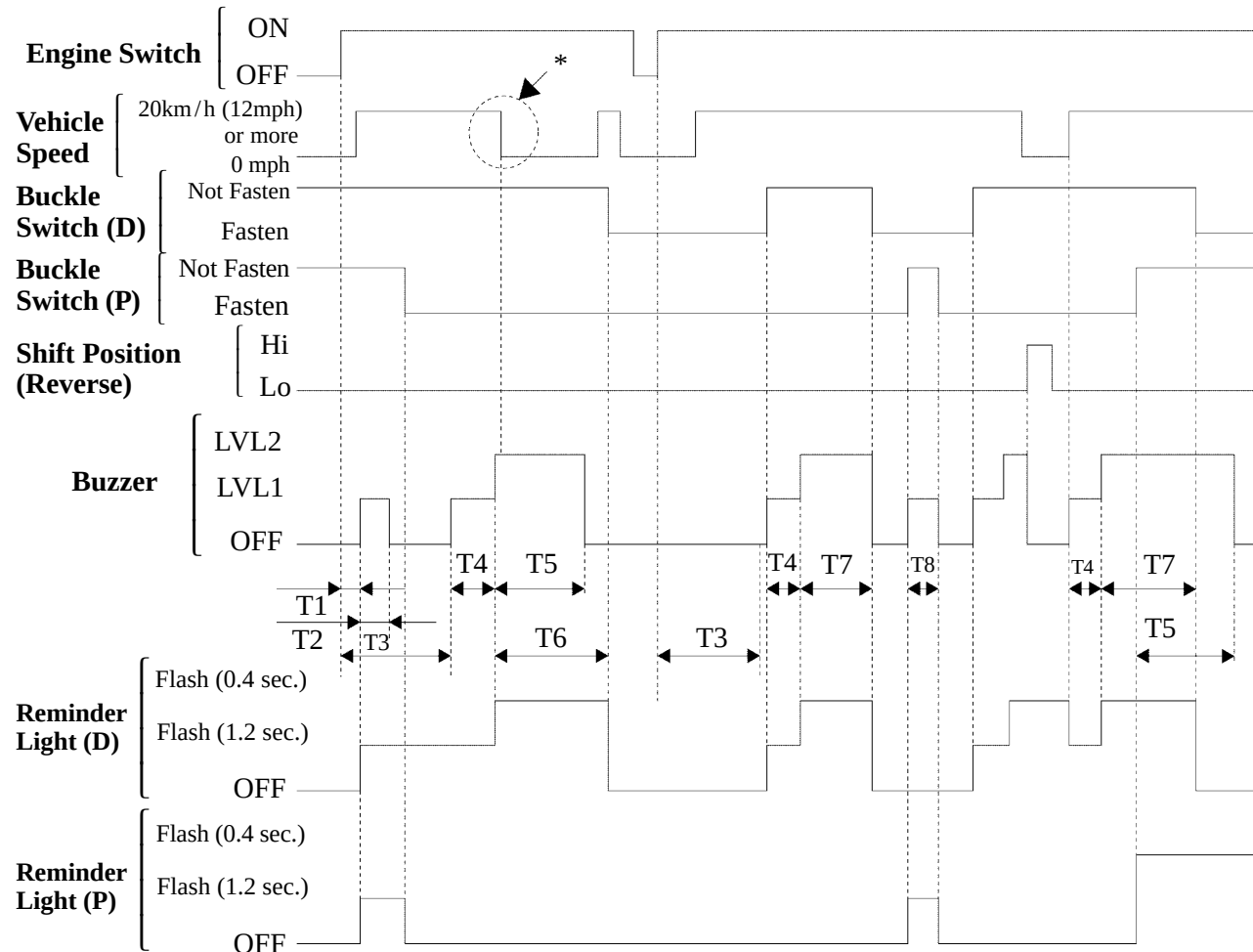
*2: With multi display

■ LAYOUT OF MAIN COMPONENTS**Rear Window Defogger & Mirror Heater Switch**

REMINDER METHOD

The timing chart of the buzzer and details of the reminder method are shown below.

► Timing Chart ◀



0140BE193C

T1: About 1.8 sec.

T2: About 1.5 sec. x 5

T3: About 13.8 sec.

T4: About 9.6 sec.

T5: About 20 sec.

T6: About 20 sec. or more

T7: About 20 sec. or less

T8: About 9.6 sec. or less

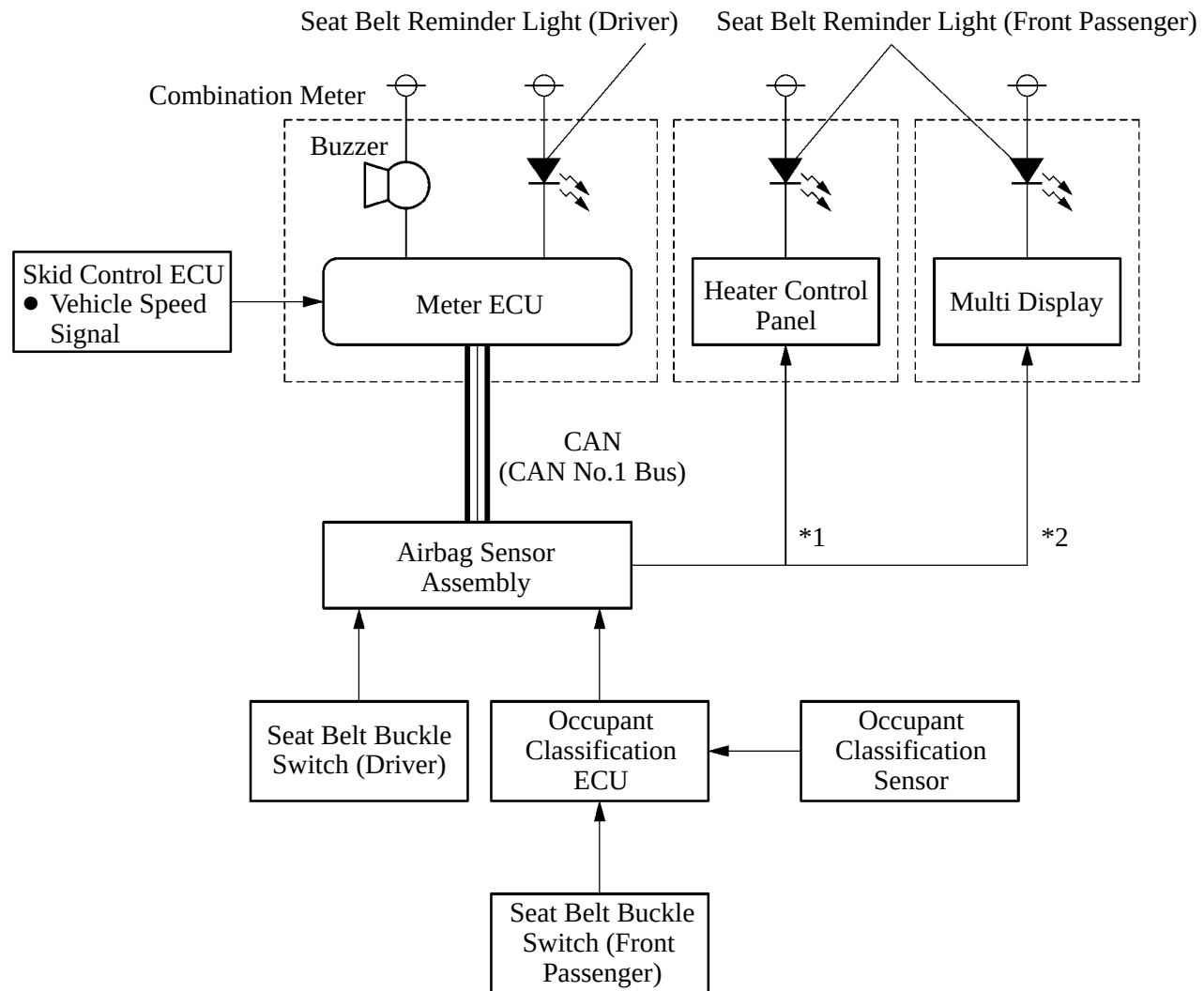
*: If the vehicle speed drops below the setting level for seat belt warning after a buzzer begins to sound, the buzzer will continue to sound. After the vehicle speed exceeds 20km/h (12 mph) again, the buzzer will stop.

SEAT BELT REMINDER SYSTEM

DESCRIPTION

- If a seat belt is not fastened, this system flashes the seat belt reminder light or sounds the buzzer in the combination meter as a reminder.
- When the engine switch is turned ON, this system detects the condition of the seat belts based on the signals from the seat belt buckle switches (for the driver and front passenger) and the occupant classification sensor.

► System Diagram ◀



*1: Models without Multi Display

*2: Models with Multi Display

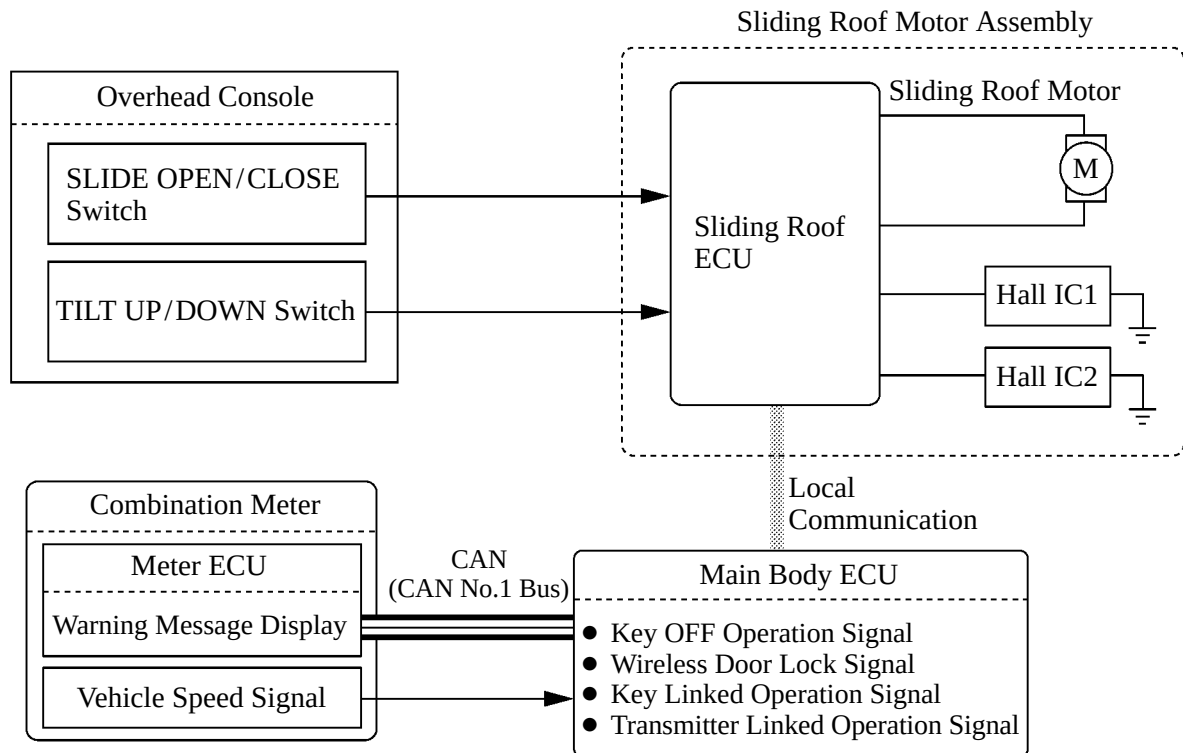
01YBE144TE

■ CONVENTIONAL TYPE SLIDING ROOF SYSTEM

1. General

- This system uses a single glass panel to perform tilt-up-down and open-and-close operations.
- The sliding roof ECU uses 2 type Hall ICs to detect the position of the sliding roof. Sliding roof ECU and the 2 Hall ICs are integrated into the sliding roof motor assembly.

► System Diagram ◀



01YBE139P

Service Tip

The memory is not cleared if battery terminals are disconnected. However, initialization is necessary after the sliding roof motor assembly is replaced. Perform the initialization as follows:

- 1) Keep pressing the TILT UP or SLIDE CLOSE switch until the roof tilts up completely. This will enable the sliding roof ECU to start initializing and perform the tilt up, tilt down, open, and close operations of the sliding roof in sequence.
- 2) Keep the switch pressed for 1 second after the tilt-up operation is completed.
- 3) The sliding roof ECU performs the tilt down, open, and close operations.
- 4) The initialization process ends when the close operation is completed.

Keep the tilt-up or slide close switch pressed during initialization. If the tilt up or close switch is released during initialization, the system will not be able to complete the initialization. If this occurs, the aforementioned steps must be performed again.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

2. Function

The conventional type sliding roof system has the following functions:

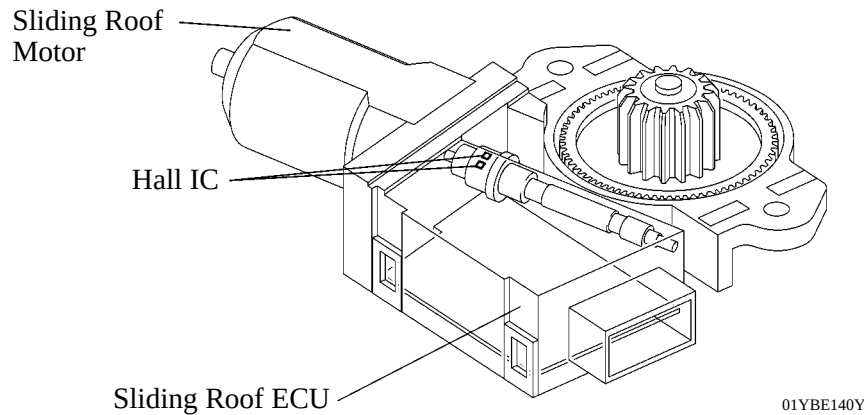
Function	Outline
Manual open-and-close	This function causes the sliding roof to open (or close) while the SLIDE OPEN switch (or SLIDE CLOSE switch) is momentarily pressed. The sliding roof stops as soon as the switch is released.
One touch auto open-and-close	This function enables the sliding roof to be fully opened (or closed) by the SLIDE OPEN switch (or SLIDE CLOSE switch) for 0.3 sec. or longer.
Manual tilt up-and-down	This function causes the sliding roof to tilt up (or tilt down) while the TILT UP switch (or TILT DOWN switch) is momentarily pressed. The sliding roof stops as soon as the switch is released.
One touch auto tilt up-and-down	This function enables the sliding roof to be fully tilt up (or down) by the TILT UP switch (or TILT DOWN switch) for 0.3 sec. or longer.
Jam protection	The “jam protection” function automatically stops the sliding roof and moves it open half way (or fully tilt up) if a foreign object gets jammed in the sliding roof during close or tilt down operation.
Key-off operation	The “key-off operation” function makes it possible to operate the sliding roof for approximately 43 seconds after the ignition switch or power source mode is turned to the ACC or OFF position, if the front doors are not opened.
Key-linked open-and-close Function* ¹	When the key is not in the detection area, the driver’s door is locked, and the key in the driver’s door is turned and maintained in the lock direction for 1.5 seconds or more, the sliding roof ECU activates the sliding roof motor to close the moon roof while the key is turned. Similarly, when the driver’s door is unlocked, turning and maintaining the driver’s door key in the unlock direction for 1.5 seconds or more will cause the moon roof to be opened.
Transmitter - linked open-and-close function* ^{1,2}	When the main body ECU receives an unlock/lock signal from the transmitter continuously for longer than 2.5 seconds, the sliding roof ECU controls the sliding roof motor in accordance with the signal to open/close the moon roof.
Sliding roof open warning (see page BE-180)	When the engine switch is turned from IG-ON to OFF and the driver door is opened with the sliding roof open, the buzzer in the combination meter sounds once. Then, a warning message appears on the multi-information display.

*¹: The setting of functions can be changed using the customized body electronics system. For details, refer to the Customized Body Electronics System section on page BE-14.

*²: Only the open function is available on U.S.A. and Canadian package models.

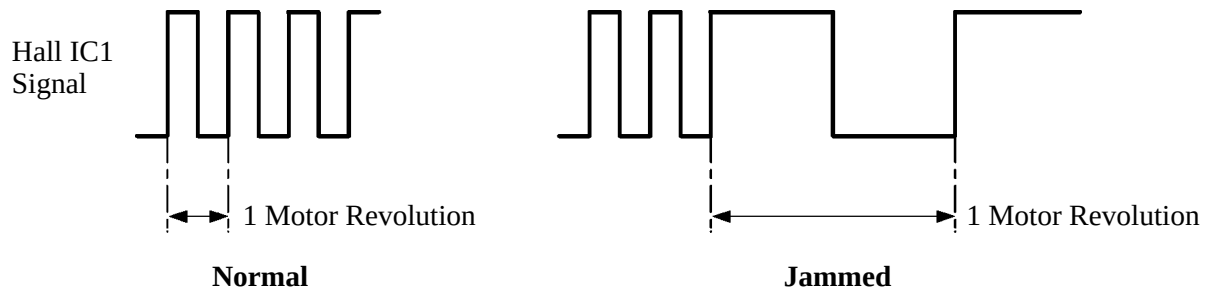
3. Jam Protection Function

- The Hall IC converts the changes in the magnetic flux that occur due to the rotation of the worm gear into pulse signals and outputs them to the ECU.



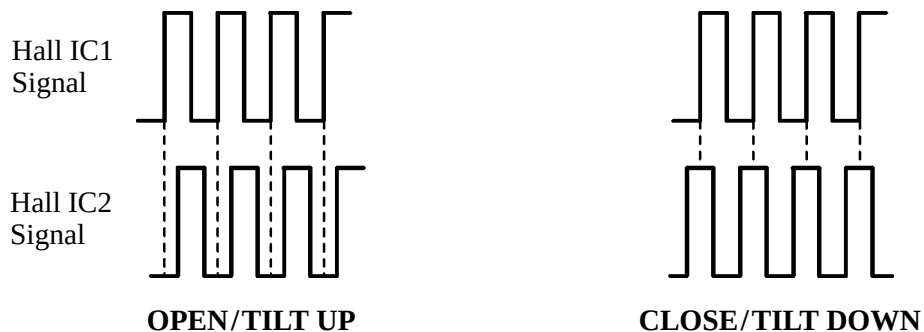
- To control the jam protection function, the ECU monitors the amount of movement and judges jamming of the moon roof based on the pulse signals from the Hall IC1, and the moving direction of the moon roof from the phase difference between the pulsed from the Hall IC1 and Hall IC2.

► Monitoring Amount of Movement Judgment of Jamming ◀



232BE34

► Judgment of Movement Direction ◀



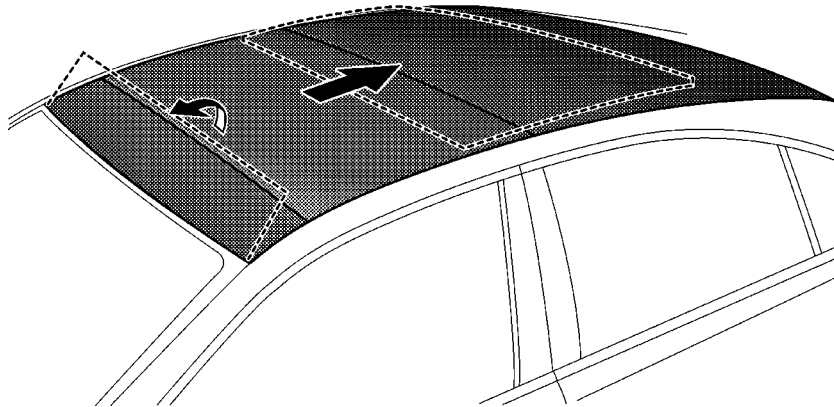
232BE35

SLIDING ROOF SYSTEM

■ DESCRIPTION

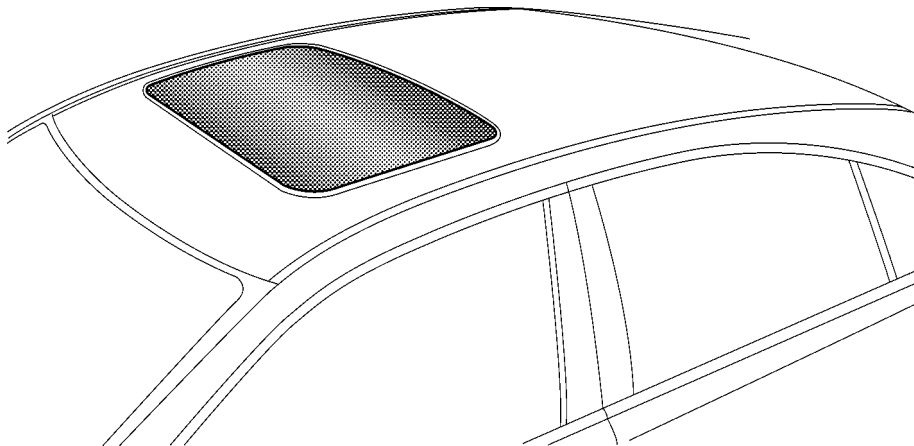
On the '07 ES350, the following 2 types of sliding roof systems are used:

- The panorama moon roof with 3 glass panels is optional equipment.
- The conventional type sliding roof with a single glass panel is standard equipment.



01YMO39Y

Panorama Moon Roof



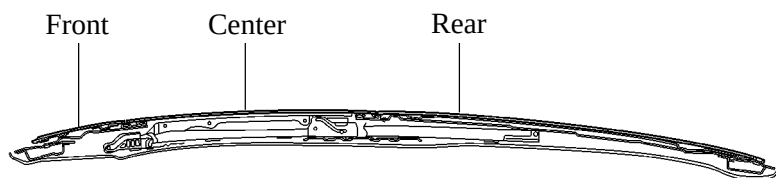
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Conventional Type Sliding Roof

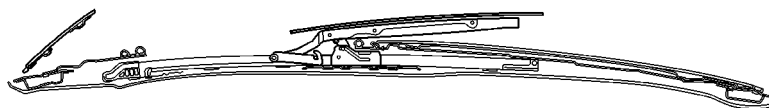
■ PANORAMA MOON ROOF SYSTEM

1. General

- The panorama moon roof system uses 3 glass panels (front, center and rear). By using 3 glass panels in the roof opening, this system provides a larger sliding roof glass area than the conventional type sliding roof. As a result, the amount of the opening and lighting has been increased.
- The sliding roof motor uses a cable to simultaneously move the 2 (front and center) glass panels. The rear glass panel does not move.
- The front glass panel moves in the tilt up-and-down direction, and the center glass panel moves in the tilt up-and-down and open-and-close directions.



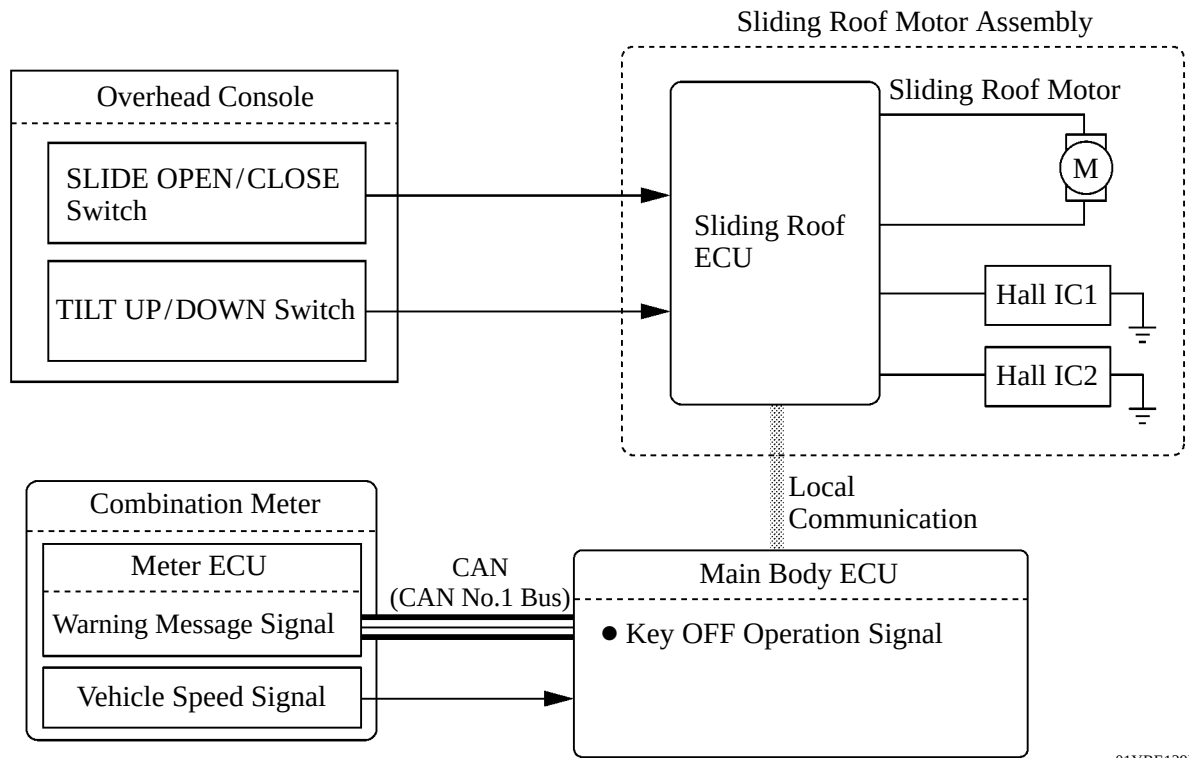
Fully Closed Condition



Fully Open Condition

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► System Diagram ◀



01YBE139P

Service Tip

The memory is not cleared if battery terminals are disconnected. However, initialization is necessary after the sliding roof motor assembly is replaced. Perform the initialization as follows:

- 1) Keep pressing the sliding roof switch to the close side until the center glass panel is fully closed.
- 2) If the switch remains pressed for approximately 2 more seconds after the panel is fully closed, the sliding roof ECU stores the fully closed position.
- 3) The center panel glass returns in the open direction a little and indicates that initialization is complete.

Keep the tilt-up or slide close switch pressed during initialization. If the tilt up or close switch is released during initialization, the system will not be able to complete the initialization. If this occurs, the aforementioned steps must be performed again.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

2. Function

The panorama moon roof system has following functions:

Function	Outline
Manual open-and-close	This function causes the sliding roof to open (or close) while the SLIDE OPEN switch (or SLIDE CLOSE switch) is pressed. The sliding roof stops as soon as the switch is released.
One touch auto open	This function enables the sliding roof to be fully opened at 0.3 sec. or long press of the SLIDE OPEN switch.
Manual tilt up-and-down	This function causes the sliding roof to tilt up (or tilt down) while the TILT UP switch (or TILT DOWN switch) is pressed. The sliding roof stops as soon as the switch is released.
One touch auto tilt up	This function enables the sliding roof to be fully tilt up at 0.3 sec. or long press of the TILT UP switch.
Jam protection	The “jam protection” function automatically stops the sliding roof and moves it open half way (or fully tilt up) if a foreign object gets jammed in the sliding roof during close or tilt down operation.
Key-off operation	The “key-off operation” function makes it possible to operate the sliding roof for approximately 43 seconds after the ignition switch or power source mode is turned to the ACC or OFF position, if the front doors are not opened.
Sliding roof open warning (see page BE-179)	When the engine switch is turned from IG-ON to OFF and the driver door is opened with the sliding roof open, the buzzer in the combination meter sounds once. Then, a warning message appears on the multi-information display.

3. Jam Protection Function

- The reverse operation is effected when the sliding motor ECU detects that a foreign object is jammed during the manual tilt down or close function. If jamming is detected at other times (such as during auto/manual open), the sliding roof ECU will stop the operation of the sliding roof.
- Similar to the conventional type sliding roof system, this detects whether the sliding roof has jammed in accordance with the amount and direction of the movement of the sliding roof motor, which are output by the 2 Hall ICs provided in the sliding motor assembly. The sliding motor assembly is the same type as in the conventional type sliding roof system.
- For details, refer to jam protection function in CONVENTIONAL TYPE SLIDING ROOF SYSTEM.

■ WARNING

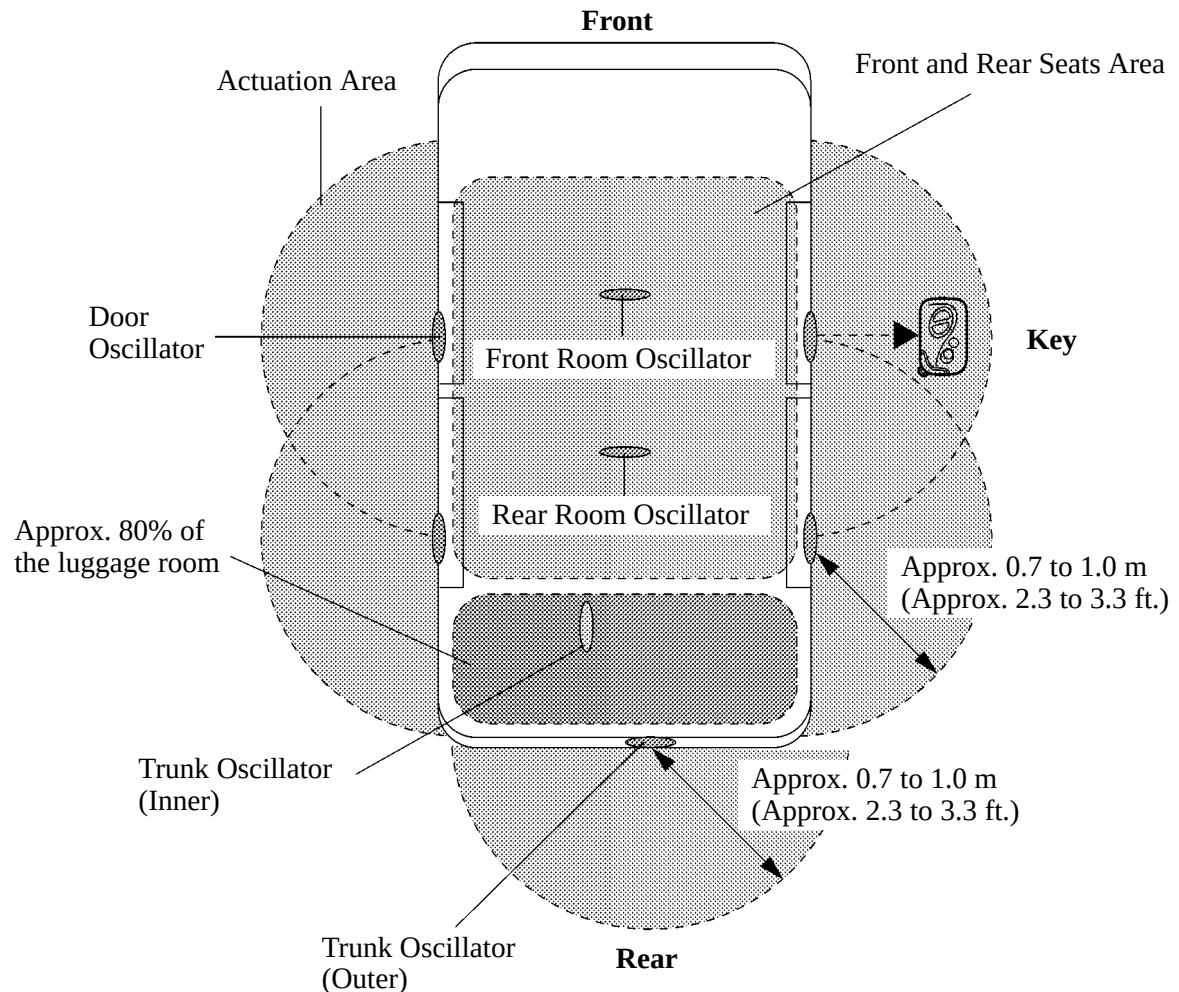
When the power source is changed from IG-ON to OFF and the driver door is opened when the sliding roof is open, the sliding roof ECU sounds the buzzer in the combination meter. Then, a warning message appears on the multi-information display.

Warning Condition		The warning is activated if all of the following conditions are met: ● Sliding roof is not fully closed. ● Power source is “OFF” ● Driver door is opened.
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 01YBE143P
	Master Warning Light	Flash
Warning Stop Condition		The warning is stopped when one of the following conditions is met. ● 8 seconds have elapsed after the warning condition is detected. ● Power source is “ON” ● Driver door is closed.

■ ACTUATION AREA

The special functions of the smart access system with push button start only work when the key is in the actuation area formed by the eight oscillators.

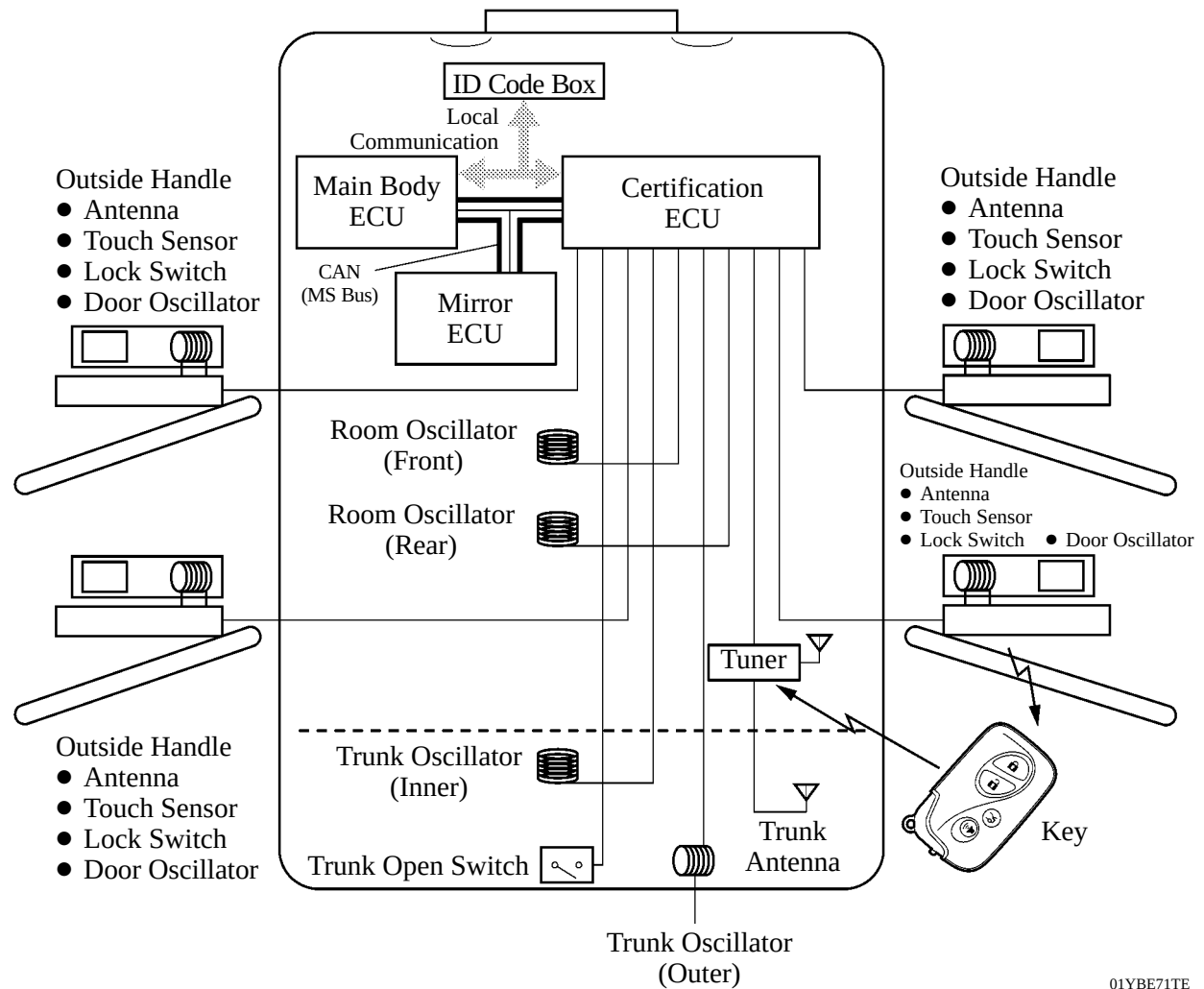
- The front and rear room oscillators form the actuation area of the push button start function.
- The four door oscillators and inner and outer trunk oscillators form the actuation area of the entry function.



ENTRY FUNCTION

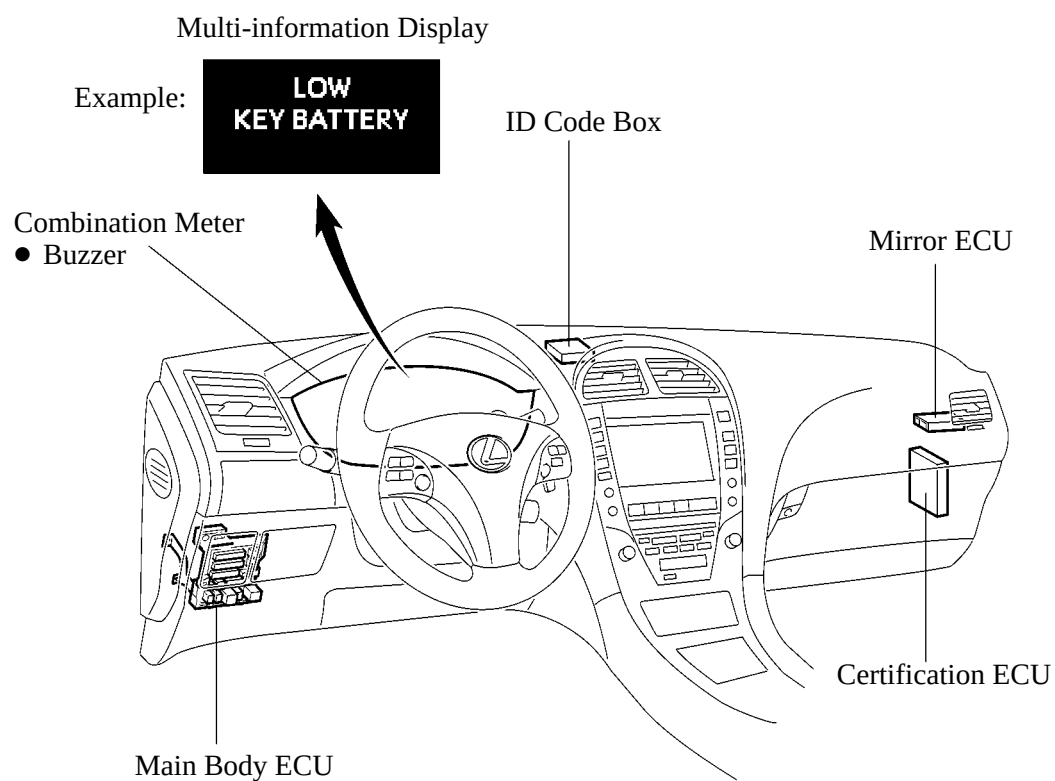
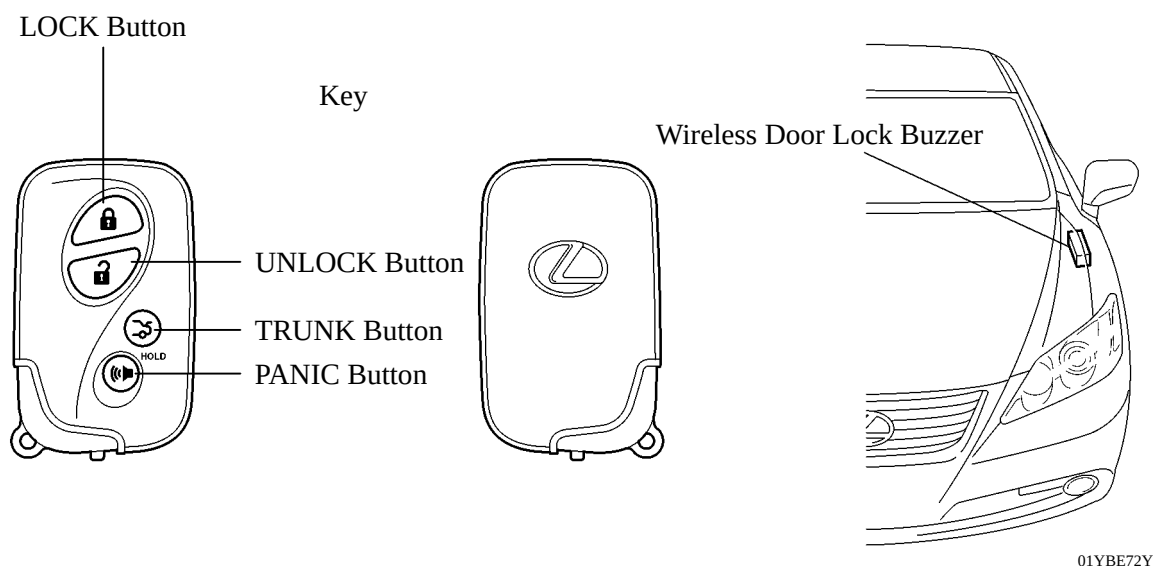
1. System Diagram

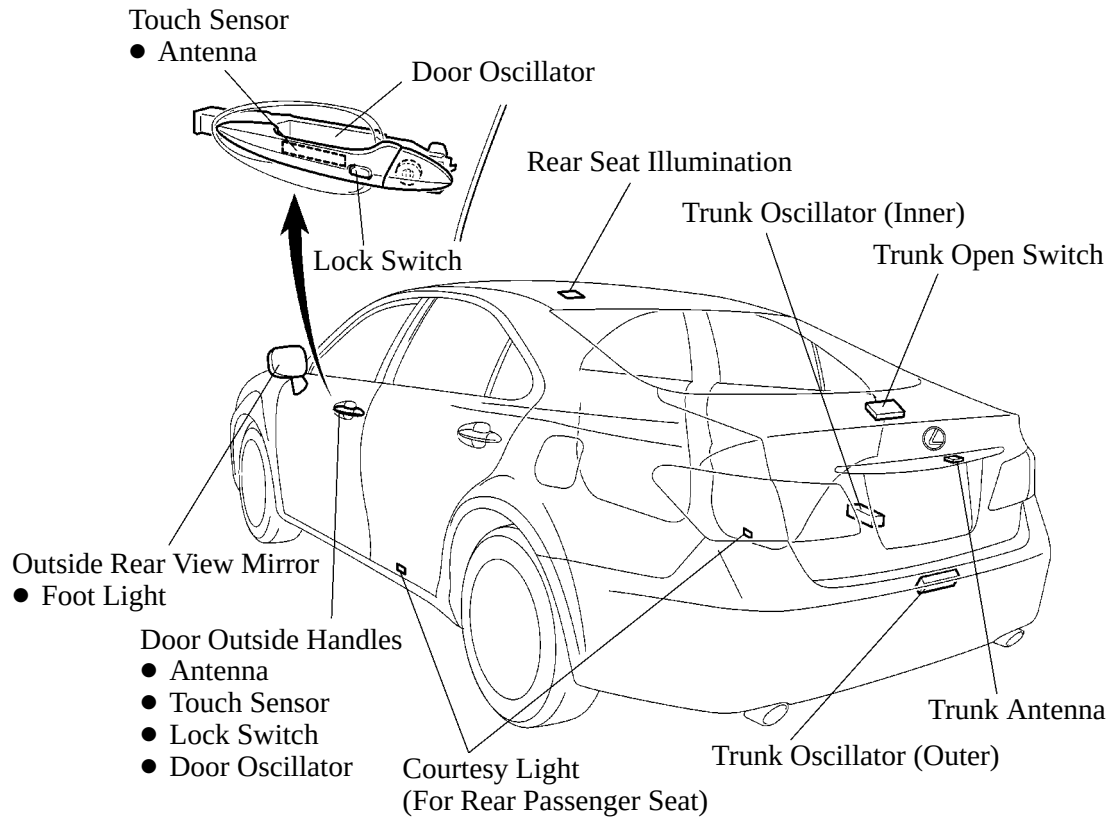
The certification ECU controls the entry function. The system diagram below shows the main components that relate to the function.



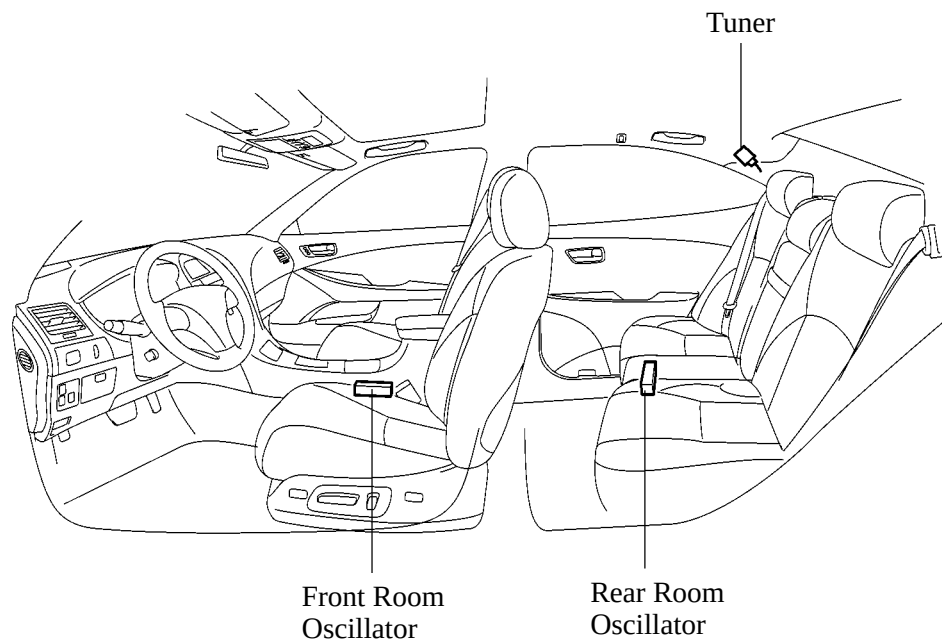
01YBE71TE

2. Layout of Main Components





01YBE73TE



01YBE68TE

3. Function of Main Components

Component		Function
Key		The key consists of a mechanical key, the transmitter for the wireless door lock remote control, the transceiver for the smart access system with push-button start and a transponder chip for the engine immobilizer control.
Certification ECU		Controls the smart access system with push button start in accordance with the signals from each oscillator, various switches, ECUs and the key. • Judges and certifies the ID code from the tuner. • Transmits the engine immobilizer deactivation signal to the ID code box. • Transmits steering unlock signals to the steering lock ECU.
Main Body ECU		Controls the push button start system in accordance with the signals from the various switches, ECUs and combination meter. • Transmits the key certification request signal to the certification ECU in accordance with the engine switch signal, and turns the relays ON and OFF. • Receives the request signal from the certification ECU and actuates the door lock motor to unlock or lock the door. • Transmits the condition each door to the certification ECU.
ID Code Box		Receives and certifies the engine immobilizer deactivation signal transmitted from the certification ECU, and sends it to the ECM.
Outside Handle	Antenna	Transmits the request signals.
	Touch Sensor	Detects when a person touches the inside of an outer door handle.
	Lock Switch	Transmits door lock request signals to the certification ECU.
	Door Oscillator • Front RH and LH • Rear RH and LH	Receives the request signal from the certification ECU, and creates an actuation area around front door.
Room Oscillator • Front and Rear		Receives the request signal from the certification ECU, and forms the actuation area in the vehicle interior.
Trunk Oscillator • Inner		Receives the request signal from the certification ECU, and forms the actuation area in the trunk.
Trunk Oscillator • Outer		Receives the request signal from the certification ECU, and forms the actuation area around the trunk lid.
Tuner		• Receives the ID code from the key in the actuation area and transmits it to certification ECU. • Receives the ID code from the key in the trunk and transmits it to certification ECU.
Trunk Antenna		Receives the ID code from the key in the luggage room and transmits it to the tuner.
Outside Rear View Mirror	Foot Light	When the key enters the exterior actuation area, the foot lights are illuminated in accordance with the request signals of the certification ECU.

(Continued)

Component		Function
Trunk Open Switch		Transmits a trunk lid open request signal to certification ECU.
Wireless Door Lock Buzzer		Sounds as an answerback for entry lock or unlock to inform the driver.
Combination Meter	Multi-information Display	When the certification ECU detects human error, it warns the driver by sounding the wireless door lock buzzer and the buzzer in the combination meter, and by illuminating a warning on the multi-information display and the master warning light, in accordance with the request signal from the certification ECU.
	Master Warning Light	
	Buzzer	

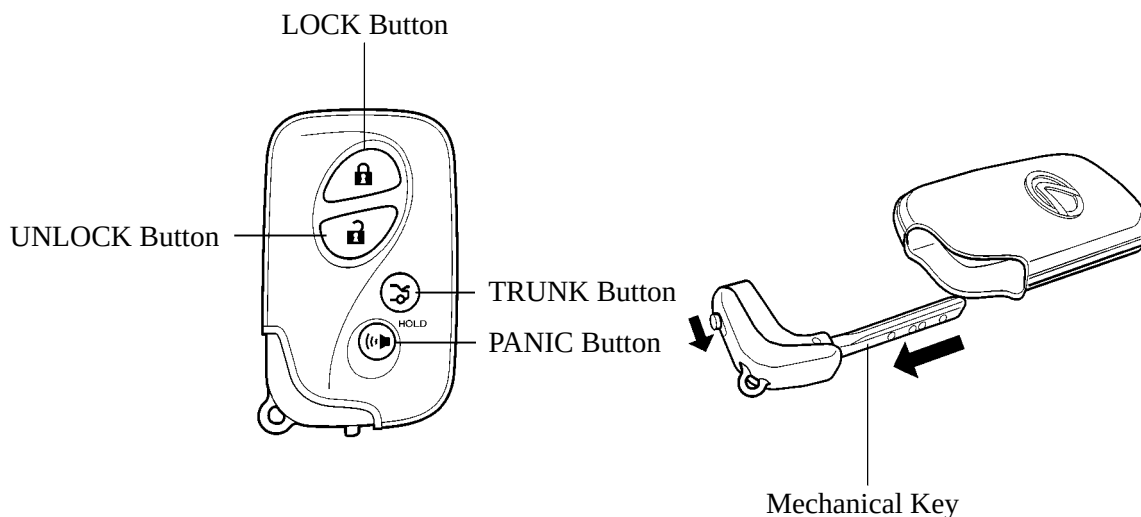
4. Construction and Operation

Key (Mechanical Key)

The key consists of a mechanical key, a transmitter for the wireless door lock remote control and a transceiver for the smart access system, and a transponder chip for the engine immobilizer control.

- The transceiver function of the key receives the signals from the oscillators and returns the ID code to the tuner.
- The transmitter function for the wireless door lock remote control has a LOCK button, UNLOCK button, TRUNK button, and PANIC button.
- The transponder chip in the key for the engine immobilizer control returns a signal to the engine switch as a response to the radio wave it received from the engine switch.
- This mechanical key operates the driver door lock cylinder and glove box lock cylinder, but cannot be used to start the engine. When the mechanical key is used, the cap of the driver door lock cylinder must be removed.

A total of four keys can be registered. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).



0140BE143C

Oscillator (Each Door, Front and Rear Rooms, Trunk Inner, Trunk Outer)

Each oscillator functions based on a request signal received from the certification ECU, and creates a key actuation area that is used to detect the presence of a key.

The actuation area formed by the front door oscillator and trunk outer oscillator is approximately 0.7 to 1.0 m (2.3 to 3.3 ft.) from the outside handle of the front doors, or the center of the rear bumper.

- The actuation area of each door oscillator is formed by transmitting a request signal every 0.25 seconds while the engine switch is OFF and each door is locked. In this way it detects the proximity of a key. When locking the door using the lock switch on the outer door handle, the actuation area is formed when the lock switch is pressed.
- The actuation area of the trunk outer oscillator is formed when the trunk open switch is ON. It is formed twice to allow the key to be verified.
- The actuation area of the front and rear room oscillator is formed when the driver door is opened or closed, when the start button is pressed, when a warning is activated, or when the lock switch is ON.
- The actuation area of the trunk inner oscillator forms when the trunk lid is closed or the trunk open switch is pressed, and is formed twice to allow the key to be verified.

5. Entry Function Operation

General

The entry function has the following functions.

Function	Outline
Mechanical Key [See page BE-140]	The operation is same as a usual mechanical key.
Wireless Door Lock Remote Control [See page BE-142]	This function is a convenient system for locking and unlocking all the doors or trunk, at a distance. The operation is same as wireless door lock remote control system.
Entry Illumination [See page BE-142]	When a key enters the actuation area of any door oscillator, the foot light, the front interior lights, courtesy lights (for rear passenger seat), and engine switch illumination illuminate.
Entry Unlock [See page BE-143]	When a key is located in the actuation area any door oscillator, the door will unlock after the inside of an outside door handle is touched.
Entry Unlock Mode Switching [See page BE-144]	Allows selection of one of two modes that can be operated with the entry unlock function. ● Driver Door Mode ● All Door Mode
Entry Lock [See page BE-145]	When a key is located in the actuation area of any door oscillator and the power source is OFF, the door can be locked by merely pressing the lock switch on the outside door handle.
Trunk Open [See page BE-146]	When a key is in the actuation area of the trunk outer oscillator, the trunk can be opened by merely pressing the trunk open switch.
Window Close [See page BE-147]	With the key in the actuation area of any door oscillators, all open windows are closed when the lock switch on the door outside handle is pressed for 3 seconds or more.
Memory Call [See page BE-148]	This function operates the driving position memory system in accordance with key ID.
Prevention of Key Confinement [See page BE-152]	● Prevents the confinement of the key in the vehicle by the door being locked with the outside door handle while the key is still inside the vehicle. ● If the trunk lid is closed while the key is still in the luggage compartment, the warning buzzer sounds. If the trunk open switch is operated for 2 seconds during this period, the trunk lid can be opened.
Warning [See page BE-154]	When any of the situations below occur, the smart access system causes the certification ECU to sound the buzzer in the combination meter and the wireless door lock buzzer, and indicate a warning on the multi-information display in order to alert the driver. ● An exit warning if the shift lever is in a position other than “P” and the power source is a mode other than “OFF”. ● An exit warning if the shift lever is in “P” and the power source is a mode other than “OFF”. ● A warning if the occupant leaves with the key in inappropriate circumstances. ● A warning if the engine switch is operated while the key is outside the actuation area. ● A warning if the entry lock button on the door handle is operated while the key is inside the vehicle. ● A warning if the key battery is weak.
Battery Saving [See page BE-164]	If the key remains within the actuation area of any door oscillator, the system maintains periodic communication with key. Therefore, if the vehicle remains parked in that state for a long time, the key battery and the vehicle battery could be drained.
Key Cancel [See page BE-165]	The following key functions can be cancelled by following certain procedures. ● Entry Unlock/Lock ● Trunk Open ● Memory Call ● Prevention of Key Confinement ● Warning
Key Code Registration [See page BE-165]	A total of four keys can be registered. Enables the registering (writing and storing) of transmitter recognition codes in the EEPROM that is contained in the certification ECU.

Wireless Door Lock Remote Control Function

The wireless door lock remote control function has the following functions:

Function	Outline
All Doors Lock	Pressing the LOCK button of the transmitter locks all doors.
All Doors Unlock	Pressing the UNLOCK button of the transmitter (key) unlocks all doors.
All Doors Unlock (2-step Unlock)* ¹	Pressing the UNLOCK button of the transmitter once unlocks the driver's door, and pressing it again within three seconds unlocks all the doors.
Trunk Opener* ¹	Keeping the TRUNK button of the transmitter pressed longer than about 1 second opens the trunk lid.
Answer Back* ¹	The hazard light flashes once when locking, and flashes twice when unlocking, to indicate that the operation has been completed.
Panic Alarm	Keeping the PANIC button of the transmitter pressed longer than about 0.8 of a second causes the following functions of the alarm to activate. ● Sounds the horn and security horn. ● Flashes the hazard lights, headlights, and taillights. ● Illuminates the front interior light (If the interior light Switch is in the DOOR position).
Automatic Lock* ¹	If none of the doors are opened within 30 seconds* ² /60 seconds* ³ of being unlocked by the wireless door lock remote control, all the doors will be locked again automatically.
Door Ajar Warning* ¹	If any door is open or ajar, pressing the LOCK button of the transmitter will cause the wireless door lock buzzer to sound for about ten seconds.
Repeat	If a door is not locked in response to the locking operation of the transmitter, the integration relay will output a lock signal after approximately 1 second.
Illuminated Entry	When all the doors are locked, pressing the UNLOCK button causes the interior lights to illuminate simultaneously with the unlock operation.
Security	Sends an operation signal as a rolling code.
Wireless Buzzer	The wireless door lock buzzer sounds when the theft deterrent system performs warning operations.

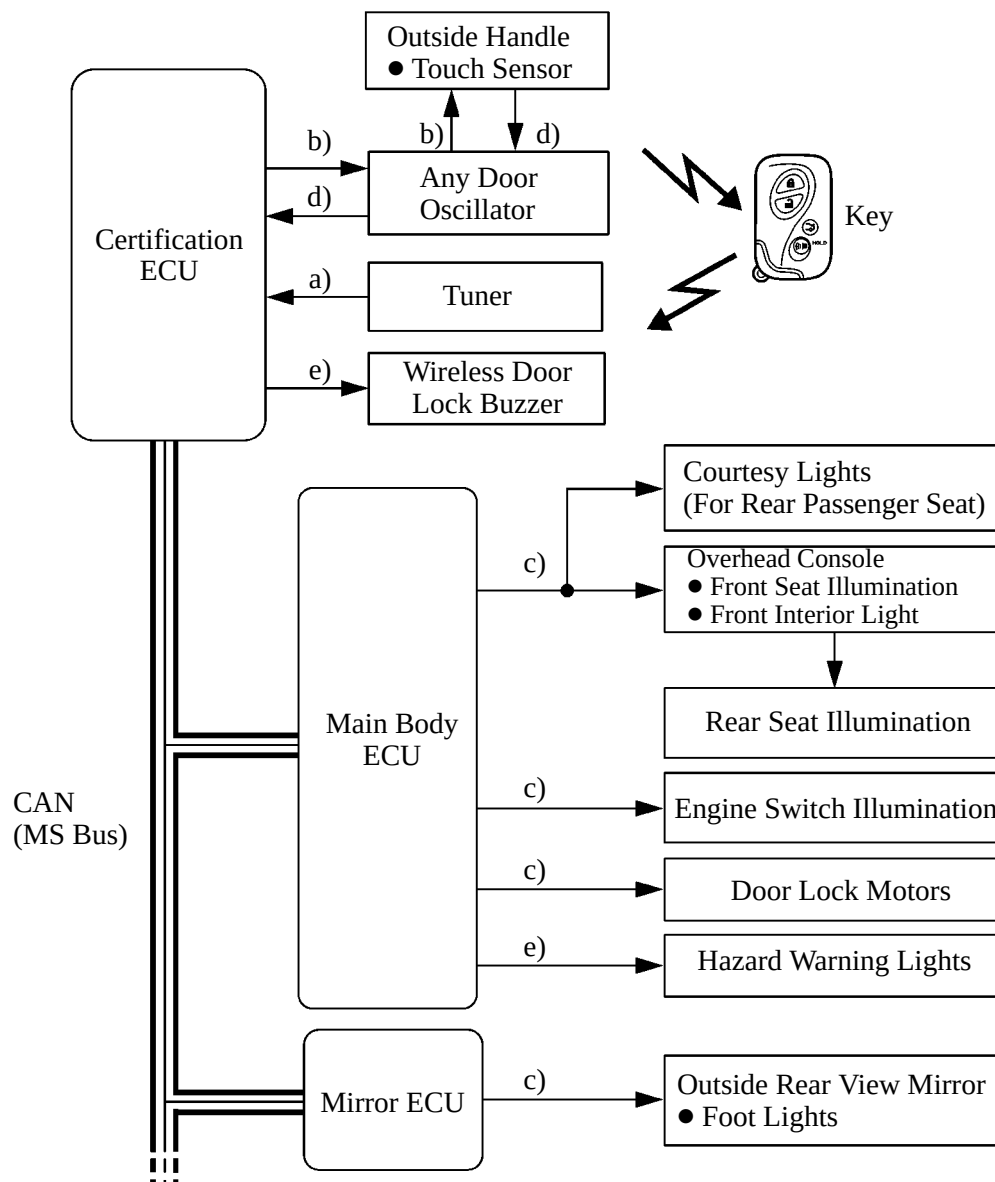
*¹: The function setting can be changed using the customized body electronics system. For details, refer to Customized Body Electronics System section on page BE-14.

*²: Except U.S.A and Canadian Package Models

*³: Only for U.S.A and Canadian Package Models

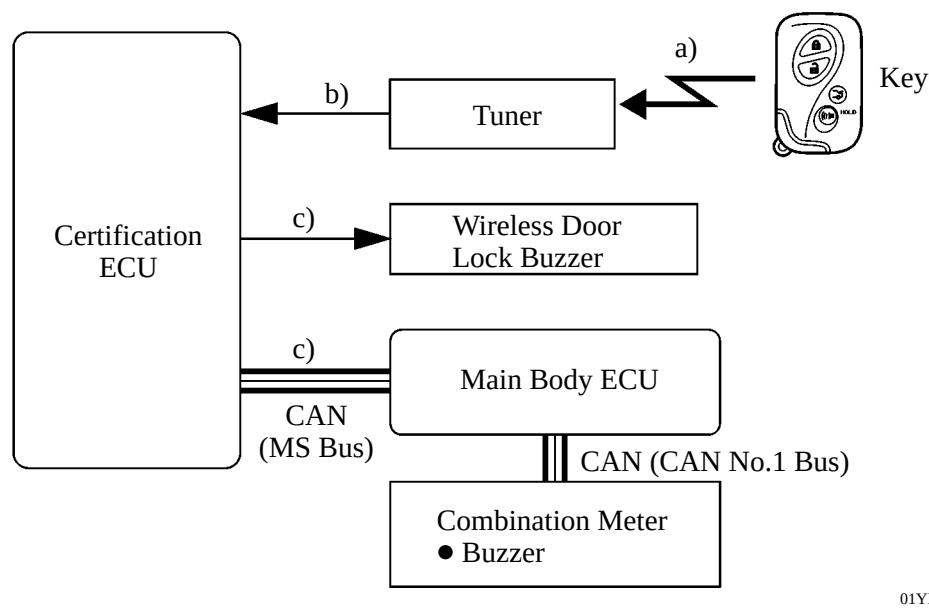
Entry Unlock

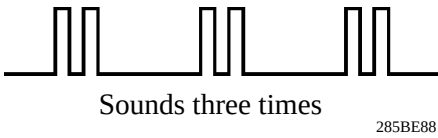
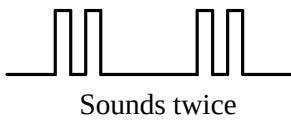
- When a key enters the actuation area of any door oscillator, the certification ECU judges and certifies the key ID code received from the tuner.
- After the key certification OK is confirmed, the certification ECU transmits an unlock stand-by signal to the touch sensor of the relevant door.
- At the same time, the certification ECU transmits the lighting signals to the foot lights on the outside rear view mirror and interior lights (engine switch illumination, front interior light, front and rear seat illumination, and courtesy lights [for rear passenger seat]), and turns ON these illuminations (Entry Illumination Function).
- If the touch sensor is touched during this condition, the certification ECU transmits a door unlock signal to the main body ECU, and unlocks the door.
- The certification ECU sounds the wireless door lock buzzer twice and main body ECU blinks the hazard warning light twice as an answerback for entry unlock.



Entry Unlock Mode Switching

- a) When the power source is OFF, press the lock button and one of the other three buttons on the key at the same time for approximately 5 seconds while the key is in the actuation area.
- b) The certification ECU receives this signal from the tuner and switches the entry unlock mode.
- c) The certification ECU sounds the wireless door lock buzzer and the buzzer of the combination meter to inform the user that the mode has been switched.
- d) If the entry unlock mode needs to be switched again, press the lock button and one of the other three buttons on the key at the same time for approximately 5 seconds after the LED of the key goes off.

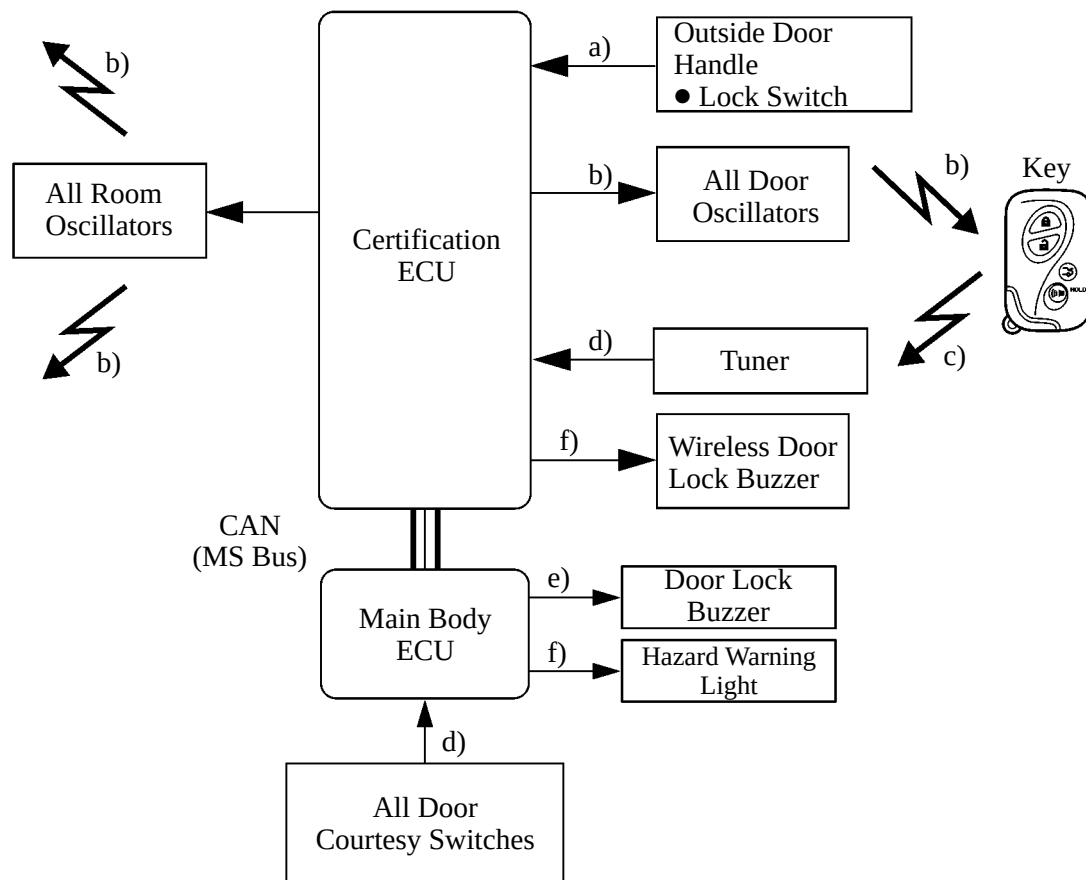


Mode	Wireless Door Lock Buzzer	Buzzer in Combination Meter
Driver Door (Default)		Sounds once
All Doors (Customized)		Sounds once

NOTE: This function only switches the entry unlock mode of the smart access system. It is not applied to the unlock function using the wireless door lock remote control.

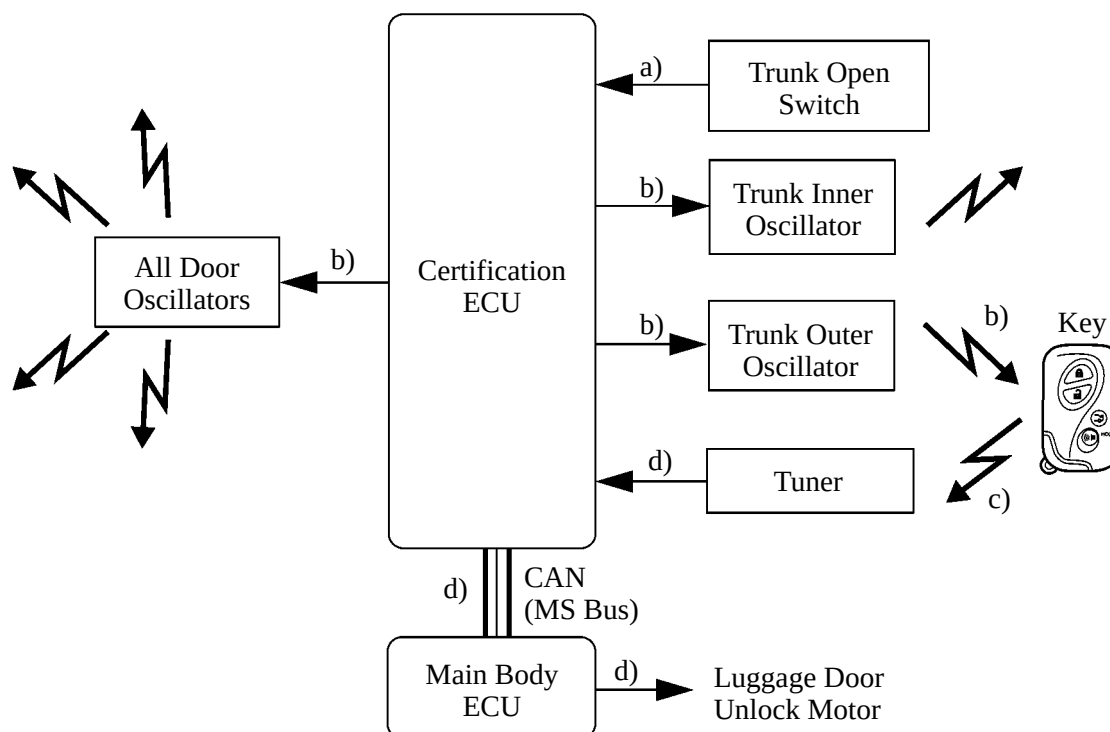
Entry Lock Function

- This signal is transmitted to the certification ECU when the driver (who has the key in their possession), exits the vehicle and presses the lock switch on the outside door handle.
- The Certification ECU transmits a request signal for all door and room oscillators to form actuation areas.
- The key receives this signal and returns the ID code to the tuner.
- The certification ECU judges and certifies the ID code from the tuner. It then checks the location of the key and, if all the doors are closed, the ECU transmits a door lock signal to the main body ECU.
- The main body ECU receives this signal and actuates the door lock motors to lock the doors.
- The main body ECU blinks hazard warning lights once and the certification ECU sounds the wireless door lock buzzer once as an answerback for the entry lock function.



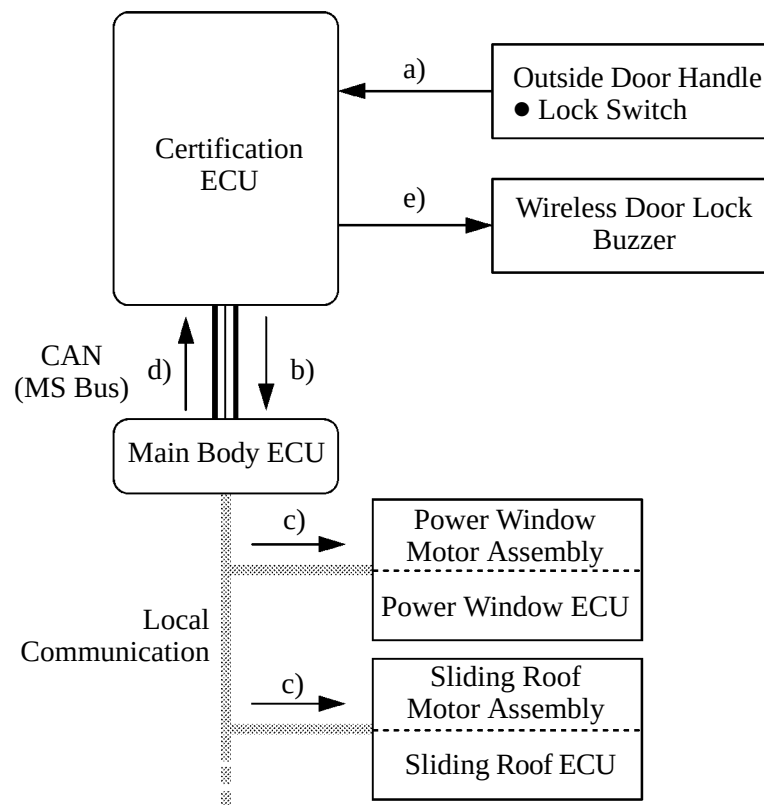
Trunk Open Function

- a) This signal is transmitted to the certification ECU when the driver (who has the key in their possession) pushes the trunk open switch on the outside of the trunk lid.
- b) The certification ECU transmits a request signal for all the room, trunk inner and outer oscillators to form actuation areas.
- c) The key receives this signal and returns the ID code to the tuner.
- d) The certification ECU judges and certifies the ID code, and checks the location of the key. The ECU transmits a trunk open signal to the main body ECU.
- e) The main body ECU receives this signal and actuates the luggage door unlock motor to open the trunk.



Window Close Function

- a) After all the doors are locked, when the driver keeps pressing the lock switch on the outside door handle for approximately 3 seconds, the certification ECU receives door lock switch ON signals continuously.
- b) The certification ECU transmits these signals to the main body ECU.
- c) The main body ECU transmits the window close request signals to the power window ECU built into the power window motor assembly and sliding roof ECU built into the sliding roof motor assembly. These ECUs operate their motors to close windows.
- d) After all the windows are closed, the main body ECU receives the full close signals from the power window ECU and the sliding roof ECU, and transmits these signals to the certification ECU.
- e) The certification ECU receives the signals from the main body ECU and sounds the wireless door lock buzzer as an answer back for the window close function.



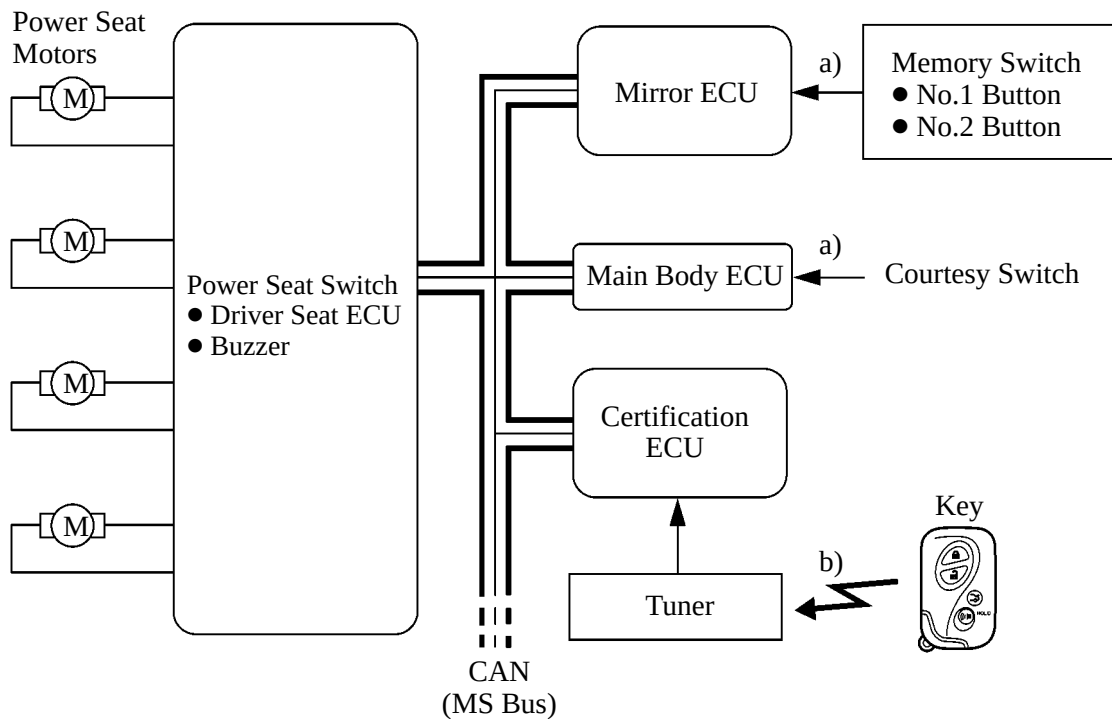
Memory Call Function**1) General**

The memory call function using a key utilizes the key ID to restore the seat position (driving position memory system), and outside rear view mirror position, automatically, which increases driver convenience.

Condition	Outline
Memory Registration	When all the following conditions are met, the key ID is recorded. ● Power source is “OFF”. ● Driver door closed. ● Memory No. (1 or 2) button pressed and held. ● LOCK or UNLOCK button in the key pressed and held.
Memory Call Operation	After the door is unlocked using the function of the smart access system or the wireless door lock remote control function, if the driver door is opened, the memory call function is operated.
Memory Call Cancel	When all the following conditions are met, the memory call function can be disabled. ● Power source is “OFF”. ● Driver door closed. ● SET button pressed and held. ● LOCK or UNLOCK button on the key is pressed and held.

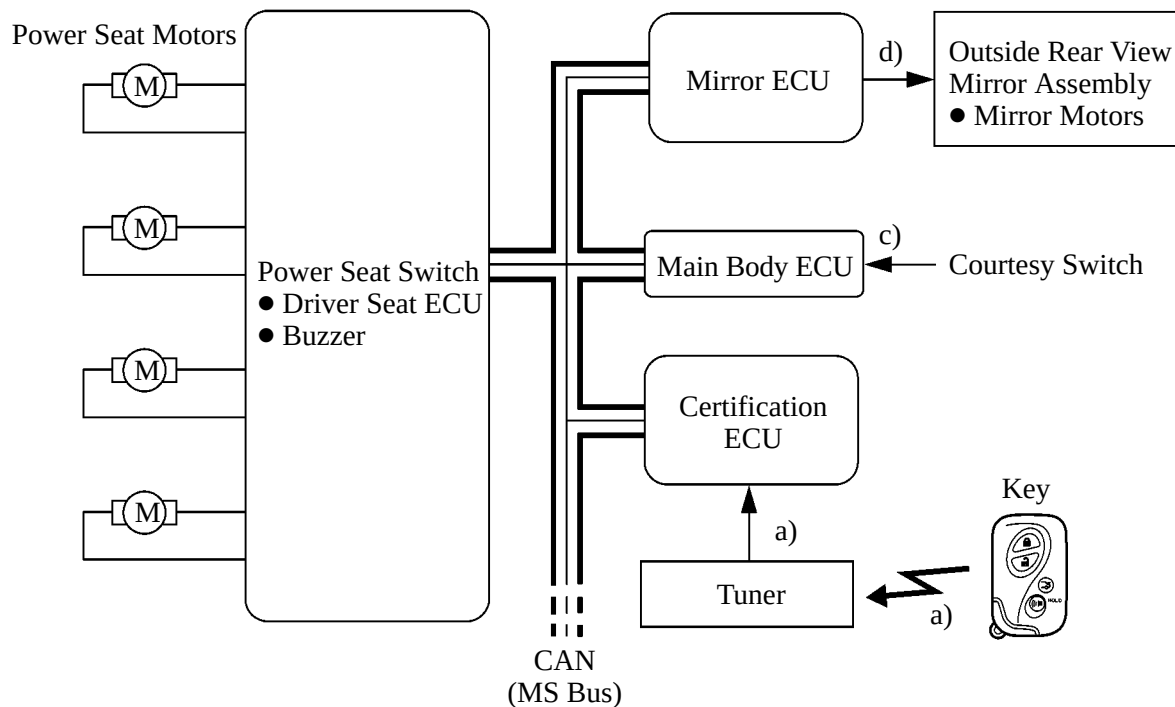
2) Memory Registration

- a) The driver seat ECU enters the key ID registration mode (linking mode), if the seat memory No.1 or No.2 button is pressed with the power source OFF and driver door closed.
- b) In this condition, when the LOCK or UNLOCK button on the key is pressed, the key ID is transmitted from certification ECU to the driver seat ECU.
- c) The driver seat ECU records the key ID and each position into the memory.
- d) When the driver seat ECU completes recording, it beeps the buzzer in the driver seat ECU once as an answer back.



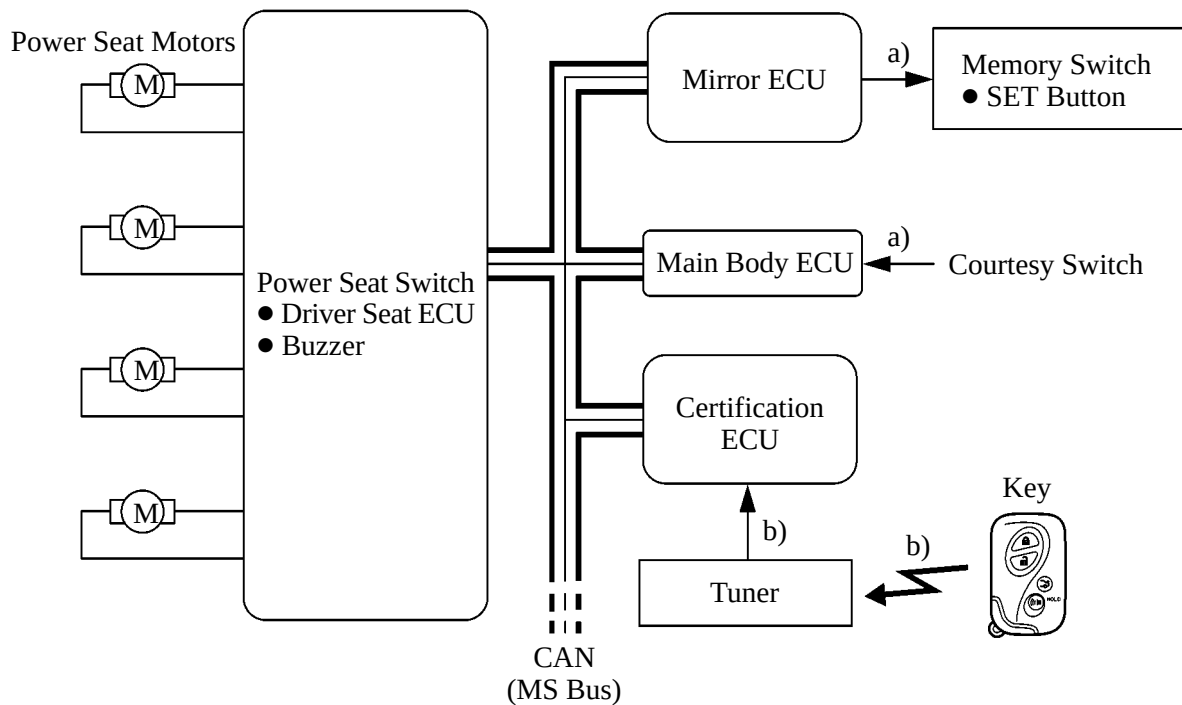
3) Memory Call Operation

- When the UNLOCK button on the key is pressed or the key enters the actuation area, the key ID is input to certification ECU through the tuner.
- The certification ECU transmits the key ID to the driver seat ECU.
- If the driver door is opened, the driver seat ECU outputs a key ID memory restoration signal from certification ECU to each ECU and activates the drive seat motors.
- When each ECU receives this signal, it activates each actuator.



4) Memory Call Cancel

- a) If the SET button is pressed when the power source is OFF and the driver door is closed, the driver seat ECU enters the memory call cancel mode.
- b) In this condition, when LOCK or UNLOCK button in a key is pressed, the key ID is transmitted from certification ECU to the driver seat ECU.
- c) If the key ID has already been registered, the driver seat ECU will cancel the key ID memory call function. To perform the key ID memory call function again, it is necessary to register the key ID.
- d) When the driver seat ECU completes switching, it beeps the buzzer in the driver seat ECU twice as an answer back.



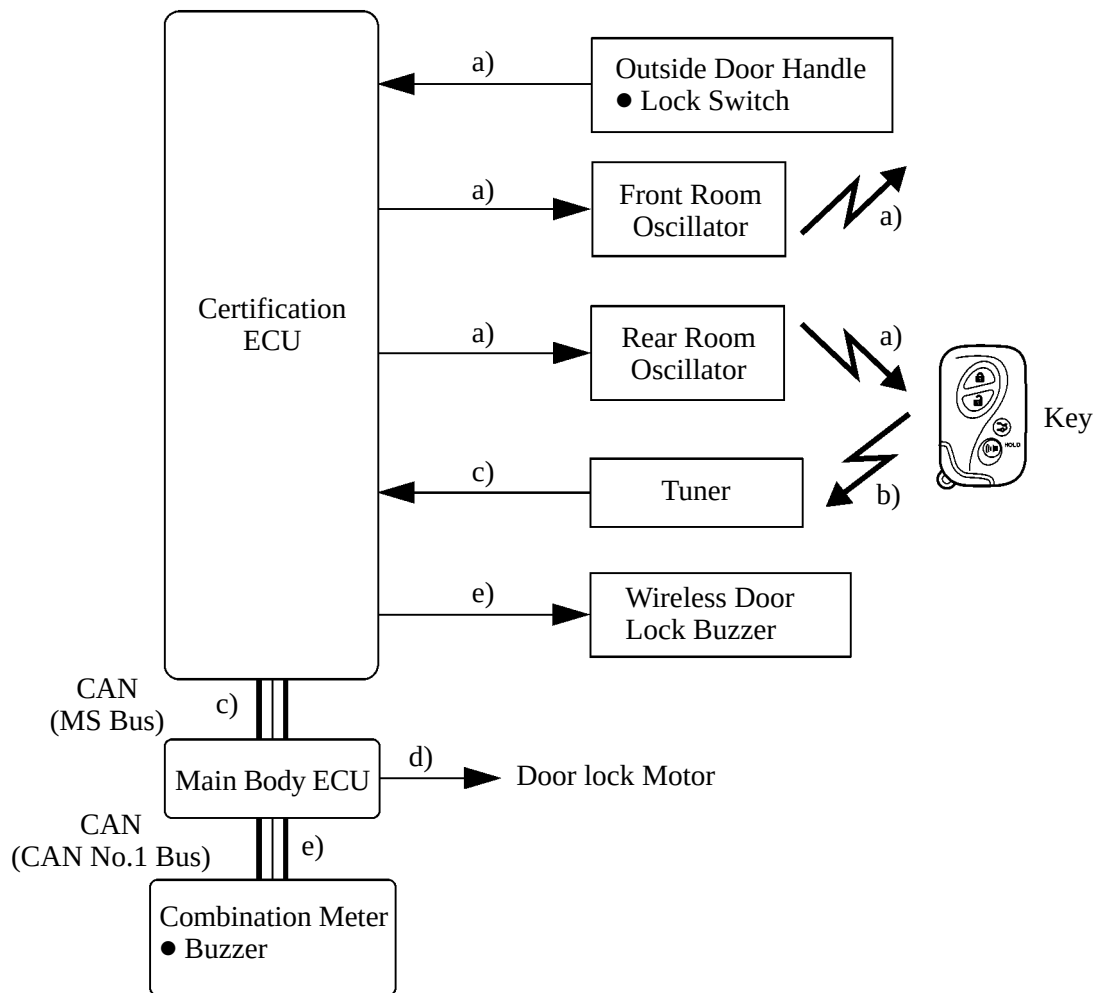
Prevention of Key Confinement

1) General

This function has two system operations: inside room (cabin) and inside luggage compartment.

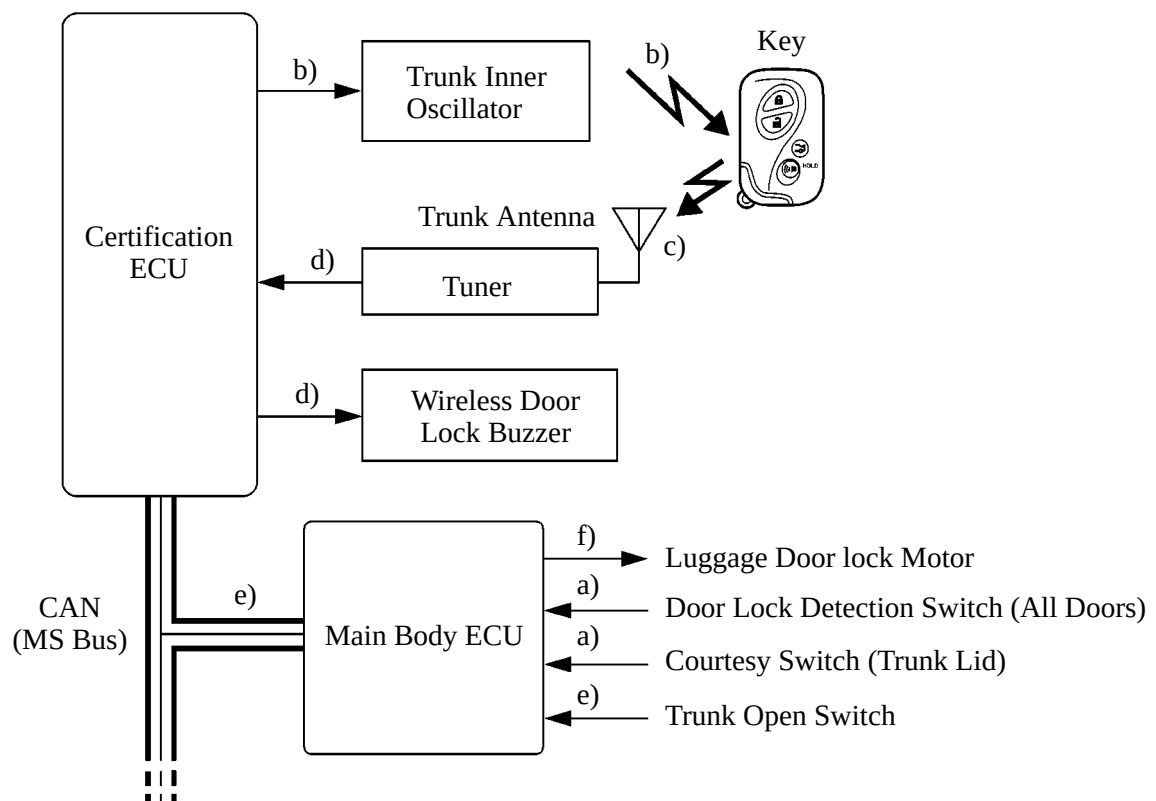
2) Inside Room

- a) When the door is locked with the outside door handle while the key is still inside the vehicle, the certification ECU receives this signal and transmits a request signal for the front and rear room oscillators to form an actuation area.
- b) The key receives this signal and returns the ID code to the tuner.
- c) The certification ECU judges and certifies the ID code, and checks the location of the key. The ECU transmits a door unlock signal to the main body ECU.
- d) The main body ECU receives the signal and operates each door lock motor to unlock the doors.
- e) The certification ECU sounds the wireless door lock buzzer and the buzzer of the combination meter as an answerback for the unlock function that was performed.



3) Inside Luggage Room

- a) When the trunk lid is closed while the key is still inside the luggage room and all doors are locked, the certification ECU recognizes that a trunk lid close condition has occurred based on signals from the main body ECU.
- b) The certification ECU receives this signal, and transmits a request signal for the trunk inner oscillator to form an actuation area.
- c) The key receives this signal and returns the ID code to the tuner.
- d) The certification ECU judges and certifies the ID code, and checks the location of the key. The ECU sounds the wireless door lock buzzer for 2 seconds to inform the driver.
- e) If the trunk open switch is turned ON (pressed) while the key is inside the luggage room, the certification ECU sends another request signal for the trunk inner oscillator to form an actuation area. The ECU judges and certifies the key and checks its location, before transmitting a trunk open signal to the main body ECU.
- f) The main body ECU receives the signal and operates the luggage door lock motor to open the trunk.



Warning**1) General**

When any of the situations below occur, the smart access system with push-button start causes the certification ECU to sound a buzzer in the combination meter and the wireless door lock buzzer, and illuminate the multi-information display in order to alert the driver.

Situation	Condition
A	The engine is left running and the shift lever is in a position other than P when the driver gets out of the vehicle.
B	The key is left in the vehicle.
C	The engine is left running and the shift lever is in the P position when the driver gets out of the vehicle.
D	A door is ajar.
E	The engine is left running when a passenger gets out of the vehicle holding the key.
F	The key is not within the actuation areas.
G	The key is left in the cabin.
H	The key is left in the luggage room.
I	The key battery is weak.
J	Steering lock does not release.
K	The steering lock mechanism is malfunctioning.
L	The main body ECU is malfunctioning.
M	An engine start method is displayed.

2) Situation: A

There are two patterns for situation A.

- Pattern 1: When the engine is left running and the shift lever is in a position other than P, the driver opens the door and attempts to get out of the vehicle.
- Pattern 2: Under the conditions of pattern 1, the driver closes the door and attempts to leave the vehicle holding the key.

In these situations, the following control is performed:

Pattern 1.

Possible Effects without Warning		Sudden vehicle start, Vehicle theft, Vehicle roll-away
Warning Condition		The warning is activated when all of the following conditions are met: ● Power source is in a mode other than “OFF”. ● Shift lever is in any position except “P”. ● Vehicle speed is 0 mph (0 km/h). ● Driver door is opened.
Combination Meter	Buzzer	Continuous sound
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 3 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: ● Power source is “OFF”. ● Shift lever is in the “P” position. ● Vehicle speed is above 0 mph (0 km/h). ● Driver door is closed.

Pattern 2.

Possible Effects without Warning		Sudden vehicle start, Vehicle theft, Vehicle roll-away
Warning Condition		The warning is activated when all of the following conditions are met: ● Shift lever is in any position except “P”. ● Power source is in a mode other than “OFF”. ● Vehicle speed is 0 mph (0 km/h). ● Key is not in the vehicle. ● Driver door is opened → closed.
Combination Meter	Buzzer	Continuous sound
	Multi-information Display	The following warnings are alternately displayed:  01YBE83TE  01YBE84TE
	Master Warning Light	Flash
Wireless Door Lock Buzzer		Sounds continuously
Engine Switch Indicator Light		—

Warning Stop Condition	Key is in the vehicle.
	- The wireless door lock buzzer stops. - Multi-information Display:  01YBE83TE
	Vehicle speed is above 0 mph (0 km/h).
	- The wireless door lock buzzer stops. - Multi-information Display:  01YBE84TE
Power source is “OFF”.	
All warning operations stop.	

3) Situation: B

There are two patterns for situation B.

- Pattern 1: When the driver’s door is open, the driver changes the power source mode to ACC and attempts to leave the vehicle.
- Pattern 2: When the driver’s door is open, the driver changes the power source mode from ON to OFF and attempts to leave the vehicle.

In these situations, the following control is performed:

Pattern 1. and Pattern 2.

Possible Effects without Warning		Vehicle theft
Warning Condition		The warning is activated when one of the following conditions is met: - Power source is in “ACC” mode and the driver door is opened. - Power source is in “OFF” mode the steering is unlocked, and the driver door is opened.
Combination Meter	Buzzer	Continues to sound at short and even intervals
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: - Power source is in “ON ” mode. - Driver door is closed. - Power source is in “OFF” mode and the steering is locked.

4) Situation: C

There are two patterns for situation C.

- Pattern 1: When the engine is left running and the shift lever is in the P position, the driver closes the driver's door and attempts to leave the vehicle while holding the key.
- Pattern 2: Under the conditions of pattern 1, the driver presses the lock switch on the door outside handle.

In these situations, the following control is performed:

Pattern 1.

Possible Effects without Warning		Vehicle theft, Engine cannot be restarted, Discharged battery
Warning Condition		The warning is activated when all of the following conditions are met: ● Shift lever is "P". ● Power source is in a mode other than "OFF". ● Key is not in the vehicle. ● Driver door is opened → closed.
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 01YBE84TE
	Master Warning Light	Flash
Wireless Door Lock Buzzer		Sounds three times
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: ● Power source is "OFF". ● Key is in the vehicle.

Pattern 2.

Possible Effects without Warning		Vehicle theft, Discharged battery
Warning Condition		The warning is activated when all of the following conditions are met: ● Shift lever is “P”. ● Power source is in a mode other than “OFF”. ● All doors are closed. ● The key is outside the vehicle (within one of the actuation areas).
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 2 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: ● The power source is OFF and the key is not within the actuation areas. ● Key is in the vehicle.

5) Situation: D

The lock switch on the door outside handle is pressed to perform entry lock with a door open. In this situation, the following control is performed:

Possible Effects without Warning		Vehicle theft
Warning Condition		The warning is activated when all of the following conditions are met: ● Power source is “OFF”. ● Any doors are opened. ● Entry lock button on the outer door handle is operated.
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds continuously
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: ● Power source is in a mode other than “OFF” ● All doors are closed. ● Wireless door lock remote function is unlocked. ● Entry unlock is operated ● 10 seconds have elapsed since the wireless door lock buzzer was activated.

6) Situation: E

When the engine is left running, a passenger leaves the vehicle holding the key.
In this situation, the following control is performed:

Possible Effects without Warning		Engine cannot be restarted
Warning Condition		The warning is activated when all of the following conditions are met: ● Power source is in a mode other than “OFF”. ● Door except driver door is opened → closed. ● Vehicle speed is 0 mph (0 km/h). ● Key is not in the vehicle.
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 01YBE84TE
	Master Warning Light	Flash
Wireless Door Lock Buzzer		Sounds 3 times
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: ● Power source is “OFF”. ● Vehicle speed is above 0 mph (0 km/h). ● Key is in the vehicle.

7) Situation: F

When the key is not in the cabin or the key battery is dead, the driver attempts to start the engine or change the power mode to ON.

In this situation, the following control is performed:

Possible Effects without Warning		Confuses the user
Warning Condition		The warning is activated when all of the following conditions are met: ● Engine switch is pushed. ● Key is not in the vehicle.
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 01YBE84TE Displayed for 8 seconds (and then automatically turned off)
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		Check if the key is in the detection area. If the key is in the detection area, press the wireless door lock switch and confirm that the indicator comes on. If the indicator does not come on, replace the key battery with a new one.

8) Situation: G

The lock switch on the door outside handle is pressed to perform entry lock with the key left in the cabin.
In this situation, the following control is performed:

Possible Effects without Warning		Vehicle theft
Warning Condition		The warning is activated when all of the following conditions are met: ● Power source is “OFF”. ● All doors are closed. ● Key is in the vehicle. ● Lock switch on the door outside handle switch is “ON”.
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 2 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		The key is removed from the cabin and the lock switch on the door outside handle is pressed again.

9) Situation: H

The luggage door is closed with the key left in the luggage room.
In this situation, the following control is performed:

Possible Effects without Warning		Key Confinement
Warning Condition		The warning is activated when all of the following conditions are met: ● Vehicle speed is 0 mph (0 km/h). ● All doors are closed. ● Trunk open function is available.
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		Sounds for 2 seconds
Engine Switch Indicator Light		—
Warning Stop Condition		The luggage room is opened using the trunk open function and the key is removed from the luggage room.

10) Situation: I

The vehicle is driven using a key that has a low battery.

In this situation, the following control is performed:

Possible Effects without Warning		Smart access system does not function
Warning Condition		The warning is activated when all of the following conditions are met: ● Power source switches to OFF after being left in IG-ON for over 20 minutes. ● Key battery voltage is low. ● Key is in the vehicle.
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 01YBE85TE
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		The key battery is replaced with a new one.

11) Situation: J

Steering lock cannot be released.

In this situation, the following control is performed:

Possible Effects without Warning		Steering usability function
Warning Condition		The steering lock cannot be released, thus the engine is prevented from starting.
Combination Meter	Buzzer	—
	Multi-information Display	 01YBE86TE Displayed for 15 seconds (and then automatically turned off)
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		The green indicator blinks at 1-second intervals (goes off automatically in 15 seconds).
Warning Stop Condition		The engine switch is pressed while the steering wheel is turned left and right, and the steering lock successfully disengages.

12) Situation: K

A malfunction of the steering lock ECU is detected.

In this situation, the following control is performed:

Possible Effects without Warning		Malfunction detection
Warning Condition		A malfunction of the steering lock ECU is detected.
Combination Meter	Buzzer	—
	Multi-information Display	
	Master Warning Light	Flash
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		The amber indicator blinks at 2-second intervals.
Warning Stop Condition		The steering lock ECU returns to normal.

13) Situation: L

A malfunction of the main body ECU is detected.

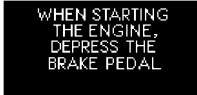
In this situation, the following control is performed:

Possible Effects without Warning		Malfunction detection
Warning Condition		A malfunction in the main body ECU is detected.
Combination Meter	Buzzer	—
	Multi-information Display	—
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		The amber indicator blinks at 2-second intervals.
Warning Stop Condition		The main body ECU returns to normal.

14) Situation: M

A warning message appears on the meter when the driver does not follow the proper procedure to start the vehicle.

In this situation, the following control is performed:

Possible Effects without Warning		Usability function
Warning Condition		The warning is activated when under all of the following conditions: ● Power source is in a mode other than “ON”. ● Any doors are closed → opened. ● The power source is changed from OFF to ACC more than once with the engine off and brake pedal not depressed.
Combination Meter	Buzzer	Sounds once
	Multi-information Display	 01YBE149TE
	Master Warning Light	—
Wireless Door Lock Buzzer		—
Engine Switch Indicator Light		—
Warning Stop Condition		The warning is stopped when one of the following conditions is met: ● 10 seconds have elapsed since a warning message was displayed. ● The engine switch is pushed with the brake pedal depressed.

Battery Saving

1) Vehicle Battery Saving Function

In the smart access system with push button start, signals are emitted outside the vehicle at a prescribed interval (250 msec.) when the doors are locked. Therefore, the vehicle battery could be drained if the vehicle remains parked for a long time. For this reason, the controls listed below are effected.

Condition	Control
No response from key for more than 5 days	Signal transmission interval is extended from 250 msec. to 750 msec.
No response from key for more than 14 days	Automatically deactivates the smart access system.

► Reinstatement Conditions ◀

- A wireless door lock remote control signal (lock, unlock, or trunk lid open) is input and the ID matches.
- A user carries the key and pushes a lock switch signal for the outside door handle.
- A door is locked or unlocked using the mechanical key.

2) Key Battery and Vehicle Battery Saving Function

In the smart access system with push button start, if the key is constantly located within the vehicle exterior actuation area of the doors, the system will maintain periodic communication with the key. Therefore, if the vehicle remains parked in that state for a long time, the key battery and the vehicle battery could be drained.

For this reason, if this state continues longer than 10 minutes, the smart access system with push button start automatically becomes deactivated.

► Reinstatement Conditions ◀

- A wireless door lock remote control signal (lock, unlock, or trunk lid open) is input and the ID matches.
- A user who has the key in their possession pushes a lock switch signal on an outside handle.
- A door is locked or unlocked using the mechanical key.

Key Cancel

Key cancel is operated when certain operations are performed with the vehicle in the following condition:

- Power source is OFF.
- Driver door is closed.
- Driver door is unlocked.

The operation procedure is as follows:

- 1) Unlock once with the UNLOCK button of the key.
- 2) Open the driver door within 5 seconds.
- 3) Unlock twice with the UNLOCK button of the key within 5 seconds.
- 4) Repeat open → close twice for the driver door within 30 seconds, and open again.
(Driver Door: Open → Close → Open → Close → Open)
- 5) Unlock twice with the UNLOCK button of the key within 30 seconds.
- 6) Repeat open → close once for the driver door within 30 seconds, and open again.
(Driver Door: Open → Close → Open)
- 7) Close the driver door within 5 seconds.

When key cancel is activated, the wireless door lock buzzer sounds once.

To return to the original condition, perform the procedures again. When key cancel is returned, the wireless door lock buzzer sounds twice.

Key Code Registration Function

The table below shows the four special coded ID registration function modes through which up to four different codes can be registered. The codes are electronically registered (written to and stored) in the EEPROM. For details of the recognition code registration procedure, refer to the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

Mode	Function
Rewrite	Erases all previously registered codes and registers only the newly received codes. This mode is used whenever a transmitter or the integration relay is replaced.
Add	Adds a newly received code while preserving previously registered codes. This mode is used when adding a new transmitter. If the number of codes exceeds 4, the oldest registered code is erased first.
Confirm	Confirms how many codes are currently registered. When adding a new code, this mode is used to check how many codes already exist.
Prohibit	To delete all the registered codes and to prohibit the wireless door lock function. This mode is used when a transmitter (key) is lost.

SMART ACCESS SYSTEM WITH PUSH-BUTTON START

■ DESCRIPTION

The smart access system with push-button start not only has a wireless door lock remote control function and engine immobilizer function, but by carrying the key the following functions (entry function and push button start function) are also possible without having to use a key or transmitter button. It is an extremely convenient system.

- Door unlock/lock (Entry Unlock/Entry Lock Functions)
- The engine can be started by simply pressing the engine switch while depressing the brake pedal (Start Function)
- The trunk can be opened (Trunk Open Function)
- Wireless door lock control function.

This system is standard equipment.

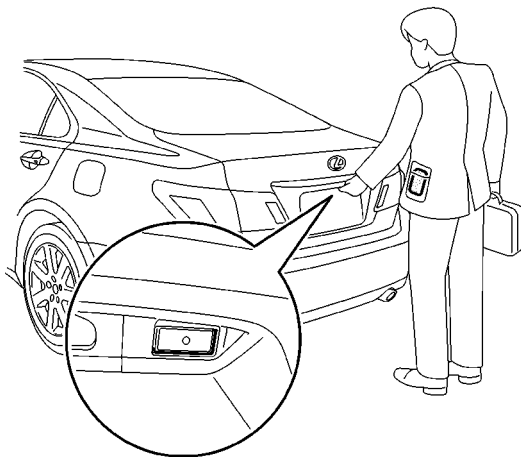
Entry Unlock/Lock Functions



Start Function



Trunk Open Function



■ START FUNCTION

1. General

- While an ignition key must be inserted into the ignition key cylinder and turned from OFF to ACC, IG ON or START position to start the engine of the '06 ES330, the '07 ES350 uses the smart access system with push-button start, which starts the engine when the push-type engine switch is pressed while the brake pedal is depressed and a key is carried by the driver.
- This function has different power source control patterns to suit the state of the brake pedal and shift lever position. For details, see page BE-126.
- Along with the adoption of the start function, an engine cranking hold function is used. For details, see page EG-69.



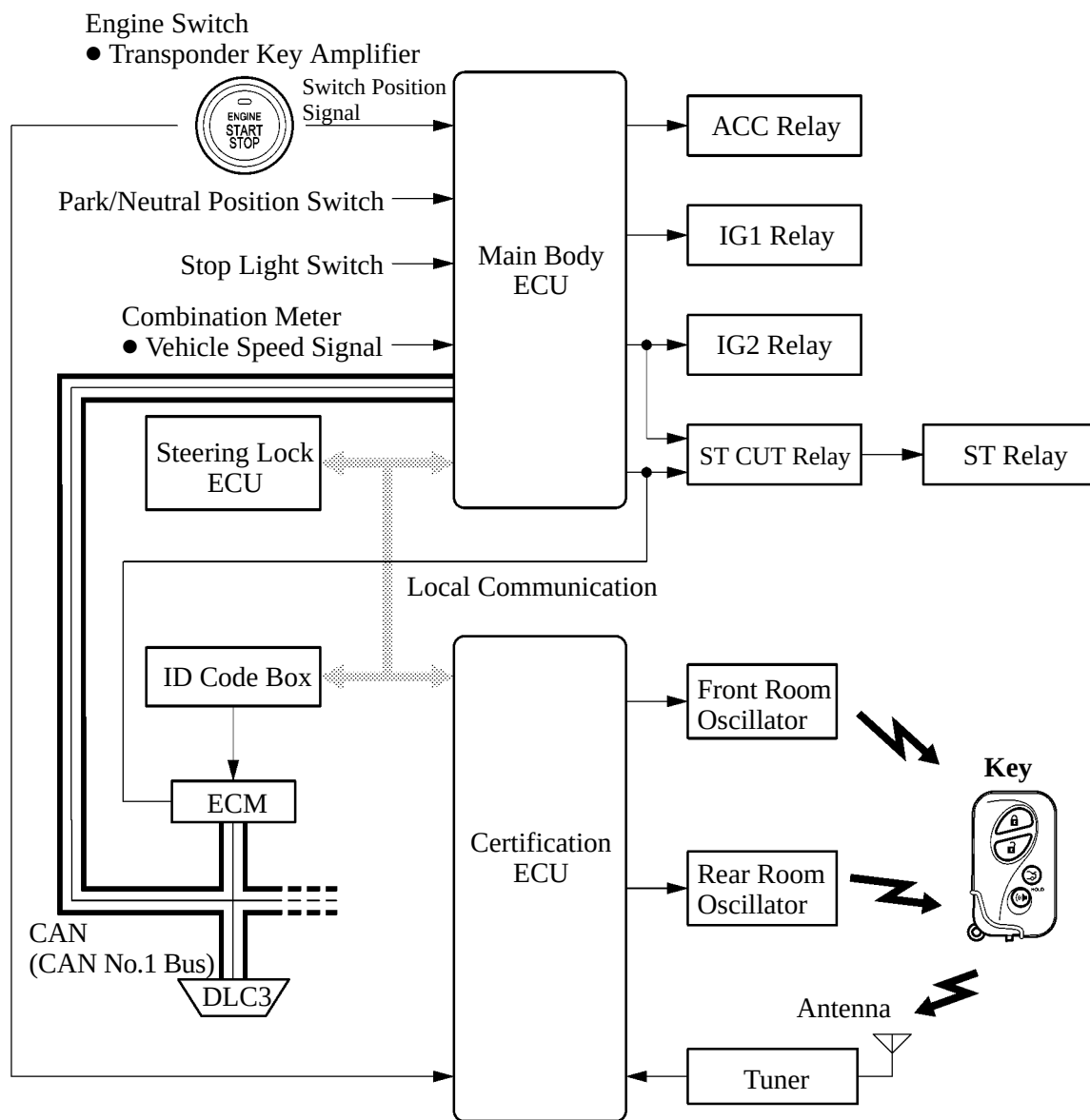
'07 ES350



'06 ES330

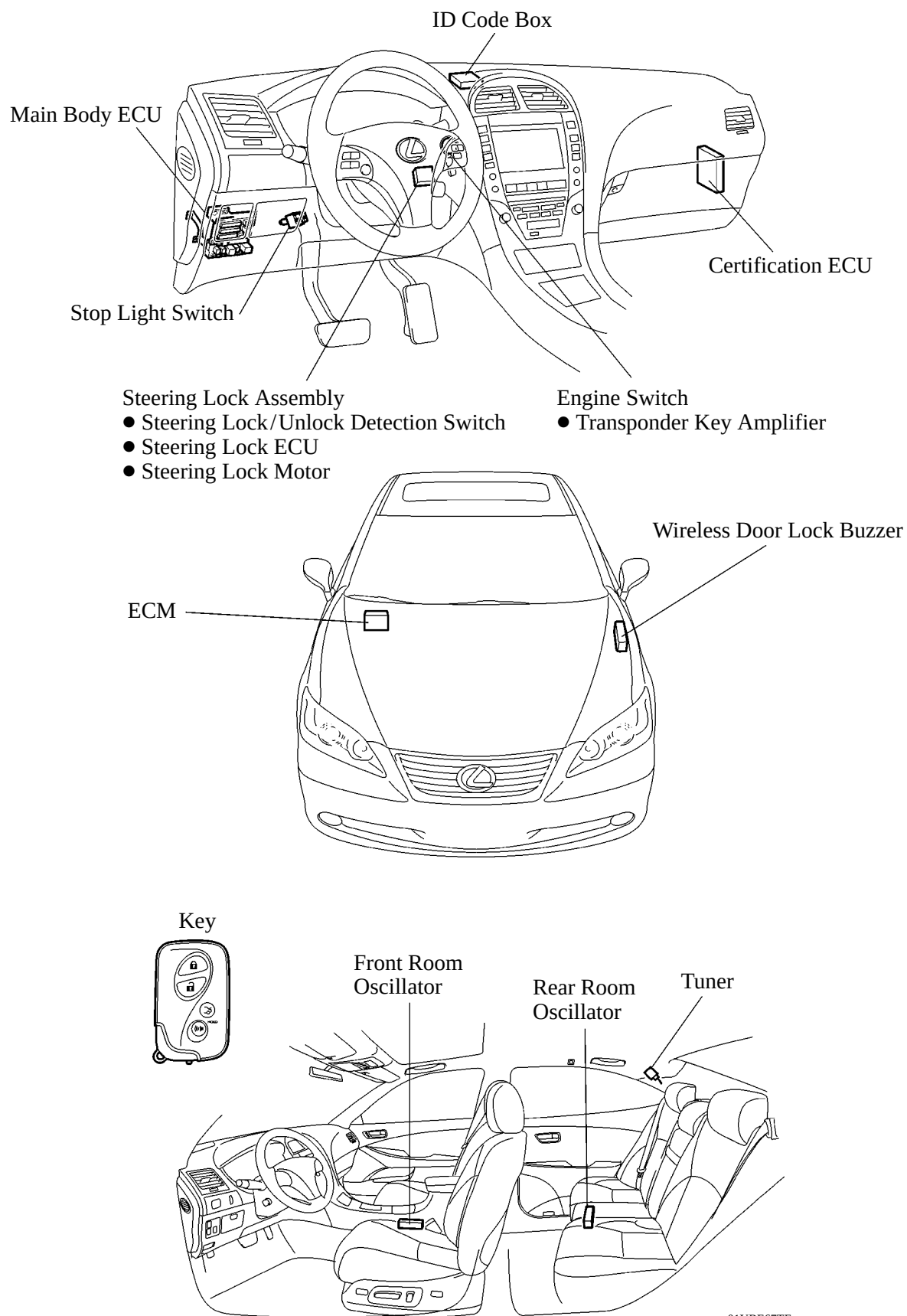
2. System Diagram

The main body ECU controls the push button start function. The system diagram below shows the components that relate to this function.



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3. Layout of Main Components



4. Function of Main Components

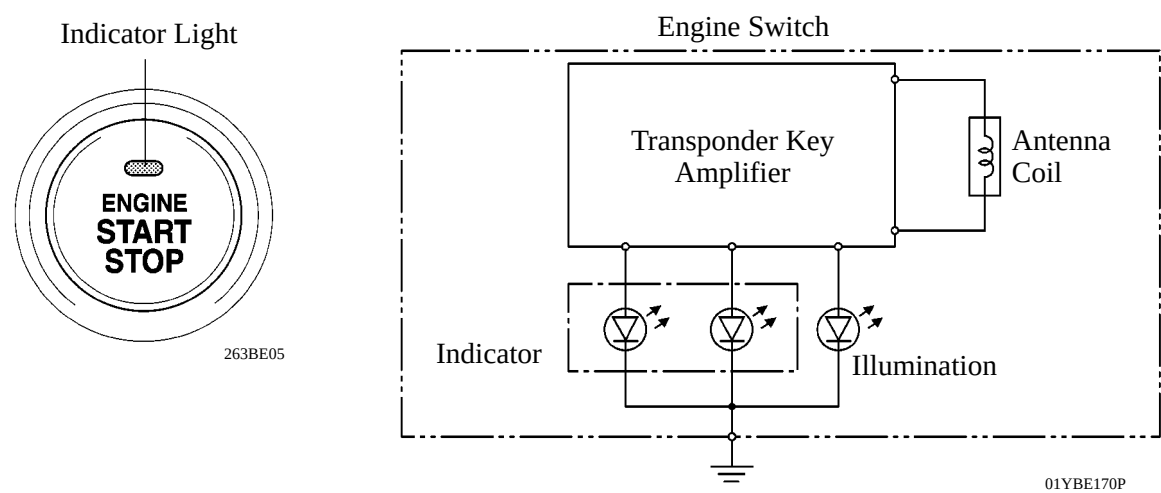
Component		Function
Engine Switch Transponder Key Amplifier		- Transmits the engine switch signal to the main body ECU. - Informs the driver of any power source or system abnormality through the illumination stage of the indicator light. - Receives the ID code and transmits it to the certification ECU when the key battery is too weak to respond to the tuner based on the room oscillators.
Key		Receives the signals from the oscillators and returns the ID code to the tuner. For details, see page BE-140.
Room Oscillator Front and Rear		Receives a request signal from the certification ECU and forms the actuation area in the vehicle interior.
Tuner		Receives the ID code from the key and transmits it to certification ECU.
Main Body ECU		- Switches the power source among four modes (OFF, ACC, IG-ON, START) in accordance with the shift position and the state of the stop light switch. - Controls the push button start system in accordance with the signals received from the switches and each ECU.
Certification ECU		Certifies the ID code received from the tuner and transmits the certification results to the ID code box and steering lock ECU.
Stop Light Switch		Outputs the state of the brake pedal to main body ECU.
ID Code Box		Receives the steering unlock or engine immobilizer disengage signals from the certification ECU, certifies them, and transmits each disengage signal to the steering lock ECU or ECM.
Steering Lock ECU		Receives the steering lock/unlock signal from ID code box, and activates the steering lock motor.
ECM		- Receives the engine start request signal from the main body ECU, turns ON the ST relay, and starts the engine. - Receives the signal from the ID code box and performs engine ignition and injection.
Combination Meter	Multi-information Display	Informs the driver of malfunctions in the push button start system.
	Master Warning Light	Illuminates simultaneously with a buzzer sound to inform the driver of malfunctions in the push button start system.

5. Construction and Operation

Engine Switch

The engine switch consists of a momentary type switch, two color (Amber, Green) LEDs, and transponder key amplifier.

- The amber and green LEDs are for the indicator light.
- The driver can determine the present power source and check whether the engine can start or not in accordance with the illumination state of the indicator light.
- When the main body ECU detects an abnormality with the push button start system, it makes the amber indicator light flash. If the engine is stopped in this state, it might not be possible to restart it.

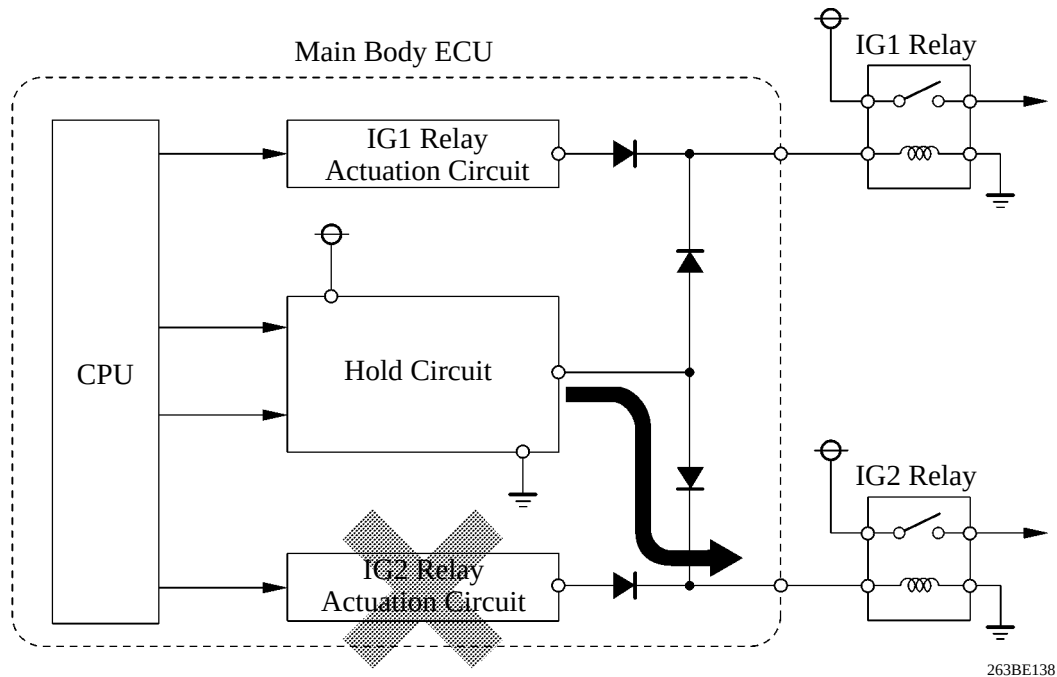


► Indicator Light Condition ◀

Power Source Condition	Indicator Light Condition	
	Brake pedal not depressed	Brake pedal depressed with shift lever in “P” or “N”.
OFF	OFF	ON (Green)
ACC, IG-ON	ON (Amber)	ON (Green)
Engine Running	OFF	OFF
Steering lock not unlocked	Flashes (Green) for 15 seconds	Flashes (Green) for 15 seconds
Push Button Start System Malfunction	Flashes (Amber) for 15 seconds	Flashes (Amber) for 15 seconds

Main Body ECU

- Main body ECU consists of the IG relay No.1 and No.2 actuation circuits, CPU, and hold circuit.
- The hold circuit is installed to prevent the power supply to the relays from being cut off when an abnormality occurs in IG Relay No.1 and/or No.2 actuation circuits while driving.



Service Tip

The main body ECU constantly stores the present power source state in its memory. Therefore, if the power to main body ECU is interrupted due to the removal of the battery, the main body ECU restores the power source after the battery is reconnected.

For this reason, if the battery is removed when the engine switch is in a state other than OFF, the power will be restored to the vehicle at the same time the power is restored to main body ECU (by reconnecting the battery).

Therefore, before removing the battery, be sure to turn the engine switch OFF.

6. Start Function Operation

General

The start function has different power source patterns to suit the brake pedal state and shift lever position.

Pattern	Brake Pedal	Shift Lever	Power Source Pattern
A	Depressed	P or N Position	When the engine switch is pushed once. ● OFF → IG ON (after the engine is started)
B	Not Depressed	P Position	Each time the engine switch is pushed. ● OFF → ACC → IG ON → OFF
C		Except P Position	Each time the engine switch is pushed. ● OFF → ACC → IG ON → ACC
D	—	P Position	When the engine switch is pushed in the IG-ON condition.
E	—	Except P Position	When the engine switch is pushed in the IG-ON condition.

► Transition of Power Source ◀

Shift Position		P			N		Except P, N	
Pattern		B or D	A or D	—	C or E	A or E	C or E	—
Engine Switch		Pushed	Pushed	—	Pushed	Pushed	Pushed	Pushed
Brake		—	Depressed	—	—	Depressed	—	Depressed
Hour		—	—	After 1 hour	—	—	—	—
Power Source	OFF							
	ACC							
	IG							
	Engine Start							

◀ : Transition

◀ : Only when the key certification is OK

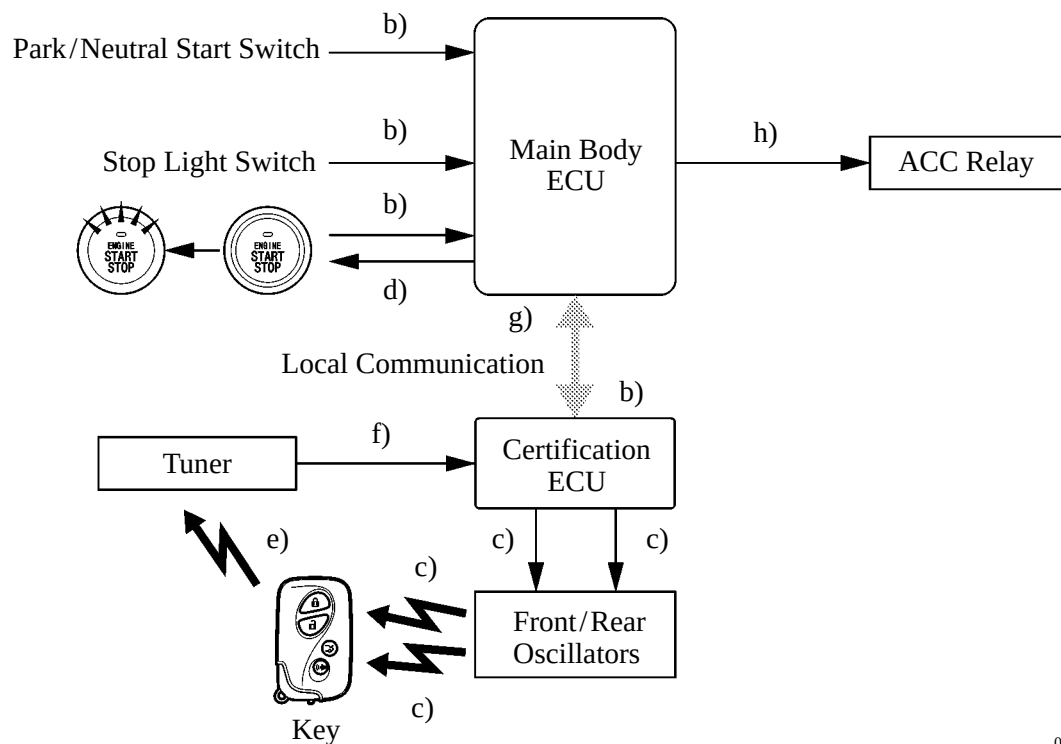
◀ : Only when the vehicle is stopped

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- NOTE:**
- Normally, the operation of the engine switch is disabled while the vehicle is being driven. However, if engine must be stopped in an emergency while the vehicle is in motion, the driver can press the engine switch for approximately 3 seconds or more to stop the engine.
 - If no signals are transmitted to the main body ECU due to malfunctions in the stop light switch system, the engine may not start when the engine switch is pressed with the brake pedal depressed. In such cases, performing the following procedure may enable the engine to start: 1) press the engine switch to turn the power source from OFF to ACC, and 2) press the engine switch again and hold it for 15 seconds or more.
 - Above two operations must be applied only in emergency situations. Under normal conditions, the engine must not be stopped by pressing the engine switch during driving or started without depressing the brake pedal when the shift lever is in any position other than P or N.

Pattern A: OFF → IG-ON (after the engine is started)

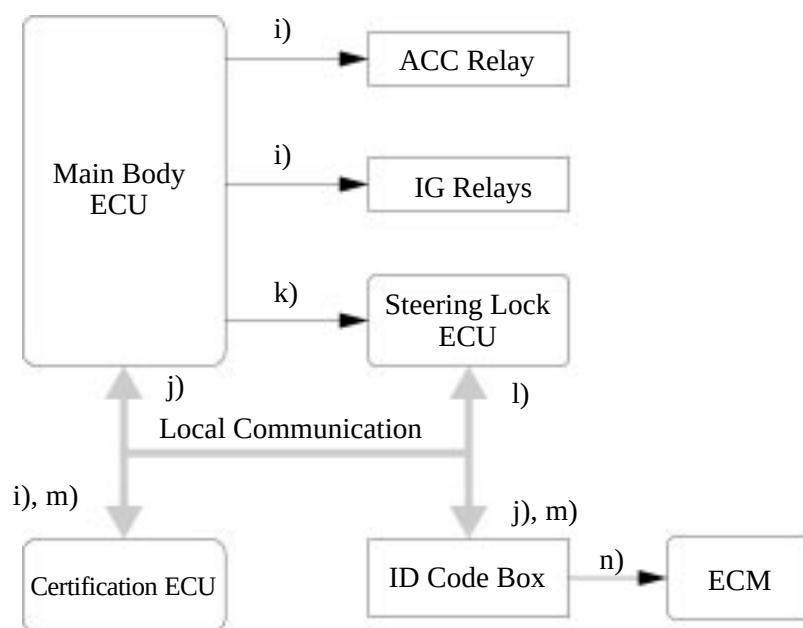
Step	System Operation
a)	The driver holds the key and enters the vehicle.
b)	When the driver presses the engine switch once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and transmits the key certification request to the certification ECU. ● Shift position is “P” or “N”. ● Brake pedal depressed. ● Power source is at “OFF”.
c)	The certification ECU receives the certification request and transmits a request signal to the front/rear oscillators. These oscillators then transmit the request signal.
d)	The brake pedal is depressed, so the main body ECU turns ON the green indicator light of the engine switch.
e)	The moment the key receives the request signal, it transmits its ID code to the tuner. The signal includes the response code.
f)	The tuner receives this code and transmits it to the certification ECU.
g)	The certification ECU judges and certifies the ID code, and transmits a key certification OK signal to the main body ECU.
h)	After receiving the key certification OK signal, the main body ECU turns ON the ACC relay.



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(Continued)

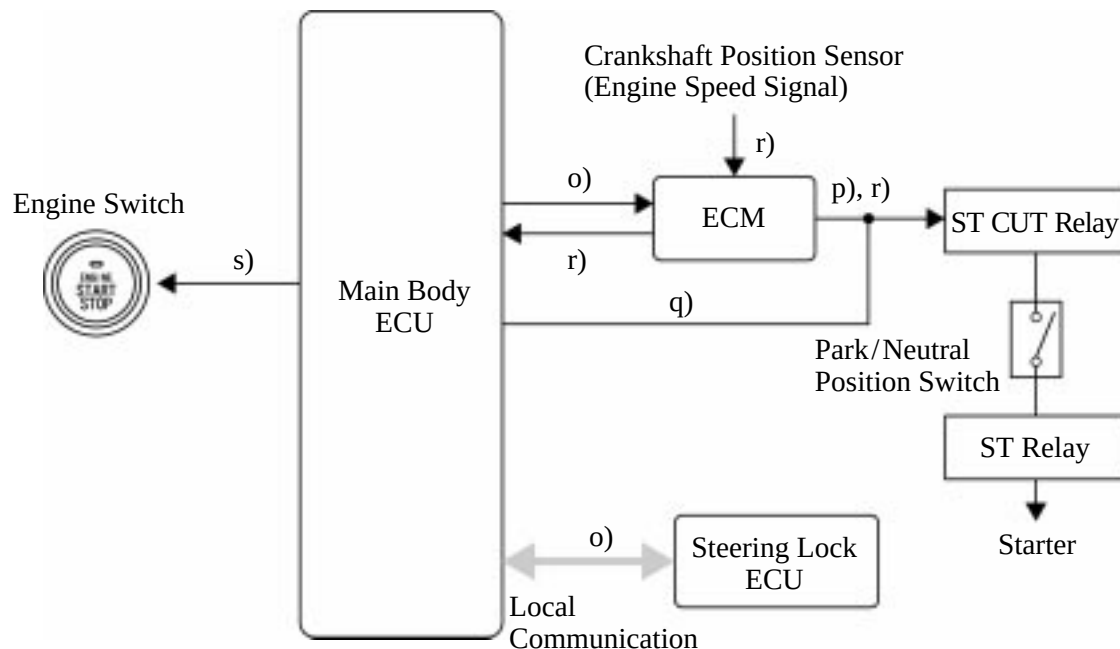
Step	System Operation
i)	The main body ECU turns ON the ACC relay, and then turns ON the IG relays.
j)	The certification ECU checks that the power source has switched from OFF to IG-ON, and transmits a steering unlock signal to the main body ECU and ID code box.
k)	The main body ECU receives this signal and supplies power to the steering lock ECU.
l)	The steering lock ECU receives the steering unlock signal via the ID code box, and releases the steering lock.
m)	After checking the steering unlock condition, the certification ECU transmits an engine immobilizer disengage signal to the ID code box.
n)	The ID code box certifies the disengage signal of the certification ECU, transmits the engine immobilizer disengage signal to the ECM, and disengages the engine immobilizer.



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(Continued)

Step	System Operation
o)	After checking that the steering is in the unlocked condition, the main body ECU transmits a starter request (STSW) signal to the ECM.
p)	The ECM receives this signal, outputs an ST relay (STAR) signal, and actuates the starter. (For details see the cranking hold function on page EG-69.)
q)	The ECM and main body ECU both output the starter relay signal in order to actuate the starter. Both the ECM and main body ECU output the signal in order to prevent situations where the starter may fail to operate, such as when the battery voltage supplied to the ECM is low.
r)	When the ECM judges from the engine speed that engine start is completed, it stops the starter relay (STAR) signal, and stops the starter.
s)	The main body ECU receives this signal, checks that engine start is completed, and turns OFF the indicator light of the engine switch.



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Pattern B: OFF → ACC → IG ON → OFF**1) OFF → ACC**

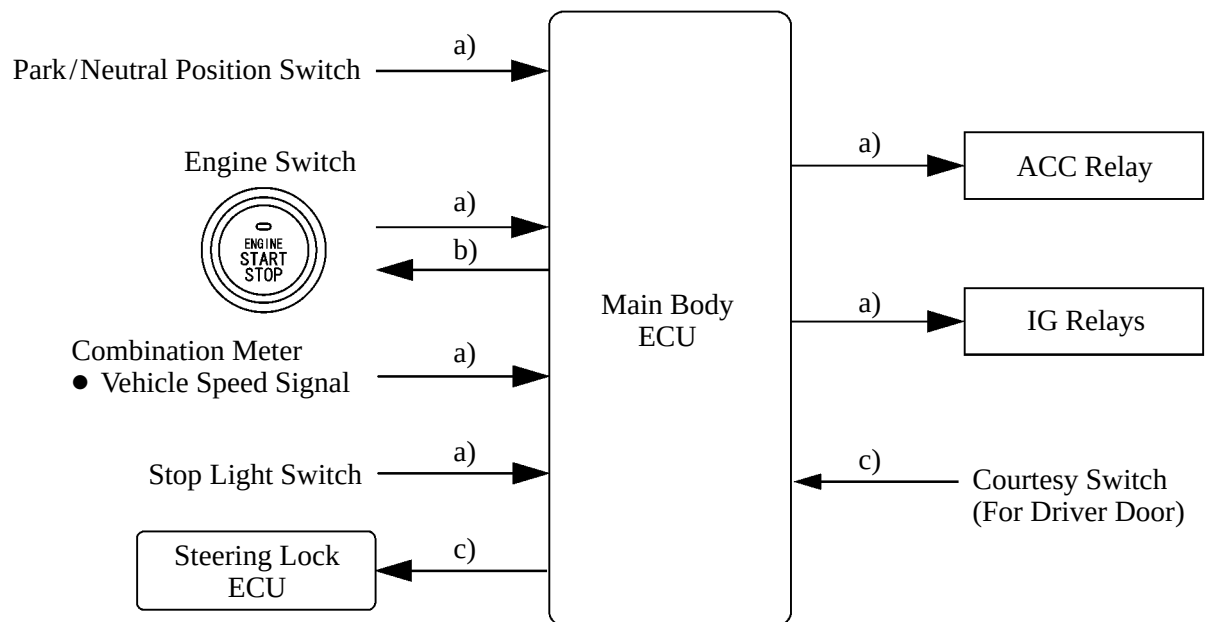
Step	System Operation
a)	The driver has the key in their possession and enters the vehicle.
b)	When the driver presses the engine switch once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and transmits the key certification request to the certification ECU. ● Shift position is “P”. ● Brake pedal is not depressed. ● Power source is “OFF”.
c)	Due to the brake pedal not being depressed, the main body ECU will turn ON the amber indicator light of the engine switch.
d)	The rest of the system operation is the same as d) to h) in pattern “A” . For details, see page BE-127.

2) ACC → IG ON

Step	System Operation
a)	When the power source is at “ACC” and the driver pressed the engine switch again, the main body ECU recognizes the engine switch signal and turns ON the IG relays.
b)	The rest of the system operation is the same as j) to n) in pattern “A” . For details, see page BE-128.

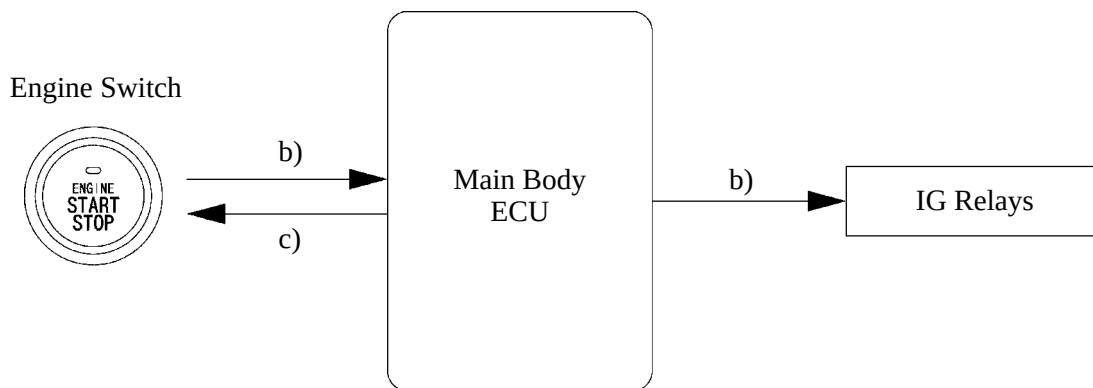
3) IG ON → OFF

Step	System Operation
a)	When the engine switch is pressed once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and turns OFF the ACC, IG relays. ● Shift position is “P”. ● Brake pedal is not depressed . ● Vehicle speed is 0 km/h (0 mph). ● Power source is in “IG-ON” mode.
b)	When the power source is switched from IG-ON to OFF, the main body ECU will turn OFF the indicator light of the engine switch.
c)	If the driver’s door is opened, the main body ECU receives a signal from the courtesy switch (for driver door). Then, the power supply to the steering lock ECU stops in order to lock the steering.



Pattern C: OFF → ACC → IG ON → ACC

Step	System Operation
a)	The system operations for the power source “OFF → ACC → IG ON” are the same as those in pattern B. For details, see page BE-130.
b)	When the engine switch is pressed once with the following conditions satisfied, the main body ECU recognizes the engine switch signal and turns OFF the IG relays. ● Shift position is in any position except “P”. ● Brake pedal is not depressed. ● Vehicle speed is 0 km/h (0 mph). ● Power source is in “IG-ON” mode.
c)	Even after the power source switches from IG ON to ACC, the indicator light of the engine switch will remain illuminated in amber.



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Pattern D: IG ON → OFF

This system operation is the same as IG ON → OFF for pattern “B”. For detail, see page BE-131.

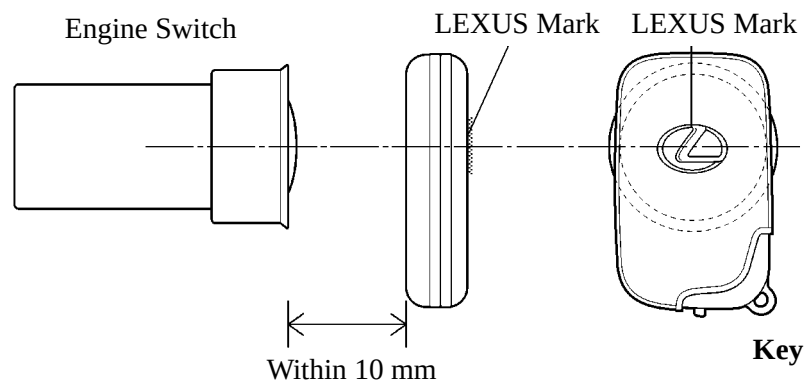
Pattern E: IG ON → ACC

This system operation is the same as pattern “C”. For details, see page BE-132. However, the indicator light of the engine switch will illuminate as follows:

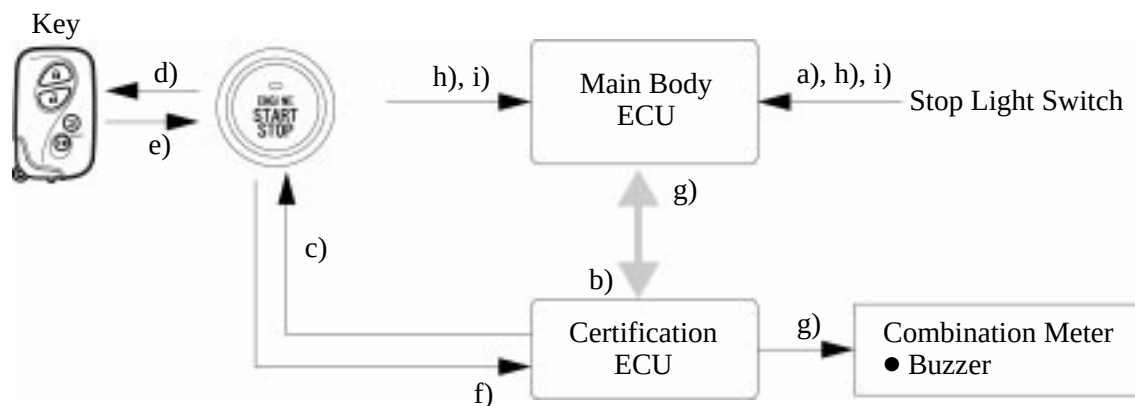
- When the power source is switched from IG-ON to ACC, the main body ECU makes the amber indicator light of the engine switch continue to illuminate.
- When the power source is switched from engine running to OFF, the main body ECU turns OFF the indicator light of the engine switch.

When key battery is low

Step	System Operation
a)	To operate the push button start system when the key battery is low, hold the key against the engine switch as shown in the illustration while depressing the brake pedal.
b)	The main body ECU receives the stop light switch signal and transmits a key certification request signal to the certification ECU.
c)	The certification ECU does not receive an ID code response from the tuner, so it actuates the transponder key amplifier built into the engine switch.
d)	The transponder key amplifier outputs an engine immobilizer radio wave to the key.
e)	The key receives the radio wave, and returns a radio wave response to the transponder key amplifier.
f)	The transponder key amplifier combines the key ID codes with the radio wave response, and transmits it to the certification ECU.
g)	The certification ECU judges and verifies the ID code, and transmits a key certification OK signal to the main body ECU. The buzzer in the combination meter sounds at the same time.
h)	After the buzzer sounds, if the engine switch is pressed within five seconds while the brake pedal is depressed, the power source switches to start the engine running, the same as with normal key operation.
i)	After the buzzer sounds, if the engine switch is pressed within five seconds while the brake pedal is not depressed, the power source will be switched to ACC or IG-ON, the same as with normal smart key operation.



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7. Diagnosis

Main body ECU and certification ECU can detect malfunctions in the push button start system when the power source is in the IG-ON mode.

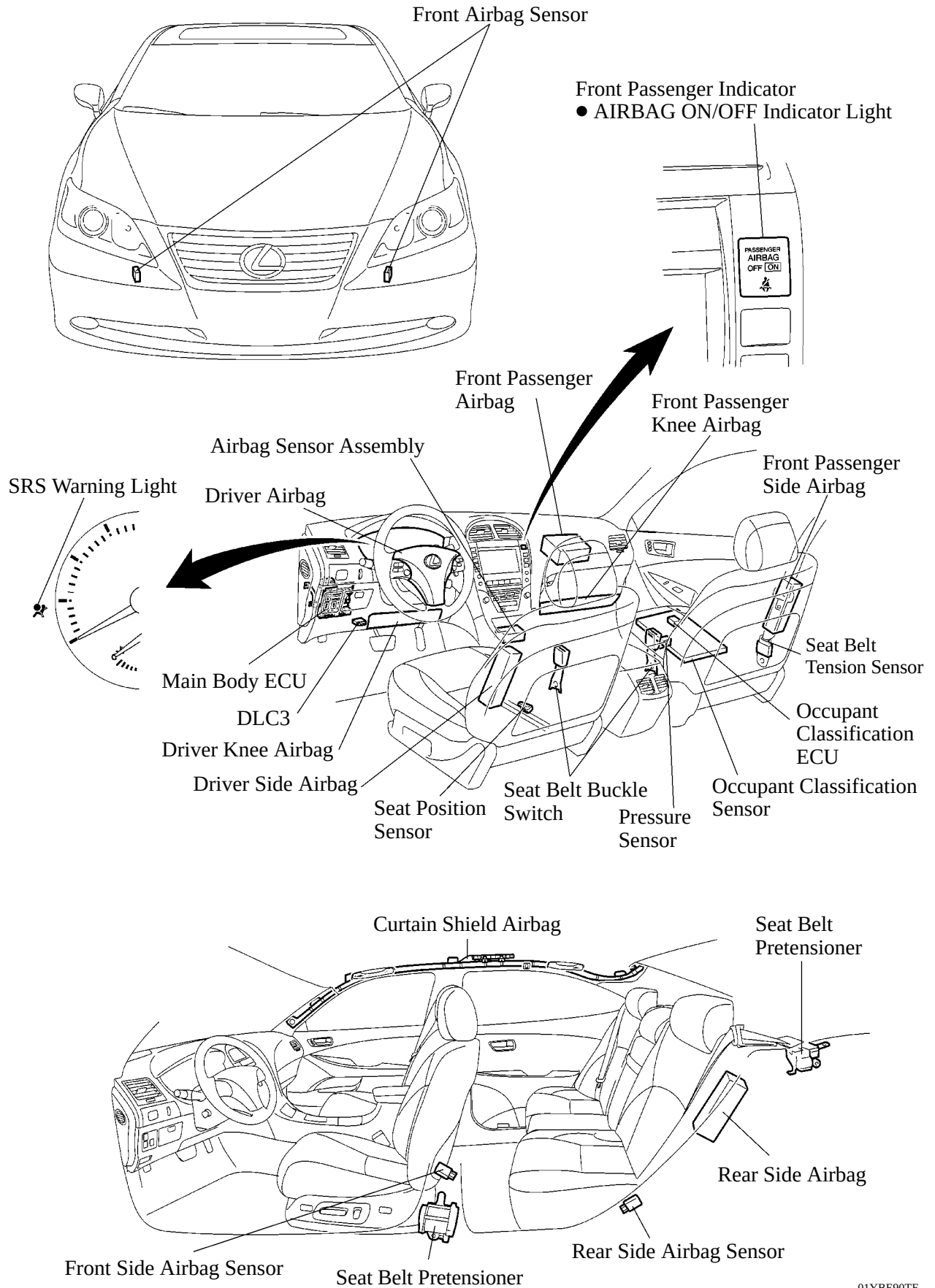
When the ECUs detect a malfunction, the amber indicator light of the engine switch flashes to warn the driver. At the same time, the ECUs store 5-digit DTC (Diagnostic Trouble Code) in their memories.

- The indicator light warning continues for 15 seconds even after the power source is switched to OFF.
- The DTC can be read by connecting a hand-held tester to the DLC3.
- The push button start system may not operate successfully if a malfunction occurs.

Service Tip

The ECM of the '07 LEXUS ES350 uses CAN protocol for diagnostic communication. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

■ LAYOUT OF MAIN COMPONENT

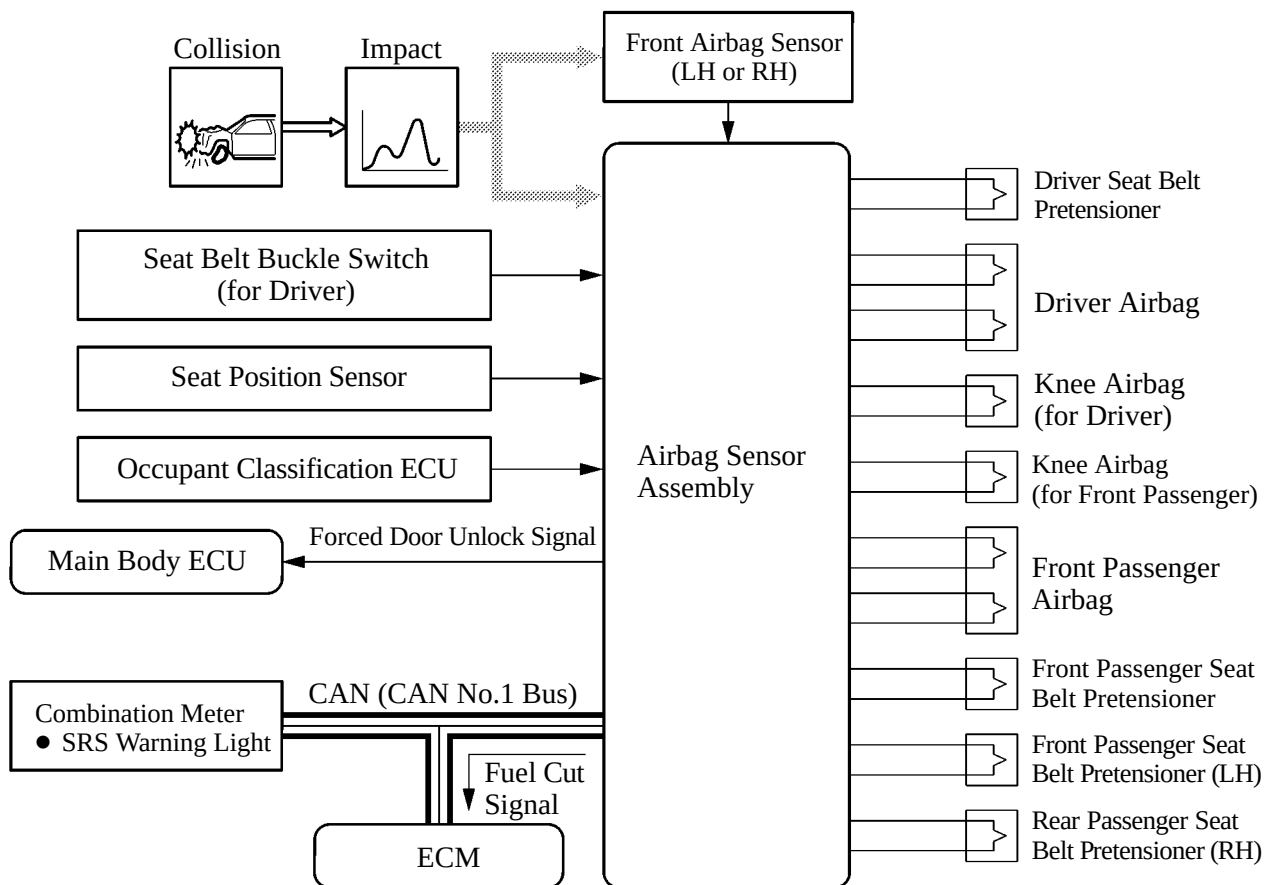


■ AIRBAG FOR FRONTAL COLLISION

1. General

- In conjunction with their impact absorbing structure for frontal collisions, the driver and front passenger dual-stage SRS airbags and the driver and front passenger knee airbags deploy simultaneously, and are supplements to the seat belts. The driver and front passenger dual-stage SRS airbags have been designed to help reduce injuries to the head and chest in the event of a frontal collision. The driver and passenger knee airbags restrict the lower parts of the occupants' bodies, thus enhancing the excellent passenger protection provided by the seat belts and front airbags.
- The deceleration sensor is enclosed in the front airbag sensor. Due to the deceleration of the vehicle during a front collision, a distortion is created in the sensor and converted into an electrical signal. Accordingly, the extent of the initial collision can be detected in detail.

► Front Airbag Operation ◀



2. Dual-stage SRS Airbag System

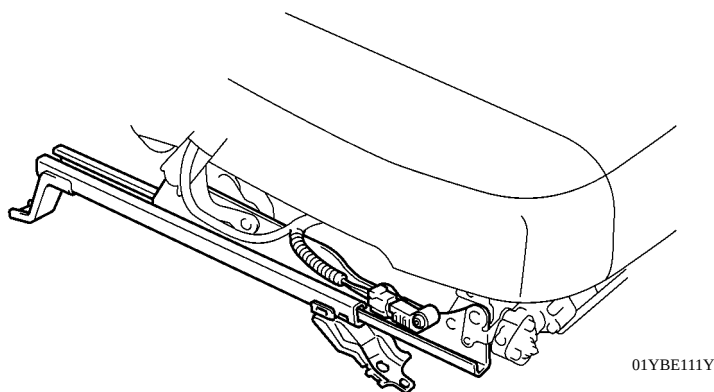
General

In this system, when the front airbag sensors and airbag sensor assembly detect a front collision, the airbag sensor assembly judges the extent of impact, seat position and whether or not the seat belts are fastened, thus optimising the airbag inflating output by delaying the inflation timing of the 2nd initiator and the 1st initiator.

Seat Position Sensor

1) General

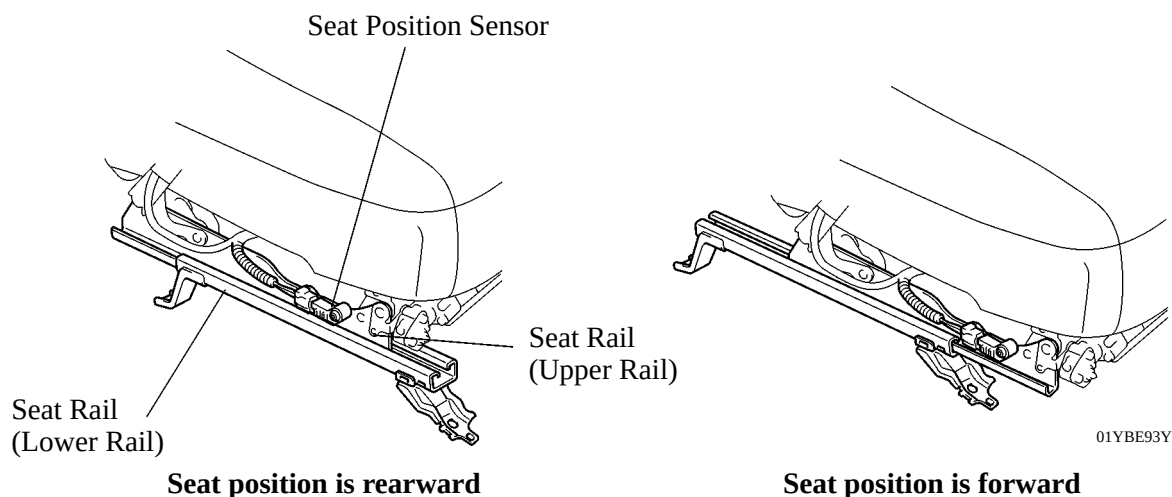
The seat position sensor is mounted on the upper rail portion of the driver seat rail, and includes a Hall IC and a magnet. This sensor is used to detect the sliding position of the driver seat.



2) Operation

When the seat is in the rearward position, the lower rail portion of the seat rail is close to the seat position sensor. When it is in the forward position, the distance between the lower rail portion and the sensor becomes larger.

Thus, the magnetic flux of the magnet inside the seat position sensor varies depending on the seat position. The Hall IC detects this variation and outputs signals to the airbag sensor assembly.

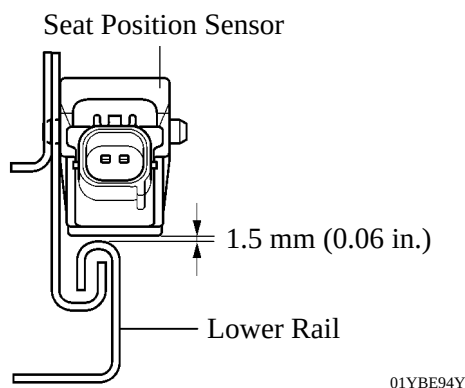


Service Tip

Follow the procedure indicated below to install the seat position sensor.

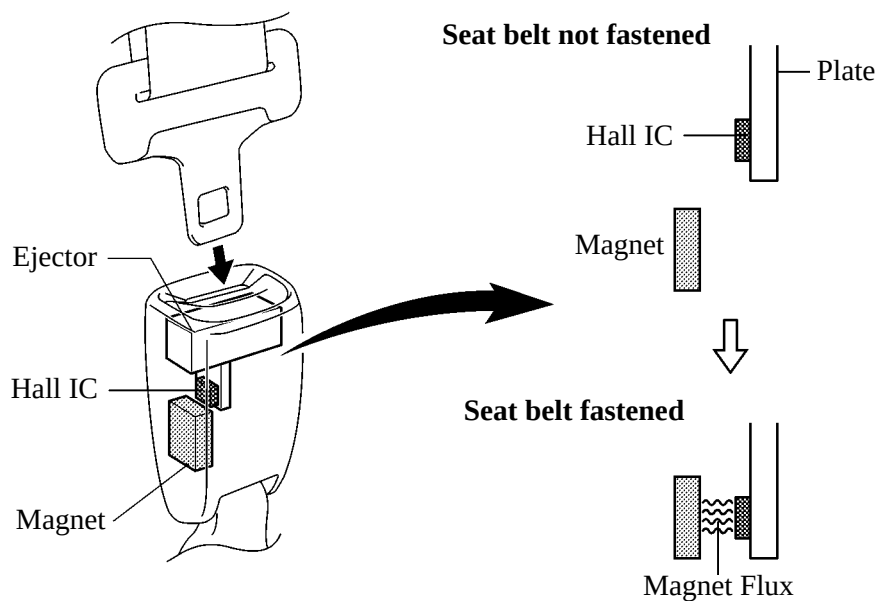
- 1) Insert a 1.5 mm (0.06 in.) feeler gauge between the seat position sensor and the lower rail portion.
- 2) Tighten the mounting bolt to the specified torque with the seat position sensor pushed down as shown.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

**Seat Belt Buckle Switch**

The seat belt buckle switch detects whether or not the seat belt is fastened.

- The non-contact type switch is composed of a Hall IC and two magnets, installed into the front seat inner belt assembly.
- The ejector inside the front seat inner belt assembly and the plate installed to the ejector move when the seat belt is removed or inserted. The movement of the plate changes the magnetic flux density of the magnet.
- The Hall IC detects the changes in the magnetic flux density in accordance with the seat belt removal or insertion, and outputs a signal to the airbag sensor assembly (for driver seat) and occupant classification ECU (for front passenger seat).



3. SRS Driver and Front Passenger Airbags

SRS driver and front passenger airbags contain two sets of initiators and propellants. The airbag sensor assembly helps optimize the airbag inflation speed by controlling the inflation timing of these initiators.

4. Front Airbag Sensor

Front airbag sensor uses an electrical type deceleration sensor. Based on the deceleration of the vehicle during a frontal collision, distortion is created in the sensor and converted into an electrical signal. Accordingly, the extent of the initial collision can be accurately detected.

5. SRS Knee Airbag

The knee airbag deploys simultaneously with the front airbag in a frontal collision. With the deployment of the knee airbag, the driver and front passenger's lower bodies are restricted, thus enhancing the excellent passenger protection provided by the seat belt and front airbag.

■ AIRBAG FOR SIDE/REAR OF SIDE COLLISION

1. General

- With the airbag for side collisions, if the front side airbag sensor detects an impact, the airbag sensor assembly causes the front side, rear side and curtain shield airbags to be deployed simultaneously.
- With the airbag for rear of side collisions, if the rear side airbag sensor detects an impact, the airbag sensor assembly causes the curtain shield airbag to be deployed. When the optional rear side airbags are provided, the rear side airbags and the curtain shield airbags are deployed simultaneously.
- The airbag deployment during side collisions is shown in the tables below.

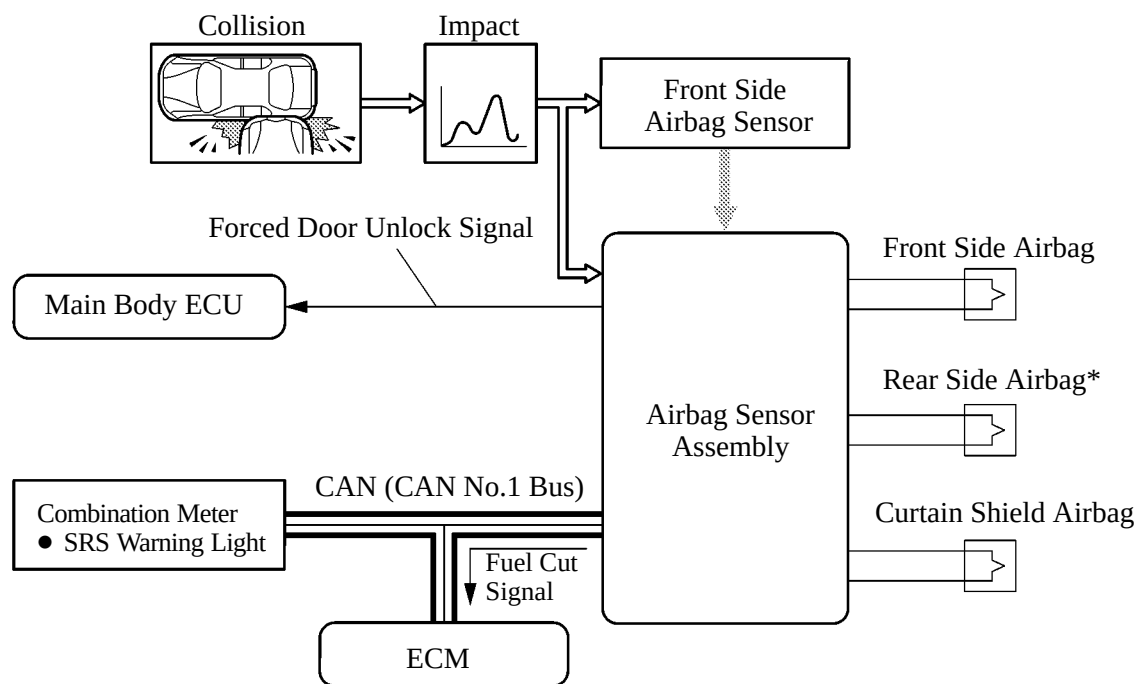
► Airbag For Side Collision ◀

Collision detecting sensor	Front Side Airbag	Rear Side Airbag	Curtain Shield Airbag
Front Side Airbag Sensor	○	○	○

► Airbag For Rear of Side Collision ◀

Collision detecting sensor	Front Side Airbag	Rear Side Airbag*	Curtain Shied Airbag
Rear Side Airbag Sensor	—	○	○

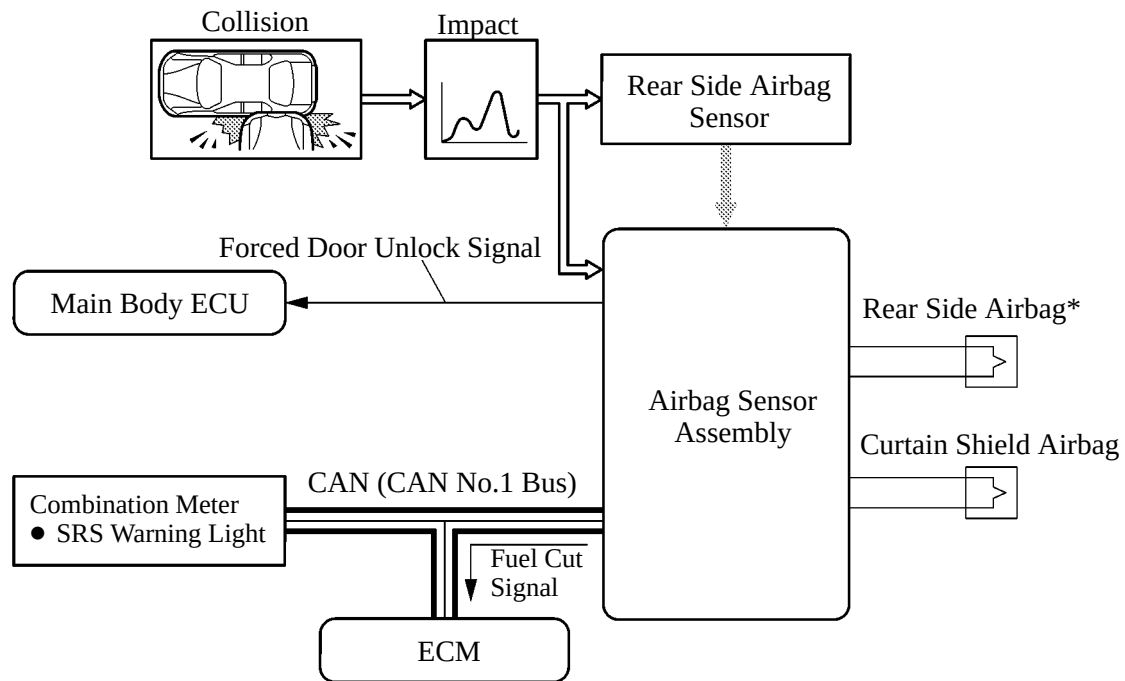
► System Operation ◀



Airbags for Side Collision

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*: Optional equipment



Airbag for Rear of Side Collision

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*: Optional equipment

2. SRS Side Airbag

SRS side airbags are installed in the backs of the driver seat and the front passenger seat. SRS side airbags for the rear passengers are installed in the rear seat back side garnish as optional equipment. Each SRS airbag is a one-piece design, consisting of an inflator, a bag, and a garnish.

3. SRS Curtain Shield Airbag

SRS curtain shield airbags are located in the areas that extend from the driver's and front passenger's front pillars to the rear pillars in the rear seat areas. Each SRS airbag is a one-piece design, consisting of an inflator, a bag, and a cover.

4. Front and Rear Side Airbag Sensors

A deceleration sensor is enclosed in front side airbag and rear side airbag sensor. Based on the change of acceleration of the sensor during a side or side rear collision, distortion is created in the sensor and converted into an electrical signal.

FRONT PASSENGER OCCUPANT CLASSIFICATION SYSTEM

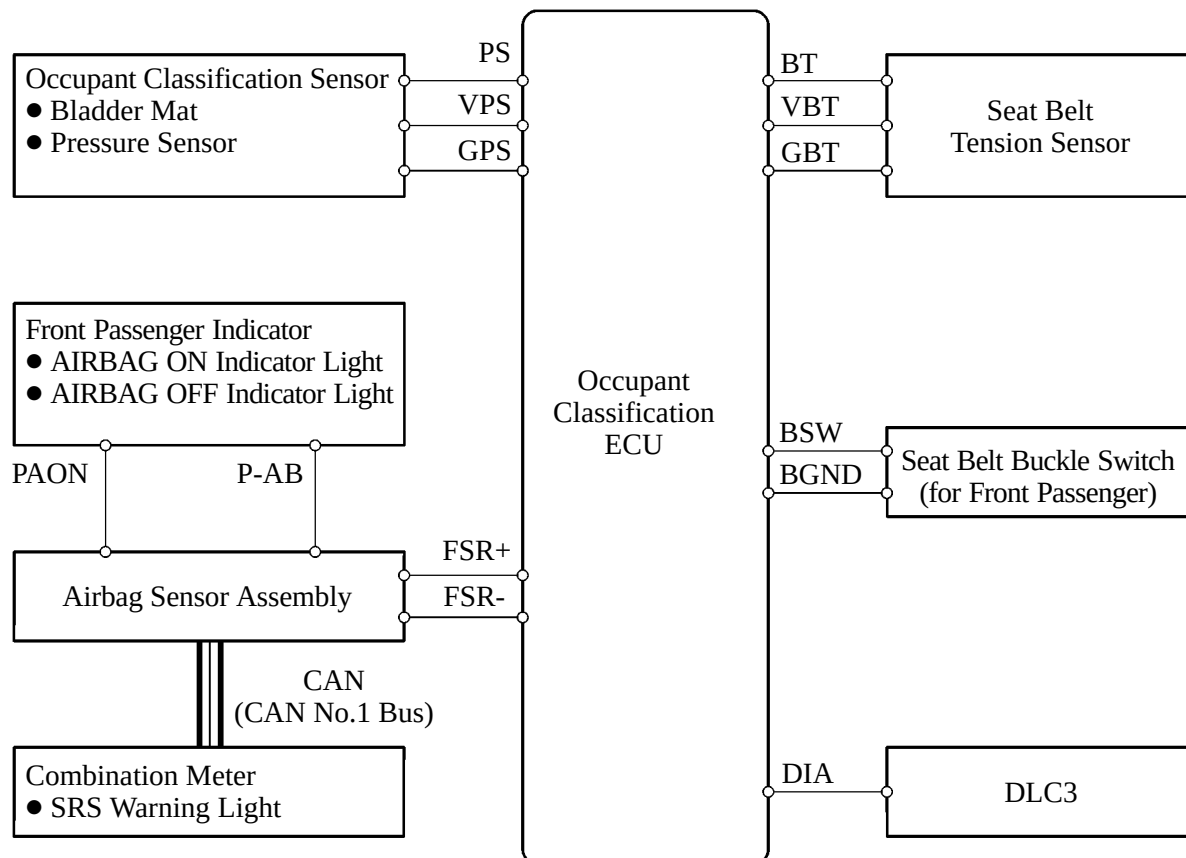
1. General

- As with the '06 ES330, the '07 ES350 uses the front passenger occupant classification system that detects the weight of the front passenger, judges whether the seat is occupied and determines whether to deploy the airbags. However, the front passenger weight detection method of the '07 ES350 is changed.
- This system consists mainly of the occupant classification ECU, occupant classification sensor (bladder mat and pressure sensor), seat belt tension sensor, seat belt buckle switch, AIRBAG ON/OFF indicator light and airbag sensor assembly.

► Major Difference ◀

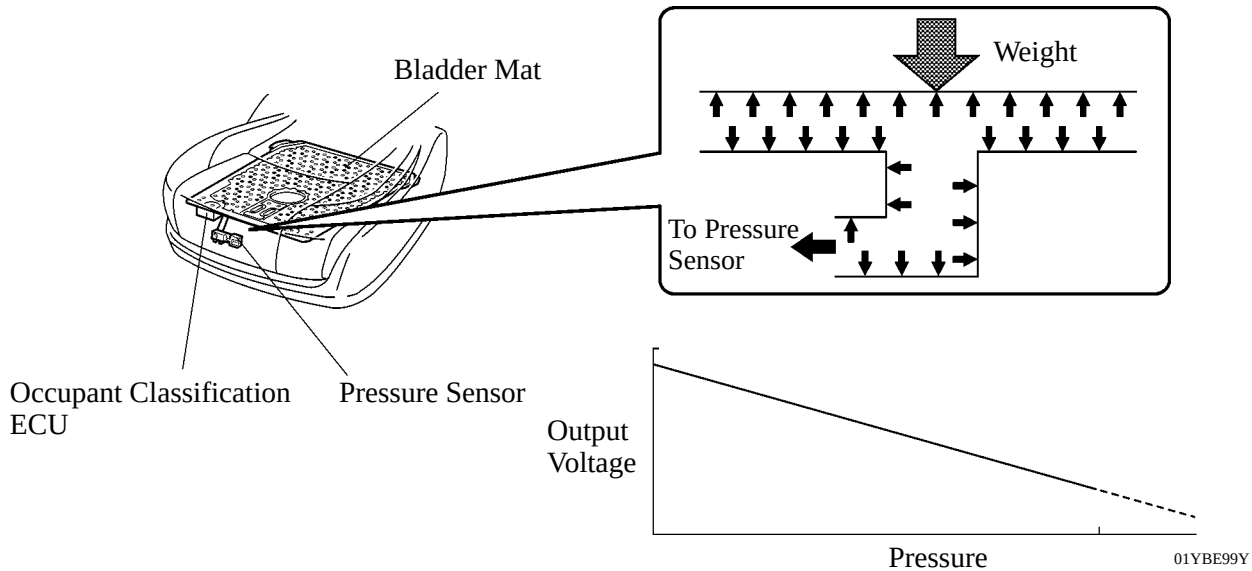
	'07 ES350	'06 ES330
Front passenger weight detection	The pressure sensor detects the weight applied to the bladder mat positioned under the seat cushion.	The strain on 4 occupant classification sensors on the seat rail is detected when weight is applied to the seat.
Seat belt status detection	- The seat belt status is detected using the front passenger buckle switch. - The seat belt tension sensor detects the amount of tension applied when the seatbelt is fastened.	The seat belt status is detected using the front passenger buckle switch.

2. System Diagram



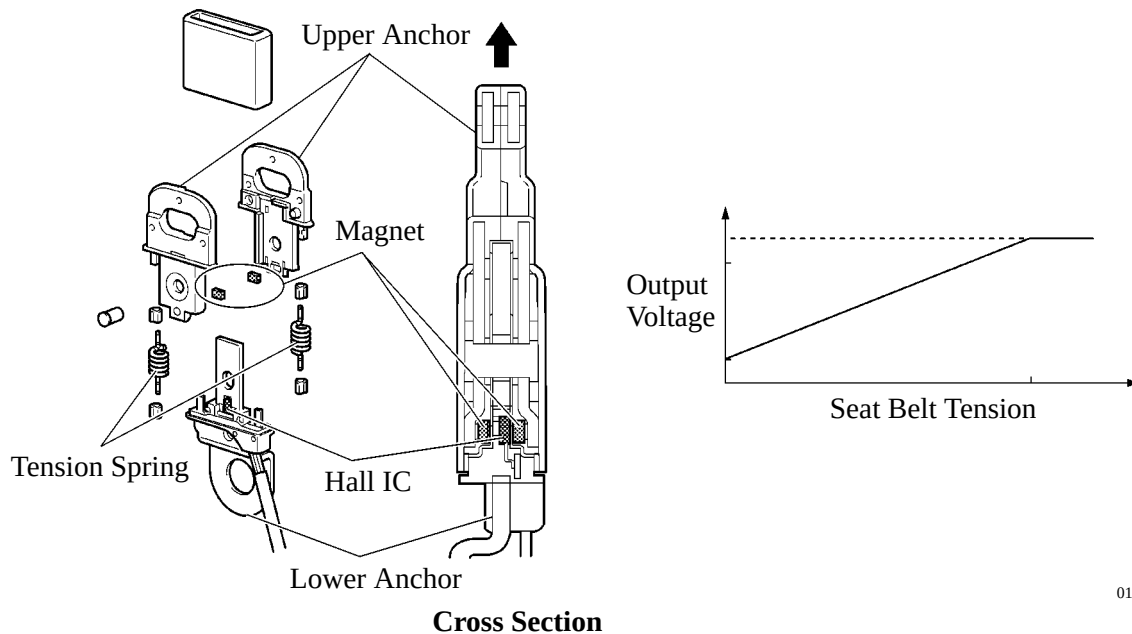
3. Bladder Mat Type Occupant Classification Sensor

- The bladder mat type occupant classification sensor consists of a silicone-filled bladder mat and a pressure sensor, and is installed on the upper section of the front passenger seat frame.
- When weight is applied to the bladder mat, the pressure applied through the silicone to the pressure sensor changes. The pressure sensor converts these changes into voltages and transmits them to the occupant classification ECU.



4. Seat Belt Tension Sensor

- The seat belt tension sensor consists mainly of the upper anchor, lower anchor, 2 tension springs, 2 magnets, and the Hall IC.
- The seat belt tension sensor detects the tension applied to the seat belt and transmits it to the occupant classification ECU.
- When the seat belt webbing is withdrawn and the tension applied to the webbing overcomes the tension spring force, the upper anchor is pulled in the same direction as the webbing. The seat belt tension sensor detects changes in the distance (magnetic field changes) between the magnets on the upper anchor and the Hall IC on the lower anchor, and transmits them to the occupant classification ECU as voltage changes.



5. System Operation

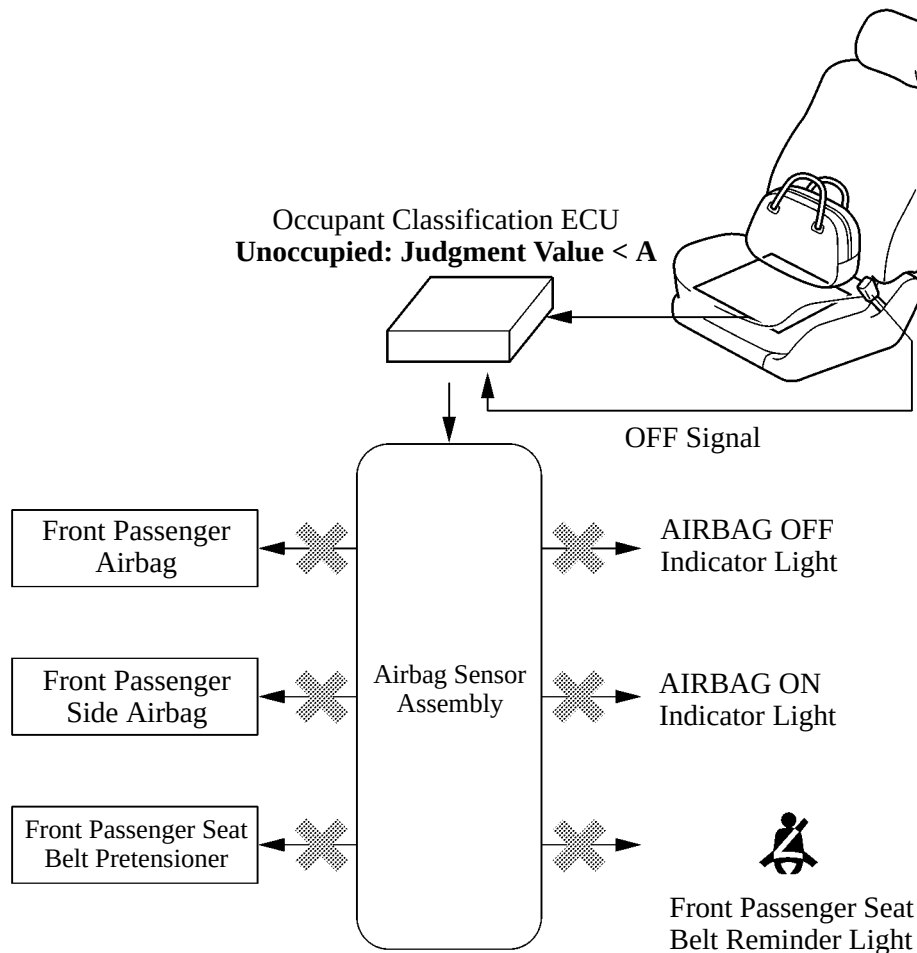
General

This system makes the following judgments: unoccupied judgment, child seat judgment, child judgment, and adult judgment. In addition, it performs an initial check to check the circuit of the AIRBAG ON/OFF indicator lights when the ignition switch is ON.

- The occupant classification ECU constantly monitors the weight of the front passenger seat, and makes a judgment in accordance with the signals from the pressure sensor, seat belt tension sensor and the state of the seat belt buckle switch, regardless of the position of the engine switch.
- The occupant classification ECU receives signals from the pressure sensor and seat belt buckle switch and determines whether a child or an adult is seated based on criteria values A or B respectively.
- The occupant classification ECU receives signals from the seat belt tension sensor and distinguishes between child seats and adults. When the ECU judges that a child seat is installed, a child judgment is made.
- The occupant classification ECU makes an occupied or unoccupied judgment in accordance with the signals from the seat belt buckle switch.

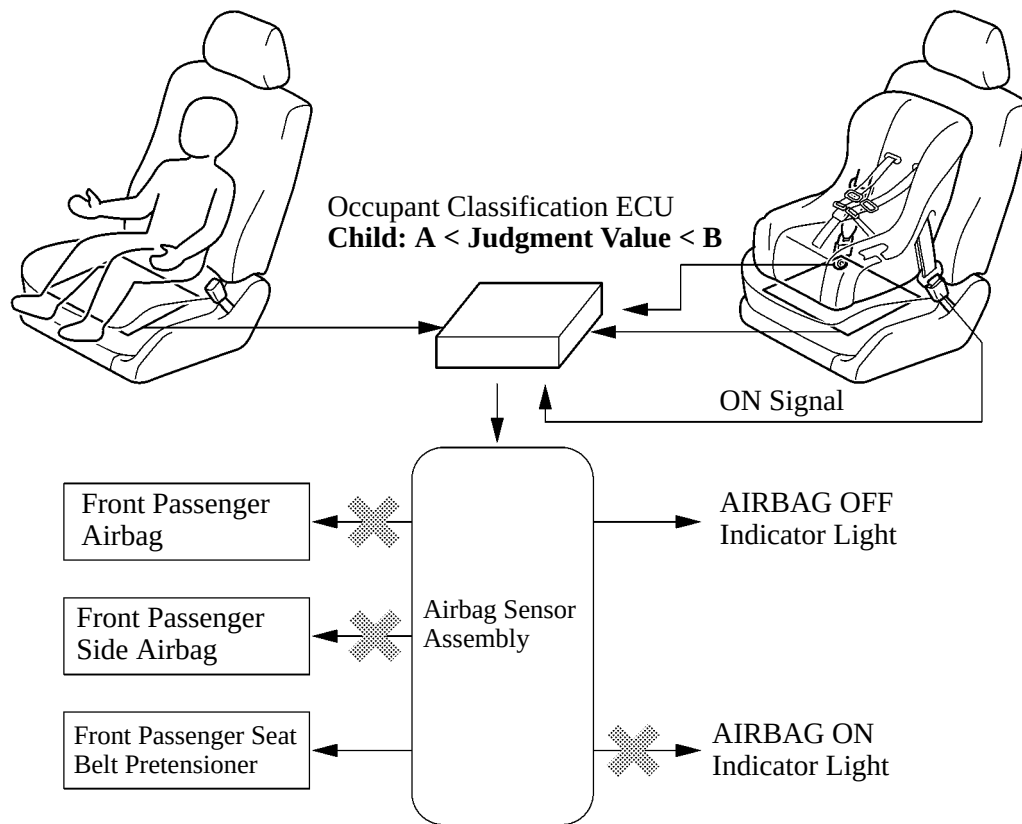
Unoccupied Judgment

- The occupant classification ECU makes an unoccupied judgment when the judgment value is lower than criteria value A and the seat belt buckle switch is OFF.
- If the ignition switch is turned ON in this state, the system performs an initial check, and does not illuminate the AIRBAG ON/OFF indicator lights. Then, the system prohibits the deployment of the front passenger airbag, front passenger side airbag, and the front passenger seat belt pretensioner, and does not blink the seat belt reminder light.



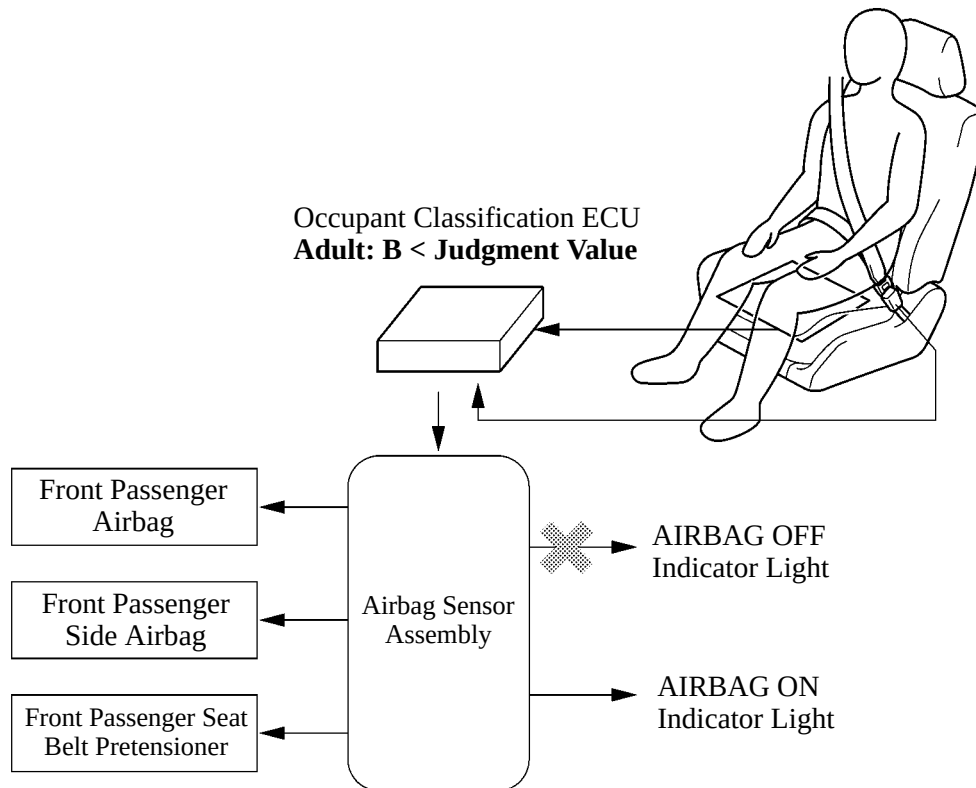
Child Seat or Child Judgment

- If the judgment value is higher than criteria value A, but lower than criteria value B, and the occupant classification ECU judges that the seat is being occupied by a child.
- When a child seat is installed, the occupant classification ECU corrects the pressure applied to the bladder mat in accordance with the signal from the seat belt tension sensor, and judges that a child is seated. If the occupant classification ECU receives a certain value for a certain time from the seat belt tension sensor, the ECU judges that a child is seated regardless of the pressure applied to the bladder mat. If the seat belt is not buckled, the occupant classification ECU makes an unoccupied judgment despite the child seat being installed.
- When the ignition switch is turned ON under these conditions, the system performs an initial check and illuminates the AIRBAG OFF indicator light to indicate that the front passenger airbag and the front passenger side airbag have been deactivated.



Adult Judgment

- When the judgment value is higher than criteria value B, the occupant classification ECU judges that the seat is being occupied by an adult.
- If the engine switch is turned ON in this state, the system performs an initial check and illuminates the AIRBAG ON indicator light, indicating that the front passenger airbag and the front passenger side airbag are active.



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- After the occupant classification ECU judges that the occupant is as adult, and if the judgment value is determined as criteria value B or less according to occupant load movement, the ECU continues adult judgment for approximately ten seconds before switching to the child judgment.

6. Occupant Classification ECU

General

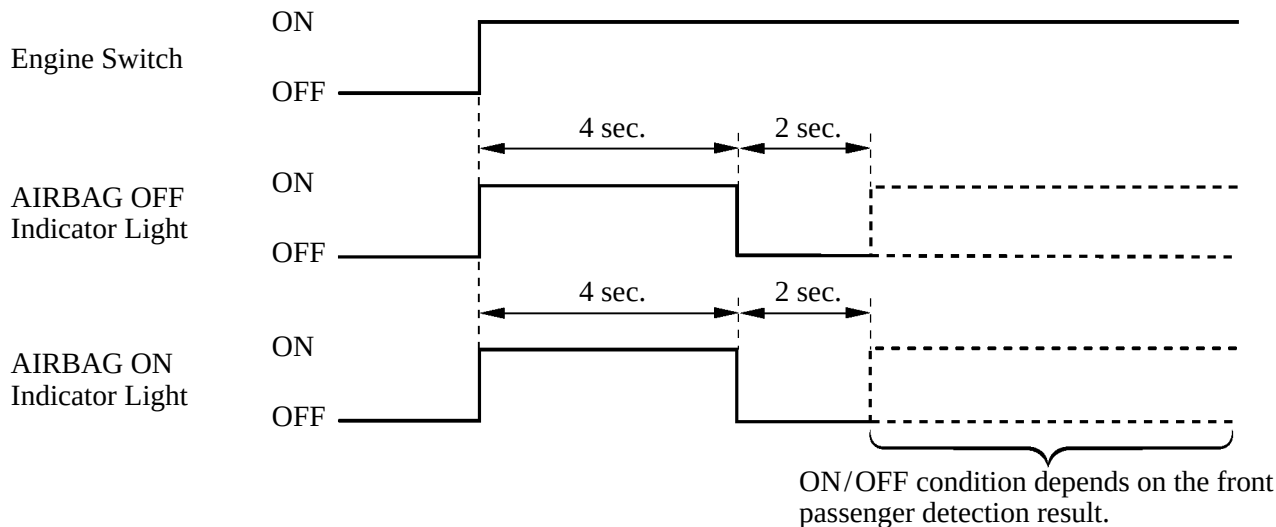
- The occupant classification ECU determines whether the seat is occupied by an adult or a child (with child seat) or is unoccupied, in accordance with the weight applied to the seat cushion of the front passenger seat, the seat belt buckle switch status and the signals from the pressure sensor and seat belt tension sensor.
- When a child seat is installed, the seat belt tension is applied to the seat cushion as well as the weight of the child seat. The occupant classification ECU corrects the weight applied to the seat cushion in accordance with the seat belt tension transmitted from the seat belt tension sensor.

► Passenger Airbag Deployment Condition ◀

Passenger Airbag	Occupant Classification		
	Adult	Child	Child Seat
Front/Knee	○	—	—
Side	○	—	—
Curtain Shield	○	○	○
Seat Belt Pretensioner	○	○	○

Initial Check

- After the engine switch is turned ON, the occupant classification ECU illuminates the AIRBAG ON/OFF indicator lights via the airbag sensor assembly on the timing chart below in order to check the indicator light circuits.



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- The AIRBAG ON/OFF indicator light illuminates as follows after the initial check:

Occupant	Indicator Light	
	AIRBAG ON	AIRBAG OFF
Adult	○	—
Child	—	○
Unoccupied	—	—

Service Tip

When removing/installing the passenger seat, connect the hand-held tester and be sure to perform a system check and perform a zero-point calibration of the occupant classification ECU. For details, refer to the 2007 LEXUS ES350 Repair Manual (Pub. No.RM01Y0U).

7. Precaution for Occupant Classification System Operation

To avoid potential death or serious injury due to the front passenger occupant classification system not detecting the conditions correctly, observe the following.

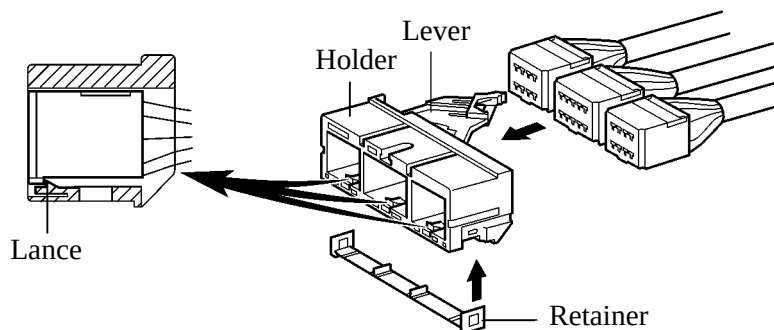
- Wear the seat belt properly.
- Make sure the front passenger's seat belt tab has not been left inserted into the buckle before someone sits in the front passenger seat.
- Make sure the AIRBAG ON indicator light is illuminated when using the seat belt extender for the front passenger seat. If the AIRBAG OFF indicator light is illuminated, disconnect the extender tongue from the seat belt buckle, then reconnect the seat belt. Reconnect the seat belt extender after making sure the AIRBAG ON indicator light is illuminated. If you use the seat belt extender while the AIRBAG OFF indicator light is illuminated, the front passenger airbag and side airbag on the front passenger side may not activate correctly, which could cause death or serious injury in the event of collision.
- Do not put a heavy load in the front passenger seatback pocket or attach a seatback table to the front passenger seat seatback.
- Do not put weight on the front passenger seat by putting your hands or feet on the front passenger seat seatback from the rear passenger seat.
- Do not let a rear passenger lift the front passenger seat with their feet or press on the seatback with their legs.
- Do not put objects under the front passenger seat.
- Do not recline the front passenger seat seatback so far that it touches a rear seat. This may cause the AIRBAG OFF indicator light to be illuminated, which indicates that the passenger's airbags will not deploy in the event of a severe accident. If the seatback touches the rear seat, return the seatback to a position where it does not touch the rear seat.

Keep the front passenger seatback as upright as possible when the vehicle is moving. Reclining the seatback excessively may lessen the effectiveness of the seat belt system.

- Make sure the AIRBAG ON indicator light is illuminated when an adult sits in the front passenger seat. If the AIRBAG OFF indicator light is illuminated, ask the passenger to sit properly with their back upright and against the seat, with legs comfortably extended and to wear the seat belt correctly. If the AIRBAG OFF indicator light remains illuminated nonetheless, let the passenger sit in the rear seat. When it is unavoidable to sit in the front passenger seat, ask the passenger to move the seat as far back as possible and remain properly seated.
- When it is unavoidable to install a forward-facing child restraint system on the front passenger seat, install the child restraint system on the front passenger seat in the proper order.
- Do not kick the front passenger seat or subject it to severe impact. Otherwise, the SRS warning light may come on to indicate a malfunction of the detection system.
- Child restraint systems installed on the rear seat should not come into contact with the front seatbacks.

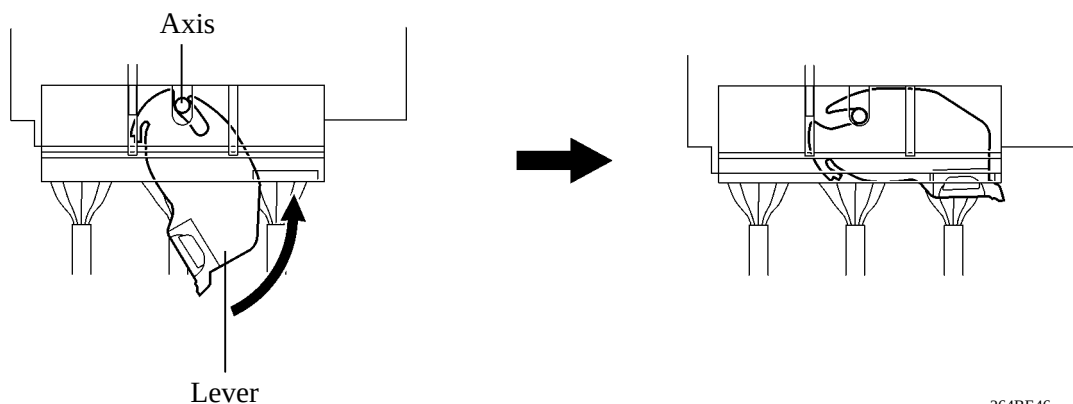
■ IMPROPER CONNECTION PREVENTION LOCK MECHANISM

- This improper connection prevention lock mechanism consists of the airbag sensor assembly and the holder.
- The airbag sensor assembly has a connector lock pin.
- The holder has a lever with a lock groove. The holder and the connectors are locked via a retainer and a lance.



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- When connecting the holder and connectors to the airbag sensor assembly, the lever is pushed into position and by rotating it around the axis of the connector lock pin in order to lock the holder securely.



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■ AIRBAG SENSOR ASSEMBLY

- It reaches a deploy judgment to deploy the dual stage driver's and front passenger's airbags, driver's and front passenger's knee airbags, and pretensioners based on the signals received from the front airbag sensor and the airbag sensor assembly. In addition, it can reach a deploy judgment to deploy the SRS front and rear side airbags and SRS curtain shield airbags based on signals received from the side airbag sensors and rear side airbag sensors. Furthermore, it is equipped with a diagnosis function to perform self-diagnosis in case of system malfunctions.
- Each signal is transmitted as follows:

Target ECU	Signal	Communication path
ECM	Fuel Cut Signal	CAN communication circuit
Main Body ECU	Forced Door Unlock Signal	Direct Circuit
Combination Meter	SRS Warning Light ON Demand Signal Driver Seat Belt Remainder Light ON Demand Signal	CAN communication circuit

■ EDR (EVENT DATA RECORDER)

The airbag sensor assembly monitors and control certain aspects of the vehicle.

These computers assist in driving and maintaining optimal vehicle performance.

Besides storing data useful for troubleshooting, there is a system to record data in a crash or a near car crash event.

This is called the Event Data Recorder (EDR).

The airbag sensor assembly contains the EDR.

In a crash or a near car crash event, this device may record some or all of the following information:

- Engine speed
- Whether the brake pedal was applied or not
- Vehicle speed
- To what extent the accelerator pedal was depressed
- Position of the transmission selector lever
- Whether the driver and front passenger wore seat belts or not
- Driver's seat position
- SRS airbag deployment data
- SRS airbag system diagnostic data

The information above is intended to be used for the purpose of improving vehicle safety performance.

Unlike general data recorders, the EDR does not record sound data such as conversation between passengers.

Toyota will not disclose the data recorded in an EDR to a third party except when:

- An agreement from the vehicle's owner (or the leasing company for a leased vehicle) is obtained
- Officially requested by the police or other authorities
- Used as a defense for Toyota in a law suit
- Ordered by the court

However, if necessary Toyota will:

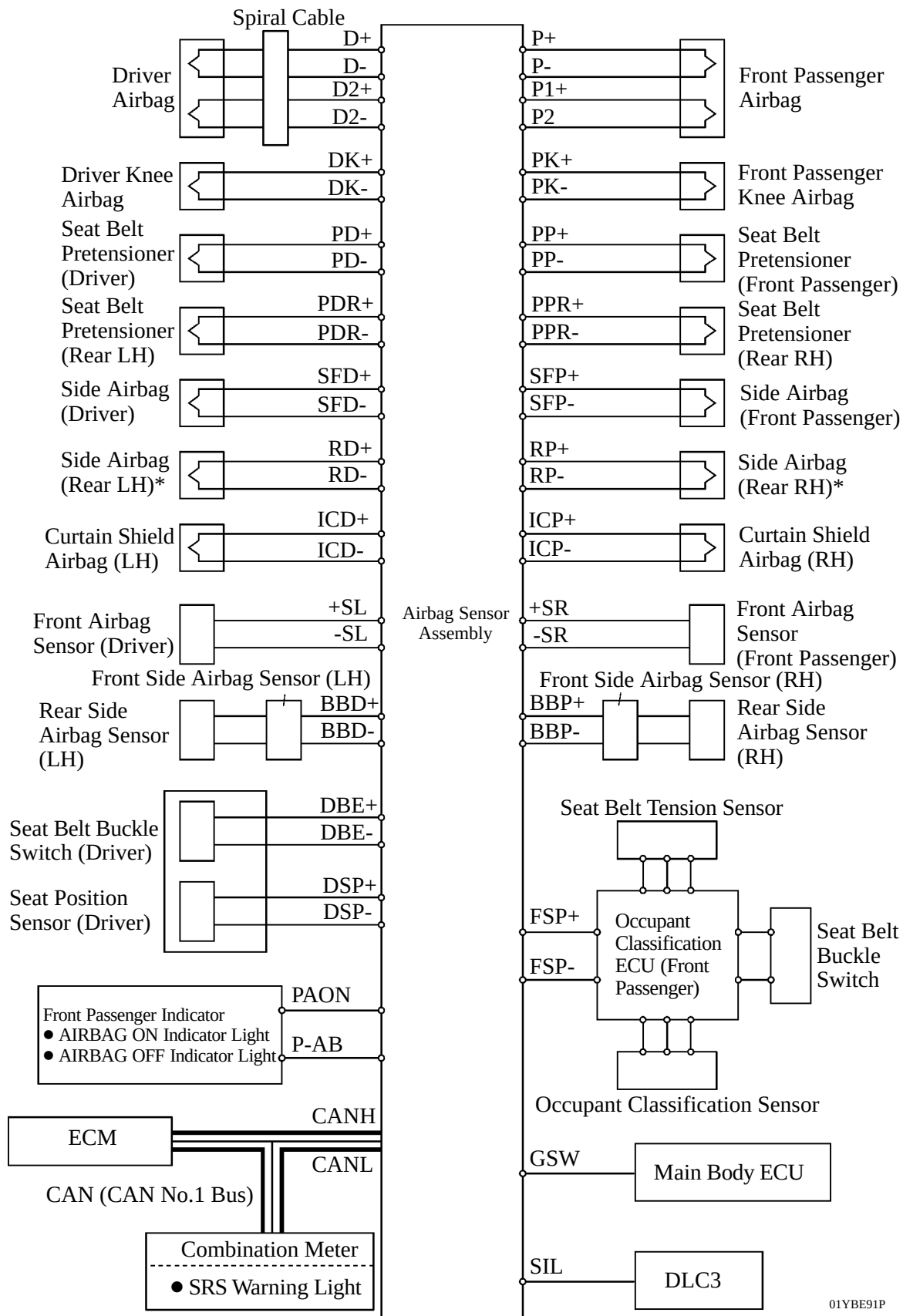
- Use the data for research on Toyota vehicle safety performance
- Disclose the data to a third party for research purposes without disclosing details of the vehicle owner, and only when it is deemed necessary
- Disclose summarized data cleared of vehicle identification information to a non-Toyota organization for research purposes

■ DIAGNOSIS

If the airbag sensor assembly detects a malfunction in the SRS airbag system, the airbag sensor assembly stores the malfunction data in memory, in addition to illuminating the SRS warning light.

- There are 2 types of DTC for the SRS airbag system: 5-digit and 2-digit.
- The 5-digit DTC can be read by connecting a hand-held tester to DLC3.
- The 2-digit DTC can be read by connecting the SST (09843-18040) to the Tc and CG terminals of the DLC3 and reading the blinking of the SRS warning light.
- If the SRS airbags deploy, the airbag sensor assembly will turn ON the SRS warning light. However, differing from the ordinary diagnosis function, a DTC will not be memorized. The SRS warning light can be turned OFF only by replacing the airbag sensor assembly with a new one.

WIRING DIAGRAM



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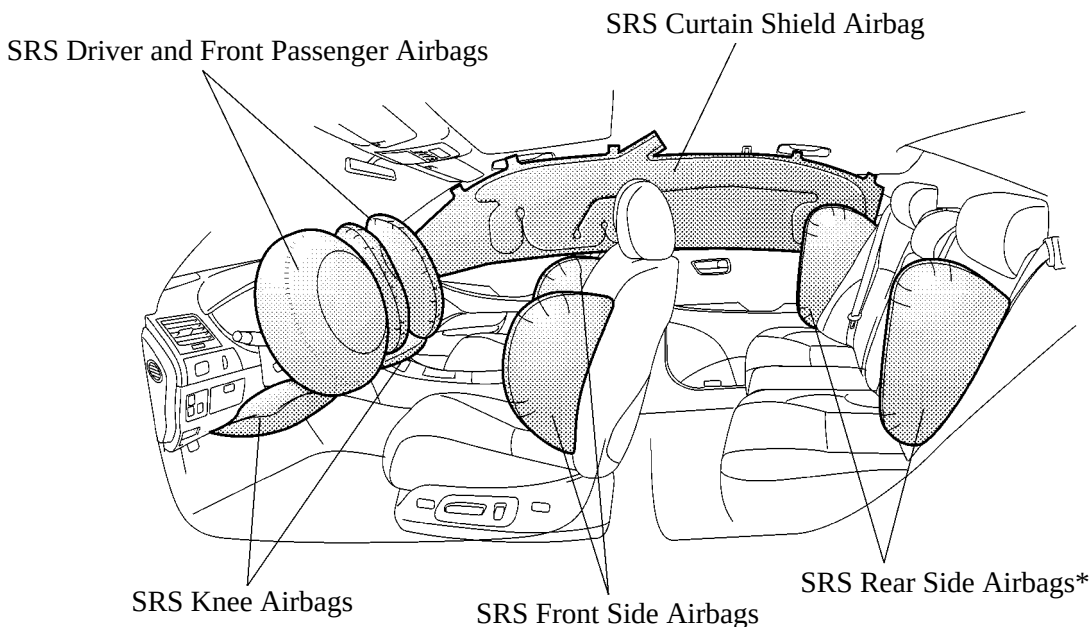
*: Optional equipment

SRS AIRBAG SYSTEM

■ DESCRIPTION

1. General

- The driver and front passenger dual-stage SRS (Supplemental Restraint System) airbags supplement the seat belts to help to reduce the shocks to the head and chest of the driver and front passenger in the event of a frontal collision.
- The SRS side airbags for the driver and front passenger are standard equipment, while the SRS side airbags for the rear passengers are optional.
- The SRS side and curtain shield airbags help to reduce the shocks to the chest and head of the driver, the front passenger, and rear outer passengers in the event of a side collision.
- The SRS knee airbags help restrain the lower parts of the bodies of the driver and front passenger, thus enhancing the excellent passenger protection provided by the seat belts and front airbags.
- A front passenger occupant classification system is used. This enables/disables the front passenger airbag and front passenger side airbag by determining whether or not there is a front passenger seat occupant, and whether it is an adult or child (or child seat), based on the load applied to the passenger seat and the fitted condition of the front passenger seat belt.
- The front passenger airbag door is designed to be invisible. This means that when the airbag inflates, the instrument panel will split along the cleavage line.
- The function of the airbag sensor assembly is to memorize the driver seat belt wearing condition while the airbag is inflating.
- A fuel cut control that stops the fuel pump when any airbags are deployed, is used. For details, see page EG-66.



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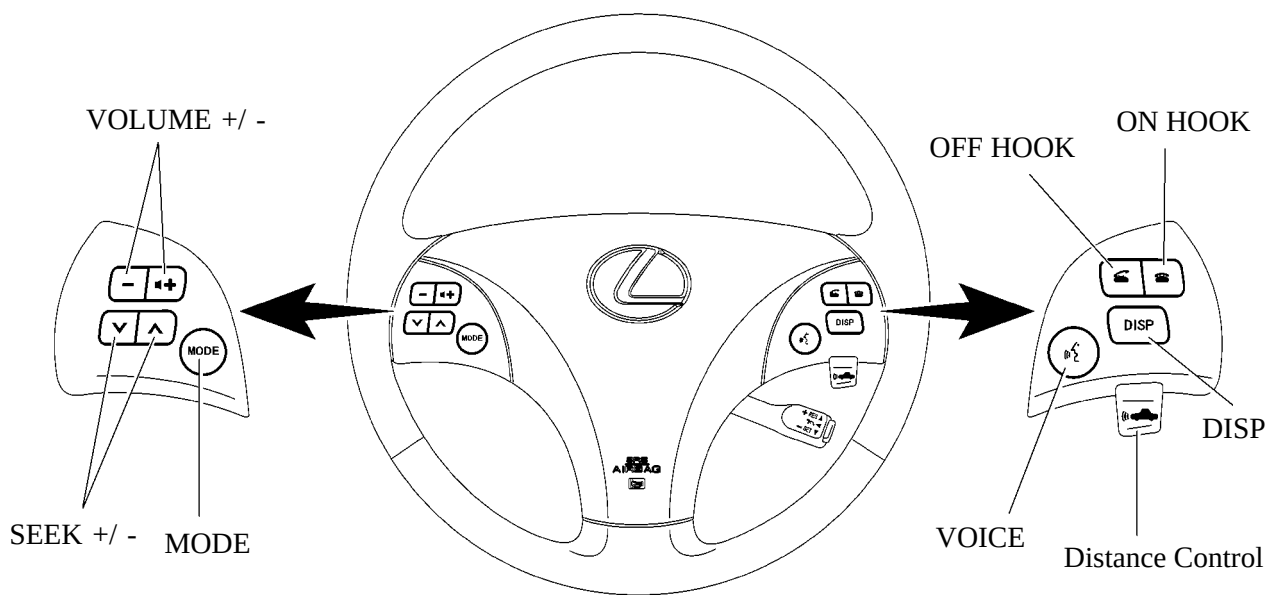
*: Optional equipment

STEERING PAD SWITCH

DESCRIPTION

- Steering pad switches are standard equipment on all models.
- The steering pad switches that are provided on the steering pad may vary due to optional equipment, as indicated in the table below.

System	Switch	Equipment			
		Standard	Navigation	Dynamic Radar Cruise	Navigation & Dynamic Radar Cruise
Audio	- VOLUME +/- - SEEK +/- - MODE	○	○	○	○
Multi-information Display (Combination Meter)	DISP	○	○	○	○
Navigation	VOICE	—	○	—	○
Dynamic Radar Cruise Control	Distance Control	—	—	○	○
Telephone	- ON HOOK - OFF HOOK	—	○	—	○



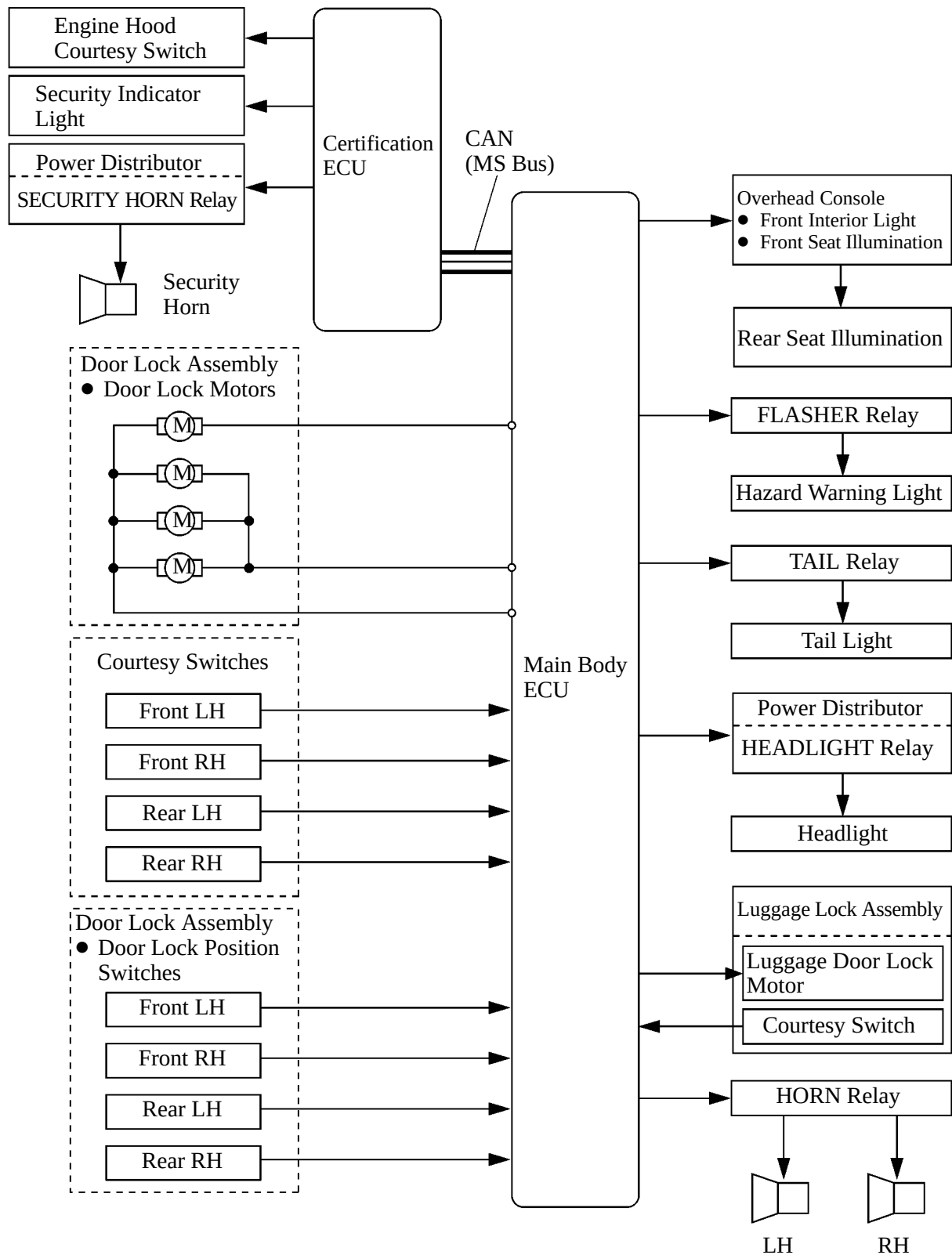
THEFT DETERRENT SYSTEM

■ DESCRIPTION

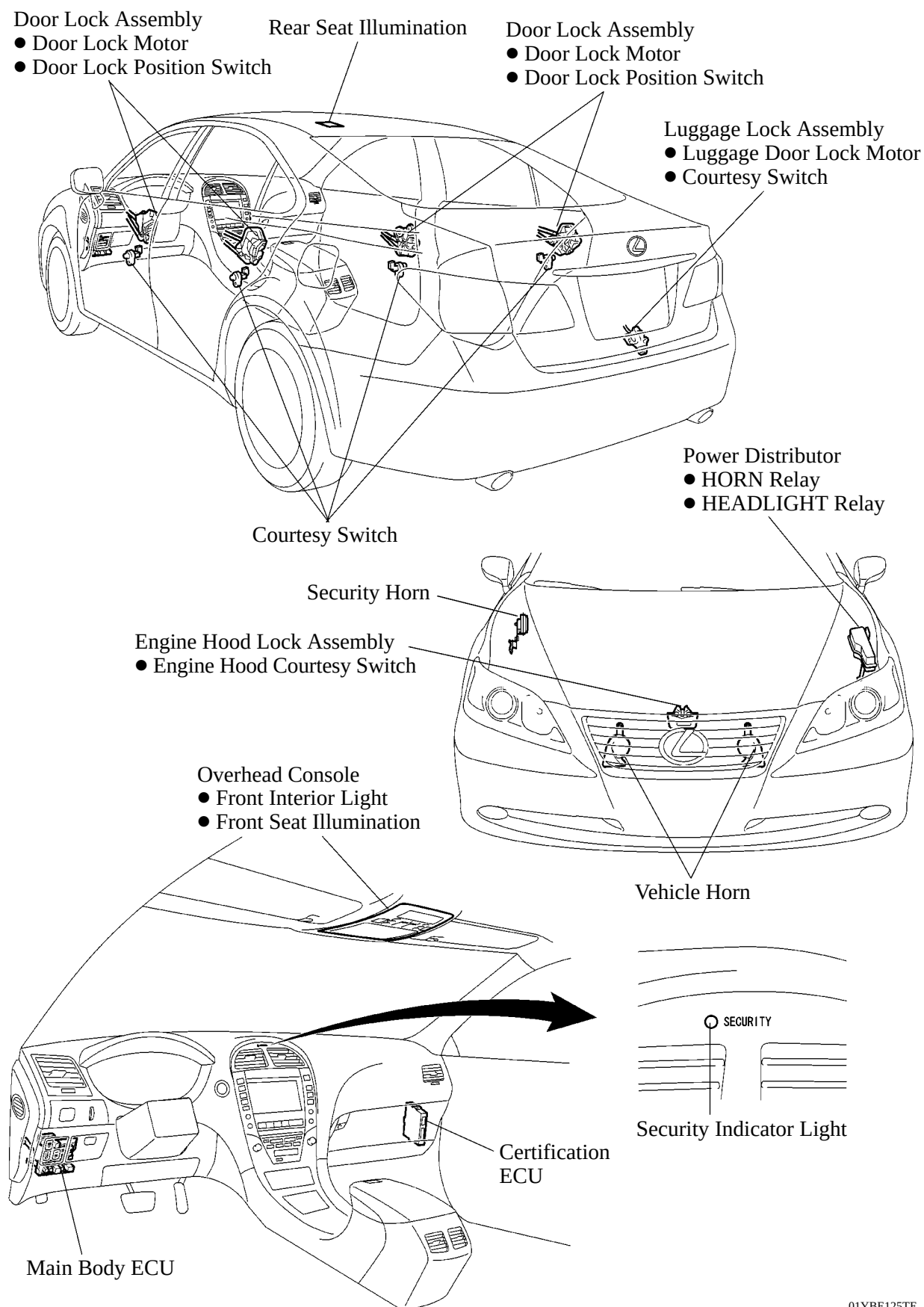
- The theft deterrent system sounds an alarm when any of the following activates are detected:
 - The vehicle being forcibly entered.
 - The engine hood or trunk lid being opened.
 - Any door or trunk lid being unlocked without the key.
 - The battery terminals are removed and reconnected.
- The system consists of door lock control system parts, smart access system with push button start parts, security horn and the security indicator light.
- The certification ECU controls this system.
- The warning methods and timing of the system are listed below.

Warning Method	Interior Light	Illuminates
	Hazard Light	Flashing
	Headlight	Flashing
	Taillight	Flashing
	Vehicle Horn	Sound (approx. 0.4 second cycles)
	Security Horn	Sound (approx. 0.4 second cycles)
	Door Lock Motor	Locking
Warning Time		60 seconds

SYSTEM DIAGRAM



■ LAYOUT OF MAIN COMPONENTS



■ FUNCTION

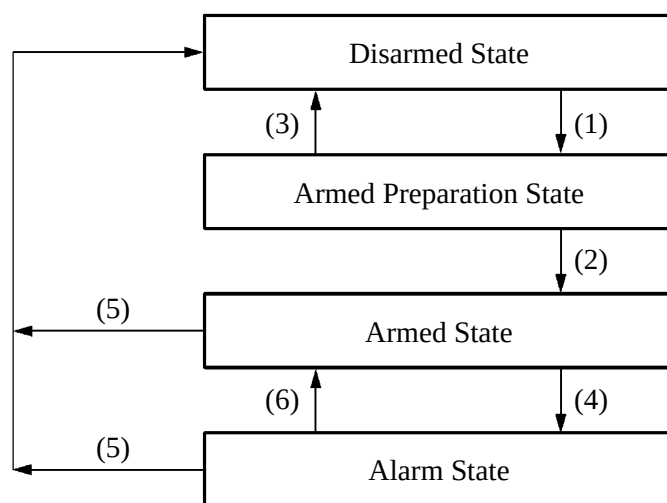
The theft deterrent system has the following function:

Function	Outline
Alarm	When the theft deterrent system is enters the alarm state, the warning items (interior light, headlight, taillight, hazard warning light and security horn) are operated for approximately 60 seconds.
Vehicle Horn Alarm	When the theft deterrent system is enters the alarm state, the vehicle horn is operated for approximately 60 seconds.
Alarm Indicator	When the state of the theft deterrent system enters the armed preparation or alarm state, the security indicator light is illuminated to inform the user. This indicator is also the engine immobilizer indicator, it blinks when the engine immobilizer is in an engaged state.
Forced Door Lock	The main body ECU transmits a door lock signal to all the doors when all the following conditions are satisfied. ● The theft deterrent system is in the alarm state. ● Key is not in the actuation area. ● One of the front doors has been unlocked. The function stops when one of the following conditions is met. ● All doors are locked. (lock function of door lock or transmitter is operated). ● The warning ends after approximately 60 seconds. ● Key is in the actuation area.
Alarm Memory	In order to inform the user that the theft deterrent system had entered the alarm state, the main body ECU will illuminate the taillights for 2 seconds when the system is switched to the disarmed state.
Panic Control	When the PANIC button of the transmitter or key is pressed, the main body ECU operates the alarm function.
Passive Mode	When the user forgets to lock the doors, the theft deterrent system operates to lock them. (When the user closes all the doors, the theft deterrent system operates to lock all the doors after a delay.)

■ SYSTEM OPERATION

- The states of the theft deterrent system are as follows:

State	Description	Theft detection
Disarmed State	The theft deterrent system is not set by the user.	—
Armed Preparation State	The standby state before the theft deterrent system activates when the system has already set.	—
Armed State	The theft deterrent system is being activated. (Theft can be detected.)	○
Alarm State	Theft has been detected and the warning operation activates.	○



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- The theft deterrent system activates as described in the diagram below when one of items in the chart occurs in order to cause the system to enter the respective state.

Condition	Item
(1)	In the disarmed state, when the key is not in the actuation area, the system state is switched if all of the following conditions are met. - All doors, engine hood and trunk lid are closed. - All doors are locked using the transmitter lock button, the smart access system with push-button start, or mechanical key.
(2)	The system state is switched when the doors, engine hood, and trunk lid are all closed and locked, and 60 seconds have elapsed.
(3)	The system state is switched when one of the following conditions is met. - Any door, engine hood, or trunk lid is opened. - Any door is unlocked. - The engine switch is pushed. - A terminal is disconnected from the battery and reconnected.

(Continued)

Condition	Item
(4)*	The system state is switched when one of the following conditions is met. ● With all doors closed, any door is opened. ● With all doors locked, any door is unlocked by a method other than the mechanical key or transmitter. ● The trunk lid and engine hood are opened by a method other than the mechanical key or transmitter.
(5)	The system state is switched when one of the following conditions is met. ● Any door is unlocked with the mechanical key or transmitter. ● The trunk lid is opened with the mechanical key or transmitter. ● The power source is changed to IG-ON.
(6)	The system state is switched after the alarm time elapses.

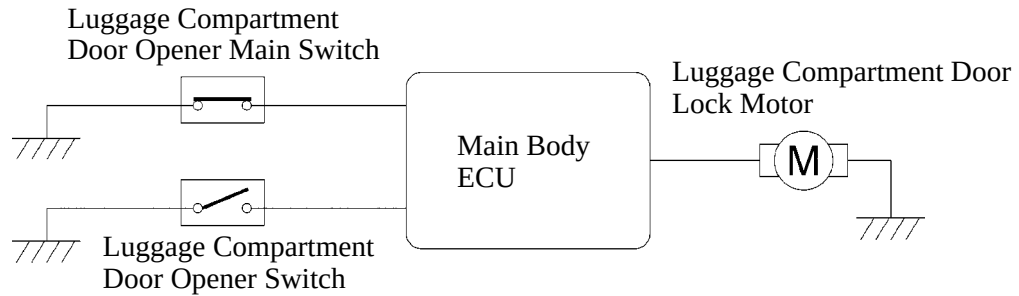
*: If detection of the apparent theft continues, the warning resumes 5 seconds after the previous warning ends and is repeated maximum of 10 times.

TRUNK OPENER

DESCRIPTION

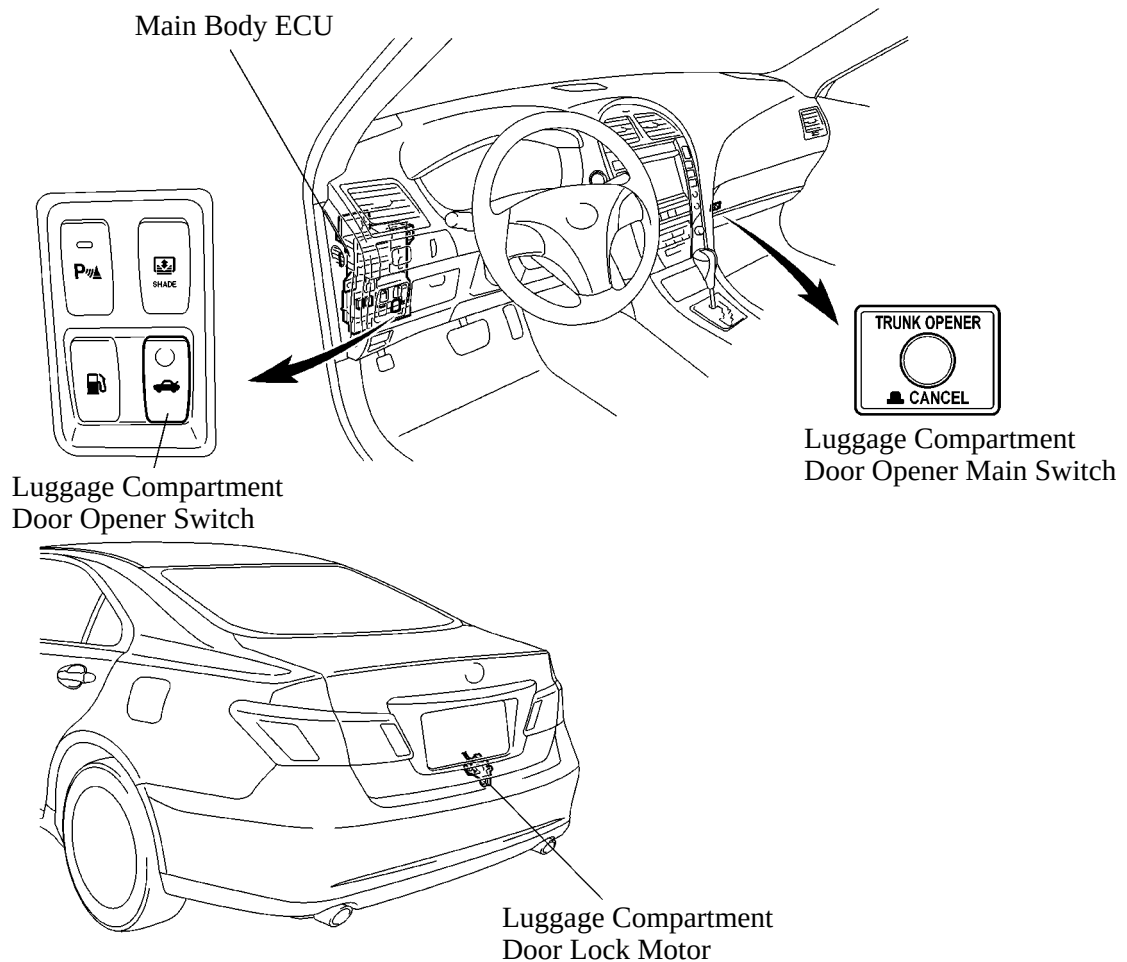
- The trunk opener is an electric type.
- An internal trunk release handle is provided to manually unlock the luggage compartment door in case that the system does not operate because a battery has run out any malfunction occurs. For details, refer to INTERNAL TRUNK RELEASE HANDLE in BODY section (see page BO-22).

► System Diagram ◀



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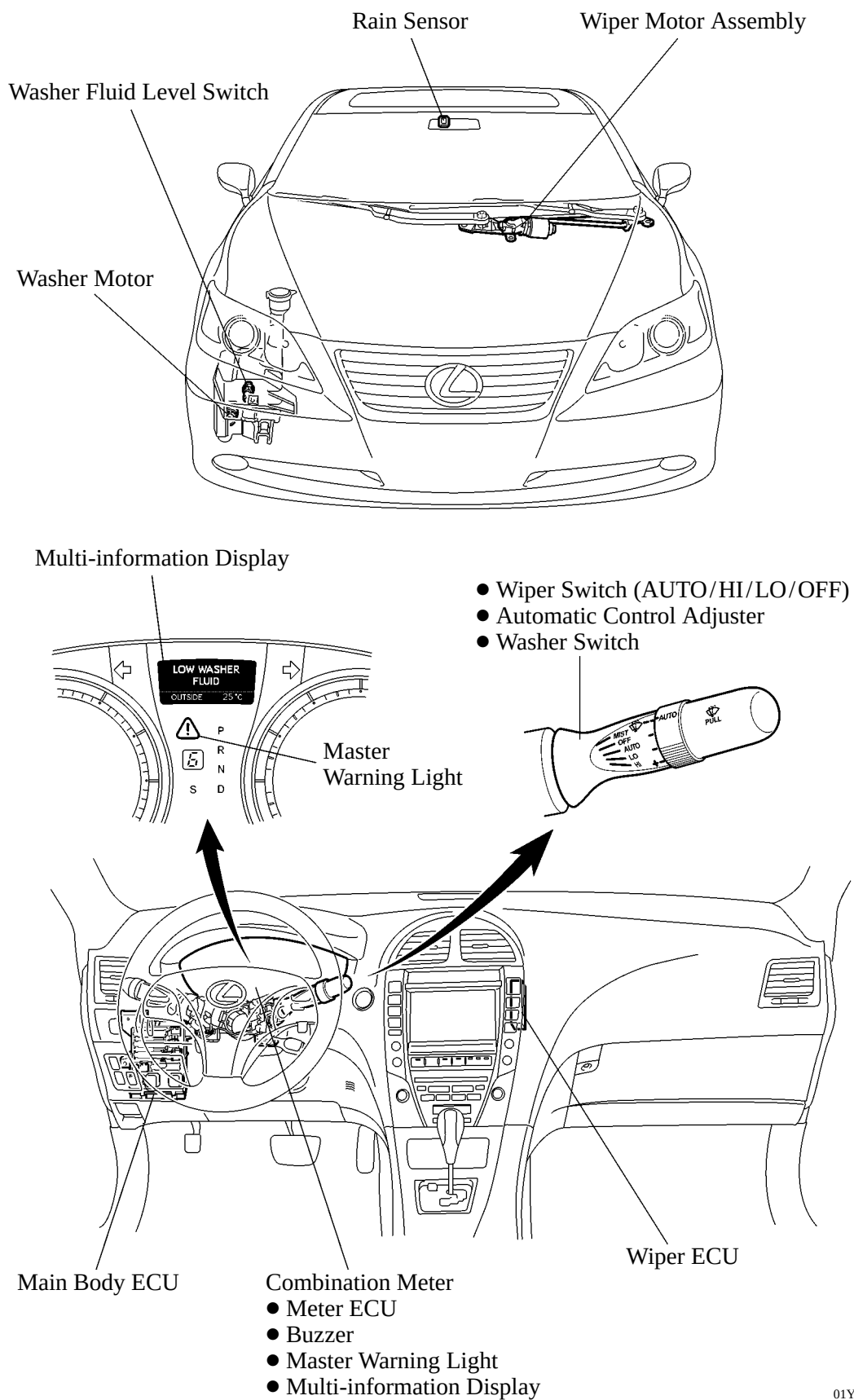
LAYOUT OF MAIN COMPONENTS



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- MEMO -

■ LAYOUT OF MAIN COMPONENTS



WIPER AND WASHER

■ DESCRIPTION

- A wiper system with a rain sensing function is available as optional equipment.
- This system has the following functions.

Function		Outline
Wiper*1	Rain Sensing	Controls the wiping interval and speed in accordance with the amount of rain, vehicle speeds and taillight signals when the wiper switch is in the AUTO position.
	Forced Wiping	When any one of the following conditions is met while wiping is controlled by the rain sensing function, the wiper ECU forcibly operates the wipers once. • The wiper switch is turned from OFF to AUTO when the power source is IG-ON. • The vehicle starts off. • The automatic control adjuster is turned to the + direction. (to boost the sensitivity)
	Fail-safe	When the wiper motor malfunctions, the wiper ECU terminates both the rain sensing function and the wiper operation.
		When the rain sensor malfunctions, the wiper ECU sets the wiper interval depending on the vehicle speed and the automatic adjuster position, as follows: • While stationary: Approx. 4 to 13 sec, in accordance with the automatic control adjuster position. • At low speeds*3: Approx. 3 to 11 sec, in accordance with the automatic control adjuster position. • At normal speeds*4: Approx. 2 to 10 sec, in accordance with the automatic control adjuster position.
	Washer-linked Wiper with Drip-prevention	To prevent the fluid from dripping after the washer has been operated, this function operates the wipers once after they have operated in unison with the washer.
Washer*2	Washer Fluid Level Warning	When the volume of washer fluid decreases to below a certain level (when the washer fluid level switch is turned ON), the combination meter warns the driver through the master warning light illumination, the buzzer and the warning message on the multi-information display.

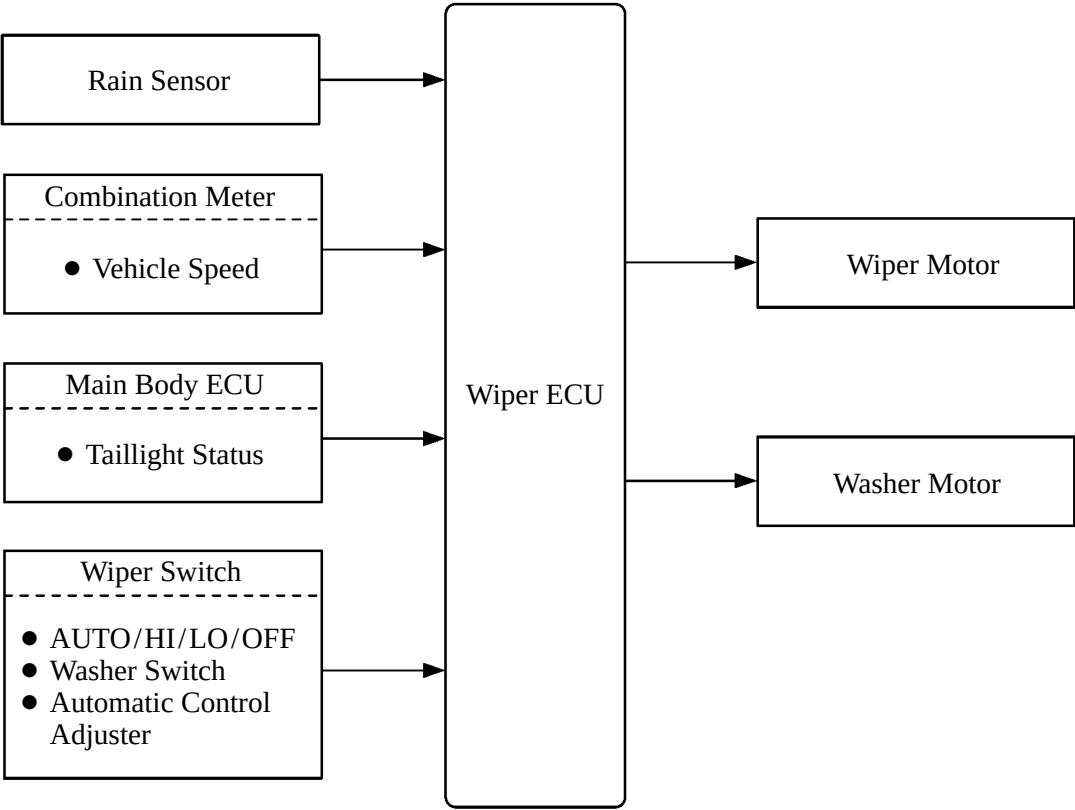
*1: These functions are applicable to models equipped with the wiper system with the rain sensing function.

*2: The washer fluid warning function is standard on all models.

*3: Approximately 6 to 23 km/h (4 to 14 mph) during acceleration. Approximately 4 to 16 km/h (2.5 to 10 mph) during deceleration.

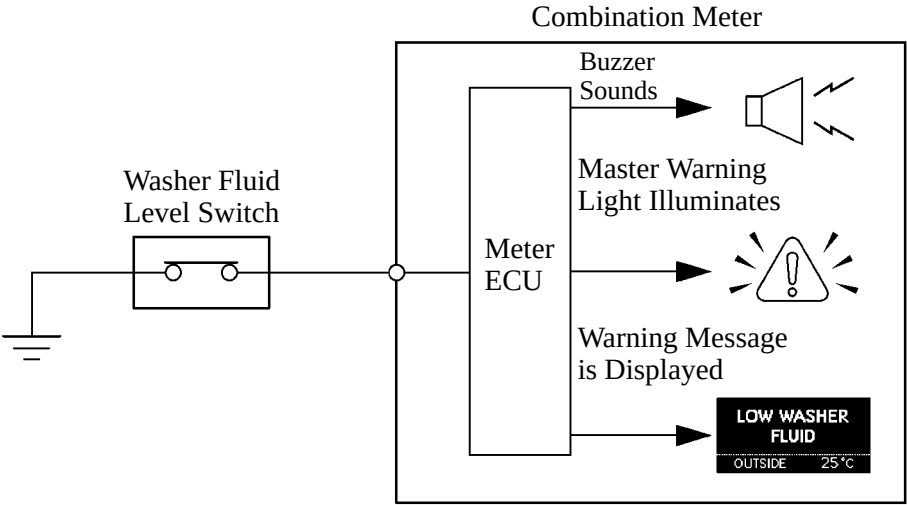
*4: Approximately 23 km/h (14 mph) or more during acceleration. Approximately 16 km/h (10 mph) or more during deceleration.

► System Diagram ◀



01YBE33P

Wiper and Washer



01YBE34P

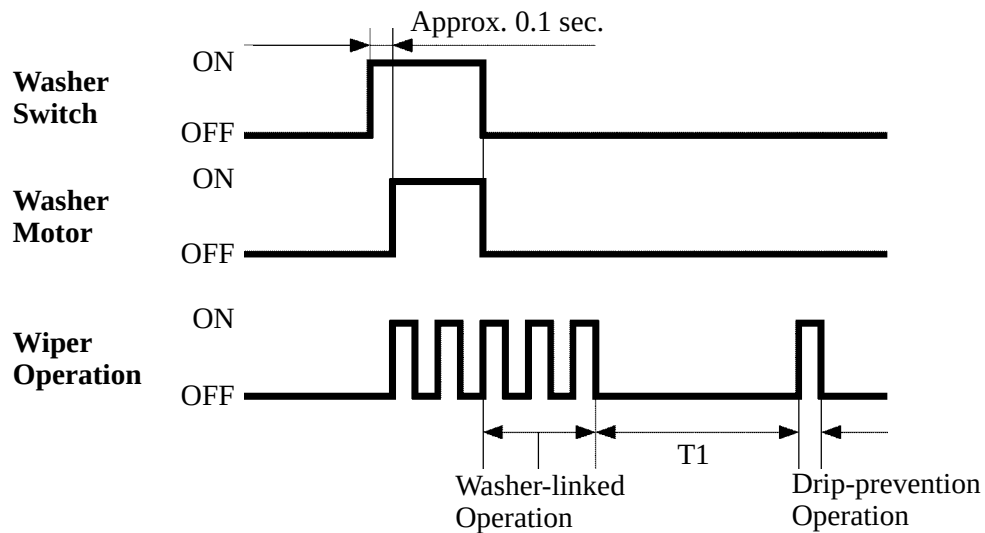
Washer Fluid Level Warning

■ WASHER-LINKED WIPER WITH DRIP-PREVENTION FUNCTION

When the wiper switch is set to OFF or AUTO and the washer switch is turned ON for approximately 0.1 seconds or more, the wipers start on LO at the same time as the washer fluid is sprayed.

- The wipers operate three times on LO after the washer switch is turned OFF.
- As shown in the following diagram, after the end of this operation, the wipers operate once more. They do so after an interval time determined by the vehicle speed, so that any washer fluid drips are wiped away.

► Timing Chart ◀



T1: From the interval time table

0140BE226C

► Interval Time Table ◀

Vehicle Speed km/h (mph)	Interval Time
Approx. 0 to 59 (0 to 37)	Approx. 3 sec.
Approx. 60 to 79 (37 to 49)	Approx. 5 sec.
Approx. 80 to 119 (50 to 74)	Approx. 7 sec.
Approx. 120 to 159 (75 to 99)	Approx. 5 sec.
Approx. 160 to 169 (99 to 105)	Approx. 3 sec.
Approx. 170 or more (106 or more)	No operation

■ RAIN SENSING FUNCTION

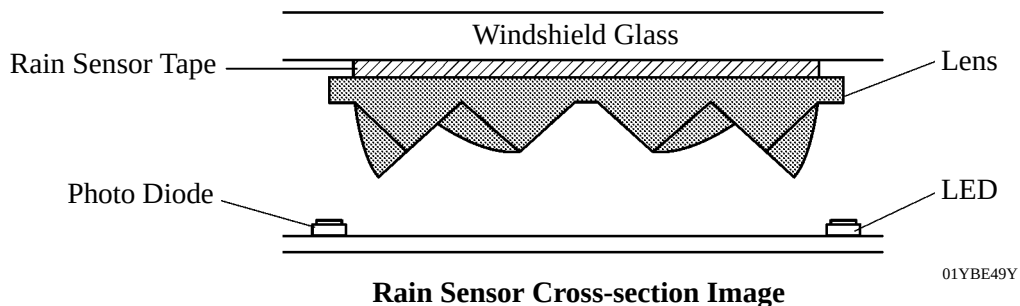
1. General

- The rain sensing function controls the wiping interval and speed in accordance with the amount of rain that strikes the windshield when the wiper switch is in the AUTO position.
- The wiper ECU controls the wiper operation by calculating the optimal wiping interval and speed in accordance with the following information:
 - Rainfall data transmitted by the rain sensor
 - Taillight status signals transmitted by the main body ECU (whether it is day or night)
 - Vehicle speed signals transmitted by the combination meter
 - Set values regarding the system sensitivity transmitted by the automatic control adjuster

2. Rain Sensor

General

The rain sensor consists of two LEDs (Light Emitting Diodes) that emit infrared rays, a photo diode that can receive those rays, a lens and rain sensor tape.

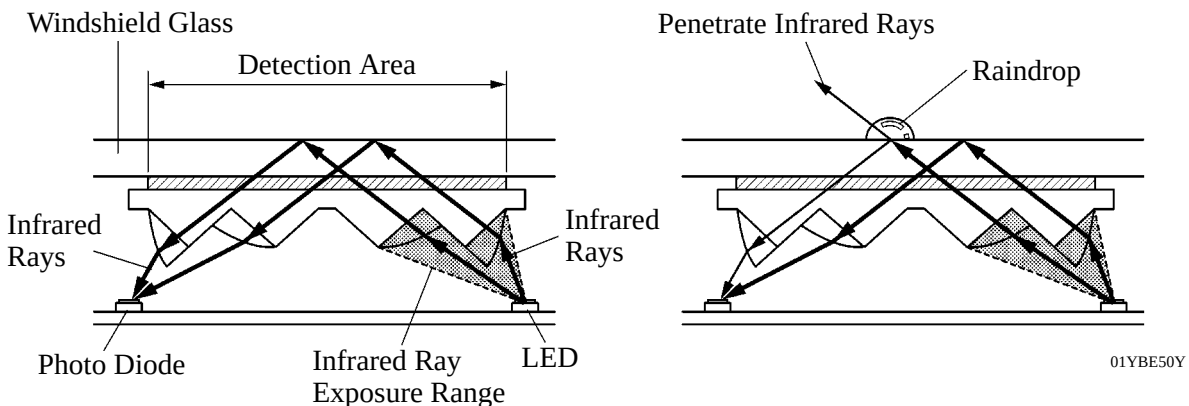


Service Tip

If the rain sensor tape has been peeled off during a windshield glass replacement, be sure to affix new rain sensor tape. Failure to do so will lead to a system malfunction.

Operation

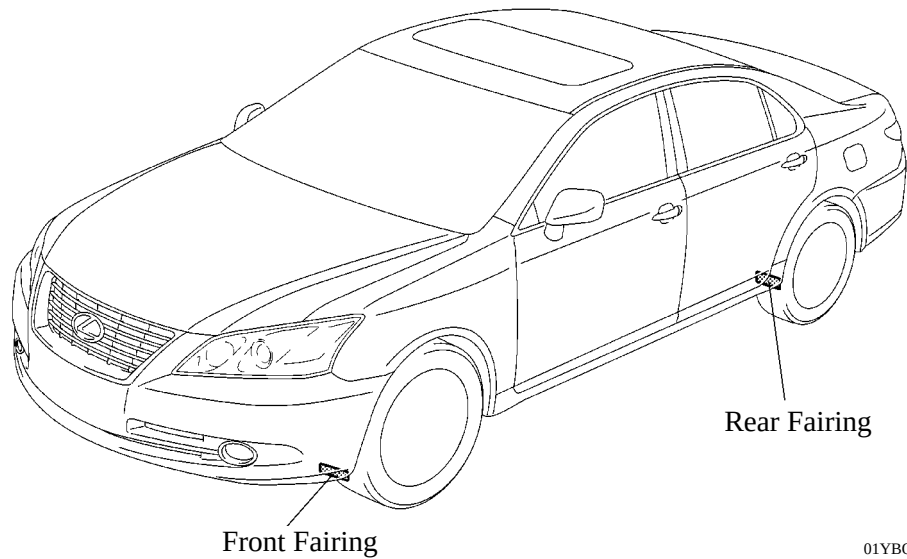
- If no rain is present in the detection area, the infrared rays emitted by the LED are all reflected by the outer surface of the windshield glass and are received by the photo diode.
- If rain is present in the detection area, a portion of the emitted infrared rays passes through the windshield glass due to the change in the difference between the refractive indexes of the glass and the area outside the windshield (the refractive difference between air and water). The ability of the windshield glass to reflect light back inside is reduced by the presence of the rain. This change in the internal reflection due to the presence of the water reduces the proportion of the infrared rays that are received by the photo diode. The extent of this reduction is used to determine the amount of rain falling on the windshield.



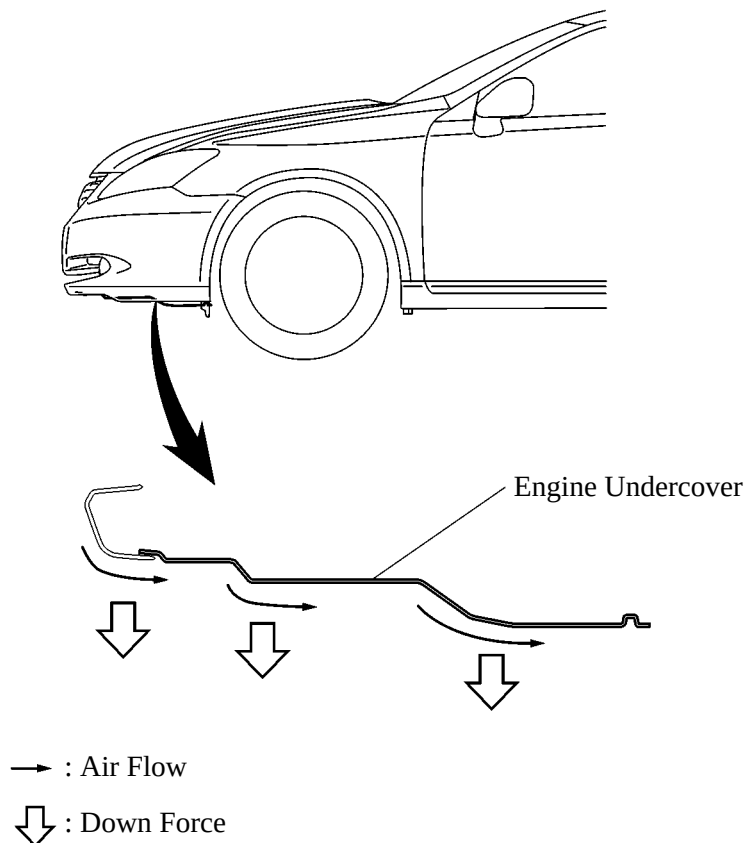
■ AERODYNAMICS

To improve aerodynamic performance, the following measures have been taken.

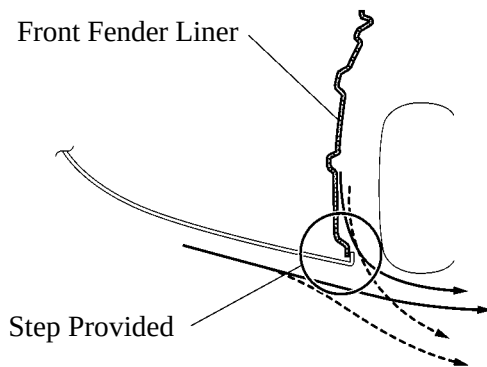
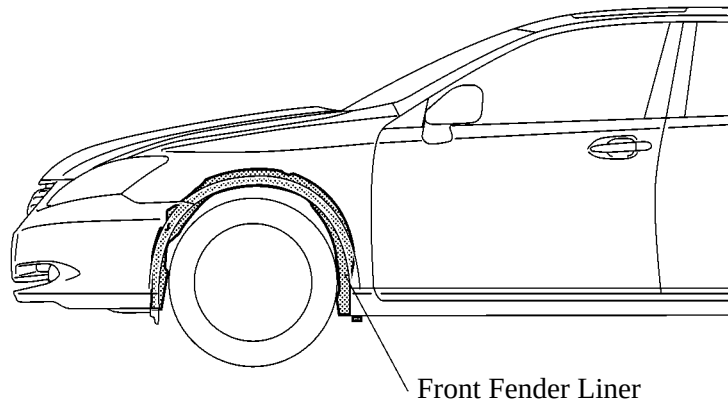
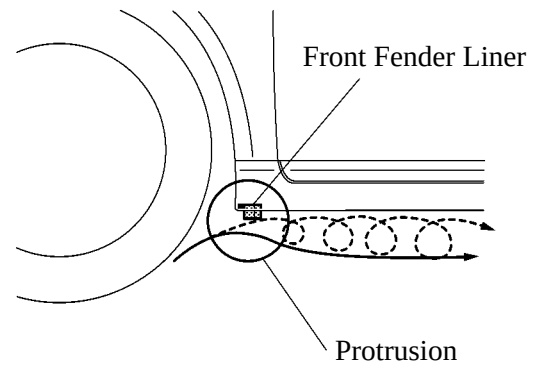
- Front and rear fairings are provided to smooth out the airflow around the tires and reduce the air resistance while the vehicle is in motion.



- The engine undercover has been formed into a step shape to increase the velocity of the air flowing underneath the vehicle. This creates a vacuum and suppresses the lift force, thus, excellent maneuverability and stability have been achieved.



- By reshaping the front and rear of the front fender liner, airflow around the wheel has been improved. As a result, excellent maneuverability and stability have been realized.

**Top View****Side view**

----- : Before Reshaping
————— : After Reshaping

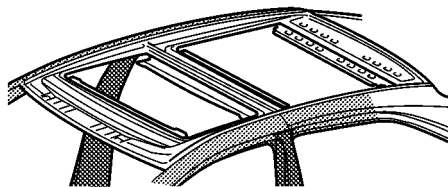
BODY

BODY STRUCTURE

■ LIGHTWEIGHT AND HIGHLY RIGID BODY

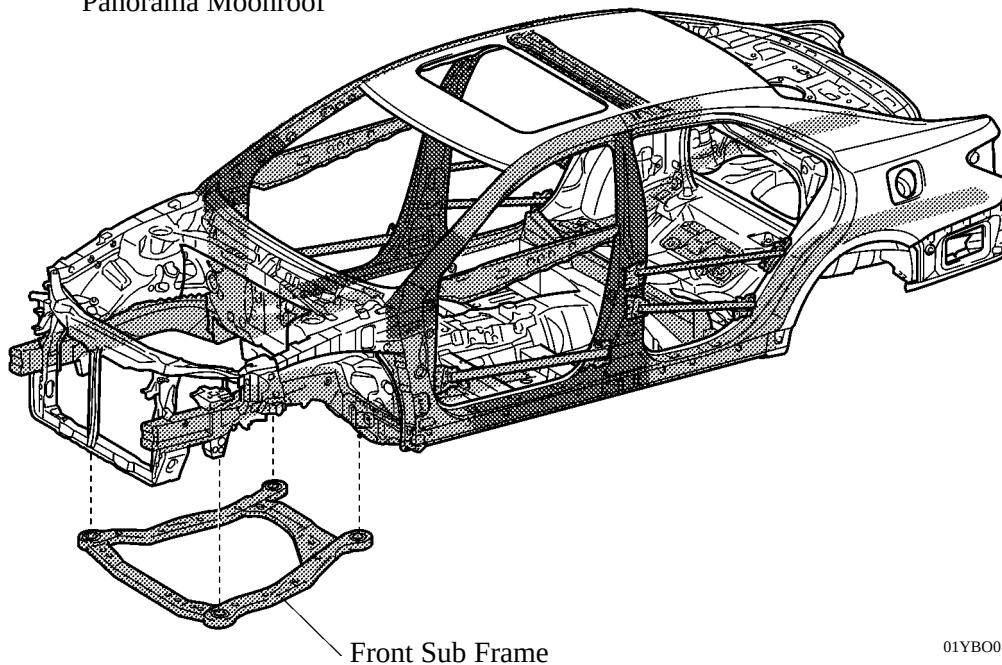
1. High Strength Sheet Steel

- High strength sheet steel is used in order to ensure body rigidity and realize a lightweight body.
- In the front pillar reinforcement, center pillar reinforcement and rocker members, ultra high strength sheet steel is used.
- Ultra high strength sheet steel has approximately 1.6 times the strength of conventional high strength sheet steel. Therefore, to provide the same strength of high strength sheet steel, a weight reduction of approximately 40% can be realized.



Panorama Moonroof

 : High Strength Sheet Steel
 : Ultra High Strength Sheet Steel

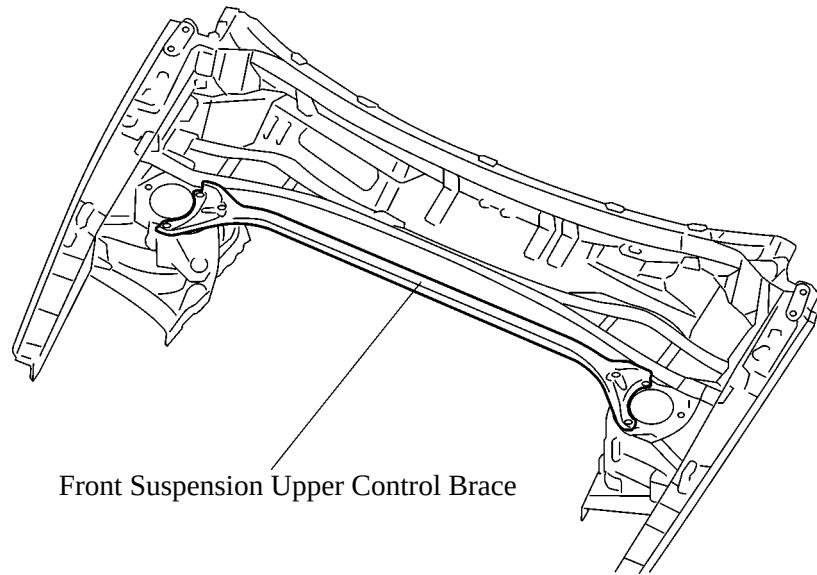


Front Sub Frame

01YB001Y

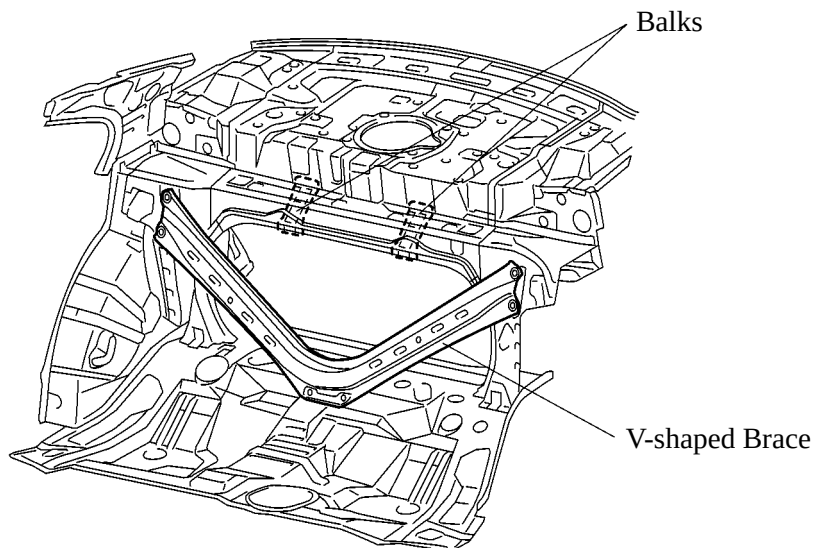
2. Brace

- Excellent maneuverability and stability has been achieved by providing a front suspension upper control brace for the front suspension tower.



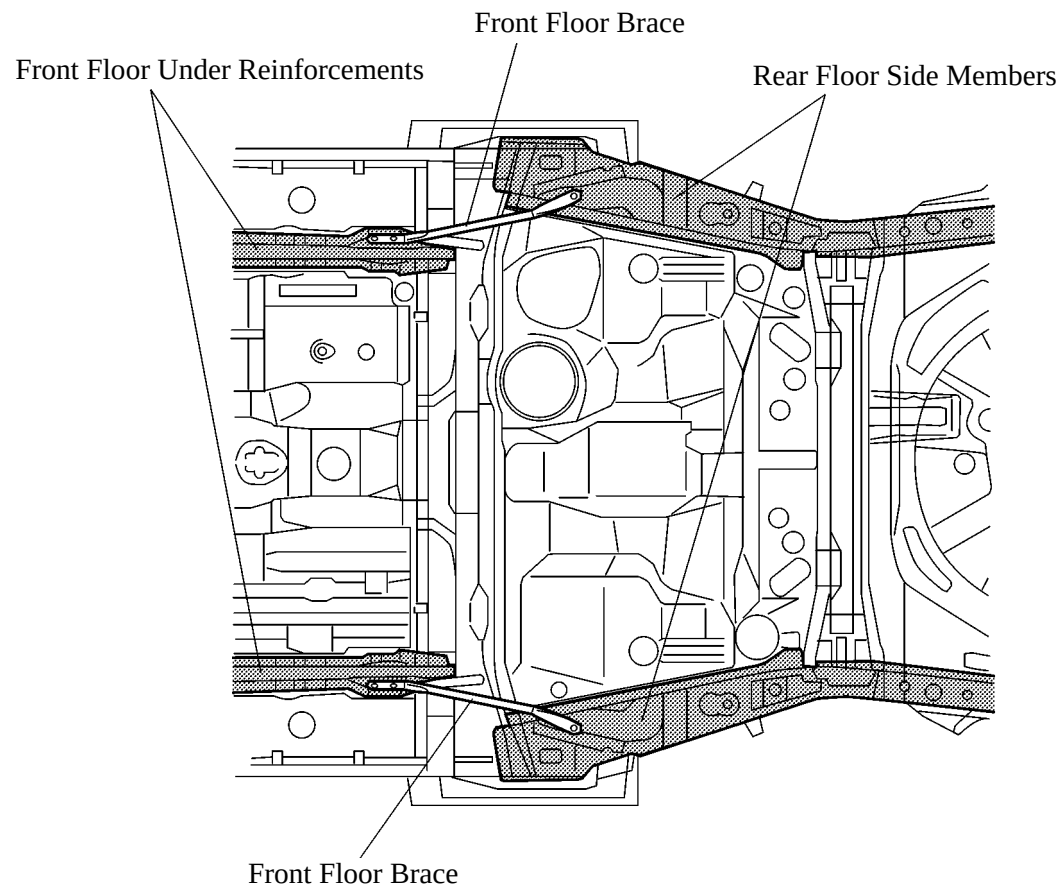
01YBO02Y

- A V-shape brace has been provided between the rear suspension tower and the floor cross member. In addition, bunks have been provided in the lower portion of the upper back. As a result, the body rigidity has been enhanced and excellent maneuverability and stability have been realized.



01YBO03Y

- High body rigidity has been achieved through the use of front floor braces between the front floor under reinforcements and rear floor side members.



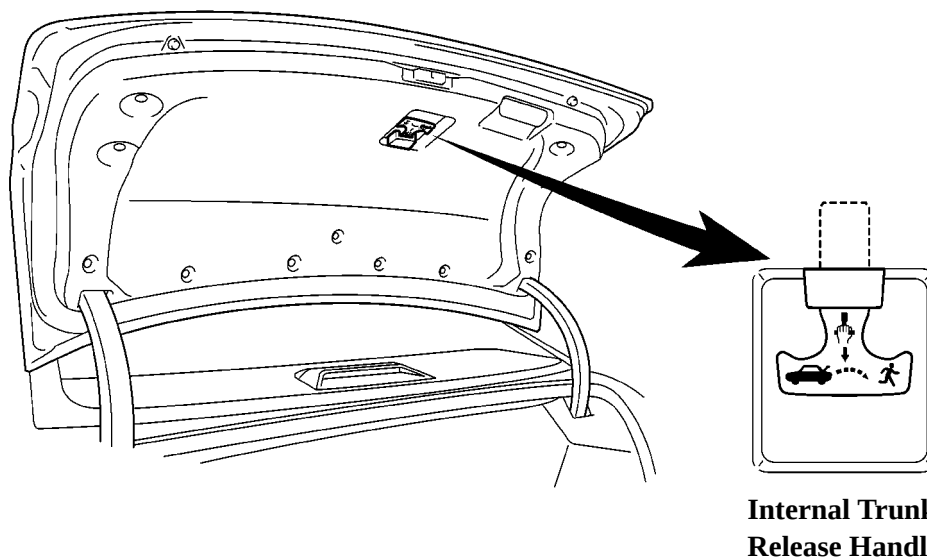
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View from Bottom Side

■ INTERNAL TRUNK RELEASE HANDLE

In case a person is inadvertently locked inside the trunk and needs to get out, an internal trunk release handle is included inside the luggage room.

The handle is made of phosphorescent plastic, so that it is visible in the luggage room for a while even after the luggage room door has been closed.

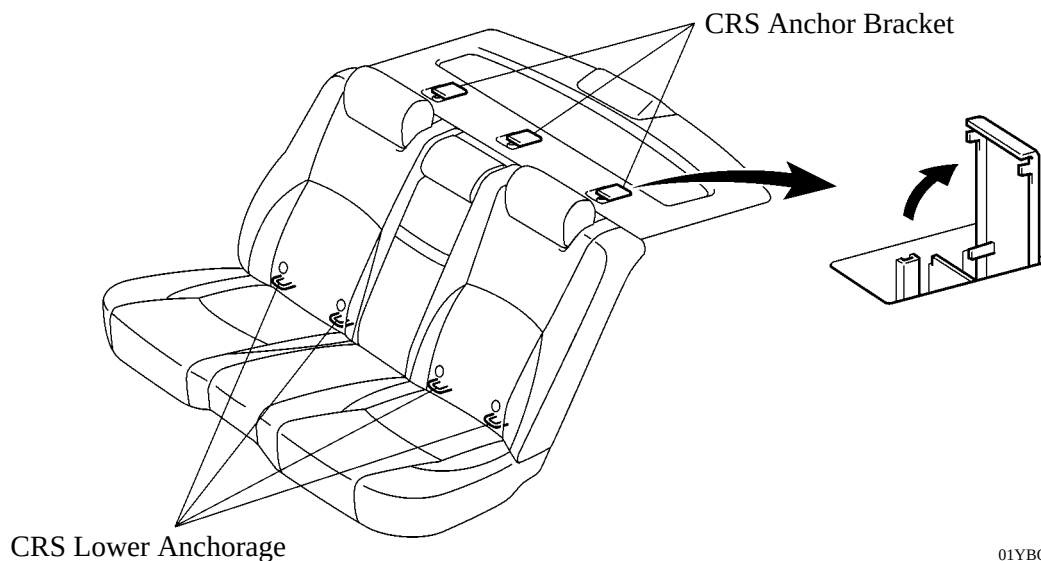


01YB033Y

■ CHILD RESTRAINT SYSTEM

CRS (Child Restrain System) lower anchorage for securing child seats has been provided behind the seat cushion of the rear seat.

Three CRS anchor brackets for securing a child seat are provided above the package tray trim.

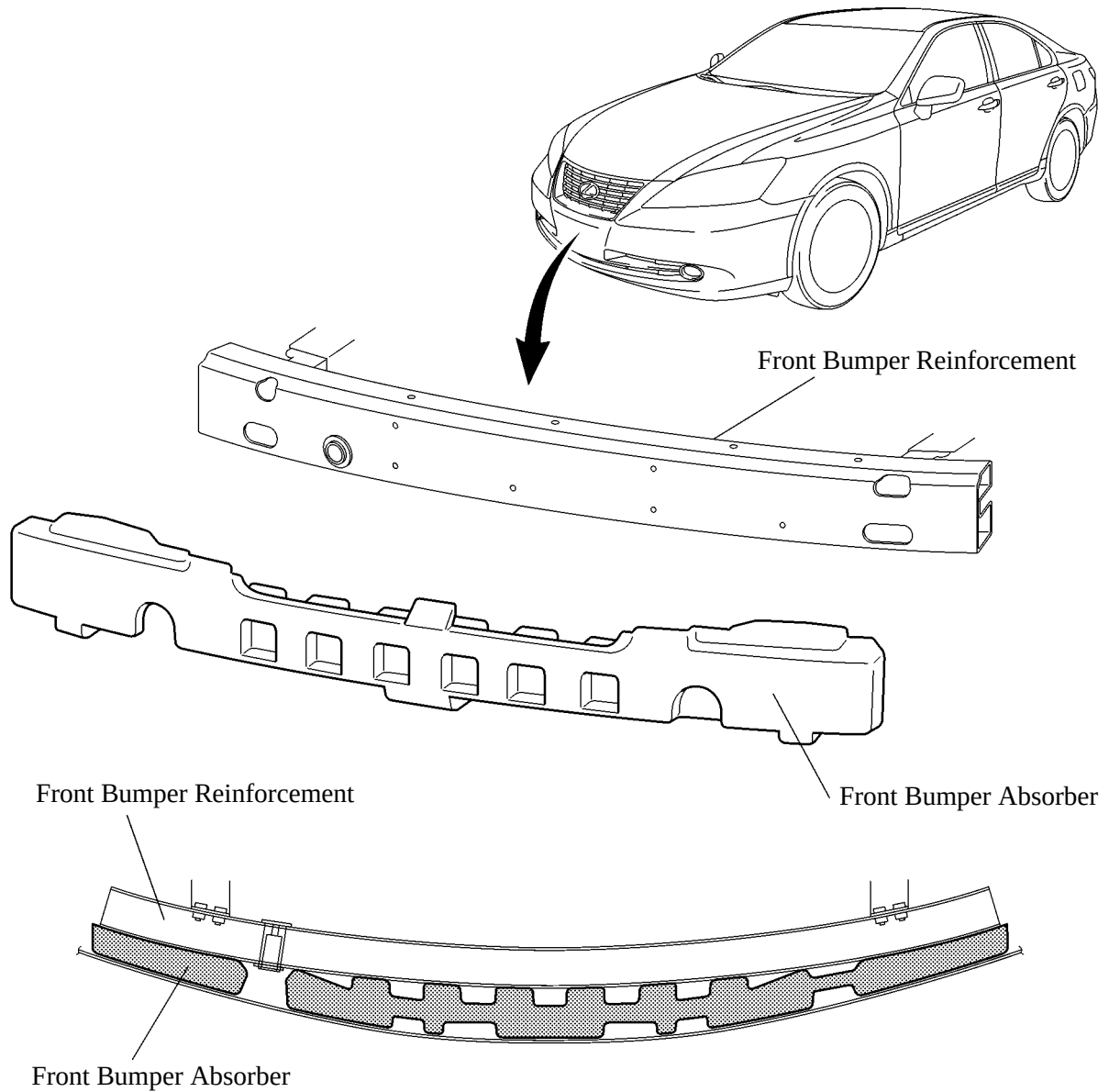


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ENHANCEMENT OF PRODUCT APPEAL

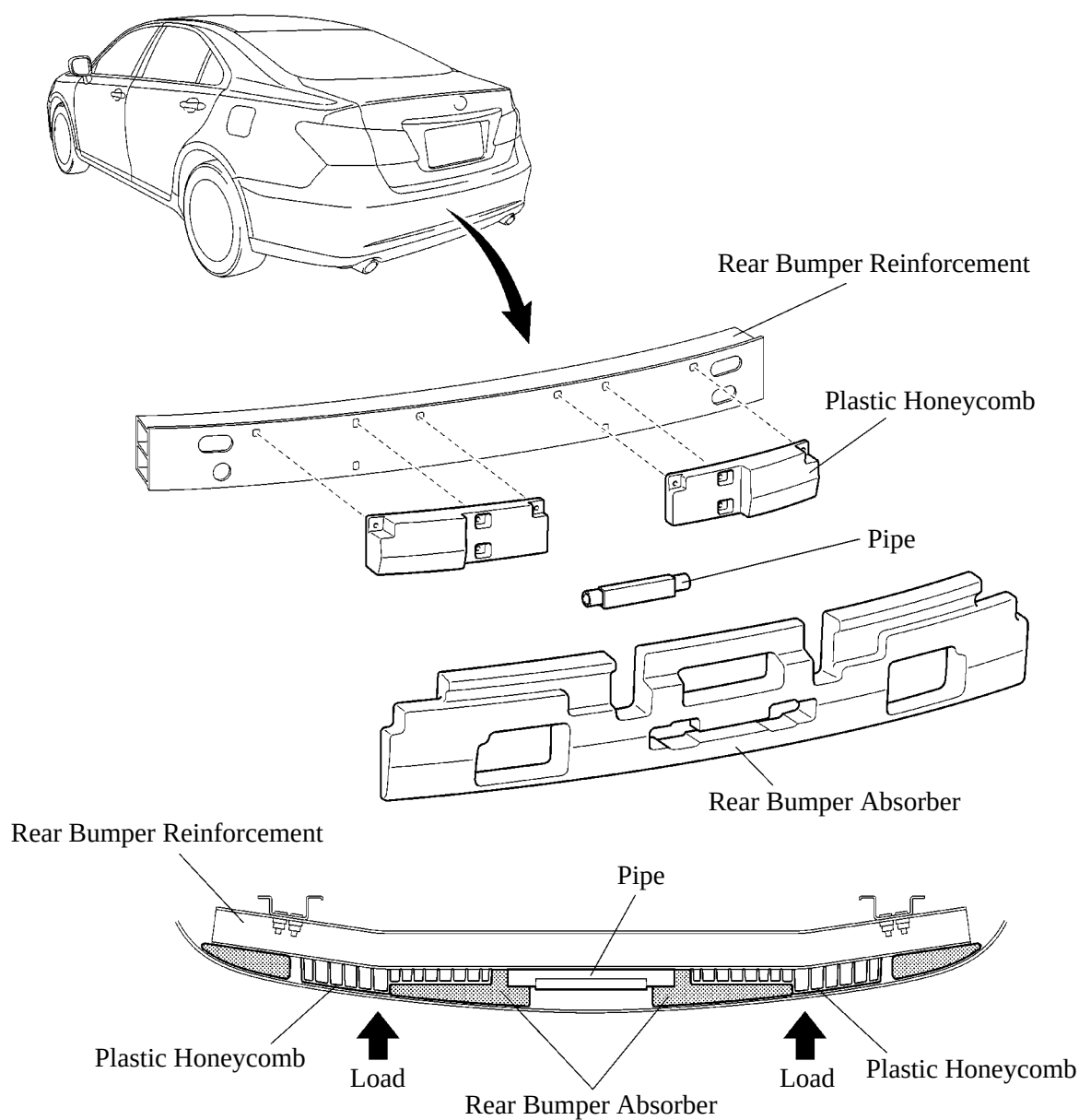
■ PARTS WITH LOW REPAIR COST

- By giving the bumper absorber of the front bumper protrusions, impact energy is dispersed and body deformation in the event of a slight collision is minimized.



Cross Section of Front Bumper

- Plastic honeycomb has been provided in two places on the rear bumper. When a slight collision occurs, they divide the load concentration and this prevents the center of the aluminum bumper reinforcement from being deformed. As a result, service cost can be reduced. Furthermore, repairs are easy because the honeycombs are fitted onto the bumper reinforcement by using clips.

**Cross Section of Rear Bumper**

01YBO29Y

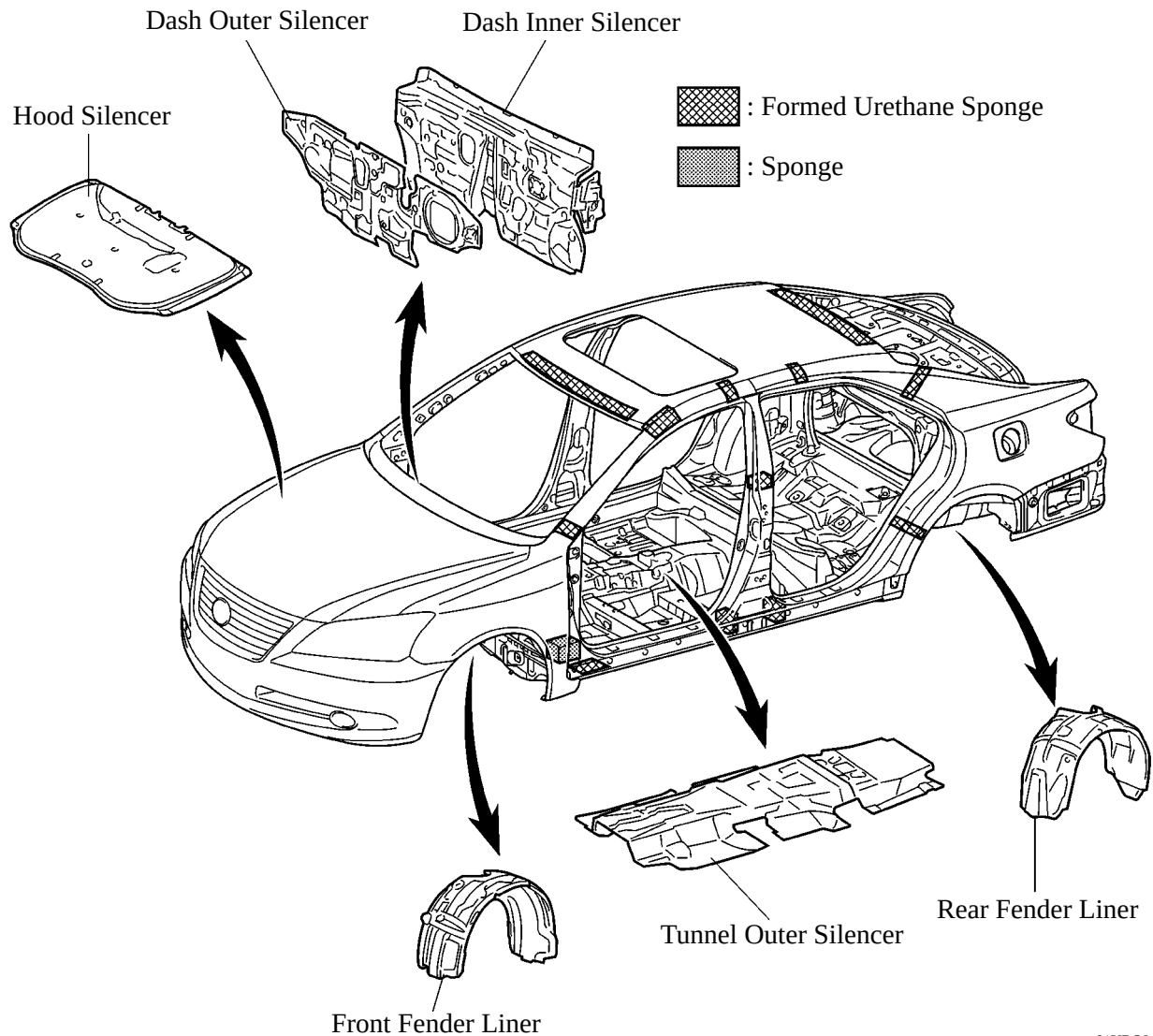
■ LOW VIBRATION AND LOW NOISE BODY

1. General

Effective application of vibration damping and noise suppressant materials reduces engine and road noise.

2. Sound Absorbing and Vibration Damping Materials

- Foamed urethane sponge and foamed sealing material are applied onto the roof panel and pillars to reduce wind and road noise.
- A large-size dash inner silencer, dash outer silencer, hood silencer and tunnel outer silencer are used to reduce engine and road noise and improve quietness inside the passenger compartment.
- The fender liner inside the front wheelhouse is covered with a sound absorbing material (Thinsulate) in order to minimize grit, water and road noises.
- The plastic fender liner, which is made of SBR (Styrene Butadiene Rubber), and PET (Polyethylene Terephthalate) felt is fitted inside the rear wheelhouse in order to minimize grit, water and road noises.



- In place of the asphalt sheet used on conventional models, a vibration damping foam coating is used on the floor of the new model to reduce road noise.
- The thickness of the vibration damping foam coating has been optimally adjusted for the individual portions. As a result, a lightweight coating has been realized.

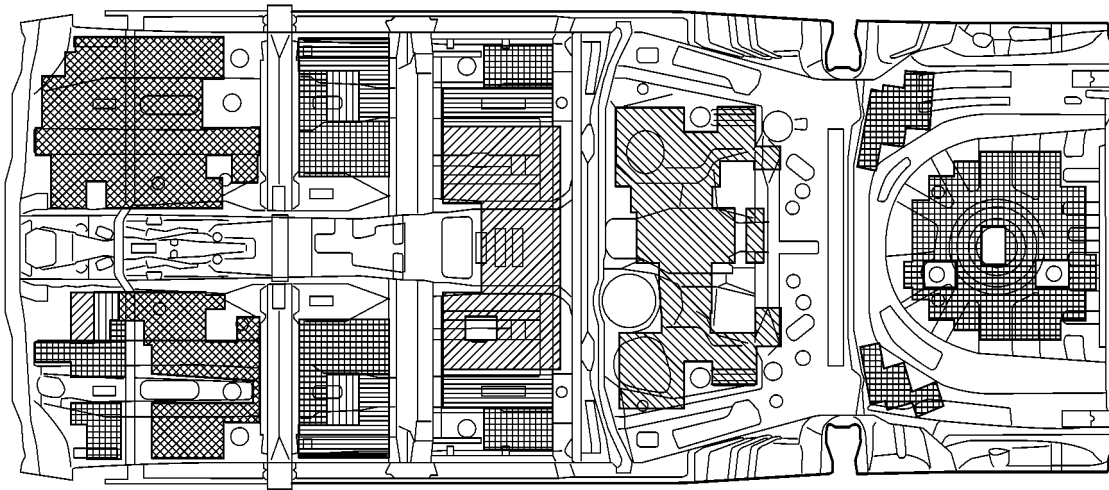
 : Coating Thickness 1.8 mm (0.07 in.)

 : Coating Thickness 2.3 mm (0.09 in.)

 : Coating Thickness 3.3 mm (0.13 in.)

 : Coating Thickness 4.1 mm (0.16 in.)

 : Coating Thickness 5.4 mm (0.21 in.)

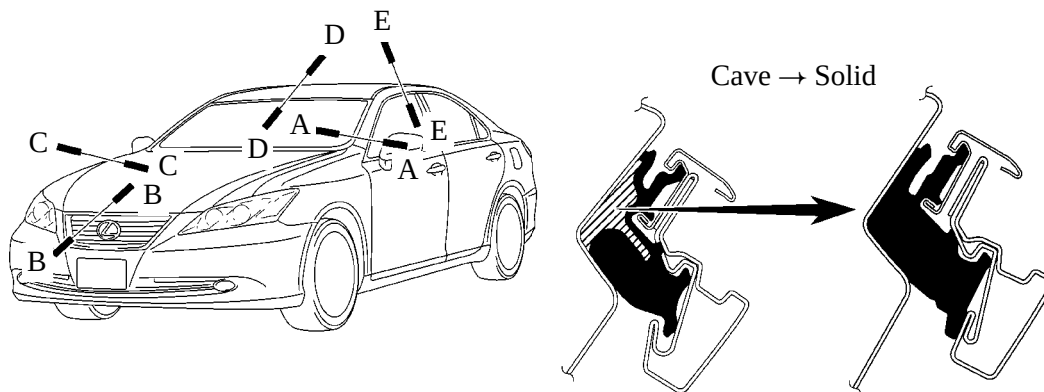


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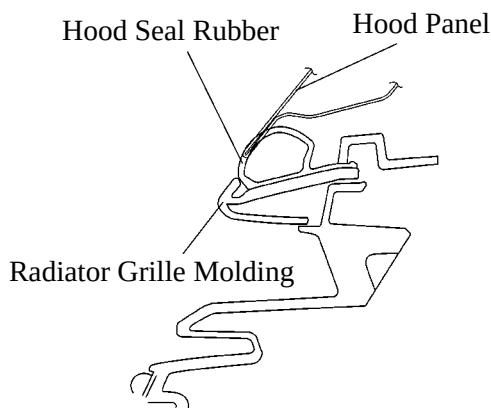
View from Top Side

3. Reducing Wind Noise

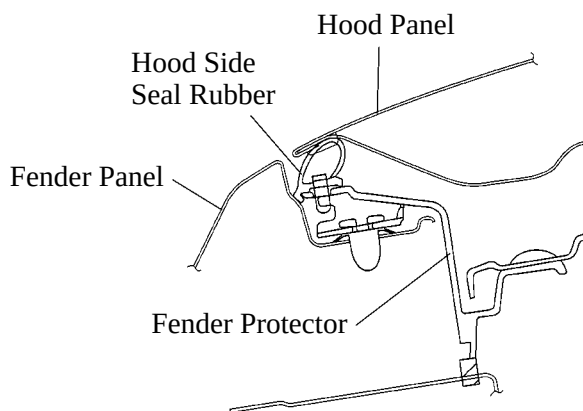
- A structure that blocks the airflow is used in a portion of the door weather strip (at the front corner) in order to reduce wind noise (A - A cross section).
- The air turbulence has been eliminated through the optimization of the shape of the hood seal rubber (B - B cross section) and the use of the hood side seal rubber (C - C cross section).
- By streamlining the joins between the windshield glass and the roof (D - D cross section) and between the doorframe and the door window glass (E - E cross section), air turbulence has been minimized.



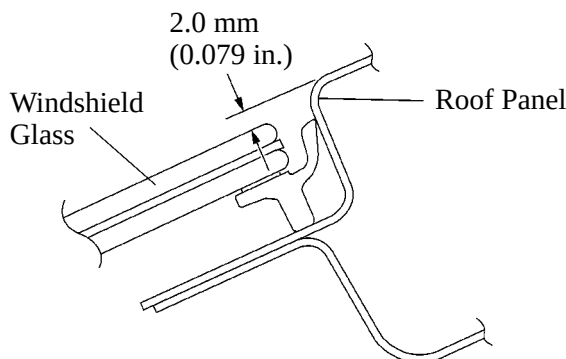
A - A Cross Section



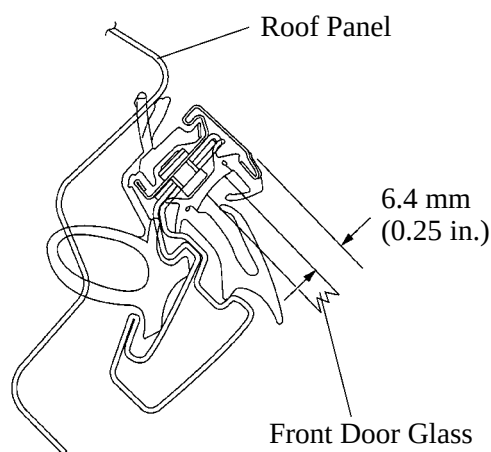
B - B Cross Section



C - C Cross Section

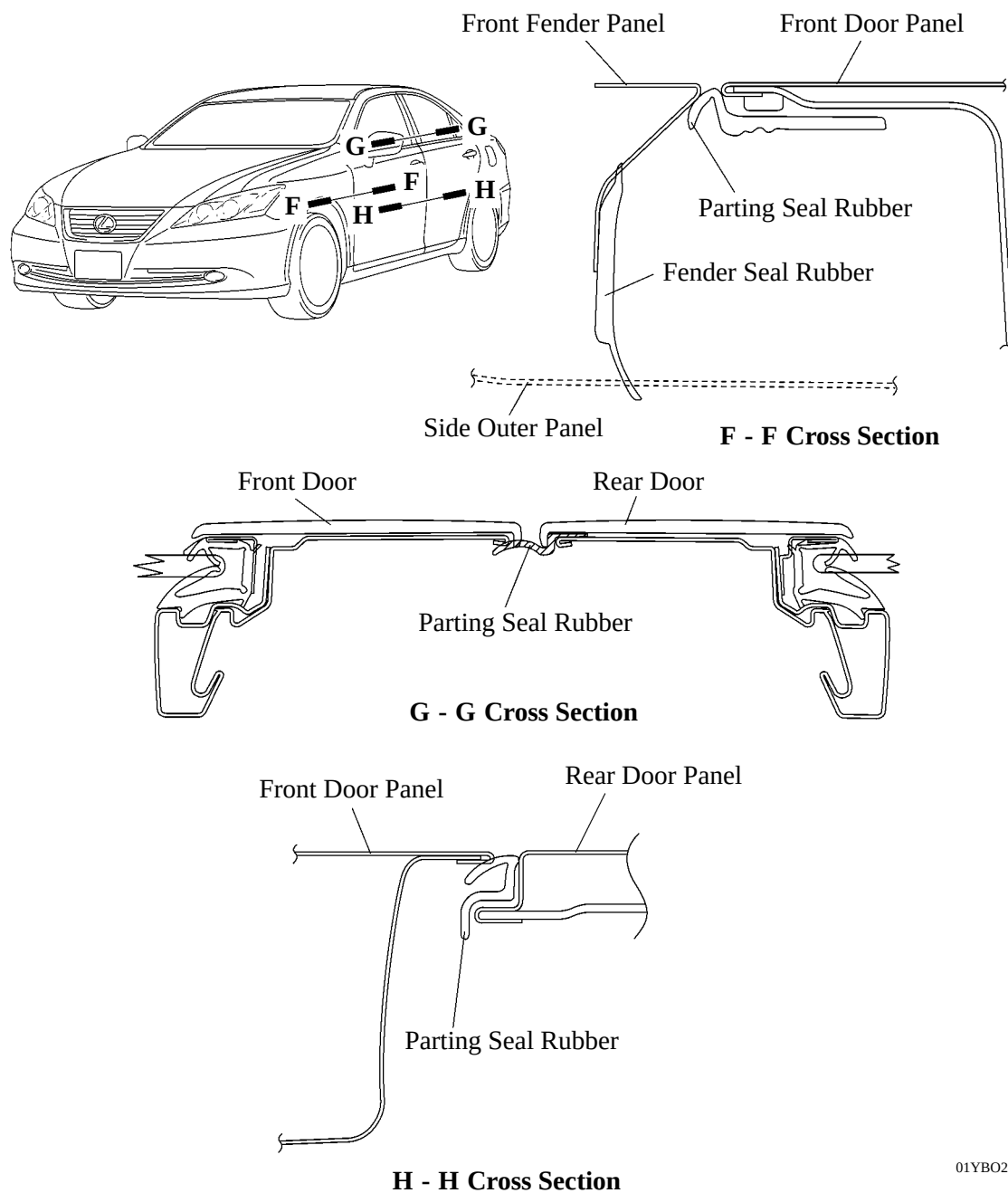


D - D Cross Section



E - E Cross Section

- A seal rubber is used between the front fender and the side outer to prevent air from blowing through. In addition, a seal rubber is used between the front fender and the front door to eliminate air turbulence. (F - F cross section)
- Seal rubbers are employed between the front and rear doors to eliminate air turbulence (G - G and H - H cross sections).



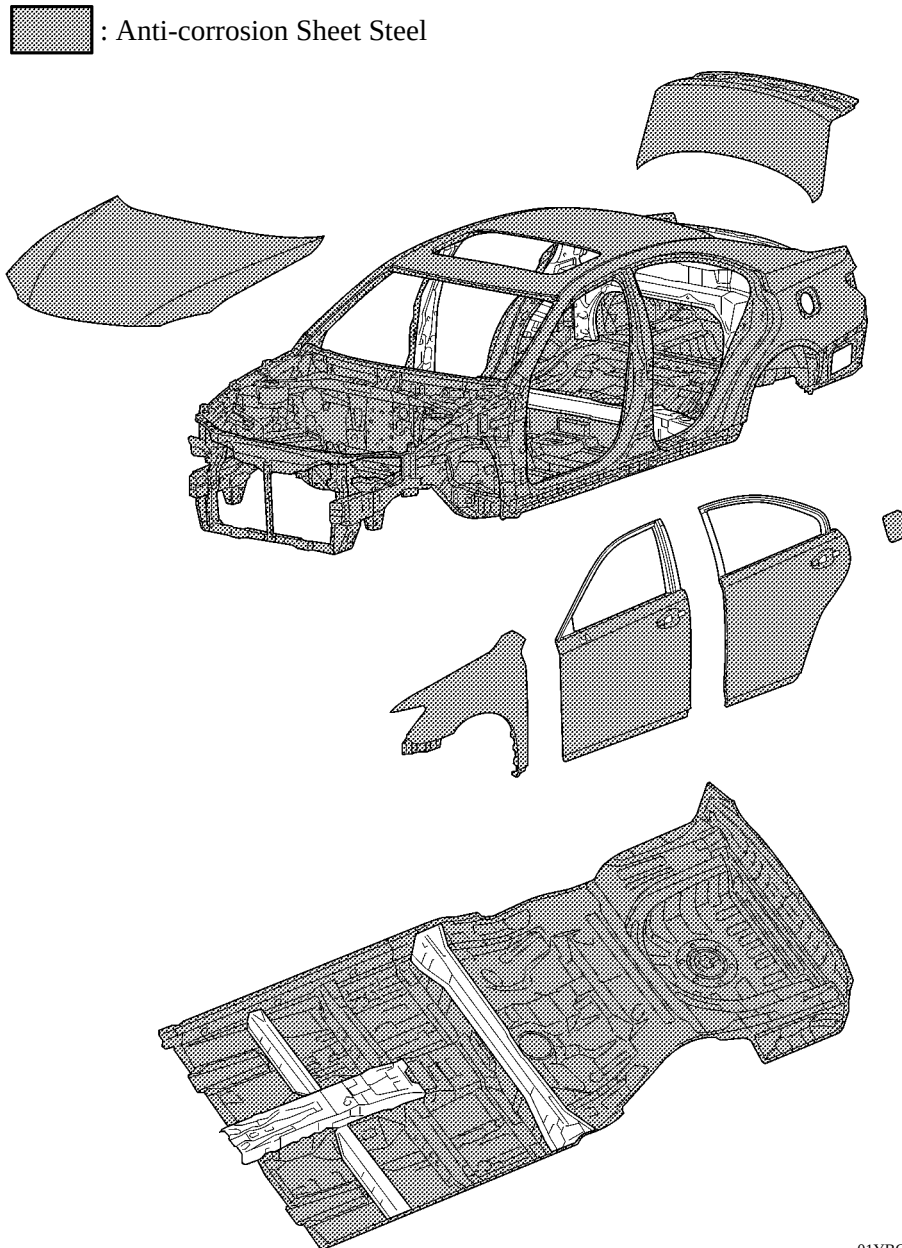
■ RUST-RESISTANT BODY

1. General

Rust-resistant performance is enhanced extensive use of anti-corrosion sheet steel, as well as by an anti-corrosion treatment that includes the application of anti-rust wax, sealer and anti-chipping paint to easily corroded parts such as the hood, doors and rocker panels.

2. Anti-corrosion Sheet Steel

Anti-corrosion sheet steel is used as the following illustration.



01YB018Y

3. Wax and Sealer

Wax is applied to edge of the hood, door lower portion, door hinge and fuel filler lid hinge to improve rust-resistant performance. Sealer is applied to hemmed portions of the hood, door panels and luggage door.

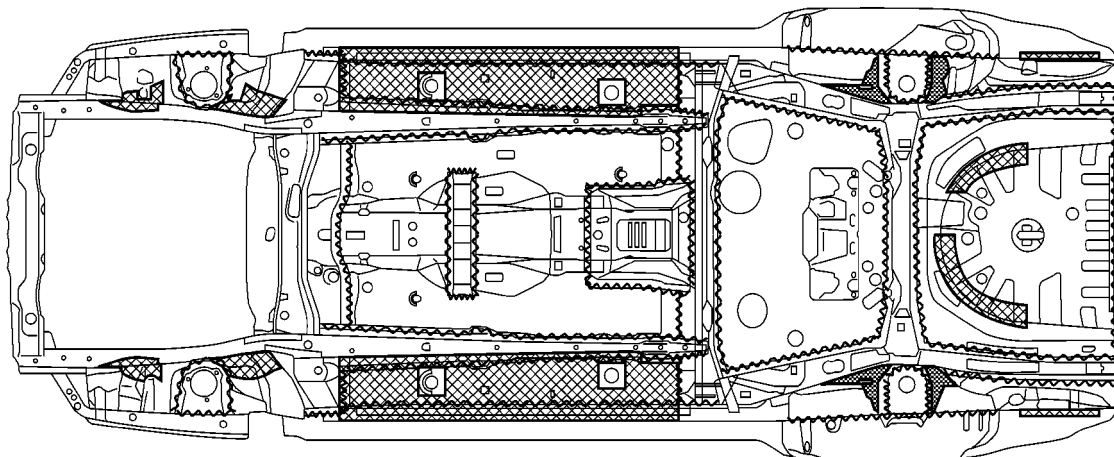
4. Under Coat

Acrylic acid resin is applied to under side of the body, inside the rear wheel housing and other parts that are susceptible to stone chipping damage, thus improving the rust-resistant performance of these areas.

~~~~~ : Edge Seal

■ : Acrylic Acid Resin Coating  
(Thick Coating)

▨ : Acrylic Acid Resin Coating



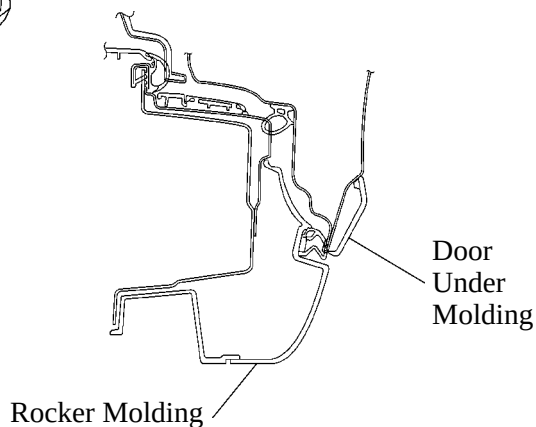
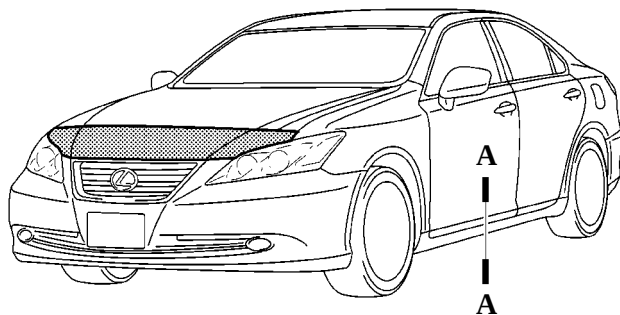
01YBO19Y

View from Top Side

#### 5. Anti-chipping Application

Soft-chip primer has been applied to the front end of the hood. Furthermore, large rocker moldings and large door under moldings are used on all models as standard equipment in order to ensure chip resistance performance in the rocker panel and door area.

■ : Soft-chip Primer



A - A Cross Section

01YBO20Y

## ■ SAFETY FEATURES

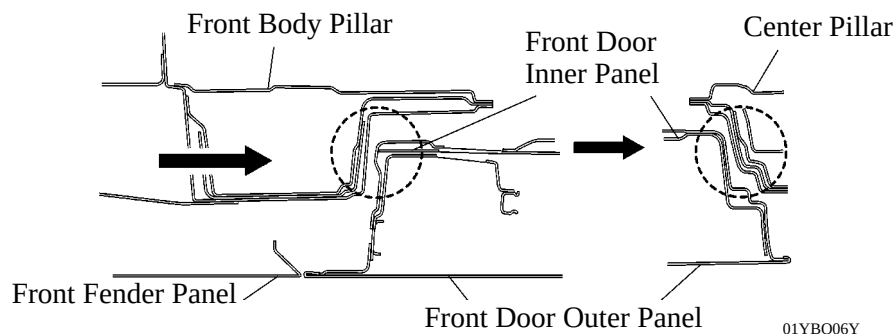
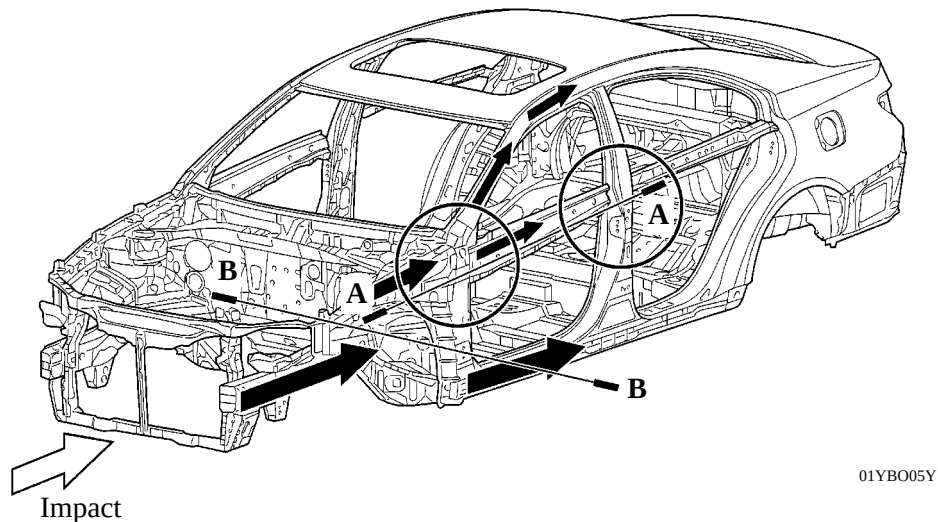
### 1. General

The impact absorbing structure of the '07 ES350 minimizes cabin deformation by effectively helping to absorb the impact energy in the event of a front, side or rear collision. This provides high-performance occupant protection.

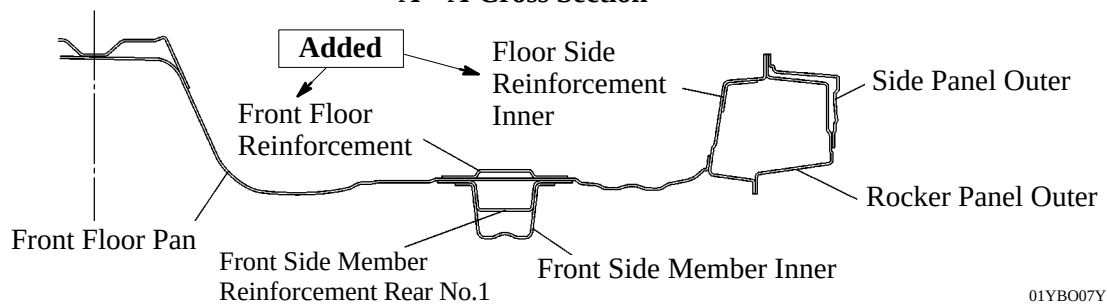
### 2. Impact Absorbing Structure for Front Collision

An optimal arrangement of the basic frame and reinforcements helps to minimize cabin deformation in the event of a collision.

- The body disperses the impact force in the event of an offset frontal collision.
- The body strengthens inner door reinforcements and reduces the gap between the door inner panel and the pillar. This communicates impact load to the door belt line reinforcement, reducing the load on the pillar in the event of an offset frontal collision.
- The floor side reinforcement inner and the front floor reinforcement have been added to, minimizing the cabin deformation.



**A - A Cross Section**

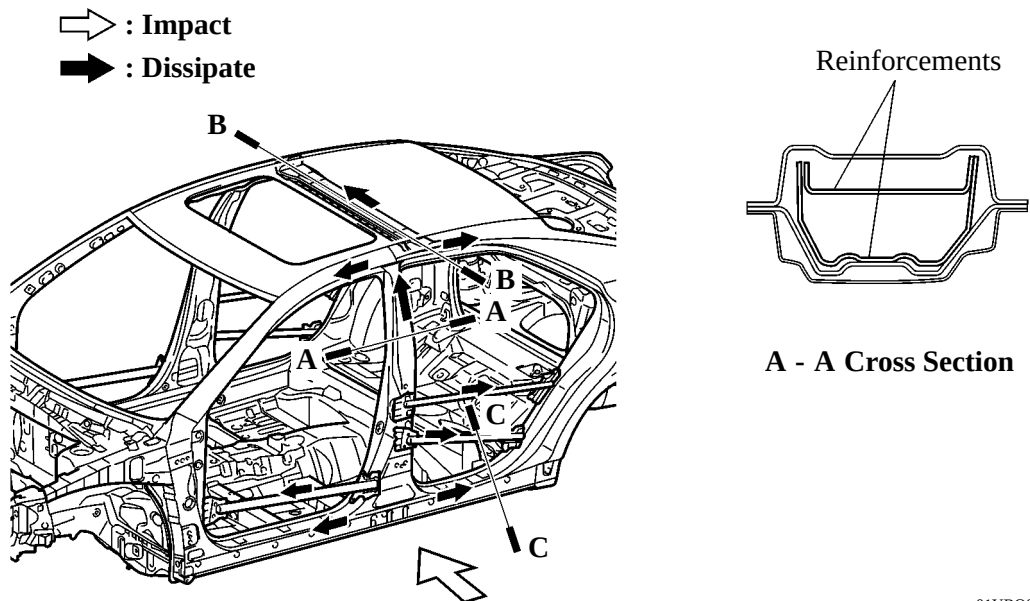


**B - B Cross Section**

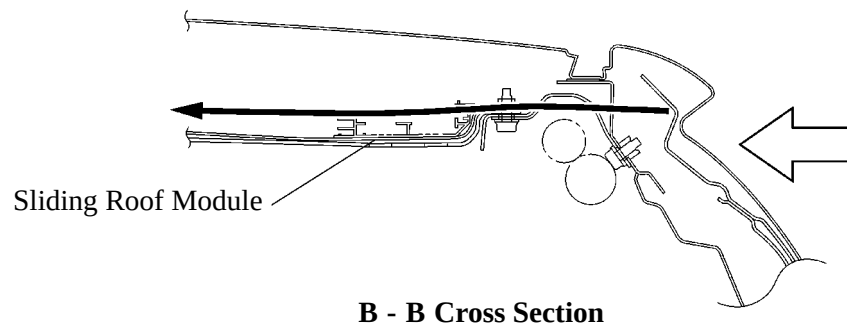
### 3. Impact Absorbing Structure for Side Collision

The impact energy of a side collision directed to the cabin area is dispersed throughout the body via the pillar reinforcements, side impact protection beams, and floor cross members, thus helping minimize the impact energy finally directed to the cabin.

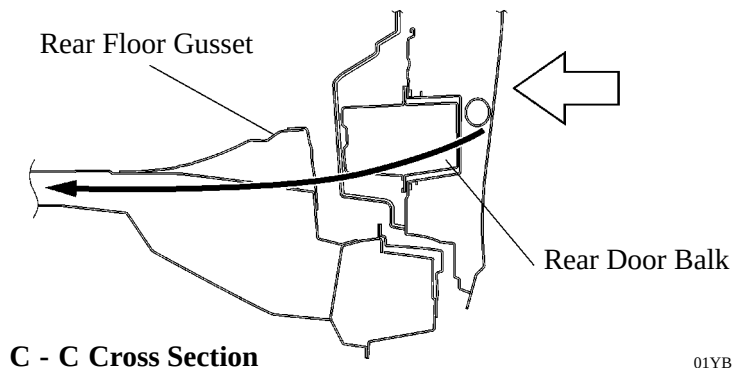
- In order to obtain optimal bearing force, ultra high strength sheet steel is employed in the center pillar reinforcement as described on page BO-2, furthermore, box-shaped reinforcement is used inside the center pillar (A - A cross section).
- High strength sheet steel is used in the roof reinforcement supporting the sliding roof mechanism. In addition, the structure has been made to bear impact loads with both side rails (B - B cross section). This reduces the intrusion of the roof rail into the cabin in the event of a side collision.
- A box is used for the rear door inner and a gusset is used for the rear end of the rocker on the cabin interior side. Overlapping the box and the gusset ensures strength, reducing deformation of the vehicle body in the event of a side collision. (C - C cross section)



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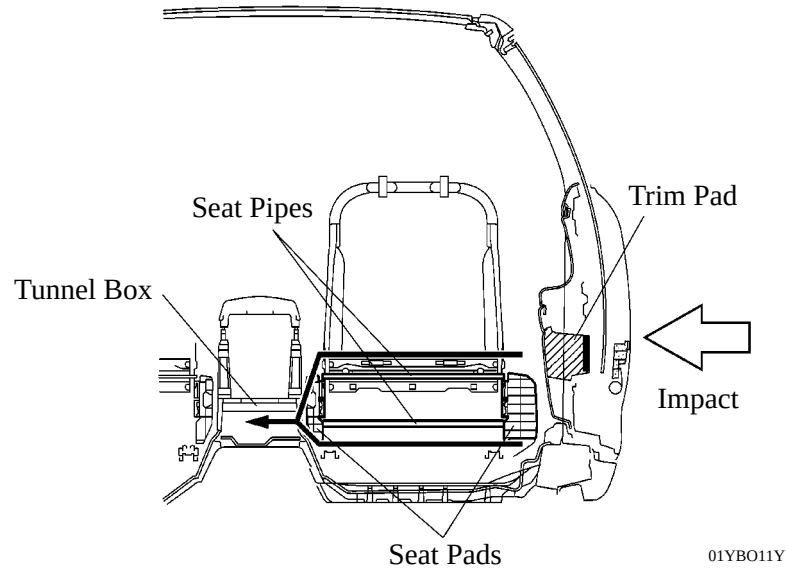


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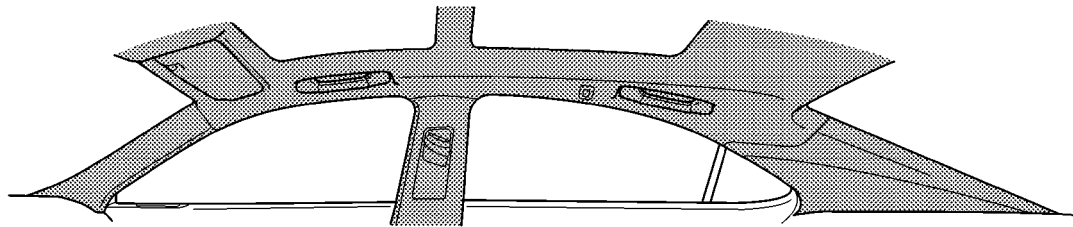
01YBO10Y

- Seat pipes and seat pads have been provided on the front seat pillar frame for load conduction. Furthermore, the tunnel box has been reinforced and the trim pad has been provided inside both front doors. Thus, input load is conducted from the pillar and door to the seat, tunnel box and opposite seat, minimizing deformation of the body.



- A Head Impact Protection Structure is used. With this type of construction, if the occupant's head hits against the roof side rail or pillar due to a collision, the inner panels of the roof side rail, roof area and pillar collapse to help reduce the impact.

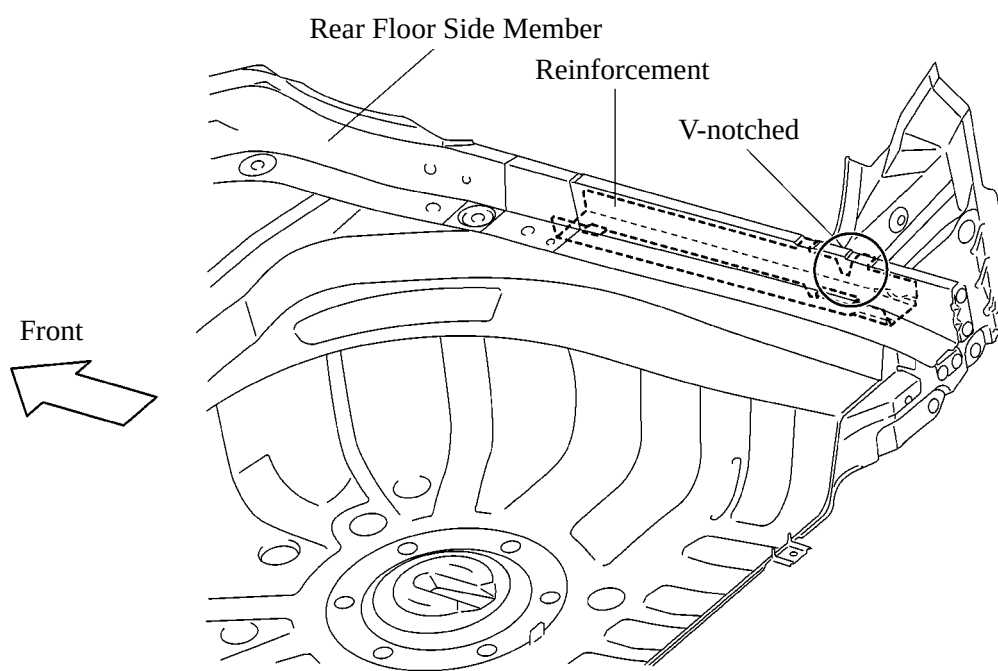
■ : Head Impact Protection Structure





#### 4. Impact Absorbing Structure for Rear Collision

Rear floor side members and reinforcements have been optimally allocated to control body deformation mode during a collision.

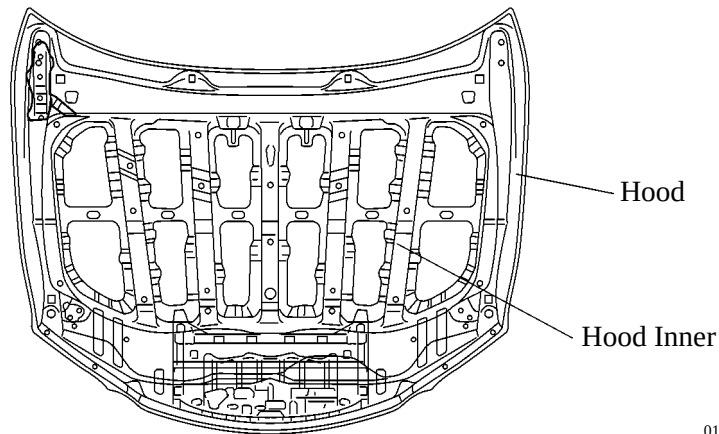


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**View from Bottom Side**

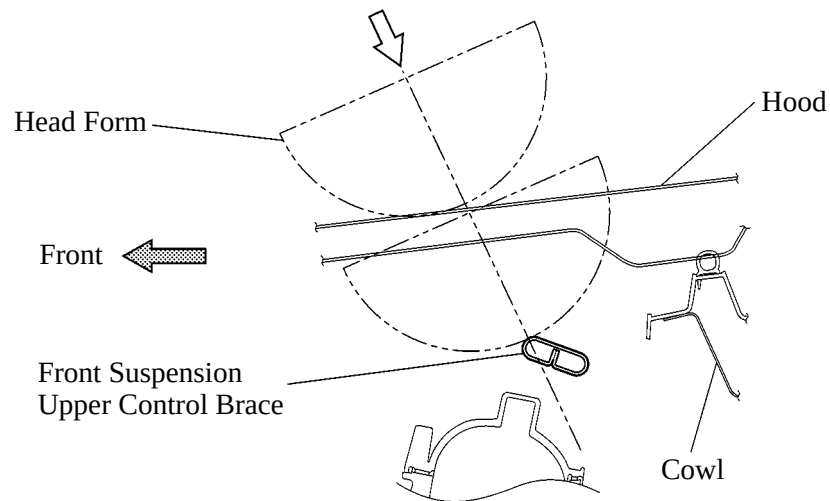
## 5. Lessening Pedestrian Head Injury

- A longitudinal frame is used as the principle structure of the hood inner, giving uniform rigidity to the hood surface.



01YBO14Y

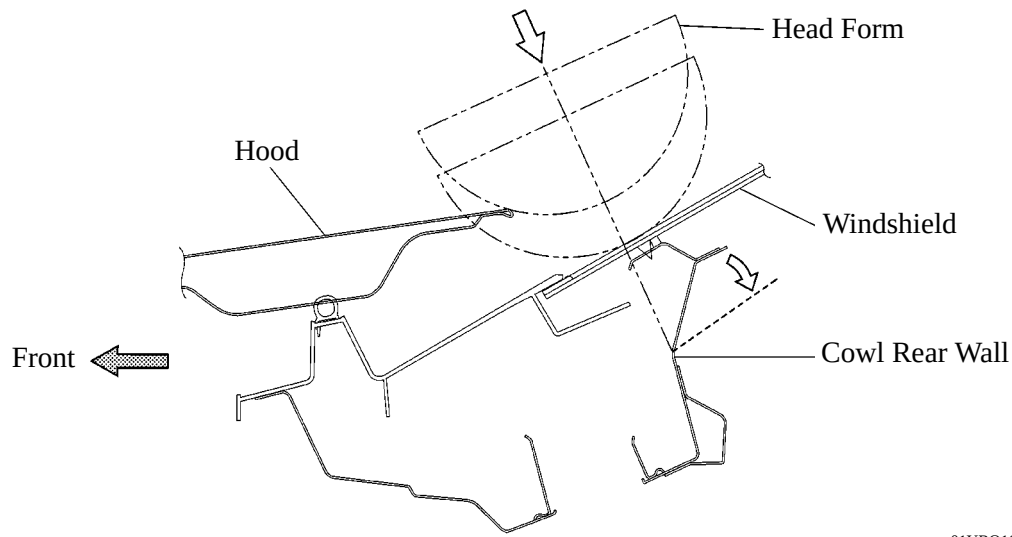
- The portion of the front suspension upper control brace has been lowered, ensuring a certain deformation stroke in the event of a head form collision, reducing the impact.



01YBO15Y

**Cross Section near Front Suspension Upper Control Brace**

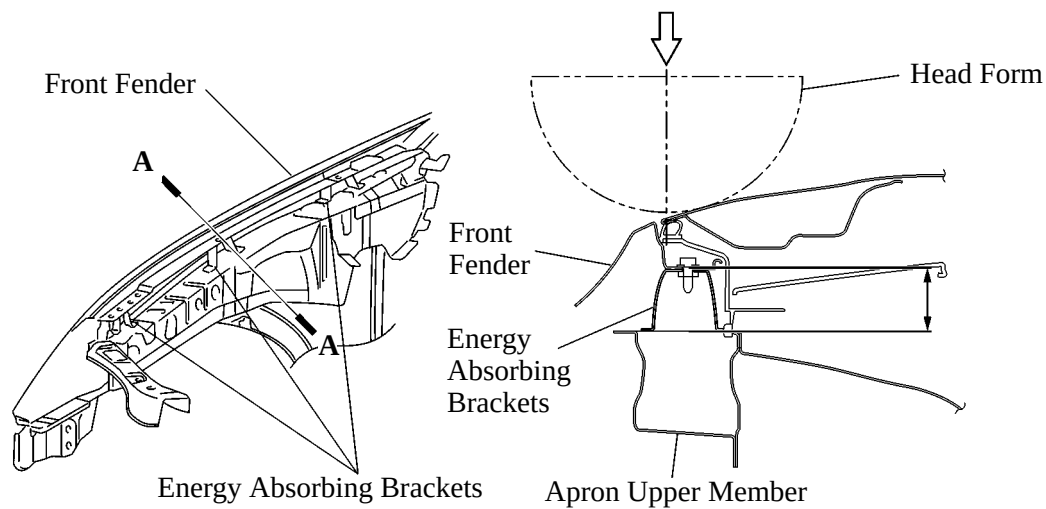
- The rear wall of the cowl has been opened, so that it can easily collapse in the direction of an impact. Thus, a completely collapsible structure has been realized.



01YBO16Y

**Cross Section at Lower Portion of Windshield**

- Energy absorbing brackets are used in the joint portion of the front fender. Thus, a certain deformation stroke in the event of a head form collision has been ensured, reducing the impact.



01YBO17Y

**A - A cross Section**

## ■ SEAT BELT

### 1. General

The following types of seat belts are provided.

| Seat Position              | Seat Belt Type                                | Remarks                                                                 |
|----------------------------|-----------------------------------------------|-------------------------------------------------------------------------|
| Driver                     | 3-point ELR* <sup>1</sup>                     | Electrical Sensing Type Pretensioner, Force Limiter and Tension Reducer |
|                            |                                               | Pre-collision Seat Belt (Option)                                        |
| Front Passenger            | 3-point ELR* <sup>1</sup> & ALR* <sup>2</sup> | Electrical Sensing Type Pretensioner, Force Limiter and Tension Reducer |
|                            |                                               | Pre-collision Seat Belt (Option)                                        |
| Rear Passenger (RH and LH) | 3-point ELR* <sup>1</sup> & ALR* <sup>2</sup> | Electrical Sensing Type Pretensioner & Force Limiter                    |
| Rear Passenger (Center)    | 3-point ELR* <sup>1</sup> & ALR* <sup>2</sup> | —                                                                       |

\*1: Emergency Locking Retractor

\*2: Automatic Locking Retractor

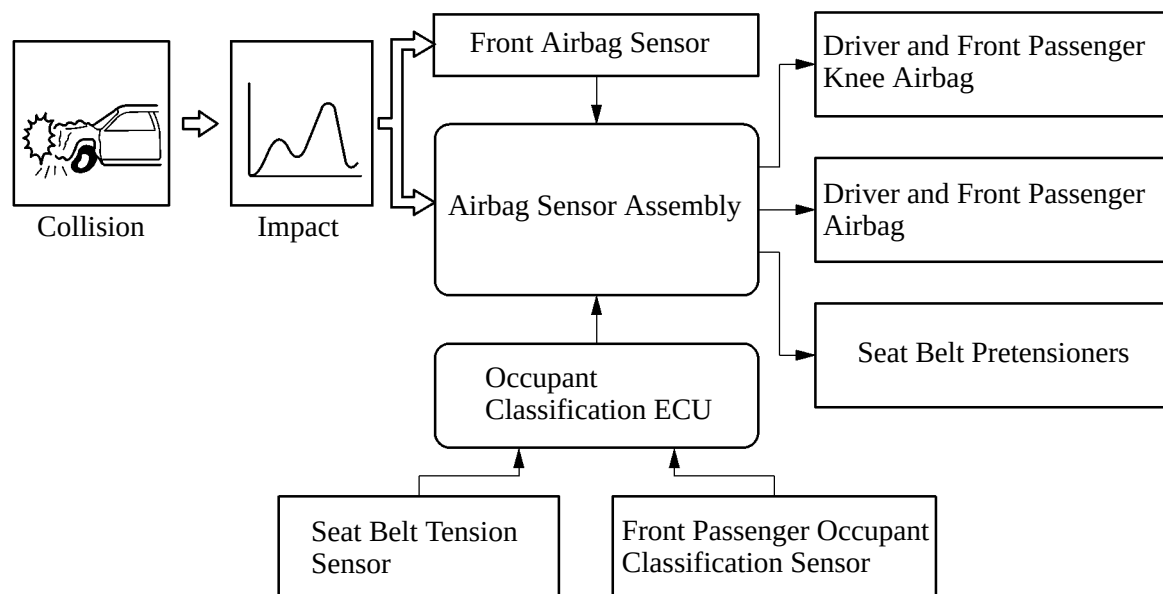
### 2. Pretensioner and Force Limiter

In accordance with the ignition signal from the airbag sensor assembly, the seat belt pretensioner activates simultaneously with the deployment of SRS airbag for the driver and front passenger.

In the beginning of the collision if the tension of the seat belt applied to the occupant reaches a predetermined level, the force limiter activates to control the force.

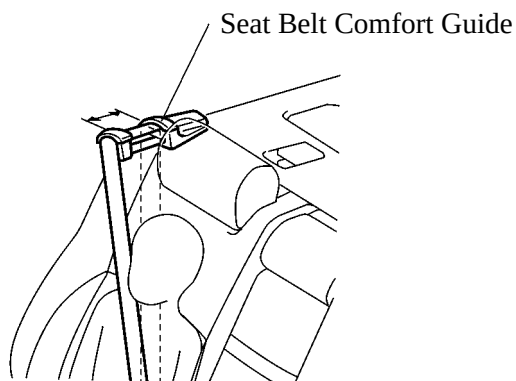
Even if the front passenger airbag is not deployed in accordance with the front passenger occupant classification system, the pretensioner and force limiter for the front passenger will be deployed.

#### ► Front Airbag Operation ◀



### 3. Seat Belt Comfort Guide

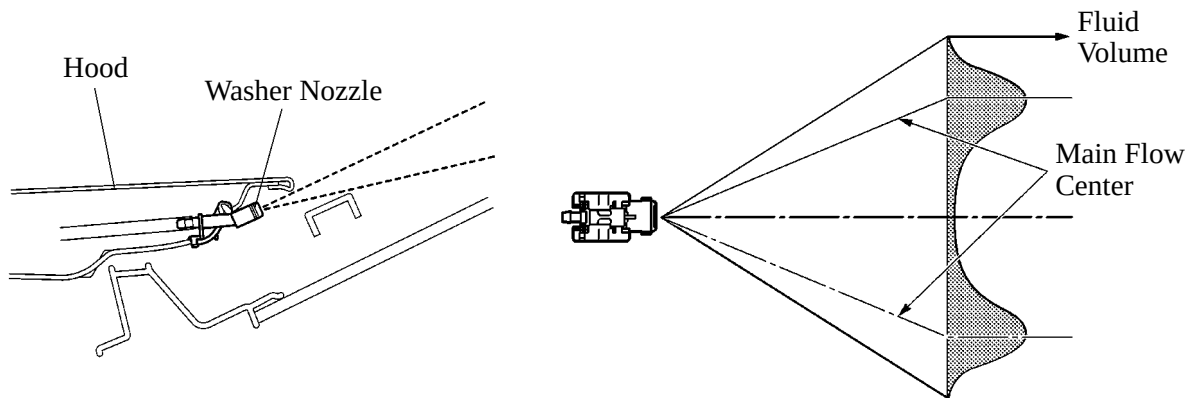
This belt comfort guides for child or occupant have been added on the both sides of rear seat, With this device, the belt guide can be slid to a position to reduce seatbelt discomfort.



01YBO36Y

## ■ WASHER NOZZLE

Spray type washer nozzles are located under the engine hood to ensure good appearance. These nozzles can spray windshield washer fluid over a wide area by spraying it in a fan shape. The washer fluid volume has been reduced so as not to hinder the driver's view when washer system is operated.



01YB030Y

01YB031Y

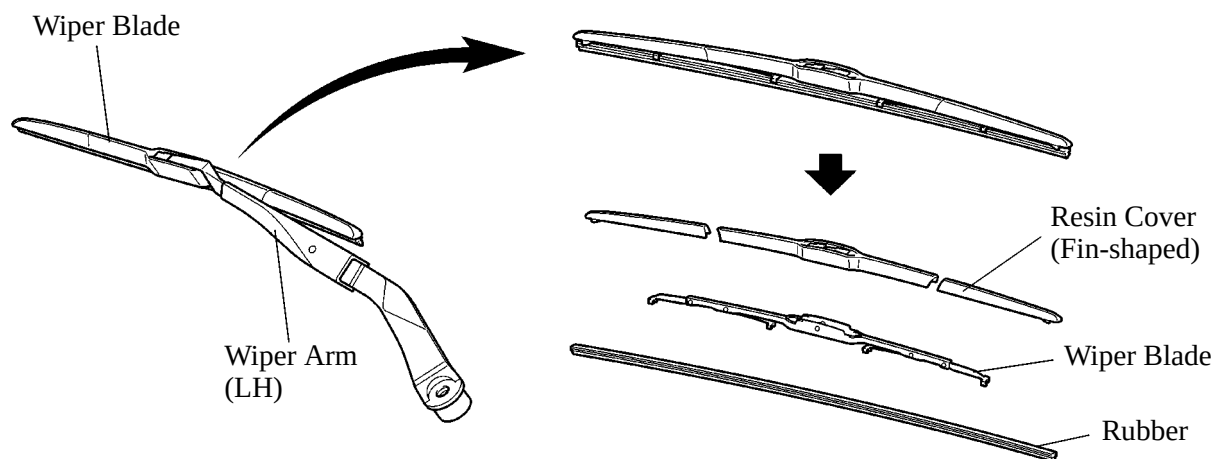
### Service Tip

Spray type washer nozzles cannot be adjusted because of their structure. Do not attempt to adjust the nozzles as it could damage them.

If adjustment is necessary, adjust the nozzles after replacing them with those selected from five part numbers with different spray angles. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## ■ WIPER ARM & BLADE

The unified construction of the wiper blade and arm is used. A fin-shaped resin cover is used for the entire wiper blade. This ensures the effectiveness of the wipers even when traveling at high speeds.

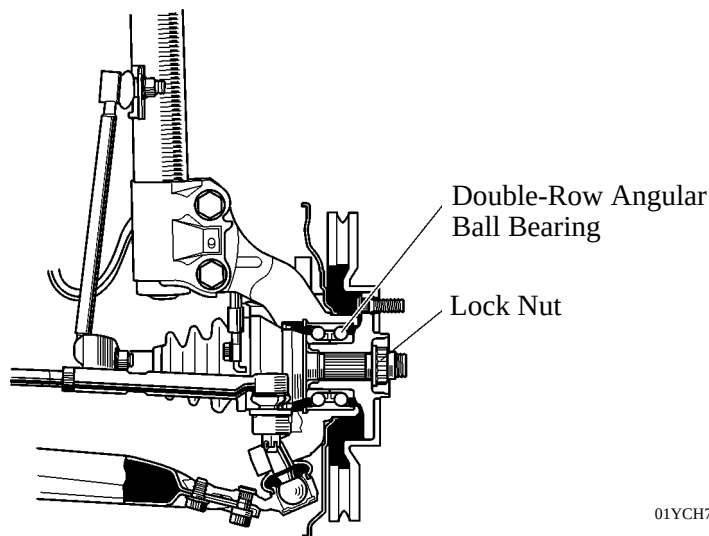


01YB032Y

## ■ AXLE

### 1. Front Axle

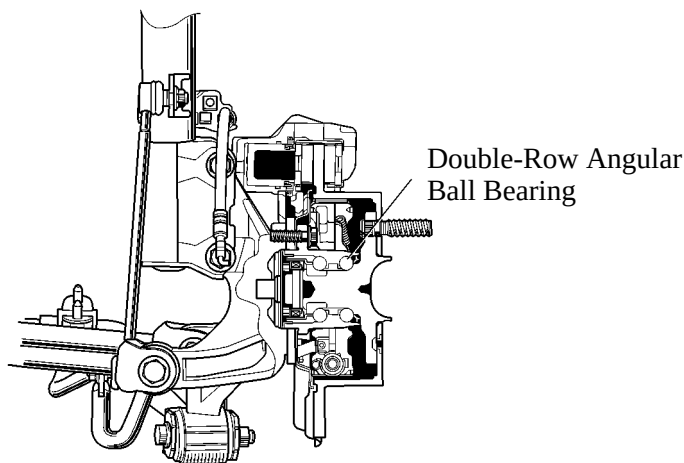
- The front axle uses compact and highly double-row angular ball bearings. The bearings and the axle hub have been integrated to ensure high rigidity, thus realizing excellent driving and braking stability.
- A lock nut (12-point) is used and staked in order to ensure that the axle hub is properly secured. Once removed, this nut cannot be reused.



01YCH77Y

### 2. Rear Axle

A compact and highly rigid double-row angular ball bearing is used on the front axle. The double-row angular ball bearing and the axle hub have been integrated to ensure high rigidity, thus realizing excellent driving stability and braking stability.



01YCH59Y

## BRAKE

### DESCRIPTION

#### 1. General

The '07 ES350 has a brake system with the following specifications:

|                          |                                          |                 |
|--------------------------|------------------------------------------|-----------------|
| Front Brake Type         |                                          | Ventilated Disc |
| Rear Brake Type          |                                          | Solid Disc      |
| Brake Control System     | ABS with EBD, Brake Assist, TRAC and VSC | Standard        |
| Parking Brake Lever Type |                                          | Pedal           |

#### ► Specifications ◀

|                             |                              |                            |
|-----------------------------|------------------------------|----------------------------|
| Master Cylinder             | Type                         | Tandem<br>(Plunger type)   |
|                             | Diameter mm (in.)            | 22.22 (0.87)               |
| Brake Booster               | Type                         | Single, Tie Rod Type       |
|                             | Size in.                     | 10                         |
| Front Disc Brake            | Caliper Type                 | PE63                       |
|                             | Wheel Cylinder Dia. mm (in.) | 63.5 (2.5)                 |
|                             | Rotor Size (D x T)* mm (in.) | 296 x 28<br>(11.65 x 1.10) |
|                             | Pad Material                 | PN562H                     |
| Rear Disc Brake             | Caliper Type                 | PEAL38                     |
|                             | Wheel Cylinder Dia. mm (in.) | 38.1 (1.50)                |
|                             | Rotor Size (D x T)* mm (in.) | 281 x 10<br>(11.06 x 0.39) |
|                             | Pad Material                 | D6234                      |
| Parking Brake               | Type                         | Duo Servo                  |
|                             | Drum Inner Dia. mm (in.)     | 170.0 (6.69)               |
| Brake Actuator Manufacturer |                              | ADVICS                     |

\*: D: Outer Diameter, T: Thickness

#### Service Tip

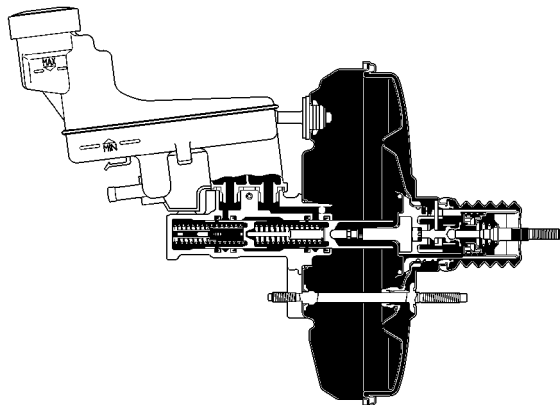
- To ensure the performance and reliability of the plunger type master cylinder, it must not be disassembled. If it malfunctions, replace the entire assembly.
- Before removing the plunger type master cylinder from the brake booster, discharge the vacuum from the brake booster. Otherwise, the piston of the master cylinder may be left inside the brake booster.

For details, see the 2007 LEXUS ES350 Repair Manual (Pub.No.RM01Y0U).

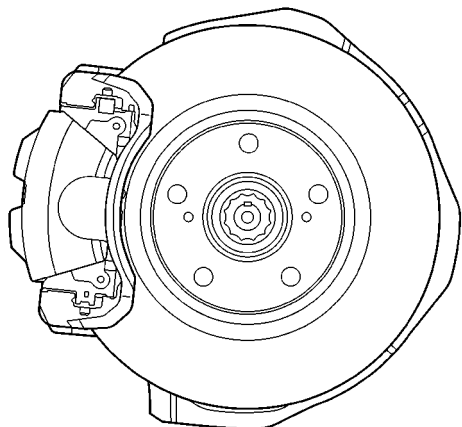
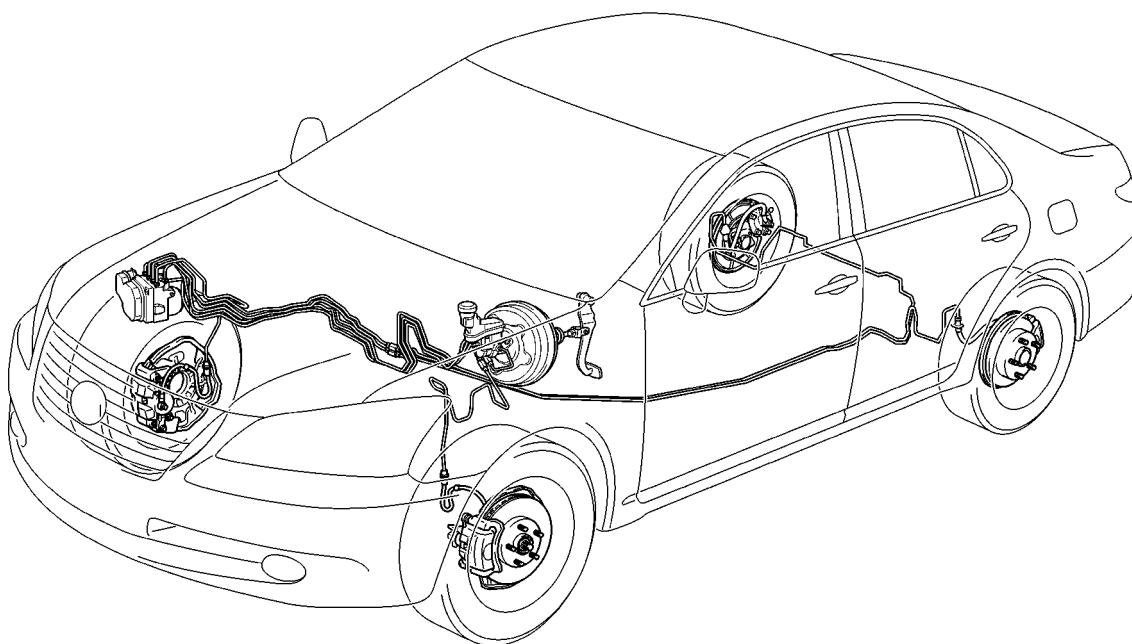
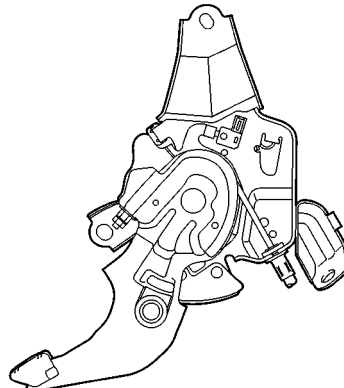


## 2. Component of Brake System

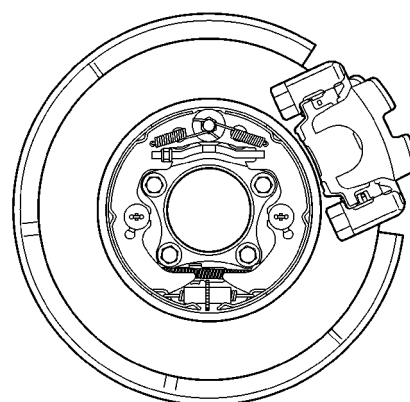
► Master Cylinder & Brake Booster ◀



► Parking Brake Pedal ◀



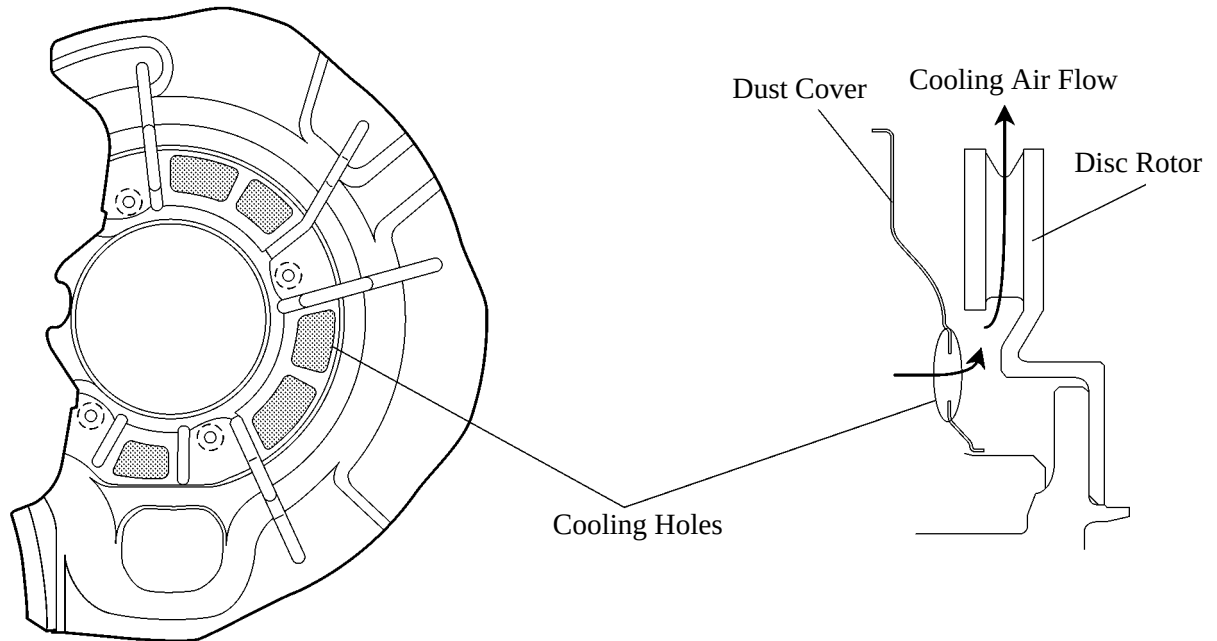
► Front Brake ◀



► Rear Brake ◀

### Front Brake

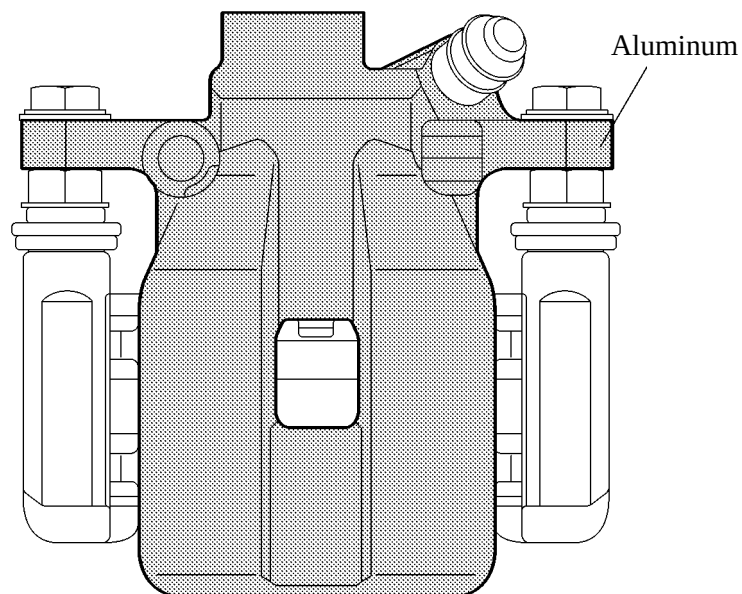
- The diameter of the front rotors is 296 mm (11.65 in.). They are the ventilated type that excels in heat dissipation to ensure reliability.
- The shape of the front dust cover has been optimized to efficiently direct cool air to the ventilated disc, thus ensuring excellent cooling performance.



01YCH72TE

### Rear Brake

- The diameter of the rear rotors is 281 mm (11.06 in.). It has a built-in duo servo type parking brake.
- For weight reduction, a caliper cylinder made of aluminum is used for the rear caliper of the '07 ES350.



01YCH61TE

### 3. Outline of EBD Control Function

#### General

The distribution of the brake force, which was performed mechanically in the past, is now performed under electrical control of the skid control ECU, which precisely controls the braking force in accordance with the vehicle's driving conditions.

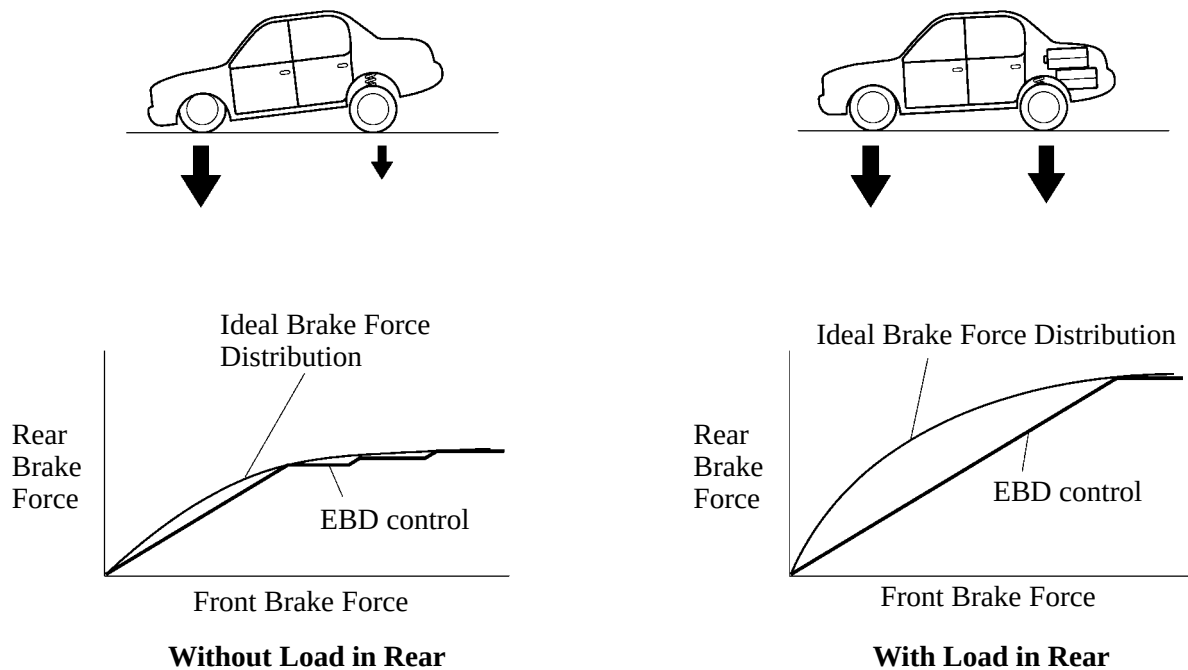
#### Front/Rear Wheels Brake Force Distribution

If the brakes are applied while the vehicle is moving straight forward, the transfer of the road reduces the load that is applied to the rear wheels. The skid control ECU determines this condition by way of the signals from the wheel speed sensors, and the brake actuator regulates the distribution of the brake force of the rear wheels to optimally control.

For example, the amount of the brake force that is applied to the rear wheels during braking varies whether or not the vehicle is carrying a load. The amount of the brake force that is applied to the rear wheels also varies in accordance with the extent of the deceleration.

Thus, the distribution of the brake force to the rear is optimally controlled in order to effectively utilize the braking force of the rear wheels under these conditions.

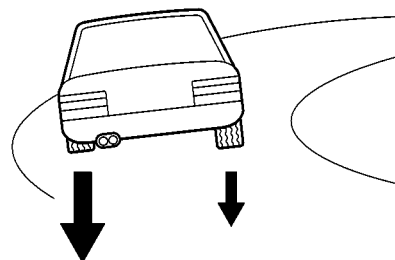
#### ► EBD Control Concept ◀



182CH56

#### Right/Left Wheels Brake Force Distribution (During Cornering Braking)

When the brakes are applied while the vehicle is cornering, the load that applied to the inner wheel decreases and the outer wheel increases. The skid control ECU determines this condition by way of the signals from the wheel speed sensors, and the brake actuator regulates the brake force in order to optimally control the distribution of the brake force to the inner wheel and outer wheel.

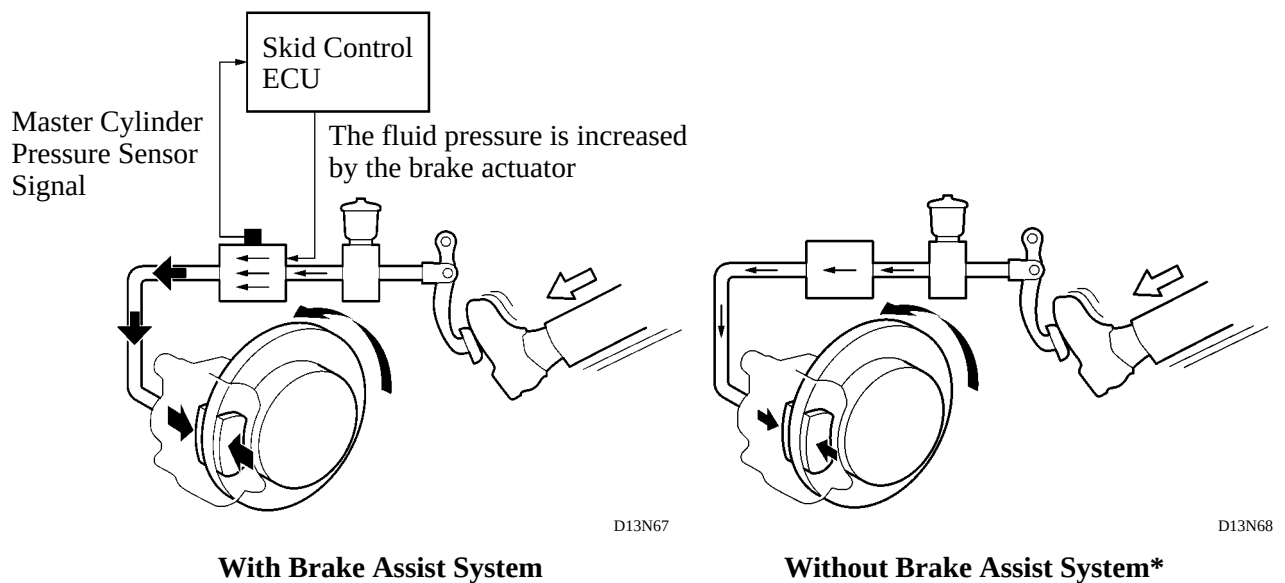


181CH56

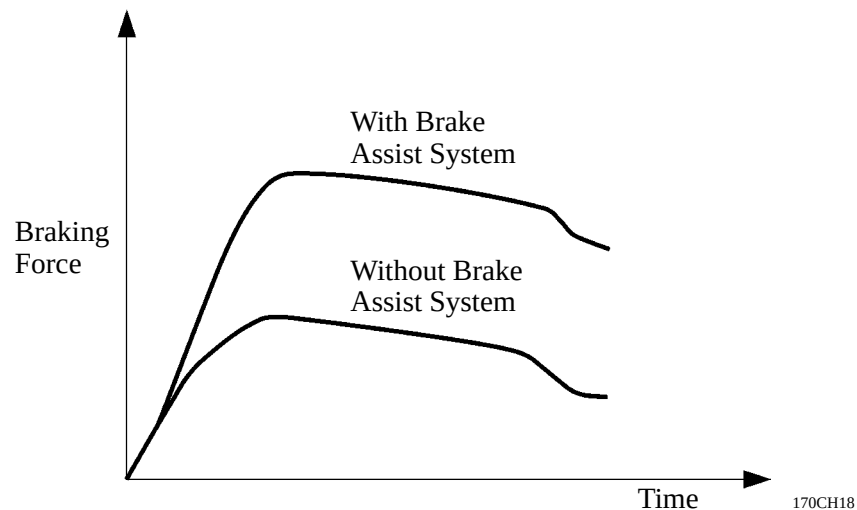
#### 4. Outline of Brake Assist System

- The brake assist system in combination with ABS helping improves the vehicle's brake performance.
- The brake assist system interprets a quick push of the brake pedal as emergency braking and supplements the brake power applied if the driver has not stepped hard enough on the brake pedal. In emergencies, driver, especially inexperienced ones, often panic and do not apply sufficient pressure on the brake pedal.
- A key feature of brake assist system is that the timing and the degree of braking assistance are designed to help ensure that the driver does not discern anything unusual about the braking operation. When the driver intentionally eases up on the brake pedal, the system reduces the amount of assistance it provides.
- Based on the signals from the master cylinder pressure sensor, the skid control ECU calculates the speed and the amount of the brake pedal application and then determines the intention of the driver to make an emergency braking. If the skid control ECU determines that the driver intends the emergency braking, the system activates the brake actuator to increase the brake fluid pressure, which increases the braking force.

► In case that the driver's depressing force is small when applying emergency braking ◀



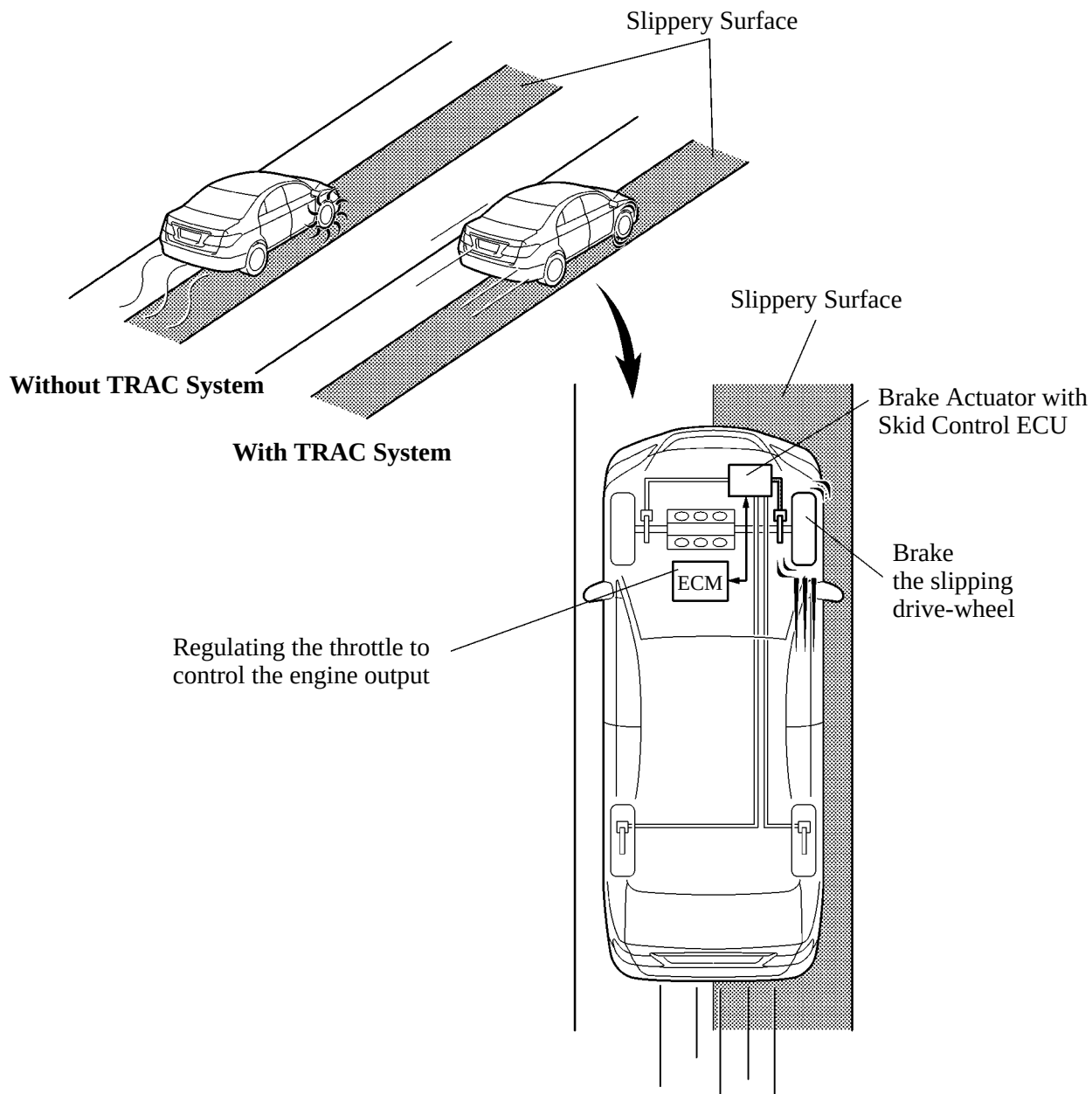
\*: The basic performance of the brake is the same as of the model with the brake assist system.



## 5. Outline of TRAC Function

- If the driver presses the accelerator pedal aggressively when initially acceleration or when accelerating on a slippery surface, the drive wheels could slip due to the excessive amount of torque that is generated. By applying hydraulic brake control to the drive wheels and regulating the throttle to control the engine output, the TRAC helps minimize the slippage of the drive wheels, thus generating the drive force that is appropriate for the road surface conditions.
- For example, a comparison may be made between two vehicles, one with the TRAC function and the other without. If the driver of each vehicle operates the accelerator pedal in a rough manner while driving over a surface with different surface friction characteristics, the drive wheel on the slippery surface could slip as illustrated. As a result, the vehicle could become unstable. However, when the vehicle is equipped with the TRAC function, the skid control ECU instantly determines the state of the vehicle and operates the brake actuator in order to apply the brake of the slipping drive wheel. Furthermore, the ECM receives the signals from the skid control ECU and regulates the throttle in order to control the engine output. Thus, this function can constantly maintain a stable vehicle posture.

### ► Driving condition on road with different surface friction characteristics ◀



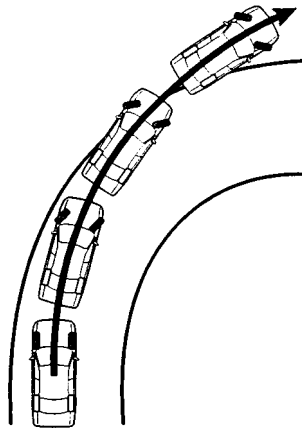
## 6. Outline of VSC Function

### General

The followings are two examples that can be considered as circumstances in which the tires exceed their lateral grip limit.

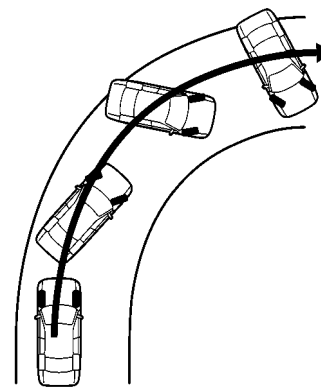
The VSC function is designed to help control the vehicle behavior by controlling the motive force and the brakes at each wheel when the vehicle is under one of the conditions indicated below.

- When the front wheels lose grip in relation to the rear wheels (front wheel skid tendency).
- When the rear wheels lose grip in relation to the front wheels (rear wheel skid tendency).



151CH17

**Front Wheel Skid Tendency**



189CH100

**Rear Wheel Skid Tendency**

### Method for Determining the Vehicle Condition

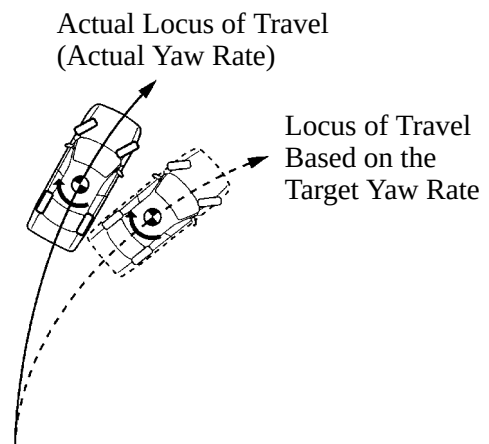
To determine the condition of the vehicle, sensors detect the steering angle, vehicle speed, vehicle's yaw rate, and the vehicle's lateral acceleration, which are then calculated by the skid control ECU.

#### 1) Determining Front Wheel Skid

Whether or not the vehicle is in the state of front wheel skid is determined by the difference between the target yaw rate and the vehicle's actual yaw rate.

When the vehicle's actual yaw rate is smaller than the yaw rate (a target yaw rate that is determined by the vehicle speed and steering angle) that should be rightfully generated when the driver operates the steering wheel, it means the vehicle is making a turn at a greater angle than the locus of travel.

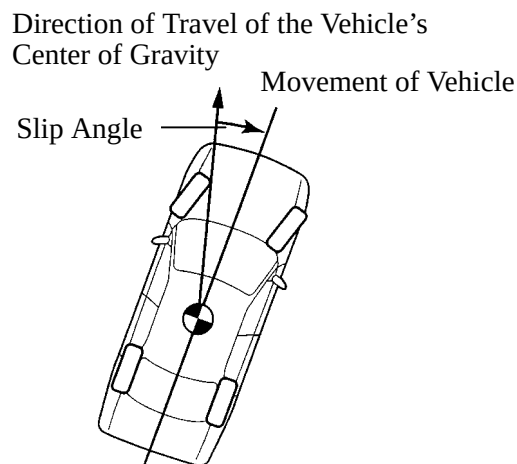
Thus, the skid control ECU determines that there is a large tendency to front wheel skid.



151CH19

## 2) Determining Rear Wheel Skid

Whether or not the vehicle is in the state of rear wheel skid is determined by the values of the vehicle's slip angle and the vehicle's slip angular velocity (time-dependent changes in the vehicle's slip angle). When the vehicle's slip angle is large, and the slip angular velocity is also large, the skid control ECU determines that the vehicle has a large rear wheel skid tendency.



151CH18

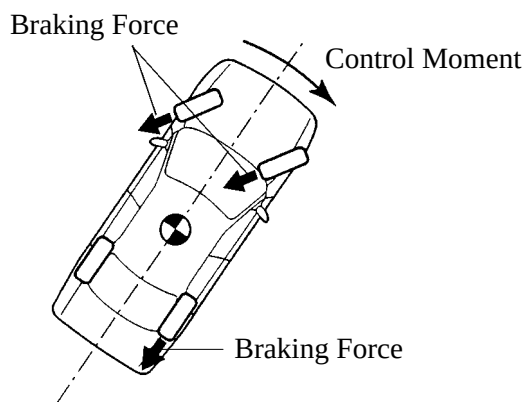
### Method for VSC Operation

When the Skid Control ECU determines that the vehicle exhibits a tendency to front wheel skid or rear wheel skid, it decreases the engine output and applies the brake of a front or rear wheel to control the vehicle's yaw moment.

The basic operation of the VSC is described below. However, the control method differs depending on the vehicle's characteristics and driving conditions.

#### 1) Dampening a Strong Front Wheel Skid

When the skid control ECU determines that there is a large front wheel skid tendency, it counteracts in accordance with the extent of that tendency. The skid control ECU controls the engine output and applies the brakes of the front wheels and rear wheel of the inner circle of the turn in order to help restrain the front wheel skid tendency.



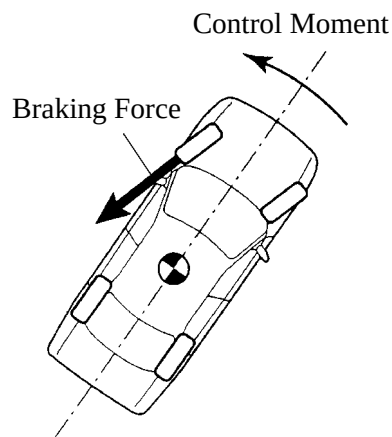
**Making a Right Turn**

161ES30

#### 2) Dampening a Strong Rear Wheel Skid

When the skid control ECU determines that there is a large rear wheel skid tendency, it counteracts in accordance with the extent of that tendency. It applies the brakes of the front wheel of the outer circle of the turn, and generates an outward moment of inertia in the vehicle, in order to restrain the rear wheel skid tendency. Along with the reduction in the vehicle speed caused by the braking force, the excellent vehicle's stability is ensured.

In some cases, the skid control ECU applies the brake of the rear wheels, as necessary.



**Making a Right Turn**

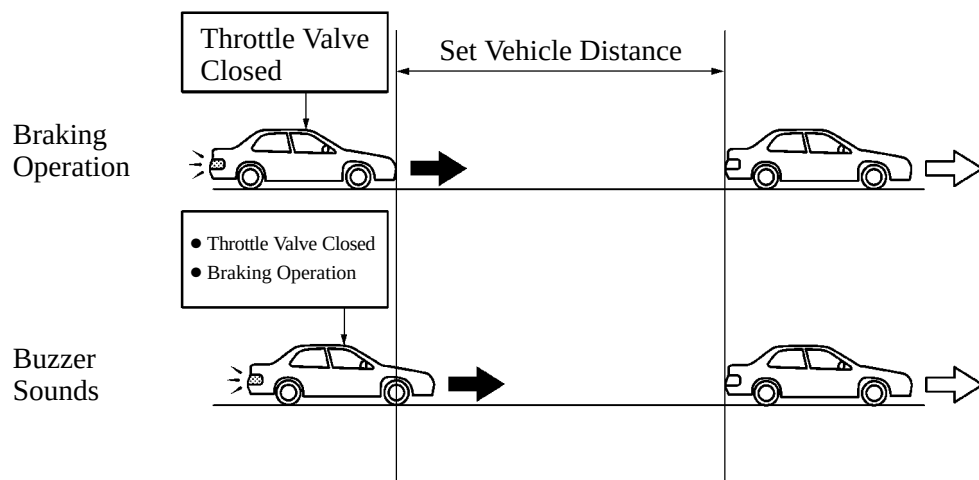
204CH15

## 7. Outline of Brake Control (Operating of Dynamic Radar Cruise Control System)\*

During dynamic radar cruise control system operation, if the distance to the vehicle being driven ahead is reduced, and if a sufficient deceleration cannot be attained by fully closing the throttle valve, the skid control ECU activates the brake actuator to apply the brakes according to the distance control ECU's request. As a result, the stoplights illuminate.

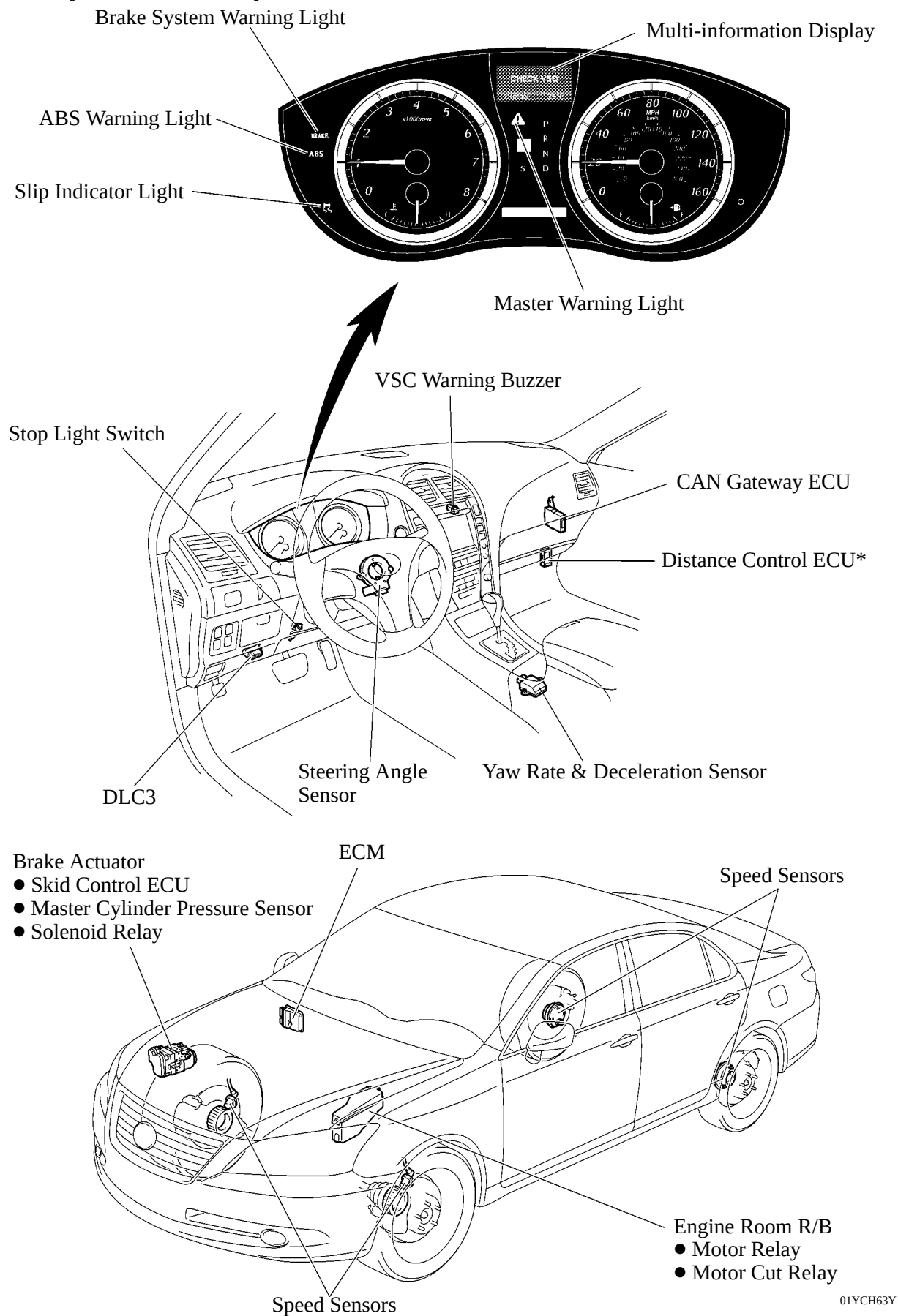
If further deceleration is required, the system sounds a VSC warning buzzer to alert the driver to apply the brakes. This warning buzzer is the same buzzer that the VSC system uses.

\*: With Dynamic Radar Cruise Control System





## 8. Layout of Main Components



## 9. Function of Main Components

| Component                      |                                 | Function                                                                                                                                                                                                                                                                                          |
|--------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Combination Meter              | ABS Warning Light               | Lights up to alert the driver when the skid control ECU detects the malfunction in the ABS, EBD or Brake Assist system.                                                                                                                                                                           |
|                                | Slip Indicator Light            | <ul style="list-style-type: none"> <li>● Blinks to inform the driver when the TRAC system or the VSC system is operated.</li> <li>● Light up to alert the driver when the skid control ECU detects the malfunction in the TRAC or VSC system.</li> </ul>                                          |
|                                | Brake System Warning Light      | <ul style="list-style-type: none"> <li>● Lights up together with ABS warning light to alert the driver when the skid control ECU detects the malfunction in the EBD control.</li> <li>● Lights up to inform the driver when the parking brake is ON or the brake fluid level is low.</li> </ul>   |
|                                | Master Warning Light            | Illuminates to alert the driver when the skid control ECU detects the malfunction in the TRAC or VSC system.                                                                                                                                                                                      |
|                                | Multi-information Display       | Displays a warning message “CHECK VSC” to alert the driver when the skid control ECU detects a malfunction in the TRAC or VSC system.                                                                                                                                                             |
| ECM                            |                                 | <ul style="list-style-type: none"> <li>● Sends the throttle valve angle signal, accelerator pedal position signal, engine speed signal, and shift lever position signal to the skid control ECU.</li> <li>● Receives the signal of throttle control request from the skid control ECU.</li> </ul> |
| Parking Brake Switch           |                                 | Detects when the parking brake lever is pulled up.                                                                                                                                                                                                                                                |
| Speed Sensors                  |                                 | Detects the wheel speed of each 4 wheels.                                                                                                                                                                                                                                                         |
| Stop Light Switch              |                                 | Detects the brake pedal depressing signal.                                                                                                                                                                                                                                                        |
| Distance Control ECU*          |                                 | Transmits a signal to the skid control ECU via the ECM, in order to activate brake control when the distance control ECU has determined that the distance to the vehicle being driven ahead has been shortened based on signals from the millimeter wave radar sensor.                            |
| Millimeter Wave Radar Sensor*  |                                 | Emits millimeter waves forward, and uses the reflected millimeter waves to measure the distance and the direction of the object in front, as well as to calculate the relative speed.                                                                                                             |
| Brake Actuator                 |                                 | Changes the fluid path based on the signals from the skid control ECU during the operation of the ABS with EBD & brake assist & TRAC & VSC system, in order to control the fluid pressure that is applied to the wheel cylinders.                                                                 |
|                                | Master Cylinder Pressure Sensor | Assembled in the brake actuator and detects the master cylinder pressure.                                                                                                                                                                                                                         |
|                                | Skid Control ECU                | Judges the vehicle driving condition based on signals from each sensor, and sends brake control signal to the brake actuator.                                                                                                                                                                     |
|                                | Solenoid Relay                  | Supply power to the solenoid valves.                                                                                                                                                                                                                                                              |
| VSC Warning Buzzer             |                                 | Emits an intermittent sound to inform the driver that the skid control ECU detects the strong front skid tendency or strong rear skid tendency.                                                                                                                                                   |
| Yaw Rate & Deceleration Sensor |                                 | <ul style="list-style-type: none"> <li>● Detects the vehicle's yaw rate.</li> <li>● Detects the vehicle's longitudinal and lateral acceleration.</li> </ul>                                                                                                                                       |
| Steering Angle Sensor          |                                 | Detects the steering direction and angle of the steering wheel.                                                                                                                                                                                                                                   |
| Motor Relay                    |                                 | Supply power to the pump motor in the brake actuator.                                                                                                                                                                                                                                             |
| Motor Cut Relay                |                                 | Cut the power to the pump motor in the brake actuator.                                                                                                                                                                                                                                            |

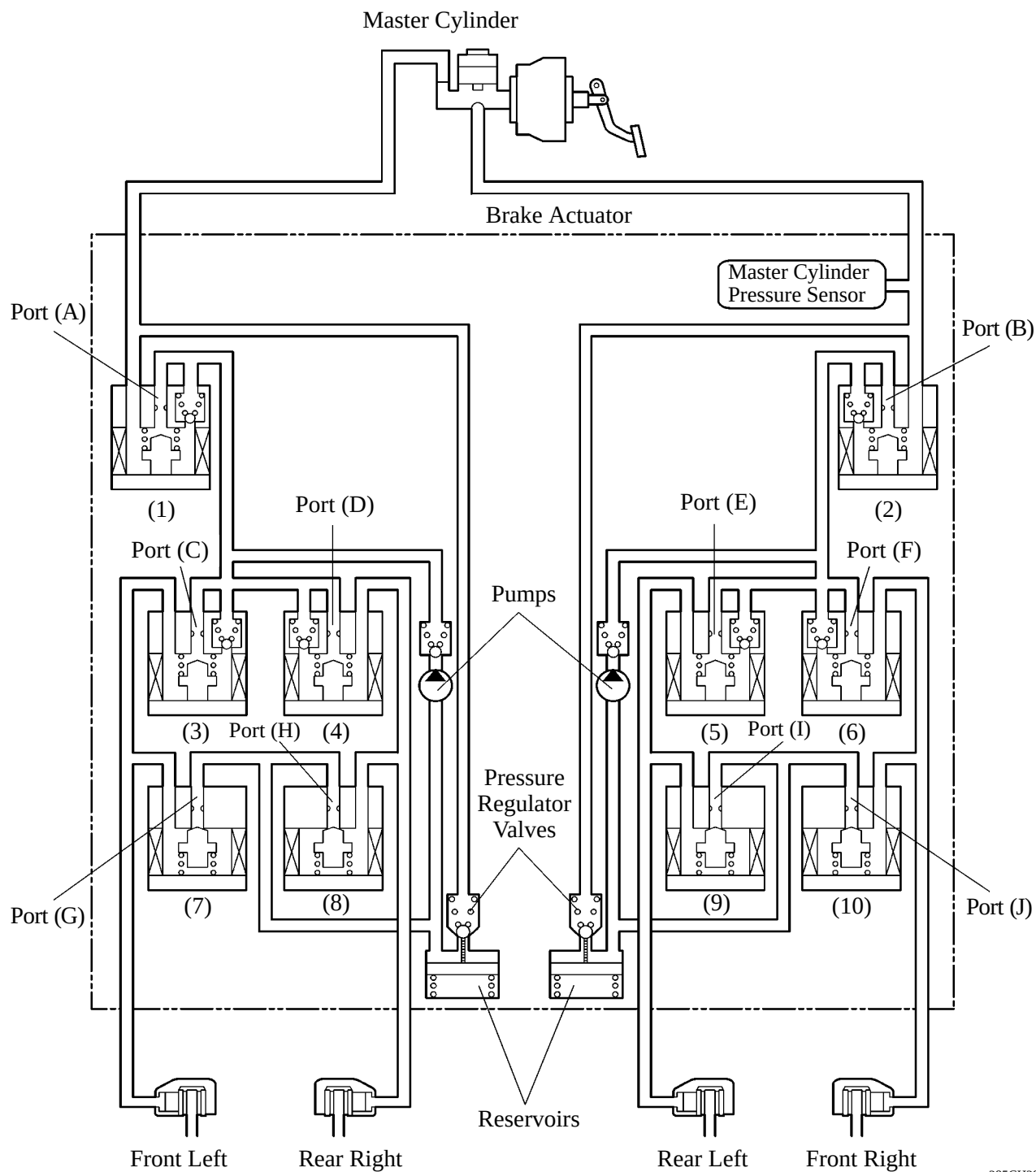
\*: With Dynamic Radar Cruise Control System

## 10. Brake Actuator

The brake actuator consists of the actuator portion, skid control ECU, solenoid relay, pump motor, and master cylinder pressure sensor.

- The actuator portion consists of 10 solenoid valves, 2 pressure regulator valves, 2 pumps, 2 reservoirs, and master cylinder pressure sensor.
- The 10 solenoid valves of 2 master cylinder cut solenoid valves [(1), (2)], four pressure holding solenoid valves [(3), (4), (5), (6)], and four pressure reduction solenoid valves [(7), (8), (9), (10)].

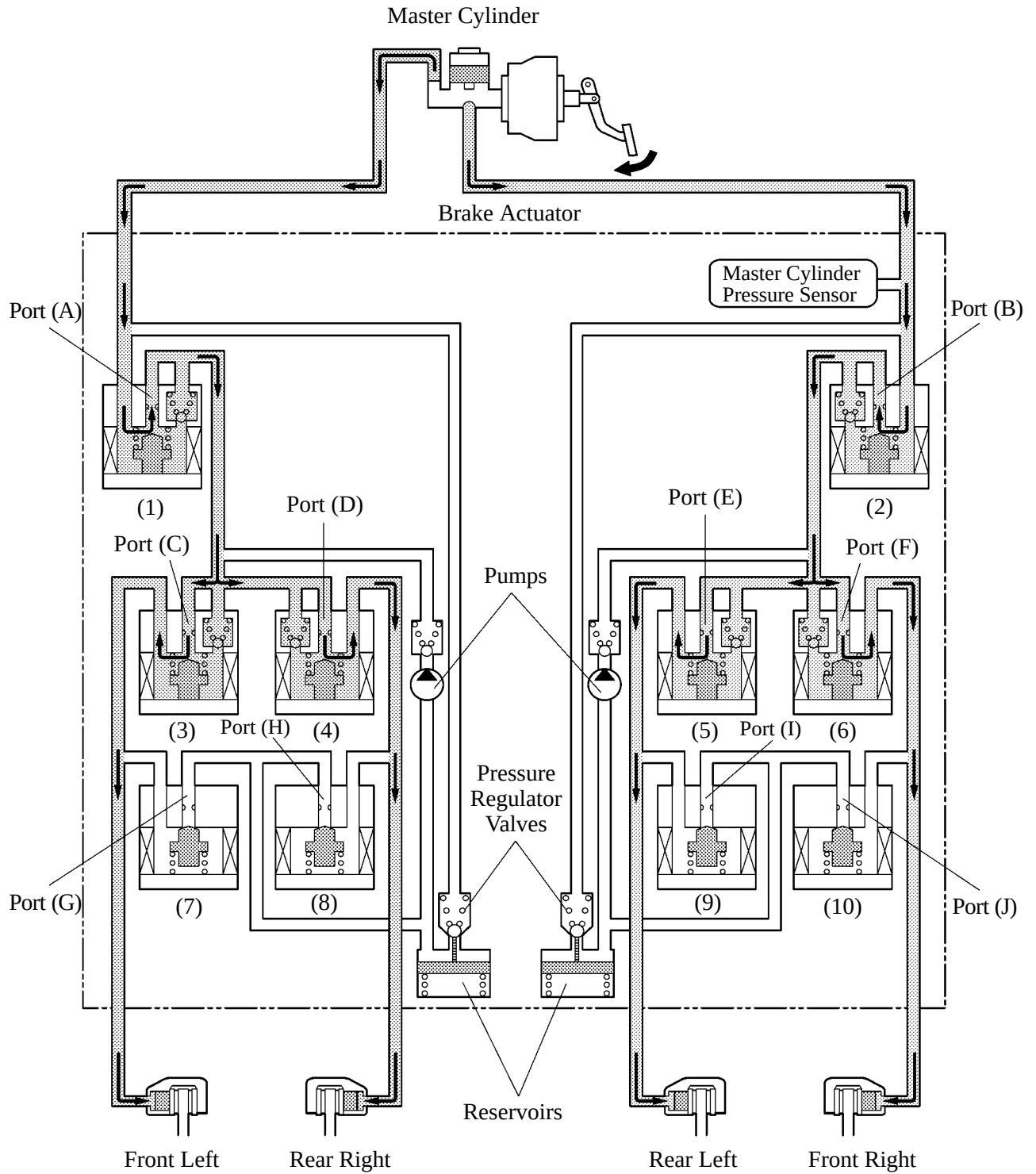
### ► Hydraulic Circuit ◀



## 11. System Operation

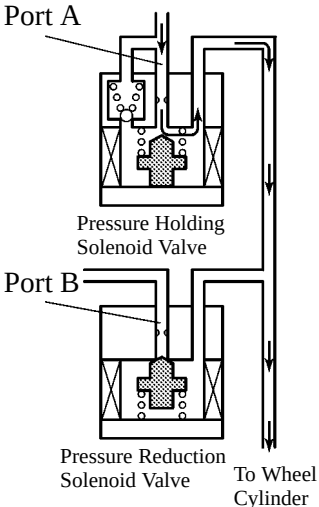
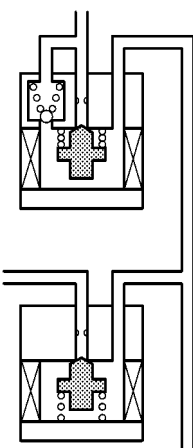
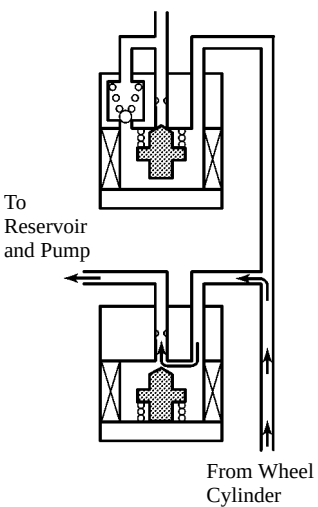
### Normal Braking Operation

During normal braking, all solenoid valves are remained OFF.



ABS with EBD Operation

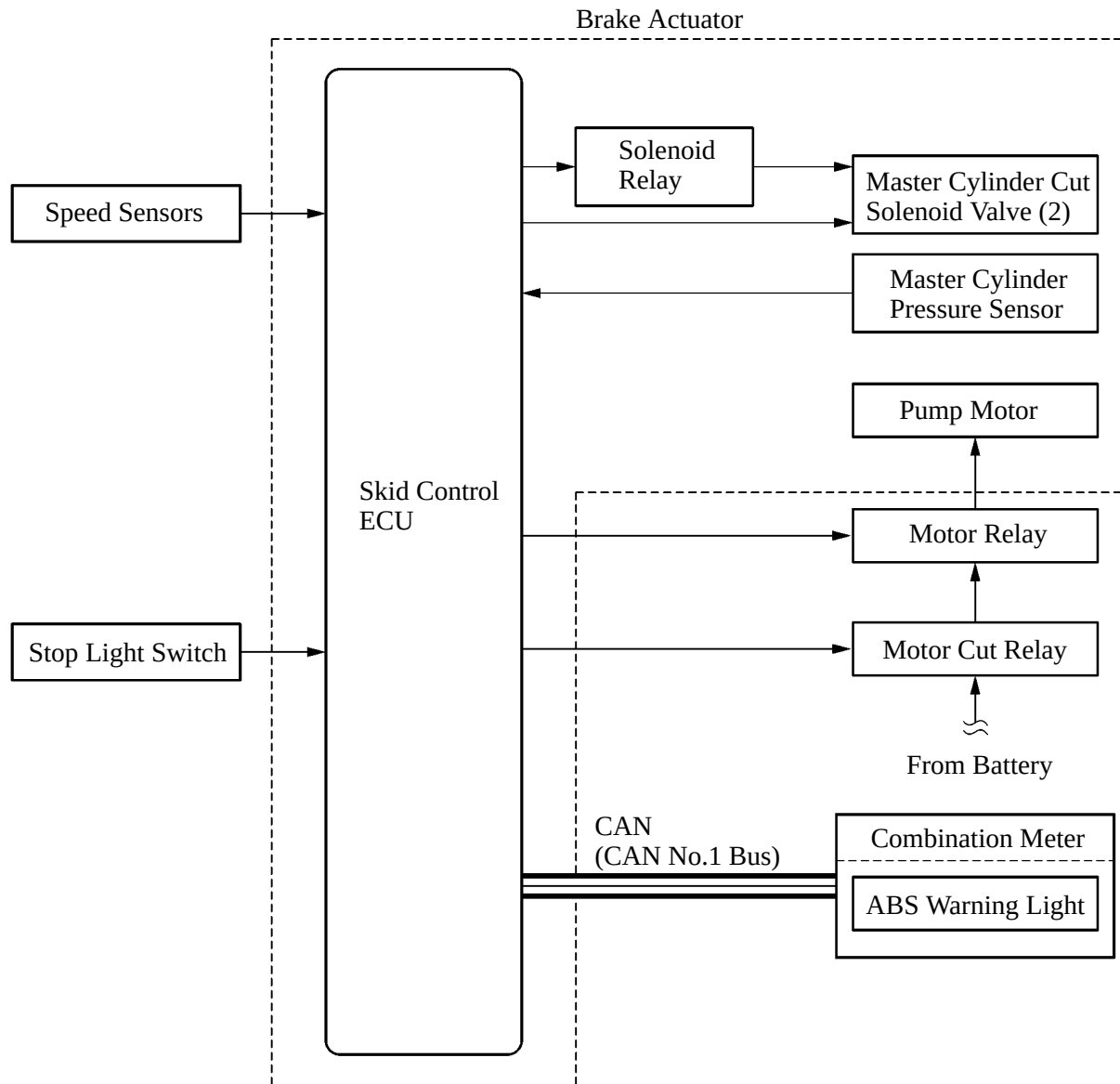
Based on the signals received from the four wheel speed sensors and yaw rate & deceleration sensor, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping condition. According to the slipping condition, the ECU controls the pressure holding solenoid valve and pressure reduction solenoid valve in order to adjust the fluid pressure of each wheel cylinder in the following three modes: pressure reduction, pressure holding, and pressure increase modes.

|                   |                                                                                              |                                                                                              |                                                                                                |
|-------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Not Activated     | Normal Braking                                                                               | —                                                                                            | —                                                                                              |
| Activated         | Pressure Increase Mode                                                                       | Pressure Holding Mode                                                                        | Pressure Reduction Mode                                                                        |
| Hydraulic Circuit | <br>D13N69 | <br>D13N70 | <br>D13N71 |
|                   | Pressure Holding Valve (Port A)                                                              | OFF/Open                                                                                     | ON/Close                                                                                       |
|                   | Pressure Reduction Valve (Port B)                                                            | OFF/Close                                                                                    | ON/Open                                                                                        |
|                   | Pressure                                                                                     | Increase                                                                                     | Hold                                                                                           |
|                   |                                                                                              |                                                                                              | Reduce                                                                                         |

### Brake Assist Operation

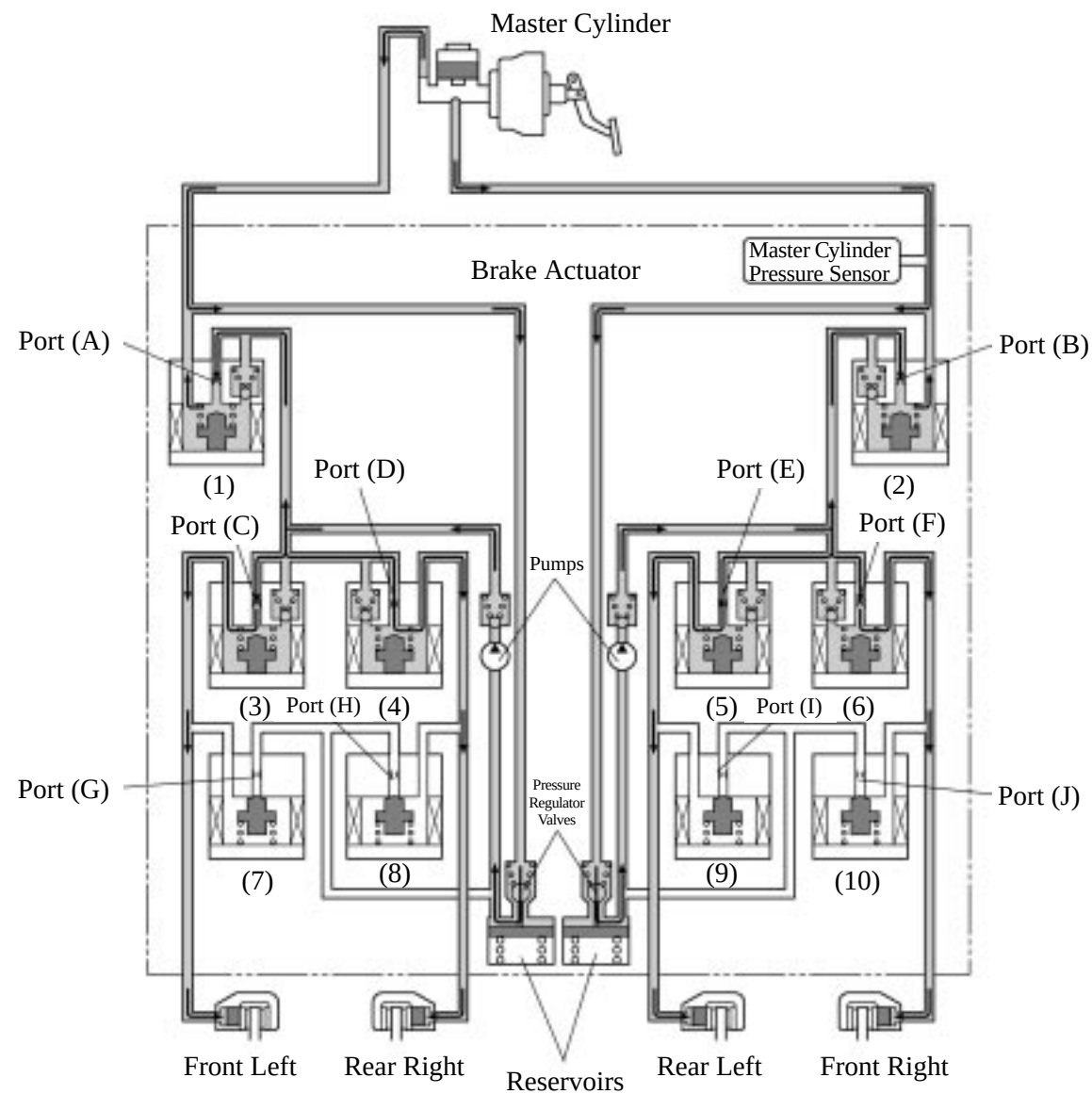
- In the event of emergency braking, the skid control ECU detects the driver's intention based on the speed of the pressure increase in the master cylinder determined by the pressure sensor signal. If the ECU judges the need for the additional brake assist, the fluid pressure is generated by the pump in the actuator and directed to the wheel cylinder to apply a greater fluid pressure than the master cylinder.
- The brake assist system is activated, each solenoid operates as shown in the table on the next page.

### ► System Diagram ◀



01YCH65TE

► Pressure Increase Mode ◀



Brake Assist Activated

259ES108

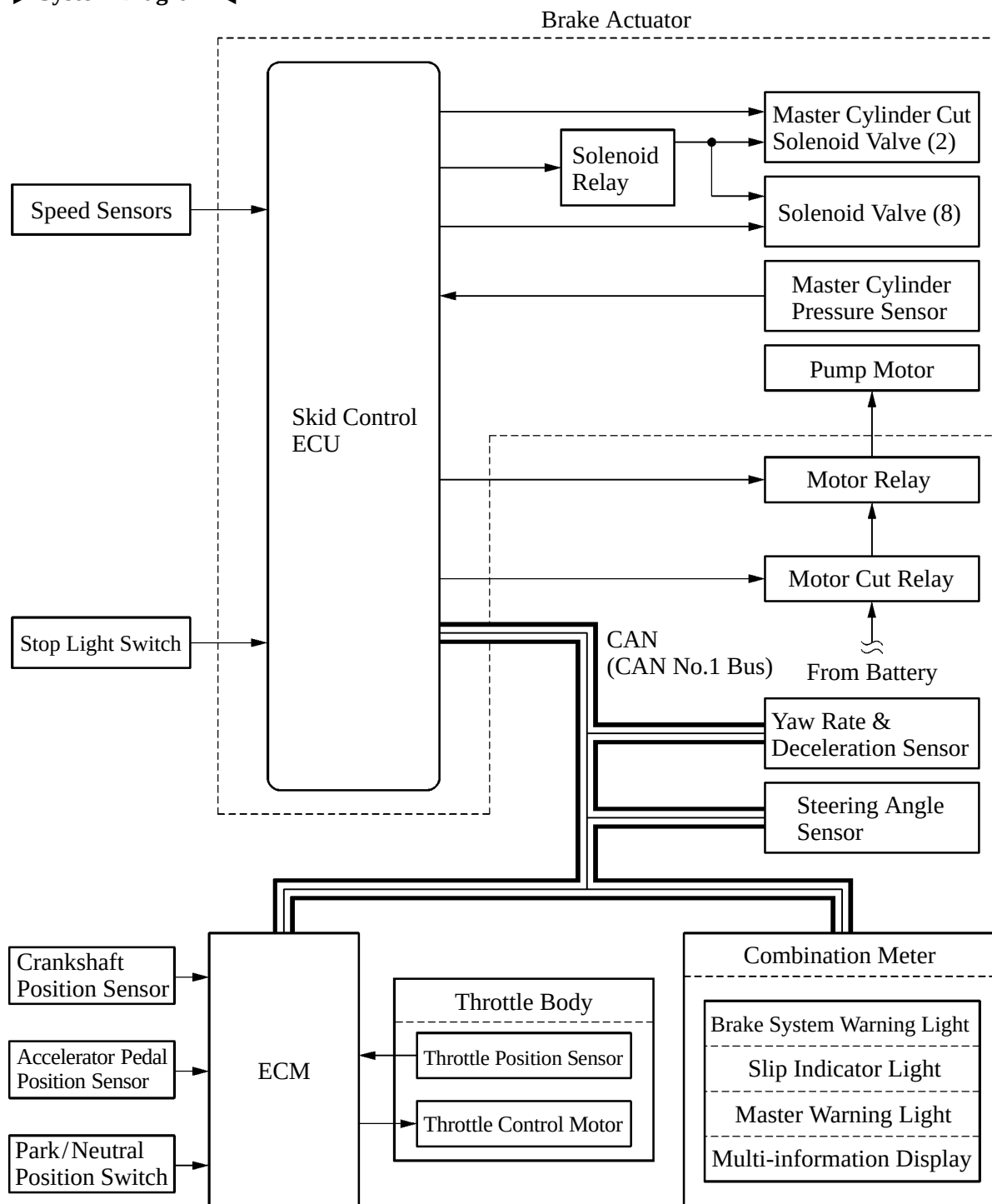
| Item                   |                                    | Brake Assist<br>Not Activated | Brake Assist<br>Activated |
|------------------------|------------------------------------|-------------------------------|---------------------------|
| (1), (2)               | Master Cylinder Cut Solenoid Valve | OFF/Open                      | ON*                       |
|                        | Port: (A), (B)                     |                               |                           |
| (3), (4),<br>(5), (6)  | Pressure Holding Solenoid Valve    | OFF/Open                      | ←                         |
|                        | Port: (C), (D), (E), (F)           |                               |                           |
| (7), (8),<br>(9), (10) | Pressure Reduction Solenoid Valve  | OFF/Close                     | ←                         |
|                        | Port: (G), (H), (I), (J)           |                               |                           |

\*: The solenoid valve controls the hydraulic pressure between “open” and “close” according to the operating condition by adjusting continually.

## TRAC Operation

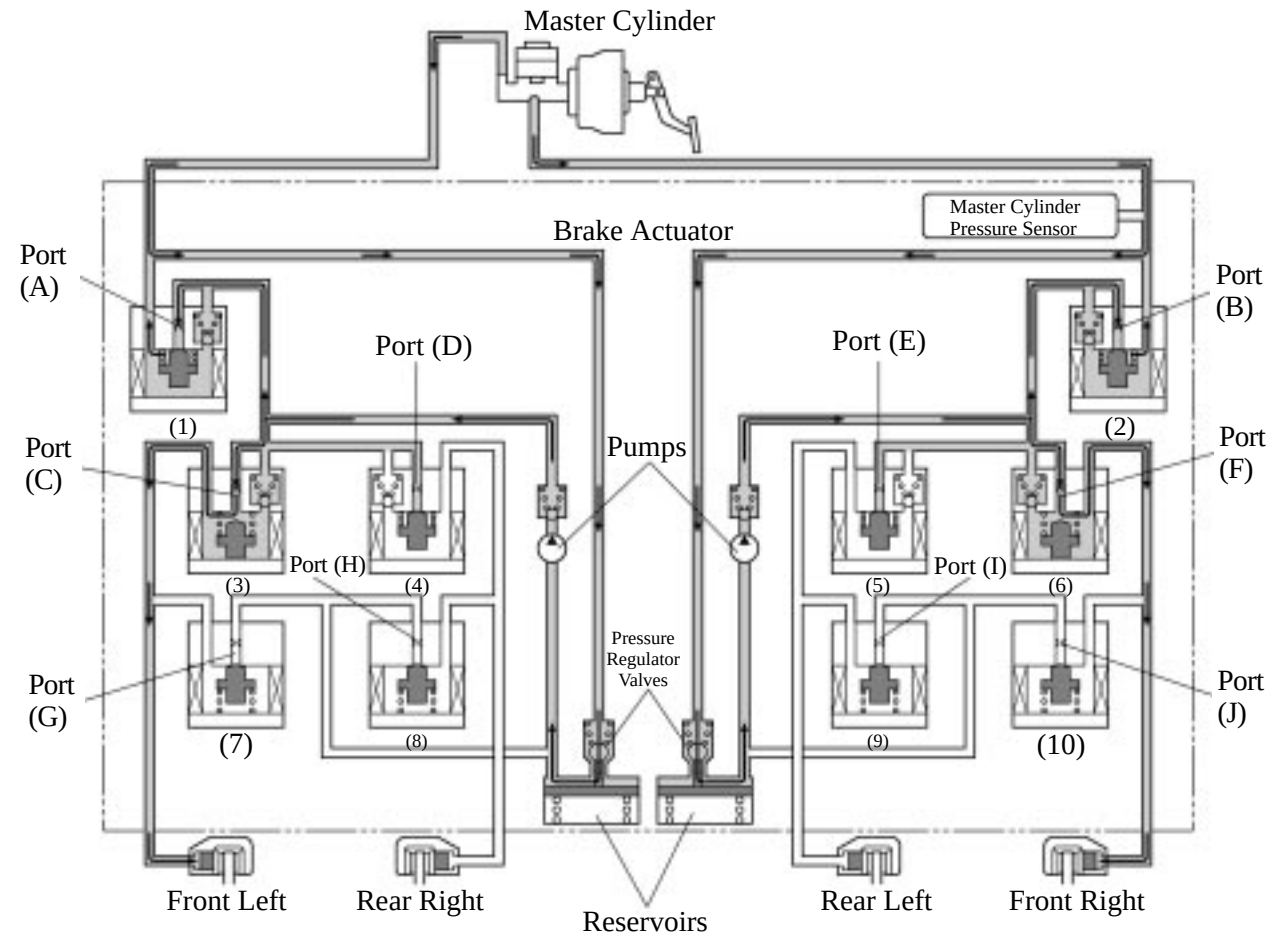
- The fluid pressure generated by the pump is regulated by the master cylinder cut solenoid valve to the required pressure. Thus, the wheel cylinders of the drive wheels are controlled in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes, to control the slippage of the drive wheels.
- The diagram below shows the hydraulic circuit in the pressure increase mode when the TRAC is activated.
- The pressure holding solenoid valve and the pressure reduction solenoid valve are turned ON/OFF according to the ABS operation pattern described on the previous page.
- The TRAC is activated, each solenoid operates as shown in the table on the next page.

### ► System Diagram ◀





► Pressure Increase Mode ◀



Pressure Increase Mode

259ESI10

| Item        |                                    |                                   | TRAC not Activated | TRAC Activated    |                  |                    |
|-------------|------------------------------------|-----------------------------------|--------------------|-------------------|------------------|--------------------|
|             |                                    |                                   |                    | Mode              |                  |                    |
|             |                                    |                                   |                    | Pressure Increase | Pressure Holding | Pressure Reduction |
| (1), (2)    | Master Cylinder Cut Solenoid Valve |                                   | OFF/Open           | ON*               | ←                | ←                  |
|             | Port: (A), (B)                     |                                   |                    |                   |                  |                    |
| Front Brake | (3), (6)                           | Pressure Holding Solenoid Valve   | OFF/Open           | ←                 | ON/Close         | ←                  |
|             |                                    | Port: (C), (F)                    |                    |                   |                  |                    |
|             | (7), (10)                          | Pressure Reduction Solenoid Valve | OFF/Close          | ←                 | ←                | ON/Open            |
|             |                                    | Port: (G), (J)                    |                    |                   |                  |                    |
|             | Wheel Cylinder Pressure            |                                   | —                  | Increase          | Holding          | Reduce             |
| Rear Brake  | (4), (5)                           | Pressure Holding Solenoid Valve   | OFF/Open           | ON/Close          | ←                | ←                  |
|             |                                    | Port: (D), (E)                    |                    |                   |                  |                    |
|             | (8), (9)                           | Pressure Reduction Solenoid Valve | OFF/Close          | ←                 | ←                | ←                  |
|             |                                    | Port: (H), (I)                    |                    |                   |                  |                    |
|             | Wheel Cylinder Pressure            |                                   | —                  | —                 | —                | —                  |

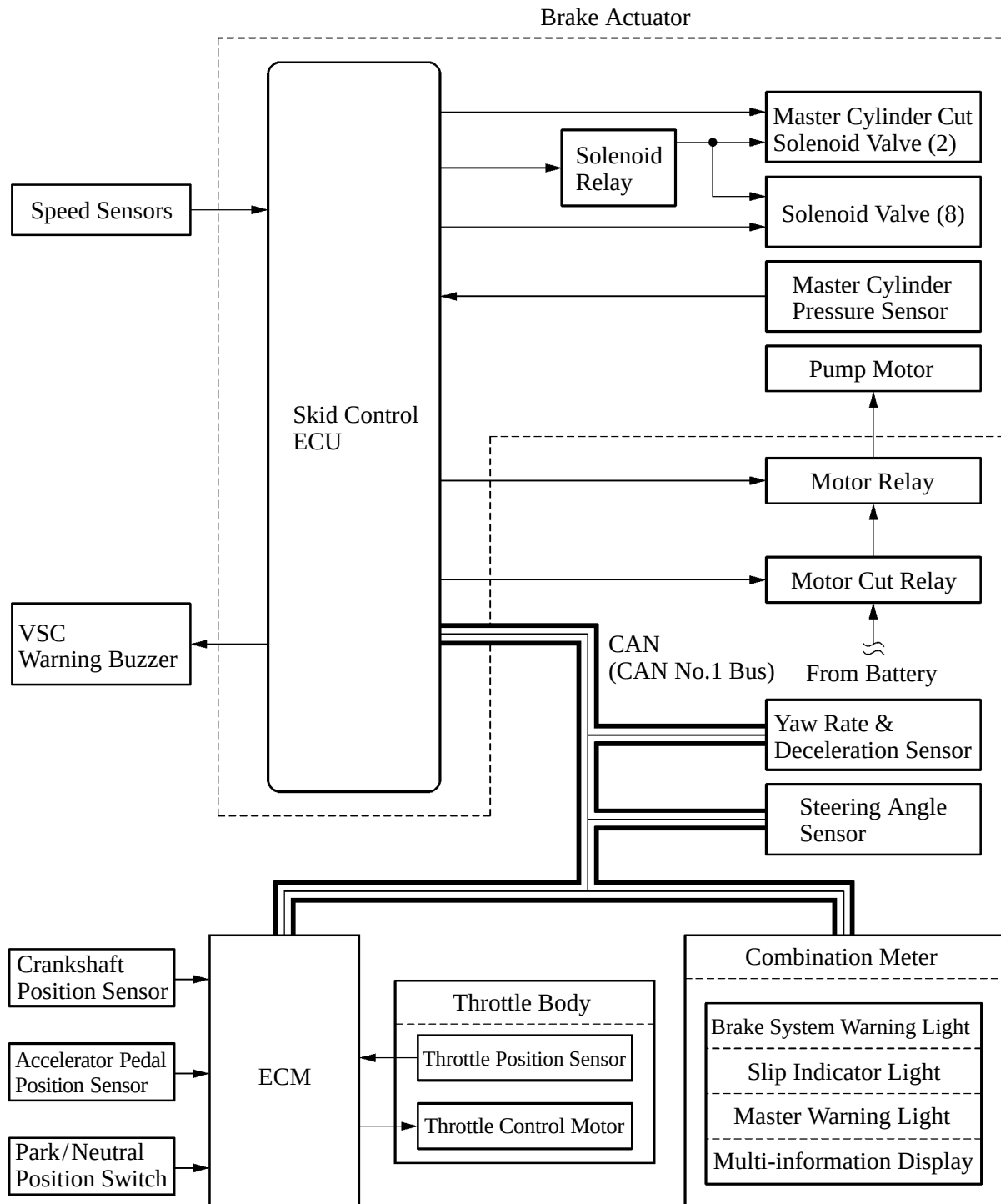
\*: The solenoid valve controls the hydraulic pressure between “open” and “close” according to the operating condition by adjusting continually.

## VSC Operation

### 1) General

The VSC operation, by way of solenoid valves, controls the fluid pressure that is generated by the pump and applies it to the brake wheel cylinder of each wheel in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes. As a result, the tendency to front wheel skid or rear wheel skid is controlled.

#### ► System Diagram ◀

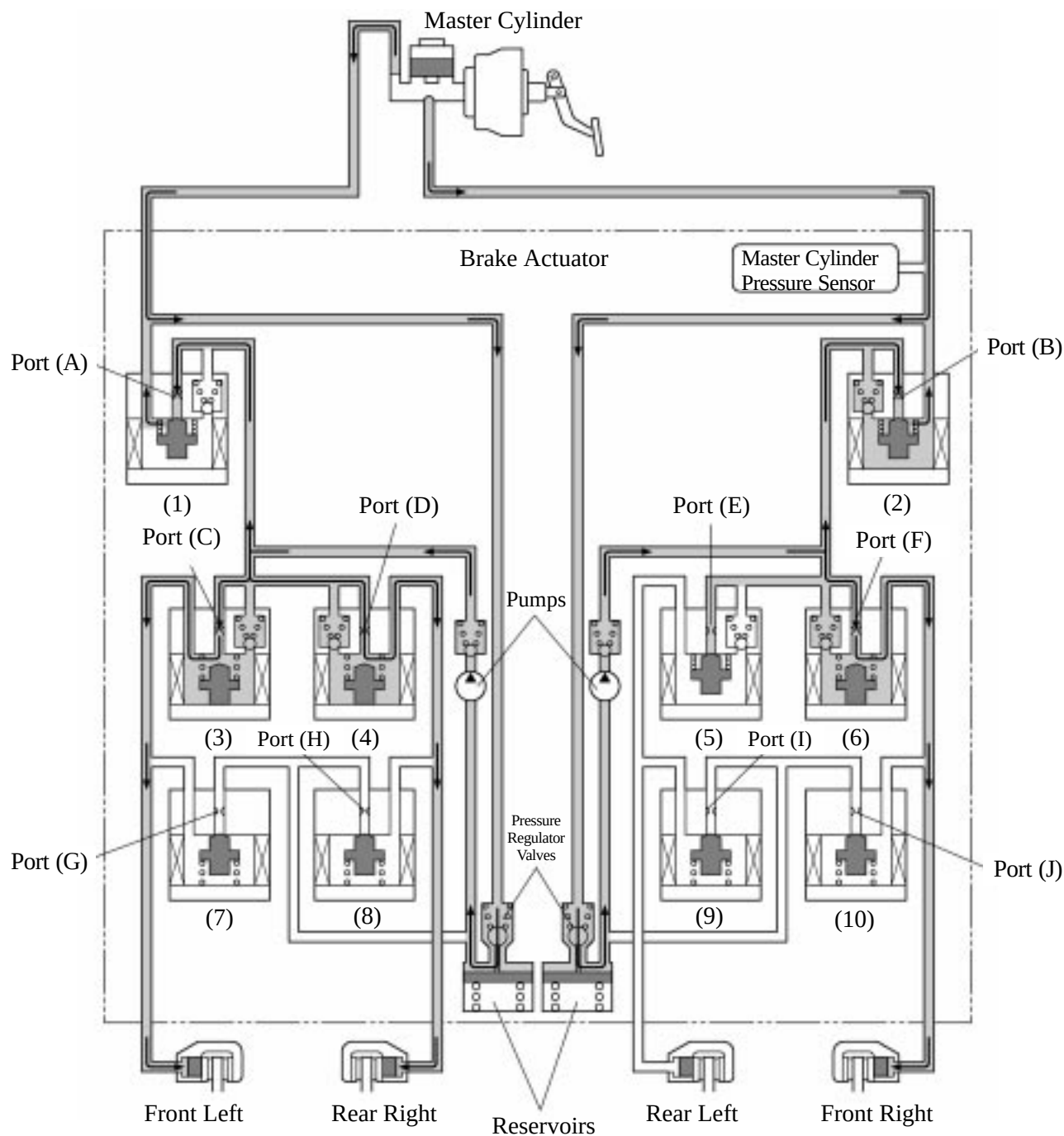


## 2) Front Wheel Skid Restraining Control (Turn to the Right)

In the front wheel skid restraining control, the brakes of the front wheels and the rear wheel of the inner circle of the turn are applied. Also, depending on whether the brake is ON or OFF and the condition of the vehicle, there are circumstances in which the brake might not be applied to the wheels even if those wheels are targeted for braking.

- The diagram below shows the hydraulic circuit in the pressure increase mode, as it controls the front wheel skid condition while the vehicle makes a right turn.
- In other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS with EBD operation pattern.
- The front wheel skid restraining control is activated, each solenoid operates as shown in the table on the next page.

### ► Pressure Increase Mode ◀



**Pressure Increase Mode**

| Item                          |                                    |                                   | VSC not<br>Activated<br>Pressure | VSC Activated        |                     |                       |
|-------------------------------|------------------------------------|-----------------------------------|----------------------------------|----------------------|---------------------|-----------------------|
|                               |                                    |                                   |                                  | Mode                 |                     |                       |
|                               |                                    |                                   |                                  | Pressure<br>Increase | Pressure<br>Holding | Pressure<br>Reduction |
| (1), (2)                      | Master Cylinder Cut Solenoid Valve |                                   | OFF/Open                         | ON*                  | ←                   | ←                     |
|                               | Port: (A), (B)                     |                                   |                                  |                      |                     |                       |
| Front<br>Brake                | (3)                                | Pressure Holding Solenoid Valve   | OFF/Open                         | ←                    | ON/Close            | ←                     |
|                               |                                    | Port: (C)                         |                                  |                      |                     |                       |
|                               | (6)                                | Pressure Holding Solenoid Valve   | OFF/Open                         | ←                    | ON/Close            | ←                     |
|                               |                                    | Port: (F)                         |                                  |                      |                     |                       |
|                               | (7)                                | Pressure Reduction Solenoid Valve | OFF/Close                        | ←                    | ←                   | ON/Open               |
|                               |                                    | Port: (G)                         |                                  |                      |                     |                       |
|                               | (10)                               | Pressure Reduction Solenoid Valve | OFF/Close                        | ←                    | ←                   | ON/Open               |
|                               |                                    | Port: (J)                         |                                  |                      |                     |                       |
| Wheel<br>Cylinder<br>Pressure | Right                              | —                                 | Increase                         | Holding              | Reduce              |                       |
|                               | Left                               | —                                 | Increase                         | Holding              | Reduce              |                       |
| Rear<br>Brake                 | (4)                                | Pressure Holding Solenoid Valve   | OFF/Open                         | ←                    | ON/Close            | ←                     |
|                               |                                    | Port: (D)                         |                                  |                      |                     |                       |
|                               | (5)                                | Pressure Holding Solenoid Valve   | OFF/Open                         | ON/Close             | ←                   | ←                     |
|                               |                                    | Port: (E)                         |                                  |                      |                     |                       |
|                               | (8)                                | Pressure Reduction Solenoid Valve | OFF/Close                        | ←                    | ←                   | ON/Open               |
|                               |                                    | Port: (H)                         |                                  |                      |                     |                       |
|                               | (9)                                | Pressure Reduction Solenoid Valve | OFF/Close                        | ←                    | ←                   | ←                     |
|                               |                                    | Port: (I)                         |                                  |                      |                     |                       |
| Wheel<br>Cylinder<br>Pressure | Right                              | —                                 | Increase                         | Holding              | Reduce              |                       |
|                               | Left                               | —                                 | —                                | —                    | —                   |                       |

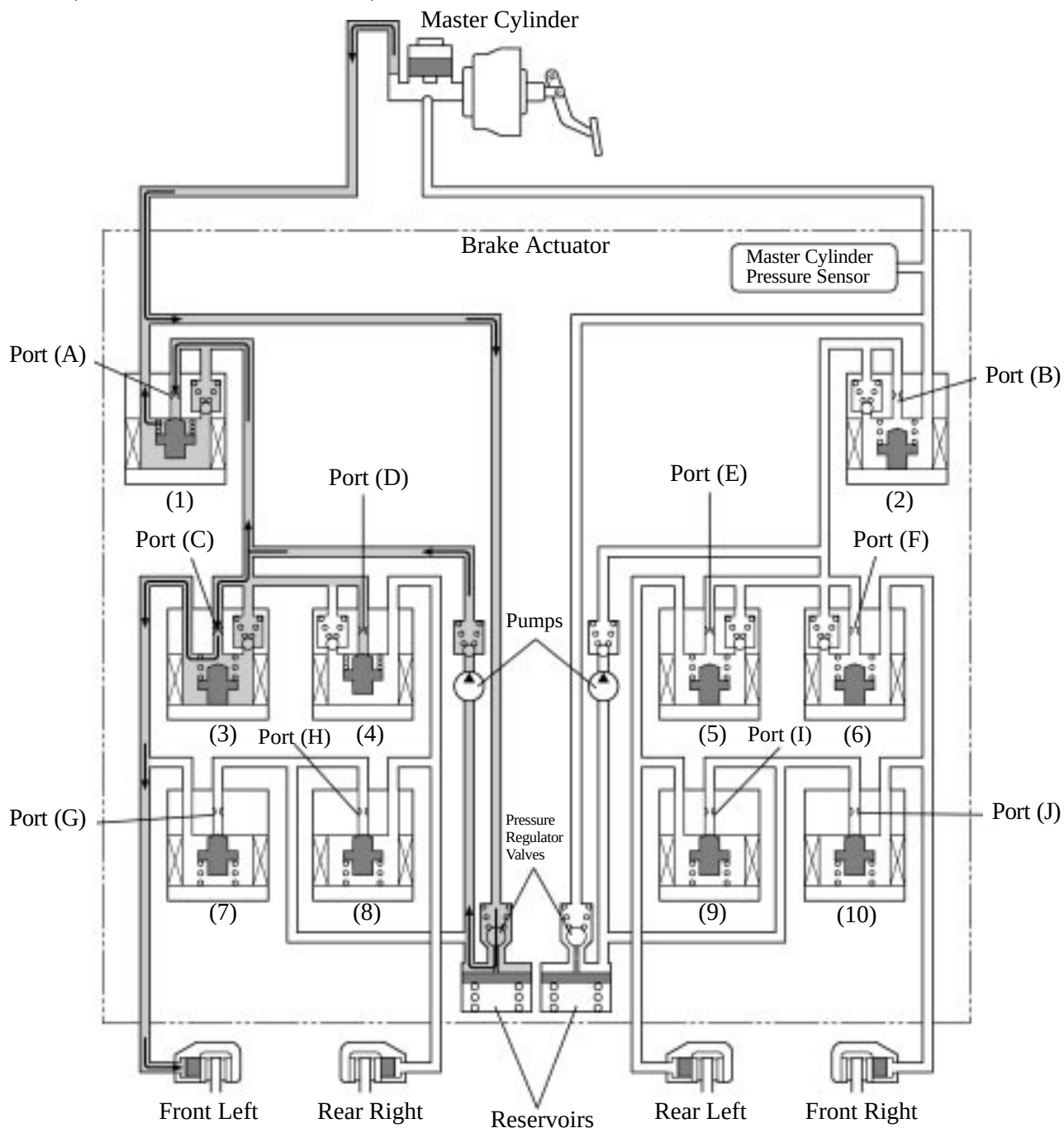
\*: The solenoid valve controls the hydraulic pressure between “open” and “close” according to the operating condition by adjusting continually.

### 3) Rear Wheel Skid Restraining Control (Turn to the Right)

In rear wheel skid restraining control, the brake of the front wheel of the outer circle of the turn is applied. Also, depending on whether the brake is ON or OFF and the condition of the vehicle, there are circumstances in which the brake might not be applied to the wheels even if those wheels are targeted for braking.

- The diagram below shows the hydraulic circuit in the pressure increase mode, as it controls the rear wheel skid condition while the vehicle make a right turn.
- In other operating modes, the pressure holding valve and the pressure reduction valve are turned ON/OFF according to the ABS with EBD operating pattern.
- The rear wheel skid restraining control system is activated, each solenoid operates as shown in the table on the next page.

#### ► Pressure Increase Mode ◀



**Pressure Increase Mode**

| Item                          |                                    |                                   | VSC not<br>Activated | VSC Activated        |                     |                       |
|-------------------------------|------------------------------------|-----------------------------------|----------------------|----------------------|---------------------|-----------------------|
|                               |                                    |                                   |                      | Mode                 |                     |                       |
|                               |                                    |                                   |                      | Pressure<br>Increase | Pressure<br>Holding | Pressure<br>Reduction |
| (1)                           | Master Cylinder Cut Solenoid Valve |                                   | OFF/Open             | ON*                  | ←                   | ←                     |
|                               | Port: (A)                          |                                   |                      |                      |                     |                       |
| (2)                           | Master Cylinder Cut Solenoid Valve |                                   | OFF/Open             | ←                    | ←                   | ←                     |
|                               | Port: (B)                          |                                   |                      |                      |                     |                       |
| Front<br>Brake                | (3)                                | Pressure Holding Solenoid Valve   | OFF/Open             | ←                    | ON/Close            | ←                     |
|                               |                                    | Port: (C)                         |                      |                      |                     |                       |
|                               | (6)                                | Pressure Holding Solenoid Valve   | OFF/Open             | ON/Close             | ←                   | ←                     |
|                               |                                    | Port: (F)                         |                      |                      |                     |                       |
|                               | (7)                                | Pressure Reduction Solenoid Valve | OFF/Close            | ←                    | ←                   | ON/Open               |
|                               |                                    | Port: (G)                         |                      |                      |                     |                       |
|                               | (10)                               | Pressure Reduction Solenoid Valve | OFF/Close            | ←                    | ←                   | ←                     |
|                               |                                    | Port: (J)                         |                      |                      |                     |                       |
| Wheel<br>Cylinder<br>Pressure | Right                              | —                                 | —                    | —                    | —                   |                       |
|                               | Left                               | —                                 | Increase             | Holding              | Reduce              |                       |
| Rear<br>Brake                 | (4)                                | Pressure Holding Solenoid Valve   | OFF/Open             | ON/Close             | ←                   | ←                     |
|                               |                                    | Port: (D)                         |                      |                      |                     |                       |
|                               | (5)                                | Pressure Holding Solenoid Valve   | OFF/Open             | ON/Close             | ←                   | ←                     |
|                               |                                    | Port: (E)                         |                      |                      |                     |                       |
|                               | (8)                                | Pressure Reduction Solenoid Valve | OFF/Close            | ←                    | ←                   | ←                     |
|                               |                                    | Port: (H)                         |                      |                      |                     |                       |
|                               | (9)                                | Pressure Reduction Solenoid Valve | OFF/Close            | ←                    | ←                   | ←                     |
|                               |                                    | Port: (I)                         |                      |                      |                     |                       |
| Wheel<br>Cylinder<br>Pressure | Right                              | —                                 | —                    | —                    | —                   |                       |
|                               | Left                               | —                                 | —                    | —                    | —                   |                       |

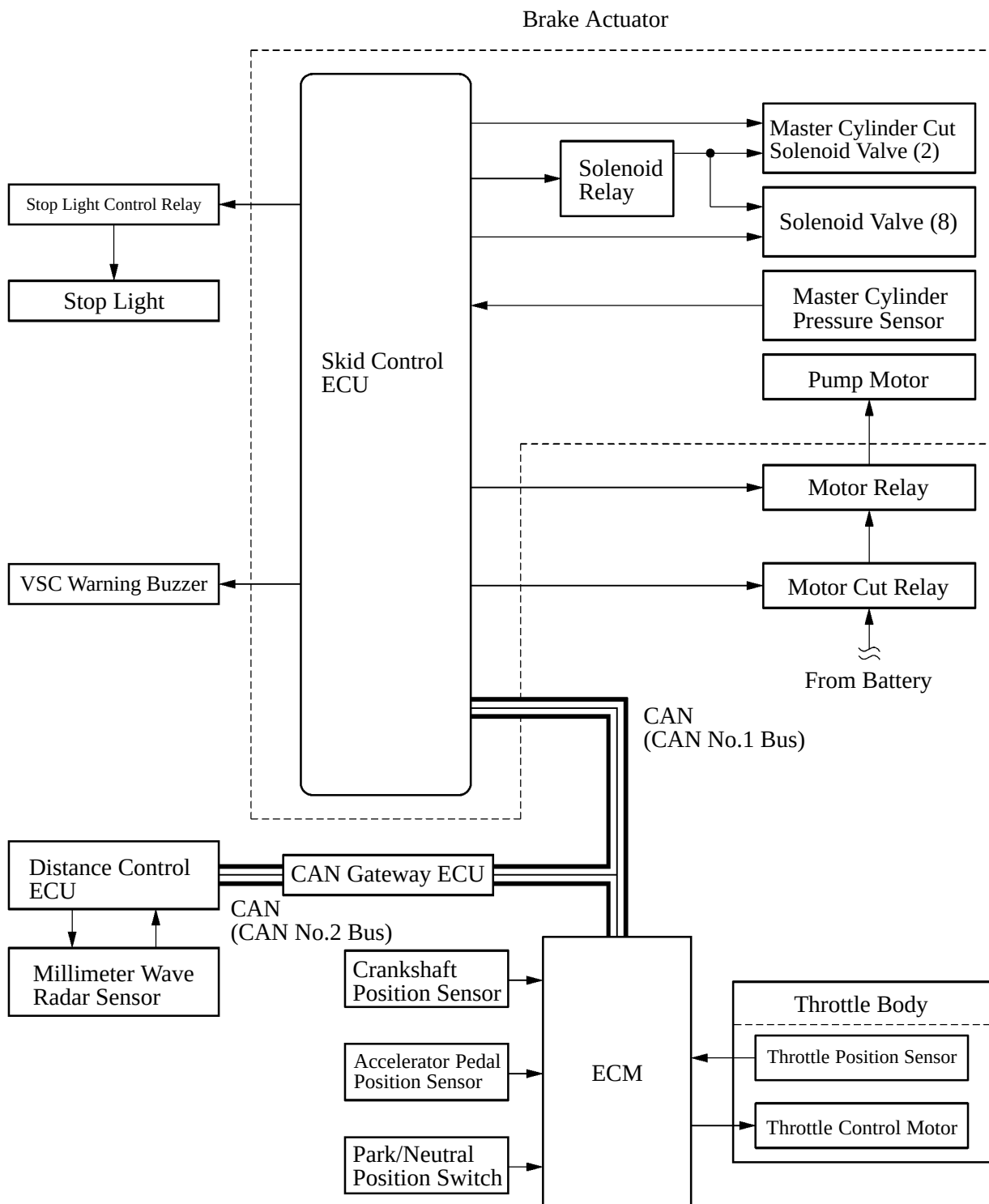
\*: The solenoid valve controls the hydraulic pressure between “open” and “close” according to the operating condition by adjusting continually.

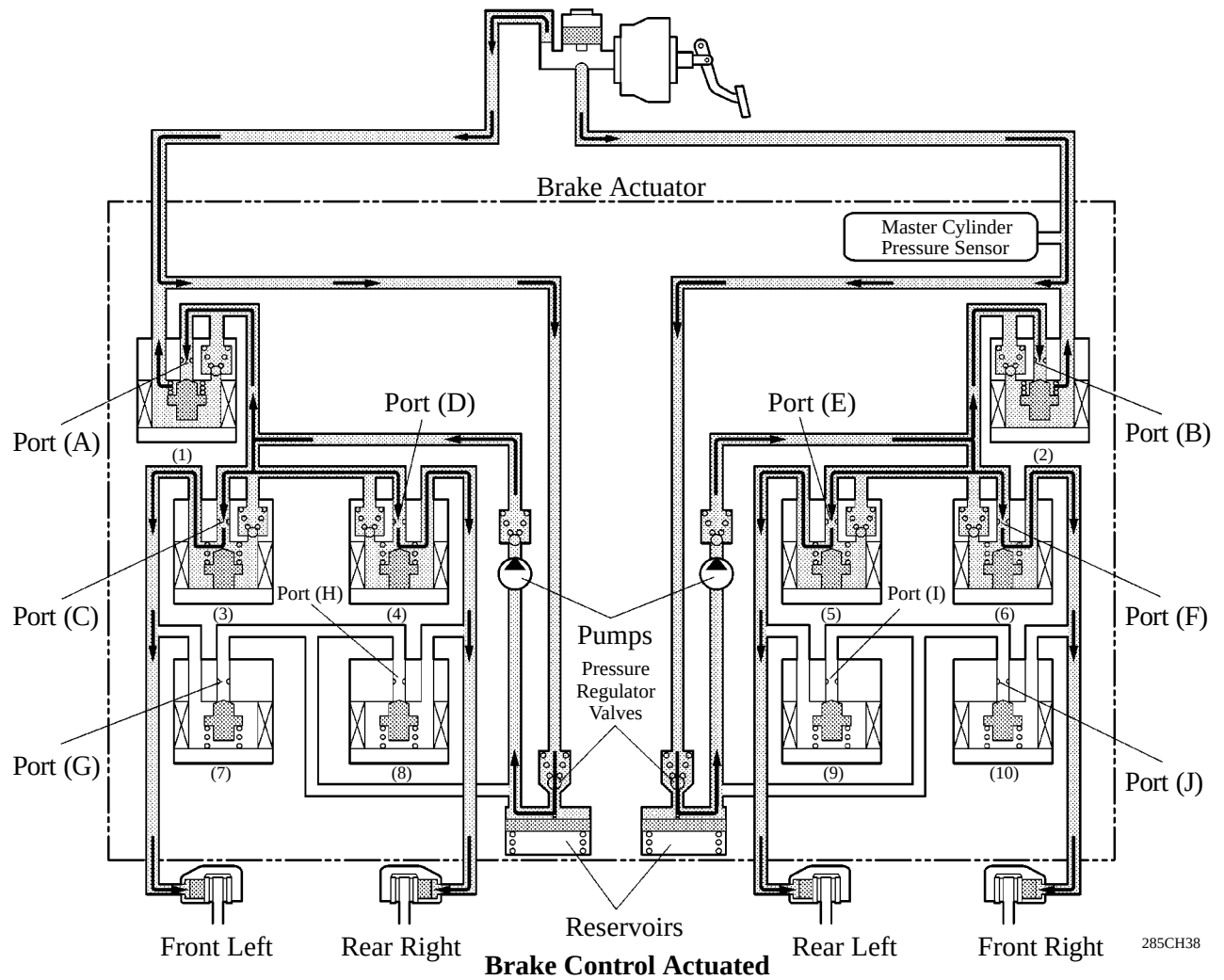
### Brake Control Operation (Operating Dynamic Radar Cruise Control System)\*

- The fluid pressure that is generated by the pump in the brake actuator is directed to the wheel cylinders.
- When the brake control is activated, each solenoid operates as shown in the table on the next page.

\*: With Dynamic Radar Cruise Control System

#### ► System Diagram ◀





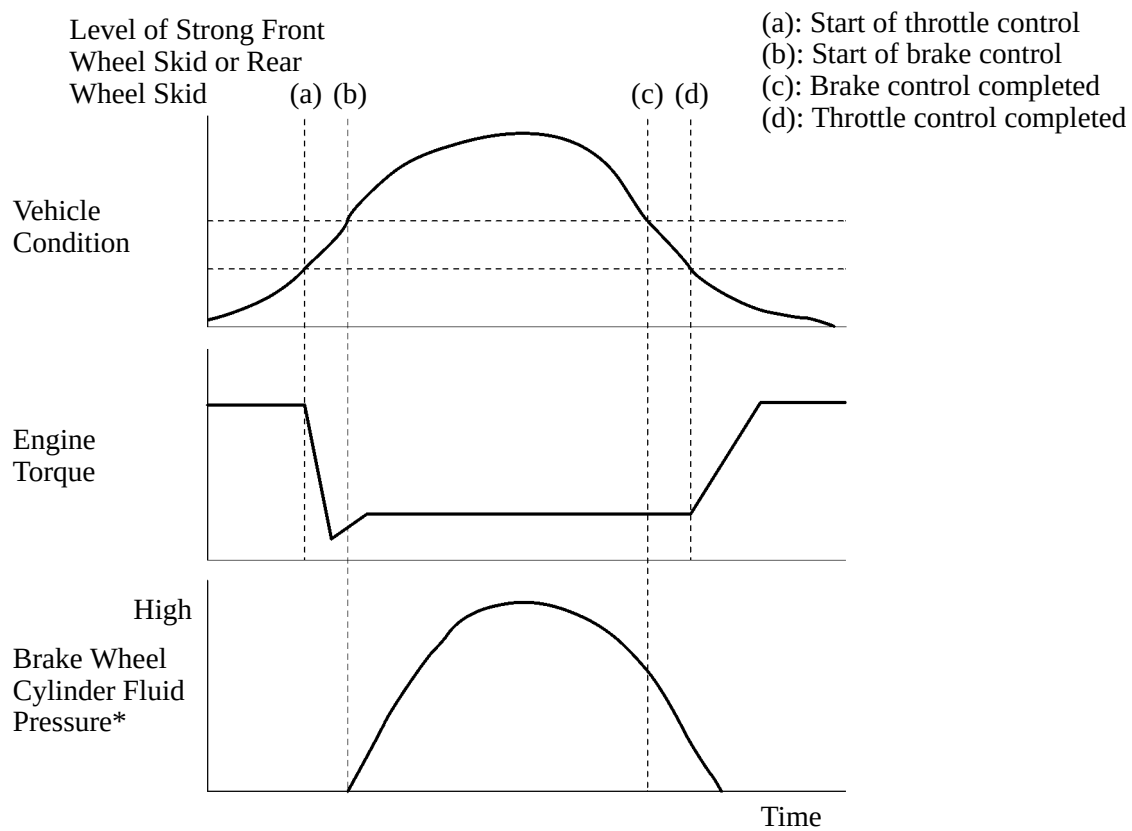
| Item        |                                    |                          | Brake Control<br>Not Activated | Brake Control<br>Activated |
|-------------|------------------------------------|--------------------------|--------------------------------|----------------------------|
| (1), (2)    | Master Cylinder Cut Solenoid Valve |                          | OFF/Open                       | ON*                        |
|             | Port: (A), (B)                     |                          |                                |                            |
| Front Brake | (3), (6)                           | Pressure Holding Valve   | OFF/Open                       | ←                          |
|             |                                    | Port: (C), (F)           |                                |                            |
|             | (7), (10)                          | Pressure Reduction Valve | OFF/Close                      | ←                          |
|             |                                    | Port: (G), (J)           |                                |                            |
| Rear Brake  | (4), (5)                           | Pressure Holding Valve   | OFF/Open                       | ←                          |
|             |                                    | Port: (D), (E)           |                                |                            |
|             | (8), (9)                           | Pressure Reduction Valve | OFF/Close                      | ←                          |
|             |                                    | Port: (H), (I)           |                                |                            |

\*: The solenoid valve controls the hydraulic pressure between “open” and “close” according to the operating condition by adjusting continually.



## Engine Output Control

During a VSC operation, the skid control ECU outputs a VSC operation signal to the ECM. Upon receiving this signal, the ECM effects throttle control to regulate the engine output.



151CH31

\*: The wheel cylinder that activates varies depending on the condition of the vehicle.

## Initial Check

Each time the power source is IG ON, and the vehicle reaches a speed of approximately 6 km/h (4 mph) or more, the skid control ECU performs an initial check. The functions of each solenoid valve and pump motor in the brake actuator are checked in sequence.

## 12. CAN (Controller Area Network)

CAN communication is used between the skid control ECU, steering angle sensor, yaw rate & deceleration sensor, ECM, CAN gateway ECU, main body ECU, distance control ECU and DLC3. For details of CAN communication, see page BE-8.

## 13. Service Mode

- The TRAC OFF switch designed for '06 ES330 is not used on '07 ES350.
- A new service mode has been created for '07 ES350. In this mode, TRAC and VSC functions can be forcibly turned off, either through the operation of a hand-held tester or by operating the parking brake and the brake pedal together. Please see the following service tip for information regarding changing the service mode.

### Service Tip

#### Transition to the service mode (TRAC and VSC OFF mode).

The TRAC and VSC systems can be turned off by following the procedures below:

- When using the parking brake and brake pedal:
  - 1) Check that the power source is OFF and the shift lever is in position P.
  - 2) Start the engine after turning the power source ON.
  - 3) Operate the following steps 4 to 8 within 30 seconds of starting the engine.
  - 4) Turn the parking brake switch on.
  - 5) Depress and release the brake pedal twice.
  - 6) Turn the parking brake switch on and off twice while depressing the brake pedal.
  - 7) Depress and release the brake pedal twice while the parking brake switch is on.  
**Notice:** Steps 6 and 7 should each be performed within 15 seconds.
  - 8) Check that the slip indicator light and multi-information display are turned on. If not, repeat the procedure from the step 1.
  - 9) The brake control system can be returned to the normal mode by turning the power source ON position from OFF.
- When using the hand-held tester:
  - 1) Check that the power source is OFF and the shift lever is in position P.
  - 2) Start the engine after turning the power source ON.
  - 3) Connect the hand-held tester to the DLC3, and operate it to send signals of memory change function.
  - 4) The brake control system can be returned to the normal mode by turning the power source ON position from OFF.

For details of the transition to service mode, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## 14. Diagnosis

### General

- If the skid control ECU detects a malfunction in the brake control system (ABS with EBD, brake assist, TRAC, and VSC), the ABS, brake system, master warning lights, slip indicator light and multi-information display the corresponds to the function for which the malfunction has been detected illuminates or indicates, as indicated in the table below, to alert the drive of the malfunction.

○: Illuminate    Δ : Indicate

| Item                                                                                                                                                | ABS | EBD | Brake Assist | TRAC | VSC |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------------|------|-----|
| ABS Warning Light                                                                                                                                   | ○   | ○   | ○            | —    | —   |
| Brake System Warning Light                                                                                                                          | —   | ○   | —            | —    | —   |
| Master Warning Light                                                                                                                                | —*  | —*  | —*           | ○    | ○   |
| Multi-information Display<br>(Warning Message “CHECK VSC”)<br><br> | —*  | —*  | —*           | Δ    | Δ   |

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\*: Failure in the ABS, EBD, and brake assist systems prohibits operation of the TRAC, VSC, systems. Accordingly, the master warning lights and slip indicator light will be illuminated and the “CHECK VSC” message will appear on the multi-information display.

- At the same time, the DTC (Diagnostic Trouble Code) are stored in the memory. The DTC can be read by connecting SST (09843-18040) between the Tc and CG terminals of the DLC3, and observing the blinking of the ABS warning light or the observing the diagnostic code indicated on the multi-information display, connecting a hand-held tester.
- This system has a sensor signal check (test mode) function. This function is activated by connecting the SST (09843-18040) between the Ts and CG terminal of the DLC3 or by connecting a hand-held tester. The ABS warning light blinks at a 0.13-second interval and “VSC TEST MODE” will appear on the multi-information display. This check function performs deceleration sensor check, yaw rate sensor check, master cylinder pressure sensor check, and speed sensor check.

### ► Display example of the multi-information display ◀



Normal system code is displayed

01YCH70Y



DTC is displayed

01YCH76Y



Test mode is activated

01YCH71Y

- If the skid control ECU detects a malfunction during a sensor signal check (test mode), it stores the DTC in its memory. These DTC can be read during a sensor check operation by connecting the SST (09843-18040) to the Tc and CG terminals of the DLC3 and observing the blinking of the ABS warning light or observing the diagnostic code indicated on the multi-information display, or connecting a hand-held tester.

For details of the DTC that are stored in skid control ECU memory and the DTC that are output through the sensor signal check (test mode) functions, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

### Diagnosis of CAN

- If a malfunction occurs on a CAN communication line, the skid control ECU is connected to the CAN communication lines and it will store the DTC (Diagnostic Trouble Code) in its memory.
- There are 2-digit DTC and 5-digit DTC for CAN communications related to the brake control system (ABS with EBD, brake assist, TRAC and VSC).
  - 2-digit DTC can be read by connecting the SST (09843-18040) to Tc and CG terminals of the DLC3, and observing the diagnostic code indicated on the multi-information display in the combination meter.
  - 5-digit DTC can be read by connecting a hand-held tester to the DLC3.

#### Service Tip

The skid control ECU uses the CAN protocol for diagnostic communication. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

### Fail-Safe

- In the event of a malfunction in the ABS and/or brake assist controls, the skid control ECU prohibits the ABS, brake assist, TRAC and VSC operations.
- In the event of a malfunction in the EBD control, the skid control ECU prohibits the EBD operation. Even in this case, usual braking performance excluding the brake control system (ABS with EBD, brake assist, TRAC and VSC) is secured.
- In the event of a malfunction in the TRAC and/or VSC, the skid control ECU prohibits TRAC and VSC operations
- If a communication malfunction occurs between the skid control ECU, the steering angle sensor, the yaw rate & deceleration sensor or ECM, the skid control ECU stops the TRAC and VSC.
- When the ECM detects the DTC, it will disable the TRAC and VSC operations.

## ■ BRAKE CONTROL SYSTEM (ABS with EBD, Brake Assist, TRAC and VSC)

### 1. General

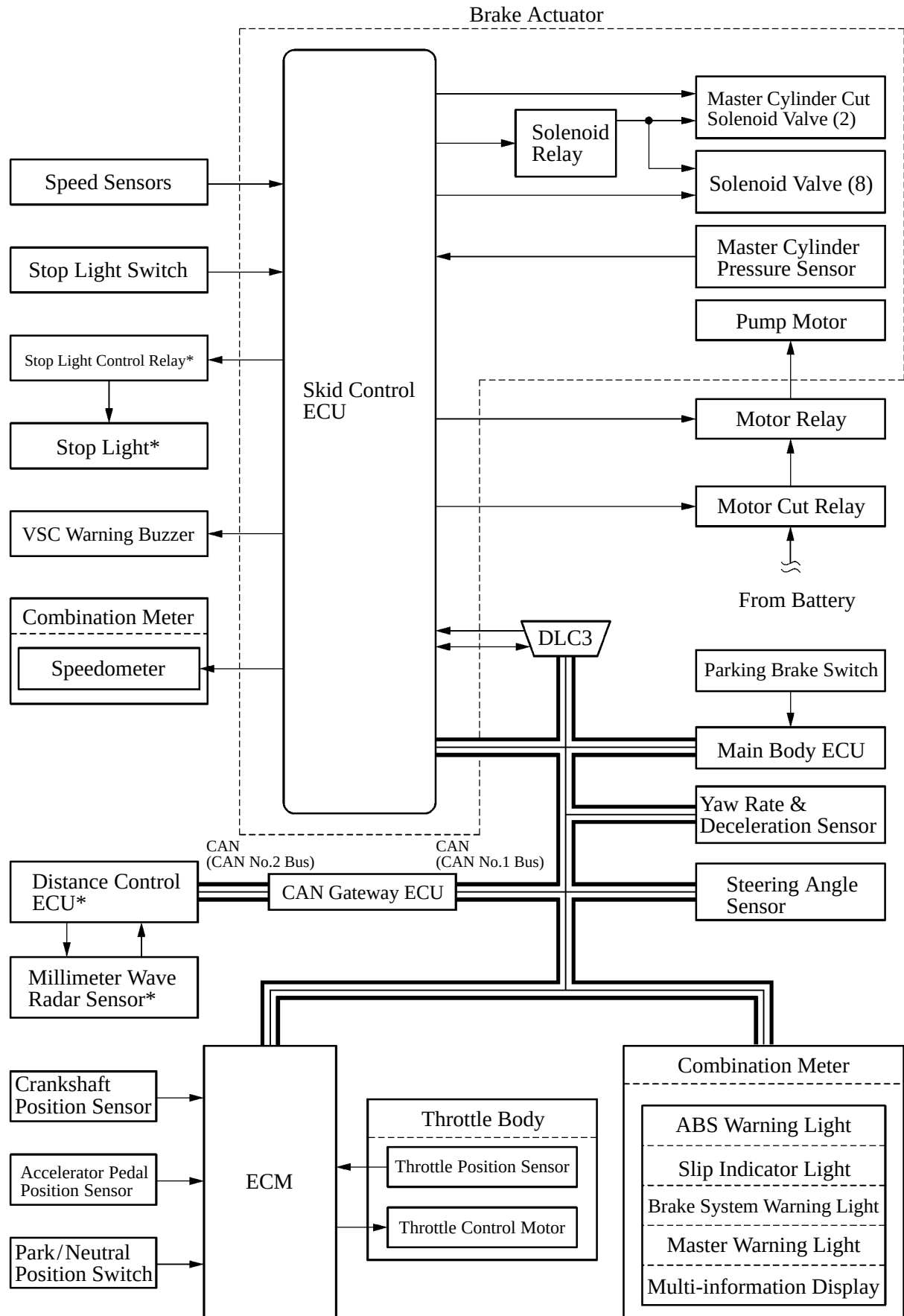
The brake control system (ABS with EBD, brake assist, TRAC and VSC) of '07 ES350 has the following functions:

| Function                                     | Outline                                                                                                                                                                                                                                                                                              |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ABS<br>(Anti-lock Brake System)              | The ABS helps prevent the wheels from locking when the brakes are applied firmly or when braking on a slippery surface.                                                                                                                                                                              |
| EBD<br>(Electronic Brake force Distribution) | The EBD control utilizes ABS, realizing the proper brake force distribution between front and rear wheels in accordance with the driving conditions.<br>In addition, during cornering braking, it also controls the brake forces of right and left wheels, helping to maintain the vehicle behavior. |
| Brake Assist                                 | The primary purpose of the brake assist is to provide an auxiliary brake force to assist the driver who cannot generate a large brake force during emergency braking, thus helping draw the vehicle's brake performance.                                                                             |
| TRC<br>(Traction Control)                    | The TRAC system helps prevent the drive wheels from slipping if the driver presses the accelerator pedal excessively when starting off or accelerating on a slippery surface.                                                                                                                        |
| VSC<br>(Vehicle Stability Control)           | The VSC system helps prevent the vehicle from slipping sideways as a result of strong front wheel skid or strong rear wheel skid during cornering.                                                                                                                                                   |

#### Service Tip

When brake control system is activated, the brake pedal could shudder, which is a normal occurrence of the system in operation and should not be considered a malfunction.

## 2. System Diagram

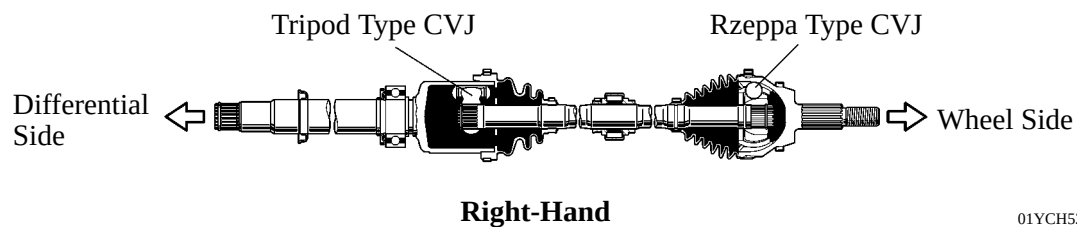
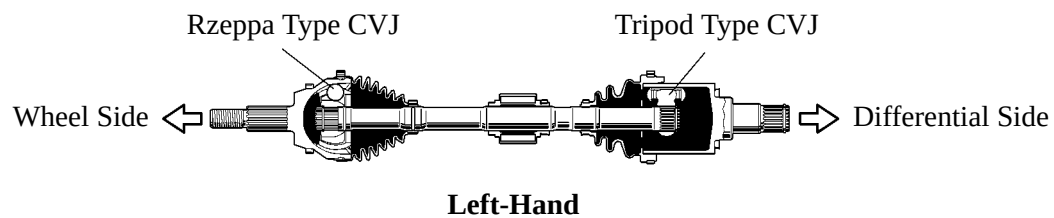


\*: With Dynamic Radar Cruise Control System

## DRIVE SHAFT

### ■ DESCRIPTION

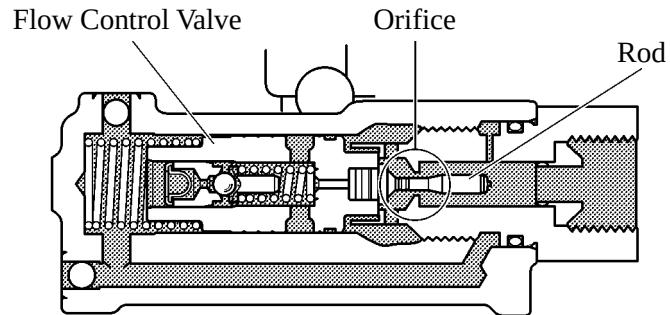
The drive shaft uses a tripod type CVJ (Constant Velocity Joint) on the differential side, and Rzeppa type CVJ on the wheel side.



## ■ POWER STEERING VANE PUMP

### 1. Construction

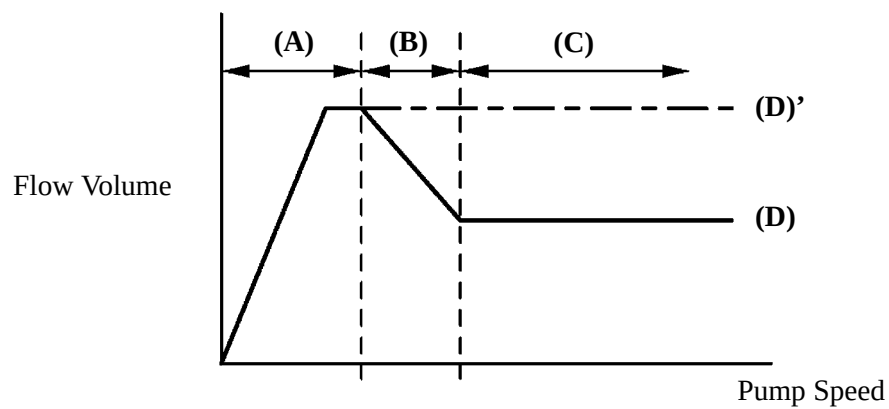
A flow control valve, which fluctuates in accordance with the pump load, and a rod for adjusting the orifice opening area are integrated into this pump.



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### 2. Operation

#### ► Flow Volume Characteristics ◀

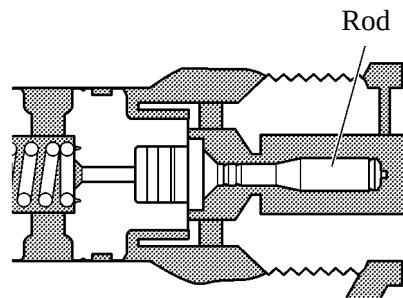


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### Low Pump Speed Range (A)

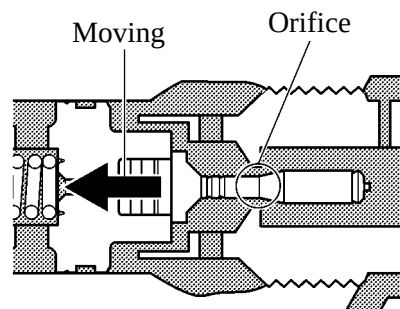
Flow volume increases in accordance with the increase of pump speed.



01YCH112Y

### Middle Pump Speed Range without Steering (B)

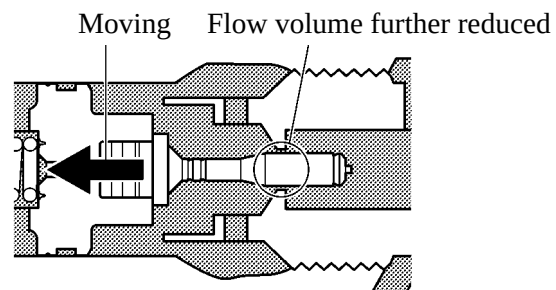
The flow control valve moves to the left and the flow volume is reduced by drawing the orifice in accordance with the change of the shaft diameter of the rod.



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### High Pump Speed Range without Steering (C)

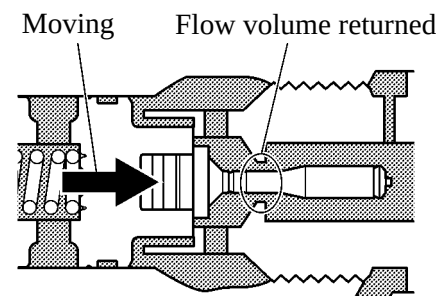
The flow control valve moves further left and the flow volume is further reduced by the maximum rod shaft diameter.



01YCH114Y

### During Pressure Loading (D → D')

If operating the steering in the middle and high speed range, the flow control valve moves to the right in accordance with the pressure increase of the vane pump, resulting in the opening of the orifice and returning the flow volume.



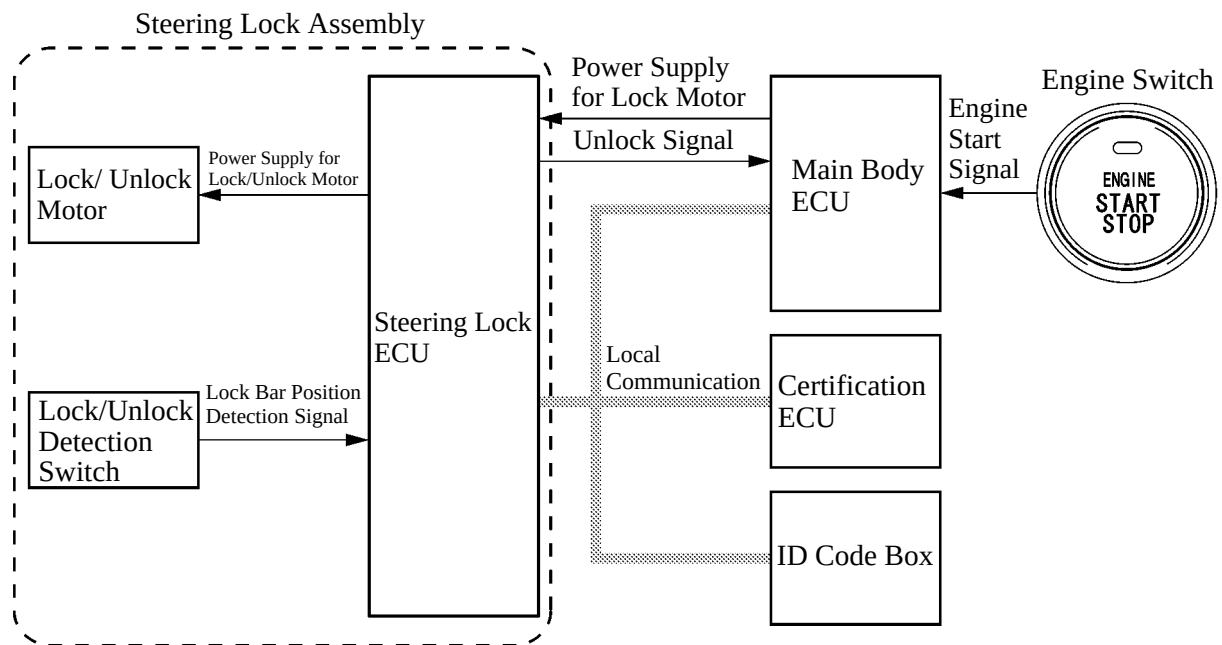
01YCH115Y

## ■ STEERING LOCK SYSTEM

According with the use of the smart access system with push-button start, a steering lock system which uses a lock/unlock motor to lock and unlock the steering wheel is used. This system mainly consists of the steering lock assembly, main body ECU, certification ECU and ID code box.

- The steering lock ECU is integrated in the steering lock assembly, and it controls the lock bar operation in the steering lock assembly through the control of lock/unlock motor.
- The steering lock ECU detects the position (lock/unlock) of the lock bar and transmits this information to the main body ECU and certification ECU.
- In this system, the certification ECU determines whether to lock or unlock the steering based on communication with the main body ECU. Then, the certification ECU sends lock or unlock command signals to the steering lock ECU through the ID code box. Upon receiving the signals, the steering lock ECU operates the lock/unlock motor to lock or unlock the steering. For details, see page BE-118.

### ► System Diagram ◀



01YCH109TE

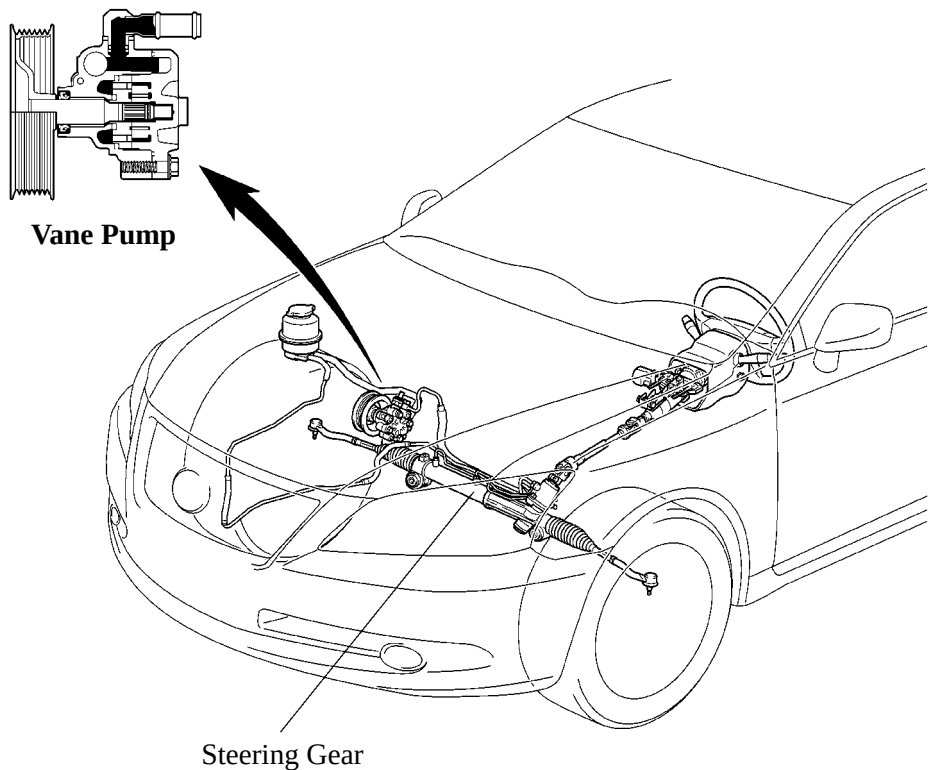
### Service Tip

It is not possible to replace only the steering lock ECU in the steering lock assembly. Therefore, if a malfunction occurs in the ECU, the entire steering lock assembly must be replaced.

STEERING

DESCRIPTION

- A rack and pinion type steering gear with an engine speed sensing type power steering is used on the all models.
- The pressure return type vane pump is used which makes the discharge pressure flow volume return at middle and high speed, thus secured the fine steering feeling.
- A power tilt and power telescopic mechanism is used. The memory function is available as an option.
- The steering column uses an energy absorbing mechanism that uses an energy absorbing plate on all models.
- An electrical steering lock system is used on all models.



01YCH104Y

Specifications

|                           |          |                           |
|---------------------------|----------|---------------------------|
| Gear Ratio (Overall)      |          | 16.0                      |
| No. of Turns Lock to Lock |          | 3.20                      |
| Rack Stroke               | mm (in.) | 156.0 (6.14)              |
| Fluid Type                |          | ATF Type DEXRON®II or III |

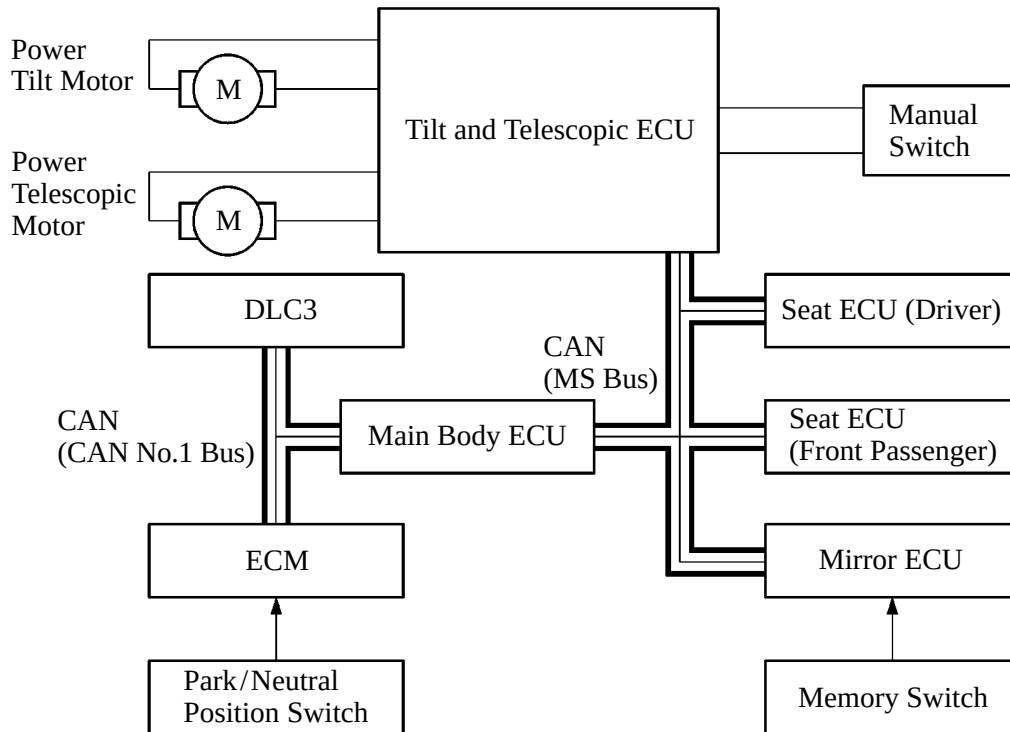
## ■ STEERING COLUMN

### 1. Power Tilt and Power Telescopic Steering Column

#### General

- A compact and lightweight power tilt and telescopic steering column is used.
- The automatic set (Away and Return) function is used.
- On the models with the memory system, this steering column contains a driving position memory function, which operates in unison with the driver's seat, front passenger seat and outside rear view mirror. This function memorizes 2 driving positions. For driver's seat, front passenger seat and out side vear view mirror details, refer to "Memory System" on page BE-247.

#### ► System Diagram ◀

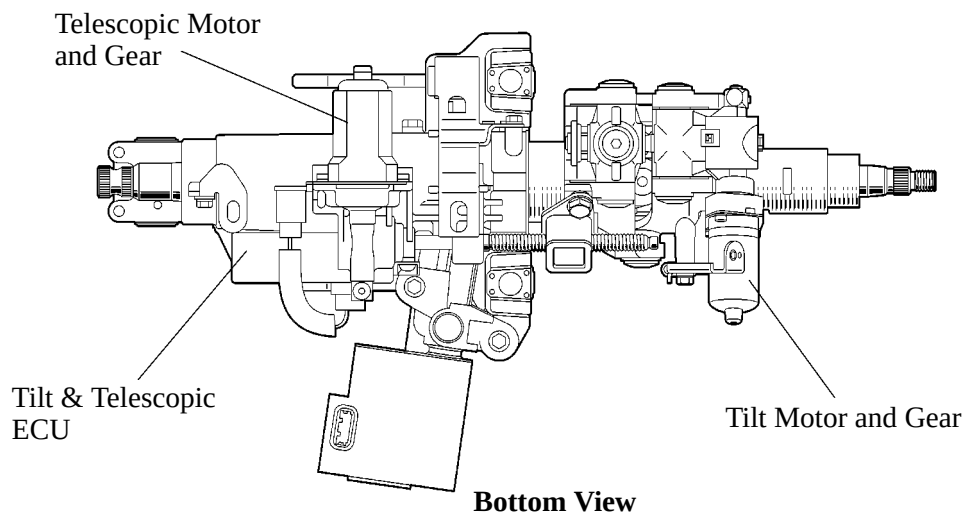


01YCH105TE

#### Construction

The power tilt and power telescopic steering column consists of the tilt and telescopic ECU, tilt motor, telescopic motor and gears.

The tilt and telescopic motors contain position sensors that use hall elements.



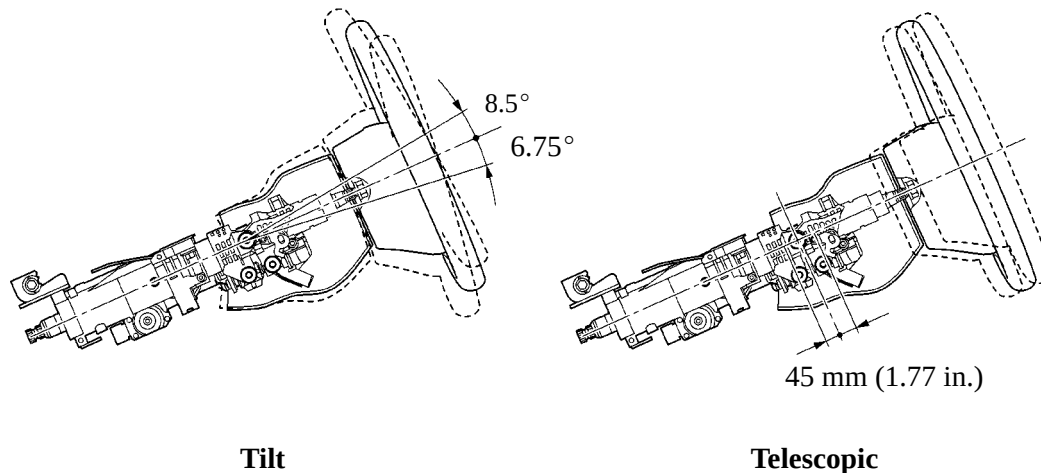
01YCH116Y

## Operation

### 1) Manual Operation

The tilt position and the telescopic position can be adjusted as desired by operating the tilt and telescopic manual switch.

A stepless adjustment enables the tilt mechanism to be tilted  $15.25^\circ$  vertically, and the telescopic mechanism to be moved 45 mm (1.77 in.) longitudinally.



01YCH106Y

### 2) Automatic Set (Away and Return) Function

When the engine switch is turned OFF, the steering column moves forward away from the driver and also tilts up for easy exit and entry.

When the engine switch is turned ON, the steering column returns to the previously set position.

The automatic set function can be prohibited by using a hand-held tester.

### 3) Driving Position Memory Function (Only for Models with Memory System)

The steering column moves to the previously set position by pressing the driving position memory switches that are located on the driver's door.

### 4) Position Detection

To detect the position of the tilt and telescopic steering column, position sensors that utilize hall elements are located in the tilt and telescopic motors and are used to detect the changes in the magnetic field of the magnets, which are attached to the shafts of the motors.

## Diagnosis

If the tilt and telescopic ECU detects a malfunction in the power tilt and power telescopic steering column system, the ECU stores the malfunction data in memory. Then, by connecting a hand-held tester to the DLC3 terminal, the DTC (Diagnostic Trouble Code) can be accessed and an active test can be performed to actively operate the tilt motor and the telescopic motor. For details, see the 2007 LEXUS ES350 Repair Manual (RM01Y0U).

### Service Tip

The tilt and telescopic ECU uses the CAN protocol for diagnostic communication. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## Fail-Safe

- If malfunction in the tilt position sensor signal or telescopic position sensor signal occurs while operating the power tilt or power telescopic function, the tilt and telescopic ECU stops the operation of the power tilt and power telescopic steering column system.
- If the power voltage to the ECU drops below approximately 8 V while operating the power tilt or power telescopic function, the ECU stops the operation of the power tilt and power telescopic steering column system.
- If the tilt and telescopic ECU detects that the motor has locked during the operation of the power tilt or power telescopic function, the ECU stops the operation of the power tilt and power telescopic steering column system.
- If the communication of an ECU that is related to the power tilt and power telescopic steering column system is interrupted, the tilt and telescopic ECU effects the controls listed below.

| Function         | Main Body ECU<br>Communication<br>Interruption | Mirror ECU<br>Communication<br>Interruption | Seat ECU<br>Communication<br>Interruption | All ECUs*1<br>Communication<br>Interruption |
|------------------|------------------------------------------------|---------------------------------------------|-------------------------------------------|---------------------------------------------|
| Manual           | X*2                                            | ○                                           | ○                                         | X*2                                         |
| Automatic Away   | X                                              | X                                           | ○                                         | X                                           |
| Automatic Return | X*3                                            | X*3                                         | ○                                         | X*3                                         |
| Memory           | X                                              | X                                           | X                                         | X                                           |

\*1: All ECUs that are related to the power tilt and power telescopic steering column system.

\*2: ● The operation is permitted if the engine switch signal is ON while the signal from main body ECU is interrupting.

- The operation is prohibited if the engine switch signal is OFF while the signal from main body ECU is interrupting.

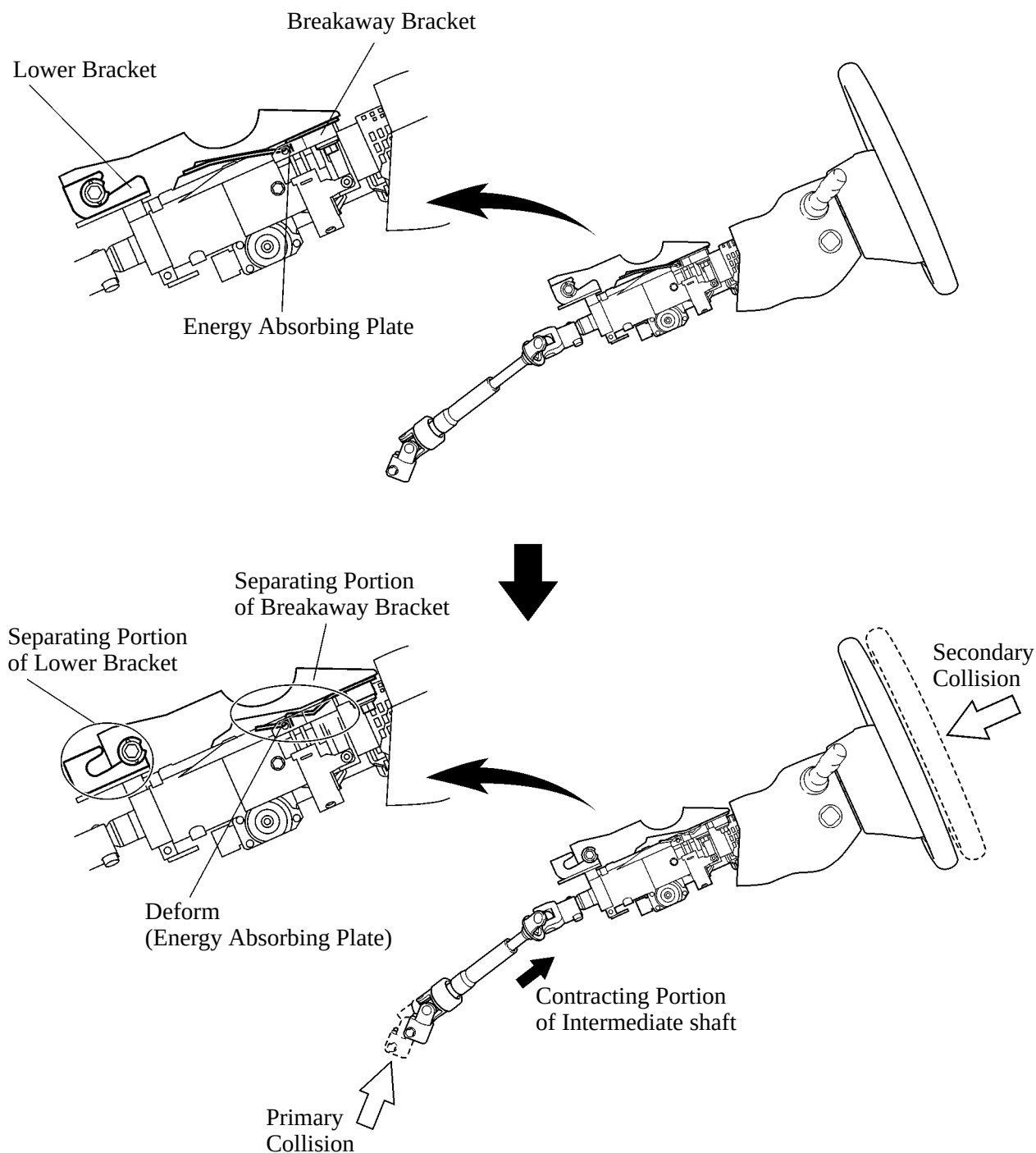
\*3: ● In case that the signal from main body ECU is interrupted after the operation was started, the operation will be continued if the engine switch signal is ON.

- The operation is prohibited if the engine switch signal is OFF while the signal from main body ECU is interrupting.

## 2. Energy Absorbing Mechanism

- The energy absorbing mechanism mainly consists of a lower bracket, breakaway bracket, energy absorbing plate, main shaft, and column tube.
- When an impact is transmitted to the steering wheel in a collision (secondary collision), the steering wheel and the steering wheel pad help absorb the impact. In addition, the breakaway bracket and the lower bracket separate, causing the entire steering column to move forward. At the time, the energy absorbing plate becomes deformed to help absorb the impact of the secondary collision.

### ► Energy Absorbing Mechanism ◀

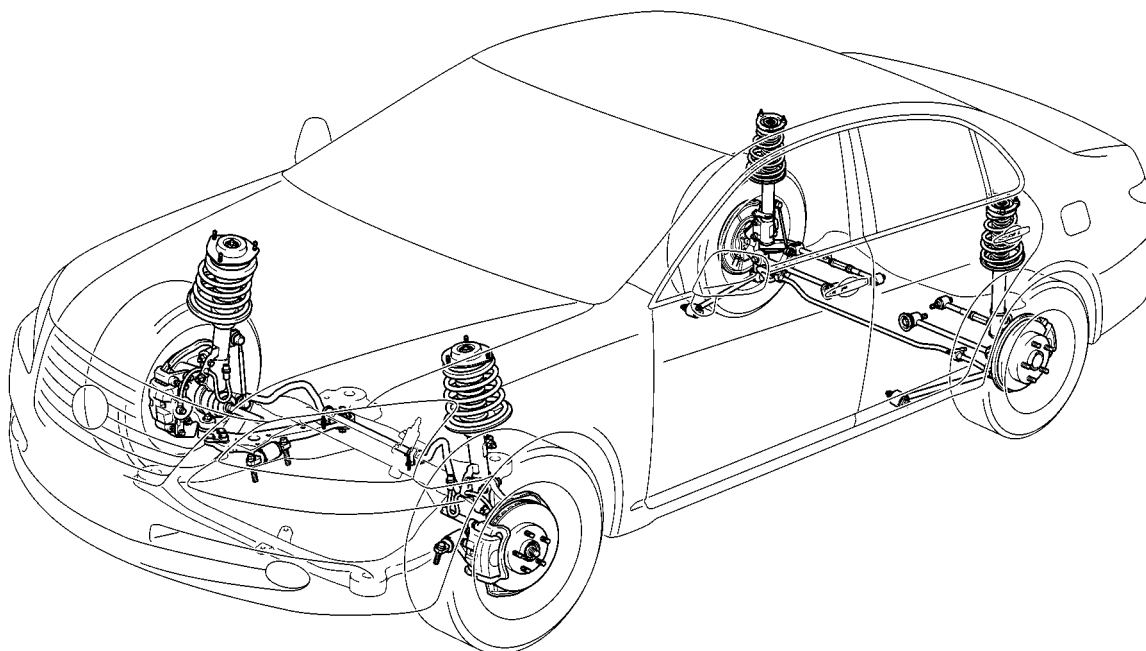


## SUSPENSION AND AXLE

### ■ SUSPENSION

#### 1. General

- MacPherson strut type independent suspension is used for the front.
- Dual link MacPherson strut type independent suspension is used for the rear.



01YCH53Y

#### ► Specifications ◀

|                       |                       |          |                            |
|-----------------------|-----------------------|----------|----------------------------|
| Front Wheel Alignment | Type                  |          | MacPherson Strut           |
|                       | Tread*                | mm (in.) | 1,575 (62.0)               |
|                       | Caster*               | degrees  | 2° 57'                     |
|                       | Camber*               | degrees  | -0 ° 43'                   |
|                       | Toe-in*               | mm (in.) | 0                          |
|                       | King Pin Inclination* | degrees  | 12° 20'                    |
| Rear Wheel Alignment  | Type                  |          | Dual link MacPherson Strut |
|                       | Tread*                | mm (in.) | 1,565 (61.6)               |
|                       | Camber*               | degrees  | -1 ° 21'                   |
|                       | Toe-in*               | mm (in.) | 4 (0.16)                   |

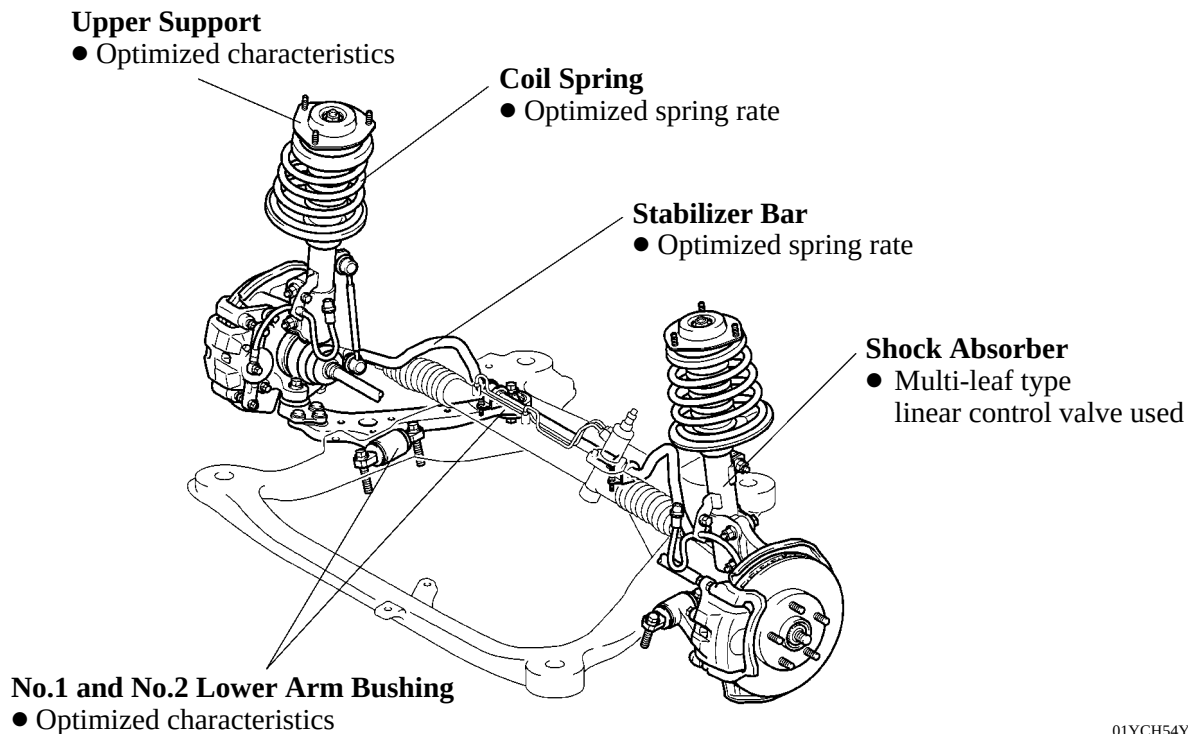
\*: Unload Vehicle Condition



## 2. Front Suspension

### General

Through the optimal location of components, and the use of Nachlauf geometry, the front suspension provides excellent riding comfort and controllability.

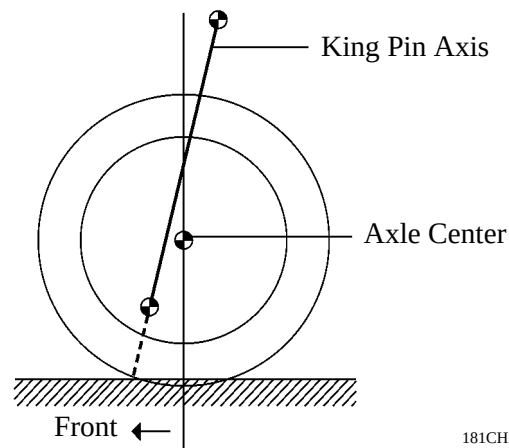


### Service Tip

To prevent hazardous conditions, make sure to empty the gas from the shock absorber before discarding a low-pressure (N<sub>2</sub>) gas sealed shock absorber. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

### Nachlauf Geometry

The front suspension uses the Nachlauf geometry in which the king pin axis is located ahead of the axle center. As a result, excellent straight-line stability and steering feel has been improved.

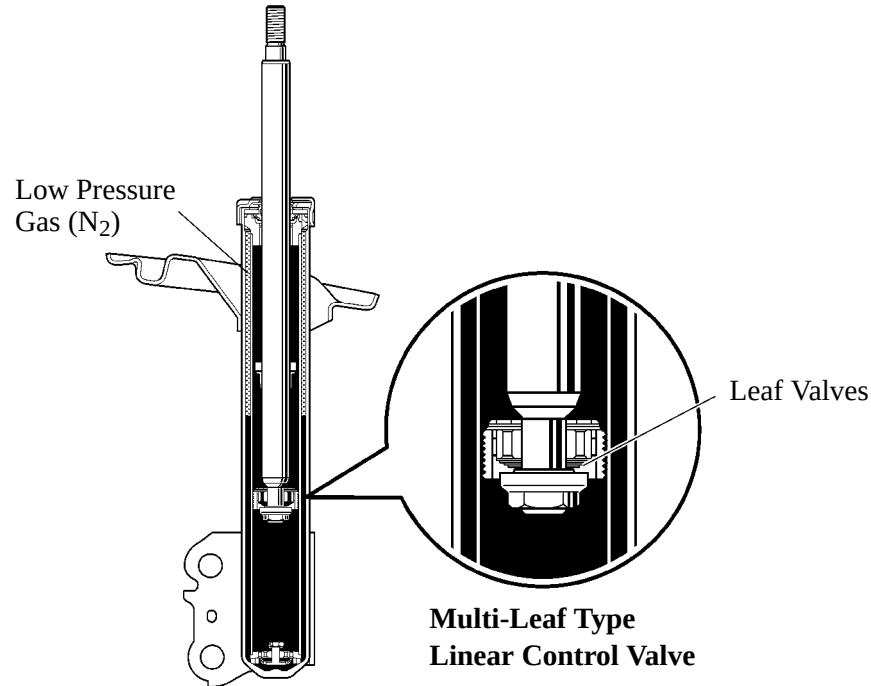


## Shock Absorber

### 1) General

The two functions listed below are used for the shock absorber to realize both driving stability and riding comfort.

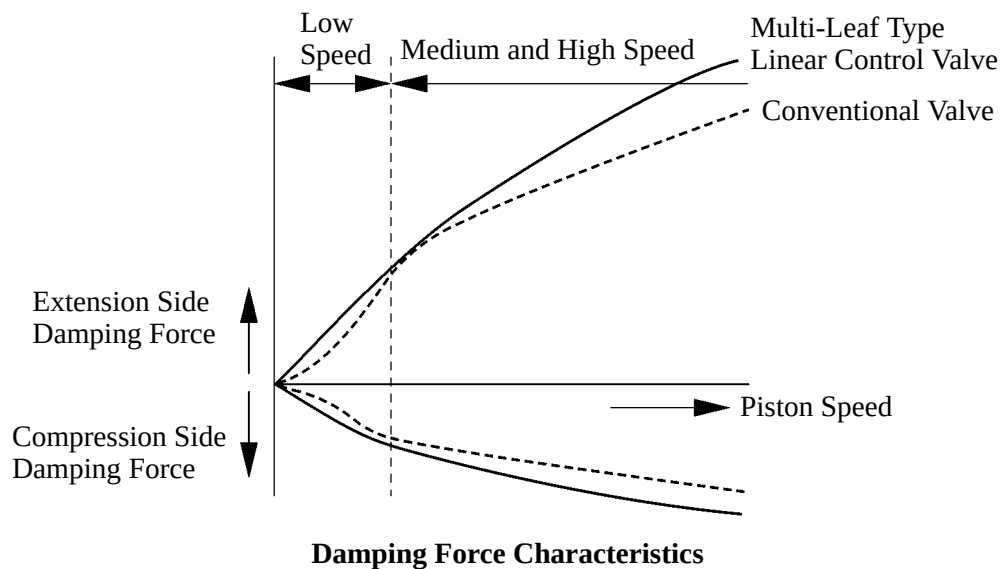
- A low-pressure ( $N_2$ ) gas sealed type construction is used to suppress cavitation.
- A multi-leaf type linear control valve is used to attain linear damping force characteristics.



01YCH55Y

### 2) Construction of Multi-Leaf type Linear Control Valve

The multi-leaf type linear control valve has a structure of several layered leaf valves with different diameter. With the adoption of the multi-leaf type linear control valve, the changes in the damping force are made constant at low piston speeds, thus realizing the excellent riding comfort and controllability.



199CH110

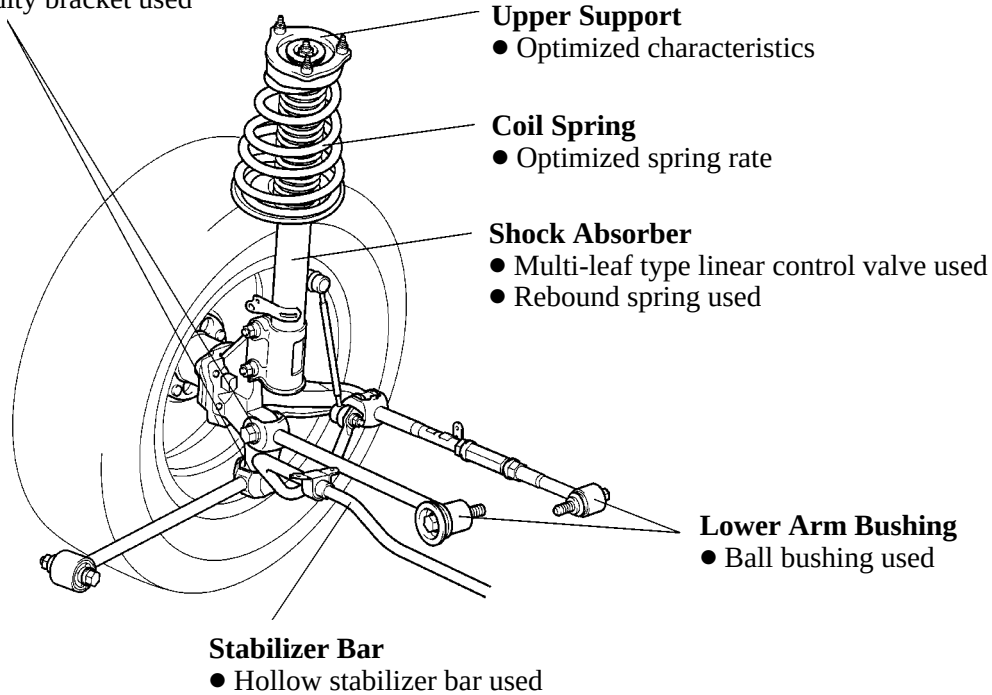
### 3. Rear Suspension

#### General

Rear suspension realizes excellent stability and controllability by optimizing the suspension geometry and the allocation of components.

#### No.1 Lower Arm and Strut Rod Bracket

- High rigidity bracket used



01YCH56Y

#### Service Tip

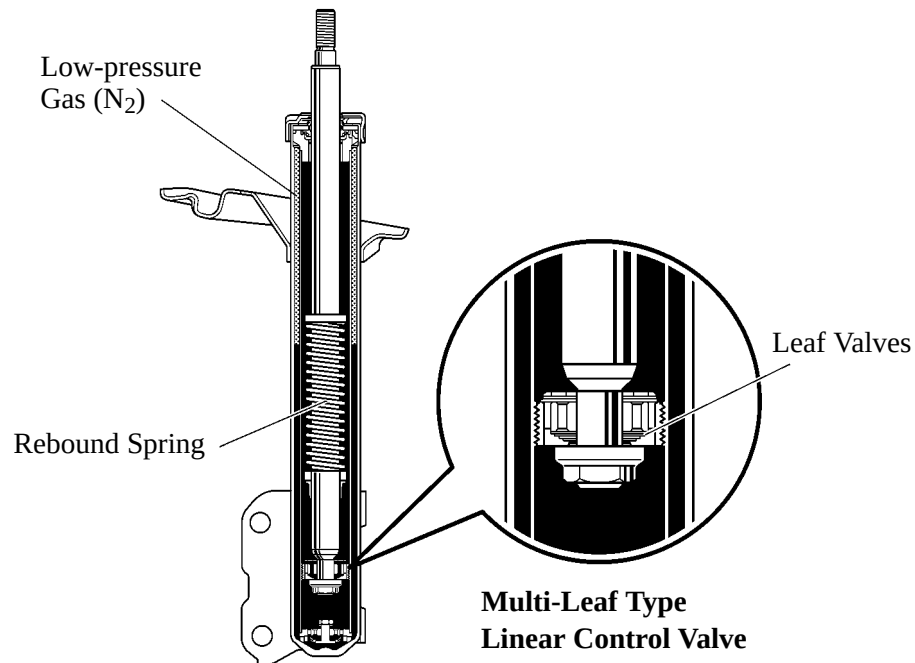
To prevent hazardous conditions, make sure to empty the gas from the shock absorber before discarding a low-pressure (N<sub>2</sub>) gas sealed shock absorber. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## Shock Absorber

### 1) General

The three functions listed below are used for the shock absorber to realize both driving stability and riding comfort.

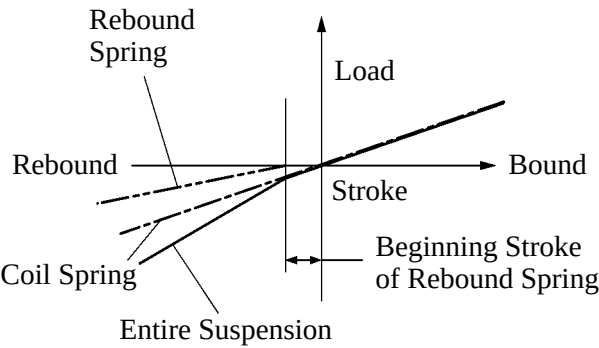
- A low-pressure ( $N_2$ ) gas sealed type construction is used to suppress cavitation.
- A multi-leaf type linear control valve is used to attain linear damping force characteristics. For details, see page CH-47 in the front suspension.
- A rebound spring is used to ensure vehicle stability during cornering.



01YCH57Y

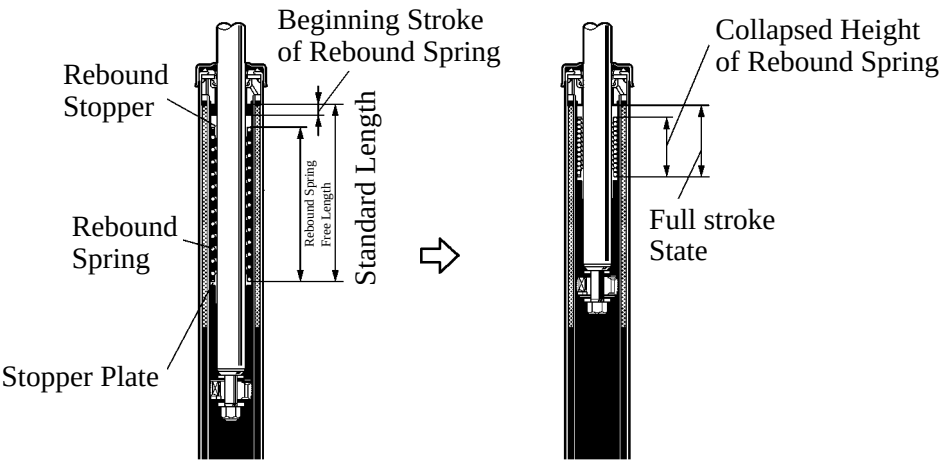
2) Rebound Spring

The function of the built-in rebound spring is to combine with the function of the coil spring in order to restrain the elongation of the entire suspension during rebounds. Consequently, only the function of the coil spring is applied when the suspension stroke is small during normal driving, in order to realize a soft and comfortable ride. However, when the inner wheel makes large rebounds, such as when the vehicle is cornering, the functions of both the rebound spring and the coil spring are combined in order to reduce the elongation of the entire suspension. As a result, the vehicle has excellent maneuverability and stability.



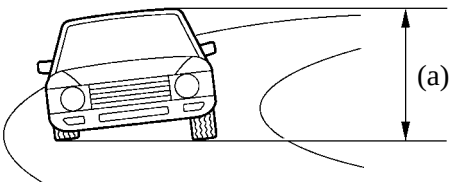
Characteristic of Shock Absorber With Built-in Rebound Spring

185CH16

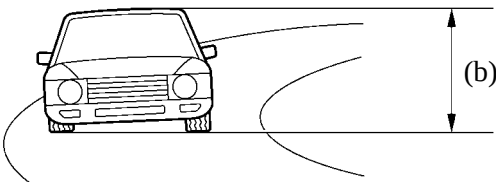


277CH107

► During Cornering ◀



Without Rebound Spring



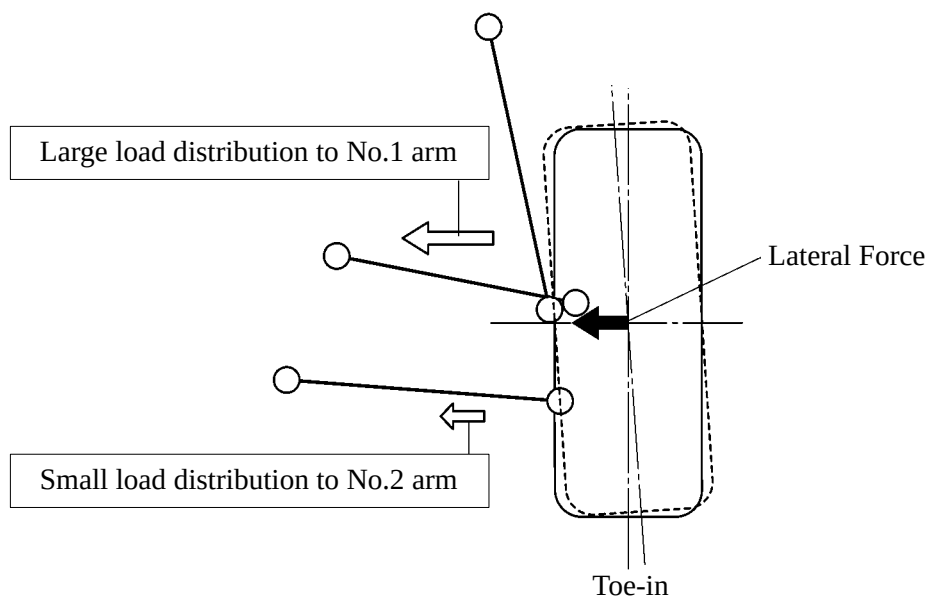
With Rebound Spring

(a) > (b)

241CH90

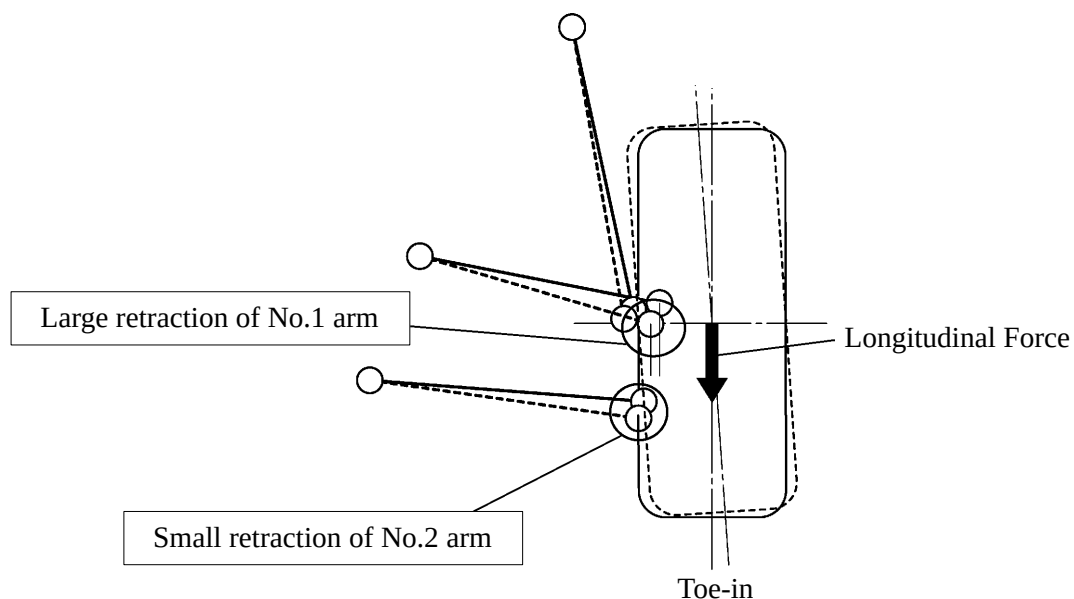
### Cornering Geometry

When a lateral force is generated, the load becomes distributed to the No. 1 and No. 2 suspension arms. The illustration shown below indicates the lateral force distribution suspension arms of the right side rear wheel during left cornering. This causes the wheels to toe-in, in order to ensure the proper stability of the rear suspension.

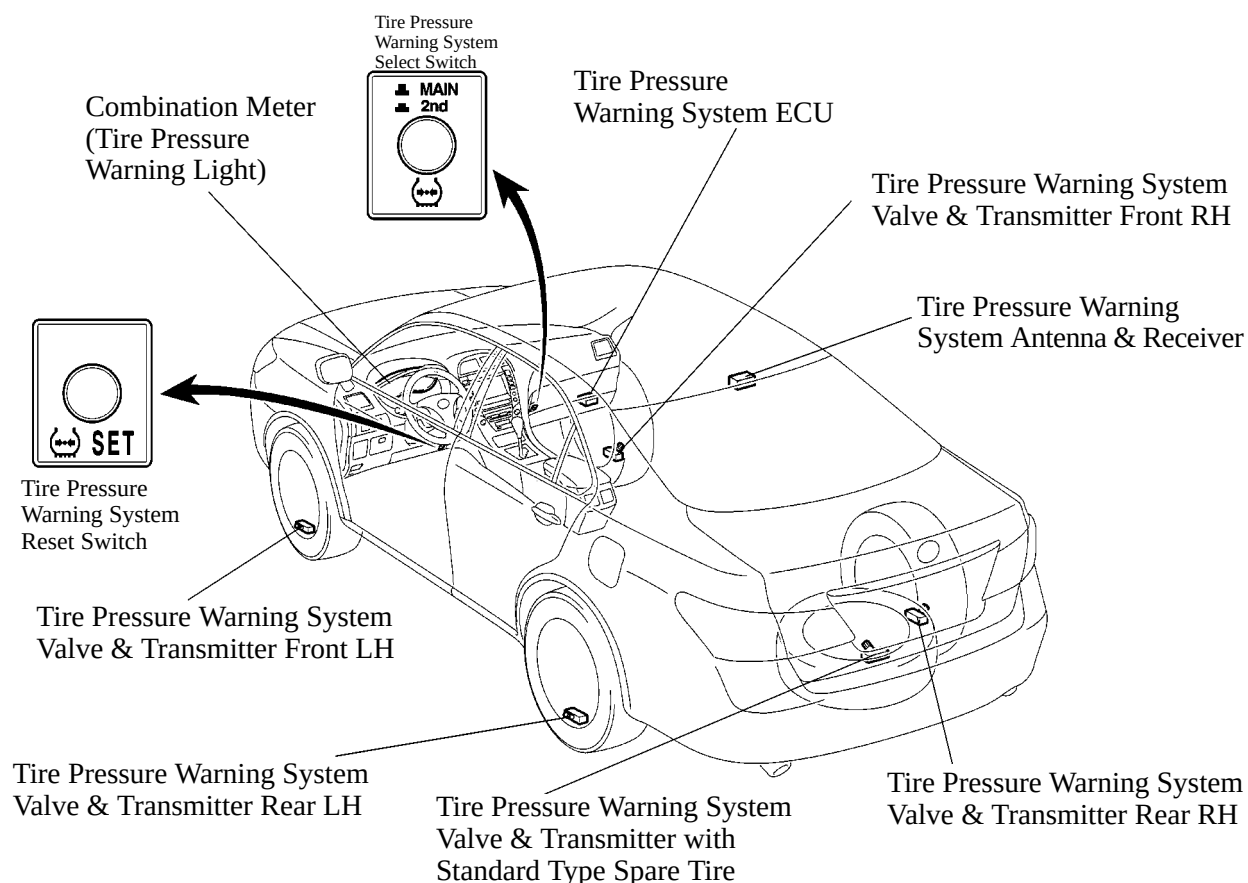


### Braking Geometry

When the longitudinal force is generated, the displacement locus of the No. 1 and No. 2 suspension arms will toe-in as shown below, in order to ensure the stability of the vehicle.



## ■ LAYOUT OF MAIN COMPONENTS



01YCH101TE

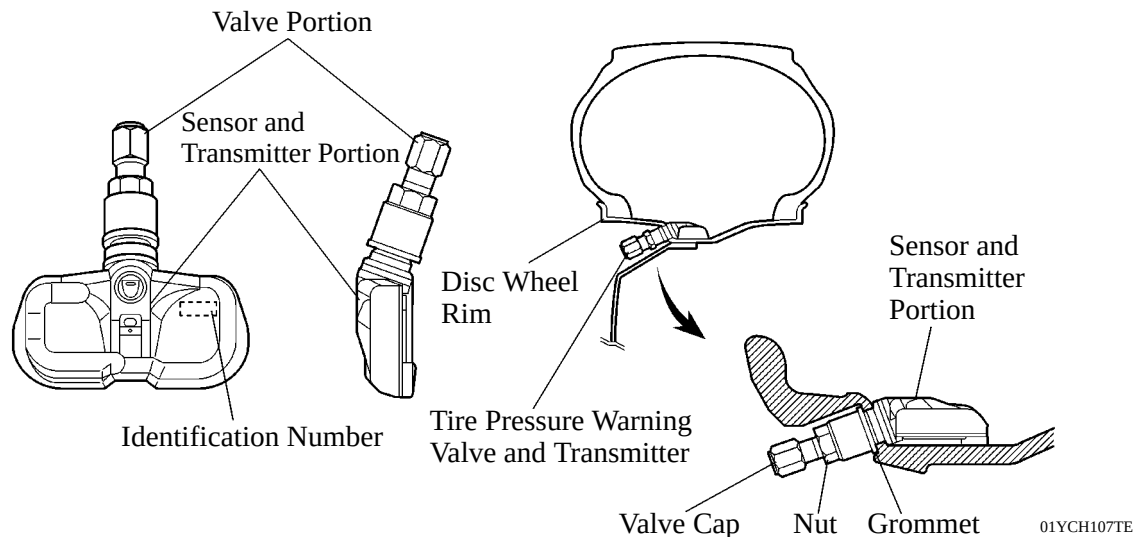
## ■ Functions of Main Components

| Component                                        | Outline                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Combination Meter                                | Transmits the vehicle speed signal to the tire pressure warning system ECU for vehicle speed confirmation.                                                                                                                                                                                                                                                                                                                                                                           |
| Tire Pressure Warning Light                      | <ul style="list-style-type: none"> <li>Turns ON or blinks to warn the driver in accordance with the signal from the tire pressure warning system ECU.</li> <li>Displays the 2-digit DTC (Diagnostic Trouble Code).</li> </ul>                                                                                                                                                                                                                                                        |
| Tire Pressure Warning System Select Switch       | Transmits the main or 2nd switching signal to the tire pressure warning System ECU.                                                                                                                                                                                                                                                                                                                                                                                                  |
| Tire Pressure Warning System Reset Switch        | The appropriate air pressures of the tires currently mounted on the vehicle are stored in the tire pressure warning system ECU by operating the tire pressure warning system reset switch.                                                                                                                                                                                                                                                                                           |
| Tire Pressure Warning System Valve & Transmitter | Detects the inflation pressure and internal temperature of the tire and transmits the measured value and the ID number to the tire pressure warning system antenna & receiver.                                                                                                                                                                                                                                                                                                       |
| Tire Pressure Warning System Antenna & Receiver  | Receives the tire pressure warning system valve & transmitten signal and transmits this data to the tire pressure warning system ECU.                                                                                                                                                                                                                                                                                                                                                |
| Tire Pressure Warning System ECU                 | <ul style="list-style-type: none"> <li>Receives the data from the tire pressure warning system antenna &amp; receiver and monitors the tire inflation pressure.</li> <li>When the tire pressure warning system ECU detects a drop in the tire inflation pressure or a system malfunction, it outputs the respective signal to the combination meter.</li> <li>Switches to main or 2nd tire mode in accordance with the tire pressure warning system select switch signal.</li> </ul> |

## ■ CONSTRUCTION AND OPERATION

### 1. Tire Pressure Warning System Valve & Transmitter

- The tire pressure warning system valve & transmitter is integrated in the air valve of a disc wheel. It measures the pressure and the temperature of the air in the tire and transmits the measured values and a recognition ID to the tire pressure warning system valve & transmitter.
- If the battery voltage drops, the tire pressure warning system valve & transmitter assembly must be replaced. Furthermore, if the battery voltage drops, tire pressure warning system valve & transmitter will be unable to transmit signals, which causes a DTC to be output.
- Tire pressure warning system valve & transmitter with 5 different ID code range are used on one vehicle.
- Each tire pressure warning system valve & transmitter has a built-in semi-conductor to directly measure the inflation pressure of the tire.
- Frequency of the tire pressure warning system valve & transmitter is 314.98 MHz.



#### NOTICE

- Ensure the proper direction of the tire pressure warning system valve & transmitter by adhering to the prescribed procedure for installing a tire pressure warning system valve & transmitter on a wheel. Failure to do so could result in an incorrect measurement of the tire air inflation pressure.
- Make sure to replace the tires in accordance with the prescribed procedure. To prevent tire pressure warning system valve & transmitter from damage, drop the tire pressure warning system valve & transmitter into the wheel before removing the tire. Failure to do so could damage the tire pressure warning system valve & transmitter.

For further details regarding the above, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

#### Service Tip

- If the lithium battery is depleted, replace the entire tire pressure warning system valve & transmitter assembly.
- After a tire pressure warning system valve & transmitter has been replaced, the ID of the tire pressure warning system valve & transmitter must be registered in the ECU. To register an ID, use a hand-held tester to enter the ID code that is indicated on the sensor.
- When replacing the tire pressure warning system valve & transmitter, all the separate ID codes of the 5-tire pressure warning system valve & transmitter must be registered. Even if only 1 tire pressure warning system valve & transmitter is replaced, the ID codes of all five sensors must be registered again.
- A new tire pressure warning system valve & transmitter that is available as a service part is in the sleep mode in its initial state, to prevent the battery from depleting. During PDS (Pre-Delivery Service), after the sensor and the tire are correctly mounted on the disc wheel, inflating the tire to the specified pressure causes the sleep mode to cancel. Keep the air pressure of the spare tire the same as the set air pressure amount of the front and rear tires.

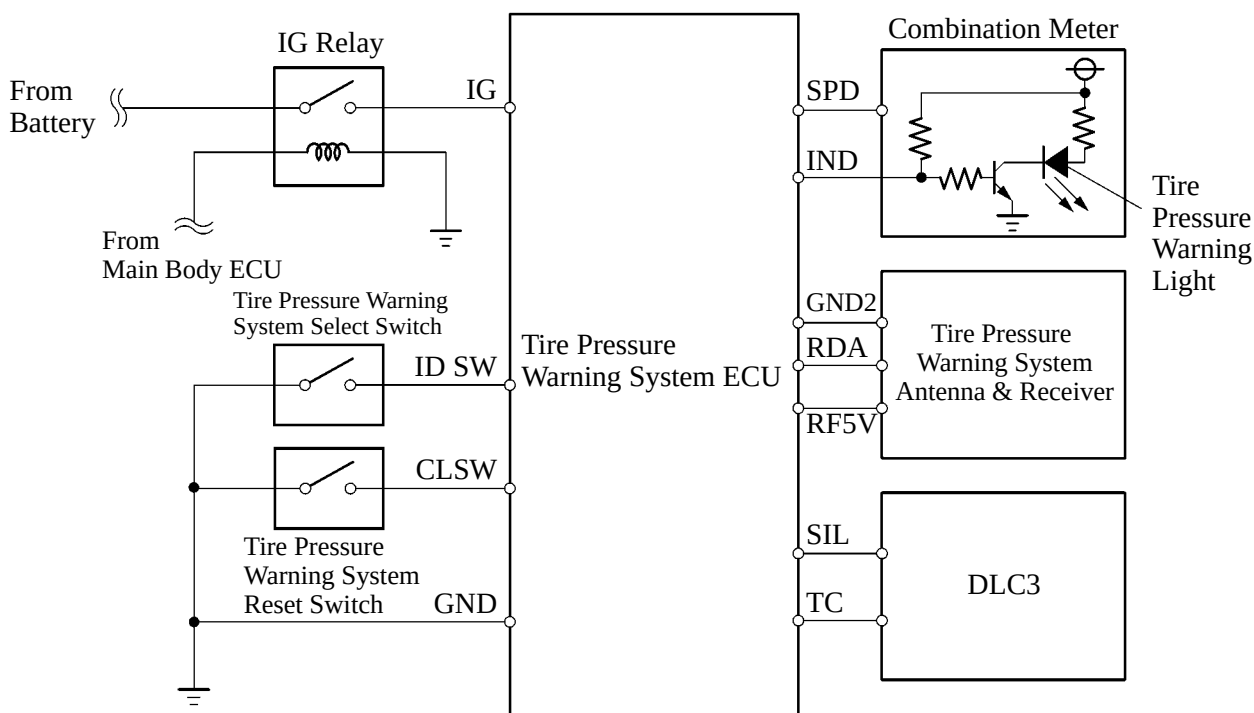
For further details regarding the above, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).



## 2. Tire Pressure Warning System Antenna & Receiver and Tire Pressure Warning System ECU

- The tire pressure warning system antenna & receiver, which contains an antenna, receives the radiowave signals from the tire pressure warning system valve & transmitter and transmits those signals to the tire pressure warning system ECU.
- The tire pressure warning system antenna & receiver receives the tire inflation pressure data and sensor identification data.
- The tire pressure warning system antenna & receiver can determine from the received data whether the signals came from its own tires.
- On tire pressure warning system antenna & receiver, the numbers of ID1, ID2, ID3, ID4 and ID5 are allotted as the information to recognize each tire (tire pressure warning system valve & transmitter) on the initial condition.

### ► Wiring Diagram ◀



### 3. Tire Pressure Warning System Reset Switch

- By operating the tire pressure warning system reset switch, tire pressure warning system ECU can be set to issue a warning at an inflation pressure that corresponds with the type of tires. Therefore, the dealer must set the warning threshold to the proper value in order to comply with the local regulations.
- Operate the tire pressure warning system reset switch only after the inflation pressures of all 5 tires (including the standard type spare tire\*) have been adjusted on the vehicle.
- To initialize the system, press and hold the tire pressure warning system reset switch for 3 seconds or longer with the engine switch turned ON. After the system has been initialized, the warning light blinks 3 times at 0.5 Hz.
- During the initialization, the tire pressure warning system valve & transmitter measures the inflation pressure of the tires, and registers the signals that are transmitted into the ECU at a frequency of 1 per minute. The initialization process is completed when the signals from the 5 tires have been received.
- To initialize the system, the tire pressure warning system reset switch must be once the tire pressure warning system reset switch has been pressed, turning OFF the engine switch is not recommended for a minimum of 20 minutes.

\*: Optional Equipment

#### Service Tip

- Since the initialized values are dependent upon the accuracy of the tire pressure gauge to be used, use a tire pressure gauge that has been properly calibrated.
- The system must be initialized in the following conditions:
  - 1) New vehicle delivery
  - 2) Tire rotation
  - 3) Tire pressure warning system valve & transmitter replacement
  - 4) Replacement with tires of different size (inflation pressure)
  - 5) Tire pressure warning system ECU replacement

#### CAUTION

If the system is initialized with tires whose inflation pressure deviates from the threshold pressure, the system can be initialized at those values. Therefore, initialize only after the tires have been inflated to the specified air pressure.

#### 4. Tire Pressure Warning Light

- The tire pressure warning light is located in the combination meter.
- This warning illuminates or blinks in accordance with signals from the tire pressure warning system antenna & receiver if the vehicles own tires are inflated with low pressure or if malfunction occurs in the system.



Tire Pressure Warning Light

## 5. Self-Diagnosis

If malfunctions are detected in the system, the tire pressure warning system ECU warns the driver by illuminating the tire pressure warning light after blinking it at 1 Hz intervals for 1 minute, and stores the DTC (Diagnostic Trouble Code) in the memory.

The DTC that are stored by the tire pressure warning system ECU can be accessed by connecting the SST (09843-18040) to the DLC3 terminals TC and CG, and reading the blinking of the tire pressure warning light. They can also be accessed by connecting a hand-held tester. The table below lists the DTC that pertain to this system. For further details, see the 2007 LEXUS ES350 Repair Manual (Pub No. RM01Y0U).

### Service Tip

After the DTC have been detected, it is necessary to identify the wheel that contains the faulty tire pressure warning system valve & transmitter. It can be identified by performing the operation in accordance with the prescribed procedure. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U)

| DTC No.  | Detection Item                                              | DTC Deletion Condition                                                                                                                                                                         |
|----------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C2111/11 | Tire pressure sensor ID1 operation stop (sleep mode)        | When data is received from a transmitter with an ID code that is registered in the ECU, or the ID code of the tire pressure warning system valve & transmitter is newly registered in the ECU. |
| C2112/12 | Tire pressure sensor ID2 operation stop (sleep mode)        |                                                                                                                                                                                                |
| C2113/13 | Tire pressure sensor ID3 operation stop (sleep mode)        |                                                                                                                                                                                                |
| C2114/14 | Tire pressure sensor ID4 operation stop (sleep mode)        |                                                                                                                                                                                                |
| C2115/15 | Tire pressure sensor ID5 operation stop (sleep mode)        |                                                                                                                                                                                                |
| C2121/21 | Tire pressure sensor ID1 not received (Main)                | When a DTC deletion operation is implemented or the ID code of the tire pressure warning system valve & transmitter is newly registered in the ECU.                                            |
| C2122/22 | Tire pressure sensor ID2 not received (Main)                |                                                                                                                                                                                                |
| C2123/23 | Tire pressure sensor ID3 not received (Main)                |                                                                                                                                                                                                |
| C2124/24 | Tire pressure sensor ID4 not received (Main)                |                                                                                                                                                                                                |
| C2125/25 | Tire pressure sensor ID5 not received (Main)                |                                                                                                                                                                                                |
| C2131/31 | Tire pressure sensor ID1 not received (2nd)                 |                                                                                                                                                                                                |
| C2132/32 | Tire pressure sensor ID2 not received (2nd)                 |                                                                                                                                                                                                |
| C2133/33 | Tire pressure sensor ID3 not received (2nd)                 |                                                                                                                                                                                                |
| C2134/34 | Tire pressure sensor ID4 not received (2nd)                 |                                                                                                                                                                                                |
| C2135/35 | Tire pressure sensor ID5 not received (2nd)                 |                                                                                                                                                                                                |
| C2141/41 | A malfunction in the tire pressure sensor registered to ID1 |                                                                                                                                                                                                |
| C2142/42 | A malfunction in the tire pressure sensor registered to ID2 |                                                                                                                                                                                                |
| C2143/43 | A malfunction in the tire pressure sensor registered to ID3 |                                                                                                                                                                                                |
| C2144/44 | A malfunction in the tire pressure sensor registered to ID4 |                                                                                                                                                                                                |
| C2145/45 | A malfunction in the tire pressure sensor registered to ID5 |                                                                                                                                                                                                |

(Continue)

| DTC No.  | Detection Item                                         | DTC Deletion Condition                                                                                                                              |
|----------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| C2165/65 | Abnormal temperature inside ID1 tire                   | When a DTC deletion operation is implemented or the ID code of the tire pressure warning system valve & transmitter is newly registered in the ECU. |
| C2166/66 | Abnormal temperature inside ID2 tire                   |                                                                                                                                                     |
| C2167/67 | Abnormal temperature inside ID3 tire                   |                                                                                                                                                     |
| C2168/68 | Abnormal temperature inside ID4 tire                   |                                                                                                                                                     |
| C2169/69 | Abnormal temperature inside ID5 tire                   |                                                                                                                                                     |
| C2171/71 | Tire pressure sensor ID not registered (Main)          |                                                                                                                                                     |
| C2172/72 | Tire pressure sensor ID not registered (2nd)           |                                                                                                                                                     |
| C2176/76 | Tire pressure monitor receiver is error                |                                                                                                                                                     |
| C2177/77 | Initialization incomplete                              |                                                                                                                                                     |
| C2181/81 | Tire pressure sensor ID1 not received (test diagnosis) | When deletion conditions of the ID codes have been established or departing from the test mode.                                                     |
| C2182/82 | Tire pressure sensor ID2 not received (test diagnosis) |                                                                                                                                                     |
| C2183/83 | Tire pressure sensor ID3 not received (test diagnosis) |                                                                                                                                                     |
| C2184/84 | Tire pressure sensor ID4 not received (test diagnosis) |                                                                                                                                                     |
| C2185/85 | Tire pressure sensor ID5 not received (test diagnosis) |                                                                                                                                                     |
| C2191/91 | Vehicle speed signal error (test diagnosis)            |                                                                                                                                                     |
| C2192/92 | Malfunction in tire pressure warning select switch     |                                                                                                                                                     |

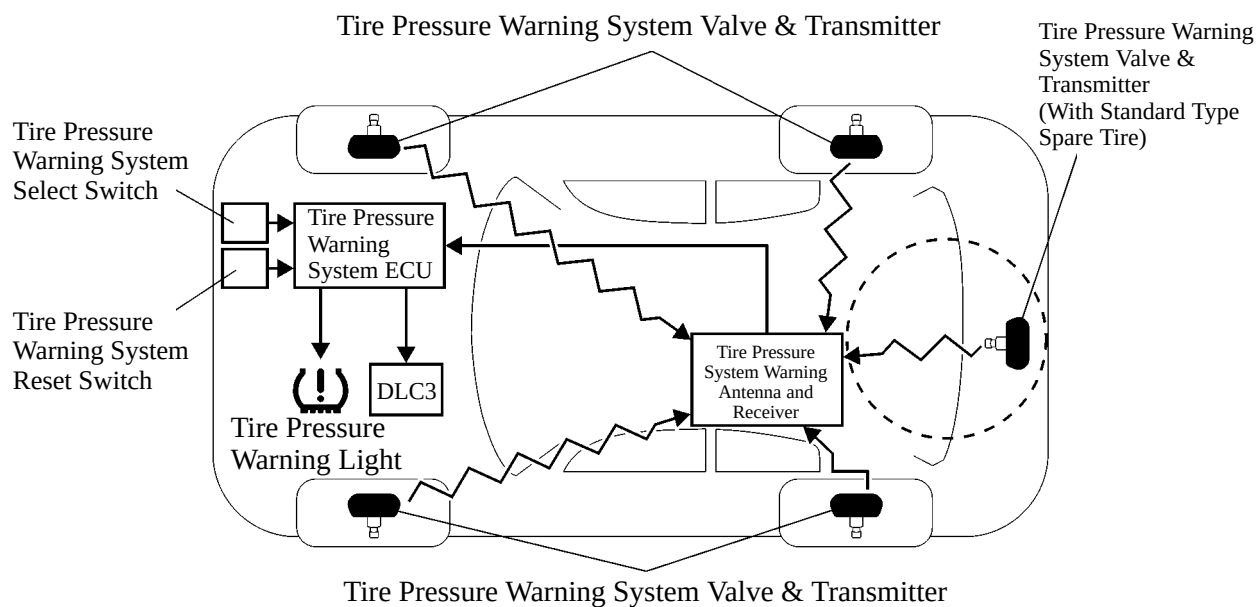
## TIRE PRESSURE WARNING SYSTEM

### ■ DESCRIPTION

- A direct-sensing type tire pressure warning system is used U.S.A. and Canadian package models.
- If the vehicle continues to be driven with one or more of the 5 tires (which includes the standard type spare tire\*) inflated to a low air pressure that could cause problems during driving, this system will illuminate the tire pressure warning light to inform the driver of the low air pressure.
- Furthermore, this system directly senses the air pressure of each tire through tire pressure warning system valve and transmitter that are attached to each wheel.
- This system can register main (normal) and 2nd (winter) tire settings in the tire pressure warning system ECU. The main or 2nd tires can be selected by pressing the tire pressure warning system select switch.
- When the tires are changed, the tire pressure warning system reset switch is used to store the appropriate tire pressures in the tire pressure warning system ECU.

\*: Optional Equipment

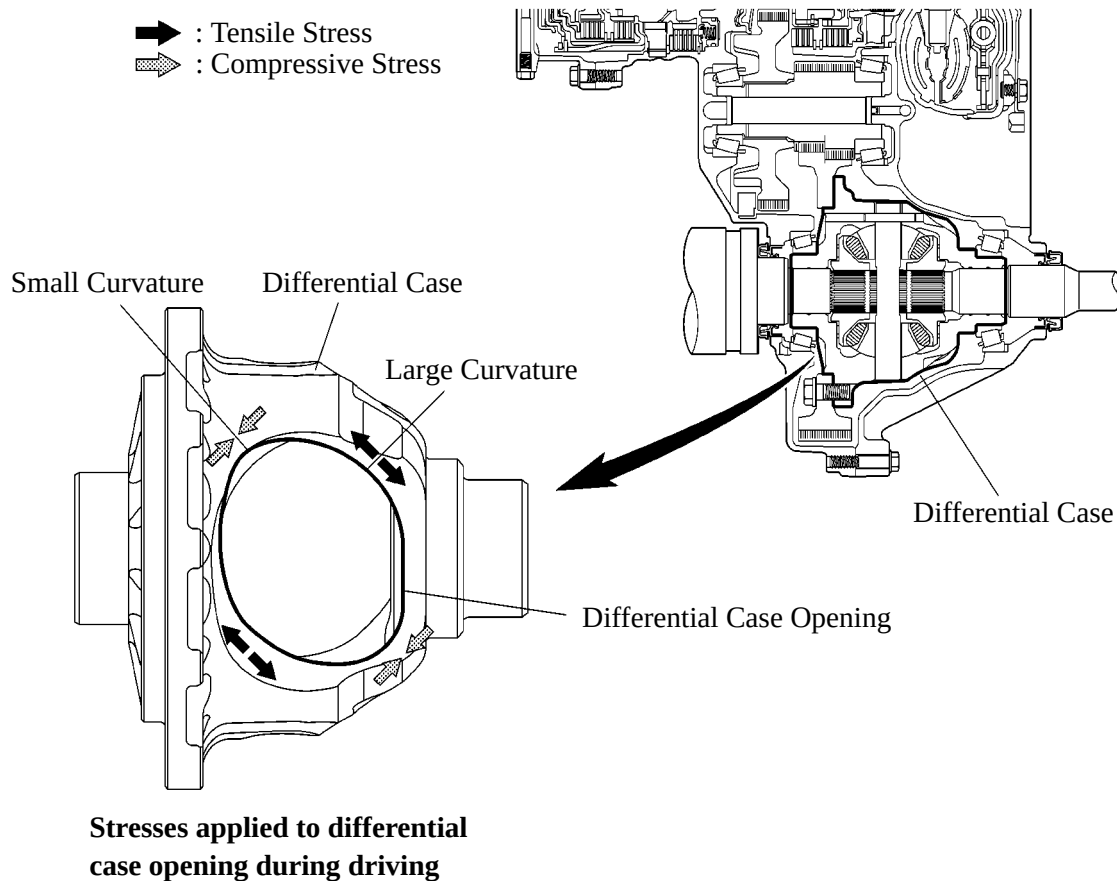
### ► System Diagram ◀



01YCH110TE

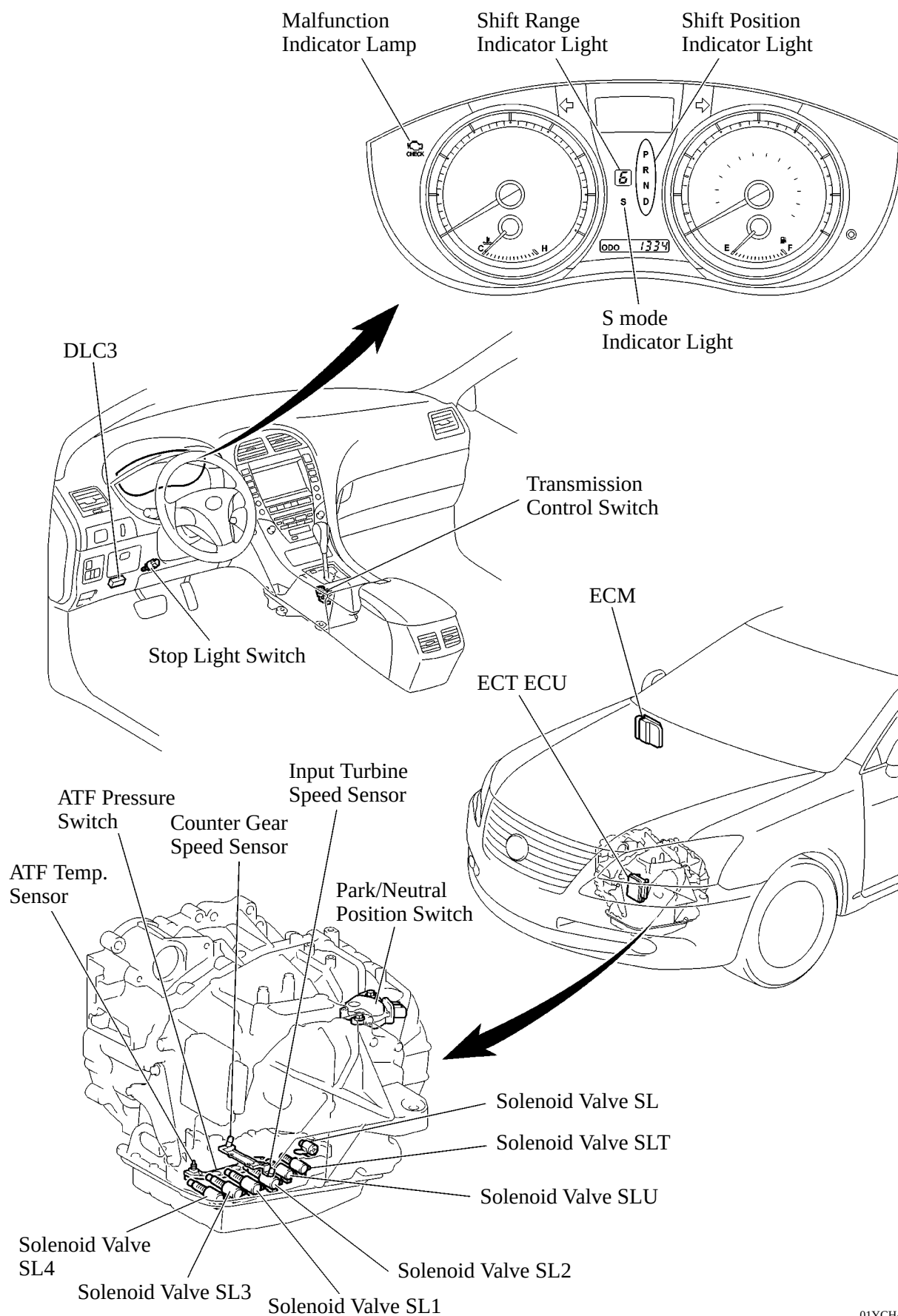
## ■ DIFFERENTIAL CASE

The curvature of the differential case opening, where tensile stress is concentrated during driving, is enlarged, in order to moderate the stress concentration and enhance the differential gear tolerant torque. As a result, use of the lightweight 2-pinion differential gears is possible.



01YCH04Y

### 3. Layout of Main Components

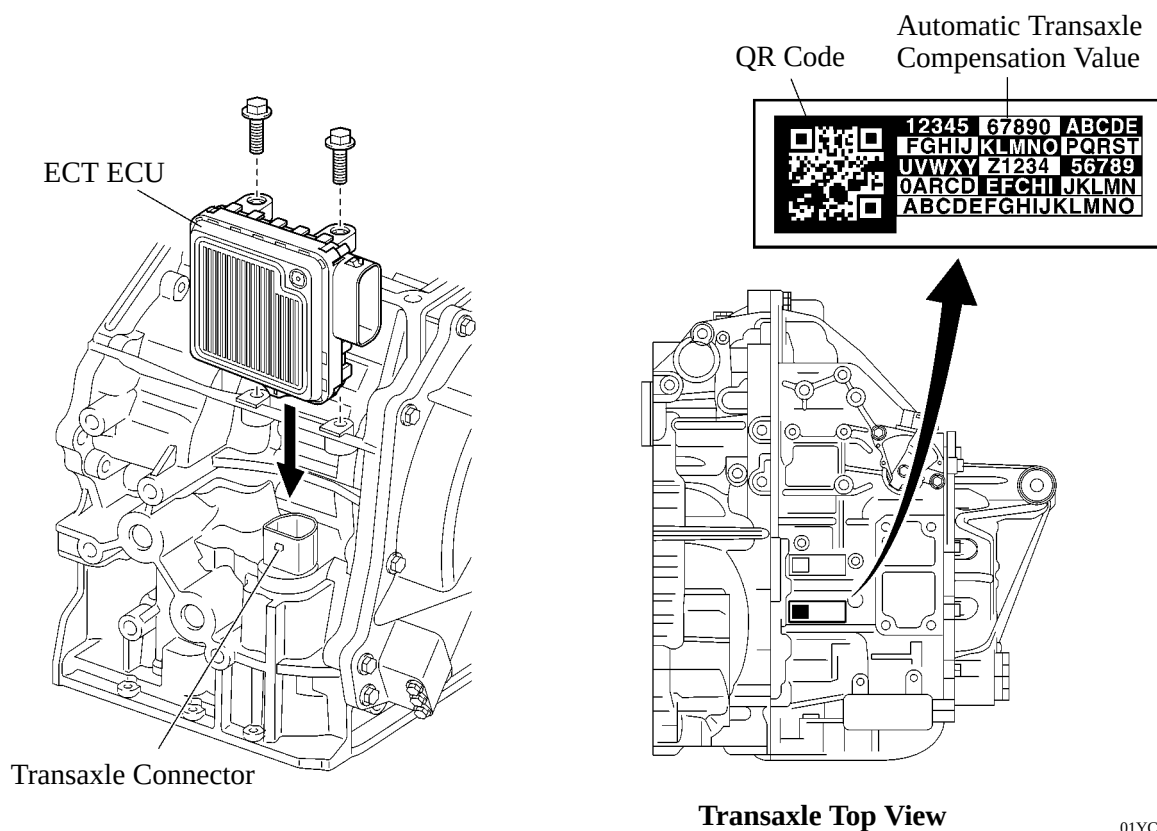




## 4. Construction and Operation of Main Components

### ECT ECU

- The ECT ECU has been isolated from the ECM and directly fitted to the transaxle. Thus, the wiring harness has been shortened allowing the weight to be reduced. All the solenoid valves and sensors used for automatic transaxle control are directly connected to the ECT ECU through the connector located in front of the automatic transaxle.
- The ECT ECU maintains communication with the ECM through the CAN (Controller Area Network). Thus, engine control is effected in coordination with ECT control.
- A label, on which the automatic transaxle compensation values and QR (Quick Response) code are printed, is attached on the top of the automatic transaxle. The label contains encoded automatic transaxle property information. When the automatic transaxle is replaced, allow the ECT ECU to learn the automatic transaxle property information by inputting the automatic transaxle compensation values into the ECT ECU using a hand-held tester. In this way, the shift control performance immediately after replacement of the automatic transaxle is improved. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).
- The QR code, which requires a special scan tool, is used at the vehicle assembly plant.



01YCH43TE

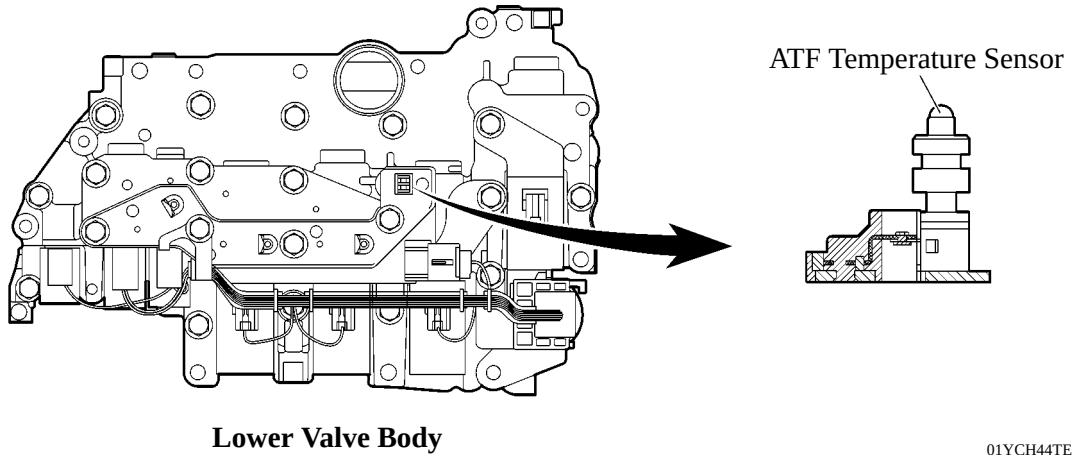
### — REFERENCE —

#### What are QR (Quick Response) Codes?

- QR code, a matrix symbology consisting of an array of nominally square cells, allows omni-directional, high-speed reading of large amounts of data.
- QR codes encode many types of data such as numeric, alphanumeric, kanji, kana and binary codes. A maximum of 7,089 characters (numeric) can be encoded.
- QR codes (2D code) contain information in the vertical and horizontal directions, whereas bar codes only contain data in one direction. QR codes (2D code) hold considerably greater volumes of information than bar codes.

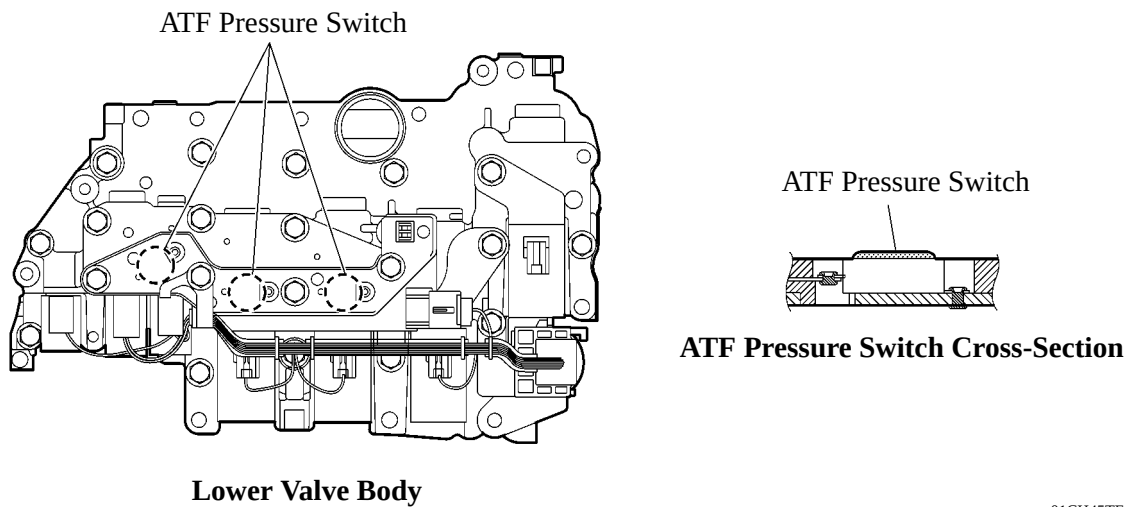
### ATF Temperature Sensor

- The ATF temperature sensor is installed in the valve body for direct detection of the fluid temperature.
- The ATF temperature sensor is used for the revision of clutch and brake pressures to maintain a smooth shift quality every time.



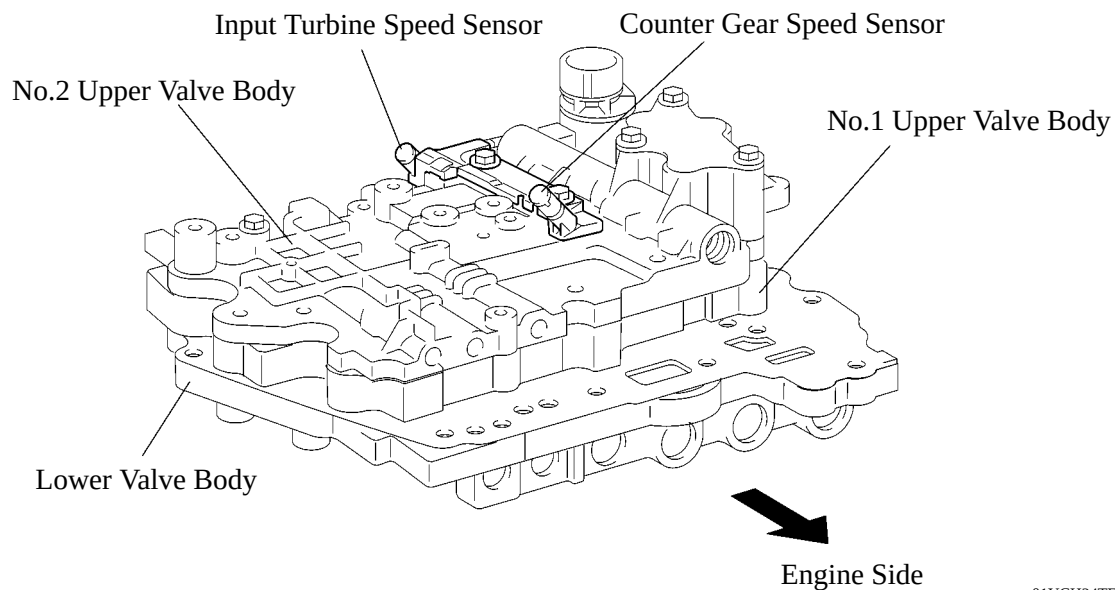
### ATF Pressure Switch

- The ATF pressure switches are located in the output fluid passages of SL1, SL2 and SLU, and turn ON/OFF in accordance with the solenoid valve output fluid pressure.
- The ECT ECU detects malfunctions in solenoid valves SLU and SL used in lock-up control in accordance with the ON/OFF signals from ATF pressure switch 3 located in the SLU output fluid passage.
- When any of SL1 to SL4 malfunctions, the ECT ECU determines the appropriate fail-safe operation to be actuated in accordance with the ON/OFF signals from ATF pressure switches 1 and 2 located in the SL1 and SL2 output fluid passages.



### Speed Sensors

- The U660E automatic transaxle uses an input turbine speed sensor (for the NT signal) and a counter gear speed sensor (for the NC signal). Thus, the ECT ECU can detect the timing of the shifting of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions. These speed sensors are the Hall type.
- The input turbine speed sensor detects the input speed of the transaxle. The No.2 clutch piston is used as the timing rotor for this sensor.
- The counter gear speed sensor detects the speed of the counter gear. The counter drive gear is used as the timing rotor for this sensor.
- The Hall type speed sensor consists of a magnet and Hall IC. The Hall IC converts the changes in the magnetic flux density that occur through the rotation of the timing rotor into electric signal, and outputs the signal to the ECT ECU.



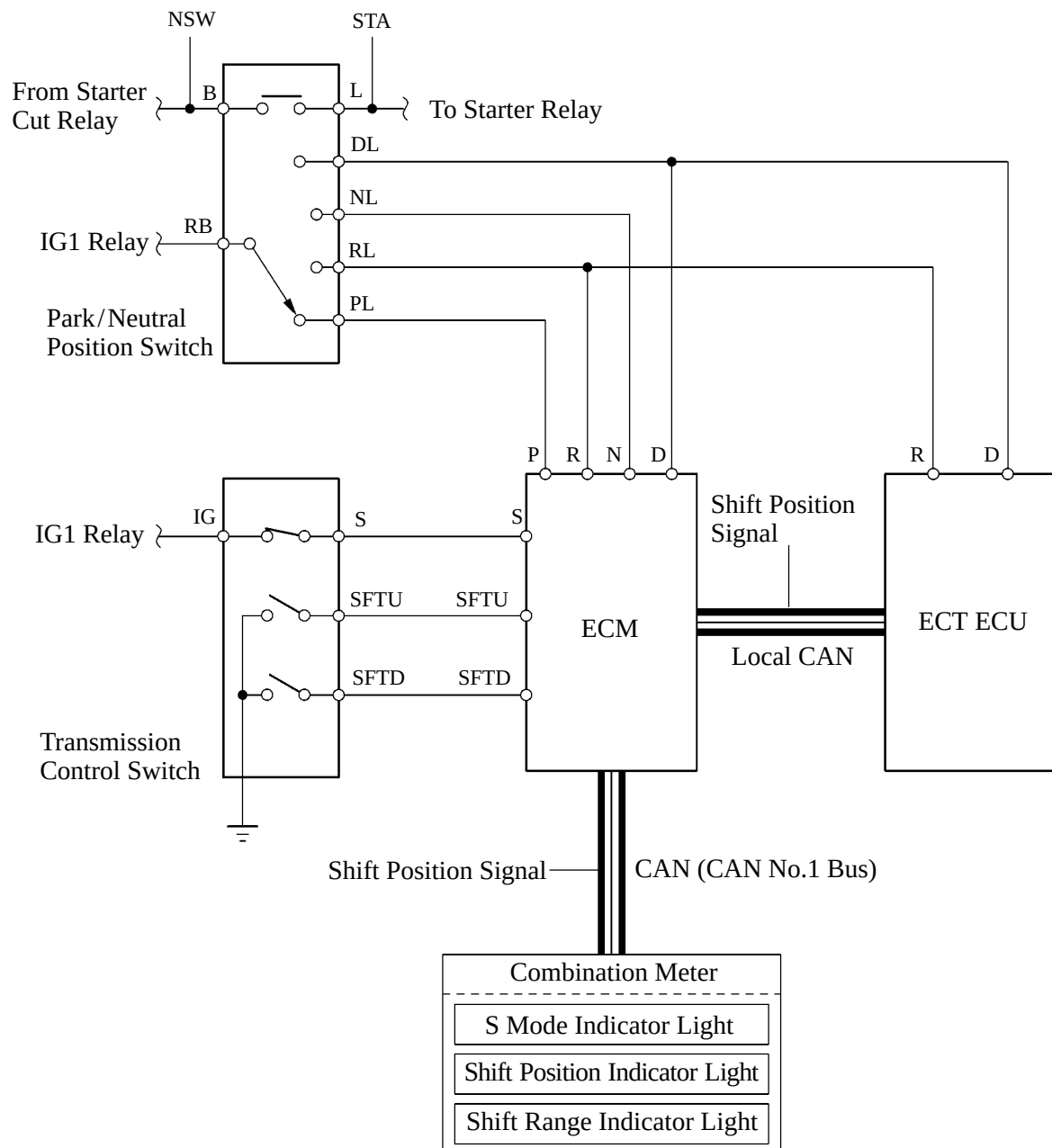
01YCH24TE

## Transmission Control Switch and Park/Neutral Position Switch

The ECT ECU and ECM use these switches to detect the shift lever position.

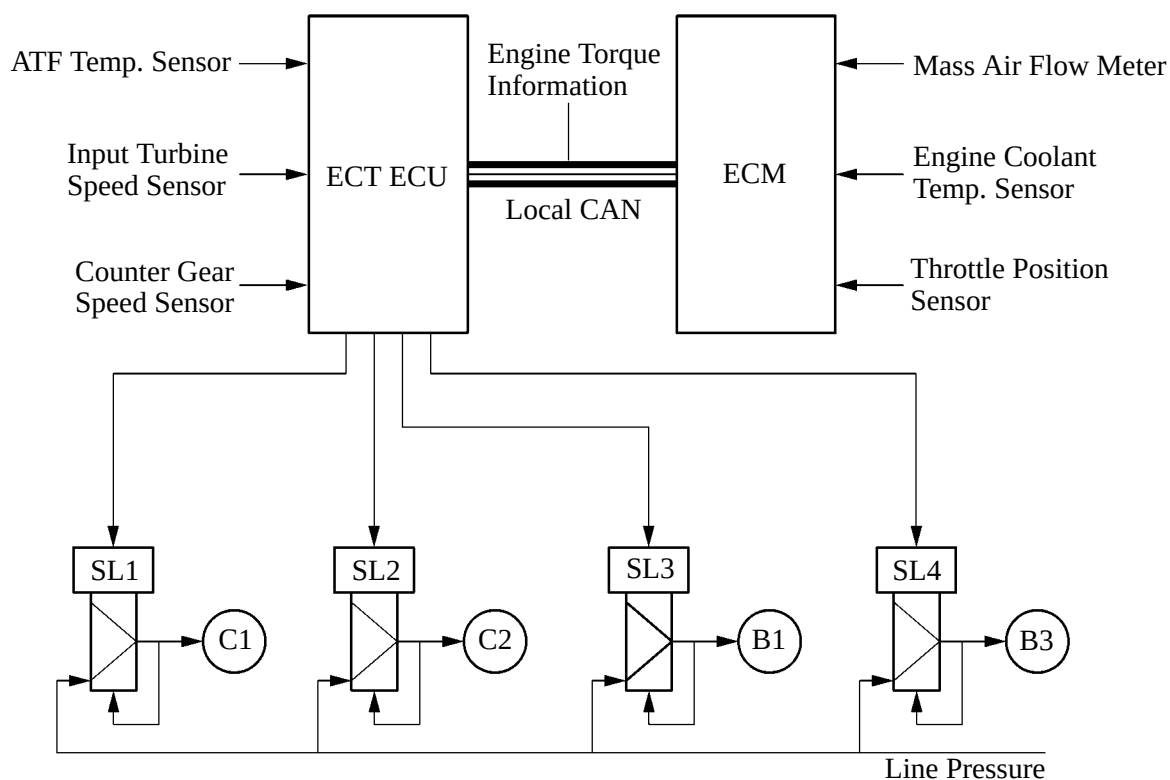
- The park/neutral position switch sends the P, R, N and D position signals to both the ECM and ECT ECU. The ECM transmits signals to the combination meter for the shift position indicator light (P, R, N and D) in response to the signal it receives from the switch.
- The transmission control switch is installed inside the shift lever assembly. Switch terminal S is used to detect whether the shift lever is in the D position or S mode position, and terminals SFTU and SFTD are used to detect the operating conditions of the shift lever (front [+ position] or rear [- position]) if S mode is selected. By transmitting signals to the ECM, the transmission control switch turns on both the shift range indicator light and S mode indicator light when the shift lever is moved to the S mode position, and indicates the selected range position through shift range indicator light.

### ► Wiring Diagram ◀



## 5. Clutch to Clutch Pressure Control

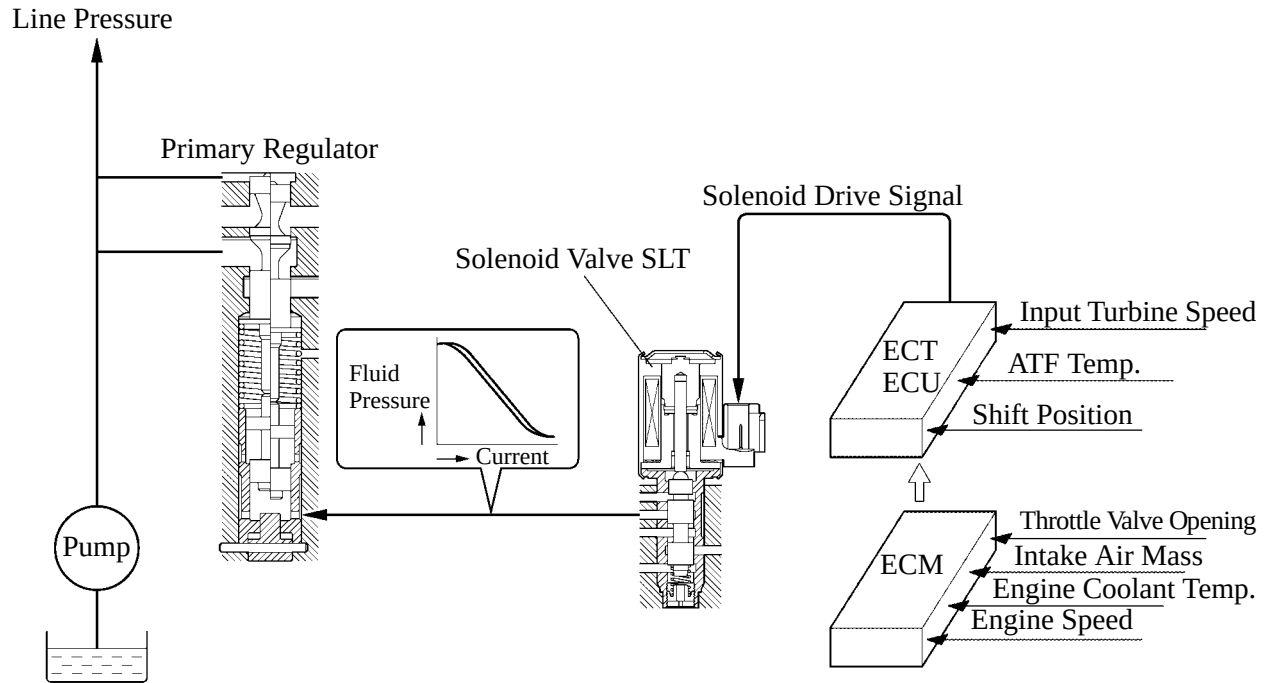
- Clutch to clutch pressure control is used for shift control. As a result, shift control in the 2nd gear or above is possible without using the one-way clutch, and the automatic transaxle has been made lightweight and compact.
- Using the fluid pressure circuit, which enables the clutches and brakes (C1, C2, B1 and B3) to be controlled independently, and the high flow SL1, SL2, SL3 and SL4 linear solenoid valves, which directly control the line pressure, the ECT ECU controls each clutch and brake accordingly with the optimum fluid pressures and timings in accordance with the information transmitted by the sensors, and then shifts the gears. As a result, highly responsive and excellent shift characteristics have been realized.



01YCH26TE

## 6. Line Pressure Optimal Control

The line pressure is controlled by using solenoid valve SLT. Through the use of solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle. Accordingly, the line pressure can be accurately controlled in accordance with the engine output, traveling condition, and the ATF temperature, thus realizing smooth shift characteristics and optimizing the workload of the oil pump.



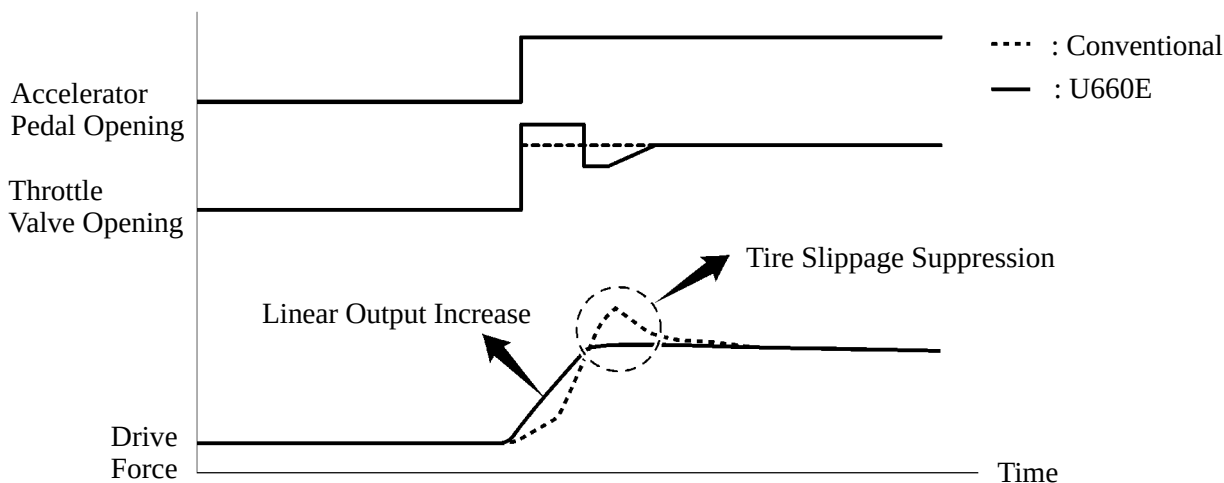
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\*: This diagram illustrates the fundamentals of Line Pressure Control. The valve shapes differ from the actual ones.

## 7. Powertrain Cooperative Control

### Throttle Control at Launch

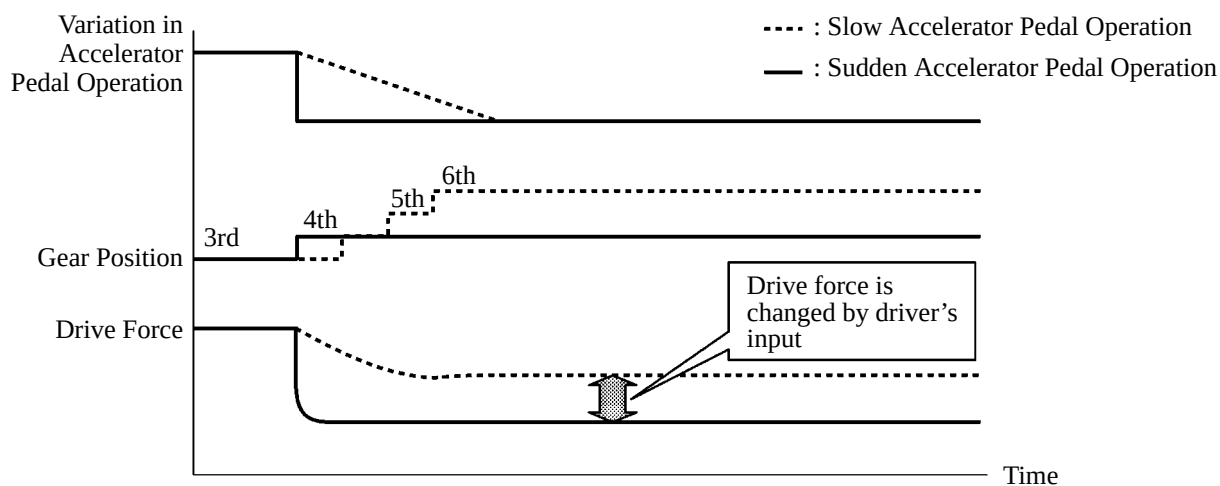
By controlling the engine output in cooperative control with ETCS-i (Electronic Throttle Control System-intelligent) when the vehicle is launched, excellent launch performance (improved response and suppression of tire slippage) is ensured.



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### Deceleration Force Control

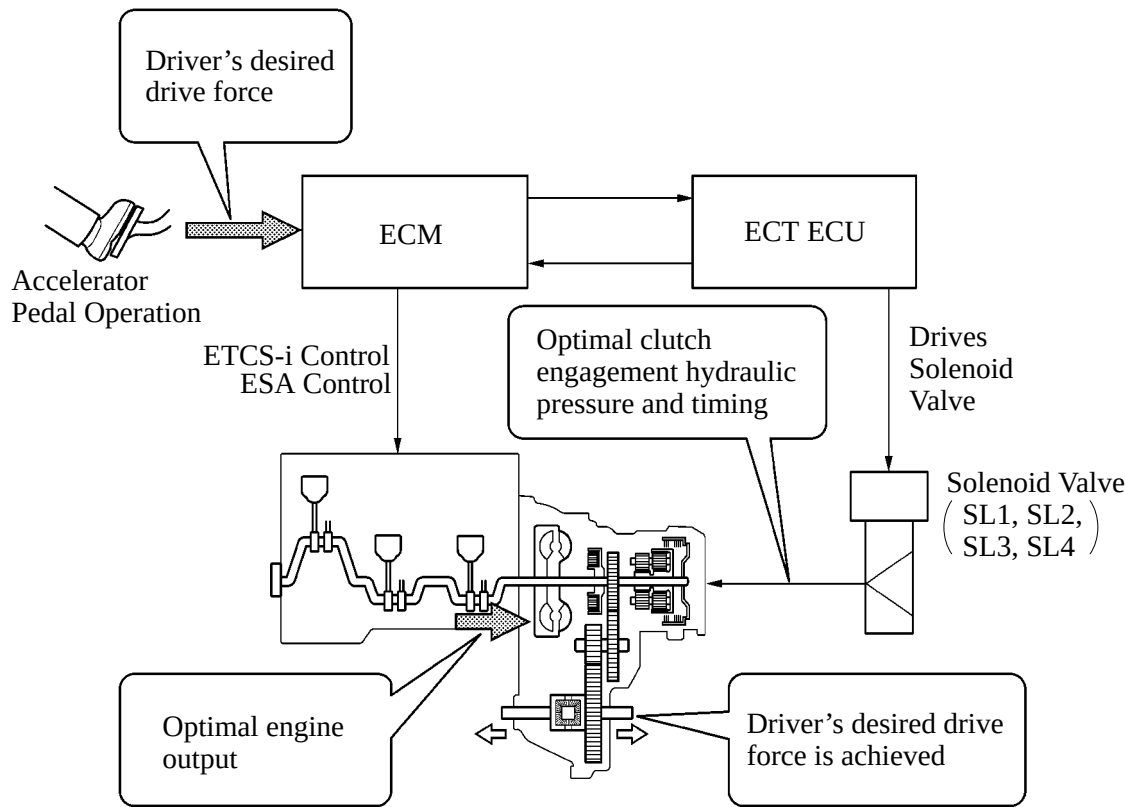
The ECT ECU determines the gear position when the accelerator pedal is OFF (released completely) in accordance with the operation of the accelerator pedal (released suddenly or slowly) during deceleration. In this way, preventing unnecessary upshifts and downshifts when the accelerator pedal is OFF and ensuring smooth acceleration when the vehicle needs to accelerate again.



01YCH29Y

Transient Shifting Control

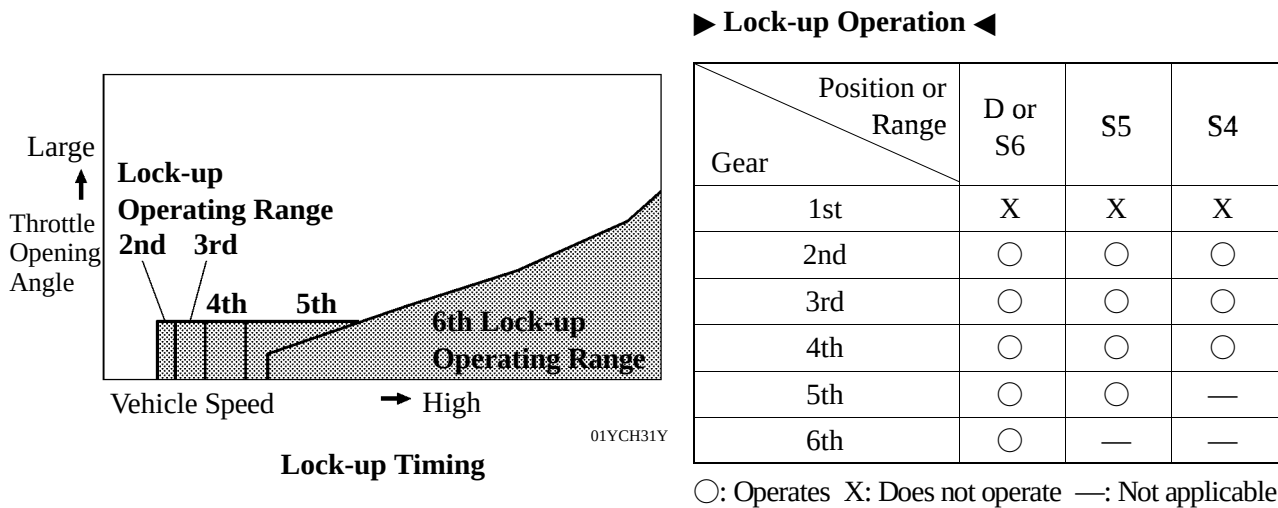
Through cooperative control with ETCS-i (Electronic Throttle Control System-intelligent) and ESA (Electronic Spark Advance), and electronic control of the engagement and release speed of the clutch and brake hydraulic pressures, excellent response and shift shock reduction have been achieved.



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8. Lock-up Timing Control

The ECT ECU operates the lock-up timing control in order to improve the fuel consumption while in the 2nd gear or above with the shift lever in the D, S6, S5, S4 range.

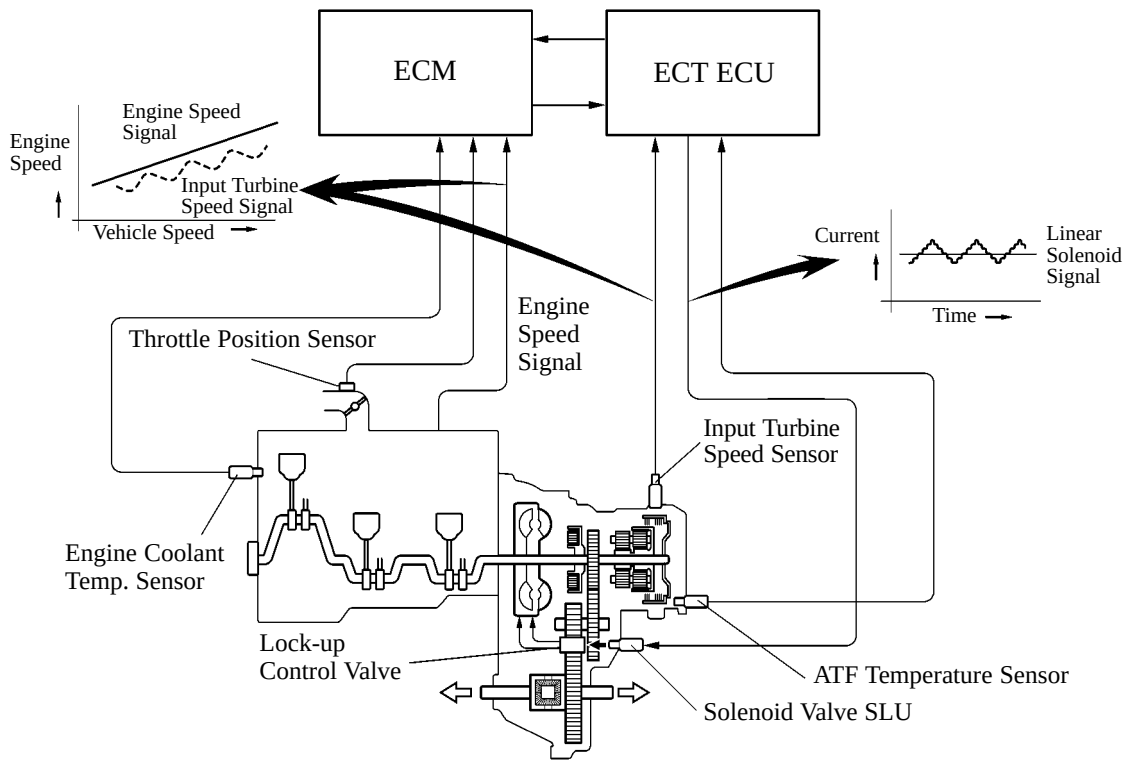


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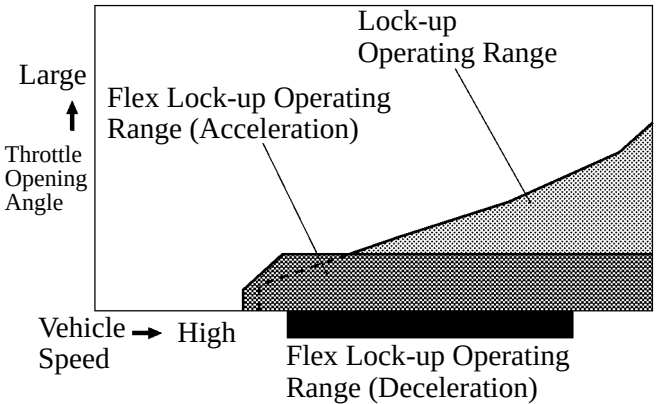
9. Flex Lock-up Clutch Control

- In addition to the conventional lock-up timing control, flex lock-up clutch control is used.
- This flex lock-up clutch control regulates solenoid valve SLU as an intermediate mode between the ON and OFF operations of the lock-up clutch.
- During acceleration, flex lock-up clutch control operates when the gear position is the 2nd or higher and the shift lever is in the D, S6, S5 or S4 range position. During deceleration, it operates when the gear position is the 4th or higher and the shift lever is in the D, S6, S5 or S4 range position.
- During acceleration, the partition control of the power transmission between the lock-up clutch and torque converter greatly boosts the transmission efficiency in accordance with the driving conditions, improving the fuel economy.
- During deceleration, the lock-up clutch is made to operate. Therefore the fuel-cut area is expanded and fuel economy is improved.
- By allowing flex lock-up clutch control to continue operating during gearshift, the smooth torque transmission has been obtained. As a result, the fuel economy and drivability have been improved.



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► Flex Lock-up Operation ◀



Flex Lock-Up Timing in 6th Gear

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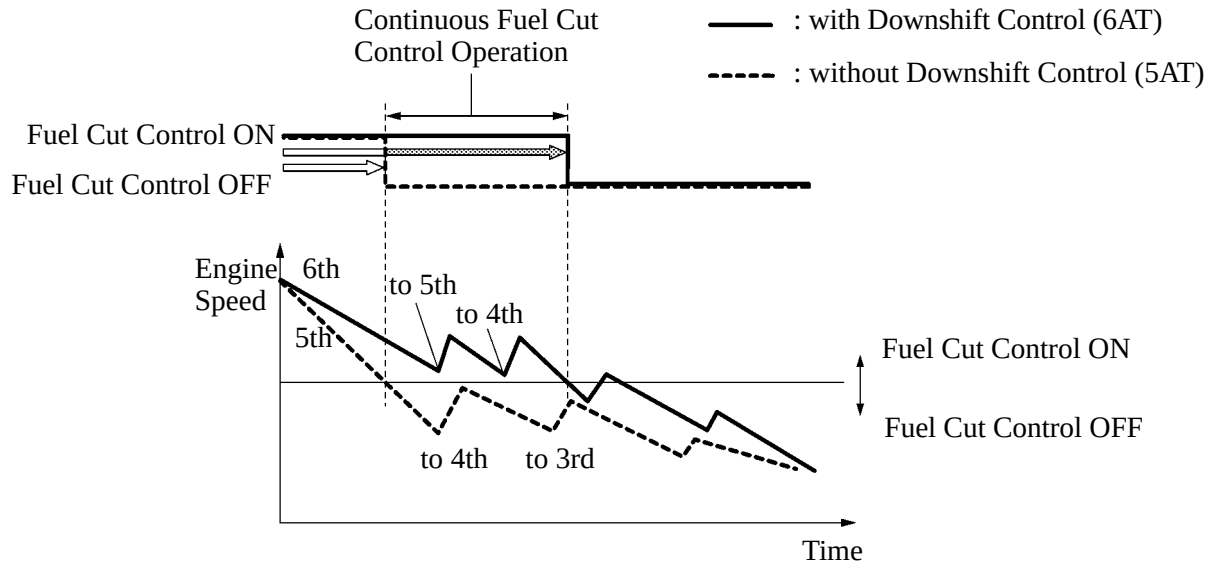
| Position or Range | D, S6 | S5 | S4 |
|-------------------|-------|----|----|
| Gear              |       |    |    |
| 1st               | X     | X  | X  |
| 2nd               | ○     | ○  | ○  |
| 3rd               | ○     | ○  | ○  |
| 4th               | ○*    | ○* | ○* |
| 5th               | ○*    | ○* | —  |
| 6th               | ○*    | —  | —  |

○: Operates X: Does not operate —: Not applicable

\*: Flex Lock-up Clutch Control also operates when the vehicle is decelerated.

## 10. Coast Downshift Control

- The ECT ECU performs downshift control to restrain the engine speed from decreasing, and keeps fuel cut control operating for as long as possible. In this way, the fuel economy is improved.
- In this control, the transaxle downshifts from 6th to 5th and then 5th to 4th before fuel cut control ends when the vehicle is decelerated in the 6th gear, so that fuel cut control continues operating.

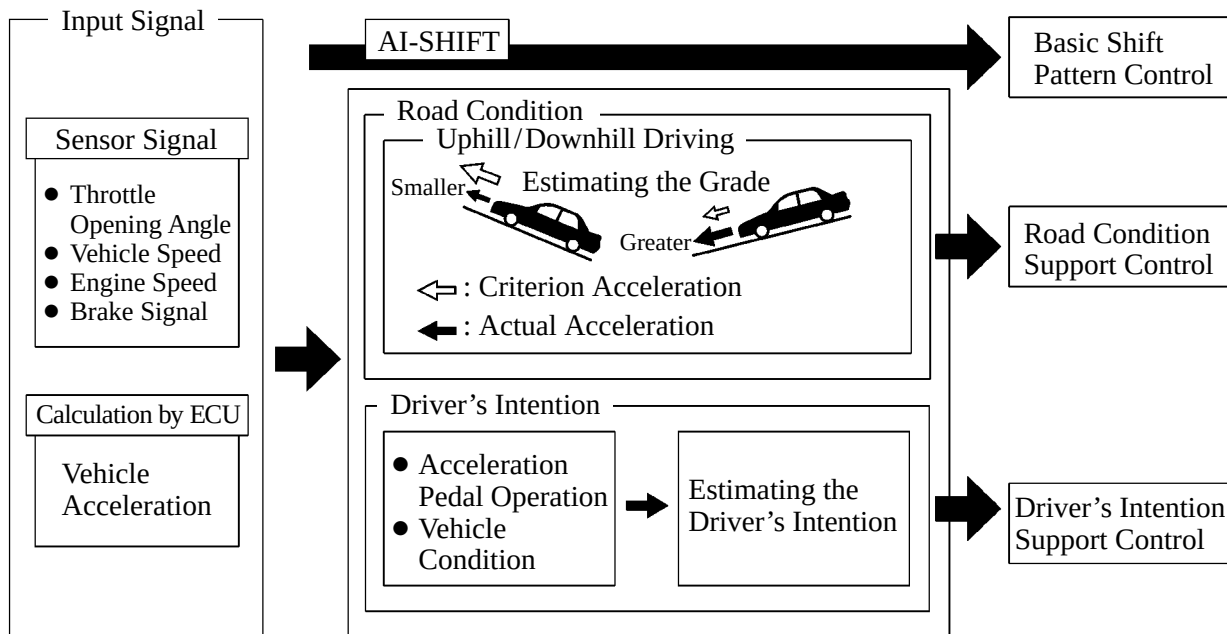


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## 11. AI (Artificial Intelligence)- Shift Control

### General

AI- SHIFT control enables the ECT ECU to estimate the road conditions and the driver's intention in order to automatically control the shift pattern in the optimal manner. As a result, a comfortable ride has been achieved.

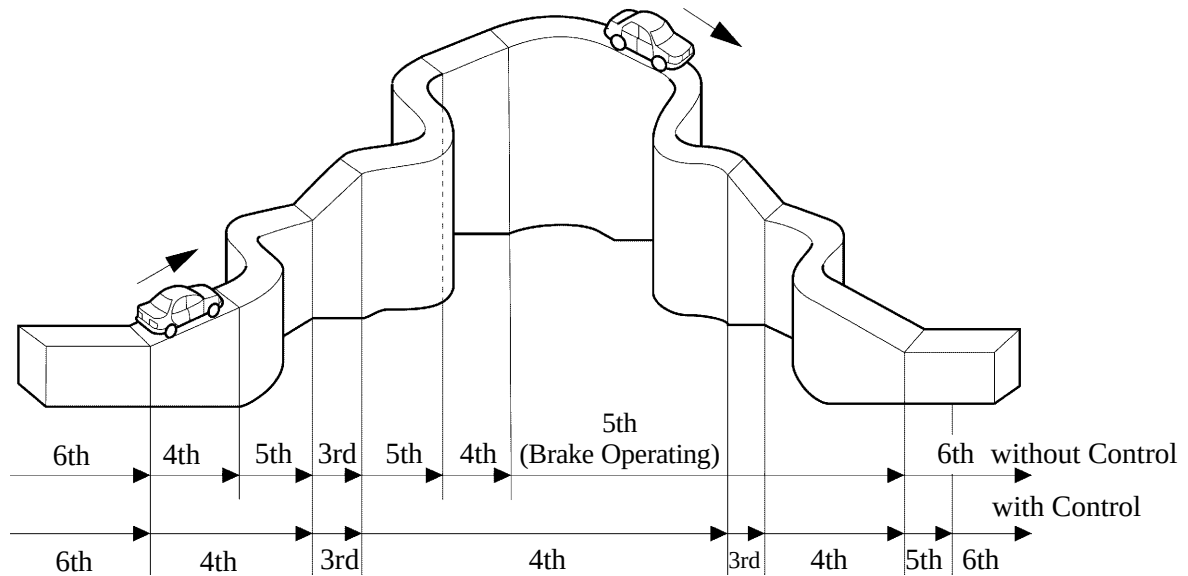


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### Road Condition Support Control

Under road condition support control, ECT ECU determines the throttle valve opening angle and the vehicle speed whether the vehicle is being driven uphill or downhill.

To achieve the optimal drive force while driving uphill, this control prevents the transaxle from up shifting to the 5th or 6th gear. To achieve the optimal engine brake effect while driving downhill, this control automatically downshifts the transaxle to the 5th or 4th or 3rd gear.



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### Driver's Intention Support Control

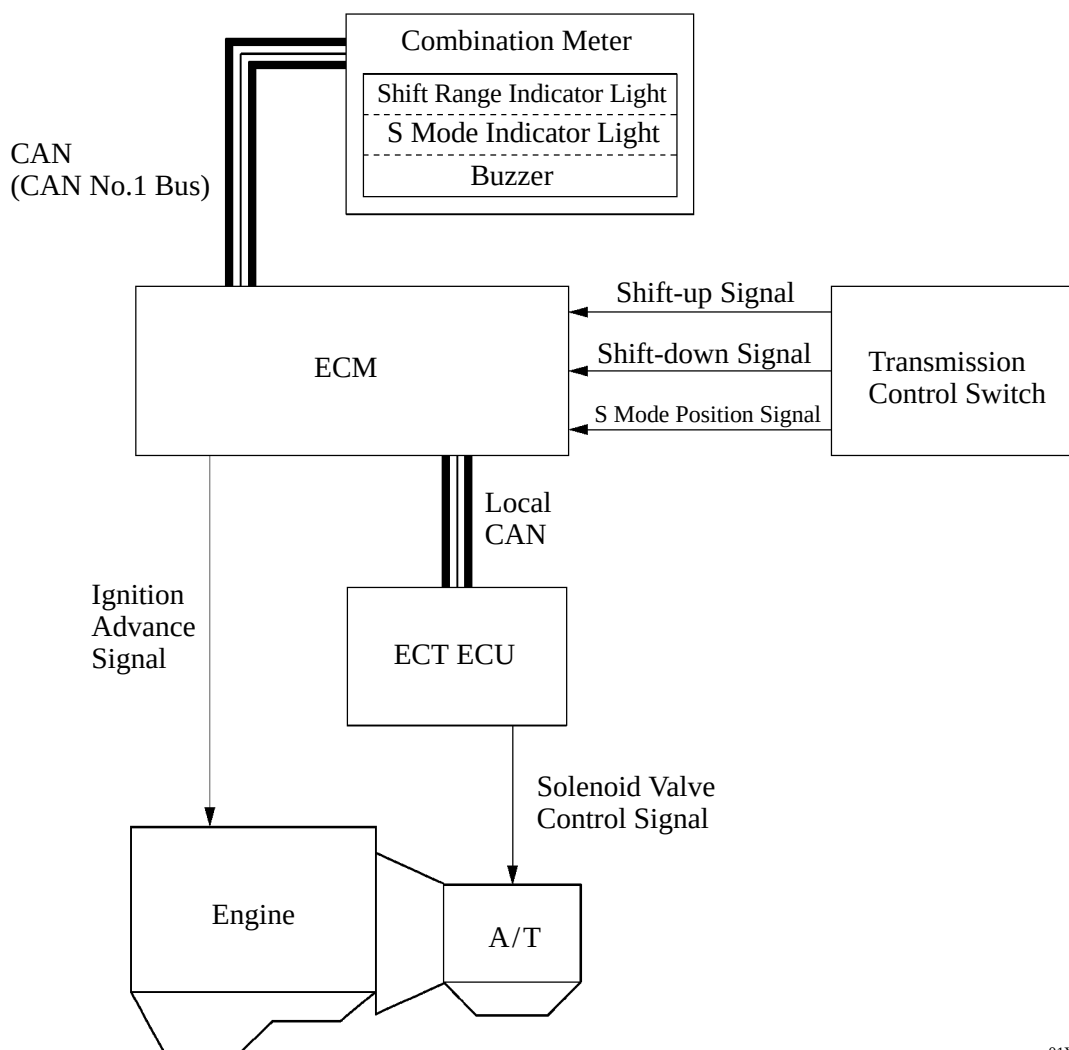
Estimates the driver's intention based on the accelerator operation and vehicle condition to switch to a shift pattern that is well-suited to each driver, without the need to operate the shift pattern select switch used in the conventional models.

## 12. Multi-Mode Automatic Transmission

### General

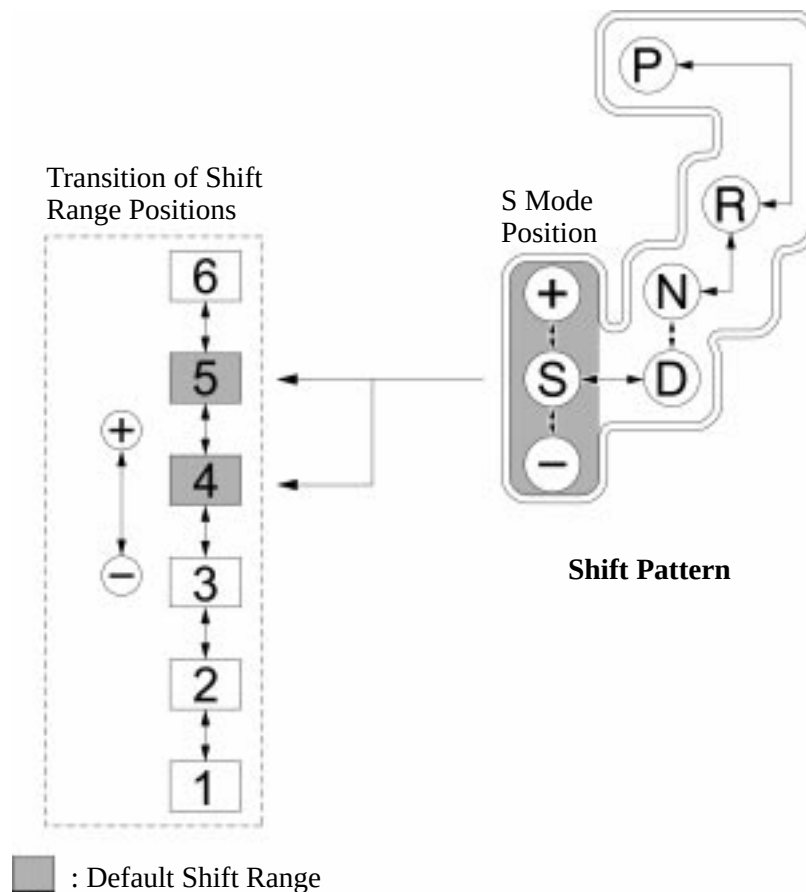
By moving the shift lever to the front (“+” position) or to the rear (“-” position), the driver can select the desired shift range position. Thus, the driver is able to shift gears with a manual-like feel.

- This Multi-mode automatic transmission is designed to allow the driver to switch the gear ranges; not for manually selecting single gears.
- An S mode indicator light, which illuminates when the S mode position is selected and a shift range indicator light, which indicates the range position, have been provided in the combination meter.
- When the vehicle is being driven at a prescribed speed or higher, any attempt to shift down the range by through the operation of the shift lever will not be executed, in order to protect the mechanism of the automatic transaxle. In this case, the ECM sounds the buzzer in the combination meter twice to alert the driver.



## Operation

- The driver selects the S mode position by engaging the shift lever. At this time, the shift range position selects the 4th or 5th range according to the vehicle speed. (During AI-Shift control, the shift range that has the currently controlled gear position as the maximum usable gear position is displayed.) Then, the shift range positions change one at a time, as the driver moves the shift lever to the front (“+” position) or to the rear (“-” position).
- Under this control, the ECT ECU effects optimal shift control within the usable gear range that the driver has selected. As with an ordinary automatic transmission, it shifts to the 1st gear when the vehicle is stopped.
- When the shift lever is in the S mode position, the S mode indicator light in the combination meter illuminates. The shift range indicator light indicates the state of the shift range position that the driver has selected.



030SC29C

## ► Usable Gear Chart ◀

| Shift Range Indicator Light Indication | Shift Range | Usable Gear                       |
|----------------------------------------|-------------|-----------------------------------|
| 6                                      | 6           | 6th ↔ 5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st |
| 5                                      | 5           | 5th ↔ 4th ↔ 3rd ↔ 2nd ↔ 1st       |
| 4                                      | 4           | 4th ↔ 3rd ↔ 2nd ↔ 1st             |
| 3                                      | 3           | 3rd ↔ 2nd ↔ 1st                   |
| 2                                      | 2           | 2nd ↔ 1st                         |
| 1                                      | 1           | 1st                               |

### 13. Diagnosis

- When the ECT ECU detects a malfunction, the ECT ECU makes a diagnosis and memorizes the information related to the fault. Furthermore, the MIL (Malfunction Indicator Lamp) in the combination meter illuminates or blinks to inform the driver of the malfunction.
- At the same time, the DTC (Diagnosis Trouble Code) are stored in the memory. The DTC stored in the ECT ECU are output to a hand-held tester connected to the DLC3 via the ECM.
- For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

#### Service Tip

The ECM uses the CAN protocol for diagnostic communication. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

### 14. Fail-safe

This function minimizes the loss of operation when any abnormality occurs in a sensor or solenoid.

#### ► Fail-safe Control List ◀

| Malfunction Part                         | Function                                                                                                                                                                                                                                                               |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Turbine Speed Sensor               | Shifting to only either the 1st or 3rd gears is allowed.                                                                                                                                                                                                               |
| Counter Gear Speed Sensor                | <ul style="list-style-type: none"> <li>● The counter gear speed is detected through the signals from the skid control ECU (speed sensor signals).</li> <li>● Shifting between the 1st to 4th gears is allowed.</li> </ul>                                              |
| ATF Temp. Sensor                         | Shifting between the 1st to 4th gears is allowed.                                                                                                                                                                                                                      |
| ECT ECU<br>Power Supply (Voltage is Low) | When the vehicle is being driven in 6th gear, the transaxle is fixed in 6th gear. When being driven in any of the 1st to 5th gears, the transaxle is fixed in 5th gear.                                                                                                |
| CAN Communication                        | Shifting to only either the 1st or 3rd gears is allowed.                                                                                                                                                                                                               |
| Knock Sensor                             | Shifting between the 1st to 4th gears is allowed.                                                                                                                                                                                                                      |
| Solenoid Valve SL1,<br>SL2, SL3 and SL4  | The current to the failed solenoid valve is cut off and operating the other solenoid valves with normal operation performs shift control. (Shift controls in fail-safe mode are described in the table on the next page. For details, refer to Fail-Safe Control List) |

## ► Solenoid Valve Operation when Normal ◀

| Gear Position  |     | 1st | 2nd | 3rd | 4th | 5th | 6th |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| Solenoid Valve | SL1 | ○   | ○   | ○   | ○   | X   | X   |
|                | SL2 | X   | X   | X   | ○   | ○   | ○   |
|                | SL3 | X   | ○   | X   | X   | X   | ○   |
|                | SL4 | X   | X   | ○   | X   | ○   | X   |

## ► Fail-safe Control List ◀

|     | Gear Position in Normal Operation                                                     | 1st                   | 2nd     | 3rd     | 4th     | 5th     | 6th     |
|-----|---------------------------------------------------------------------------------------|-----------------------|---------|---------|---------|---------|---------|
| SL1 | OFF Malfunction (without Fail-safe Control)                                           | 1st→N                 | 2nd→N   | 3rd→N   | 4th→N   | 5th     | 6th     |
|     | ON Malfunction (without Fail-safe Control)*1                                          | 1st                   | 2nd     | 3rd     | 4th     | 5th→4th | 6th→4th |
|     | Fail-safe Control during OFF Malfunction                                              | Fixed in 3rd or 5th*2 |         |         |         |         |         |
|     | Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 and 2 Malfunctions) | Fixed in 3rd or 5th*2 |         |         |         |         |         |
| SL2 | OFF Malfunction (without Fail-safe Control)                                           | 1st                   | 2nd     | 3rd     | 4th→1st | 5th→N   | 6th→N   |
|     | ON Malfunction (without Fail-safe Control)*1                                          | 1st→4th               | 2nd→4th | 3rd→4th | 4th     | 5th     | 6th     |
|     | Fail-safe Control during OFF Malfunction                                              | 1st                   | 2nd     | 3rd     | 3rd*3   | 3rd*3   | 3rd*3   |
|     | Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 and 2 Malfunctions) | Fixed in 2nd or 3rd*3 |         |         |         |         |         |
| SL3 | OFF Malfunction (without Fail-safe Control)                                           | 1st                   | 2nd→1st | 3rd     | 4th     | 5th     | 6th→N   |
|     | ON Malfunction (without Fail-safe Control)*1                                          | 1st→2nd               | 2nd     | 3rd     | 4th     | 5th     | 6th     |
|     | Fail-safe Control during OFF Malfunction                                              | 1st                   | 3rd     | 3rd     | 4th     | 5th     | 5th*3   |
|     | Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 and 2 Malfunctions) | Fixed in 3rd*3        |         |         |         |         |         |
| SL4 | OFF Malfunction (without Fail-safe Control)                                           | 1st                   | 2nd     | 3rd→1st | 4th     | 5th→N   | 6th     |
|     | ON Malfunction (without Fail-safe Control)*1                                          | 3rd                   | 3rd     | 3rd     | 4th     | 5th     | 5th     |
|     | Fail-safe Control during OFF Malfunction                                              | 1st*4                 | 2nd*4   | 4th*4   | 4th*4   | 6th     | 6th     |
|     | Fail-safe Control during OFF Malfunction (ATF Pressure Switches 1 and 2 Malfunctions) | Fixed in 2nd*3        |         |         |         |         |         |

\*1: Fail-safe control is not actuated when the ON malfunction occurs.

\*2: If malfunctions already exist in any of the P, R or N range positions and a malfunction is detected when the gear is shifted to the 1st gear, the gear position is fixed in the 5th gear. After that, if any of the P, R or N range positions is selected, the gear is fixed in the 3rd gear position.

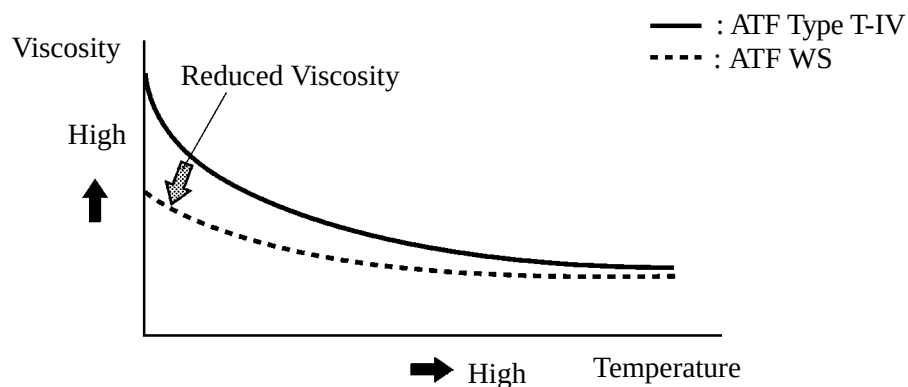
\*3: The gear is fixed in the neutral position until the vehicle speed reaches a certain speed that enables the transaxle to be shifted.

\*4: Shifting to the 5th and 6th gears is prohibited.



**■ ATF (AUTOMATIC TRANSMISSION FLUID) WS**

- ATF WS is used to reduce the resistance of the ATF and improve the fuel economy by reducing its viscosity in the practical operating temperature range. At higher fluid temperatures, the viscosity is the same as that of ATF Type T-IV, which ensures the durability of the automatic transaxle.
- ATF WS and other types of ATF (ATF Type T-IV, D-II.) are not interchangeable.

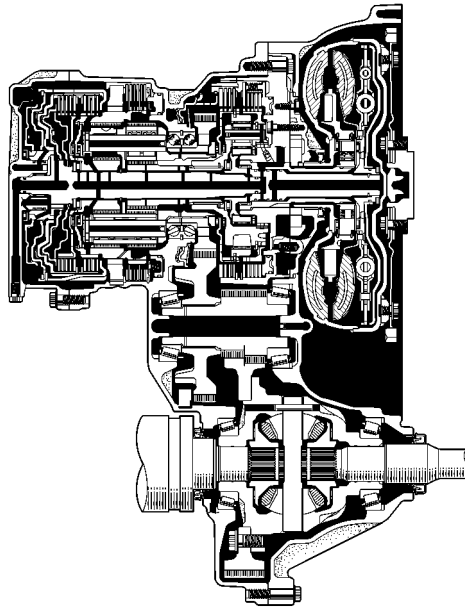


## CHASSIS

### U660E AUTOMATIC TRANSAXLE

#### DESCRIPTION

A newly developed U660E automatic transaxle is used. This automatic transaxle is a compact, lightweight and high-capacity 6-speed Super ECT (Electronically Controlled Transaxle).



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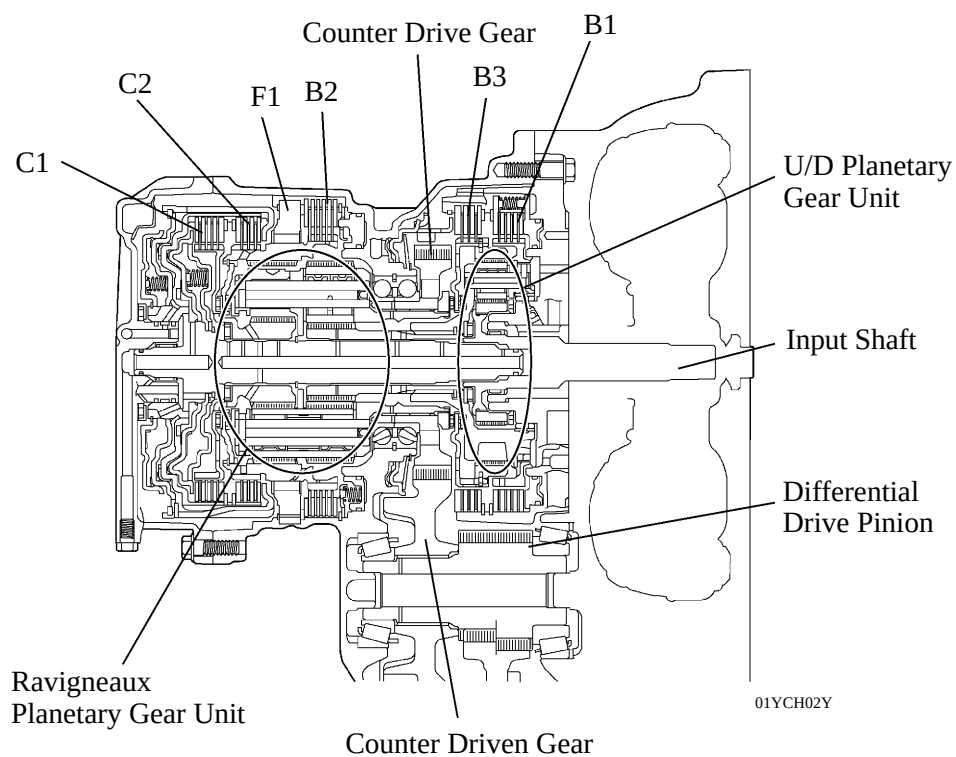
#### ► Specifications ◀

| Model                                                  |         | '07 ES350             | '06 ES330           |
|--------------------------------------------------------|---------|-----------------------|---------------------|
| Transaxle Type                                         |         | U660E                 | U151E               |
| Gear Ratio                                             | 1st     | 3.300                 | 4.235* <sup>1</sup> |
|                                                        | 2nd     | 1.900                 | 2.360* <sup>1</sup> |
|                                                        | 3rd     | 1.420                 | 1.517* <sup>1</sup> |
|                                                        | 4th     | 1.000                 | 1.047* <sup>1</sup> |
|                                                        | 5th     | 0.713                 | 0.756* <sup>1</sup> |
|                                                        | 6th     | 0.608                 | —                   |
|                                                        | Reverse | 4.148                 | 3.378* <sup>1</sup> |
| Differential Gear Ratio                                |         | 3.685* <sup>1</sup>   | 3.291               |
| Fluid Capacity* <sup>2</sup> Liters (US qts, Imp. qts) |         | 6.57 (6.99, 5.84)     | 8.9 (9.4, 7.8)      |
| Fluid Type                                             |         | Toyota Genuine ATF WS | ATF Type T-IV       |
| Weight (Reference)* <sup>3</sup> kg (lb)               |         | 94.4 (208.1)          | 101 (222.2)         |

\*1: Counter gear ratio included

\*2: Differential included

\*3: Weight shows the figure with the fluid filled to the maximum level.



► Specifications ◀

|                                |                     |                                    |     |
|--------------------------------|---------------------|------------------------------------|-----|
| C1                             | No.1 Clutch         | The No. of Discs                   | 4   |
| C2                             | No.2 Clutch         |                                    | 3   |
| B1                             | No.1 Brake          |                                    | 4   |
| B2                             | No.2 Brake          |                                    | 5   |
| B3                             | No.3 Brake          |                                    | 3   |
| F1                             | No.1 One-Way Clutch | The No. of Sprags                  | 20  |
| Ravigneaux Planetary Gear Unit |                     | The No. of Front Sun Gear Teeth    | 30  |
|                                |                     | The No. of Rear Sun Gear Teeth     | 27  |
|                                |                     | The No. of Long Pinion Gear Teeth  | 20  |
|                                |                     | The No. of Short Pinion Gear Teeth | 22  |
|                                |                     | The No. of Ring Gear Teeth         | 69  |
| U/D Planetary Gear Unit        |                     | The No. of Sun Gear Teeth          | 66  |
|                                |                     | The No. of Pinion Gear Teeth       | 21  |
|                                |                     | The No. of Ring Gear Teeth         | 110 |
| Counter Gear                   |                     | The No. of Drive Gear Teeth        | 44  |
|                                |                     | The No. of Driven Gear Teeth       | 47  |

## ■ ELECTRONIC CONTROL SYSTEM

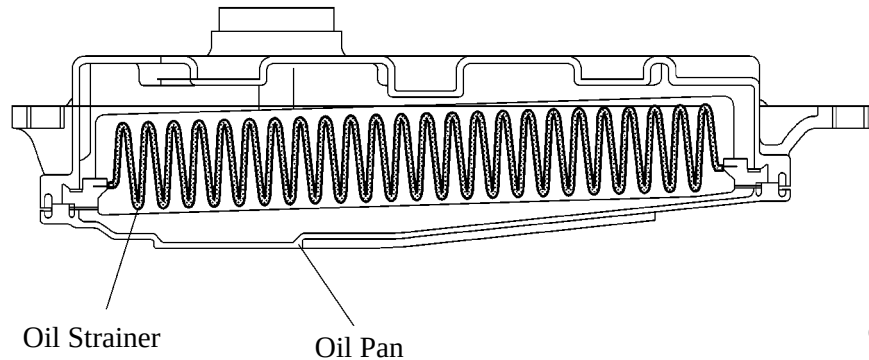
### 1. General

The electronic control system of the U660E automatic transaxle consists of the control listed below.

| System                                                  | Outline                                                                                                                                                                                                              |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shift Timing Control                                    | The ECT ECU supplies current to 6 solenoid valves (SL1, SL2, SL3, SL4, SL and/or SLU) based on signals from each sensor to shift the gear.                                                                           |
| Clutch to Clutch Pressure Control<br>(See page CH-30)   | Controls the pressure that is applied directly to the C1, C2 clutches and B1, B3 brakes by actuating the shift solenoid valves (SL1, SL2, SL3 and SL4) in accordance with ECT ECU signals.                           |
| Line Pressure Optimal Control<br>(See page CH-31)       | Actuates solenoid valve SLT to control the line pressure in accordance with information from the ECT ECU and the operating conditions of the transaxle.                                                              |
| Powertrain Cooperative Control<br>(See page CH-32)      | Controls both the shift control and engine output control in an integrated way, achieving excellent shift characteristics and drivability.                                                                           |
| Lock-up Timing Control<br>(See page CH-33)              | The ECT ECU supplies current to shift solenoid valves SL and SLU based on signals from each sensor and engages or disengages the lock-up clutch.                                                                     |
| Flex Lock-up Clutch Control<br>(See page CH-34)         | Controls solenoid valves SLU and SL, provides an intermediate mode between the ON/OFF operation of the lock-up clutch, and increases the operating range of the lock-up clutch to improve fuel economy.              |
| Coast Downshift Control<br>(See page CH-35)             | The ECT ECU performs downshift control so that fuel cut control can continue for as long as possible during deceleration.                                                                                            |
| AI (Artificial Intelligence) -SHIFT<br>(See page CH-36) | Based on the signals from various sensors, the ECT ECU determines the road condition and the intention of the driver. Thus, the shift pattern is automatically regulated to an optimal level, improving drivability. |
| Multi-Mode Automatic Transmission<br>(See page CH-38)   | The ECT ECU appropriately controls the automatic transaxle in accordance with the range position selected while the shift lever is in the S mode position.                                                           |
| Diagnosis<br>(See page CH-40)                           | When the ECT ECU detects a malfunction, the ECT ECU makes a diagnosis and memorizes the malfunctioning part.                                                                                                         |
| Fail-safe<br>(See page CH-40)                           | Even if a malfunction is detected in the sensors or solenoids, the ECT ECU activates fail-safe control to prevent the vehicle's drivability from being significantly affected.                                       |

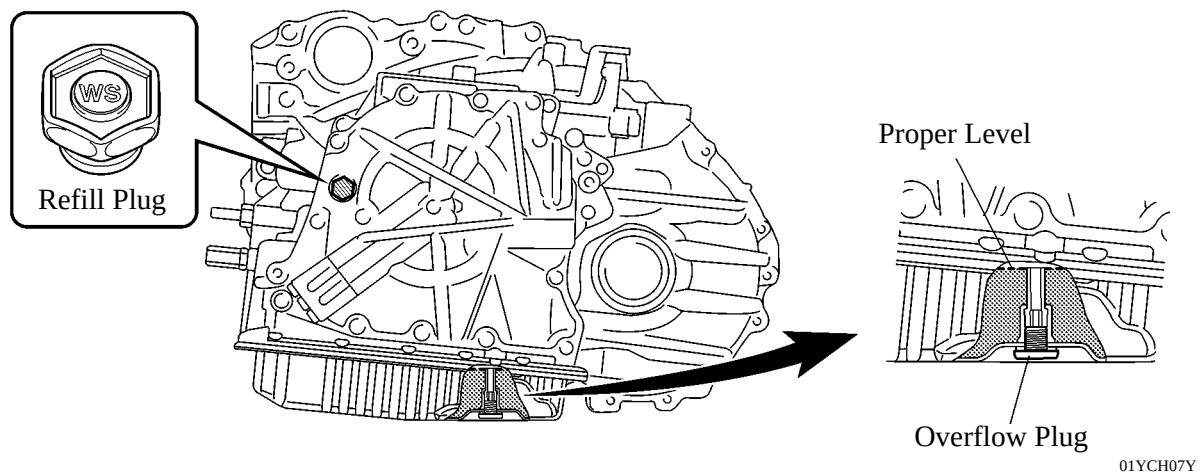
## ■ OIL STRAINER

A felt type oil strainer is used because it is lightweight, provides excellent filtering ability, is more reliable and free from maintenance.



## ■ ATF FILLING PROCEDURES

- The ATF filling procedure is changed in order to improve the accuracy of the ATF level when the transaxle is being repaired or replaced. As a result, the oil filler tube and the oil level gauge used for a conventional automatic transaxle are discontinued, eliminating the need to inspect the fluid level as a part of routine maintenance.
- This filling procedure employs a refill plug, overflow plug, ATF temperature sensor, and shift indicator light "D". After the transaxle is refilled with ATF, remove the overflow plug and drain the extra ATF at the proper ATF temperature. Thus, the appropriate ATF level can be obtained. For details about the ATF filling procedure, refer to the Service Tip on the next page.



**Service Tip****ATF Filling procedure using SST (09843-18040)**

When a large amount of ATF needs to be filled (i.e. after removal and installation of oil pan or torque converter), perform the procedure from step 1.

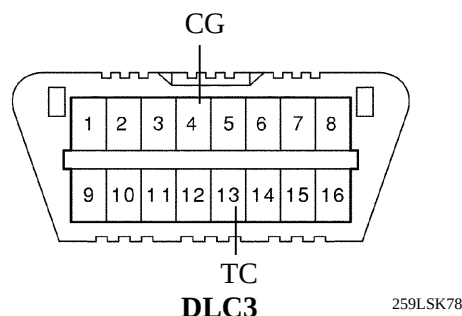
When a small amount of ATF is required (i.e. removal and installation of oil cooler tube, repair of a minor oil leak), perform the procedure from step 7.

- 1) Raise the vehicle while keeping it level.
- 2) Remove the refill plug and overflow plug.
- 3) Fill the transaxle with WS type ATF through the refill plug hole until it overflows from the overflow plug hole.
  - ATF WS must be used to fill the transaxle.
- 4) Reinstall the overflow plug.
- 5) Add the specified amount of ATF (specified amount is determined by the procedure that was performed) and reinstall the refill plug.

**Example:**

| Procedure                                                              | Liters (US qts, Imp.qts) |
|------------------------------------------------------------------------|--------------------------|
| Removal and installation of transaxle oil pan (including oil drainage) | 2.9 (3.1, 2.6)           |
| Removal and installation of transaxle valve body                       | 3.3 (3.5, 2.9)           |
| Replacement of torque converter                                        | 4.9 (5.2, 4.3)           |

- 6) Lower the vehicle
- 7) Use the SST (09843-18040) to make shorts between the TC and CG terminals of the DLC3 connector:
- 8) Start the engine and allow it to idle.
  - A/C switch must be turned off.
- 9) Move the shift lever from the P position to the S mode position and slowly selects each gear S1 - S6. Then move the shift lever back to the P position.
- 10) Move the shift lever to the D position, and then quickly move it back and forth between N and D (at least once every 1.5 seconds) for at least 6 seconds. This will activate oil temperature detection mode.



**Standard: The shift position indicator light “D” remains illuminated for 2 seconds and then goes off.**

- 11) Return the shift lever to the P position and disconnect the TC terminal.
- 12) Idle the engine to raise the ATF temperature.
- 13) Immediately after the shift position indicator “D” light turns on, lift the vehicle up.
  - The shift position indicator light “D” will indicate the ATF temperature according to the following table.

| ATF Temp.                          | Lower than Optimal Temp. | Optimal Temp. | Higher than Optimal Temp. |
|------------------------------------|--------------------------|---------------|---------------------------|
| Shift Position Indicator Light “D” | OFF                      | ON            | Blinking                  |

(Continued)

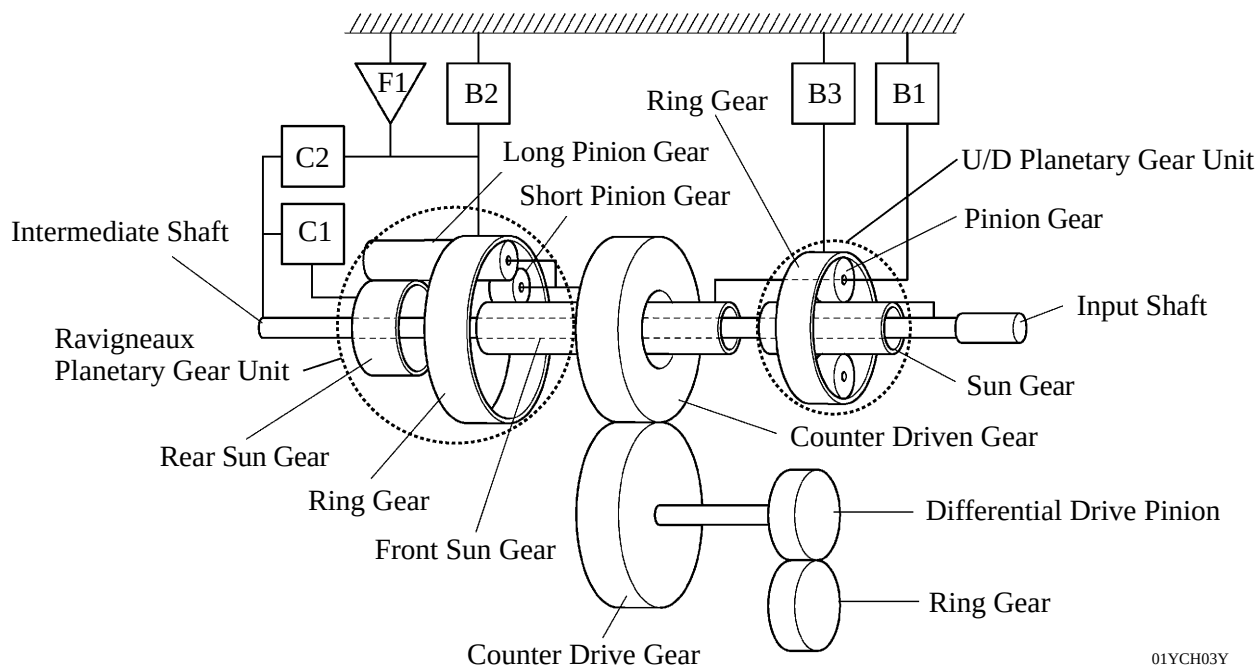
- 14) Remove the overflow plug and adjust the oil quantity.
  - If the ATF overflows, go to step 17, and if the ATF does not overflow, go to step 15.
- 15) Remove the refill plug.
- 16) Add ATF through the refill plug hole until it flows out from the overflow plug hole.
- 17) When the ATF flow slows to a trickle, install the overflow plug and a new gasket.
- 18) Reinstall the refill plug (if the refill plug was removed).
- 19) Lower the vehicle.
- 20) Turn the engine switch OFF to stop the engine.

For details about the ATF Filling procedures, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## ■ PLANETARY GEAR UNIT

### 1. Construction

- The 6-speed configuration has been achieved by using 2 planetary gear units, creating a 6-speed automatic transaxle.
- A Ravigneaux type planetary gear unit is used as the rear gear unit. The gear unit consists of pairs of sun gears (front and rear) and planetary pinion gears (long and short) with different diameters within a single planetary gear.
- The centrifugal fluid pressure canceling mechanism is used in the C1 and C2 clutches that are applied when shifting between the 1st to 6th gears. Refer to CH-16 for details.
- The shapes of the grooves in the clutches and brake linings have been optimized in order to reduce drag during clutch and brake operation.



01YCH03Y

### 2. Function of Components

| Component       |                     | Function                                                                                                                                                                                        |
|-----------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C1              | No.1 Clutch         | Connects intermediate shaft and Ravigneaux planetary rear sun gear.                                                                                                                             |
| C2              | No.2 Clutch         | Connects intermediate shaft and Ravigneaux planetary ring gear.                                                                                                                                 |
| B1              | No.1 Brake          | Prevents Ravigneaux planetary front sun gear and U/D planetary carrier from turning either clockwise or counterclockwise.                                                                       |
| B2              | No.2 Brake          | Prevents Ravigneaux planetary ring gear from turning either clockwise or counterclockwise.                                                                                                      |
| B3              | No.3 Brake          | Prevents U/D planetary ring gear from turning either clockwise or counterclockwise.                                                                                                             |
| F1              | No.1 One-Way Clutch | Prevents Ravigneaux planetary ring gear from turning counterclockwise.                                                                                                                          |
| Planetary Gears |                     | These gears change the route through which driving force is transmitted, in accordance with the operation of each clutch and brake, in order to increase or reduce the input and output speeds. |



## 3. Transaxle Power Flow

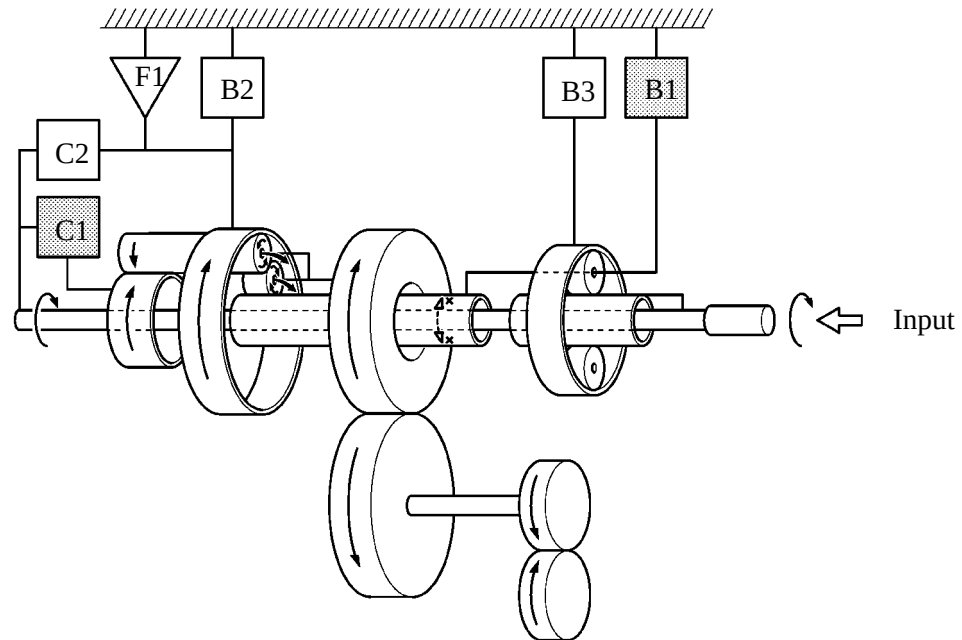
| Shift<br>Lever<br>Position | Gear    | Solenoid Valve |     |     |     |     |     | Clutch |    | Brake |    |    | One-way<br>Clutch |
|----------------------------|---------|----------------|-----|-----|-----|-----|-----|--------|----|-------|----|----|-------------------|
|                            |         | SL             | SL1 | SL2 | SL3 | SL4 | SLU | C1     | C2 | B1    | B2 | B3 | F1                |
| P                          | Park    |                | ○   |     |     |     |     |        |    |       |    |    |                   |
| R                          | Reverse | ●              |     |     |     | ○   |     |        |    |       | ○  | ○  |                   |
| N                          | Neutral |                | ○   |     |     |     |     |        |    |       |    |    |                   |
| D, S6                      | 1st     |                | ○   |     |     |     |     | ○      |    |       |    |    | ○                 |
|                            | 2nd     | ○              | ○   |     | ○   |     | Δ   | ○      |    | ○     |    |    |                   |
|                            | 3rd     | ○              | ○   |     |     | ○   | Δ   | ○      |    |       |    | ○  |                   |
|                            | 4th     | ○              | ○   | ○   |     |     | Δ   | ○      | ○  |       |    |    |                   |
|                            | 5th     | ○              |     | ○   |     | ○   | Δ   |        | ○  |       |    | ○  |                   |
|                            | 6th     | ○              |     | ○   | ○   |     | Δ   |        | ○  | ○     |    |    |                   |
| S5                         | 1st     |                | ○   |     |     |     |     | ○      |    |       |    |    | ○                 |
|                            | 2nd     | ○              | ○   |     | ○   |     | Δ   | ○      |    | ○     |    |    |                   |
|                            | 3rd     | ○              | ○   |     |     | ○   | Δ   | ○      |    |       |    | ○  |                   |
|                            | 4th     | ○              | ○   | ○   |     |     | Δ   | ○      | ○  |       |    |    |                   |
|                            | 5th     | ○              |     | ○   |     | ○   | Δ   |        | ○  |       |    | ○  |                   |
| S4                         | 1st     |                | ○   |     |     |     |     | ○      |    |       |    |    | ○                 |
|                            | 2nd     | ○              | ○   |     | ○   |     | Δ   | ○      |    | ○     |    |    |                   |
|                            | 3rd     | ○              | ○   |     |     | ○   | Δ   | ○      |    |       |    | ○  |                   |
|                            | 4th     | ○              | ○   | ○   |     |     | Δ   | ○      | ○  |       |    |    |                   |
| S3                         | 1st     |                | ○   |     |     |     |     | ○      |    |       |    |    | ○                 |
|                            | 2nd     |                | ○   |     | ○   |     |     | ○      |    | ○     |    |    |                   |
|                            | 3rd     |                | ○   |     |     | ○   |     | ○      |    |       |    | ○  |                   |
| S2                         | 1st     |                | ○   |     |     |     |     | ○      |    |       |    |    | ○                 |
|                            | 2nd     |                | ○   |     | ○   |     |     | ○      |    | ○     |    |    |                   |
| S1                         | 1st     |                | ○   |     |     |     | ○   | ○      |    |       | ○  |    | ○                 |

○: ON    Δ: In accordance with flex lock-up    ●: ON while engaging, OFF after engaged

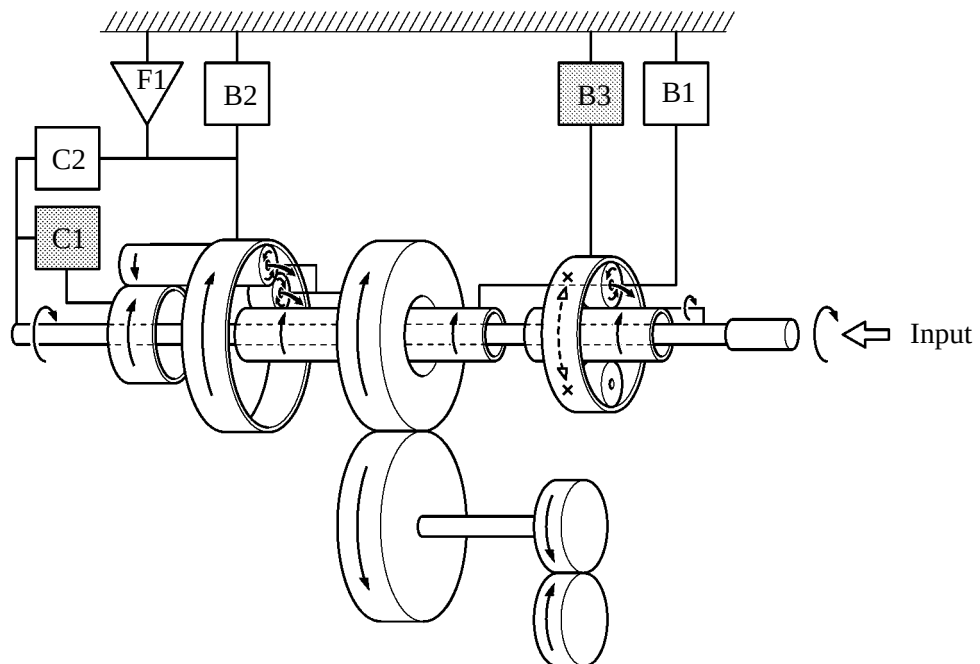
The diagram illustrates a mechanical system with a feedback loop. An input shaft on the right, labeled 'Input', is connected to a gear assembly. This assembly includes a gear with a 4-tooth profile (labeled 'x4') and a feedback path that passes through blocks B1 and B3 before returning to the input shaft. The main shaft continues through a central gear assembly (labeled 'x4') and is connected to a feedback path that passes through blocks C1 and C2 before returning to the input shaft. The system is supported by a base with a hatched pattern. Arrows indicate the direction of rotation for various components.

[illegible]

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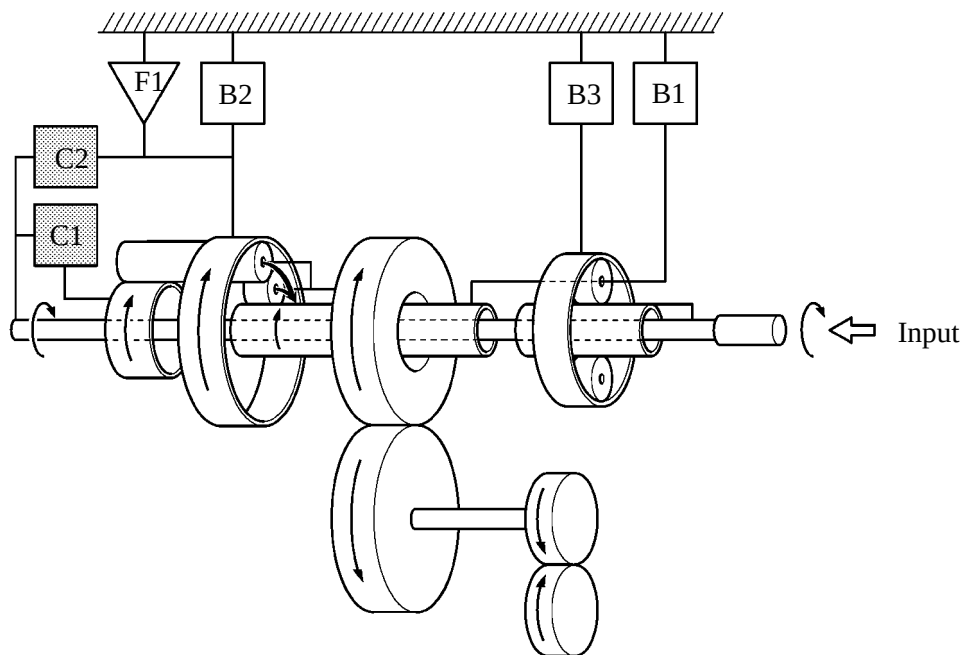
**2nd Gear (D Position or S Mode)**

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**3rd Gear (D Position or S Mode)**

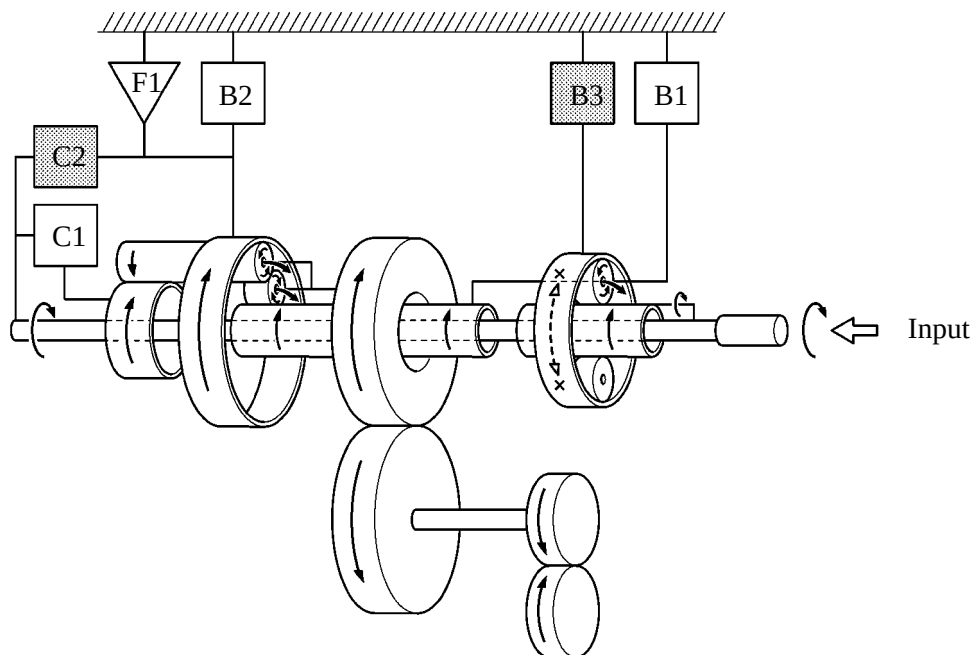
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### 4th Gear (D Position or S Mode)



01YCH12Y

### 5th Gear (D Position or S Mode)



01YCH13Y

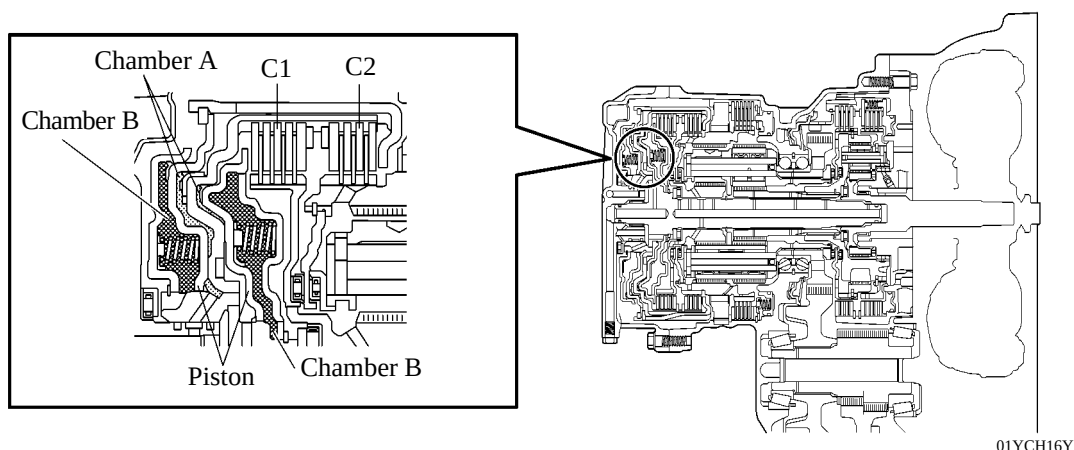
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#### 4. Centrifugal Fluid Pressure Canceling Mechanism

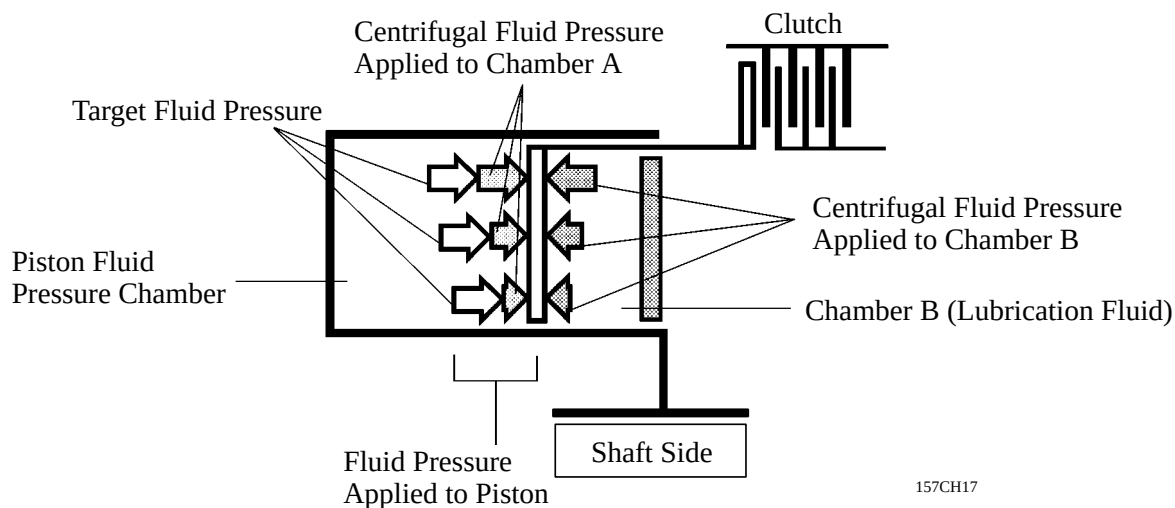
There are two reasons for improving the conventional clutch mechanism:

- To prevent the generation of pressure by the centrifugal force that is applied to the fluid in piston fluid pressure chamber (hereafter referred to as “chamber A”) when the clutch is released, a check ball is provided to discharge the fluid. Therefore, before the clutch could be subsequently applied, it took time for the fluid to fill the chamber A.
- During shifting, in addition to the original clutch pressure that is controlled by the valve body, the pressure that acts on the fluid in chamber A also exerts influence, which is dependent upon revolution fluctuations.

To address these two needs for improvement, a canceling fluid pressure chamber (hereafter referred to as “chamber B”) has been provided opposite chamber A.



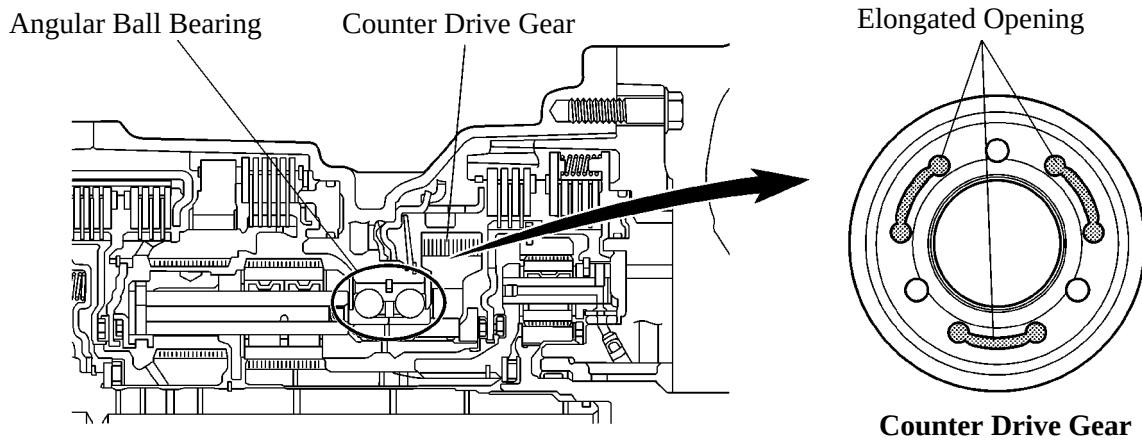
By utilizing lubrication fluid such as that of the shaft, an equal centrifugal force is applied, thus canceling the centrifugal force that is applied to the piston itself. Accordingly, it is not necessary to discharge the fluid through the use of a check ball, and a highly responsive and smooth shifting characteristic has been achieved.



|                                  |   |                                                 |   |                                                  |
|----------------------------------|---|-------------------------------------------------|---|--------------------------------------------------|
| Fluid pressure applied to piston | - | Centrifugal fluid pressure applied to chamber B | = | Target fluid pressure (original clutch pressure) |
|----------------------------------|---|-------------------------------------------------|---|--------------------------------------------------|

## 5. Counter Drive Gear

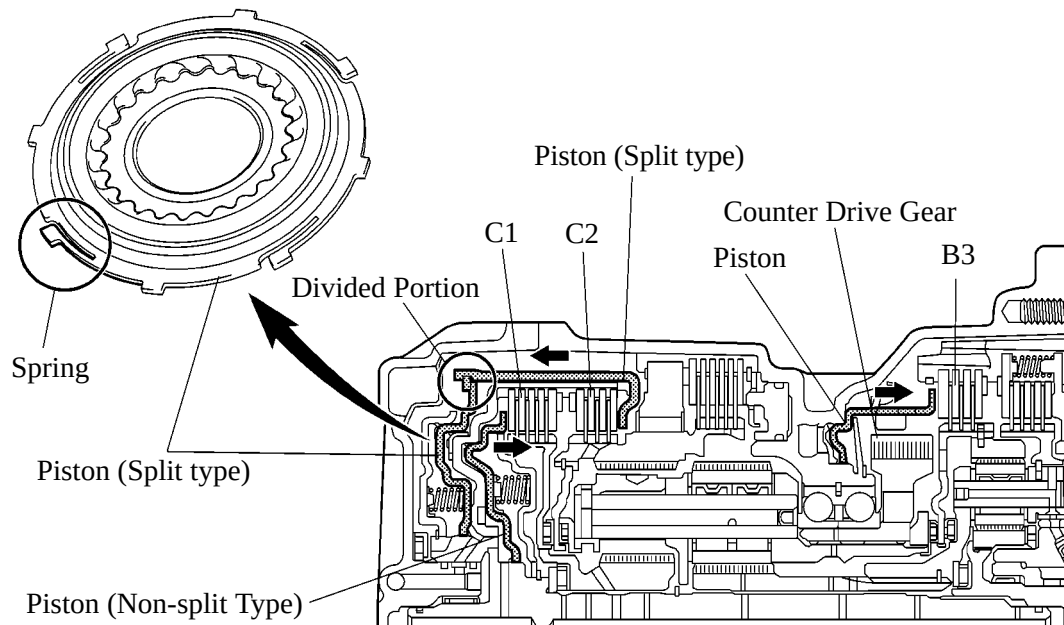
- Angular ball bearings are used to support the counter drive gear and the Ravigneaux planetary gear unit, reducing the rolling resistance and noise.
- By providing three elongated openings in the counter drive gear, the vibration conduction characteristic of the gear has been optimized. As a result, both gear noise and weight reductions have been achieved.



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## 6. Clutch and Brake Pistons

- Two types of pistons are used; a non-split piston that acts in the push direction for the No.1 clutch (C1) operation, and a split piston that acts in the pull direction for the No.2 clutch (C2) operation. These two types of pistons contribute to making the entire clutch structure compact.
- When the split piston operates, clutch drag occurs due to rattling caused by the divided portion of the piston. However, by fitting springs on the piston circumference, such rattling is restrained and the occurrence of clutch drag is minimized.
- By setting the piston for the No.3 brake (B3) operation around the counter drive gear, the brake structure has been made more compact.

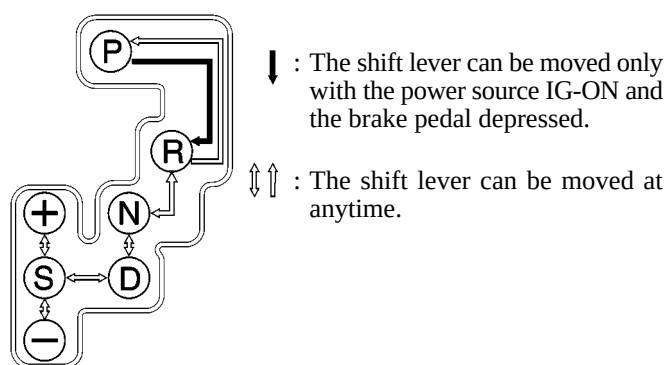
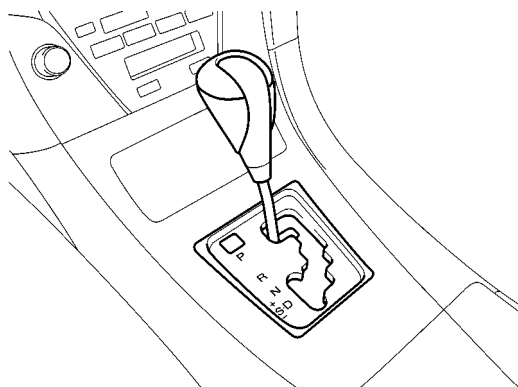


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## SHIFT CONTROL MECHANISM

### 1. General

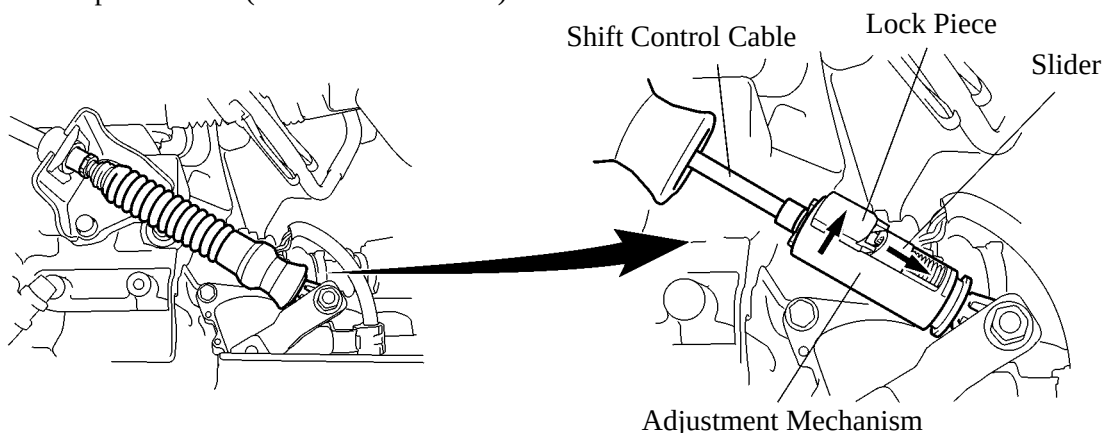
- A gate type shift lever is used in conjunction with the 6-speed automatic transaxle. With the gate type lever, the shift lever button and the overdrive switch of the straight type shift lever are discontinued. Similar functions are achieved through a single-shift operation (fore-aft and side-to-side).
- The shift control cable with a length adjustment mechanism is used.
- Shift pattern is provided with the S mode position on the side of the D position.
- A shift lock system is used.



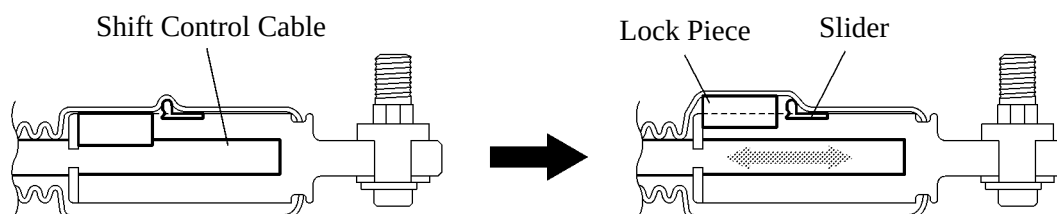
01YCH46TE

### Service Tip

The shift control cable is fixed by the lock piece of the adjustment mechanism. Adjustment of the shift control cable is possible by releasing the lock piece from the cable. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).



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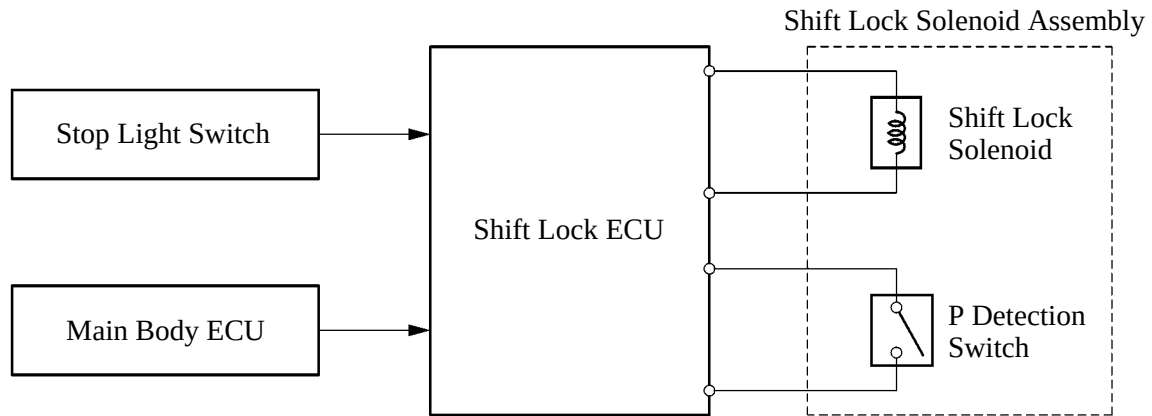


## 2. Shift Lock System

### General

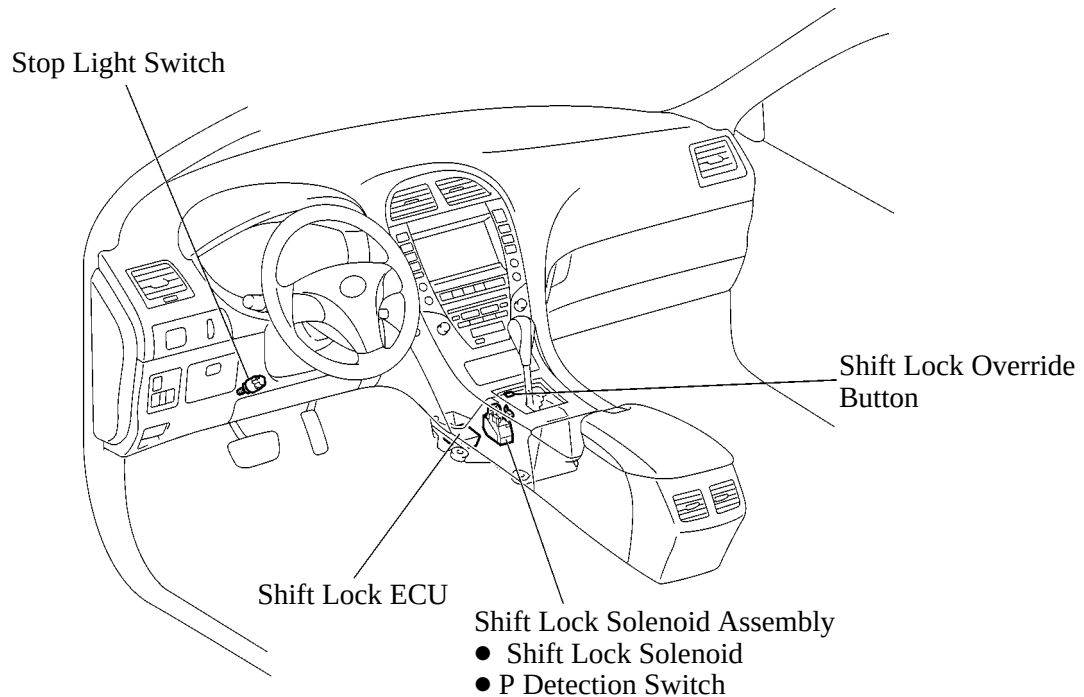
- The shift lock mechanism prevents the shift lever from being shifted to any position other than the P position, unless the IG ON mode is selected, and the brake pedal is depressed. This mechanism helps to prevent unintentional acceleration.
- The shift lock system mainly consists of the shift lock ECU, shift lock solenoid and shift lock override button.
- The shift lock solenoid has a built-in P detection switch.

### ► System Diagram ◀



01YCH49TE

### Layout of Main Components



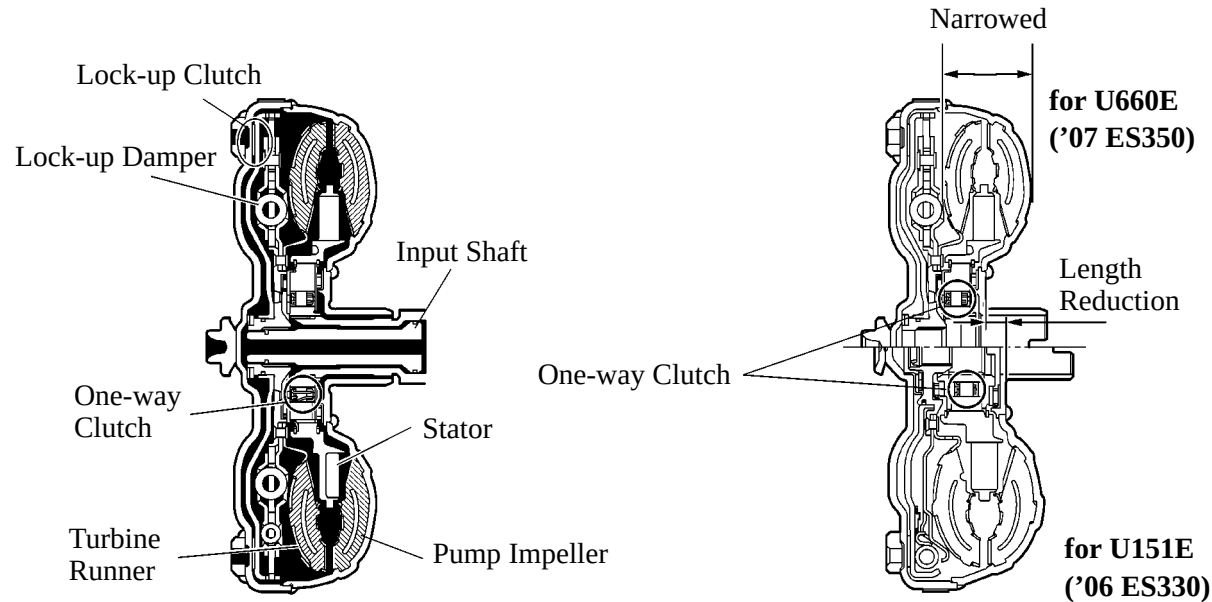
01YCH50TE

### System Operation

- The shift lock ECU uses the P detection switch to detect the shift lever position, and receives inputs from the stop light switch and the main body ECU. Upon receiving these signals, the shift lock ECU turns ON the shift lock solenoid in order to release the shift lock.
- A shift lock override button, which manually overrides the shift lock mechanism, is used.

**■ TORQUE CONVERTER**

- A compact, lightweight and high-capacity torque converter is used.
- In order to make the torque converter more compact and shorten its total length, the pump impeller and turbine runner portions have been made narrower, and the structure of the one-way clutch has been simplified.
- This torque converter has optimally designed fluid passages and impeller configuration resulting in substantially enhanced transmission efficiency to ensure better starting, acceleration and fuel economy.
- Furthermore, a hydraulically operated lock-up mechanism, which enables the lock-up (flex lock-up) operation at low to high vehicle speeds, is used to reduce the slip loss of the torque converter.



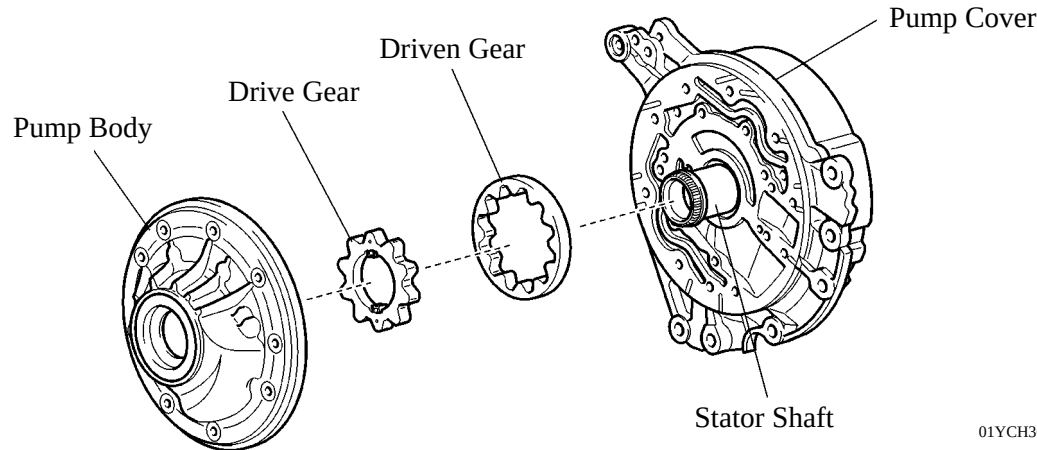
01YCH05Y

**► Specifications ◀**

|                       |                            |           |
|-----------------------|----------------------------|-----------|
| Model                 | '07 ES350                  | '06 ES330 |
| Transaxle Type        | U660E                      | U151E     |
| Torque Converter Type | 3-Element, 1-Step, 2-Phase | ←         |
| Stall Torque Ratio    | 1.80                       | 1.75      |

**■ OIL PUMP**

- The oil pump is operated by the torque converter. It lubricates the planetary gear units and supplies operating fluid pressure for hydraulic control.
- The pump cover is made of aluminum to reduce weight.

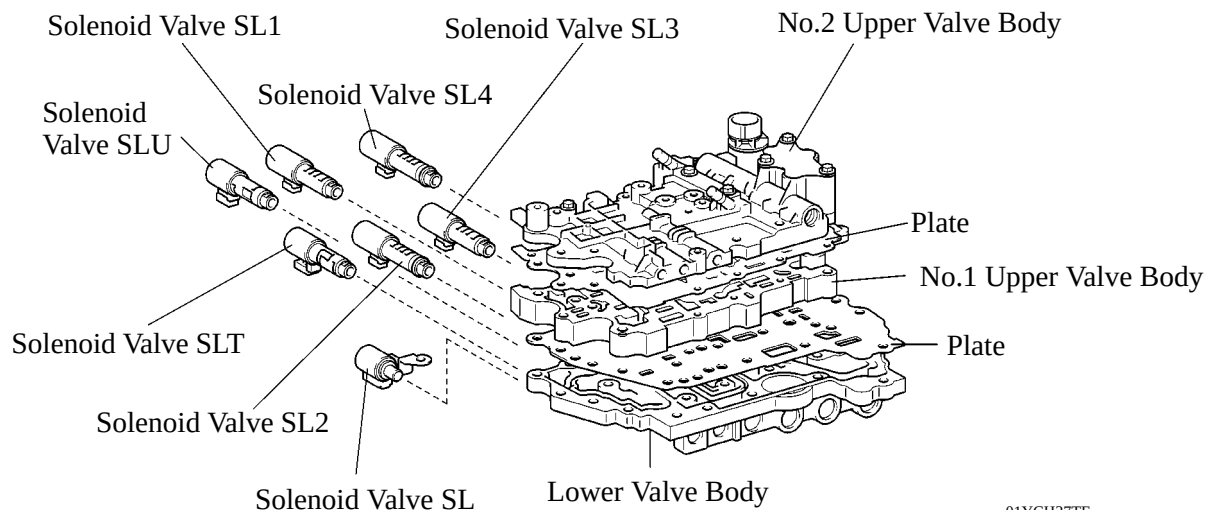


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## ■ VALVE BODY UNIT

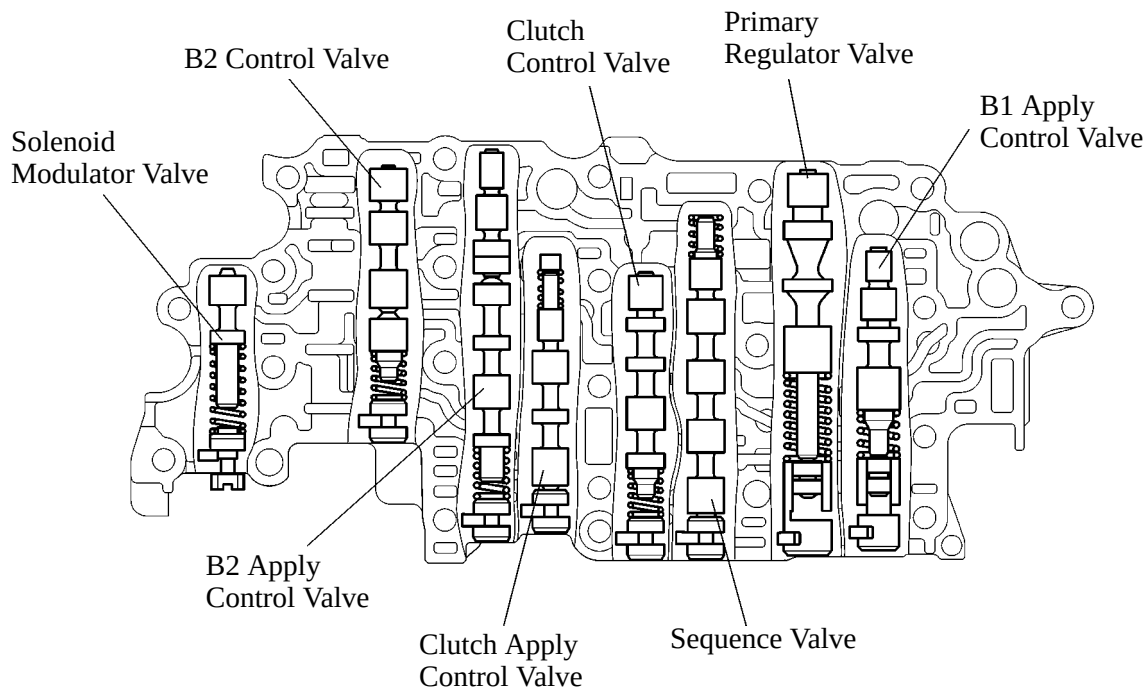
### 1. General

The valve body unit consists of the No.1 upper, No.2 upper and lower valve bodies and 7 solenoid valves (SL1, SL2, SL3, SL4, SLU, SLT, SL).



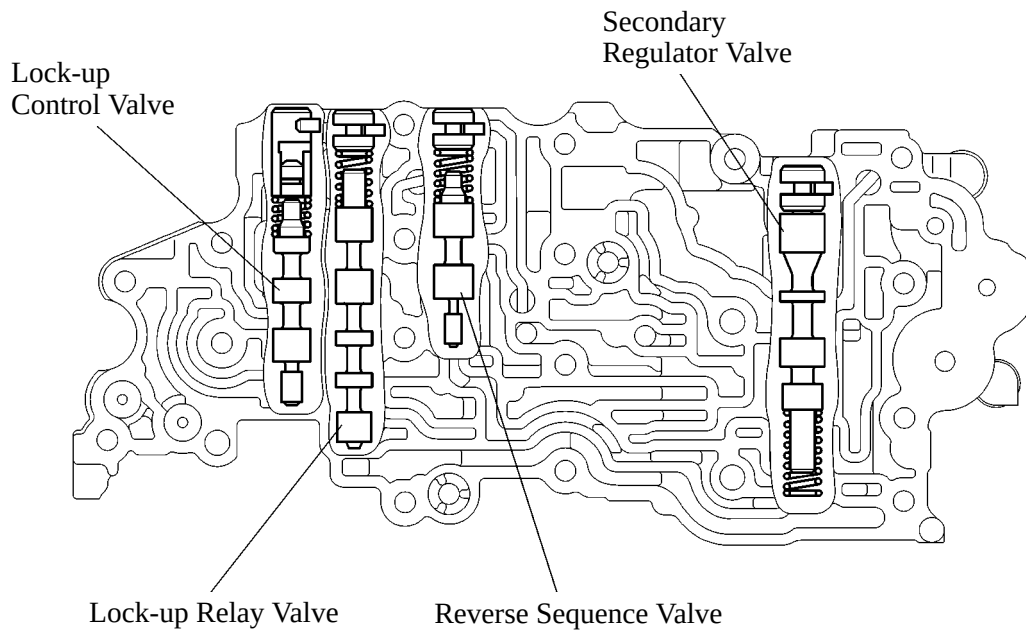
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### ► No.1 Upper Valve Body ◀



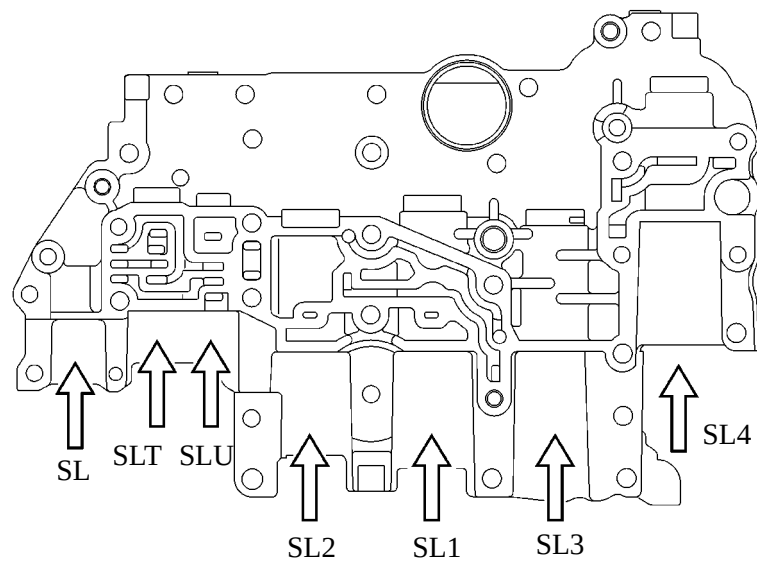
01YCH38TE

## ► No.2 Upper Valve Body ◀



01YCH39TE

## ► Lower Valve Body ◀

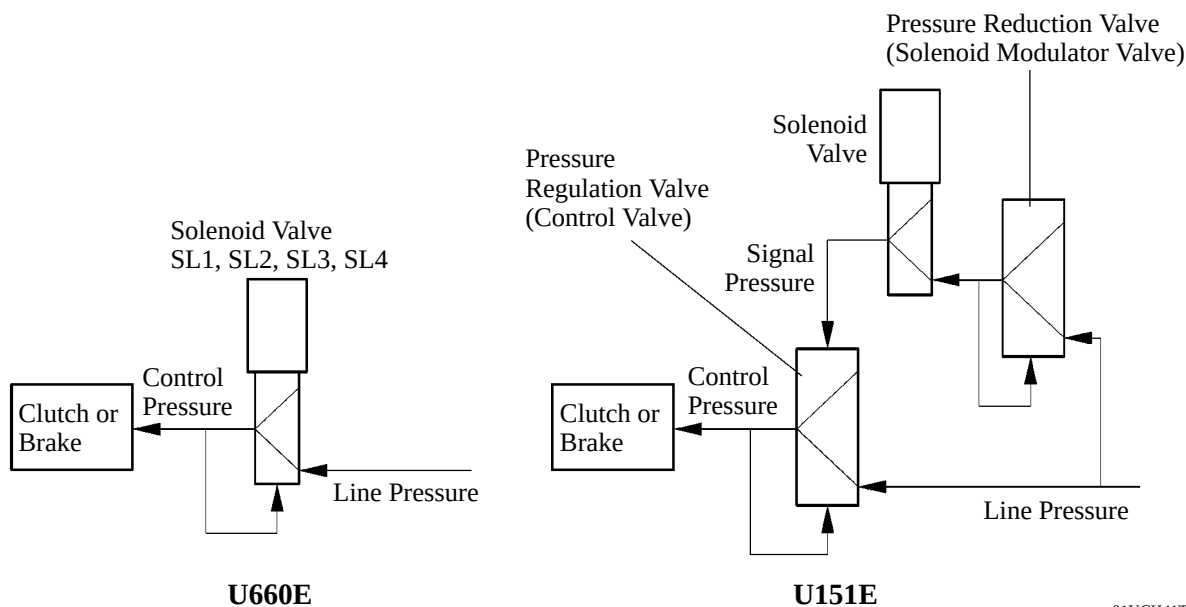


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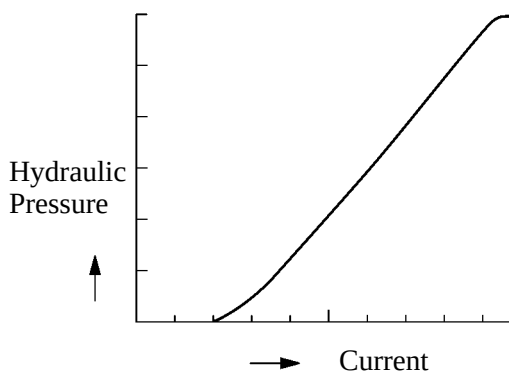
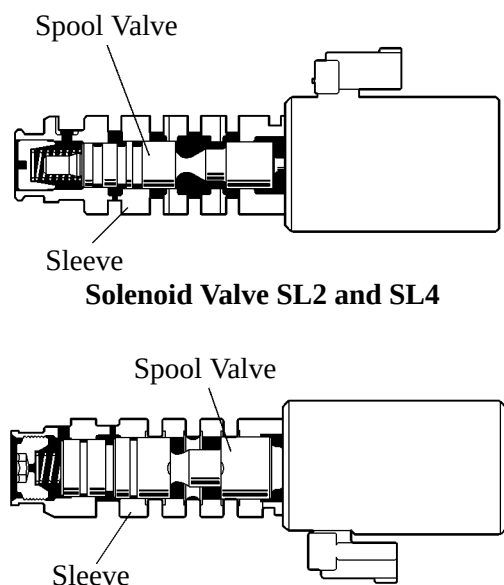
## 2. Solenoid Valves

### Solenoid Valves SL1, SL2, SL3, SL4, SLU and SLT

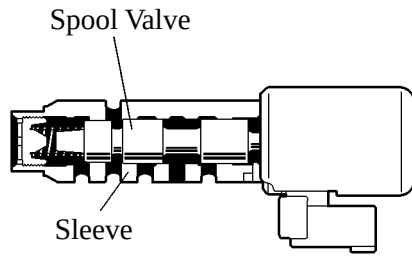
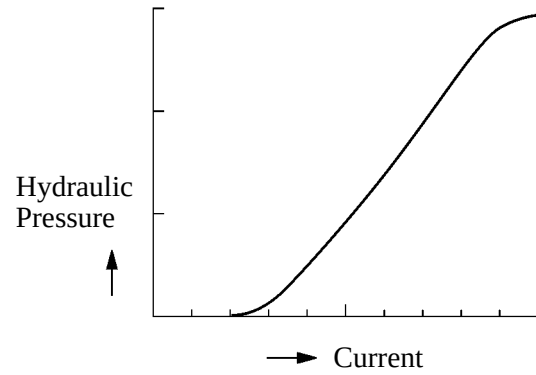
- In order to provide a hydraulic pressure that is proportional to the current that flows to the solenoid coil, solenoid valves SL1, SL2, SL3, SL4, SLU and SLT linearly control the line pressure and clutch and brake engagement pressure based on the signals from the ECT ECU.
- Solenoid valves SL1, SL2, SL3 and SL4 are large flow linear solenoid valves that can supply more pressure than conventional ones. These solenoid valves control engagement elements by directly regulating the line pressure without using the pressure regulation valve (control valve) or the pressure reduction valve (solenoid modulator valve). Thus, the number of valves and the length of the valve body fluid passage have been reduced, the shifting response has been increased and the shift shock has been minimized.



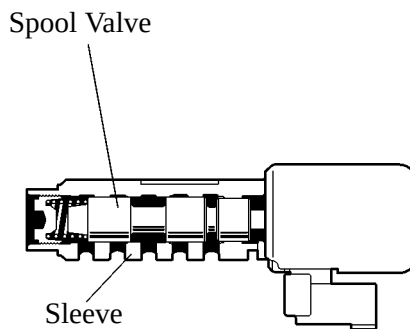
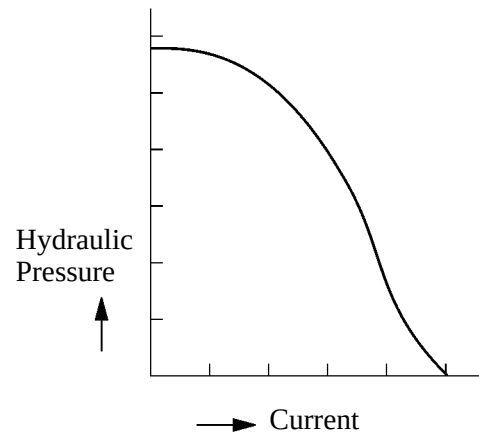
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01YCH19Y

**Solenoid Valve SLU**

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**Solenoid Valve SLT**

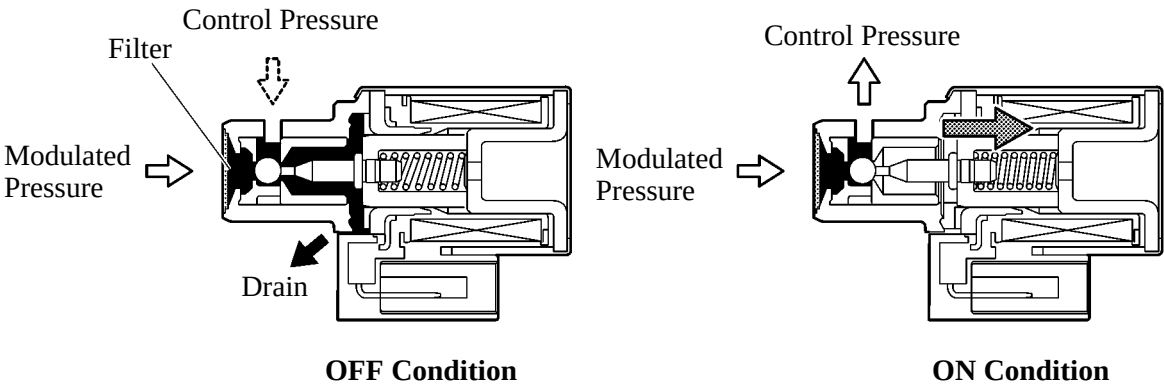
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► **Function of Solenoid Valves** ◀

| Solenoid Valve | Function                                                                                                                 |
|----------------|--------------------------------------------------------------------------------------------------------------------------|
| SL1            | C1 clutch pressure control                                                                                               |
| SL2            | C2 clutch pressure control                                                                                               |
| SL3            | B1 brake pressure control                                                                                                |
| SL4            | B3 brake pressure control                                                                                                |
| SLU            | <ul style="list-style-type: none"> <li>● Lock-up clutch pressure control</li> <li>● B2 brake pressure control</li> </ul> |
| SLT            | Line pressure control                                                                                                    |

Solenoid Valve SL

- Solenoid valve SL uses a three-way solenoid valve.
- A filter is provided at the tip of the solenoid valve to further improve operational reliability.



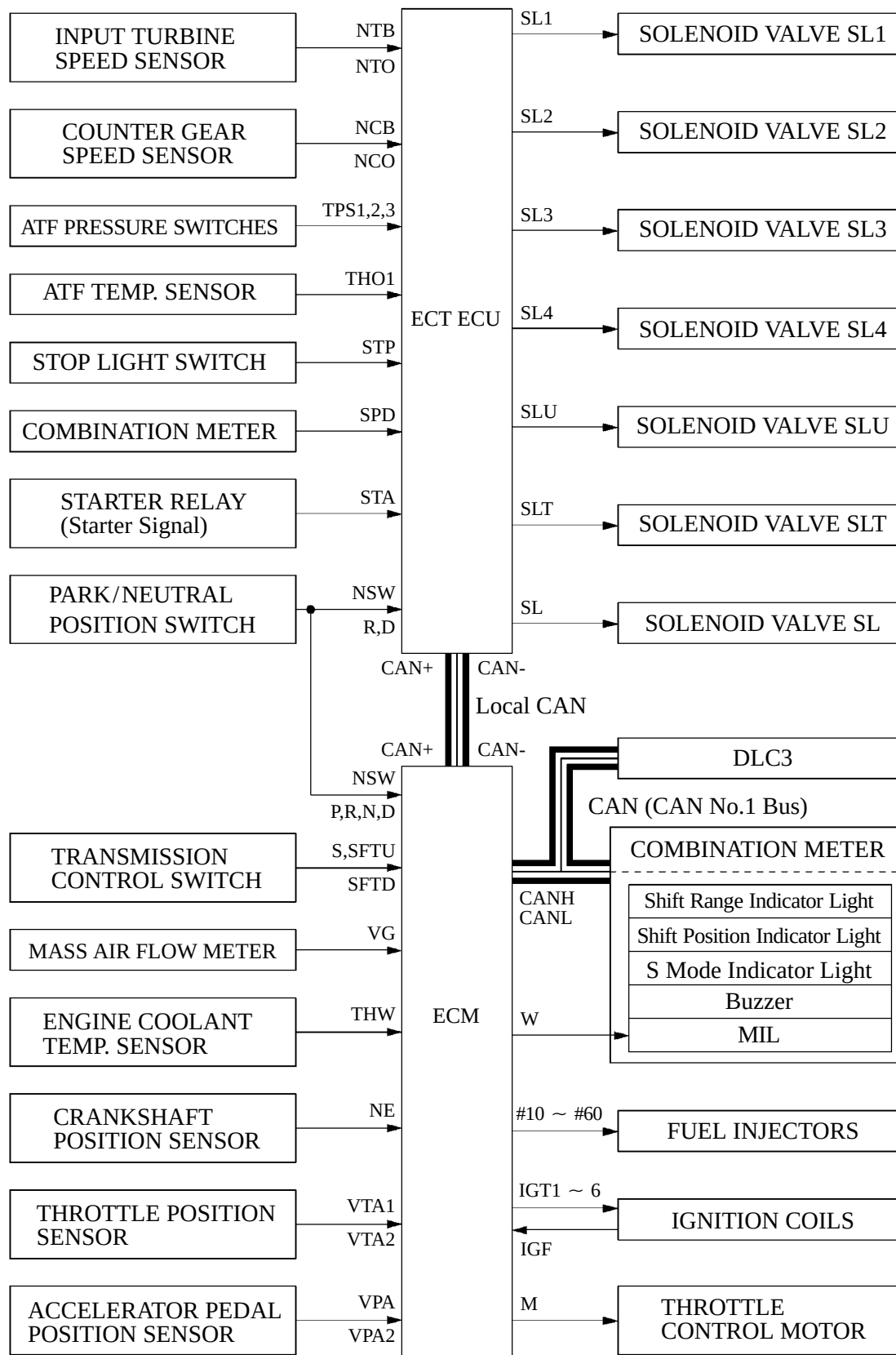
01YCH22Y

► Function of Solenoid Valve ◀

| Solenoid Valve | Type  | Function                                                                                                                                                          |
|----------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SL             | 3-way | <ul style="list-style-type: none"><li>• Switches the lock-up relay valve.</li><li>• Switches the B2 apply control valve and the reverse sequence valve.</li></ul> |

## 2. Construction

The configuration of the electronic control system in the U660E automatic transaxle is as shown in the following chart.





## ■ FEATURES OF 2GR-FE ENGINE

The 2GR-FE engine has achieved the following performance through the use of the items listed below.

- (1) High performance and reliability
- (2) Low noise and vibration
- (3) Lightweight and compact design
- (4) Good serviceability
- (5) Clean emission and fuel economy

| Item                      |                                                                                   | (1) | (2) | (3) | (4) | (5) |
|---------------------------|-----------------------------------------------------------------------------------|-----|-----|-----|-----|-----|
| Engine Proper             | A steel laminate type cylinder head gasket is used.                               | ○   |     |     |     |     |
|                           | An upright intake port is used.                                                   | ○   |     | ○   |     |     |
|                           | A taper squish shape is used for combustion chamber.                              | ○   |     |     |     | ○   |
|                           | A cylinder block made of aluminum alloy is used.                                  |     |     | ○   |     |     |
|                           | The skirt portion of the piston is applied with resin plating to reduce friction. | ○   | ○   |     |     | ○   |
|                           | An oil pan No.1 made of aluminum alloy is used.                                   |     | ○   | ○   |     |     |
| Valve Mechanism           | The Dual VVT-i (Variable Valve Timing-intelligent) system is used.                | ○   |     |     |     | ○   |
|                           | A hydraulic lash adjuster is used.                                                | ○   | ○   |     | ○   |     |
|                           | A timing chain and chain tensioner are used.                                      |     | ○   | ○   | ○   |     |
|                           | Roller rocker arms are used.                                                      | ○   |     |     |     | ○   |
| Lubrication System        | An oil filter with a replaceable element is used.                                 |     |     |     | ○   |     |
| Cooling System            | The engine coolant is used the TOYOTA Genuine SLLC (Super Long Life Coolant).     |     |     |     | ○   |     |
| Intake and Exhaust System | The link-less type throttle body is used.                                         |     |     | ○   | ○   |     |
|                           | The intake air chamber made of plastic is used.                                   |     |     | ○   |     |     |
|                           | A stainless steel exhaust manifold is used.                                       |     |     | ○   |     | ○   |
|                           | A ceramic type TWC (Three-Way Catalytic Converter) is used.                       |     |     |     |     | ○   |
| Fuel System               | The fuel delivery pipe made of plastic is used.                                   |     |     | ○   |     |     |
|                           | A compact 12-hole type injector is used.                                          | ○   |     |     |     | ○   |
|                           | Quick connectors are used to connect the fuel hose with the fuel pipe.            |     |     |     | ○   |     |
|                           | The quick turn construction fuel cap is used.                                     |     |     |     | ○   |     |
| Ignition System           | The DIS (Direct Ignition System) makes ignition timing adjustment unnecessary.    | ○   |     |     | ○   | ○   |
|                           | The long-reach type spark plugs are used.                                         | ○   |     |     |     |     |
| Charging System           | A segment conductor type generator is used.                                       | ○   |     | ○   |     |     |
|                           | A generator pulley with a clutch is used.                                         |     |     |     |     | ○   |
| Starting System           | The PS (Planetary reduction-Segment conductor motor) type starter is used.        |     |     | ○   |     |     |

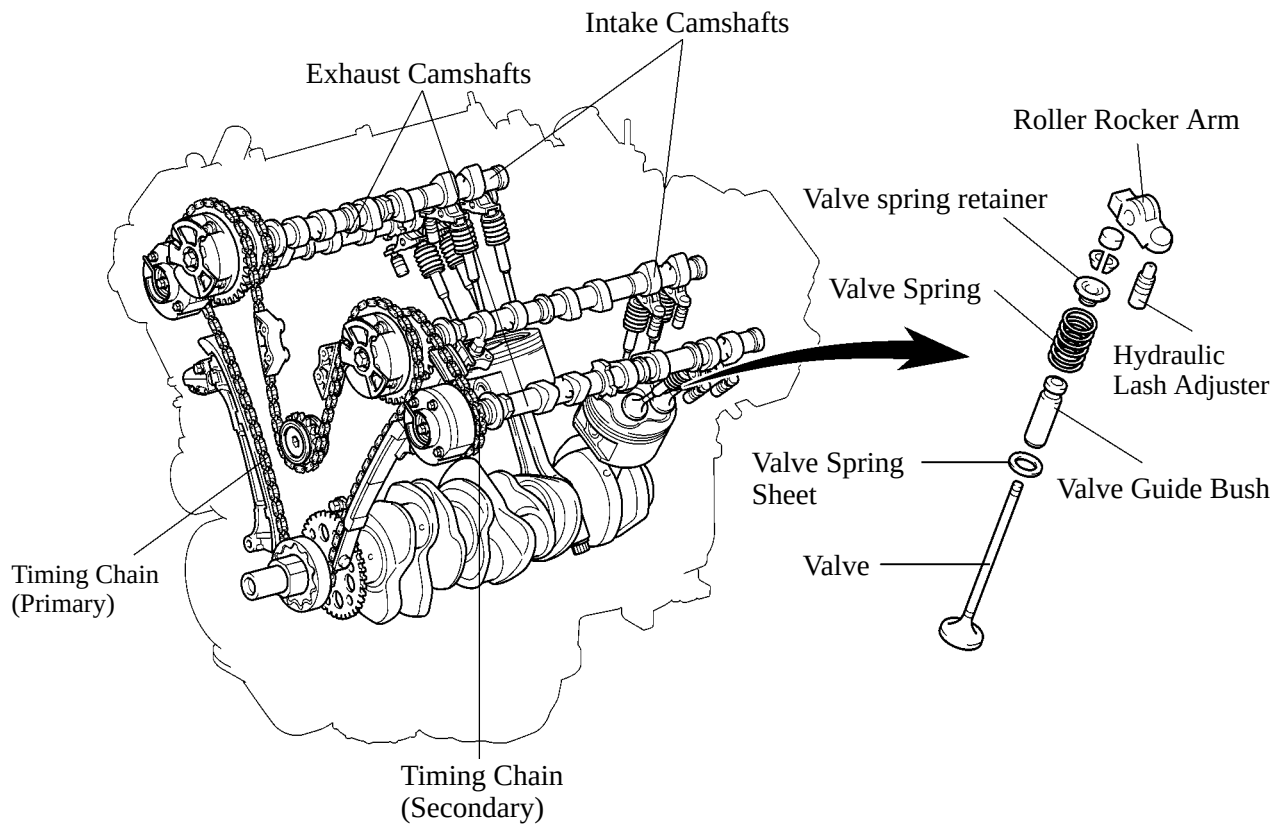
(Continued)

| Item                         |                                                                      | (1) | (2) | (3) | (4) | (5) |
|------------------------------|----------------------------------------------------------------------|-----|-----|-----|-----|-----|
| Engine Mount                 | An active control engine mount is used.                              |     | ○   |     |     |     |
| Serpentine Belt Drive System | A serpentine belt drive system is used.                              |     |     | ○   | ○   |     |
| Engine Control System        | The MRE (Magnetic Resistance Element) type VVT sensors are used.     | ○   |     |     |     |     |
|                              | The ETCS-i (Electronic Throttle Control System-intelligent) is used. | ○   |     |     |     | ○   |
|                              | The ACIS (Acoustic Control Induction System) is used.                | ○   |     |     |     | ○   |
|                              | The cranking holding function is used.                               | ○   |     |     |     |     |
|                              | The air intake control system is used.                               | ○   | ○   |     |     |     |
|                              | Evaporative emission control system is used.                         |     |     |     |     | ○   |

## ■ VALVE MECHANISM

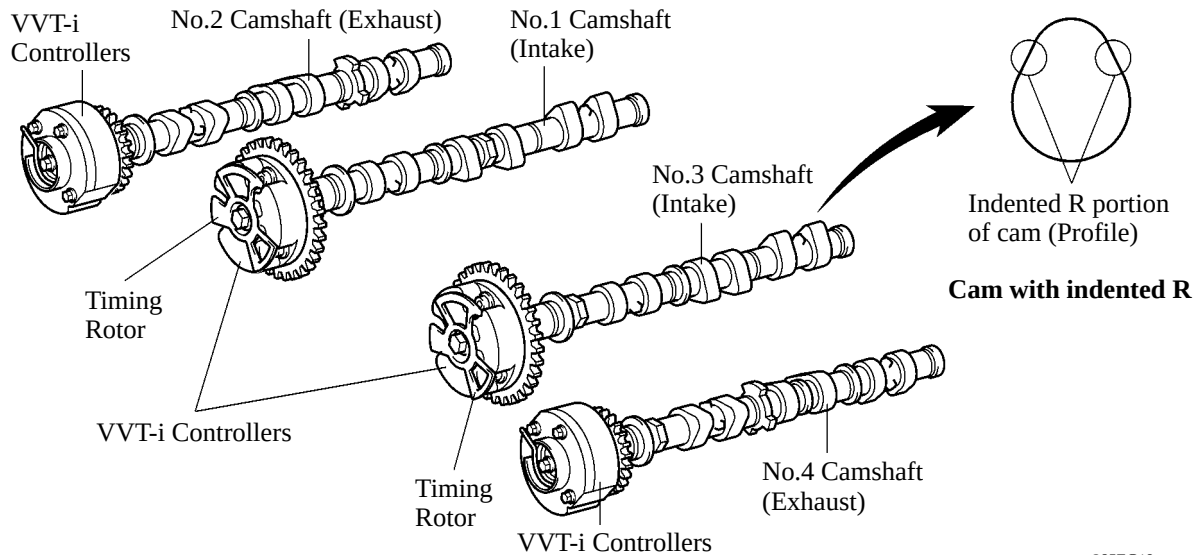
### 1. General

- Each cylinder of this engine has 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency is increased due to the larger total port areas.
- This engine uses roller rocker arms with built-in needle bearings. This reduces the friction that occurs between the cams and the areas (roller rocker arms) that push the valves down, thus improving fuel economy.
- A hydraulic lash adjuster, which maintains a constant zero valve clearance through the use of oil pressure and spring force, is used.
- The intake camshafts are driven by the crankshaft via the primary timing chain. The exhaust camshafts are driven by the intake camshaft of the respective bank via the secondary timing chain.
- This engine uses a dual VVT-i (Variable Valve Timing-intelligent) system, which controls the intake and exhaust camshafts to provide optimal valve timing according to driving conditions. With this adoption, lower fuel consumption, higher engine performance, and fewer exhaust emissions have been achieved. For details of dual VVT-i control, refer to page EG-57.



## 2. Camshaft

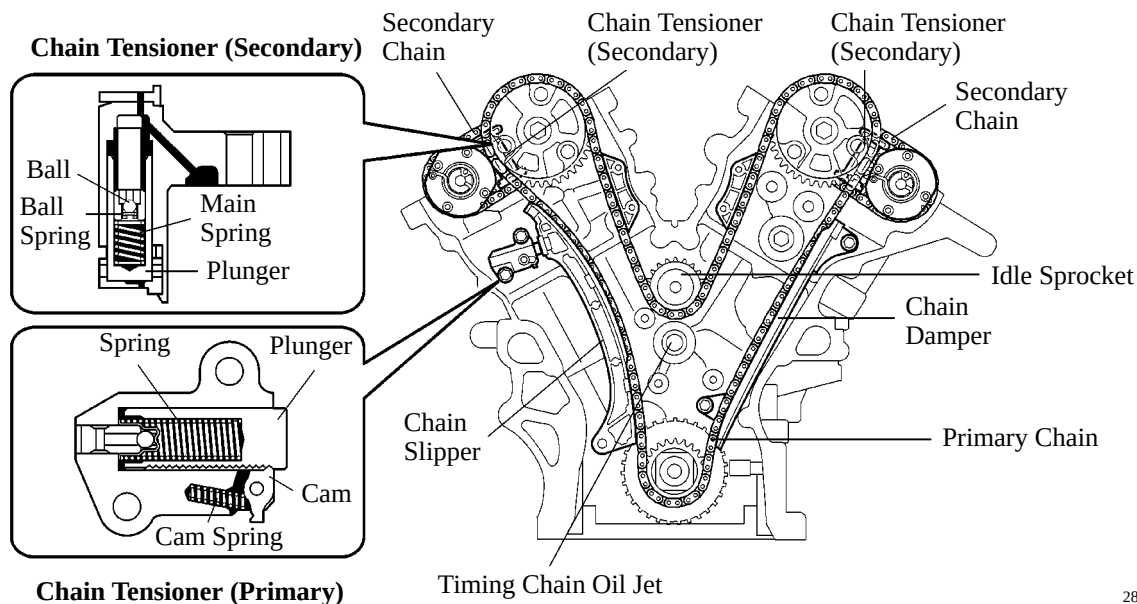
- The camshafts are made of cast iron alloy.
- An oil passage is provided on the intake and exhaust camshaft in order to supply engine oil to the VVT-i system.
- A VVT-i controller has been installed on the front of the intake and exhaust camshaft to vary the timing of the intake and exhaust valves.
- Together with the use of the roller rocker arm, the cam profile has been designed with an indented R (radius). This results in increased valve lift when the valve begins to open and finishes closing, helping to achieve enhanced output performance.



285EG19

## 3. Timing Chain and Chain Tensioner

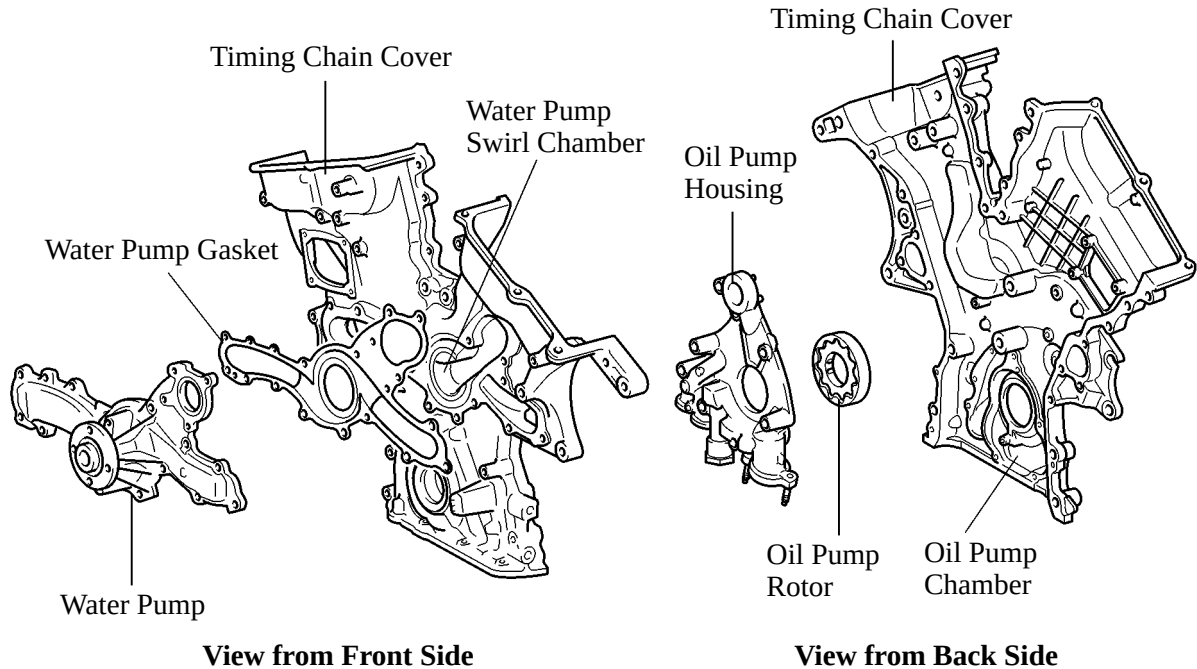
- Both the primary and secondary timing chains use roller chains with a pitch of 9.525mm (0.375 in.).
- The timing chain is lubricated by an oil jet.
- The primary chain uses one timing chain tensioner and each of the secondary chains for the right and left banks uses one timing chain tensioner.
- Both the primary and secondary chain tensioners use a spring and oil pressure to maintain proper chain tension at all times. They suppress noise generated by the timing chains.
- The chain tensioner for the primary chain is the ratchet type with a non-return mechanism.



285EG20

#### 4. Timing Chain Cover

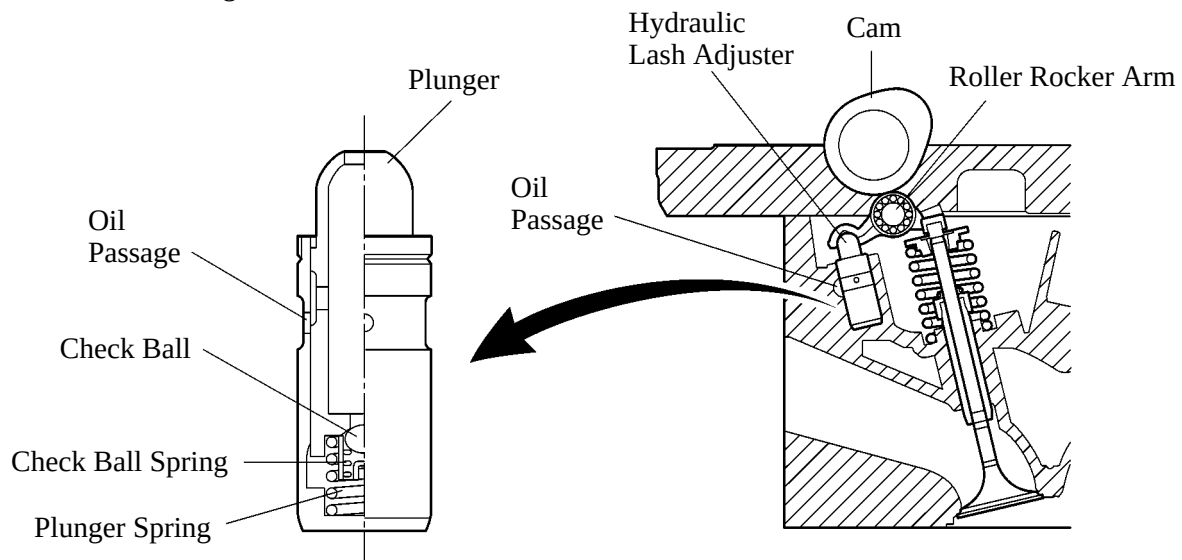
The timing chain cover has an integrated construction consisting of the cooling system (water pump and water passage) and the lubrication system (oil pump and oil passage). Thus, the number of parts has been reduced to reduce weight.



285EG21

#### 5. Hydraulic Lash Adjuster

- The hydraulic lash adjuster, which is located at the fulcrum of the roller rocker arm, consists primarily of a plunger, plunger spring, check ball, and check ball spring.
- The engine oil that is supplied by the cylinder head and the built-in spring actuate the hydraulic lash adjuster. The oil pressure and the spring force that act on the plunger push the roller rocker arm against the cam, in order to adjust the valve clearance that is created during the opening and closing of the valve. As a result, engine noise is reduced.



285EG22

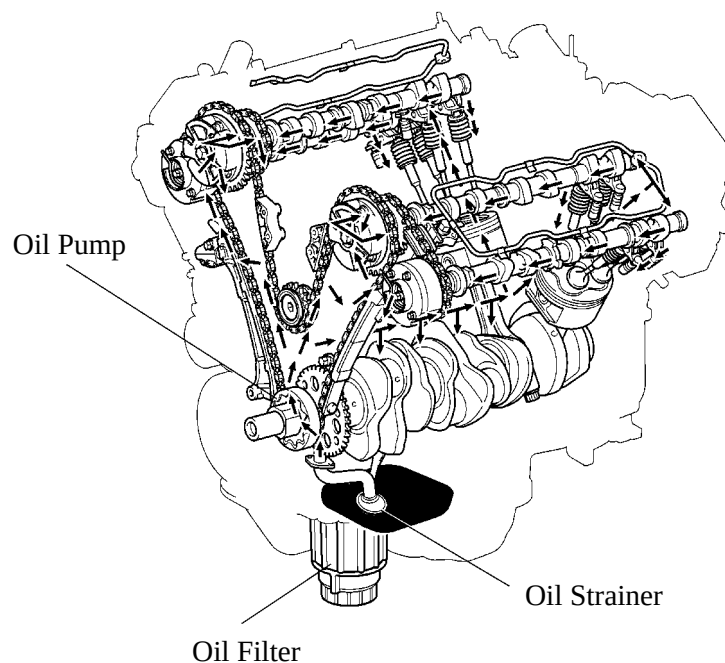
#### Service Tip

Valve clearance adjustment is not necessary because a hydraulic lash adjuster is used in this model.

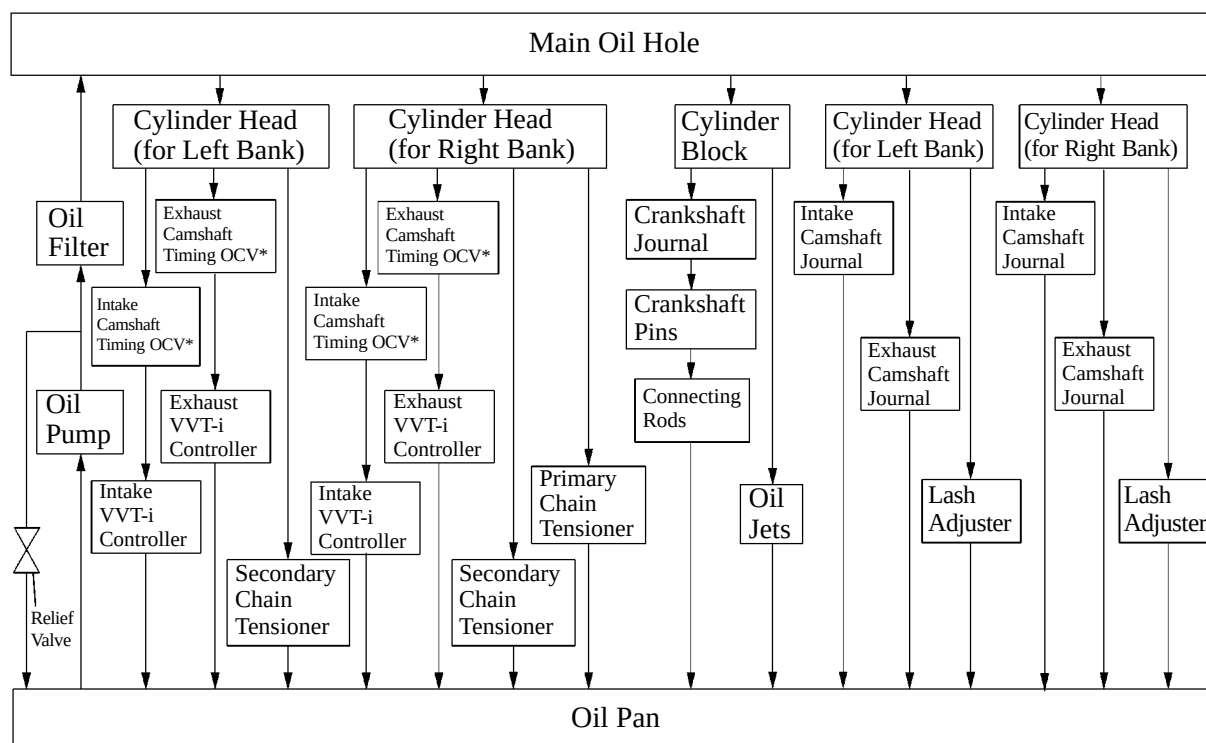
## ■ LUBRICATION SYSTEM

### 1. General

- The lubrication circuit is fully pressurized and all oil passes through an oil filter.
- A cycloid rotor type oil pump is used.



285EG23

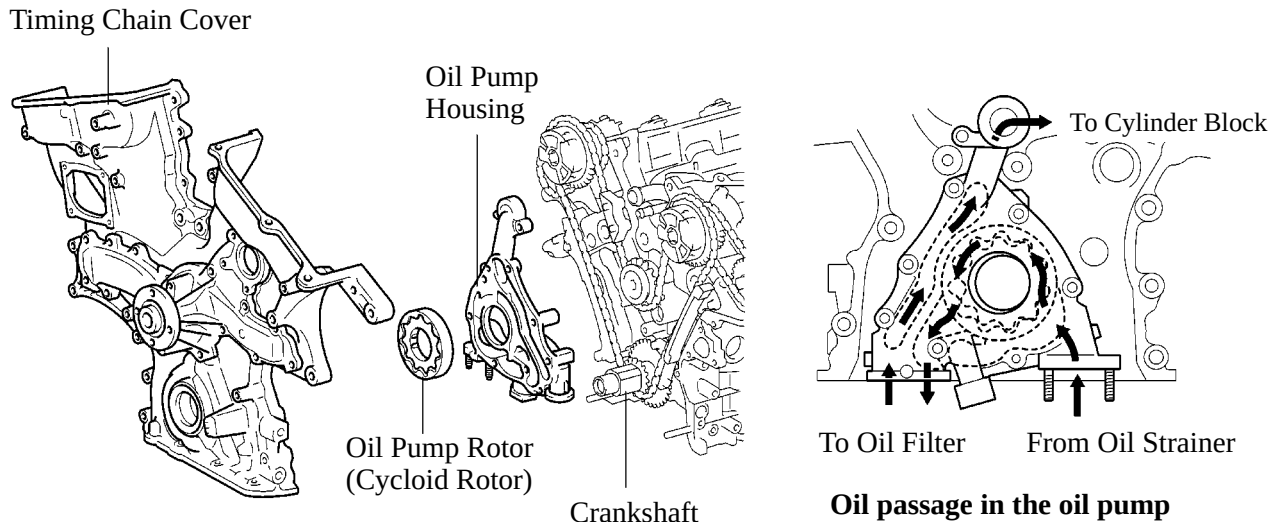


\*: Oil Control Valve

285EG77

## 2. Oil Pump

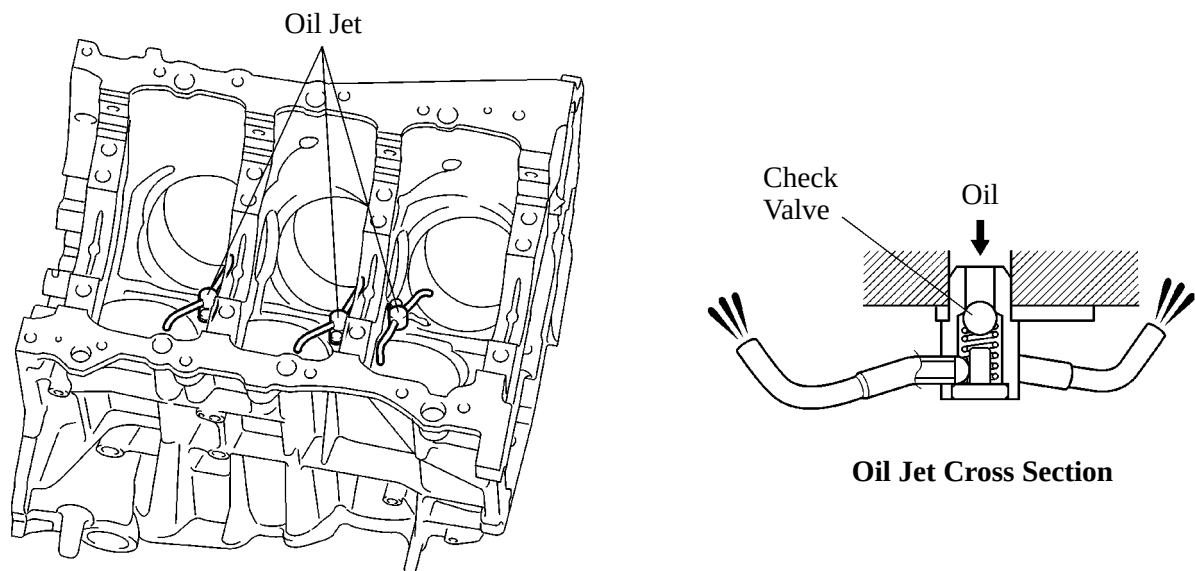
- A compact cycloid rotor type oil pump directly driven by the crankshaft is used.
- This oil pump uses an internal relief method which circulates relief oil to the suction passage in the oil pump. This aims to minimize oil level change in the oil pan, reduce friction, and reduce air mixing rate in the oil.



285EG24

## 3. Oil Jet

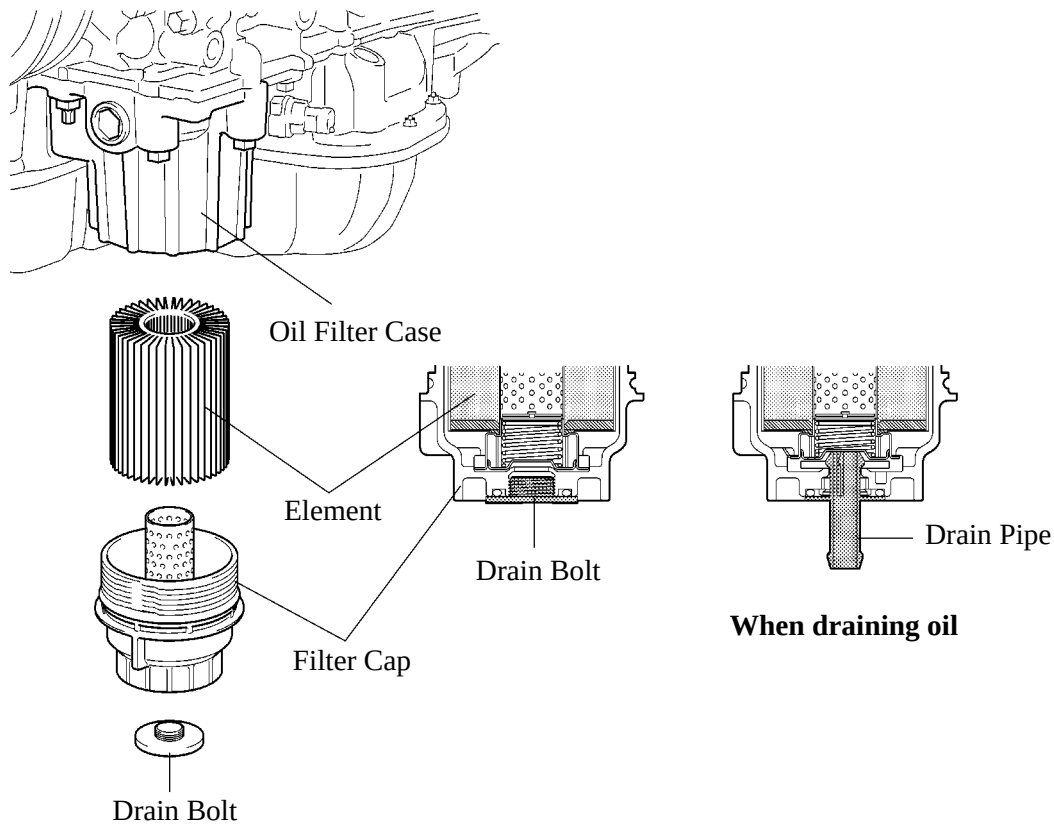
- Oil jets for cooling and lubricating the pistons have been provided in the cylinder block, in the center of the right and left banks.
- These oil jets contain a check valve to prevent oil from being fed when the oil pressure is low. This prevents the overall oil pressure in the engine from dropping.



285EG25

#### 4. Oil Filter

- A newly developed oil filter with a replaceable element is used. The element uses a high-performance filter paper to improve filtration performance. It is also combustible for environmental protection.
- An aluminum alloy filter cap is used to extend its life.
- This oil filter has a structure which can drain the oil remaining in the oil filter. This prevents oil from spattering when replacing the element and allows the technician to work without touching hot oil.



285EG26

#### Service Tip

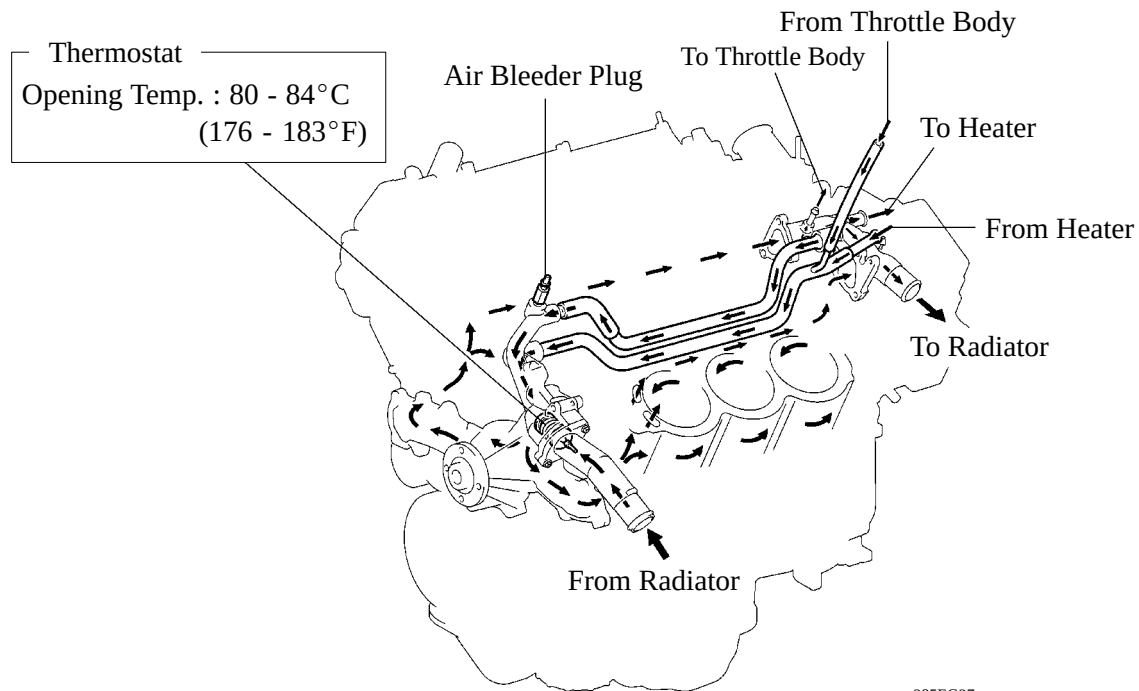
- The oil in the oil filter can be drained by removing the drain bolt and inserting the drain pipe supplied with the element into the oil filter. For details, refer to the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).
- The engine oil maintenance interval for a model that has an oil filter with a replaceable element is the same as that for the conventional model.



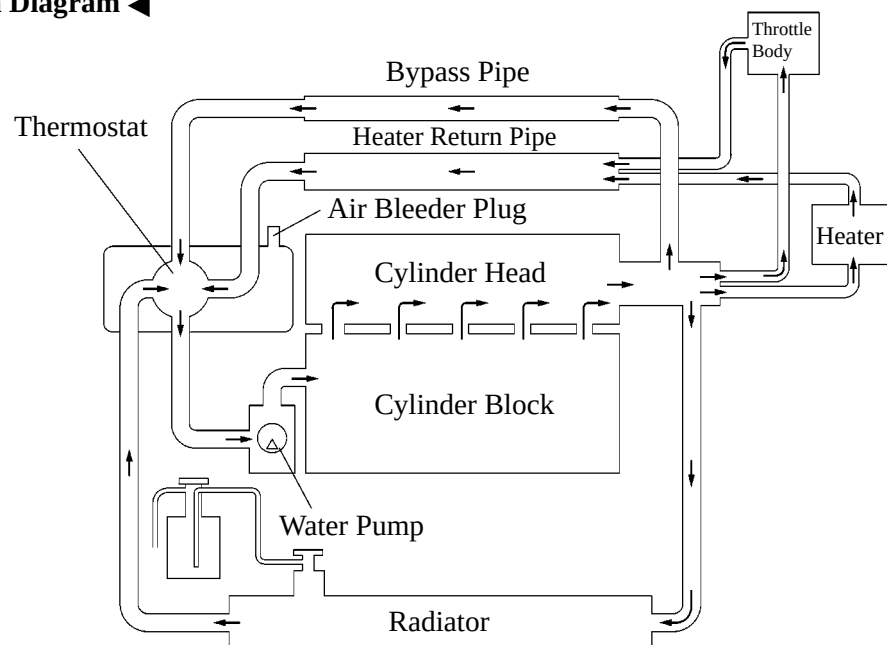
## ■ COOLING SYSTEM

### 1. General

- The cooling system is a pressurized forced circulation system with open air type reserve tank.
- A thermostat with a bypass valve is located on the water inlet housing to maintain suitable temperature distribution in the cooling system.
- A cooling fan control system in which the ECM optimally controls cooling fan speed is used. For details, see page EG-67.
- An air bleeder plug is provided on the water inlet assembly to improve the efficiency of changing the engine coolant. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).
- The engine coolant uses TOYOTA genuine SLLC (Super Long Life Coolant).

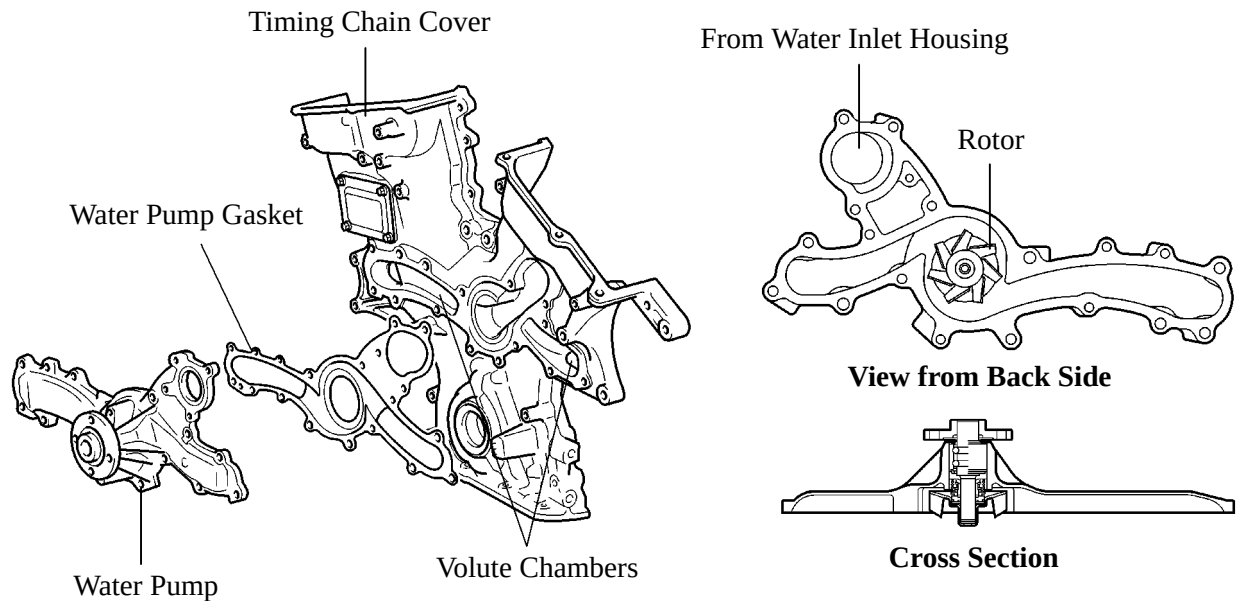


### ► System Diagram ◀



2. Water Pump

- The water pump has two volute chambers, and circulates coolant uniformly to the left and right banks of the cylinder block.
- A rust-resistant water pump rotor made of stainless steel is used.



285EG29

3. Engine Coolant

TOYOTA genuine SLLC (Super Long Life Coolant) is used. Maintenance interval is as shown in the table below:

| Type                  |            | TOYOTA Genuine SLLC or the Following* |
|-----------------------|------------|---------------------------------------|
| Maintenance Intervals | First Time | 100,000 miles (160,000 km)            |
|                       | Subsequent | Every 50,000 miles (80,000 km)        |
| Color                 |            | Pink                                  |

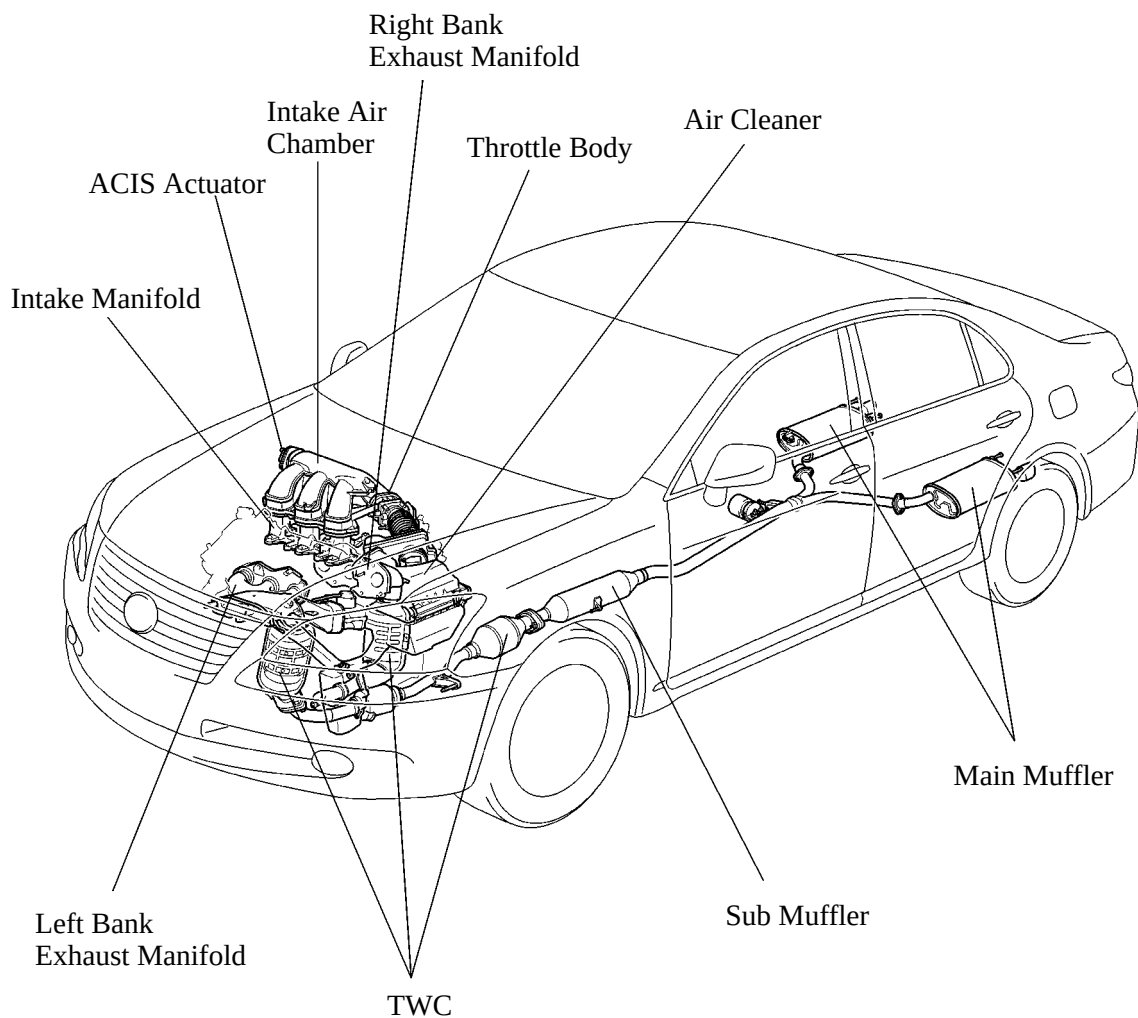
\*: Similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology. (Coolant with hybrid organic acid technology consists of the combination of low phosphates and organic acids.)

- SLLC is pre-mixed (50 % coolant and 50 % deionized water), so no dilution is needed when adding or replacing SLLC in the vehicle.
- You can also apply the new maintenance interval (every 50,000 miles/80,000 km) to vehicles initially filled with LLC (red-colored), if you use SLLC (pink-colored) for the engine coolant change.

## ■ INTAKE AND EXHAUST SYSTEM

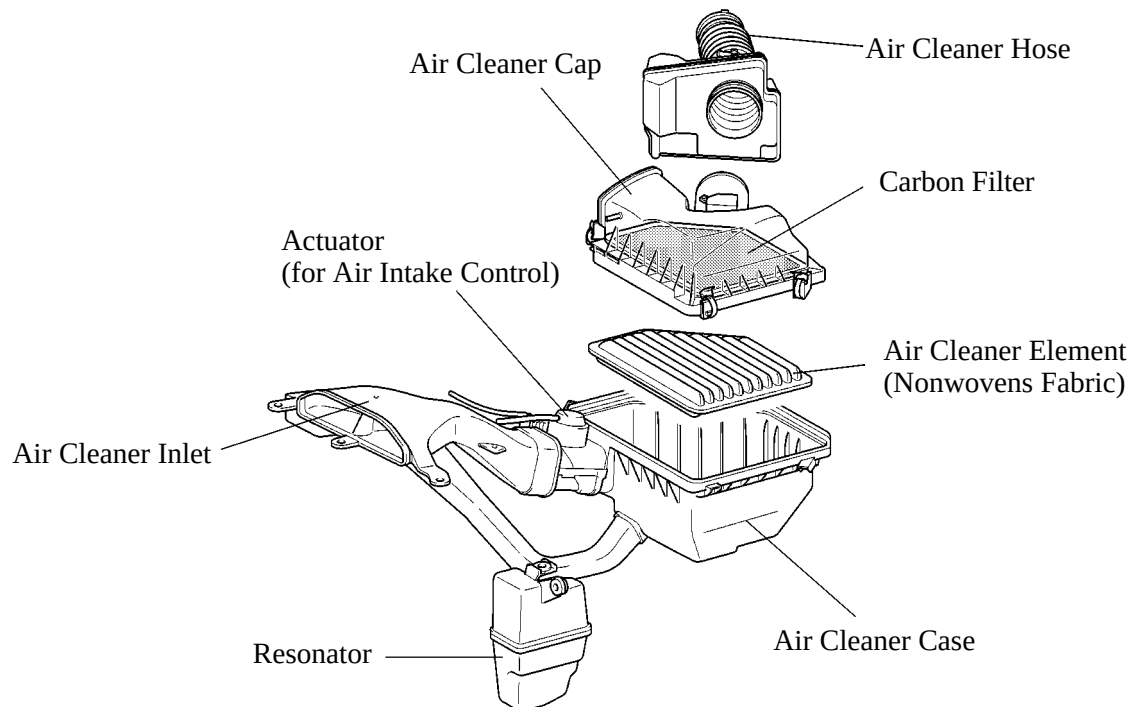
### 1. General

- The link-less type throttle body is used and it realizes excellent throttle control.
- The intake air chamber made of plastic is used.
- A stainless steel exhaust manifold is used for weight reduction.
- ETCS-i (Electronic Throttle Control System-intelligent) provides excellent throttle control. For details, see page EG-55.
- ACIS (Acoustic Control Induction System) has improved the engine performance. For details, see page EG-63.
- The air intake control system is used to reduce engine noise. For details, see page EG-65.



## 2. Air Cleaner

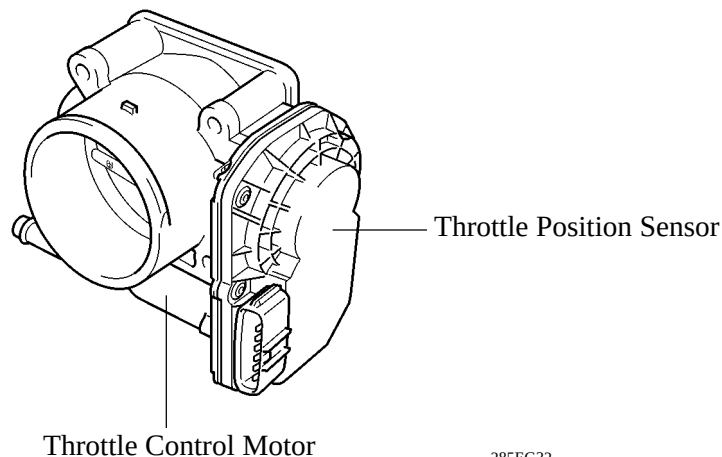
- A nonwoven, full-fabric type air cleaner element is used.
- A carbon filter, which adsorbs the HC that accumulates in the intake system when the engine is stopped, is used in the air cleaner case in order to reduce evaporative emissions. This filter is maintenance-free.
- Along with the use of the air intake control system, an air intake control valve is provided on the air cleaner case. For details, see page EG-65.
- Resonators have been provided to reduce the amount of intake air sound.



01YEG02Y

## 3. Throttle Body

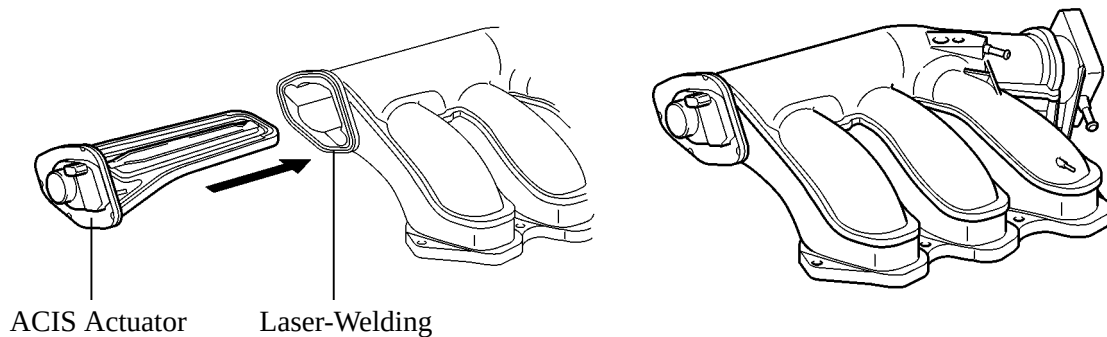
- A link-less type throttle body in which the throttle position sensor and the throttle control motor are integrated is used. It realizes excellent throttle valve control. For details, see page EG-50.
- In the throttle control motor, a DC motor with excellent response and minimal power consumption is used. 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 throttle valve angle.



285EG32

#### 4. Intake Air Chamber

- The intake air chamber is made of plastic to realize lightweight.
- The air intake chamber consists of upper and lower section and contains an intake air control valve. This valve is activated by ACIS (Acoustic Control Induction System) and is used to alter the intake pipe length to improve the engine performance in all speed range. For details, see page EG-63.
- The ACIS actuator has used an electric actuator and is laser-welded onto the intake air chamber. Many of the components are made of plastic for weight reduction.



285EG33

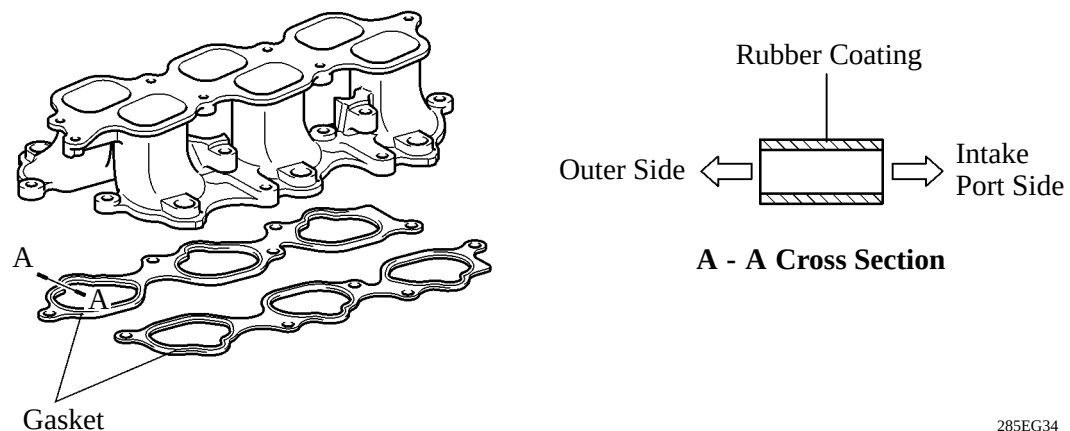
#### — REFERENCE —

##### *Laser-Welding:*

*In laser-welding, a laser-absorbing material (for the intake air chamber) is joined to a laser-transmitting material (for the ACIS actuator). Laser beams are then irradiated from the laser-transmitting side. The beams penetrate the laser-transmitting material to heat and melt the surface of the laser-absorbing material. Then, the heat of the laser-absorbing material melts the laser-transmitting material and causes both materials to become welded.*

#### 5. Intake Manifold

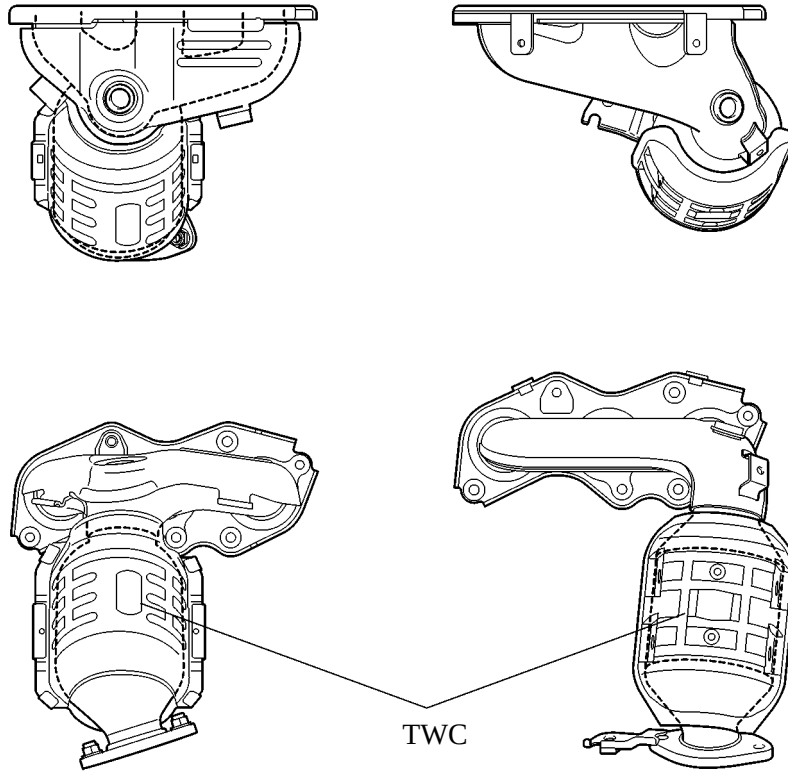
- Light weight aluminum alloy is used for the intake manifold.
- The intake manifold gaskets has rubber coating applied onto surface, and provide superior durability.



285EG34

## 6. Exhaust Manifold

- A stainless steel exhaust manifold with an integrated TWC (Three-Way Catalytic converter) is used for warm-up of the TWC and for weight reduction.
- A ceramic type TWC is used. This TWC is incorporated on each of the right and left banks.
- This TWC enables to improve exhaust emissions by optimizing the cells density and the wall thickness.



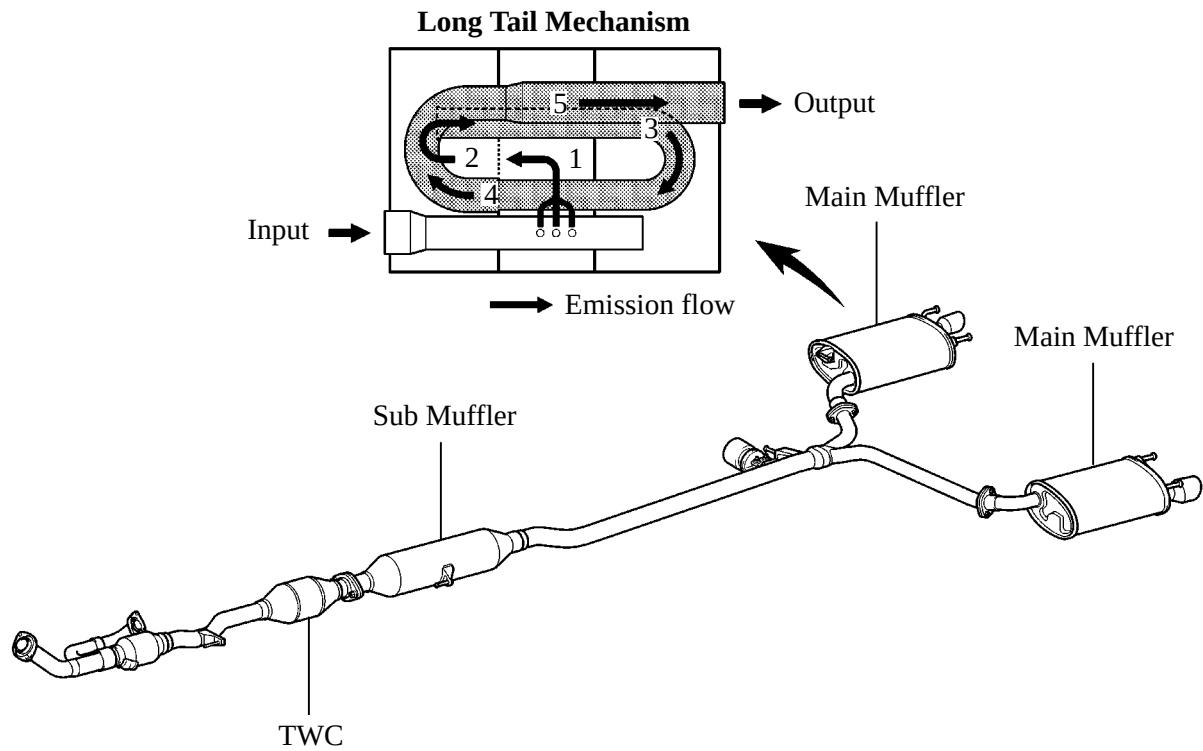
**Right Bank  
Exhaust Manifold**

**Left Bank  
Exhaust Manifold**

01YEG18TE

## 7. Exhaust Pipe

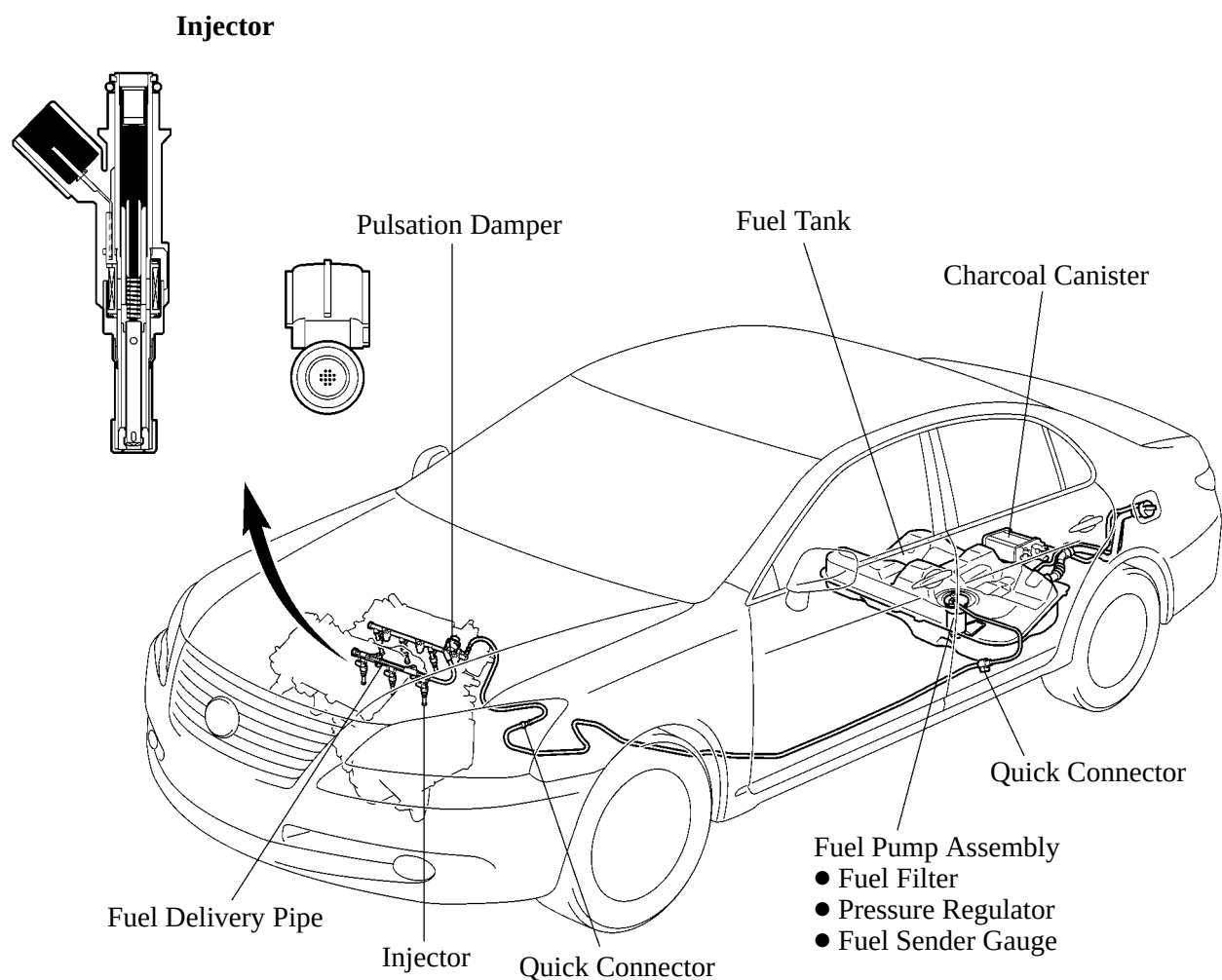
- The exhaust pipe is made of stainless steel for improved rust resistance.
- A ceramic type TWC is used.
- A dual main muffler is used to ensure engine performance and reduce exhaust noise.
- A long tail mechanism is used in the main muffler to aim at reducing exhaust noise while the engine is running in the low speed range.



## ■ FUEL SYSTEM

### 1. General

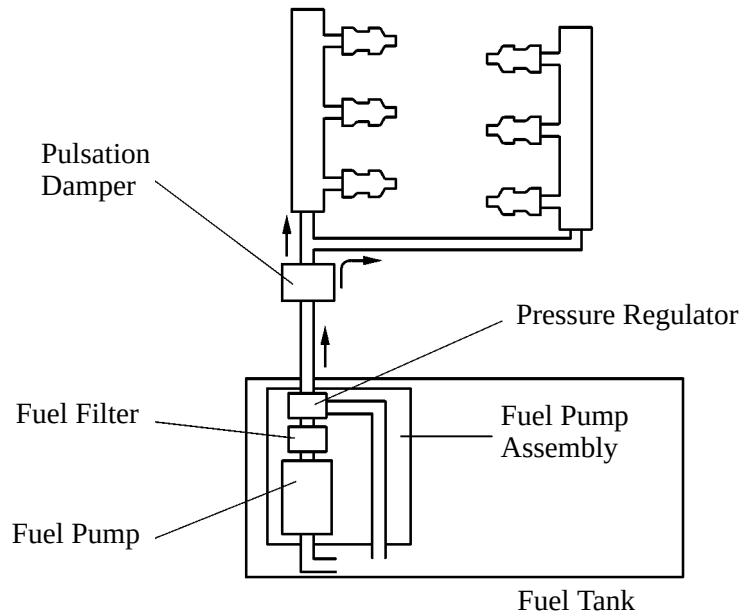
- The fuel returnless system is used to reduce evaporative emissions.
- A fuel cut control is used to stop the fuel pump when the SRS airbag is deployed in a frontal or side collision. For details, see page EG-66.
- The fuel delivery pipe made of plastic is used.
- A quick connector is used to connect the fuel pipe with the fuel hose for excellent serviceability.
- A compact 12-hole type injector is used to increase atomization of the fuel.
- A compact fuel pump in which a fuel filter, pressure regulator, and fuel sender gauge is integrated in the fuel pump assembly is used.
- A quick turn construction fuel cap is used.
- The ORVR (On-Board Refueling Vapor Recovery) system is used. For details, see page xx.





## 2. Fuel Returnless System

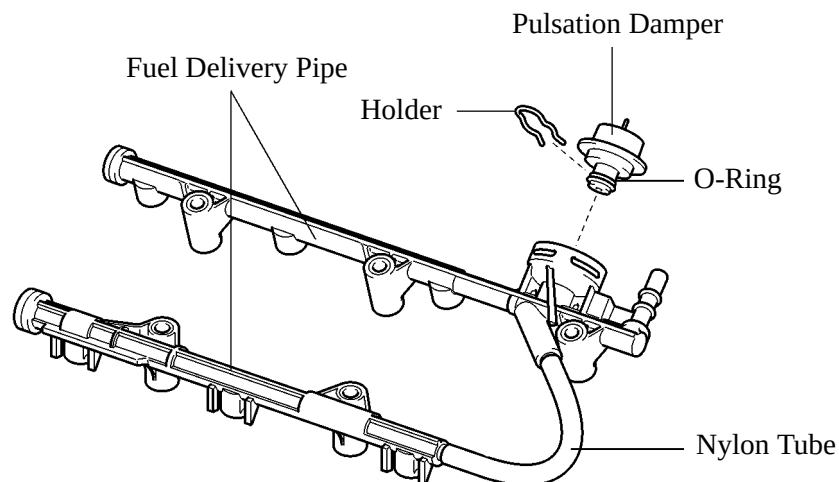
This system is used to reduce the evaporative emission. As shown below, integrating the fuel filter, pressure regulator, and fuel sender gauge with fuel pump assembly, it possible to discontinue the return of fuel from the engine area and prevent temperature rise inside the fuel tank.



208EG117

## 3. Fuel Delivery Pipe

- The fuel delivery pipe made of plastic is used to realize lightweight.
- The right and left fuel delivery pipes are connected by a nylon tube.
- The pulsation damper is sealed with an O-ring and secured with a holder.



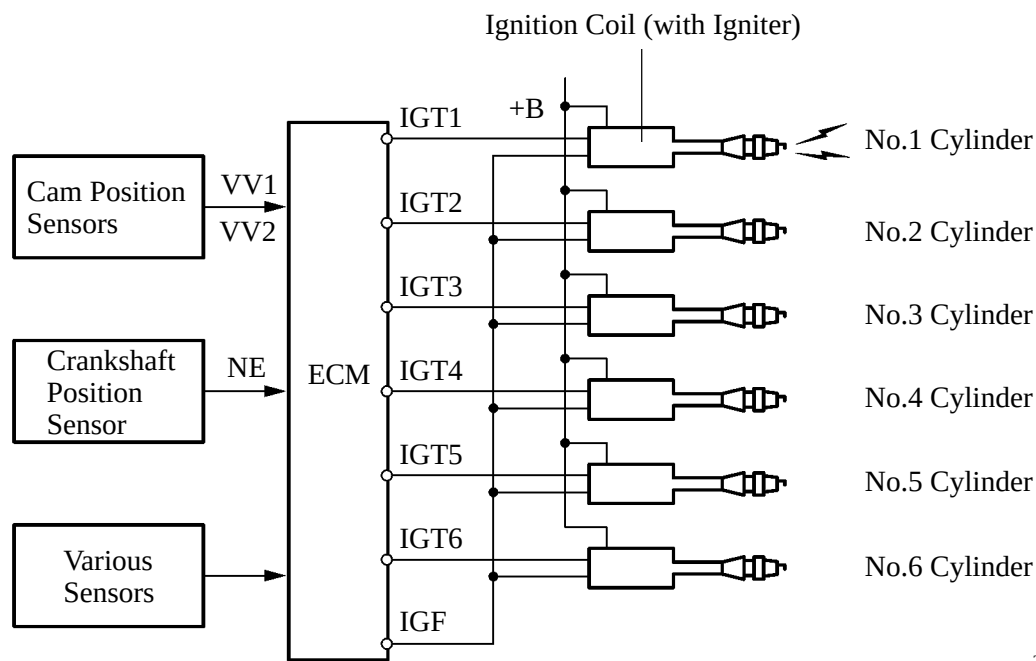
285EG38

## ■ IGNITION SYSTEM

### 1. General

A DIS (Direct Ignition System) is used. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor.

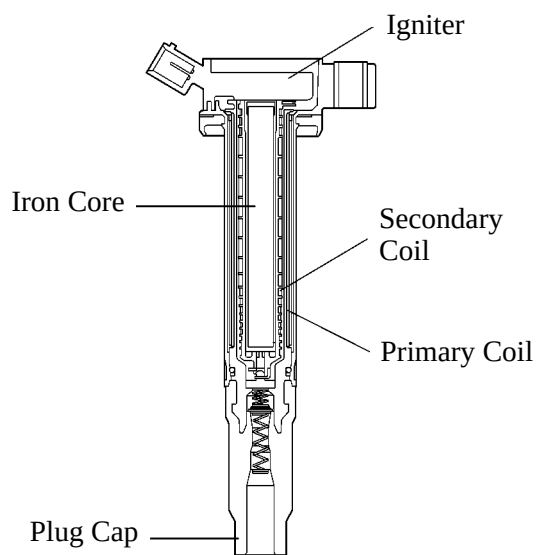
The DIS is an independent ignition system which has one ignition coil (with igniter) for each cylinder.



238EG68

### 2. Ignition Coil

The DIS provides 6 ignition coils, one for each cylinder. The spark plug caps, which provide contact to spark plugs, are integrated with an ignition coil. Also, an igniter is enclosed to simplify the system.

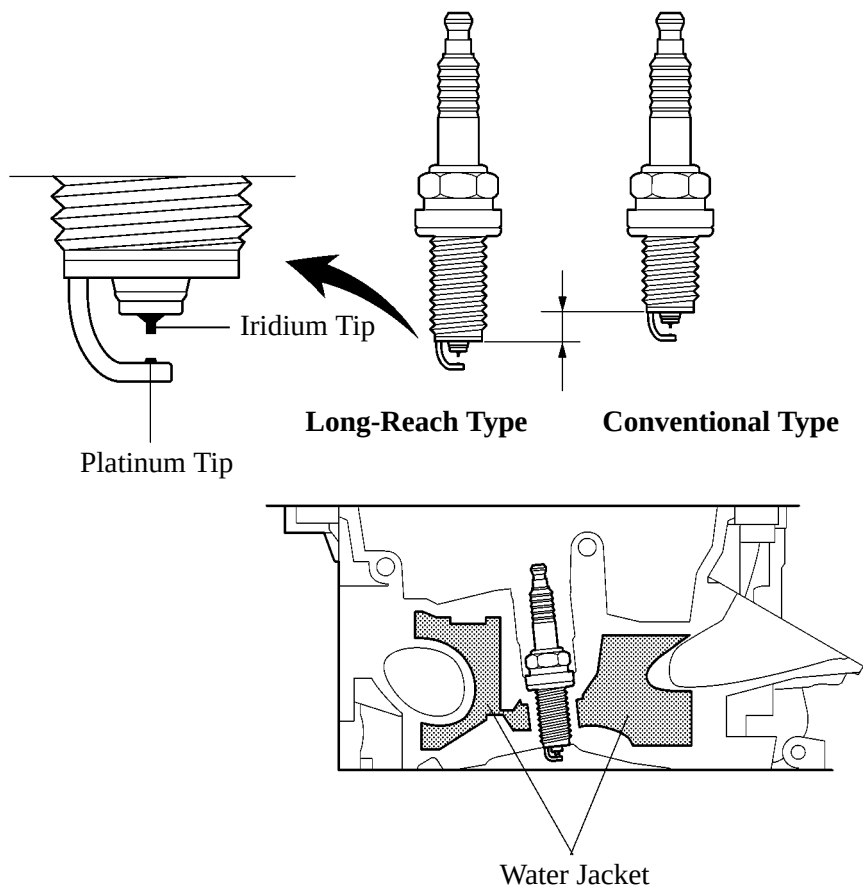


**Ignition Coil Cross Section**

285EG39

### 3. Spark Plug

- Long-reach type spark plugs are used. This type of spark plugs allows the area of the cylinder head to receive the spark plugs to be made thick. Thus, the water jacket can be extended near the combustion chamber, which contributes to cooling performance.
- Iridium-tipped spark plugs are used to achieve a 120,000 miles (192,000 km) maintenance interval. By making the center electrode of iridium, the superior ignition performance as platinum-tipped spark plugs is achieved and durability has been increased.



285EG40

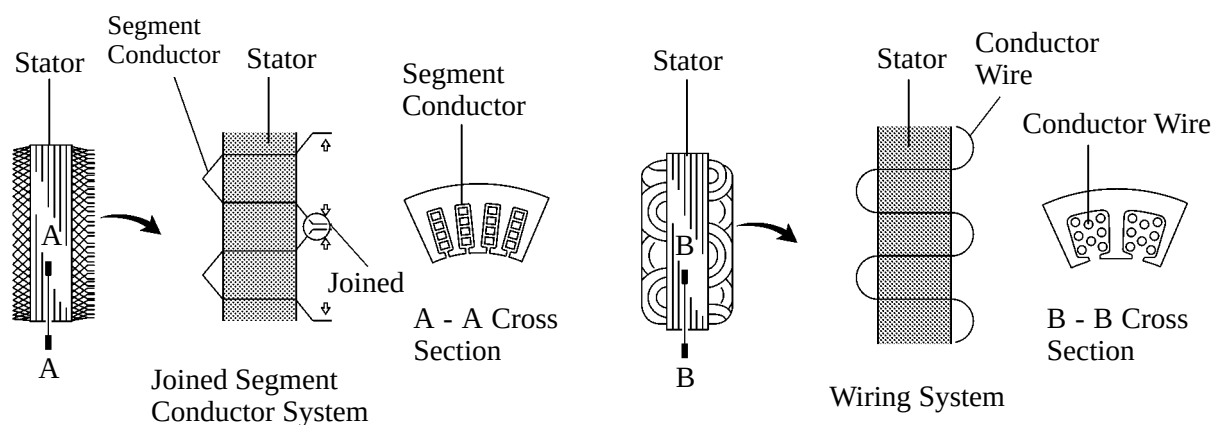
#### ► Specifications ◀

|          |                                   |
|----------|-----------------------------------|
| Maker    | DENSO                             |
| Type     | FK20HR11                          |
| Plug Gap | 1.0 - 1.1 mm (0.0394 - 0.043 in.) |

## ■ CHARGING SYSTEM

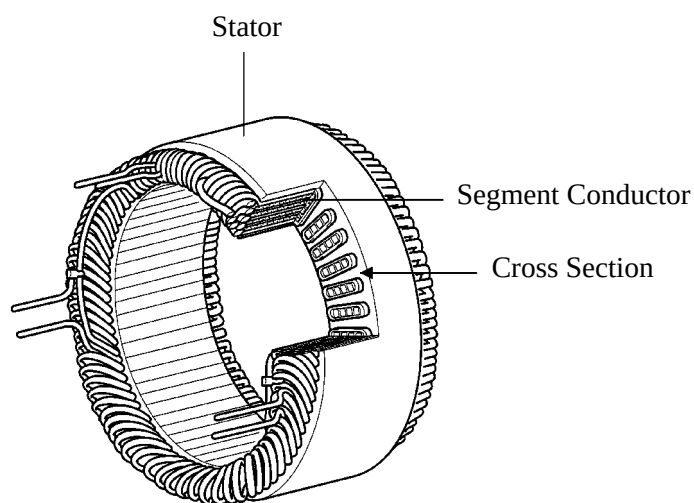
### 1. General

- Instead of the conventional type generator, a compact and lightweight segment conductor type generator is used. This type of generator generates a high amperage output in a highly efficient manner.
- This generator uses a joined segment conductor system, in which multiple segment conductors are welded together to the stator. Compared to the conventional winding system, the electrical resistance is reduced due to the shape of the segment conductors, and their arrangement helps to make the generator more compact.



**Segment Conductor Type Generator**

**Conventional Type Generator**

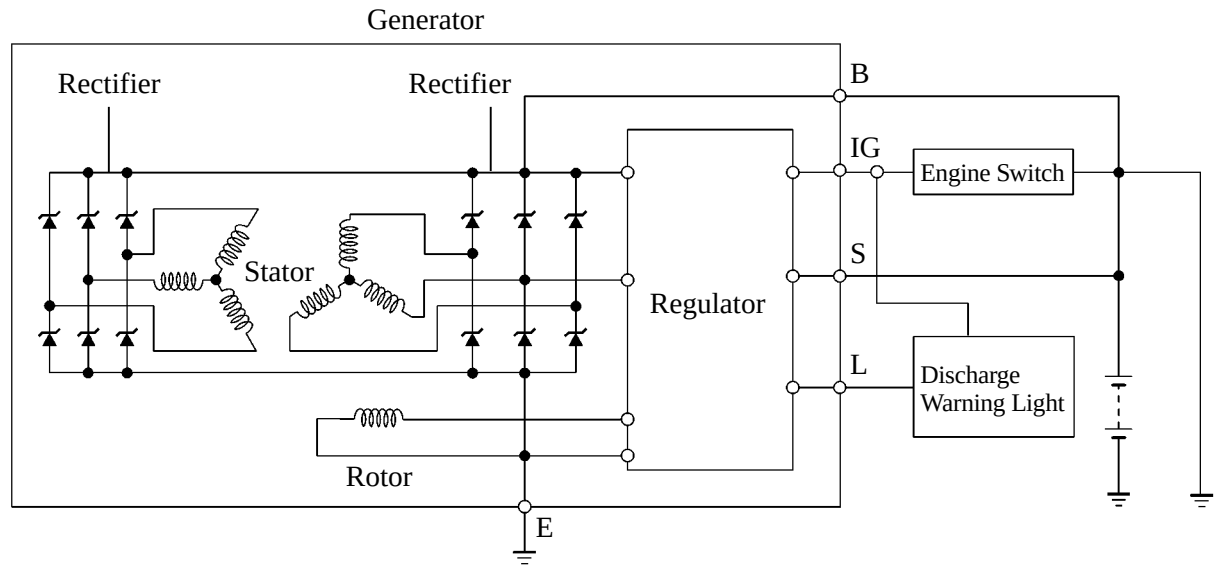


**Stator of Segment Conductor Type Generator**

### ► Specifications ◀

|               |       |
|---------------|-------|
| Type          | SC1   |
| Rated Voltage | 12 V  |
| Output Rated  | 130 A |

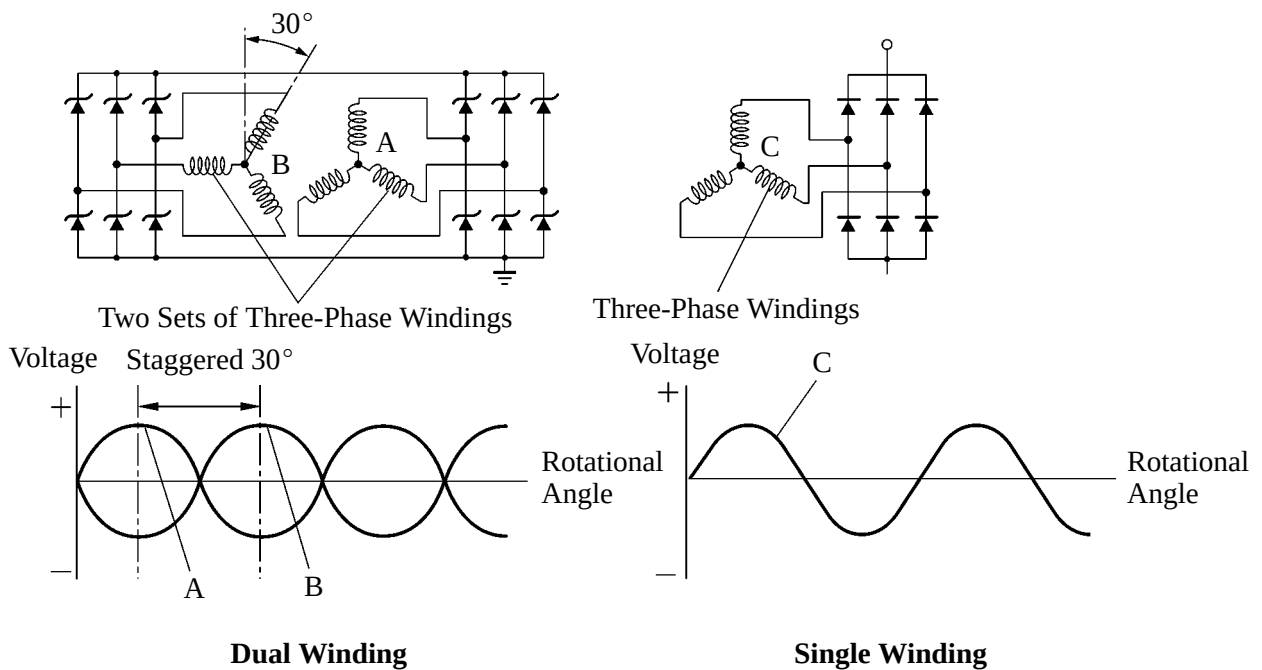
## ► Wiring Diagram ◀



279EG31

## 2. Dual Winding System

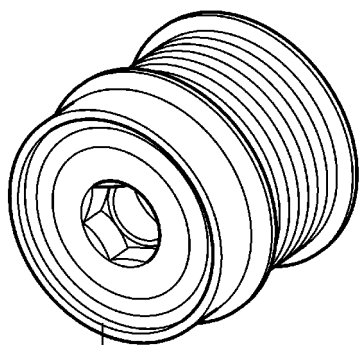
A dual winding system is used. This system consists of two sets of three-phase windings whose phases are staggered  $30^\circ$ . Because the generated waves from the respective windings cancel out each other, magnetic noise is reduced.



279EG32

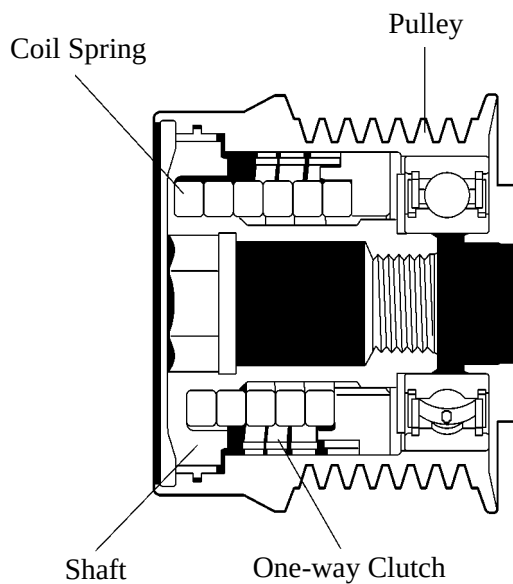
### 3. Generator Pulley

A one-way clutch is set to the generator pulley. Operation of the one-way clutch cancels generator pulley inertia and helps to prevent slipping of the V-ribbed belt. This realizes a low tension V-ribbed belt that achieves reduced friction.



Alternator Pulley

281EG12

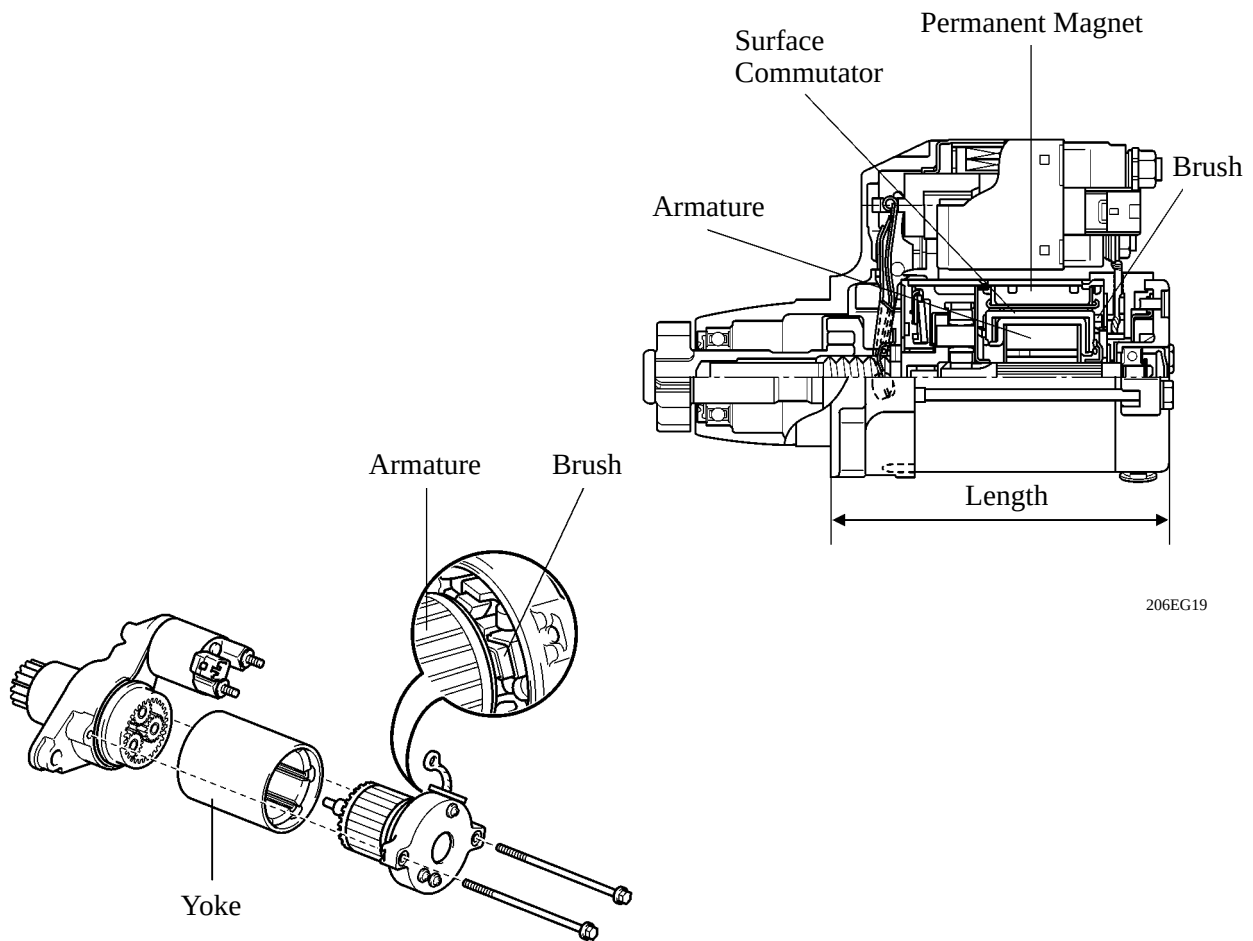


281EG13

## ■ STARTING SYSTEM

### 1. General

- A compact and lightweight PS (Planetary reduction-Segment conductor motor) starter is used on all models.
- The PS starter contains an armature that uses square-shaped conductors and its surface functions as a commutator, resulting in improved output torque and overall length reduction.
- In place of the field coil used in the conventional starter, the PS starter uses two types of permanent magnets: main magnets and interpolar magnets. The main magnets and interpolar magnets have been efficiently arranged to increase the magnetic flux and to shorten the length of the yoke.



206EG19

206EG18

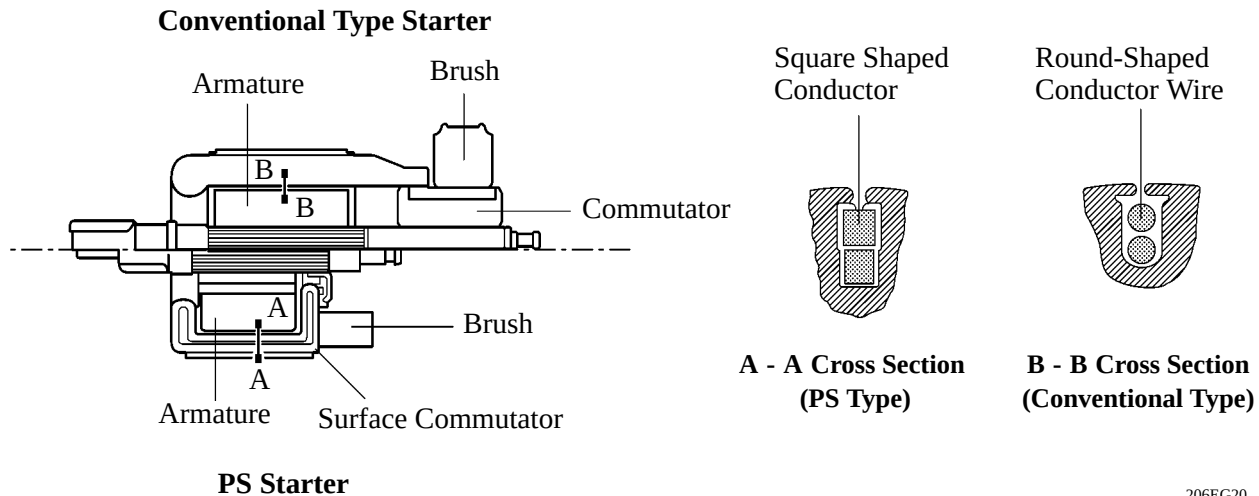
### ► Specifications ◀

|                    |                    |
|--------------------|--------------------|
| Type               | PS Starter (PS1.7) |
| Length             | 128 mm (5.04 in.)  |
| Weight             | 2950 g (6.50 lb)   |
| Rating Voltage     | 12 V               |
| Rating Output      | 1.7 kW             |
| Rotating Direction | Counterclockwise*  |

\*: Viewed from Pinion Side

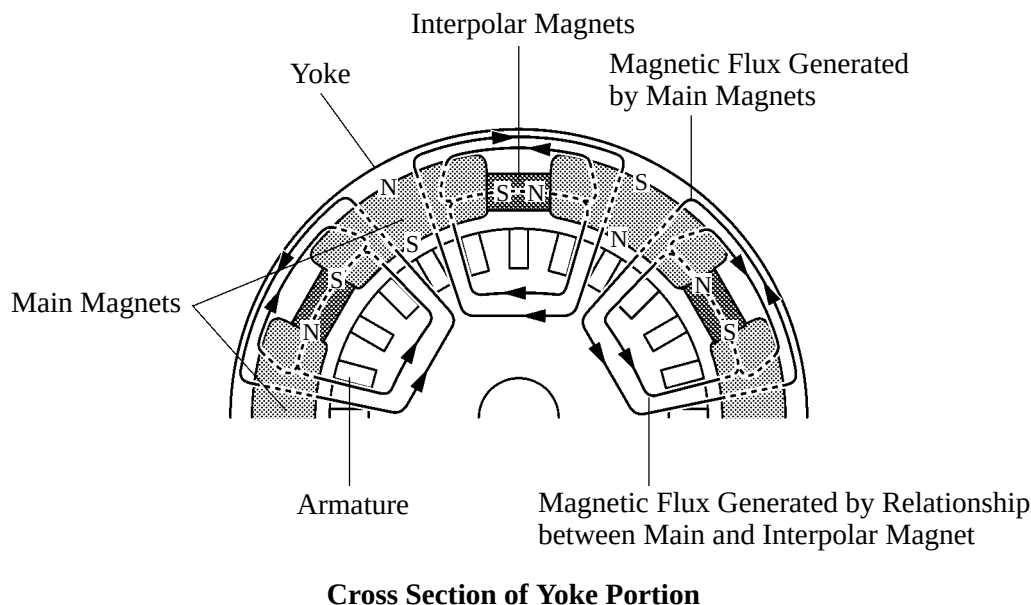
## 2. Construction

- Instead of the round-shaped conductor wires used in the conventional starter, the PS type starter uses square-shaped conductors. In this type of construction, square-shaped conductors can achieve the same conditions as those achieved by winding numerous round-shaped conductor wires, but without increasing the mass. As a result, the output torque is increased, and the armature coil is more compact.
- Because the surface of the square-shaped conductors that are used in the armature coil functions as a commutator, the overall length of the PS type starter has been shortened.



206EG20

- Instead of the field coils used in the conventional starter, the PS type starter uses two types of permanent magnets: the main magnets and the interpolar magnets. The main and interpolar magnets are arranged alternately inside the yoke. This allows the magnetic flux generated between the main and interpolar magnets to be added to the magnetic flux generated by the main magnets. In addition to increasing the amount of magnetic flux, this construction shortens the overall length of the yoke.



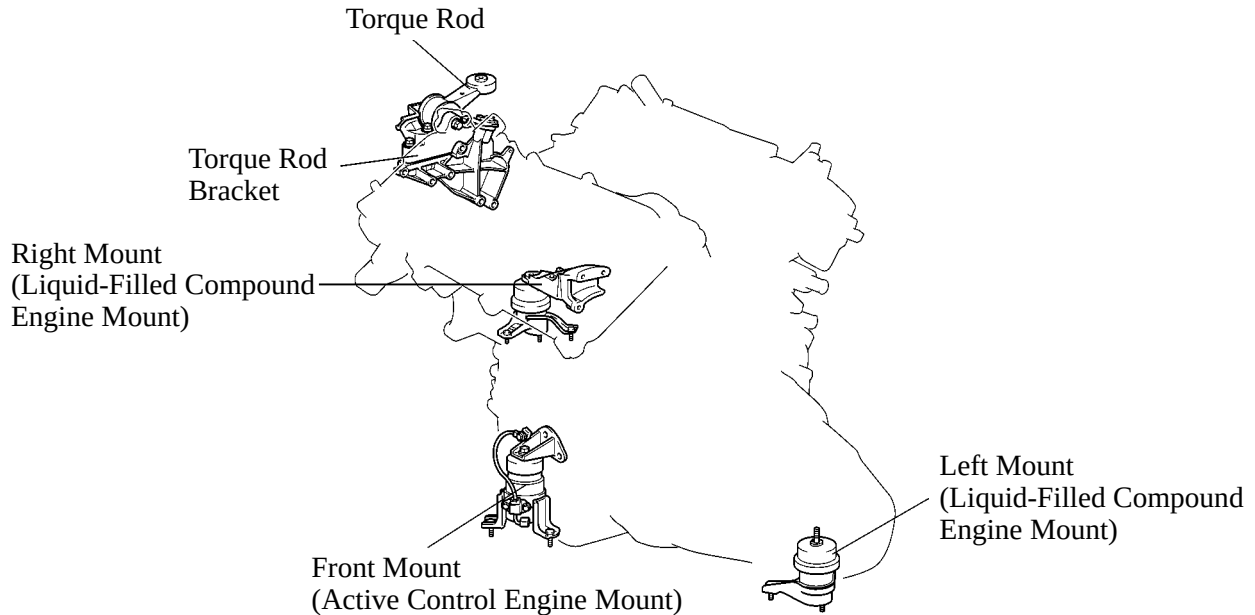
264EG14



## ENGINE MOUNT

### 1. General

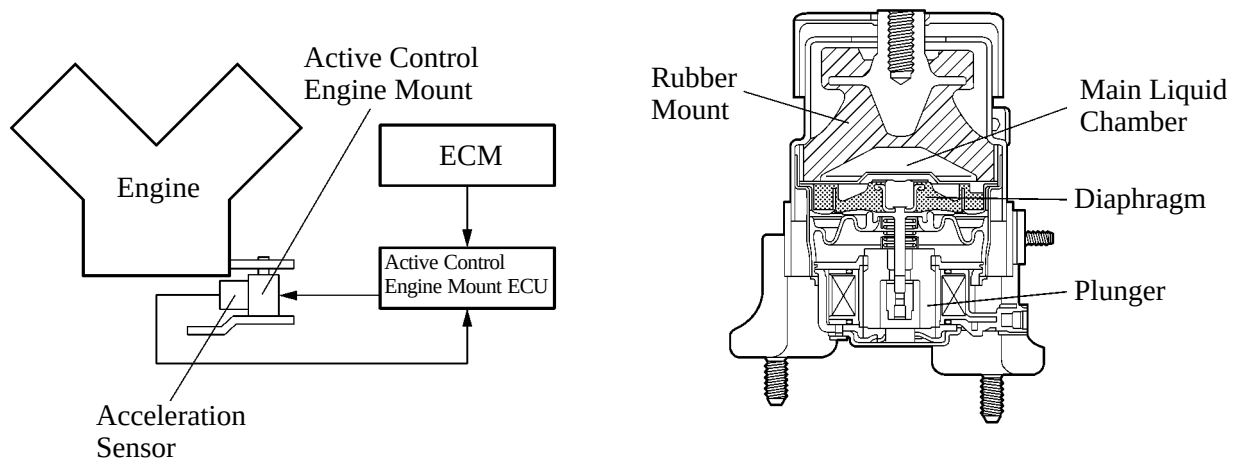
A 3-point support on the front sub-frame is used. An active control engine mount is used as the front engine mount and a liquid-filled compound engine mount is used as the right and left engine mounts to realize minimum noise and vibration and to achieve high levels of both riding comfort and drivability.



01YEG19Y

### 2. Active Control Engine Mount

- The active control engine mount is used to reduce engine vibration and noise during idling. It is controlled by the active control engine mount ECU through signals which vary in accordance with the engine operating conditions, allowing the engine vibration and noise to be minimized effectively.
- Engine idling vibration is canceled out by vibration of the active control engine mount. The engine mount vibration is produced control signals from the active control engine mount ECU which are applied to the actuator's solenoid, these trigger the plunger inside the engine mount to vibrate the diaphragm. The vibration is conducted to the rubber mount through the main liquid chamber.
- The active control engine mount has an acceleration sensor that detects the engine mount vibration. The sensor continuously monitors the engine mount operating condition.



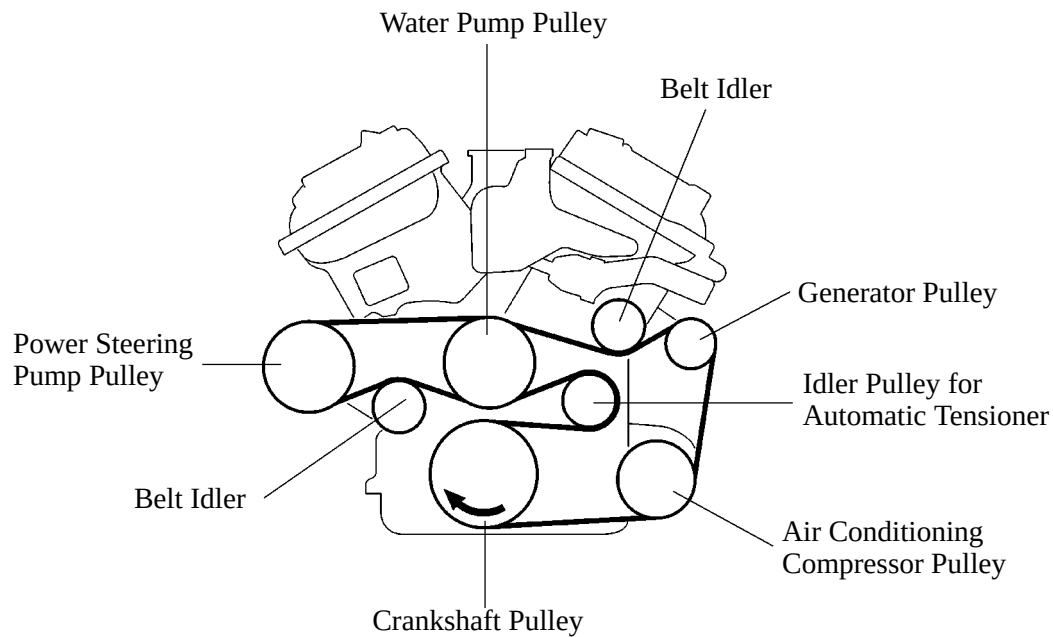
01YEG17TE

01YEG20Y

## ■ SERPENTINE BELT DRIVE SYSTEM

### 1. General

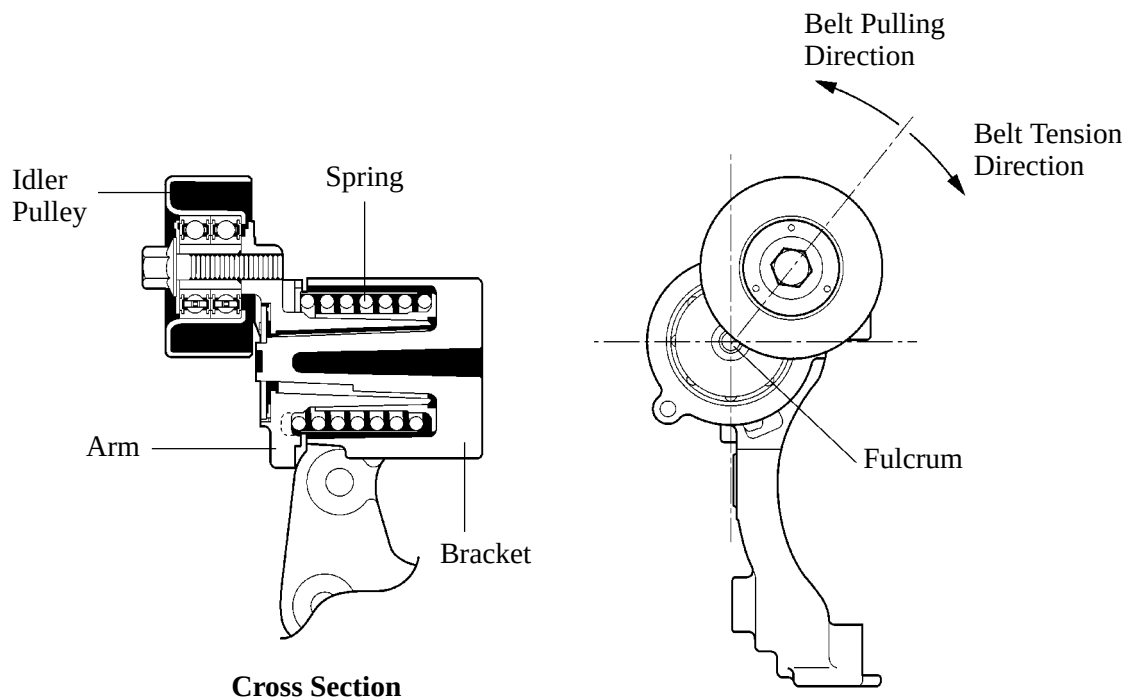
- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.
- An automatic tensioner eliminates the need for tension adjustment.



285EG41

### 2. Automatic Tensioner

The tension of the V-ribbed belt is properly maintained by the tension spring that is enclosed in the automatic tensioner.



285EG78

## ■ ENGINE CONTROL SYSTEM

### 1. General

The engine control system of the 2GR-FE engine has the following features.

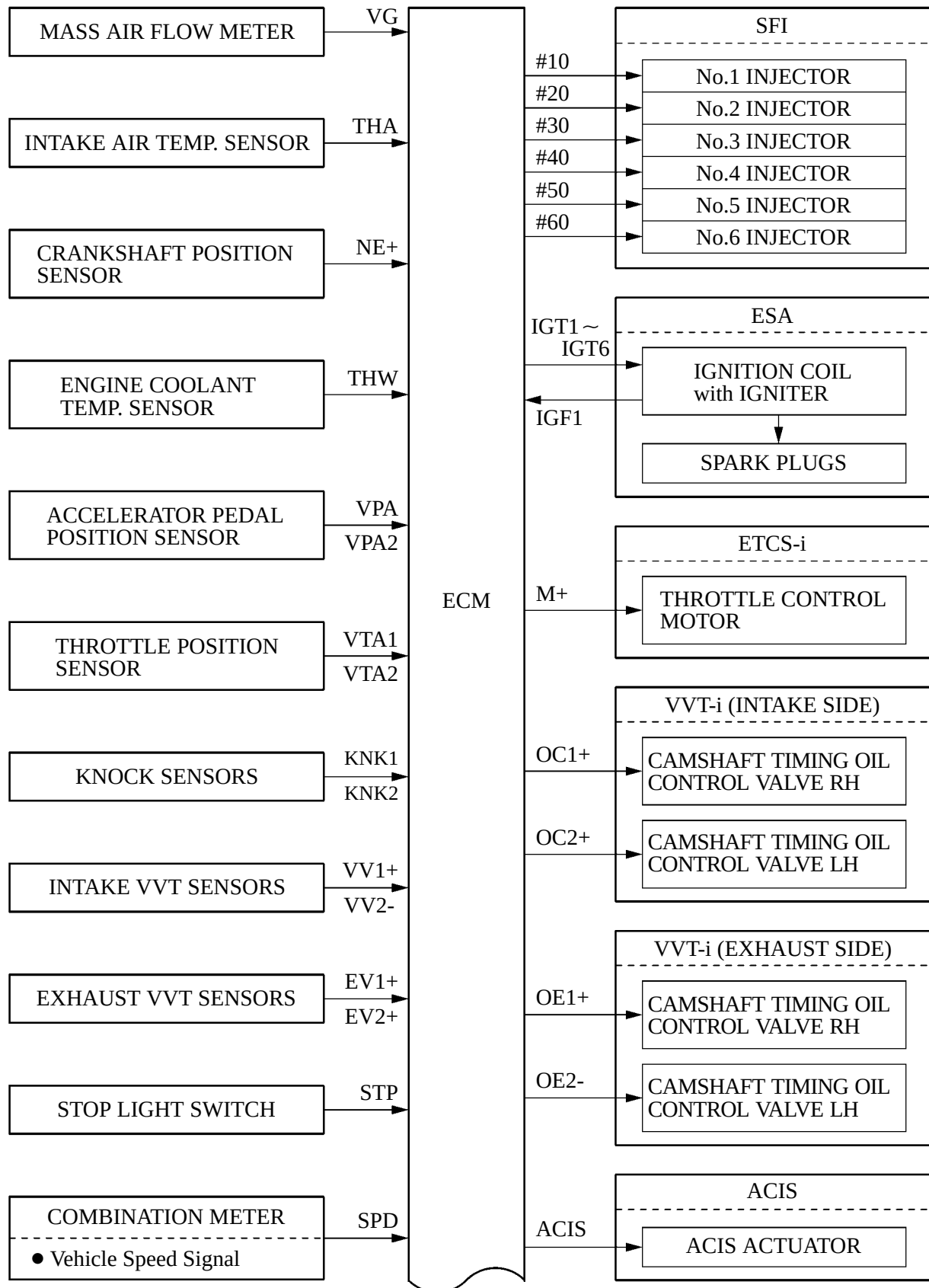
| System                                                                                        | Outline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SFI<br>( Sequential Multiport<br>Fuel Injection )                                             | <ul style="list-style-type: none"> <li>● An L-type SFI system directly detects the intake air mass with a hot wire type air flow meter.</li> <li>● The fuel injection system is a sequential multiport fuel injection system.</li> <li>● Fuel injection takes two forms:<br/>Synchronous injection, which always takes place with the same timing in accordance with the basic injection duration and an additional correction based on the signals provided by the sensors. Non-synchronous injection, which takes place at the time an injection request based on the signals provided by the sensors is detected, regardless of the crankshaft position.</li> <li>● Synchronous injection is further divided into group injection during a cold start, and independent injection after the engine is started.</li> </ul> |
| ESA<br>(Electronic Spark Advance)                                                             | <ul style="list-style-type: none"> <li>● Ignition timing is determined by the ECM based on signals from various sensors. The ECM corrects ignition timing in response to engine knocking.</li> <li>● This system selects the optimal ignition timing in accordance with the signals received from the sensors and sends the (IGT) ignition signal to the igniter.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| ETCS-i<br>( Electronic<br>Throttle Control<br>System-intelligent )<br>[See page EG-55]        | Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Dual VVT-i System<br>( Dual Variable Valve<br>Timing-intelligent System )<br>[See page EG-57] | Controls the intake and exhaust camshafts to an optimal valve timing in accordance with the engine condition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| ACIS<br>( Acoustic Control<br>Induction System )<br>[See page EG-63]                          | The intake air passages are switched according to the engine speed and throttle valve opening angle to provided high performance in all speed ranges.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Air Intake Control<br>System<br>[See page EG-65]                                              | The intake air duct is divided into two areas, and the ECM controls the air intake control valve and the actuator that are provided in one of the areas to reduce the amount of engine noise.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Fuel Pump Control<br>[See page EG-66]                                                         | <ul style="list-style-type: none"> <li>● Fuel pump operation is controlled by signals from the ECM.</li> <li>● The fuel pump is stopped, when the SRS airbag is deployed in a frontal, side, and rear of side collision.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Air Conditioner<br>Cut-off Control                                                            | By turning the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Cooling Fan Control<br>[See page EG-67]                                                       | The cooling fan ECU steplessly controls the speed of the fans in accordance with the engine coolant temperature, vehicle speed, engine speed, and air conditioning operating conditions. As a result, the cooling performance is improved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Starter Control<br>( Cranking Hold<br>Function )<br>[See page EG-69]                          | Once the engine switch is pushed, while the brake pedal is depressed, this control continues to operate the starter until the engine started.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

(Continued)

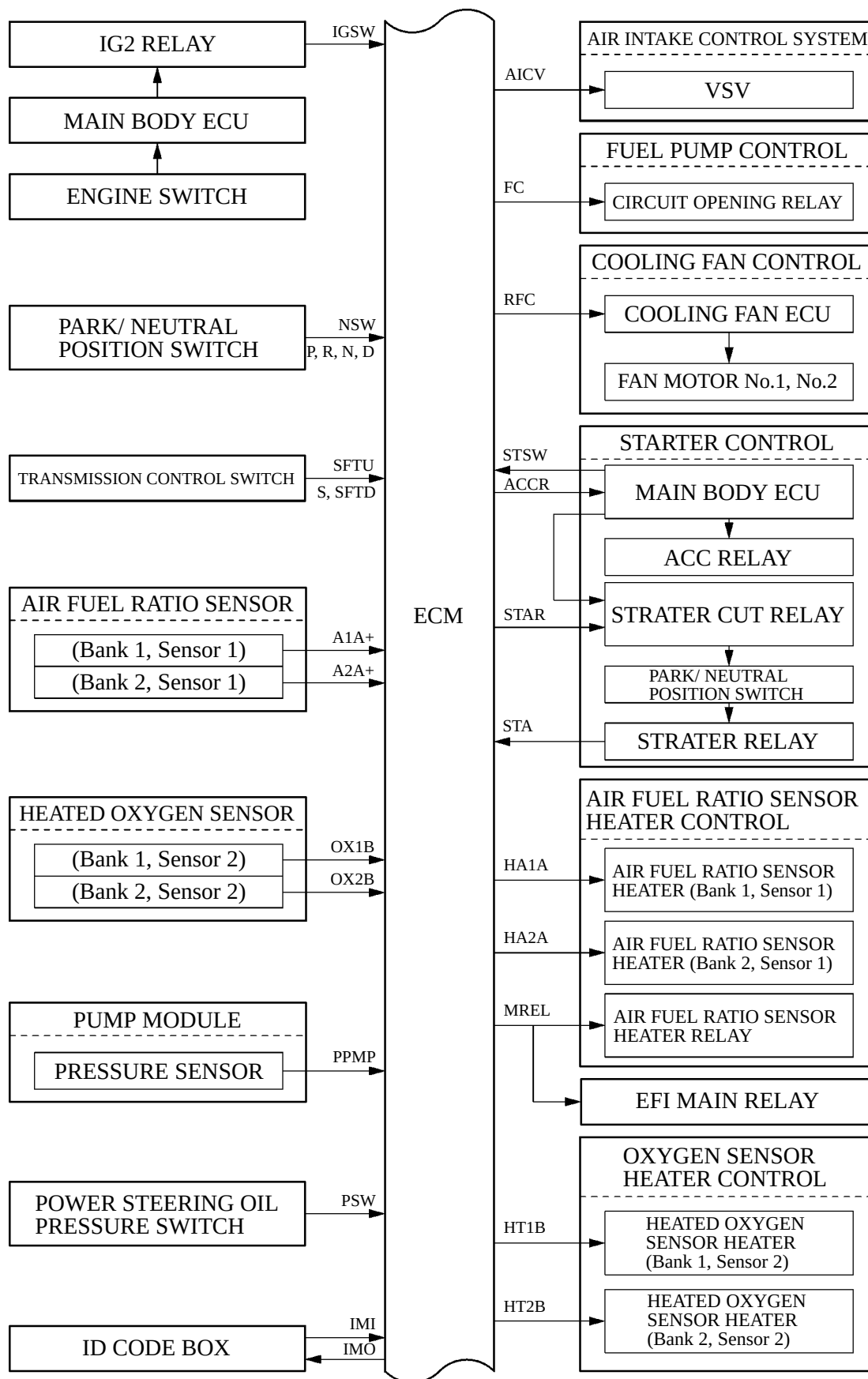
| System                                                 | Outline                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Air Fuel Ratio Sensor and Oxygen Sensor Heater Control | Maintains the temperature of the air fuel ratio sensor or oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.                                                                                                                                                                                                                                                              |
| Evaporative Emission Control<br>[See page EG-71]       | <ul style="list-style-type: none"><li>● The ECM controls the purge flow of evaporative emission (HC) in the charcoal canister in accordance with engine conditions.</li><li>● Approximately five hours after the engine switch has been turned OFF, the ECM operates the pump module to detect any evaporative emission leakage occurring between the fuel tank and the charcoal canister through changes in the fuel tank pressure.</li></ul> |
| Active Control Engine Mount<br>[See page EG-35]        | The damping characteristic of the front engine mount is controlled variably to reduce idling vibration.                                                                                                                                                                                                                                                                                                                                        |
| Engine Immobilizer                                     | Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid key.                                                                                                                                                                                                                                                                                                                                            |
| Diagnosis<br>[See page EG-83]                          | When the ECM detects a malfunction, the ECM diagnoses and memorizes the failed section.                                                                                                                                                                                                                                                                                                                                                        |
| Fail-Safe<br>[See page EG-84]                          | When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.                                                                                                                                                                                                                                                                                                                   |

## 2. Construction

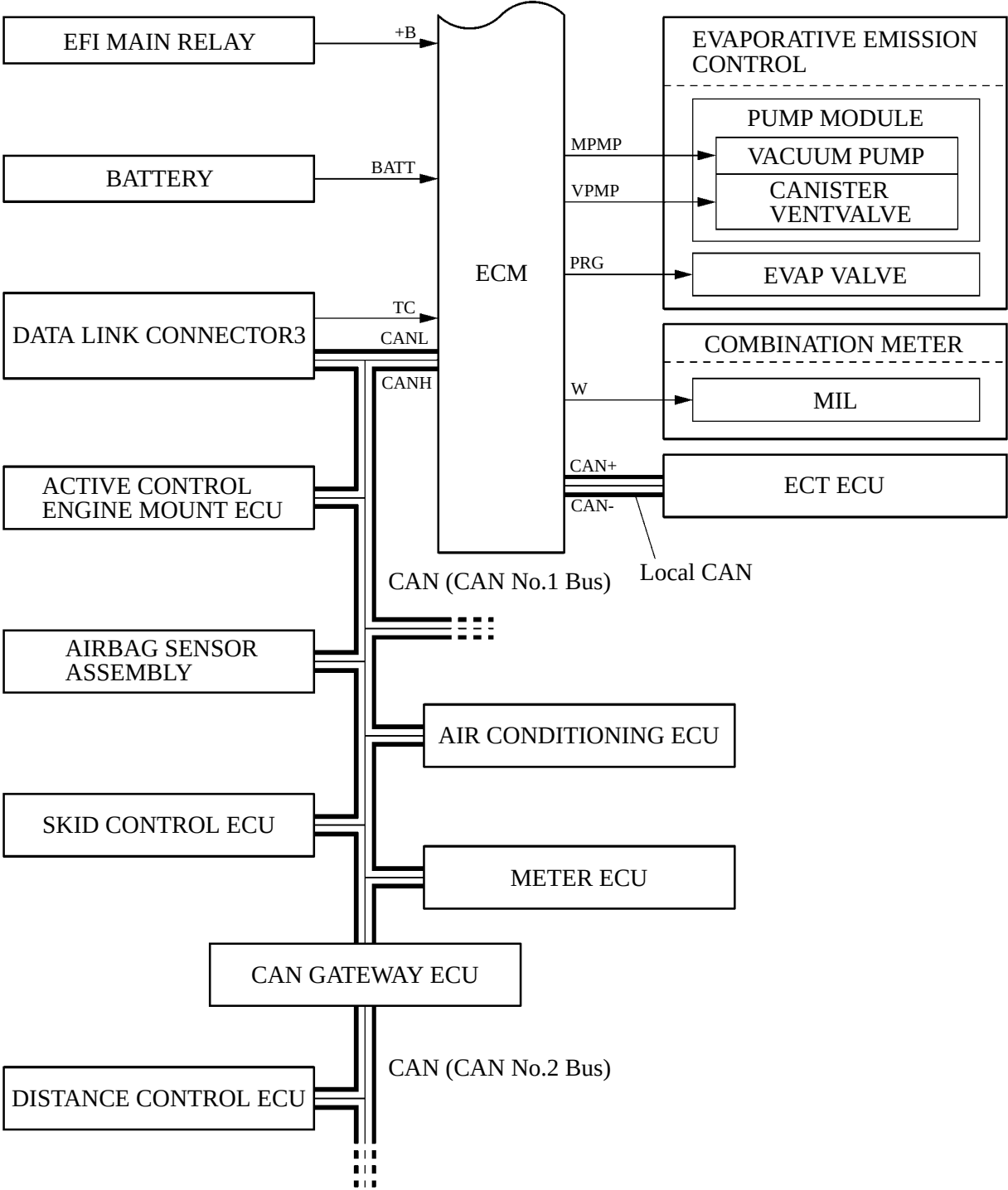
The configuration of the engine control system is as shown in the following chart.



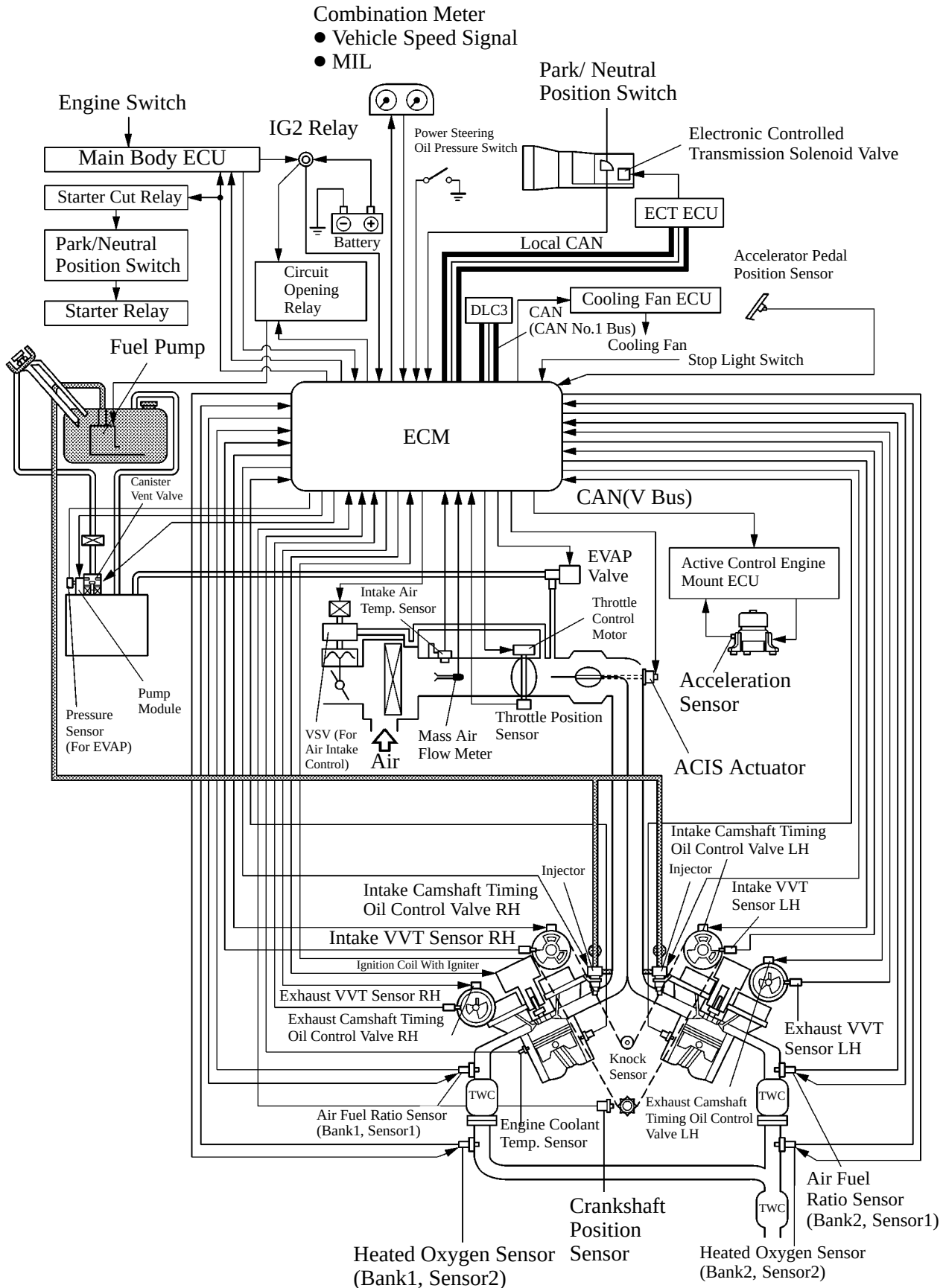
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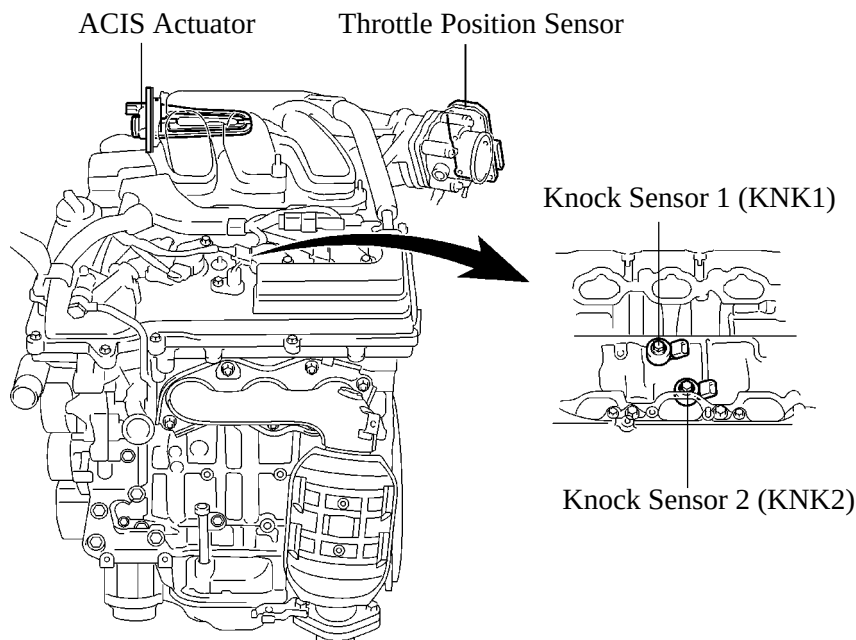
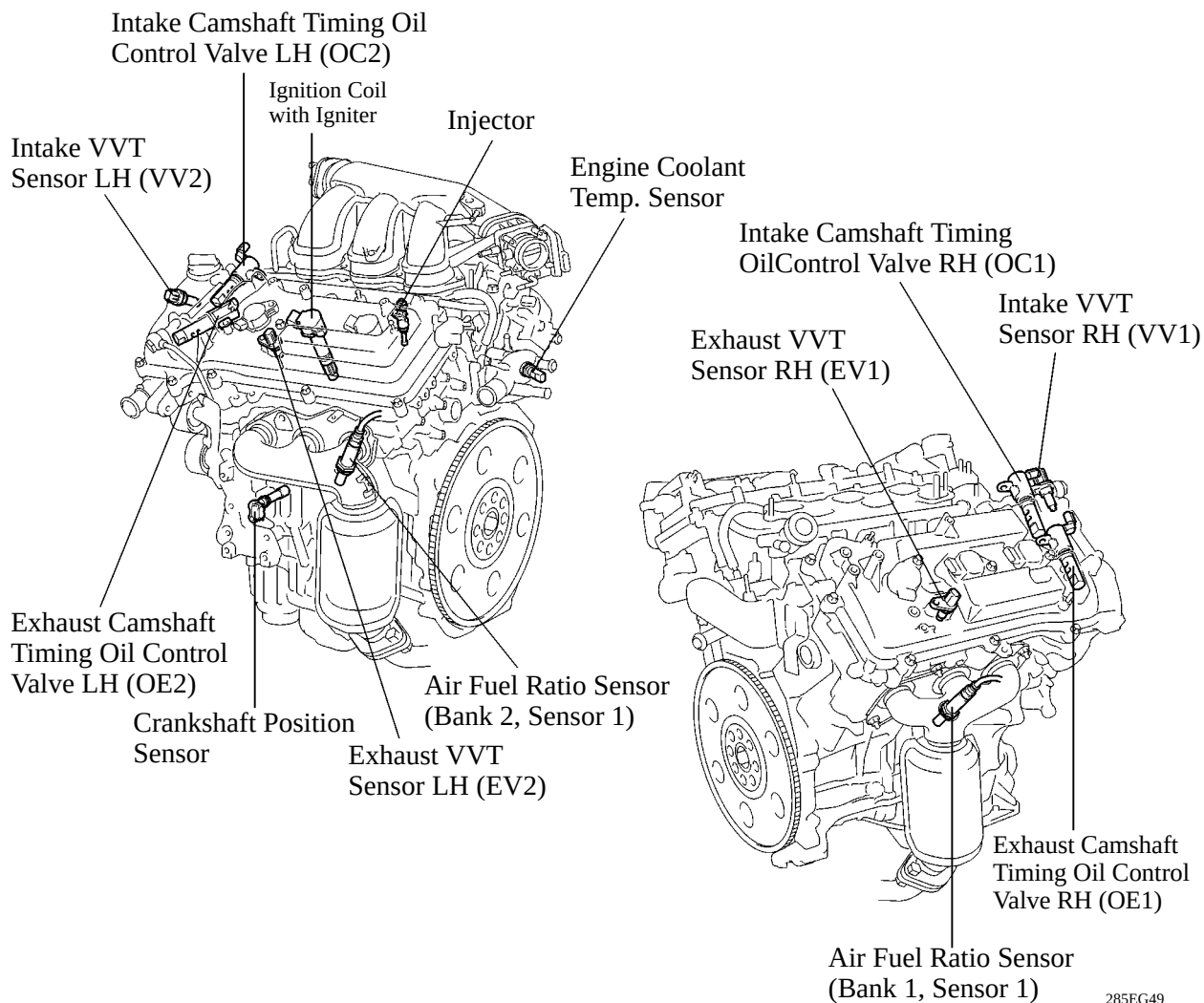


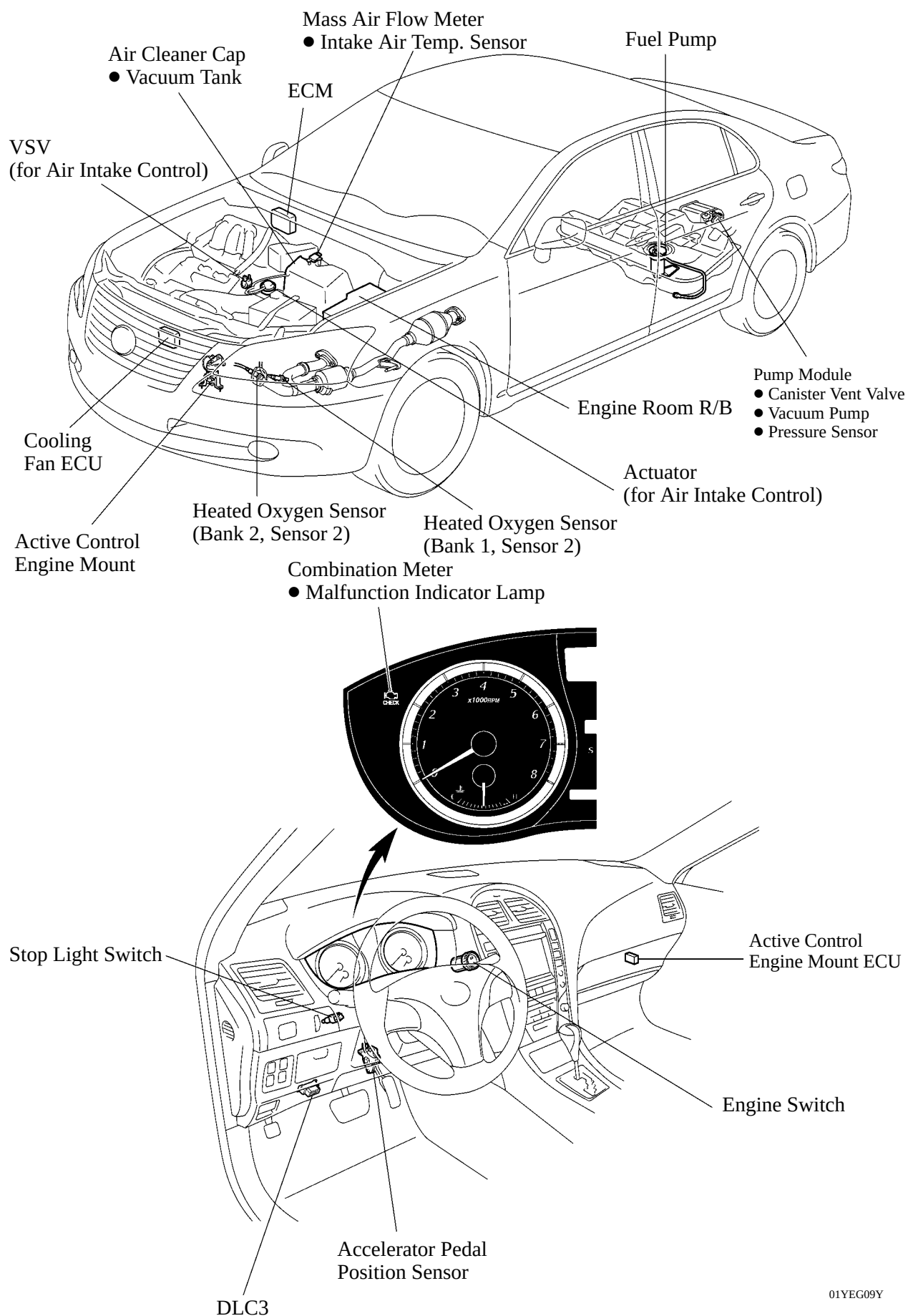
### 3. Engine Control System Diagram





#### 4. Layout of Main Components





## 5. Main Component of Engine Control System

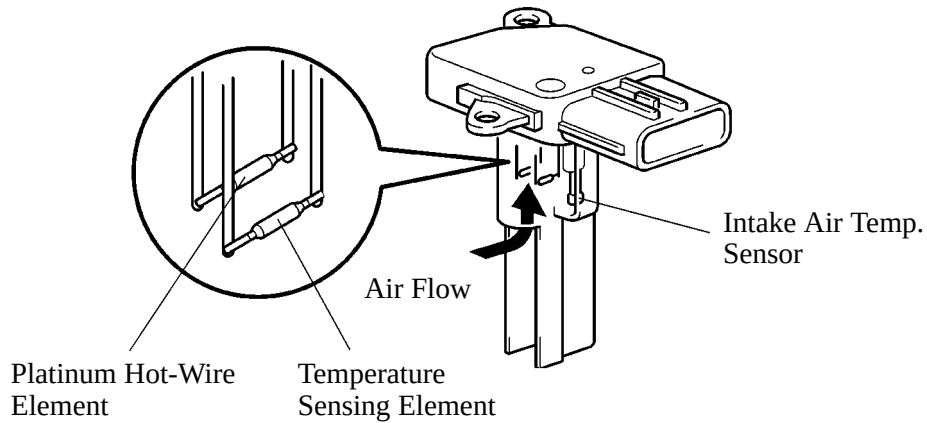
### General

The main components of the 2GR-FE engine control system are as follows:

| Components                                                           | Outline                                       | Quantity | Function                                                                                                                                                                        |
|----------------------------------------------------------------------|-----------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ECM                                                                  | 32-bit CPU                                    | 1        | The ECM optimally controls the SFI, ESA and ISC to suit the operating conditions of the engine in accordance with the signals provided by the sensors.                          |
| Oxygen Sensor<br>(Bank 1, Sensor 2)<br>(Bank 2, Sensor 2)            | Cup Type<br>with Heater                       | 2        | This sensor detects the oxygen concentration in the exhaust emission by measuring the electromotive force which is generated in the sensor itself.                              |
| Air Fuel<br>Ratio Sensor<br>(Bank 1, Sensor 1)<br>(Bank 2, Sensor 1) | Planar Type<br>with Heater                    | 2        | As with the oxygen sensor, this sensor detects the oxygen concentration in the exhaust emission. However, it detects the oxygen concentration in the exhaust emission linearly. |
| Mass Air Flow Meter                                                  | Hot-wire Type                                 | 1        | This sensor has a built-in hot-wire to directly detect the intake air mass.                                                                                                     |
| Crankshaft<br>Position Sensor<br>(Rotor Teeth)                       | Pick-up Coil Type<br>(36-2)                   | 1        | This sensor detects the engine speed and performs the cylinder identification.                                                                                                  |
| Intake VVT Sensor<br>LH, RH<br>(Rotor Teeth)                         | MRE Type (3)                                  | 2        | This sensor performs the cylinder identification.                                                                                                                               |
| Exhaust VVT Sensor<br>LH, RH<br>(Rotor Teeth)                        | MRE Type (3)                                  | 2        | This sensor performs the cylinder identification.                                                                                                                               |
| Engine Coolant<br>Temperature Sensor                                 | Thermistor Type                               | 1        | This sensor detects the engine coolant temperature by means of an internal thermistor.                                                                                          |
| Intake Air<br>Temperature Sensor                                     | Thermistor Type                               | 1        | This sensor detects the intake air temperature by means of an internal thermistor.                                                                                              |
| Knock Sensor 1, 2                                                    | Built-in<br>Piezoelectric Type<br>(Flat Type) | 2        | This sensor detects an occurrence of the engine knocking indirectly from the vibration of the cylinder block caused by the occurrence of engine knocking.                       |
| Throttle<br>Position Sensor                                          | No-contact Type                               | 1        | This sensor detects the throttle valve opening angle.                                                                                                                           |
| Accelerator Pedal<br>Position Sensor                                 | No-contact Type                               | 1        | This sensor detects the amount of pedal effort applied to the accelerator pedal.                                                                                                |
| Injector                                                             | 12-Hole Type                                  | 6        | The injector is an electromagnetically-operated nozzle which injects fuel in accordance with signals from the ECM.                                                              |

### Mass Air Flow Meter

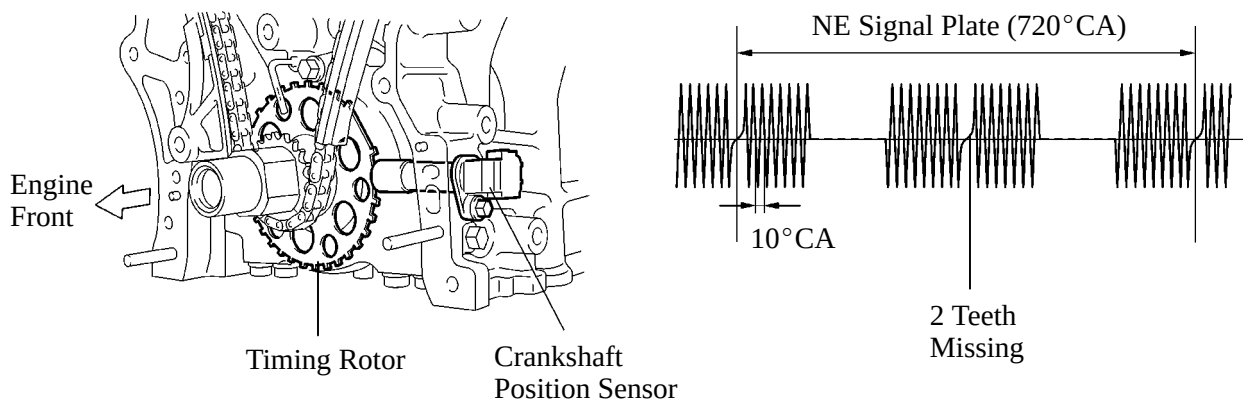
- This mass air flow meter, which is a plug-in type, allows a portion of the intake air to flow through the detection area. By directly measuring the mass and the flow rate of the intake air, the detection precision is improved and the intake air resistance is reduced.
- This mass air flow meter has a built-in intake air temperature sensor.



01YEG10Y

### Crankshaft Position Sensor

The timing rotor of the crankshaft consists of 34 teeth, with 2 teeth missing. The crankshaft position sensor outputs the crankshaft rotation signals every  $10^\circ$ , and the missing teeth are used to determine the top-dead-center.



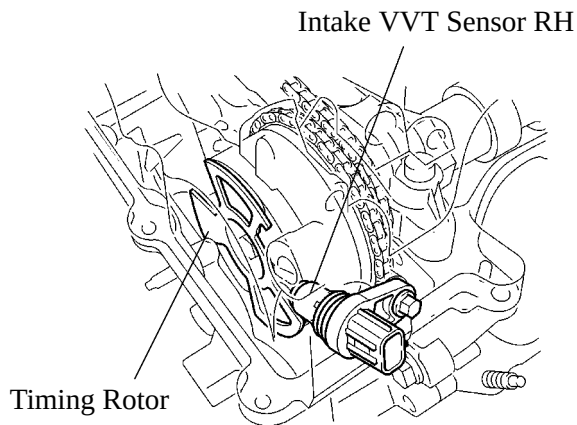
285EG79

279EG50

## Intake and Exhaust VVT Sensors

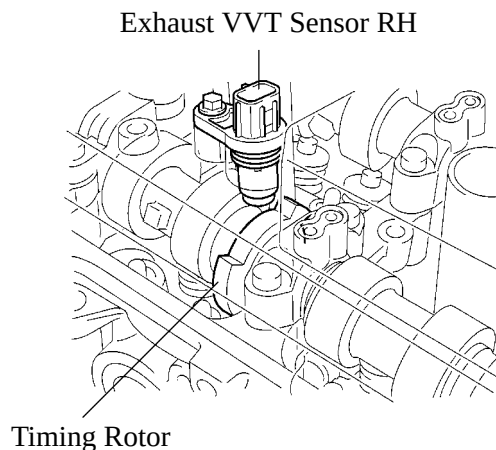
### 1) General

The MRE (Magnetic Resistance Element) type intake and exhaust VVT sensors are used. To detect the camshaft position, a timing rotor that is secured to the camshaft in front of the VVT controller is used to generate 6 (3 Hi Output, 3 Lo Output) pulses for every 2 revolutions of the crankshaft.



**Intake VVT Sensor (Right Bank)**

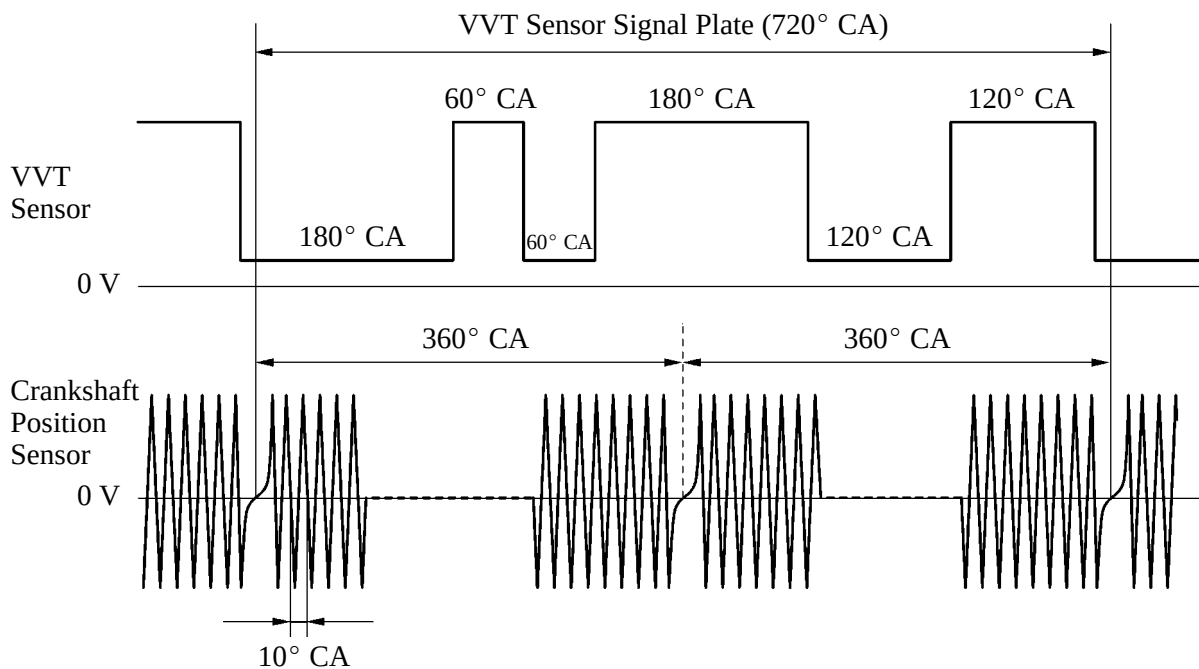
285EG82



**Exhaust VVT Sensor (Right Bank)**

285EG83

### ► Sensor Output Waveforms ◀



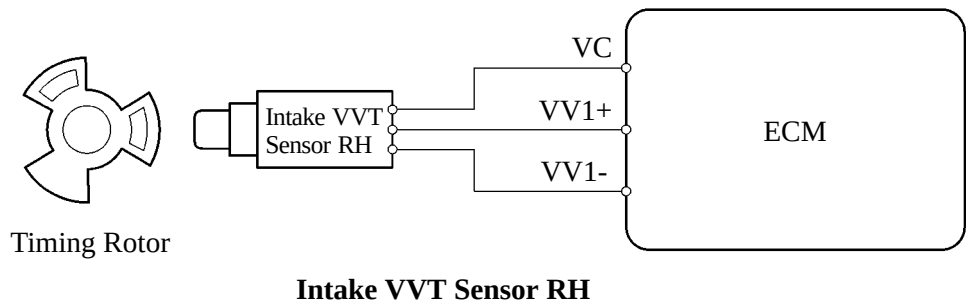
285EG84

2) MRE Type VVT Sensor

- The MRE type VVT sensor consists of an MRE, a magnet and a sensor. The direction of the magnetic field changes due to the different shapes (protruded and non-protruded portions) of the timing rotor, which passes by the sensor. As a result, the resistance of the MRE changes, and the output voltage to the ECM changes to Hi or Lo. The ECM detects the camshaft position based on this output voltage.
- The differences between the MRE type VVT sensor and the pickup coil type VVT sensor used on the conventional model are as follows.

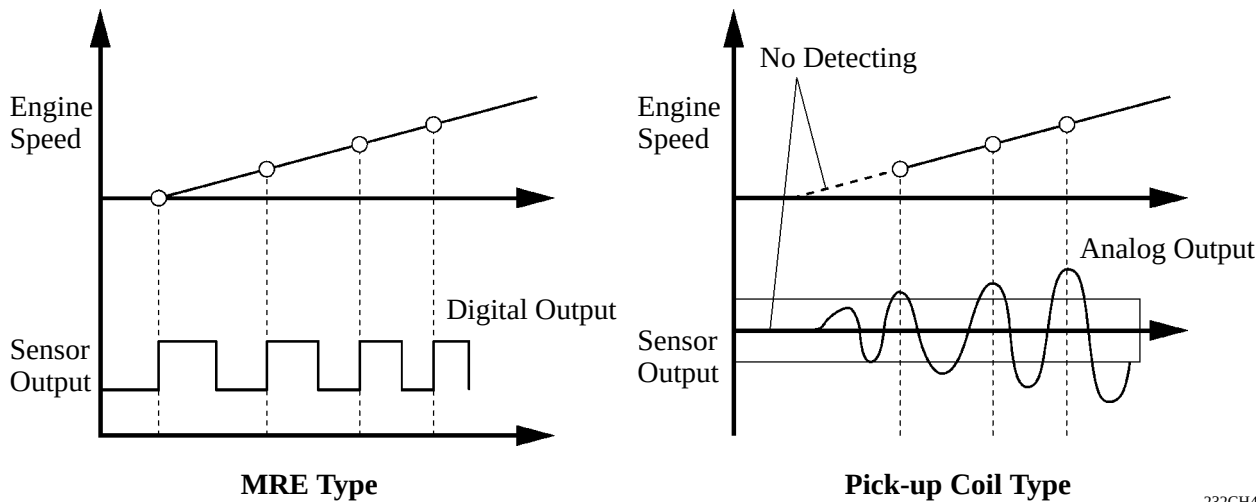
| Item                        | Sensor Type                                                                                                                                                                                                                  |                                                                                                                                                 |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | MRE                                                                                                                                                                                                                          | Pick-up Coil                                                                                                                                    |
| Signal Output               | Constant digital output starts from low engine speeds.                                                                                                                                                                       | Analog output changes with the engine speed.                                                                                                    |
| Camshaft Position Detection | Detection is made by comparing the NE signals with the Hi/Lo output switch timing due to the protruded/non-protruded portions of the timing rotor, or made based on the number of the input NE signals during Hi/Lo outputs. | Detection is made by comparing the NE signals with the change of waveform that is output when the protruded portion of the timing rotor passes. |

► Wiring Diagram ◀



271EG160

► MRE Type and Pick-up Coil Type Output Waveform Image Comparison ◀

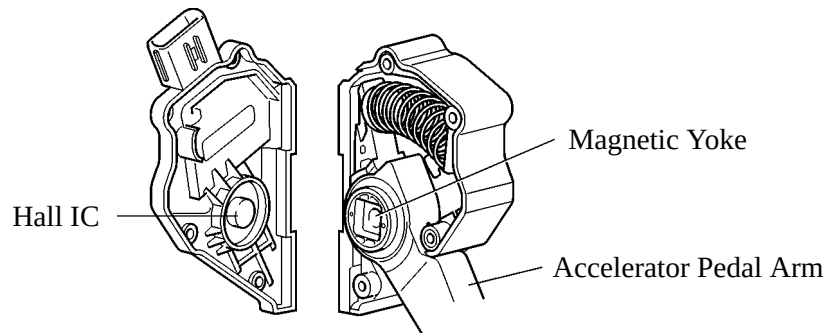


232CH41

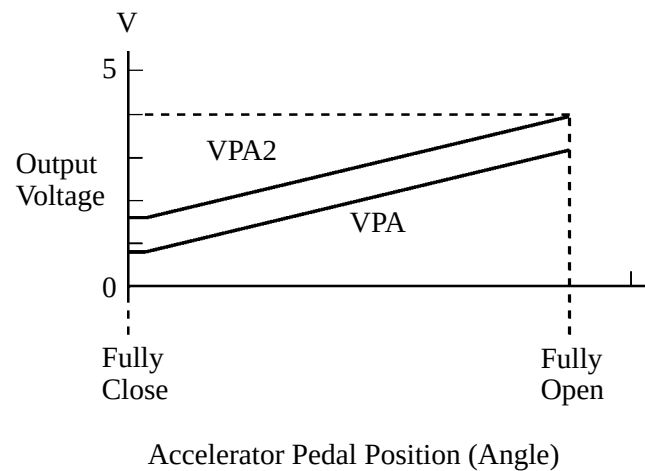
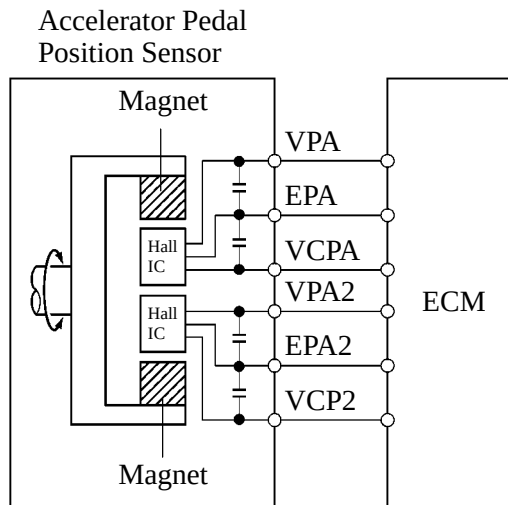
## Accelerator Pedal Position Sensor

This no-contact type accelerator pedal position sensor uses a Hall IC, which is mounted on the accelerator pedal arm.

- A magnetic yoke is mounted at the base of the accelerator pedal arm. This yoke 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 into electrical signals, and outputs them in the form of accelerator pedal position signals to the ECM.
- The Hall IC contains two circuits, one for the main signal, and one for the sub signal. It converts the accelerator pedal position (angle) into electric signals that have differing characteristics and outputs them to the ECM.



0140EG125C



228TU24

0140EG126C

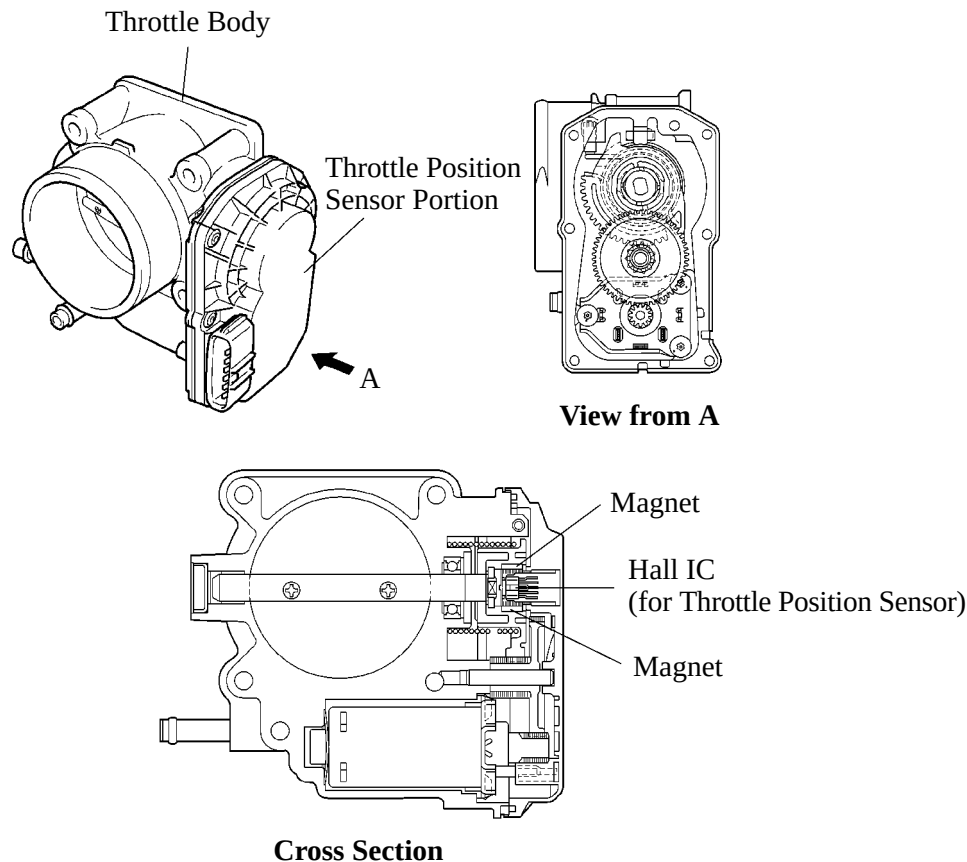
### Service Tip

The inspection method differs from a conventional accelerator pedal position sensor because this sensor uses a Hall IC. For details, refer to the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## Throttle Position Sensor

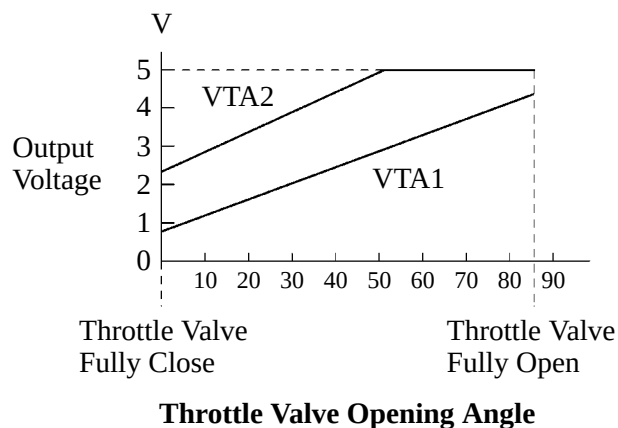
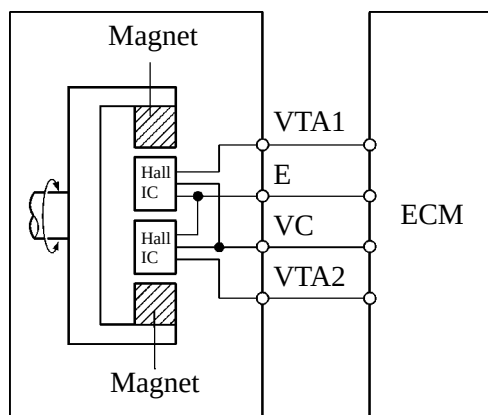
The no-contact type throttle position sensor uses a Hall IC, which is mounted on the throttle body.

- The Hall IC is surrounded by a magnetic yoke. The Hall IC converts the changes that occur in the magnetic flux at that time into electrical signals and outputs them in the form of a throttle valve effort to the ECM.
- The Hall IC contains circuits for the main and sub signals. It converts the throttle valve opening angles into electric signals with two differing characteristics and outputs them to the ECM.



Throttle Position Sensor

238EG59



230LX12

238EG79

### Service Tip

The inspection method differs from the conventional throttle position sensor because this sensor uses a hall IC. For details, refer to the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).



## Knock Sensor (Flat Type)

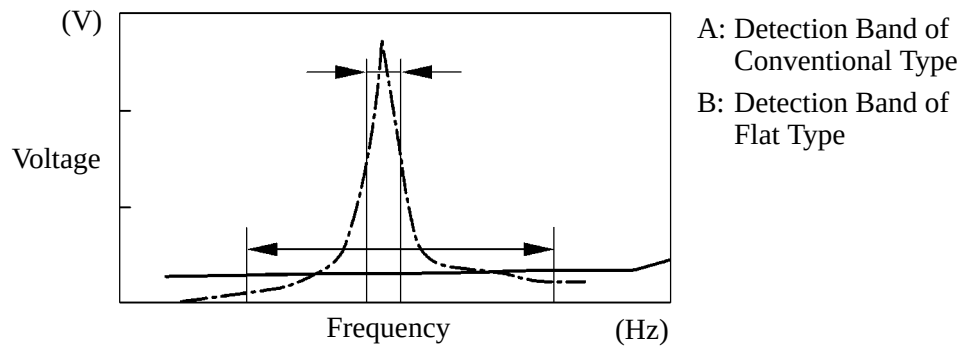
### 1) General

In the conventional type knock sensor (resonant type), a vibration plate, which has the same resonance point as the knocking frequency of the engine, is built in and can detect the vibration in this frequency band.

On the other hand, a flat type knock sensor (non-resonant type) has the ability to detect vibration in a wider frequency band from about 6 kHz to 15 kHz, and has the following features:

- The engine knocking frequency will change a bit depending on the engine speed. The flat type knock sensor can detect vibration even when the engine knocking frequency is changed. Thus the vibration detection ability is increased compared to the conventional type knock sensor, and a more precise ignition timing control is possible.

----- : Conventional Type  
 ————— : Flat Type

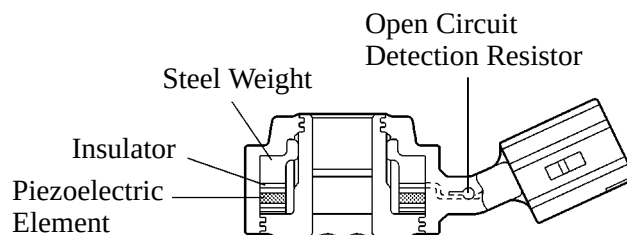


**Characteristic of Knock Sensor**

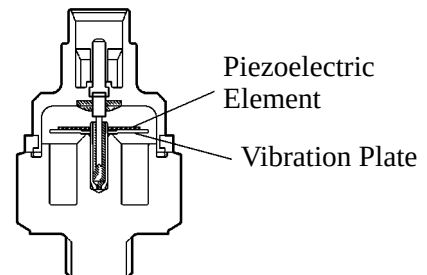
214CE04

### 2) Construction

- The flat type knock sensor is installed on the engine through the stud bolt installed on the cylinder block. For this reason, a hole for the stud bolt is running through in the center of the sensor.
- Inside of the sensor, a steel weight is located on the upper portion and a piezoelectric element is located under the weight through the insulator.
- The open/short circuit detection resistor is integrated.



**Flat Type Knock Sensor  
(Non-Resonant Type)**



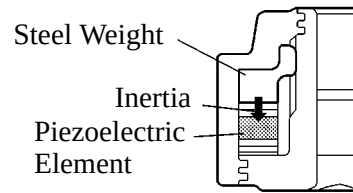
**Conventional Type Knock Sensor  
(Resonant Type)**

214CE01

214CE02

### 3) Operation

The knocking vibration is transmitted to the steel weight and its inertia applies pressure to the piezoelectric element. The action generates electromotive force.

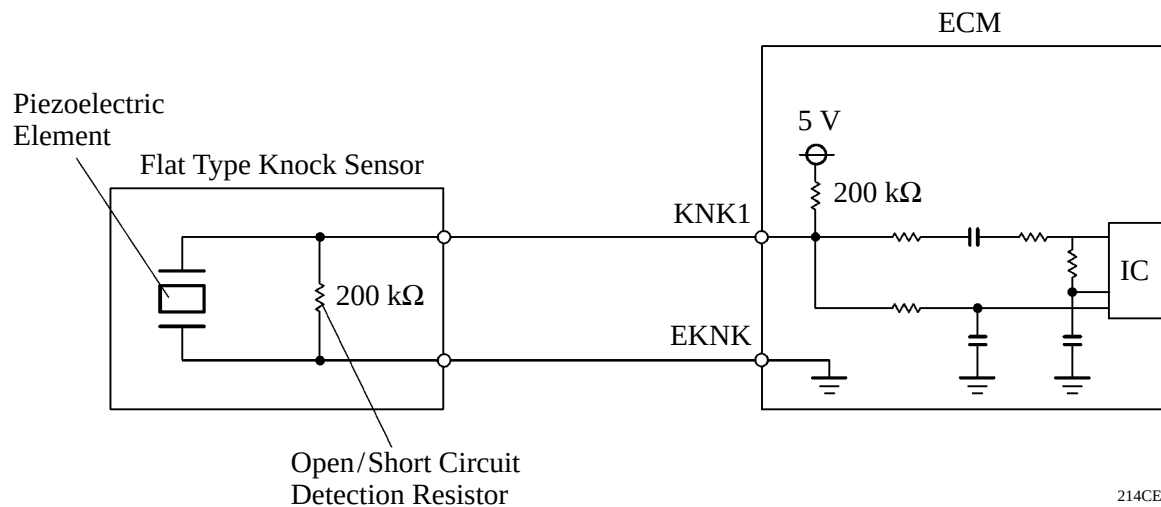


214CE08

### 4) Open/Short Circuit Detection Resistor

During the ignition is ON, the open/short circuit detection resistor in the knock sensor and the resistor in the ECM keep the voltage at the terminal KNK1 of engine constant.

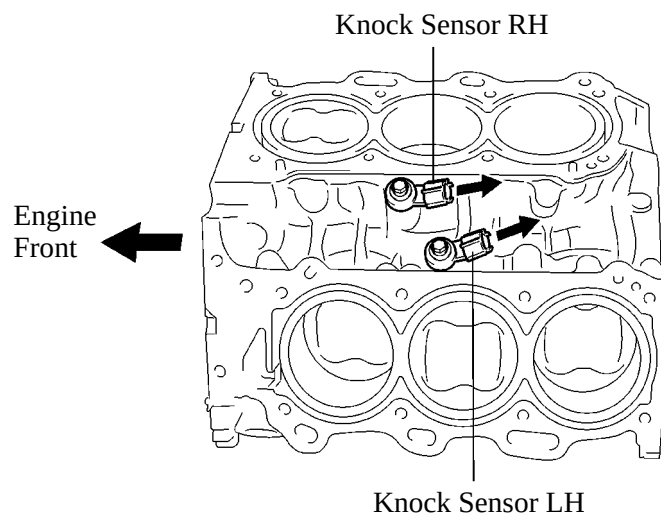
An IC (Integrated Circuit) in the ECM is always monitoring the voltage of the terminal KNK1. If the open/short circuit occurs between the knock sensor and the ECM, the voltage of the terminal KNK1 will change and the ECM detects the open/short circuit and stores DTC (Diagnostic Trouble Code).



214CE06

#### Service Tip

These knock sensors are mounted in the specific directions and angles as illustrated. To prevent the right and left bank connectors from being interchanged, make sure to install each sensor in its prescribed direction.

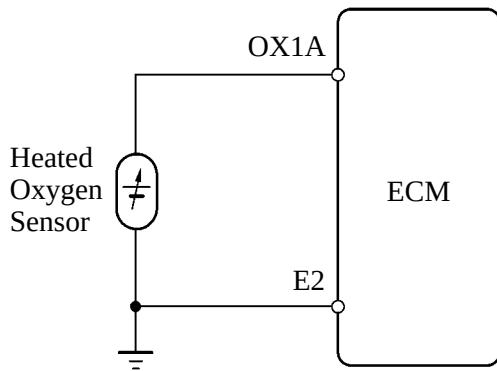


285EG55

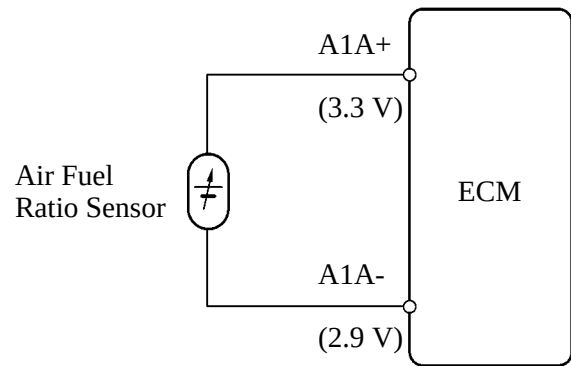
## Heated Oxygen Sensor and Air Fuel Ratio Sensor

### 1) General

- The heated oxygen sensor and the air fuel ratio sensor differ in output characteristics.
- The output voltage of the heated oxygen sensor changes in accordance with the oxygen concentration in the exhaust gas. The ECM uses this output voltage to determine whether the present air-fuel ratio is richer or leaner than the stoichiometric air-fuel ratio.
- Approximately 0.4 V is constantly applied to the air-fuel ratio sensor, which outputs an amperage that varies in accordance with the oxygen concentration in the exhaust gas. The ECM converts the changes in the output amperage into voltage in order to linearly detect the present air-fuel ratio.

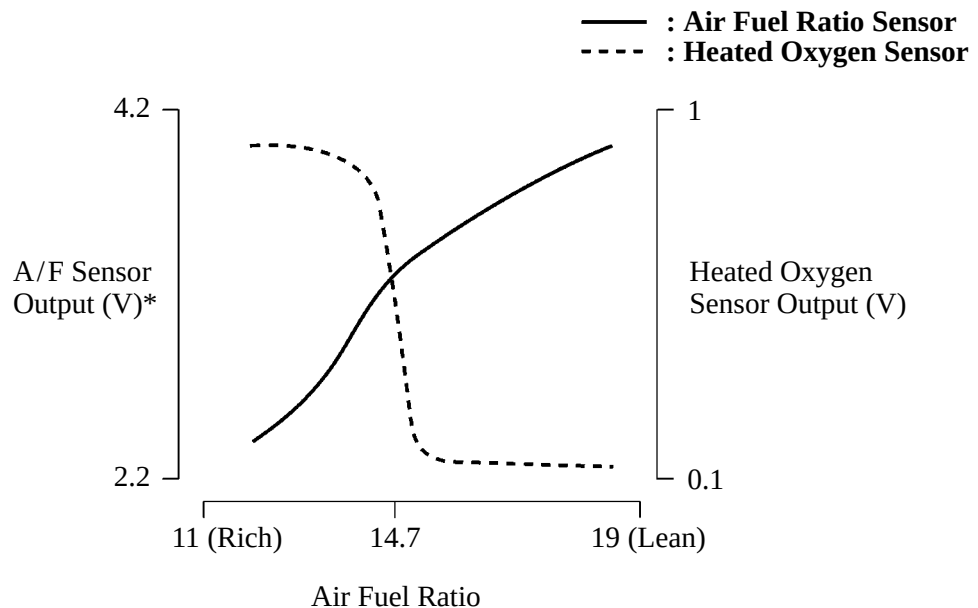


**Heated Oxygen Sensor Circuit**



**Air Fuel Ratio Sensor Circuit**

271EG44

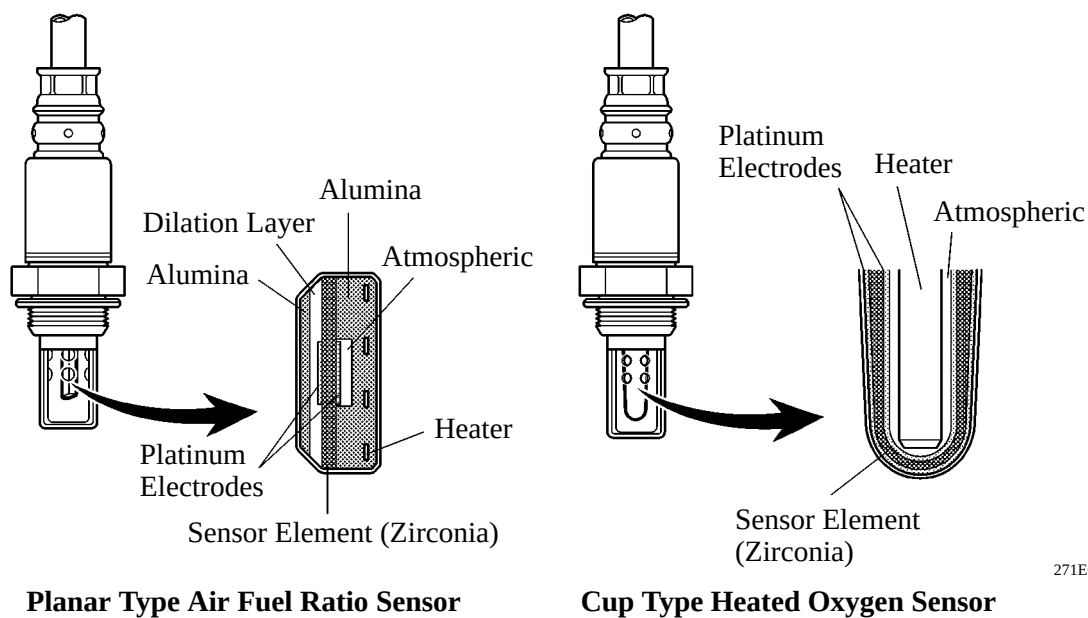


D13N11

\*: This calculation value is used internally in the ECM, and is not an ECM terminal voltage.

## 2) Construction

- The basic construction of the heated oxygen sensor and the air-fuel ratio sensor is the same. However, they are divided into the cup type and the planar type, according to the different types of heater construction that are used.
- The cup type sensor contains a sensor element that surrounds a heater.
- The planar type sensor uses alumina, which excels in heat conductivity and insulation, to integrate a sensor element with a heater, thus improving the warm-up performance of the sensor.



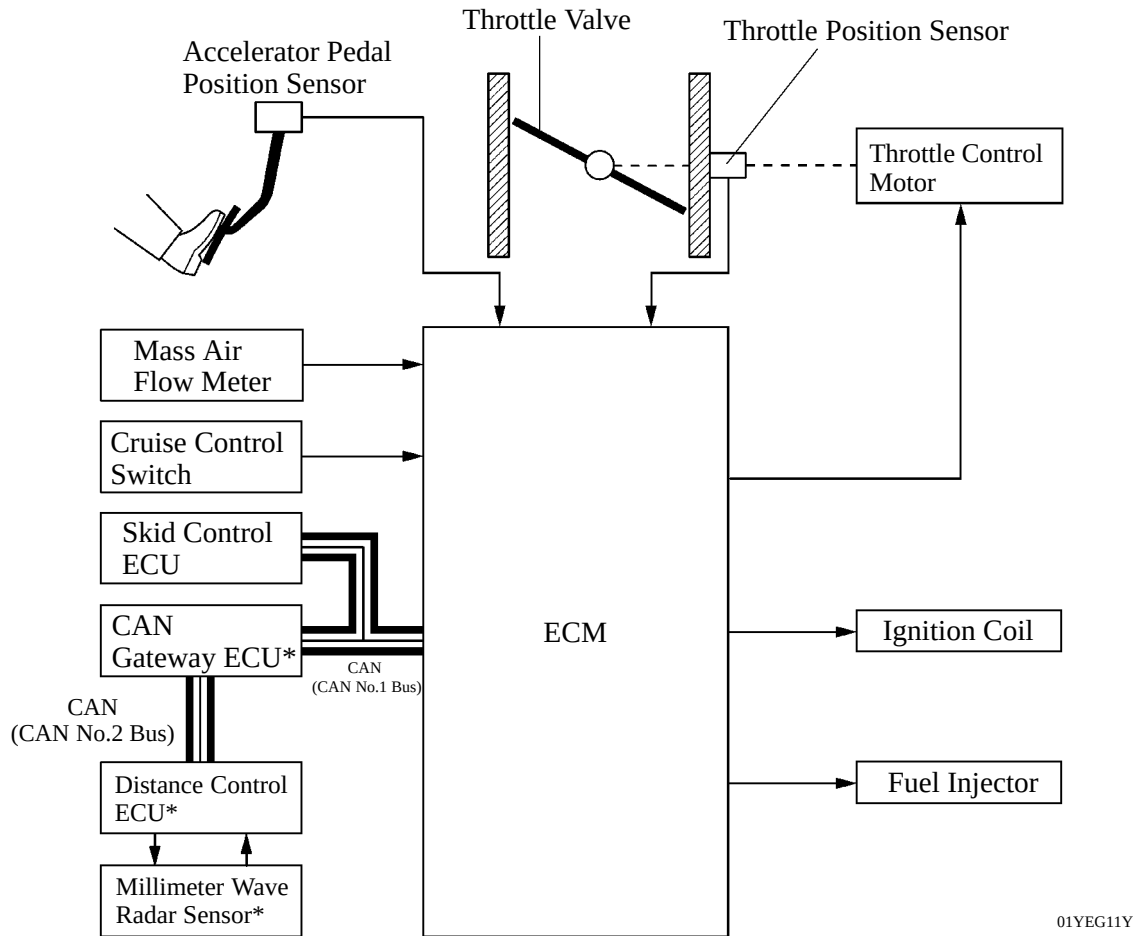
271EG45

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

### General

In the conventional throttle body, the throttle valve angle is determined invariably by the amount of the accelerator pedal effort. In contrast, ETCS-i uses the ECM to calculate the optimal throttle valve angle that is appropriate for the respective driving condition and uses a throttle control motor to control the angle.

#### ► System Diagram ◀



\*: With Dynamic Radar Cruise Control System

### Control

#### 1) General

The ETCS-i consists of the following six functions:

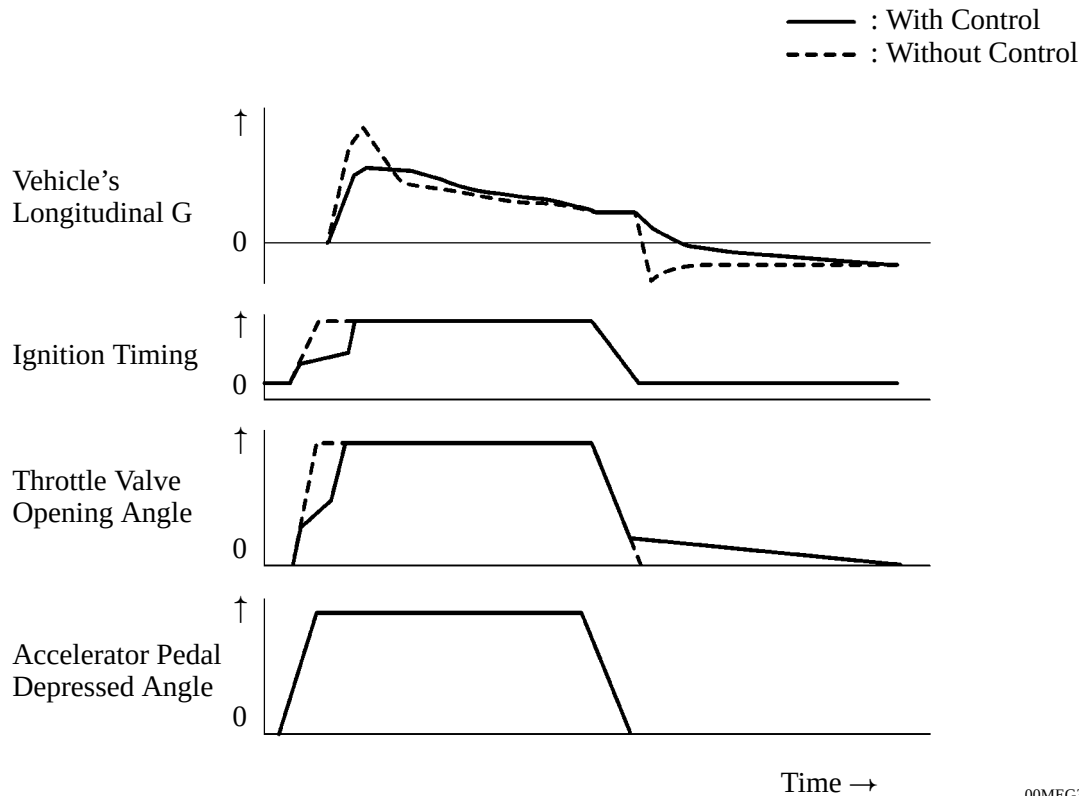
- Normal Throttle Control (Non-linear Control)
- ISC (Idle Speed Control)
- TRAC (Traction Control)
- VSC (Vehicle Stability Control)
- Cruise Control
- Dynamic Radar Cruise Control\*

\*: With Dynamic Radar Cruise Control system

## 2) Normal Throttle Control (non-linear control)

Controls the throttle to an optimal throttle valve angle 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.

### ► Conceptual Diagrams of Engine Control During Acceleration and Deceleration ◀



00MEG38Y

## 3) Idle Speed Control

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

## 4) TRAC Throttle Control

As part of the 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 excellent vehicle stability and driving force.

## 5) VSC Coordination Control

In order to bring the effectiveness of the VSC system control into full play, the throttle valve 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.

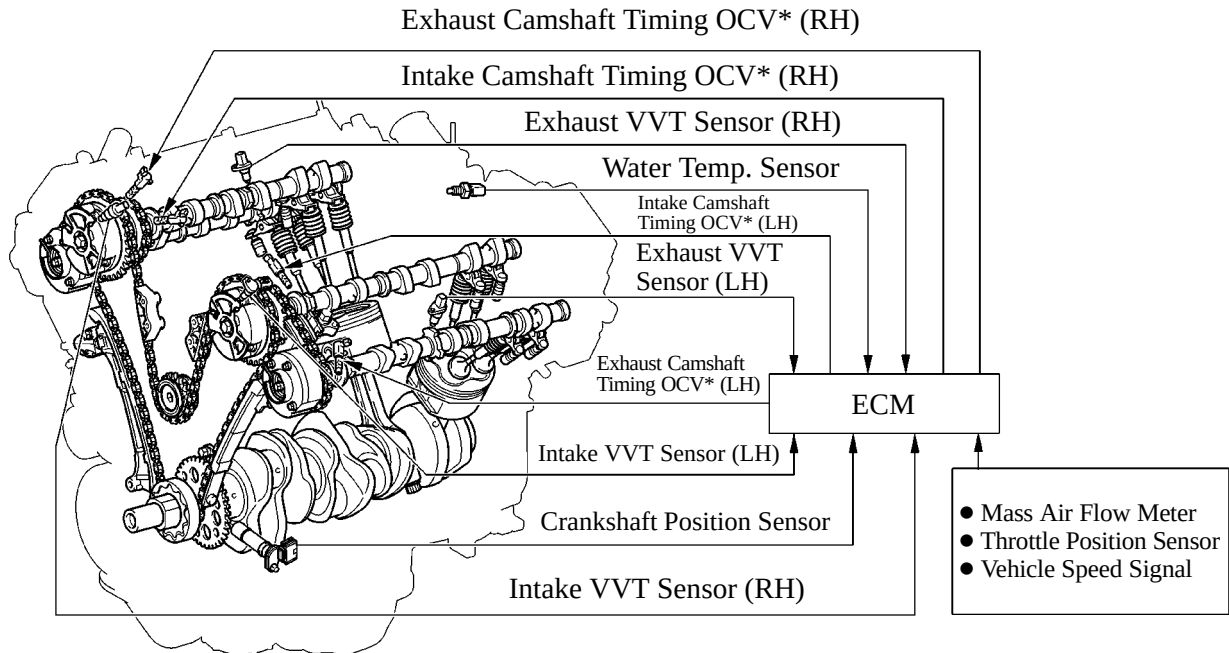
## 7) Dynamic Radar Cruise Control

The dynamic radar cruise control uses a millimeter wave radar sensor and distance control ECU to determine the distance of the vehicle driven ahead, its direction, and relative speed. Thus, the system can effect deceleration cruising control, follow up cruising control, cruising at a fixed speed control, and acceleration cruising control. To make these controls possible, the ECM controls the throttle valve.

## 7. Dual VVT-i (Variable Valve Timing-intelligent) System

### General

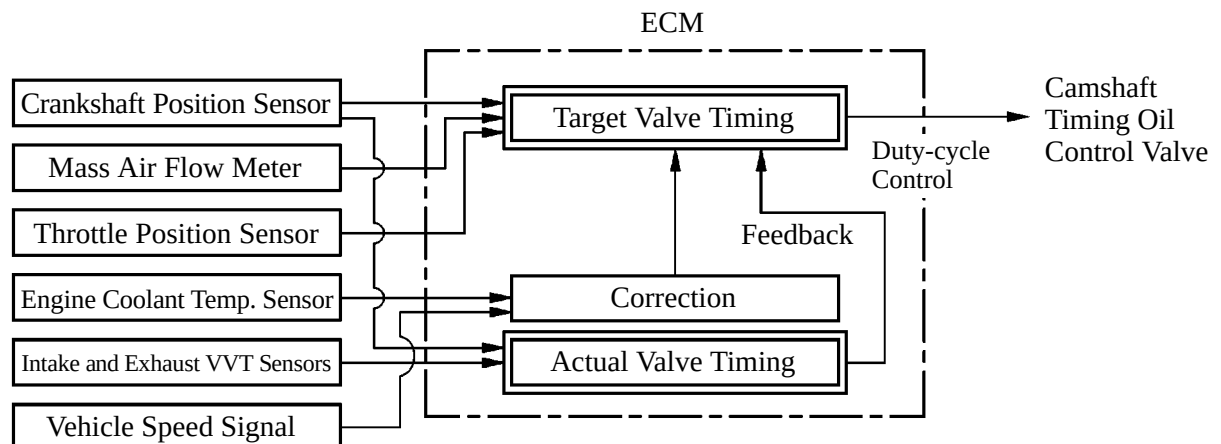
- The dual VVT-i system is designed to control the intake and exhaust camshafts within a range of 40° and 35° respectively (of Crankshaft Angle) to provide valve timing that is optimally suited to the engine condition. This improves torque in all the speed ranges as well as increasing fuel economy, and reducing exhaust emissions.



\*: Oil Control Valve

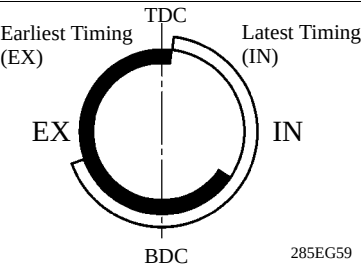
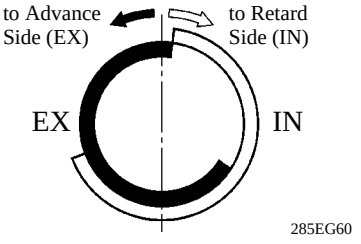
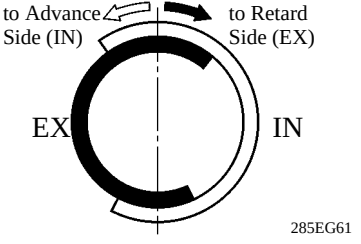
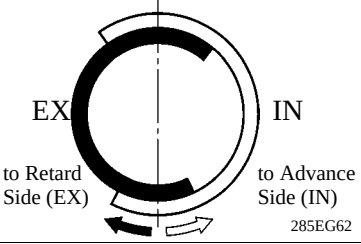
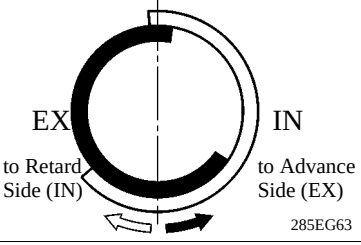
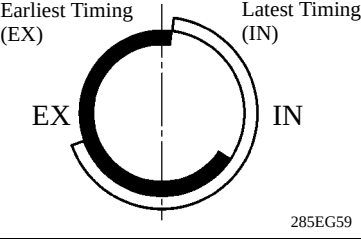
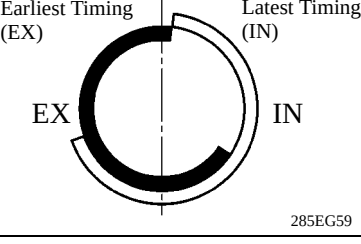
285EG57

- By using the engine speed, intake air volume, throttle position and engine coolant temperature, the ECM calculates optimal valve timing for each driving condition and controls the camshaft timing oil control valve. In addition, the ECM uses signals from the camshaft position sensor and the crankshaft position sensor to detect the actual valve timing, thus providing feedback control to achieve the target valve timing.



221EG16

## Effectiveness of the VVT-i System

| Operation State                                                                                  | Objective                                                                                                                                                                                | Effect                                                                                                       |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| During Idling                                                                                    |  <p>Eliminating overlap to reduce blow back to the intake side.</p> <p>285EG59</p>                      | <ul style="list-style-type: none"> <li>• Stabilized idling rpm</li> <li>• Better fuel economy</li> </ul>     |
| At Light Load                                                                                    |  <p>Eliminating overlap to reduce blow back to the intake side.</p> <p>285EG60</p>                      | Ensured engine stability                                                                                     |
| At Medium Load                                                                                   |  <p>Increasing overlap increases internal EGR, reducing pumping loss.</p> <p>285EG61</p>                | <ul style="list-style-type: none"> <li>• Better fuel economy</li> <li>• Improved emission control</li> </ul> |
| In Low to Medium Speed Range with Heavy Load                                                     |  <p>Advancing the intake valve close timing for volumetric efficiency improvement.</p> <p>285EG62</p>  | Improved torque in low to medium speed range                                                                 |
| In High Speed Range with Heavy Load                                                              |  <p>Retarding the intake valve close timing for volumetric efficiency improvement.</p> <p>285EG63</p> | Improved output                                                                                              |
| At Low Temperatures                                                                              |  <p>Eliminating overlap to reduce blow back to the intake side.</p> <p>285EG59</p>                    | <ul style="list-style-type: none"> <li>• Stabilized fast idle rpm</li> <li>• Better fuel economy</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Upon Starting</li> <li>• Stopping the Engine</li> </ul> |  <p>Eliminating overlap to minimize blow back to the intake side.</p> <p>285EG59</p>                  | Improved startability                                                                                        |

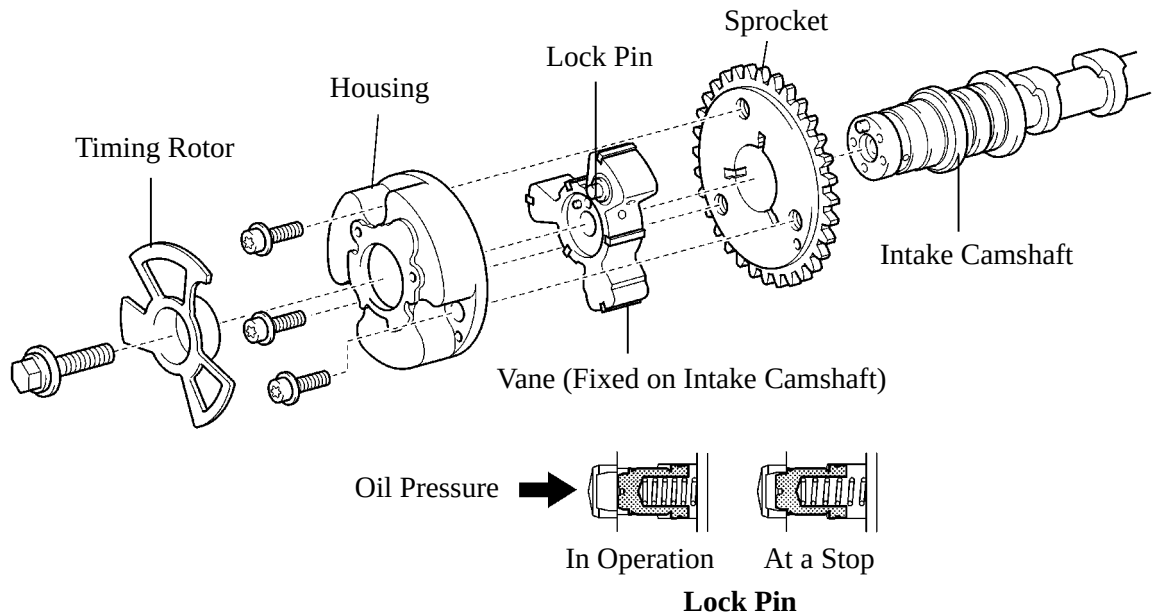


## Construction

### 1) VVT-i Controller

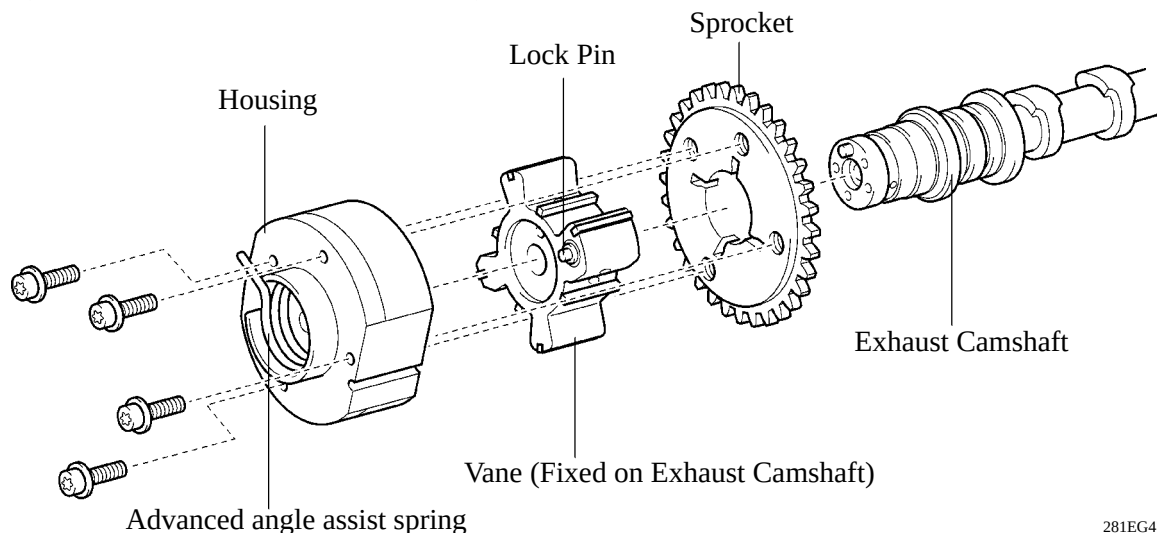
- This controller consists of the housing driven from the timing chain and the vane coupled with the intake and exhaust camshafts.
- The intake side has used a VVT-i controller with 3 vanes, and the exhaust side has used one with 4 vanes.
- When the engine stops, the intake side VVT-i controller is locked on the most retarded angle side by the lock pin, and the exhaust side controller is locked on the most advanced angle side. This ensures excellent engine startability.
- The oil pressure sent from the advance or retard side path at the intake and exhaust camshaft causes rotation in the VVT-i controller vane circumferential direction to vary the intake valve timing continuously.
- An advanced angle assist spring is provided on the exhaust side VVT-i controller. This helps to apply torque in the advanced angle direction so that the vane lock pin securely engages with the housing when the engine stops.

#### ► Intake Side VVT-i Controller ◀



271EG93

#### ► Exhaust Side VVT-i Controller ◀

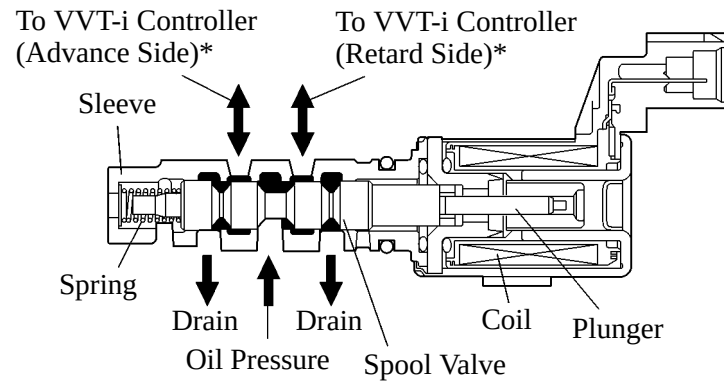


281EG47

## 2) Camshaft Timing Oil Control Valve

This camshaft timing oil control valve controls the spool valve using duty-cycle control from the ECM. This allows hydraulic pressure to be applied to the VVT-i controller advance or retard side. When the engine is stopped, the camshaft timing oil control valve is in the most retard position.

### ► Intake Camshaft Timing Oil Control Valve ◀



238EG62

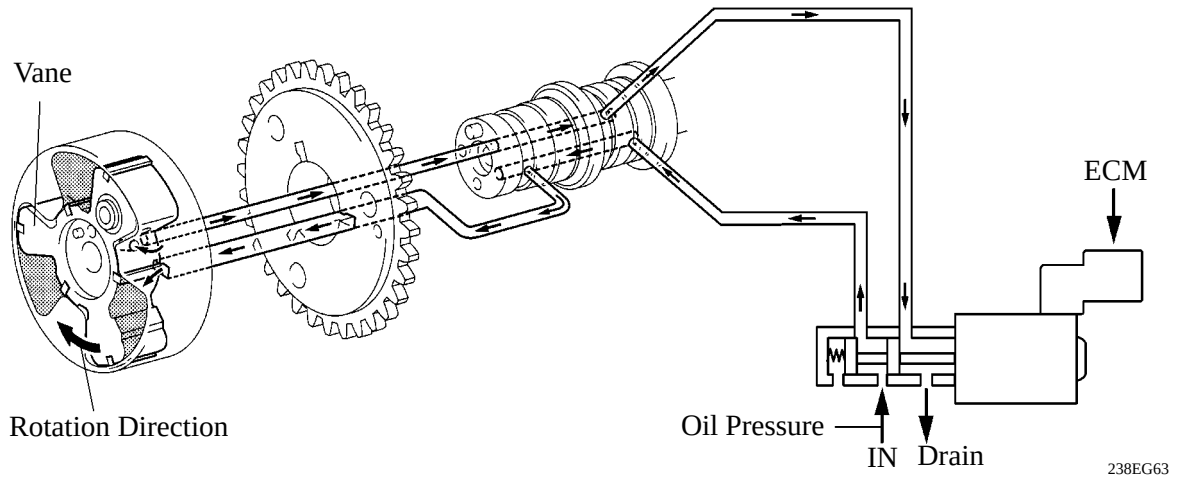
\*: The advance and retard sides of the exhaust side oil control valve are reverse of the intake side.

## Operation

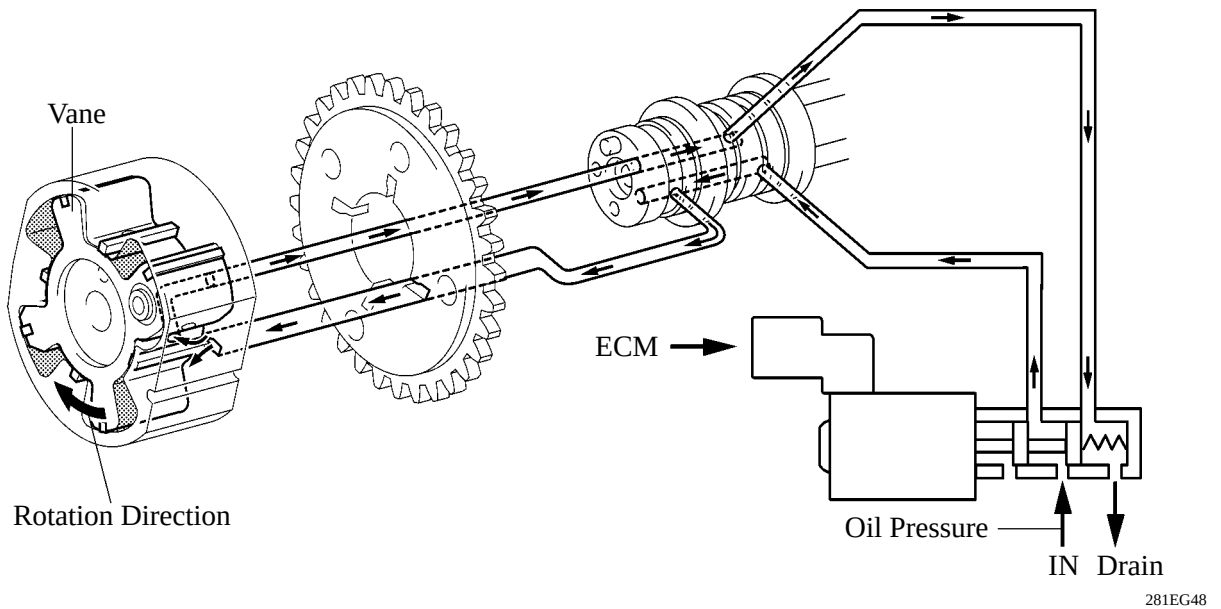
### 1) Advance

When the camshaft timing oil control valve is positioned as illustrated below by the advance signals from the ECM, the resultant oil pressure is applied to the timing advance side vane chamber to rotate the camshaft in the timing advance direction.

**► Intake Side ◀**



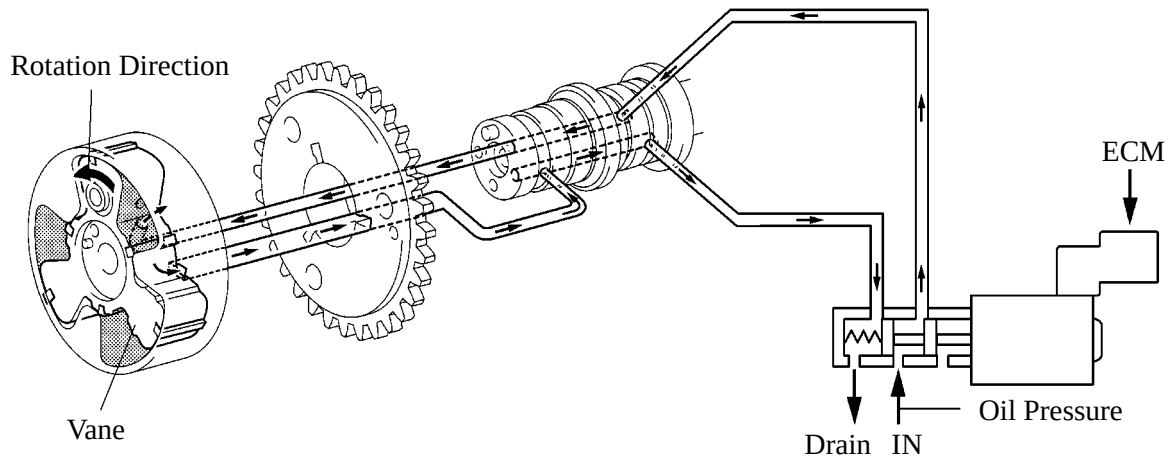
► Exhaust Side ◄



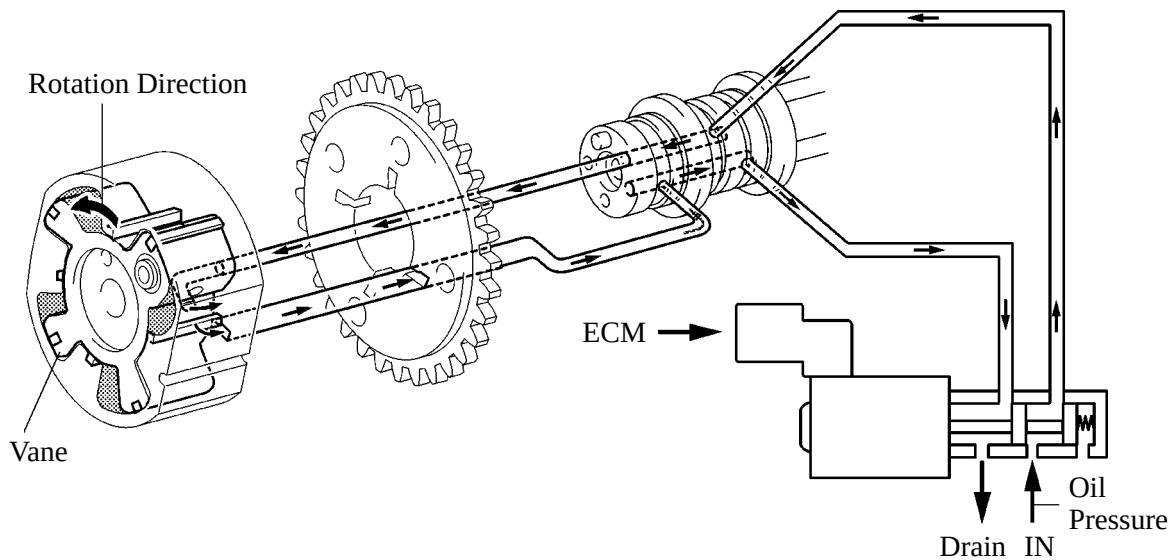
## 2) Retard

When the camshaft timing oil control valve is positioned as illustrated below by the retard signals from the ECM, the resultant oil pressure is applied to the timing retard side vane chamber to rotate the camshaft in the timing retard direction.

### ► Intake Side ◀



### ► Exhaust Side ◀



## 3) Hold

After reaching the target timing, the valve timing is held by keeping the camshaft timing oil control valve in the neutral position unless the traveling state changes.

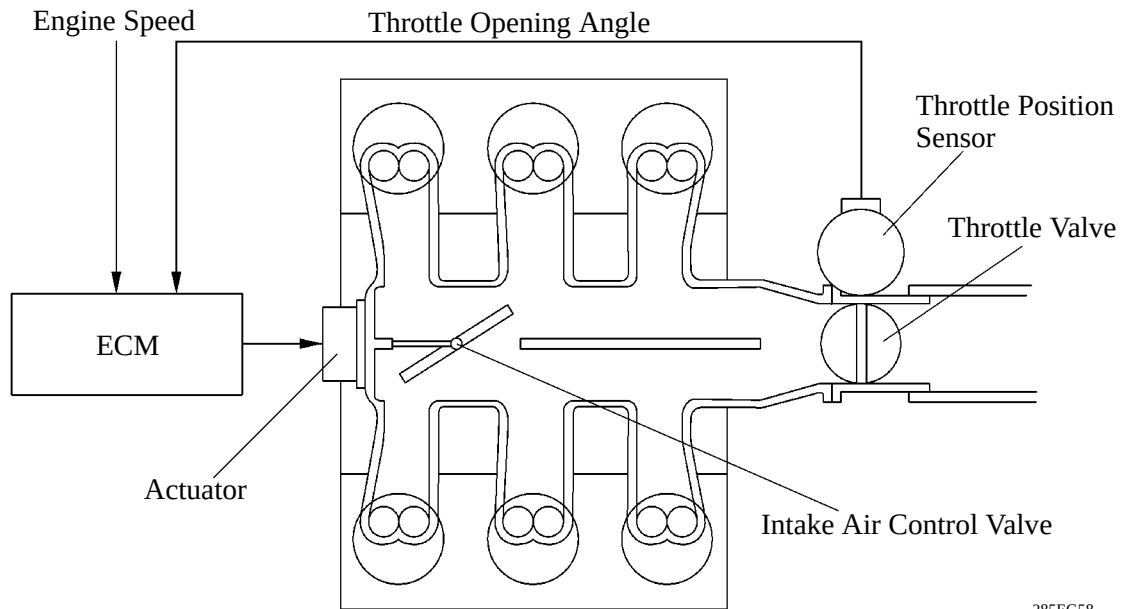
This adjusts the valve timing at the desired target position and prevents the engine oil from running out when it is unnecessary.

## 8. ACIS (Acoustic Control Induction System)

### General

The ACIS is realized by using a bulkhead to divide the intake manifold into 2 stages, with an intake air control valve in the bulkhead being opened and closed to vary the effective length of the intake manifold in accordance with the engine speed and throttle valve opening angle. This increases the power output in all ranges from low to high speed.

### ► System Diagram ◀



285EG58

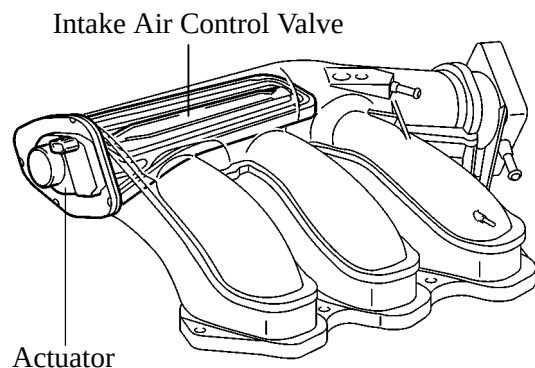
### Construction

#### 1) Intake Air Control Valve

The intake air control valve, which is provided in the intake air chamber, open and close to change the effective length of the intake manifold in 2 stages.

#### 2) Actuator (Motor)

The actuator activates the intake air control valve based on signals from the ECM.



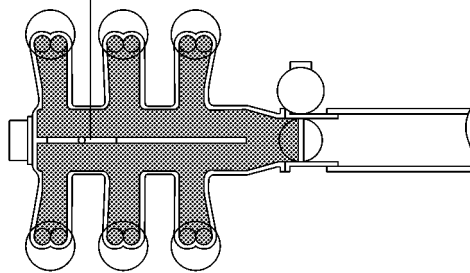
285EG64

## Operation

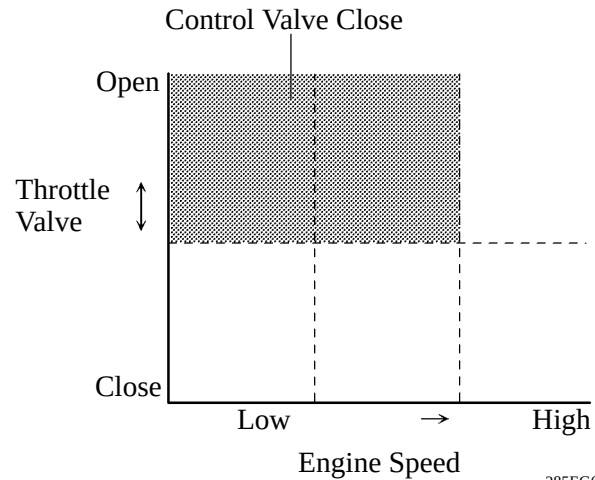
### 1) When the Intake Air Control Valve Closes

While the engine is running at middle speed under high load, the ECM controls the actuator to close the control valve. As a result, the effective length of the intake manifold is lengthened and the intake air efficiency, in the medium speed range, is improved due to the dynamic effect of the intake air, thereby increasing power output.

Intake Air Control Valve (Close)



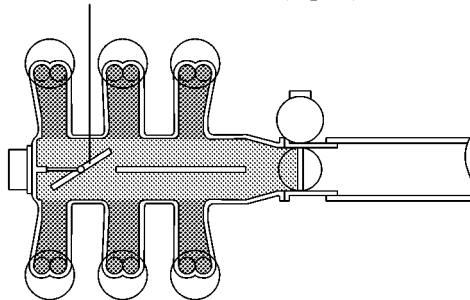
■ : Effective Intake Manifold Length



### 2) When the Intake Air Control Valve Open

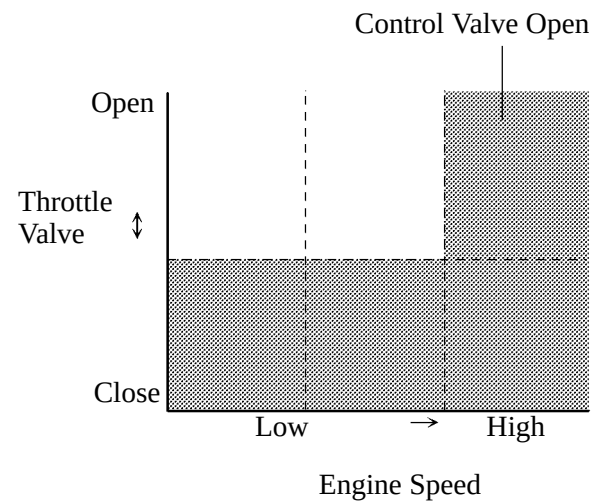
Under any condition except when the engine is running at middle speed under high load, the ECM controls the actuator to open the control valve. When the control valve is open, the effective length of the intake air chamber is shortened and peak intake efficiency is shifted to the low-to-high engine speed range, thus providing greater output at low-to-high engine speeds.

Intake Air Control Valve (Open)



■ : Effective Intake Manifold Length

▨ : Effective Intake Air Chamber Length



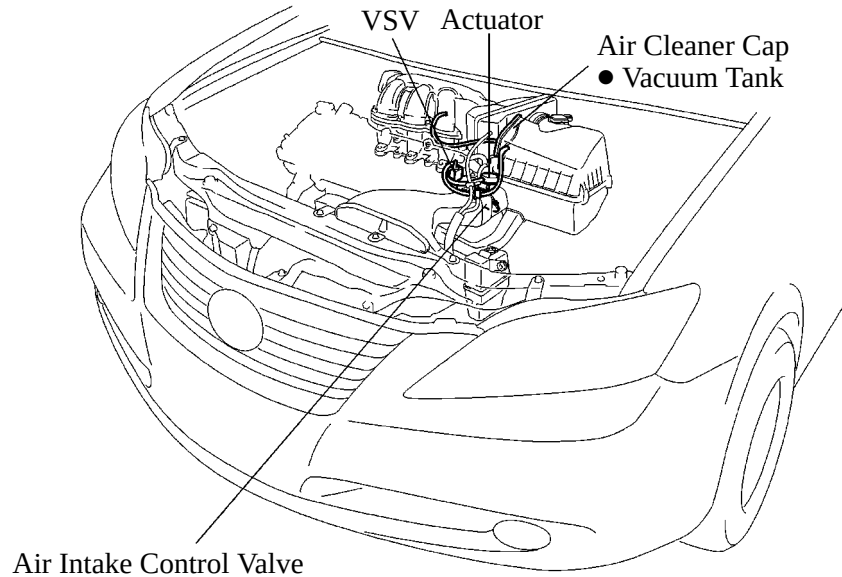
## 9. Air Intake Control System

### General

The system has a dual path design for air intake. An air intake control valve and actuator control the air flow path.

As a result, a reduction in intake noise in the low-speed range and an increase in the power output in the high-speed range is realized.

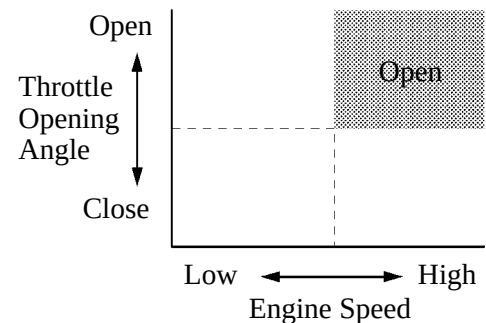
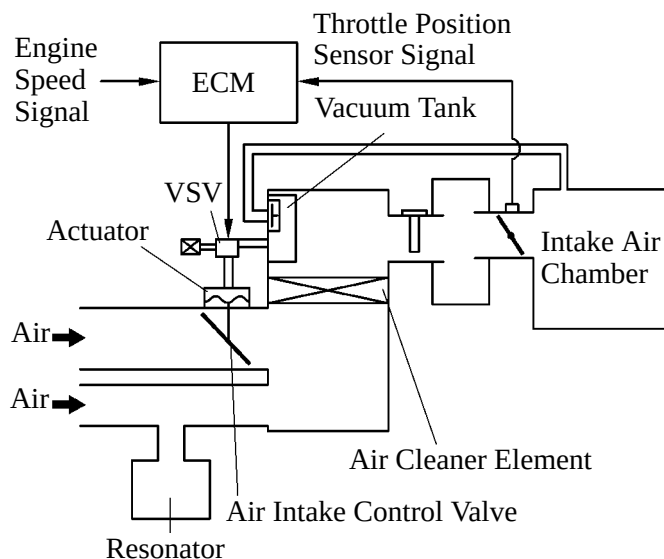
### ► Layout of Components ◀



01YEG12Y

### Operation

- When the engine is operating in the low- to mid-speed range, this control operates the air intake control valve to close one side of the air cleaner inlet. As a result, the intake area has been minimized and the intake noise is reduced.
- When the engine is operating in the high-speed range, this control operates the air intake control valve to open both sides of the air cleaner inlet. As a result, the intake area has been maximized and the intake efficiency is improved.

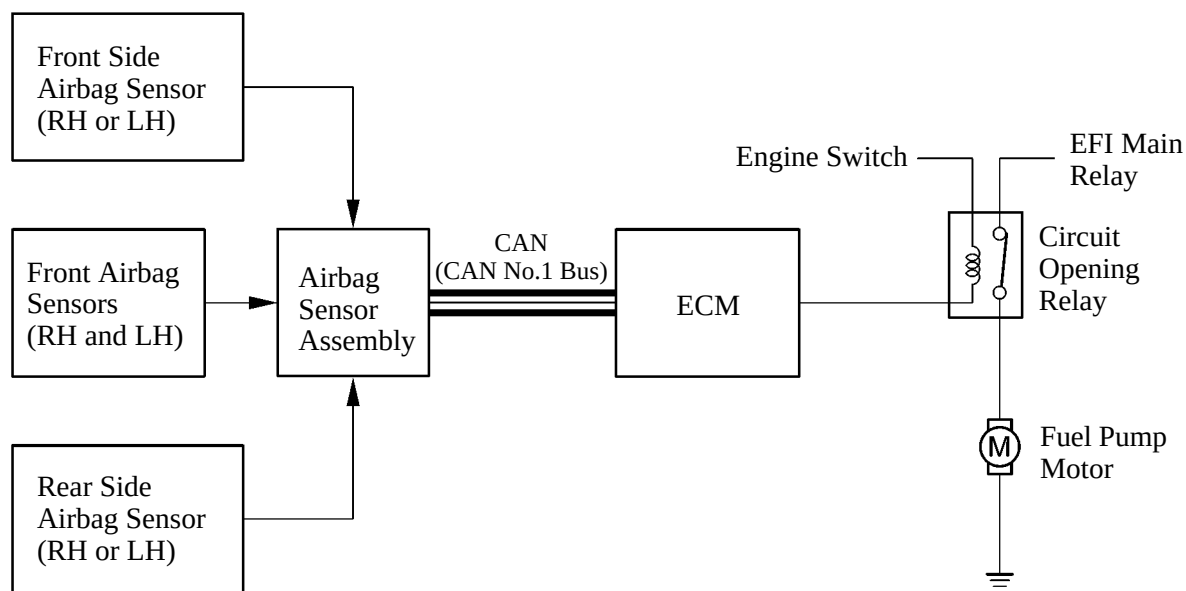


**Air Intake Control Valve Condition**

285EG68

## 10. Fuel Pump Control

A fuel cut control system is used to stop the fuel pump once when any of the SRS airbags is deployed. In this system, the airbag deployment signal from the airbag sensor assembly is detected by the ECM, and it turns OFF the circuit opening relay. After the fuel cut control has been activated, turning the engine switch from OFF to ON cancels the fuel cut control, and the engine can be restarted.



01YEG13TE

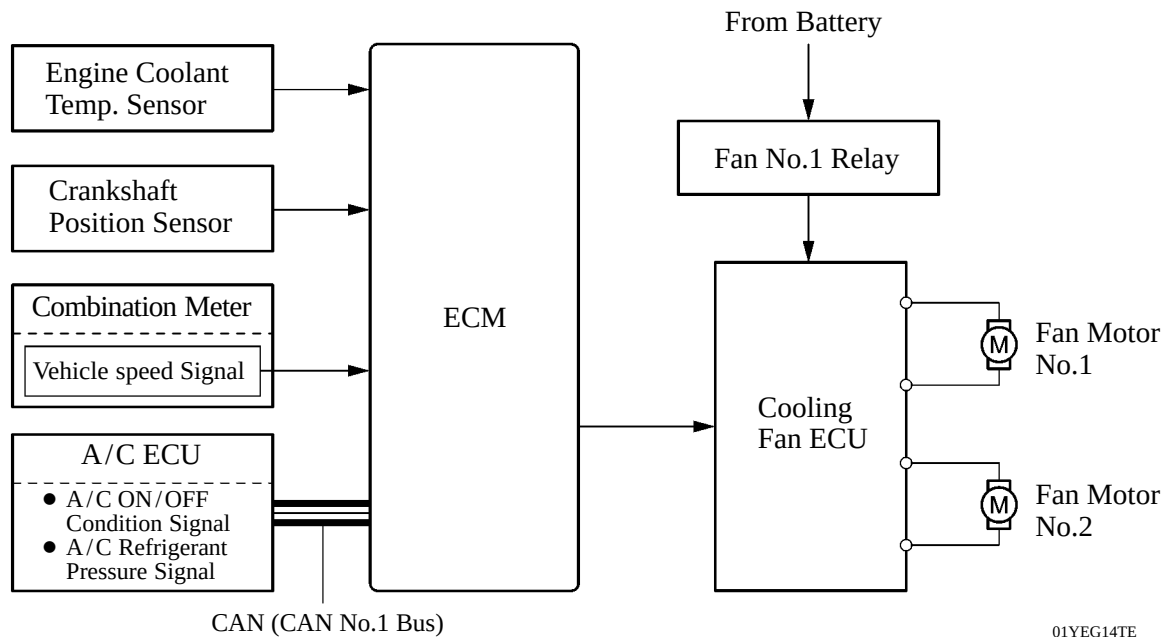


## 11. Cooling Fan Control System

### General

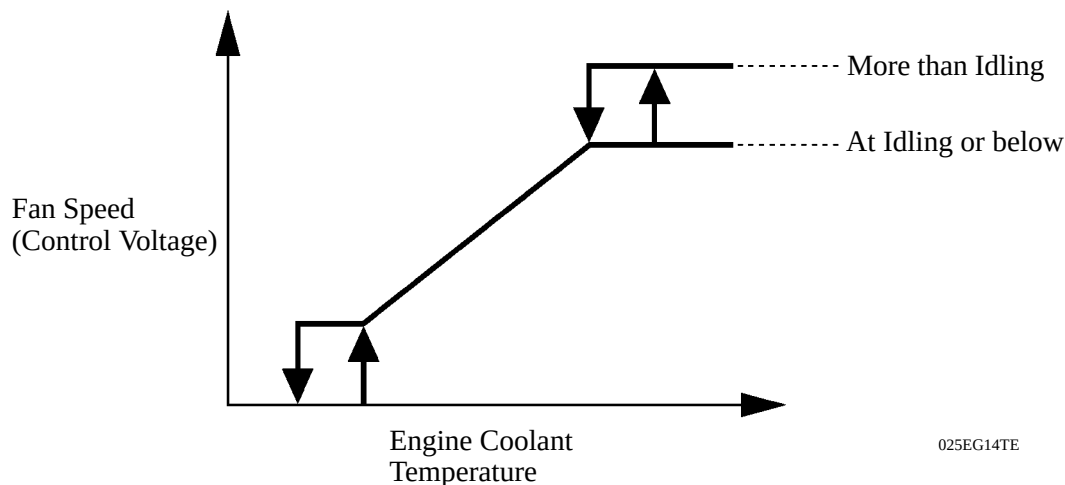
A cooling fan control system is used. To achieve an optimal fan speed in accordance with the engine coolant temperature, vehicle speed, engine speed, and air conditioning operating conditions, the ECM calculates the proper fan speed and sends the signals to the cooling fan ECU. Upon receiving the signals from the ECM, the cooling fan ECU actuates the fan motors.

### ► Wiring Diagram ◀

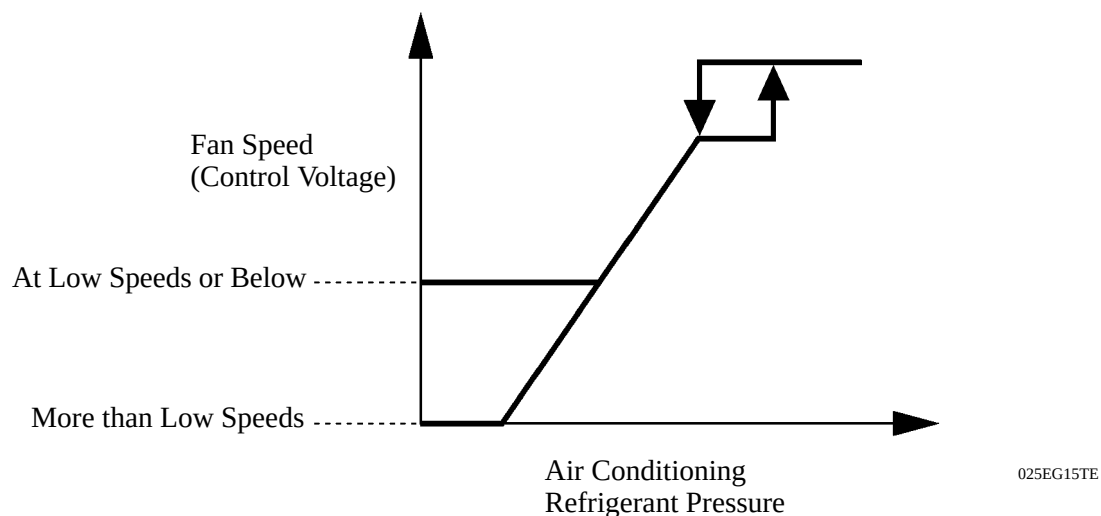


## Operation

- The ECM controls the cooling fan speed in accordance with the value of the engine coolant temperature, as shown in the graph below. When the engine coolant temperature is higher than a specific value, the control differs depending on whether the engine speed is at idling and below or more.



- The ECM controls the cooling fan speed in accordance with the value of the air conditioning refrigerant pressure, as shown in the graph below. When the air conditioning refrigerant pressure is higher than a specific value, the control differs depending on whether the engine speed is at low speeds and below or more.

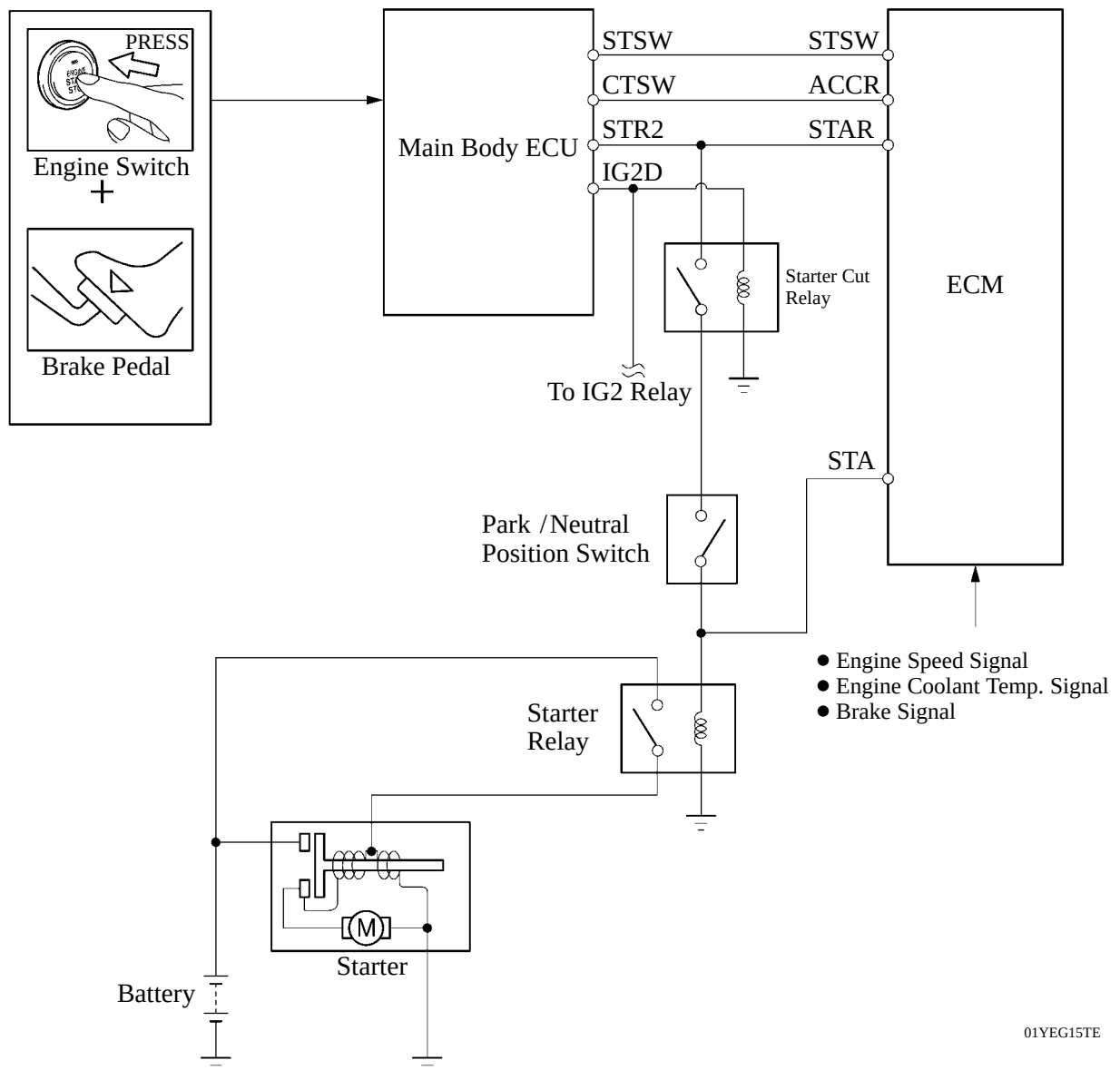


## 12. Cranking Hold Function

### General

- Once the engine switch is pressed, this function continues to operate the starter until the engine has started, provided that the brake pedal is depressed. This prevents starting failure and the engine from being cranked after it has started.
- When the ECM detects a start signal from the main body ECU, 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 main body ECU, this system will not operate the starter if the ECM has determined that the engine has already started.

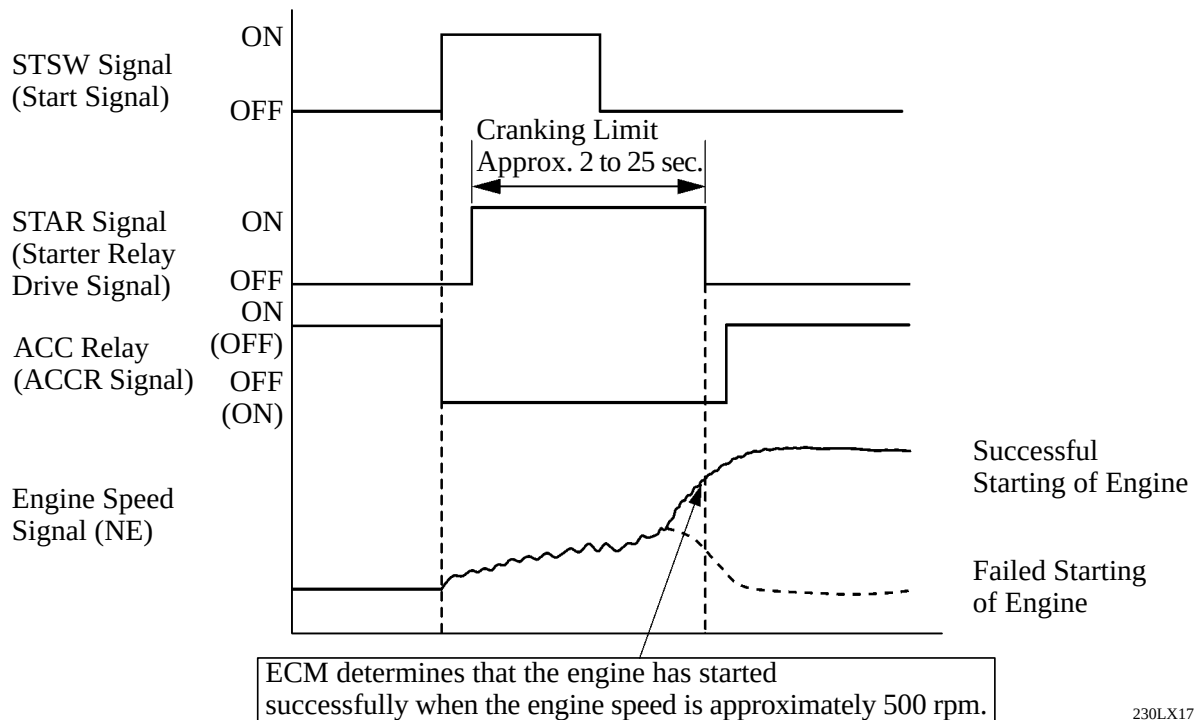
### ► System Diagram ◀



## Operation

- As indicated in the below timing chart, when the ECM detects a STSW signal (start signal) from the main body ECU, the ECM outputs STAR signal (starter relay drive signal) through the starter cut relay to the starter relay and actuates the starter. The ECM also outputs ACCR signal (ACC-cut request signal) to the main body ECU. Thus, the main body ECU will not energize the ACC relay. If the engine is already running, the ECM stops the output of the STAR signal to the starter relay and the output of the ACCR signal to the main body ECU. Thus, the starter operation stops and the main body ECU energizes the ACC 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 output of the STAR signal to the starter relay and the output of ACCR signal to the main body ECU. Thus, the starter operation stops and the main body ECU energizes the ACC relay.
- If the engine has any failure and does not start, 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 water temperature condition. When the engine water 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.
- This system has following protections.
  - While the engine is running normally, the starter does not operate.
  - Even if the driver keeps pressing the engine switch, the ECM stops the output of the STAR and ACCR signals when the engine speed becomes higher than 1200 rpm. Thus, the starter operation stops and the main body ECU energizes the ACC relay.
  - In case the driver keeps pressing the engine switch and the engine does not start, the ECM stops the output of the STAR and ACCR signals after 30 seconds have elapsed. Thus, the starter operation stops and the main body ECU energizes the ACC relay.
  - Thus, the main body ECU will stop the operation of the starter.
  - In case the ECM cannot detect an engine speed signal while the starter is operating, the ECM will immediately stop the output of the STAR and ACCR signals. Thus, the starter operation stops and the main body ECU energizes the ACC relay.

### ► Timing Chart ◀



### 13. Evaporative Emission Control System

#### General

The evaporative emission control system prevents the fuel vapors that are created in the fuel tank from being released directly into the atmosphere.

The charcoal canister stores the fuel vapors that have been created in the fuel tank.

- The ECM controls the EVAP valve in accordance with the driving conditions in order to direct the fuel vapors into the engine, where they are burned.
- In this system, the ECM checks for evaporative emission leaks and outputs DTC (Diagnostic Trouble Code) in the event of a malfunction. An evaporative emission leak check consists of an application of vacuum to the evaporative emissions system and monitoring the system for changes in pressure in order to detect a leakage.
- This system consists of an EVAP valve, charcoal canister, refueling valve, pump module, and ECM.
- An ORVR (Onboard Refueling Vapor Recovery) function is provided in the refueling valve.
- The pressure sensor has been included to the pump module.
- An air filter has been provided on the fresh air line. This air filter is maintenance-free.
- The EVAP service port has been removed.
- The following are the typical conditions necessary to enable an evaporative emission leak check:

|                            |                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Typical Enabling Condition | <ul style="list-style-type: none"> <li>• Five hours have elapsed after the engine has been turned OFF*.</li> <li>• Altitude: Below 2400 m (8000 feet)</li> <li>• Battery Voltage: 10.5 V or more</li> <li>• Ignition switch: OFF</li> <li>• Engine Coolant Temperature: 4.4 to 35°C (40 to 95°F)</li> <li>• Intake Air Temperature: 4.4 to 35°C (40 to 95°F)</li> </ul> |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

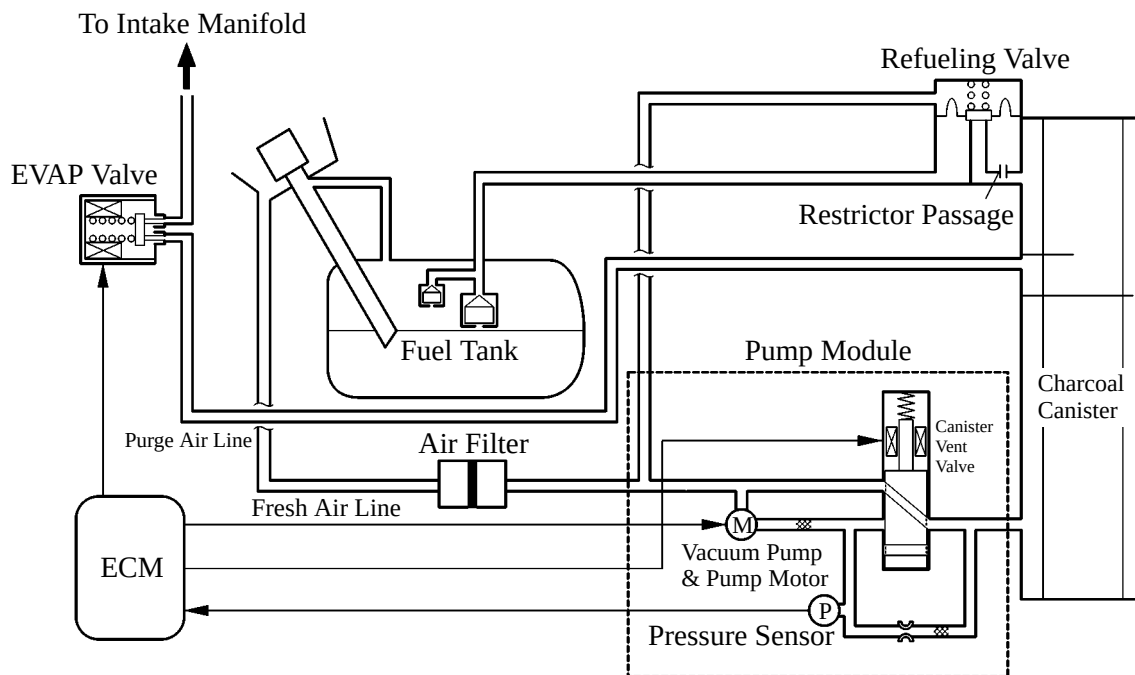
\*: If engine coolant temperature does not drop below 35°C (95°F), this time should be extended to 7 hours. Even after that, if the temperature is not less than 35°C (95°F), the time should be extended to 9.5 hours.

#### Service Tip

The pump module performs a fuel evaporative emission leakage check. This check is done approximately five hours after the engine is turned off. Sound may be heard coming from underneath the luggage compartment for several minutes. This does not indicate a malfunction.

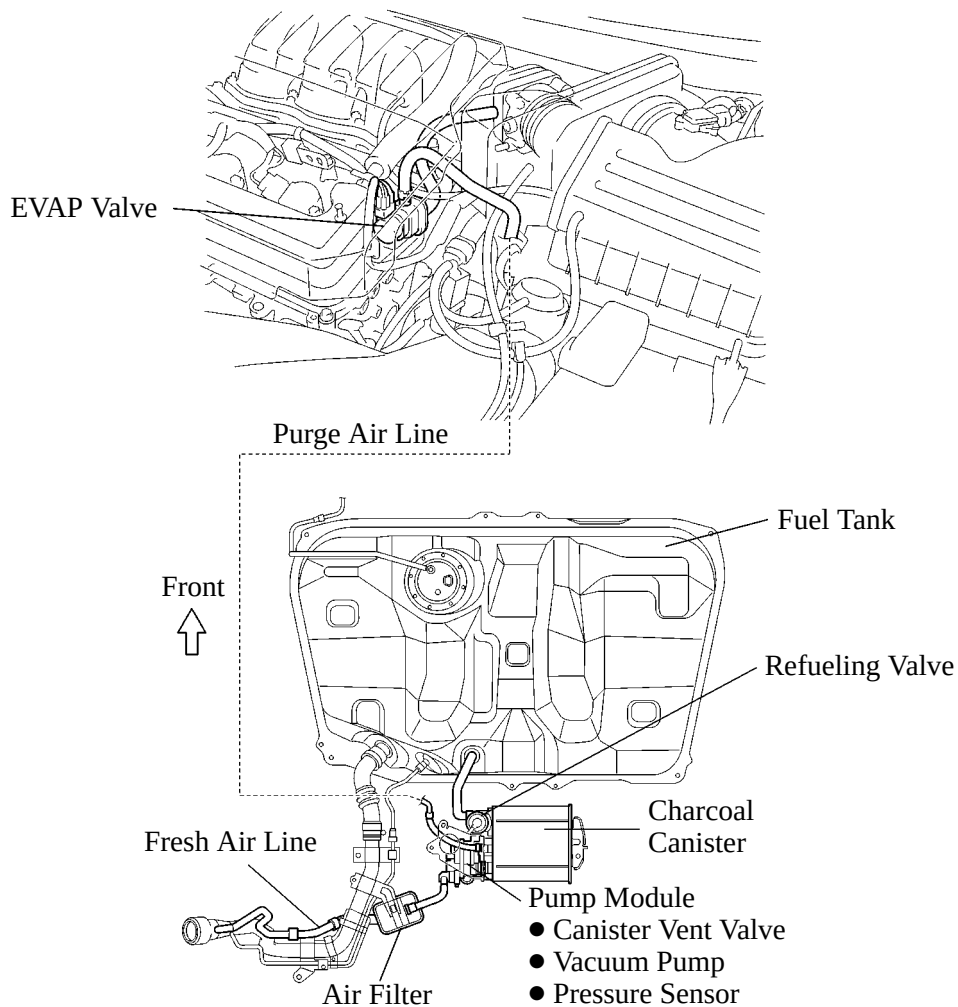
- Pinpoint pressure test procedure is adopted by pressurizing the fresh air line that runs from the pump module to the air filler neck. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

## System Diagram



060XA15C

## Layout of Main Components



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**Function of Main Components**

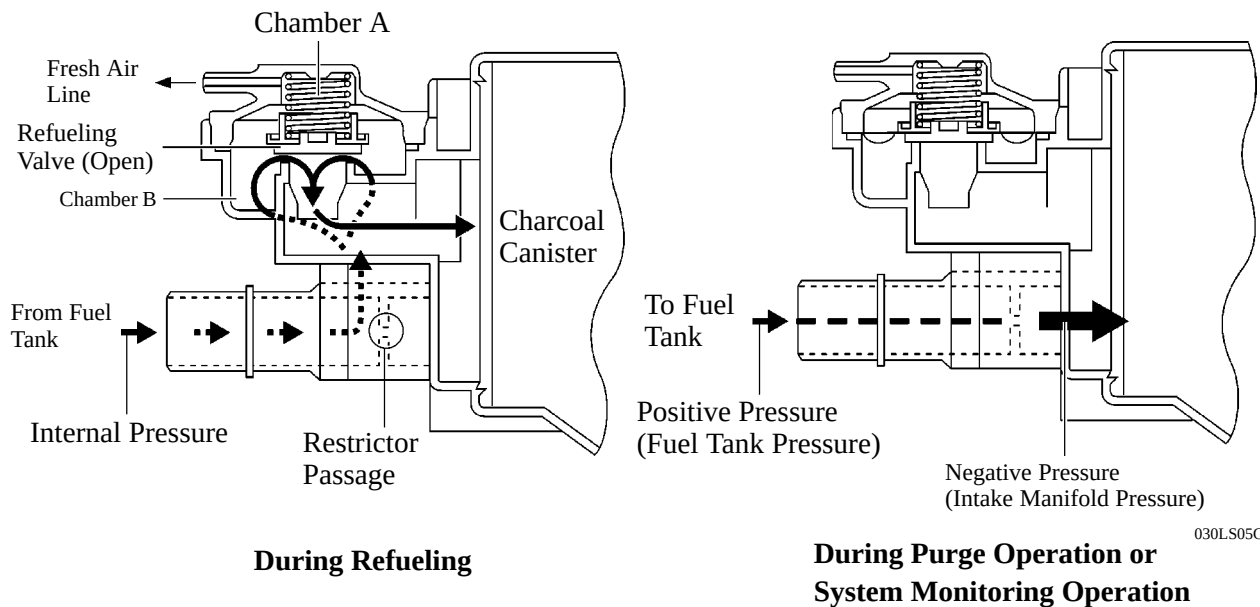
| Component         |                          | Function                                                                                                                                                                                                                                                                               |
|-------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Charcoal Canister |                          | Contains activated charcoal to absorb the fuel vapors that are created in the fuel tank.                                                                                                                                                                                               |
| Refueling Valve   |                          | Controls the flow rate of the fuel vapors from the fuel tank to the charcoal canister when the system is purging or during refueling.                                                                                                                                                  |
|                   | Restrictor Passage       | Prevents a large amount of vacuum during purge operation or system monitoring operation from affecting the pressure in the fuel tank.                                                                                                                                                  |
| Fresh Air Line    |                          | Fresh air goes into the charcoal canister and the cleaned drain air goes out into the atmosphere.                                                                                                                                                                                      |
| Pump Module       | Canister Vent Valve      | Opens and closes the fresh air line in accordance with the signals from the ECM.                                                                                                                                                                                                       |
|                   | Vacuum Pump & Pump Motor | Applies vacuum pressure to the evaporative emission system in accordance with the signals from the ECM.                                                                                                                                                                                |
|                   | Pressure Sensor          | Detects the pressure in the evaporative emission system and sends the signals to the ECM.                                                                                                                                                                                              |
| EVAP Valve        |                          | Opens in accordance with the signals from the ECM when the system is purging, in order to send the fuel vapors that were absorbed by the charcoal canister into the intake manifold. In system monitoring mode, this valve controls the introduction of the vacuum into the fuel tank. |
| Air Filter        |                          | Prevents dust and debris in the fresh air from entering the system.                                                                                                                                                                                                                    |
| ECM               |                          | Controls the pump module and the EVAP 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

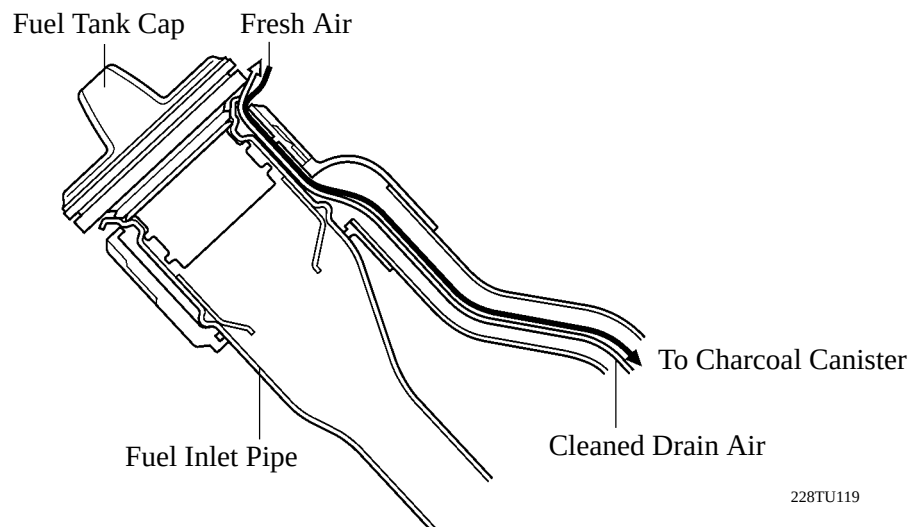
The refueling valve consists of chamber A, chamber B, and the restrictor passage. A constant atmospheric pressure is applied to chamber A.

- During refueling, the internal pressure of the fuel tank increases. This pressure causes the refueling valve to lift up, allowing the fuel vapors to enter the charcoal canister.
- 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 fuel vapors from the fuel tank to the charcoal canister. If a large volume of fuel vapors enters the intake manifold, it will affect the air-fuel ratio control of the engine. Therefore, the role of the restrictor passage is to help 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 the fresh air line inlet has been changed from the air cleaner to the near the fuel inlet. The fresh air from the atmosphere and drain air cleaned by the charcoal canister will go in or out of the system through the passages shown below.

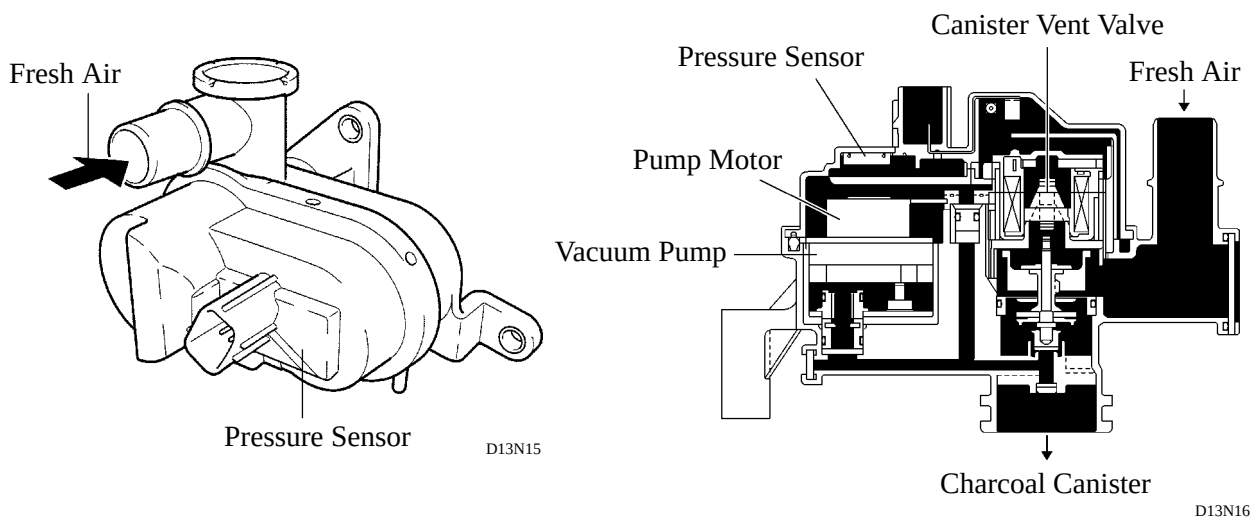




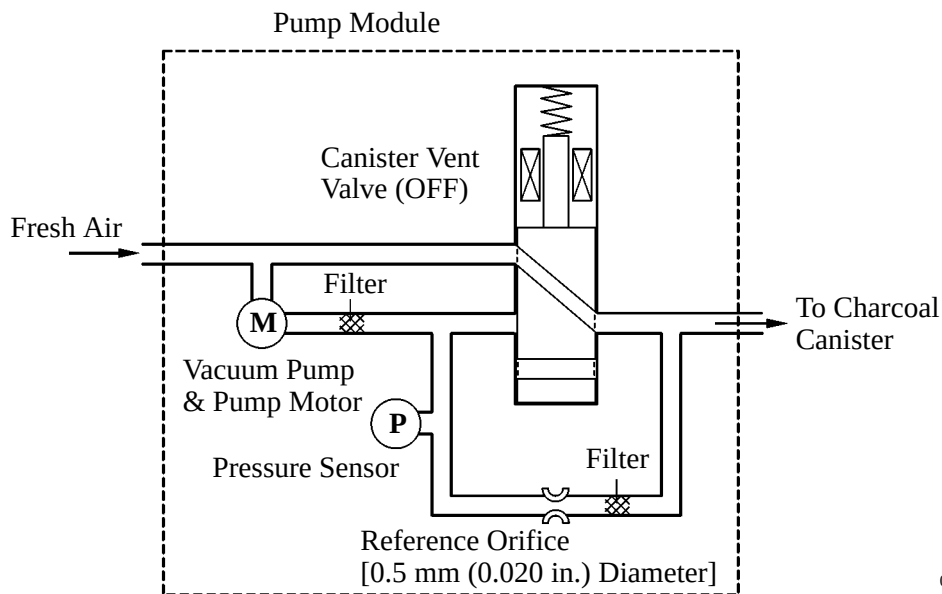
### 3) Pump module

The Pump module consists of the canister vent valve, pressure sensor, vacuum pump, and pump motor.

- The canister vent valve switches the passages in accordance with the signals received from the ECM.
- A DC type brushless motor is used for the pump motor.
- A vane type vacuum pump is used.



#### ► Simple Diagram ◀



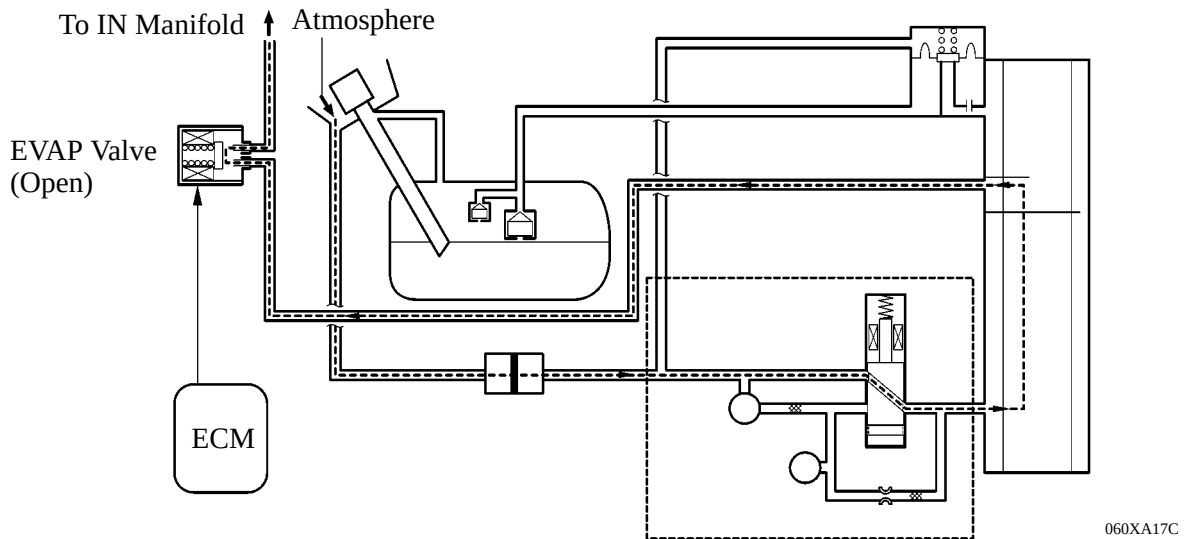
060XA16C

## System Operation

### 1) Purge Flow Control

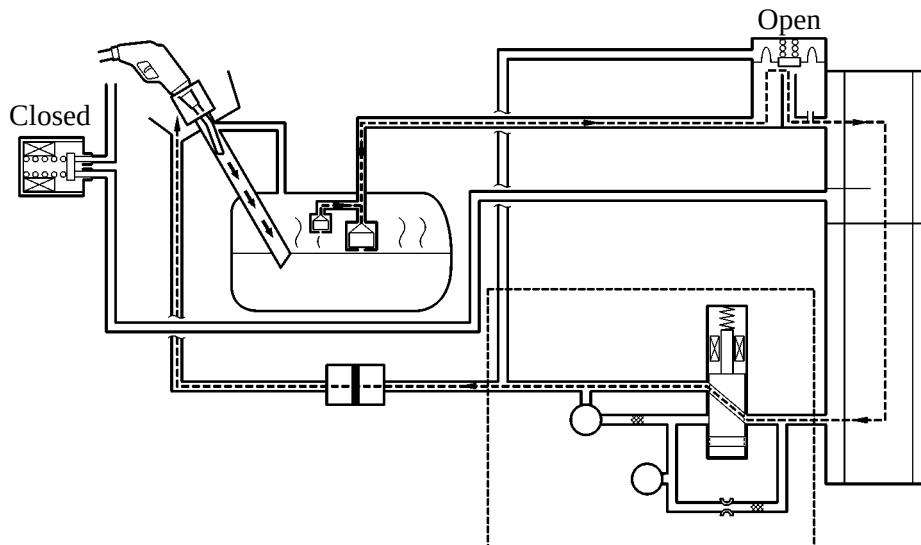
When the engine has reached predetermined parameters (closed loop, engine coolant temp. above 80 °C (176 °F), etc), stored fuel vapors are purged from the charcoal canister whenever the EVAP valve is opened by the ECM.

The ECM will change the duty ratio cycle of the EVAP valve, thus controlling purge flow volume. Purge flow volume is determined by intake manifold pressure and the duty ratio cycle of the EVAP 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. The air that has had the fuel vapors removed from it will be discharged through the fresh air line. The canister vent valve is used to open and close the fresh air line, and it is always open (even when the engine is stopped) except when the vehicle is in monitoring mode (the valve will be open as long as the vehicle is not in monitoring mode). If the vehicle is refueled in system monitoring mode, the ECM will recognize the refueling by way of the pressure sensor, which detects the sudden pressure increase in the fuel tank, and the ECM will open the canister vent valve.

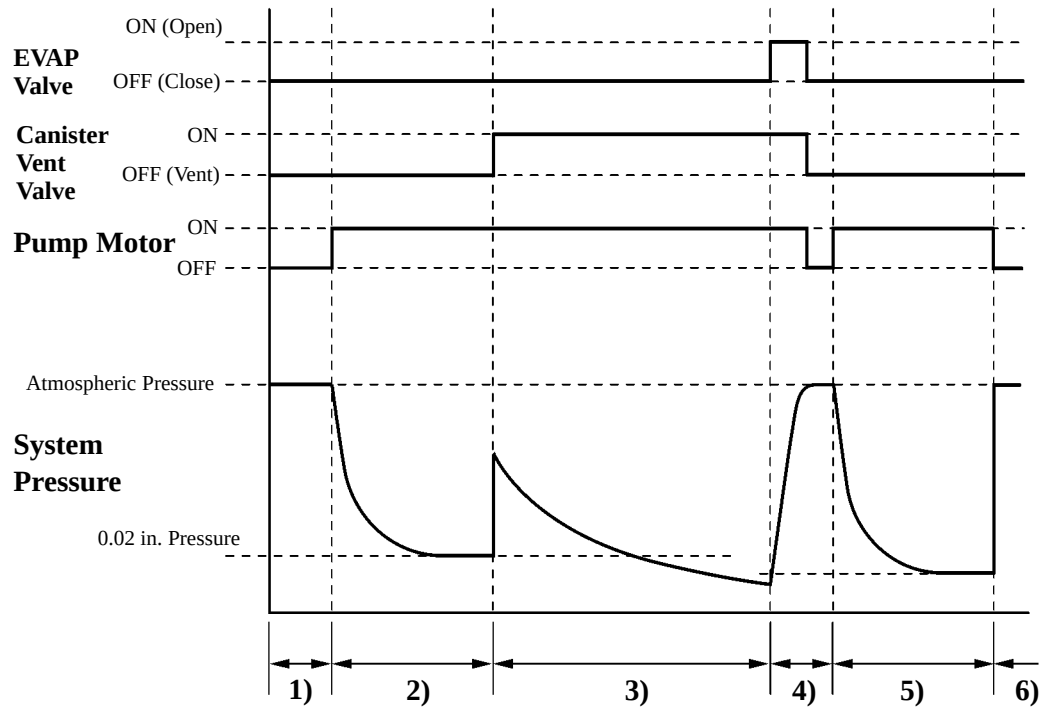


### 3) EVAP Leak Check

#### a. General

The EVAP leak check operates in accordance with the following timing chart:

#### ► Timing Chart ◀

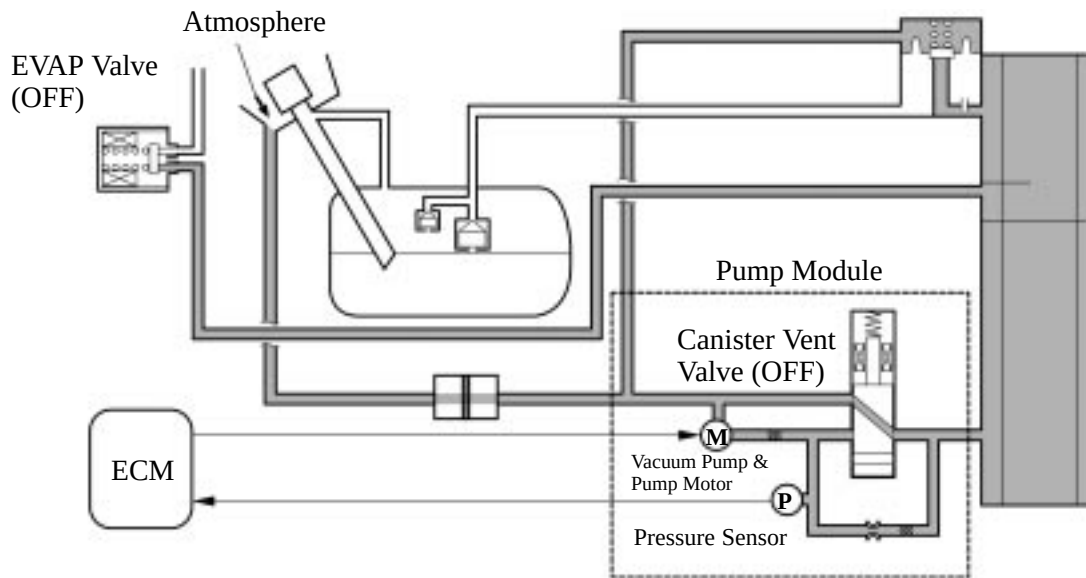


060XA19C

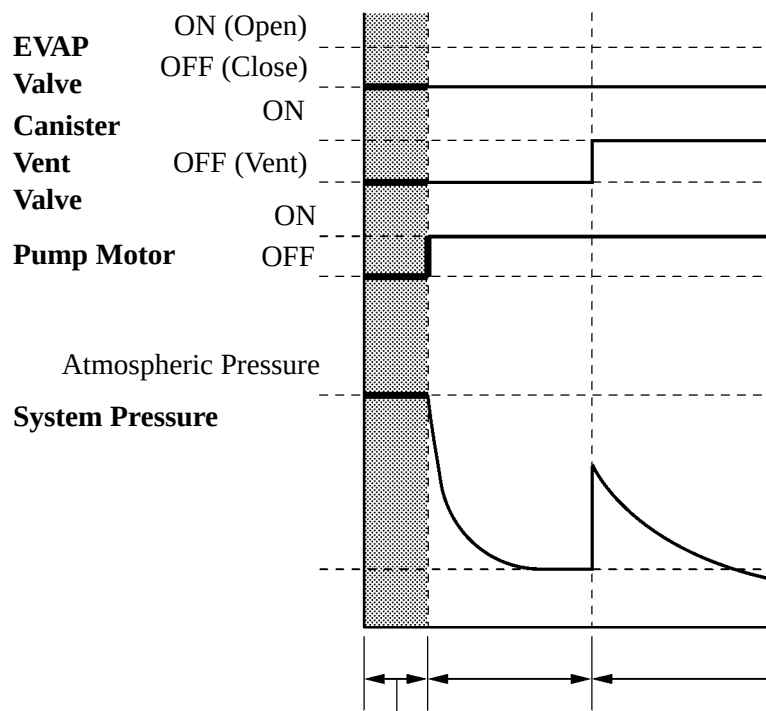
| Order | Operation                                 | Description                                                                                                                                                                                                                                                                                                                       | Time           |
|-------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1)    | Atmospheric Pressure Measurement          | The ECM turns the canister vent valve OFF (vent) and measures EVAP system pressure to memorize the atmospheric pressure.                                                                                                                                                                                                          | —              |
| 2)    | 0.02 in. Leak Pressure Measurement        | The Vacuum pump creates negative pressure (vacuum) through a 0.02 in. orifice and the pressure is measured. The ECM determines this as the 0.02 in. leak pressure.                                                                                                                                                                | 20 sec.        |
| 3)    | EVAP Leak Check                           | The Vacuum pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized pressure is larger than the 0.02 in. leak pressure, ECM determines that the EVAP system has a leak.<br>If the EVAP pressure does not stabilize within 15 minutes, the ECM cancels EVAP monitor. | Within 15 min. |
| 4)    | EVAP Valve Monitor                        | The ECM opens the EVAP valve and measures the EVAP pressure increase. If the increase is large, the ECM interprets this as normal.                                                                                                                                                                                                | 10 sec.        |
| 5)    | Repeat 0.02 in. Leak Pressure Measurement | The Vacuum pump creates negative pressure (vacuum) through the 0.02 in. orifice and the pressure is measured. The ECM determines this as the 0.02 in. leak pressure.                                                                                                                                                              | 20 sec.        |
| 6)    | Final Check                               | The ECM measures the atmospheric pressure and records the monitor result.                                                                                                                                                                                                                                                         | —              |

### b. Atmospheric Pressure Measurement

- 1) When the ignition switch is turned OFF, the EVAP valve and the canister vent valve are turned OFF. Therefore, atmospheric pressure is introduced into the charcoal canister.
- 2) The ECM measures the atmospheric pressure based on the signals provided by the pressure sensor.
- 3) If the measurement value is out of standards, the ECM actuates the vacuum pump in order to monitor the changes in the pressure.



060XA20C

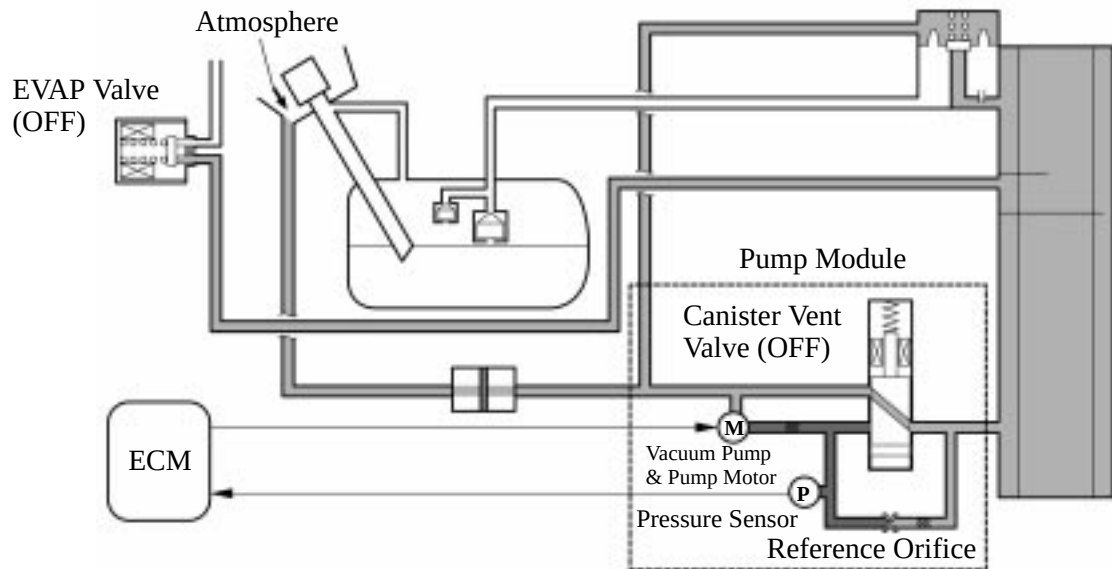


**Atmospheric Pressure Measurement**

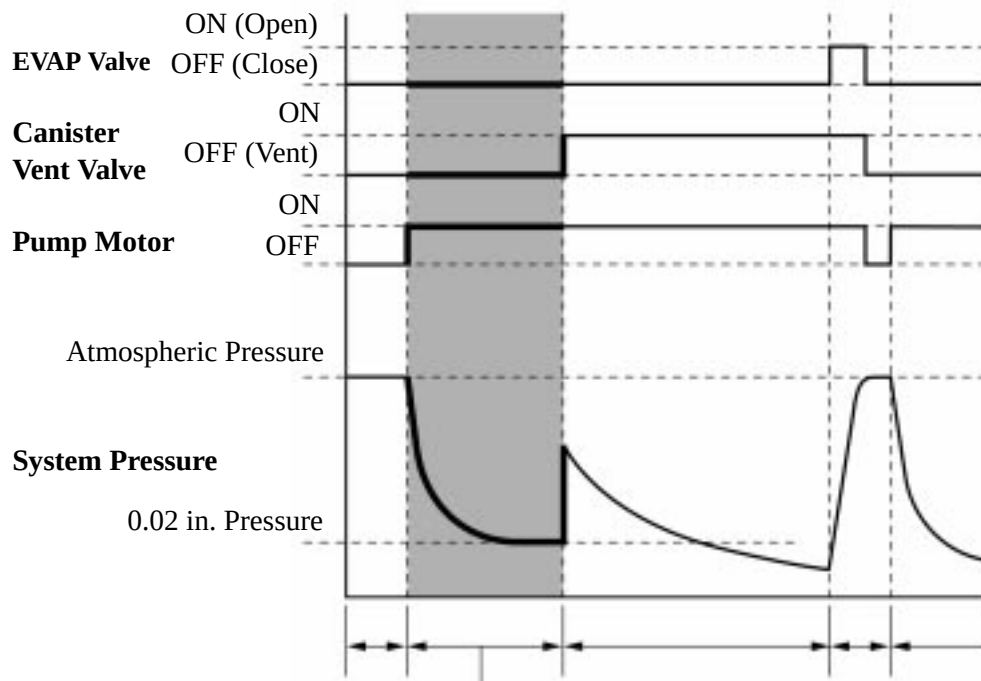
D13N22

**c. 0.02 in. Leak Pressure Measurement**

- 1) The canister vent valve remains off, and the ECM introduces atmospheric pressure into the charcoal canister and actuates the vacuum pump in order to create a negative pressure.
- 2) At this time, the pressure will not decrease beyond a 0.02 in. pressure due to the atmospheric pressure that enters through a 0.02 in. diameter reference orifice.
- 3) The ECM compares the logic value and this pressure, and stores it as a 0.02 in. leak pressure in its memory.
- 4) If the measurement value is below the standard, the ECM will determine that the reference orifice is clogged and store DTC (Diagnostic Trouble Code) P043E in its memory.
- 5) If the measurement value is above the standard, the ECM will determine that a high flow rate pressure is passing through the reference orifice and store DTC (Diagnostic Trouble Code) P043F, P2401 and P2402 in its memory.



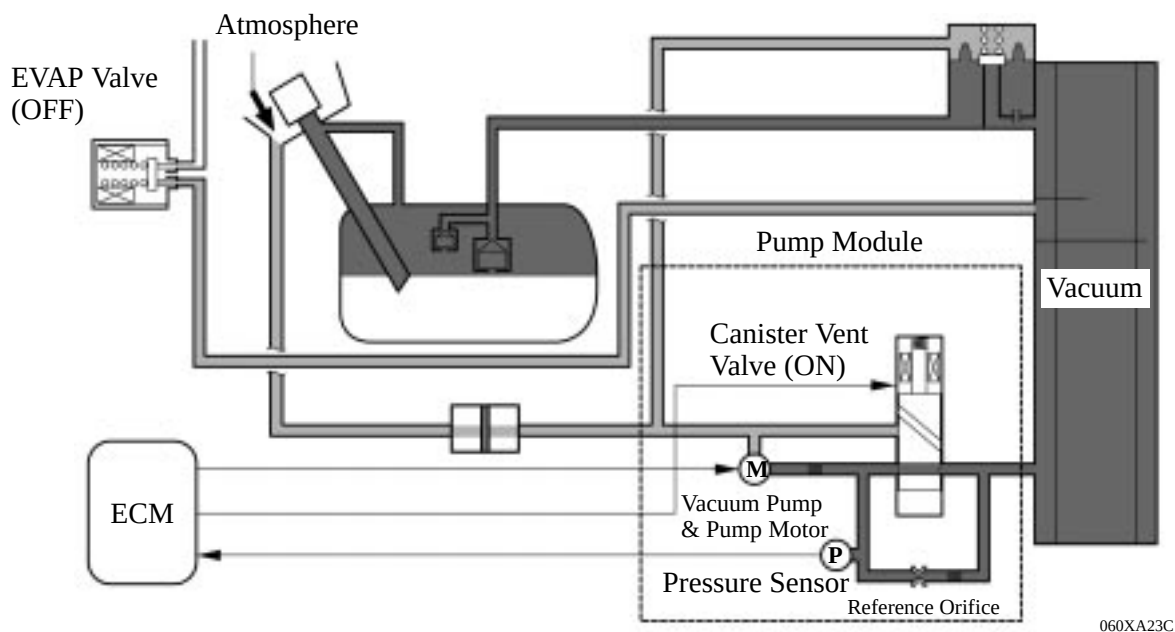
060XA21C

**0.02 in. Pressure Measurement**

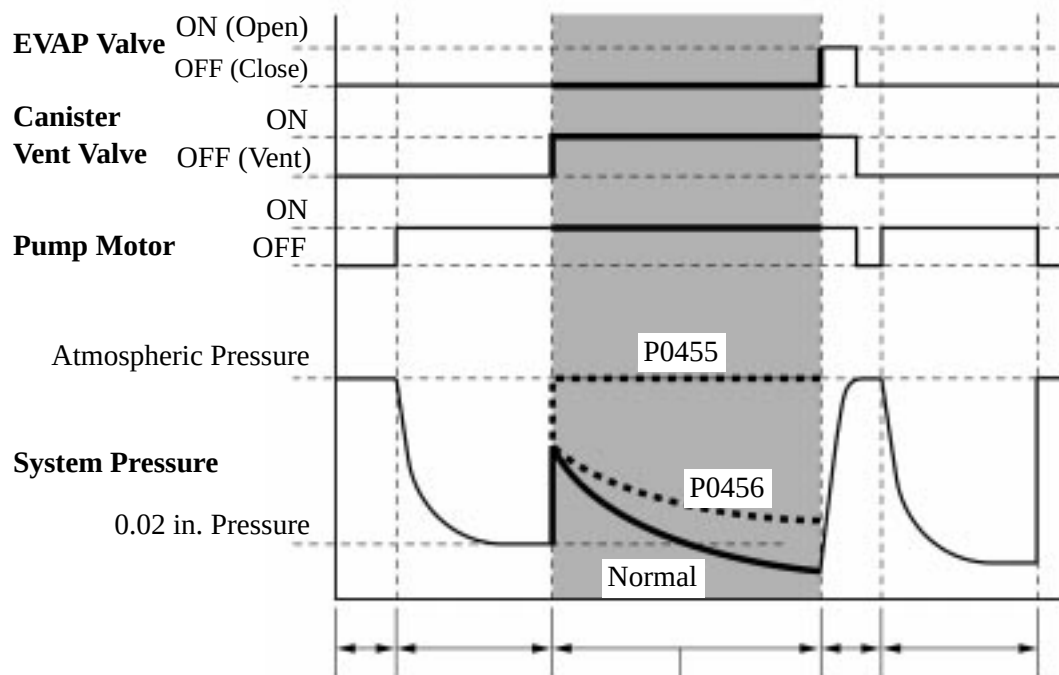
060XA22C

**d. EVAP Leak Check**

- 1) While actuating the vacuum pump, the ECM turns ON the canister vent valve in order to introduce a vacuum into the charcoal canister.
- 2) When the pressure in the system stabilizes, the ECM compares this pressure and the 0.02 in. pressure in order to check for a leakage.
- 3) If the detection value is below the 0.02 in. pressure, the ECM determines that there is no leakage.
- 4) If the detection value is above the 0.02 in. pressure and near atmospheric pressure, the ECM determines that there is a gross leakage (large hole) and stores DTC P0455 in its memory.
- 5) If the detection value is above the 0.02 in. pressure, the ECM determines that there is a small leakage and stores DTC P0456 in its memory.



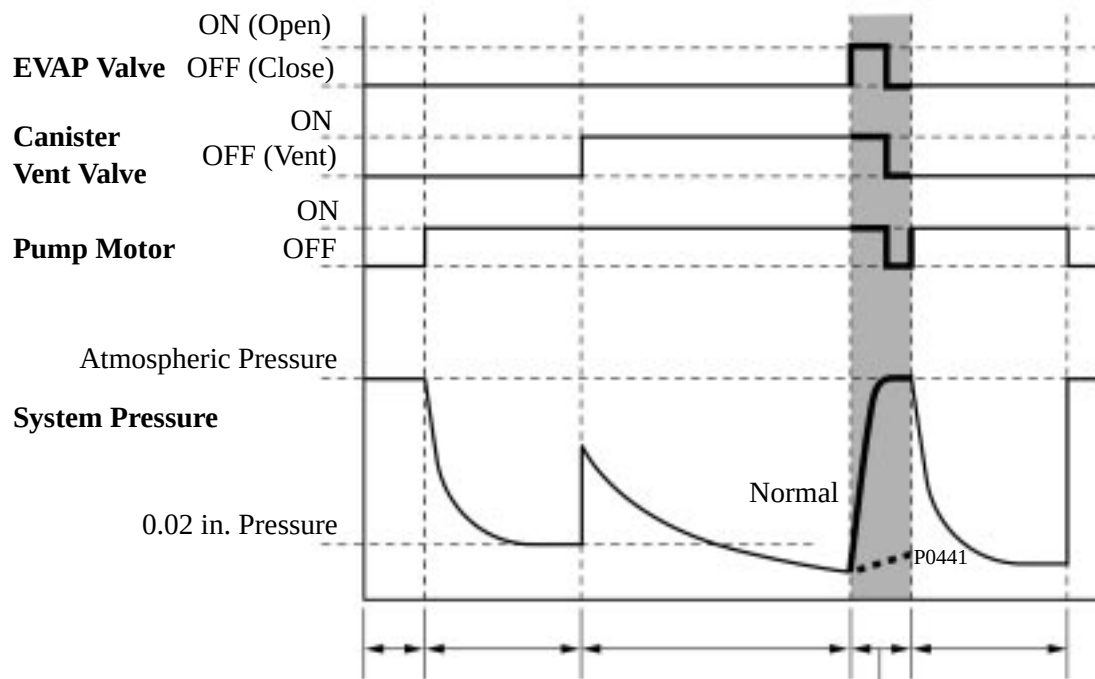
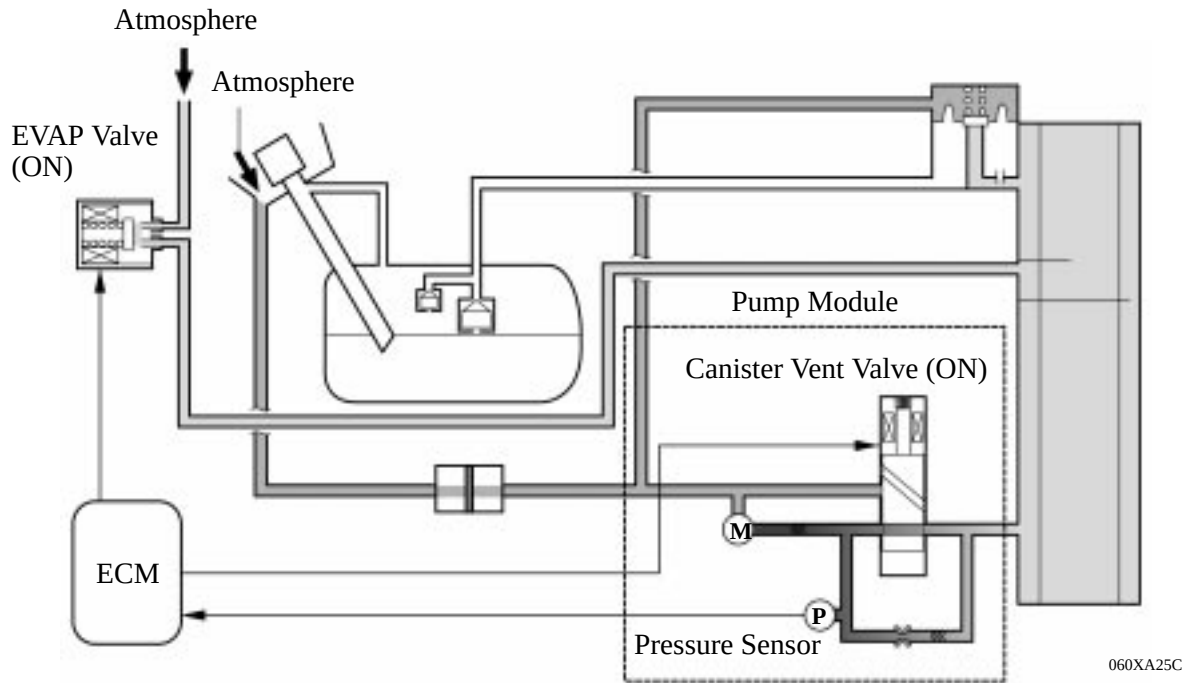
060XA23C

**EVAP Leak Check**

060XA24C

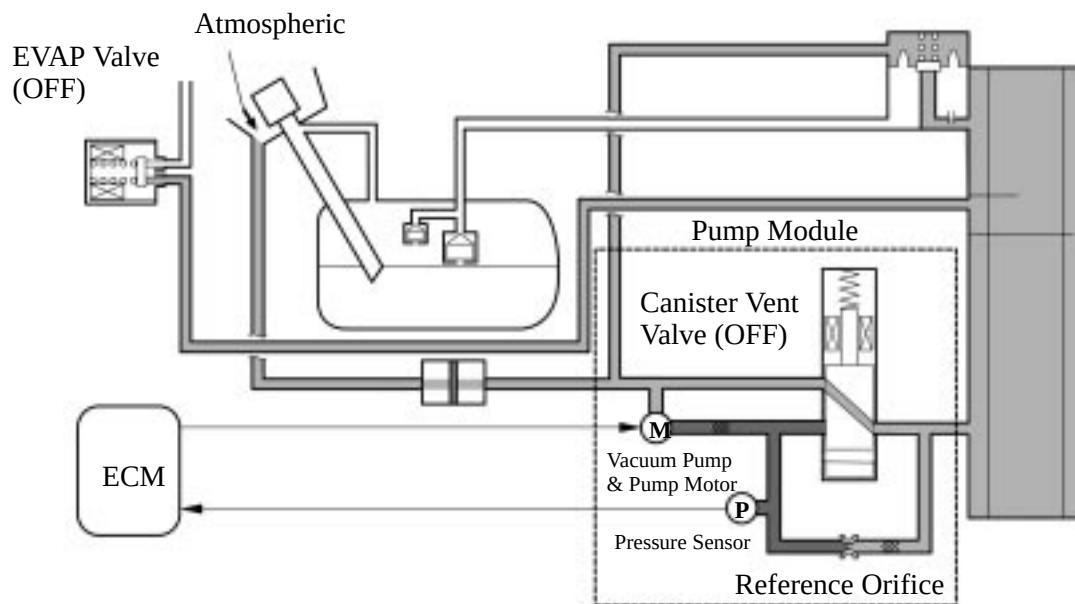
**e. EVAP Valve Monitor**

- 1) After completing an EVAP leak check, the ECM turns ON (open) the EVAP valve with the vacuum pump actuated, and introduces the atmospheric pressure from the intake manifold to the charcoal canister.
- 2) If the pressure change at this time is within the normal range, the ECM determines the condition to be normal.
- 3) If the pressure is out of the normal range, the ECM will stop the EVAP valve monitor and store DTC P0441 in its memory.

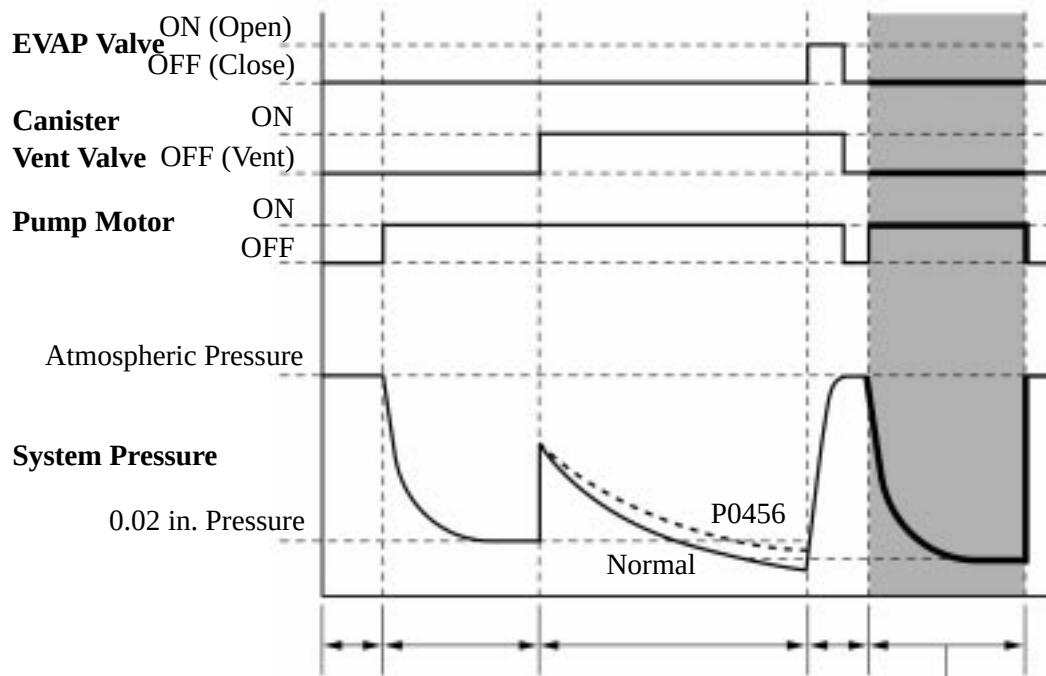


#### f. Repeat 0.02 in. Leak Pressure Measurement

- 1) While the ECM operates the vacuum pump, the EVAP valve and canister vent valve turns off and a repeat 0.02 in. leak pressure measurement is performed.
- 2) The ECM compares the measured pressure with the pressure during EVAP leak check.
- 3) If the pressure during the EVAP leak check is below the measured value, the ECM determines that there is no leakage.
- 4) If the pressure during the EVAP leak check is above the measured value, the ECM determines that there is a small leak and stores DTC P0456 in its memory.



060XA27C



Repeat 0.02 in. Pressure Measurement

060XA28C



## 14. 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 DTC (Diagnostic Trouble Code) of the malfunctions. The DTC can be accessed by using the hand-held tester.
- For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).

### Service Tip

- The ECM of the '07 ES350 uses the CAN protocol for diagnostic communication. Therefore, a hand-held tester and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2007 LEXUS ES350 Repair Manual (Pub. No. RM01Y0U).
- To clear the DTC that is stored in the ECM, use a hand-held tester, disconnect the battery terminal or remove the EFI fuse for 1 minute or longer.

## 15. Fail-Safe

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

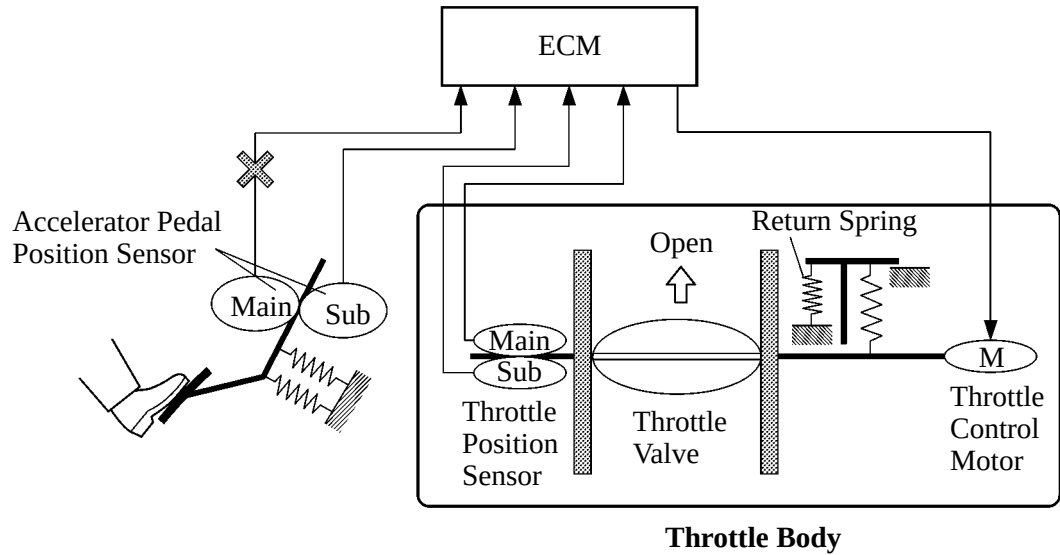
### ► Fail-Safe Chart ◀

| DTC No.                                                                                                                                              | Fail-Safe Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Fail-Safe Deactivation Conditions                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P0031, P0032,<br>P0051, P0052                                                                                                                        | ECM turns off air fuel ratio sensor heater.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Engine Switch OFF.                                                                                                                                             |
| P0037, P0038<br>P0057, P0058                                                                                                                         | ECM turns off heated oxygen sensor heater.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Engine Switch OFF.                                                                                                                                             |
| P0100, P0102,<br>P0103                                                                                                                               | Ignition timing is calculated from engine speed and throttle angle.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | “Pass” condition detected.                                                                                                                                     |
| P0110, P0112,<br>P0113                                                                                                                               | Intake air temperature is fixed at 20°C (68°F).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | “Pass” condition detected.                                                                                                                                     |
| P0115, P0117,<br>P0118                                                                                                                               | Engine coolant temperature is fixed at 80°C (176°F).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | “Pass” condition detected.                                                                                                                                     |
| P0120, P0121,<br>P0122, P0123,<br>P0220, P0222,<br>P0223, P0604,<br>P0606, P0607,<br>P0657, P2102,<br>P2103, P2111,<br>P2112, P2118,<br>P2119, P2135 | If ETCS-i (Electronic Throttle Control System-intelligent) has a malfunction, ECM cuts off current to throttle control motor. Throttle control valve returns to predetermined opening angle (approximately 6.5°) by force of return spring. ECM then adjusts engine output by controlling fuel injection (intermittent fuel-cut) and ignition timing in accordance with accelerator pedal opening angle to enable vehicle to continue at minimal speed.<br>If accelerator pedal is depressed firmly and slowly, vehicle can be driven slowly. If accelerator pedal is depressed quickly, vehicle may speed up and slow down erratically. | If “Pass” condition is detected and then the engine switch is turned OFF, fail-safe operation will stop and system will return to normal operating conditions. |
| P0327, P0328,<br>P0332, P0333                                                                                                                        | Max. timing retardation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Engine Switch OFF.                                                                                                                                             |
| P0351, P0352,<br>P0353, P0354,<br>P0355, P0356                                                                                                       | Fuel is cut.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | “Pass” condition detected.                                                                                                                                     |
| P2120, P2121,<br>P2122, P2123,<br>P2125, P2127,<br>P2128, P2138                                                                                      | Accelerator pedal position sensor has two (main and sub) sensor circuits.<br>If a malfunction occurs in either of sensor circuits, ECM detects abnormal signal voltage difference between two sensor circuits and switches into limp mode. In limp mode, remaining circuit is used to calculate accelerator pedal opening to allow vehicle to continue driving.<br>If both circuits malfunction, ECM regards opening angle of accelerator pedal to be fully closed. In this case, throttle valve will remain closed as if engine is idling.                                                                                              | If “Pass” condition is detected and then the engine switch is turned OFF, fail-safe operation will stop and system will return to normal operating conditions. |

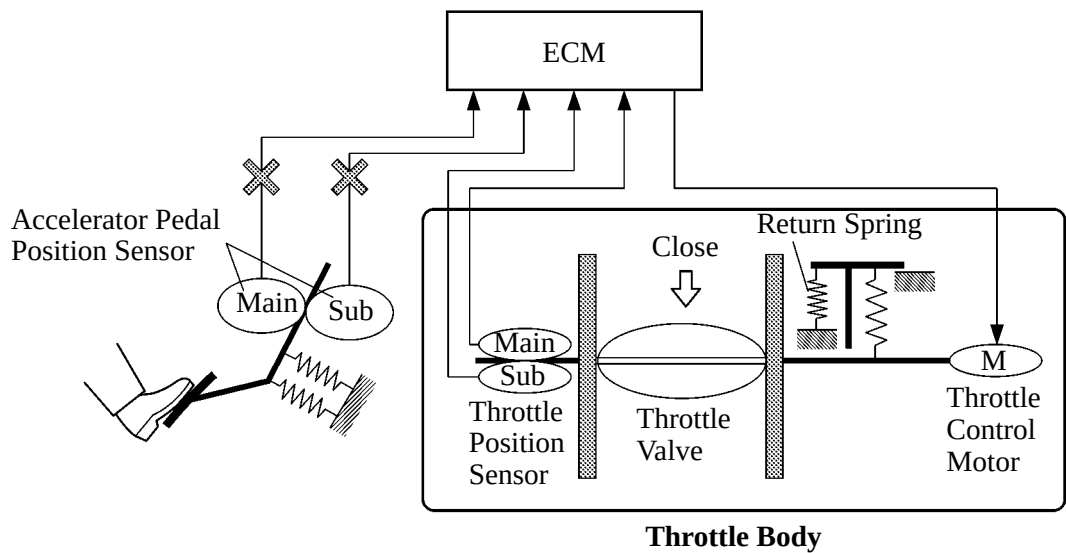
### Fail-safe of Accelerator Pedal Position Sensor

The accelerator pedal position sensor comprises two (Main, Sub) sensor circuits.

- If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between these two sensor circuits and switches into 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.



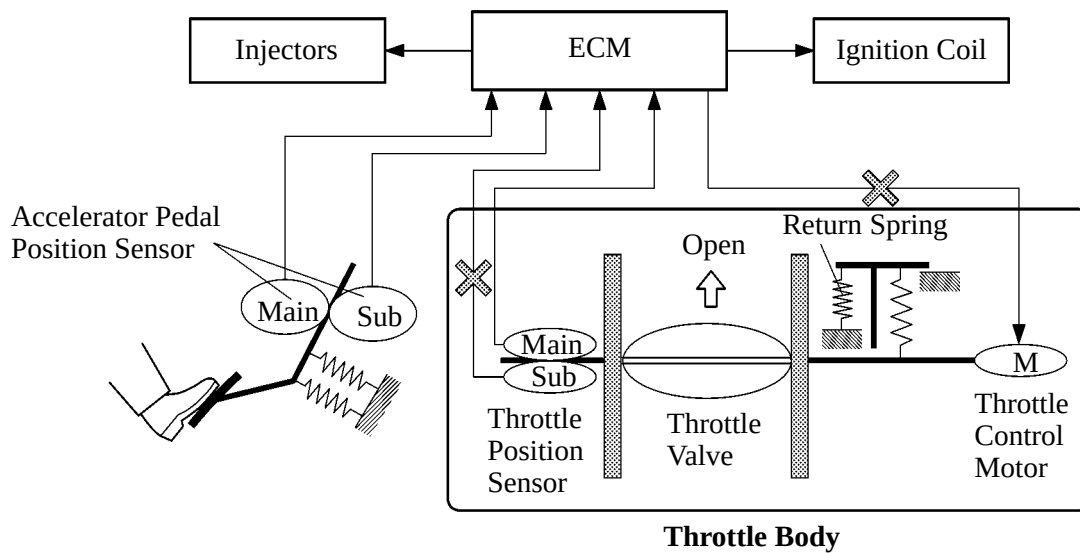
- If both circuits malfunction, the ECM detects the abnormal signal voltage from these two sensor circuits and discontinues the throttle control. At this time, the vehicle can be driven within its idling range.



### Fail-safe of Throttle Position Sensor

The throttle position sensor comprises two (Main, Sub) sensor circuits.

- If a malfunction occurs in either 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 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.



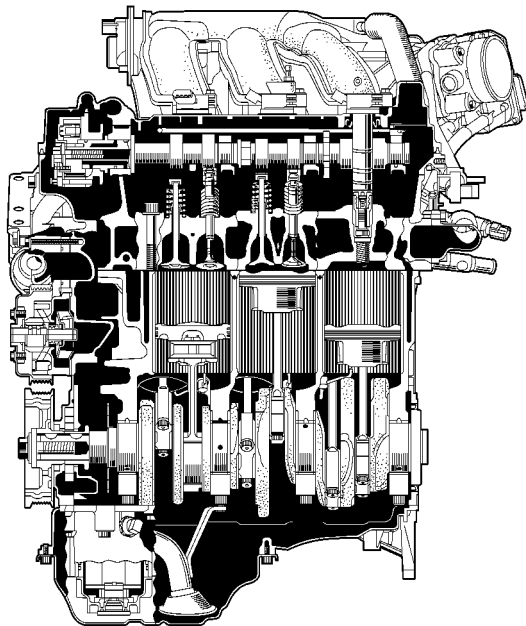
D13N10

## ENGINE

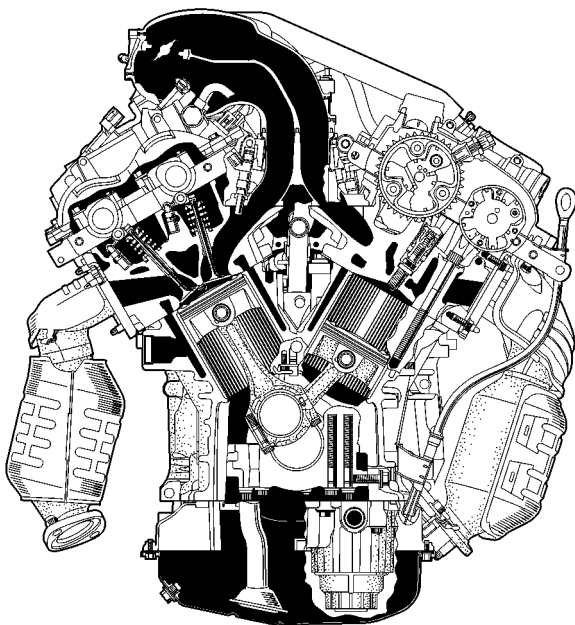
### 2GR-FE ENGINE

#### ■ DESCRIPTION

The 2GR-FE engine on the '07 ES350 is a newly developed, V6 3.5-liter, 24-valve DOHC engine. This engine uses the Dual VVT-i (Dual Variable Valve Timing-intelligent) system, DIS (Direct Ignition System), ACIS (Acoustic Control Induction System), and ETCS-i (Electronic Throttle Control System-intelligent). These control functions achieve improved engine performance, fuel economy, and reduced exhaust emissions.



285EG01



285EG02

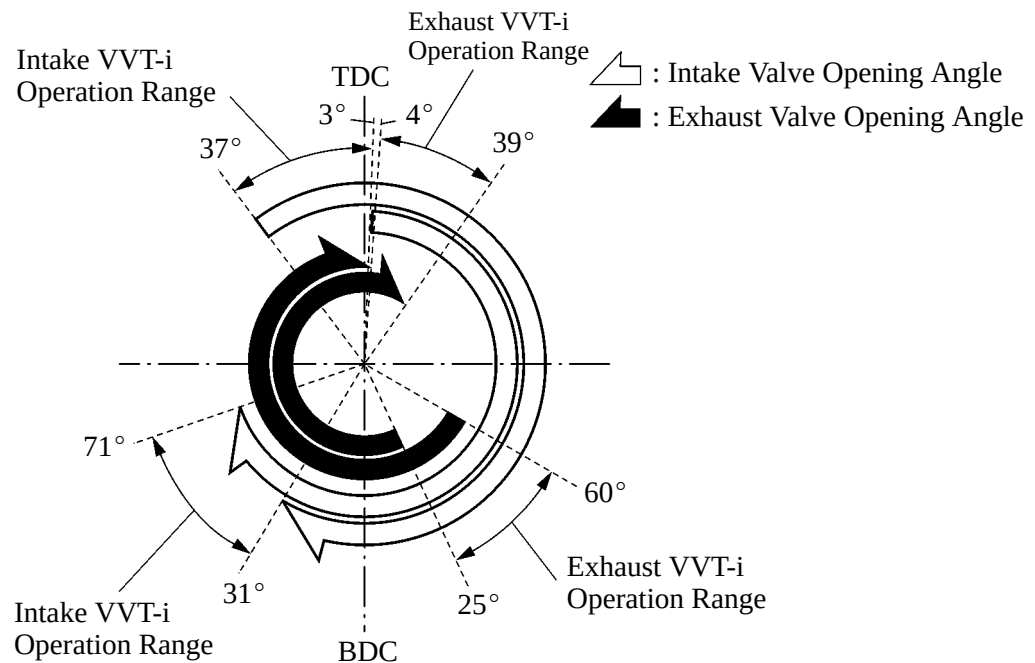
## ► Engine Specifications ◀

|                                               |             |                           |             |                                              |  |
|-----------------------------------------------|-------------|---------------------------|-------------|----------------------------------------------|--|
| No. of Cyls. & Arrangement                    |             |                           |             | 6-Cylinder, V Type                           |  |
| Valve Mechanism                               |             |                           |             | 24-Valve DOHC, Chain Drive (with Dual VVT-i) |  |
| Combustion Chamber                            |             |                           |             | Pentroof Type                                |  |
| Manifolds                                     |             |                           |             | Parallel-Flow                                |  |
| Fuel System                                   |             |                           |             | SFI                                          |  |
| Ignition System                               |             |                           |             | DIS                                          |  |
| Displacement                                  |             | cm <sup>3</sup> (cu. in.) |             | 3456 (210.9)                                 |  |
| Bore x Stroke                                 |             | mm (in.)                  |             | 94.0 x 83.0 (3.70 x 3.27)                    |  |
| Compression Ratio                             |             |                           |             | 10.8 : 1                                     |  |
| Max. Output (SAE-NET)* <sup>1</sup>           |             |                           |             | 203 kW @ 6200 rpm (272HP @ 6200 rpm)         |  |
| Max. Torque (SAE-NET)* <sup>1</sup>           |             |                           |             | 344 N·m @ 4700 rpm (254 ft·lbf @ 4700 rpm)   |  |
| Valve Timing                                  | Intake      | Open                      |             | - 3° to 37° BTDC                             |  |
|                                               |             | Close                     |             | 71° to 31° ABDC                              |  |
|                                               | Exhaust     | Open                      |             | 60° to 25° BBDC                              |  |
|                                               |             | Close                     |             | 4° to 39° ATDC                               |  |
| Firing Order                                  |             |                           |             | 1 - 2 - 3 - 4 - 5 - 6                        |  |
| Oil Grade                                     |             |                           |             | ILSAC                                        |  |
| Octane Rating                                 |             |                           |             | 91 or more                                   |  |
| Emission Regulation                           | Tailpipe    | Destination Package       | Canada      | LEVII-ULEV, SFTP                             |  |
|                                               |             |                           | Brazil      | LEVII-ULEV, SFTP                             |  |
|                                               |             |                           | Taiwan      | Tier1, SFTP                                  |  |
|                                               |             |                           | Taiwan      | Tier2-Bin5, SFTP                             |  |
|                                               |             |                           | Korea       | LEVII-ULEV, SFTP                             |  |
|                                               | Evaporative |                           | LEVII, ORVR |                                              |  |
| Engine Service Mass* <sup>2</sup> (Reference) |             |                           | kg (lb)     | 163 (359)                                    |  |

\*1: Maximum output and torque rating is determined by revised SAE J1394 standard.

\*2: Weight shows the figure with the oil and engine coolant fully filled.

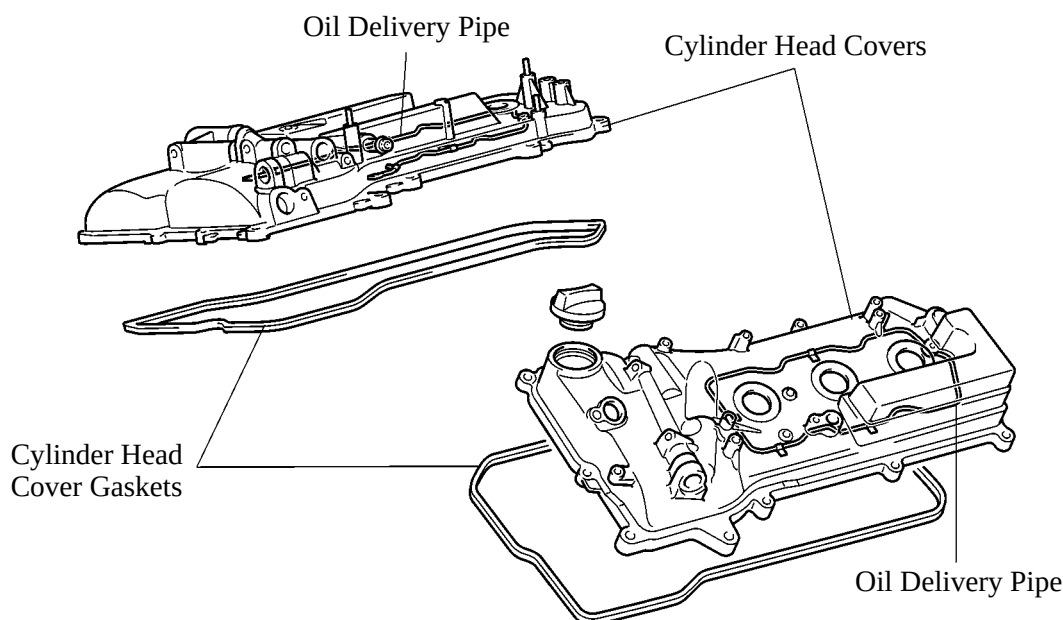
## ► Valve Timing ◀



## ENGINE PROPER

### 1. Cylinder Head Cover

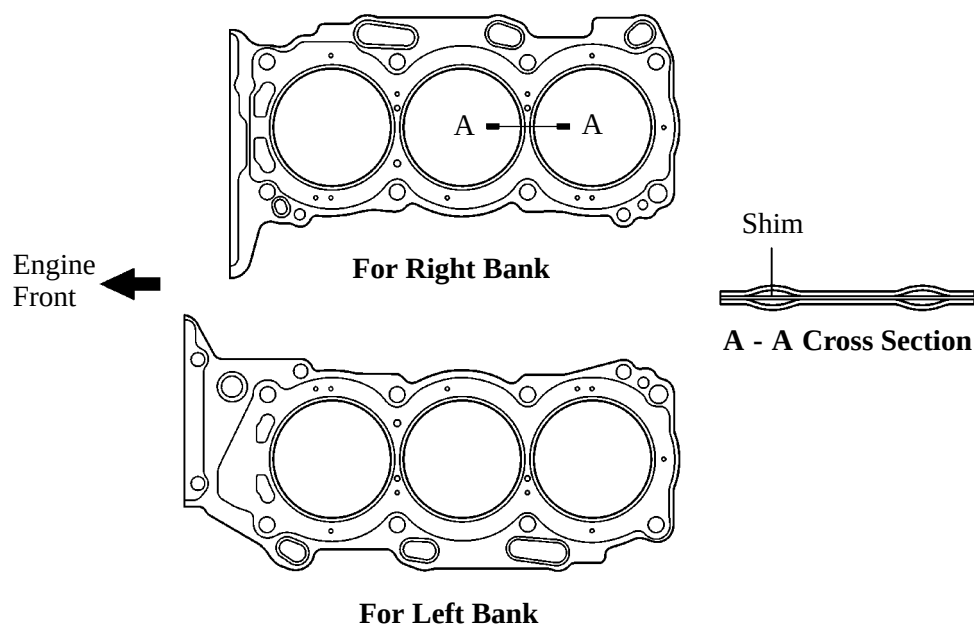
- Lightweight yet high-strength aluminum cylinder head covers are used.
- An oil delivery pipe is installed inside the cylinder head cover. This ensures lubrication to the sliding parts of the roller rocker arm, improving reliability.



285EG05

### 2. Cylinder Head Gasket

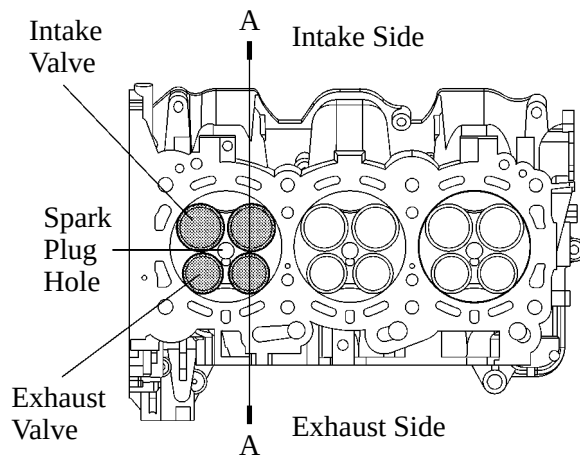
A steel-laminate type cylinder head gasket is used. A shim is used around the cylinder bore of the gasket to help enhance sealing performance and durability.



285EG06

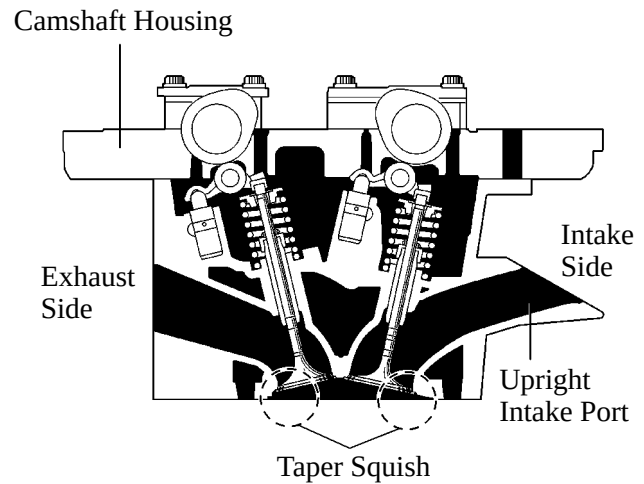
### 3. Cylinder Head

- The cylinder head structure has been simplified by separating the cam journal portion (camshaft housing) from the cylinder head.
- The cylinder head, which is made of aluminum, contains a pentroof-type combustion chamber. The spark plug is located in the center of the combustion chamber in order to improve the engine's anti-knocking performance.
- The intake ports are on the inside and the exhaust ports on the outside of the left and right banks respectively.
- Upright intake ports are used to improve the intake efficiency.
- A taper squish combustion chamber is used to improve anti-knocking performance and intake efficiency. In addition, engine performance and fuel economy have been improved.
- The siamese type intake port is used to reduce the overall surface area of the intake port walls. This prevents the fuel from adhering onto the intake port walls, thus reducing HC exhaust emissions.



**View from Back Side**

285EG07

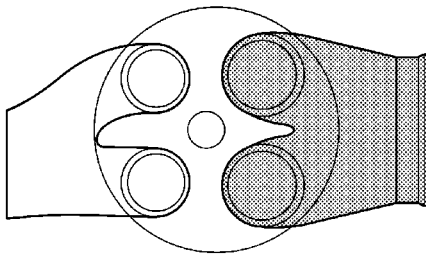


**A - A Cross Section**

285EG08

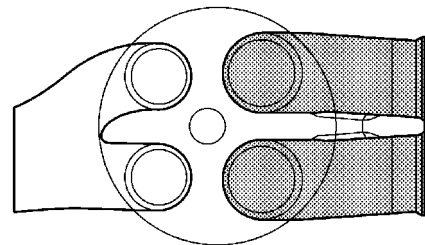
#### — REFERENCE —

##### Siamese Type



215EG18

##### Independent Type

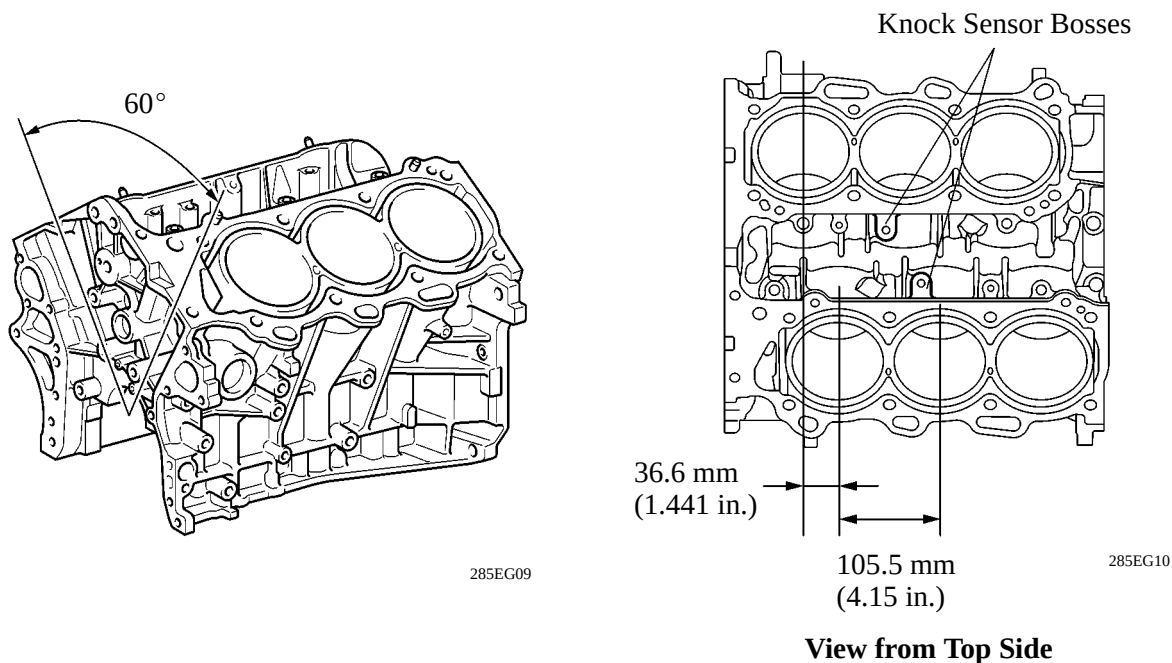


215EG19

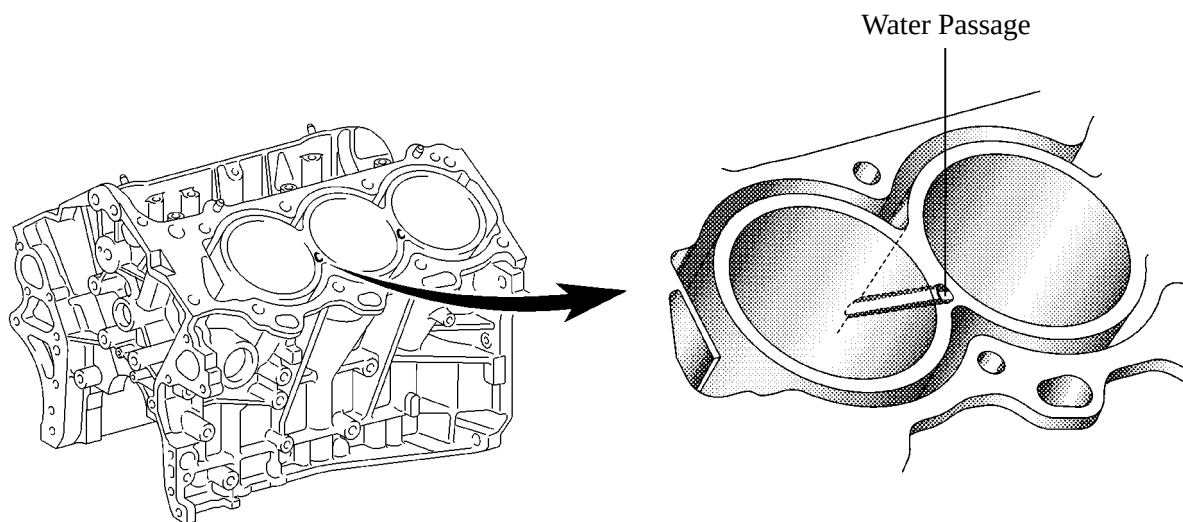


#### 4. Cylinder Block

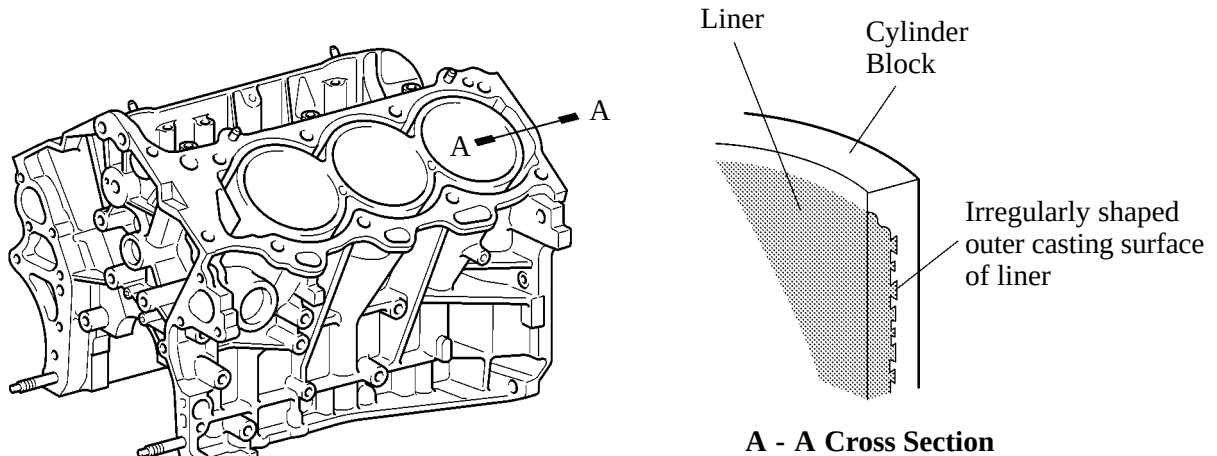
- The cylinder block is made of aluminum alloy, so it is lightweight.
- The cylinder block has a bank angle of  $60^\circ$ , a bank offset of 36.6 mm (1.441 in.) and a bore pitch of 105.5 mm (4.15 in.), resulting in a compact block in its length and width even for its displacement.
- Installation bosses of the two knock sensors are located on the inner side of left and right banks.



- A water passage has been provided between the cylinder bores. By allowing the engine coolant to flow between the cylinder bores, this construction enables the temperature of the cylinder walls to be kept uniform.



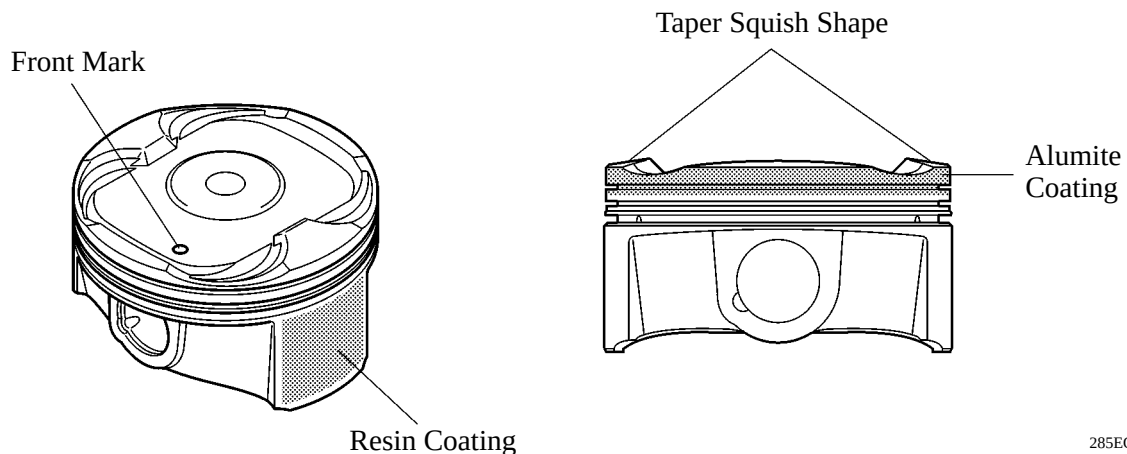
- A compact block has been achieved by producing the thin cast-iron liners and cylinder block as a unit. It is not possible to bore the block with this liner.
- The liners are the spiny-type, which have been manufactured so that their casting exterior forms a large irregular surface in order to enhance the adhesion between the liners and the aluminum cylinder block. The enhanced adhesion helps improve heat dissipation, resulting in a lower overall temperature and heat deformation of the cylinder bores.



285EG12

## 5. Piston

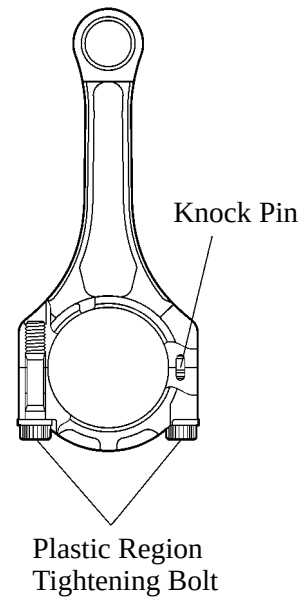
- The piston is made of aluminum alloy.
- The piston head portion uses a taper squish shape to accomplish fuel combustion efficiency.
- The piston skirt is coated with resin to reduce the friction loss.
- The groove of the top ring is coated with alumite to ensure abrasion resistance.
- By increasing the machining precision of the cylinder bore diameter, the outer diameter of the piston is made into one size.



285EG13

## 6. Connecting Rod and Connecting Rod Bearing

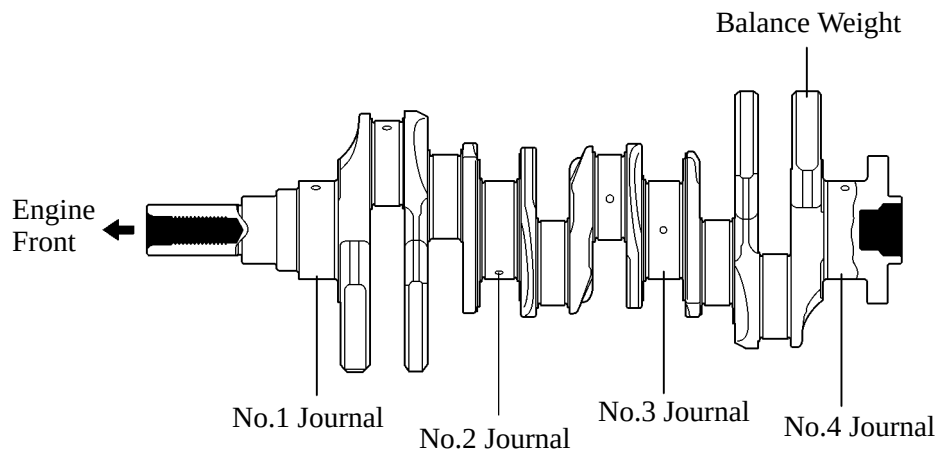
- Connecting rods that have been forged for high strength are used for weight reduction.
- Knock pins are used at the mating surfaces of the bearing caps of the connecting rod to minimize the shifting of the bearing caps during assembly.
- The connecting rods and caps are made of high-strength steel for weight reduction.
- Nutless-type plastic region tightening bolts are used on the connecting rods for a lighter design.
- An aluminum bearing is used for the connecting rod bearings.
- The connecting rod bearings are reduced in width to reduce friction.



285EG14

## 7. Crankshaft

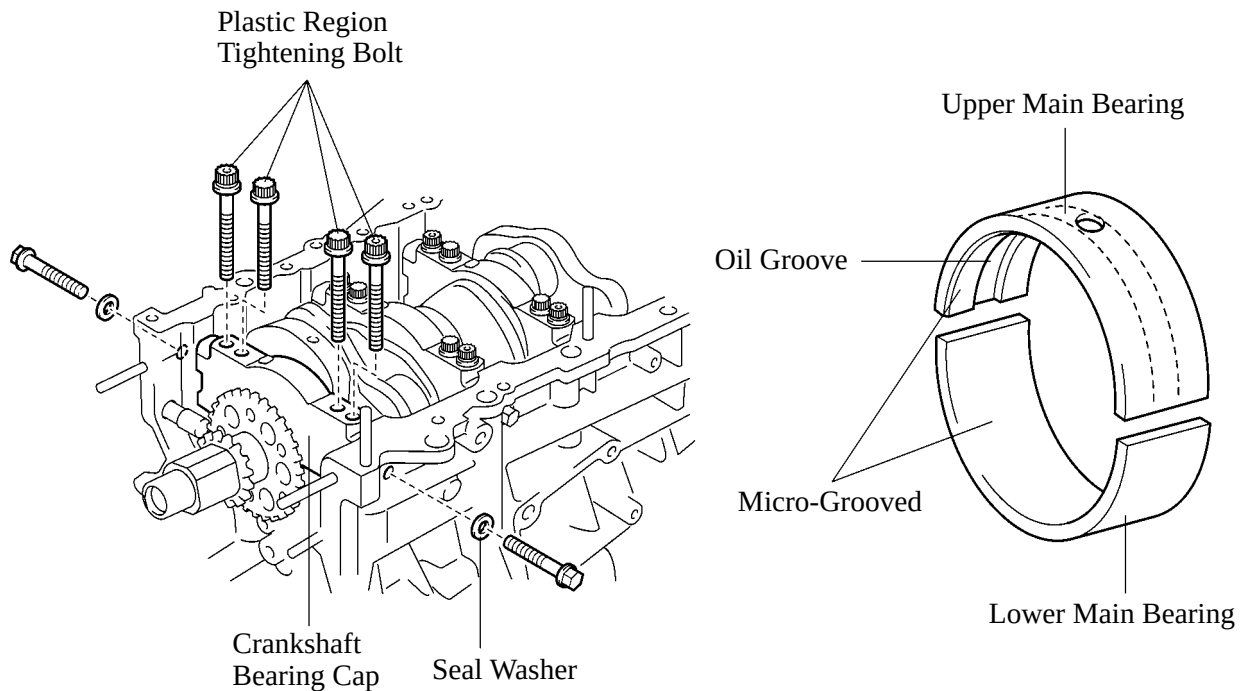
- A crankshaft made of forged steel, which excels in rigidity and wear resistance, is used.
- The crankshaft has 4 journals and 5 balance weights.



285EG15

## 8. Crankshaft Bearing and Crankshaft Bearing Cap

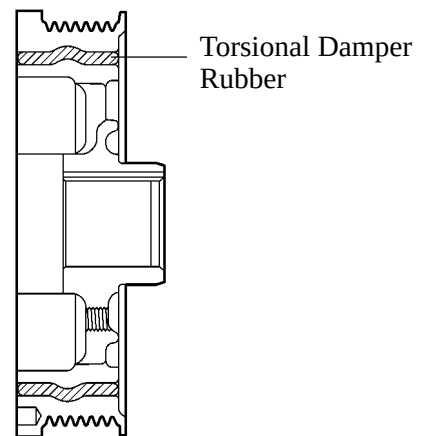
- The crankshaft bearing is made of aluminum alloy.
- Similar to the connecting rod bearings, the lining surface of the crankshaft bearings is micro-grooved to realize an optimal amount of oil clearance. As a result, cold-engine cranking performance is improved and engine vibration is reduced.
- The upper main bearing has an oil groove around its inside circumference.
- The crankshaft bearing caps are tightened using 4 plastic-region tightening bolts for each journal. In addition, each cap is tightened laterally to improve its reliability.



285EG81

## 9. Crankshaft Pulley

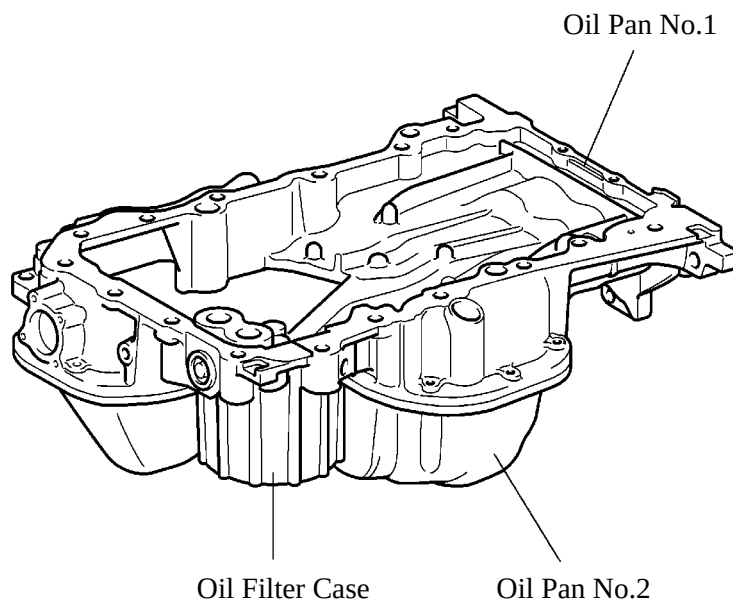
The rigidity of the crankshaft pulley with its built-in torsional damper rubber reduces noise.



285EG80

## 10. Oil Pan

- The oil pan No.1 material is made of aluminum alloy.
- The oil pan No.2 material is made of steel.
- The oil pan No.1 is secured to the cylinder block and the transmission housing and is increasing rigidity.
- The oil filter case is integrated with the oil pan No.1.



# FOREWORD

To assist you in your service activities, this manual explains the main characteristics of the new LEXUS ES350 in particular providing a technical explanation of the construction and operation of new mechanism and new technology used.

Applicable models: GSV40 series

This manual is divided into 3 sections.

- 1. New Model Outline** - Explanation of the product to give a general understanding of its features.
- 2. Technical Description** - Technical explanation of the construction and operation of each new system and component.
- 3. Appendix** - Major technical specifications of the vehicle.

**CAUTION**, **NOTICE**, **REFERENCE** and **NOTE** are used in the following ways:

|                  |                                                                                             |
|------------------|---------------------------------------------------------------------------------------------|
| <b>CAUTION</b>   | A potentially hazardous situation which could result in injury if instructions are ignored. |
| <b>NOTICE</b>    | Damage to the vehicle or components may occur if instructions are ignored.                  |
| <b>REFERENCE</b> | Explains the theory behind mechanisms and techniques.                                       |
| <b>NOTE</b>      | Notes or comments not included under the above 3 titles.                                    |

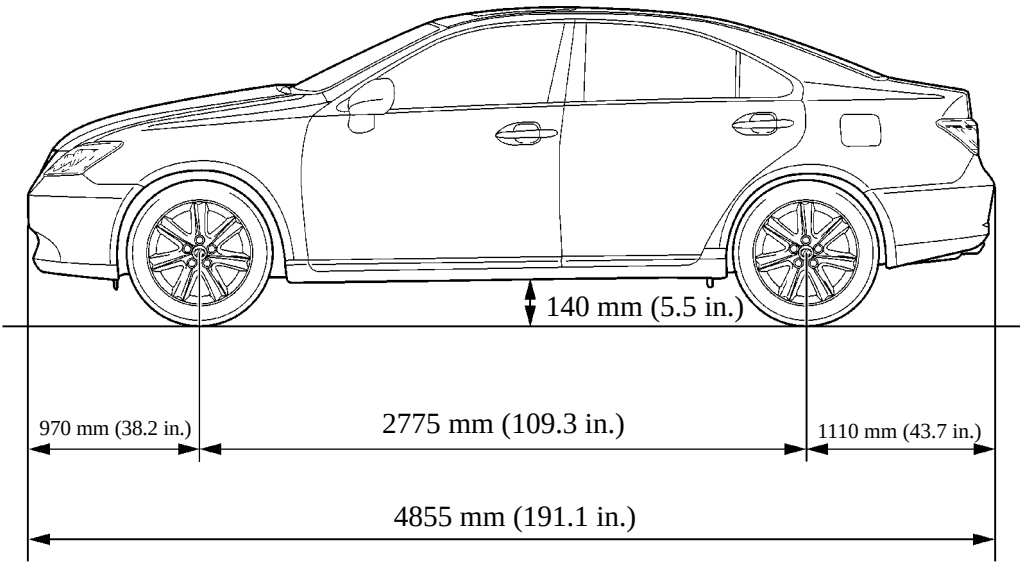
For detailed service specifications and repair procedures, refer to the following Repair Manuals:

| Manual Name                                  | Pub. No. |
|----------------------------------------------|----------|
| ● 2007 LEXUS ES350 Repair Manual             | RM01Y0U  |
| ● 2007 LEXUS ES350 Electrical Wiring Diagram | EM01Y0U  |

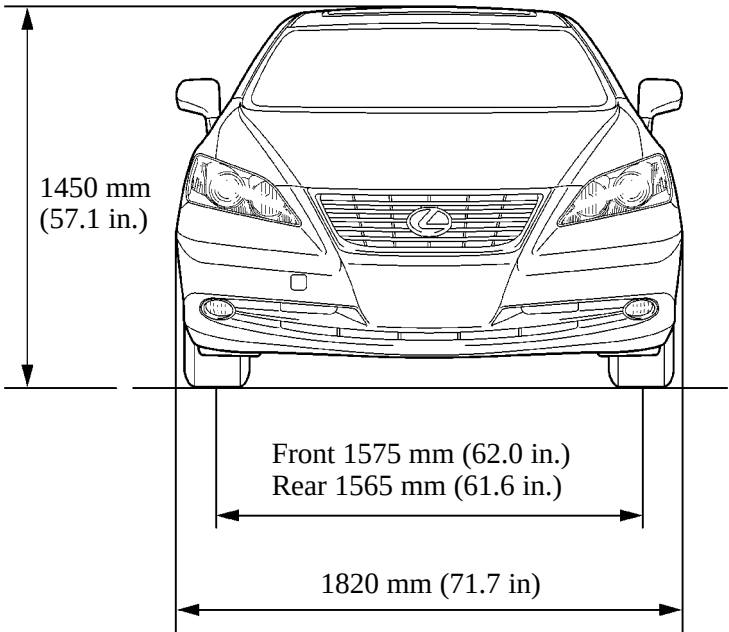
All information contained herein is the most up-to-date at the time of publication. We reserve the right to make changes without prior notice.

**TOYOTA MOTOR CORPORATION**

**DIMENSIONS**



01YMO08Y



01YMO09Y

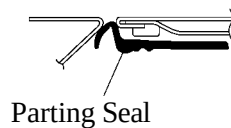
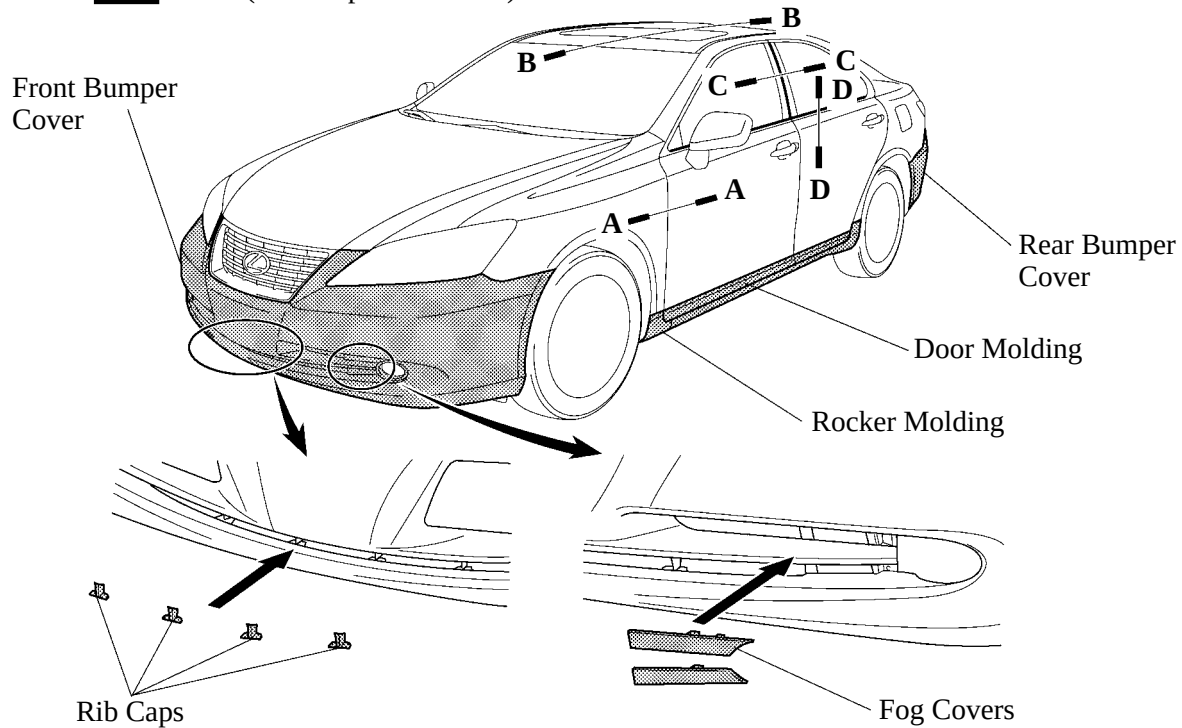
## ENVIRONMENT and RECYCLING

### Adoption of TSOP & TPO

TSOP (Toyota Super Olefin Polymer), TPO (Thermoplastic Olefin), which have superior recyclability, are actively utilized while the use of chlorine has been reduced as much as possible.

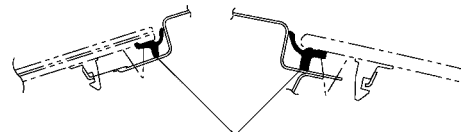
 : TSOP (Toyota Super Olefin Polymer)

 : TPO (Thermoplastic Olefin)



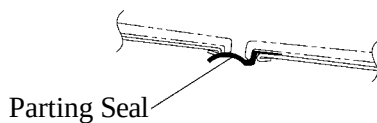
Parting Seal

A - A Cross Section



Glass Molding

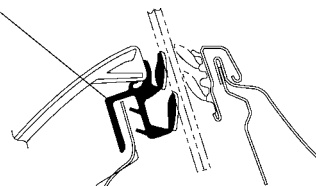
B - B Cross Section



Parting Seal

C - C Cross Section

Inner  
Weather  
Strip



D - D Cross Section

01YMO46Y

### Adoption of Lead-free Parts

By using lead-free parts, the adverse impact on the environment has successfully reduced.

| Main Lead-free Parts                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>● Radiator</li> <li>● Heater Core</li> <li>● Wiring Harness</li> <li>● Window Glass Black Coating</li> <li>● Wheel Balance Weight</li> </ul> |



# EQUIPMENT LIST

●: Standard\*<sup>1</sup> OP: Option —: None

| Item            |                                            |                                                                                | U.S.A.                                                                                       | Destination Package |       |        |        |
|-----------------|--------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------|-------|--------|--------|
|                 |                                            |                                                                                |                                                                                              | Canada              | Korea | Taiwan | Brazil |
| Chassis         | Tire                                       | P215/55R17 93V                                                                 | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 | Disc Wheel                                 | 17 x 7J Aluminum (Silver Painted)                                              | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 |                                            | 17 x 7J Aluminum (Chrome Plated)                                               | OP                                                                                           | OP                  | OP    | OP     | —      |
|                 | Brake Control System                       | ABS with EBD, Brake Assist, TRAC and VSC                                       | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 | Tire Pressure Warning System               |                                                                                | ●                                                                                            | ●                   | —     | —      | —      |
|                 | Steering Wheel                             | 3-Spoke (Leather, with Steering Switch)                                        | ●                                                                                            | ●                   | ●     | —      | ●      |
|                 |                                            | 3-Spoke (Leather & Wood Grain, with Steering Switch)                           | OP                                                                                           | OP                  | OP    | ●      | —      |
|                 | Steering System                            | Hydraulic Power                                                                | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 |                                            | Power Tilt & Telescope Mechanism                                               | ●                                                                                            | ●                   | —     | —      | —      |
|                 |                                            | Power Tilt & Telescope Mechanism with Memory                                   | OP                                                                                           | OP                  | ●     | ●      | ●      |
| Body            | Seat Cover Material                        | Fabric                                                                         | ●                                                                                            | ●                   | —     | —      | —      |
|                 |                                            | Leather                                                                        | OP                                                                                           | OP                  | ●     | ●      | ●      |
|                 |                                            | Semi-aniline Leather                                                           | OP                                                                                           | OP                  | OP    | OP     | —      |
|                 | Front Seat                                 | Power Seat                                                                     | ●                                                                                            | ●                   | —     | —      | —      |
|                 |                                            | Power Seat with Leg Support Adjustment                                         | OP                                                                                           | OP                  | ●     | ●      | ●      |
|                 | Front Seat Belt                            | Driver                                                                         | 3-Point ELR with Pretensioner, Force Limiter & Tension Reducer                               |                     | ●     | ●      | ●      |
|                 |                                            |                                                                                | 3-Point ELR with Pretensioner, Force Limiter, Tension Reducer & Pre-collision Seat Belt      |                     | OP    | OP     | —      |
|                 |                                            | Passenger                                                                      | 3-Point ELR with Pretensioner, Force Limiter & Tension Reducer+ALR                           |                     | ●     | ●      | ●      |
|                 |                                            |                                                                                | 3-Point ELR with Pretensioner, Force Limiter, Tension Reducer & Pre-collision Seat Belt +ALR |                     | OP    | OP     | —      |
|                 | Rear Seat Belt                             | 3-Point ELR with Pretensioner & Force Limiter +ALR x 2, 3-Point ELR+ALR x 1    |                                                                                              | ●                   | ●     | ●      | ●      |
|                 | CRS (Child Restraint System) Anchor System |                                                                                | ●                                                                                            | ●                   | ●     | ●      | ●      |
| Body Electrical | Headlight                                  | Halogen                                                                        | ●                                                                                            | ●                   | —     | —      | ●      |
|                 |                                            | HID (High Intensity Discharge) & Automatic Headlight Beam Level Control System | OP                                                                                           | OP                  | ●     | ●      | —      |
|                 |                                            | Intelligent AFS (Adaptive Front-lighting System)                               | OP                                                                                           | OP                  | —     | ●      | —      |
|                 | Fog Light                                  | Front                                                                          | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 |                                            | Rear                                                                           | —                                                                                            | —                   | —     | ●      | —      |
|                 | Automatic Light Control System             |                                                                                | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 | Light Turn-OFF System                      |                                                                                | ●*2                                                                                          | ●*2                 | ●     | ●      | ●      |
|                 | Daytime Running Light System               |                                                                                | ●                                                                                            | ●                   | —     | —      | —      |
|                 | Side Turn Signal Light                     |                                                                                | —                                                                                            | —                   | ●     | ●      | —      |
|                 | High Mount Stop Light                      |                                                                                | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 | Illuminated Entry System                   |                                                                                | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 | Engine Immobilizer                         |                                                                                | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 | Cruise Control System                      | Conventional System                                                            | ●                                                                                            | ●                   | ●     | ●      | ●      |
|                 |                                            | Dynamic Rader Cruise Control System                                            | OP                                                                                           | OP                  | —     | —      | —      |

(Continued)

●: Standard\*1 OP: Option —: None

| Item               |                                                                         |                                                                                                                                                    | U.S.A. | Destination Package |       |        |        |
|--------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------|-------|--------|--------|
|                    |                                                                         |                                                                                                                                                    |        | Canada              | Korea | Taiwan | Brazil |
| Body<br>Electrical | Air Conditioning System                                                 | Right/Left Independent temperature Control Automatic Air Conditioning, Clean Air Filter (removing Pollen and Dust), Automatic Recirculation System | ●      | ●                   | ●     | ●      | ●      |
|                    | Memory system (Front Seat, Outside Rear View Mirror, Steering Position) |                                                                                                                                                    | OP     | OP                  | ●     | ●      | ●      |
|                    | Heated & Ventilated Seats System (Front Seat)                           |                                                                                                                                                    | OP     | OP                  | ●     | ●      | ●      |
|                    | Wiper & Washer                                                          | Washer-linked Wiper Function                                                                                                                       | ●      | ●                   | —     | —      | ●      |
|                    |                                                                         | Washer-linked Wiper with Rain Sensing Function                                                                                                     | OP     | OP                  | ●     | ●      | —      |
|                    | Power Window System                                                     | One-touch Auto Up-and-Down with Jam Protection                                                                                                     | ●      | ●                   | ●     | ●      | ●      |
|                    | Power Door Lock Control System                                          |                                                                                                                                                    | ●      | ●                   | ●     | ●      | ●      |
|                    | Luggage Door Opener                                                     |                                                                                                                                                    | ●      | ●                   | ●     | ●      | ●      |
|                    | Smart Access System with Push-button Start                              |                                                                                                                                                    | ●      | ●                   | ●     | ●      | ●      |
|                    | SRS Airbag System                                                       | Driver and Front Passenger                                                                                                                         | ●      | ●                   | ●     | ●      | ●      |
|                    |                                                                         | Knee (for Driver and Front Passenger)                                                                                                              | ●      | ●                   | ●     | ●      | ●      |
|                    |                                                                         | Front Side and Curtain Shield                                                                                                                      | ●      | ●                   | ●     | ●      | ●      |
|                    |                                                                         | Rear Side                                                                                                                                          | OP     | OP                  | OP    | OP     | —      |
|                    | Pre-collision System                                                    |                                                                                                                                                    | OP     | OP                  | —     | —      | —      |
|                    | Front Passenger Occupant Classification System                          |                                                                                                                                                    | ●      | ●                   | ●     | ●      | ●      |
|                    | Outside Rear View Mirror                                                | Electric Remote Control, EC Mirror with Heater                                                                                                     | ●      | ●                   | —     | —      | —      |
|                    |                                                                         | Electric Remote Control, EC Mirror with Heater, Memory                                                                                             | OP     | OP                  | —     | —      | —      |
|                    |                                                                         | Electric Remote Control, EC Mirror with Heater, Memory, Automatic Power Retractable Type                                                           | —      | —                   | ●     | ●      | ●      |
|                    | Inside Rear View Mirror                                                 | Automatic Glare-resistant EC Mirror, Compass Display                                                                                               | ●      | ●                   | ●     | ●      | ●      |
|                    | Sliding Roof                                                            | Conventional Type Sliding Roof                                                                                                                     | ●      | ●                   | ●     | ●      | ●      |
|                    |                                                                         | Panorama Moonroof                                                                                                                                  | OP     | OP                  | OP    | OP     | —      |
|                    | Audio                                                                   | AM/FM/In-dash 6-CD Changer/8-Speaker                                                                                                               | ●      | ●                   | ●     | ●      | ●      |
|                    |                                                                         | AM/FM/In-dash 6-CD Changer/Bluetooth® Hands-free System/8-Speaker                                                                                  | OP     | OP                  | —     | —      | —      |
|                    |                                                                         | Multi Display/AM/FM/Cassette/In-dash 6-CD Changer/Bluetooth® Hands-free System/8-Speaker                                                           | OP     | OP                  | —     | OP     | —      |
|                    |                                                                         | AM/FM/In-dash 6-CD Changer /Mark Levinson Amp./14-Speaker                                                                                          | —      | —                   | OP    | —      | —      |
|                    |                                                                         | Multi Display/AM/FM/Cassette/In-dash 6-DVD Changer/Bluetooth® Hands-free System /Mark Levinson Amp./14-Speaker                                     | OP     | OP                  | —     | OP     | —      |
|                    | Multi-information Display                                               |                                                                                                                                                    | ●      | ●                   | ●     | ●      | ●      |
|                    | LEXUS Navigation System                                                 | Without Voice Recognition Function                                                                                                                 | —      | —                   | —     | OP     | —      |
|                    |                                                                         | With Voice Recognition Function                                                                                                                    | OP     | OP                  | —     | —      | —      |
|                    | Intuitive Parking Assist                                                |                                                                                                                                                    | OP     | OP                  | OP    | OP     | —      |
|                    | Rear View Monitor System                                                |                                                                                                                                                    | OP     | OP                  | —     | OP     | —      |
|                    | Rear Sunshade System                                                    |                                                                                                                                                    | OP     | OP                  | OP    | ●      | ●      |
|                    | Garage Door Opener                                                      |                                                                                                                                                    | ●      | ●                   | —     | —      | —      |

\*1: Grade package option B models are the standard for Korea, Taiwan and Brazil.

\*2: With delay function

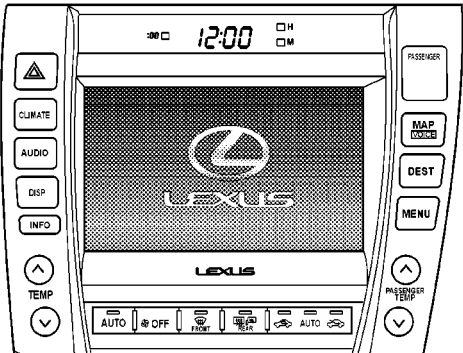
- MEMO -

EQUIPMENT

Multi Display

- A multi display has been provided on the center cluster panel as optional equipment. The display, which consists of a wide 7.0-inch LCD (Liquid Crystal Display) screen with a pressure sensitive touch panel, is easier to use.
- The items listed below are the main functions of the multi display.

| Main Functions                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>● Navigation Screen Display</li><li>● Audio Screen Display</li><li>● Air Conditioning Screen Display</li><li>● Rear View Monitor Display</li><li>● Telephone Operation Screen Display</li><li>● Warning Screen Display</li><li>● Language Selector Screen Display</li><li>● Adjustment Screen Display</li></ul> |



01YMO20Y

LEXUS Navigation System

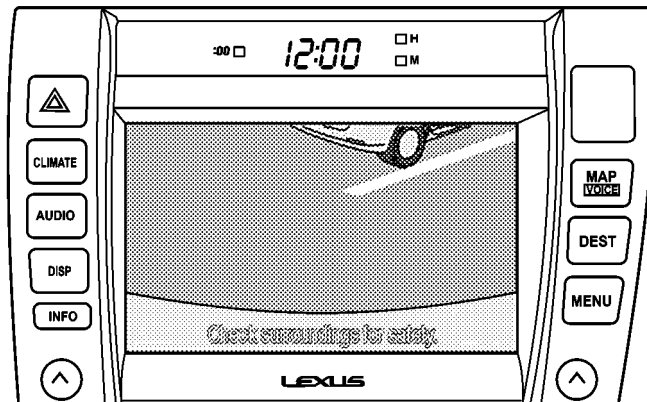
- Through the use of the GPS (Global Positioning System) and the map data in a DVD (Digital Versatile Disc), this navigation system analyzes the position of the vehicle and indicates that position on the map that is displayed on the screen. Additionally, it provides voice instructions to guide the driver along the route to reach the destination that has been selected.
- The language of the voice navigation can be selected from among 3 languages: English, French and Spanish. However the language for Taiwanese package models is only Chinese.
- The navigation system employs a voice recognition function with a voice recognition microphone installed in the overhead console. The voice recognition function can be turned on and off using the switch on the steering wheel. However Taiwanese package models are not equipped with this function.



01YMO21Y

## **Rear View Monitor System**

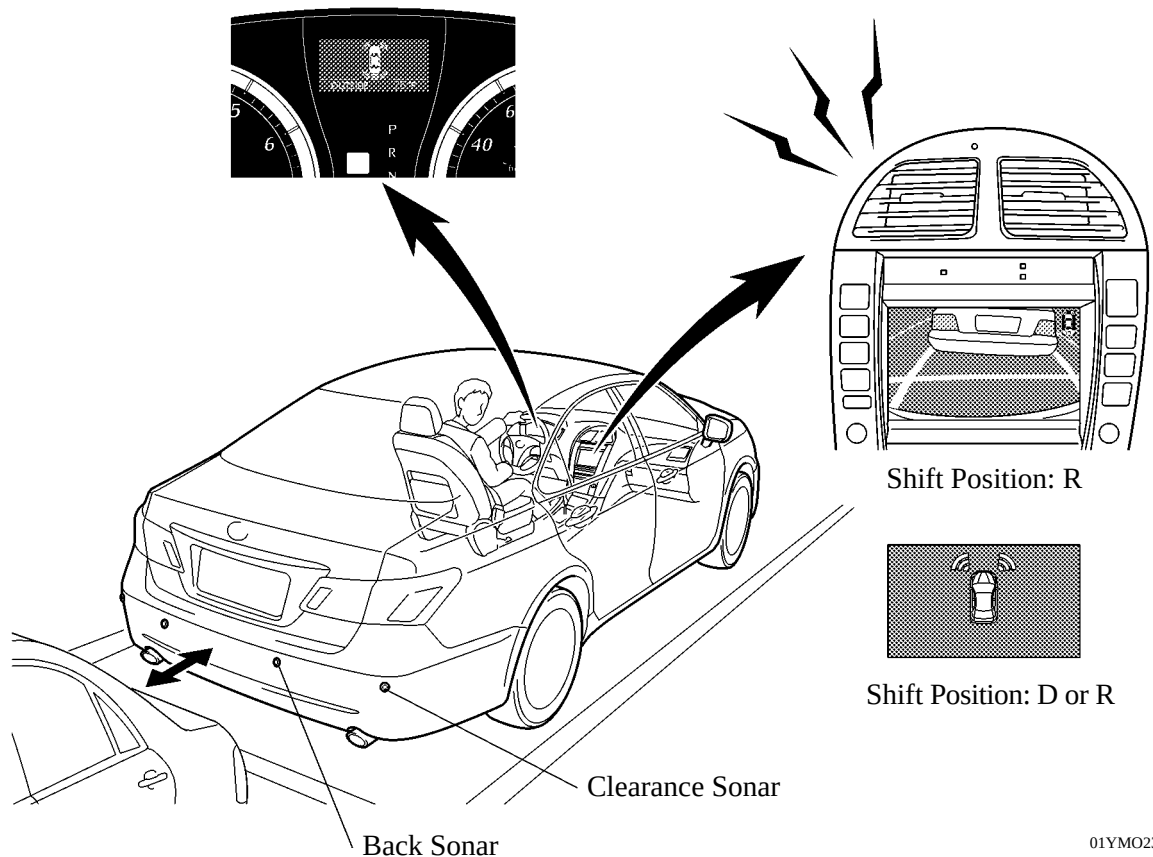
The rear view monitor system is to assist the driver in parking the vehicle by monitoring the rear view. This system has a television camera mounted on the luggage compartment door and displays the view behind the vehicle on the multi display when the shift lever is in the R position.



01YMO22Y

## **Intuitive Parking Assist**

- The intuitive parking assist assists the driver in maneuvering the vehicle in small spaces.
- This system uses two back sonars that are mounted on the rear bumper and four clearance sonars that are mounted on the front and rear bumpers.
- When the vehicle is reversing or being driven at a vehicle speed of less than about 10 km/h (6 mph), this system informs the driver if the vehicle is approaching an obstacle through the changing sounding interval of the buzzer and the illuminating or flashing the obstacle detection indicator on the multi information display. If the vehicle is equipped with the multi display, the obstacle detection indicator on the screen illuminates or flashes. The screen changes in accordance with the shift lever position: D, N or R.



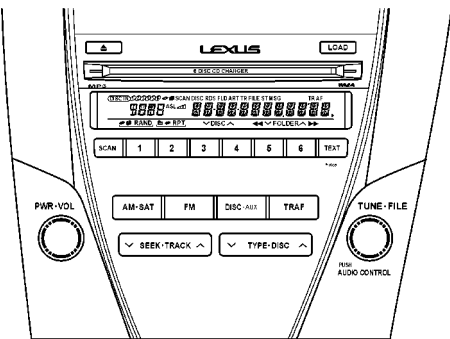
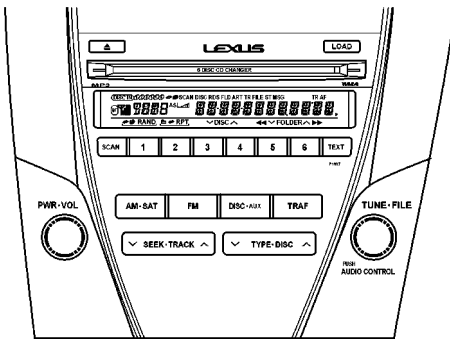
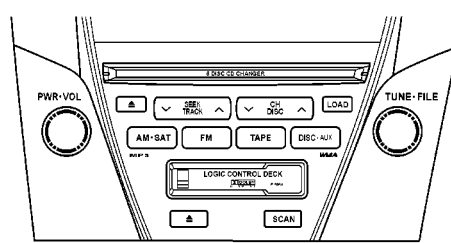
01YMO23Y

## Audio System

Two types of audio system are available for '07 model: LEXUS Premium Sound System and “Mark Levinson” Premium Sound System.

### Audio Head Unit

The five type of audio head unit are available. For information regarding which of the following optional equipment is available for each destination, refer to the equipment list on page MO-27.

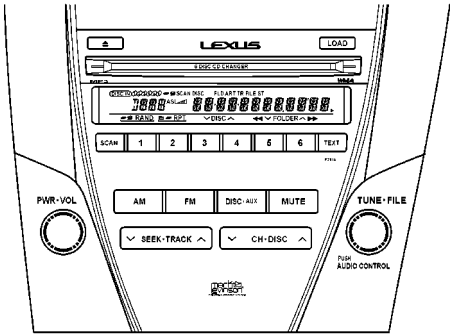
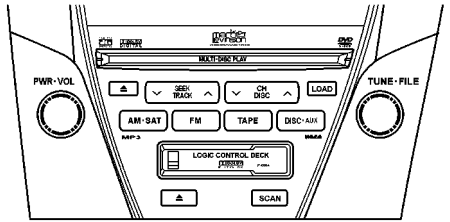
| Application                       | Design                                                                                              | Specifications                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LEXUS Premium Sound System</b> |                                                                                                     |                                                                                                                                                                                                                                                                                                                                                              |
| Standard                          |  <p>01YMO24Y</p>   | <ul style="list-style-type: none"> <li>● AM/FM Tuner</li> <li>● In-Dash 6-CD Changer (MP3, WMA Compatible*<sup>1</sup>)</li> <li>● RBDS*<sup>2</sup> function/DSP*<sup>3</sup>/ASL*<sup>4</sup></li> <li>● 8-Speaker System</li> <li>● Maker: Pioneer</li> </ul>                                                                                             |
| Option                            |  <p>01YMO25Y</p>  | <ul style="list-style-type: none"> <li>● AM/FM Tuner</li> <li>● In-Dash 6-CD Changer (MP3, WMA Compatible*<sup>1</sup>)</li> <li>● Bluetooth® Hands-free System</li> <li>● RBDS*<sup>2</sup> function/DSP*<sup>3</sup>/ASL*<sup>4</sup></li> <li>● 8-Speaker System</li> <li>● Maker: Pioneer</li> </ul>                                                     |
| Option                            |  <p>01YMO26Y</p> | <ul style="list-style-type: none"> <li>● Multi Display</li> <li>● AM/FM Tuner</li> <li>● Cassette Player</li> <li>● In-Dash 6-CD Changer (MP3, WMA Compatible*<sup>1</sup>)</li> <li>● Bluetooth® Hands-free System</li> <li>● RBDS*<sup>2</sup> function/DSP*<sup>3</sup>/ASL*<sup>4</sup></li> <li>● 8-Speaker System</li> <li>● Maker: Pioneer</li> </ul> |

\*1: Compatible with the compressed sound and music files complying with MP3 (MPEG Audio Layer-3) standard and WMA (Windows Media Audio)

\*2: Radio Broadcast Data System

\*3: Digital Sound Processor

\*4: Auto Sound Levelizer

| Application                                 | Design                                                                                            | Specifications                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>"Mark Levinson" Premium Sound System</b> |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Option                                      |  <p>01YMO27Y</p> | <ul style="list-style-type: none"> <li>● AM/FM Tuner</li> <li>● In-Dash 6-CD Changer (MP3, WMA Compatible*<sup>1</sup>)</li> <li>● DSP*<sup>3</sup>/ASL*<sup>4</sup></li> <li>● 14-Speaker System</li> <li>● Maker: Pioneer (Head Unit) &amp; Mark Levinson (Stereo Amplifier, Speaker)</li> </ul>                                                                                                                         |
| Option                                      |  <p>01YMO28Y</p> | <ul style="list-style-type: none"> <li>● Multi Display</li> <li>● AM/FM Tuner</li> <li>● Cassette Player</li> <li>● In-Dash 6-DVD Changer (MP3, WMA Compatible*<sup>1</sup>)</li> <li>● Bluetooth® Hands-free System</li> <li>● RBDS*<sup>2</sup> function/DSP*<sup>3</sup>/ASL*<sup>4</sup></li> <li>● 14-Speaker System</li> <li>● Maker: Pioneer (Head Unit) &amp; Mark Levinson (Stereo Amplifier, Speaker)</li> </ul> |

\*1: Compatible with the compressed sound and music files complying with MP3 (MPEG Audio Layer-3) standard and WMA (Windows Media Audio)

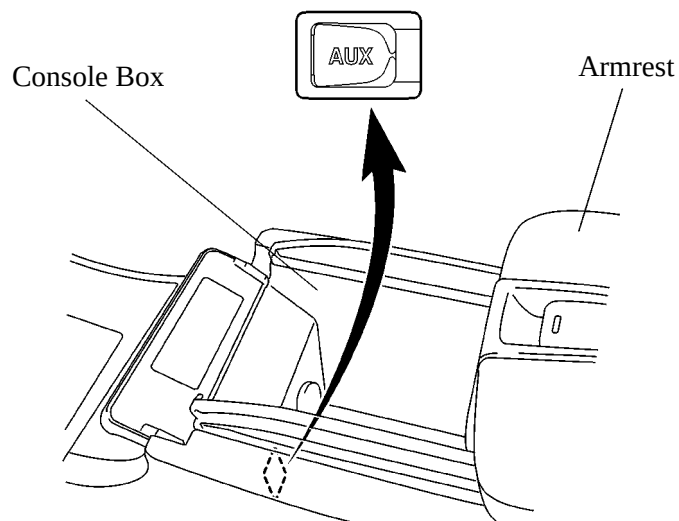
\*2: Radio Broadcast Data System

\*3: Digital Sound Processor

\*4: Auto Sound Levelizer

### AUX Adapter

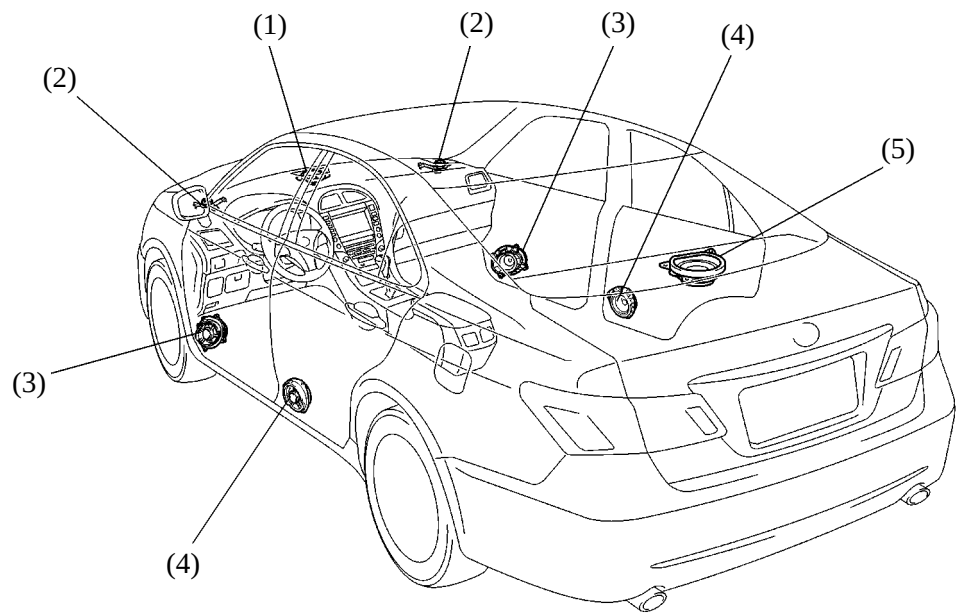
An AUX adapter, which is located in the console box, is used by the audio system as an input terminal for portable audio devices.



01YMO35Y

Speaker (LEXUS Premium Sound System)

► Speaker Location ◀

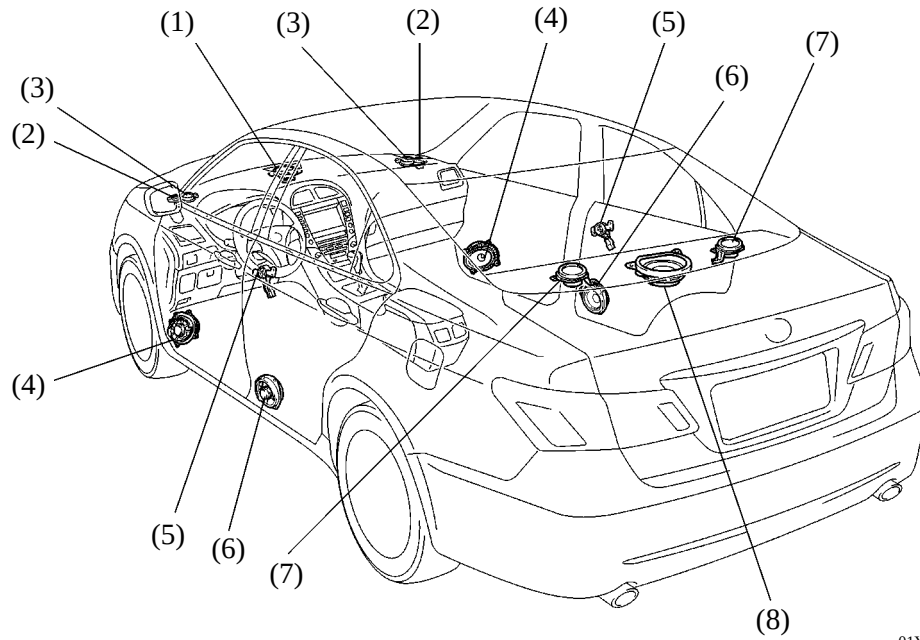


01YMO29Y

► Speaker Specifications ◀

| Location | Speaker Type        | Caliber          | Impedance | Input<br>Rated (Max) |
|----------|---------------------|------------------|-----------|----------------------|
| (1)      | Center x 1          | 65 mm (2.6 in.)  | 10 Ω      | 10 W (20 W)          |
| (2)      | Front Tweeter x 2   | 25 mm (1.0 in.)  | 4 Ω       | 25 W (50 W)          |
| (3)      | Front Woofer x 2    | 160 mm (6.5 in.) | 4 Ω       | 21 W (50 W)          |
| (4)      | Rear Full Range x 2 | 160 mm (6.5 in.) | 4 Ω       | 21 W (50 W)          |
| (5)      | Sub-Woofer x 1      | 200 mm (8 in.)   | 25 Ω x 2  | 30/30 W (60/60 W)    |



**Speaker ("Mark Levinson" Premium Sound System)****► Speaker Location ◀**

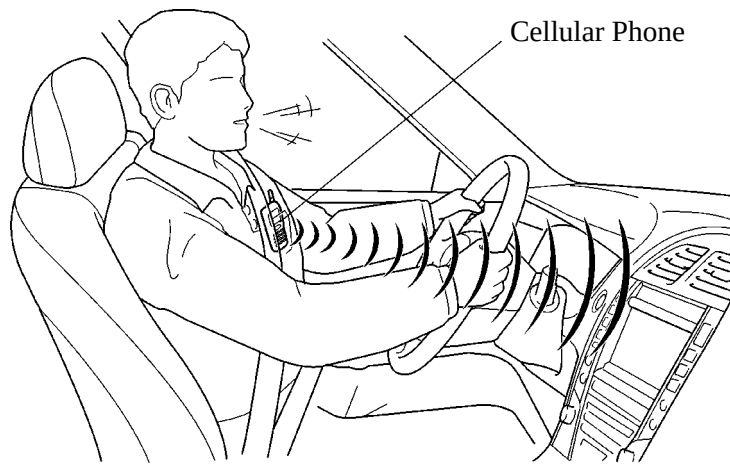
01YMO30Y

**► Speaker Specifications ◀**

| Location | Speaker Type       | Caliber                         | Impedance  | Input Rated |
|----------|--------------------|---------------------------------|------------|-------------|
| (1)      | Center x 1         | 65 mm (2.6 in.)                 | 8 $\Omega$ | 25 W        |
| (2)      | Front Tweeter x 2  | 25 mm (1.0 in.)                 | 8 $\Omega$ | 20 W        |
| (3)      | Front Midrange x 2 | 65 mm (2.6 in.)                 | 8 $\Omega$ | 40 W        |
| (4)      | Front Woofer x 2   | 150 x 225 mm<br>(6.0 x 9.0 in.) | 8 $\Omega$ | 25 W        |
| (5)      | Rear Tweeter x 2   | 25 mm (1.0 in.)                 | 6 $\Omega$ | 20 W        |
| (6)      | Rear Woofer x 2    | 160 mm (6.5 in.)                | 8 $\Omega$ | 25 W        |
| (7)      | Rear Satellite x 2 | 65 mm (2.6 in.)                 | 8 $\Omega$ | 25 W        |
| (8)      | Sub-Woofer x 1     | 200 mm (8 in.)                  | 6 $\Omega$ | 30 W        |

## **Bluetooth® Hands-free System**

- Bluetooth® is a high-speed wireless data communication system that uses the 2.4 GHz frequency band prescribed by the Bluetooth SIG (Special Interest Group), with a communication speed of 1 Mbps. By simply bringing a cellular phone that has been pre-registered on the audio head unit or the multi display into the vehicle, the user can talk hands-free. Thus, it is no longer necessary to connect the telephone to a hands-free connection device as in the past.
- A Bluetooth® hands-free system, which enables the user to make and receive calls and talk hands-free by operating the switches on the steering pad or the screen display, is provided on the audio head unit or the multi display.
- A Bluetooth® hands-free system consists of an audio head unit or a multi display, a microphone in the overhead console, and the switches on the steering pad.



01YMO31Y

**Smart Access System with Push-button Start**

The smart access system with push-button start provides a key with a bi-directional communication function. Accordingly, by enabling the certification ECU to recognize the presence of the key within the detection area, this system can lock or unlock the doors, or start the engine without the use of the key, as long as the user has the key in his/her possession.



01YMO32Y

**Door Open**

01YMO33Y

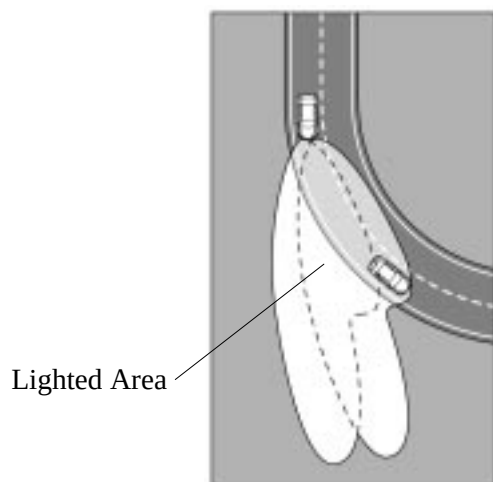
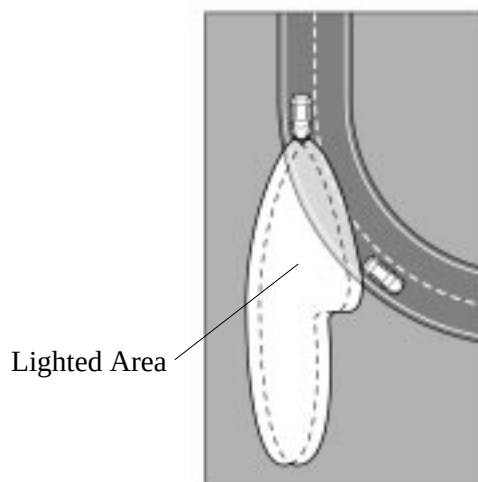
**Trunk Open**

01YMO34Y

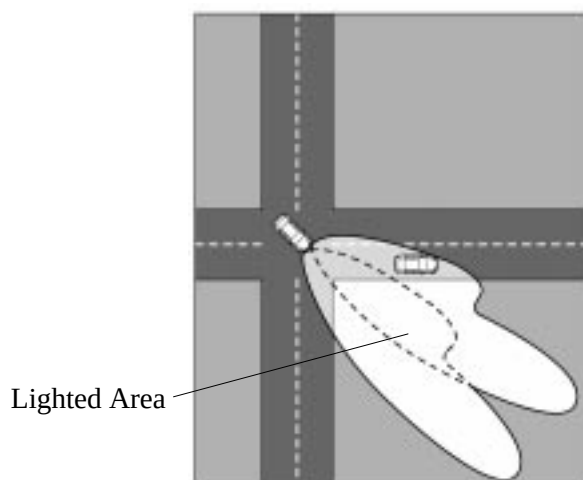
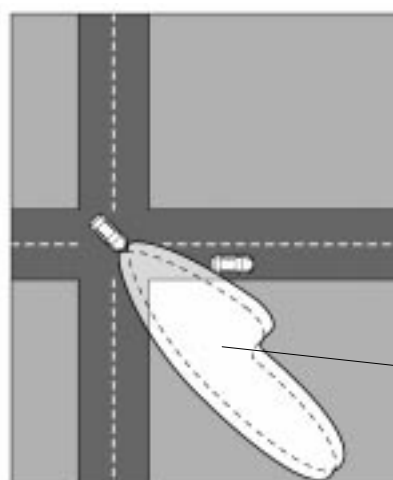
**Engine Start**

**Intelligent AFS (Adaptive Front-lighting System)**

- An intelligent AFS (Adaptive Front-lighting System) orients the front headlight (low beam) toward the inside of curves in accordance with the vehicle speed and steering angle. This improves the driver's view at night when cornering, to help safe driving.
- At low speeds the system used on this model turns only the headlight on the side of the vehicle facing into the curve, at medium and high speeds it turns both headlights.

**With Intelligent AFS****Without Intelligent AFS**

01YMO36Y

**Control at Mid to High Speeds****With Intelligent AFS****Without Intelligent AFS**

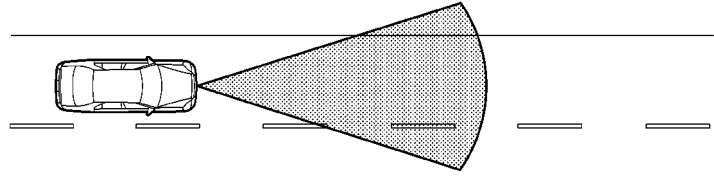
01YMO37Y

**Control at Low Speeds**

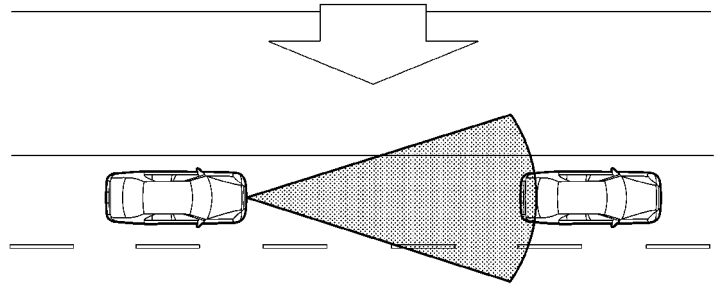
## **Dynamic Radar Cruise Control System**

In addition to conventional type cruise control function, the dynamic radar cruise control system includes a function that controls the distance from the vehicle ahead while driving, based on the information of the driving lane of the vehicle, the preceding vehicle, and the vehicle speed (Vehicle-to-Vehicle Distance Control Mode).

Maintaining a set driving speed  
(No vehicle ahead)



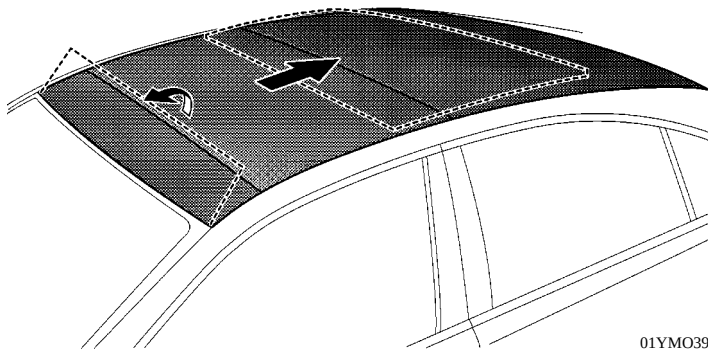
Maintaining a set time-gap, or  
adjusting the speed to that of the  
preceding vehicle to  
maintain a set distance.  
(with a vehicle ahead)



01YM047Y

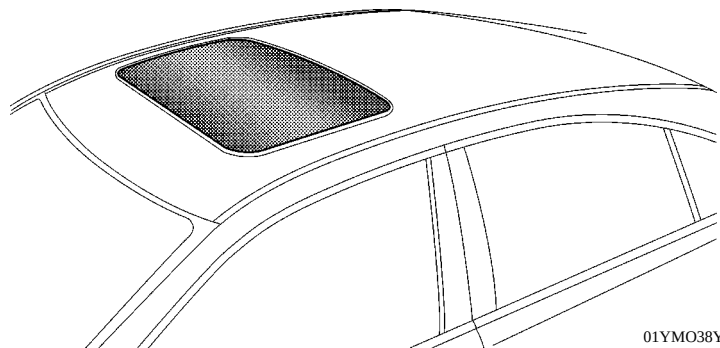
## **Sliding Roof**

- A panorama moonroof is available as an option. The panorama moonroof is a glass roof, which is divided into three portions. The front panel can tilt upward, and the center panel can tilt and slide.
- A conventional type sliding roof, which is provided with a jam protection function, is fitted as standard equipment.
- Two separate sliding roof switches are provided in the overhead console: one for tilting, and the other for sliding.



01YM039Y

**Panorama Moonroof**



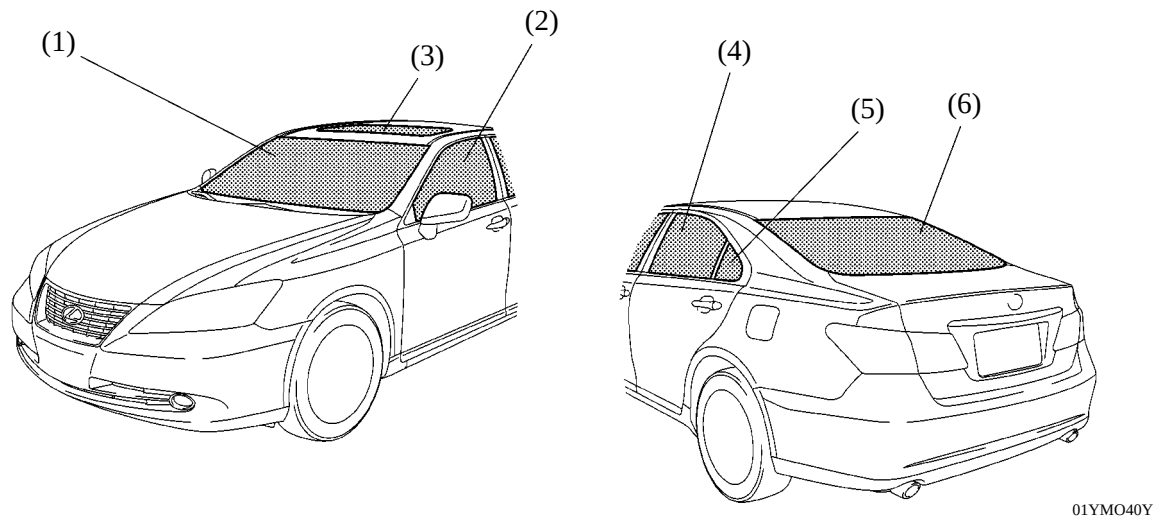
01YM038Y

**Conventional Type Sliding Roof**

**Glass**

**UV Reduction Glass**

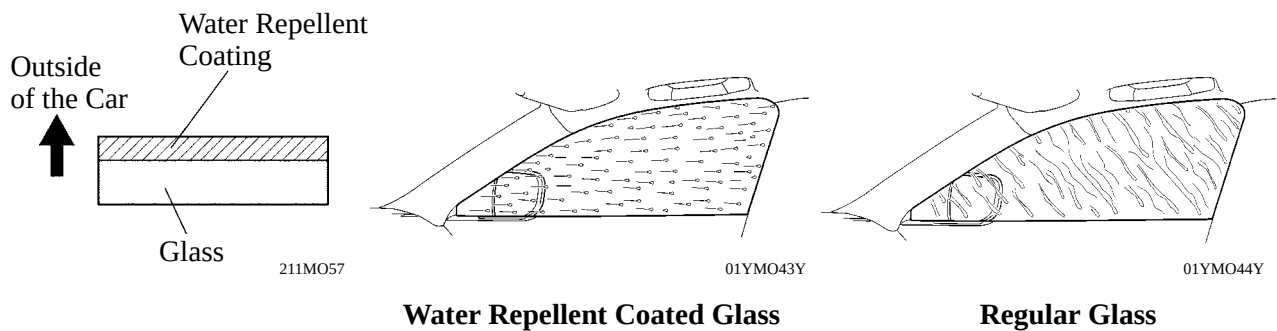
UV Reduction Glass which blocks the ultraviolet and infrared rays in the sunlight is used to ensure comfort.



| Glass Portion |                   | Color                 | Glass Type        | Ultraviolet Reduction Rate | Visible Light Penetration Rate |
|---------------|-------------------|-----------------------|-------------------|----------------------------|--------------------------------|
| (1)           | Windshield        | Green with Dark Shade | Laminated         | 100%                       | 78%                            |
| (2)           | Front Door        | Green                 | Tempered & UV Cut | 90%                        | ≧ 70%                          |
| (3)           | Moon Roof Panel   | Gray                  | Tempered          | 93%                        | 20%                            |
| (4)           | Rear Door         | Green                 | Tempered & UV Cut | 90%                        | ≧ 70%                          |
| (5)           | Rear Door Quarter | Green                 | Tempered & UV Cut | 90%                        | ≧ 70%                          |
| (6)           | Back Window       | Green                 | Tempered & UV Cut | 90%                        | ≧ 70%                          |

**Water Repellent Coated Glass**

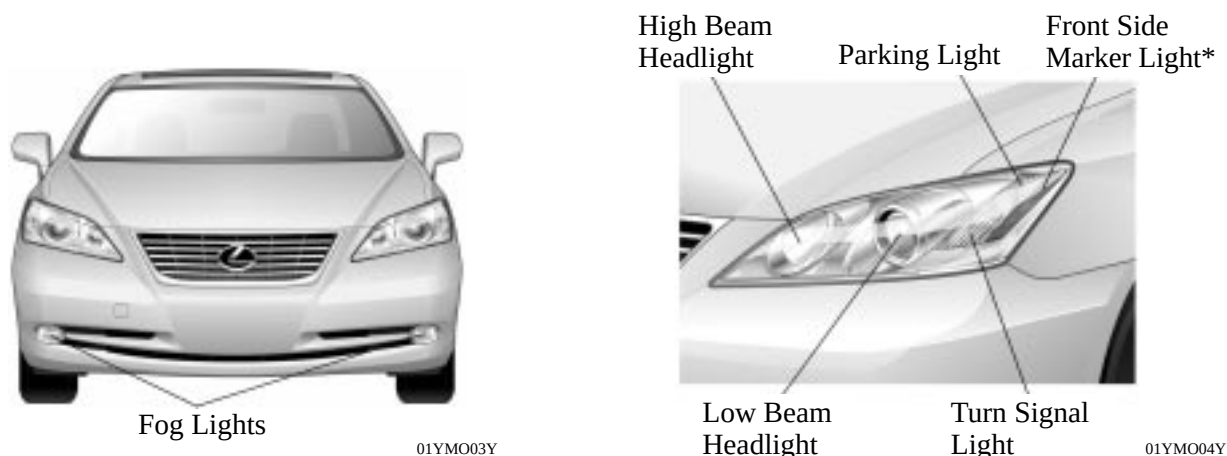
The front doors are fitted with water repellent coated glass to increase visibility in rain.



## EXTERIOR

### Front View

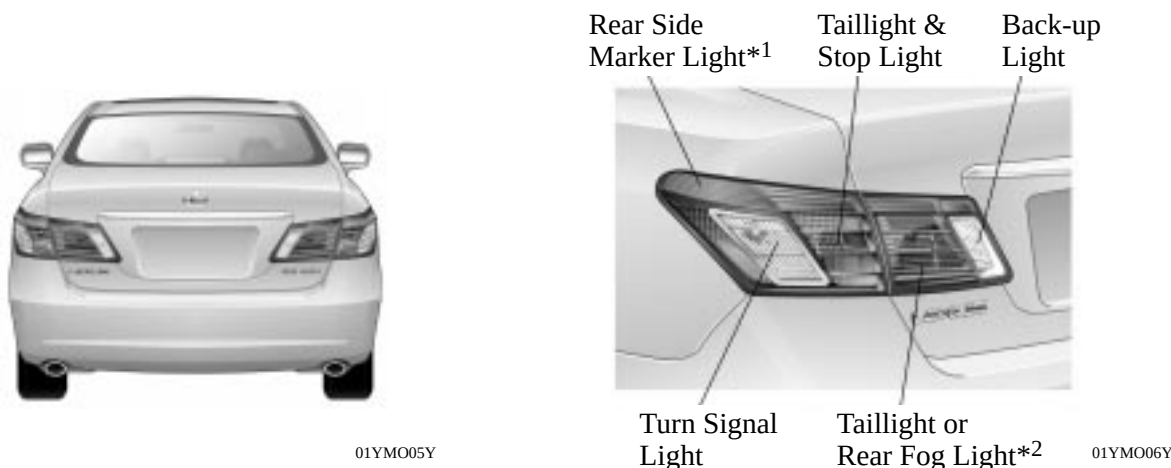
- The combination of the low position radiator grille and the wide, vertically slanting headlights, gives the impression of strength.
- A smooth concave surface has been added to the boundary between the rounded surfaces of the hood and the fender, expressing speed and elegance.
- The characteristic horizontal pattern, which is identified with the luxury of LEXUS, is used on the radiator grille.
- The combination of the fin shape of the lower bumper portion, extending from the hood, and the fog lights located at both ends, provides the front exterior with its sedate look.



\*: Except Taiwanese package models

### Rear View

- The character lines, generated by the concave surfaces on the sides of the rear pillar bases, are arranged to gently lead towards the rear of the vehicle.
- The originality of the rear exterior is expressed by the combination of the contour line, curving between the side edges of the rear of the vehicle, and the character lines, which radiate out from the central chrome ornament.
- The taillights have a flowing design that radiates out from the center. In combination with the chrome ornaments, this gives the impression of a wide rear exterior.



\*1: Except Taiwanese package models

\*2: Only for Taiwanese package models

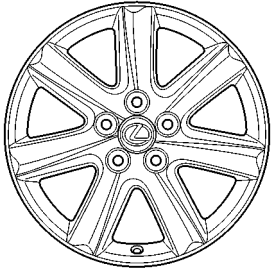
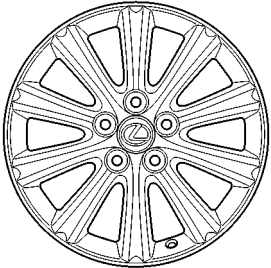
**Side View**

- The elegant side exterior has been created through the long cabin proportions and the curved rear corner line of the rear passenger door window.
- A concave surface has been provided along the upper portion of the body side and linearly extended from the front to the rear, in order to create a feeling of speed.



01YMO07Y

**Tire & Disc Wheel**

|              |                   |                                                                                                 |                                                                                                   |
|--------------|-------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Tire         | Size              | 215/55R17                                                                                       | 215/55R17                                                                                         |
| Disc Wheel   | Size              | 17 x 7J                                                                                         | 17 x 7J                                                                                           |
|              | P.C.D.*           | 114.3 mm (4.5 in.)                                                                              | 114.3 mm (4.5 in.)                                                                                |
|              | Off Set           | 45 mm (1.8 in.)                                                                                 | 45 mm (1.8 in.)                                                                                   |
|              | Material          | Aluminum with Center Ornament                                                                   | Aluminum with Center Ornament                                                                     |
|              | Surface Finishing | Silver painted                                                                                  | Chrome plated                                                                                     |
| Wheel Design |                   | <br>01YMO10Y | <br>01YMO11Y |
| Equipment    |                   | Standard                                                                                        | Option                                                                                            |

\*: Pitch Circle Diameter



**Exterior Color List**

| Color No. | Color Name                | Color No. | Color Name                   |
|-----------|---------------------------|-----------|------------------------------|
| 062       | White Pearl Crystal Shine | 3R5       | Dark Red Mica Color Clear    |
| 1G0       | Dark Gray Mica            | 4T0       | Blond Mica Metallic          |
| 1G1       | Silver Mica Metallic      | 4T1       | Beige Metallic               |
| 202       | Black                     | 778       | Dark Turquoise Mica Metallic |
| 3R4       | Shell Mica Metallic       | 8P8       | Dark Blue Mica               |

## ***EXTERIOR APPEARANCE***

### ***Front View***



01YM001Y

### ***Rear View***



01YM002Y

## INTERIOR

### Instrument Panel

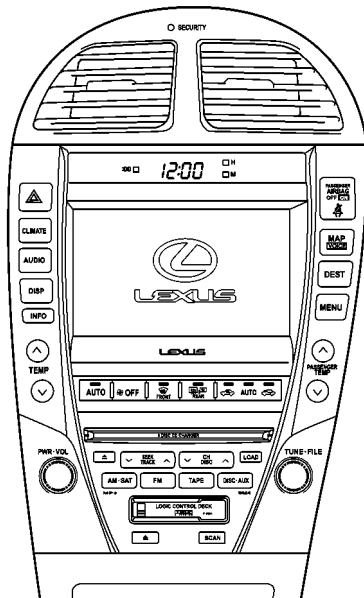
The functional components of the instrument panel have been centrally concentrated to create open space, and the center cluster panel has been given an original circular design.



01YMO12Y

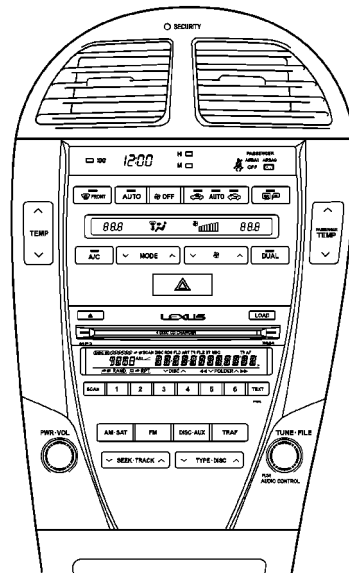
### Center Cluster

- Inlaid work-like precise parts arrangement is used on the center cluster panel to express luxury.
- Two types of center clusters have been made available, one with and one without the multi display.



01YMO13Y

**With Multi Display**



01YMO14Y

**Without Multi Display**

### **Combination Meter**

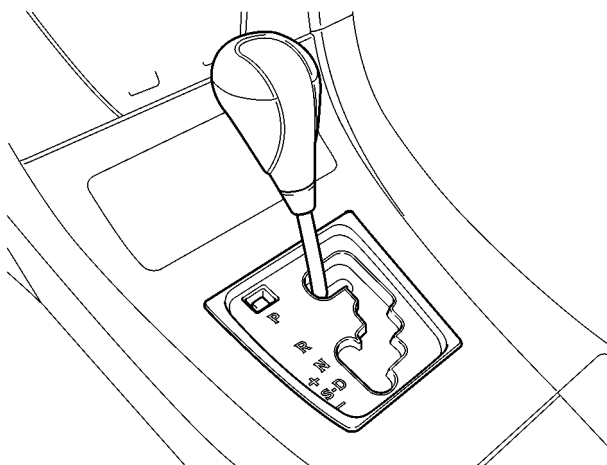
- The two-dial type optitron meter with the multi information display is used.
- The metallic style and the illuminated scale of the whet-finish ring along with the three-dimensional dial, give the delicacy and elegance of handcrafted wristwatches.
- A function that fades in the dial illumination when the meter activates has been implemented, creating a feeling of luxury.



01YMO15Y

### **Shift Lever**

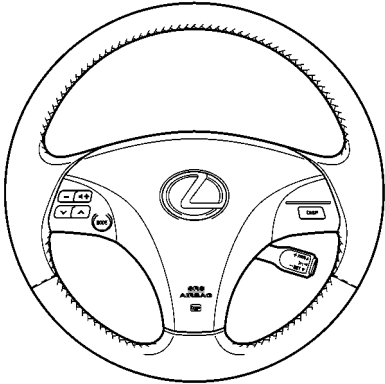
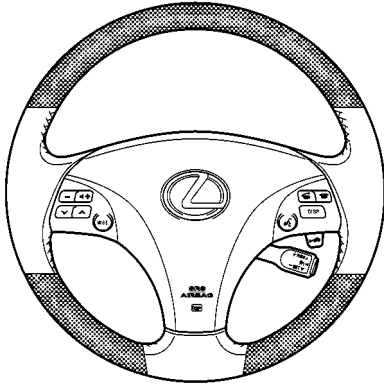
- A gate type shift lever with an S-mode position is used.
- Two types of shift lever knobs are available: the leather-covered chrome type (standard) and the leather-covered wood type (optional).



01YMO16Y

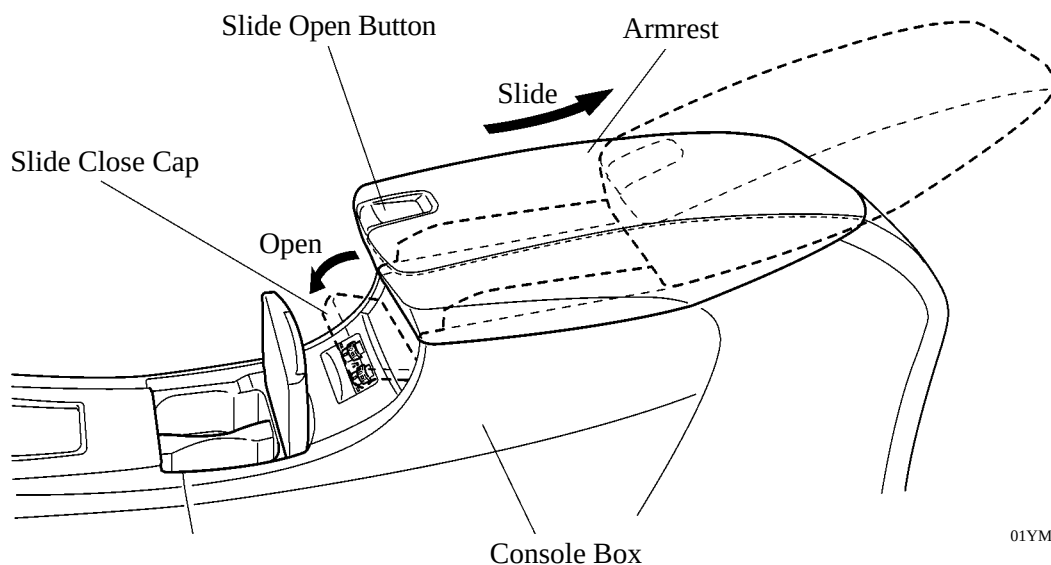
## **Steering Wheel**

- The following two types of steering wheels are available: 3-spoke leather-wrapped and 3-spoke leather-wrapped with wood-grain.
- A newly designed steering pad switch is used, which allows the audio, multi-information display, telephone\* and navigation voice recognition systems\* to be easily operated.  
\*: Telephone switch and voice switch are provided if the telephone and navigation system are optionally installed.
- The cruise control switch and the distance control switch have been incorporated in the steering wheel for ease of operation.

|           | 3-Spoke<br>Leather-wrapped                                                         | 3-Spoke<br>Leather-wrapped with Wood-grain                                           |
|-----------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|           |  |  |
| Design    |                                                                                    |                                                                                      |
| Equipment | Standard                                                                           | Option                                                                               |

## **Console Box**

The console box lid can also be used as an armrest. This lid can be opened and closed using the slide open button and the slide close cap located close to the driver's hands, thus improving the usability of the console box.



**MODEL CODE**

**GSV40** **L** - **B** **E** **T** **G** **K** **A**

1                      2                      3                      4                      5                      6                      7                      8

| 1 | BASIC MODEL CODE          |
|---|---------------------------|
|   | GSV40: With 2GR-FE Engine |

| 5 | GEAR SHIFT TYPE             |
|---|-----------------------------|
|   | T: 6-Speed Automatic, Floor |

| 2 | STEERING WHEEL POSITION |
|---|-------------------------|
|   | L: Left-Hand Drive      |

| 6 | GRADE |
|---|-------|
|   | G: —  |

| 3 | MODEL NAME |
|---|------------|
|   | B: ES350   |

| 7 | ENGINE SPECIFICATION |
|---|----------------------|
|   | K: DOHC and SFI      |

| 4 | BODY TYPE       |
|---|-----------------|
|   | E: 4-Door Sedan |

| 8 | DESTINATION |
|---|-------------|
|   | A: U.S.A.   |

**MODEL LINE-UP**

| Destination | Engine | Body Type    | Grade | Transaxle               |
|-------------|--------|--------------|-------|-------------------------|
|             |        |              |       | U660E 6-Speed Automatic |
| U.S.A.*     | 2GR-FE | 4-Door Sedan | —     | GSV40L-BETGKA           |

\*: Canadian, Korean, Taiwanese and Brazilian package model options are included.

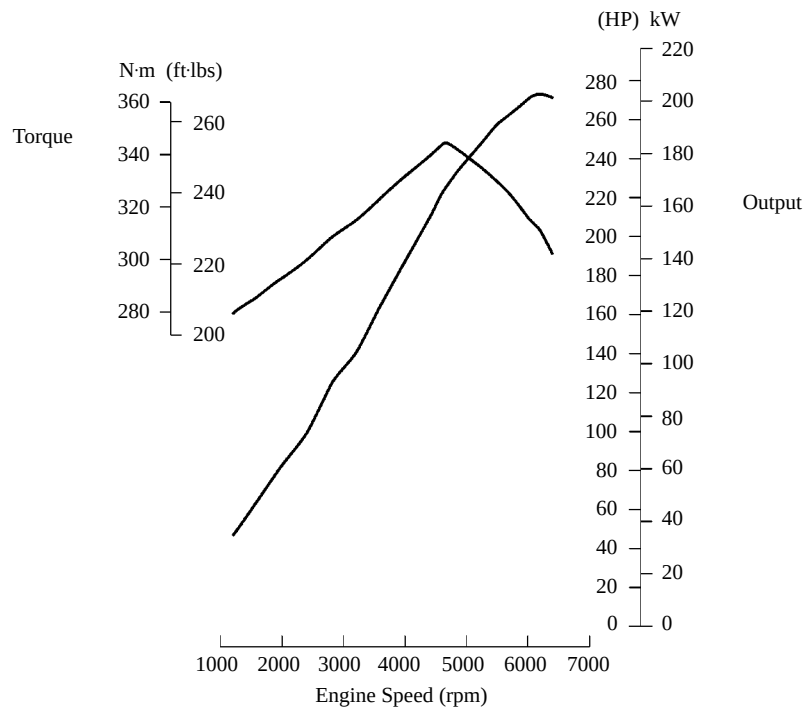
## PERFORMANCE

### Power Train

#### Engine

|                                |                                              |
|--------------------------------|----------------------------------------------|
| Type                           | 2GR-FE                                       |
| No. of Cylinders & Arrangement | 6-Cylinder, V Type                           |
| Valve Mechanism                | 24-Valve DOHC, Chain Drive (with Dual VVT-i) |
| Displacement                   | 3456 cm <sup>3</sup> (210.9 cu. in.)         |
| Max. Output [SAE-NET]*         | 203 kW @6200 rpm (272 HP@6200 rpm)           |
| Max. Torque [SAE-NET]*         | 344 N·m @4700 rpm (254 ft·lbs@4700 rpm)      |

\*: Maximum output and torque rating is determined by revised SAE J1394 standard.

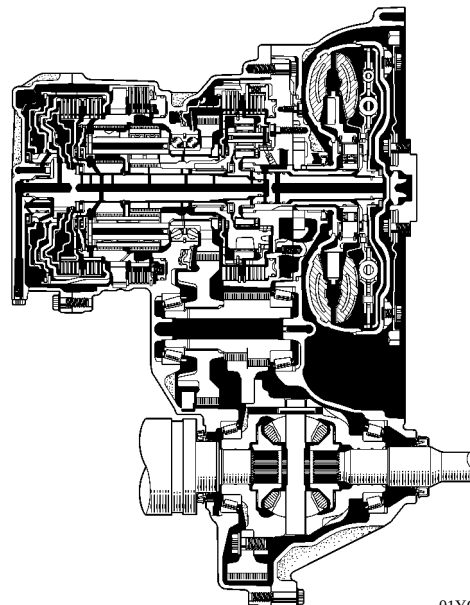


01YMO41Y

#### Transaxle

| Type                     |     | 6-Speed Automatic |
|--------------------------|-----|-------------------|
|                          |     | U660E             |
| Gear Ratio               | 1st | 3.300             |
|                          | 2nd | 1.900             |
|                          | 3rd | 1.420             |
|                          | 4th | 1.000             |
|                          | 5th | 0.713             |
|                          | 6th | 0.608             |
| Reverse                  |     | 4.148             |
| Differential Gear Ratio* |     | 3.685             |

\*: Counter gear ratio included

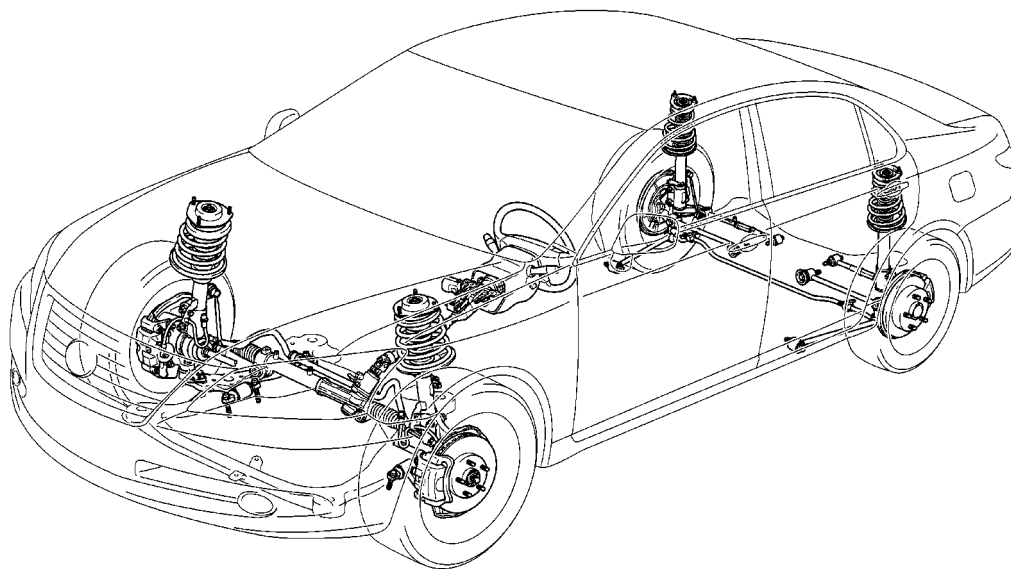


01YCH01Y

## **Chassis**

### **Suspension**

| Front Suspension                                | Rear Suspension                                            |
|-------------------------------------------------|------------------------------------------------------------|
| MacPherson Strut Type<br>Independent Suspension | Dual Link Mac Pherson Strut Type<br>Independent Suspension |



01YMO42Y

### **Steering**

|               |                                                       |
|---------------|-------------------------------------------------------|
| Steering Type | Engine Speed Sensing<br>Hydraulic Type Power Steering |
| Gear Type     | Rack & Pinion                                         |

### **Brake**

|                      |                                             |
|----------------------|---------------------------------------------|
| Front Rotor Size     | Ventilated Disc                             |
| Front Rotor Size     | 296 mm (11.65 in.)                          |
| Rear Brake Type      | Solid Disc                                  |
| Rear Rotor Size      | 281 mm (11.06 in.)                          |
| Parking Brake        | Foot pedal type with foot release           |
| Brake Control System | ABS with EBD, Brake Assist,<br>TRAC and VSC |

## **Aerodynamics**

A CD (Coefficient of Drag) of approximately 0.28 has been achieved.



# SAFETY

## Pre-collision System

The pre-collision system retracts the front seatbelts and brings the brake control system to the brake assist standby condition under the below conditions before a collision to reduce injury to the driver and front passenger.

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating Condition | <ul style="list-style-type: none"> <li>• When a collision with an obstacle in front of the vehicle or the vehicle ahead is determined to be unavoidable.</li> <li>• When the front wheels lose grip in relation to the rear wheels (front wheel skid tendency).</li> <li>• When the rear wheels lose grip in relation to the front wheels (rear wheel skid tendency).</li> <li>• When the brakes are suddenly applied.</li> </ul> |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

