4WD SYSTEM

■ DESCRIPTION

- The 4WD system of the new model uses an active torque control 4WD system.
- It is a compact, lightweight, and high performance 4WD system that optimally controls the torque distribution to the front and rear wheels through the electric control coupling in the rear differential.

■ ACTIVE TORQUE CONTROL 4WD SYSTEM

1. General

- Based on information provided by various sensors, the 4WD ECU controls the amperage that is applied to the electric control coupling, in order to transmit drive torque to the rear wheels when needed, and in the amount needed. The following describes the features of the active torque control 4WD system.

Traction performance	Realizes stable start-off and acceleration performance.
Driving stability performance	Realizes stable cornering performance.
Fuel economy	Realizes better fuel economy by transmitting drive torque to the rear wheels when needed, in the amount needed.

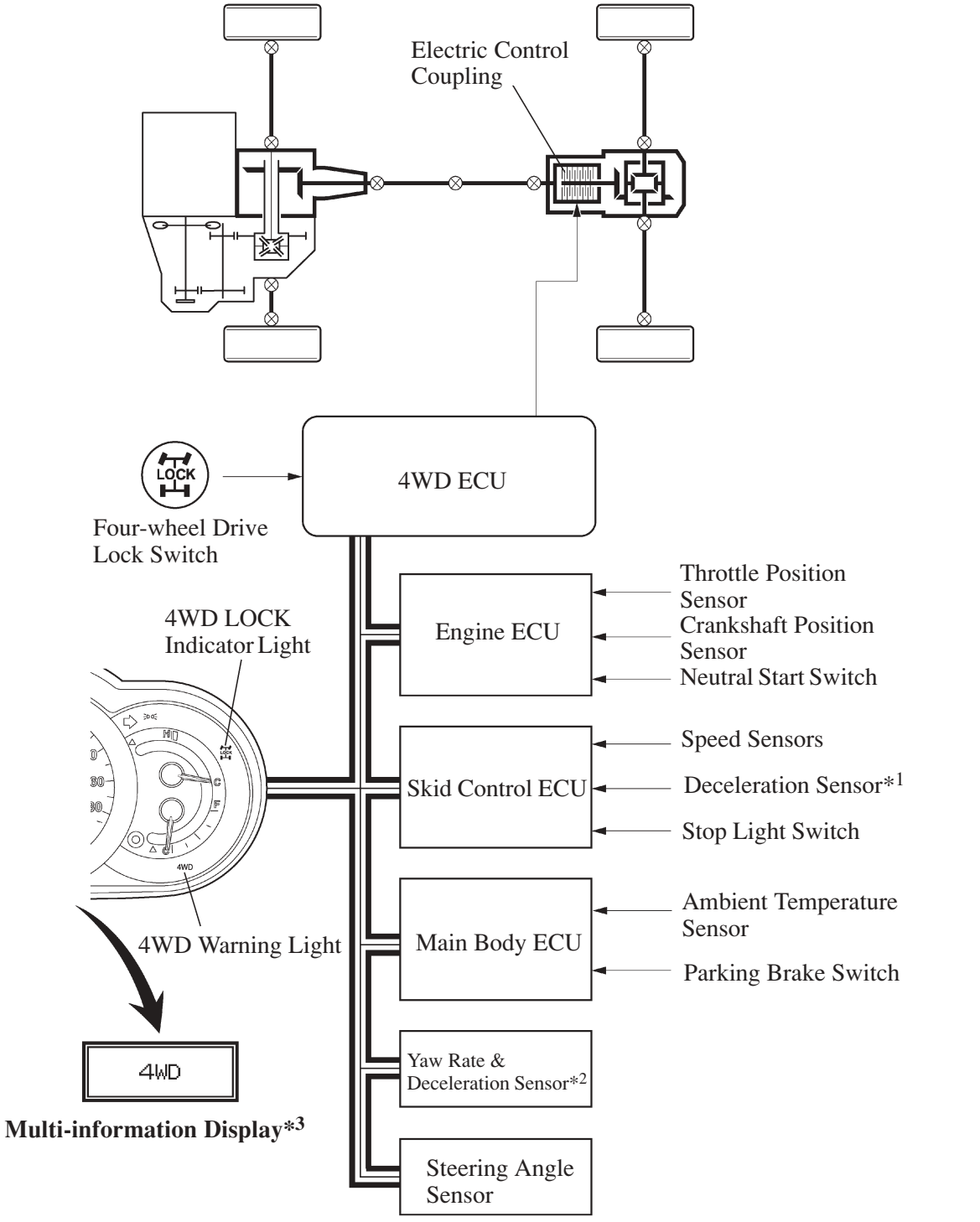
- A four-wheel drive lock switch has been provided. This enables the driver to select between the AUTO and LOCK modes by operating the switch. The system optimally controls the torque distribution to the front and rear wheels in the respective modes.

Mode	Four-wheel Drive Lock Switch and Indicator Light	Outline
AUTO	OFF	● Optimally distributes drive torque to the front and rear wheels. ● Ensures optimal start-off performance during a start-off, based on information provided by various sensors. ● Suppresses the tight corner braking phenomenon* during low-speed cornering. ● Reduces the amount of torque distribution to the rear wheels and improves fuel economy when the system judges that the vehicle is traveling steadily. ● Disengages the 4WD during braking deceleration.
LOCK	ON	● Distributes the maximum torque limit to the rear wheels. ● Distributes the maximum torque limit to the rear wheels during start-off. ● Distributes optimal torque during low-speed cornering. ● Disengages the 4WD during braking deceleration. ● Disengages the LOCK mode and transfers to the AUTO mode when the vehicle speed exceeds 40 km/h (25 mph).

*: Tight corner braking phenomenon: a condition in which the brakes are applied due to a rotational difference between the front and rear wheels, such as during low-speed cornering in the 4WD mode.

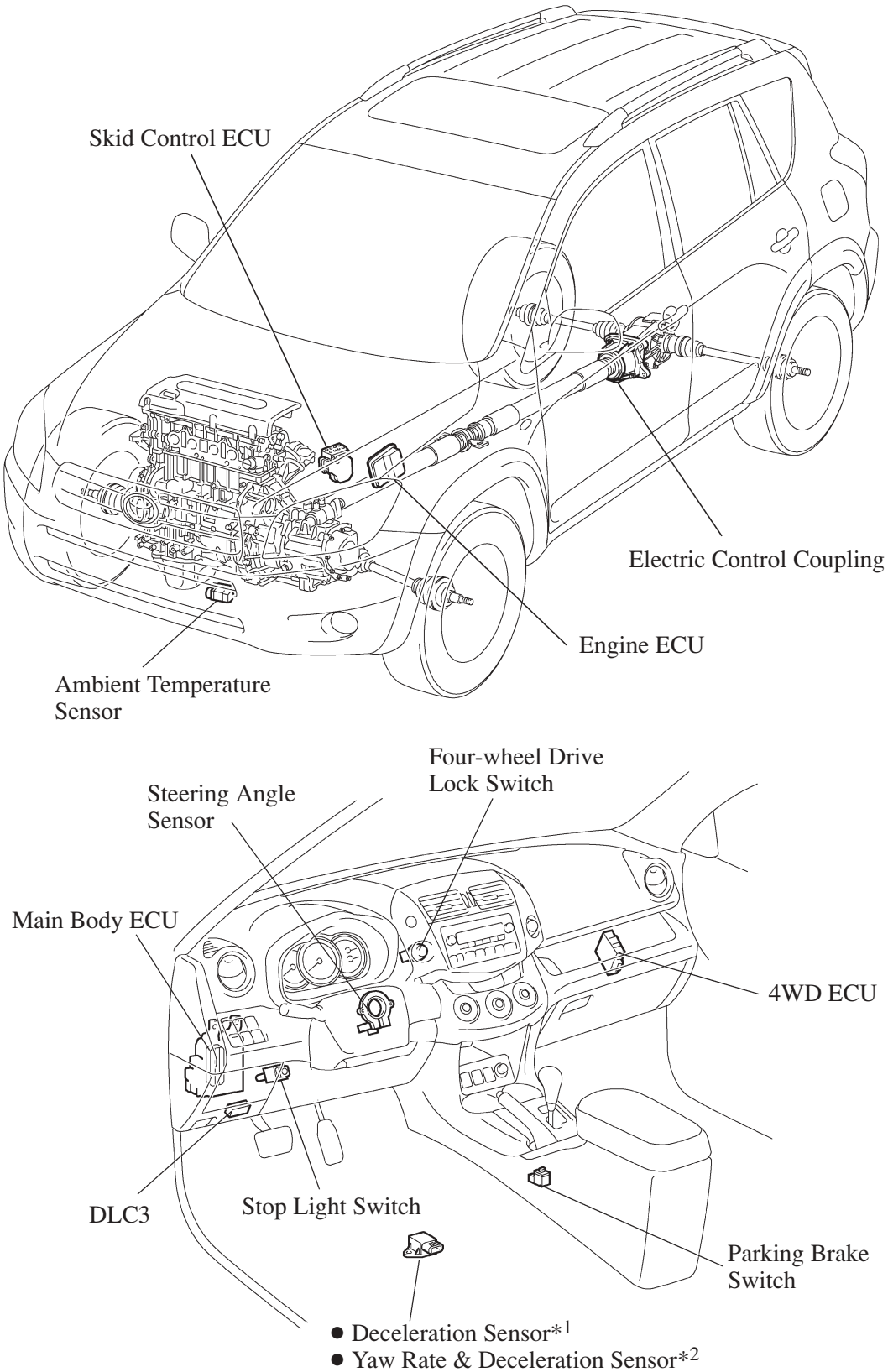
- The 4WD ECU effects cooperative control with the skid control ECU, in order to control the drive torque distribution to the front and rear wheels in accordance with information received from the skid control ECU. These controls ensure a smooth acceleration and driving stability.

2. System Diagram



*1: Only for Models with ABS with EBD
*2: Only for Models with VSC
*3: Only for Europe Models

3. Layout of Main Components



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*1: Only for Models with ABS with EBD
*2: Only for Models with VSC

4. Function of Main Components

Component		Function
Combination Meter	4WD LOCK Indicator Light	Illuminates to inform the driver of the 4WD LOCK mode control.
	4WD Warning Light	Illuminates to warn the driver of a malfunction in the 4WD system.
	Multi-information Display*1	● Indicates that the 4WD LOCK mode control is operating. ● Indicates a malfunction in the 4WD system.
Speed Sensor (4)		Detects the wheel speed of each 4 wheel.
Steering Angle Sensor		Detects the direction and angle of the steering wheel.
Deceleration Sensor*2		Detects the vehicle's longitudinal and lateral acceleration.
Yaw Rate & Deceleration Sensor*3		
Crankshaft Position Sensor		Detects the engine speed and outputs it to the engine ECU.
Accelerator Pedal Position Sensor		Detects the accelerator pedal position and outputs it to the engine ECU.
Throttle Position Sensor		Detects the throttle valve position and outputs it to the engine ECU.
Neutral Start Switch		Detects the neutral position of the transaxle and outputs it to the engine ECU.
Stop Light Switch		Detects the brake pedal depressing signal.
Parking Brake Switch		Detects when the parking brake lever is pulled up.
Four-wheel Drive Lock Switch		Switches between the AUTO and LOCK modes.
4WD ECU		Controls the amperage that is applied to the electromagnetic solenoid of the electric control coupling based on the signals provided by the sensors in order to optimally distribute drive torque in accordance with driving conditions.
Engine ECU		Outputs signals such as the shift position signal, throttle position signal, and crankshaft position signal to the 4WD ECU.
Skid Control ECU		Outputs signals such as the vehicle speed signal and deceleration signal to the 4WD ECU.
Electric Control Coupling		Distributes drive torque in accordance with the amperage applied by the 4WD ECU.

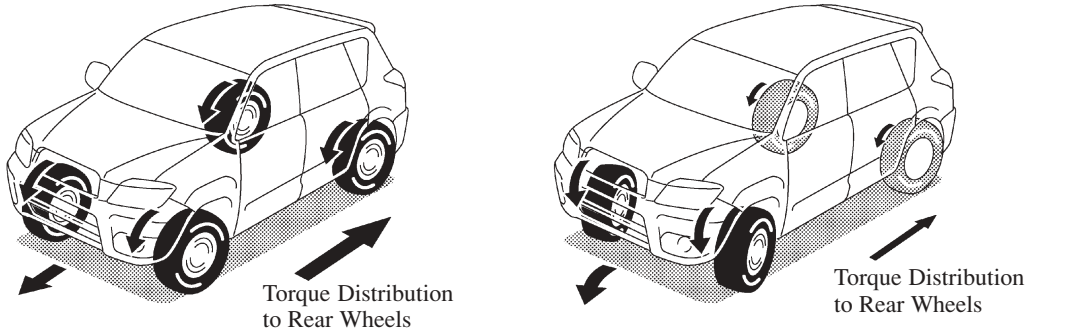
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*2: Only for Models with ABS with EBD
*3: Only for Models with VSC

5. System Operation

AUTO Mode

1) Starting Off

- The system ensures start-off performance by optimally distributing the entire drive torque, which is transmitted by the engine, to the front and rear wheels.
- To prevent the tight corner braking phenomenon from occurring during low-speed cornering, the system reduces the amount of torque distribution to the rear wheels.

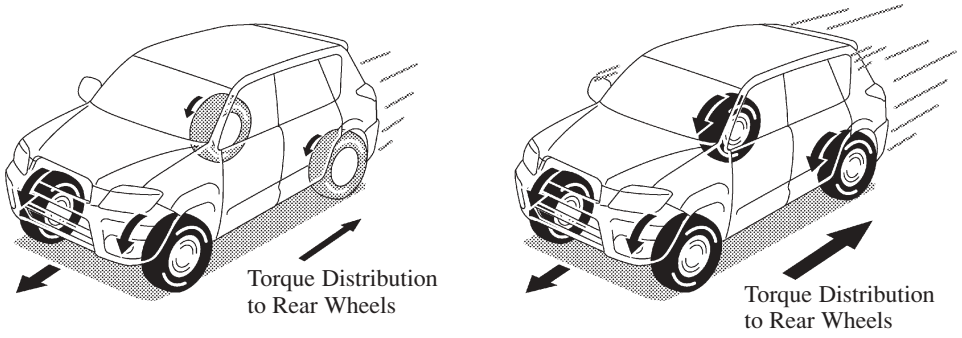


Straightline Driving **Low-Speed Cornering**

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2) Normal Driving

- During normal driving, when the system judges that the vehicle is traveling steadily, it reduces the amount of torque distribution to the rear wheels. This allows the vehicle to operate in conditions similar to front-wheel-drive, which improves fuel economy.
- To ensure excellent acceleration performance during straightline acceleration and excellent driving stability during cornering, the system controls the amount of torque distribution to the rear wheels.



Steady Driving **Straightline Acceleration**

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LOCK Mode

When the vehicle is in a situation that poses difficulty for it to pull itself out, such as sand, the driver can switch to LOCK mode by operating the four-wheel drive lock switch. Thus, this mode effects optimal control in accordance with the driving conditions and transmits as much drive torque as possible to the rear wheels.

NOTICE

In the LOCK mode after the four-wheel drive lock switch is pressed, the system starts control upon judging that the vehicle is operating in a stable manner. During this judgment, the 4WD LOCK indicator light blinks.

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6. Diagnosis

- When the 4WD ECU detects a malfunction, the 4WD ECU makes a diagnosis and memorizes the failed section. Furthermore, the 4WD warning light in the combination meter illuminates to inform the driver.
- At the same time, the DTCs (Diagnosis Trouble Codes) are stored in memory. The DTCs can be read by connecting an intelligent tester II, or by connecting the SST (09843-18040) to the TC and CG terminals of DLC3 and observing the blinks of the 4WD warning light.

For details of the DTCs that are stored in 4WD ECU memory, see the RAV4 Repair Manual (Pub. No. RM01N0E).

7. Fail-safe

When there is a possibility of causing damage to the drive system due to a malfunction in the 4WD system or rough driving, the system illuminates or blinks the 4WD warning light to inform the driver, stops the 4WD controls, and enables the vehicle to operate in the front-wheel-drive mode.

Malfunction	4WD Warning Light	
4WD System Malfunction	Illuminate	
Rough driving in 4WD	Pre-warning for stopping 4WD control	Slow blinking
	Stopping 4WD control	Fast blinking

Service Tip

When the 4WD ECU judges that the vehicle has become stable, it cancels the stopping of the 4WD control and transfers to AUTO mode control. If the 4WD warning light blinks, take the following actions without turning the engine OFF:

- Drop the vehicle speed until the light goes out
- Stop the vehicle and stay there until the light goes out