

ACTIVE TORQUE CONTROL 4WD SYSTEM

GENERAL

1. OUTLINE

- (a) It is a compact, lightweight, and high performance active torque control 4WD system that optimally controls torque distribution to the front and rear wheels through the electromagnetic control coupling in the rear differential.

2. MAIN FEATURES

- (a) Active Torque Control 4WD
 - (1) Based on information provided by various sensors, the 4WD ECU assembly controls the amperage applied to the electromagnetic control coupling in order to transmit an appropriate amount of drive torque to the rear wheels when needed. The following describes the features and benefits of the active torque control 4WD:

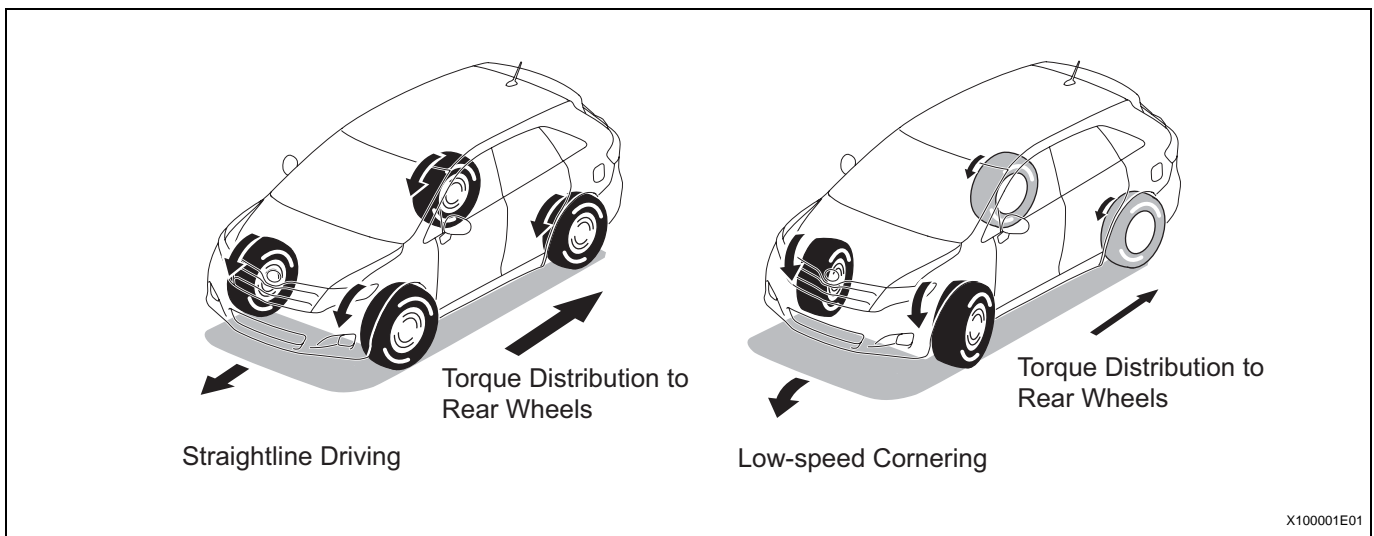
Traction performance	Realizes stable start-off and acceleration performance.
Driving stability performance	Realizes stable cornering performance.
Fuel economy	Realizes better fuel economy by transmitting an appropriate amount of drive torque to the rear wheels when needed.

- Optimally distributes drive torque to the front and rear wheels.
- Ensures optimal start-off performance 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 AWD during braking deceleration.

*: Tight corner braking phenomenon: a phenomenon in which a AWD vehicle may lurch and decelerate due to a rotational speed difference between the front and rear wheels, such as during low-speed cornering in AWD mode.

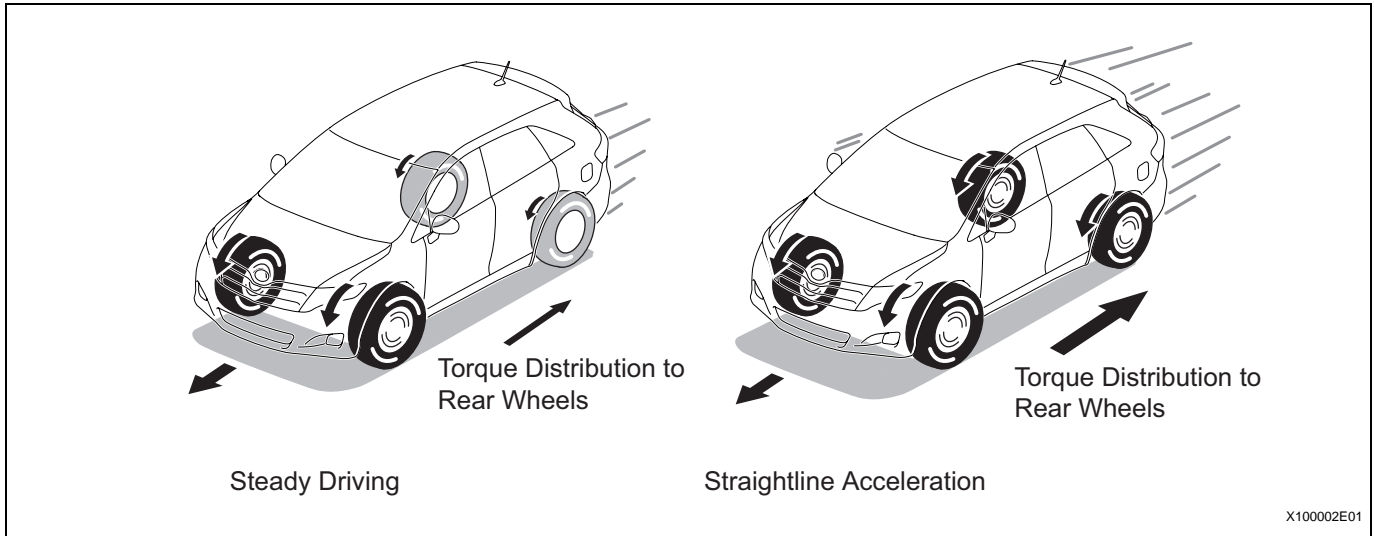
(2) Starting Off

- The system ensures start-off performance by optimally distributing engine drive torque 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 distributed to the rear wheels.

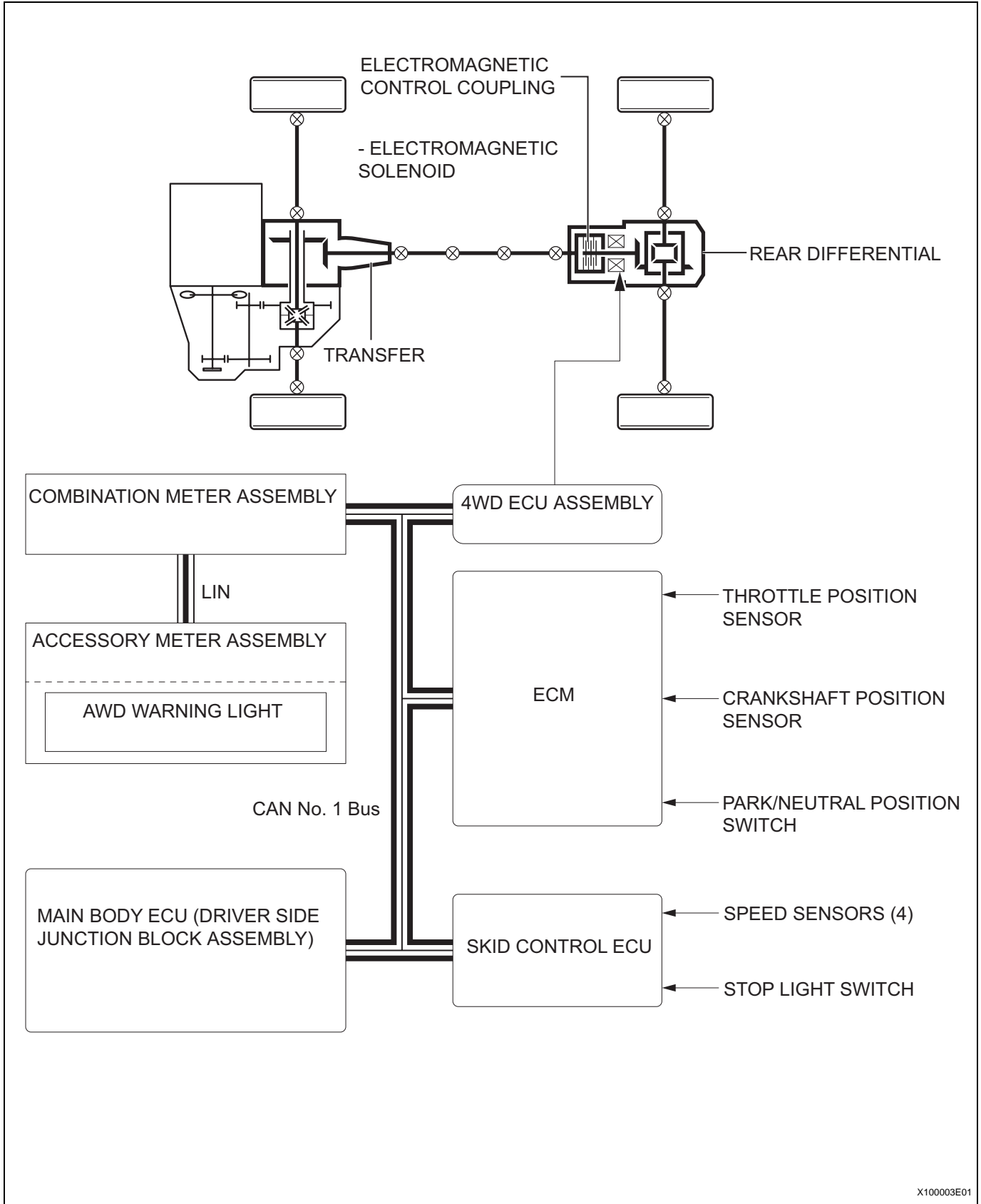


(3) Normal Driving

- 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.
- The system optimizes torque distribution to the rear wheels to ensure both excellent straightline acceleration performance and excellent driving stability while cornering.

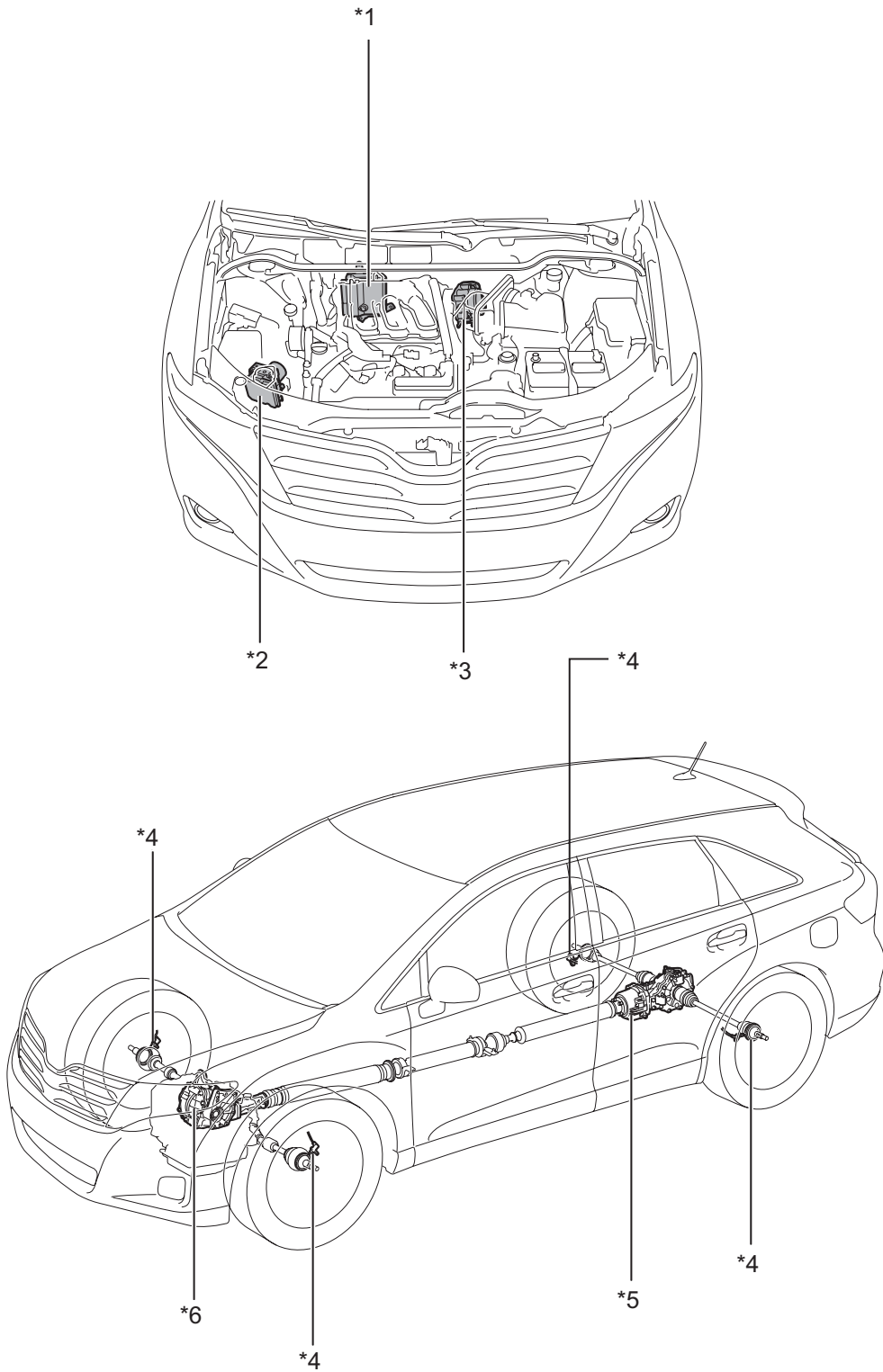


SYSTEM DIAGRAM

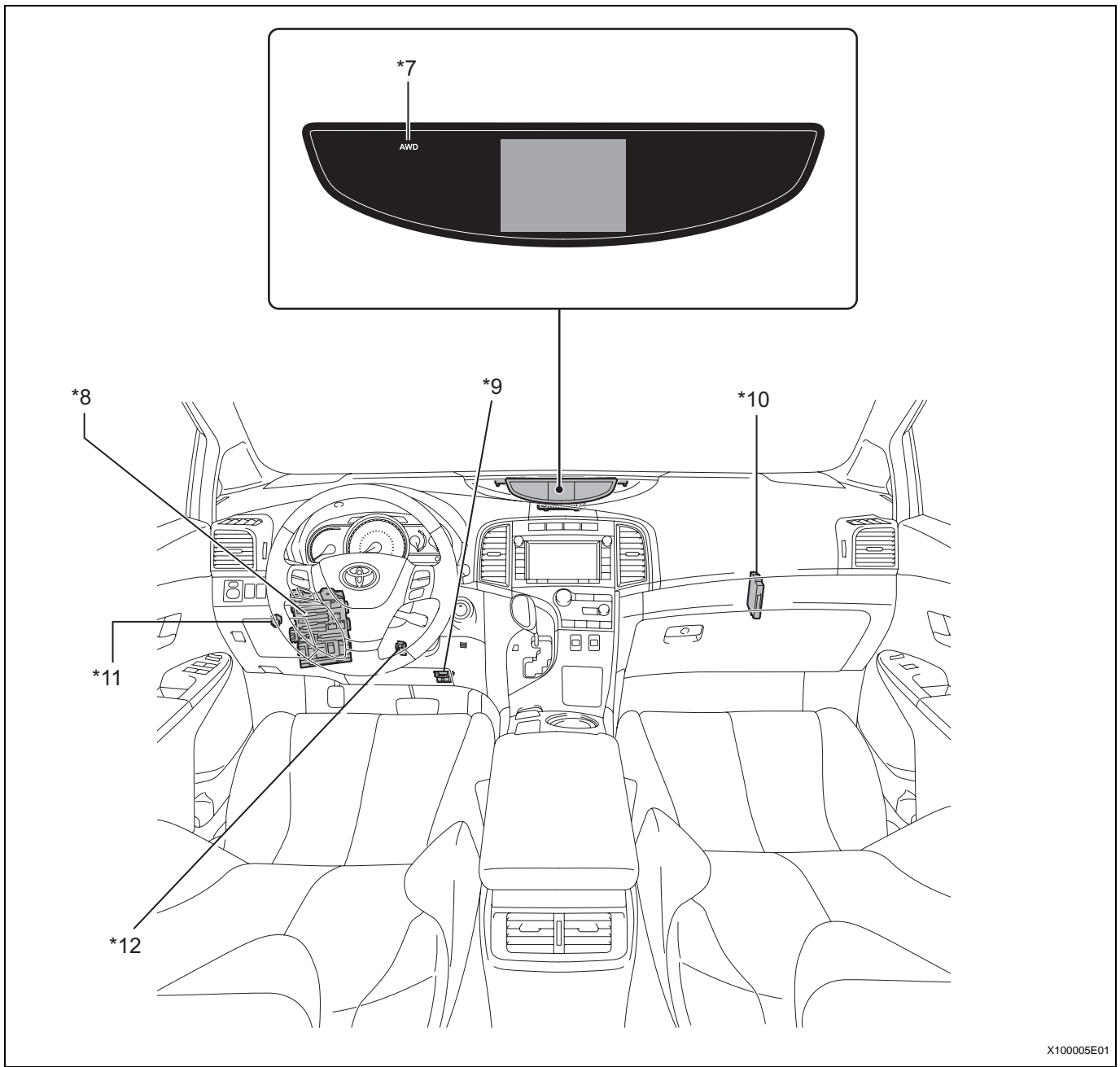


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PARTS LOCATION



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Text in Illustration

*1	Throttle Body Assembly - Throttle Position Sensor	*2	Skid Control ECU (Brake Actuator Assembly)
*3	ECM	*4	Speed Sensor
*5	Rear Differential - Electromagnetic Control Coupling - Electromagnetic Solenoid	*6	Transfer
*7	AWD Warning Light	*8	Main Body ECU (Driver Side Junction Block Assembly)
*9	DLC3	*10	4WD ECU Assembly
*11	Parking Brake Switch Assembly	*12	Stop Light Switch

DETAILS

1. FUNCTION OF MAIN COMPONENTS

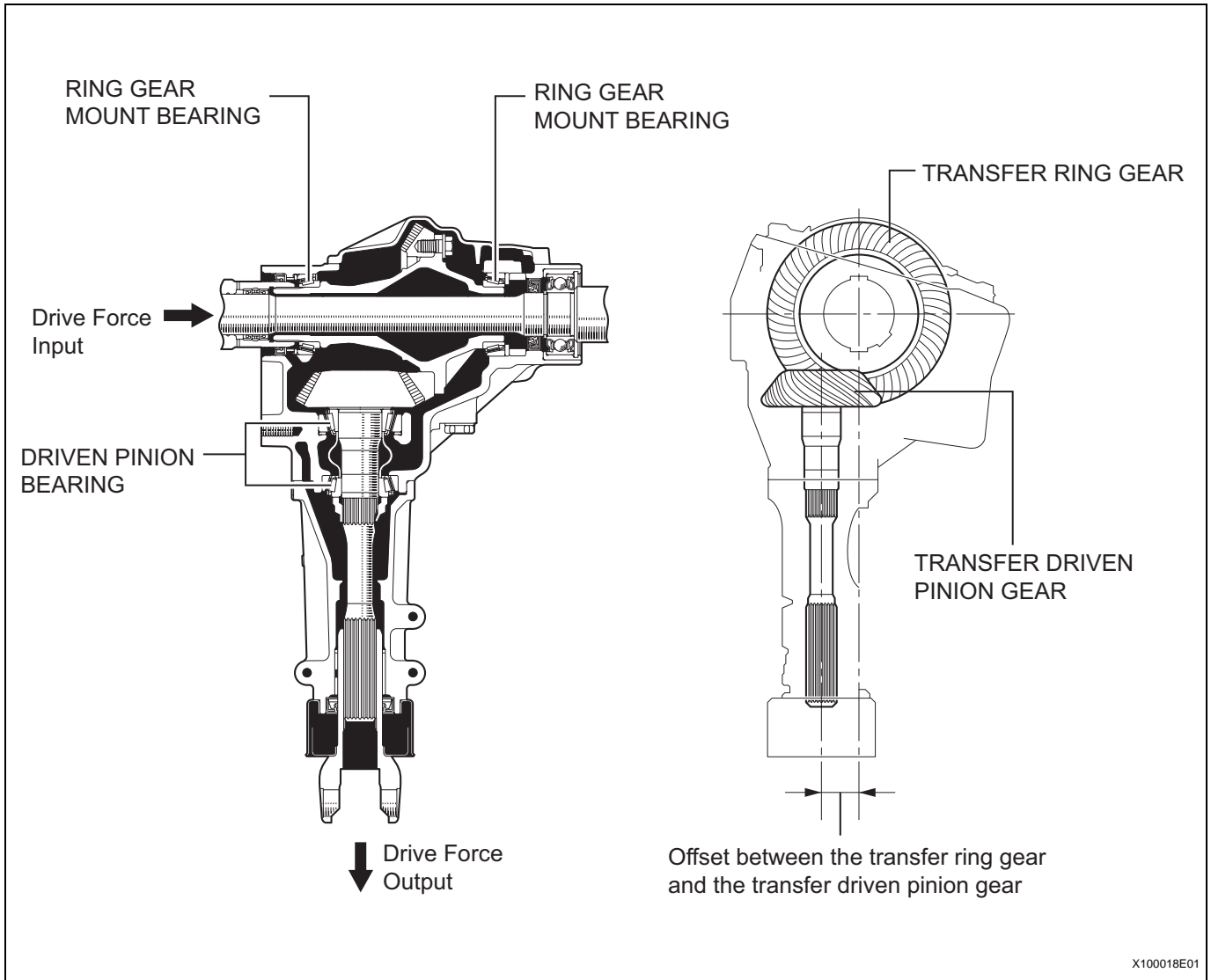
Component		Function
4WD ECU ASSEMBLY		<ul style="list-style-type: none"> Controls the amperage applied to the electromagnetic control coupling solenoid based on signals provided by the sensors in order to optimally distribute drive torque in accordance with driving conditions. Turns AWD mode off when a parking brake on signal is received from the main body ECU (driver side junction block assembly). Turns AWD mode off when a shift position signal (P or N) is received from the ECM.
Rear Differential	Electromagnetic Control Coupling - Electromagnetic Solenoid	Distributes drive torque in accordance with the amperage applied by the 4WD ECU assembly.
Transfer		Drive force input into the differential is redirected 90 degrees and output to the propeller shaft by the transfer.
Accessory Meter Assembly	AWD Warning Light	<ul style="list-style-type: none"> Illuminates to warn the driver of a malfunction in the active torque control 4WD system. Blinks to inform the driver of the DTCs in the diagnostic mode.
Speed Sensor		Detects the wheel speed of each wheel.
Crankshaft Position Sensor		Detects the engine speed and outputs it to the ECM.
Throttle Position Sensor		Detects the throttle valve position and outputs it to the ECM.
Park/Neutral Position Switch		Detects the shift position of the transaxle and outputs it to the ECM.
Stop Light Switch		Detects when the brake pedal is depressed.
Parking Brake Switch Assembly		Detects when the parking brake is applied.
ECM		Outputs signals such as the shift position signal, throttle position signal, and crankshaft position signal to the 4WD ECU assembly.
Skid Control ECU (Brake Actuator Assembly)		Outputs signals such as the vehicle speed signal and deceleration signal to the 4WD ECU assembly.
Main Body ECU (Driver Side Junction Block Assembly)		Outputs signals such as the parking brake signal to the 4WD ECU assembly.

2. CONSTRUCTION

(a) Transfer

- The compact and lightweight MF1A transfer is used.
- Drive force input into the differential is redirected 90 degrees and output to the propeller shaft by the transfer.

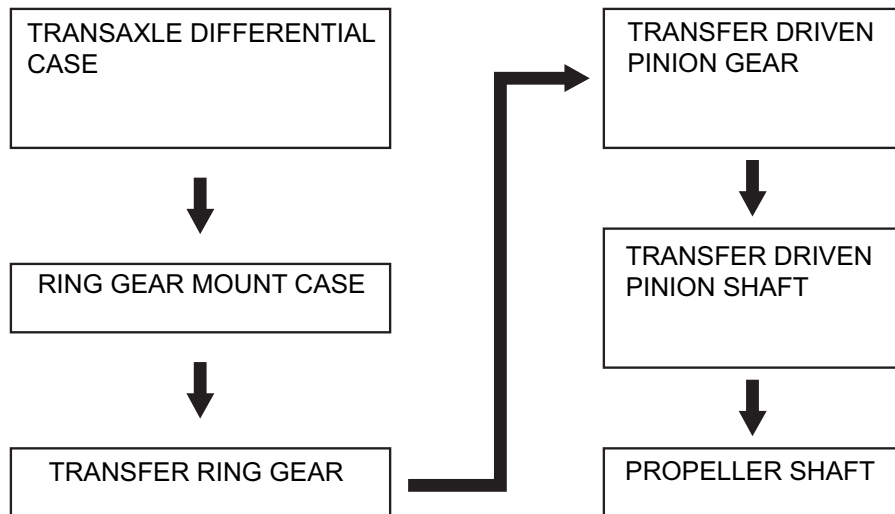
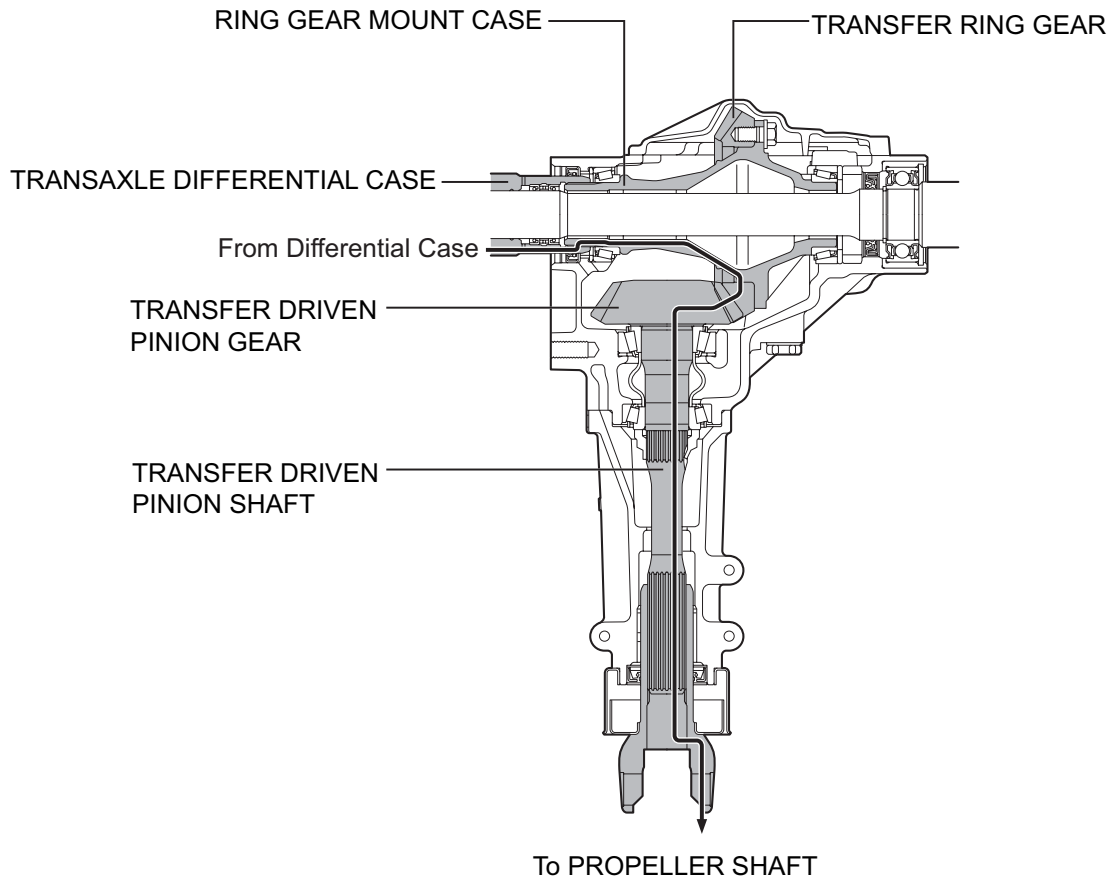
(3) The offset between the transfer ring gear and the transfer driven pinion gear is increased, the distance between the driven pinion bearings is reduced, and a small-diameter ring gear mount bearing is used. As a result, the transfer is easier to install.



Transfer Type		MF1A
Gear Type		Hypoid Gear
Gear Ratio		0.439
Transfer Ring Gear	The No. of Teeth	41
Transfer Driven Pinion Gear	The No. of Teeth	18
Oil Viscosity		Above -18°C (0°F): SAE 90 Below -18°C (0°F): SAE 80W or SAE 80W-90
Oil Grade		API GL-5
Oil Type		Hypoid Gear Oil
Oil Capacity	Liters (US qts, Imp. qts)	0.8 (0.85, 0.70)
Weight (Reference)*	kg (lb)	15.4 (33.9)

*: Weight shows the figure with the oil fully filled.

(4) The illustration below shows the flow of power from the transaxle.



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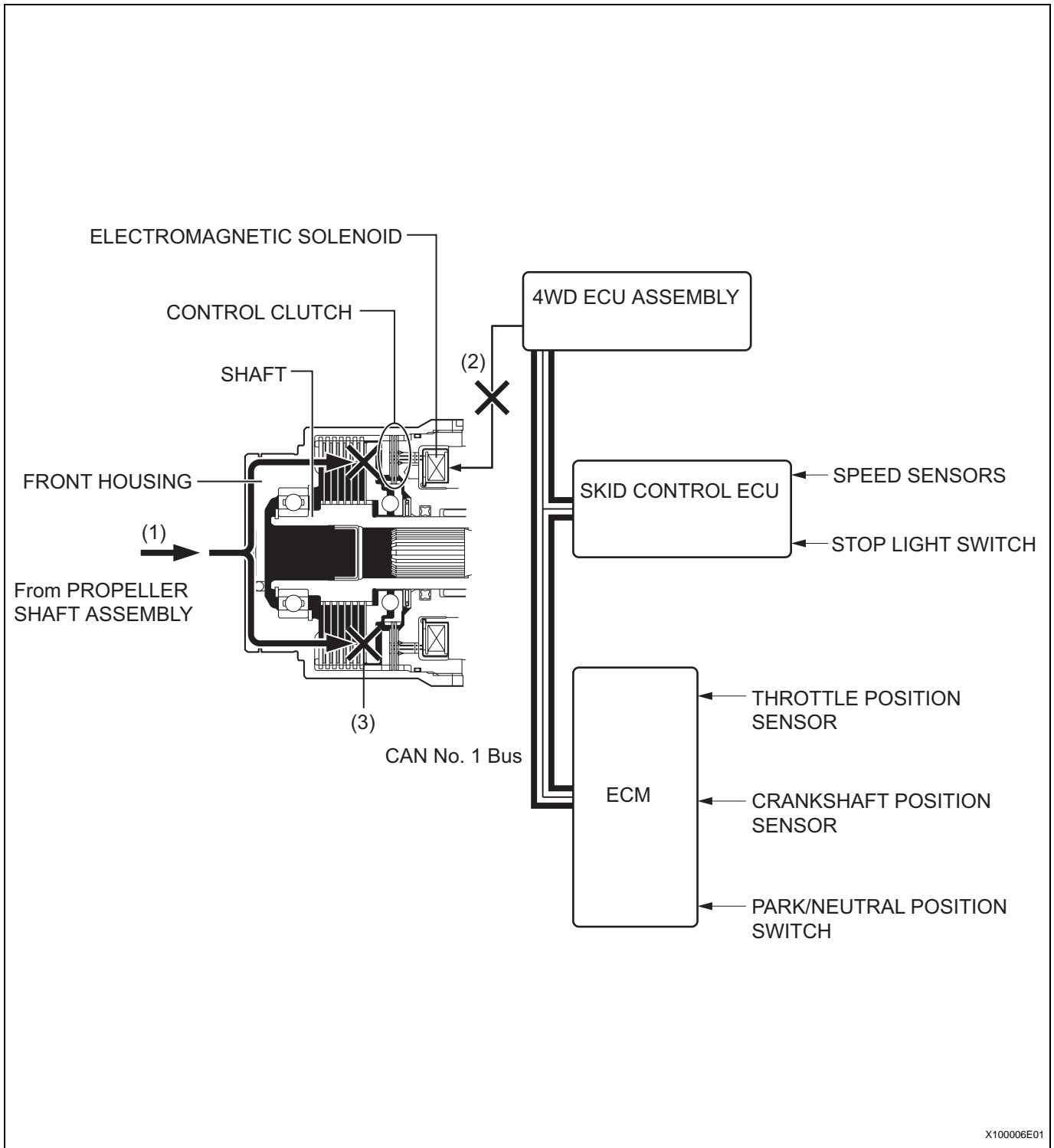
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3. OPERATION

(a) 2WD Mode

(1) The drive force is transmitted from the propeller shaft to the front housing.

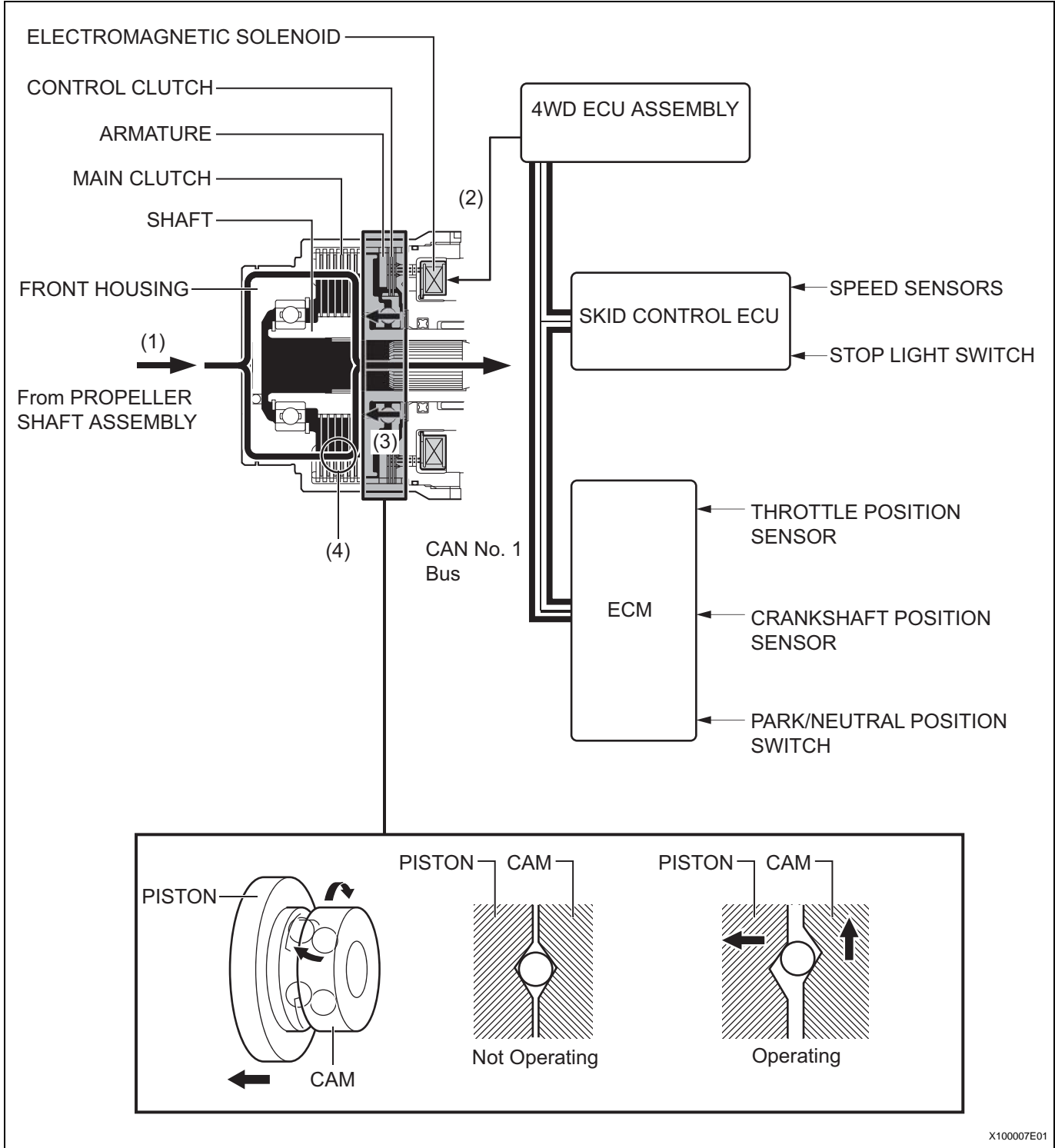
- (2) The 4WD ECU assembly judges whether it is necessary to send drive torque to the rear wheels based on input from various sensors. When it is not necessary to send drive torque to the rear wheels, the electromagnetic solenoid is not operated.
- (3) The drive force of the front housing is not transmitted to the shaft because the control clutch is not engaged.
- (4) Accordingly, drive force from the propeller shaft is not transmitted to the rear wheels.



(b) AWD Mode

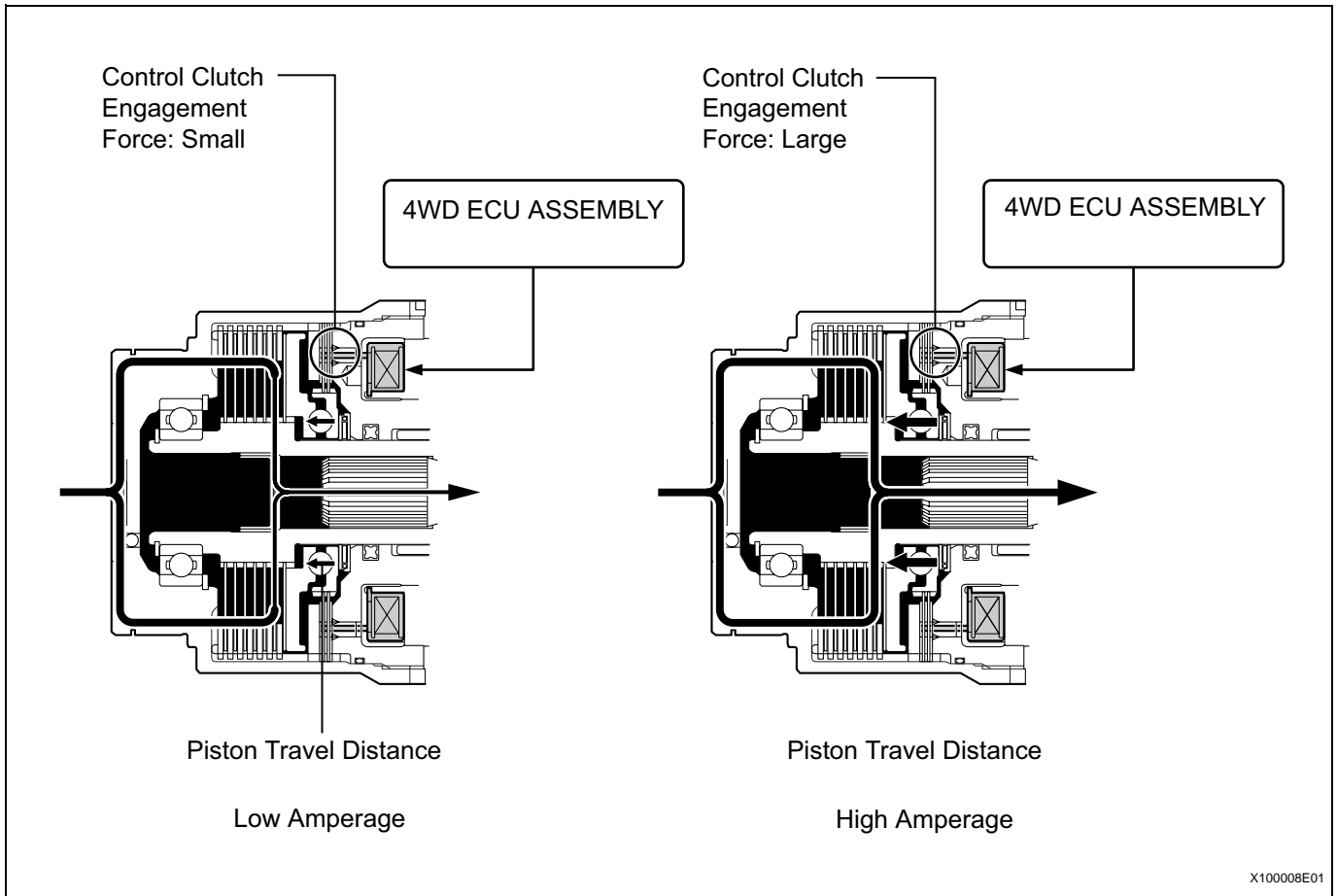
- (1) The drive force is transmitted from the propeller shaft to the front housing.

- (2) The 4WD ECU assembly judges whether it is necessary to send drive torque to the rear wheels based on input from various sensors. When it is necessary to send drive torque to the rear wheels, the electromagnetic solenoid is operated.
- (3) It attracts the armature to the control clutch side. This causes the control clutch to engage and the cam to rotate.
- (4) The rotational movement of the cam causes the piston to push on the main clutch, causing the main clutch to engage.



- (5) The amount of drive force that is transmitted to the rear wheels is controlled steplessly by controlling the amperage that is applied to the electromagnetic solenoid.

(6) Accordingly, drive force from the propeller shaft is transmitted to the rear wheels.



4. DIAGNOSIS

- (a) When the 4WD ECU assembly detects a malfunction, it will record information related to the fault. Furthermore, the AWD warning light in the accessory meter assembly will illuminate to inform the driver.
- (b) At the same time, Diagnostic Trouble Codes (DTCs) are stored in memory. The DTCs can be read using the Techstream or by connecting SST (09843-18040) to the TC and CG terminals of the DLC3 and observing the blinking pattern of the AWD warning light.
- (c) For details of the DTCs that are stored in 4WD ECU assembly memory, refer to the Repair Manual.

5. FAIL-SAFE

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

Condition	AWD Warning Light
AWD system malfunction	Illuminates
Rough driving in AWD mode	Fast Blinking

HINT:

When the 4WD ECU assembly judges that the vehicle has stabilized, it resumes AWD mode. If the AWD warning light blinks, take the following actions without turning the engine OFF:

- Decelerate the vehicle until the light goes out.
- Stop the vehicle and wait until the light goes out.