■ BRAKE CONTROL SYSTEM

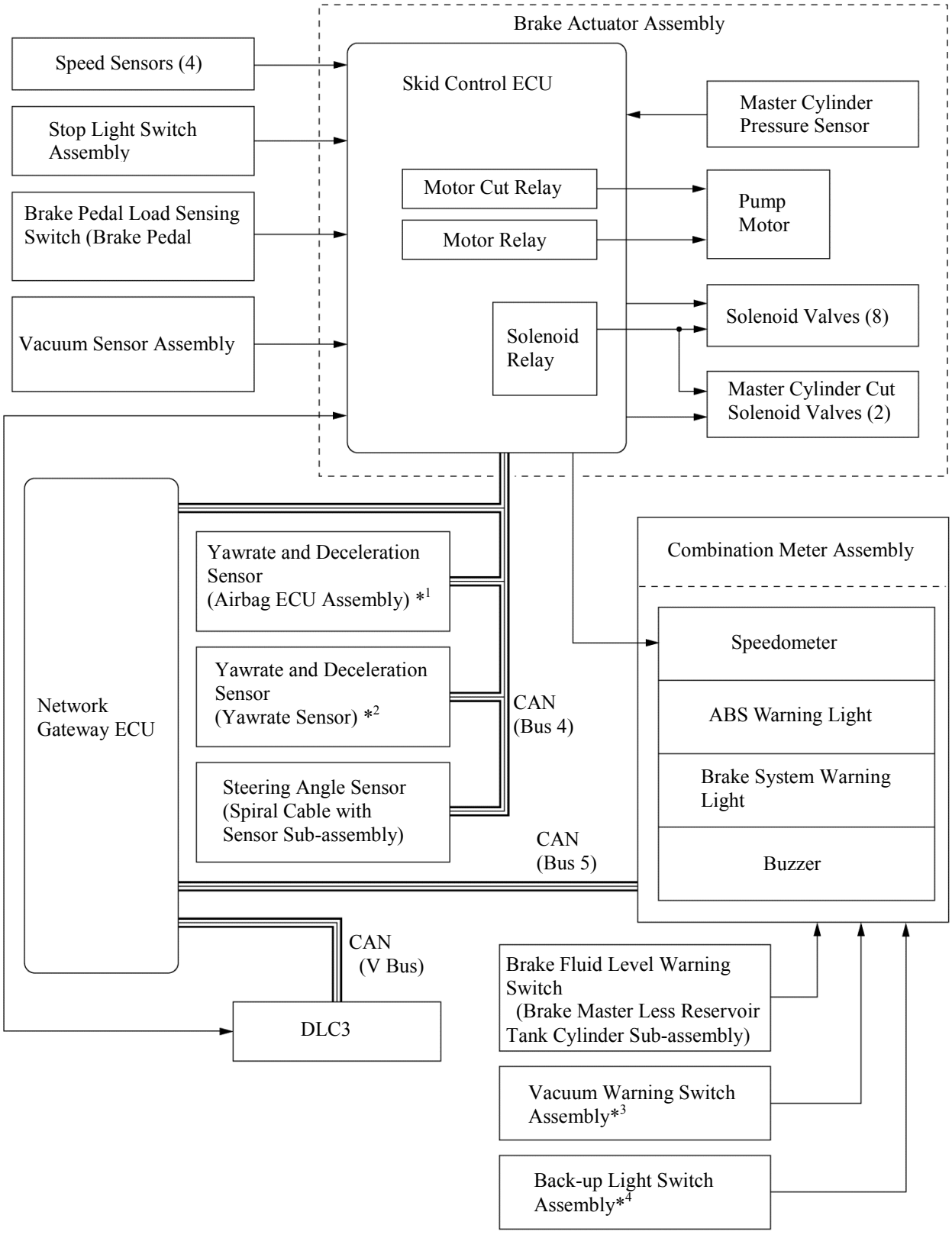
1. General

- A CAN communication compliant brake control system (ABS, EBD, PAB*[1]) was employed and provided according to specifications.
- A brake actuator assembly integrated with a skid control ECU was employed for vehicles with an ABS that uses CAN communication. The brake actuator assembly has a small size and light weight while still having sufficient ejection performance and guarantees excellent safety and running performance even for heavy vehicles.
- On vehicles with an ABS that uses CAN communication, the LSP and BV (Load Sensing Proportioning and Bypass Valve) was discontinued due to the addition of an EBD function to the brake actuator assembly.
- The speed sensor was changed from a passive type to a solid-state active type, which enables the detection of wheel speed from very low speeds.*[2]
- The existing brake warning light switches on when the brake fluid level is low. The warning for the driver was enhanced through the sounding of a buzzer.

*[1]: Power Assist Brake (brake pressure increase function (braking force assist control, servo failure assist control)). Details are provided in a separate section. (Referent: PAB (Power Assist Brake))
*[2]: Models with ABS

2. System Diagram

►Models with CAN Communication System◄

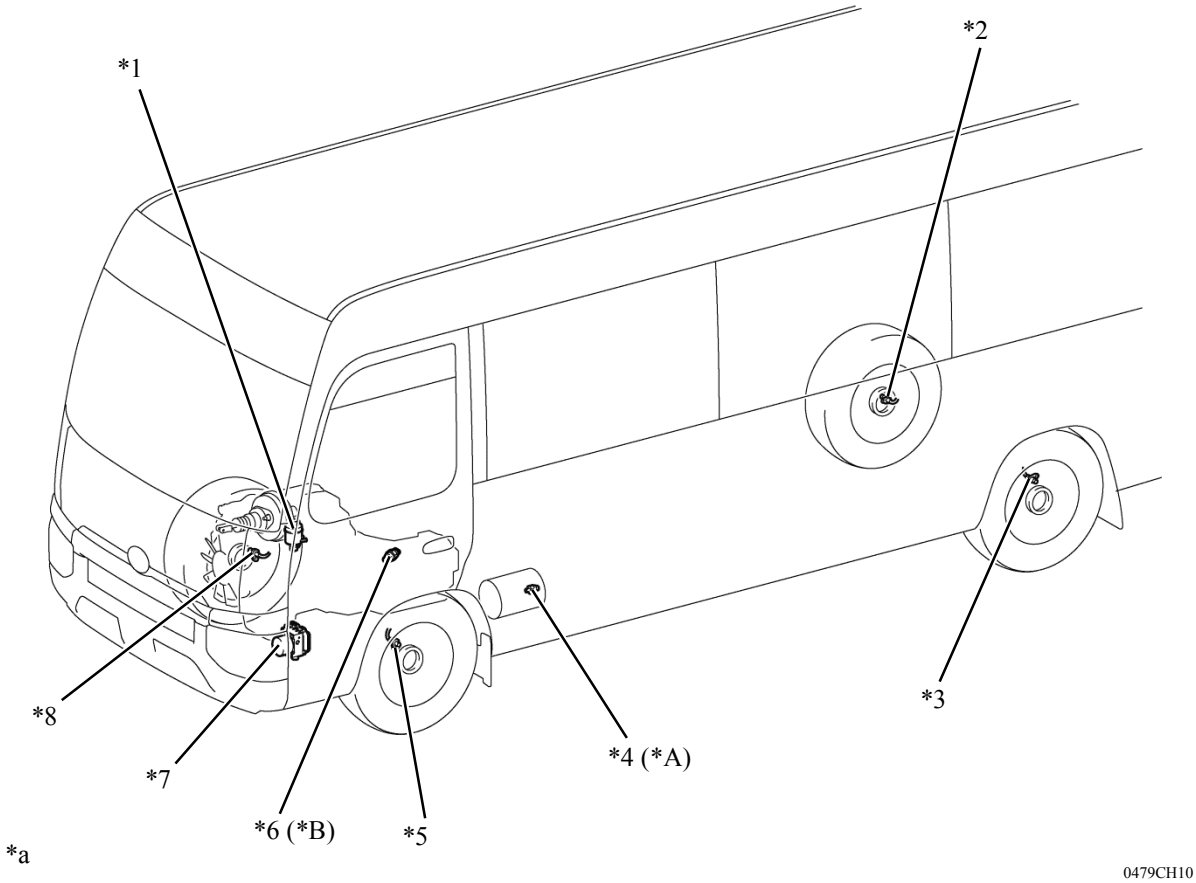


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*1: Models with SRS Airbag System
*2: Models without SRS Airbag System
*3: Except Models with 2TR-FE Engine
*4: Models with M/T

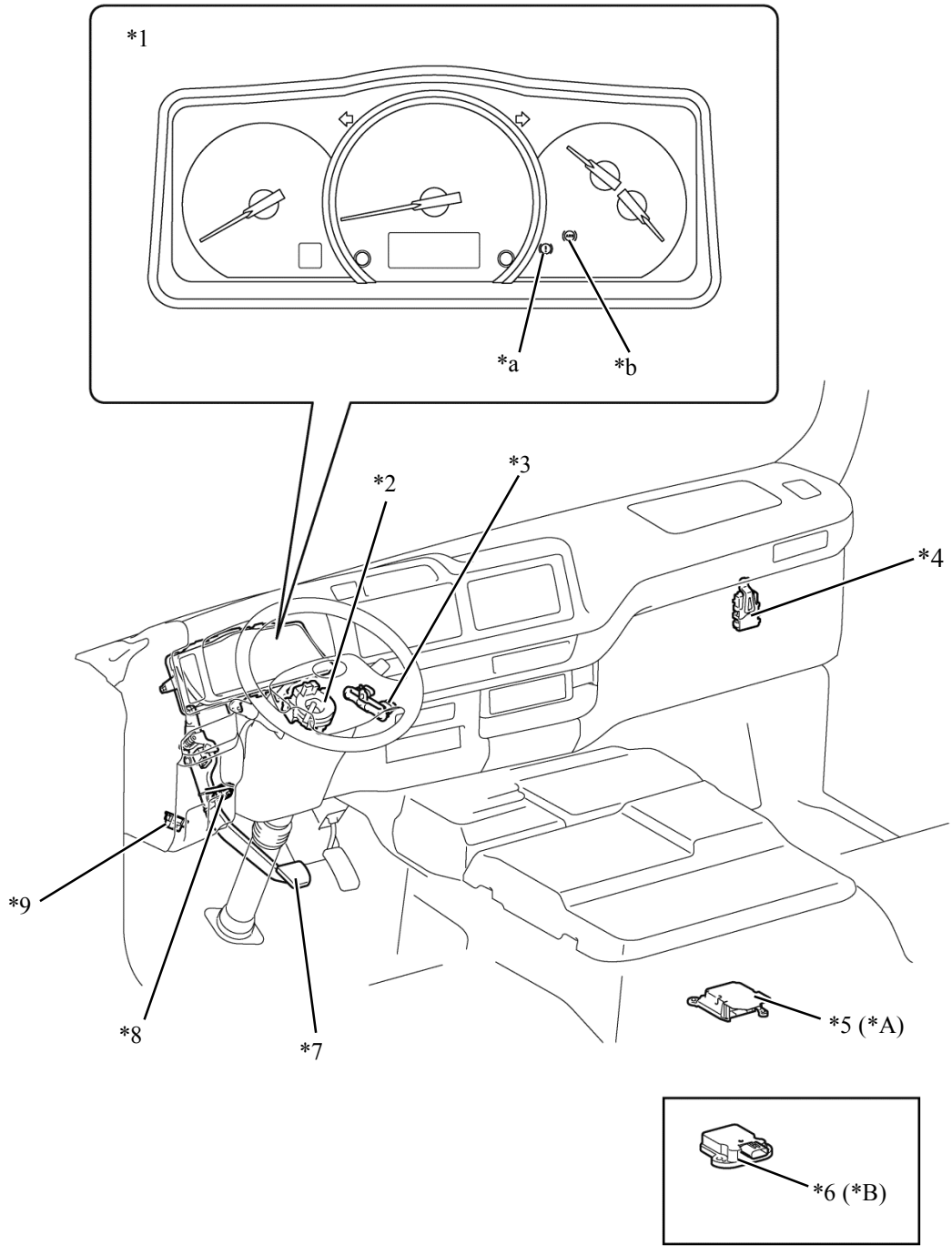
3. Parts Location

►Models with CAN Communication System◄



Text in Illustration

*A	Except Models with 2TR-FE Engine	*B	Models with M/T
*1	Brake Master Less Reservoir Tank Cylinder Sub-assembly · Brake Fluid Level Warning Switch	*2	Rear Speed Sensor RH
*3	Rear Speed Sensor LH	*4	Vacuum Warning Switch Assembly
*5	Front Speed Sensor LH	*6	Back-up Light Switch Assembly
*7	Brake Actuator Assembly · Skid Control ECU	*8	Front Speed Sensor RH
*a	The illustrations shown are examples only.	-	-



Text in Illustration

*A	Models with SRS Airbag System	*B	Models without SRS Airbag System
*1	Combination Meter Assembly	*2	Spiral Cable with Sensor Sub-assembly · Steering Angle Sensor
*3	Vacuum Sensor Assembly	*4	Network Gateway ECU
*5	Airbag ECU Assembly · Yawrate and Deceleration Sensor	*6	Yawrate Sensor · Yawrate and Deceleration Sensor
*7	Brake Pedal Sub-assembly · Brake Pedal Load Sensing Switch	*8	Stop Light Switch Assembly
*9	DLC3	-	-
*a	Brake System Warning Light	*b	ABS Warning Light
*c	The illustrations shown are examples only.	-	-

4. Brake Control

►Models with CAN Communication System◄

Component		Function
Speed Sensors		Detect the wheel speed of each of the 4 wheels.
Stop Light Switch Assembly		Detect the brake pedal depressing signal.
Back Up Light Switch Assembly*1		Detects the reverse position.
Vacuum Sensor Assembly		The pressure inside the brake booster assembly is detected.
Vacuum Waning Switch Assembly*2		Detect the lowering of the brake negative pressure.
Brake Pedal Sub-assembly	Brake Pedal Load Sensing Switch	The pressing force of the brake pedal is detected.
Brake Master Less Reservoir Tank Cylinder Sub-assembly	Brake Fluid Level Warning Switch	Detect the brake fluid level.
Brake Actuator Assembly	Solenoid Valves	Changes the fluid path based on the signals from the skid control ECU during the operation of the brake control system functions, in order to control the fluid pressure that is applied to the wheel cylinders.
	Solenoid Relay	Supplies power to the solenoid valves.
	Motor Relay	Supplies power to the pump motor.
	Motor Cut Relay	Cuts the power to the pump motor in the brake actuator.
	Master Cylinder Pressure Sensor	Assembled in the brake actuator, detects the master cylinder pressure.
	Skid Control ECU	Judges the vehicle driving condition based on the signals from each sensor, and sends the brake control signals to the brake actuator.
	Pump Motor	Drivers the pumps inside the brake actuator.
Combination Meter Assembly	Brake System Warning Light	· Illuminates to alert the driver when the skid control ECU detects a malfunction in the EBD or brake system. · Illuminates to alert the driver when the brake fluid level is low.
	ABS Warning Light	Illuminates to alert the driver when the skid control ECU detects a malfunction in the ABS.
	Buzzer	Emits a warning sound to alert the driver when the brake fluid level is low, when the pressure inside the vacuum tank is low.
Spiral Cable with Sensor Sub-assembly	Steering Angle Sensor	Detects the direction and angle of the steering wheel.

(Continued)

Component		Function
Airbag ECU Assembly*3	Yawrate and Deceleration Sensor	· The yawrate sensor detects the vehicle's yaw rate. · The deceleration sensor detects the vehicle's longitudinal and lateral acceleration and deceleration.
Yawrate Sensor*4		
Network Gateway ECU		Sends the detection signals from the deceleration sensor and steering angle sensor to the skid control ECU via CAN communication.

*1: Models with M/T
*2: Except Models with 2TR-FE Engine
*3: Models with SRS Airbag System
*4: Models without SRS Airbag System

• Fail-safe

If a failure occurs in the skid control ECU, sensors, or brake actuator assembly, the system continues performing brake control by excluding the failed area and using only the areas that are operating normally.

• Diagnosis

1) If the skid control ECU detects a malfunction in the brake control system, the warning lights or indicator light illuminate. At the same time, a Diagnostic Trouble Code (DTC) is stored in the memory of the skid control ECU.

2) This system has a sensor signal check (test mode) function.

3) For details of DTCs and check function, refer to the Repair Manual.

5. Anti-Lock Brake System (ABS)

►Models with CAN Communication System◄

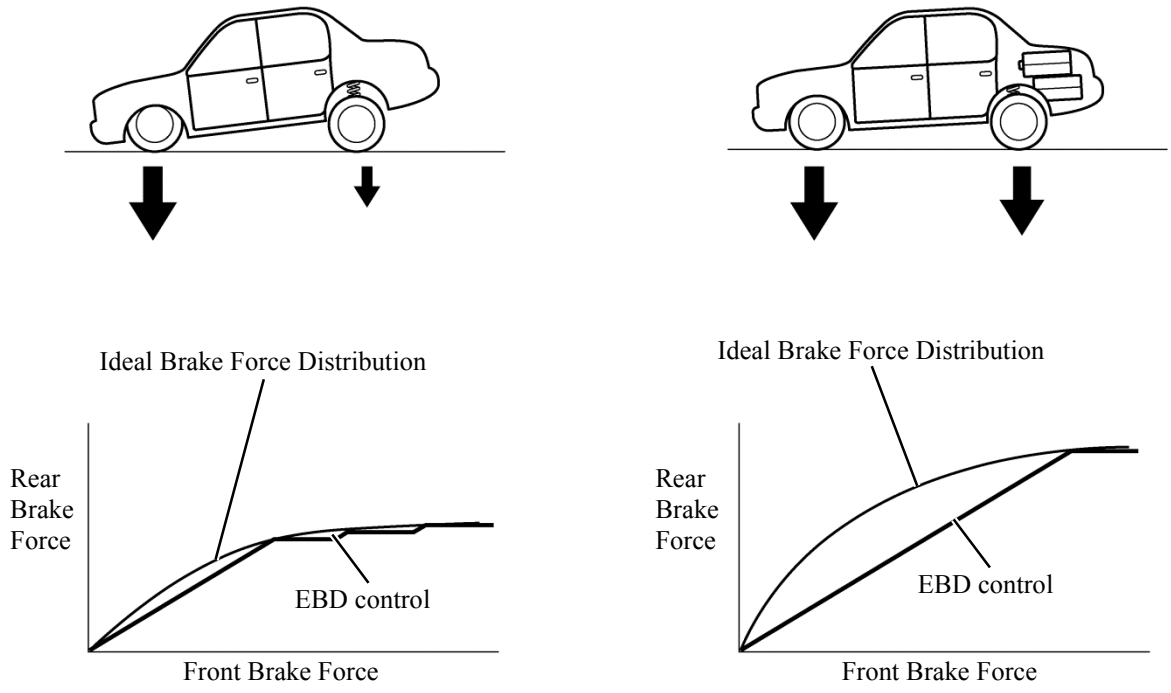
• EBD Control

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 Wheel Brake Force Distribution

If the brakes are applied while the vehicle is moving straight forward, the transfer of load due to braking reduces the load that is applied to the rear wheels. The skid control ECU determines this condition by way of the signals from the speed sensor, and the brake actuator regulates the distribution of the brake force of the rear wheels to optimally control brake balance.
For example, the amount of the brake force that can be applied to the rear wheels during braking varies depending on whether 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 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** ◄

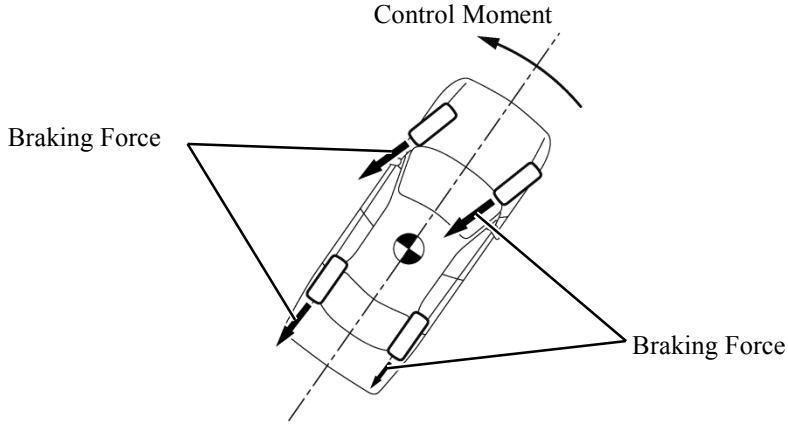


Without Load in Rear **With Load in Rear**

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- Right/Left Wheel Brake Force Distribution (During Cornering Braking)

  During braking while cornering, this function controls the brake force that acts on the left and right wheels in accordance with the vehicle conditions at that time. This ensures vehicle stability and excellent braking performance.

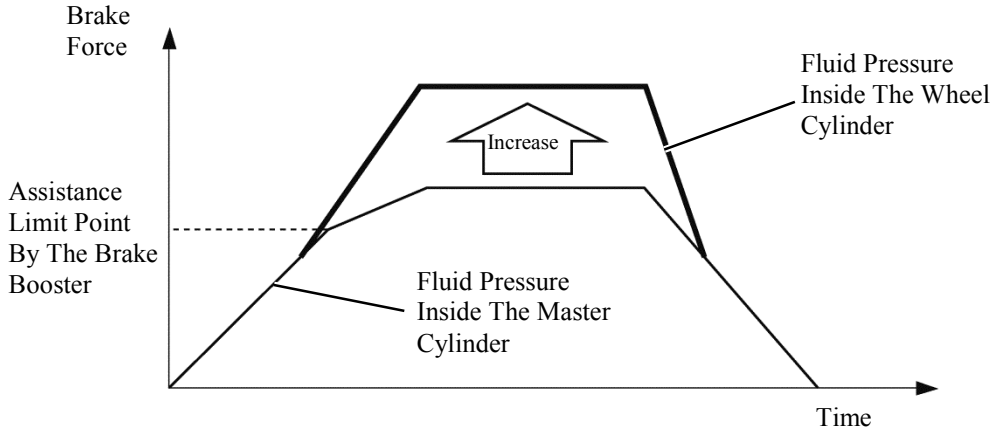


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• PAB (Power Assist Brake)
(brake pressure increase function (braking force assist control, servo failure assist control))

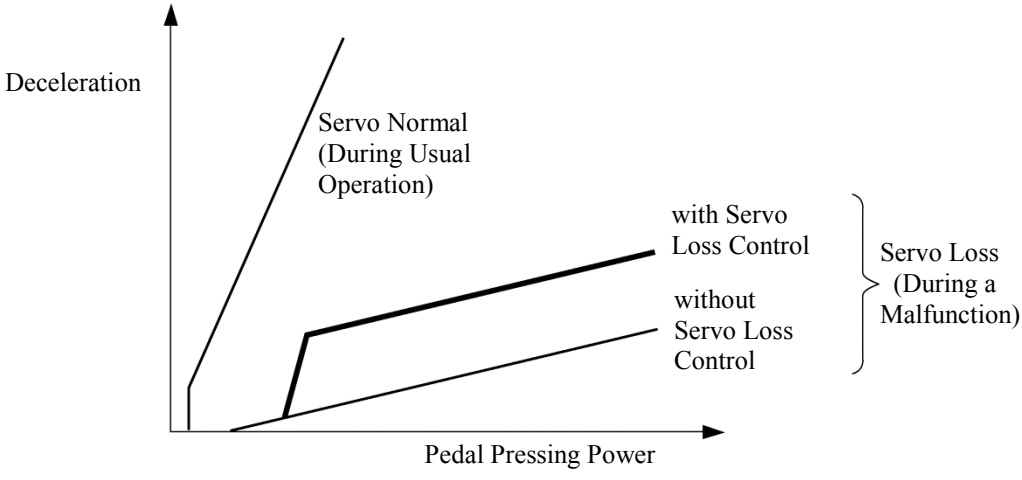
In certain situations when the vacuum pressure of the vacuum booster calculated using the vacuum sensor and master cylinder pressure sensor is low, the skid control ECU may provide brake assist. Or in the event of a brake booster failure, based on the brake pedal load sensing switch and master cylinder pressure sensor signal, the skid control ECU may provide brake assist.
If the skid control ECU judges the need for additional brake assist, pressure is generated by the pump in the brake actuator and directed to the wheel cylinder to apply a large amount of fluid pressure.

► Effects of the Braking Force Assist Control Function ◄



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► Effects of the Servo Failure Assist Control Function ◄



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