Sensotronic brake control (SBC)

Sensotronic brake control (SBC) is an electrohydraulic brake system that combines the functions of a brake servo unit and the ABS (antilock braking system) equipment, including ESP (electronic stability program). The mechanical operation of the brake pedal is redundantly measured by the actuator unit and transmitted to the control unit. There, control commands are calculated according to specific algorithms and passed to the hydraulic modulator where they are converted into pressure modulating operations for the brakes. If the electronics fail, a hydraulic fallback system is automatically available.

**Purpose and function**

By utilizing its “brake-by-wire” capabilities, SBC can control the hydraulic pressure in the wheel brake cylinders independently of driver input. As a result, functions beyond those performed by ABS (antilock braking system), TCS (traction control system) and ESP (electronic stability program) can be implemented. One example is the convenient method of brake application for ACC (adaptive cruise control).

**Basic functions**

As with a conventional braking system, sensotronic brake control must be capable of:

- reducing the speed of the vehicle,
- bringing the vehicle to a halt, and
- keeping the vehicle stationary when it is stopped.

As an active braking system, it also performs the tasks of:

- operating the brakes,
- amplifying the brake force, and
- modulating the brake force.

SBC is an electronic control system with hydraulic actuators. Braking force distribution takes place electronically to each wheel in response to driving conditions. A vacuum source for the brake servo function is no longer required. The self-diagnosis capability enables an early warning function for detection of possible system faults.

SBC uses hydraulic standard wheel brakes. Because of the fully electronic pressure control, SBC can be easily networked with vehicle handling systems. It thus meets all the demands made of future braking systems.

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Fig. 1

1 Active wheel speed sensor with direction sensing
2 Engine management ECU
3 SBC ECU
4 Yaw rate and lateral acceleration sensor
5 Hydraulic modulator (for SBC, ABS, TCS and ESP)
6 Actuator unit with pedal travel sensor
7 Steering angle sensor

By using a high-pressure accumulator, SBC is capable of extremely rapid dynamic pressure increases and thus offers the potential for achieving short braking distances and excellent vehicle handling stability. Brake pressure modulation and active braking are silent and produce no brake pedal feedback. Consequently, SBC also satisfies demands for greater levels of comfort.

Braking characteristics can be adapted to the driving conditions (e.g. sharper response at high speeds or with more dynamic driving styles). “Duller” pedal characteristics allow the reduction of the braking effect, which is necessitated by physics, to be signaled to the driver before fading due to overheating occurs.

Additional SBC functions
The auxiliary functions provided by SBC make a significant extra contribution to safety and convenience.

Hill hold control
After hill hold control is activated by a significant increase in brake pressure while the vehicle is stationary, the vehicle remains braked without the need to keep the pedal down. The hill hold control is automatically released as soon as the driver has built up sufficient engine torque by depressing the accelerator. This allows the driver to start the car on a hill, for example, without activating the parking brake system. Likewise, in other situations in which the vehicle would roll out of position if not braked, the driver does not need to keep his or her foot on the brake at all times once hill hold control has been activated.

Enhanced brake assist function
If the driver abruptly releases the accelerator, an automatically regulated brake pressure build-up takes place that gently applies the brake pads. If panic braking follows, this allows the brake to “grab” more quickly and thus allows a shorter total braking distance.

If the system detects panic braking, the brake pressure is briefly increased until the optimum friction value is fully utilized. This results in a significant reduction of total braking distance for hesitant drivers. The highly dynamic braking force build-up of SBC exceeds that of conventional systems in this regard.

Soft stop assist
SBC provides comfortable braking that stops the car with no jerking by automatically reducing the pressure just before the car comes to a complete stop. If more deceleration is desired, this function is not activated and SBC minimizes the braking distance.

Traffic jam assist
When traffic jam assist is activated, SBC builds up a higher drag torque, which means that the driver does not have to constantly alternate between the accelerator and brake. The vehicle is automatically braked and, if necessary, brought to a complete stop and kept at a complete stop. This function can be activated at speeds of 50 - 60 km/h.

Brake wiping
“Brake wiping” is an operation whereby the film of water is regularly removed from the brake disks in wet weather. It results in shorter stopping distances in wet conditions. You can take the information for activating this function from the windshield wiper signal, for example.