

Steering angle sensor

General

In order to function, the DSC system requires the overall steering wheel angle. The overall steering wheel angle is measured by the steering angle sensor. As the software could not be accommodated on the DSC control unit for reasons of processor capacity, a separate control unit with its own fault memory has been developed.

Arrangement in vehicle

The steering angle sensor is mounted on the steering shaft.

Operating principle

The steering-angle sensor has two potentiometers offset by 90°. The steering-wheel angle determined by these two potentiometers covers one full steering-wheel turn; each of these values is repeated after +/- 180°. The steering angle sensor knows this and counts the steering-wheel revolutions accordingly. The overall steering wheel angle is thus made up of the current steering wheel angle together with the number of steering wheel rotations. In order that the overall steering wheel angle is available at any time, uninterrupted detection of all steering wheel movements - even when the vehicle is stationary - is required. In order to achieve this, the steering angle sensor is permanently supplied with power from Terminal 30. This means that steering-wheel movements are also detected with "ignition off". The steering angle detected by the potentiometers remains available even after interruptions to the power supply; the number of steering wheel revolutions, however, is not. In order that the steering angle sensor remains functional after power supply interruptions, software that calculates the number of steering wheel rotations on the basis of the speed of rotation of the road wheels (and, on some models, the steering wheel being turned from lock to lock) has been integrated. This process is referred to as initialization or imposition. If imposition does not succeed by the time a speed of approx. 20 km/h is reached from a standing start, the DSC is switched to passive mode, the DSC warning lamp comes on, and a fault is recorded on the DSC control unit. The imposition process is performed whenever the ignition is switched on if the number of steering wheel revolutions is not available. Four-wheel drive vehicles are an exception to this rule: The DSC system is immediately switched to passive mode and a fault entered in the DSC control unit memory if there has been an interruption in the power supply to the steering angle sensor. In contrast with conventional-drive vehicles, the imposition process is then not aborted on reaching a specific road speed, but rather continued until the DSC is receiving correct steering angle data. At that point, the DSC warning light goes out and the DSC is operational again. In both cases, there is no fault recorded on the steering angle sensor. As an additional safety measure, the DSC control unit calculates the steering angle on the basis of the speed of the road wheels and compares it with the information supplied by the steering angle sensor. This plausibility check prevents the vehicle operating on the basis of incorrect calibration. An incorrect zero position can result from incorrect calibration or alteration of the steering geometry as a result of damage or repairs. Another safety factor is precise assignment of sensor to vehicle. During calibration, the VIN number is stored in the EEPROM and then compared with the VIN number received from the instrument cluster whenever the ignition is switched on.

Replacing the steering-angle sensor

After replacing the steering-angle sensor, it must first be coded and then calibrated using the ABS/DSC diagnostic program.

Encoding

In order to perform its internal calculations, the steering angle sensor requires model-specific data which has to be loaded onto it by means of coding.

Calibration

Calibration permanently stores the current steering wheel position as the straight-ahead position in the steering angle sensor EEPROM. Therefore, the front wheels and the steering wheel must be set exactly to the

straight-ahead position before calibration. In addition, the vehicle identification number is also read from the instrument cluster and stored permanently in the steering angle sensor EEPROM. On successful completion of calibration, the steering angle sensor fault memory is automatically cleared.

Calibration must always be carried out after the following operations:

- Replacement of the steering-angle sensor
- Replacement of the DSC control unit
- Adjustment work on the steering-angle geometry
- Any work on the steering or front suspension

Voltage supply

The steering angle sensor is permanently supplied with power from Terminal 30 which also has its own fuse. In addition, the steering angle sensor also receives a power supply from Terminal 87 or, depending on model, from Terminal 15. This supply is brought via a different fuse.

Frequency counter:

- When a fault is detected after "ignition off" the frequency counter is incremented upwards by "1". The maximum value is "31".
- If the fault no longer occurs during the next trip, the frequency counter is reduced by "1". The minimum value is "0".