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F01 Sliding Tilting Sunroof

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Sliding Tilting Sunroof

Model: F01/F02

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Understand the operation of the sunroof on the F01/F02

Introduction

The F01/F02 with Slide/tilt Sunroof

The slide/tilt sunroof is an option on the F01/F02. Several control units are involved in the operation of the slide/tilt sunroof.

The roof control module controls and monitors the motors of the slide/tilt sunroof.

The roof control module (FZD) is linked with the Car Access System CAS which enables or disables operation of the slide/tilt sunroof.

The footwell module FRM supplies the signal from the door contacts. The Junction Box electronics provide the power supply for the motors via terminal 30.

The dynamic stability control acquires the signals from the wheel speed sensors while the integrated chassis management makes available the speed signal to the vehicle electrical system.

Slide/tilt Sunroof Operating Concept

The button for operating the slide/tilt sunroof has three directions of movement. In addition to the manual and overpress functions, the button has a double-click function in the three movement directions.

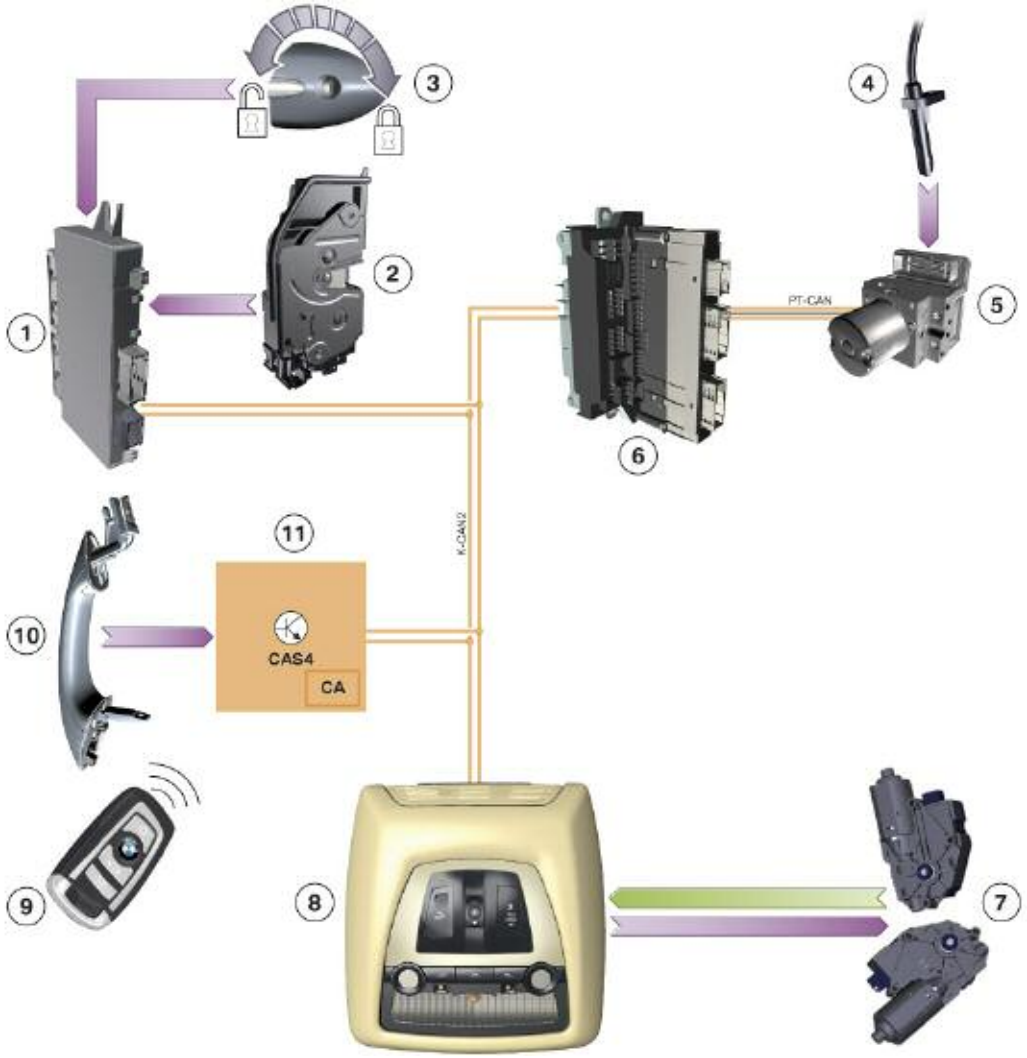
With the double-click function the button is actuated twice within a short time into the overpress position or tilt position.

This allows the customer to have the slide/tilt sunroof opened and closed automatically from any position of the slide/tilt sunroof and sunroof shade.

While moving, the slide/tilt sunroof can be stopped by pressing the button again.

System Overview

Input/output slide/tilt sunroof



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5	Dynamic stability control	K-CAN2	Body-CAN2
6	Junction Box electronics JB	PT-CAN	Powertrain CAN
7	Slide/tilt sunroof motors		

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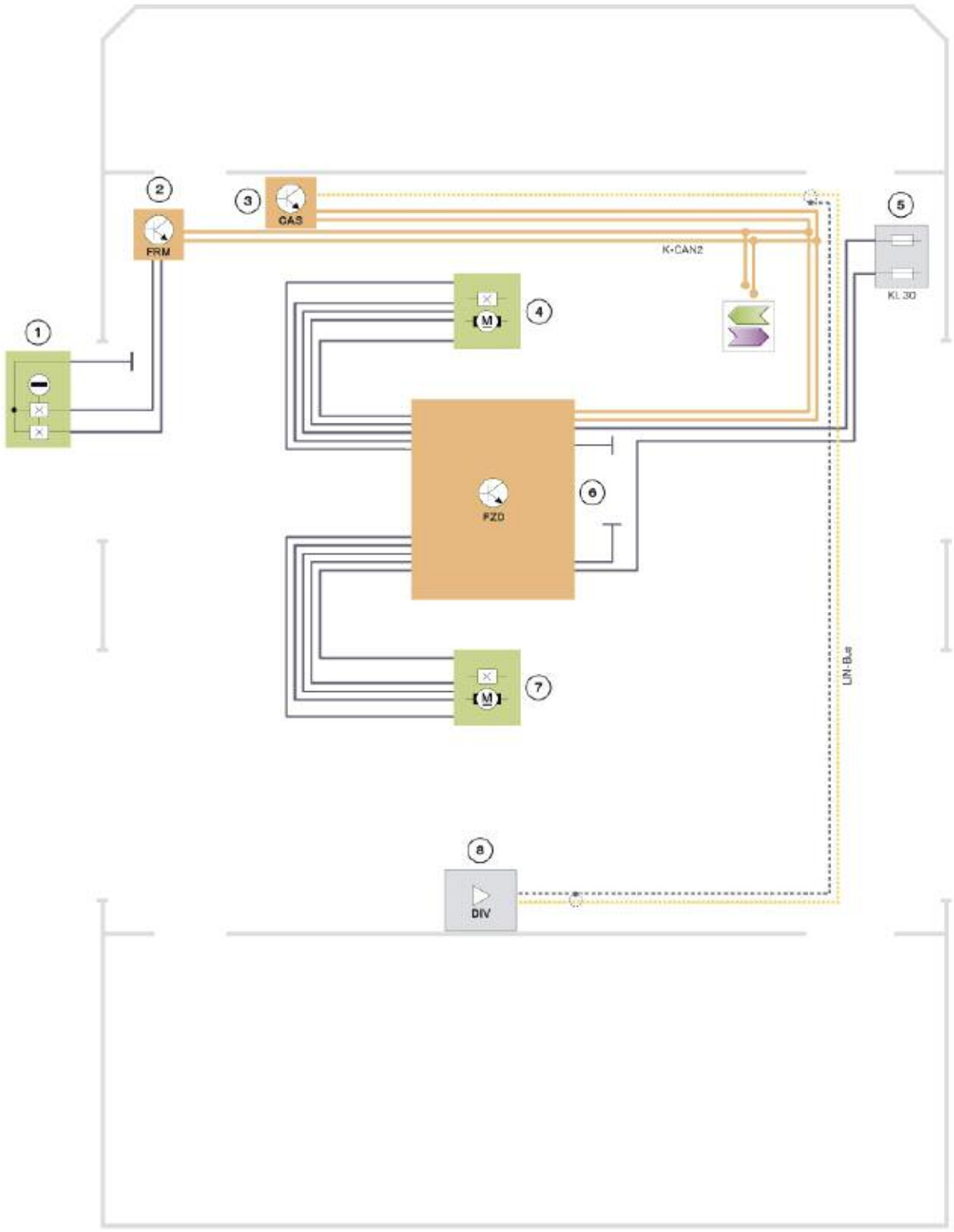
System Circuit Diagram - Slide/tilt Sunroof



Index	Explanation	Index	Explanation
1	Hall sensors, driver's door lock barrel	7	Slide/tilt sunroof motor
2	Footwell module (FRM)	8	Remote control receiver in Diversity module
3	Car Access System (CAS)	K-CAN2	Body-CAN2
4	Slide/tilt sunroof motor	LIN-Bus	Local Interconnect Network bus
5	Front power distribution box	Kl. 30	Terminal 30
6	Roof control module FZD with button for slide/tilt sunroof		

K-CAN2 signals at roof control module

In/out	Information	Source/sink	Function
In	Vehicle speed	Wheel speed sensor > Dynamic stability control >	Release wind deflector Integrated chassis management
In	Outside temperature	Outside temperature sensor > instrument cluster	Value used in determining overheating protection for the slide/tilt sunroof motors
In	Slide/tilt sunroof enable	Car Access System 4 > roof control module	Enable for slide/tilt sunroof operation
In	Terminal 50 status	Car Access System 4 > roof control module	Interruption in sunroof slide/tilt sunroof actuation
In	Auto-remote opening	Identification transmitter > Car Access System 4	Slide/tilt sunroof auto-remote opening
In	Auto-remote opening	Driver's door lock barrel > footwell module	Slide/tilt sunroof auto-remote opening
In	Auto-remote closing	Identification transmitter > Car Access System 4	Slide/tilt sunroof auto-remote closing
In	Auto-remote closing	Driver's door lock barrel > footwell module	Slide/tilt sunroof auto-remote closing
In	Auto-remote closing	Outer door handle > Comfort Access	Slide/tilt sunroof auto-remote closing
Out	Anti-trapping protection function deactivated	Roof control module > instrument cluster	Anti-trapping protection function indicator deactivated

Auto-remote opening and auto-remote closing can be operated from the identification transmitter/remote control or via the lock barrel in the driver's door. This is done by holding down the lock/unlock button until the slide/tilt sunroof is closed/opened.

The lock barrel operates in a similar fashion. The mechanical key must be held in the lock/ unlock position until the slide/tilt sunroof is closed/opened.

With comfort access, the slide/tilt sunroof can be closed by touching the touch-sensitive area on the outer door handle. The touch-sensitive area must be touched until the slide/tilt sunroof is closed.

Functions

Overview

The roof control module receives signals from the other control units for the functions of the slide/tilt sunroof.

The executing control unit is the roof control module. It controls the slide/tilt sunroof motors while also monitoring motor rotation.

The slide/tilt sunroof is equipped with two motors. One motor is for the glass panel and the other for the sunroof shade.

The following functions of the slide/tilt sunroof are integrated in the roof control module:

- Reading operation requests
- Controlling slide/tilt sunroof motors
- Opening/closing the slide/tilt sunroof and sunroof shade
- Anti-trapping protection function
- Blocking protection
- Panic mode
- Load cut-out during start procedure
- Terminal 58g
- Initialization

Reading Operation Requests

Slide/tilt sunroof operation may be requested through the following controls:

- Slide/tilt sunroof button
- Identification transmitter
- Driver's door lock barrel
- Outer door handle in Comfort Access

Slide/tilt sunroof button

The button for the slide/tilt sunroof is located in the roof control module.

When operated, the button sends a low signal to the electronic module that drives the slide/ tilt sunroof motor corresponding to the button selection.

The power to the LED (locator lamp) of the button in the roof control module is supplied from "Terminal 58g ON".

Identification transmitter
The auto-remote opening/closing function is initiated by pressing the button on the identification transmitter.

Driver's door lock barrel
The convenient opening/closing function is triggered by turning and holding the mechanical key or the spare key in the open/ close position in the driver's door lock barrel.

Outer door handle
Auto-remote closing can only be triggered using the outer door handle with Comfort Access. The touch-sensitive area must be touched for a longer time to start auto-remote closing.

Only then will the roof control module execute auto-remote closing. Releasing the touch-sensitive area interrupts auto-remote closing.

Controlling Slide/tilt Sunroof Motors

The roof control module actuates the integrated relay when it receives a corresponding request for the slide/tilt sunroof. The slide/tilt sunroof motor is supplied with power through the relay.

The relay contacts are monitored by the roof control module to ensure trouble-free operation of the motor and the slide/tilt sunroof. In addition, the motor speed is calculated and the direction of the motor's rotation is detected from the pulses of the Hall sensors.

The distance the slide/tilt sunroof must cover during the opening or closing procedure is defined in the roof control module. The slide/ tilt sunroof motor generates a certain number of pulses within this distance and therefore recognizes the end positions of the slide/tilt sunroof.

Anti-trapping Protection Function

Both the glass panel and the sunroof shade are equipped with an indirect anti-trapping protection function. The indirect anti-trapping protection function operates on the basis of the power consumption of the slide/tilt sunroof motor.

If the roof control module detects a trapping situation, the corresponding motor is stopped and controlled in the opposite direction. This opens the glass panel or sunroof shade again (approximately 20 cm) and releases the obstruction.

Blocking Protection

If the pulses from the Hall sensors drop out for more than 500 ms during an opening or closing operation, the roof control module detects a blockage.

The power supply to the motor is switched off.

Overheating Protection

The overheating protection for the slide/tilt sunroof motor is calculated in the roof control module. To this end, a temperature sensor is mounted on the board in the roof control module to measure the ambient temperature.

The roof control module calculates the current temperature of the motor based on the running time of the slide/tilt sunroof motor.

The warm-up and cool-down periods are stored in a temperature model in the roof control module.

The current temperature is stored in the memory before the roof control module passes into sleep mode. The motor temperature is made equal to the ambient temperature when the vehicle is started again.

Panic Mode
The slide/tilt sunroof is closed with maximum closing force in panic mode. Panic mode is triggered by pressing and holding, reversing, releasing and again pressing and holding the slide/tilt sunroof button.

A valid enable signal from Car Access System is the precondition for executing the emergency closing function.

It is necessary to release and press the button again as the first time the button is pressed the anti-trapping protection function is still active. The slide/tilt sunroof closes with maximum force after pressing the button again within a short period of time.

It is possible to activate panic mode up to a vehicle speed of 16 km/h (10 mph). Panic mode can be activated from both the tilt position (approximately 100 ms) and from the open position (approximately 1 s).

Load Deactivation
Operation of the slide/tilt sunroof is stopped/ interrupted during the vehicle start procedure.

The Car Access System sends “Terminal 50 ON” status. The signal is received by the footwell module and Junction Box electronics via K-CAN2.

The Junction Box electronics and the footwell module prevent operation of the slide/tilt sunroof during the starting procedure or interrupt current operation.

This protects the battery during the starting procedure.

Operation of the slide/tilt sunroof can resume on completion of the starting procedure.

Terminal 58g
When the exterior lighting is switched on, the footwell module sends this information via KCAN2.

The roof control module receives this information and adopts the set value for the instrument lighting.

The LED in the button for the slide/tilt sunroof is controlled by a pulse-width modulated signal from the roof control module. This achieves a constant brightness of the LED even under fluctuating system voltage conditions.

Opening/closing the Slide/tilt Sunroof
The button can be moved to two engaged positions in the opening and closing directions. In the first engaged position, a movement is initiated which is only executed for as long as the button is being pressed.

Control functions

- Opening sunroof shade only
- Opening sunroof shade and glass panel (to comfort position)
- Glass panel tilt position and sunroof shade ventilation position
- Closing glass panel only
- Closing glass panel and sunroof shade
- Closing sunroof shade only with glass panels already closed.

All control functions are also available as one-touch control functions (comfort functions). The one-touch control function is reached by pressing the button again to the second engaged position in the direction required for the slide/tilt sunroof.

The one-touch control function automatically opens or closes of the slide/tilt sunroofs.

Directions of movement

Initial state:

The glass panel and sunroof shade are closed.

Opening sunroof shade

Press “OPEN” 1 x

- Signal from switch to roof control module
- Roof control module controls the rear motor for as long as the button is pressed or until the sunroof shade is fully opened.
- Rear motor opens the sunroof shade
- Glass panel remains closed.

Opening sunroof shade (one-touch control function)

Press “OPEN” 1 x

- Signal from switch to roof control module
- Roof control module activates rear motor
- Rear motor opens the sunroof shade
- Glass panels remains closed

Opening sunroof shade and glass panel

Press “OPEN” 2 x (double-click function)

- Signal from switch to roof control module
- Roof control module first activates the rear motor
- Rear motor opens the sunroof shade
- Roof control module controls the front motor after a time, from a short distance from the sunroof shade.
- Front motor opens the glass panel
- Rear motor raises wind deflector.

Tilt position

Press “TILT” 1 x

- Signal from switch to control unit
- Roof control module activates both motors
- Front motor tilts the glass panel
- Rear motor moves the sunroof shade into the gap position (front ventilation position).

Closing glass panel

Press “CLOSE” 1 x

- Signal from switch to roof control module
- Roof control module controls the front motor for as long as the button is pressed or until the glass panel is fully closed.
- Front motor closes the glass panel.

Closing the glass panel (one-touch control function)

Press “CLOSE” 1 x past the first stop

- Signal from switch to roof control module
- Roof control module activates front motor
- Front motor closes the glass panel.

Closing glass panel and sunroof shade

Press “CLOSE” 2 x (double-click function)

- Signal from switch to roof control module
- Roof control module first activates the front motor
- Front motor closes the glass panel
- Roof control module controls the rear motor after a time, from a short distance from the glass panel.
- Rear motor closes the sunroof shade and releases the wind deflector so that the glass panel can press it down.

Closing the sunroof shade

(only possible if glass panel is already closed) Press “CLOSE” 1 x

- Signal from switch to roof control module
- Roof control module activates rear motor
- Rear motor closes the sunroof shade.

Wind deflector with roof open

The roof control module receives the speed signal from the integrated chassis management. The dynamic stability control DSC evaluates the wheel speed sensors.

The roof control module controls the rear motor to release the wind deflector from a road speed of 180 km/h (112 mph). Consequently, the wind deflector is depressed into a lower position.

Note: The motor only runs lightly, the sunroof shade does not move.

Auto-remote opening

The slide/tilt sunroof can be opened by extended actuation of the unlock button with the identification sensor by turning the mechanical key in Open direction.

Note: Movement of the power windows must be completed before auto-remote opening of the slide/tilt sunroof can be started.

Auto-remote closing

The slide/tilt sunroof can be closed by extended actuation of the lock button with the identification sensor by turning the mechanical key in Close direction.

If the vehicle is equipped with Comfort Access, auto-remote closing can be started by touching the touch-sensitive outer surface.

System Components

Spare Parts of Slide/tilt Sunroof

The slide/tilt sunroof in the F01/F02 consists The following table lists the most important of mechanical and electrical components.

Mechanical components	Electrical components
Glass panel	Button
Sunroof shade	Control unit (CAS 4, FRM, FZD)
Slide/tilt sunroof module	Sunroof motors
Wind deflector	

Electrical Components

The following graphic shows all the electrical components of the slide/tilt sunroof system together with the appropriate control units.

(Refer to the “Body/Complete Vehicle section for a description of the Mechanical components of the sunroof.)

Index	Explanation	Index	Explanation
1	Car Access System	6	Dynamic stability control
2	Junction Box electronics	7	Roof control module
3	Remote control receiver in Diversity module	8	Door lock with door contact *Hall sensors, lock barrel, only driver's door
4	Footwell module	9	Slide/tilt sunroof motor
5	Central gateway module		

Control Units

Car Access System 4

The Car Access System 4 issues the enable signal for the slide/tilt sunroof.

"Terminal 50 ON" status is sent via K-CAN2 while starting the engine. The roof control module prevents activation of the motors for the slide/tilt sunroof or interrupts current operation. This means that there is more energy available from the battery for the starter to start the engine.

Footwell module

The footwell module makes available the status of the door contacts and the driver's door lock barrel.

The footwell module also supplies the roof control module with information concerning the "Terminal 58g ON" status.

Roof control module

The roof control module contains the complete functions of the slide/tilt sunroof. The roof control module is always installed in connection with the slide/tilt sunroof.

The relays required to drive the slide/tilt sunroof motors are integrated in the roof control module.

Slide/tilt Sunroof Motors

One motor for the slide/tilt sunroof has two Hall sensors.

The Hall sensors are located on the motor shaft and are offset against one another by 90°.

When the motor is running, this results in two temporally offset Hall signals that are used to register the direction of rotation of the motor and for the anti-trapping protection function.

Note: Two motors are fitted to move the slide/. tilt sunroof.

Service Information

Initialization

Initialization of the slide/tilt sunroof involves the following procedures that are necessary to ensure complete functionality of the slide/tilt sunroof:

- Normalization

  Normalization means locating the mechanical end position at the stop for the tilt position. This position is stored and is used in calculating the remaining end positions for the slide/tilt sunroof.

- Learning the characteristic curve

  The learning procedure registers the closing force necessary for each direction of the slide/tilt sunroof and stores this value.

Complete functionality of the slide/tilt sunroof can be guaranteed only by full initialization.

The initialization procedure can be initiated with the button for the slide/tilt sunroof or via the diagnosis system.

Initialization with the Button

Initialization is performed as follows:

- Press and hold control button in slide/tilt sunroof Tilt direction

  The glass panel moves into the tilt position and the sunroof shade into the ventilation position

- After approximately 15 seconds the initialization run starts in the tilt direction and stores the end position
- The slide/tilt sunroof is closed after 5 seconds in the Tilt position
- The slide/tilt sunroof is then opened and the end position stored.

Note: The control button must remain pressed during the entire initialization procedure. The initialization procedure must be repeated if the button is released.

Initialization takes approximately 120 seconds.

Interruption in Power Supply
An interruption in the power supply does not require a new normalization. The initialization is invalidated if the power supply is interrupted during the initialization. A new initialization will then be necessary.

Clearing the initialization
Initialization is cleared under the following circumstances:

- Failure of the power supply during initialization
- Hall sensor fault detected
- Position implausible
- Certain calls in the diagnostics
- Changed vehicle coding
- Coding data faulty.