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F01 Steering Column Switch Cluster

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Steering Column Switch Cluster

Model: F01/F02

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Understand the operation of the SZL in the F01/F02

Introduction

The Steering Column Switch Cluster - An Interface

The steering column switch cluster is a “mechanical and electrical interface” from the steering wheel to the vehicle; it is firmly connected mechanically to the steering column. On top of this purely mechanical connection, the steering column switch cluster is connected electrically via bus systems or directly to components.

In the F01/F02, the steering column switch cluster has a steering column stalk on either side of the steering column. The right-hand steering column stalk is for activating/ deactivating the wiper/washer system functions. The left-hand steering column stalk is for activating/deactivating the high-beam headlight or turn indicators and for operating the on-board computer functions.

A steering column switch cluster with optical steering-angle sensor is built into the F01/ F02. The steering-angle sensor uses a non-contact optical measuring system for steering-angle detection.

The steering column switch cluster receives the button signal of the steering wheel directly or across the LIN bus. These signals are forwarded from the steering column switch cluster to the respective control units.

Signals such as the buttons for controlling the volume of the radio are transmitted by the steering column switch cluster across the FlexRay. The steering column switch cluster receives e.g. the signal to activate the vibration actuator across the FlexRay.

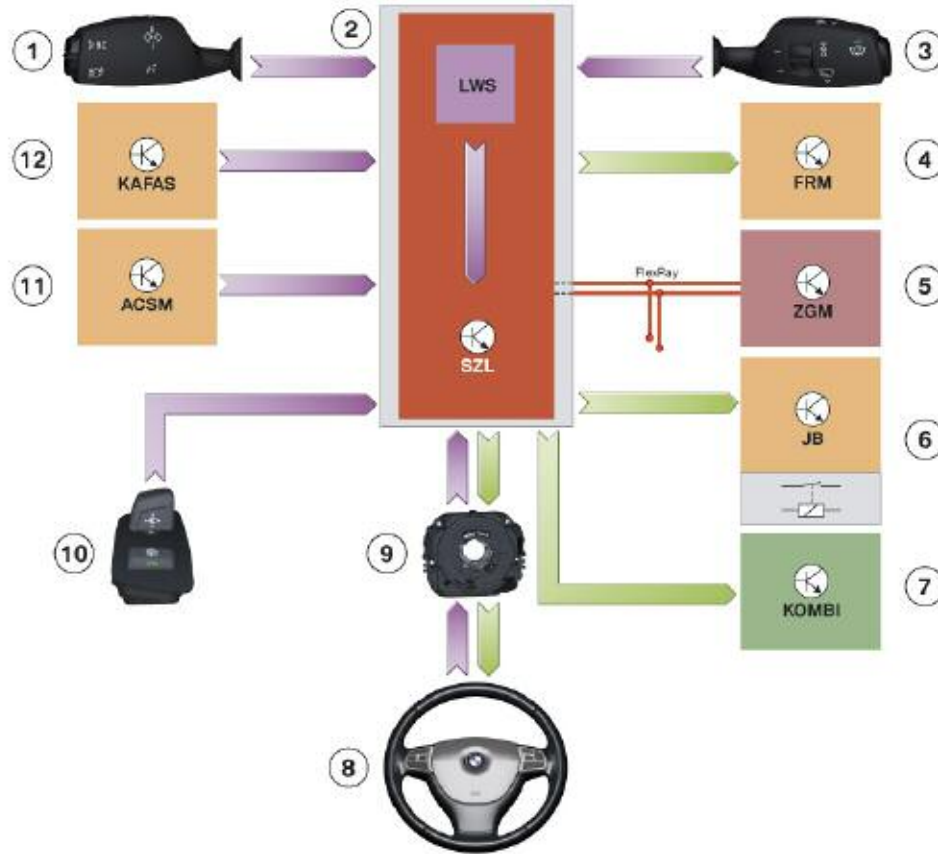
The steering column switch cluster forwards the trigger signal of the driver’s airbag directly to the priming caps of the airbag.

For the electrical steering column adjustment, the switch cluster evaluates the button and transmits requests across the FlexRay.

The steering column switch cluster also evaluate the button for the steering wheel heating. The steering column switch cluster forwards this signal across the LIN bus to the steering wheel electronics.

System Overview

Input/output Diagram, Steering Column Switch Cluster

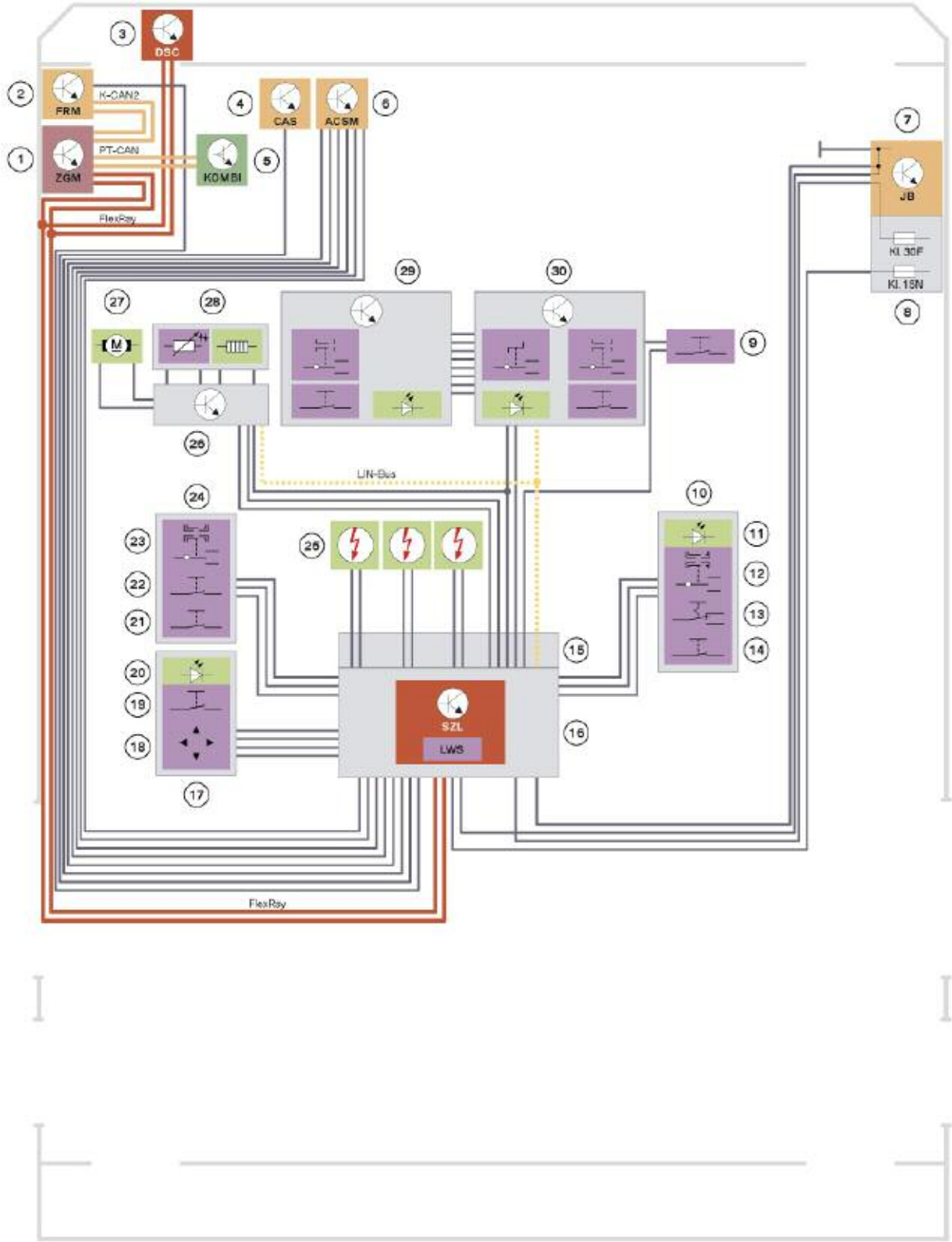


Index	Explanation	Index	Explanation
1	Steering column stalk for turn-indicator / high-beam switch	9	Coil-spring assembly
2	Steering column switch cluster (SZL)	10	Steering wheel heating / steering wheel adjustment buttons
3	Steering column stalk wiper switch	11	Crash Safety Module (ACSM)
4	Footwell module (FRM)	12	Control unit (KAFAS)
5	Central gateway module (ZGM)	FlexRay	FlexRay
6	Junction box electronics (JB)	LIN-Bus	Local Interconnect Network bus
7	Instrument cluster (KOMBI)	LWS	Steering-angle sensor
8	Multifunction steering wheel		

The signals which are triggered by the turn-indicator / high-beam switch steering column stalk (1) or wiper switch (3) are made available to the footwell module (4) or the junction box electronics (6).

The button signals at the multifunction steering wheel (8) are directed through the coil-spring assembly (9) to the steering column switch cluster (2), where they are evaluated and then transmitted across the FlexRay.

System Circuit Diagram, Steering Column Switch Cluster



Index	Explanation
1	Central gateway module (ZGM)
2	Footwell module (FRM)
3	Dynamic Stability Control (DSC)
4	Car Access System (CAS)
5	Instrument cluster (KOMBI)
6	Crash Safety Module (ACSM)
7	Junction box electronics (JB)
8	Front distribution box
9	Fanfare-horn button
10	Steering column stalk wiper switch
11	Automatic wiping LED
12	Wiper switch
13	Knurled wheel for intensity of the rain-light-solar-condensation sensor
14	Automatic wiping button
15	Steering column switch cluster coil spring
16	Steering column switch cluster (SZL)
17	Button combination steering wheel heating / electrical steering column adjustment
18	Electrical steering column adjustment button
19	Steering wheel heating button
20	Steering wheel heating button LED
21	High-beam assistant button
22	On-board computer button
23	Turn-indicator / high-beam switch
24	Steering column stalk for turn-indicator / high-beam switch
25	Driver's airbag priming caps
26	Steering wheel electronics
27	Vibration actuator
28	Steering wheel heating
29	Button block for cruise control system in the multifunction steering wheel
30	Button block for radio / telephone etc. in the multifunction steering wheel
FlexRay	FlexRay
KI. 30	Terminal 30
KI. 30B	Terminal 30 base operation
LIN-Bus	Local Interconnect Network bus
LWS	Steering-angle sensor

Note: A three-stage driver's airbag is installed in the US version.

Functions

Signal Detection

The functions of the steering column switch cluster are:

- Detecting the switching signals of the steering-column switches
- Detecting the controls in the multifunction steering wheel
- Resetting the turn indicator
- Transmitting and receiving information.

Detecting the Switching Signals of the Steering-column Switches

The switching signals of the F01/F02 steering-column switches are triggered by the steering column stalks. The relevant switches are located on the printed-circuit board of the steering column switch cluster. The steering column stalks do not have detent notches. Therefore, each time the steering column stalks are operated, they return automatically to their starting position.

The resistance to movement of the steering column stalks is increased at the end stops and in the individual switching positions. This provides the customer with noticeable feedback on the respective lever position.

The toggle switch is designed as locking. Three stop positions are available.

Steering column switch cluster F01/F02



Index	Explanation	Index	Explanation
1	Steering column stalk for turn-indicator / high-beam switch	5	Connection to horn button, multifunction buttons and steering wheel electronics
2	Connection to the priming caps of the airbag	6	Power supply connection for vibration actuator
3	Retaining pin for steering column switch cluster	7	Steering column stalk wiper switch
4	Steering wheel driver		

■ Steering column stalk for turn-indicator / high-beam switch

The steering column switch cluster generates the switching signals depending on the respective position of the steering column stalk. The switching signals are made available by the steering column switch cluster across the FlexRay.

The footwell module receives the requests from the turn-indicator / high-beam switch as well as for the high-beam assistant.

Pressing the on-board computer button in the axial direction initiates the requests for the onboard computer. The steering column switch cluster sends the requests for display of the on-board computer functions across the FlexRay.

Note: In the case of vehicle equipment without the high-beam assistant, the button on the steering column stalk for turn-indicator / high-beam switch is not required. Instead, a large button is used.

Directions of movement of the steering column stalk F01/F02



Index	Explanation
1	High-beam assistant button
2	On-board computer button
3	High-beam headlights
4	Triple turn signal for turn indicator, passenger's side
5	Continuous flashing for turn indicator, passenger's side
6	Headlight flasher
7	Triple turn signal for turn indicator, driver's side
8	Continuous flashing for turn indicator, driver's side

Function matrix for turn-indicator / high-beam switch

Operation	Initial state	Function	Configuration
One-touch operation in upward direction	OFF	One-touch indicating	Setting with no detent notch
	Continuous indicating, right	OFF	Setting with no detent notch
	Continuous indicating, left	OFF	Setting with no detent notch
One-touch operation in downward direction	OFF	One-touch indicating	Setting with no detent notch
	Continuous indicating, right	OFF	Setting with no detent notch
	Continuous indicating, left	OFF	Setting with no detent notch
Overpressing in upward direction	OFF	Continuous indicating, right	Setting with no detent notch
	Continuous indicating, right	Continuous indicating, right	Setting with no detent notch
	Continuous indicating, left	Continuous indicating, right	Setting with no detent notch
Overpressing in downward direction	OFF	Continuous indicating, left	Setting with no detent notch
	Continuous indicating, right	Continuous indicating, left	Setting with no detent notch
	Continuous indicating, left	Continuous indicating, left	Setting with no detent notch
One-touch operation against direction of travel (pulling)	OFF	Headlight flasher	Setting with no detent notch
	High-beam headlights ON	High-beam headlights OFF	Setting with no detent notch
One-touch operation in direction of travel (pressing)	Dipped-beam headlights	High-beam headlights ON	Setting with no detent notch
One-touch in axial direction, on-board computer button (pressing)	On-board computer function switched off	On-board computer ON	Setting with no detent notch
	On-board computer function switched on	On-board computer OFF	Setting with no detent notch
One-touch in axial direction, high-beam assistant button	High-beam assistant switched on	Deactivate high-beam assistant	Setting with no detent notch
	High-beam assistant switched off	Activate high-beam assistant	Setting with no detent notch
Overpressing in downward direction	Terminal 30, light switch in "0" position	Parking light, left	Setting with no detent notch
Overpressing in upward direction	Terminal 30, light switch in "0" position	Parking light, right	Setting with no detent notch

■ Steering column stalk wiper switch

This steering column stalk is designed exclusively for the front wiper/washer system. All requests for the wiper/washer system are detected in the steering column switch cluster. The steering column switch cluster sends the requests across the FlexRay to the junction box electronics. The junction box electronics execute the requests.



Index	Explanation
1	Steering column stalk wiper switch
2	Intensity of rain-light-solar-condensation sensor
3	Function indicator, automatic wiping activated
4	Rain-light-solar-condensation sensor button

Function matrix, steering column stalk wiper switch

Operation	Initial state	Function	Configuration
One-touch operation in upward direction	OFF	Wiper stage 1	Setting with no detent notch
	Continuous wipe, Stage 1	Wiper stage 2	Setting with no detent notch
	Continuous wipe, Stage 2	Wiper stage 2	Setting with no detent notch
Overpressing in upward direction	OFF	Wiper stage 2	Setting with no detent notch
	Continuous wipe, Stage 1	Wiper stage 2	Setting with no detent notch
	Continuous wipe, Stage 2	Wiper stage 2	Setting with no detent notch
One-touch operation in downward direction	OFF	Flick wipe	Setting with no detent notch
	Continuous wipe, Stage 1	OFF	Setting with no detent notch
	Continuous wipe, Stage 2	Wiper stage 1	Setting with no detent notch
One-touch operation against direction of travel (pulling)	OFF	Windscreen wash	Setting with no detent notch

■ Rain-light-solar-condensation sensor

If the vehicle is in the automatic mode via rain-light-solar-condensation sensor, the function matrix of the steering column stalk is altered. Please refer to the following function matrix for the functions.

Function matrix, steering column stalk for wiper/washer system

Operation	Initial state	Function	Configuration
One-touch operation in upward direction	OFF	Wiper stage 1	Setting with no detent notch
	Automatic operation	Wiper stage 1	Setting with no detent notch
	Continuous wipe, Stage 1	Wiper stage 2	Setting with no detent notch
	Continuous wipe, Stage 2	Wiper stage 2	Setting with no detent notch
Overpressing in upward direction	OFF	Wiper stage 2	Setting with no detent notch
	Automatic operation	Wiper stage 2	Setting with no detent notch
	Continuous wipe, Stage 1	Wiper stage 2	Setting with no detent notch
	Continuous wipe, Stage 2	Wiper stage 2	Setting with no detent notch
One-touch operation in downward direction	OFF	Flick wipe	Setting with no detent notch
	Automatic operation	Flick wiping*	Setting with no detent notch
	Continuous wipe, Stage 1	Intermittent wipe	Setting with no detent notch
	Continuous wipe, Stage 2	Wiper stage 1	Setting with no detent notch
One-touch operation against direction of travel (pulling)	OFF	Windscreen wash	Setting with no detent notch
One-touch in axial direction, automatic wiping button (pressing)	Automatic wiping switched off	Automatic wiping ON	Setting with no detent notch
	Automatic wiping switched on	Automatic wiping OFF	Setting with no detent notch
Turning the knurled wheel upwards/downwards	Sensitivity of rain-light-solar-condensation sensor	Sensitivity of automatic wiping or	Setting with detent notch

(automatic mode is retained)

Detecting the Controls

The multifunction steering wheel has additional buttons. The buttons increase in-car comfort and convenience by providing for comfort and convenience functions.

The steering column switch cluster reads in the signals from the steering-wheel buttons. The steering column switch cluster transmits these signals across the FlexRay. The associated ECU executes the request.

■ Steering wheel

The steering wheel is equipped with the following components:

- Fanfare-horn button
- Priming caps for the driver's airbag
- Driver's airbag
- Buttons for radio operation
- Buttons for telephone operation
- Cruise control system buttons
- Steering wheel electronics
- Steering wheel heating
- Vibration actuator.

The fanfare-horn button is connected directly to the steering column switch cluster. The junction box electronics requests the button status of the fanfare-horn button in cycles.

The steering column switch cluster evaluates the button status and sends this across the FlexRay to the junction box electronics.

The buttons for the radio, telephone and cruise control system are connected via the LIN bus. This applies to the steering wheel electronics. The central control unit for this equipment attached to the LIN bus is the steering column switch cluster.

The right-hand button block contains the master function for the left-hand button block and has an electronic evaluation unit. The electronic evaluation unit picks up the button status of the individual buttons. The electronic evaluation unit implements the button status on the LIN bus. The steering column switch cluster requests the button status in cycles and thus finds out whether a button was operated or not. The steering column switch cluster transmits the button status across the FlexRay. In this way, the information reaches the other control units in the vehicle network.

Note: The signal sent from the steering column switch cluster across the FlexRay must be implemented in the central gateway module on the K-CAN2, PT-CAN or MOST. This enables the footwell module, the junction box electronics etc. to execute the desired requests.

Resetting the Turn Indicator

The footwell module the information regarding the steering-wheel turn requires to reset the turn indicator lights.

The steering column switch cluster determines this steering-wheel turn and makes it available across the FlexRay. The central gateway module implements the signal on the K-CAN2, thus providing the footwell module with the information. Depending on the steering-wheel position, the footwell module decides whether the turn indicator has to be deactivated or not.

■ Steering-wheel-rotation information

The optical steering-angle sensor detects the neutral position within 360° of the optical steering-angle sensor. With a steering wheel turn of more than 360°, the information regarding the steering-wheel turn is also included in the steering angle calculation.

Receiving and Transmitting Signals

The detected and calculated data from the steering column switch cluster are forwarded across the FlexRay to the corresponding control units.

The steering column switch cluster can be diagnosed via the central gateway module with the BMW diagnosis system. The diagnosis information can be called up via the FlexRay.

■ Vibration actuator

The KAFAS control unit, for example, requests activation of the vibration actuator via the PT-CAN. The central gateway module implements the signal on the FlexRay. This means the Integrated Chassis Management receives the request for activation. The Integrated Chassis Management co-ordinates activation of the vibration actuator.

Note: Coordination is necessary, as the lane departure warning and lane change warning can be fitted in the vehicle. Depending on the request from the two assistance systems, the Integrated Chassis Management forwards this to the vibration actuator.

The steering wheel electronics evaluate the request, activate the vibration actuator and monitor its function. In the event of a defect in the vibration actuator or steering wheel electronics, the steering column switch cluster indicates this via the FlexRay.

■ Priming caps for the driver's airbag

The priming caps of the driver's airbag are connected directly via the coil spring to the Crash Safety Module, ACSM. Triggering the airbag is the responsibility of the Crash Safety Module.

■ Redundant signal

The signals from the steering column stalk for turn-indicator / high-beam switch for turn indicator lights as well as headlight flasher are transferred across the FlexRay. To increase the availability, the steering column switch cluster is connected directly by a cable to the footwell module. The signals e.g. for the headlight flasher or turn indicator lights are transferred redundantly across this cable.

Optical Steering-angle Sensor

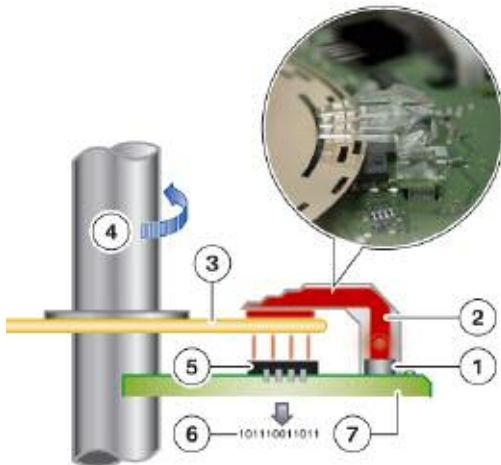
All systems that influence driving dynamics are required alongside other data for the steering angle and steering-angle speed as the basis for calculation.

The steering angle as well as steering-angle speed are picked up by a non-contact optical measuring system, the optical steering-angle sensor.

The data of the optical steering-angle sensor are processed by the electronics in the steering column switch cluster and sent across the FlexRay to the Integrated Chassis Management.

Information such as the absolute steering angle or the steering-wheel-turn is calculated. The optical steering-angle sensor picks up a steering angle of -640° / $+640^{\circ}$.

Structural principle of the optical steering-angle sensor F01/F02



Index	Explanation
1	LED
2	Light-conducting element
3	Code disc
4	Steering column
5	Photo-transistors
6	Output: Conversion into electrical signals
7	Printed-circuit board

Detecting Steering Angle and Steering-Angle Speed

To pick up the steering angle, a code disc is illuminated from above by an LED and a light-conducting element. Due to the pattern in the code disc, the light from above only reaches down to certain areas. There, the light encounters photo-transistors.

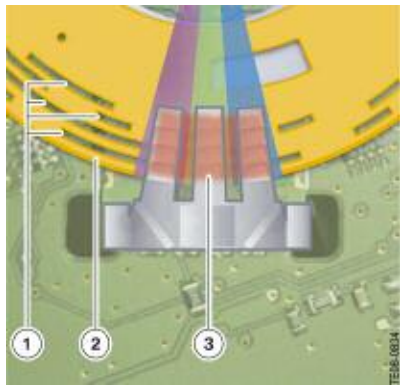
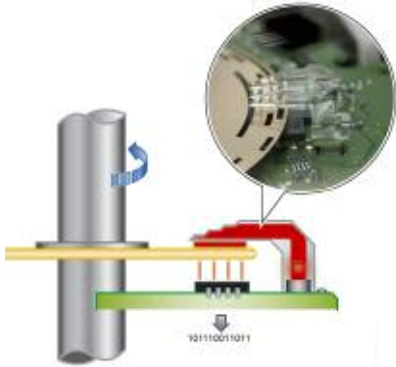
The pattern of the code disc corresponds to the digital code of the steering angle.

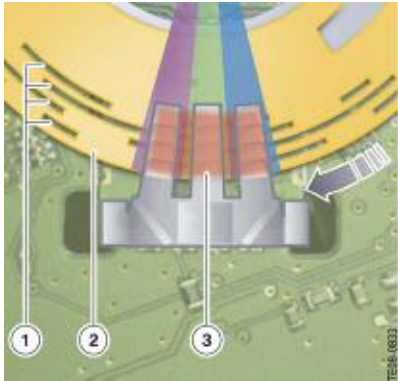
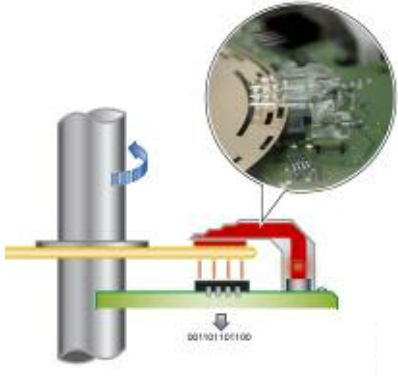
The photo-transistors convert the light signals into electrical signals. As the signals are not yet sufficiently unambiguous, they are processed by downstream electronics.

Thereafter, the signals are digitized and have the signal states 1 or 0.

The steering column switch cluster receives the current value of the steering angle, the digital code, and forwards this across the FlexRay.

A section of the code disc and the optical sensor are shown below.

Section on the code disc	Optical sensor
	
<p>The code disc (1) rotates depending on the steering-wheel position. The pattern of the digital code (2) on the code disc changes in 0.5° steps. The light of the light-conducting element (3) penetrates the pattern of the digital code of the code disc.</p>	<p>The light beams encounter the photo-transistors in accordance with the pattern of the digital code. The photo-transistors convert the light beams into electrical signals. The downstream electronics ensure that the electrical signals have the signal states 1 or 0. This means that the steering angle is available to the steering column switch cluster as a digital code.</p>

Section on the code disc	Optical sensor
	
<p>If the code disc (1) continues to rotate, the pattern (2) on the code disc changes. The light of the light-conducting element (3) penetrates the code disc in other areas.</p>	<p>A new digital code is generated in accordance with the changed pattern of the digital code. This means that the new steering angle is available to the steering column switch cluster as a digital code.</p>

■ **Relative steering angle ($\pm 640^\circ$)**

The relative steering angle specifies the angle position of the steering wheel. The information regarding the relative steering angle is always retained, even if the power to the control unit is switched off. A renewed zero-point adjustment is only necessary if the steering column switch cluster has been replaced. This also applies if the dynamic stability control system is replaced or repairs become necessary on the steering / steering column.

■ **Absolute steering angle**

The absolute steering angle is a calculation based on the relative steering angle and the information regarding steering-wheel turn. The absolute and relative steering angles are defined during the zero-point adjustment of the steering column switch cluster. The steering column switch cluster knows every position of the steering wheel across the entire range of steering rotation.

A precondition before every zero-point adjustment is the straight-ahead setting of the wheels and of the steering wheel.

■ **Steering-angle speed**

The steering-angle speed is the product of the change in the individual steering-angle data during steering wheel turn.

The steering column switch cluster calculates the value and forwards it across the FlexRay to the vehicle network.

NOTES

PAGE

System Components

The Steering Column Switch Cluster as Standard Equipment

The steering column switch cluster (SZL) consists of, among other things, the following components:

- Electronic steering column switch cluster module
- Coil-spring assembly
- Steering-column switch for turn indicators
- Steering column switch for wipers
- Optical steering-angle sensor.

The steering column switch cluster (SZL) can only be replaced as a **complete** unit. The individual components such as the coil-spring assembly or steering column stalk can **not** be removed or replaced.

The design and the components of the steering column switch cluster are explained in brief in the following.

Installation location of the steering column switch cluster F01/F02



Index	Explanation
1	Steering column switch cluster

Rear View of the Steering Column Switch Cluster



Index	Explanation
1	Connection, vehicle wiring harness
2	Connection for wiring harness in the vehicle (airbag signals)
3	Connection for steering wheel heating / electrical steering column adjustment button block

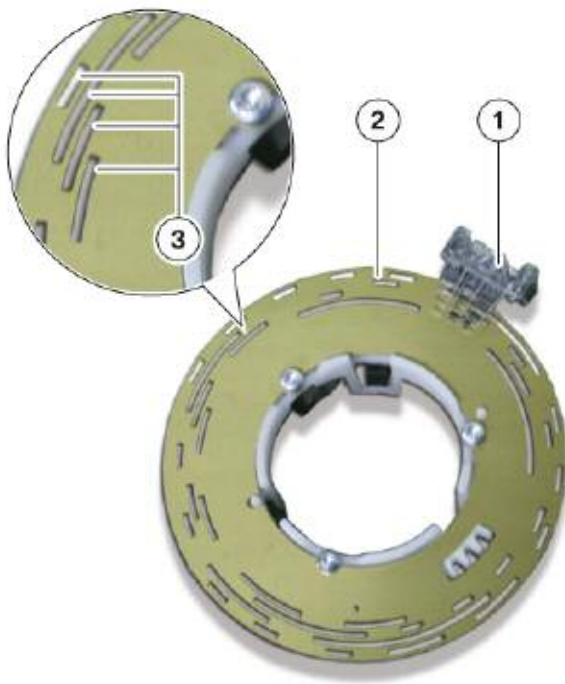
Optical Steering-angle Sensor

The steering column switch cluster contains the optical steering-angle sensor as well as the associated electronics. A second processor on the underside of the board backs up the information regarding the steering angle and steering-angle speed. This is why the steering angle and steering-angle speed are evaluated and calculated in the second processor in addition to the main processor of the steering column switch cluster.

The steering-angle sensor is designed as a non-contact optical angle measurement system. The system consists of a code disc and an optical sensor. The code disc is connected directly to the steering wheel via a driver. If the steering wheel is moved, the code disc rotates within the optical sensor.

The code disc has a pattern of holes. The pattern of holes is arranged in such a way that four circular tracks are formed. The four tracks represent the digital range of the sensor. The digital code changes when the steering is turned every 0.5° .

Code disc and optical sensor F01/F02

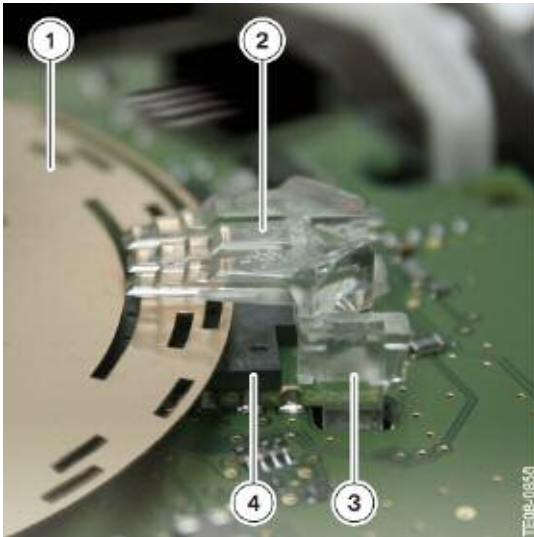


Index	Explanation
1	Optical sensor
2	Code disc
3	Hole pattern tracks

■ Optical sensor

The optical sensor is located on a circuit board soldered onto the board of the steering column switch cluster. The major components of the measuring system are:

- LED
- Light-conducting element
- Code disc
- Photo-transistors.



Index	Explanation
1	Code disc
2	Light-conducting element
3	LED
4	Photo-transistors

■ LED and light-conducting element

The LED - in conjunction with the light-conducting element - has the task of projecting light from above onto the code disc. The LED is directly soldered onto the sensor circuit board. The light-conducting element is clipped onto the board of the steering column switch cluster.

The light-conducting element is split three ways at the light exit. The light is projected in such a way that a light field is formed at each light exit and beamed downwards onto the code disc. Depending on the pattern on the code disc, light is allowed through or not.

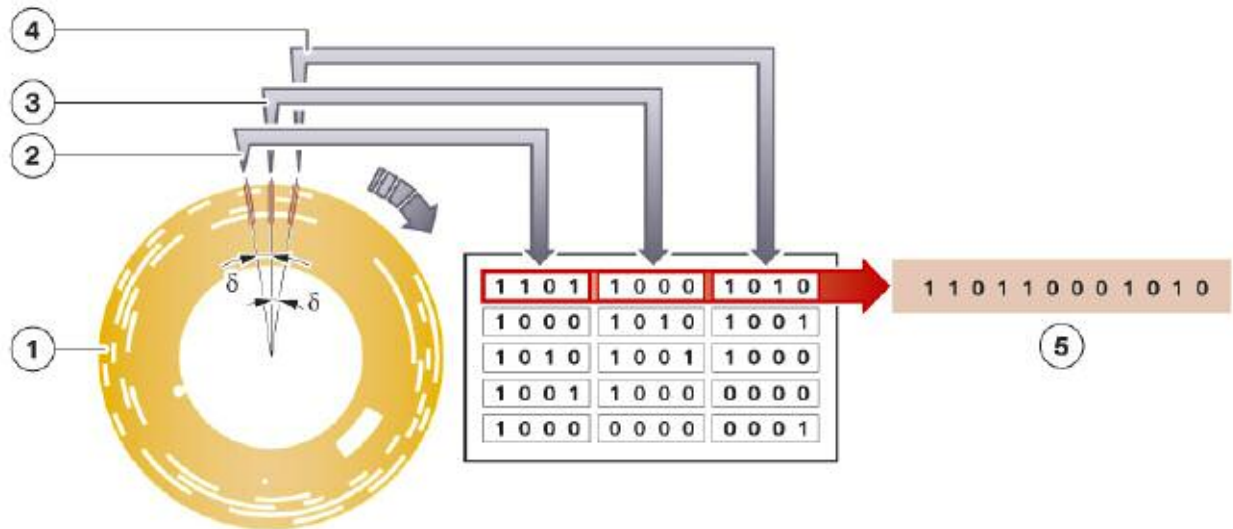
■ Photo-transistors

There are four photo-transistors below the light exits on the circuit board of the optical sensor of the steering column switch cluster. The photo-transistors detect the optical signals that penetrate the code disc. The photo-transistors convert the optical signals into electrical signals.

Operating Principle of Optical Steering Angle Detection

Steering angle detection

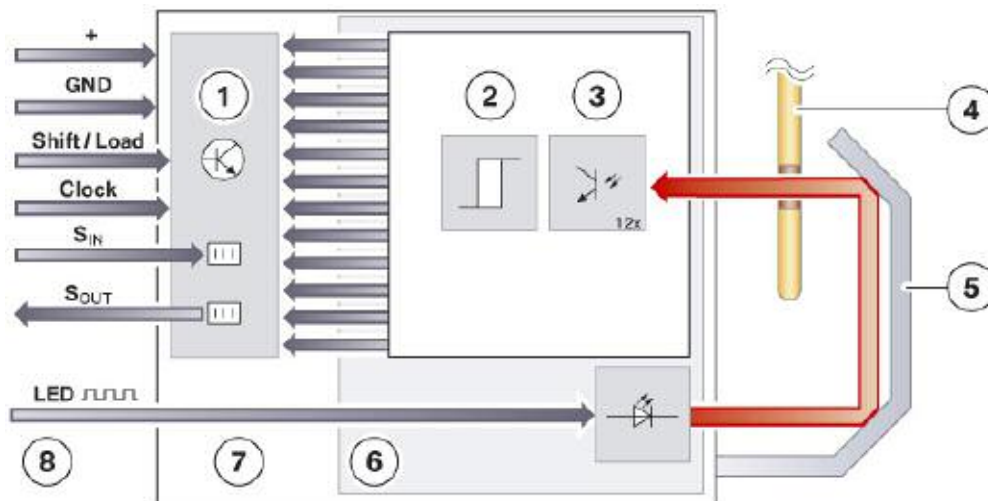
The code disc enables a 4-digit digital code to be generated for each light field. The 12-digit digital code is formed by lining up the 4-digit digital codes. The steering-angle speed can be ascertained from the changes to the individual digital codes.



Index	Explanation	Index	Explanation
1	Code disc	4	Digital code for light field 3
2	Digital code for light field 1	5	12-digit digital code
3	Digital code for light field 2		

Block diagram of steering angle detection

The following block diagram shows the steering angle detection in simplified form.



Index	Explanation	Index	Explanation
1	Sliding register	5	Light-conducting element
2	Schmitt trigger	6	LED (infrared)
3	Photo-transistor	7	Sensor circuit board
4	Code disc	8	Activation of LED

The LED (8) is supplied with pulse-width modulated voltage, thus also supplying the light-conducting element (5) with infrared light. The light-conducting element projects the light onto the code disc (4). The photo-transistors (3) pick up the light signals.

The signals of the photo-transistors are processed in the downstream electronics (2) into the signals "1" or "0". The signals of the 12 photo-transistors are put together to form the digital code.

The sliding register (1) picks up the digital code and forwards it to the electronics of the steering column switch cluster.

Steering Wheel

Depending on the vehicle equipment, the following components are located in the steering wheel:

- Button block for telephone / radio
- Button block for cruise control system / Active Cruise Control
- Airbag with associated priming caps
- Horn button
- Vibration actuator for lane departure warning
- Steering wheel electronics
- Steering wheel heating.

Steering Wheel Structure

Important components in the steering wheel F01/ F02



Index	Explanation	Index	Explanation
1	Steering wheel heating	4	Vibration actuator for lane departure warning
2	Button block for cruise control	5	Steering wheel electronics system
3	Airbag unit	6	Button block for telephone / radio

The button blocks as well as the steering wheel electronics are linked across the LIN bus to the electronics in the steering column switch cluster.

With the corresponding request, the steering wheel electronics control and monitor the function of the vibration actuator and steering wheel heating.

The priming caps of the airbags are connected directly and are activated by the Crash Safety Module, ACSM.

The fanfare-horn button is evaluated by the electronics of the steering column switch cluster.

Steering Wheel Button Block

■ Button block for driving functions

The steering wheel contains a button block for the Dynamic Cruise Control (DCC) or Active Cruise Control (ACC) Stop & Go functions. The button block is located on the left-hand side of the steering wheel.



Index	Explanation
1	Set button
2	Reduce distance button (ACC)*
3	Toggle switch
4	Increase distance button (ACC)*
5	Switching DCC/ACC to standby or switching off
6	Resume / call-up stored speed button

* Buttons 2 and 4 are only present on vehicles with the option Active Cruise Control Stop & Go.

The SET button can be used to set the desired driving speed.

The toggle switch be moved upwards or downwards and is not designed as locking. Each time the toggle switch is operated, it returns to its home position. Each direction of the toggle switch has two stages. See table.

The I/O button can be used to switch the Dynamic Cruise Control (DCC) and Active Cruise Control (ACC) Stop & Go function to standby or to switch it off.

Pressing the RES button (resume) calls up and activates the last stored driving speed value.

Position	Explanation
+2	Increase driving speed in steps of 10 kph (6 mph)
+ 1	Increase driving speed in steps of 1 kph (.5mph)
± 0	Toggle switch in home position
-1	Reduce driving speed in steps of 1 kph (.5 mph)
-2	Reduce driving speed in steps of 10 kph (6 mph)

■ Button block for telephone / radio

The button block is located on the right-hand side of the steering wheel. The buttons can be used to operate functions for the radio or telephone.

The MODE button can be used e.g. to switch between the individual audio sources.

Operating the toggle switch + or - changes the radio volume, for example.

The knurled wheel is designed as locking. Operating the knurled wheel (turning upwards or downwards) selects individual radio stations, for example.

Pressing the knurled wheel memorizes the selection of the radio station, for example.



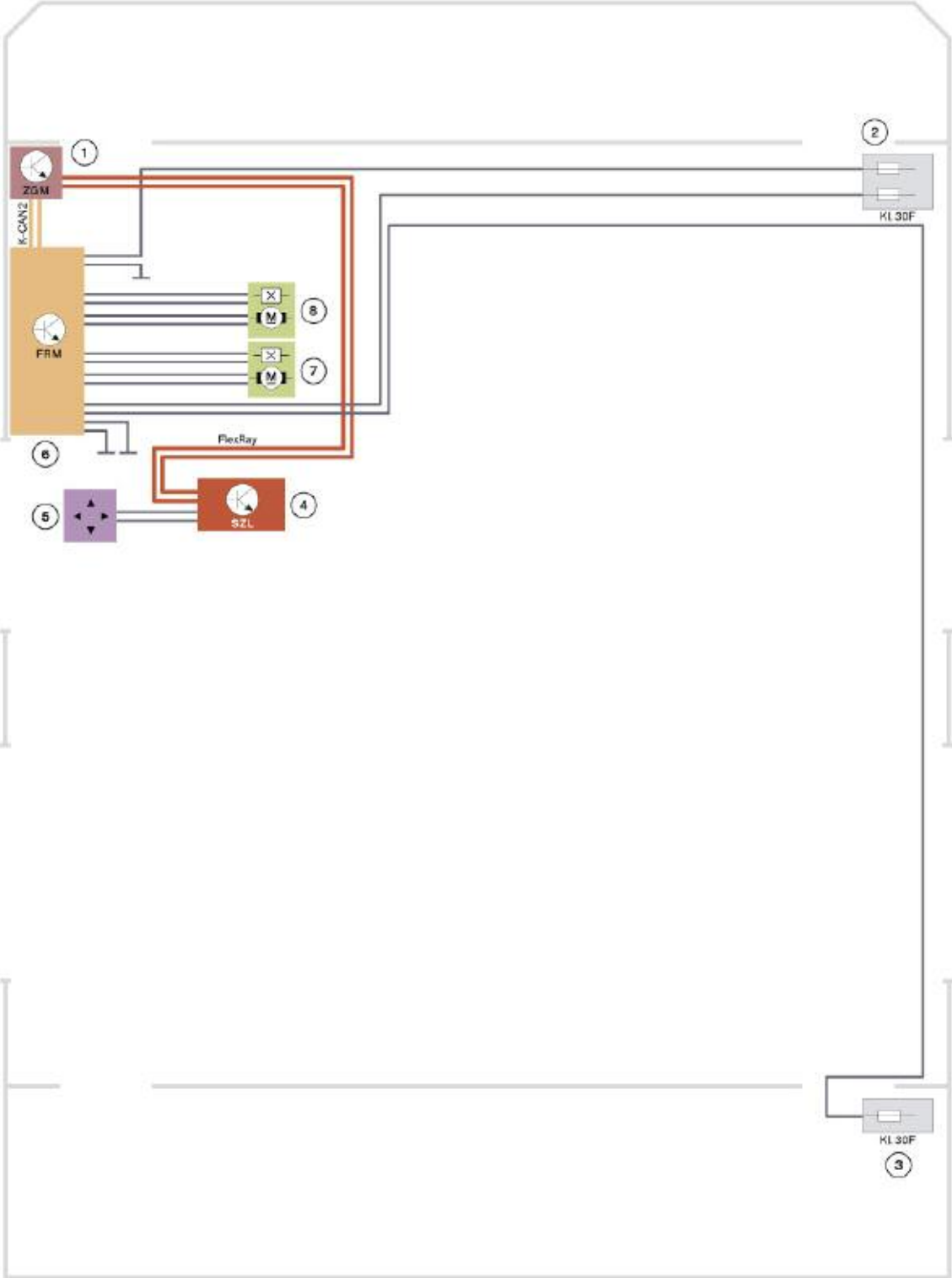
Index	Explanation
1	MODE button
2	Toggle switch +
3	Toggle switch -
4	Hands-free button
5	Telephone button
6	Knurled wheel

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Electrical Steering Column Adjustment

System Circuit Diagram for Electrical Steering Column Adjustment



Index	Explanation	Index	Explanation
1	Central gateway module ZGM	7	Motor for electrical steering column adjustment, height
2	Front distribution box	8	Motor for electrical steering column adjustment, vertical
3	Distribution box in luggage compartment	K-CAN2	Body CAN2
4	Steering column switch cluster	FlexRay	FlexRay
5	Steering column adjustment button	Kl. 30F	Terminal 30 incorrectly switched
6	Footwell module		

Steering Column Adjustment and Steering Wheel Heating Button

The button for the steering column adjustment can be moved in four directions. It can be used to adjust the steering column upwards and downwards; the distance to the driver can also be adjusted.

The steering column switch cluster evaluates the button status and forwards it to the footwell module. The signal must go across the FlexRay to the central gateway module. From there, the signal is sent on the K-CAN2 to the footwell module. Accordingly, the footwell module activates the motors for steering column adjustment.

The footwell module monitors activation and function.

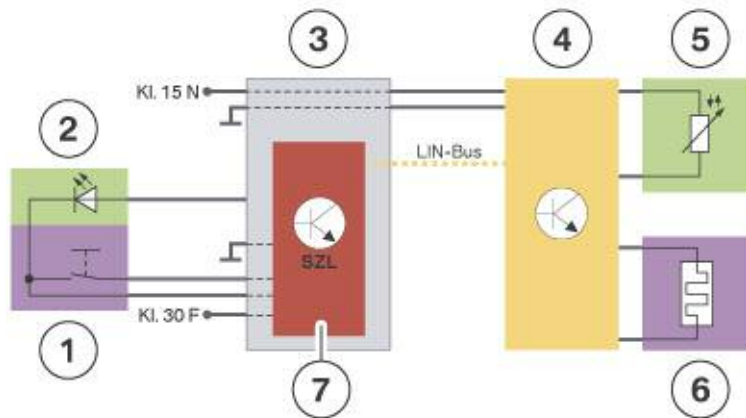
Note: The footwell module is the central control unit for the electrical steering column adjustment. The position of the steering column can be called up or stored in the footwell module for the memory function.

The button for the steering wheel heating is evaluated by the electronics of the steering column switch cluster. The electronics in the steering column switch cluster send a request across the LIN bus to the steering wheel electronics to switch the steering wheel heating on / off.

The steering wheel electronics switch the steering wheel heating on and monitor its function. The steering wheel heating has an NTC resistor. This resistor is required for temperature control of the steering wheel heating.

Signal path for the steering wheel heating F01/f02





Index	Explanation	Index	Explanation
1	Steering wheel heating button	6	Steering wheel heating
2	Steering wheel heating function indicator	7	Electronics of the steering column switch cluster
3	Steering column switch cluster (SZL)	Kl. 15N	Terminal 15 after-run
4	Steering wheel electronics	Kl. 30F	Terminal 30 incorrectly switched
5	NTC resistor	LIN-Bus	Local Interconnect Network bus

Service Information

Replacing the Steering Column Switch Cluster

Particular care must be taken when replacing the steering column switch cluster or working on the steering column. Comply with the repair instructions.

The coil spring is a very sensitive component of the steering column switch cluster. If sufficient care is not taken when replacing the steering column switch cluster, the coil spring or another component can be destroyed. A consequence of this can be that the steering column switch cluster only works in part or does not work at all.

Note: If e.g. communication with the steering column switch cluster across the FlexRay is disrupted, the junction box electronics switch the wind-screen wipers to the emergency mode.

The steering column switch cluster can only be ordered as a complete exchange part. After replacement, the new steering column switch cluster must be adapted to the car.

This involves among other things:

- Initialization of the steering column switch cluster
- Zero-point adjustment of the steering-angle sensor
- Front wheels in the straight-ahead position
- Function test.

For further information, refer to the repair instructions and the BMW diagnosis system.

Note: The transportation lock of the steering column switch cluster is only to be removed after replacement, shortly before fitting the steering wheel.