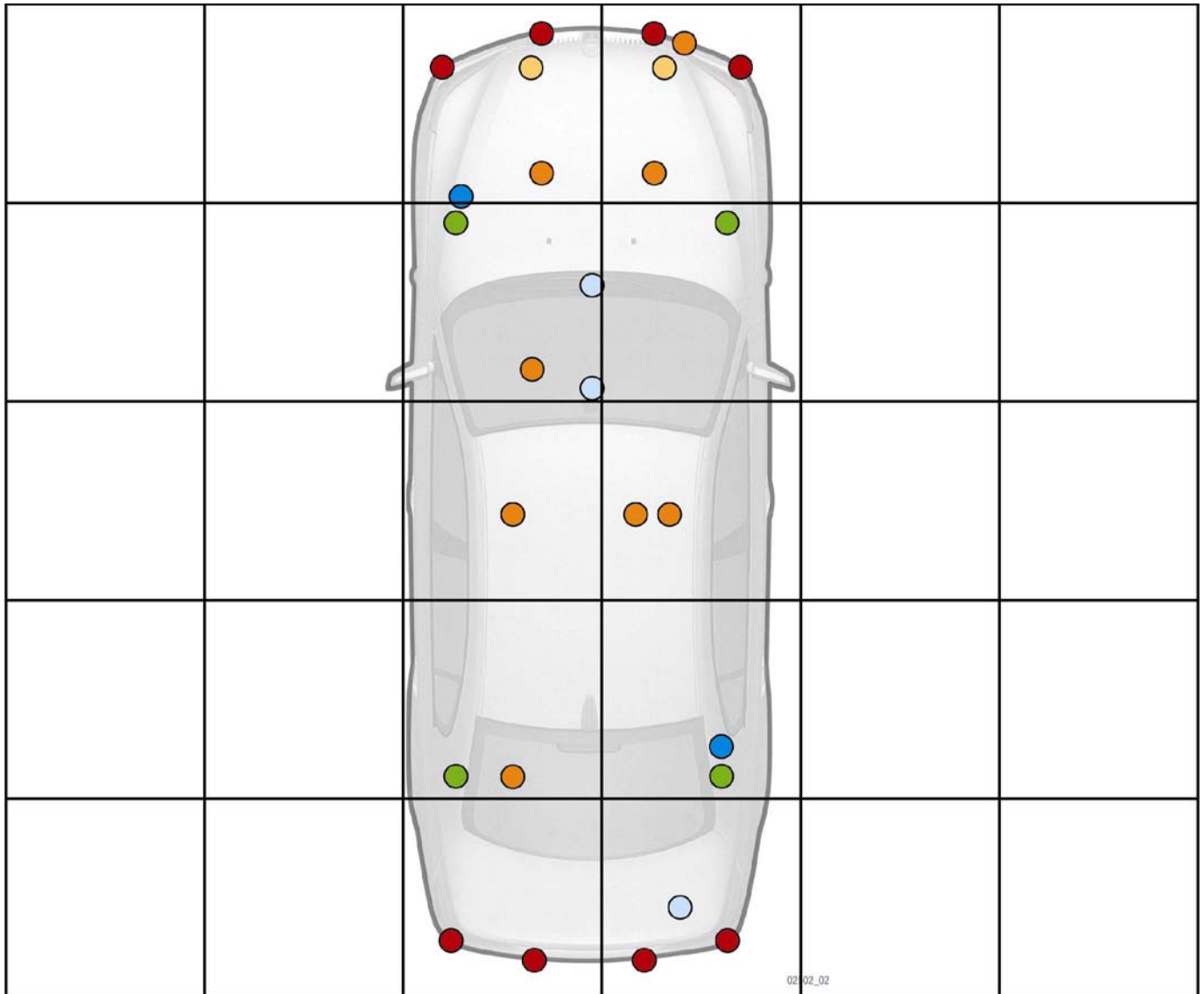


## E60 General Vehicle Electrical Systems



## General vehicle electrical systems

This training document offers a description of the following components of the general vehicle electrical system:

- Power windows
- Slide/tilt sunroof
- Central locking system
- Wipe/wash system
- Car Access System
- Anti-theft alarm system
- Park distance control
- Tyre pressure monitoring system
- Active cruise control
- Exterior lighting
- Adaptive cornering lights
- Interior lighting
- Roller sunblind
- Seat, exterior mirror and steering column adjustment, including memory function

-System overview

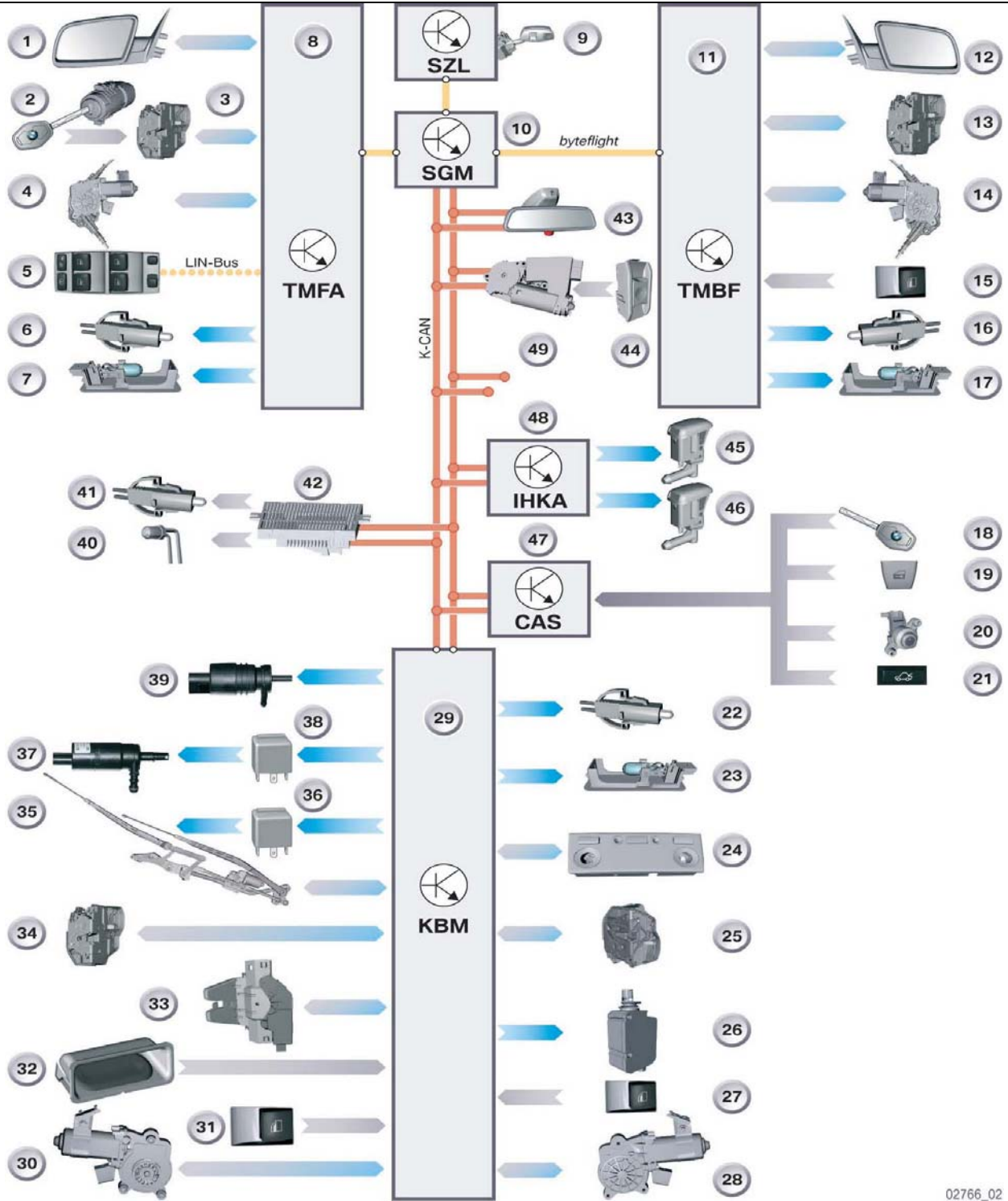


Fig. 1: E60 Overview of general vehicle electrical system

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Index	Explanation	Index	Explanation
1	Exterior mirror, driver	16	Ambient lighting
2	Lock cylinder, driver's door	17	Exit light, passenger side
3	Central locking, driver's side, front	18	Remote control
4	Power window motor, driver's side, front	19	Centerlock push button
5	Driver's switch block	20	Lock cylinder, tailgate
6	Ambient lighting	21	Tailgate button, interior
7	Exit light, driver's side	22	Ambient lighting
8	Driver's door module (TMFA)	23	Make-up/luggage compartment/ glove box lighting
9	Steering column switch cluster (SZL)	24	Interior lighting, front
10	Safety and gateway module (SGM)	25	Central locking, passenger side, rear
11	Passenger door module (TMBF)	26	Central locking, fuel filler flap
12	Exterior mirror, passenger side	27	Power window motor switch, passenger side, rear
13	Central locking, passenger side, front	28	Power window motor, passenger side, rear
14	Power window motor, passenger side, front	29	Body base module (KBM)
15	Power window motor switch, passenger side, front	30	Power window motor, driver's side, rear

Index	Explanation	Index	Explanation
31	Power window motor switch, driver's side, rear	42	Light module
32	Exterior central locking switch, tailgate	43	Rain and light sensor
33	Central locking, tailgate	44	Slide/tilt sunroof module
34	Central locking, driver's side, rear	45	Switch, slide/tilt sunroof
35	Wipe/wash system	46	Integrated automatic heating and air conditioning control unit (IHKA)
36	Relay, wipe/wash system	47	Jet with heater
37	Headlight cleaning system (SRA) pump	48	Jet with heater
38	Relay, headlight cleaning system (SRA)	49	Car Access System (CAS)
39	Washer fluid pump	<b>byteflight</b>	<b>byteflight</b>
40	Ambient lighting	K-CAN	Bodyshell CAN
41	Ambient lighting	LIN-Bus	Local Interconnect Network bus

## Power windows

The front power windows are activated decentrally by the door modules. The rear power windows are activated by the basic body module KBM. The Car Access System control unit functions as the master for:

-Operation by radio remote control key

-Comfort functions

-Central-locking interface

-Child lock

-Launch of various country-specific versions

The power windows are operated as usual from the switch block in the driver's door (SBFA) and the switches in the other doors.

LAUNCH

-System overview

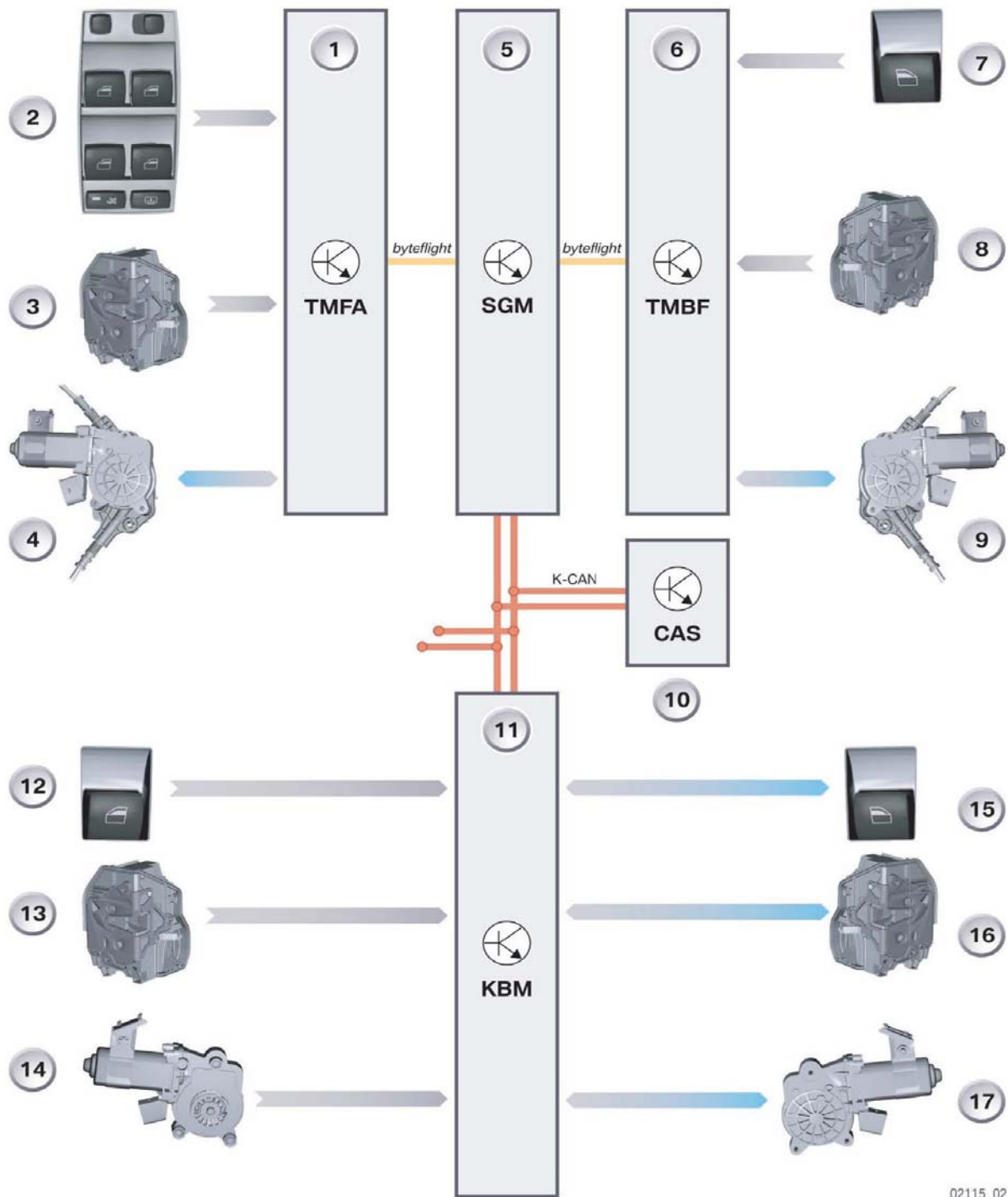


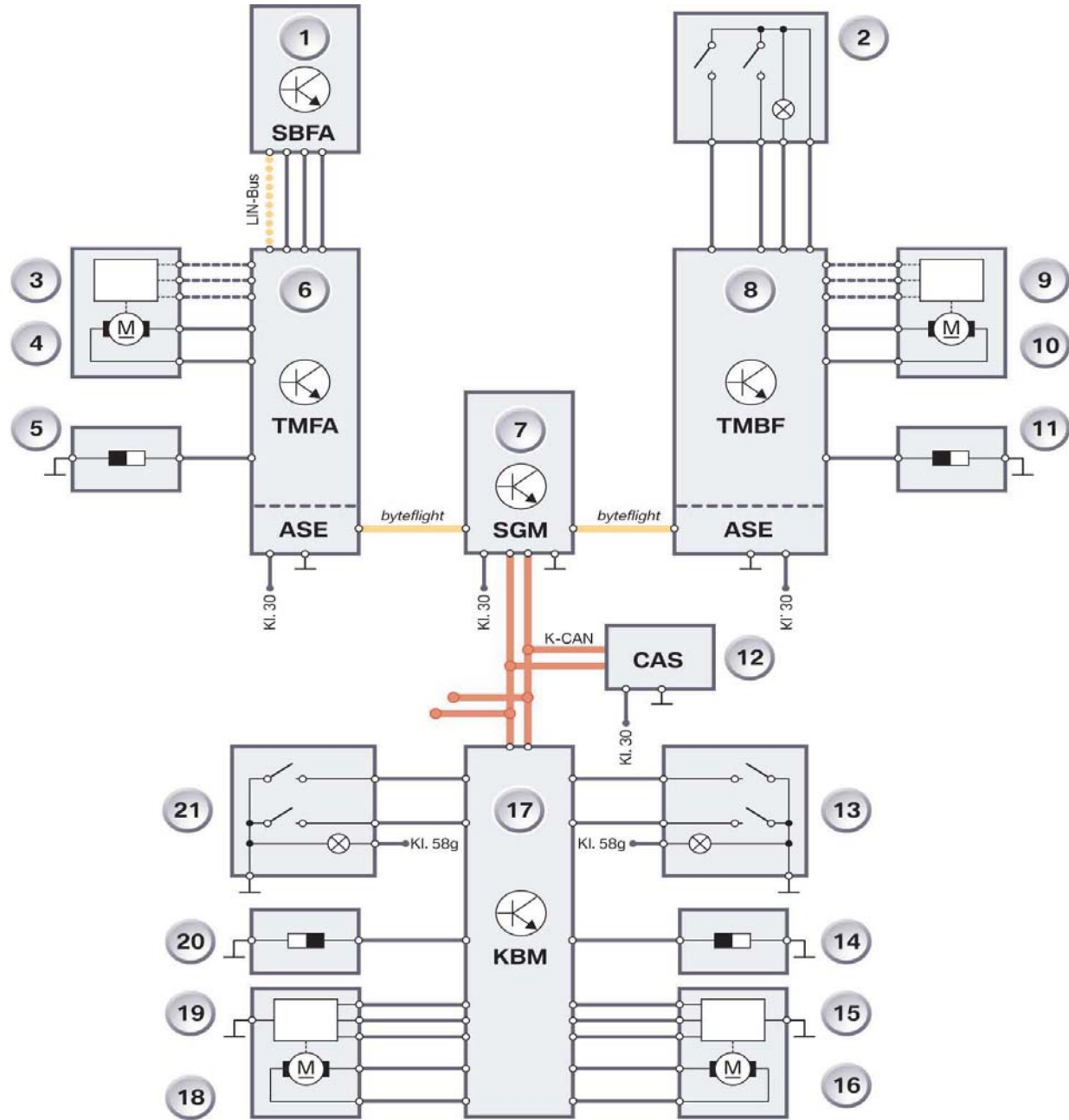
Fig. 2: Power windows

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Index	Explanation	Index	Explanation
1	Driver's door module TMFA	11	Basic body module KBM
2	Switch block, driver's door	12	Power window motor switch, driver's side, rear
3	Door contact, driver's door	13	Door contact, driver's side rear door
4	Power window lift, driver's door	14	Power window lift, driver's side rear door
5	Safety and gateway module (SGM)	15	Power window motor switch, passenger side, rear
6	Passenger's door module TMBF	16	Door contact, passenger side rear door
7	Power window motor switch, front passenger door	17	Power window motor, passenger side rear door
8	Door contact, front passenger door	K-CAN	Bodyshell CAN
9	Power window motor, front passenger door	<b>byteflight</b>	<b>byteflight</b>
10	Car access system (CAS)		



-System circuit diagram



02127\_02

Fig. 3: Power windows

Index	Explanation	Index	Explanation
1	Switch block, driver's door SBFA	14	Door contact, passenger side rear door
2	Power window motor switch, front passenger door	15	Incremental sensor for power window, passenger side rear door
3	Incremental sensor for power window, driver's door	16	Power window motor, passenger side rear door
4	Power window motor, driver's door	17	Basic body module KBM
5	Door contact, driver's door	18	Power window motor, driver's side rear door
6	Driver's door module TMFA	19	Incremental sensor for power window, driver's side rear door
7	Safety and gateway module (SGM)	20	Door contact, driver's side rear door
8	Passenger's door module TMBF	21	Power window motor switch, driver's side rear door
9	Incremental sensor for power window, front passenger door	K-CAN	Bodyshell CAN
10	Power window motor, front passenger door	<b>byteflight</b>	<b>byteflight</b>
11	Door contact, front passenger door	Kl. 30	Terminal 30
12	Car access system (CAS)	ASE	Advanced Safety Electronics
13	Power window motor switch, passenger side, rear		

## -Components

### Switch block and switches

All the power windows can be operated from the SBFA. The SBFA incorporates the button for the power-window child lock. The SBFA sends its signal via a LIN bus to the driver's door module. The power windows switch on the other doors switches from ground.

## Functional principle

### Opening of the window on the passenger side by the driver

The signal triggered in the SBFA when the button is pressed is sent via a LIN bus to the TMFA. The door module sends the signal via the **byteflight** to the SGM.

The SGM converts the signal and sends it on the K-CAN to the CAS. The power-window master for the front windows is located in the CAS.

The CAS receives the signal and evaluates it.

The CAS sends a command to the SGM on the K-CAN. The SGM forwards the command via the **byteflight** to the TMFA.

The TMFA controls the power window motor on the driver's side.

The TMFA receives a check signal from the incremental sensor in the power-window motor and if necessary takes into account the indirect anti-trapping protection.

## Body base module (KBM)

The basic body module serves as the interface between the following components:

- Power-window switches, rear
- Power window motor, rear -Door contacts, rear -Car Access System (CAS)
- Safety and Gateway Module SGM

## Installation location

The KBM is installed on the device carrier near the glove compartment.

## Functional principle

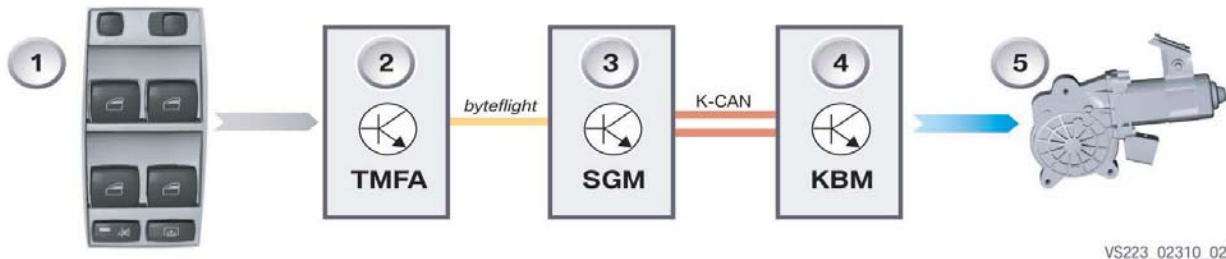
The switches on the rear doors forward the information about the requested control function to the KBM. The basic body module communicates with CAS and SGM via the K-CAN.

The power window motor on the rear driver's side and rear passenger sides is controlled if an appropriate request is sent by the KBM.

The status of the rear doors and windows (open/closed) is forwarded by the KBM via the K-CAN.

The KBM controls the power supply to the rear power window motors +/-+.

### Signal path



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Fig. 4: Signal path, power window motor

Index	Explanation	Index	Explanation
1 2 3 4	Switch block, driver's door SBFA Driver's door module (TMFA) Safety and gateway module (SGM) Body base module (KBM)	5 K-CAN <i>bytelight</i>	Power window motor, driver's side rear door BodysHELL CAN <i>bytelight</i>

LAUNCH

### Door module

The door module contains separate "modules" for the door module electronics and the Advanced Safety

Electronics. The door module is the interface between:

-Switch block, driver's door

-Switch, passenger side

-Door contact

-Incremental sensor in power-window motor

-**byteflight** –

Power-window motor

The driver's door switch block is linked to the driver's door module by means of an LIN bus.

The activation facility for wing-mirror adjustment, heating and front-area light is also integrated in the door modules.

Functional principle

Driver opens the window on the passenger side:

The driver can use the relevant switch in the SBFA to open the window on the front passenger side. The control request is forwarded to the TMFA via the LIN bus, and then from the TMFA to the SGM via the **byteflight**.

The SGM forwards the control request via the **byteflight** to the TMBF. The TMBF then activates the power-window motor on the passenger side.

## Door module service information

When removing the door module, only unscrew the two outer screws. The inner screws are exclusively for holding the door module housing together. Loosening the inner screws will cause operation of the door module to fail.

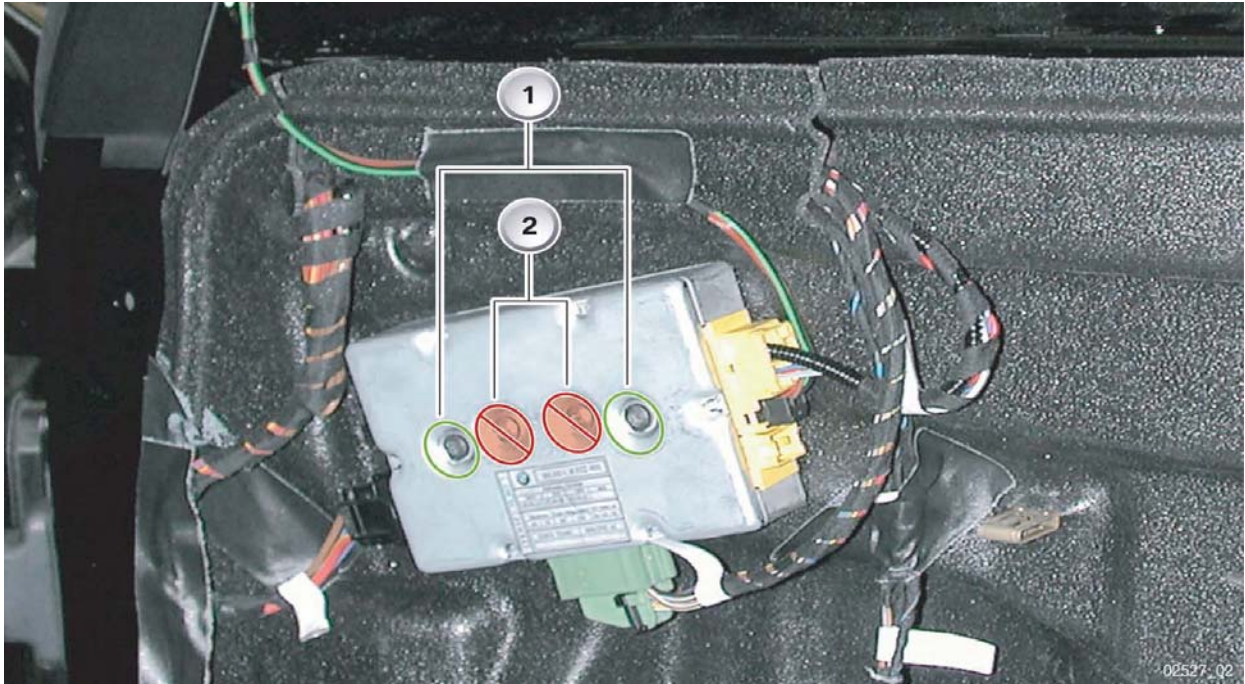


Fig. 5: Installation location of the door module

Index	Explanation
1	Outer screws for removing the door module
2	Do not loosen the inner screws

The door module is powered with 10 V from terminal 30. The door module is supplied with 10 V by the SGM. The 10 V supply is buffered for the function of the ASE system. When replacing the door module, bear in mind that the capacitor needs a few minutes to discharge. The airbag might be deployed if you replace the door module with the capacitor still charged.

### -System functions

The power window functions are similar to those of the E65. The following power window functions are possible:

- Opening and closing
- Comfort opening and closing
- One-touch opening and closing
- Child lock
- Anti-repeat circuit
- Load deactivation
- Emergency close
- Indirect anti
- trapping protection
- Smooth startup and rundown
- Synchronous motor operation

LAUNCH

### -Service information



## Initialization of power windows

Front windows	Rear windows
On initial startup, only the upper window stop has to be learnt. For this purpose, the initialization procedure during the initial window must be held for 500 ms at the startup. Initialization consists of normalizing upper stop position.	The power windows are subjected to an initialization procedure during the initial startup. Initialization consists of normalizing upper stop position. and learning the characteristic curve.
A characteristic curve is not learnt for the front windows. The lower stop does not have to be approached.	When the windows are standardized, the end positions of the window travel are determined by limit runs into the upper window seal and down to the lower window stop.
In order to compensate for mechanical ageing, an automatic readjustment of the end position is performed cyclically at the upper stop.	During initialization, the characteristic of the closing force is also measured over the entire closing travel and permanently stored (learning of the characteristic curve).

## Slide/tilt sunroof

The glass slide/tilt sunroof is designated option SA 403. The functions were adopted from earlier models.

-System overview

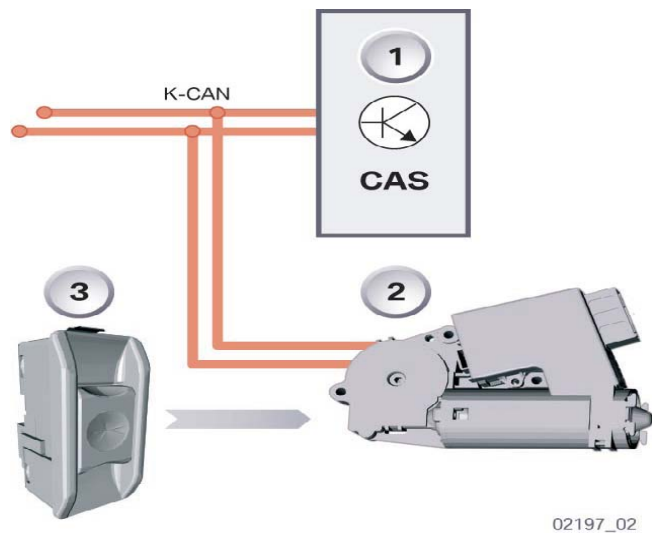


Fig. 6: Slide/tilt sunroof

Index	Explanation	Index	Explanation
1	Car Access System (CAS)	3	Slide/tilt sunroof push-button
2	Slide/tilt sunroof module with integrated electronics		

-System circuit diagram

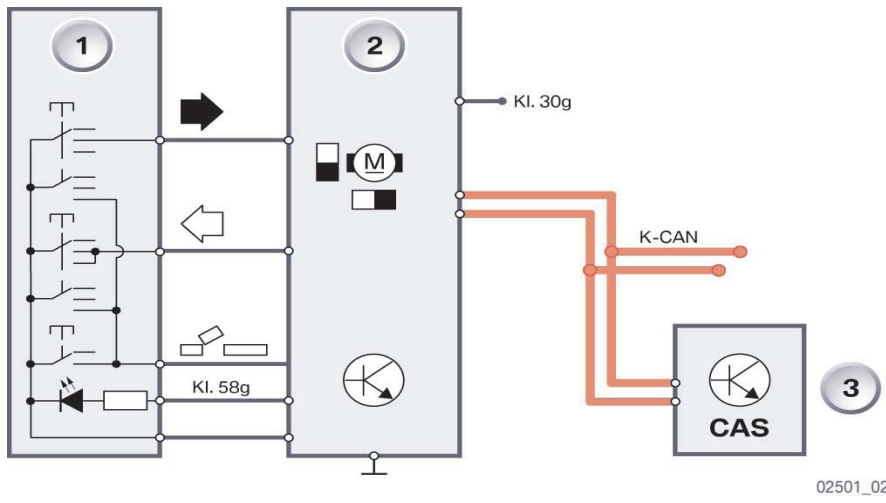


Fig. 7: System diagram slide/tilt sunroof

Index	Explanation	Index	Explanation
1	Slide/tilt sunroof push-button	K-CAN	Bodyshell CAN
2	Slide/tilt sunroof module Car Access	KI. 30g	Terminal 30g
3	System (CAS)	KI. 58g	Terminal 58g from SHD module

## -Components Slide/tilt sunroof push-button

The push-button for the slide/tilt sunroof (SHD) switches to ground. The power supply of the push-button features polarity reversal protection and is disconnected from the power supply in the event of overvoltage and in sleep mode.

### **Slide/tilt sunroof module**

The SHD module controls and monitors the electric motor and therefore the movement of the slide/tilt sunroof.

The commands the driver selects with the push-button are transferred directly to the slide/tilt sunroof module.

Communication with the vehicle is controlled via the K-CAN.

The SHD module receives information relating to terminal 58g via the K-CAN from the light module. The SHD module controls the LEDs of the SHD push-button. Terminal 58g has a clock cycle of 200 Hz for the purpose of dimming the lighting.

### **Car Access System**

The CAS contains the master function for auto-remote opening and closing.

## -System functions

### List of functions

- Manual opening, tilt and close
- One-touch function
- Auto-remote opening and closing
- Panic close -Actuation of SHD motor

- Actuation of push-button lighting
- Anti-drumming position
- Electric load control - load shedding
- Anti-trap protection by closing force limitation -Adaptation of anti-trap protection by linking with speed signal
  
- Service information

## Initialization

Initialization comprises two procedures that are necessary to ensure complete operability of the slide/tilt sunroof (SHD):

- Scaling creates the absolute reference point for internal relative position management at the lift stop.
- Teaching registers the force for closing the sunroof for each position.

The available movements are restricted if scaling is not carried out. Without the teaching-in procedure, there are no characteristic curves and therefore also no closing force limitation.

LAUNCH

## Scaling

Subsequent scaling is necessary when, for example, the emergency crank handle is used or the roof was tampered with while the electronics/motor were removed.

### Scaling after power resumption

A break in the voltage supply normally does not require rescaling. The scaling is set invalid, however, if the voltage supply is interrupted during motor operation. Rescaling will then be necessary.

### Scaling deletion

Scaling is deleted under the following circumstances:

- A new scaling procedure deletes the previous scaling
- Failure of the supply voltage during motor operation
- Hall sensor fault detected
- Position implausible
- Checksum of position in EEPROM incorrect
- Certain calls in diagnosis mode
- Changed vehicle coding

LAUNCH

### Learning the characteristic curve for closing force limitation

Closing force limitation functions on the basis of comparing the currently required motor power with a value taken from a characteristic curve for the current position of the slide/tilt sunroof. This characteristic curve must be recorded once for a new vehicle/sunroof system and is then updated automatically over the service life of the slide/tilt sunroof.

Since closing force limitation is active when closing from the slide position and from the tilt position, there are two branches of the characteristic curve for both areas. These branches must be learned for complete operability of the respective closing function.

The lift/tilt button must still be held and pressed during this entire procedure. The button must not be released before the drive has switched off in the closed end position. The learning procedure will remain incomplete if the button is released beforehand.

If interrupted in the lift range, none of the two characteristic curves will be learned, if interrupted in the closing range, the characteristic curve for the lift range will be learned, that for the closing range not.

The need for the learning procedure is indicated to the driver by means of the check control message "sunroof initialization necessary". Clearance of the check control message indicates full initialization has been concluded.

## Deleting the characteristic curve

The characteristic curves are deleted when:

- The checksum of the respective branch in the EEPROM is incorrect
- The coding is changed
- The respective characteristic curve branch is deleted on relearning at the start of the learn procedure (passing through the closing force limitation range). It is replaced by a new characteristic curve branch only after fully and uninterrupted passing through the corresponding closing force limitation range. If the learning procedure is interrupted, a characteristic curve branch may be retained or deleted depending when the interruption took place.
- In connection with certain calls in diagnosis mode

### **New or reinitialization of the slide/tilt sunroof**

The characteristic curve is relearned during every new or reinitialization

of the slide/tilt sunroof. The following conditions must be maintained to ensure correct initialization of the slide/tilt sunroof:

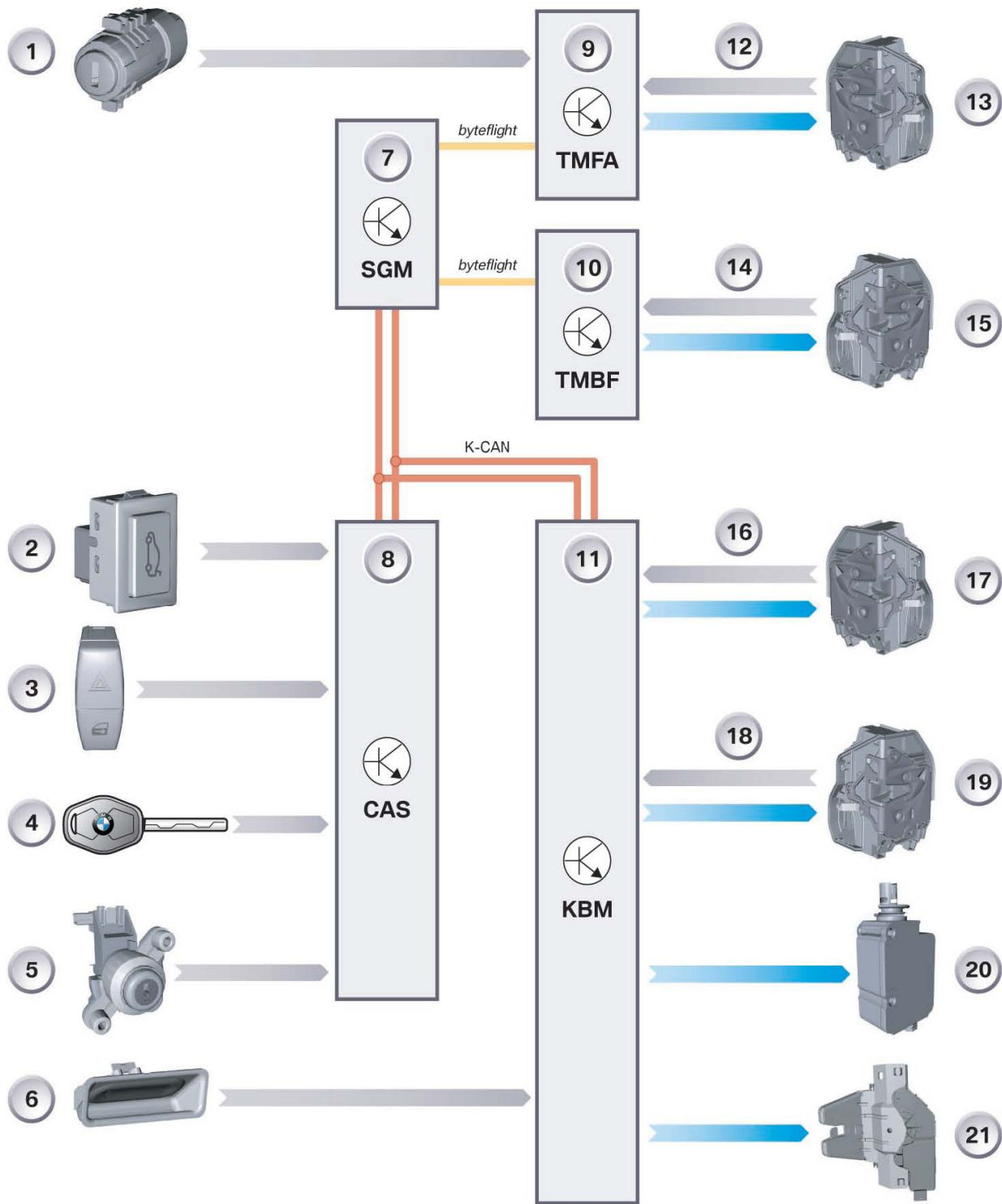
- Initialization at room temperature only
- Clean slide/tilt sunroof

### **Central locking system**

The central locking system ZV involves the actuation/evaluation of the doors, boot lid and fuel filler flap.

- System overview



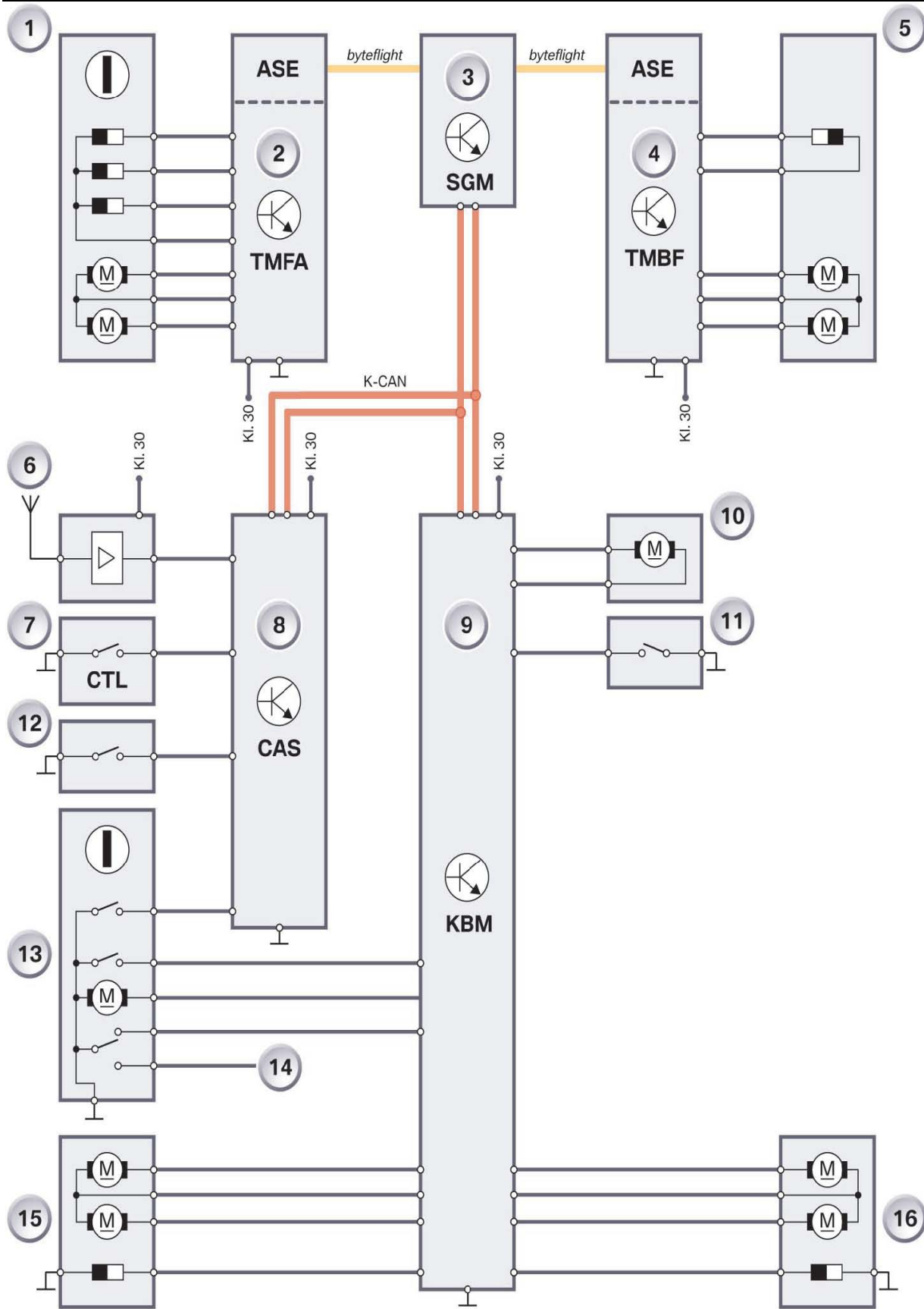


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Fig. 8: Central locking system

Index	Explanation	Index	Explanation
1	Lock cylinder, driver's door	12	Door contact, driver's door
2	Tailgate button, interior	13	Central locking, driver's door
3	Centre-lock button	14	Door contact, front passenger door
4	Remote control	15	Central locking, passenger's door
5	Lock cylinder, tailgate	16	Door contact, rear driver's side door
6	Tailgate button, exterior	17	Central locking, rear driver's side door
7	Safety and gateway module (SGM)	18	Door contact, rear passenger's side door
8	Car Access System (CAS)	19	Central locking, rear passenger's side door
9	Driver's door module (TMFA)	20	Central locking, fuel filler flap
10	Passenger door module (TMBF)	21	Central locking, tailgate
11	Body base module (KBM)		

-System circuit diagram



02126\_02

Fig. 9: System diagram central locking

Index	Explanation	Index	Explanation
1	Driver's door lock cylinder, driver's door contact Central locking, driver's door	12	Tailgate button, interior
2	Driver's door module TMFA	13	Boot lid lock cylinder Central locking, tailgate
3	Safety and gateway module (SGM)	14	Luggage compartment lighting
4	Passenger's door module TMBF	15	Central locking, rear driver's side door Door contact, rear driver's side door
5	Door contact, passenger's door Central locking, passenger's door	16	Central locking, rear passenger's side door Door contact, rear passenger's side door
6	Remote control	15	Central locking, rear driver's side door Door contact, rear driver's side door
7	Centre-lock button CLT	16	Central locking, rear passenger's side door Door contact, rear passenger's side door
8	Car access system (CAS)	ASE	Advanced safety system
9	Basic body module KBM	<b>byteflight</b>	<b>byteflight</b>
10	Central locking, fuel filler flap	K-CAN	Bodyshell CAN
11	Tailgate button, exterior	KL.30	Terminal 30

## -System functions

As the central locking master, the CAS is responsible for ensuring that all central locking procedures in the vehicle function correctly. The commands are forwarded via the K-CAN and the **byteflight**.

The door modules control the central locking facilities of the front doors. The basic body module controls the central locking in the rear area.

## List of functions

Possible functions of the central locking system are:

- Centre lock
- Forced unlocking
- Automatic locking
- Crash unlock
- Anti-repeat circuit
- Signalling to the anti-theft alarm system
- Remote control
- Automatic relocking
- Hotel setting
- Single release via centre
- lock push button

## Wipe/wash system

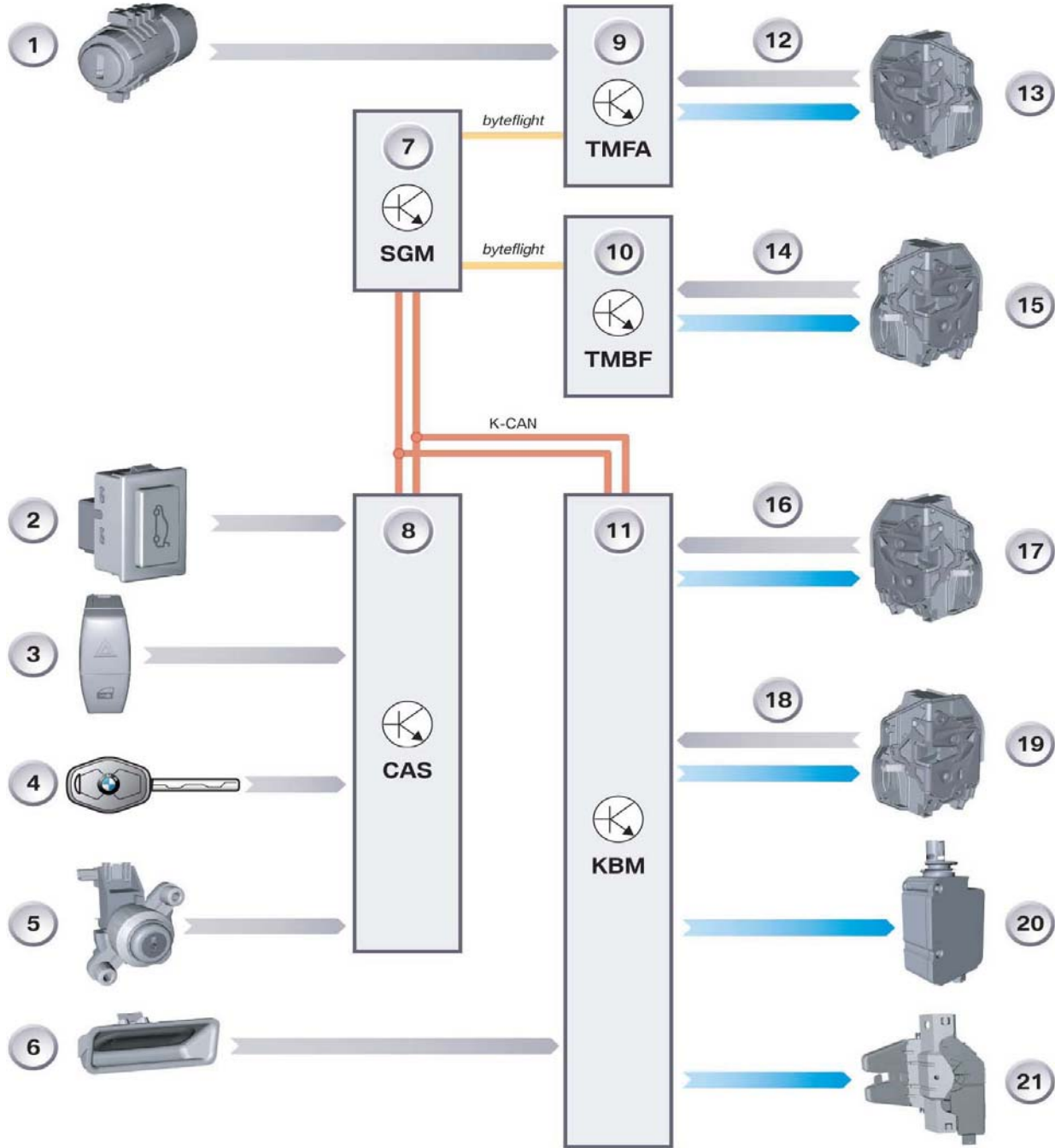
The wipe/wash system is a conventional wipe/wash system with reset contact.

The wipe/wash functions are controlled by the body base module. The wipe/wash functions available depend on the vehicle speed.

The rain and light sensor is fitted as standard.

LAUNCH

-System overview

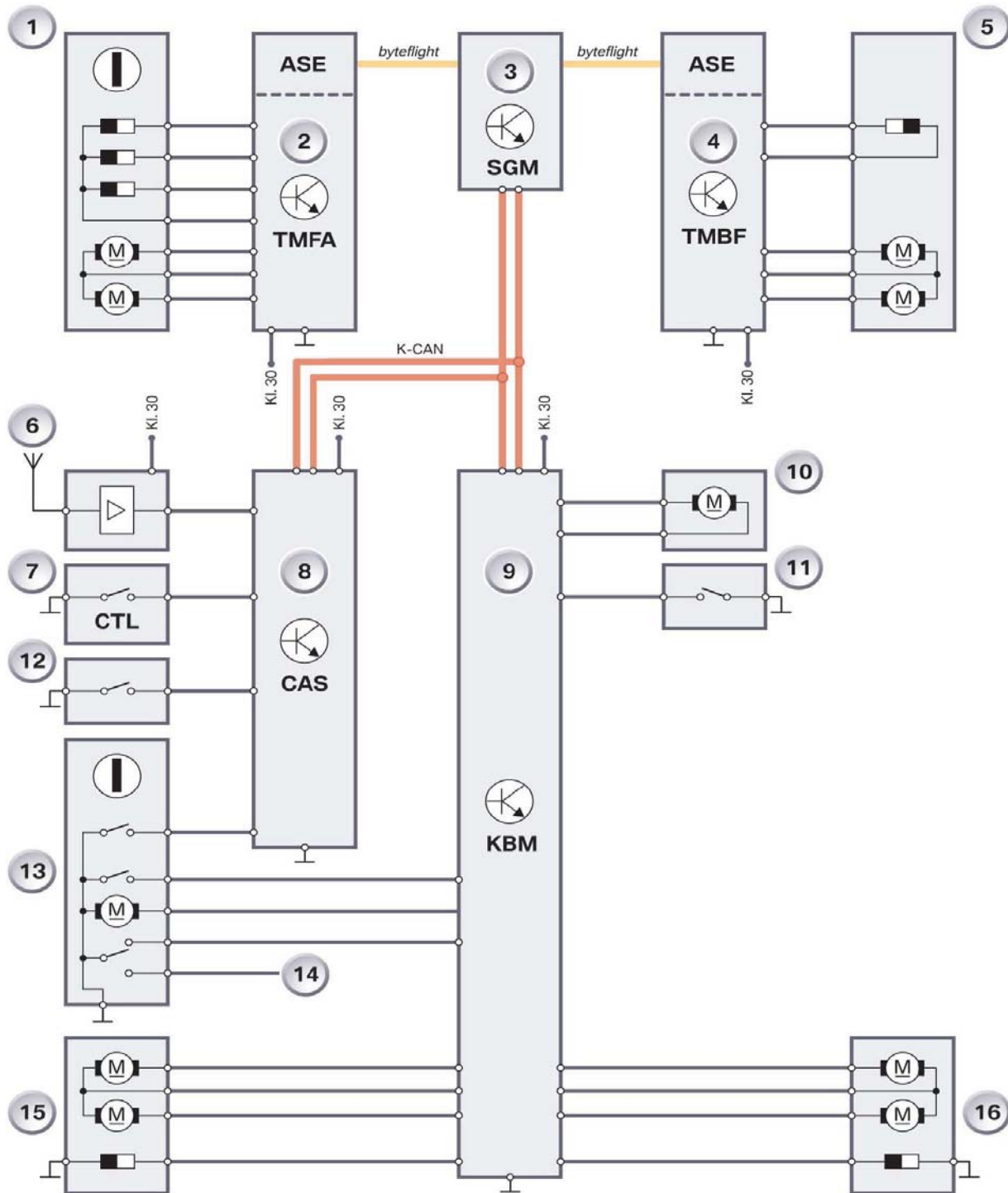


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Index	Explanation	Index	Explanation
1	Lock cylinder, driver's door	12	Door contact, driver's door
2	Tailgate button, interior	13	Central locking, driver's door
3	Centre-lock button	14	Door contact, front passenger door
4	Remote control	15	Central locking, passenger's door
5	Lock cylinder, tailgate	16	Door contact, rear driver's side door
6	Tailgate button, exterior	17	Central locking, rear driver's side door
7	Safety and gateway module (SGM)	18	Door contact, rear passenger's side door
8	Car Access System (CAS)	19	Central locking, rear passenger's side door
9	Driver's door module (TMFA)	20	Central locking, fuel filler flap
10	Passenger door module (TMBF)	21	Central locking, tailgate
11	Body base module (KBM)		



-System circuit diagram



02126\_02

Index	Explanation	Index	Explanation
1	Driver's door lock cylinder, driver's door contact Central locking, driver's door	12	Tailgate button, interior
2	Driver's door module TMFA	13	Boot lid lock cylinder Central locking, tailgate
3	Safety and gateway module (SGM)	14	Luggage compartment lighting
4	Passenger's door module TMBF	15	Central locking, rear driver's side door Door contact, rear driver's side door
5	Door contact, passenger's door Central locking, passenger's door	16	Central locking, rear passenger's side door Door contact, rear passenger's side door
6	Remote control	15	Central locking, rear driver's side door Door contact, rear driver's side door
7	Centre-lock button CLT	16	Central locking, rear passenger's side door Door contact, rear passenger's side door
8	Car access system (CAS)	ASE	Advanced safety system
9	Basic body module KBM	<b>byteflight</b>	<b>byteflight</b>
10	Central locking, fuel filler flap	K-CAN KL.	Bodyshell CAN
11	Tailgate button, exterior	30	Terminal 30

## -Components

### Headlight cleaning system (SRA)

The headlight wipe/wash function is controlled by the KBM.

### Rain and light sensor

If the rain and light sensor should fail or be faulty, the KBM will take control. The KBM will switch to an emergency mode. Emergency mode is a speed-dependent intermittent mode.

### Safety and gateway module

The SGM switches the wiper switch signal from the *bytelight* to the K-CAN.

### Body base module

The body base module receives all the information that is required for operation of the wipe/wash system.

The body base module activates the following components:

-Dual relay module for the wiper motor

-Relay for the headlight cleaning system

-Washer fluid pump

### Integrated automatic heating and air conditioning

The IHKA activates the heated jets.

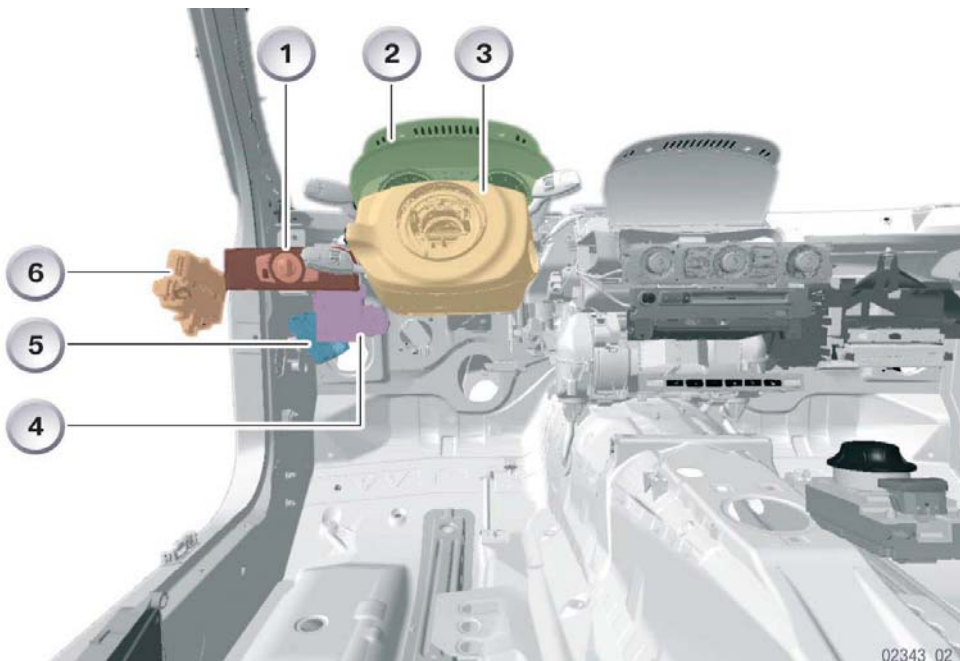
## Car Access System

The CAS of the E60 is based on the CAS of the E65. The internal design

nation is CAS 2. The following changes have been made compared with the CAS of the E65:

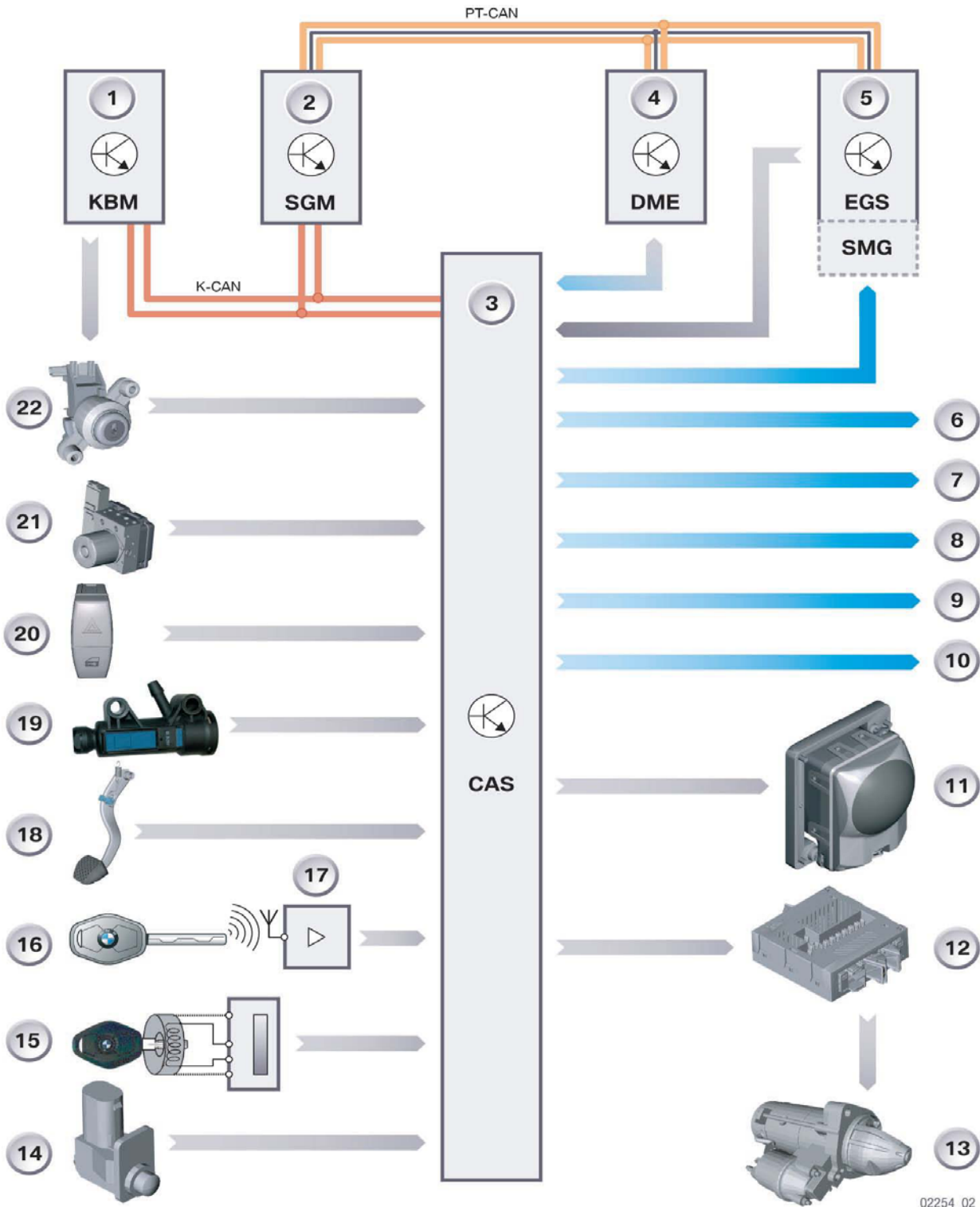
- Direct connection to the K-CAN
- Repeater function has been omitted
- Ignition starter switch and the CAS are 2 separate components
- Data transfer as part of the Condition Based Service

### Installed position



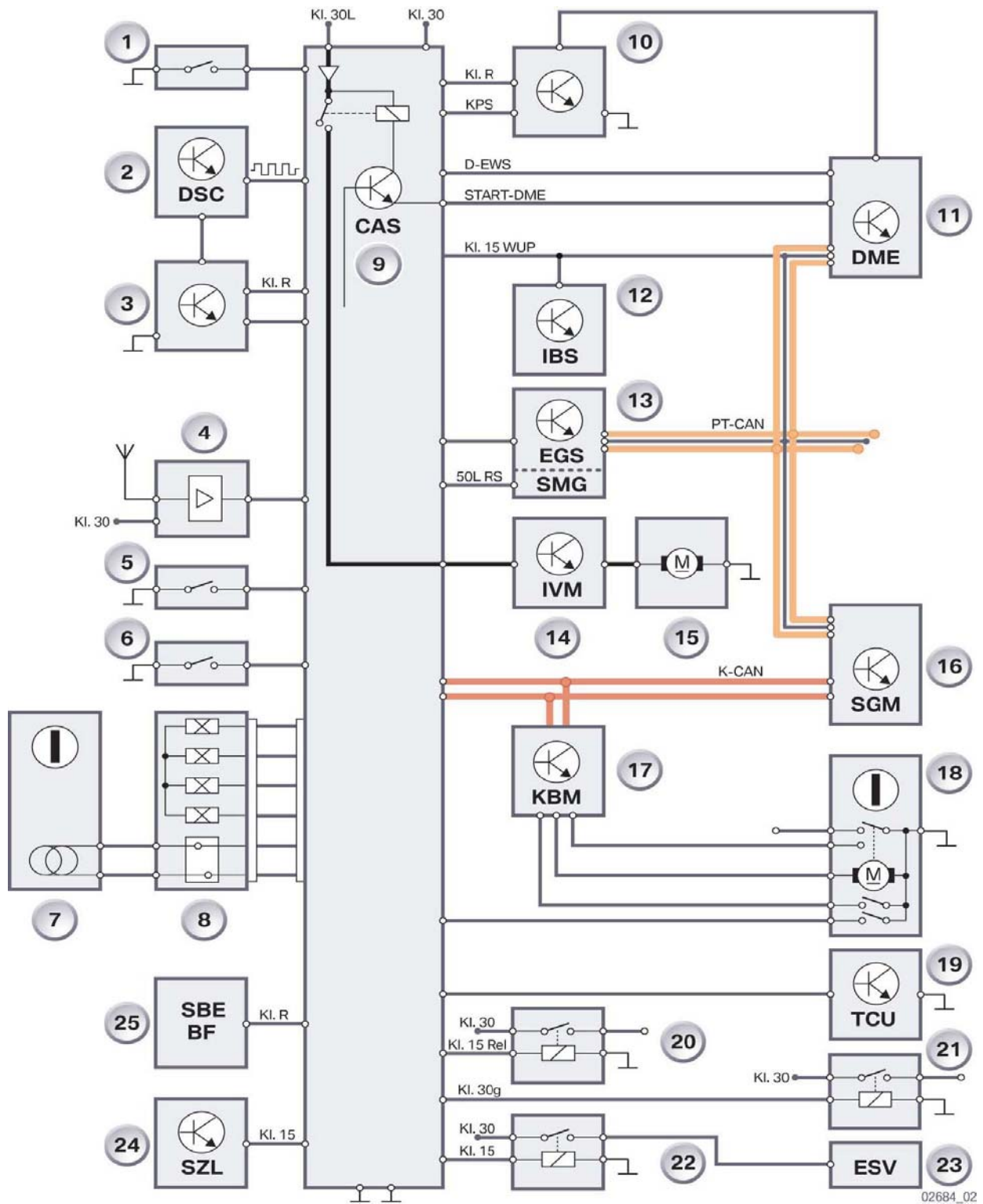
Index	Explanation	Index	Explanation
1	Light switch with control panel unit	4	Car Access System (CAS)
2	Instrument cluster (KOMBI)	5	Light module (LM)
3	Steering column switch cluster (SZL)	6	Driver's door module (TMFA)

-System overview



Index	Explanation	Index	Explanation
1	Body base module (KBM)	12	Integrated power supply module Installation depends on engine
2	Safety and gateway module (SGM)	13	Starter
3	Car Access System (CAS)	14	Bonnet contact
4	Digital motor electronics (DME)	15	Ignition/starter switch
5	Electronic transmission control (EGS) Sequential manual gearbox (SMG)	16	Remote control
6	Output, electronic immobilizer	17	Radio receiver
7	Output, terminal R	18	Brake light switch
8	Output, terminal 15 wake-up	19	Clutch switch module Automatic gearbox
9	Output, terminal 15-1 to terminal 15-3	20	Centerlock button
10	Output, terminal 30g relay	21	Dynamic Stability Control
11	Active Cruise Control, wake-up line 15WUP_RS	22	Lock cylinder, tailgate Country-specific equipment

-System circuit diagram



Index	Explanation	Index	Explanation
1	Bonnet contact	20	Terminal 15 relay
2	Dynamic Stability Control (DSC)	21	Terminal 30g relay
3	Brake light switch	22	Relay for injection valves -DME Diesel heater relay - DDE
4	Remote control/aerial amplifier	23	Injection valves
5	Centerlock button	24	Steering column switch cluster (SZL)
6	Tailgate button, interior	25	Seat occupancy detection system, passenger seat SBE_BF
7	Coil	Kl. R	Terminal R
8	Ignition/starter switch	Kl.15	Terminal 15
9	Car Access System (CAS)	Kl.15 REL	Terminal 15 relay
10	Clutch switch module	Kl.15 WUP	Terminal 15 wake-up
11	Digital motor electronics (DME)	Kl. 30	Terminal 30
12	Intelligent battery sensor (IBS)	Kl. 30g	Terminal 30g relay
13	Electronic transmission control/ Sequential manual gearbox	Kl. 30L	Terminal 30 load
14	Integrated power supply module (IVM) * dependent on engine variant	50L_RS	Terminal 50 load
15	Starter	D_EWS	Electronic immobilizer
16	Safety and gateway module (SGM)	START_ DME	Starting detection for comfort start
17	Body base module (KBM)	K-CAN	Bodyshell CAN
18	Tailgate lock		
19	Telephone Control Unit (TCU)	PT-CAN	Powertrain CAN



## -System functions

### List of functions

The CAS includes the following functions:

- Reading in ignition starter switch (ZAS)
- Transponder authentication
- Terminal control
- Electronic immobilizer enable to injection system
- Master function for central locking system (ZV)
- Master function for power windows (FH) and slide/tilt sunroof (SHD)
- Remote control services (FBD)
- Internal CAS functions
  - Wake-up signals
  - Sleep signals
  - etc.
- Vehicle functions
  - Personalization
  - Auto encoding of vehicle model/transmitter
  - Vehicle order
  - Total distance recorder
  - Condition Based Service CBS
  - etc.
- Voltage supply, brake-light switch

## Wake-up time

The vehicle can be woken up by various control units. These control units use different wake-up times.

Control unit	Wake-up time
Car Access System (CAS)	750 ms
Safety and gateway module (SGM)	500 ms
Intelligent battery sensor (IBS)	550 ms

## -Service information

### Manual update of the Condition Based Service Data

The procedure for transferring current data to the key during servicing is as follows:

- Insert key in ignition and turn to position "R"
- Press and hold Centerlock button
- After 15 s the CBS data will have been transferred to the key
- Read out the key

**Manual update of fault memory data**

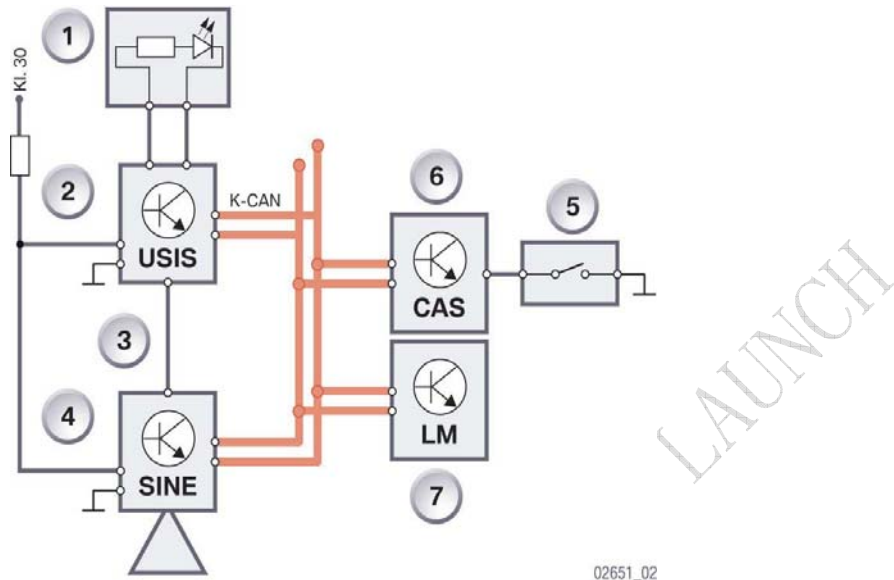
- Press and hold Centerlock button
- Insert key in ignition
- Turn key from position "0" to position "R"
- After 15 s, the fault memory data will have been transferred to the key
- Read out the key

LAUNCH

## Antitheft alarm system

The system can be installed in various vehicle models, can be adapted for different country-specific versions and can be fitted with a variety of options.

-System circuit diagram -System functions



02651\_02

Index	Explanation	Index	Explanation
1	DWA LED	6	Car Access System (CAS)
2	Interior motion sensor (USIS)	7	Light module (LM)
3	DWA bus	K-CAN	K-CAN
4	Tilt sensor with integrated emergency siren	Kl. 30	Terminal 30
5	Bonnet contact		

## **-System functions**

The system functions are based on the previous functions of the anti-theft alarm system. The following are monitored:

- Doors -Boot
- Bonnet
- Vehicle interior
- Vehicle inclination
- DWA bus line to the emergency siren
- Voltage supply for vehicle electrical system
- Voltage level at the emergency siren

LAUNCH

## Park Distance Control PDC

The E60 is equipped with the 8-channel PDC system already known from the E65. PDC is available as an option SA 508.

The PDC button is integrated in the centre console switch centre SZM. In the E60 the button signal is forwarded via the K-CAN to the PDC control unit.

The PDC sensors for front and rear introduced in the E65 are used as sensors here.

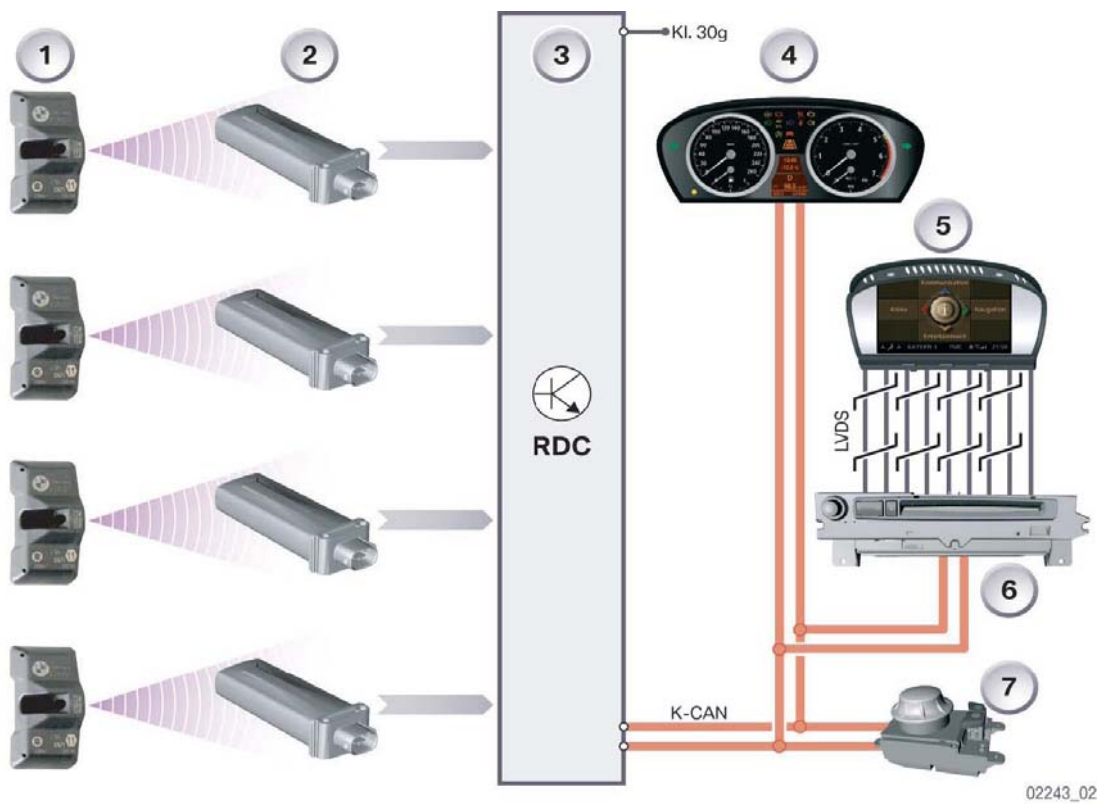
For a manual gearbox, the signal for reverse gear is made available by the light module by way of a K-CAN message.

For an automatic gearbox, the signal for reverse gear is made available by the transmission control unit by way of a K-CAN message.

## Tyre pressure monitoring system

The tyre pressure control system monitors tyre pressure both when the vehicle is in motion and when stationary. The modules installed inside the tyre measure the tyre pressure, air temperature in the tyres and the charge state of the batteries in the wheel electronics at regular intervals.

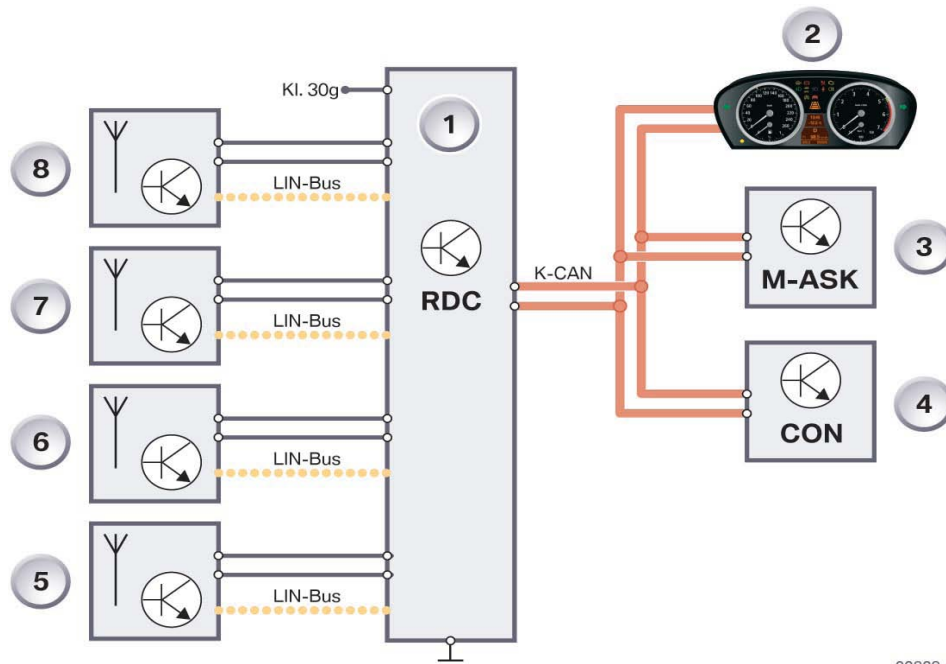
### -System overview



Index	Explanation
1	Wheel electronics
2	Receiving aerials
3	RDC control unit
4	Instrument cluster
5	Central Information Display
6	Multi Audio System
7	Controller Controller
Kl. 30g	Terminal 30g
K-CAN	Bodyshell CAN
LVDS	Low Voltage Differential Signalling



# -System circuit diagram



02838\_02

Index	Explanation
1	RDC control unit
2	Instrument cluster
3	Multi Audio System Controller (M-ASK)
4	Controller (CON)
5	Receiving/transmitting aerial
6	Receiving/transmitting aerial
7	Receiving/transmitting aerial
8	Receiving/transmitting aerial
Kl. 30g	Terminal 30g
K-CAN	Bodyshell CAN
LIN-Bus	Local Interconnect Network bus

## -Components

### Wheel electronics

The wheel electronics send the information via radio transmission to the relevant receiving aerials in the wheel housings.

The transmission frequency of the wheel electronics is 433 MHz. A transmission frequency of 315 MHz is used in the US version.

The wheel electronics have a higher transmitting power and improve the robustness of the signal in extremely low profile and run-flat tyres.

The wheel electronics are triggered every 30 s by the RDC control unit to measure the tyre pressure and temperature.

### Receiving aerials in the wheel housings

The signals received by the wheel electronics are converted into digital signals in the receiving aerials and then forwarded to the RDC control unit. The signals are transmitted via the LIN bus.

### Transmitting aerials in the wheel housings

The transmitting aerials in the wheel housings transmit at 125 KHz to trigger the wheel electronics.

## -System functions

The system functions are based on the RDC in the E65.

Initialization of the RDC now only takes a maximum of 3 minutes.

## -Service information

### Initialization

After a tyre pressure check, the RDC system has to be re-initialized. On the E60, this is done by means of the controller:

-In the main menu, press the controller to confirm

-A sub-menu with the menu item "Vehicle settings" will appear

-Select this menu item and confirm with the controller

-In the header bar, "RDC" will appear along with other items. Select "RDC" and confirm

-The vehicle and its tyre pressures will be displayed

-Confirm the "Set tyre pressures" menu item with the controller

The RDC then learns the wheel positions. On successful completion of the learning process, the pressures for each wheel are shown on the CID.

Minor differences (0.1-0.2 bar) between the pressures detected and those indicated by the service station's calibrated tester are possible.



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After the wheels have been changed, full initialization can take up to 3 minutes. Only a speed of > 6 km/h will count. The time required also depends on how many other radio transmitters using the same frequency may be obscuring the wheel electronics signals.

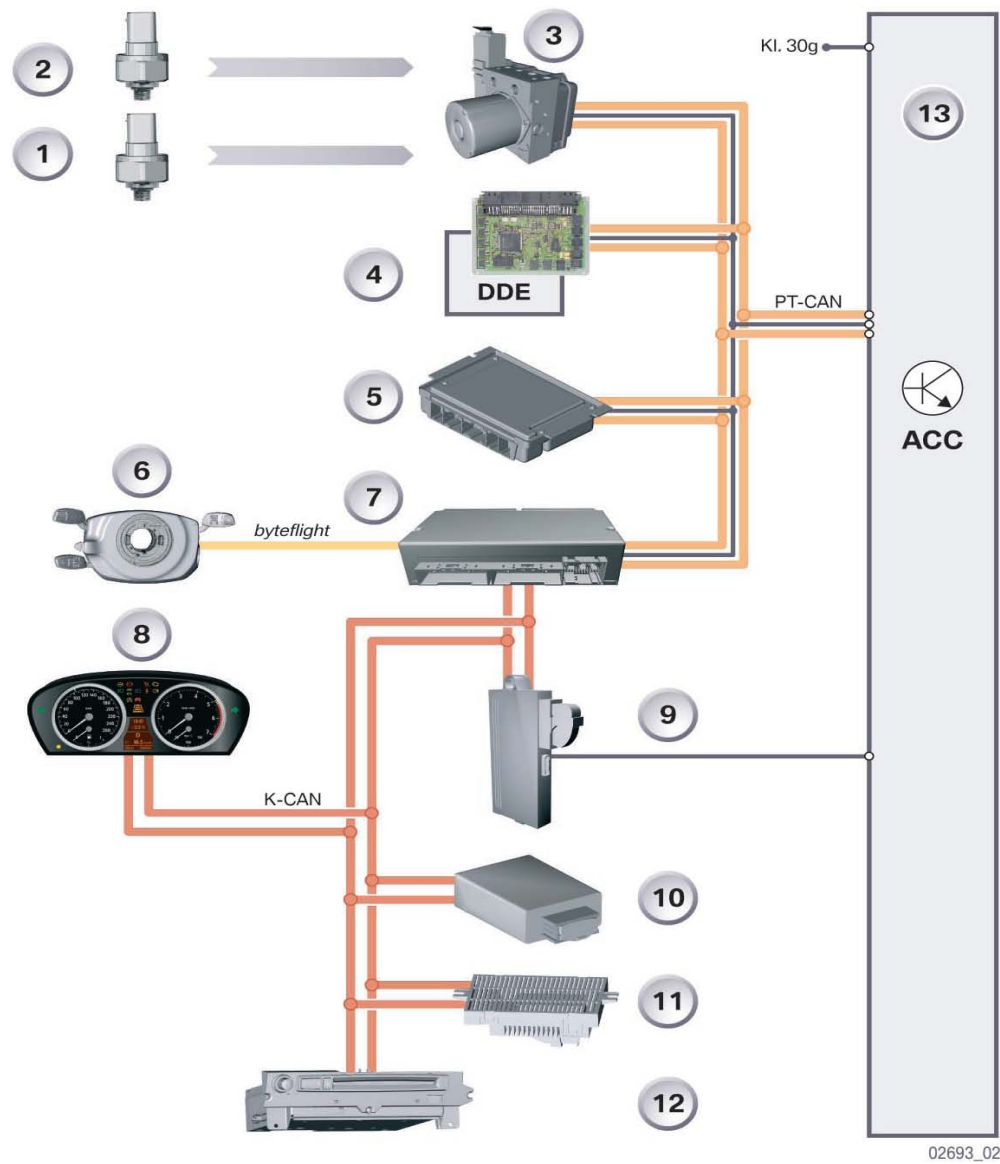
During initialization, the CC message "RDC initialization in progress" is displayed in the instrument cluster.

If wheel position assignment has not been completed, when the RDC menu is called up in the CID, the wheels will be shown in black and the pressures will not be displayed.

# Active Cruise Control

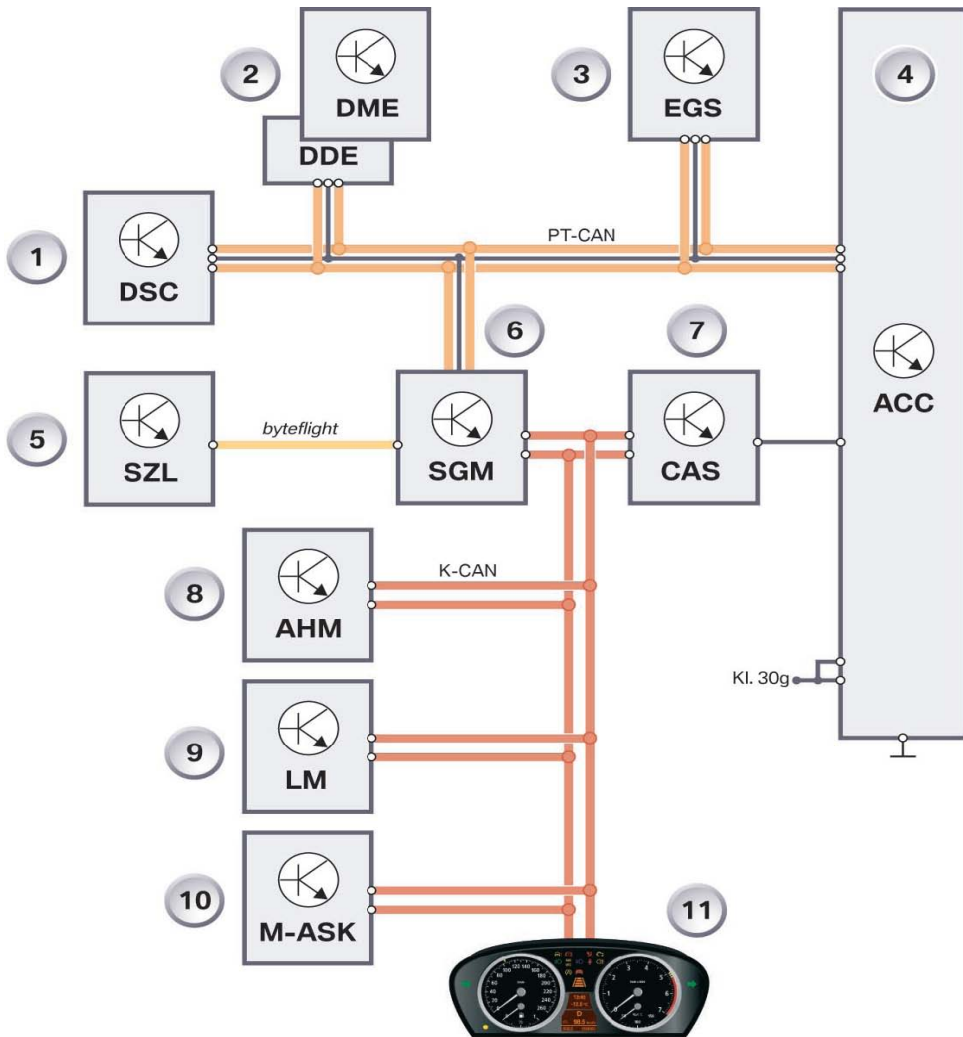
The Active Cruise Control system (ACC) is the same as that in the E65.

## -System overview



Index	Explanation	Signal
1	Pressure sensor, rear brake circuit	Brake pressure
2	Pressure sensor, front brake circuit	Brake pressure
3	DSC module	Brake pressure, speed signal
4	Digital motor electronics or digital diesel electronics DDE	Power reduction
5	Electronic transmission control unit	Gear stages
6	Steering column switch cluster	Steering angle
7	Safety and gateway module	Diagnostics, signal nodal point
8	Instrument cluster	Display, warning lights
9	Car Access System	Wake-up signal
10	Trailer module	Trailer status
11	Light module	Brake light activation
12	Multi Audio System Controller	Navigation data
13	ACC control unit	
PT-CAN	Powertrain CAN	
K-CAN	BodysheIl CAN	
<i>byteflight</i>	<i>byteflight</i>	
Kl. 30g	Terminal 30g	

-System circuit diagram



02706\_02

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Digital motor electronics (DME) or digital diesel electronics (DDE)
3	Electronic transmission control (EGS)
4	Active Cruise Control (ACC)
5	Steering column switch cluster (SZL)
6	Safety and gateway module (SGM)
7	Car Access System (CAS)
8	Trailer module AHM
9	Light module (LM)
10	Multi Audio System Controller (M-ASK)
11	Instrument cluster
PT-CAN	Powertrain CAN
K-CAN	Bodyshell CAN
<i>byteflight</i>	<i>byteflight</i>
Kl. 30g	Terminal 30g



## -System functions

The system functions are described in the Active Cruise Control training document. The ACC has the following defining properties:

- Operated from a steering column stalk
- Statuses are shown in the instrument cluster display
- Four selectable increment stages
- Speed preselection in 1 km/h stages
- Sheet steel bracket in the E60 with plastic intermediate holder for the  
sensor control unit
- Audible instructions to the driver have been omitted

LAUNCH

## Exterior lights

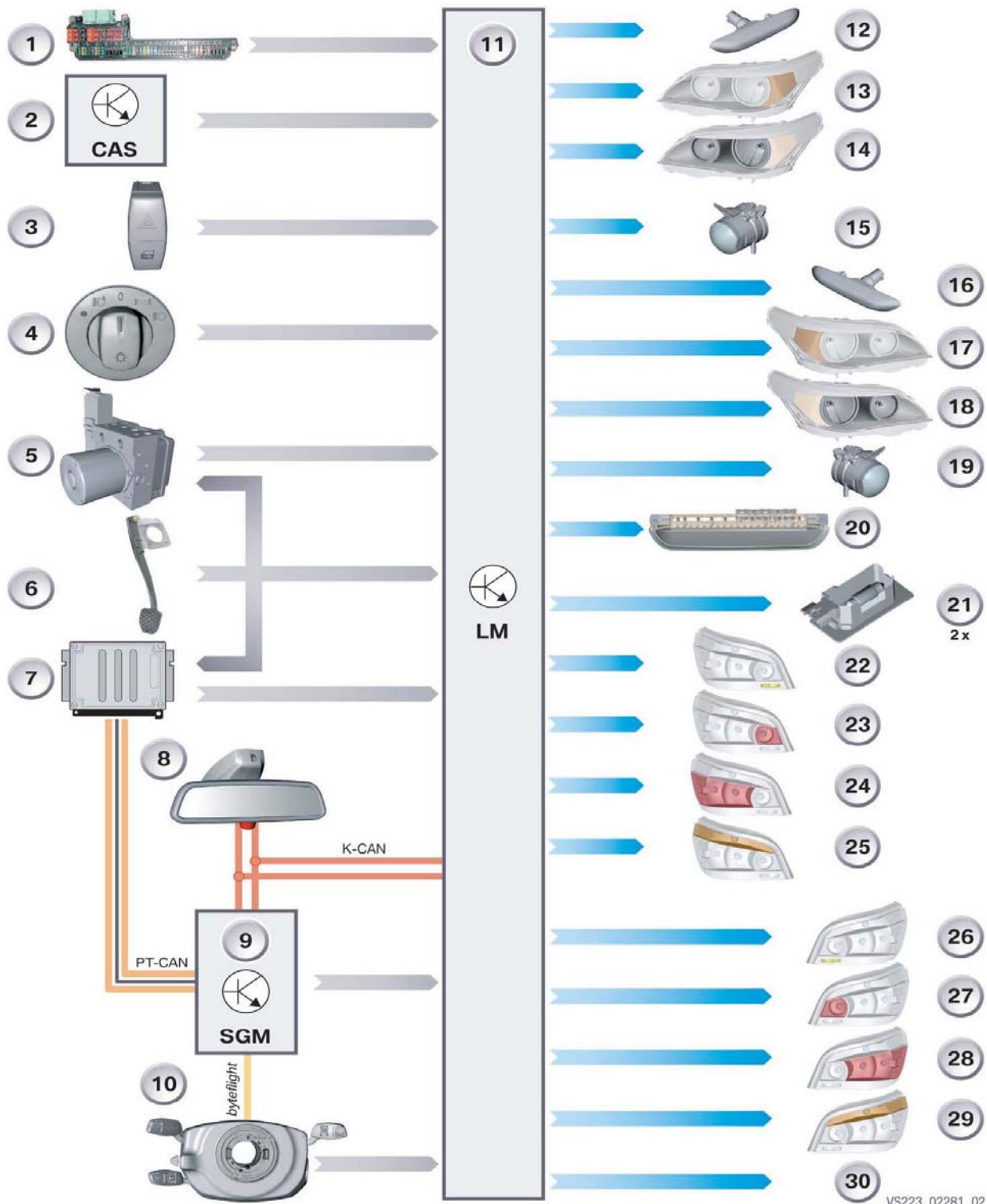
The exterior lighting is based on the exterior lighting of the E65.

The exterior lighting of the E60 is available in the following versions:

- Basic version with halogen headlights
- Option 522 with bi-xenon headlights
- Option 524 Adaptive cornering light with bi-xenon headlights

LAUNCH

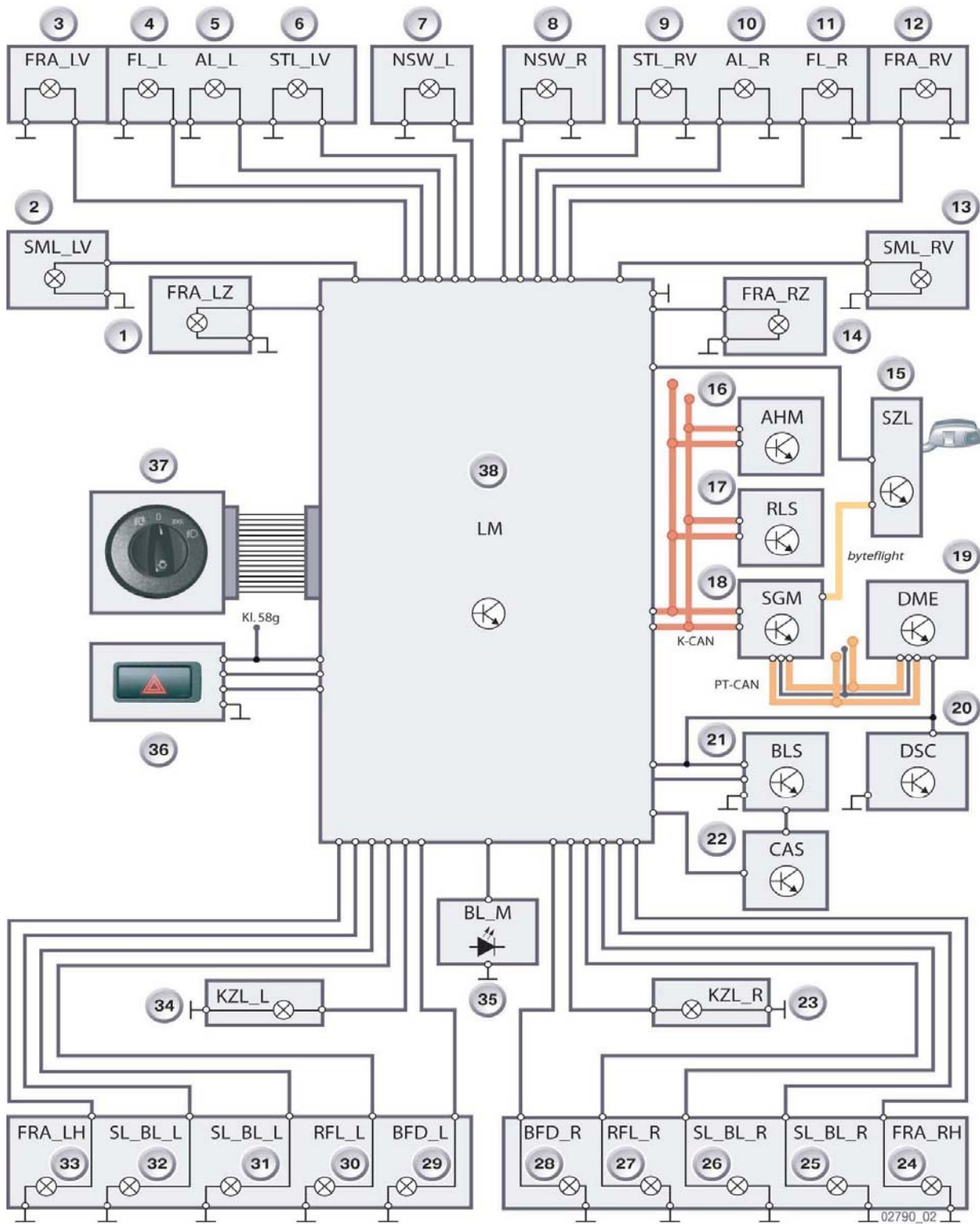
-System overview



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Index	Explanation	Index	Explanation
1	Current distributor, front	19	Front fog light, right
2	Car Access System (CAS)	20	Raised brake light
3	Centre-lock button	21	Licence plate light
4	Light Switch	22	Reversing light, left
5	Dynamic Stability Control	23	Tail light, left
6	Brake pedal switch	24	Brake light, left
7	Digital motor electronics	25	Direction indicator light, rear left
8	Rain and light sensor	26	Reversing light, right
9	Safety and gateway module SGM	27	Tail light, right
10	Steering column switch cluster	28	Brake light, right
11	Light module (LM)	29	Direction indicator light, rear right
12	Direction indicator repeater, front left	30	Signal, terminal 58g
13	Direction indicator light, front left	29	Direction indicator light, rear right
14	Headlight, left	30	Signal, terminal 58g
15	Front fog light, left	<b>byteflight</b>	<b>byteflight</b>
16	Direction indicator repeater, front right	K-CAN	Bodyshell CAN
17	Direction indicator light, front right	PT-CAN	Powertrain CAN
18	Headlight, right		

-System circuit diagram



Index	Explanation	Index	Explanation
1	Direction indicator repeater, left FRA_LZ	12	Direction indicator light, front right FRA_RV
2	Side marker light, front left SML_LV	13	Side marker light, front right SML_RV
3	Direction indicator light, front left FRA_LV	14	Direction indicator repeater, front right FRA_RZ
4	High beam, left FL_L	15	Steering column switch cluster (SZL)
5	Low beam, left AL_L	16	Trailer module AHM
6	Side light, front left STL_LV	17	Rain and light sensor (RLS)
7	Front fog light, left NSW_L	18	Safety and gateway module SGM
8	Front fog light, right NSW_R	19	Digital motor electronics (DME)
9	Side light, front right STL_RV	20	Dynamic Stability Control (DSC)
10	Low beam, right AL_R	21	Brake pedal switch BLS
11	High beam, right FL_R	22	Car Access System (CAS)

Index	Explanation	Index	Explanation
23	Licence plate light, right KZL_R	33	Direction indicator light, rear left FRA_LH
24	Direction indicator light, rear right FRA_RH	34	Licence plate light, left KZL_L
25	Tail light/brake light, right SL_BL_R	35	Raised brake light BL_M
26	Tail light/brake light, right SL_BL_R	36	Hazard warning switch
27	Reversing light, right RFL_R	37	Light Switch
28	Brake force display, right BFD_R	38	Light module (LM)
29	Brake force display, left BFD_L	<b>byteflight</b>	<b>byteflight</b>
30	Reversing light, left RFL_L	K-CAN	Bodyshell CAN
31	Tail light/brake light, left SL_BL_L	PT-CAN	Powertrain CAN
32	Tail light/brake light, left SL_BL_L	Kl. 58g	Terminal 58g

## -Components

Each light voltage is dimmed by the light module. The dimming compensates for fluctuations in the vehicle electrical system.

### Front lights

Power output ratings for the front lights in the EU version:

Light	Quantity	Output	Output max	Voltage
Side light	4	5W	20 W	13.5 V
Low beam	2	55 W	110 W	12.8 V
High beam	2	60 W	120 W	13.5 V
Direction indicator	4	21 W	84 W	13.5 V
Direction indicator repeater	2	5W	10 W	13.5 V
Fog lights	2	55 W	110 W	13.5 V

### Bi-xenon lights

Power output ratings of the bi-xenon lights in the EU and US versions:

Light	Quantity	Output	Output max	Voltage
Side light	2	10 W	20 W	12.7 V
High beam	2	55 W	110 W	12.8 V
Bi-xenon light	2	35 W	70 W	Vehicle voltage
Direction indicator	4	21 W	84 W	13.5 V
Direction indicator repeater	2	5W	10 W	11.7 V
Fog lights	2	55 W	110 W	13.5 V
Side marker light	2	5 x LED	0.5 W	13.5 V



## Tail lights

Power output ratings for the tail light clusters in the EU version:

Light	Quantity	Output	Output max	Voltage
Tail light/ brake light	2	10 W	20 W	Dimmed 13.5 V
Tail light/ brake light	2	21 W	42 W	Dimmed 13.5 V
Raised brake light	1	10 W	20 W	Vehicle voltage
Reversing light	2	21 W	42 W	13.5 V 13.5 V
Direction indicator	2	20 LEDs	0.5 W	13.5 V
Rear fog light	2	16 W	32 W	
		21 W	42 W	
		21 W	42 W	

Power output ratings for the tail light clusters in the US version:

Light	Quantity	Output	Output max	Voltage
Tail light brake light	2	10 W 21 W	20 W 42 W	Dimmed 13.5 V
Tail light/ brake light/ side marker light	2	10 W 21 W	20 W 42 W	Dimmed 13.5 V
Brake force display	2	21 W	42 W	13.5 V
Raised brake light	1	20 LEDs	0.5 W	Vehicle voltage
Reversing light	2	16 W	32 W	13.5 V
Direction indicator	2	21 W	42 W	13.5 V

### Light switch with control panel unit

The light switch and operating unit are fitted such that they are remote from the light module. The light module and the light switch are connected by means of a ribbon cable.

### Brake light switch

The car access system supplies the brake light switch with voltage. Among other things, the brake light switch provides the brake signal for the light module.

### Reverse

On manual transmission vehicles, the signal is made available via a switch from the gear selector lever. The light module controls the reversing lights accordingly.

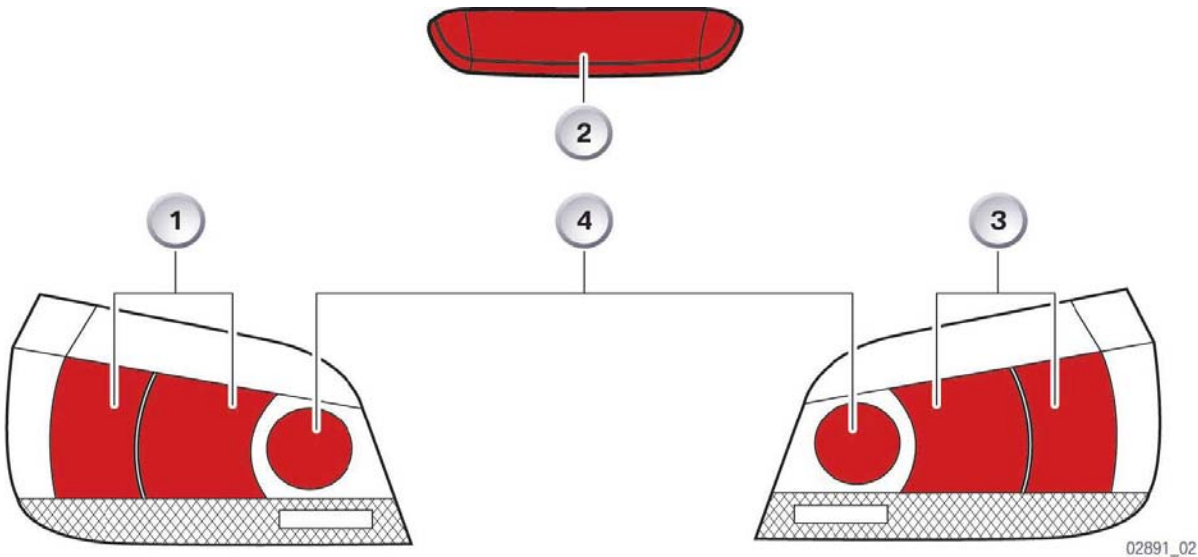
On automatic transmission vehicles, the signal is made available by the transmission control unit via the PT-CAN.

The signals for reverse gear and the brake light are made available to other subscribers by the light module via the K-CAN.

## Brake force display

The BFD is currently used in the US version.

The segments of the rear fog light are used as the BFD as of a deceleration of 5 km/h.



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Index	Explanation	Index	Explanation
1	Brake light segments, left Raised	3	Brake light segments, right Brake
2	brake light	4	force display

## -Service information

In the E60, the light switch contributes to improved protection for the occupants. This increased level of protection is achieved by artificially enlarging the impact surface of the light switch.

In the event of an accident, a person sitting behind the steering wheel could knock against the light switch with his/her knee for instance. While retaining full functionality, the light switch can be shifted towards the rear. This increases the impact surface about the light switch.

After being pressed back, the light switch must be pulled out to move it into the forward position again.

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LAUNCH

## Adaptive cornering light AHL

The BMW option (SA) 524 Adaptive cornering light AHL will be phased in from 03/03. The option 524 requires the following options:

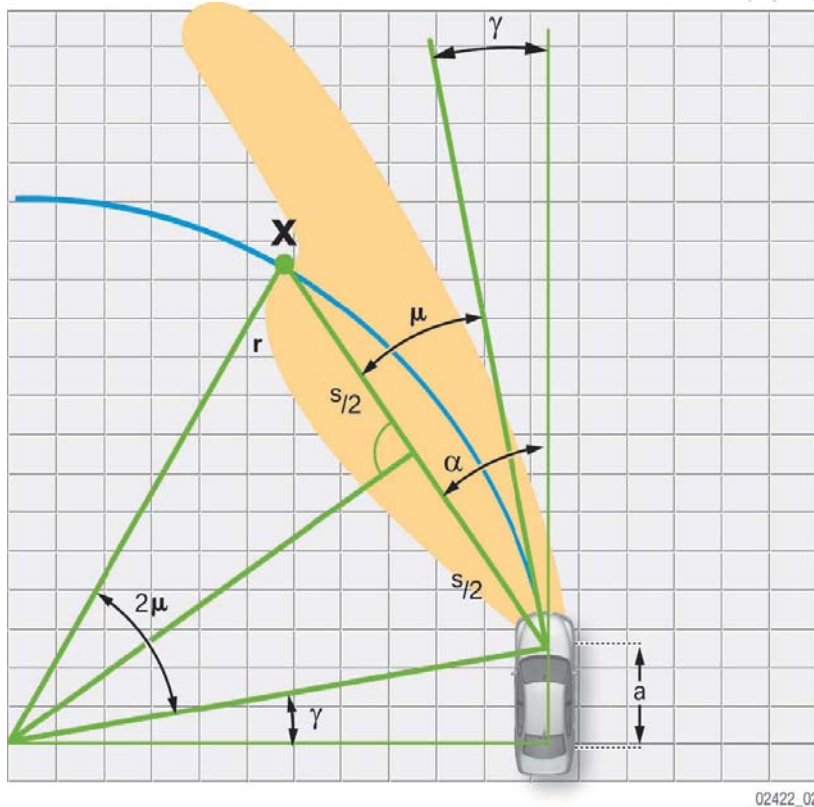
-Headlight washer system SA 502

-Bi-xenon headlight SA 522

The adaptive cornering light facility enables the bi-xenon dipped and main beam lights to swivel during cornering.

-Swivel range boundaries

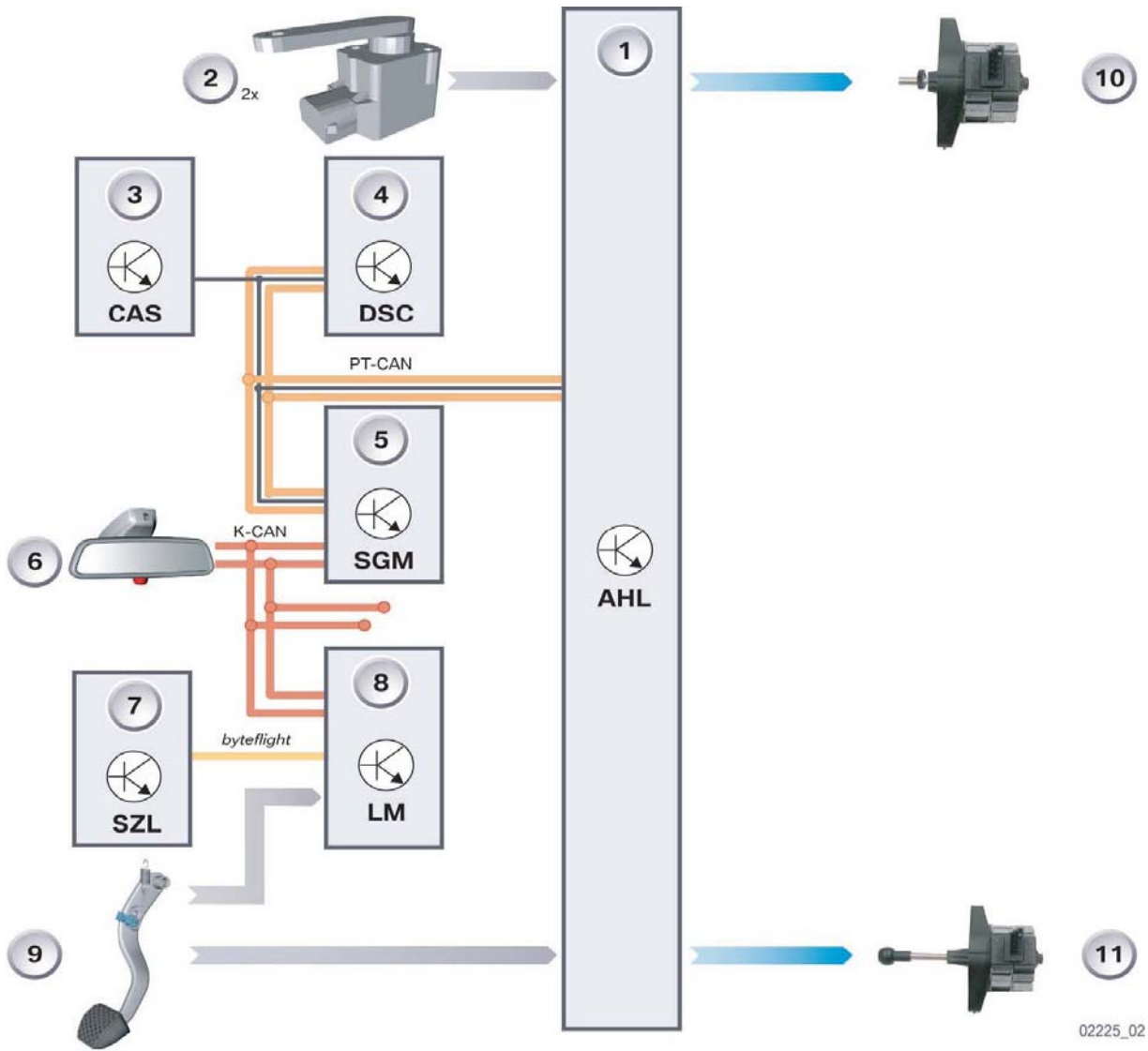
Permissible swivel range for left-hand cornering when driving on the right



Index	Explanation
a	Wheelbase
h	Headlight height
$\gamma$	Angle of wheel lock
$\mu$	Angle between direction to point X and direction of turned wheels
$\alpha$	Maximum permissible swivel angle of bi-xenon module
s	Distance between vehicle and point of intersection of salient point with road
r	Radius of vehicle movement
X	Point of intersection between r and s

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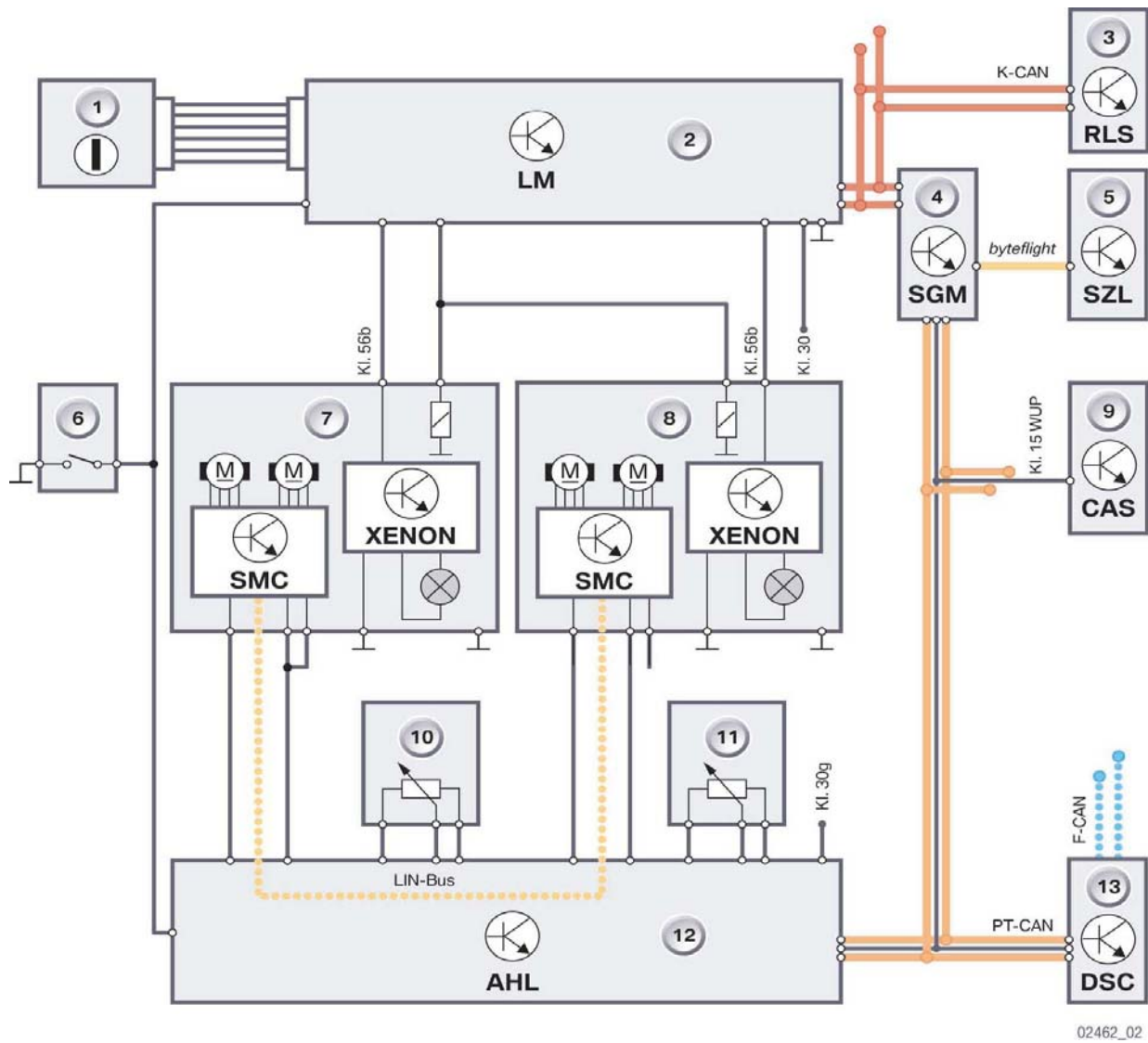
-System overview



Index	Explanation	Index	Explanation
1	Adaptive cornering lights (AHL)	8	Light module (LM)
2	Level sensor, front Level sensor, rear	9	Brake light switch
3	Car Access System (CAS)	10	Stepper motor for vertical swivel action
4	Dynamic Stability Control (DSC)	11	Stepper motor for headlight vertical aim control
5	Safety and gateway module (SGM)	PT-CAN	Powertrain CAN
6	Rain and light sensor	K-CAN	Bodyshell CAN
7	Steering column switch cluster (SZL)	<b>byteflight</b>	<b>byteflight</b>



# -System circuit diagram



Index	Explanation	Index	Explanation
1	Light Switch	10	Level sensor, front
2	Light module (LM)	11	Level sensor, rear
3	Rain and light sensor (RLS)	12	Adaptive cornering lights (AHL)
4	Safety and gateway module (SGM)	13	Dynamic Stability Control (DSC)
5	Steering column switch cluster (SZL)	<b>byteflight</b>	<b>byteflight</b>
6	Brake light switch	F-CAN	Chassis CAN
7	Left swivel module including stepper motor controller SMC, bi-xenon control unit XENON and high beam shutter	K-CAN	Bodyshell CAN
8	Right swivel module including stepper motor controller SMC, bi-xenon control unit XENON and high beam shutter	PT-CAN	Powertrain CAN
9	Car Access System (CAS)	Kl. 30g	Terminal 30g

## -Components

The AHL control unit is linked to the following components:

- Front and rear level sensor
- Brake pedal switch
- Steering angle sensor
- Yaw rate sensor
- DSC control unit, supplies speed signal
- Car Access System
- Safety and gateway module
- Light module
- Steering column switch cluster
- Swivel module for bi-xenon headlights
- Stepper motor controller
- Stepper motors for AHL and steering angle sensor (LWR)
  
- LIN bus

## Control unit for adaptive cornering light

The AHL control unit is the master control unit for vertical and horizontal adjustment of the bi-xenon headlights. The stepper motor controllers actuate the stepper motors of the bi-xenon headlights.

## Installation location

The AHL control unit is installed on the carrier plate behind the glove compartment.

## -System functions

To ensure its operability, the cornering light system (AHL) must be adapted to the vehicle-specific data.

The vehicle-specific data are entered in the AHL control unit and in the SMC.

## Switch-on conditions

The AHL control unit activates on the SMCs when the "side light ON" or "engine running" signals are detected. The AHL system is ready for operation following a reference run.

## Switch-off conditions

When the "side light ON" and "engine running" signals are no longer applied, the AHL control unit sends the request to assume the off position to the SMCs via the LIN bus. On reaching the off position of both headlights, the SMCs send an acknowledgment to the AHL control unit. On receiving the acknowledgment, the AHL control unit switches off the SMCs.

## Horizontal adjustment

The AHL control unit makes use of the following signals for the purpose of horizontally adjusting the bi-xenon headlights:

-Steering angle

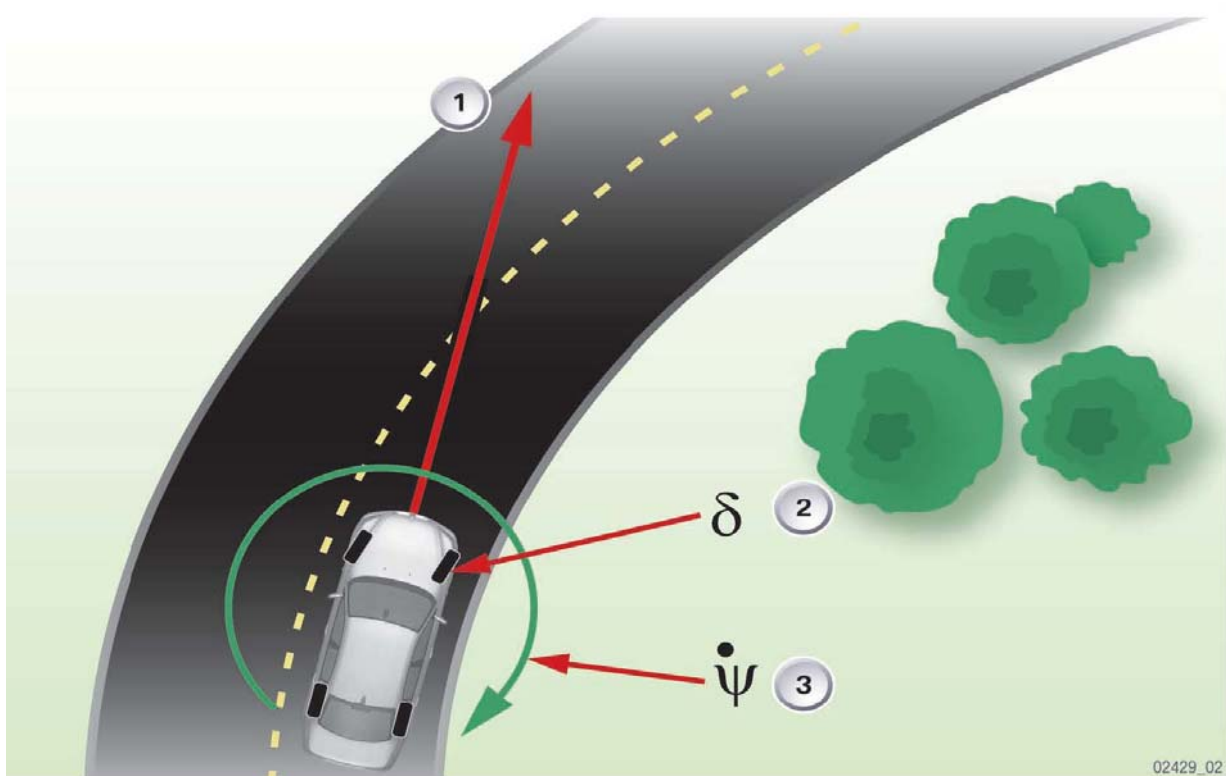
-Road speed

-Yaw rate

Under normal driving conditions, the AHL is controlled by the data from the steering angle sensor up to a speed of approx. 40 km/h. The yaw rate sensor is included in the calculation

- at speeds higher than approx. 40 km/h
- in the event of vehicle oversteering or understeering
- when the vehicle tends to yaw

The vehicle oversteering/understeering or yawing is detected by means of the steering angle sensor and the yaw rate sensor. The AHL system is deactivated in the event of the vehicle oversteering/understeering or yawing. The bi-xenon module moves back to its rest position.



Index	Explanation	Index	Explanation
1	Vehicle speed	3	Yaw rate $\psi$
2	Steering angle $\delta$		

## AHL headlight module

The AHL headlight module contains the following components:

- Position sensor
- Stepper motor controller SMC
- Stepper motor for vertical and horizontal adjustment of the bi-xenon module
- Bi-xenon control unit

The SMC has the following functions:

- Receipt and evaluation of information relating to the reference run and target position command as well as diagnosis requests sent by the AHL control unit via the LIN bus
- Power control of the stepper motors in accordance with received messages
- Actuation of stepper motors
- Position acquisition of bi-xenon modules
- Sensors for referencing
- Position feedback of bi-xenon modules to the AHL control unit
- Diagnosis
- Feedback of diagnosis data to the AHL control unit

## Swivel range $\alpha$

The swivel angle is 15°.

## Position feedback via position sensor

The position feedback of the bi-xenon module is provided by a position sensor. In zero position, the bi-xenon module assumes a defined position with respect to the position sensor.

During adjustment of the headlight modules, the position sensor receives a defined position with respect to the optical axis.

The position of the bi-xenon module is detected inductively by the position sensor and processed further electronically. Close to the zero position, the position sensor supplies a defined pulse width-modulated output signal. The clock rate of the PWM signal is in base position 50:50.

## Adaptation and calibration

The sensor setting is adapted to the corresponding swivel module by the headlight manufacturer.

## Input and output signals

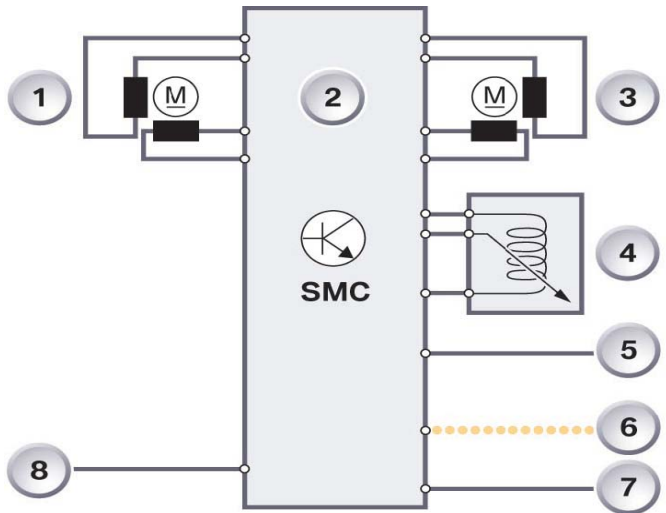
The mechanical angle at the bi-xenon module serves as the only input value for the position sensor.

With the aid of an electronic circuit, this angle is converted to a pulse width-modulated output signal.

The sensor signal is read out during diagnosis. The sensor is defective if no signal is applied.

### Stepper motor controllers SMC

The stepper motor controllers control and regulate the stepper motors of the AHL as well as the headlight vertical aim control LWR.



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Index	Explanation	Index	Explanation
1	Stepper motor AHL	5	Coding pin for right/left
2	Stepper motor controller	6	LIN bus
3	Stepper motor LWR	7	Voltage supply +
4	Position sensor	8	Ground

### Positive swivel direction

Actuation of the swivel motor in positive direction of the bi-xenon module corresponds to swivelling to the right.



## Mechanical reference point

The maximum and minimum positions represent the mechanical stops of the bi-xenon module. The mechanical stops are defined by the design of the headlights.

## PWM signal of the position sensor over travel range

A differential angle is required when the position of the bi-xenon module is not known. A hard reference run must be performed if the position is not known.

It is assumed that the mechanical reference point is always reached during the hard reference run.

## Optical axis

The term optical axis refers to the swivel position at which the headlight module is aligned in the direction of the longitudinal axis of the vehicle. The angle  $0^\circ$  is assigned to this position.

## Headlight swivel range

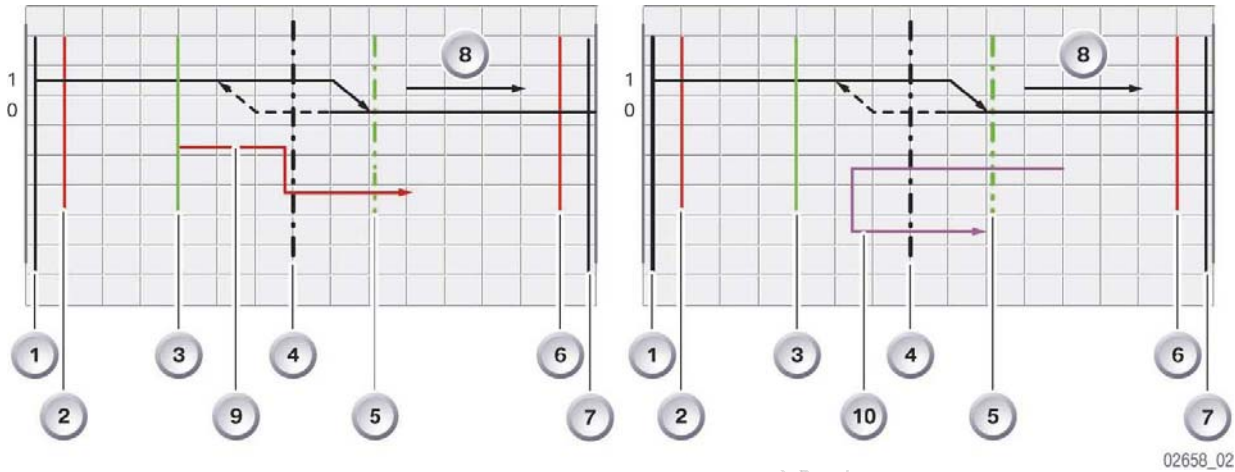
The bi-xenon module is normally not moved right up to the mechanical stop in negative and positive direction but rather up to an electrically determined minimum and maximum.

## Position sensor

The zero position of the bi-xenon module with respect to the position sensor is detected by a 1/0 edge when swivelling from the direction of the off position in the direction of the optical axis.

The bi-xenon module is repeatedly calibrated during operation based on this "soft" reference point.

To avoid a hysteresis during calibration, the bi-xenon module always moves from the same side over the position sensor. When on the other side, it passes over the position sensor without calibration (signal goes from 0 to 1) and then returns from the correct side for calibrating to the zero position (signal goes from 1 to 0).



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Index	Explanation	Index	Explanation
1	Mechanical stop	6	Electric stop, maximum
2	Electric stop, minimum	7	Mechanical stop
3	OFF position	8	Positive swivel direction
4	Zero position	9	Reference run from left
5	Position of optical axis = 0	10	Reference run from right

**Front and rear level sensor**

The signals of the level sensors are used for the headlight vertical aim control LWR.

**Brake pedal switch**

The signal of the brake pedal switch is used for the headlight vertical aim control (LWR).

**Steering angle sensor**

The calculated value of the signals from the steering angle sensor are used for the purpose of swivelling the bi-xenon modules.

On vehicles equipped with the active steering option, the total steering angle sensor assumes the task of specifying the steering angle of the wheels.

**Rain and light sensor (RLS)**

The signals from the rain and light sensor are used to switch on the bi-xenon headlights in the automatic low beam control function AFC.

**Dynamic Stability Control (DSC)**

The DSC supplies the signals for the yaw rate, steering angle and the speed to the AHL.

## AHL activation

When the light switch is set to automatic low beam control (FLC), the AHL is switched on together with the low beam headlight. The conditions for switching on the AHL are: -Terminal 15 active or engine running  
-Light switch in automatic low beam control position -RLS detects darkness -Both bi-xenon headlights are intact

The AHL control unit receives information relating to the lamp status from the light module.

## Function indicator

The function of the AHL is indicated by the FLC LED lighting permanently.

A fault in the AHL system is indicated by the FLC LED flashing with the AHL active.

The low beam headlight and the headlight vertical aim control (LWR) remain active in the case of fault.  
The swivel function of the bi-xenon modules is deactivated.

A reference run is performed during every new start. If a defect is found, the bi-xenon headlights are switched off to ensure oncoming traffic cannot be dazzled. The fog lights are switched on as a substitute function.

## -Service information

The following jobs can be carried out on the AHL system:

- To replace the AHL control unit
- To replace the SMC control unit
- To replace bi-xenon headlights
- To retrofit bi-xenon headlights

## Repairs

Various repairs may be necessary during the course of vehicle's service life. As a consequence of repair work, it may be that the system parts for the AHL are installed with different software and hardware versions.

In each case, the replaced components must be adapted to the specific requirements of the vehicle.

### To replace the AHL control unit

After replacing an AHL control unit, it is necessary to enter the vehicle identification number and to encode the control unit depending on specific vehicle data.

The complete AHL function will not be operative if adaptation to the vehicle is not performed.

## Replacing SMC

After replacing the SMC, it is necessary to enter the vehicle identification number and headlight-dependent coding in the SMC control unit.

The complete AHL function will remain inoperative if this adaptation is not performed.

Particular care must be taken when replacing the SMC to ensure that the housing seal of the SMC is fitted correctly.

## To replace bi-xenon headlights

After replacing the bi-xenon headlights, it is necessary to encode the corresponding SMC depending on the headlights.

If this adaptation is not performed, the function will appear to be operative but not correct. The swivel range and zero point can vary from vehicle model to vehicle model and the bi-xenon headlight can have a different status!

The headlights must be adjusted and checked.

## -Diagnosis

The AHL system must be set to diagnosis mode in order to perform the following jobs:

-Read out of relevant bus signals with vehicle stationary

Road speed

Yaw rate

Steering angle

-Checking signal plausibility

-Checking that conditions for activation are fulfilled

Rain and light sensor status

Light switch status

Missing or non-plausible BUS signals are stored in the form of fault codes in the AHL control unit. The types of fault are stored in the SMC.

The SMCs are accessed via the AHL control unit.

## Interior lighting

The interior lights of the E60 are automatically controlled by various inputs.

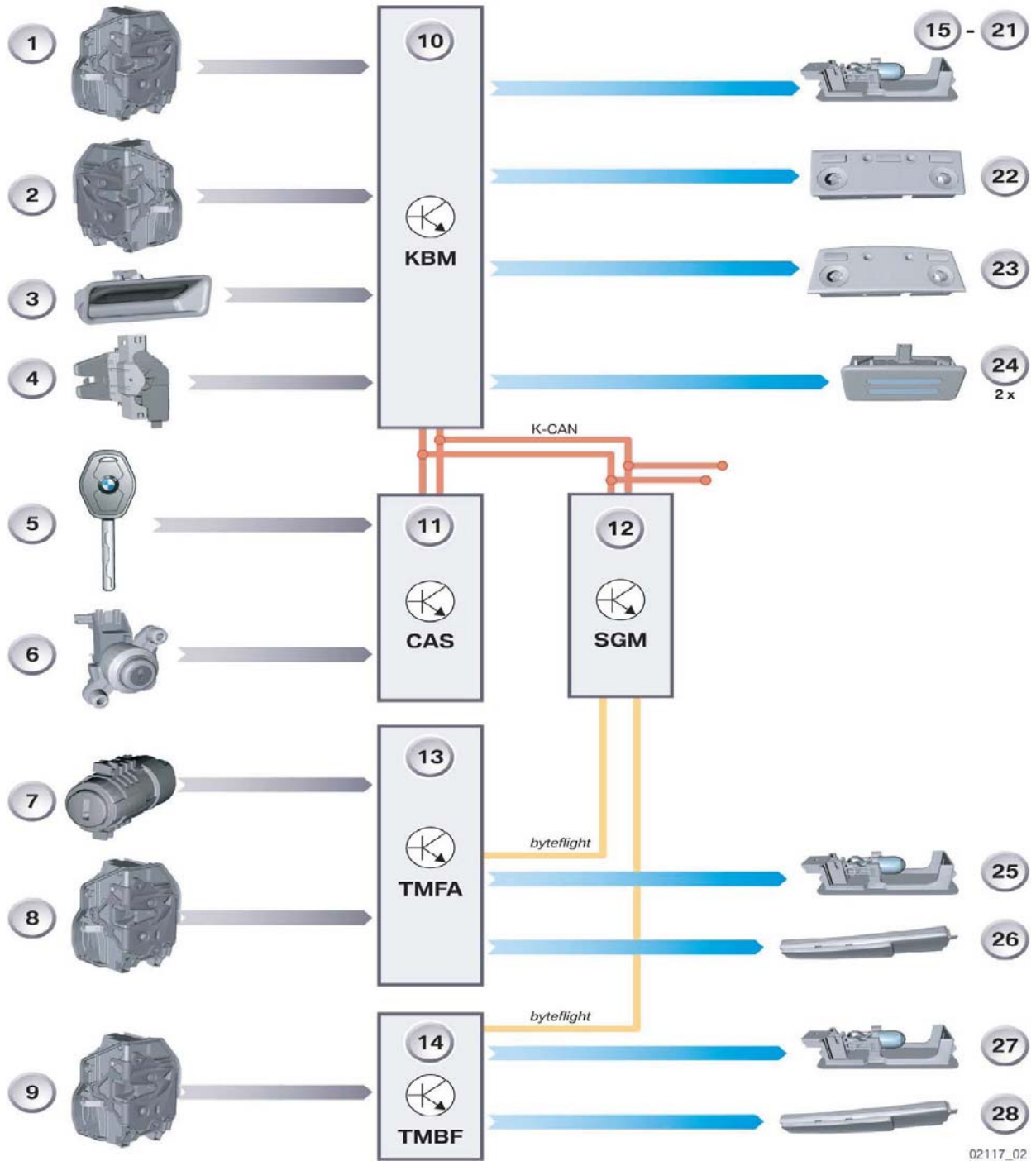
The interior lights are pulse width-modulated.

The interior lights are available in the following equipment packages:

Standard	Option, lights package SA 564
Interior/reading lights, front	Front-area light in wing mirror
Interior/reading lights, rear	Door-opener lights, front and rear, by means of wide-diffusing LEDs
Vanity mirrors, left/right	Footwell light, front, in instrument-panel lower trim
Luggage-compartment light	Door exit lights, rear
Door exit lights, front	Door compartment lights, front and rear
Glove box lighting	



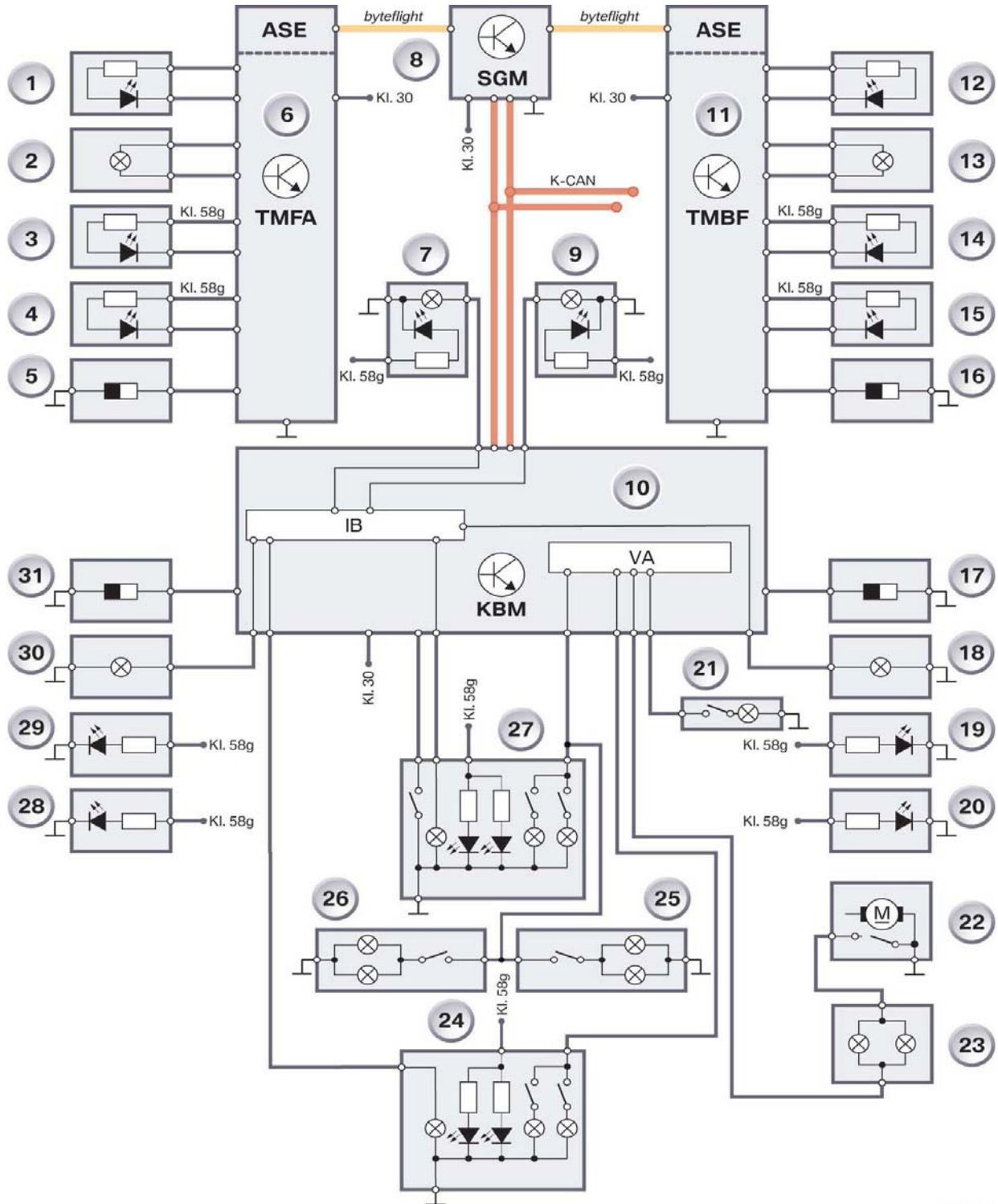
-System overview



02117\_02

Index	Explanation	Index	Explanation
1	Door contact, rear driver's side door	16	Footwell light, passenger, front
2	Door contact, rear passenger's side door	17	Glove box lighting
3	Button, boot lid, exterior	18	Exit light, driver, rear
4	Central locking, tailgate	19	Exit light, passenger, rear
5	Remote control	20	Luggage-compartment light
6	Lock cylinder, tailgate	21	Luggage-compartment light
7	Lock cylinder, driver's door	22	Interior/reading lights, front
8	Door contact, driver's door, front, and lock cylinder, driver's door	23	Interior/reading lights, rear
9	Door contact, passenger door, front	24	Vanity light, driver/passenger
10	Body base module (KBM)	25	Exit light, driver's side
11	Car Access System (CAS)	26	Front-area light, driver
12	Safety and gateway module (SGM)	27	Exit light, driver's side
13	Door module TMFA, driver's door, front, front-area light	28	Front-area light, passenger side
14	Door module TMBF, passenger door, front	<b>byteflight</b>	<b>byteflight</b>
15	Footwell light, driver, front	K-CAN	Bodyshell CAN

-System circuit diagram



02129\_02

Index	Explanation	Index	Explanation
1	Front-area lighting	21	Glove box lighting
2	Door exit light	22	Central locking, tailgate
3	Handle-recess light	23	Luggage-compartment light
4	Storage-compartment light	24	Interior/reading lights, rear
5	Door contact, driver's door	25	Vanity-mirror light, passenger
6	Door module TMFA, driver's door, front	26	Vanity-mirror light, driver
7	Footwell light, driver, front	27	Interior/reading lights, front
8	Safety and gateway module (SGM)	28	Storage-compartment light
9	Footwell light, passenger, front	29	Handle-recess
10	Body base module (KBM)	30	light Door exit light
11	Door module TMBF, passenger door, front	31	Door contact, rear driver's side door
12	Front-area lighting	ASE	Advanced Safety Electronics
13	Door exit light	K-CAN	Bodyshell CAN
14	Handle-recess light	<b>byteflight</b>	<b>byteflight</b>
15	Storage-compartment light	Kl. 30	Terminal 30
16	Door contact, passenger door, front	Kl. 58g	Terminal 58 switched
17	Door contact, rear passenger's side door	IB	Interior lighting
18	Door exit light	VA	Consumer shutdown
19	Handle-recess light		
20	Storage-compartment light		

## -System functions

### PWM control

The output is active from terminal 15 with a permanent clocking in a frequency of 100 Hz. In this way the power output is controlled. From a voltage of 12.8 V the pulse width modulation is adjusted in such a way as to provide a power output of 100% as for 12.8 V.

In the case of voltage drops in the vehicle electrical system of up to 1 V, the pulse width modulation is corrected and thus a constant brightness of the lamps connected at the consumer shutdown output is ensured.

Below 12.8 V voltage regulation is no longer corrected. The brightness can fluctuate with the battery voltage level.

### Consumer shutdown terminal

Some loads/consumers such as reading, glovebox and luggage-compartment lights can remain switched on when the car is stopped. In order to protect the battery, these consumers are shut down after a drop at terminal R with a delay of 16 mins. or immediately with the diagnosis telegram.

### Consumer shutdown

Power outputs are made available by the KBM 2 for consumer shutdown.

Output 1:

-Reading lights

-Vanity lights

-Boot

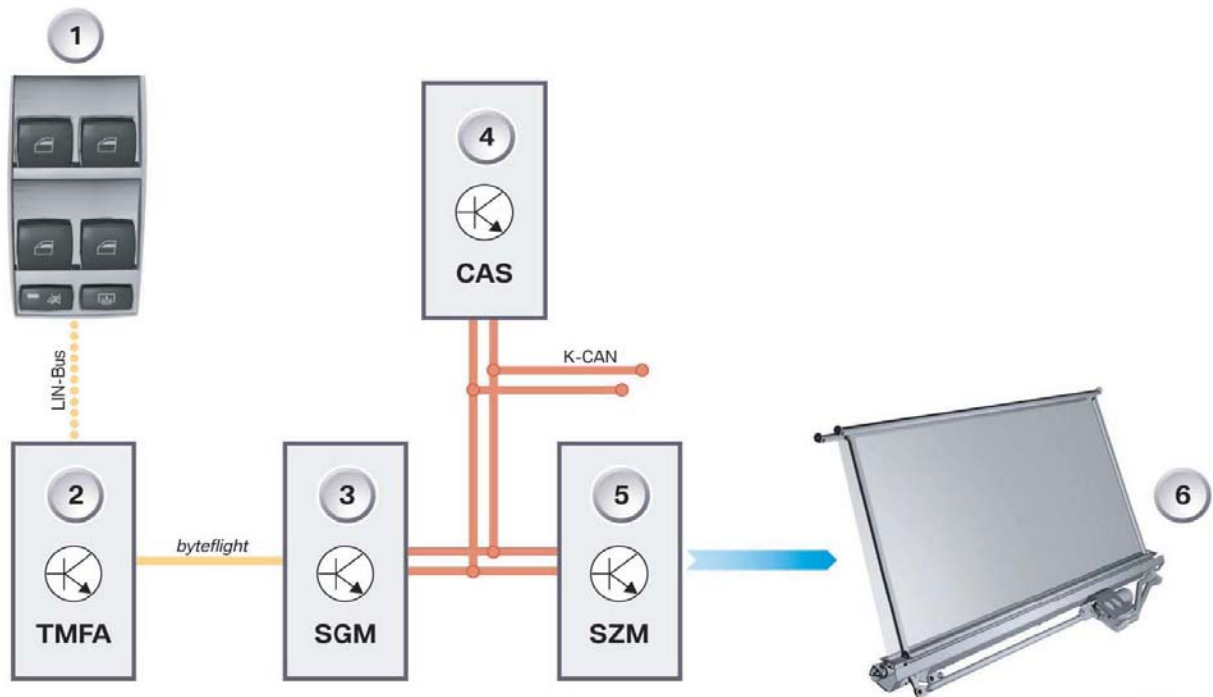
Output 2:

-Glovebox light

## Roller sunblind

An electric roller sunblind (option 415) is available for the rear window of the E60. Mechanical roller sunblinds (option 416) are also available for the side windows of the E60.

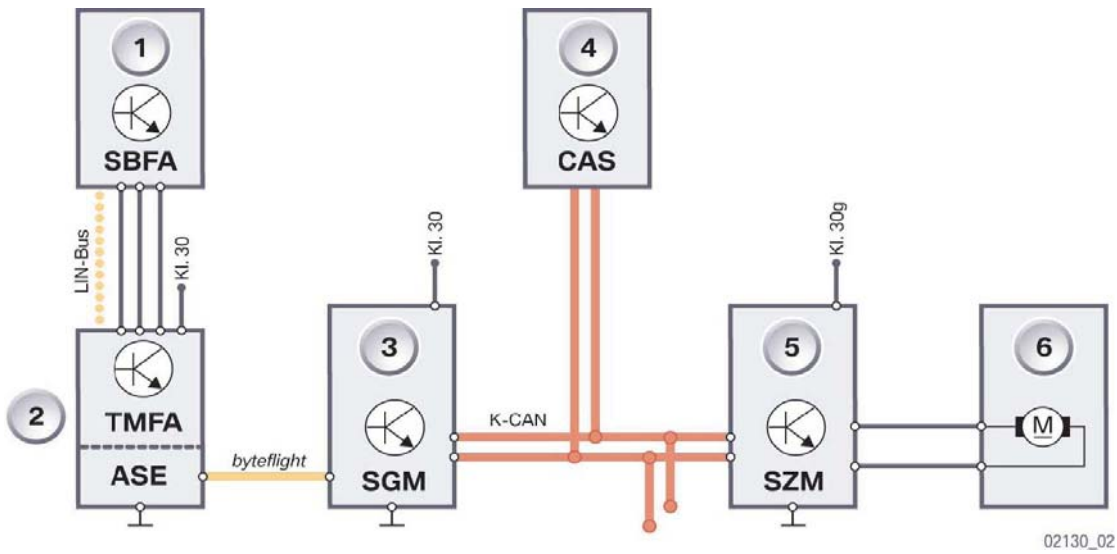
### -System overview



02118\_02

Index	Explanation	Index	Explanation
1	Driver's switch block	6	Roller sunblind
2	Driver's door module (TMFA)	<i>byteflight</i>	<i>byteflight</i>
3	Safety and gateway module	K-CAN	Bodyshell
4	Car access system (CAS)	LIN-Bus	CAN LIN bus
5	Centre console switch centre (SZM)		

-System circuit diagram



Index	Explanation	Index	Explanation
1	Switch block, driver's side (SBFA)	ASE	Advanced Safety Electronics
2	Driver's door module (TMFA)	K-CAN	BodysheIl CAN
3	Safety and gateway module (SGM)	<b>bytflight</b>	<b>bytflight</b>
4	Car access system (CAS)	LIN-Bus	LIN bus
5	Centre console switch centre (SZM)	Kl. 30	Terminal 30
6	Roller sunblind	Kl. 30g	Terminal 30 switched

## -System function

The roller sunblind is operated from the switch in the driver's side switch block.

## Signal curve

The signals from the SBFA to the TMFA are transmitted via the LIN bus. From the TMFA via **byteflight** to the SGM. From the SGM via the SZM to the electric roller sunblind motor.

LAUNCH



## Seats

### Seat variants

Four different basic seat versions are available for the E60.

-Semi-electric basic seat

- standard -Electric basic seat with memory option 459

-Electric sports seat with memory option 481

-Multi-function seat with memory option 456

Provision is also made for the installation of various options:

-Electric seat heater option 494

-Seat ventilation system option 453

-Active seat option 455

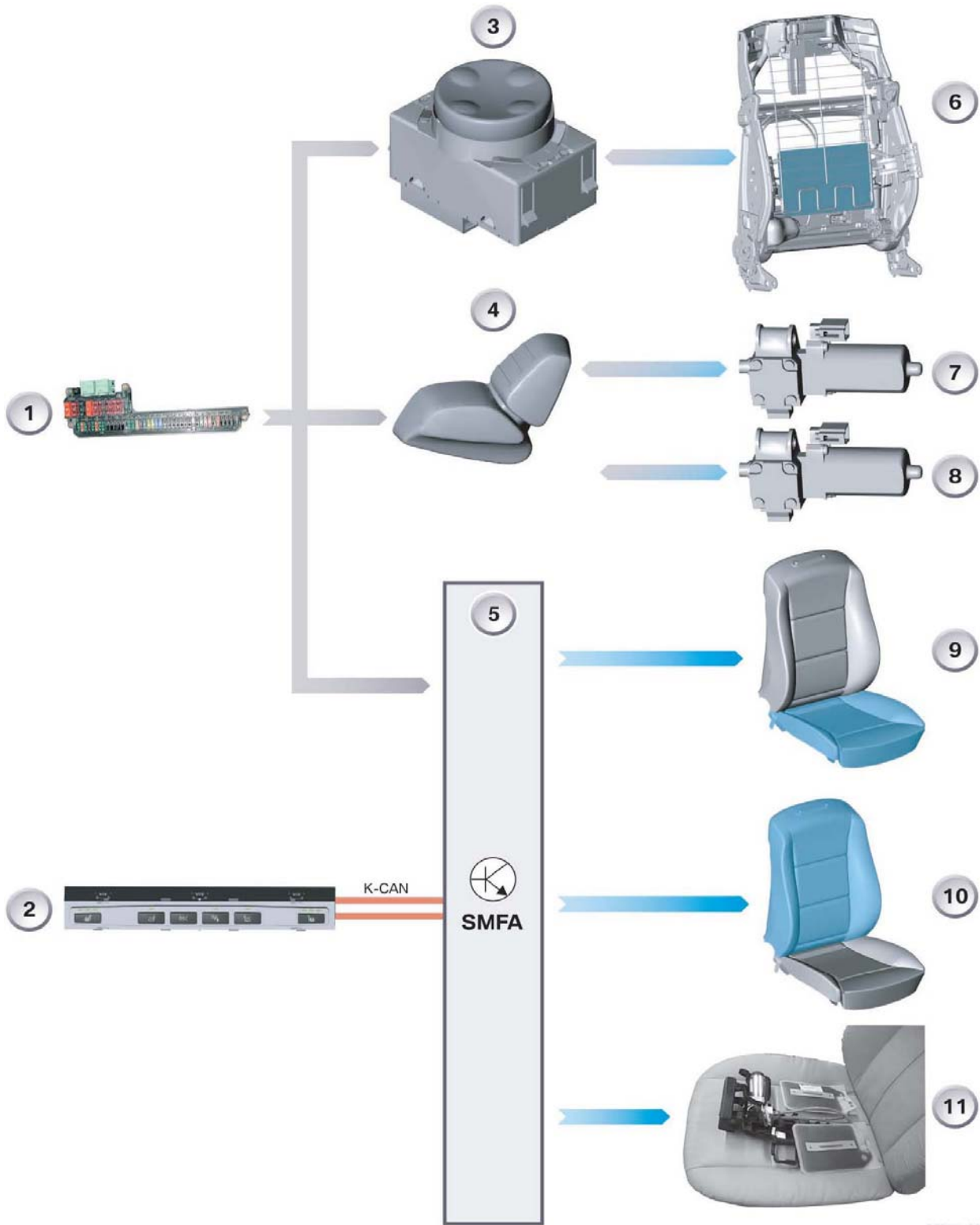
-Lumbar support option 488

## Possible components

The system may comprise the following components:

- Driver's seat control panel
- Passenger seat control panel
- Centre console switch centre
- Car Access System
- K-CAN
- K-bus
- Driver's seat module
- Passenger seat module
- 2 to 8 motors for seat adjustment
- Seat heating -Backrest heating
- Lumbar support pump with 4 valves
- Active seat pump and active seat valve
- Up to 9 fans for the seat ventilation system

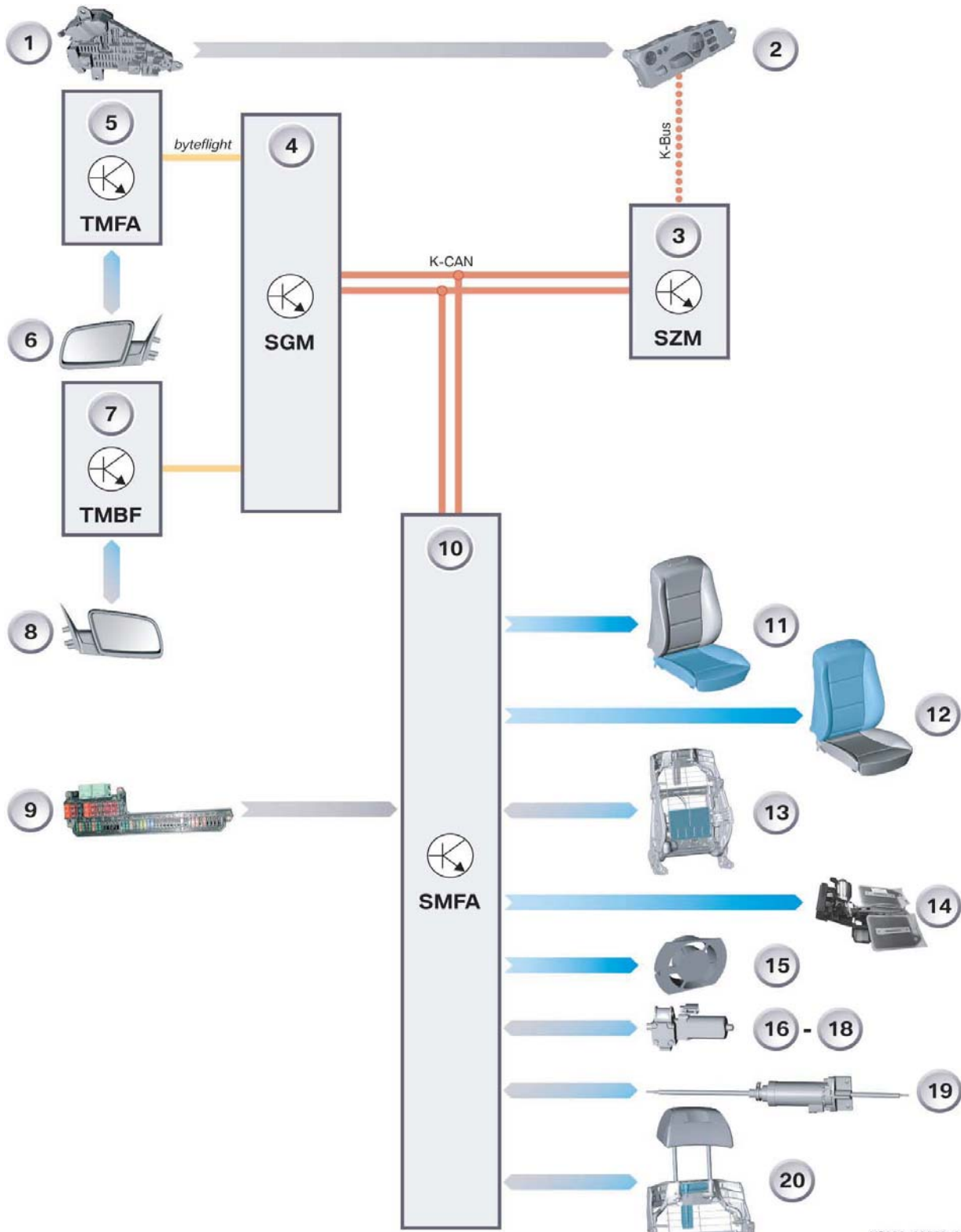
-System overview



02257\_02

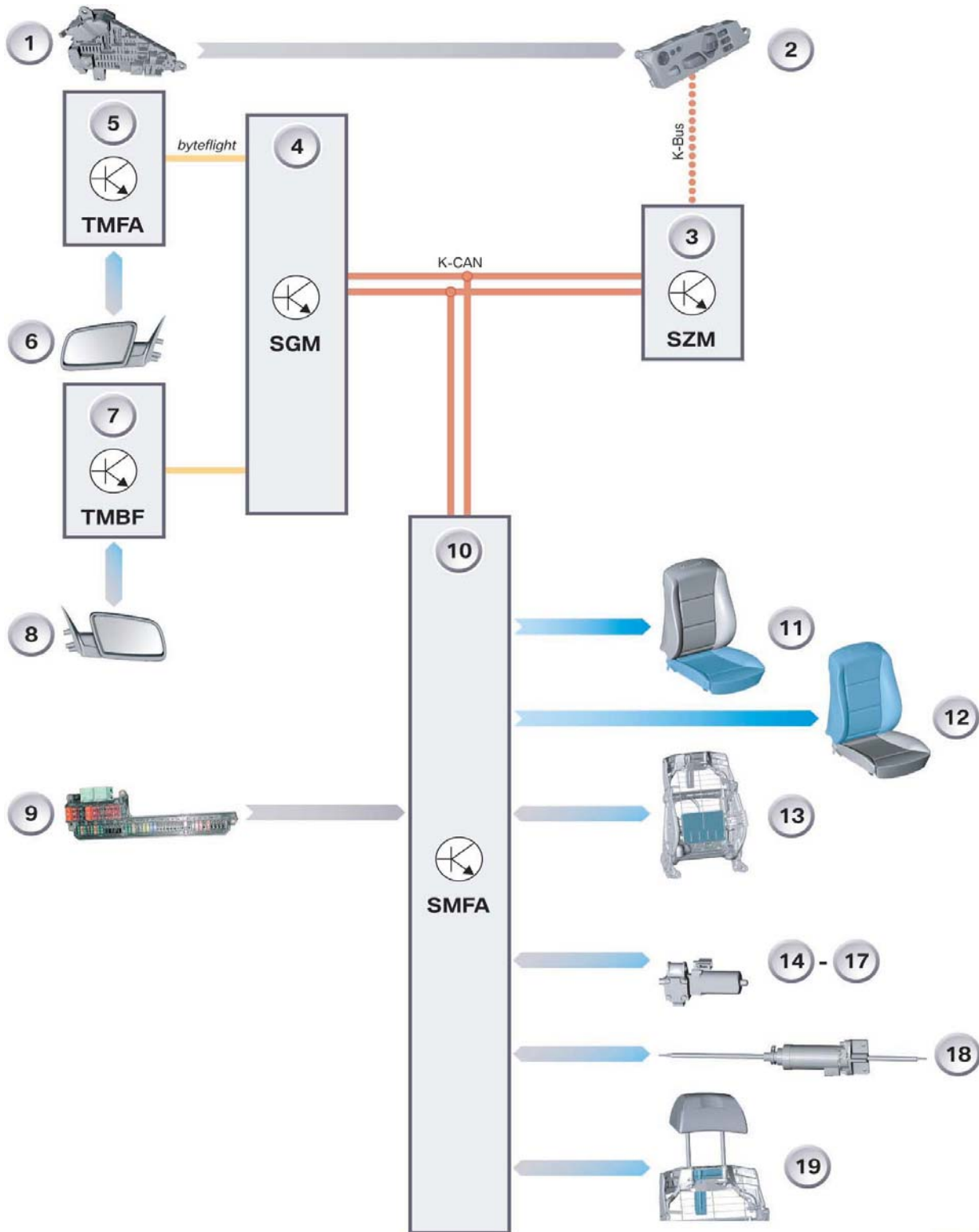
Index	Explanation	Index	Explanation
1	Current distributor, front	7	Seat adjustment motor
2	Centre console switch centre	8	Seat adjustment motor
3	Lumbar support switch	9	Seat heating
4	Seat adjustment switch	10	Backrest heating
5	Driver's seat module (SMFA)	11	Active seat
6	Lumbar support		

LAUNCH



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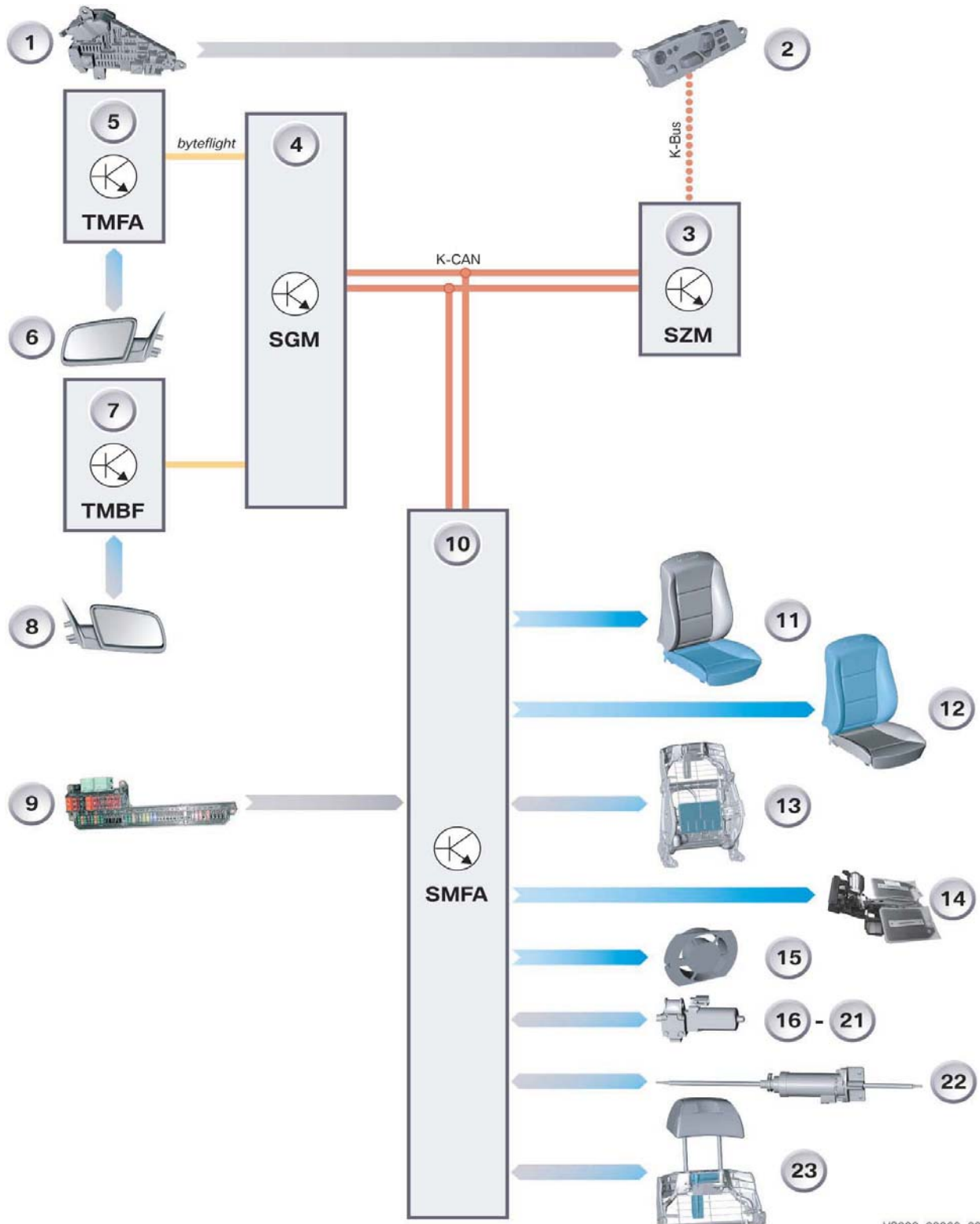
Index	Explanation	Index	Explanation
1	Current distributor, rear	11	Seat heating
2	Control panel unit for seat adjustment	12	Backrest heating
3	Centre console switch centre (SZM)	13	Lumbar support
4	Safety and gateway module (SGM)	14	Active seat
5	Driver's door module (TMFA)	15	Fan motors, ventilated seat
6	Exterior mirror, driver	16 -19	Seat adjustment motors
7	Passenger door module (TMBF)	20	Head-restraint adjustment
8	Exterior mirror, passenger side	<b>byteflight</b>	<b>byteflight</b>
9	Current distributor, front	K-CAN	Bodyshell CAN
10	Driver's seat module (SMFA)	K-Bus	Body bus



02259\_02

Index	Explanation	Index	Explanation
1	Current distributor, rear	10	Driver's seat module (SMFA)
2	Control panel unit for seat adjustment	11	Seat heating
3	Centre console switch centre (SZM)	12	Backrest heating
4	Safety and gateway module (SGM)	13	Lumbar support
5	Driver's door module (TMFA)	14-18	Seat adjustment motors
6	Exterior mirror, driver	19	Head-restraint adjustment
7	Passenger door module (TMBF)	<b>byteflight</b>	<b>byteflight</b>
8	Exterior mirror, passenger side	K-CAN	Bodyshell CAN
9	Current distributor, front	K-Bus	Body bus

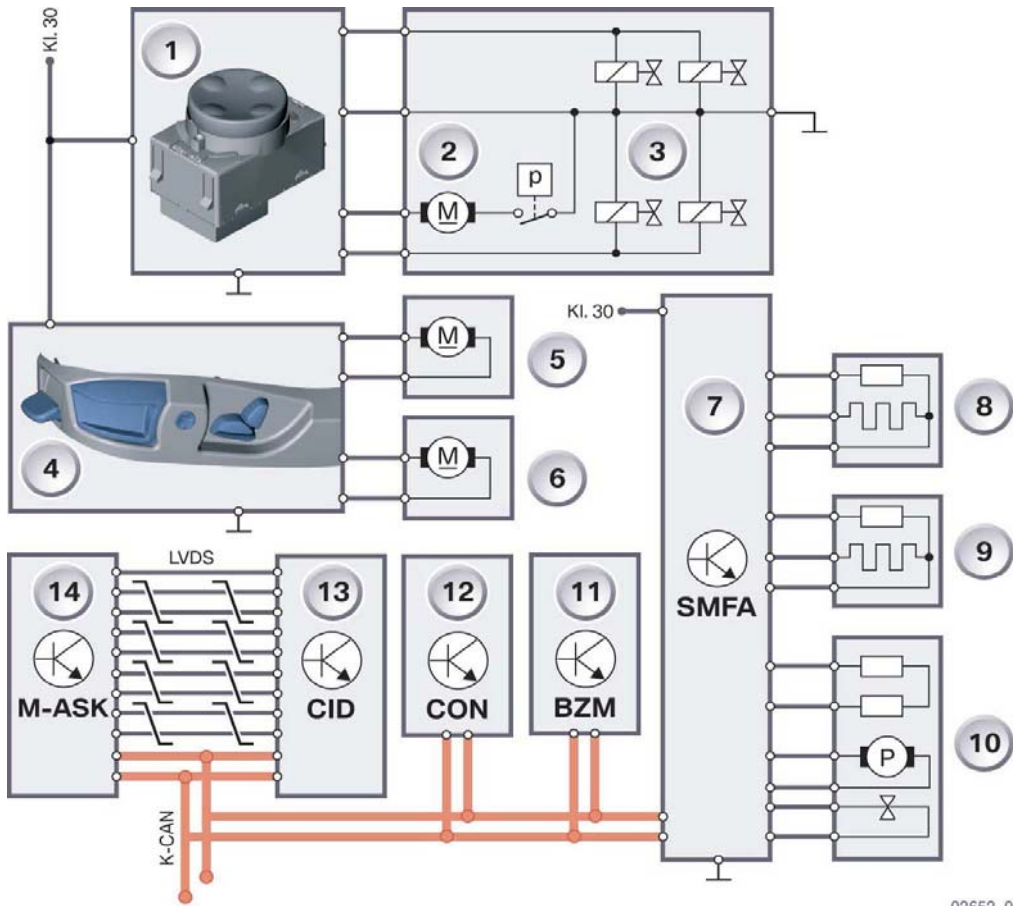




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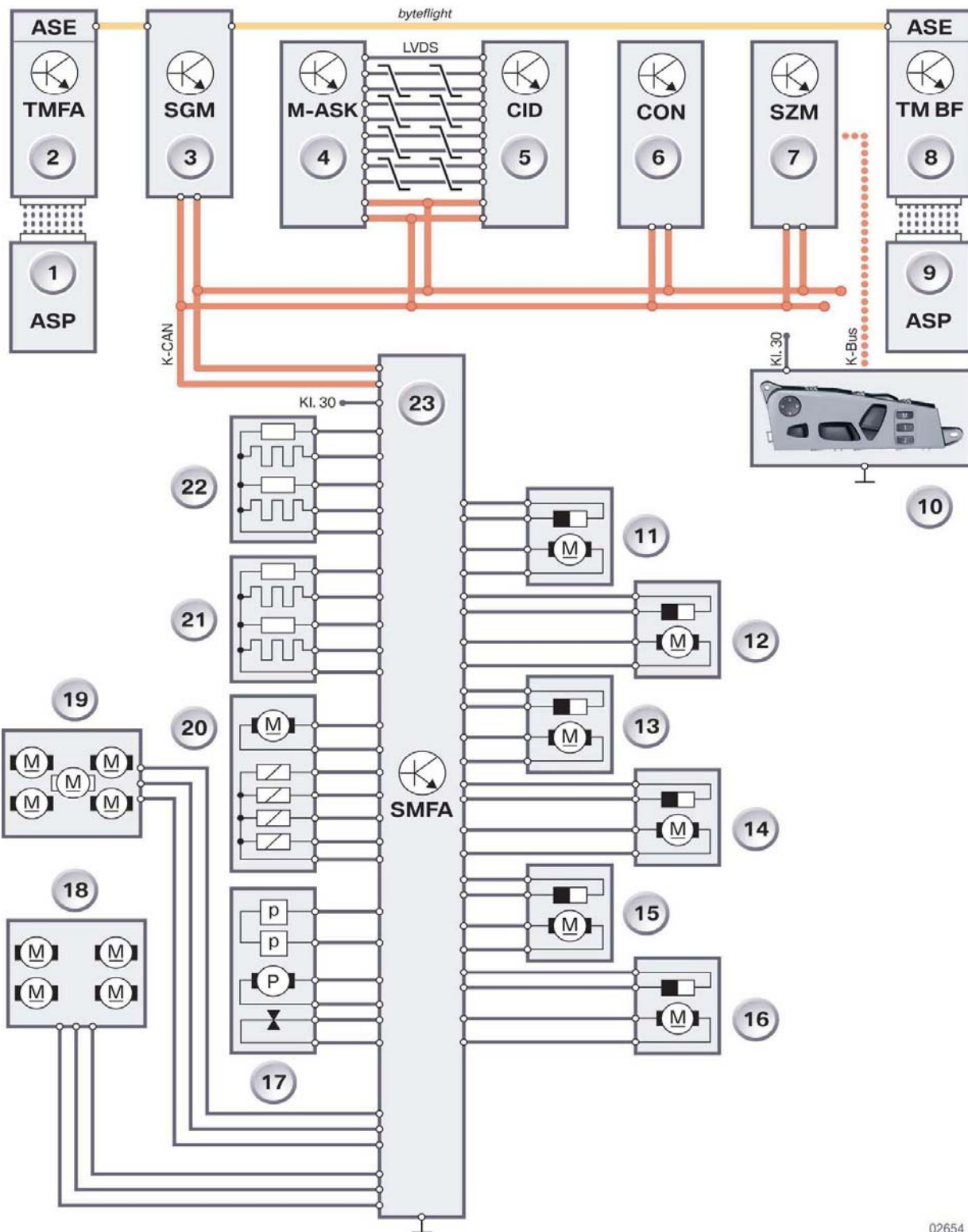
Index	Explanation	Index	Explanation
1	Current distributor, rear	11	Seat heating
2	Control panel unit for seat adjustment	12	Backrest heating
3	Centre console switch centre (SZM)	13	Lumbar support
4	Safety and gateway module (SGM)	14	Active seat
5	Driver's door module (TMFA)	15	Fan motors, ventilated seat
6	Exterior mirror, driver	16 -22	Seat adjustment motors
7	Passenger door module (TMBF)	23	Head-restraint adjustment
8	Exterior mirror, passenger side	<b>byteflight</b>	<b>byteflight</b>
9	Current distributor, front	K-CAN	Bodyshell CAN
10	Driver's seat module (SMFA)	K-Bus	Body bus

-System circuit diagram



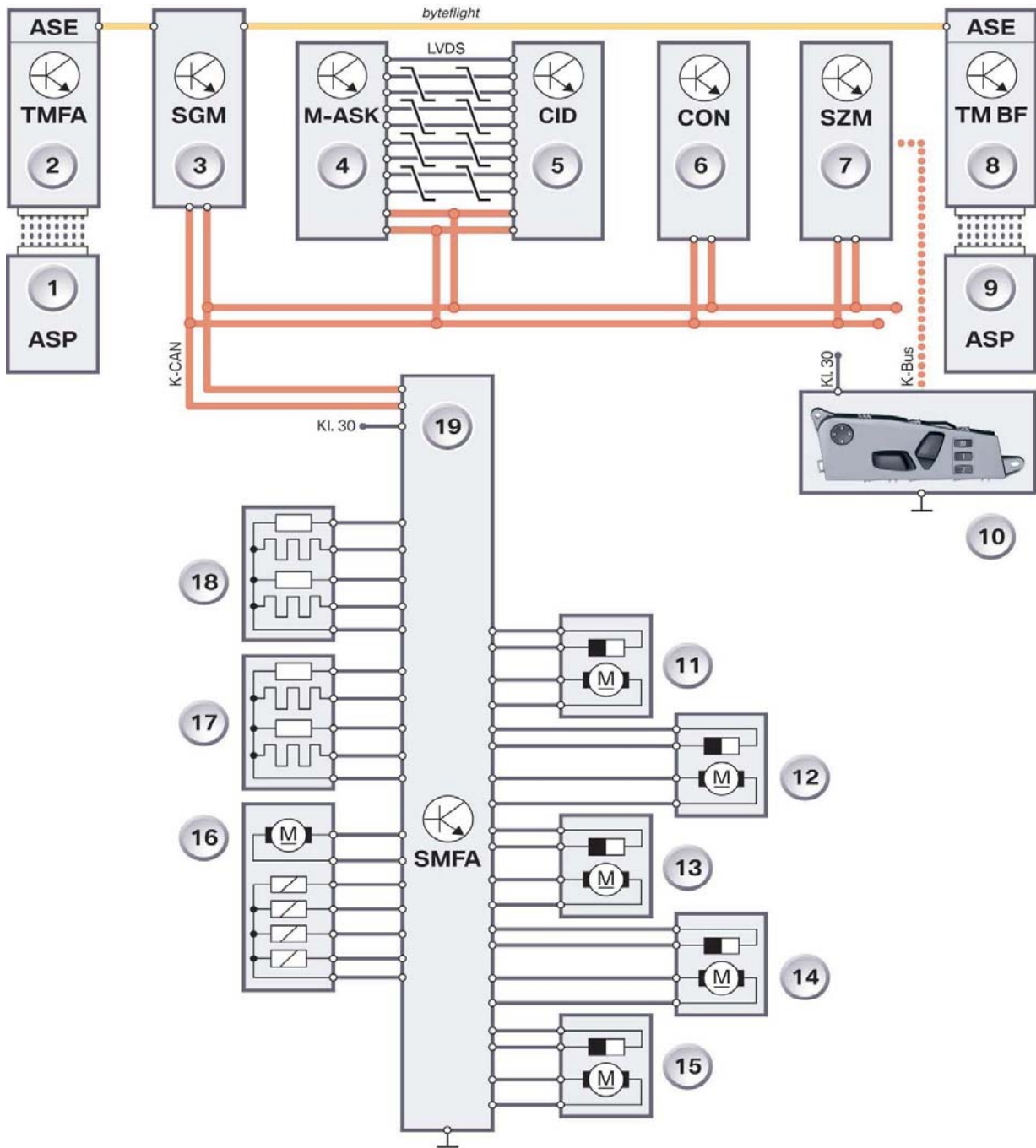
02652\_02

Index	Explanation	Index	Explanation
1	Lumbar support switch	10	Active seat
2	Lumbar support	11	Centre console switch centre (SZM)
3	Hydraulic valves for lumbar support	12	Controller (CON)
4	Control panel unit for seat adjustment	13	Central Information Display (CID)
5	Motor for seat height adjustment	14	Multi Audio System Controller (M-ASK)
6	Motor for seat backrest angle adjustment	LVDS	Low Voltage Differential Signal
7	Driver's seat module (SMFA)	K-CAN	Bodyshell CAN
8	Backrest heating	Kl. 30	Terminal 30
9	Seat heating		



02654\_02

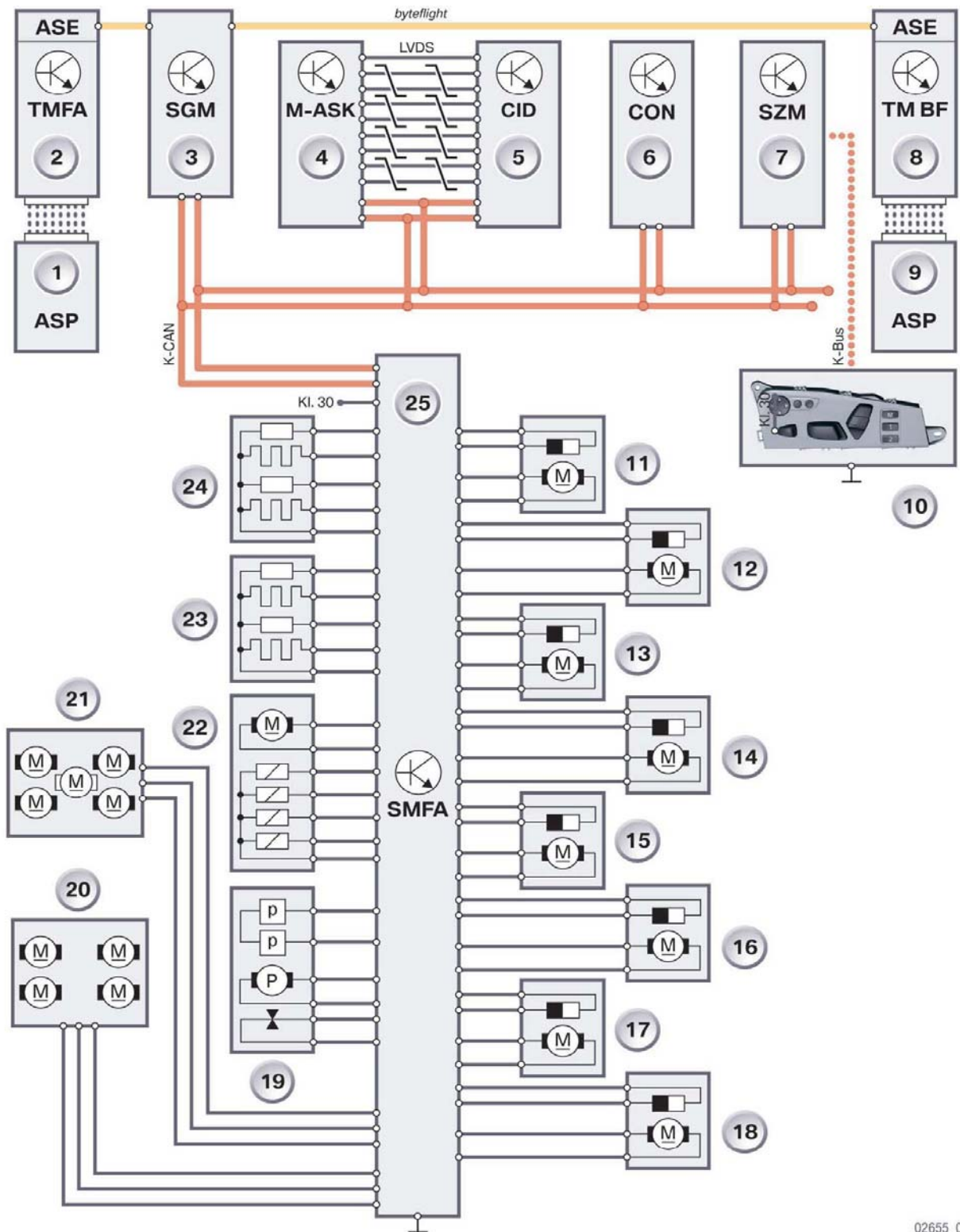
Index	Explanation	Index	Explanation
1	Outside mirrors	16	Motor for backrest head adjustment
2	Driver's door module (TMFA)	17	Motor for backrest width adjustment
3	Safety and gateway module (SGM)	18	Motor for seat cushion depth adjustment
4	Multi Audio System Controller (M-ASK)	19	Active seat
5	Central Information Display (CID)	20	Fan motors, ventilated seat backrest
6	Controller (CON)	21	Fan motors, ventilated seat cushion area
7	Centre console switch centre (SZM)	22	Lumbar support
8	Passenger door module (TMBF)	23	Seat heating, seat cushion area
9	Exterior mirror, passenger side	24	Seat heating, backrest
10	Control panel unit for seat adjustment	25	Seat heating, backrest
11	Motor for seat longitudinal adjustment	<b>byteflight</b>	<b>byteflight</b>
12	Motor for seat height adjustment	K-CAN	Bodyshell CAN
13	Motor for seat angle adjustment	K-Bus	Body bus
14	Motor for seat backrest angle adjustment	Kl. 30	Terminal 30
15	Motor for head restraint height adjustment	LVDS	Low Voltage Differential Signal



02657\_02

Index	Explanation	Index	Explanation
1	Outside mirrors	14	Motor for seat backrest angle adjustment
2	Driver's door module (TMFA)	15	Motor for head restraint height adjustment
3	Safety and gateway module (SGM)	16	Motor for seat cushion depth adjustment
4	Multi Audio System Controller (M-ASK)	17	Lumbar support
5	Central Information Display (CID)	18	Seat heating, seat cushion area
6	Controller (CON)	19	Seat heating, backrest
7	Centre console switch centre (SZM)	20	Driver's seat module (SMFA)
8	Passenger door module (TMBF)	<b>byteflight</b>	<b>byteflight</b>
9	Exterior mirror, passenger side	K-CAN	Bodyshell CAN
10	Control panel unit for seat adjustment	K-Bus	Body bus
11	Motor for seat longitudinal adjustment	Kl. 30	Terminal 30
12	Motor for seat height adjustment	LVDS	Low Voltage Differential Signal
13	Motor for seat angle adjustment		



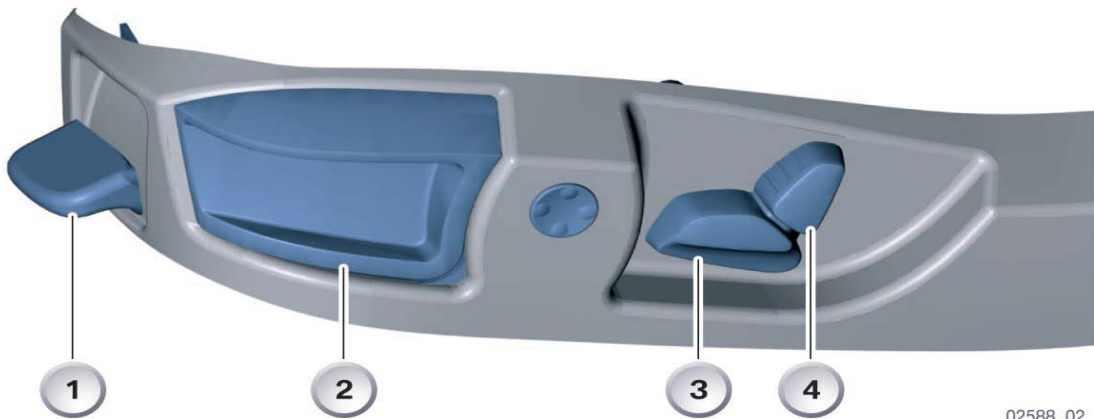


02655\_02

Index	Explanation	Index	Explanation
1	Outside mirrors	16	Motor for backrest head
2	Driver's door module (TMFA)	17	Motor for backrest width adjustment
3	Safety and gateway module (SGM)	18	Motor for seat cushion depth adjustment
4	Multi Audio System Controller (M-ASK)	19	Active seat
5	Central Information Display (CID)	20	Fan motors, ventilated seat backrest
6	Controller (CON)	21	Fan motors, ventilated seat cushion area
7	Centre console switch centre (SZM)	22	Lumbar support
8	Passenger door module (TMBF)	23	Seat heating, seat cushion area
9	Exterior mirror, passenger side	24	Seat heating, backrest
10	Control panel unit for seat adjustment	25	Driver's seat module (SMFA)
11	Motor for seat longitudinal adjustment	<b>byteflight</b>	<b>byteflight</b>
12	Motor for seat height adjustment	K-CAN	Bodyshelel CAN
13	Motor for seat angle adjustment	K-Bus	Body bus
14	Motor for seat backrest angle adjustment	Kl. 30	Terminal 30
15	Motor for head restraint height adjustment	LVDS	Low Voltage Differential Signal

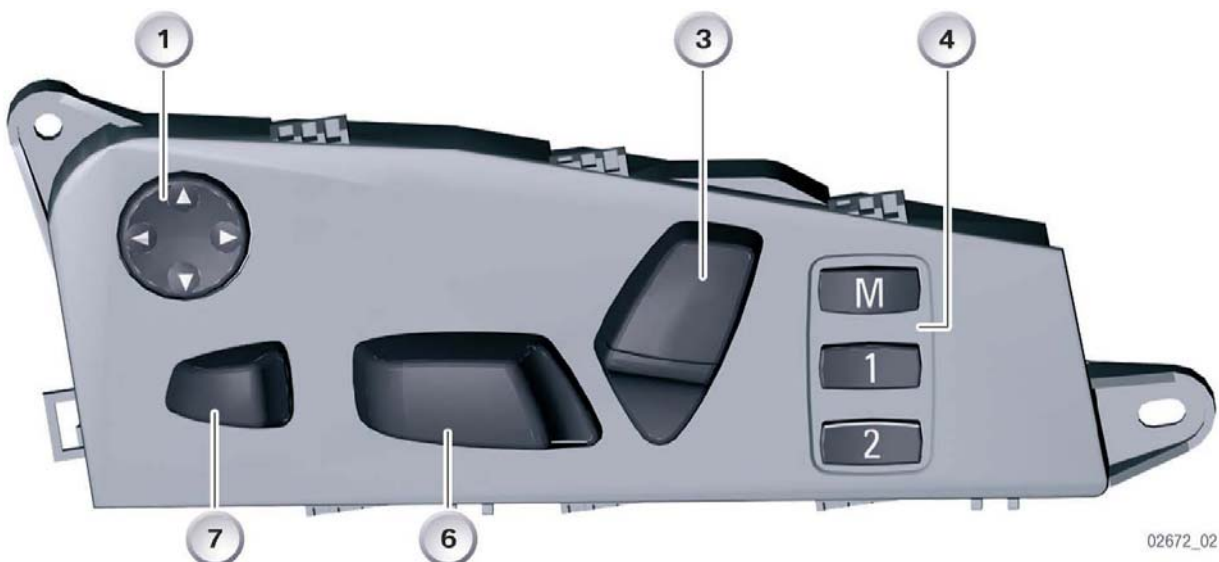
-Components

Buttons



02588\_02

Index	Explanation	Index	Explanation
1	Seat angle adjustment	3	Seat height adjustment
2	Seat longitudinal adjustment	4	Seat backrest angle adjustment

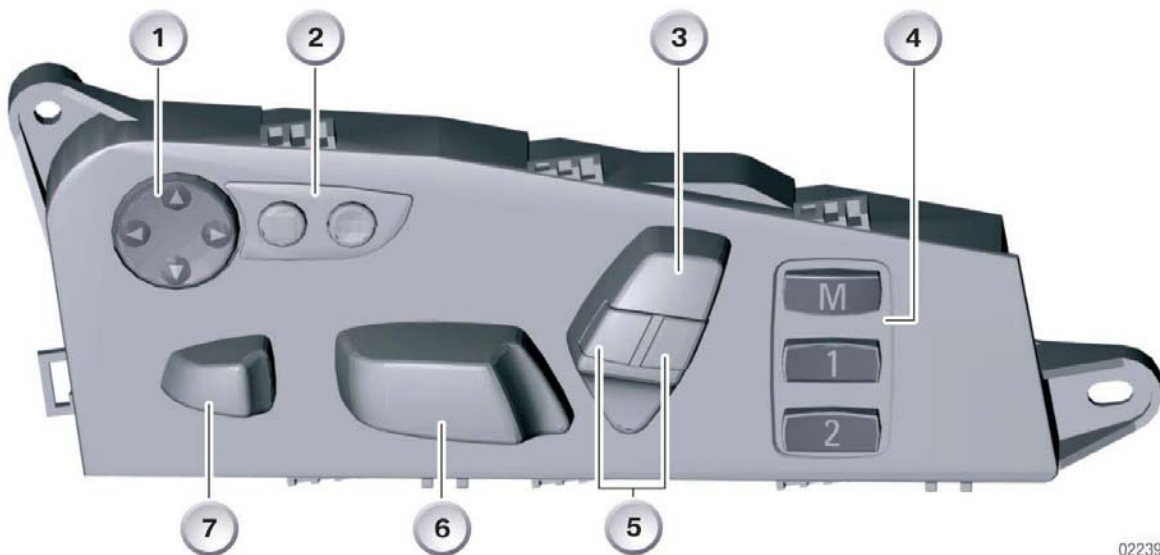


02672\_02

Refer to the description of the multi-function seat control panel for more information.



02671\_02



02239\_02

Index	Explanation	Index	Explanation
1	Lumbar support adjustment	5	Backrest head adjustment
2	Backrest width adjustment	6	Seat longitudinal, seat height and seat angle adjustment
3	Backrest angle and head restraint height adjustment	7	Seat cushion depth adjustment
4	Memory setting		

The main menu switch, button 6, can be moved along 3 axes:

-Push forwards / backwards

-Push up / down

-Turn left / right

The switch for the seat cushion depth adjustment, button 7, can be moved along 1 axis:

-Push forwards / backwards

The switch for seat backrest and head restraint adjustment, button 3, can be moved along 2 axes:

-Turn forwards / backwards

-Push up / down

The switch for backrest head adjustment, button 5, can be moved along 1 axis:

-Front button: Push forwards

-Rear button: Push backwards

The lumbar support is adjusted by means of a disc-type rocker switch, button 1.

The backrest width is adjusted by means of 2 buttons, button panel 2. The memory function, button panel 4, is operated by means of 3 buttons.

-Memory button - Button panel 4, button M

-Memory program 1 - Button panel 4, button 1

-Memory program 2 - Button panel 4, button 2

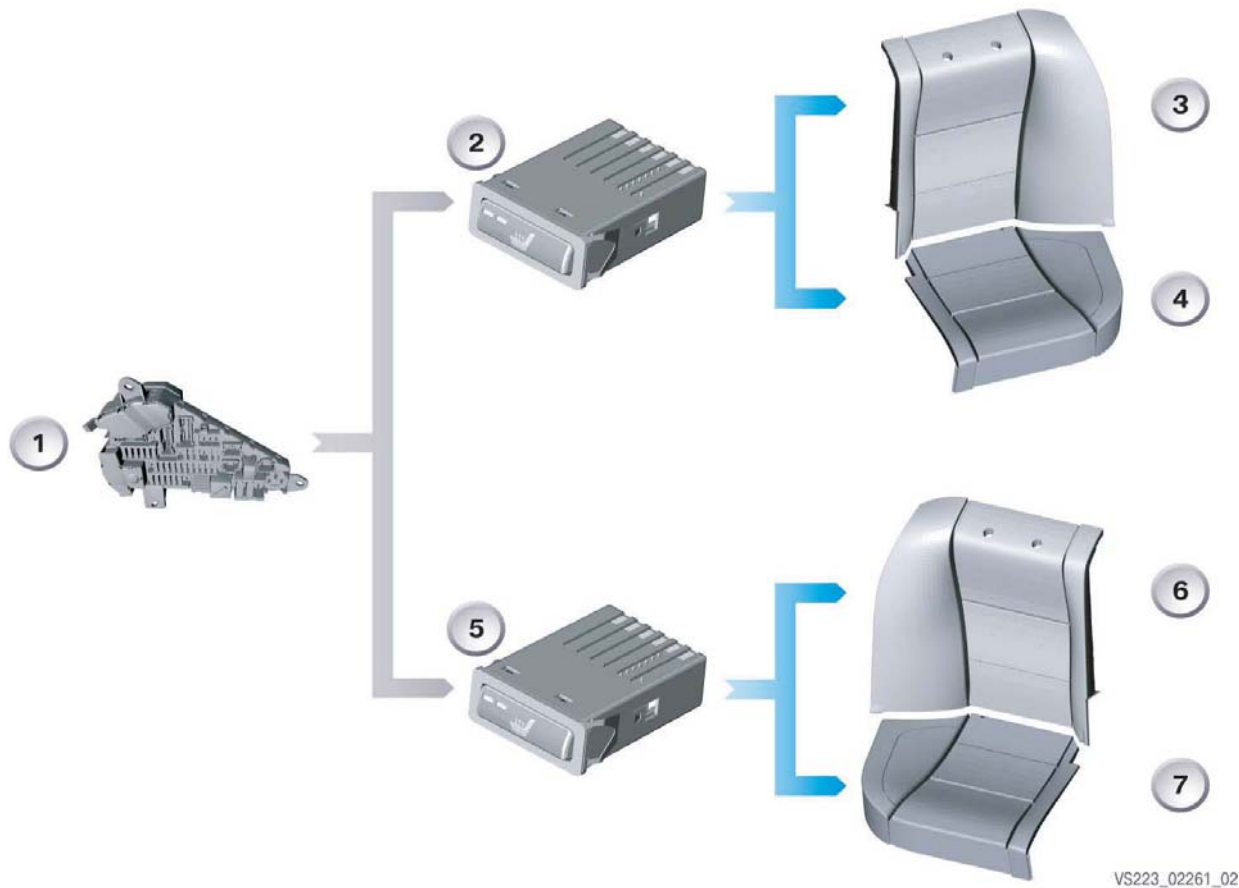
In total there are 23 control options, 20 of which are for moving the seats and the remaining 3 are for the memory functions.

**Electrical interfaces**

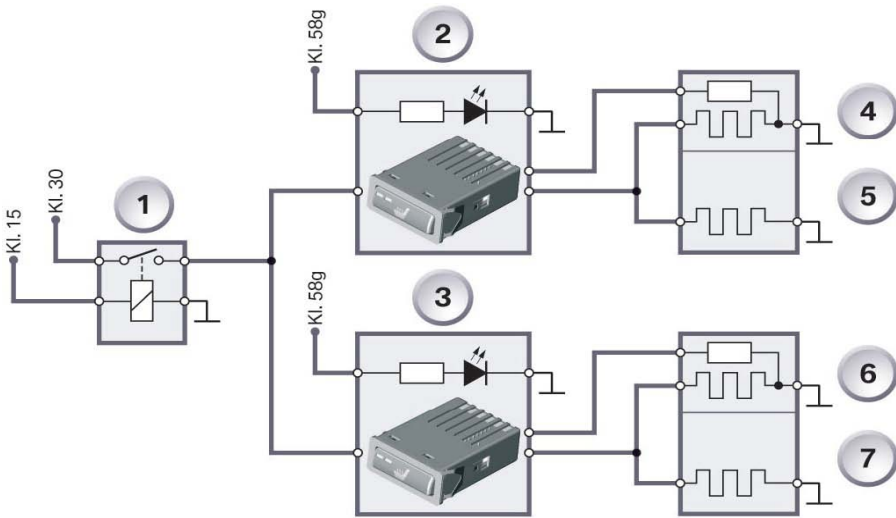
One 8-pin and one 25-pin connector are used to connect the system to the vehicle electrical system.

The pin assignment of the 10 compartment plug connections has not changed from those for the seats in the E65. The 6 compartment plug connections for the seat modules have not changed either.

**Seat heating, rear**



Index	Explanation	Index	Explanation
1	Current distributor, rear	5	Button, seat heating
2	Button, seat heating	6	Seat heating, backrest
3	Seat heating, backrest	7	Seat heating, seat cushion
4	Seat heating, seat cushion		



02683\_02

Index	Explanation	Index	Explanation
1	Terminal 15, unload relay	7	Seat heating, backrest, passenger side rear seat
2	Seat heating button, driver's side rear seat	Kl.15	Terminal 15
3	Seat heating button, passenger side rear seat	Kl. 30	Terminal 30
4	Seat heating, seat cushion, driver's side rear seat	Kl. 58g	Terminal 58g
5	Seat heating, backrest, driver's side rear seat		
6	Seat heating, seat cushion, passenger side rear seat		

-System functions

<b>Functions</b>	<b>Semi-electric seat</b>	<b>Electric seat with memory</b> <small>Memory for driver's seat only</small>	<b>Electric sports seat with memory</b> <small>Memory for driver's seat only</small>	<b>Multi-function seat with memory</b> <small>Memory for driver/ passenger seat</small>
Longitudinal seat adjustment (SLV)	manual	electric	electric	electric
Seat height adjustment (SHV)	electric, switch	electric, seat module (SM)	electric, seat module (SM)	electric, seat module (SM)
Seat angle adjustment (SNV)	manual, driver's seat only	electric, seat module (SM)	electric, seat module (SM)	electric, seat module (SM)
Seat cushion depth adjustment (STV)	---	---	electric	electric
Seat heating (SHZ)	option	option	option	option
Seat ventilation	---	option	---	option
Active seat	option	option	---	option
Backrest angle adjustment (LNV)	electric, switch	electric, seat module (SM)	electric, seat module (SM)	electric, seat module (SM)
Backrest width adjustment (LBV)	---	---	---	electric
Backrest head adjustment (LKV)	---	---	---	electric
Backrest heating (SHZ)	option	option	option	option
Backrest ventilation	---	option	---	option
Lumbar support (LTV/LHV)	option	option	option	option
Head restraint height adjustment (KHV)	manual	electric	electric	electric
Active head restraint (AKS)				pyrotechnical
Car & key memory (CKM)		X	X	X

The functions are described in the E65 training document.



## Seat adjustment

### Semi-electric basic seat

The motors for seat adjustment are controlled directly from the adjustment switch.

### Electric, sport and multi-function seats

The signals required for seat adjustment are generated with the aid of the adjustment switches. The signals are forwarded to the centre console switch centre (SZM) by means of an interface similar to a K bus. The centre console switch centre then forwards the data to the seat modules via the K-CAN.

Signals are processed in the seat modules. With the aid of the output stage in the seat modules, the motors in the seat are activated for seat adjustment.

## Seat heating

### Heating circuits

The heating circuits vary depending on the equipment fitted. The multi-function seat and the option seat ventilation system have 4 heating circuits. In a 4 heating circuit system, the backrest and seat cushion each have a rapid-heat area and a secondary heat area. Each heat area is fitted with a temperature sensor. Current is applied to a maximum of two heating circuits at any one time.

Seat variants that are not based on the multi-function seat and that are not fitted with the option seat ventilation system have 2 heat circuits. In a 2 heating circuit system, the backrest and seat cushion each have one heat area.

Operation of the seat heating system is dependent on power management. The seat heating may be switched off, to prevent the voltage supply from overloading in certain situations. Messages from the power management system are received via the K-CAN.

### **Clocking**

The heating output control that is required in order to regulate the temperature is achieved by pulse width modulation of the heating current. The clocking frequency is 25 Hz.

### **Seat air conditioning**

The seat air conditioning function is already described in the systems information for the E65.

### **Lumbar support**

The seats are fitted with a pneumatically operated lumbar support adjustment.

### **Active seat**

The active seat is already described in the training material for the E65.

To provide support and relieve the strain on the spinal column and back muscles during long journeys, the active seat, option 455, can be installed in the vehicle. The up and down movement of the seat surface is initiated at the ischiatic tuberosity.

## Entry/exit function for the multi-function seat

There is an entry/exit aid for both the driver and passenger. The entry/ exit aid is available in conjunction with the multi-function seat. The entry/exit aid system uses the backrest width (LBV) and seat cushion depth (STV) adjustment functions.

The backrest width is retracted to allow entry/exit into the vehicle. This creates more space in the area of the backrest.

The seat cushion depth is reduced. This creates more space around the seat area.

If the entry/exit aid is encoded ex-works, the following vehicle parameters may be used:

- |                                    |                              |
|------------------------------------|------------------------------|
| -Status of door contact            | Door "OPEN"/"CLOSED"         |
| -Status of seat belt contact       | Belt "Fastened"/"Unfastened" |
| -Seat occupancy recognition system | SBE "occupied"               |
| -Status of terminal 15             | Terminal 15 "ON"/"OFF"       |

"AND" logic operators are applied to the parameters. If a parameter is not used, it is removed for the entry/exit aid function.

The entry/exit aid function is stopped in the following vehicle states:

- Vehicle speed  $v > 0$
- Gear engaged and terminal 15 active

The option of manual seat adjustment is retained even if the entry/exit aid is installed.

The entry/exit aid is deactivated and the seat is moved to a memorysetting in the following conditions:

-Door contact reports door "CLOSED"

-CAS reports terminal 15 "ON"

The entry/exit aid is activated under the following conditions:

-Door contact reports door "OPEN"

### **Functional principle**

One example in which the entry/exit aid is activated:

The customer stops the vehicle. The vehicle is not in gear, the engine is either running or switched off. The vehicle door is opened. The door contact indicates this. The exit aid is activated. The LBV and then the STV are retracted. The customer gets out and the door is closed. The exit aid remains in that position and is used to assist entry when the customer gets back in the car.

## Outside mirrors

Activation of the wing mirrors is performed by the door modules by means of the local electronics in the front doors.

All the mirror functions, except for electrochrome wing mirror and mirror heating, are active with terminal R on through to consumer shutdown.

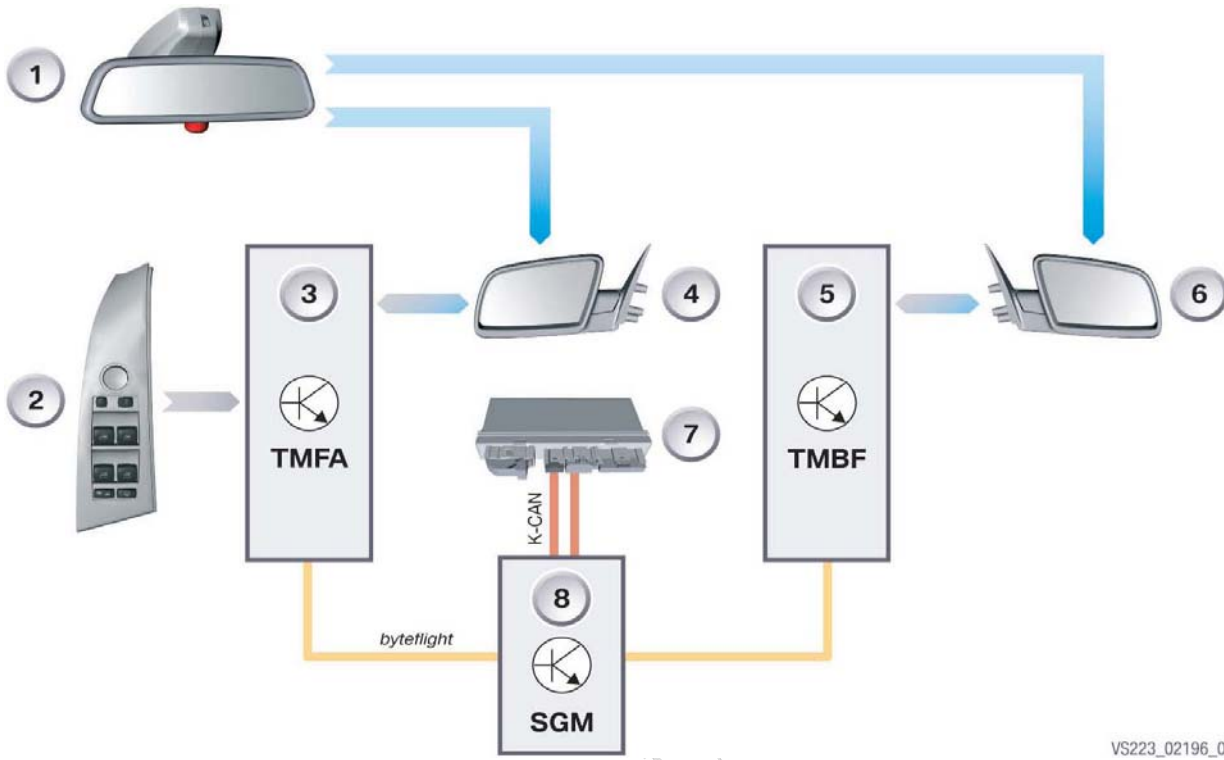
The mirror functions are controlled exclusively in the door modules, which communicate with each other via the **byteflight**. All the mirror adjustment functions are served by the adjusting switches in the switchblock in the driver's door.

The following options are available:

- SA 430 Electrochrome interior rearview and wing mirrors
- SA 431 Electrochrome interior rearview mirror
- SA 563 Light package including front-area lights in wing mirrors
- Wing-mirror memory in conjunction with seat memory

LAUNCH

-System overview

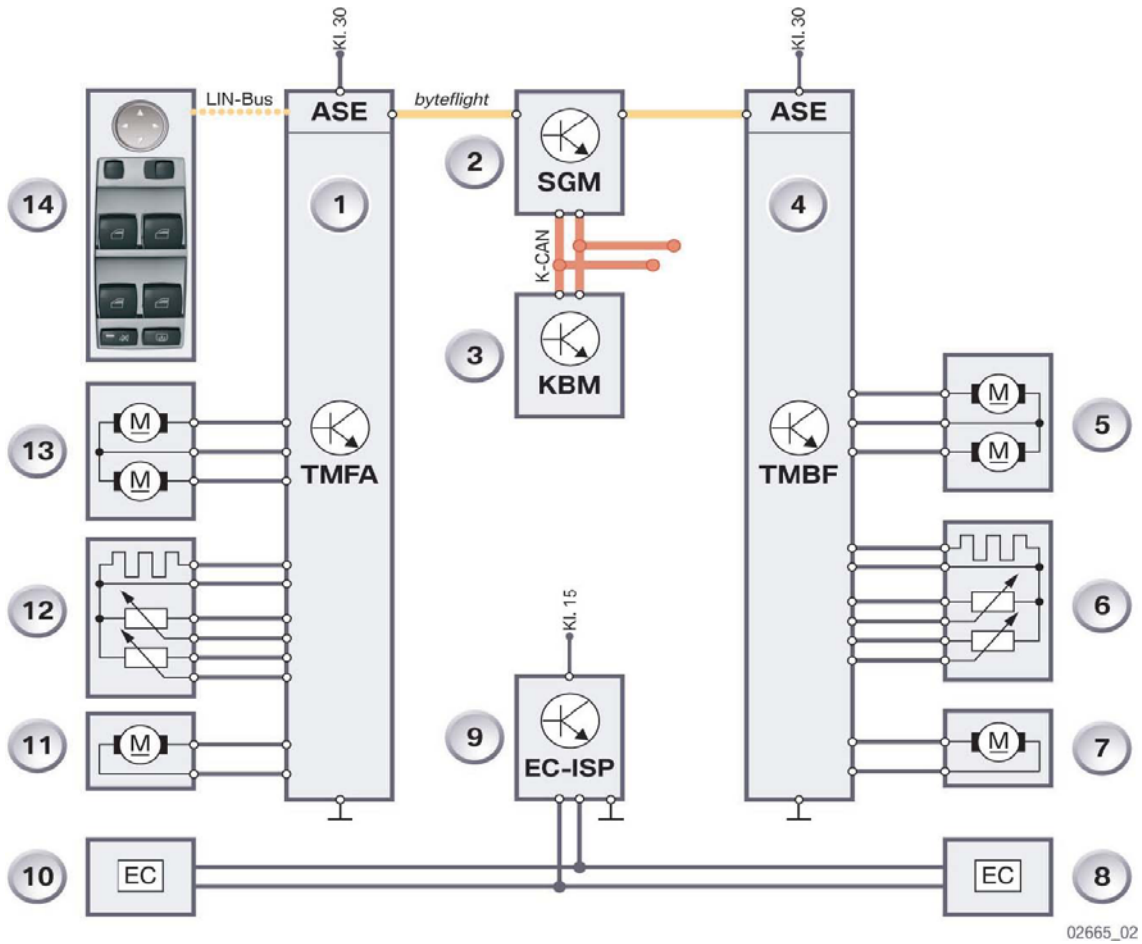


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Index	Explanation	Index	Explanation
1	EC interior rearview mirror	6	Passenger wing mirror with EC
2	Driver's switch block	7	Body base module
3	Driver's door module (TMFA)	8	Safety and gateway module (SGM)
4	Wing mirror with EC	<b>byteflight</b>	<b>byteflight</b>
5	Passenger door module (TMBF)	K-CAN	Bodyshell CAN

LAUNCH

-System circuit diagram





Index	Explanation	Index	Explanation
1	Door module, driver's door TMFA, front	10	Driver's EC wing mirror
2	Safety and gateway module (SGM)	11	Mirror-pivoting motor, driver
3	Body base module (KBM)	12	Driver's wing-mirror heating and memory
4	Door module, passenger door TMBF, front	13	Wing-mirror adjusting motor, driver
5	Wing-mirror adjusting motor, passenger	14	Switch block, driver's side (SBFA)
6	Passenger wing-mirror heating and memory	ASE	Advanced Safety Electronics ASE
7	Mirror-pivoting motor, passenger	Kl. 30g	Terminal 30 switched
8	Passenger EC wing mirror	<b>byteflight</b>	<b>byteflight</b>
9	EC interior rearview mirror	LIN-Bus	LIN bus
10	Driver's EC wing mirror	Kl. 30	Terminal 30

## -System functions

The mirror functions are based on those of other BMW vehicles and are divided into the following categories:

-Horizontal mirror adjustment

-Vertical mirror adjustment

-Mirror heating

-Electrochrome wing mirrors (control by the electrochrome interior rearview mirror, no function of door electronics)

-Codable special-equipment functions

- Mirror pivoting
- Automatic kerb view
- Wing-mirror memory

Horizontal/vertical mirror adjustment

The SBFA switch block on the driver's door can be used to electrically adjust the exterior mirrors horizontally and vertically. The SBFA is connected to the door module via a LIN bus.

### **Mirror heating**

The heat output is automatically controlled and is dependent on outside temperature and wiper intensity. The mirror heating is operational from terminal 15 "ON".

The mirrors are also heated with terminal 15 inactive if the option independent heating is fitted. The information required is received via the **byteflight**.

## Electrochrome exterior rearview mirrors

The wing mirrors are activated directly by the electrochrome interior rearview mirror.

## Mirror pivoting

The signal for pivoting the exterior mirrors is transmitted by the SBFA to the TMFA via the LIN bus. The TMFA operates as the master for the mirror pivoting function.

## Mirror memory

The mirror memory data is stored in the door modules.

The seat module assumes the master function. The seat modules control the request for and storing of positions via the K-CAN, SGM and *byteflight*.

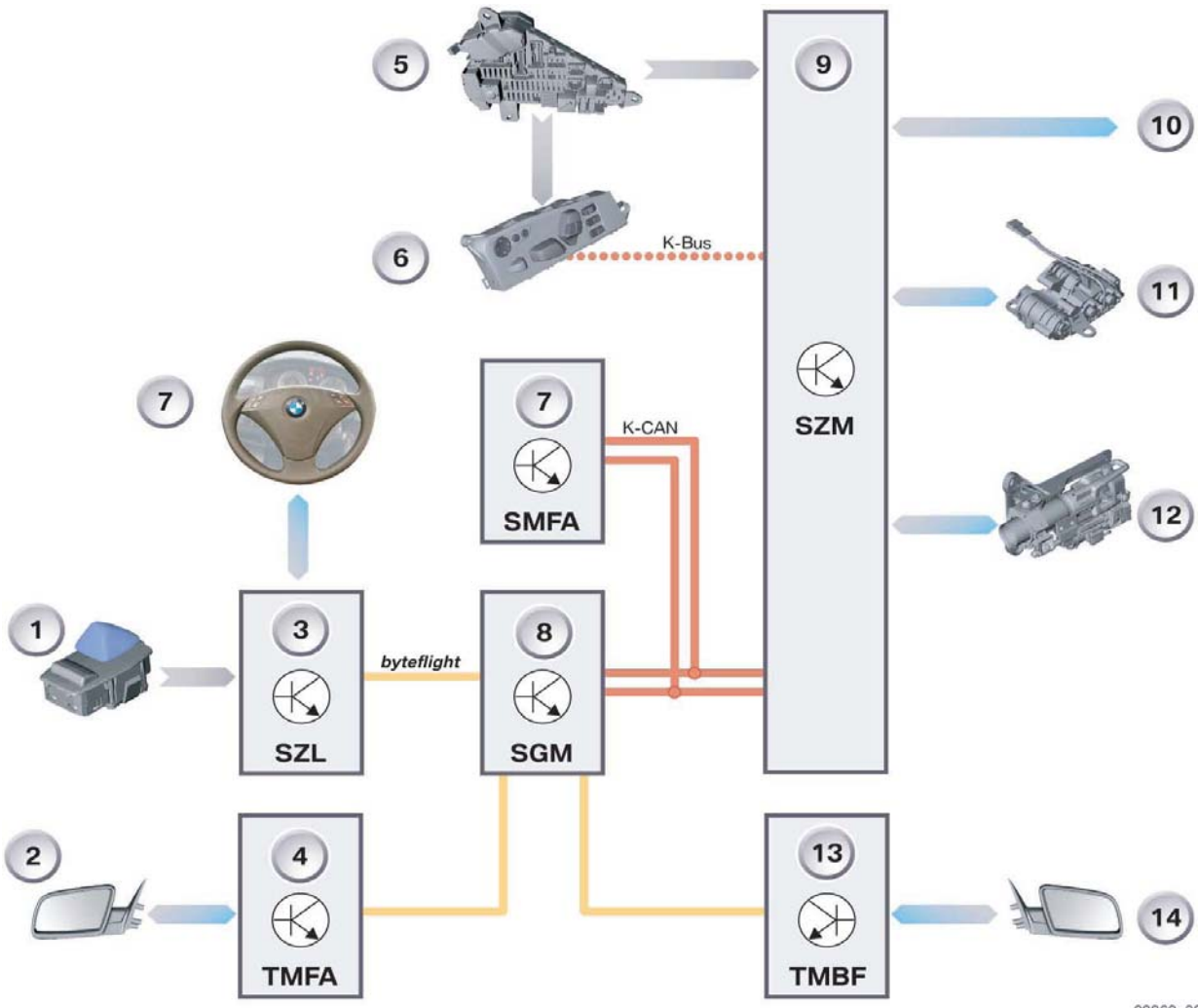
## Steering column adjustment (LSV)

The steering column can be adjusted if the vehicle is equipped with the following options:

- Option 456 Multi-function seat including memory and electric steering column adjustment
- Option 459 Electric seat including memory and electric steering column adjustment

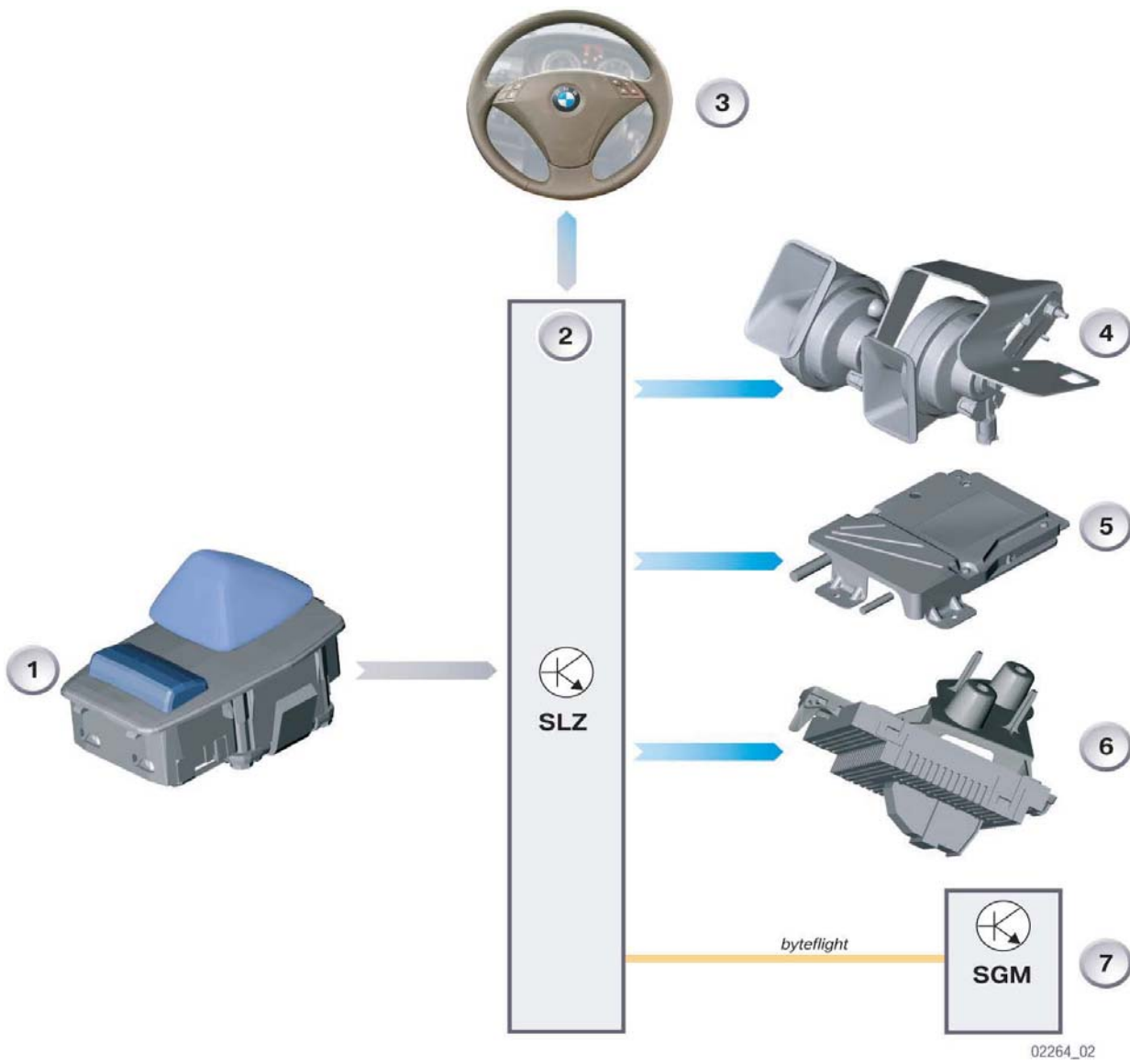
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-System overview



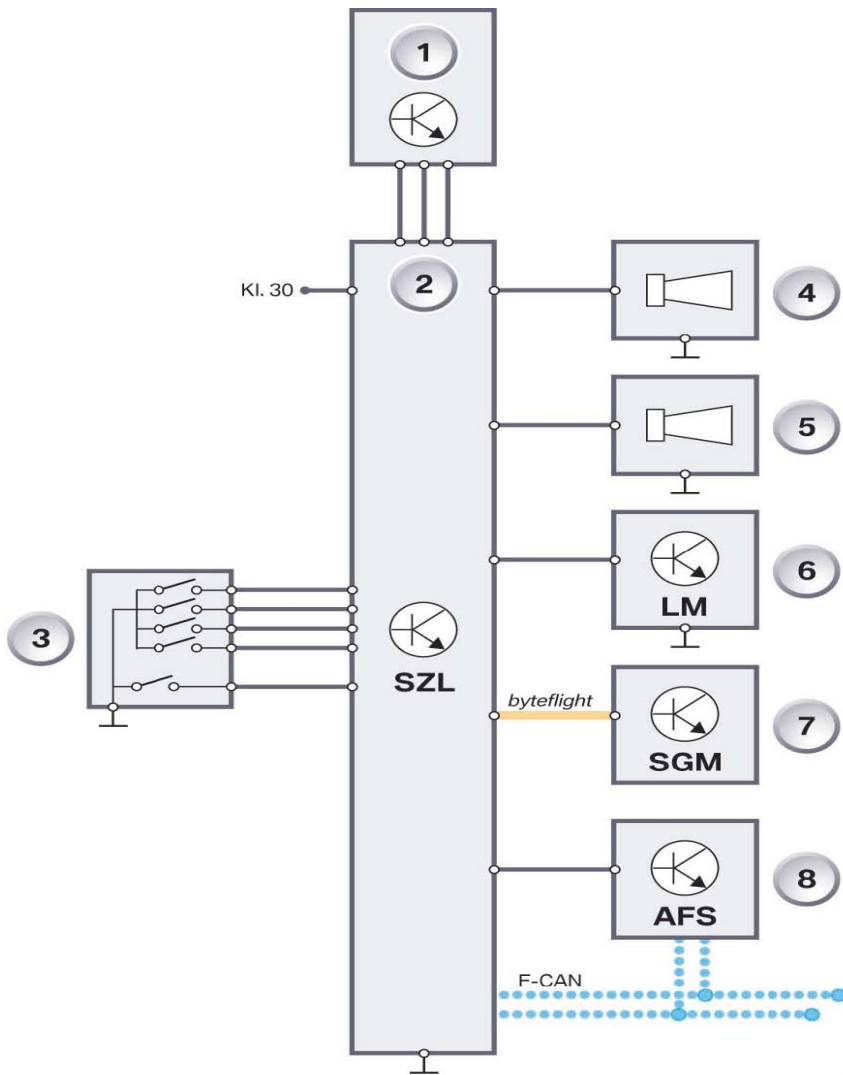
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Index	Explanation	Index	Explanation
1	Steering column adjustment button	9	Centre console switch centre (SZM)
2	Exterior mirror, driver	10	Seat module memory
3	Steering column switch cluster (SZL)	11	Motor for steering column adjustment
4	Driver's door module (TMFA)	12	Motor for steering column adjustment
5	Current distributor, rear	13	Passenger door module (TMBF)
6	Control panel unit for seat adjustment	14	Exterior mirror, passenger side
7	Multi-function steering wheel	<b>byteflight</b>	<b>byteflight</b>
8	Safety and gateway module (SGM)	K-CAN	Bodyshell CAN



Index	Explanation	Index	Explanation
1	Steering wheel heating button	5	Active steering system
	Steering wheel adjustment button	6	Light module
2	Steering column switch cluster (SZL)	7	Safety and gateway module (SGM)
3	Multi-function steering wheel	<i>byeflight</i>	<i>byeflight</i>
4	Fanfare horn		

-System circuit diagram



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Index	Explanation	Index	Explanation
1	Multi-function steering wheel	7	Safety and gateway module (SGM)
2	Steering column switch cluster (SZL)	8	Active steering system (AFS)
3	Buttons for steering column adjustment and steering wheel heating	<b>byteflight</b>	<b>byteflight</b>
4	Fanfare horn	K-CAN	Bodyshell CAN
5	Fanfare horn	F-CAN	Chassis CAN
6	Light module (LM)		



## - System functions

The steering column adjustment function is described in the information for the E65. Possible functions of steering column adjustment are:

- Height adjustment
- Reach adjustment
- Entry/exit aid
- Steering
- column memory
- Motor protection

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