

F12/F13 General Vehicle Electronics

9. Exterior Lights

The exterior lights of the F12/F13 are based on the standard equipment with bi-xenon headlights in current BMW models.

The exterior lights of the F12/F13 are based on most current BMW models.

The F12/F13 include bi-xenon headlights standard equipment. The daytime running lights and side lights are implemented in the corona rings using LED technology and thus guarantee a high recognition value in traffic.

The LEDs can be operated in two power stages. When dimmed to roughly 10% of their maximum power they operate as side lights, while at full power they operate as daytime driving lights.

The daytime driving lights are activated when the vehicle is started. If the automatic lighting system switches the low-beam headlight on, or if the driver switches the side lights or low-beam headlight on at the light switch himself, the light ring changes automatically to side lights.

A white LED is installed in the positioning light (eyebrow).

The fog light has been implemented in LED technology for the first time in the F12/F13.

The adaptive LED headlight (optional equipment 552) is also available in the F12/F13 for the first time. The similar to daylight color temperature allows the LED light to appear even brighter and therefore ensures even greater comfort and safety. Particularly traffic signs and other reflective objects appear higher in contrast and can be subjectively better perceived.

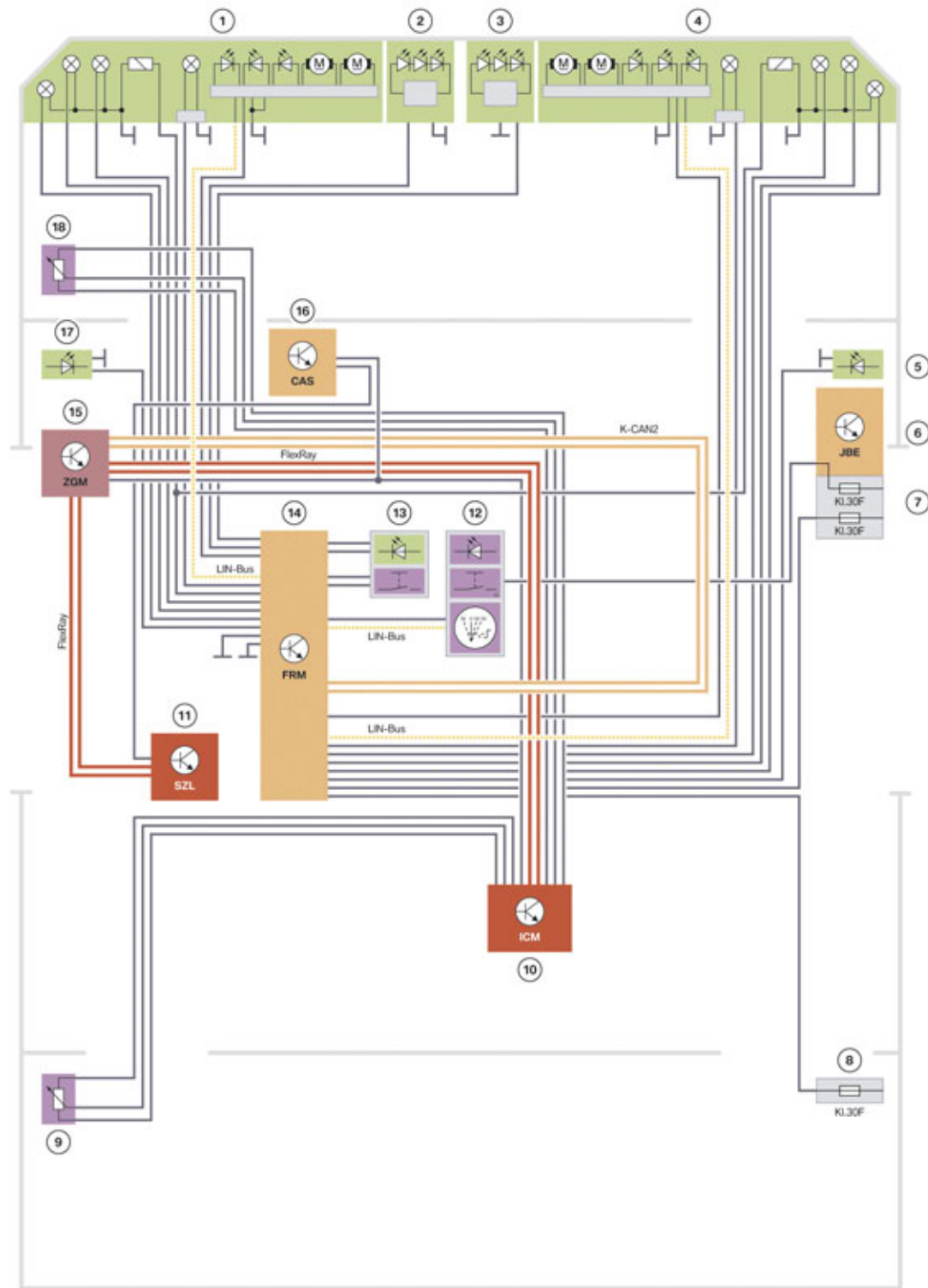
The LED full headlight has a low-beam headlight which is made from numerous LEDs and an additional reflector. Unlike the Xenon, the cornering light has the same light color as the low-beam headlight. It is convincing with its very bright and clear illumination of the entire area of the road being turned onto.

For more information on exterior lights, refer to the "F01/F02 Exterior lights" training material available on TIS and ICP.

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9. Exterior Lights

9.1. System wiring diagram



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F12/F13 exterior lights system wiring diagram, front bi-xenon headlight

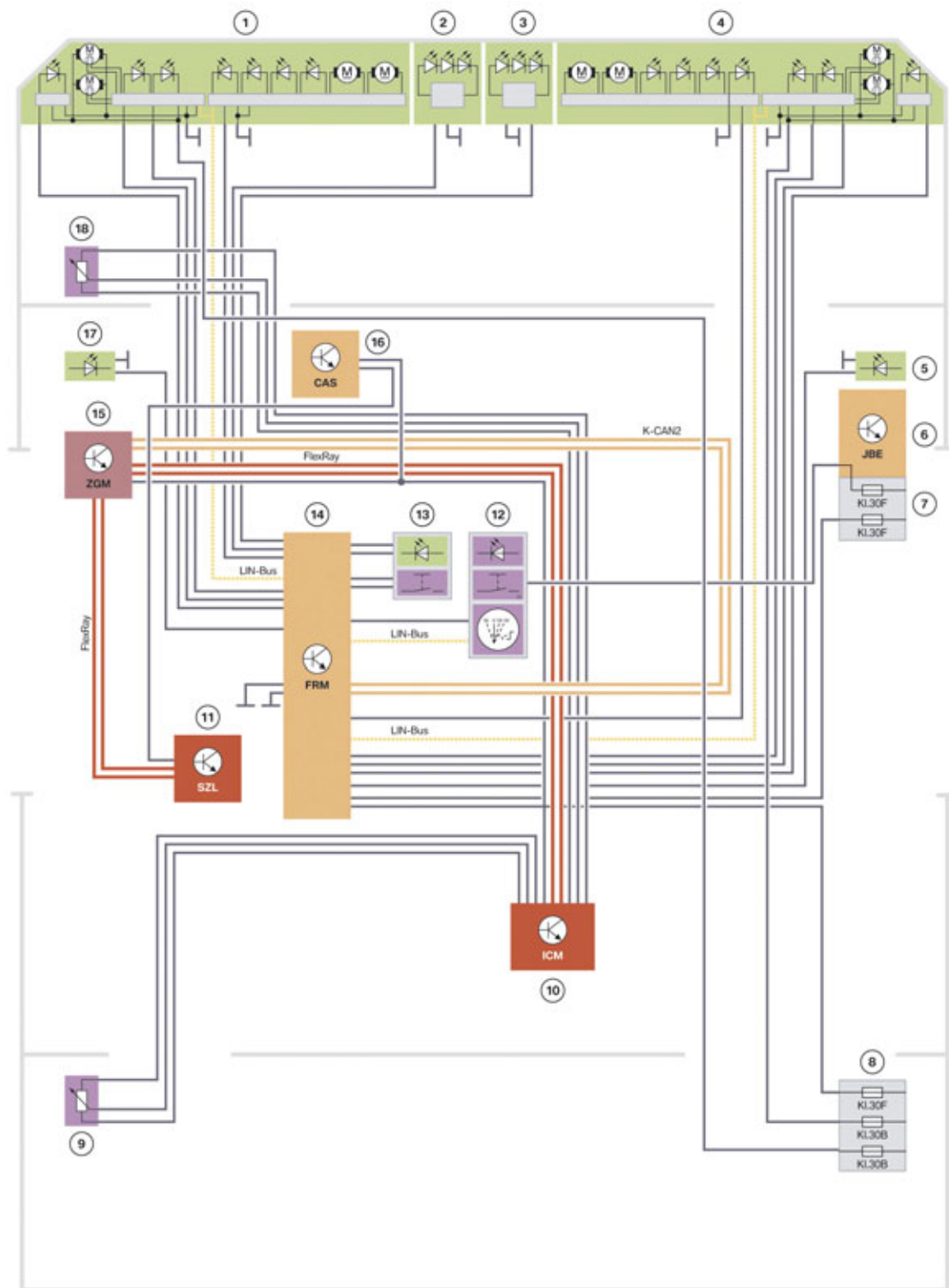
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Index	Explanation
1	Left headlight (cornering light, second stepper motor, positioning light and position sensor only required)
2	Left fog light
3	Right fog light
4	Right headlight (cornering light, second stepper motor, positioning light and position sensor only required)
5	Side repeater, right
6	Junction box electronics
7	Power distribution box, junction box
8	Power distribution box, luggage compartment
9	Ride height sensor, rear
10	Integrated Chassis Management (ICM)
11	Steering column switch cluster (SZL)
12	Operating facility, light switch
13	Central locking button/hazard warning switch
14	Footwell module (FRM)
15	Central gateway module (ZGM)
16	Car Access System (CAS)
17	Side repeater, left
18	Ride height sensor, front
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

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F12/F13 exterior lights system wiring diagram, adaptive LED headlights front

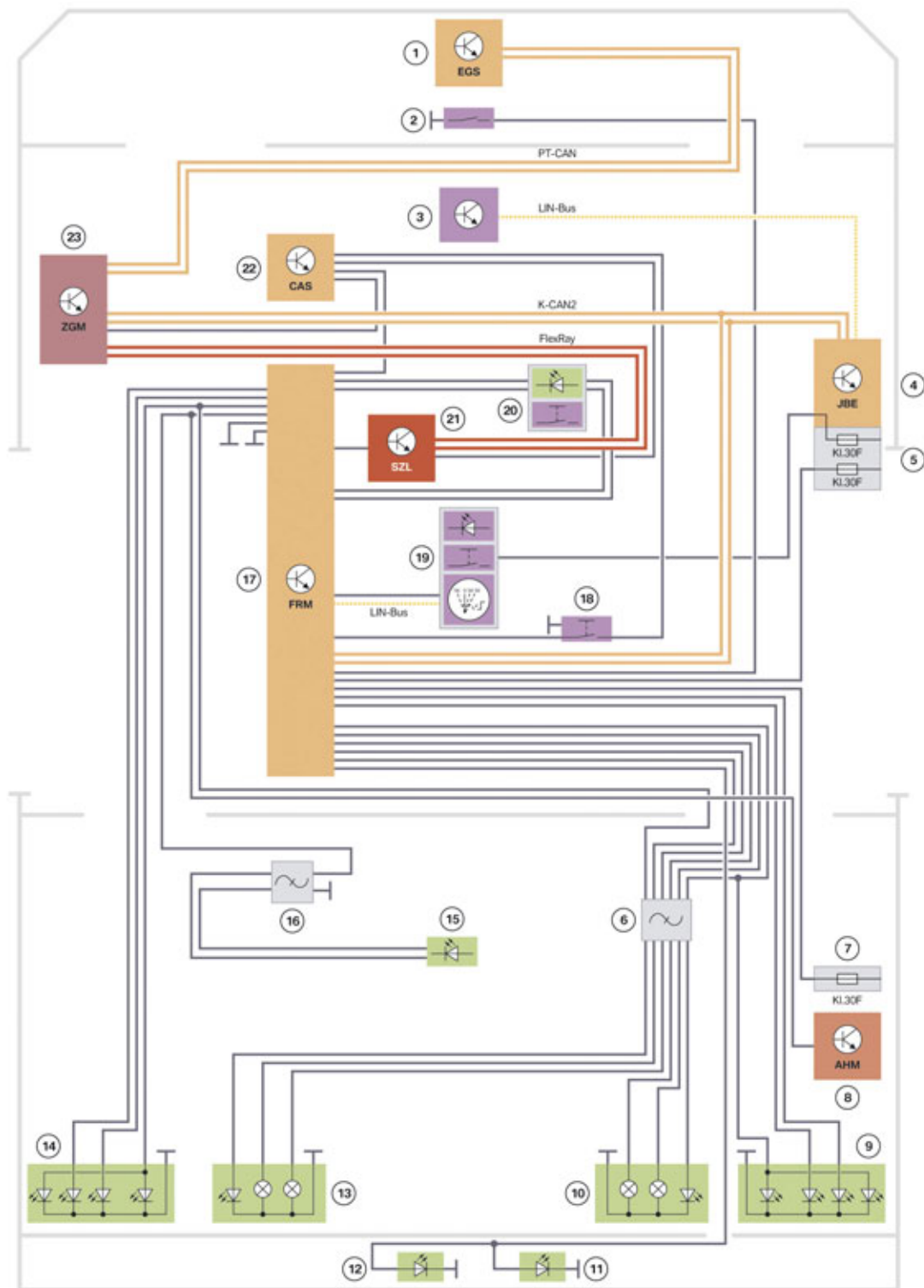
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Index	Explanation
1	Left LED headlight with positioning light, cornering light and Adaptive Headlight
2	Left fog light
3	Right fog light
4	Right LED headlight with positioning light, cornering light and Adaptive Headlight
5	Side repeater, right
6	Junction box electronics
7	Power distribution box, junction box
8	Power distribution box, luggage compartment
9	Ride height sensor, rear
10	Integrated Chassis Management (ICM)
11	Steering column switch cluster (SZL)
12	Operating facility, light switch
13	Central locking button/hazard warning switch
14	Footwell module (FRM)
15	Central gateway module (ZGM)
16	Car Access System (CAS)
17	Side repeater, left
18	Ride height sensor, front
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

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F12/F13 system wiring diagram, rear exterior lights

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9. Exterior Lights

Index	Explanation
1	Electronic transmission control (EGS)
2	Reversing light switch (only with manual gearbox)
3	Rain-light-solar-condensation sensor
4	Junction box electronics
5	Junction box for the power distribution box
6	Interference suppression filter (F12 only)
7	Power distribution box, luggage compartment
8	Outer rear light, right
9	Inner rear light, right (Not for US)
10	Number plate light on right (in rear bumper)
11	Number plate light on left (in rear bumper)
12	Inner rear light, left (Not for US)
13	Outer rear light, left
14	Additional brake light
15	Interference suppression filter (F12 only)
16	Footwell module (FRM)
17	Brake light switch
18	Operating facility, light switch
19	Central locking button/hazard warning switch
20	Steering column switch cluster (SZL)
21	Car Access System (CAS)
22	Central gateway module (ZGM)
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

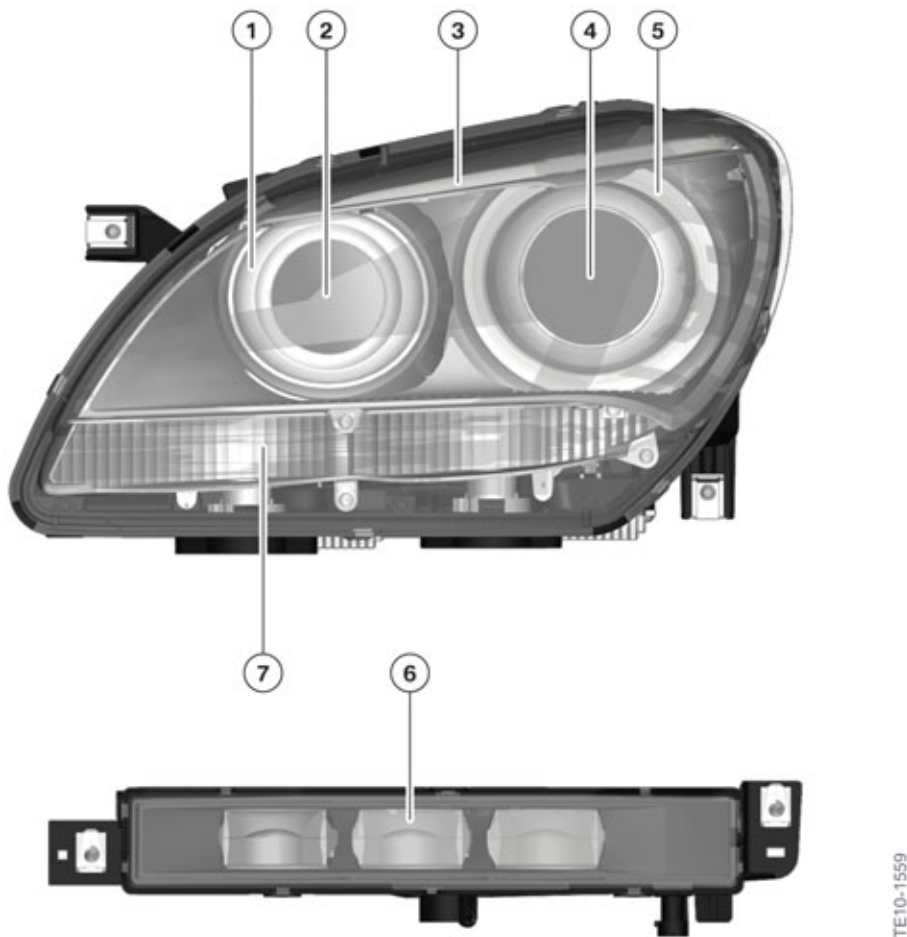
9.2. Front lights

9.2.1. Bi-xenon headlights

The following graphic shows the layout of the front bi-xenon headlight.

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F12/F13 bi-xenon headlights

Index	Explanation
1	Corona ring with LED for side lights/daytime driving lights
2	Cornering light
3	Positioning light (LED)
4	Xenon light for low and high-beam headlight
5	Corona ring with LED for side lights/daytime driving lights
6	Fog light (LED)
7	Turn indicator

9.2.2. Adaptive LED headlight

LEDs are components made from semiconductors that convert electrical energy into light energy.

The advantages of the LEDs are:

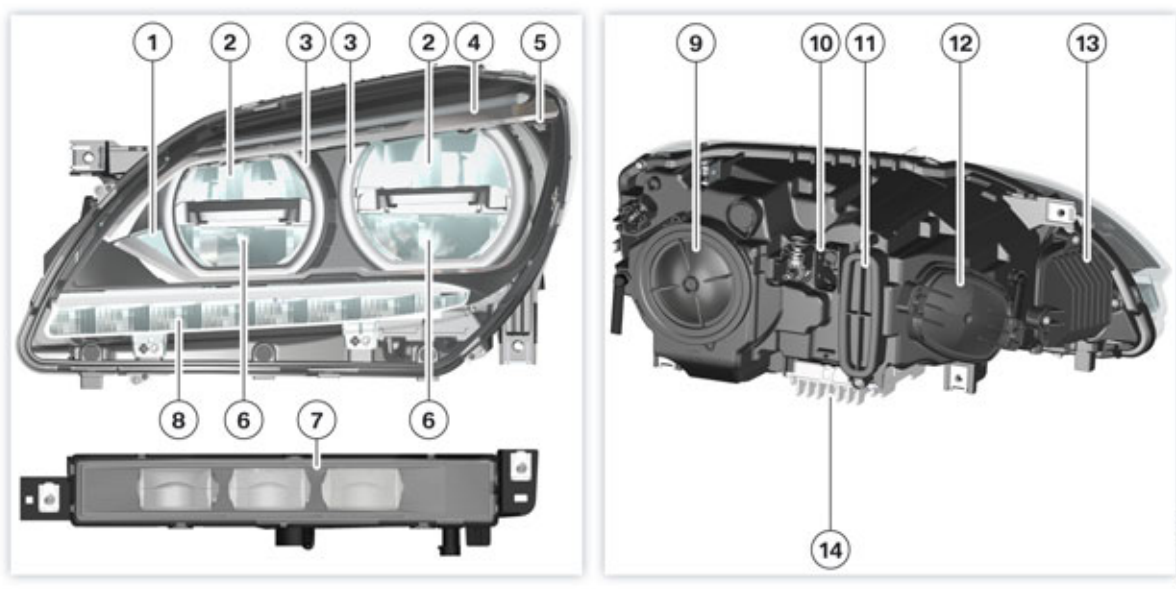
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9. Exterior Lights

- Long service life
- High efficiency
- Mechanically durable
- Adaptation of the light color
- Possibility of dimming.

The adaptive LED headlight optional equipment (552) also includes the Adaptive Headlight.

The following graphic shows the components of the LED headlight.



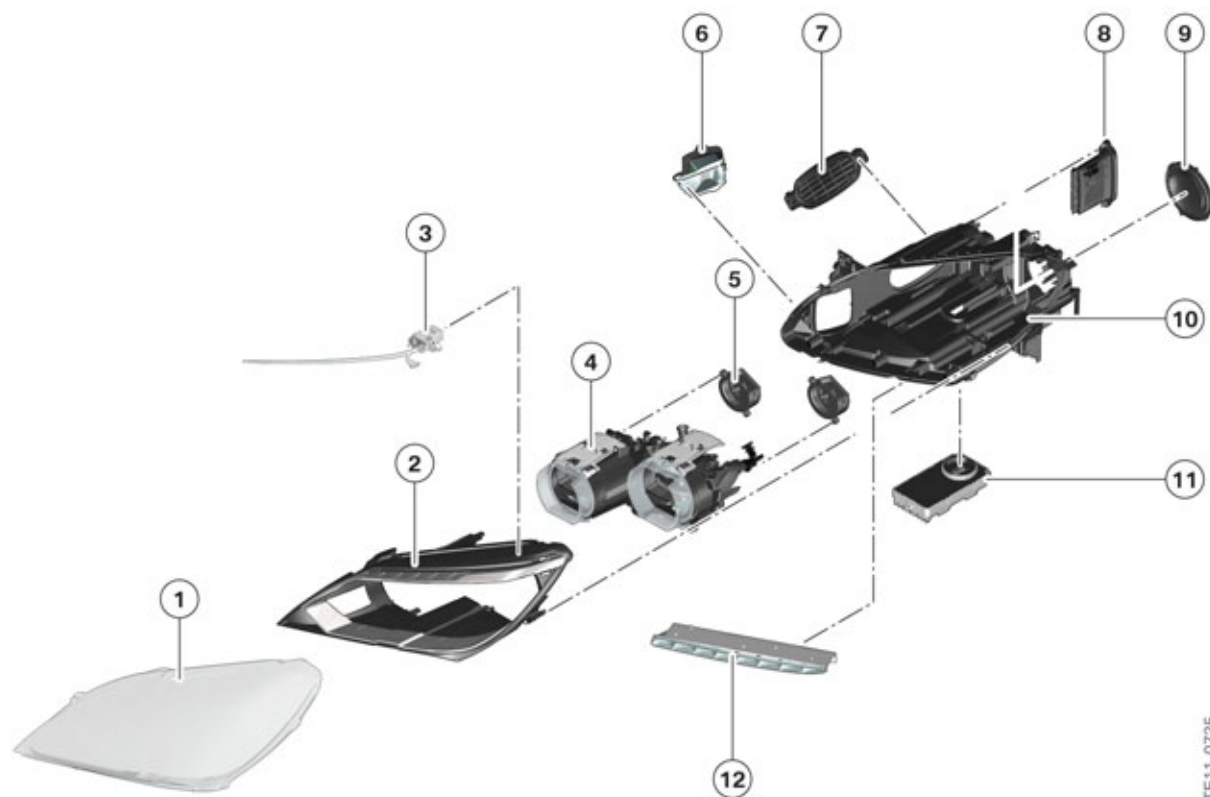
F12/F13 LED headlight

Index	Explanation
1	Cornering light
2	Low-beam headlight
3	Corona ring for side light/daytime driving light
4	Positioning light
5	Side marker light
6	High-beam headlight and headlight flasher
7	Fog light
8	Turn indicator
9	Outer fan cover
10	12-pin electrical plug connection

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9. Exterior Lights

Index	Explanation
11	Headlight driver module
12	Inner fan cover
13	Cornering light LED module
14	LED main light module (LHM)



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F12/F13 LED headlight main components

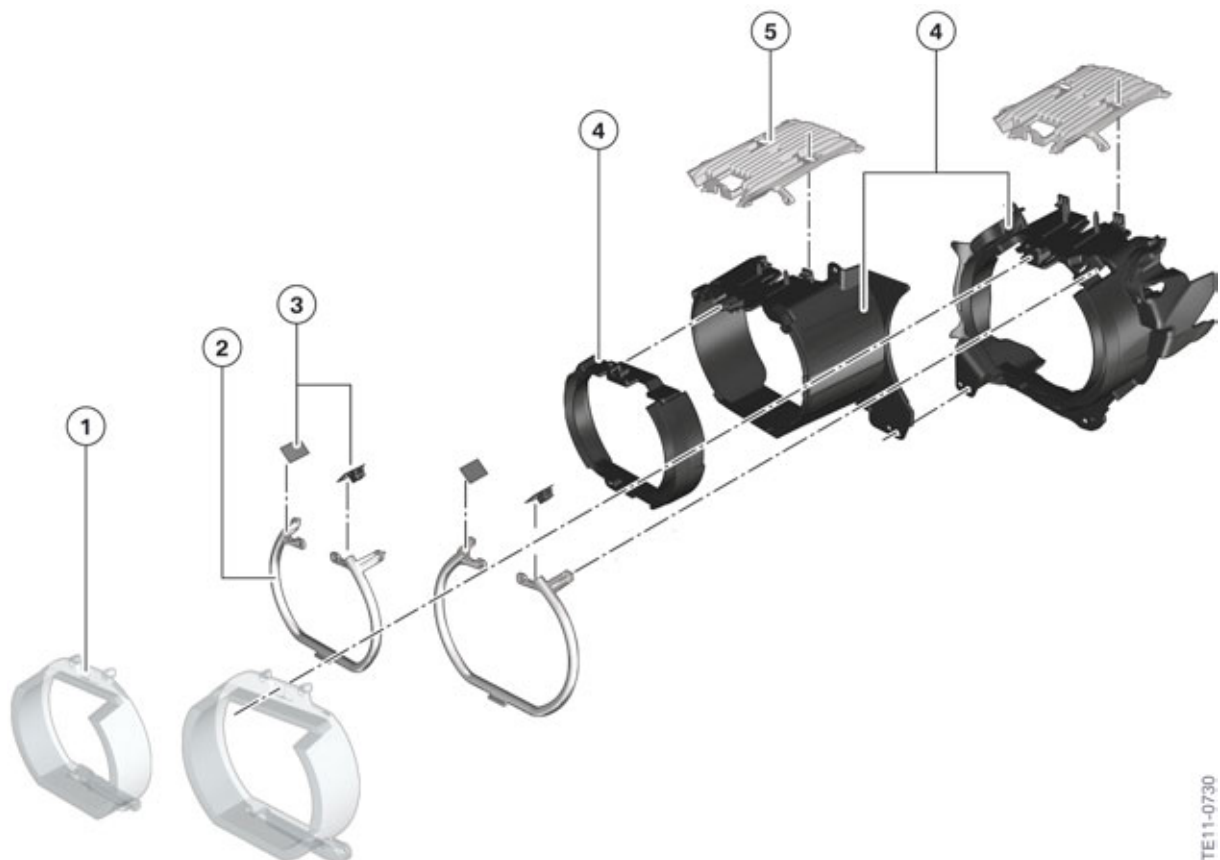
Index	Explanation
1	Lens
2	Cover frame with inner frame
3	Positioning light with heat sink, LED fixture and side marker light
4	LED main light components
5	Fan
6	Cornering light with heat sink, LED fixture and reflector
7	Cover
8	Headlight driver module

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9. Exterior Lights

Index	Explanation
9	Cover
10	Headlight housing
11	LED main light module (LHM)
12	Turn indicator with reflector, LEDs and heat sinks

The corona rings as well as the positioning light (side lights) are pulse-width-modulated. The LEDs are supplied with battery voltage to realize the daytime driving light function. This makes the daytime driving light significantly brighter than the side lights.



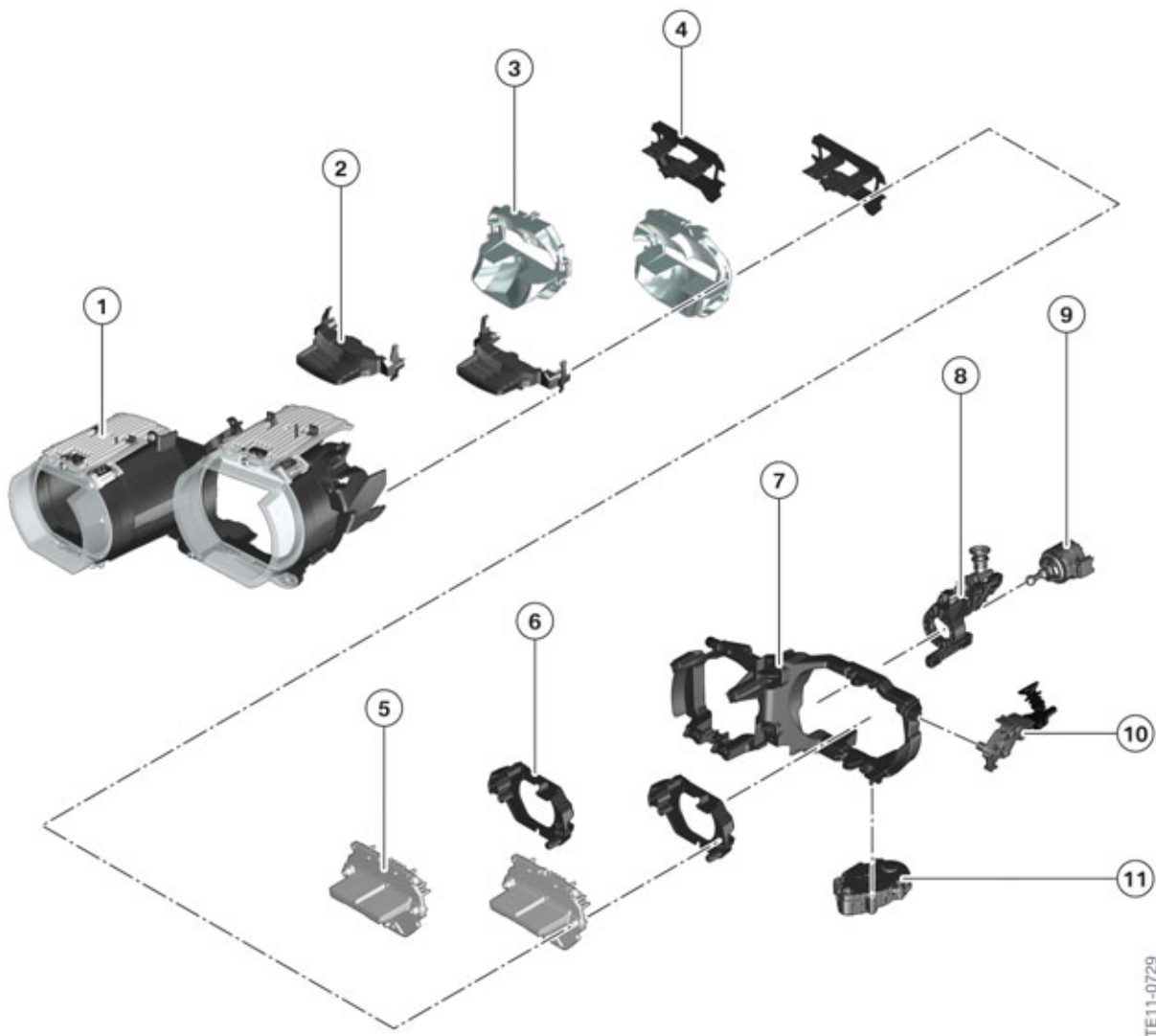
F12/F13 side lights and daytime driving light components

Index	Explanation
1	Daytime driving light – Tube
2	Corona ring
3	LED support
4	Trim
5	Side/daytime driving light heat sinks

Switching on the driving light/high-beam headlight switches on the LEDs of the side lights as well as the LEDs of the low-beam headlight/high-beam headlight.

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9. Exterior Lights



F12/F13 low-beam headlight and high-beam headlight components

Index	Explanation
1	Side lights and daytime driving light components
2	Low-beam headlight cover
3	Low-beam/high-beam headlight reflector
4	LED support
5	Dipped/high-beam headlight heat sink
6	Holder
7	Supporting frame

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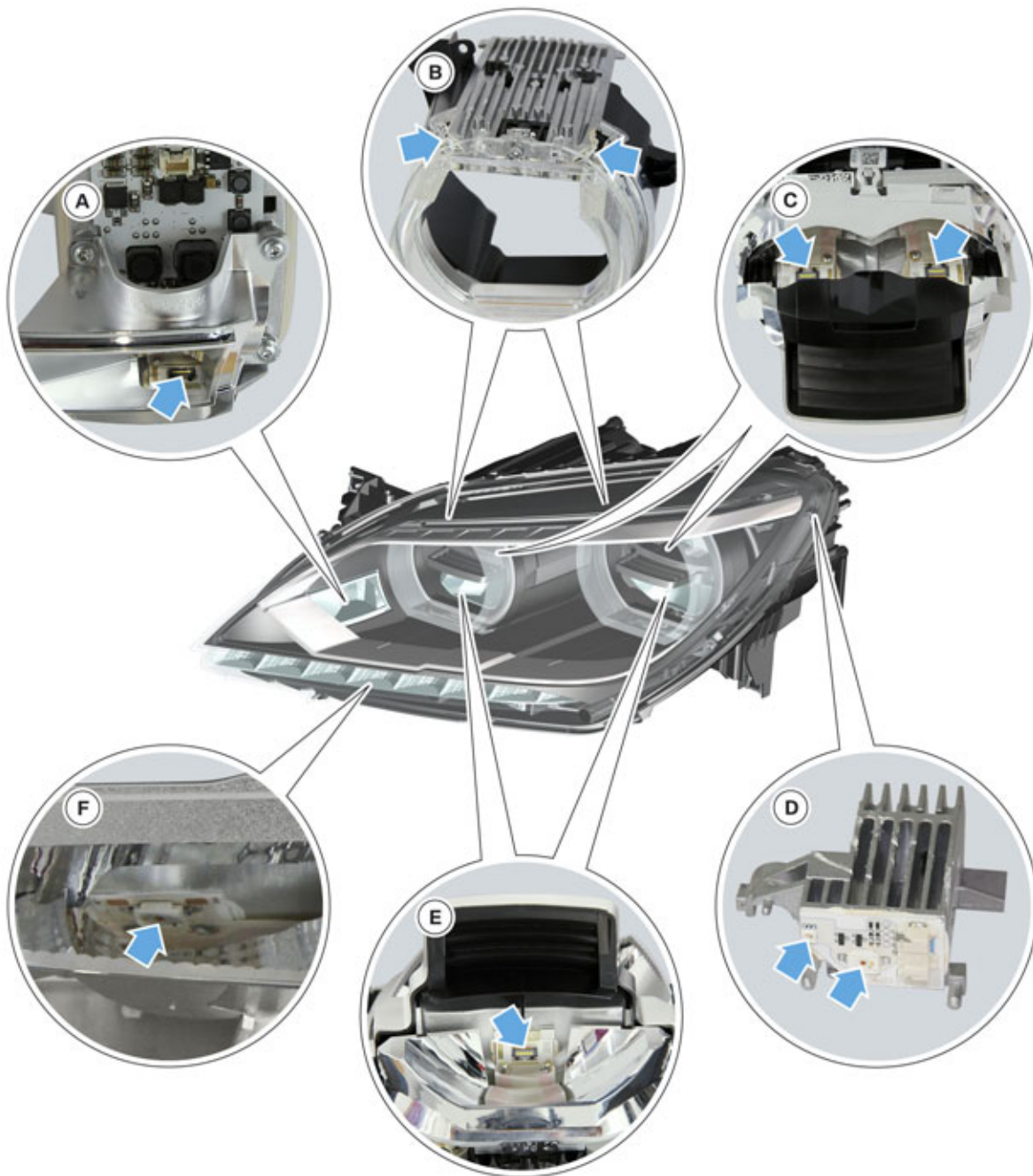
9. Exterior Lights

Index	Explanation
8	Vertical adjustment
9	Servomotor height
10	Horizontal adjustment
11	Cornering light servomotor

As the individual LEDs exhibit a lower light quantity compared to the bulbs or xenon bulbs numerous LEDs are bundled and interconnected with so-called LED supports. Various numbers of LEDs are responsible for each lighting function.

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9. Exterior Lights



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F12/F13 LED headlight light source

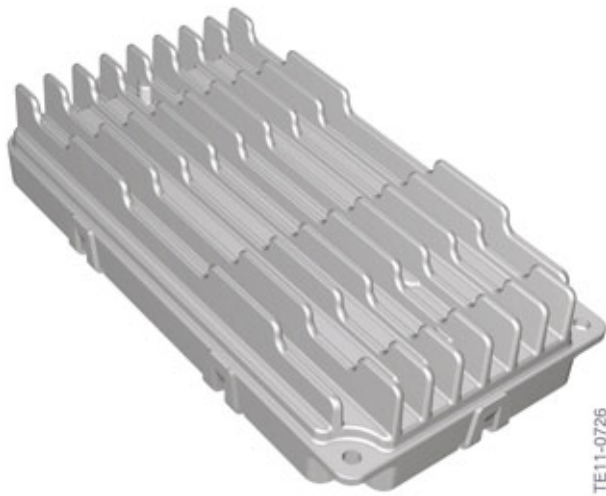
Index	Light function	Light source per LED headlight
A	Cornering light	1 LED support with 5 LEDs
B	Corona rings for side lights and daytime driving light	4 LED supports each with 2 LEDs
C	Low-beam headlight	4 LED supports each with 5 LEDs

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9. Exterior Lights

Index	Light function	Light source per LED headlight
D	Positioning light and side marker light	1 LED support each with 2 LEDs
E	High-beam headlight	2 LED supports each with 5 LEDs
F	Turn indicator	1 LED support with 8 LEDs

LED main light module



F12/F13 LED main light module

The LED main light module is fitted to the underside of the LED headlight and controls the following functions:

- Low-beam headlight
- High-beam headlight
- Headlight flasher.

The control of the lighting function takes place via pins 56a and 56b.

The LED main light module additionally controls the temperature control in the LED headlights. The values from 2 temperature sensors on the dipped and high-beam headlight heat sink serve as an input signal as well as the driving speed and ambient temperature signals communicated via LIN bus. The fans are adjusted differently. After switching off the lighting functions an after-run of the fans of up to 60 s is possible. In the temperature control there is also a function for the deicing of the LED headlight.

In the case of a failure of a temperature sensor the fans are switched on at full power to protect the components in the LED headlight. The data from the LED main light module is transferred from the LIN bus to the footwell module FRM for the diagnosis of the fans and temperature sensors.

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9. Exterior Lights

Headlight driver module



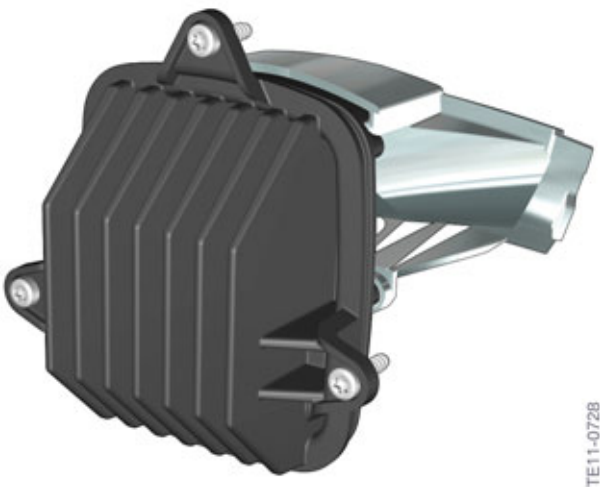
F12/F13 headlight driver module

The headlight driver module is installed as a printed circuit board in the LED headlight. The headlight driver module evaluates the signals sent via the LIN bus from the footwell module (FRM). The headlight driver module takes over the control of the following lighting functions of the LED headlight:

- Side lights
- Daytime lights
- Side marker light
- Turn indicator
- Positioning light.

As well as the lighting functions the headlight driver module also controls the stepper motors of the headlight beam throw adjustment and the cornering light.

Cornering light LED module



F12/F13 cornering light LED module

The cornering light LED module is installed as an additional light source in the LED headlight. Encoding country-specific settings makes it possible to comply with regulations worldwide.

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9. Exterior Lights

The modular design allows the interchangeability of the cornering light LED module in the existing LED headlight.

Emergency light operation

In order to prevent the exterior lights from being switched off when driving a driving light switched on by the driving remains on. In the following situations the exterior lights would be switched off:

- Failure of "terminal 15 on"
- Engine emergency stop (press the start/stop button three times)
- Accidentally pressing the START-STOP button.

If the driving speed is reduced to below 20 kph/12.4 mph the driving light is only switched off after a delay of approx. 30 s.

Adjust LED headlights

The headlight adjustment can be undertaken as before.

If the driving light is switched on via the automatic driving lights control then the urban traffic light distribution is activated. The LED headlights are only properly adjustable in the country road light distribution. The left LED headlight is moved a little to the left and simultaneously lowered in the urban traffic light distribution. If the light has been set in the urban traffic light distribution the on-coming traffic can be dazzled during the journey by the automatic driving lights control.

Therefore always put the headlight adjustment in "position 2".

Replacing components

During the service life of the vehicle various repairs can occur. Repairs can lead to components of varying software versions and hardware numbers being installed. New parts are used with the components already used in the vehicle. The replaced components must always be adjusted to the vehicle.

The following components can be replaced:

- Footwell module (FRM)
- LED main light module
- Headlight driver module
- LED headlight
- Cornering light LED module
- Outer fan
- Inner fan.

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9. Exterior Lights



Follow repair instructions when replacing individual components. Ensure that only Original BMW replacement parts are used. Only Original BMW replacement parts guarantee the function of the LED headlights.

Diagnostics

The LED headlights can be moved for various diagnosis orders in the diagnostic mode.

The diagnostic mode is required in the following diagnosis orders:

- Read out of the relevant bus signals
 - Speed
 - Yaw rate
 - Steering angle
- Check for a correct signal
- Switch-on conditions check
 - Rain-light-solar-condensation sensor status
 - FLA status
 - Light operating facility status.

Missing or implausible bus signals are saved as faults in the footwell module FRM.

The footwell module (FRM) allows the diagnosis of the LED main light module as well as the cornering light LED module.

Monitoring of the light source

Faulty LEDs are recognized by the LED main light module or the headlight driver module and sent to the footwell module FRM as a fault message.

Hot monitoring when "Light on"

The hot monitoring is based on the current measurement of the individual outputs of the footwell module FRM. Thus, with the help of power consumption a short circuit or an open circuit can be recognized. A failure of the LED headlights is given as a Check Control message in the KOMBI instrument cluster.

Emergency operation

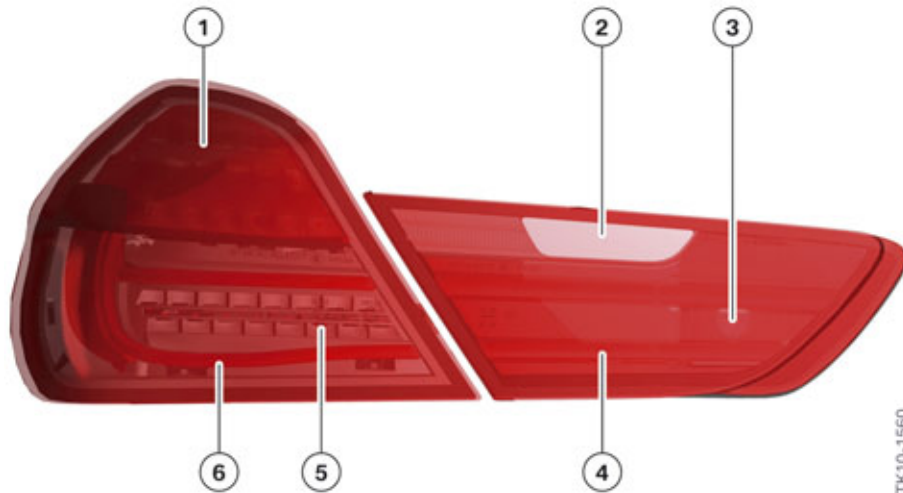
If there is a fault in the footwell module FRM that could lead to the failure of an LED headlight then an emergency operation is activated via the LED main light module. In the case of a fault in the LED main light module the emergency operation is activated via the footwell module FRM. The driving light remains switched on until the automobile is stopped. The driver is displayed the malfunction in the KOMBI instrument cluster as a Check Control message.

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9. Exterior Lights

9.3. Rear lights

The F12/F13 features a two-part rear light. The layout of the rear lights is shown in the following graphic.



F12/F13 rear light

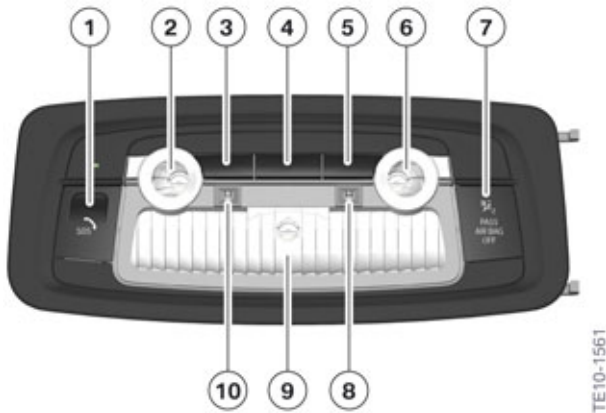
Index	Explanation
1	Turn indicator (LED)
2	Reversing light
3	Brake light for Brake Force Display
4	Tail light (LED)
5	Brake light (LED)
6	Tail light/side marker light (LED)

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10. Interior Lighting

The footwell module is the central control unit for the interior lighting. All interior light outputs of the footwell module are pulse-width-modulated. This ensures that the brightness of the interior lighting remains uniform in the event of voltage fluctuations. The pulse-width modulation is also used for the soft ON/soft OFF function.

The components of the interior light in the front roof area are integrated in the interior light unit and in the sun visors. The footwell lighting is located on the underside of the dashboard.



F12 interior light unit

Index	Explanation
1	Emergency call button
2	Reading light on left
3	Button for reading light on left
4	Button for interior light
5	Button for reading light on right
6	Reading light, right
7	Indicator lamp for front passenger airbag deactivation
8	Ambient lighting
9	Interior light
10	Ambient lighting

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10. Interior Lighting



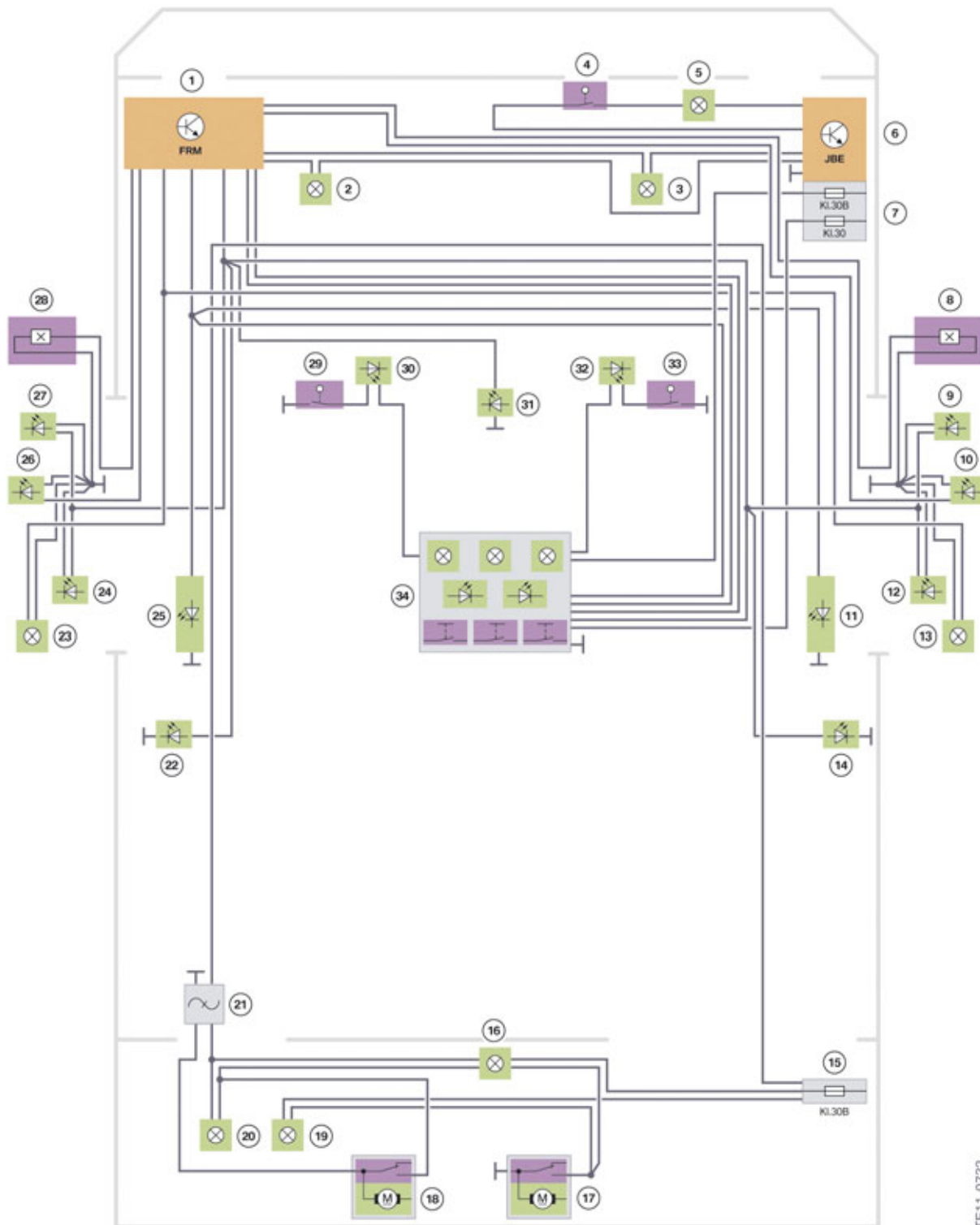
F13 roof function center

Index	Explanation
1	Interior light
2	Reading light, right
3	Emergency call button
4	Glass tilt sunroof switch
5	Indicator lamp for front passenger airbag deactivation
6	Reading light on left
7	Button for reading light on left
8	Button for interior light
9	Button for reading light on right
10	Ambient lighting right
11	Ambient lighting left

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10. Interior Lighting

10.1. System wiring diagram



F12/F13 interior light system wiring diagram

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10. Interior Lighting

Index	Explanation
1	Footwell module (FRM)
2	Footwell light, driver's side at front
3	Footwell light, front passenger side at front
4	Glove box switch
5	Glove box light
6	Junction box electronics (JBE)
7	Junction box for the power distribution box
8	Door contact, front passenger side
9	Inside door handle light, front passenger side
10	Ground lights, front passenger side
11	Entrance lighting, front passenger side
12	Door pocket lighting, front passenger side
13	Door entry lighting, front passenger side
14	Side trim panel lighting, front passenger side at rear
15	Power distribution box, luggage compartment
16	Luggage compartment light
17	Trunk lid contact with trunk lid lock (F13)
18	Trunk lid contact with trunk lid lock (F12)
19	Trunk light (F13)
20	trunk light (F12)
21	Interference suppression filter (F12 only)
22	Side trim panel lighting, driver's side at rear
23	Door entry lighting, driver's side
24	Door pocket lighting, driver's side
25	Entrance lighting, driver's side
26	Ground lights, driver's side
27	Inside door handle light, driver's side
28	Door contact, driver's side
29	Vanity mirror light switch on driver's side
30	Vanity mirror light on driver's side
31	Center console storage compartment lighting
32	Vanity mirror light on front passenger side

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10. Interior Lighting

Index	Explanation
33	Vanity mirror light switch, front passenger side
34	Interior light unit (F12) or roof function center FZD with interior light unit and reading lights (F13)
Kl.30	Terminal 30
Kl.30B	Terminal 30 basic operation

10.2. Examples of switching operations

If a door is opened when the vehicle is unlocked, the status of the relevant door contact changes. The footwell module FRM evaluates the status and sends the request to switch on the interior light. Parallel to this, the footwell module FRM switches on the door entry lighting for the open door, the door entry lighting and footwell lighting.

The status of the door contact changes again when the door is closed. The footwell module initiates the procedure to switch off the interior light.

The luggage compartment lights are connected to the voltage supply via terminal 30B. If the trunk lid is opened, the luggage compartment light and trunk lid light are switched on via the trunk lid contact.