Non-glare high-beam assistant

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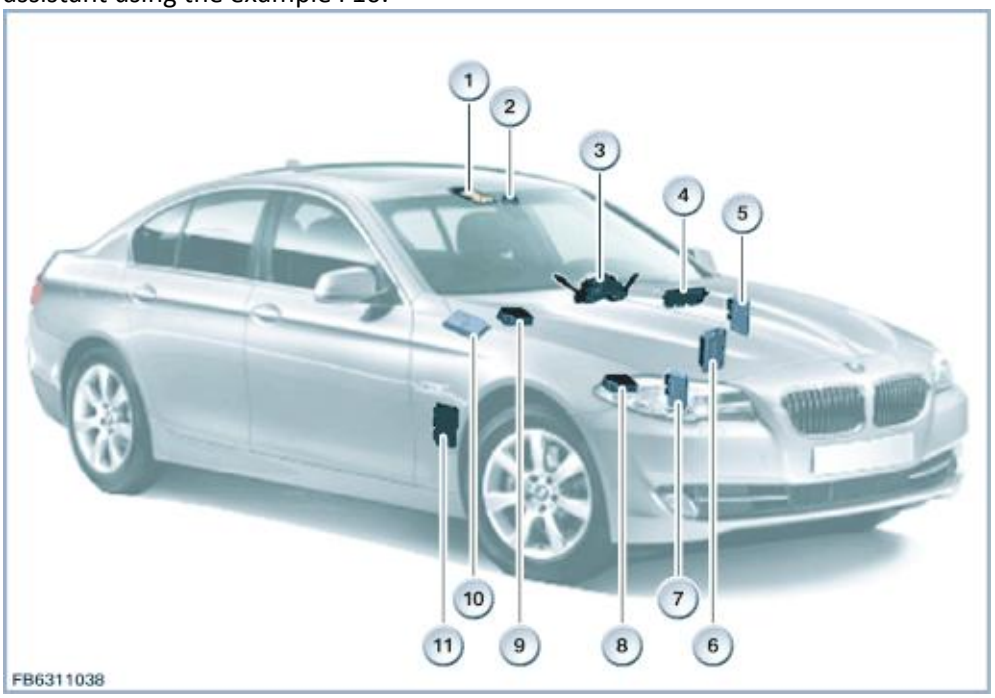
Non-glare high-beam assistant
The exterior lights allows the owner to identify the vehicle and signal driving manoeuvres during both the day and night. The vehicle lights illuminate the vehicle driving area.
In order to meet the requirements derived from the different traffic situations and road surface types, the use of headlights will occur with variable light distribution in the future. The goal is an improved illumination of the roadway with greater headlight beam throw even with oncoming traffic or traffic ahead.
The non-glare high-beam assistant system can remain switched on throughout the entire night drive. Oncoming cars or traffic ahead will be detected on time and "suppressed" from the light beam. The more intensive use of the high-beam headlight at night results in an improved recognition of dangerous situations. The exterior lights thus contribute to active safety in traffic.
The non-glare high-beam assistant is integrated in the optional equipment Adaptive Headlight SA524. This results in a forced connection with the following optional equipment:

- Xenon headlight SA522 or LED headlight SA552
- Rain sensor SA521
- Fog lights SA520
- high-beam assistant SA5AC

The non-glare high-beam assistant is only offered in the European version. The non-glare high-beam assistant is not available in the US version and Japanese version.
Depending on the model series, version, model year and vehicle equipment, different systems may be used for the anti-dazzle high beam assist function:

- Example F06, F12, F13:
  - Vehicles with xenon headlights:
    The left-hand and right-hand headlight driver modules are connected to the LIN bus.
  - Vehicles with LED headlights:
    The left-hand and right-hand main LED headlight modules are connected to the LIN bus.
    The left-hand and right-hand headlight driver modules are connected to the LIN bus.
- Example F01, F02 and F10, F11, F18 and F15, F16:
  - Vehicles with xenon headlights:
    The left-hand headlight driver module (STML) and right-hand driver module (STMR) are connected to the K-CAN3 and to the LIN bus.
  - Vehicles with LED headlights:
    The left-hand LED main headlight module (LHML) and right-hand LED main headlight module (LHMR) are connected to the K-CAN3 .
    The left-hand headlight driver module (STML) and right-hand driver module (STMR) are connected to the K-CAN3 and to the LIN bus.
- Example F32, F33, F36, F8x:
  - Vehicles with xenon headlights:
    The left-hand headlight driver module (STML) and right-hand driver module (STMR) are connected to the K-CAN2 and to the LIN bus.
  - Vehicles with LED headlights:
    The left-hand LED main headlight module (LHML) and right-hand LED main headlight module (LHMR) are connected to the K-CAN2 .
    The left-hand headlight driver module (STML) and right-hand driver module (STMR) are connected to the K-CAN2 and to the LIN bus.

The graphic below shows the components that are involved in the control of the non-glare high-beam assistant using the example F10.



Item	Explanation	Item	Explanation
1	KAFAS camera (KAFAS) or FLA camera	2	Rain-light-solar-condensation sensor
3	Steering column switch cluster	4	Car access system (CAS)
5	Footwell module (FRM)	6	Crash Safety Module (ACSM)
7	Roller drive of cover	8	Stepper motors of the LWR
9	Integrated Chassis Management (ICM)	10	Central gateway module (ZGM)
11	Junction Box Electronics (JBE)		

Brief component description

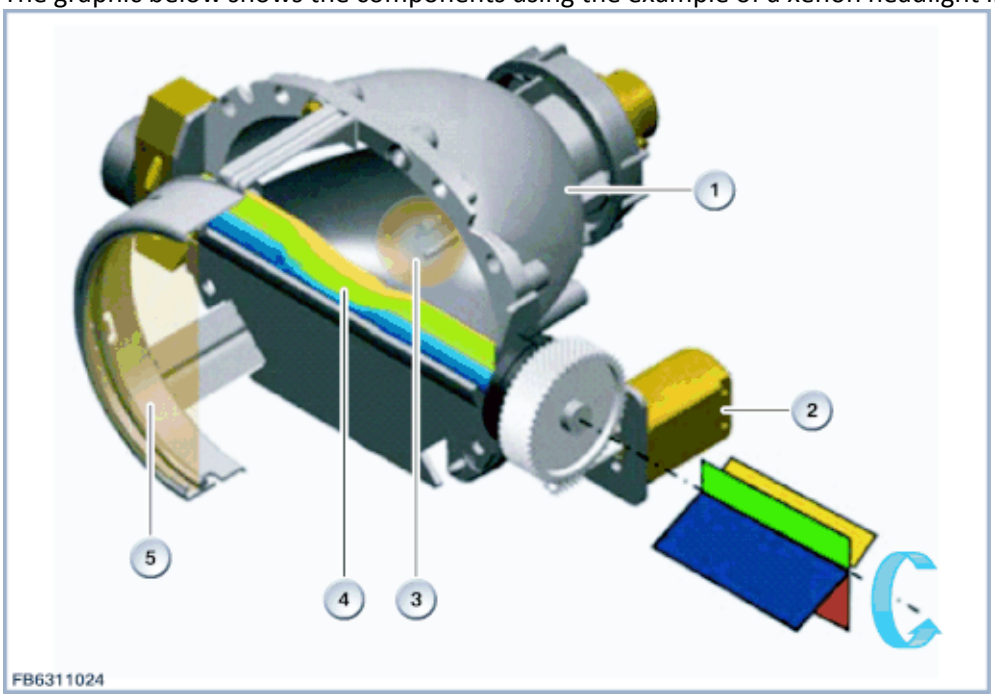
Components can vary depending on the vehicle-specifics and equipment-specifics. For example: The front electronics module (FEM) replaces the footwell module (FRM) in the F3x and the junction box electronics (JBE). In F15, F16, the Body Domain Controller (BDC) replaces the footwell module (FRM) and junctin box electronics (JBE).

The following components are described for the non-glare high-beam assistant:

- Headlight
- Headlight driver module
- Footwell module
- LED main light module
- Integrated chassis management
- Junction Box Electronics
- Central gateway module
- Front Electronic Module
- Body Domain Controller
- Steering column switch cluster
- Rain-light-solar-condensation sensor
- Inside mirror with high-beam assistant
- Camera-based driver support systems camera
- Operating facility for light
- Turn signal/high beam switch

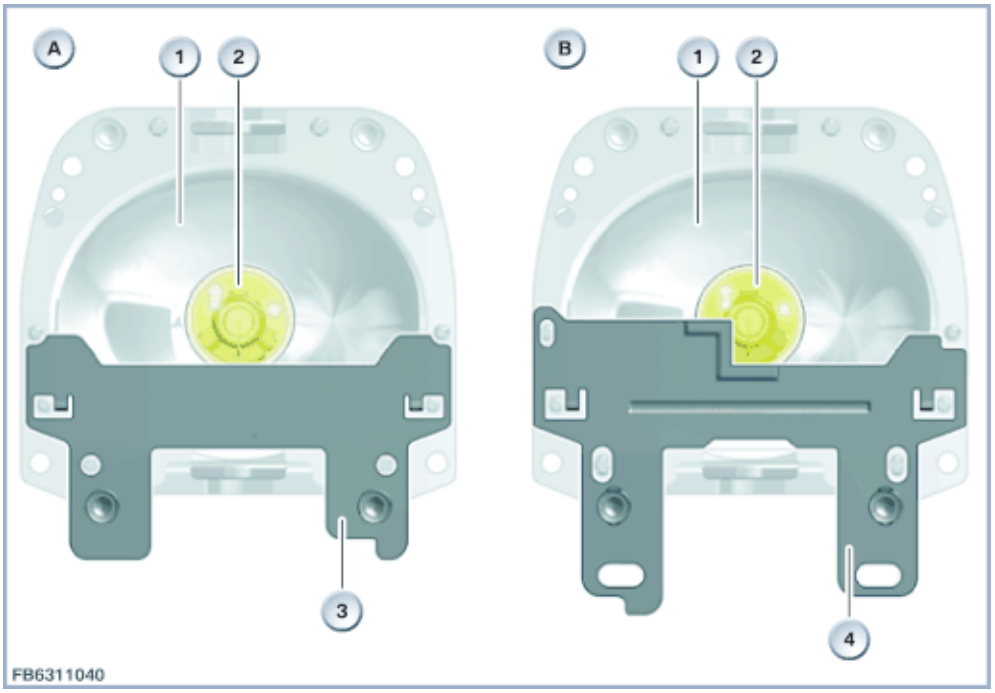
Headlight

Xenon headlights and LED headlights are available as optional equipment. Xenon headlights or LED headlights are required for the non-glare high-beam assistant. The low-beam headlight of the xenon headlight is located in the outer chamber of the headlight. If the vehicle has LED headlights, the LEDs of the low-beam headlight will be switched on in both chambers of the headlight when the driving light is switched on.
Each of the headlights has two stepper motors. One for the headlight beam throw adjustment, and the second stepper motor is responsible for the function of the curve light and also the function of the non-glare headlight assistant. Each headlight can hereby be swivelled up to a maximum of 15° separately. This results in an adjustment of the headlight, which provides a non-glare range from 5° - 7° in the event of oncoming traffic or traffic ahead.
The light beam of the headlight is limited to the inside with a permanent cover. This results in a light distribution that is different from conventional headlights.
The high-beam headlight is also used for the headlight flasher function.
The graphic below shows the components using the example of a xenon headlight in the F01LCI.



Item	Explanation	Item	Explanation
1	Reflector	2	Servomotor for the cover
3	Light source	4	Rotating roller with different contours
5	Lens of the headlight		

The graphic below shows the components using the example of a xenon headlight in the F30.



Item	Explanation	Item	Explanation
A	Outer chamber (low-beam headlight)	B	Inner chamber (high-beam headlight)
1	Reflector	2	Light source
3	Permanent cover	4	Shutter (anti-dazzle high beam assist)

Headlight driver module

The headlight driver module is fitted as a printed circuit board in the headlight. The headight driver module evaluates the signal sent from the footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC). In this process, the headlight driver module assumes control of the following lighting functions of the headlight.

In addition to the light function, the headlight driver module also controls the following functions of the stepper motors:

- Headlight beam throw adjustment
- Adaptive Headlights
- Non-glare high-beam assistant

LED main light module

The LED main headlight module is integrated in the LED headlight.

The LED main light module controls the following functions:

- Low-beam headlights
- High-beam headlight
- Headlight flasher

The lighting functions are controlled via terminals 56 a and 56 b.

The LED main light module also regulates the temperature control in the LED headlight. The values of 3 temperature sensors and the signals relating to driving speed and ambient temperature serve as an input signal. The temperature control also includes a function for de-icing the LED headlight.

The data from the LED main headlight module are sent to the footwell module (FRM) or the front electronics module (FEM) or to the body domain controller (BDC) for diagnosis of the fan and temperature sensors.

FRM: Footwell module

All functions of the exterior lights are controlled by the footwell module (FRM).

The footwell module (FRM) receives many input signals that cause the headlights to be switched on. The footwell module (FRM) forms the interface to the instrument cluster (KOMBI). It enables communication between the LIN bus and the K-CAN and therefore message transmission to the respective other data

bus.
ICM: Integrated chassis management
Data from ride height sensors at the front and rear axle is evaluated by the Integrated Chassis Management (ICM). The automatic headlight beam throw adjustment thus ensures that oncoming traffic is not dazzled. The Integrated Chassis Management (ICM) also contains sensors for driving dynamics control. The footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) receives the signals from the integrated chassis management (ICM)..
JBE: Junction Box Electronics
The Junction Box Electronics (JBE) requests information on ambient brightness from the rain-light-solar-condensation sensor through the LIN bus. The junction box electronics (JBE) send the status to the footwell module (FRM). The footwell module (FRM) assesses the status of the ambient brightness.
ZGM: Central gateway module
The central gateway module (ZGM) links all of the data buses. The central gateway module's (ZGM) gateway function thus supports data exchanges amongst the various bus systems. Stored system functions can be called up using appropriate commands.
Front electronic module (FEM): Front Electronic Module
The Front Electronic Module (FEM) represents a new generation which supersedes existing control units and their functions. The Front Electronic Module (FEM) is the central control unit in the vehicle electrical system. At the same time, the Front Electronic Module (FEM) is the gateway for the other control units. The Front Electronic Module (FEM) provides functions from the previous control units footwell module (FRM), Car Access System (CAS), Junction Box Electronics (JBE) and central gateway module (ZGM). The central gateway module (ZGM) is installed in the Front Electronic Module (FEM) as an independent control unit.
As the master control unit, the Front Electronic Module (FEM) is responsible for the functions of the exterior lights. The front electronic module (FEM) decides which lighting functions must be activated and/or deactivated. For many functions, information from sensors, contacts and switches is required. The Front Electronic Module (FEM) receives the signals from the components and transmits the corresponding information to the bus users.
BDC Body Domain Controller
The Body Domain Controller (BDC) represents a new generation superseding existing control units and their functions. The body domain controller (BDC) is the central control unit in the vehicle electrical system. At the same time, the body domain controller (BDC) is the gateway for the other control units. The body domain controller (BDC) makes available functions from the previous control units footwell module (FRM), Car Access System (CAS), Junction Box Electronics (JBE) and central gateway module (ZGM). The central gateway module (ZGM) is an independent module in the Body Domain Controller (BDC).
The Body Domain Controller (BDC) as the master control unit is responsible for the exterior lights functions. The Body Domain Controller (BDC) decides which light functions are to be activated or deactivated. For many functions, information from sensors, contacts and switches is required. The Body Domain Controller (BDC) receives the signals from the components and transmits the corresponding information to the bus users.
Steering column switch cluster
The steering column switch cluster features one steering column switch each on the left and right sides. The right-hand steering column switch controls the functions of the wash/wipe system. The steering column switch on the left side of the steering column controls the high-beam headlight and turn indicators as well as operation of the on-board computer.
The signals for the integrated steering angle sensor are sent to the Integrated Chassis Management (ICM).
Rain-light-solar-condensation sensor
The rain-light-solar-condensation sensor receives its voltage supply from the roof function centre (FZD) and consists of the following sensors:

- Rain sensor
- Photosensor

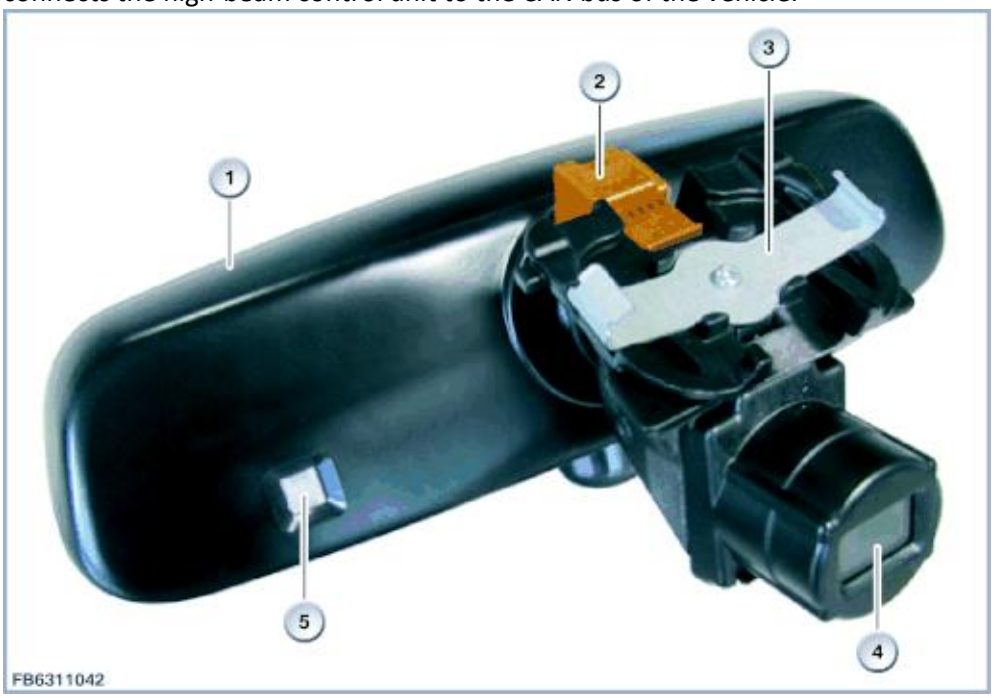
- Solar sensor
- Condensation sensor

The photosensors measure the ambient brightness and the near field of the vehicle. The photosensors supply the signal for switching the automatic driving lights control on or off.

Inside mirror with high-beam assistant

The high-beam assistant camera and high-beam assistant control unit are installed in a common housing in the interior mirror. The high-beam assistant camera is a simplified image sensor that can recognise the colour and intensity of the light.

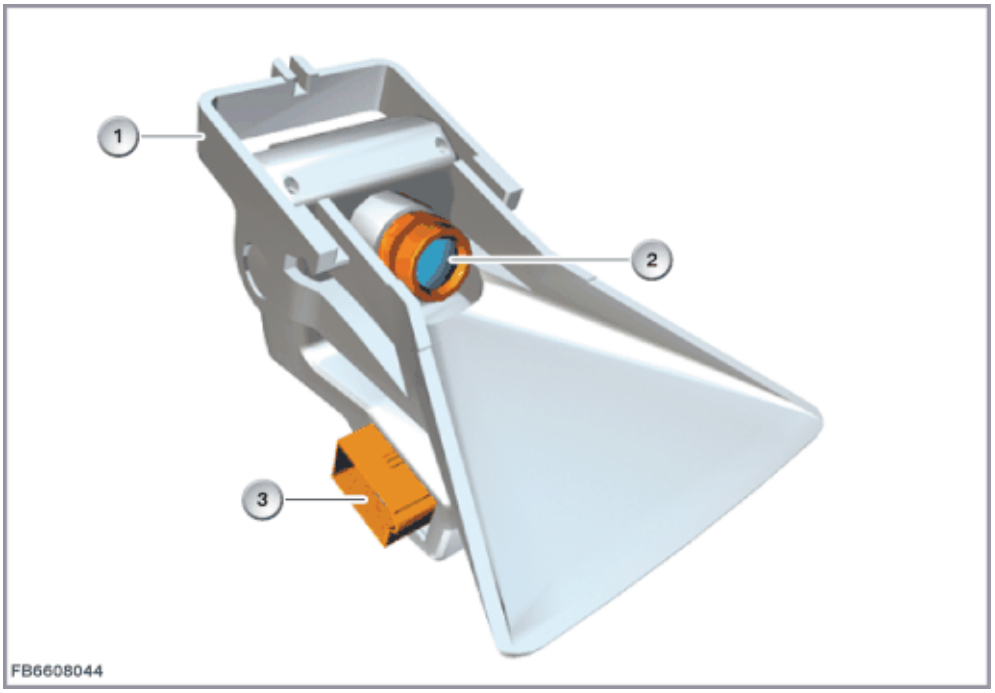
A plug connector supplies the high-beam assistant camera with voltage. An additional connector connects the high-beam control unit to the CAN bus of the vehicle.



Item	Explanation	Item	Explanation
1	Inside mirror with high-beam assistant	2	Plug connection, LVDS line
3	Camera holder	4	Camera
5	Photosensor		

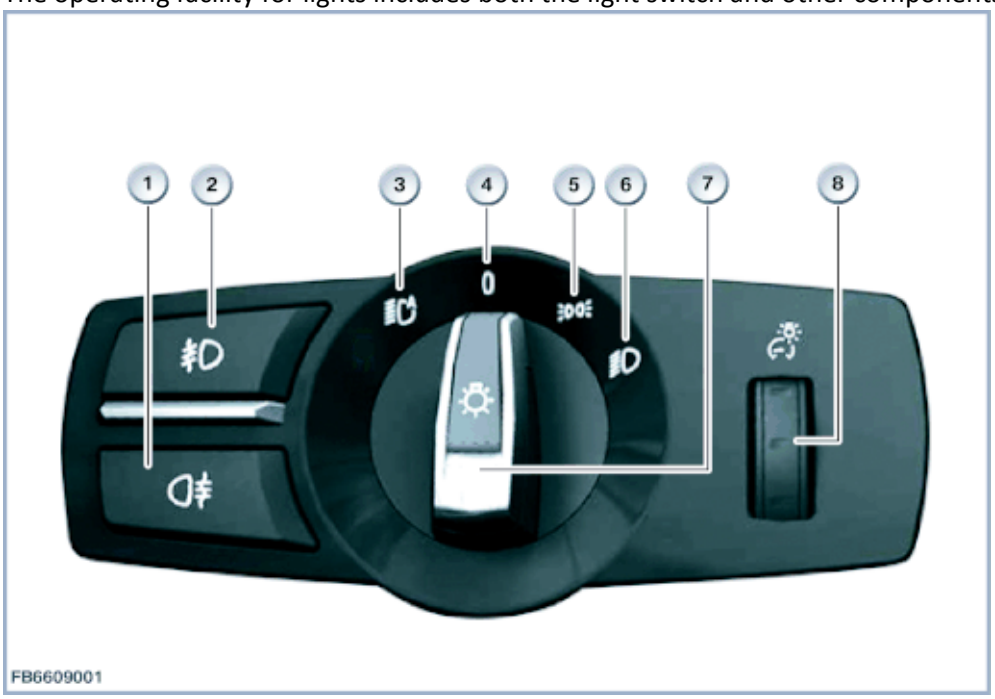
Camera-based driver support systems camera

Depending on the options fitted, various camera-based systems are available. The light points, light colours and light intensities picked up by the KAFAS camera are evaluated by the KAFAS control unit. The evaluation by the KAFAS control unit results in a recommendation to switch on or off the non-glare high-beam assistant. The technical implementation occurs with the a KAFAS camera and KAFAS control unit.



Item	Explanation	Item	Explanation
1	Camera holder	2	Camera
3	Plug connection, LVDS line		

Operating facility for light
The exterior lights can be switched on and off at the operating facility for lights.
The operating facility for lights includes both the light switch and other components.



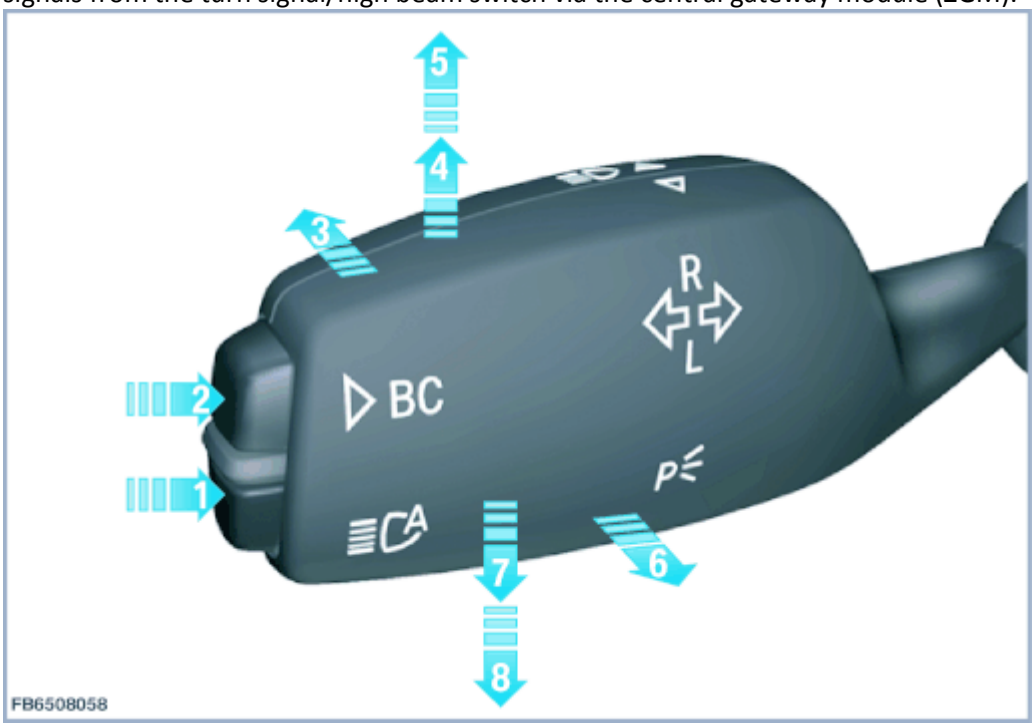
Item	Explanation	Item	Explanation
1	Button for the rear fog lights	2	Button for the fog lights
3	Light switch in the switch position A (switch position for automatic driving lights control)	4	Switch position 0 for daytime driving lights
5	Switch position 1 for side lights	6	Switch position 2 for low-beam headlights

7	Rotary switch for lighting functions	8	Dimmer for instrument lighting

Turn signal/high beam switch

The turn indicators and the high-beam headlight are controlled by turn signal/high beam switch on the steering column switch cluster.

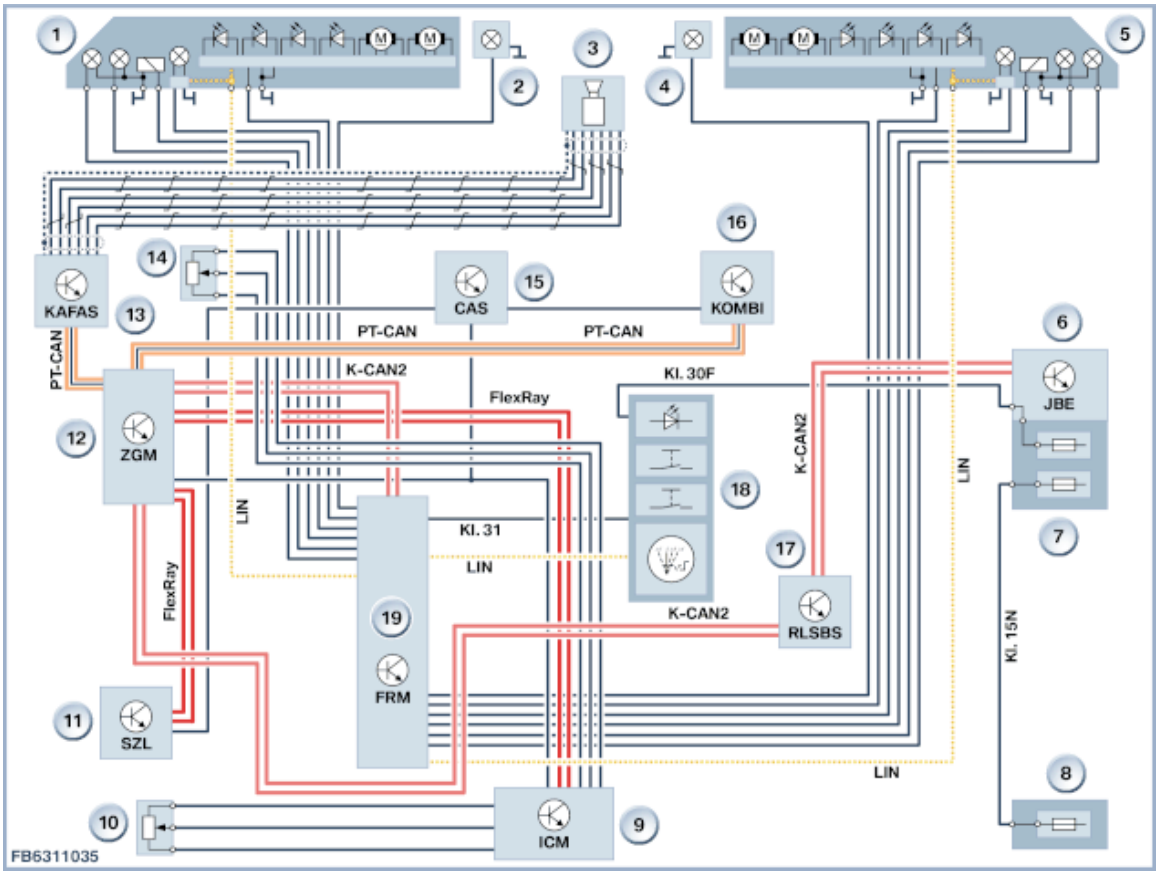
The signal for the turn signal/high beam switch is sent by the steering column switch cluster The footwell module (FRM) or front electronics module (FEM) or Body Domain Controller (BDC) receives the signals from the turn signal/high beam switch via the central gateway module (ZGM).



Item	Explanation	Item	Explanation
1	Non-glare high-beam assistant button	2	On-board computer button
3	High-beam headlight	4	One-touch flashing, right
5	Continuous flashing, right	6	Headlight flasher
7	One-touch flashing, left	8	Continuous flashing, left

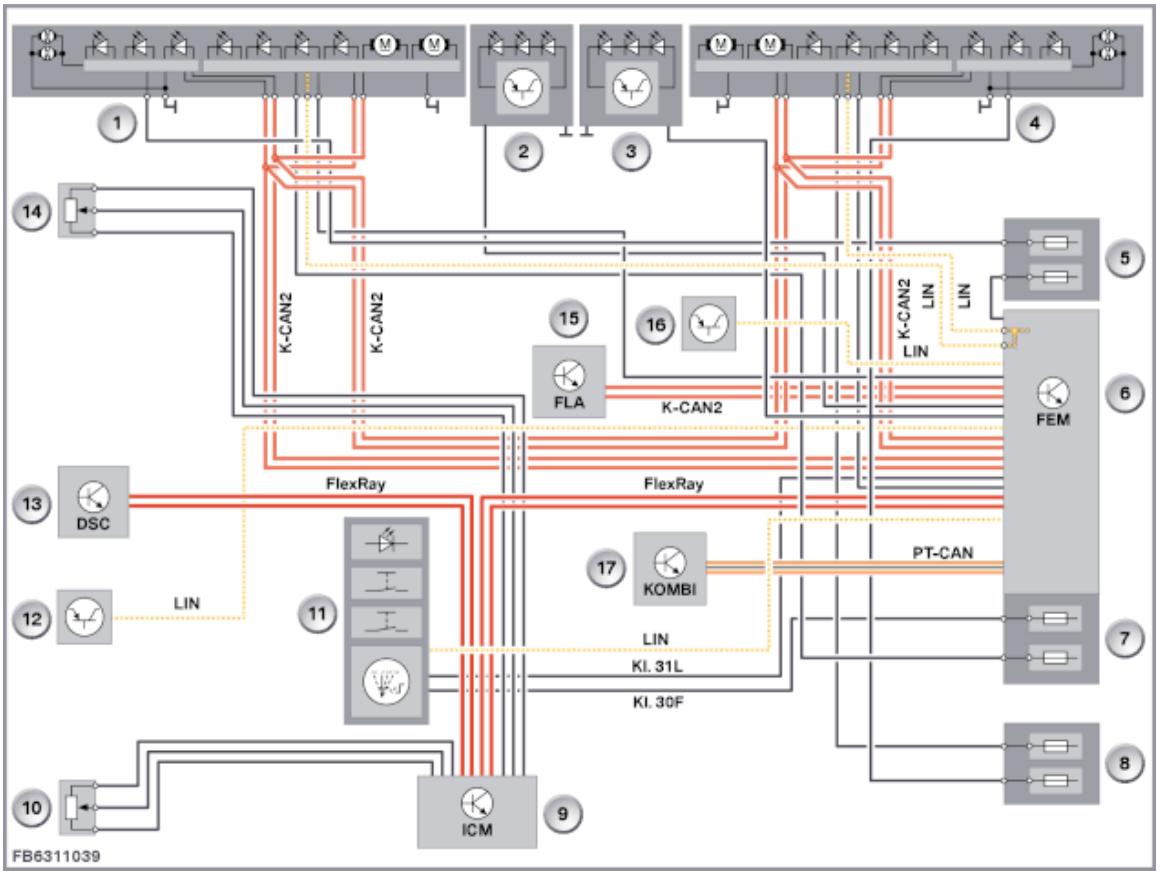
System overview

The graphic below shows the system network of the non-glare headlight assistant with KAFAS camera and xenon headlights on the example F10.



Item	Explanation	Item	Explanation
1	Left headlight	2	Left fog light
3	Camera-based driver support systems camera	4	Right fog light
5	Right headlight	6	Junction Box Electronics (JBE)
7	Junction box electronics (JBE) power distribution box	8	Power distribution box
9	Integrated chassis management (ICM)	10	Ride height sensor, rear
11	Steering column switch cluster	12	Central gateway module (ZGM)
13	Camera-based driver support systems camera control unit (KAFAS)	14	Front ride height sensor
15	Car access system (CAS)	16	Instrument panel (KOMBI)
17	Rain-light-solar-condensation sensor	18	Operating facility for light
19	Footwell module (FRM)		

The graphic below shows the system network of the non-glare headlight assistant in the inside mirror and LED headlights on the example F32.



Item	Explanation	Item	Explanation
1	Left headlight	2	Left fog light
3	Right fog light	4	Right headlight
5	Front fuse and relay module	6	Front Electronic Module (FEM)
7	Front electronic module power distribution box	8	Power distribution box, rear
9	Integrated chassis management (ICM)	10	Ride height sensor, rear
11	Operating facility for light	12	Steering column switch cluster
13	Dynamic stability control (DSC)	14	Front ride height sensor
15	Inside mirror with high-beam assistant	16	Rain-light-solar-condensation sensor
17	Instrument panel (KOMBI)		

System functions

The lighting functions of the headlights are controlled with one headlight driver module each. The headight driver module receives the information for the voltage supply to the light sources from the footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC). The xenon headlights or LED headlights are supplied with voltage by a power distribution box.

The following system functions are described:

- Side lights, driving light and high-beam headlight
- Dynamic headlight beam throw adjustment
- Automatic driving lights control
- Variable light distribution
- Adaptive Headlights
- Non-glare high-beam assistant

Side lights, driving light and high-beam headlight

The exterior lights can be switched on and off at the lights operating facility.

Side lights

To use the side lights to make the parked vehicle easier to identify in darkness, the light switch must be turned to switch position 1. When the side lights are switched on, an acoustic signal sounds if the driver's door is opened, while a Check Control message also appears in the instrument panel (KOMBI). Leaving the side lights on can drain the vehicle's battery.

Driving light

The light switch of the operating facility must be rotated to switch position 2 to activate the low-beam headlight. When the engine is switched off, the side lights remain on although the light switch is in switch position 2. When the driver's door is opened, the side lights are also switched off.

In switch position A (switch position for automatic driving lights control), the driving light is activated depending on the ambient brightness (signal from the rain-light-solar-condensation sensor). The footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) switches on the daytime driving light.

The headlights execute a reference run each time terminal 15 is activated. The adjustment range of the headlight beam throw adjustment and adaptive head light will hereby be referenced.

High-beam headlight

The high-beam headlight is switched on under the following preconditions:

- Terminal 15 on
- Driving light on
- High-beam headlight selected at turn signal/high beam switch or with high-beam assistant activated

The headlight flasher is activated by pulling back the turn signal/high beam switch.

Dynamic headlight beam throw adjustment

The automatic headlight beam throw adjustment thus ensures that oncoming traffic is not dazzled. The automatic headlight beam throw adjustment is supported by two ride height sensors. one ride height sensor each located on the front axle and the rear axle of the vehicle. Data from ride height sensors are evaluated directly by the Integrated Chassis Management (ICM). The footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) receives the signals from the integrated chassis management (ICM)..

The dynamic headlight beam throw adjustment was developed for compensating pitching movements that occur as a result of braking and acceleration.

Automatic driving lights control

The following preconditions must be satisfied before the driving light can be activated automatically:

- Light switch in the switch position A (switch position for automatic driving lights control)
- Terminal 15 on
- Rain-light-solar-condensation sensor reports low brightness

The junction box electronics (JBE) or the front electronics module (FEM) or the body domain controller (BDC) module requests the status of the ambient brightness from the rain-light-solar-condensation sensor. The footwell module (FRM) or the front electronics module (FEM) or the body domain controller (BCD) carries out any prompt received to switch the daytime driving lights on or off. The automatic driving lights control switches on the driving light together with the side lights.

Should no signal be received from the rain-light-solar-condensation sensor owing to a defect while the automatic driving lights control is activated, the footwell module (FRM) or the front electronics module (FEM) or the body domain controller (BDC) will respond by switching on the daytime driving lights.

Once the headlamps have been switched on by the automatic driving lights control, they can be switched off again with the light switch or by the rain-light-solar-condensation sensor, provided that ambient lighting of adequate brightness is present. Even after Terminal 15 off the side lights can remain on because they were activated by the automatic driving lights control system. The side lights are switched off automatically when the driver's door is opened. When the occupants exit the vehicle from another door, the side lights are switched off when the vehicle's locks are engaged.

The footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) switches on the daytime driving light only at low ambient brightness levels. There may thus be a delayed

activation of the driving light when the vehicle enters a tunnel or a tree-shaded lane. The light switch must be in switch position A (switch position for automatic driving lights control)

Variable light distribution

In the Europe version, the variable light distribution function is integrated in the footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC). The variable light distribution is not available in US market versions.

City light distribution

The urban light distribution pattern projects more light toward the left edge of the road than the previous lighting system. The footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) achieves improved illumination of the roadway through following measures:

- Lowering the left headlight
- Tilting the left headlight to the left

The urban light distribution pattern is available as soon as the engine running signal is present. The Digital Engine Electronics (DME) and Digital Diesel Electronics (DDE) furnish the signal.

Country road light distribution

The secondary road light distribution pattern corresponds to the pattern hitherto employed for the driving light. This lighting function is available once Terminal 15 on status is present. The country road light distribution represents the basic setting for the headlights. The basic setting is assumed when there are faults in the complete light distribution system.

The system switches from urban traffic light distribution to country road light distribution as soon as the driving speed exceeds 45 kilometres per hour. The system reverts to the urban light distribution pattern when the driving speed falls back below 40 kilometres per hour. The footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) receives the speed signal as well as the engine running signal from the central gateway module (ZGM).

Motorway light distribution

The motorway light distribution increases the range of the driving light under certain conditions.

The foowell module (FRM) or front electronics module (FEM) or body domain controller (BDC) switches the headlights to motorway light distrubution mode under following conditions:

- Driving speed exceeds 110 kilometres per hour for longer than 30 seconds
- Driving speed exceeds 140 kilometres per hour

The headlights are lowered once the driving speed falls below 110 kilometres per hour. The headlights are lowered (reducing the headlight beam throw) in gradual stages as the speed drops below 110 kilometres per hour:

- 110 kilometres per hour
- 100 kilometres per hour
- 90 kilometres per hour
- 80 kilometres per hour

From 80 kilometres per hour, the headlights are fully reset to country road light distribution.

Adaptive Headlights

The adaptive head light is offered as optional equipment required for the non-glare high-beam assistant. The Adaptive Headlight is basically a headlight that can tilt along a horizontal and vertical axis and is part of both the low-beam headlight and high-beam headlight function. The Adaptive Headlight feature allows the headlights to turn into the direction of the driving area while cornering. Using the automatic headlight beam throw adjustment ensures optimum adaptation in every driving situation. The headlights swivel angle is continuously adjusted for the duration of cornering. This enhanced illumination during cornering improves visibility for the driver.

The Adaptive Headlight's electronics componentry facilitates rapid reaction to current driving situation. The electronics can also activate an emergency program.

Non-glare high-beam assistant

The object recognition of the KAFAS camera and/or the inside mirror with high-beam assistant uses a motor to control a movable cover in the headlight. The high-beam headlight is thereby masked so that oncoming traffic or traffic driving ahead is not blinded. Your own high-beam headlight is thereby suppressed for the other vehicle. The greatest possible headlight illumination is thereby available to the

driver with the non-glare high-beam assistant without blinding other road users.
The non-glare high-beam assistant is a combination of the following light controls:

- Dynamic headlight beam throw adjustment
- Automatic driving lights control
- Variable light distribution
- Adaptive Headlights

When activated with the headlights on, the high-beam assistant automatically activates and switches off the high-beam headlights. The non-glare high-beam headlight assistant uses the KAFAS camera and/or high beam assistant camera to recognise the oncoming traffic and traffic driving ahead. The non-glare high-beam assistant ensures that the high-beam headlights are activated whenever traffic situations allow.

Item	Explanation	Item	Explanation
1	Road reflections	2	Oncoming traffic headlights
3	Rear lights of traffic driving ahead.	4	Reflections of road markings
5	Reflections of traffic signs		

The light cones of the headlights were continuously adjusted by the servomotors of the headlight beam throw adjustment and also the servomotors of the adaptive headlight.
Recognised road users will be suppressed using a cover in the headlight. If required due to traffic conditions, the non-glare high-beam assistant will suppress on one side or both sides.
The non-glare high-beam assistant recognises oncoming traffic from distances of 1000 m. Traffic driving ahead is recognised up to 400 m.
The high-beam headlights can always be switched on and off manually.
To activate the non-glare high-beam assistant:

1. Turn light switch to switch position A (switch position for automatic driving lights control)
2. Press the non-glare high-beam assistant button on the left steering column switch
3. The indicator light (2) in the instrument cluster lights up.

Item	Explanation	Item	Explanation
1	Indicator light for switched on high-beam headlight or partial high-beam headlight.	2	Indicator light for activated non-glare high-beam assistant

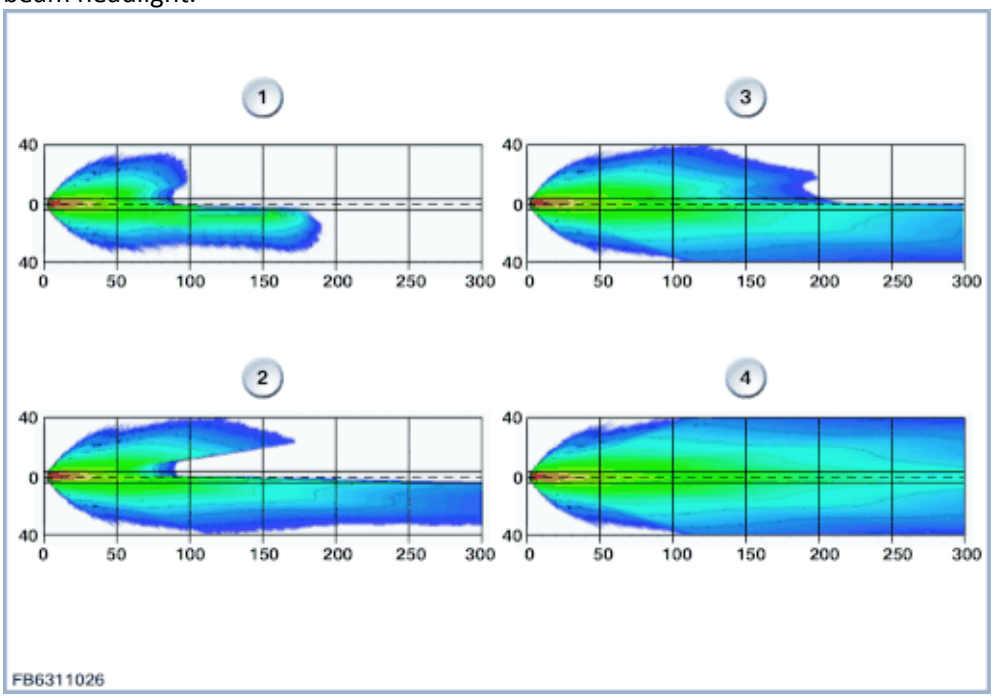
The non-glare high-beam assistant responds to lights on approaching and preceding vehicles while also monitoring the surrounding area for adequate illumination.

Manual high-beam activation and dipping

1. High-beam headlight on or headlight flasher on
2. High-beam headlight off

To switch the non-glare high-beam assistant off, press the high-beam assistant button on the left steering column switch again.

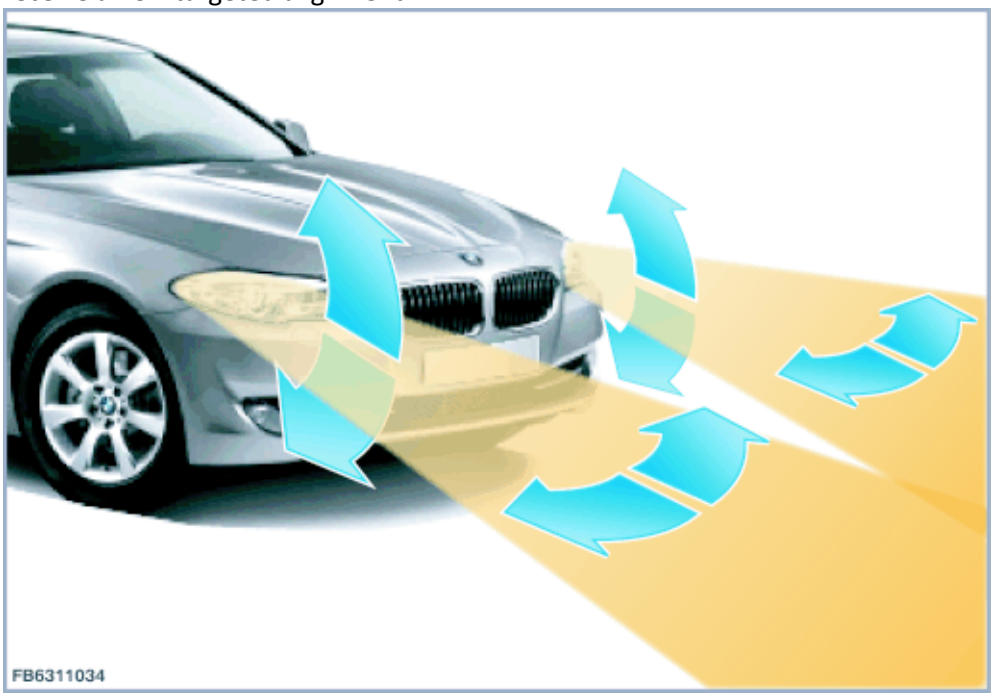
The graphic below shows the different light distributions for city, county road, freeway and full high-beam headlight.



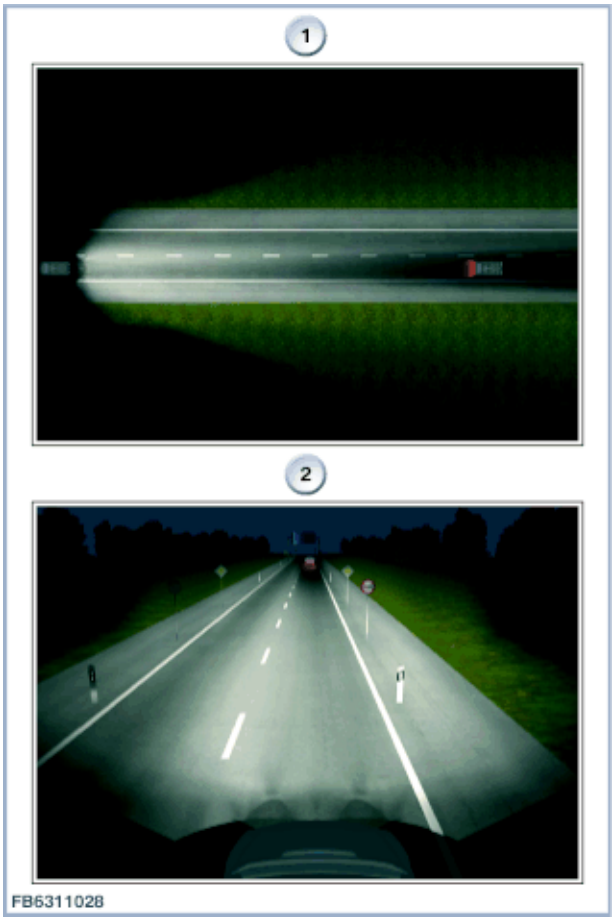
Item	Explanation	Item	Explanation

1	City light distribution	2	Light distribution for county road (oncoming traffic suppressed)
3	Country road light distribution	4	Light distribution for freeway (full high-beam headlight)

An asymmetrical shorter headlight beam through was realised in the light distribution for city. A greater headlight beam throw is not necessary due to the street lighting.
In the light distribution for county road the light distribution targets good illumination of the road sides and high range. For this purpose, the light/dark boundary will be raised in the outer area. This illuminates traffic signs and obstacles clearly sooner and better. A limitation of the headlight beam throw in the center serves to prevent blinding oncoming traffic.
The light distribution for freeway approximately correspond with the light distribution for county road; however, the limitation in the centre does not apply.
Combined light distributions are also available for the last mentioned light distributions. During the transition from light distribution for county road to light distribution for freeway, the characteristic properties of the correspondent light distributions vary. In addition, a speed-dependent raise of the light/dark boundary occurs for the light distribution for freeway to increase the range.
Conditions between a light distribution and the full high-beam headlight and low-beam headlight can be implemented with defined recesses in the cover.
Horizontal movement range of headlights
Both headlights can be moved vertically and also horizontally by a few degrees. The light cones thereby receive a new targeted alignment.



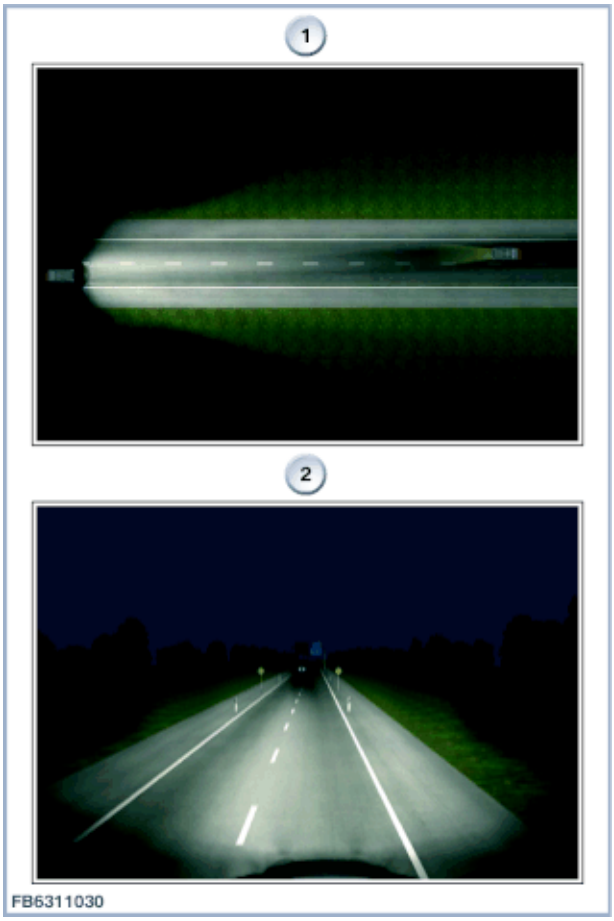
Preceding vehicle
To recognize a vehicle, the non-glare high-beam assistant monitors the immediate area (up to 400 m) in front of the vehicle. The non-glare high-beam assistant recognises the rear lights of vehicles driving ahead. When recognising road users driving ahead, the non-glare high-beam assistant will automatically adjust the high-beam headlight. The traffic driving ahead can thereby not be blinded.
The graphic below shows the light distribution from the "top" (1) and from the driver's perspective (2).



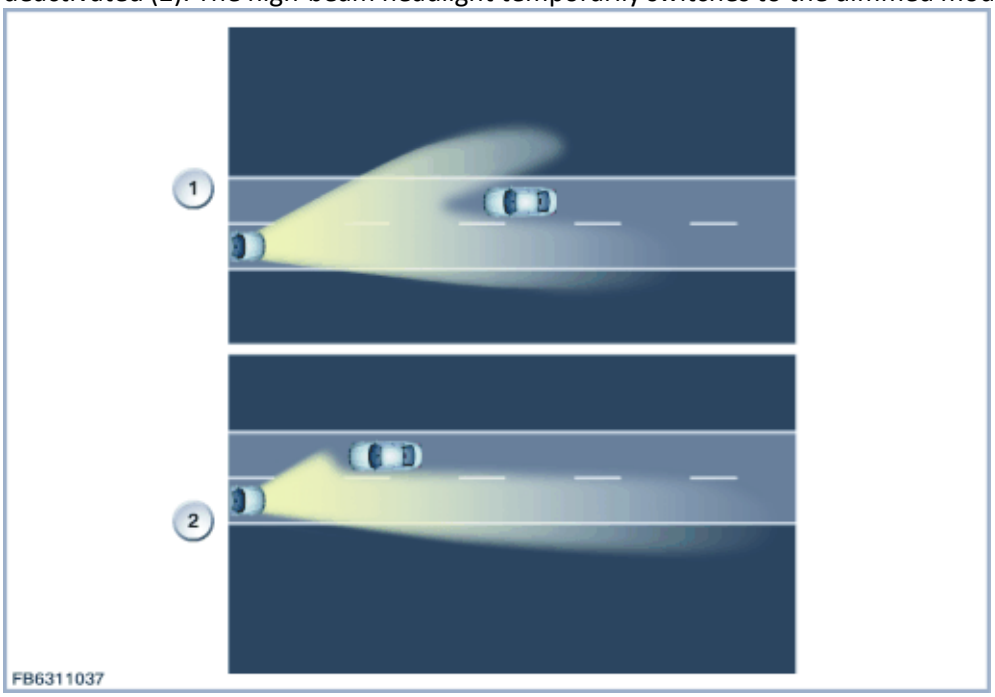
Oncoming vehicle

To recognize a vehicle, the non-glare high-beam assistant monitors the distant area (up to 1000 m) in front of the vehicle. The non-glare high-beam assistant recognises the light of oncoming traffic. While recognising oncoming road users, the system adjusts the high-beam headlight automatically so that they will not be blinded. Both headlights will be moved by a few degrees for this purpose: The light cones are aligned again.

The graphic below shows the light distribution from the "top" (1) and from the driver's perspective (2).

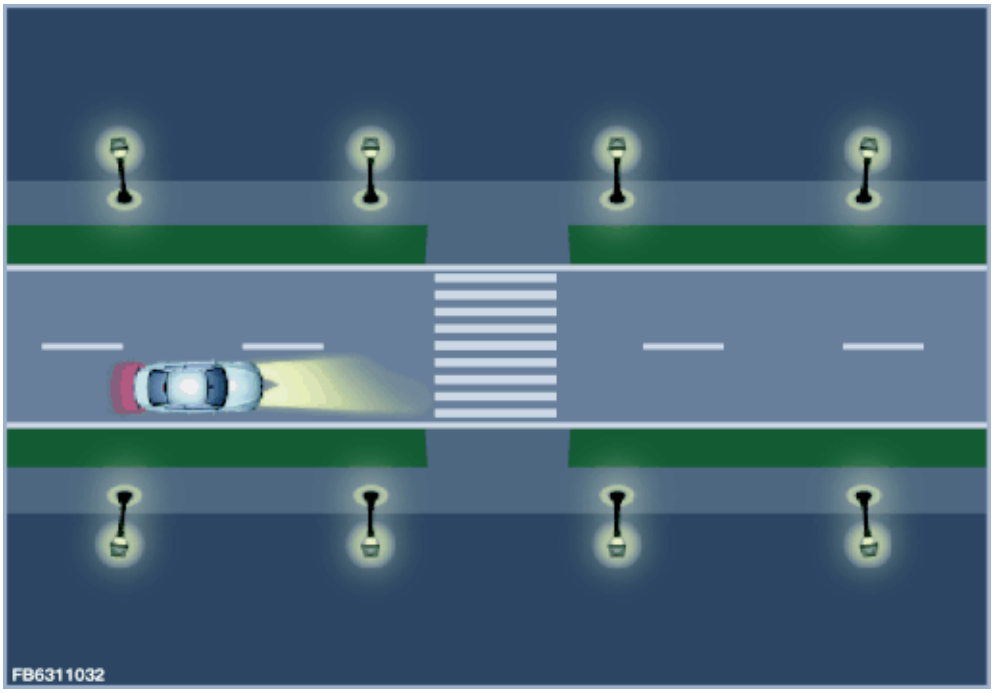


When oncoming traffic is recognised, a range will develop that is only scarcely illuminated by the high-beam headlight. Outside of this range, the optimized illumination of the road will be maintained (1). The non-glare alignment will adjust to the movement of the other road users as needed. When the oncoming vehicle passes an unfavourable angle, the high-beam headlight facing him will be deactivated (2). The high-beam headlight temporarily switches to the dimmed mode.



Locality

The high-beam headlight for both headlights will be switched off as soon as the surrounding area is light enough. For example, this is the case with closed localities.



Limits of the system

The non-glare high-beam assistant does replace the individual's responsibility to decide when the high-beam headlights are used. Thus the headlights must be dipped manually whenever conditions render it necessary to do so.

Operation of the non-glare high-beam assistant is restricted, or it may fail to operate entirely, under the following conditions:

- Unfavourable weather conditions, such as fog or heavy precipitation
- Road users with poor lighting
- Sharp curves, steep rises and dips
- Crossing traffic or partially hidden traffic on the opposite side of motorways
- Poorly lit towns and intense reflections from road signs
- Low driving speed
- Contamination or stickers on the windscreen in the area around the KAFAS camera

Field of view of KAFAS camera and from inside mirror with high-beam assistant

The field of view of the KAFAS camera and/or high-beam assistant camera is near the inside mirror. The area around the inside mirror must not be obstructed by air fresheners, etc.

Notes for Service department

Right-hand traffic and left-hand traffic

When driving in countries where vehicles drive on the opposite side of the road from the country in which the vehicle is registered, the headlights must be partially covered with foil. The light switch must be turned to switch position 2. The function of the non-glare high-beam assistant is then not available.

In the F01LCI light setting "tourist light" can be activated in the menu of the personal profile.

Adjust headlight.

The basic setting of the headlights can be performed as usual; however, the light switch must be in switch position 2. The lateral adjustment is then performed using a service function in the diagnosis system.

When the lights are switched on by the automatic driving lights control, the urban light distribution pattern is active. The headlights can only be correctly adjusted in the country road light distribution mode. In the urban traffic light distribution mode, the left headlight is simultaneously lowered and swivelled slightly to the left.

If the headlights are adjusted while in their urban light distribution mode, the automatic driving lights control will dazzle oncoming traffic. This is why the headlights should always be adjusted with the switch position 2 and the engine must be shut off.

The repair instructions must be followed without exception. Ensure that only original BMW parts are

used when renewing the headlights.
Renewing components.
Various repairs may be necessary over the service life of the vehicle. In the course of repairs, components for various software versions and hardware numbers may be installed. New parts are then used together with components already installed in the vehicle. It is always essential to adapt the replacement components for operation in the vehicle. Among the components that may be replaced when the vehicle is serviced are the:

- Footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC)
- Headlight driver module
- Light source
- Headlight

Refer to the appropriate repair instructions for more details.
Diagnosis
The exterior lighting must be set to the "diagnostic mode" as a condition for carrying out various diagnosis orders.
For example, the "diagnostic mode" is required for the following diagnosis orders:

- Reading out relevant bus signals while the vehicle is stationary
  - Speed
  - Yaw rate
  - Steering angle
- Analysis of switch-on conditions
  - Status of rain-light-solar-condensation sensor.
  - Status of non-glare high-beam assistant
  - Status of light switch

Missing or implausible bus signals will be stored as faults.
The types of faults are stored in the headlight driver module. The footwell module (FRM) or the front electronics module (FEM) or the body domain controller (BDC) enables access to the headlight driver module..
General notes
Monitoring of light source
When switched on, all exterior light sources are monitored by the footwell module (FRM(or front electronics module (FEM) or body domain controller (BDC). The monitoring starts at terminal 15 ON.
Hot monitoring with light ON
Hot monitoring is based on the current measurement. The power consumption readings assist in detection of short and open circuits. For example, if the power consumption of the gas discharge bulb cannot be measured while the xenon light is switched on, the footwell module (FRM) or front electronics module (FEM) or body domain controller (BDC) detects a faulty xenon light. The system cancels the activation signal to the affected xenon light and a Check Control message appears in the instrument panel's display panel.
The monitoring function also embraces the light-emitting diodes in the exterior lighting. This function relies on monitoring of power consumption. Failure of light-emitting diodes is also indicated as a Check Control message in the instrument panel (KOMBI).