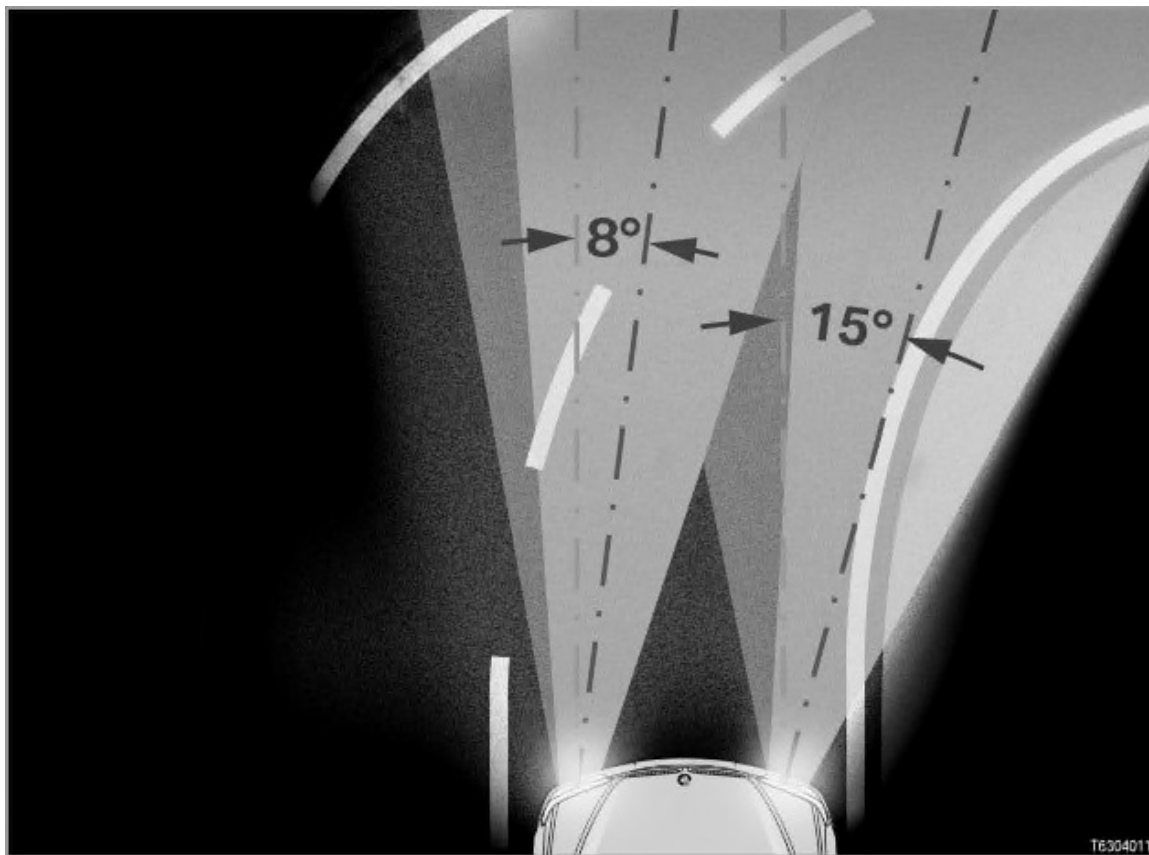


Adaptive headlights

E60, E61, E63, E64, E65, E66, E70, E81, E87, E90, E91, E92, E93



Note: Option 524 is only available in conjunction with option 522.

Option 524 "Adaptive headlights" is only available in conjunction with option 522 "Xenon dipped and main-beam headlights".

Note: EU approval for option 522 only in conjunction with option 502.

Option 522 "Xenon dipped and main-beam headlights" is only available together with option 502 "Headlight cleaning system" (in countries subject to EU approval).

Note: ALC => AHL

The development code for the adaptive headlights was "ALC".

ALC stood for "Adaptive Light Control".

The marketing and sales designation for option 524 in English-language markets is "adaptive headlights", abbreviated to "AHL".

Diagnosis and technical vehicle documentation therefore use the abbreviation "AHL".

However, "ALC" is still used on some control units and in the EPC (Electronic Parts Catalogue).

Introduction

Adaptive headlights turns the bi-xenon headlights towards the inside of a bend when cornering. This improves illumination of the curve of the road. Visibility is therefore improved.

When cornering, the driver is not looking into a "black hole" - instead, the adaptive headlights allow the driver to see the curve of the road.

This SI Technology bulletin (SBT) describes the adaptive headlights for the following model series:

> E60, E61, E63, E64 up to 03/2005:

[System overview ...]

The system overview applies accordingly for the E65 and E66 up to 03/2005.

- > E60, E61, E63, E64 from 03/2005 until 09/2005

[System overview ...]

The system overview applies accordingly for the E65 and E66 from 03/2005.

Note: AHL control unit discontinued from 03/2005.

From 03/2005, the AHL control unit software is integrated into the light module on the E60, E61, E63, E64, E65 and E66. The AHL control unit is no longer fitted.

- > E60, E61, E63, E64 from 09/2005

[System overview ...]

The vehicle electrical system was changed from 09/2005.

As a result of the change, several control units were discontinued and some control unit functions were integrated into new control units.

- > E70

[System overview ...]

The turning lights function is new on the E70 from the start of series production.

The turning lights give the area next to the carriageway additional illumination when you are turning or cornering (driving in tight bends). They are also active when you park the vehicle.

Depending on the country concerned, the turning lights are activated when cornering.

- > E81, E87, E90, E91, E92, E93

[System overview ...]

For the E81, E92, E93 from start of series production and for the E87 from 03/2007, the turning light function is new.

Note: Turning lights on E70, E81, E87, E92, E93 only in conjunction with option 524

Turning lights are a subfunction of option 524 "Adaptive headlights".

Bi-xenon headlights are standard equipment on the E92, E93.

Option 524 is standard on the US version.

Note: AHL components on E46, E53 and E83

There is a separate system description for the adaptive headlights on the E46, E53, E83. [more in SI Technical (SBT) 63 03 03 047]

Note: AHL components on the E63, E64

- The E63, E64 has a zero-position sensor.

[more in SI Technical (SBT) 63 03 03 047]

- Otherwise, the E63 and E64 are the same as the other 5-Series models.

Note: Components for adaptive headlight on E70, E81, E87, E90, E91, E92, E93

On the E81, E87, E90, E91, E92, E93, the adaptive headlights largely correspond to those on the E60, E61, E63, E64, E65 and E66:

- E70, E81, E87, E90, E91, E92, E93 vehicles are equipped with a zero-position sensor.
- On the E70, E81, E87, E90, E91, E92, E93, the FRM (footwell module) acts as control unit for exterior lighting. The footwell module contains the functions of the light module, AHL control unit and the general module (or body general module).

[for further information, please refer to SI Technology (SBT) 61 04 04 094]

Brief description of components

The following components and control units provide signals for the adaptive headlight system:

- **CAS: Car Access System**

The Car Access System supplies signals for the terminal management (e.g. terminal 15 ON).

The adaptive headlights control unit is activated when terminal 15 is switched ON.

- **Light switch**

The rotary switch for the side lights and dipped headlights differs depending on the vehicle equipment level (adaptive headlights, automatic driving lights control, automatic or manual headlight-range adjustment). For the adaptive headlights function to operate, the light switch must be set to position "A" ("A" = "automatic driving lights control" and "adaptive headlights").

[more ...]

- **Turn-signal/main-beam switch**

The main-beam headlights are switched on and off with the turn-signal/main-beam switch (by pressing or pulling the switch). The adaptive headlights function operates with both dipped and main-beam headlights.

[more ...]

- **SZL: Steering Column Switch**

The SZL control unit forwards the signals from the turn-signal/main-beam switch to the adaptive headlights control unit.

> E60, E61, E63, E64, E65 and E66

[more ...]

> E70, E81, E87, E90, E91, E92, E93

The steering column switch cluster forwards the signals from the turn-signal/main-beam switch to the footwell module (FRM).

[for more information, please refer to SI Technology (SBT) 61 07 04 103]

- **Ride-height sensors**

If the special equipment "Adaptive headlights" is fitted, the adaptive headlights control unit evaluates the signals from the ride-height sensors. This is because: the adaptive headlights control unit also controls the automatic headlight-range adjustment.

The automatic headlight-range adjustment feature adjusts the vertical aim of the headlights to compensate for variations in the vehicle tilt angle (e.g. when the vehicle is laden, and under braking and acceleration in dynamic driving situations).

[more ...]

- **Brake light switch**

If the special equipment "Adaptive headlights" is fitted, the signals from the brake light switch are read by the adaptive headlights control unit.

In addition, the brake light switch signal is also a signal for automatic headlight-range adjustment, see above: Ride-height sensors.

- **Position sensor**

> E60, E61

> E65, E66

Hella headlights have a position sensor.

The position sensor in the positioner module for the bi-xenon headlights supplies a signal for the horizontal movement of the headlights.

[more ...]

- **Zero-position sensor**

> E63, E64

> E70, E81, E87, E90, E91, E92, E93

Automotive Lighting headlights, previously Bosch, have a zero-position sensor.

The zero-position sensor registers the horizontal movement of the headlight.

[more ...]

- **EGS control unit or reversing light switch**

When reverse gear is engaged, the headlights are moved to the straight-ahead position.

- On vehicles with automatic transmission, the EGS control unit provides the "Reverse gear engaged" signal. (EGS: electronic transmission control).

- On vehicles with manual transmission, the signal is supplied by the reversing light switch.

- **Rain-light sensor for automatic driving lights control**

The rain-light sensor measures the ambient brightness outside the vehicle.

- In twilight conditions, the rain-light sensor transmits the message "Twilight" so that the automatic headlight-range adjustment can activate dipped headlights. The headlights are tilted up and down as required, but they are not yet moved towards the bend in the road.
- In darkness, the rain-light sensor sends the message "Darkness". The adaptive headlights are then activated when the vehicle is cornering. The headlights are moved to the left or right:

[more ...]

- **Steering-angle sensor and DSC sensor**

The steering angle sensor and DSC sensor (DSC = Dynamic Stability Control) supply signals for the adaptive headlights to the adaptive headlights control unit. These signals are evaluated as follows, depending on the vehicle's speed:

- **Vehicle speeds up to 30 km/h:**
The adaptive headlights function is controlled using the information from the **steering angle sensor** (in the steering column switch cluster).
- **Vehicle speeds between 30 km/h and 50 km/h :**
In the 30 to 50 km/h speed range, there is a **continuous transition** in signal evaluation: from the evaluation of signals sent by the steering angle sensor to evaluation of the signals sent by the yaw-rate sensor (in the DSC sensor).
- **In extreme dynamic driving situations**, e.g. if the vehicle starts to skid or fishtail, even at speeds less than **50 km/h** , the signals from the yaw-rate-sensor are considered.
If the vehicle starts to skid or fishtail, the headlights will move to the straight-ahead position. The headlights are not moved until the vehicle has stabilised.

- **Vehicle speeds over 50 km/h:**
At speeds upwards of 50 km/h, the signals from the **yaw-rate sensor** (in the DSC sensor) form the primary basis for control of the adaptive headlights function.

Reason: For a constant cornering radius, the steering angle required increases disproportionately with speed. In addition, the steering angle required also depends on the coefficient of friction of the road surface.

Yaw rate is directly proportional to speed. For this reason, the yaw rate is always the most suitable measure for controlling the adaptive headlights at high speeds.

Even at high speeds, however, the steering angle sensor signal is used to detect (predict) the driver's commands **in advance**. This prediction is important: The yaw rate signal is not supplied until the vehicle has **responded** to the steering wheel movement.

The steering-angle sensor signal is disabled so that rapid, momentary steering adjustments do not affect the adaptive headlights function.

A number of control units are involved in the adaptive headlights system (see above: CAS, EGS, SZL).

Depending on the model series and model version concerned, the adaptive headlights are actuated by the following control units:

- **AHL: Adaptive headlights**

> E60, E61, E63, E64, E65, E66 up to 03/2005

The AHL control unit actuates the adaptive headlights.

For safety reasons, the AHL control unit is also responsible for the automatic headlight-range adjustment. This is because: Oncoming traffic must not be dazzled by the adaptive headlights. If a headlight sticks in an unfavourable position, the AHL control unit will attempt to move this headlight down (using the stepper motors in the automatic headlight-range adjustment).

The AHL control unit is connected to the PT-CAN.

[more ...]

- **LM: Light module**

> E60, E61, E63, E64, E65, E66 from 03/2005

From 03/2005, the AHL control unit is integrated in the light module.

The light module (LM) controls and monitors all vehicle lights. Information is transmitted and received via the K-CAN data bus.

The light module actuates the indicator light for the adaptive headlights (on the light switch).

[more ...]

- **FRM: Footwell module**

> E70, E81, E87, E90, E91, E92, E93

The footwell module controls the exterior lighting and the adaptive headlights.

The footwell module thus takes the place of the light module and the AHL control unit.

The footwell module actuates the indicator light for the adaptive headlights (on the light switch).

[more ...]

The footwell module has its own system description.

[For more information, please refer to SI Technology (SBT) 61 04 04 094] "Footwell module".

The following additional control units are involved in the adaptive headlights:

- **SMC: Stepper motor controllers**

The stepper motor controllers control the stepper motors in the headlights (for the automatic headlight-range adjustment and for the adaptive headlights). The stepper motor controllers are not capable of self-diagnosis. The stepper motor controllers are diagnosed and encoded via the control unit for adaptive headlights.

[more ...]

- **SGM: Safety and gateway module**

> E60, E61, E63, E64 until 09/2005 and E65, E66

The safety and gateway module (SGM) is the interface between the two data buses K-CAN and PT-CAN. Thus, all information exchanged between the light module and the AHL control unit passes through the SGM. Information from the yaw-rate sensor (in the DSC sensor) is also fed through the SGM to the AHL control unit.

- **KGM: Body gateway module**

> E60, E61, E63, E64 from 09/2005

The vehicle electrical system was changed from 09/2005.

As a result of the change, several control units were discontinued and some control unit functions were integrated into new control units.

The new body gateway module (KGM) supersedes the safety and gateway module (SGM) previously fitted, the door modules and the micro-power module.

[For more information, please refer to SI Technology (SBT) 610205143] "Body gateway module"

- **Xenon-headlight control unit**

The xenon-headlight control unit actuates the bulb in the bi-xenon headlights.

The xenon-headlight control unit is not capable of self-diagnosis. The xenon control unit is monitored by the light module (E70, E81, E87, E90, E91, E92, E93: footwell module).

[more ...]

The following components are controlled:

- **Headlights**

Option 524 "Adaptive headlights" is only available in conjunction with option 522 "Xenon dipped and main-beam headlights". This means that bi-xenon headlights are employed.

[more ...]

- **Stepper motors for the adaptive headlights**

The stepper motors turn the positioner modules in the bi-xenon headlights.

The stepper motors move the headlights vertically and horizontally (vertically = up and down for automatic headlight range adjustment;

horizontally = left and right for the adaptive headlights function).

The positioner modules execute the movement.

[more ...]

- **Indicator light on the light switch**

The indicator light (green LED) next to the "A" (= "automatic driving lights control" and "adaptive headlights") has 2 display functions:

- The indicator light **lights up permanently** when the automatic driving lights control or adaptive headlights function is switched on (= light switch in position "A").
- The indicator light **flashes** if a fault develops in the adaptive headlight system.

> E60, E61, E63, E64, E65 and E66:

The indicator light is actuated by the light module.

> E70, E81, E87, E90, E91, E92, E93:

The indicator light is actuated by the footwell module.

Note: From 09/2007, the fault indicator in the form of the indicator lamp on the light switch flashing is discontinued.

From 09/2007, the fault indicator in the form of the indicator lamp on the light switch flashing is discontinued due to legal stipulations.

From 09/2007 system fault will be indicated by a Check-Control message in the instrument cluster.

System functions

The adaptive headlights system moves headlights horizontal (i.e. from left to right) in order to illuminate the inside of a bend when cornering.

The following functions of the adaptive headlights system are described below:

- System activation and automatic calibration
- Activation of stepper motor controllers
- Speed-dependent analysis of signals
- Adjustment of headlight horizontal aim
- Deactivation of adaptive headlights function under extreme handling conditions
- Deactivation of adaptive headlights function in response to system faults
- Setting headlights to parked position
- Automatic headlight-range adjustment
- Adaptive headlights for automatic driving lights control
- Turning light

Note: Different control units for adaptive headlights.

> E60, E61, E63, E64, E65, E66 up to 03/2005: The adaptive headlights are actuated by the AHL control unit.

> E60, E61, E63, E64, E65, E66 from 03/2005: The adaptive headlights are actuated by the light module (LM).

> E70, E81, E87, E90, E91, E92, E93: The adaptive headlights are actuated by the footwell module (FRM).

The footwell module has its own system description.

[For more information, please refer to SI Technology (SBT) 61 04 04 094]

For this reason, the following text refers to the general "control unit for adaptive headlights".

System activation and automatic calibration

When terminal 15 is switched ON, the headlights always perform a calibration sequence, even if the dipped headlights are not switched on. The control unit for adaptive headlights sends the "perform calibration sequence" request to the stepper motor controllers (SMCs, control units for the headlight stepper motors).

The stepper motor controllers actuate the stepper motors in the headlights. The calibration sequence is

performed. In the calibration sequence, the headlights move as follows:

1. The headlights move to the right and left (= calibration sequence for adaptive headlights).
2. The headlights move up and down (= calibration sequence for automatic headlight-range adjustment).
3. At the end of the calibration sequence, the headlights are in the straight-ahead position.

Following the calibration sequence, the system is ready for operation.

When reverse gear is engaged, the headlights are moved to the straight-ahead position.

Note: The calibration sequence is performed only after terminal 15 has been switched OFF for at least 15 seconds.

> E66, E61, E63, E64, E65, E66 **until 09/2006**

> E87, E90, E91, E92, E93 **until 03/2007**

If terminal 15 is repeatedly switched on and off (e.g. for demonstration purposes), the calibration sequence will not be executed every time terminal 15 is switched on.

Terminal 15 must have been switched off for at least 15 seconds before it is switched on again. Only then is a calibration sequence performed when terminal 15 is switched on.

Note: Calibration sequence always after terminal 15 ON and dipped-beam headlights ON.

> E66, E61, E63, E64, E65, E66 **from 09/2006**

> E70 **from start of series production**

> E81, E87, E90, E91, E92, E93 **from 03/2007**

If terminal 15 is repeatedly switched on and off (e.g. for demonstration purposes), the calibration sequence will not be executed every time terminal 15 and the dipped-beam headlights are switched ON.

Note: Calibration sequence with enlarged range of movement.

> not E65, E66

From 09/2007, starting with the E60, E61, E63, E64, a calibration sequence with larger range of movement will be introduced.

The calibration sequence with larger range of movement will then gradually be introduced on other model series.

Activation of stepper motor controllers

The control unit for adaptive headlights sends the stepper motor controllers (SMC) the nominal values for the positioner modules (position of positioner modules and speed of movement).

The control unit for adaptive headlights calculates the nominal values using the following signals:

- Vehicle road speed
- Steering angle (at speeds up to 50 km/h, dependent on encoding)
- Yaw rate (50 km/h upwards, see "Steering-angle sensor and DSC sensor" above)

Speed-dependent analysis of signals

Depending on the road speed, the adaptive headlights are controlled using the following signals: Signals from the steering angle sensor and signals from yaw-rate sensor (in the DSC sensor).

The encoding (at the end of the production line) determines the priority assigned to sensor signals above which speed threshold.

Adjustment of headlight horizontal aim

The stepper motor controllers move the headlights to the right or left when the vehicle corners.

Horizontal range of movement of headlights:

- Inwards, i.e. towards centre of vehicle: up to max. 8 °
- Outwards: up to max. 15 °

Example: Right-hand bend:

The right-hand headlight turns by up to 15° (the right-hand headlight is the "inside" headlight on a right-hand

bend).

Viewed from the vehicle, the right-hand headlight moves "outwards".

The left-hand headlight moves up to 8° (the left-hand headlight moves towards the middle of the vehicle, i.e. "inwards" as viewed from the vehicle).

The headlight on the outside of the bend has to reach its end position at the same time as the headlight on the inside of the bend so that the carriageway remains smoothly and evenly illuminated.

On a right-hand bend, the left-hand headlight is on the outside of the bend. The right-hand headlight is on the inside of the bend.

Deactivation of adaptive headlights function under extreme handling conditions

If the vehicle drifts, skids and loses sideways grip, the adaptive headlights function is deactivated as follows:

- The headlights are returned to the straight-ahead position. The headlights are no longer turned.
- The dipped headlights remain on.

Deactivation of adaptive headlights function in response to system faults

Until 09/2007, a system fault will be indicated by the indicator lamp on the light switch flashing.

From 09/2007 system fault will be indicated by a Check-Control message in the instrument cluster.

Dazzling of oncoming traffic must be prevented in the event of a system fault.

For this reason, the adaptive headlights function is deactivated as follows:

- If the stepper motors are still functional, the headlights are returned to the straight-ahead position. The headlights are no longer moved towards bends in the road.
- If it is no longer possible for a headlight to be moved back to the straight-ahead position, the headlight is tilted downwards (by the stepped motors for automatic headlight-range adjustment). This prevents dazzling of oncoming traffic.

- **Vehicles up to 09/2007**

If the headlight cannot be tilted downwards, the bi-xenon bulb in this headlight is disabled as follows:

When the vehicle is parked up, the control unit registers sleep mode for the adaptive headlights, as follows: Vehicle standstill and terminal R OFF for several minutes.

The next time the vehicle is restarted, the bi-xenon light of the defective headlight is not switched on.

The front foglights are switched on in order to ensure a minimum level of illumination.

The dipped beam headlights are **not** switched off while the vehicle is in motion.

Note: From 09/2007, the dipped-beam headlights will not be switched off in the event of a system fault.

If a system fault develops in the adaptive headlights, the dipped-beam headlights for the affected headlight will **not** be switched off.

Setting headlights to parked position

When terminal R is switched off, the headlights move to the parked position. The parked position is important for the headlights' next calibration sequence: From the parked position, the headlights are run through a calibration sequence in the pre-drive-check. During each calibration sequence, the control unit for adaptive headlights relearns the straight-ahead position for the headlights.

When the headlights have reached the parked position, the stepper motor controllers SMCs inform the control unit for adaptive headlights ("verification").

The control unit for adaptive headlights deactivates the stepper motor controllers.

The run-down period lasts approx. 10 seconds.

Automatic headlight-range adjustment

If the special equipment "Adaptive headlights" is fitted, the control unit for adaptive headlights also controls the automatic headlight-range adjustment.

The automatic headlight-range adjustment adapts the headlight range for different operating conditions.

Variations in the vehicle tilt angle are produced by vehicle loads and braking or acceleration in extreme driving situations. The automatic headlight-range adjustment moves the headlights up and down as required.

The control unit for adaptive headlights also controls the automatic headlight-range adjustment as follows:

1. The ride-height sensors and the brake light switch supply the signals for the automatic headlight-range adjustment.
2. The control unit for adaptive headlights computes the vehicle inclination (longitudinally to the roadway) from the signals.
3. The stepper motors for the automatic headlight-range adjustment automatically and dynamically control the headlight range.

The headlight range is adjusted so that the actual headlight range conforms to the legally required headlight range as follows:

- If vehicle rear is lower than front:
The actual headlight range will be longer than the legally stipulated range. The headlight beam height is lowered to reduce the headlight range to match the legal requirement.
- If the vehicle is horizontal:
The actual headlight range will be the same as the legally stipulated range.
- If vehicle front is lower than rear:
The actual headlight range will be shorter than the legally stipulated range. The headlight beam height is raised to increase the headlight range to match the legal requirement.

Adaptive headlights for automatic driving lights control

The automatic driving lights control feature (option in conjunction with the rain-light sensor) automatically switches the side lights and dipped headlights on or off.

Switch-on conditions:

- The automatic driving lights control must be encoded (in the light module on the E60, E61, E63, E64, E65, E66, in the footwell module on the E70, E81, E87, E90, E91, E92, E93).
- The light switch must be in position "A" ("A" for automatic driving lights control and adaptive headlights).
- The rain-light sensor must be installed and operational.

The rain-light sensor detects the brightness of the ambient light.

The rain-light sensor sends the following prompts to the light module (on the E70, E81, E87, E90, E91, E92, E93: footwell module):

- Ambient brightness low: In twilight, darkness, in an underground garage or tunnel.
"Switch on dipped headlights" request
- Ambient brightness sufficient.
"Switch off dipped headlights" request

If only the side lights are to be switched on, the light switch must be set to side lights (switch position 1).

When the light switch is set to position "A", the control unit for adaptive headlights is also activated:

- When the automatic driving lights control function switches on the dipped headlights (e.g. at dawn/dusk), the adaptive headlights function is notified at the same time.
The control unit for adaptive headlights thus assumes control of the automatic headlight-range adjustment.
- In addition, signals from the rain-light sensor are evaluated (E60, E61, E63, E64, E65, E66: by the light module; E90, E91, E92, E93: by the footwell module).
The headlights are not turned when the vehicle is cornering until total darkness sets in.

The message "dipped headlights on" is given individually for each headlight.

If a headlight fails, the adaptive headlights are switched off.

The front foglights are switched on in order to ensure a minimum level of illumination.

Turning lights

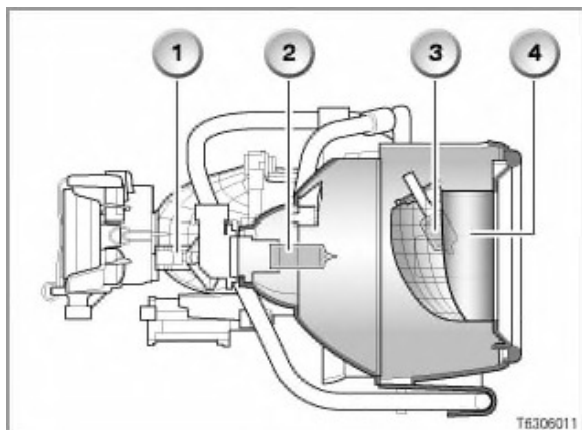
The turning lights are coupled to the adaptive headlights (option 524).

The footwell module (FRM) uses the following signals to adjust the turning lights:

- Steering angle
- Yaw rate
- Status of reverse gear

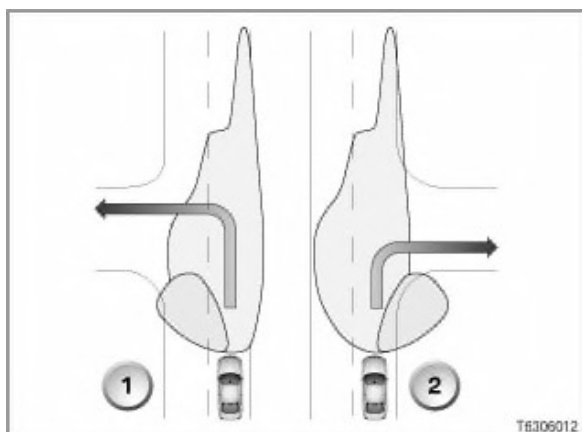
> E81, E92, E93 with start of series production and E87 from 03/2007

Instead of the main-beam headlight (H7), the main headlight with turning light has a fixed additional reflector with an H3 bulb. The special shape of the lens prevents dazzle to the front.



The illustration shows the main headlight with turning light on the E81, E87, E92, E93

- 1) Bi-xenon light
- 2) H8 bulb for side lights and daytime driving lights
- 3) H3 bulb for turning lights
- 4) Reflector for turning lights



The illustration shows the turning light on the E81, E87, E92, E93

- 1) Left turn
- 2) Right turn

The following conditions must be satisfied for the turning lights to be switched on:

- Terminal 15 ON
- Light switch in position "A" ("A" stands for automatic driving lights control)
- Rain-light sensor detects twilight or darkness (threshold exceeded)

The turning lights are not activated at speeds greater than 70 km/h.

> Europe version:

For legal reasons, the turning lights on the Europe version can only be activated via the turn signal indicator at speeds up to 40 km/h.

When reversing, the footwell module (FRM) activates the turning lights as follows in the speed range 0 km/h to 35 km/h:

- US version: both sides
- Other countries: outside of turn only

When the turn signal indicator is switched on:

If the vehicle is stationary, the turning lights will automatically be deactivated after approx. 4 seconds, e.g. when waiting at traffic lights. However, the turning lights can be activated again with the turn-signal/main-beam switch (up to 3 times) until the reflector has reached a certain temperature. A temperature model protects the headlights from excessive thermal stress.

The switching-off conditions for the turning light depend on the country concerned.

Note: Temperature monitoring by temperature model

A temperature model in the footwell module calculates the temperature of the reflector. The temperature of the reflector must not exceed a certain value. If a critical temperature is reached, the footwell module (FRM) will deactivate the turning lights. The turning lights can be activated again after a cooling-off phase.

> E70 with start of series production

The turning lights are realised using the front foglights. (Reason: The installation location of the headlights is too high for the turning lights. This prevents legal stipulations from being adhered to.)

Depending on actuation, the right-hand and/or left-hand front foglight is switched on. The turning lights are actuated by the light module (LM).

The front foglights have an additional reflector to illuminate the areas to the sides better.

When turning, the front foglight on the inside of the turn is automatically activated. The additional reflector for the turning light reflects the light beam towards the turning area.

The turning light are not switched on suddenly but rather faded according to special time parameters. Depending on the country concerned, the turning lights are switched on when cornering.



The illustration shows the front foglight on the E70

- 1) Additional reflector for the turning light
- 2) Reflector for the front foglights
- 3) Bulb

The following conditions must be satisfied for the turning lights to be **switched on**:

- Terminal 15 ON
- Light switch in position "A" ("A" stands for automatic driving lights control)
- Rain-light sensor detects twilight or darkness (threshold exceeded)

and

- Turn signal indicator ON (not one-touch turn signal)
- Speed range (forwards):
 - Europe and Japan version from 0 km/h to 35 km/h
 - US version from 0 km/h to 65 km/h
- Swivel angle (theoretical):
 - when stationary $\geq 77^\circ$
 - when driving $\geq 10^\circ$

Alternatively

- Speed range (reverse):

- 0 km/h to 35 km/h

- Swivel angle (theoretical):
 - when stationary or driving $\geq 70^\circ$

If the vehicle is stationary, the turning lights will automatically be deactivated after a certain time, e.g. when waiting at traffic lights. However, the turning lights can be activated again with the turn-signal/main-beam switch.

The following conditions must be satisfied for the turning lights to be **switched off**:

- Light switch not in position "A" ("A" stands for automatic driving lights control)
- Rain-light sensor does not detect twilight or darkness (lower threshold exceeded)

Alternatively

- Turn signal indicator OFF
- Speed range (forwards):
 - Europe and Japan versions ≥ 40 km/h
 - US version ≥ 70 km/h
- Swivel angle (theoretical):
 - when stationary 77°
 - when driving 10°

Alternatively

- Speed range (reverse): ≥ 40 km/h
- Swivel angle (theoretical): when stationary and when driving below a certain value

Alternatively

- Vehicle skids and swings out.

Alternatively

- Front foglights are switched on with the front foglights switch.

Preconditions for activation

The control unit for adaptive headlights is "awake" from terminal 15 ON.

The movement of the lights is subject to the following conditions:

- Reverse gear must **not** be engaged.
- The system is free of faults (indicator lamp **not** flashing and no Check-Control message)
- The bulbs for the bi-xenon lights are OK in both headlights.
- The vehicle must not be skidding or fishtailing.
- The rain-light sensor must detect darkness.
- Additional precondition for activation: automatic driving lights control is active (light switch in position "A", see above).

Notes for service staff

Caution: Exercise caution when working on bi-xenon headlights

Whenever inspecting or working on the headlights, always observe the safety precautions and accident prevention rules. The headlight system has dangerously high voltage.

- General notes: [more ...]
- Diagnosis: [more ...]
- Encoding/programming: [more ...]
- Car and Key Memory:
 - > E60, E61, E63, E64, E65, E66

The sensitivity of the driving light sensor can be set to one of 2 settings with the Car and Key Memory.

> E70, E81, E87, E90, E91, E92, E93

All Car and Key Memory functions are programmed inside the vehicle itself.

(Please refer to the "Personal profile" section of the Owner's Handbook: Personal settings for a maximum of 3 remote control units via the display in the instrument cluster or via the Central Information Display.)

National versions

The options "Daytime driving lights" and "Manual headlight-range adjustment" are available in certain countries. Vehicles with manual headlight-range adjustment do not have adaptive headlights. This is because vehicles with manual headlight-range adjustment have halogen dipped headlights. Adaptive headlights (option 524) are only available in conjunction with option 522 "Xenon dipped and main-beam headlights".

Switching on adaptive headlights in conjunction with daytime driving lights function

The "Daytime lights" option (Northern Europe and Canada) means that

dipped-beam headlights and side lights (E70, E92, E93: daytime driving lights) are **always** switched on:

- Light switch in position "2"
- Terminal 15 ON

The automatic headlight-range adjustment is active (actuated by the control unit for adaptive headlights).

If terminal 15 is switched off, the dipped headlights and the side lights are automatically switched off as well.

The light switch must also be set to position "A" with the "Daytime driving lights" option. The control unit for adaptive headlights is then in standby.

System functions for "Daytime lights" option when the light switch is set to position "A":

- If the vehicle is encoded with the "Daytime driving lights" option (end of production line), the light switch can remain in position "A" at all times.

When terminal R is switched on, the side lights, parking lights and licence plate lighting are switched on.

As soon as terminal 15 is switched on, the dipped headlights are also switched on.

- When the dipped headlights are switched on, the control unit for adaptive headlights is activated (for automatic headlight-range adjustment).
- The indicator lamp on the light switch lights up and indicates that the system is functional.
- The adaptive headlights turn when the vehicle is stationary if the steering wheel is turned (to the right only).
- The headlights are moved when the vehicle corners if the rain-light sensor registers darkness.

The switch-on conditions for the adaptive headlights in conjunction with special equipment "Daytime driving lights" are as follows:

- The vehicle must be encoded with the "Daytime driving lights" option (end of production line)
- The light switch must be in position "A"
- Terminal 15 must be switched on and reverse gear must not be engaged
- Rain-light sensor must detect darkness

Subject to change.