

- MODEL 212**  
as of model year 2014  
with CODE 640 (Headlamps, LED, dynamic, SAE, right-side traffic)
- MODEL 212**  
as of model year 2014  
with CODE 641 (Headlamps, LED, dynamic, left-side traffic)
- MODEL 212**  
as of model year 2014  
with CODE 642 (Headlamps, LED, dynamic, right-side traffic)

#### Function requirements, general

- No overvoltage or undervoltage (operating voltage range  $U \geq 7 \leq 17.5$  V)
- Transport mode not activated
- Low beam ON
- "Engine running" or "drive train operational" signal on

**i** Detailed information on the operating state of the transport mode is given in the separate function description for energy management.

**i** The CDI control unit (N3/9) (diesel engine) or ME-SFI [ME] control unit (N3/10) (gasoline engine) sends the "Engine running" or the "Drive train operational" signal over the chassis CAN 1 (CAN E1), front SAM control unit with fuse and relay module (N10/1) and chassis CAN 2 (CAN E2) to the left headlamp control unit (E1n9) on the left front lamp unit (E1) and to the right headlamp control unit (E2n9) on the right front lamp unit (E2).

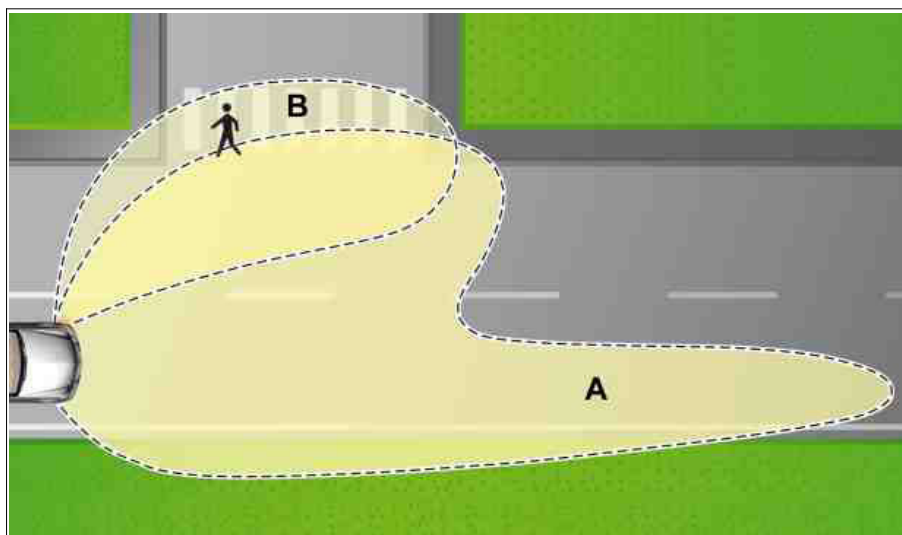
The front SAM control unit reads in the status of the exterior lights switch (S1) directly, and sends the "Low beams ON" request over chassis CAN 2 to the headlamp control units.

#### Additional function prerequisites for cornering lights

- Turn signaling active and speed  $v < 40$  km/h (except CODE 494 (USA version)) or  $v < 60$  km/h (with CODE 494 (USA version)) or steering angle recognized and speed  $v < 70$  km/h
- Radius of curve  $r \leq 80$  m

#### Schematic of light distribution for active cornering lights actuation

- A Low beams light cone  
B Corner-illuminating fog lamps light cone



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#### Intelligent Light System function in general

The Intelligent Light System function enables optimum illumination of the road to be achieved during different driving situations and weather conditions.

This is achieved by increasing light output and by means of targeted actuation of additional light sources along with various components in the front lamp units.

During actuation of the Intelligent Light System function, the driving lights actuation described in the "Driving lights actuation function" is active.

The Intelligent Light System function encompasses the following subfunctions:

- **Cornering lights function sequence**
- **Function sequence, dynamic curve illumination**
- **Function sequence for active light distribution (with CODE 641 (Dynamic left-hand traffic LED headlamp) or CODE 642 (Dynamic right-hand traffic LED headlamp))**

#### Cornering lights function sequence

The cornering lights improve the illumination of the edge of the road on the inside of the curve.

The direct input factors of the cornering lights actuation are the steering angle, recorded by the steering angle sensor (N49), and the turn signaling function, defined by the switch position of the combination switch (S4), since they describe the driver's required direction.

The vehicle speed influences the actuation characteristic for cornering lights actuation. At slow speed, a lower switch-on point is required to ensure that the cornering lights can be activated early in urban traffic.

The data of the steering angle sensor and the switch position of the combination switch are read in by the steering column tube module control unit (N80) directly, and sent by it over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit. The vehicle speed is calculated on the basis of the wheel speeds. To this end, the Electronic Stability Program control unit (N30/4) (model 212.074/075/076/092/095/098/274/275/276/292/298) except CODE 233 (DISTRONIC PLUS)), the regenerative braking system control unit (N30/6) (model 212.095/098/298) or the Premium Electronic Stability Program control unit (N30/7) (model 212 (except 212.095/098/298) with CODE 233 (DISTRONIC PLUS), model 212.074/075/076/092/274/275/276/292) sends corresponding data over the chassis CAN 1, front SAM control unit and the chassis CAN 2 to the left headlamp control unit.

The left headlamp control unit evaluates all the information and actuates the left corner-illuminating fog lamp (E1e9).

The left headlamp control unit synchronizes the right headlamp control unit over chassis CAN 2, which then actuates the right corner-illuminating fog lamp (E2e9).

Only one cornering light is actuated: the light on the inside of the curve during forward travel and the light on the outside of the curve during reverse travel. If there is a rapid change in the steering wheel angle or in the turn signaling request, both corner-illuminating fog lamps may illuminate briefly. The corresponding cornering light is switched on and off with dimming.

The request by the turn signaling function has a higher priority below a speed of  $v = 40$  km/h compared with the request by the detection of the steering angle in order to ensure the illumination of the edge of the road on the inside of the curve when the steering wheel is turned and turning in the opposite direction (situation at traffic circles). When the reverse gear is engaged, only the data of the steering angle sensor is evaluated.

The "reverse gear engaged" status is defined as follows.

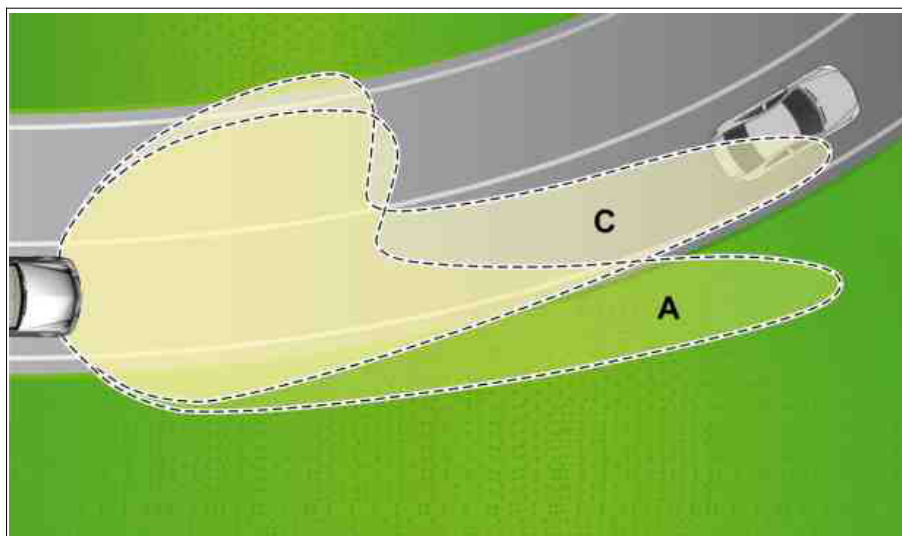
Vehicles with transmission 711 or 716:

#### Additional function requirements for dynamic curve illumination

- Vehicle moving forward
- Extended fog light function disabled

#### Schematic representation of light distribution with active dynamic curve illumination

- A Low beams light cone
- C Dynamic curve illumination light cone



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Dynamic curve illumination actuation depends on the following set variables:

- Steering angle
- Vehicle speed
- Vehicle yaw behavior (vehicle movement)

The direct input factor is the steering angle, the vehicle speed influences the control response of the function (transformation of steering angle into swivel angle).

- Engagement of the reverse gear is defined through the status of the backup lamp switch (S16/2), which is read in directly by the front SAM control unit.

Vehicles with transmission 722.9, 724.2 or 725:

- Gear range "R" is engaged by the fully integrated transmission control unit (Y3/8n4). The fully integrated transmission control unit then sends the "gear range R engaged" status over the drive train CAN (CAN C), CDI control unit or ME-SFI [ME] control unit and chassis CAN 1 to the front SAM control unit.

Two microprocessors are installed in the front SAM control unit, one for control of basic functions, e.g. the exterior lights, and the second for control of the central gateway functions. Both processors communicate with each other internally via interior CAN.

Using all incoming information, the microprocessor which controls the central gateway functions generates the "reverse gear engaged" signal (irrespective of the transmission variant) and sends this signal to the left headlamp control unit over the chassis 2 CAN.

If the cornering lights function is requested simultaneously by the detected steering angle and the turn signaling function, the actuation sensitivity is increased. The corresponding cornering light is actuated as soon as a curve radius of  $r \leq 450$  m is detected.

When the function request suddenly no longer exists, the corresponding cornering light remains switched on for a holding time of approx.  $t = 2$  s and is switched off within  $t = 2$  s with dimming.

#### Function sequence, dynamic curve illumination

Dynamic curve illumination improves the road illumination when cornering. For this the low beam cone is swiveled horizontally towards the center point of the curve.

A conventional headlamp serves as a basis, the headlamp unit of which is supported in a retaining frame so that it can swivel. When steering into a curve, the headlamp unit on the inside of the curve is swiveled up to  $\alpha = 15^\circ$ , the headlamp unit on the outside of the curve up to  $\alpha = 7.5^\circ$ .

At a low vehicle speed, a smaller conversion is required so that the light pattern does not behave in a jumpy manner (e.g. in urban traffic). At medium vehicle speeds an immediate response is given to relatively minor changes in the steering angle and at higher vehicle speeds the responses are dampened again to a greater extent. In order to compensate for the vehicle's natural pendulum motions when driving straight ahead, an area with lower sensitivity and greater damping is provided (approx.  $\pm 6^\circ$  steering angle).

**Additional function requirement for active light distribution (with CODE 641 (Dynamic left-hand traffic LED headlamp) or CODE 642 (Dynamic right-hand traffic LED headlamp))**

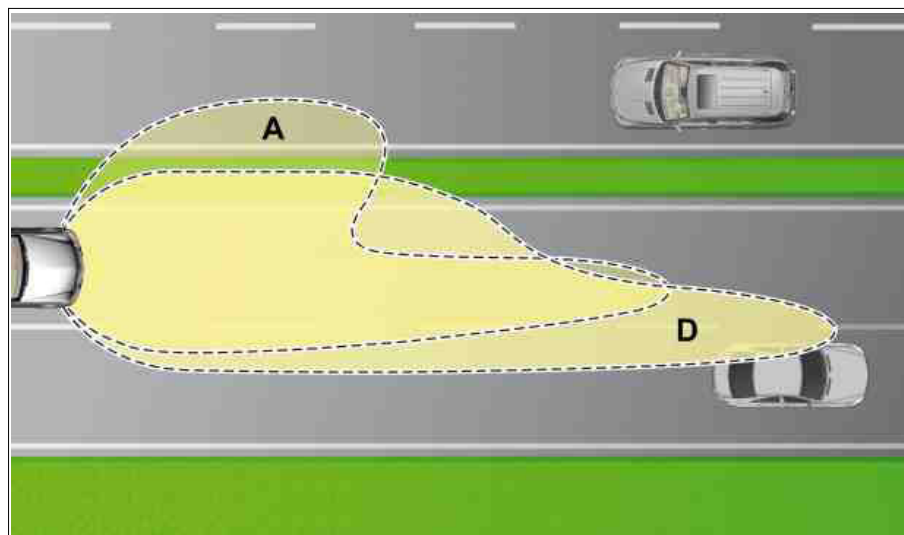
- Vehicle moving forward

**Additional function requirements, freeway lights**

- Extended fog light function disabled
- Radius of curve  $r \geq 800$  m

**Schematic of light distribution for active freeway lights function**

- A Low beams light cone
- D Freeway lights light cone



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The motorway lights function depends on the following control factors:

- Steering angle
- Vehicle yaw behavior (vehicle movement)
- Vehicle speed

The data from the steering angle sensor are read in directly by the steering column tube module control unit and it sends the data over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit.

the left headlamp control unit.

The yaw behavior of the vehicle is detected by the yaw rate sensor for lateral and longitudinal acceleration (B24/15). This sends corresponding information over the vehicle dynamics CAN (CAN H), Electronic Stability Program control unit or the regenerative braking system control unit, chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit.

The left headlamp control unit evaluates all relevant information and actuates the left active curve lights actuator motor (E1m2).

The left headlamp control unit synchronizes the right headlamp control unit over chassis CAN 2, which then actuates the right active curve lights actuator motor (E2m2).

**i** The position of the active curve lights actuator motors at any given time and any faults that occur, such as short circuits or open circuits, are reported back to the corresponding headlamp control unit.

**i** If the curve illumination actuation is defective, the headlamp units are, if possible, swiveled into the central position. If an active curve lights actuator motor malfunctions, the left light distribution actuator motor (E1m3) or the right light distribution actuator motor (E2m3) is actuated to cover up the rising part of the light-dark boundary and thereby reduce the glare for oncoming traffic.

**Function sequence for active light distribution (with CODE 641 (Dynamic left-hand traffic LED headlamp) or CODE 642 (Dynamic right-hand traffic LED headlamp))**

The active light distribution subfunction encompasses the following subfunctions:

- Function sequence for motorway lights
- Function sequence for extended fog light

**Function sequence for motorway lights**

The freeway lights improve the illumination of the road by increasing the range of the low beams without blinding the preceding traffic.

This function is achieved by means of vertically deflecting the light cone and increasing the light output.

The freeway lights are activated at speeds typical for the freeway or expressway.

**i** The motorway lights function is deactivated when it is raining. Rain is detected by evaluating the windshield wiper signal (Windshield wiper out of park position). If the windshield wiper is in the park position less than  $t = 600$  ms, this is evaluated as continuous wipe. Rain is detected if the continuous wipe function is active for  $t > 2$  min.

The left headlamp control unit evaluates all relevant information, and actuates - over the left headlamp-LIN (LIN G1) and left front LED exterior lights actuation module (E1n7) - the left front Vario LED lamp unit (E1e22).

The left headlamp control unit synchronizes the right headlamp control unit over chassis CAN 2, which in turn actuates, over the right headlamp LIN (LIN G2) and the right front LED exterior lights actuation module (E2n7), the right front Vario LED lamp unit (E2e22).

The yaw behavior of the vehicle is detected by the yaw rate sensor for lateral and longitudinal acceleration. This sends corresponding information over the vehicle dynamics CAN, Electronic Stability Program control unit or the regenerative braking system control unit, chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit.

The vehicle speed is calculated on the basis of the wheel speeds. To this end, the respective Electronic Stability Program control unit or the regenerative braking system control unit sends corresponding data over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit.

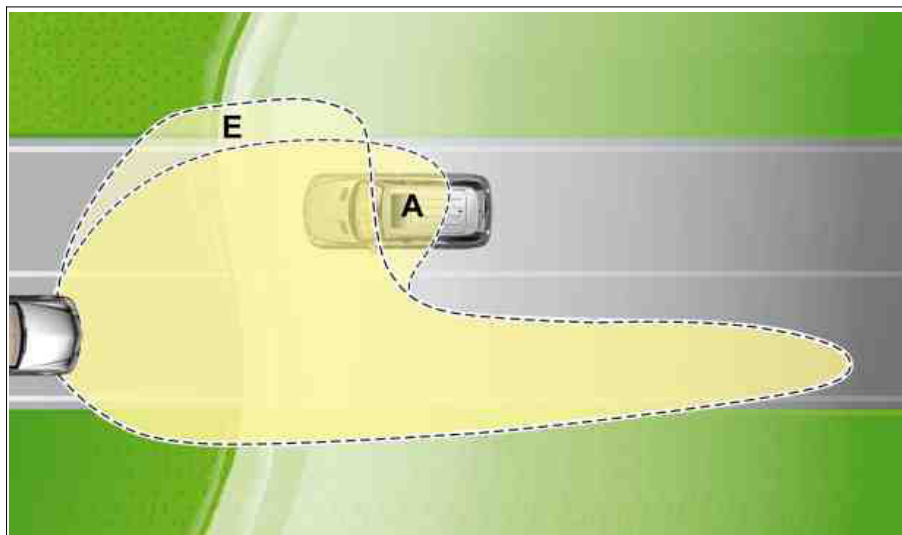
**Additional function requirements for extended fog light function**

- Rear fog lights actuation active

**i** The front SAM control unit directly reads in the status of the rear fog light button.

**Schematic of light distribution for active extended fog light function**

- A Low beams light cone
- E Extended fog light function light cone



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The vehicle speed is calculated on the basis of the wheel speeds. To this end, the respective Electronic Stability Program control unit or the regenerative braking system control unit sends corresponding data over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit.

The left headlamp control unit reads in all the relevant information, evaluates it and actuates the left light distribution actuator motor and the left active curve lights actuator motor. The headlamp unit of the left front lamp unit is swiveled outwards by  $\alpha = 8^\circ$  and the part of the light-dark boundary that slopes upward to the right is covered. Internal dazzling is reduced and illumination of the road surface at the side is improved.

**i** If the extended fog light function is active the dynamic curve illumination is deactivated.

If the high beams function is requested while the "Extended fog light function" is active, the position of the headlamp unit is retained.

**i** The daytime running lamps are switched off because of the possible dazzling effect involved.

From a vehicle speed of  $v = 90$  km/h onwards and radius of curve of  $r > 800$  m for a driving distance of more than  $s = 2.5$  km, the light output of the front Vario LED lamp units is increased linearly by the corresponding LED exterior lights actuation module to  $P = 38$  W.

The left headlamp control unit as from a speed of  $v = 110$  km/h and a curve radius of  $r > 800$  m for more than  $s = 1$  km driving distance, actuates the left headlamp range adjustment actuator motor (E1m1). The headlamp unit of the left front lamp unit is raised. The range of the low beams is thus increased. The maximum lift is reached at  $v = 130$  km/h.

If the vehicle speed drops down to below  $v = 80$  km/h, the "motorway lights" function is disabled.

**Function sequence for extended fog light**

The extended fog light function improves the illumination of the edges of the road and reduces the internal dazzling.

The light cone of the front lamp unit facing the inside of the road is raised and steered outwards at vehicle speeds below  $v = 70$  km/h.

The extended fog light function is deactivated under the following conditions:

- Failure of a lamp unit (low beam)
- Actuator motor malfunction

**i** When testing and adjusting the front lamp unit, ensure that the extended fog light function is not active.

	Electrical function schematic for Intelligent Light System		PE82.10-P-2067-97DAB
	Overview of exterior lights system components		GF82.10-P-9998FLM