

Document title Headlamp control, function

Document number gf8210p2009fn

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)

Driving lights actuation, general

Driving lights actuation includes all functions which serve the optimum illumination of the road while driving. During driving lights actuation, the standing lights actuation is active; this is described in the "Standing/parking lights actuation, function" document.

The driving lights actuation encompasses the following subfunctions:

- **Function sequence for low beam actuation**

Additional function requirements for low beams actuation

- Terminal 15 ON

i The electronic ignition lock control unit (N73) transmits the circuit status of circuit 15 to the front SAM control unit via the interior CAN (CAN B).

Function sequence for low beam actuation

Turning the exterior lights switch to the "Manual driving lights" position requests actuation of the low beams.

Additional function requirements for high beam actuation

- For high beams function: Circuit 15 and low beams On
- For headlamp flasher function: Circuit 15R On

i The electronic ignition lock control unit sends the status of circuit 15 to the front SAM control unit over the interior CAN.

Function sequence for high beams

High beam actuation is requested by pushing the combination switch (S4) forward.

The steering column tube module control unit (N80) reads in the switch position of the combination switch directly, and sends this over the chassis CAN 1 (CAN E1) to the front SAM control unit.

The front SAM control unit receives the switch position of the combination switch, uses it to generate the "High beams ON" request, and sends it over chassis CAN 2 to the left headlamp control unit and to the headlamp control unit.

Function sequence for headlamp flasher

The function sequence and signal path for the headlamp flasher function correspond to that of the high beam function.

Additional function requirements for daytime running lights actuation

- "Daytime running lights:" function activated in "Settings", "Light" menu in instrument cluster (except vehicles with code (460) Canada version)
- "Engine running" or "drivetrain ready" signal set or vehicle speed $v > 3$ km/h
- Exterior lights switch in "Auto" position

Function sequence for daytime running lights actuation

The instrument cluster sends the "Daytime running lamps ON" request depending on the national coding or activated manually in the "Settings", "Lights" menu over the interior CAN to the front SAM control unit.

- **Function sequence for high beam actuation**
- **Function sequence for daytime running lights actuation**
- **Auto on/off headlamps function sequence**
- **Function sequence for automatic headlamp range adjustment (HRA [LWR])**

i The driving lights are actuated corresponding to the position of the exterior lights switch (S1). The front SAM control unit with fuse and relay module (N10/1) reads in the status of the exterior lights switch directly.

The front SAM control unit reads in the status of the exterior lights switch directly, and sends the "Low beams ON" request over the chassis CAN 2 (CAN E2) to the left headlamp control unit (E1n9) and the right headlamp control unit (E2n9).

The left headlamp control unit actuates, via the left headlamp-LIN (LIN G1) and the left front LED exterior lights actuation module (E1n7), the left front Vario LED lamp unit (E1e22) in the left front lamp unit (E1).

The right headlamp control unit actuates, via the right headlamp-LIN (LIN G2) and right front LED exterior lights actuation module (E2n7) the right front Vario LED lamp unit (E2e22) in the right front lamp unit (E2).

The front SAM control unit also sends the "low beams indicator lamp ON" request over the interior CAN to the instrument cluster (A1).

The instrument cluster actuates the low beams indicator lamp (A1e67).

Function sequence for high beam actuation

The high beams actuation is comprised of the following subfunctions:

- **Function sequence for high beams**
- **Function sequence for headlamp flasher**

The left headlamp control unit actuates the left light distribution actuator motor (E1m3) directly and the left front Vario LED lamp unit in the left front lamp unit over the left headlamp-LIN and the left front LED exterior lights actuation module.

The right headlamp control unit actuates the right light distribution actuator motor (E2m3) directly and the right front Vario LED lamp unit in the right front lamp unit over the right headlamp-LIN and the right front LED exterior lights actuation module.

The front SAM control unit also sends the "High beams ON" request over the interior CAN to the instrument cluster.

The instrument cluster actuates the high beams indicator lamp (A1e3).

However, to request the headlamp flasher function, the combination switch must be pulled backward. If the combination switch is pulled back and held, the high beam actuation is active for maximum $t = 30$ s. The permanently present request is then interpreted as a "stuck combination switch".

The front SAM control unit reads in the status of the exterior lights switch directly.

The front SAM control unit reads in all the information, evaluates it and sends the "Daytime running lamps ON" request over chassis CAN 2 to the left headlamp control unit and to the right headlamp control unit.

The left headlamp control unit actuates the left turn signal light, parking light, side marker lamp and daytime running lamp (E1e18).

The right headlamp control unit actuates the right turn signal light, parking light, side marker lamp and daytime running lamp (E2e18).

In darkness the front SAM control unit also actuates the low beams.

The ambient brightness is sensed by the rain/light sensor (B38/2). The front SAM control unit reads in the data of the rain/light sensor via wiper/inside rearview mirror LIN (LIN 2).

The CDI control unit (N3/9) (with diesel engine) or the ME-SFI [ME] control unit (N3/10) (with gasoline engine) sends the "Engine running" or the "Drivetrain operational" signal over chassis CAN 1 to the front SAM control unit.

The instrument cluster sends the vehicle speed to the front SAM control unit over the interior CAN.

Additional function requirements for auto on/off headlamps

- "Engine running" or "drivetrain ready" signal set or vehicle speed $v > 3$ km/h
- Exterior lights switch in "Auto" position
- Rain/light sensor signals "Darkness detected"

Auto on/off headlamps function sequence

The auto on/off headlamps function is no more than a comfort function and does not exempt the driver from following the rules in the road traffic regulations.

The CDI control unit or the ME-SFI [ME] control unit sends the "engine running" signal or the "drivetrain operational" signal over chassis CAN 1 to the front SAM control unit.

Function sequence for auto on/off headlamps over rain/light sensor

Ambient brightness is assessed by the rain/light sensor. The front SAM control unit reads in the data of the rain/light sensor via wiper/inside rearview mirror LIN and activates the low beams actuation if darkness is recognized.

Function sequence for auto on/off headlamps via wiper activities

If the low beams are switched on or off due to the activities of the wiper system, one refers to wiper, rain or adverse weather light.

The daytime running lights actuation is deactivated as soon as the exterior lights switch is turned to the "Standing lights", "Manual driving lights" or "Left parking light" or "Right parking light" position.

In vehicles with code (460) Canada version, the daytime running lights actuation is switched off after expiration of a period of $t = 3$ min when the vehicle is standing still. If the vehicle is moved again, the front SAM control unit automatically activates daytime running lights actuation.

i The daytime running lights have a higher priority than the auto on/off headlamps. In countries with legal daytime running light requirements, only the headlamp flasher is permissible but not the high beams. The high beam is permissible only when the high beam is manually switched on via the exterior light switch (without code (460) Canada version or without code (494) USA version).

The instrument cluster sends the vehicle speed to the front SAM control unit over the interior CAN.

The front SAM control unit reads in the status of the exterior lights switch directly, and the data of the rain/light sensor over the wiper/inside rearview mirror-LIN.

With the auto on/off headlamps, the low beams are automatically switched on or off.

This is effected to match the ambient brightness or the activities of the wiper system:

- **Function sequence for auto on/off headlamps over rain/light sensor**
- **Function sequence for auto on/off headlamps via wiper activities**

The front SAM control unit controls the wiper system and evaluates the data of the rain/light sensor or the wipe request via the combination switch for this.

If the windshield wiper system is activated for $t \geq 20$ s with a wipe cycle time of $t < 6$ s, the front SAM control unit activates low beam actuation. If there are no wipe cycles for $t \geq 60$ s, low beams actuation is deactivated.

i In the event of rain/light sensor failure, the auto on/off headlamps are not deactivated until the engine is switched off. When the vehicle is being driven through a tunnel and if the wiper start suppression function is active, the auto on/off headlamps function remains switched on. If the wiper start suppression function is canceled, the auto on/off headlamps remain active for an additional $t = 60$ s.

Behavior of exterior lights with active auto on/off headlamps:		
Start of trip	Standing lamp	Low beam
Circuit 15C OFF	Off	Off
Circuit 15C ON	Off	Off
Circuit 15R ON	On	Off
Terminal 15 ON	On	Off
"Engine running" or "drivetrain operational" signal set or vehicle speed $v > 3$ km/h	On	On (high beams permissible)
End of trip	Standing lamp	Low beam
"Engine running" or "drivetrain operational" signal set or vehicle speed $v > 3$ km/h	On	On (high beams permissible)
Terminal 15 ON	On	Off
Circuit 15R ON	On	Off
Circuit 15C ON (driver door closed)	On	Off
Circuit 15C ON (driver door open)	Off	Off
Circuit 15C OFF	Off	Off

Additional function requirements for automatic headlamp range adjustment

- "Engine running" or "drive train operational" signal on
- Driving lights On (low beam/high beam)

Function sequence for automatic HRA [LWR]

The automatic HRA [LWR] permits the correction of the headlamp range of the vehicle headlamps as a function of the load or the vehicle pitch motions induced by the vehicle dynamics.

The CDI control unit or the ME-SFI [ME] control unit sends the set "Engine running" or "Drivetrain operational" signal over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit and the right headlamp control unit.

i Zero-point programming is performed at the end of production to compensate for suspension tolerances. With successful programming, visual feedback occurs through the movement of the headlamp units "center-down-up-center".

If the vehicle is moving at a constant speed, the automatic headlamp range adjustment system operates in "static mode" at a slow adjustment rate.

When the vehicle is accelerated, the "dynamic mode" is activated and the reaction time of the automatic headlamp range adjustment is significantly reduced.

The "dynamic mode" is activated depending on the speed change and

Determining vehicle level:

- On model 212.0/1 without code (488) Steel/air suspension and without code (489) AIRmatic (air suspension with continuous adjustment damping, the left headlamp control unit reads in the signals of the left rear level sensor (B22/7) and the left front level sensor (B22/8) directly.
- On model 212.2 without code (488) Steel/air suspension and without code (489) AIRmatic (air suspension with continuous adjustment damping) the rear axle electronic level control control unit (N97) reads in the signals of the left rear level sensor and the right rear level sensor (B22/10) directly. The left headlamp control unit reads in the signals of the left front level sensor directly. The rear axle electronic level control control unit sends the data required for evaluation of the vehicle level over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit and to the right headlamp control unit.
- On model 212 with code (488) Steel/air suspension or code (489) AIRmatic (air suspension with continuous adjustment damping) the AIRmatic control unit (N51/3) sends all the data required for evaluation of the vehicle level over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit and to the right headlamp control unit. For this purpose, the AIRmatic control unit evaluates the data from the left rear level sensor, left front level sensor, right front level sensor (B22/9) and the right rear level sensor.

additional signals from the brake and accelerator pedal positions.

i When the vehicle is standing automatic headlamp range adjustment is accomplished in the "dynamic mode". Information on wheel speed, as an indicator of vehicle speed, is sent by the Electronic Stability Program control unit (N30/4) (model 212 (except 212.074/092/095/098/274/292/298) without 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 212.074/092/274/292) over the chassis CAN 1, front SAM control unit and chassis CAN 2 to the left headlamp control unit and the right headlamp control unit. Both headlamp control units receive this information and communicate with each other over chassis CAN 2. The headlamp control units operate in a master-slave combination, whereby the left headlamp control unit acts as the master, and synchronizes the right headlamp control unit. The left headlamp control unit actuates the left headlamp range adjustment actuator motor (E1m1). The right headlamp control unit actuates the right headlamp range adjustment actuator motor (E2m1).

	Electrical function schematic for driving lights actuation		PE82.10-P-2059-97DAD
	Overview of exterior lights system components		GF82.10-P-9998FLM