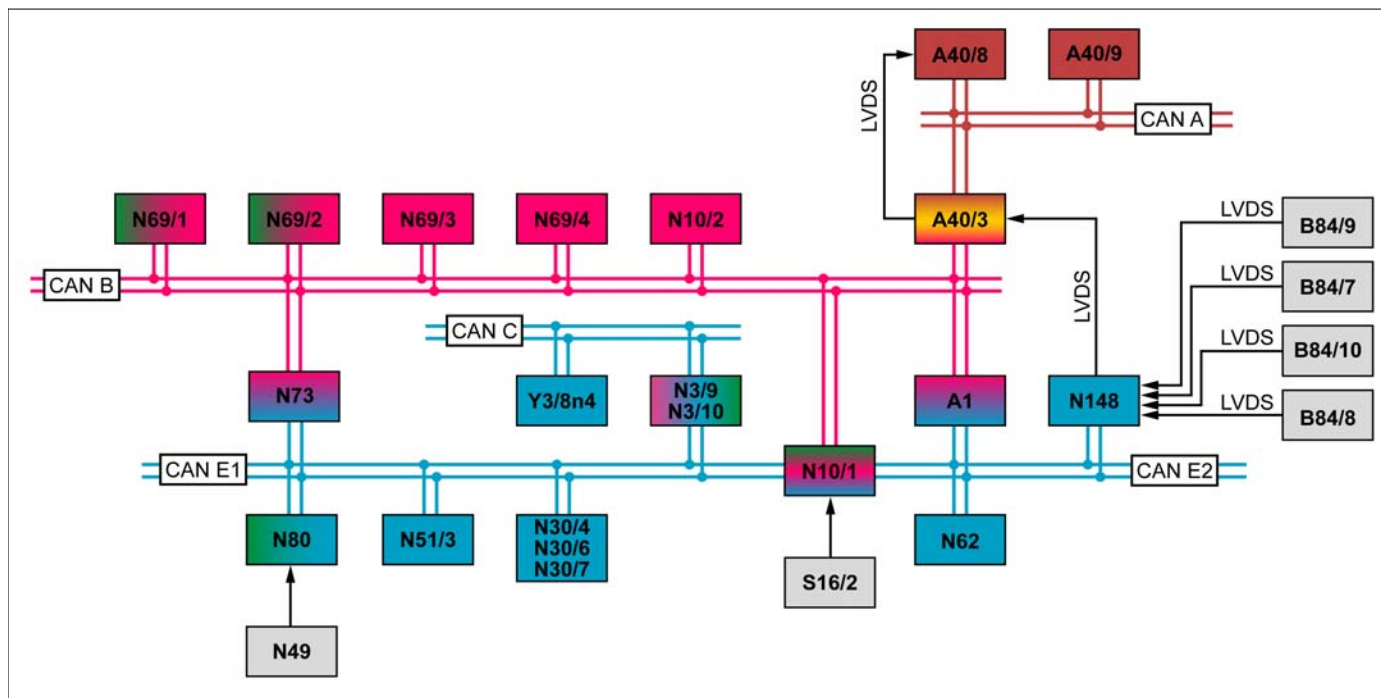


**MODEL 212**  
 as of model year 2014  
 with CODE 501 (360 degree camera)



P54.65-5222-79

- |        |  |        |  |
|--------|--|--------|--|
| A1     | Instrument cluster   | N62    | Parking system control unit (with CODE 235 (Active Parking Assist))              |
| A40/3  | COMAND control unit  | N69/1  | Left front door control unit   |
| A40/8  | Audio/COMAND display   | N69/2  | Right front door control unit  |
| A40/9  | Audio/COMAND control panel   | N69/3  | Left rear door control unit  |
| B84/7  | Left outside mirror 360° camera  | N69/4  | Right rear door control unit   |
| B84/8  | Right outside mirror 360° camera   | N73    | Electronic ignition switch control unit  |
| B84/9  | Front end 360° camera  | N80    | Steering column module control unit  |
| B84/10 | Rear end 360° camera   | N148   | 360° camera control unit   |
| N3/9   | CDI control unit (with diesel engine)  | S16/2  | Backup lamp switch (with transmission 711, 716)                                  |
| N3/10  | ME-SFI control unit (with gasoline engine)   | Y3/8n4 | Fully integrated transmission control unit (with transmission 722.9, 724.2, 725) |
| N10/1  | Front SAM control unit with fuse and relay module  | CAN A  | Telematics CAN   |
| N10/2  | Rear SAM control unit with fuse and relay module   | CAN B  | Interior CAN   |
| N30/4  | Electronic Stability Program control unit (model 212 (except 212.074/075/076/092/095/098/274/275/276/292/298) except CODE 233 (DISTRONIC PLUS))                  | CAN C  | Drive train CAN  |
| N30/6  | Regenerative braking system control unit (model 212.095/098/298)   | CAN E1 | Chassis CAN 1  |
| N30/7  | Premium Electronic Stability Program control unit (model 212 (except 212.095/098/298) with CODE 233 (DISTRONIC PLUS), model 212.074/075/076/092/274/275/276/292) | CAN E2 | Chassis CAN 2  |
| N49    | Steering angle sensor  | LVDS   | Low voltage differential signal  |
| N51/3  | AIRMATIC control unit (with CODE 489 (AIRMATIC (air suspension with continuous variable damping)))   |        |  |

**Function requirements, general**

- Circuit 15 ON

A total of seven split-screen views and two full-screen views of the area surrounding the vehicle can be displayed, however no more than

- Vehicle speed  $v < 27$  km/h

**i** The electronic ignition lock control unit sends the status of circuit 15 via the interior CAN, front SAM control unit and chassis CAN 1 to the 360° camera control unit.

The vehicle speed is calculated from the wheel speed. The Electronic Stability Program control unit or regenerative braking system control unit sends corresponding information via chassis CAN 1, the front SAM control unit and chassis CAN 2 to the instrument cluster. The instrument cluster calculates the vehicle speed to be displayed and sends this over chassis CAN 2 to the 360° camera control unit for calculating the switch-off behavior.

### 360° camera system, general

The 360° camera system consists of four digital cameras. One camera each is located behind the radiator trim, the outside mirror housings and the trunk lid (in model 212.0) or on the liftgate (in model 212.2).

The 360° camera control unit uses the picture data from the cameras to calculate a virtual picture ("Virtual viewpoint"). On the Audio/COMAND display, the vehicle and its surroundings ( $s = 3$  m to front and rear and  $s = 2.5$  m on the sides as measured on the ground) are displayed as a "Vehicle top view" (bird's eye view).

### Function sequence for activating/deactivating the 360° camera system

The 360° camera system can be manually activated or deactivated by pressing the "Sys" button in the COMAND controller unit for  $t > 2$  s.

The 360° camera system is activated automatically when gear range "R" (with transmission 722.9, 724.2, 725) or reverse gear (transmission 711, 716) is engaged.

Activating/deactivating manually:

The COMAND controller unit reads in the status of the "Sys" button and sends it via the interior CAN, front SAM control unit and chassis CAN 2 to the 360° camera control unit. The 360° camera control unit then activates or deactivates the 360° camera system.

Automatic activating/deactivating:

The automatic activation or deactivation of the 360° camera system must be enabled via the corresponding operating level of the COMAND controller unit. The Audio/COMAND control panel sends the corresponding control signals (softkey, favorite button) to the COMAND controller unit over the telematics CAN. The COMAND controller unit sends the status of the 360° camera function via the interior CAN, front SAM control unit and chassis CAN 2 to the 360° camera control unit. If gear range "R" (transmission 722.9, 724.2, 725) or reverse gear (transmission 711, 716) is now engaged, the 360° camera control unit activates the 360° camera system.

Vehicle with transmission 722.9, 724.2, 725:

Gear range "R" is engaged through the fully integrated transmission control unit. Subsequently, the fully integrated transmission control unit sends the status of the selector lever position to the 360° camera control unit via the drive train CAN, CDI control unit or ME-SFI control unit, chassis CAN 1, front SAM control unit and chassis CAN 2.

Vehicle with transmission 711, 716:

### Function sequence for picture recognition, picture output

The images recorded by each camera are read in by the 360° camera control unit via LVDS lines and processed. The 360° camera control unit calculates guide lines to be shown on the Audio/COMAND display taking into account the steering wheel angle, the wheel angle and stored vehicle parameters. Additionally, the 360° camera control unit uses the information of the parking system, for example, to mark the areas of the vehicle corners at risk during maneuvering.

The 360° camera control unit sends the request for displaying the picture via the chassis CAN 2, front SAM control unit and interior CAN to the COMAND controller unit. This then activates the Audio/COMAND display via telematics CAN. The 360° camera control unit then transmits this processed picture data to the COMAND control unit via the low voltage differential signaling lines. The COMAND controller unit sends this to the Audio/COMAND display over the low voltage differential signaling (LVDS) line. There the processed camera pictures including the guide lines are then displayed.

**i** For a better representation of the camera pictures, the 360° camera control unit corrects the pictures electronically for distortion.

The steering angle is recorded by the steering angle sensor. The steering column tube module control unit reads in the signals from the steering angle sensor directly and sends information on the steering angle via chassis CAN 1, the front SAM control unit and chassis CAN 2 to the 360° camera control unit.

The Electronic Stability Program control unit or regenerative braking system control unit calculates the wheel angle based on the position of both front wheels and sends corresponding information to the 360° camera control unit via chassis CAN 1, front SAM control unit and chassis CAN 2.

The parking system control unit sends information on the parking system to the 360° camera control unit via chassis CAN 2.

two views simultaneously: the "Vehicle top view" and an additional detailed view (e.g. after engaging gear range "R" (with transmission 722.9, 724.2, 725) or reverse gear (with transmission 711, 716), the picture recorded by the rear 360° camera is shown).

Camera lenses with a horizontal angle of vision of  $\alpha > 180^\circ$  and a vertical angle of vision of  $\alpha > 123^\circ$  record the required field of view. Dynamic and static guide lines, which represent the vehicle dimensions and driving trajectories (driving paths) based on the steering angle, are displayed on the picture to assist the driver. With the help of these representations, the driver is provided assistance especially during parking and maneuvering. Additional elements are displayed here that mark the area at risk at the vehicle corners.

The 360° camera comprises the following subfunctions:

- **Function sequence for activating/deactivating the 360° camera system**
- **Function sequence for picture recognition, picture output**

Engaging of the reverse gear is detected by the backup lamp switch. The front SAM control unit reads in the signal from the backup lamp switch directly and sends the status of the reverse gear via chassis CAN 2 to the 360° camera control unit.

The 360° camera system is now activated or deactivated.

**i** When shifting to the neutral position, the previously shown picture continues to be shown in the Audio/COMAND display. In vehicles with transmission 722.9, 724.2, 725, the 360° camera system is automatically deactivated when gear range "P" is engaged.

**i** If an attempt is made to activate the 360° camera system above a vehicle speed of  $v = 27$  km/h, an inactivity message appears on the Audio/COMAND display. When falling below this speed limit at a later stage, the 360° camera system is activated. An inactivity message also appears in the Audio/COMAND display if the 360° camera system is activated at a vehicle speed of  $v < 27$  km/h and then the vehicle speed increases to  $v > 30$  km/h within  $t = 1$  s.

During reverse travel, the 360° camera system operated independently from the speed.

**i** During initial startup as well as after replacement of the 360° camera control unit or a camera or upon removal/installation of the trunk lid, or liftgate, an outside mirror or the radiator trim, the corresponding cameras must be recalibrated. After a camera is replaced, a recoding of the 360° camera control unit is required.

The following situations lead to a deactivation of the 360° camera function:

- Vehicle speed  $v > 30$  km/h
- Circuit 15 OFF
- Engaging neutral (with transmission 711, 716) or engaging gear range "P" (with transmission 722.9, 724.2, 725)

The 360° camera system is activated during forward travel up to a vehicle speed of  $v < 30$  km/h. When this speed limit is exceeded, the 360° camera system is deactivated.

The current vehicle level is used by the 360° camera control unit to correct the image data and to calculate the optimum representation on the Audio/COMAND display. Information on the vehicle level is sent by the AIRMATIC control unit (with CODE 489 (AIRMATIC (air suspension with continuous adjustment damping))) via the chassis CAN 1, the front SAM control unit, and chassis CAN 2 to the 360° camera control unit.

It is possible to switch both automatically and manually between the views shown in the Audio/COMAND display. According to the engaged gear or gear range, an automatic switch is made between frontward view and rearward view. In addition to the automatic selection, the driver can also switch manually between the various detailed views via the COMAND controller unit.

The following views are possible on the Audio/COMAND display:

- Vehicle top view and forward field of view
- Vehicle top view and rearward field of view
- Vehicle top view and field of view of front wheels on both sides
- Vehicle top view and field of view of rear wheels on both sides
- Vehicle from above and field of view for trailer hitch (with CODE 550 (Trailer hitch))
- Full screen forward field of view
- Full screen rearward field of view
- Vehicle top view with enlarged view of vehicle front
- Vehicle top view with enlarged view of rear end

**i** Detailed information on the "Reversing camera" and "Trailer mode" functions (with CODE 550 (Trailer hitch)) is contained in the separate subfunction "Reversing camera, function".

To ensure that the surrounding area can also be recorded in the dark, the ambient illumination in each of the outside mirror housings is activated, irrespective of the ambient brightness. For this purpose, the 360° camera control unit permanently sends the "Switch on ambient illumination" request via chassis CAN 2 to the front SAM control unit. The front SAM control unit as the exterior lights master control unit then evaluates the ambient brightness. When it is dark, the front SAM control unit sends a corresponding request to the front door control units via the interior CAN. They activate the ambient illumination in the outside mirror housings.

**i** Detailed information about the "ambient illumination" can be found in the partial function "Headlamp switch-off delay (SWA), function" in the separate function description "Exterior lights, function".

The background illumination for the Audio/COMAND display can be manually adapted to the ambient brightness. The background illumination can be adjusted through the COMAND controller unit in the "360° camera" system menu function bar by choosing the "Sun" symbol.

Representation of vehicle views in the Audio/COMAND display:

The "Vehicle top view" also shows open doors or an open trunk lid or an open liftgate. The rear SAM control unit sends the status of the trunk lid or liftgate (open or closed) via the interior CAN, front SAM control unit and chassis CAN 2 to the 360° camera control unit. The status of the respective door (opened or closed) is sent by the left front door control unit, right front door control unit, left rear door control unit, or right rear door control unit via the interior CAN, the front SAM control unit and chassis CAN 2 to the 360° camera control unit. The 360° camera control unit processes this information and shows an open door or an open trunk lid or an open liftgate in the "Vehicle top view" to match. The picture data from the camera on the open front door or on the open trunk lid or on the open liftgate are hidden from view.

The position of the outside mirror housing (folded out or in) is used by the 360° camera control unit to calculate the optimum display of the "Vehicle top view". The status of the corresponding outside mirror housing is sent by the corresponding front door control unit to the 360° camera control unit via interior CAN, front SAM control unit and chassis CAN 2.

**i** While the outside mirror housings are being folded in/out, the "Vehicle top view" is temporarily removed from the display until the display is recomputed.

System limits:

The functions and representations of the 360° camera system are limited. Distortion and "blind spots" can occur.

In the "Vehicle top view", objects outside road level (e.g. vehicles) are displayed with distortion.

Objects are also shown with distortion in the views "Front field of view, full screen" and "Rear field of view, full screen" (front or rear camera active). The assignment of objects in the picture to how they appear in real-life can therefore be unusual.

There are different types of "blind spot" depending on the system and model in question. On the one hand, they result from the position of the cameras above the respective bumpers. Here the camera loses its field of view immediately in front of and behind the vehicle. On the other hand, they are system-related, particularly in the four overlapping areas of the fields of view of the cameras, when calculating a "Vehicle top view". Furthermore, due to the low installation height of the cameras there are areas where only objects close to the ground can be seen. This means, for example, that people are not shown roughly above knee height in the "Vehicle top view". In both cases, however, additional protection is provided by the parking system.

	Electrical function schematic for 360° camera		PE54.65-P-2060-97DAA
	Overview of system components of parking assistance systems		GF54.00-P-9997FLM