MODEL 212 (except 212.095/098/298) as of model year 2014

Function requirements, general
- Circuit 61 ON
- Adaptive Brake (ABR) is functional

ABR, general
ABR assists the driver in dangerous situations which occur suddenly and thus serves active safety.

To do so, the Electronic Stability Program control unit (N30/4) (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (N30/7) (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) evaluates the data from the following components in order to determine the current driving situation:
- Yaw rate sensor for lateral and longitudinal acceleration (B24/15)
- Left front axle rpm sensor (L6/1)
- Right front axle rpm sensor (L6/2)
- Left rear axle rpm sensor (L6/3)
- Right rear axle rpm sensor (L6/4)
- Steering angle sensor (N49)
- Brake lights switch (S9/1)

There are 2 ABR variants in use:
- ABR standard system (except CODE 233 (DISTRONIC PLUS))
- ABR premium system (with CODE 233 (DISTRONIC PLUS))

<table>
<thead>
<tr>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are no differences between the variants with respect to the ABR subfunctions described below. The system is made up of the following subfunctions:</td>
</tr>
<tr>
<td>Function sequence for Electronic Stability Program (ESP)</td>
</tr>
<tr>
<td>Function sequence for Electronic brake force distribution (EBD) function sequence</td>
</tr>
<tr>
<td>Function sequence of exhaust test, dynamometer test mode</td>
</tr>
<tr>
<td>Antilock brake system (ABS) function sequence</td>
</tr>
<tr>
<td>Function sequence for acceleration skid control (ASR), electronic traction system (ETS)</td>
</tr>
<tr>
<td>Brake Assist (BAS) function sequence</td>
</tr>
<tr>
<td>Function sequence for BAS PLUS, with CODE 233 (DISTRONIC PLUS)</td>
</tr>
<tr>
<td>Function sequence for ESP® trailer stabilization (with CODE 550 (Trailer hitch))</td>
</tr>
<tr>
<td>Function sequence for Hill-Start Assist (HSA)</td>
</tr>
<tr>
<td>Dry braking function sequence</td>
</tr>
<tr>
<td>Function sequence for precharging depending on accelerator pedal actuation</td>
</tr>
<tr>
<td>Function sequence for precharging depending on lateral acceleration</td>
</tr>
<tr>
<td>Function sequence for HOLD function</td>
</tr>
<tr>
<td>Function sequence for ASR and ESP passive switching, except model 212 (with CODE 990 (AMG vehicles))</td>
</tr>
<tr>
<td>Function sequence for ASR and ESP ON, Sport or OFF, only with model 212 (with CODE 990 (AMG vehicles))</td>
</tr>
<tr>
<td>Function sequence for fail boost (with CODE B03 (ECO start/stop function))</td>
</tr>
<tr>
<td>Function sequence for over boost (with CODE B03 (ECO start/stop function))</td>
</tr>
<tr>
<td>Function sequence - PRE-SAFE</td>
</tr>
<tr>
<td>Function sequence for cruise control (CC)</td>
</tr>
<tr>
<td>Function sequence - standstill coordinator (SSK)</td>
</tr>
<tr>
<td>Steer Assist function sequence</td>
</tr>
<tr>
<td>Function sequence for adaptive brake lights flashing (except with code 494 (USA version))</td>
</tr>
<tr>
<td>System fault display function sequence</td>
</tr>
<tr>
<td>ESP function sequence</td>
</tr>
</tbody>
</table>

Function sequence for acceleration skid control (ASR), model 212 (with CODE 990 (AMG vehicles))

- the engine is running or has been switched off by the ECO start/stop function
- DISTRONIC PLUS is not active (with ABR Premium system (with code (233) DISTRONIC PLUS))
- OFF condition is not present at the standstill coordinator
- the vehicle is not sliding

If the driver releases the brake pedal, an incline-dependent hold pressure is set and maintained until the driver depresses the brake pedal again or drives off. Pressure reduction when starting off is performed by the standstill coordinator according to the respective situation.

The HOLD function is deactivated automatically if:
- the accelerator pedal is depressed (except in position "N")
- the selector lever is set to position "P"
- the brake pedal is depressed again with a certain pressure until the "HOLD" status line disappears in the instrument cluster.

Warning strategy (on vehicles with electronic selector lever module control unit (N15/5), with transmission 722.6

If the HOLD function is activated and the driver wants to leave the vehicle, the position "P" is automatically engaged by the intelligent servo module for DIRECT SELECT (A80), with transmission 722.9

If the HOLD function is activated and if the driver wishes to leave the vehicle, the position "P" is automatically engaged by the intelligent servo module for DIRECT SELECT when the vehicle is at a standstill and the transmitter key removed.

A warning is issued on the instrument cluster.

Function sequence for ASR and ESP passive switching, except model 212 (with CODE 990 (AMG vehicles))

In driving mode the ASR and ESP functions. can be switched passive with the left multifunction steering wheel button group (S110) and right multifunction steering wheel button group (S111) via the "Assist" menu and "ESP" submenu in the IC.

The instrument cluster receives control signals from the multifunction steering wheel (MFL) in the following way:
- Steer wheel electronics (N135)
- Steering LIN (LIN E1)
- Steering column tube module control unit (N80)
- Chassis CAN 1
- Front SAM control unit with fuse and relay module
- Chassis CAN 2

The instrument cluster then sends the "ESP_OFF" request via chassis CAN 1 and chassis CAN 2 with the front SAM control unit with fuse and relay module interface to the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS)). If the functions are switched passive, the ESP warning lamp lights up in the instrument cluster. The control thresholds are raised when the ASR and ESP functions are switched passive.

ABS cannot be deactivated. ESP is always active during a brake application.

Function sequence for ASR and ESP ON, Sport or OFF, only with model 212 (with CODE 990 (AMG vehicles))

ESP can be operated in 3 different operating modes. It is possible to switch between the operating modes by pressing the AMG ESP Sport Off button (S193/1). To switch between ESP ON and ESP Sport mode, press the ESP OFF switch briefly. The ESP is switched off by
ESP prevents the vehicle from breaking away when oversteering or understeering. It ensures that the vehicle does not deviate from the course specified by the driver (within physical limits). Brake forces are produced selectively at the individual wheels to correct any deviations. Furthermore, reduction of the drive torque takes place in order to increase driving stability.

The Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) processes the following measured quantities in order to determine the vehicle’s behavior:
- yaw velocity
- steering angle
- brake pressure
- engine torque
- transmission shift stage
- lateral acceleration

A differentiation is made between the following vehicle characteristics:
- intervention in the case of oversteer
- intervention in the case of understeer

**Intervention in the case of oversteer**

If the vehicle begins to oversteer, brake pressure is built up at the outer front wheel. The resulting reduction in lateral force at the outer front wheel generates a yawing moment which counteracts the tendency of the vehicle to rotate inward. The vehicle speed decreases as a result of the brake force at the front wheel, which also enhances stability.

**Intervention in the case of understeer**

If the vehicle understeers, the maximum possible lateral force at the front axle has been exceeded. In other words, the vehicle pushes via the front axle to the outer edge of the curve. The resulting instability is counteracted by means of a reduction in drive torque and the following brake interventions at up to 3 wheels:
- brake pressure buildup at rear wheel on inside of curve (stage 1)
- stage 1 and in addition brake pressure buildup at rear wheel on outside of curve (stage 2)
- stage 2 and in addition brake pressure buildup at front wheel on inside of curve (stage 3)

Depending on the brake force, a torque is generated which causes the vehicle to rotate inward with a simultaneous reduction in speed. This has a considerable stabilizing effect.

The Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) sends a signal to reduce the drive torque via chassis CAN 1 (CAN E1) to the CDI control unit (N3/9) (with diesel engine) or ME-SFI control unit (N3/10) (with gasoline engine) which reduces the engine power accordingly.

A pending shift operation is suppressed for the duration of control intervention.

For this purpose, the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) sends a signal via chassis CAN 1 to the CDI control unit (with diesel engine) or to the ME-SFI control unit (with gasoline engine) which sends the information via the drive train CAN (CAN C) to the fully integrated transmission control unit (Y3/8n4) (with transmission 722.9). The fully integrated transmission control unit (with transmission 722.9) suppresses the shift operation.

**EBD function sequence**

EBD [EBV] provides assistance when the driver applies medium force to the brake pedal. EBD [EBV] prevents overbraking of the rear axle and increases vehicle stability when braking in a curve by reducing the pressure at the rear wheel on the inside of the curve or increasing it at the front wheel on the outside of the curve as required.

Pressing the AMG ESP Sport Off button for \( t > 2.5 \text{s} \) turns off ESP. The status of the AMG ESP Sport Off button is read in by the transmission mode control unit (N145) and sent via chassis CAN 1 to the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS)).

The operating modes are:
- ESP ON
- ESP SPORT
- ESP OFF

**ESP OFF**

The ABS operates as on series production vehicles with adapted control thresholds. When engine torque control is active, ASR operates with significantly reduced intervention strength and adjusted single-sided brake system interventions to improve traction. ESP operates with reduced intervention strength and adapted control thresholds.

The Electronic Stability Program warning lamp in the instrument cluster remains lit; it flashes during ESP intervention. The message "ESP SPORT" appears in the instrument cluster.

**ESP SPORT**

The ABS operates as on series production vehicles with adapted control thresholds. When engine torque control is active, ASR operates with significantly reduced intervention strength and adjusted single-sided brake system interventions to improve traction. ESP operates with reduced intervention strength and adapted control thresholds.

The Electronic Stability Program warning lamp in the instrument cluster remains lit. The message "ESP OFF" appears in the instrument cluster.

All Pre-Safe functions are deactivated in ESP OFF mode.

**Function sequence for fail boost (with CODE B03 (ECO start/stop function))**

The fail boost function ensures that a sufficiently high brake pressure level is maintained in the system in situations where the BAS brake booster is unable to provide an adequate brake boost. If, during a brake operation by the driver, the brake vacuum sensor (B64/1) (with CODE B03 (ECO start/stop function)) detects that the BAS brake booster is unable to provide any driver assistance, the fail boost function provides driver assistance by actuating the traction system hydraulic unit. Hydraulic boosting occurs with a suitable boost factor.

**Function sequence for over boost (with CODE B03 (ECO start/stop function))**

If the brake booster reaches the limits of its pneumatic boost, the brake pressure is increased through actuation of the high pressure and return flow pump, thereby ensuring that the usual level of brake boost is then provided.

The function sequence for fail boost and the function sequence for over boost differ in terms of their triggering thresholds and hydraulic boost.

**Function sequence - PRE-SAFE**

The PRE-SAFE function is integrated into the regenerative braking system control unit. If the regenerative braking system control unit detects one of the following situations, the PRE-SAFE function is activated:
- Panic after-braking (the driver's braking wish is greater than physically possible)
- Severe oversteer (vehicle rear breaks away in combination with powerful ESP control intervention functions)
- Severe understeer (the vehicle leans heavily over the front wheels for an extensive period)
The side-slip angle (angle between vehicle longitudinal axis and direction of movement of the vehicle's center of gravity) is calculated using the yaw rate (speed of vehicle rotation about vertical axis). The yaw rate, the lateral acceleration and the steer angle of the front wheels (calculated from the steering wheel angle) are used to determine the lateral forces on the wheels. The longitudinal forces on the wheels are calculated using the engine torque, transmission stage and brake pressure at each wheel. If the measured yaw rate does not match the specified value or the determined side-slip angle is too large, the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) generates a signal to increase the brake force or to reduce the brake force for the corresponding wheel. The resulting forces stabilize the vehicle.

**Function sequence of exhaust test, dynamometer test mode**

For vehicle test purposes, the ABR can be set to roller dynamometer mode if the workshop menu is activated via the instrument cluster (A1) and the engine is then started. ESP, ABS and ASR are then switched passive. The Electronic Stability Program warning lamp (A1e41) and the antilock brake system indicator lamp (A1e17) in the instrument cluster light up. In addition, a message is displayed in the multifunction display (A1p13) of the instrument cluster. The dynamometer mode can also be activated using the Diagnosis Assistance System (DAS).

**ABS function sequence**

ABS prevents the wheels from locking up when braking and as a result maintains the steering ability and directionality. Spin or road adhesion during vehicle deceleration. If a locked wheel is detected by the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) the brake pressure at the corresponding brake cylinder is reduced until the wheel begins to turn again.

**Function sequence for ASR, ETS**

ASR and ETS prevent the drive wheels from spinning when driving. ASR and ETS also serve to provide improved directional stability and road adhesion for increased traction potential over the entire vehicle speed range. Spinning of the drive wheels is detected via the signals from the rpm sensors by the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)). Wheel spinning is countered by reduction of the drive torque. For this purpose, the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) sends a signal to reduce the drive torque via chassis CAN 1 to the CDI control unit (with diesel engine) or the ME-SFI control unit (with gasoline engine) which reduces the engine power accordingly. A check is continuously performed to establish whether the drive torque specified by the driver via the accelerator pedal sensor (B37) can be permitted again, e.g. due to an improvement in road surface adhesion. As a result of targeted brake intervention at the spinning wheel (without traction), the drive torque is transferred to the opposite rotating wheel (with traction).

**BAS function sequence**

BAS detects emergency braking situations from rapid actuation of the brake pedal and, if necessary, increases the brake pressure in order to achieve maximum possible deceleration. For this purpose, the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) evaluates the degree of pressure rise in the brake system and, if a certain triggering threshold is exceeded, initiates emergency braking.

**Function sequence for BAS PLUS, with CODE 233 (DISTRONIC PLUS)**

BAS Plus increases the brake pressure depending on the speed of the brake pedal operation and the distance of the vehicle driving in front.

**Function sequence for ESP® trailer stabilization (with CODE 550 (Trailer hitch))**

- Rapid steering movements at high speeds, which suggest a shock reaction from the driver and may lead to vehicle instability
- Engine hood OPEN
- Engine OFF (unless the engine is switched off by the ECO start/stop function)
- Attempt to lock the vehicle using the key
- Door contact plausibility check

Further information on the cruise control (CC) can be found in the following document:

**Function sequence for cruise control (CC)**

The cruise control maintains the constant speed specified by the driver, irrespective of engine load condition and without the accelerator pedal being actuated.

The cruise control also includes the following functions:

- Permanent Speed Limiter
- Variable Speed Limiter (except CODE 494 (USA version))

Further information on the cruise control (CC) can be found in the following document:

**Function sequence for SSK**

The standstill coordinator monitors the braking support systems DISTRONIC PLUS (with ABR premium system (with CODE 233 (DISTRONIC PLUS)) and HOLD function below a speed of 3 km/h until the vehicle has come to a safe standstill. Within this vehicle speed range, the SSK is responsible of the transfer to a safe state when a securing event occurs.

When the vehicle is at a safe standstill, the rolling monitoring function of the SSK is requested by the support systems. If vehicle rolling is detected, the brake pressure is increased until the vehicle is stationary again. In the case of vehicles with ABR Premium system (with code 233 (DISTRONIC PLUS)), a leakage compensation is also active during the safe standstill. If the brake pressure measured by means of the circuit pressure sensors drops relative to the specified pressure request of the SSK, the specified pressure of the SSK is restored by means of an active pressure buildup.

Securing the vehicle by means of the SSK is necessary if the following events occur:

- Engine OFF, unless the engine is switched off by the ECO start/stop function
- Engine OFF (unless the engine is switched off by the ECO start/stop function)

The vehicle is secured by means of the warning strategy. The warning strategy actively involves the driver in the securing procedure so that a vehicle securing operation must take place as a result of driver action.

The warning strategy is divided into 3 stages.

**Stage 1 of warning strategy**

The driver is warned by means of a message in the instrument cluster. The message differs depending on the transmission model. With manual transmissions, the message "Brake Immediately!" appears in the instrument cluster. On vehicles with automatic transmission, the driver is warned by the message "Gear Selector Lever to P".

**Stage 2 of warning strategy**

In stage 2 of the warning strategy, the driver is additionally warned by means of an unobtrusive beeping which is actuated by the front SAM control unit with fuse and relay module.

The beeping sounds if the following events occur:

- Engine hood OPEN
- Engine OFF (unless the engine is switched off by the ECO start/stop function), driver door OPEN and driver seat belt buckle is not fastened
- Ignition OFF, driver door OPEN and driver seat belt buckle is not fastened

**Stage 3 of warning strategy**

In stage 3 of the warning strategy, a more intense beeping is output if the following events occur:

- Attempt to lock the vehicle using the key
- The beeping in stage 1 and stage 2 is output for a longer time

The beeping is stopped immediately as soon as the driver deactivates the active assistance system. This can be performed by engaging gear range "P" or by depressing the brake pedal.

Door contact plausibility check
The ESP® trailer stabilization detects rocking motion in the tractor/trailer combination based on the yawing vibrations caused in the tractor vehicle by the trailer. The front SAM control unit with fuse and relay module (N10/1) places the information on chassis CAN 1. This information is received by the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or CODE 990 (AMG vehicles)). If vehicle/trailer instability occurs, this is detected by the yaw rate sensor for lateral and longitudinal acceleration.

The Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) receives this information via the vehicle dynamics (CAN H).

No additional sensors are used on the trailer or trailer hitch. The ESP® trailer stabilization stabilizes the tractor/trailer combination by means of brake pressure requests on alternating sides of the front axle and, if necessary, slows down the tractor/trailer combination by reducing torque and by building up pressure at all wheels. The vehicle is stabilized only via the front axle. If heavy negative damping is detected, the system intervenes to decelerate the vehicle and stabilize the trailer. Several ESP interventions occur in quick succession, the simple stabilization intervention is suppressed, regardless of the damping detected. This prevents the tractor/trailer combination from constantly driving at a critical speed and prevents the brake system from being subjected to too much stress due to interventions in quick succession. Active vehicle/trailer stabilization does not change the critical speed.

**Additional function requirements for the Hill Start Assist**
- Transmission not in position “N” (with transmission 722)
- Vehicle not secured with parking brake
- Incline detected with vehicle at standstill

**Hill Start Assist function sequence**

When starting off, the Hill-Start Assist prevents the vehicle from rolling back opposite the travel direction of the engaged gear range during the time it takes for the driver to change from the brake pedal to the accelerator pedal. The function is triggered automatically, if when the vehicle is at a standstill an incline is detected via the yaw rate sensor for lateral and longitudinal acceleration which would cause rolling in the opposite direction to the gear range engaged. This is sent via the vehicle dynamics CAN to the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)). In addition, the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) also reads in the brake light switch directly and thus detects the status of the brake pedal.

The status of the parking brake is detected via the parking brake indicator switch (S12). This switch is read in by the front SAM control unit with fuse and relay module directly and its status is sent via chassis CAN 1 to the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)). The brake pressure applied by the driver is maintained in the brake cylinders by the traction system hydraulic unit (A7/3).

The plausibility check detects any faults along the signal path from the door closed” is wrongly detected although the driver door is open, this is detected by the door contact plausibility check in the SSK and a corresponding fault is stored in the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)).

**Additional function requirements for adaptive brake lights flashing (except with code 494 (USA version))**
- Vehicle speed > 50 km/h
- Deceleration > 7.5 m/s²
- BAS activated
- ABS controls both front wheels

**Hill Start Assist function sequence**

When starting off, the Hill-Assist Assist prevents the vehicle from rolling back opposite the travel direction of the engaged gear range during the time it takes for the driver to change from the brake pedal to the accelerator pedal. The function is triggered automatically, if when the vehicle is at a standstill an incline is detected via the yaw rate sensor for lateral and longitudinal acceleration which would cause rolling in the opposite direction to the gear range engaged. This is sent via the vehicle dynamics CAN to the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)).

The status of the parking brake is detected via the parking brake indicator switch (S12). This switch is read in by the front SAM control unit with fuse and relay module directly and its status is sent via chassis CAN 1 to the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)). The brake pressure applied by the driver is maintained in the brake cylinders by the traction system hydraulic unit (A7/3).

The plausibility check detects any faults along the signal path from the door closed” is wrongly detected although the driver door is open, this is detected by the door contact plausibility check in the SSK and a corresponding fault is stored in the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)).
actuates the brake lights with a flashing frequency of 5 Hz for the duration of the signal (min. 1 s).

**System fault display function sequence**
The driver is informed about the system status and about faults by the following displays:
- Antilock brake system indicator lamp (A1e17)
- Electronic Stability Program warning lamp
- Messages in multifunction display (A1p13)
  – Brake fluid and parking brake indicator lamp (A1e6)

If the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) fails, basic braking without ABS is always available.

The status of the brake fluid level switch (S11) and the parking brake indicator switch is read by the front SAM control unit with fuse and relay module and sent via the interior CAN (CAN B) to the instrument cluster.

In the function sequence for semi-automatic parking space entry (except CODE 489 (Japan version)) and the function sequence for semi-automatic parking space exit (except CODE 489 (Japan version)), the Electronic Stability Program control unit (except CODE 233 (DISTRONIC PLUS), except CODE 990 (AMG vehicles)) or the Premium Electronic Stability Program control unit (with CODE 233 (DISTRONIC PLUS) or with CODE 990 (AMG vehicles)) receives the required braking torque from the parking system control unit (N62) (with CODE 235 (Active Parking Assist) via chassis CAN 1 and chassis CAN 2 with the front SAM control unit with fuse and relay module interface and actuates the traction system hydraulic unit directly. The vehicle is braked. The vehicle is braked to stop at the required maneuvering points as well as an in the target parking position.

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**Function sequence for HOLD function**
The HOLD function assists the driver during waiting times in traffic and when starting off on a hill. The HOLD function is activated by briefly and quickly depressing the brake pedal when the vehicle is stationary. Successful activation of the HOLD function is indicated in a status line in the instrument cluster.

The HOLD function can be activated if:
- the vehicle is stationary
- the seat belt is fastened or the driver door is closed
- the selector lever is not in position "P"

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<table>
<thead>
<tr>
<th>Electrical function schematic for Adaptive Brake (ABR)</th>
<th>PE42.47-P-2050-97DAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive Brake (ABR) location of components</td>
<td>GF42.47-P-0001-02FLM</td>
</tr>
<tr>
<td>Adaptive Brake (ABR) block diagram</td>
<td>GF42.47-P-0001-03FLM</td>
</tr>
<tr>
<td>Overview of system components, Adaptive Brake (ABR)</td>
<td>GF42.47-P-99997FL</td>
</tr>
</tbody>
</table>