F10 Driver Assistance Systems

Edited for the U.S. market by:
BMW Group University
Technical Training
4/1/2010

BMW Service

General information

Symbols used

The following symbol / sign is used in this document to facilitate better comprehension and to draw attention to particularly important information:

⚠

Contains important safety guidance and information that is necessary for proper system functioning and which it is imperative to follow.

Information status and national-market versions

The BMW Group produces vehicles to meet the very highest standards of safety and quality. Changes in terms of environmental protection, customer benefits and design make it necessary to develop systems and components on a continuous basis. Consequently, this may result in differences between the content of this document and the vehicles available in the training course.

As a general principle, this document describes left-hand drive vehicles in the European version. Some controls or components are arranged differently in right-hand drive vehicles than those shown on the graphics in this document. Further discrepancies may arise from market-specific or country-specific equipment specifications.

Additional sources of information

Further information on the individual topics can be found in the following:

- in the Owner's Handbook
- in the integrated service technical application

Contact: conceptinfo@bmw.de

The information in the document is part of the BMW Group technical training course and is intended for its trainers and participants. Refer to the latest relevant BMW Group information systems for any changes/supplements to the technical data.

Information status: **November 2009**

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F10 Driver Assistance Systems

1. Introduction

BMW has always offered a comprehensive range of driver assistance systems.

These systems make it easier for the driver to control the vehicle, by:

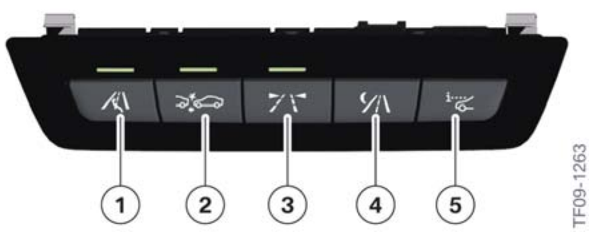
- providing the driver with information,
- prompting the driver how to act or
- actively intervening if necessary in order to ensure maximum performance efficiency and safety.

This training information provides an overview of all the driver assistance systems available in the F10, including the new Parking Assistance and Surround View (with side view cameras) features.

The Driver Assistance Package (ZDA) is available on the F10. The following options are included in the ZDA package and they are not available separately:

- Automatic High beams
- Lane Departure Warning
- Active Blind Spot Detection
- Parking Assistant

Note: Night Vision w/pedestrian detection and Head-Up Display are available as separate options.



F10 Assist system operating unit

Index	Explanation
1	Active Blind Spot Detection
2	Collision warning with brake application function (adaptive dynamic brake control with warning function)
3	Lane Departure Warning
4	Night Vision with pedestrian detection
5	Head-Up Display

For more information on the individual systems, refer to the F01/F02 information bulletins:

1 SWW F01/F02

2 DCC, ACC F01/F02

3 KAFAS F01/F02

4 BMW Night Vision 2

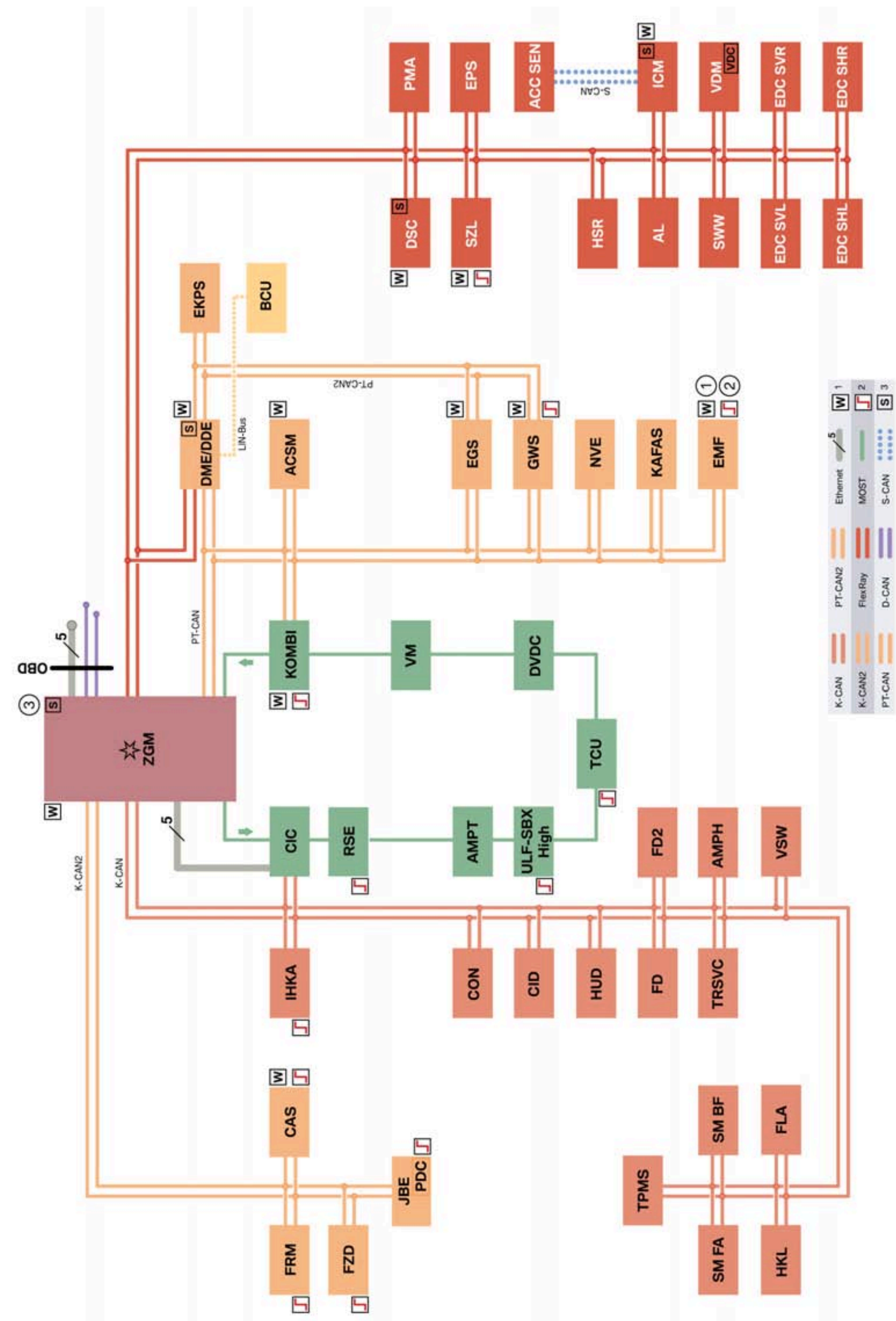
5 Head-up display HUD.

BMW Night Vision with person recognition and Head-Up Display are not described in this document, since these systems have been taken over from the F01/F02.

F10 Driver Assistance Systems

1. Introduction

1.1. Bus System Diagram



F10 Bus System Diagram

F10 Driver Assistance Systems
1. Introduction

Index	Explanation
1	Wakeable control units
2	Control units authorized to wake up the vehicle
3	Start-up node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control- Sensor
ACSM	Advanced Crash Safety Module
AHM	Trailer module
AL	Active steering
AMPH	Amplifier High (high fidelity amplifier)
AMPT	Amplifier Top (top high fidelity amplifier)
BSD	Bit-serial data interface
BCU	Battery Charge Unit (charging unit for auxiliary battery)
CAS	Car Access System
CIC	Car Information Computer
CIC Basic	Car Information Computer Basic
CID	Central Information Display
CON	Controller
D-CAN	Diagnosis on Controller Area Network
DDE	Digital Diesel Electronics
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
DVD	DVD changer
EDC SHL	Electronic Damper Control, rear left satellite unit
EDC SHR	Electronic Damper Control, rear right satellite unit
EDC SVL	Electronic Damper Control, front left satellite unit
EDC SVR	Electronic Damper Control, front right satellite unit
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic power steering
Ethernet	Cabled data network technology for local data networks
FD	Rear display
FD2	Rear display 2
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications

F10 Driver Assistance Systems
1. Introduction

Index	Explanation
FRM	Footwell module
FZD	Roof function center
GWS	Gear selector switch
HKL	Luggage compartment lid lift
HSR	Rear suspension slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
JBE	Junction box electronics
KAFAS	Camera-based driver assistance system
K-Bus	Body bus
K-CAN.	Body controller area network
K-CAN2	Body controller area network 2 (500 kBit/s)
KOMBI	Instrument cluster
LIN-Bus	Local Interconnect Network bus
Local-CAN	Local Controller Area Network
MOST	Media Oriented System Transport
MOST port	Media Oriented System Transport port
NVE	Night Vision electronics
PDC	Park Distance Control
PMA	Parking Maneuvering Assistant
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner (US)
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TCU	Telematic Control Unit
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for rear view camera and side view
ULF-SBX	Universal charger and hands-free unit, interface box (Bluetooth telephony)

F10 Driver Assistance Systems
1. Introduction

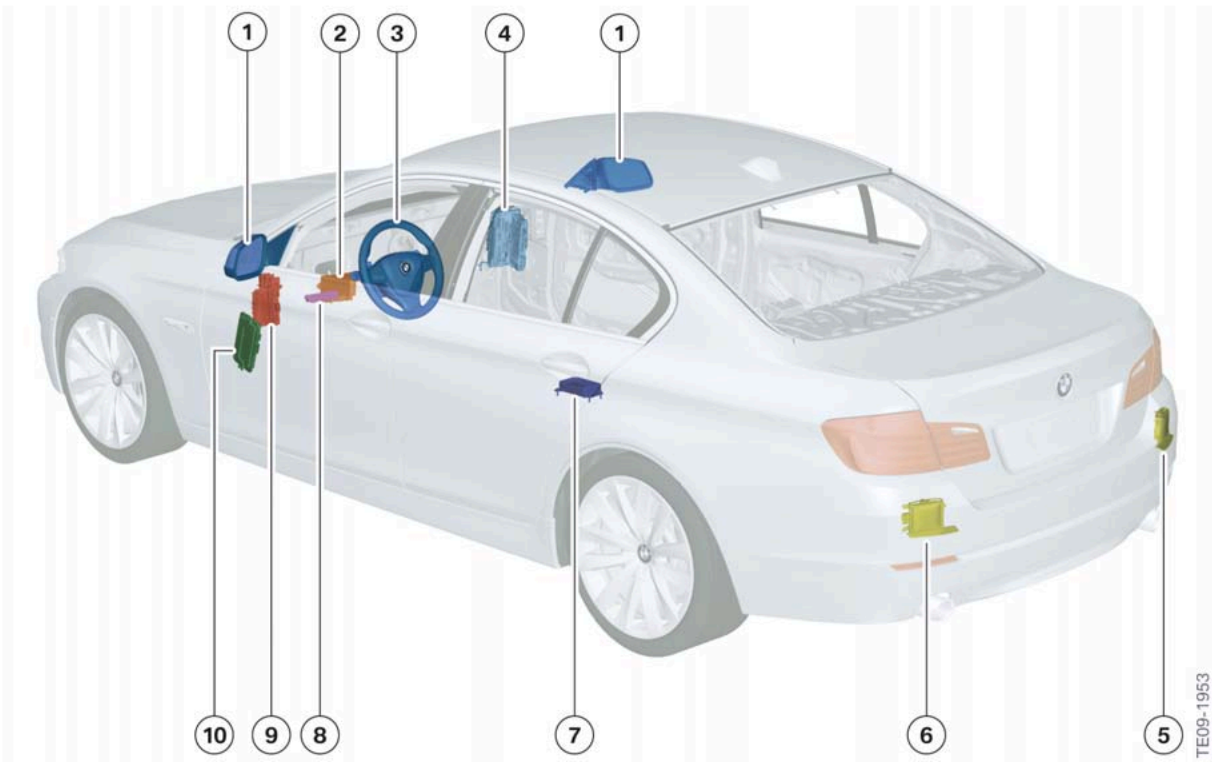
Index	Explanation
VDM	Vertical Dynamics Management
VM	Video Module
VSW	Video switch
ZGM	Central Gateway Module

F10 Driver Assistance Systems

2. Active Blind Spot Detection

The active blind spot detection system (option 5AG) is meant to assist the driver during lane changes. To do this, the active blind spot detection system monitors traffic at the rear and sides of the vehicle with two radar sensors. The radar sensors are located above the rear bumper support.

You can see the components that make up the active blind spot detection system in the following graphic.



F10 active blind spot detection system components

Index	Explanation
1	Exterior mirrors
2	Car Access System
3	Steering wheel with vibration actuator
4	Junction box (junction box electronics and front power distribution box)
5	Radar sensor, right
6	Radar sensor, left
7	Integrated Chassis Management
8	Driver assistance systems operating unit
9	Central Gateway Module
10	Footwell module
11	Steering column switch cluster

The system can detect traffic situations that could be dangerous or result in a collision if your vehicle changes lanes. The driver is first informed by a warning light in the exterior mirrors.

2. Active Blind Spot Detection

If the driver intends to change lanes in this situation and indicates this by operating the turn indicator, the driver is warned by a vibrating steering wheel and a flashing warning light in the exterior mirror.

F10 active blind spot detection system in the exterior mirror

For more information on the active blind spot detection system, refer to the F01/F02 training material available on TIS and ICP.

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Note: The system is not a substitute for the driver's assessment of the traffic situation. In the event of a warning, do not turn the steering wheel with unnecessary force, as this could cause the vehicle to vier and lose control.

F10 Driver Assistance Systems

3. Lane Departure Warning

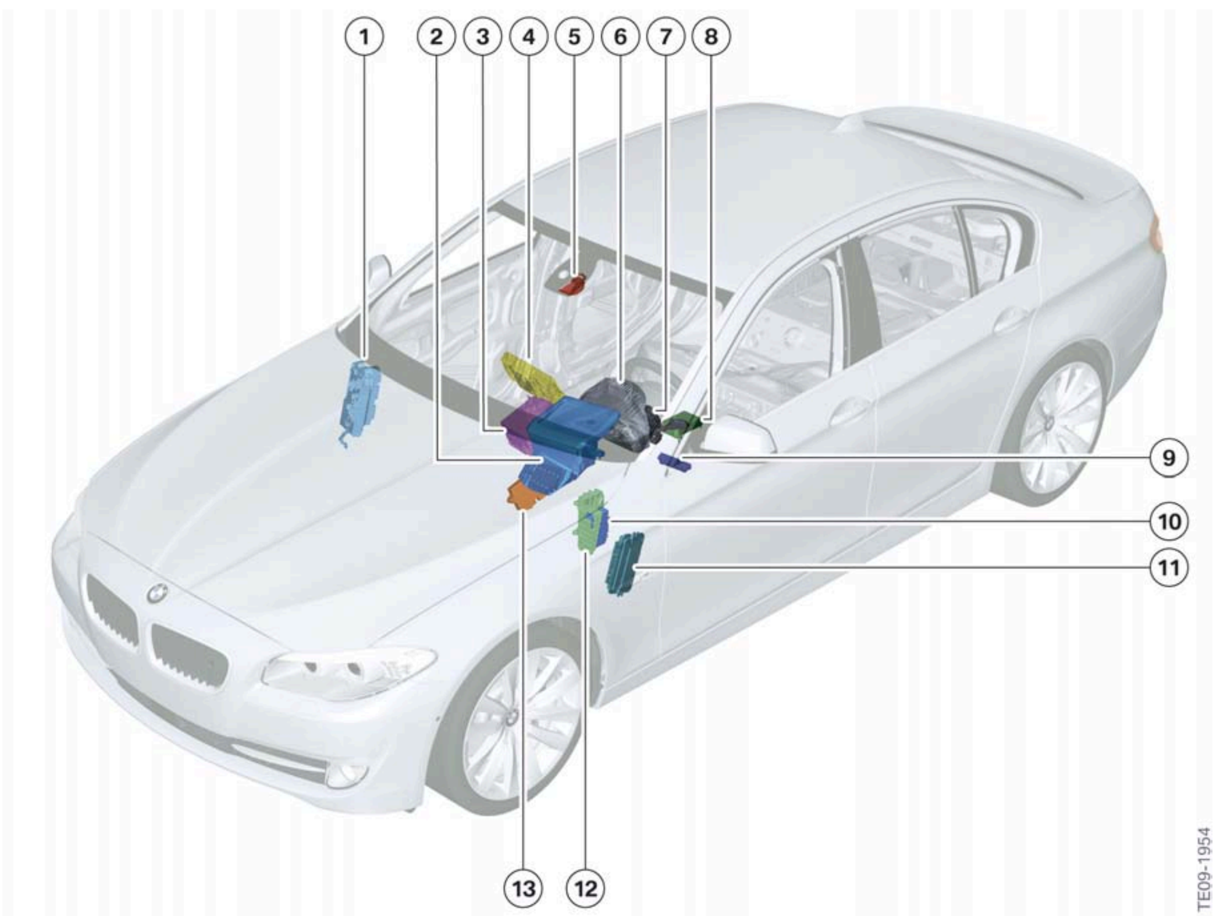
The lane departure warning (option 5AD) warns the driver in the event that the vehicle deviates from the lane it is currently traveling without the driver's intention. For this function to work properly recognizable road and lane markings should be present and detected by the system. The KAFAS control unit performs an evaluation of the images recorded by the forward-pointing video camera, located near the rear-view mirror base.

Although the driver continues to have full responsibility for driving the vehicle, the system is only designed to assist the driver in case of a lapse of attention.

This system is will only operate as intended on highways, major roads and well maintained country roads. Therefore, warnings are only given at speeds of over 70 km/h/43mph.

The driver activates the system using the lane departure warning button in the driver assistance control panel (to the left of the steering column).

The following graphic contains the components of the lane departure warning system.



F10 Lane departure warning system components

F10 Driver Assistance Systems

3. Lane Departure Warning

Index	Explanation
1	Junction box (junction box electronics and front power distribution box)
2	Head-up display (HUD)
3	Car Information Computer (CIC)
4	Central Information Display (CID)
5	Video camera
6	Instrument cluster
7	Steering column switch cluster (SZL)
8	Integrated Chassis Management (ICM)
9	Driver assistance systems operating unit
10	Camera-based driver support systems (KAFAS) control unit
11	Footwell module (FRM)
12	Central Gateway Module (ZGM)
13	Car Access System (CAS)

Note: For more information regarding the lane departure warning system, refer to the F01/F02 training material under KAFAS system.

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This system is not a substitute for the driver's assessment of the road's course or traffic situation. In the event of a warning, do not turn the steering wheel with unnecessary force, as this could cause the vehicle to vier and lose control.

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4. High-beam Assistant

The high-beam assistant FLA (option 5AC) assists the customer with the use of the high-beam headlights. Depending on the traffic situation, prevailing ambient light conditions and which vehicle lights are on, the FLA automatically switches the high-beam headlights on or off and thereby assists or relieves the driver of having to operate the high-beam headlights.

High beam can still be switched on and off manually as usual. The driver always has the capability, and the obligation, to override the system whenever the situation is required.

In the F10, the high-beam assistant option can only be ordered with the ZDA Driver Assistance Package

- Lane departure warning and the high-beam assistant functions are combined in the KAFAS control unit and share the same video camera.

The FLA video camera is a simplified image sensor that can detect light color and intensity.

F10 High-beam assistant display and button

Index	Explanation
1	Steering column stalk
2	High-beam assistant button
3	Display when high-beam assistant activated
4	Display when high-beam headlights on

4. High-beam Assistant

For more information on the high-beam assistant system, refer to the F01/F02 training material under "KAFAS System" available on TIS and ICP.

The high-beam assistant is not a substitute for the driver's decision of when to use the high-beam headlights. For safety reasons, always manually dip the high-beam headlights when confronted with oncoming traffic.

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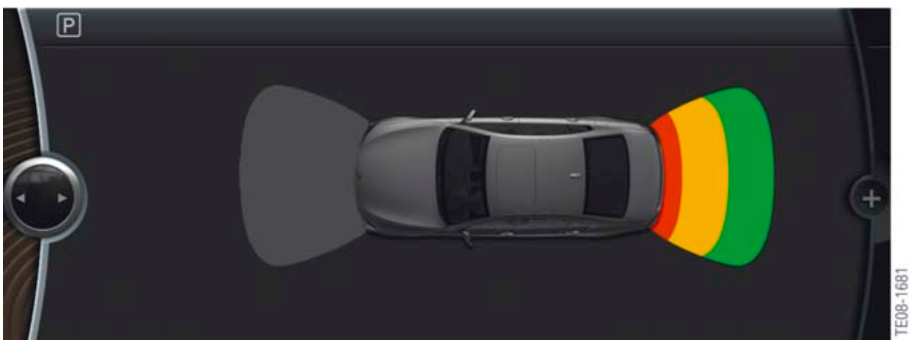
5. Park Distance Control

The Park Distance Control PDC (option 508) assists the driver when maneuvering in and out of parking spaces. Acoustic signals and a visual display indicate the current distance to an obstacle. The Park Distance Control of the F10 is similar to the F01/F02/F07 and uses the measured data from four ultrasonic sensors on both the front and rear bumper.

PDC is activated when reverse is engaged or the PDC button is pressed. The PDC button is located next to the electronic gear selector/switch.

The audible and visual distance warnings are the results of distance measurements and are provided to the driver via the speaker system and by displays in the CID respectively.



F10 Distance warning display in the CID

For more information on the Park Distance Control system, refer to the F01/F02 training material under PDC, TRSVC, available on TIS and ICP.

The PDC is not a substitute for the driver's assessment of the traffic situation. The driver must always obtain a direct view of the situation all round the vehicle in order to assess the traffic situation. Failure to exercise due diligence in this way could result in an accident risk on account of road users or objects not located within the detection range of the PDC. Loud sounds outside and inside the car can render the PDC signal inaudible.

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6. Parking Assistant

For the first time in a BMW vehicle, a system is being introduced in the F10 that assists the driver when performing a parallel parking maneuver. Parking Assistant is available as optional equipment (option 5DP) in conjunction with the optional Park Distance Control (option 508).

Parking Assistant makes it easier to maneuver the vehicle into parking spaces parallel to the roadway. The system measures potential parking spaces (on both sides of the road) when driving by them at speeds less than 35 km/h/22mph, regardless of whether parking assistant has been activated or not. When a parking space 1.2m larger than the vehicle length is detected and the system has been activated, the space is shown to the driver in the central information display. The driver remains responsible for the acceleration and braking of the vehicle while the parking assistant system takes over only the steering function and the PDC monitors the distances and obstacles. The driver is led through the parallel parking process with detailed instructions for action displayed on the CID and, where applicable, additional acoustic warnings and acknowledgements are issued.

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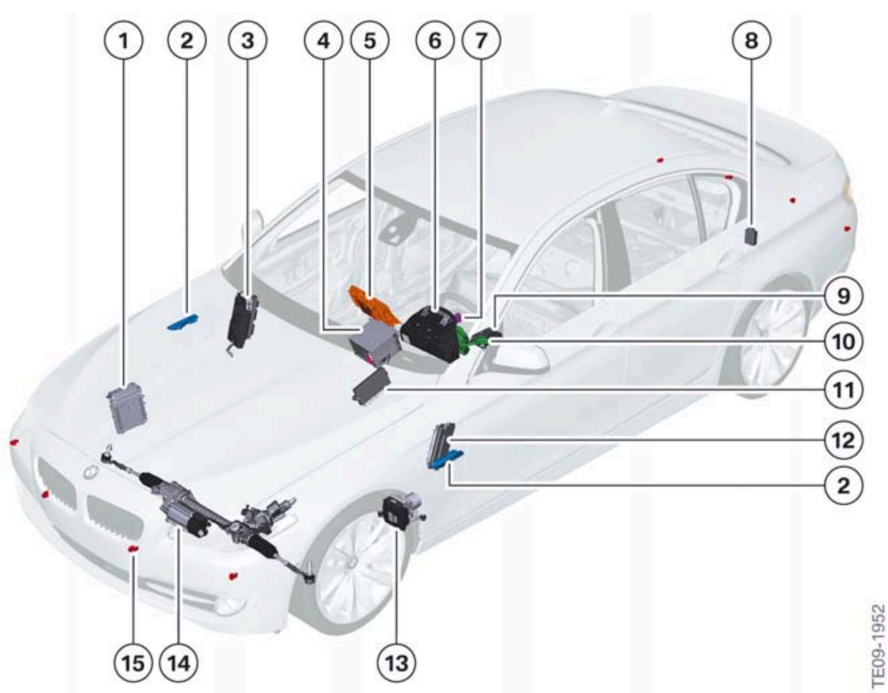
The Parking Assistant system does not relieve the driver of personal responsibility.

The driver is still responsible for monitoring the parking space and the parking process. The driver should intervene if necessary in order to avoid any potential accident.

6.1. System Components



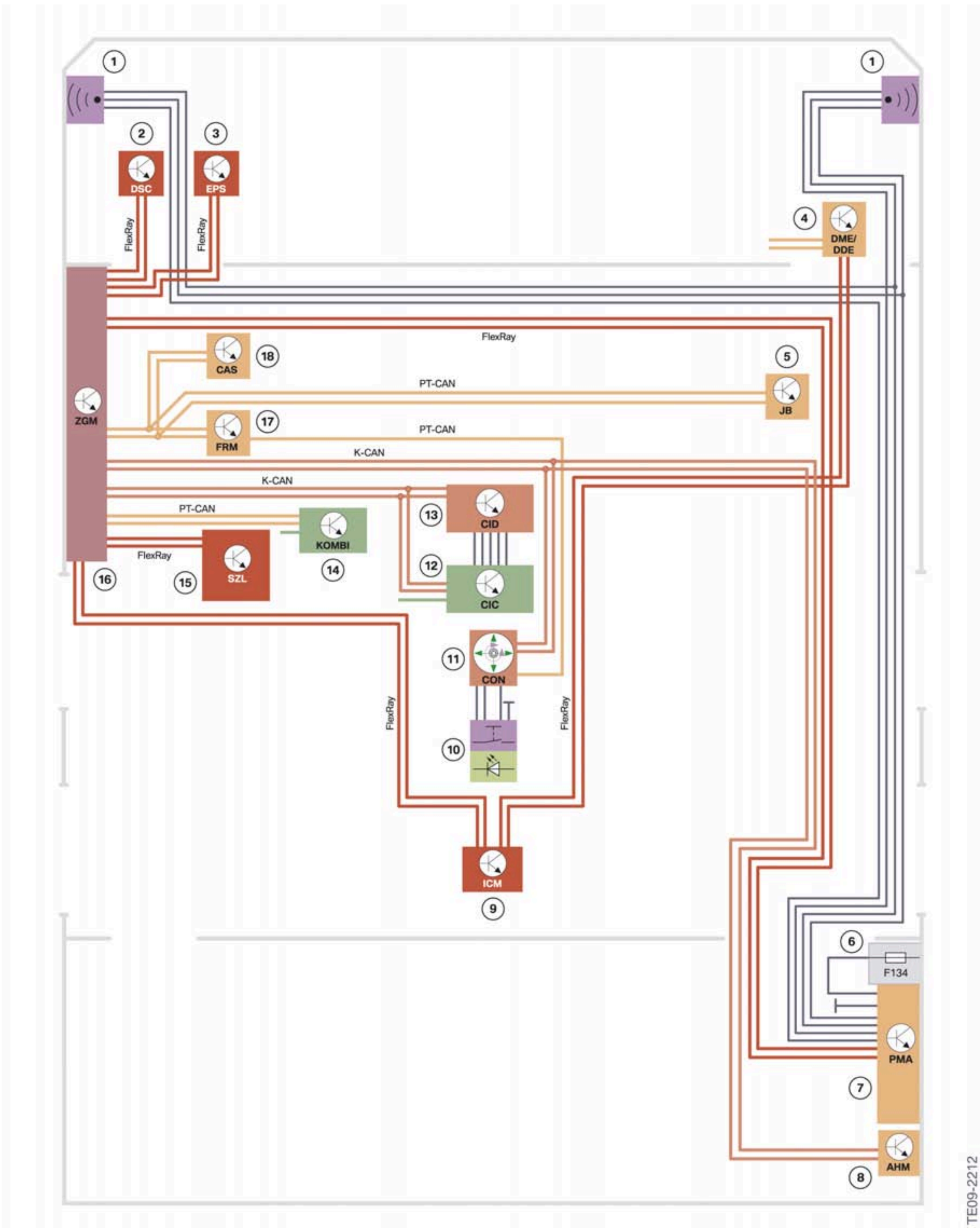
F10 System components of the parking assistant system

6. Parking Assistant

Index	Explanation
1	Digital Motor Electronics or Digital Diesel Electronics
2	Parking assistant ultrasonic sensor in the auxiliary turn indicator
3	Junction box (junction box electronics and front power distribution box)
4	Car Information Computer
5	Central Information Display
6	Instrument cluster
7	Center console operating unit and controller
8	Parking Manoeuvring Assistant (PMA)
9	Integrated Chassis Management (ICM)
10	Steering column switch cluster
11	Car Access System
12	Footwell module
13	Dynamic Stability Control
14	Electromechanical power steering
15	Park Distance Control sensors

6. Parking Assistant

6.1.1. System Wiring Diagram



F10 System wiring diagram for the parking assistant system

Index	Explanation
1	Parking assistant ultrasonic sensors
2	Dynamic Stability Control (DSC)
3	Electromechanical Power Steering (EPS)
4	Digital Motor Electronics (DME)
5	Junction box JB with junction box electronics
6	Luggage compartment junction box
7	Parking Manoeuvring Assistant (PMA)
8	Trailer module (AHM) Not for US
9	Integrated Chassis Management (ICM)
10	Park button in the center console
11	Controller (CON)
12	Car Information Computer (CIC)
13	Central Information Display (CID)
14	Instrument cluster (KOMBI)
15	Steering column switch cluster (SZL)
16	Central Gateway Module (ZGM)
17	Footwell module (FRM)
18	Car Access System (CAS)

6.1.2. Sensors

The two ultrasonic sensors of parking assistant are integrated in the side marker turn signal indicators (installed in the front fenders).

The function of these two ultrasonic sensors is similar to the function of the ultrasonic sensors of the Park Distance Control (PDC). Ultrasonic pulses are sent out and echo impulses are received. The signals are evaluated by the Parking Manoeuvring Assistant (PMA) control unit. This is used along with the distance information from the Dynamic Stability Control to calculate the length and width of the parking space.

The ultrasonic sensors communicate with the parking assistance control unit via a LIN-Bus.

F10 Installation location of the parking assistant ultrasonic sensor in the side marker

Index	Explanation
1	Parking assistant ultrasonic sensor in the side marker turn signal indicator

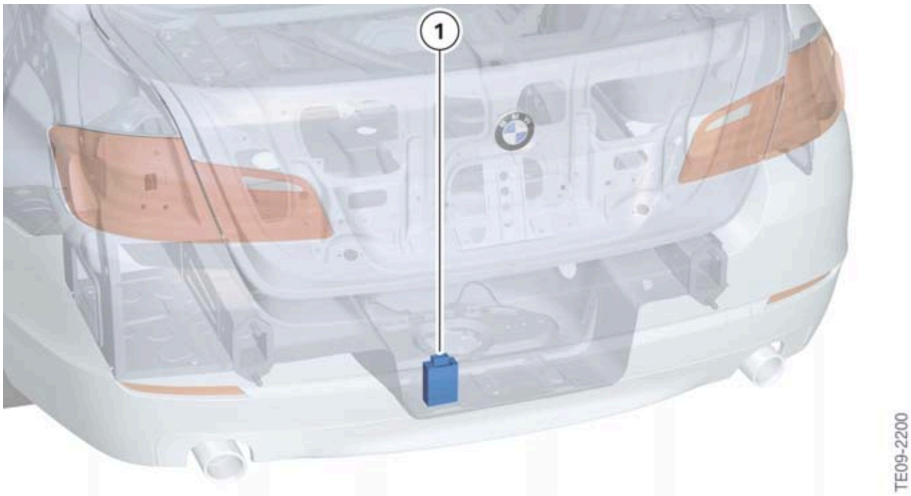
The sensor has a horizontal opening angle of +-10° and a vertical opening angle of +-60°. It has a range of approximately 4.5 m.

F10 parking assistant ultrasonic sensor in the right side marker turn signal indicator

Index	Explanation
1	Parking assistant ultrasonic sensor

6.1.3. Parking Manoeuvring Assistant (PMA)

The Parking assistant control module or Parking Manoeuvring Assistant (PMA) is located in the luggage compartment behind the battery (beneath the trunk latch mechanism). It evaluates the signals from the sensors and thereby determines potential parking spaces. It also calculates the optimum path into a parking space and monitors the parking process. It activates the electromechanical steering via the ICM.



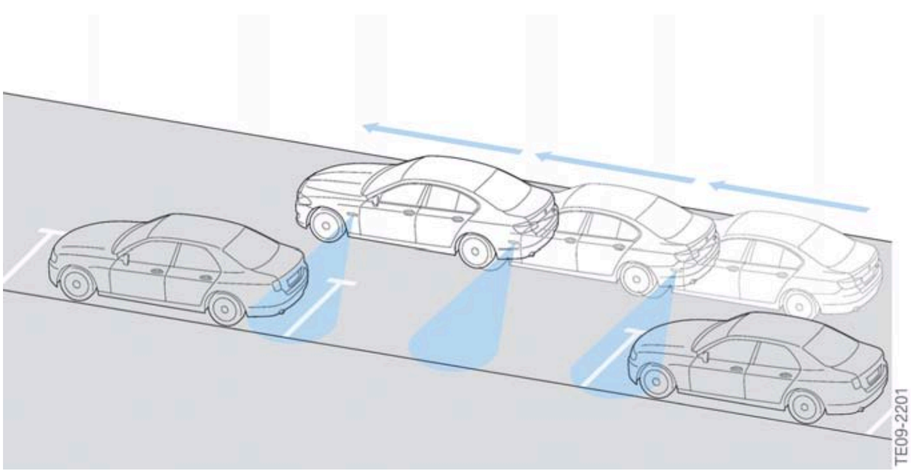
F10 Installation location of Parking Manoeuvring Assistant (PMA)

Index	Explanation
1	Parking Manoeuvring Assistant (PMA)

6.2. Parking Process

6.2.1. Measuring parking spaces

At a speed of up to 35 km/h/22mph and a maximum distance of 1.5 m/5 ft. from the row of parked vehicles, the Parking Manoeuvring Assistant (PMA) determines suitable parking spaces using the wheel speed and the sensor data from the respective ultrasonic sensor. The parking space length is determined from the distance travelled based on the distance signals and from the sensor data from the ultrasonic sensors. The width of the parking space is determined using the sensor data from the ultrasonic sensor.



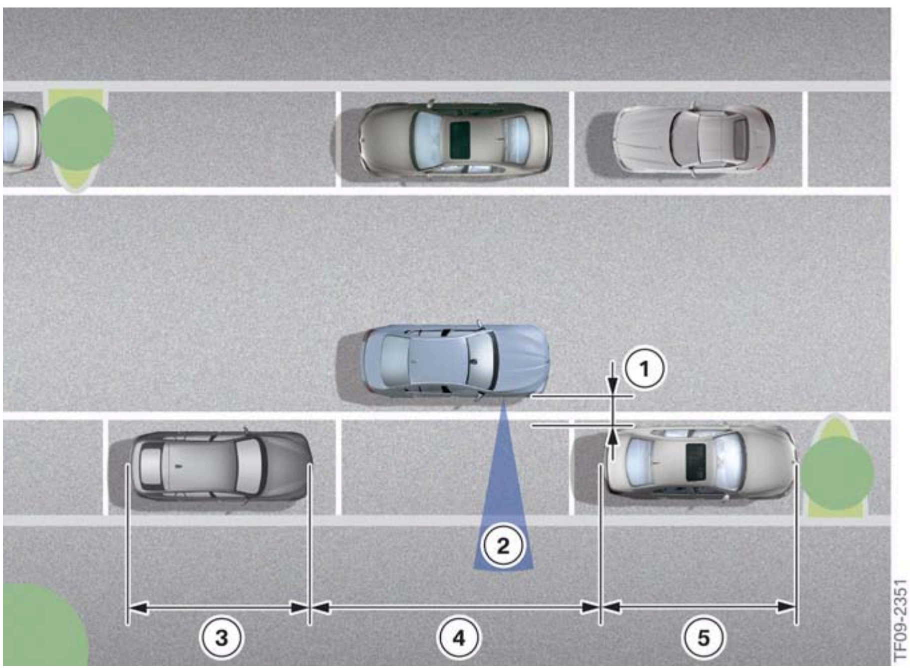
F10 Parking space measurement

The following preconditions are placed on the parking space:

6. Parking Assistant

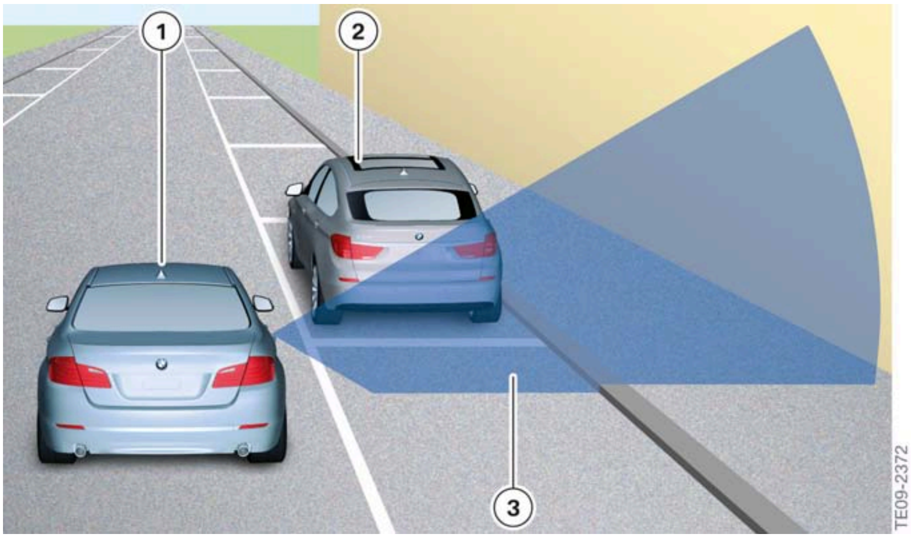
- The parking space must be between two objects each with a minimum length of about 1.5 meters (5 feet).
- The minimum width of the parking space must be about 1.5 meters (5 feet).
- The minimum length of the parking space must be at least the length of your vehicle plus about 1.2 meters (4 feet).

The requirements for the parking space and the opening angles of the ultrasonic sensor can be seen in the following graphic.



F10 Requirements for the parking space

Index	Explanation
1	Maximum distance to the row of parked vehicles: 1.5 m (5 ft.)
2	Horizontal opening angle of the ultrasonic sensor: ± 10°, range approximately 4.5 m (14.8 ft.)
3	Vehicle or object length at least 1.5 m (5 ft.)
4	Length of the parking space, vehicle length plus approximately 1.2 m (4 ft.)
5	Vehicle or object length at least 1.5 m (5 ft.)



F10 Parking space measurement

Index	Explanation
1	Your vehicle
2	Vehicle in front of parking space
3	Vertical opening angle of the ultrasonic sensor: ± 60°, range approximately 4.5 m (14.8 ft.)

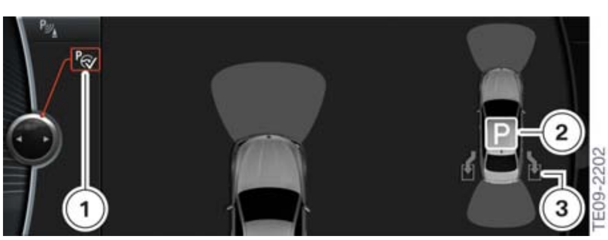
6.2.2. Activation

Basically there are two options for activating parking assistant:

- Activation via the park button in the center console
- Activation via "shifting into reverse gear" and then operating the controller.

Activation via the park button

For activation via the park button, the parking display appears in the central information display. As soon as a parking space has been found, the driver needs only to shift into reverse gear to use the parking assistant system.

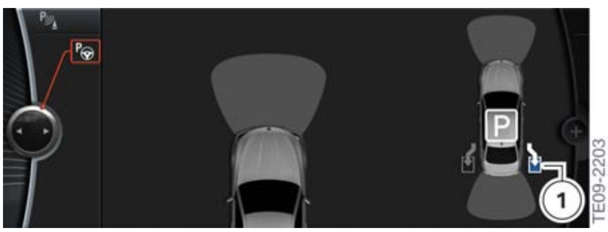


F10 Parking display with the parking assistant activated, and searching for a parking space to the right and left.

Index	Explanation
1	Activation status of parking assistant (in activated mode)
2	Status of the parking space search (in search mode)
3	Potential parking space to the right

Activation by "shifting into reverse gear"

When you shift into reverse gear, the parking display appears in the central information display; however, the parking assistant is not yet activated. Even in this state, parking spaces are already being measured and, where applicable, displayed. To park using the system, the controller must be operated.



F10 Parking display when parking assistant is not activated, with parking space found to the right

Index	Explanation
1	Suitable parking space

6.2.3. Schedule of events

The sequence described here is with the parking assistant is already activated.

The Parking Assistant system does not relieve the driver of personal responsibility when parking.

For safety reasons, the driver must always monitor the parking space and the parking process and intervene if necessary.

The Parking Assistant assists the driver in searching for a suitable parking space. If a suitable parking space (vehicle length plus 1.2 m/4 ft.) has been found while travelling forwards, the driver is directed to this parking space by a blue-lit parking space on the corresponding side of the vehicle and the blue-lit “P” in the central information display. The parking process with parking assistant can only be carried out in reverse.

By using the turn indicator, the "parking space search" display or "suitable parking space" on the opposite side disappears from the central information display. Parking spaces on this side continue to be measured in the background.

If a parking space has been found on the passenger side, the driver can use the parking assistant to maneuver into the parking space without using a turn signal. You can drive into a parking space on the driver's side only by using the left turn signal.

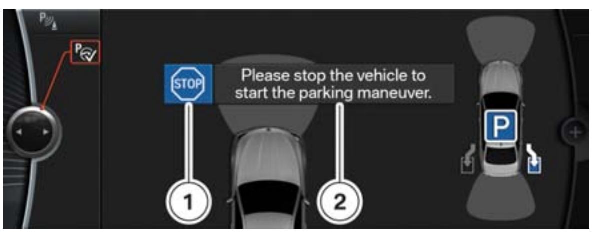
If a parking space has been found and the driver does not use a turn signal indicator, the central information display prompts the driver to do so.

6. Parking Assistant

F10 parking assistant, parking space found

Index	Explanation
1	Status of the parking space search (suitable parking space detected)
2	Suitable parking space

After a suitable parking space has been found and the vehicle has reached a position from which it can be parked, the driver is prompted to stop the vehicle.

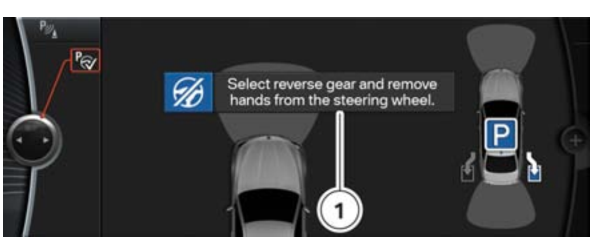


F10 parking assistant prompts to stop the vehicle.

Index	Explanation
1	Symbol for action prompt (to stop the vehicle)
2	Please stop the vehicle to start parking maneuver.

After the vehicle has come to a complete stop, the driver is prompted to shift into reverse and let go of the steering wheel. If the driver grabs the steering wheel during the parking process, parking assistance is terminated. If need be, the parking process can later be resumed. Thus the driver can end the parking process at any time.

The PMA control unit calculates an optimum path for the parking process. The steering, and thus the transverse control, is taken over by activating the electromechanical power steering (EPS) via the Integrated Chassis Management (ICM). Communication between the control units takes place via the FlexRay data bus.

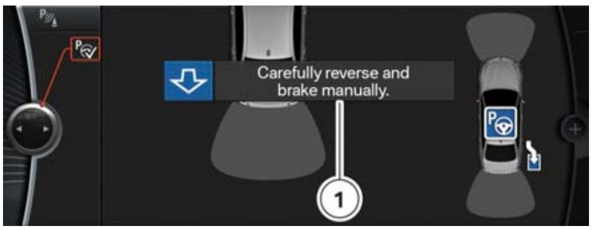


F10 parking assistant prompts the driver to select reverse.

Index	Explanation
1	Please engage reverse gear and remove hands from the steering wheel.

6. Parking Assistant

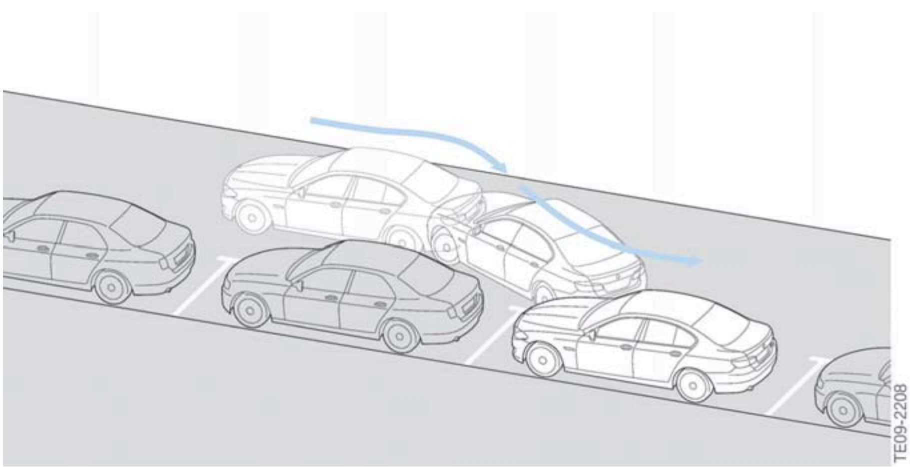
Once the driver has shifted into reverse and lets go of the steering wheel, the parking process can be started with the parking assistant. The parking assistant takes over the control of steering once the vehicle is shifted into reverse. This is indicated by a steering wheel symbol in the central information display. The "Drive slowly in reverse and brake" prompt appears in the central information display.



F10 parking assistant prompts the driver to drive in reverse.

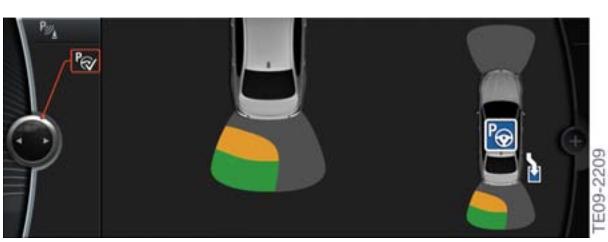
Index	Explanation
1	Carefully reverse and brake manually.

While the vehicle is moving, the driver must continuously observe the traffic and that what is happening around the vehicle. During the parking process, The parking assistant only takes over the steering of the vehicle, the driver is still responsible for accelerating and braking and thus safely driving the vehicle.



F10 Parking process

While driving in reverse, the driver is continuously shown the parking display in the central information display. The path during the parking process is continuously monitored by the PMA and corrected if necessary.



F10 parking assistant, parking display during the parking process

6. Parking Assistant

In the event that the parking assistant does not make it into the parking space in one try, it prompts the driver to drive forwards upon reaching a certain precalculated point. In some cases, the sensor data from the Park Distance Control will also be used to do this. The prompt appears in the central information display and an acoustic signal is emitted. The prompt to change directions repeats until the vehicle is completely in the parking space.

F10 parking assistant prompt for driving forwards

Index	Explanation
1	Carefully drive forward and brake manually.

After the parking process has been completed and the vehicle is completely in the parking space, the driver receives an acoustic signal and information in the central information display. The parking assistant is then deactivated.

F10 parking assistant completion of the parking process

Index	Explanation
1	Parking completed, please secure the vehicle.

The parking process is cancelled in the following cases:

- Maximum parking speed of 10 km/h (6 mph) exceeded
- Incorrect selection of turn signal indicator (for example left instead of right)
- The driver turns the steering wheel
- A door is opened
- Incorrect gear selection
- DSC detects a slip.

Each of these reasons for cancelling the process is documented in the fault memory of the Parking Manoeuvring Assistant (PMA) with an info entry. Consequently, this is not a system fault, but incorrect operation by the user. After a cancellation, the system checks to see whether it is possible to resume the parking process. The driver can immediately resume the parking process where appropriate.

6.2.4. Service Information

Notes for Service

After replacing the PMA or an ultrasonic sensor, no special start-up is required. However, each time the start-up process begins, the control unit checks whether the sensor software is compatible with the control unit software. In the event that they are not compatible, a corresponding fault code is set in the PMA control unit. In this case, the "Update software of the ultrasonic sensors" service function must be carried out.

The PMA monitors itself for faults and, if necessary, makes the corresponding fault entries. In exceptional cases, this is not always possible. The control unit cannot detect if the ultrasonic sensors (including the sealing ring) are incorrectly installed or clipped, or if the side wall in the area of the ultrasonic sensors is damaged.

This can lead to the following customer complaints without fault entries:

- Small parking spaces are only rarely detected
- While parking, the vehicle drives very close to or very far from the vehicle in front of the parking space
- After the parking process, the vehicle is either far from, very close to or on the curb
- The vehicle is crooked in the parking space.

In this case, the ultrasonic sensors must be checked for correct installation and damage on the side wall in the area of the ultrasonic sensors must be ruled out.

Parking assistant relieves the driver in two respects. First, from the task of estimating the size of a parking space and deciding based on this whether the space is large enough. Second, from the task of steering into the space on his or her own. Braking and accelerating the vehicle still remains the responsibility of the driver. While searching for a parking space and parking, the driver is presented with all relevant information, from the results of the parking space measurement, to the parking assistant status and corresponding handling instructions, to the distances to other objects, e.g. via the PDC image in an integrated display. This makes it particularly easy to monitor the parking process and simultaneously control the vehicle.

F10 Driver Assistance Systems

7. Surround View

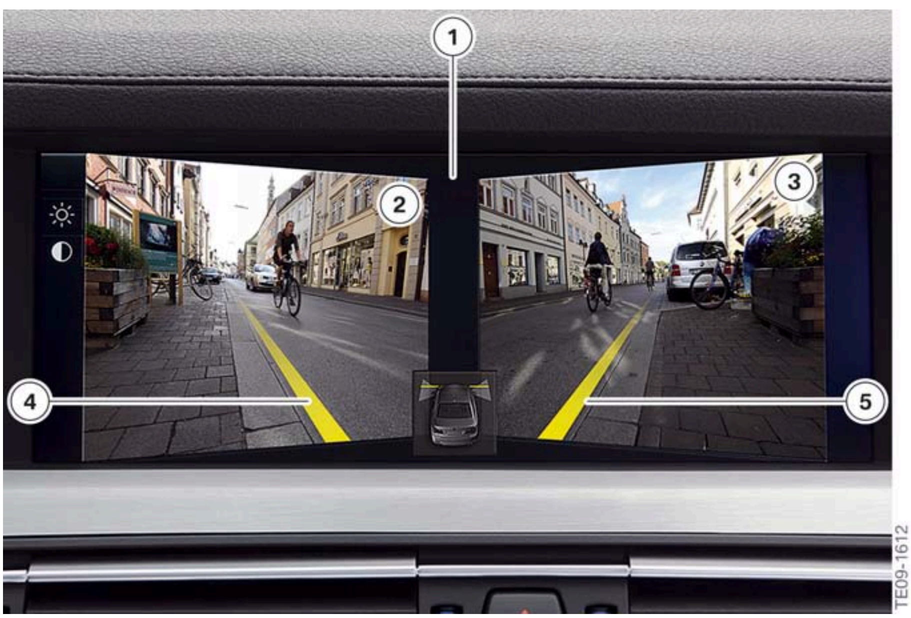
A "Surround View" of the entire vehicle can be displayed in the CID with the combination of the Side View and Top View cameras systems (option 5DL). It can only be ordered as part of the ZCE Camera Package, in conjunction with the rear view camera (option 3AG) and Park Distance Control (option 508).

The Side View and Top View systems can no longer be ordered individually.

7.1. Side View

The Side View Camera function was first introduced in a BMW with the F01/F02 and is now installed in the F10. This feature makes it easier for the driver to pull into roads or tight intersections in which the driver's view to the side is obstructed. The function is implemented by two digital cameras installed on the right and left front wheel arches.

The driver can activate the Side View using a button in the control panel next to the gear selector lever or with the iDrive controller.



F10 Side View display in the CID

Index	Explanation
1	Split screen images from the bumper cameras
2	Image from the bumper camera in the left wheel arch
3	Image from the bumper camera in the right wheel arch
4	Projected front of vehicle, view to left
5	Projected front of vehicle, view to right

The video camera images are shown in the CID in a split screen display up to 30 km/h,. Like the top and rear view cameras, the two bumper cameras send their signals to the TRSVC control unit via LVDS data lines. The signals are then forwarded via CVBS (composite video) lines to the video switch (VSW) and to the CIC. The CIC transmits the image data via LVDS data lines to the CID where it is displayed.

7. Surround View

Side View Camera (option 5DK) can only be installed in conjunction with the rear view camera (option 3AG) and is part of the ZCE Camera Package.

For more information on the Side View Camera system, refer to F01/F02 training material under "PDC, TRSVC" available on ICP and TIS.

⚠

The driver must always obtain a direct view all round the vehicle in order to assess the driving situation. Failure to do so could result in an accident, in case pedestrians or objects are found beyond the viewing range of the bumper cameras.

7.2. Top View

The Top View function familiar from the F07 is also offered in the F10. It is included in the optional equipment as part of the ZCE Camera Package.

With the Top View function, two exterior mirror cameras show the driver a view of the sides of the vehicle from above. The image is displayed on the CID. This enables the driver to see areas around the vehicle that are not directly visible both when parking and when driving slowly.

F10 Exterior mirror camera

Index	Explanation
1	Exterior mirror camera

The driver can activate the Top View using a button in the control panel next to the gear selector or with the controller.

Top View uses both the exterior mirror cameras and the rear view camera to generate the image.

Like the side and rear view cameras, the two top view cameras send their signals to the TRSVC control unit via LVDS data lines.

The driver is shown the turning-circle and tracking lines already familiar from the rear view camera system on previous vehicles.

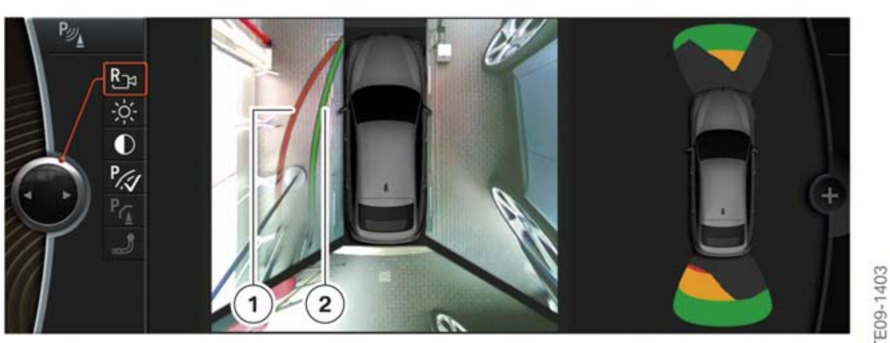
F10 Driver Assistance Systems

7. Surround View

F10 Top View

Index	Explanation
1	Obstacle
2	Obstacle warning

The PDC information is used to warn the driver of an obstacle both audibly and visually in the CID.



F10 Top View with tracking line and turning-circle line

Index	Explanation
1	Turning-circle line
2	Tracking line

The turning-circle line shows the tightest possible turning circle on a level road surface.

When the steering wheel is turned, only one turning-circle line is displayed.

The tracking line is of assistance for estimating the space needed for parallel parking and manoeuvring on level roads.

The tracking line depends on the steering angle and changes continuously in response to movements of the steering wheel.

⚠

The driver must always obtain a direct view all round the vehicle in order to assess the driving situation. Failure to exercise due diligence could result in an accident involving other road users or objects outside of the viewing range of the cameras.

F10 Driver Assistance Systems

8. DCC

8.1. Introduction

The cruise control with braking function has been used in many BMW models since the BMW 3 Series (E9x). It is also called "Dynamic Cruise Control" (DCC) and installed in the F10 as standard. It relieves the burden on the driver on quiet roads by maintaining a constant speed regardless of the resistance to vehicle motion (gradient, payload). Despite the support offered by this and other systems, the driver invariably bears full and sole responsibility for control of the vehicle. The driver can brake or accelerate at any time to override the DCC function.

DCC also offers the driver the option of adjusting the set speed in small or large increments, which is then set and maintained by the system by controlling power output and braking. The brakes are also controlled during steep downhill driving if sufficient deceleration is not achieved by engine drag-torque alone.

The cruise control with braking function is implemented in the F10 within the ICM control unit.

8.2. Control functions

8.2.1. Cruise control

Cruise control computes a target acceleration or target deceleration on the basis of the set speed input by the driver and the car's actual speed.

8.2.2. Acceleration and deceleration

The driver can specify the set speed or acceleration by using the rocker switch on the multifunction steering wheel.

8.2.3. Cruise control in curves

This function, also known as "lateral acceleration control", is designed to prevent the lateral acceleration forces generated by cornering from rising above a certain level of perceived comfort when the car is being driven with the cruise control engaged. Driving speed and yaw rate are used to compute a figure for lateral acceleration. This value is compared to a speed-dependent limit value in order to achieve the following, seemingly contradictory objectives:

- if the driver takes complete control, disruptive and overly restricted interventions are avoided, even if the car is driven at high speed.
- Most car occupants find high lateral acceleration uncomfortable so useful interventions and a perceptible restriction on dynamic handling at higher speeds are applied under these circumstances.

The output variable from cornering speed control is also a set-point for longitudinal acceleration.

8.2.4. Prioritization of the set-point value

A set-point value is selected as highest-priority set-point from the set of longitudinal-acceleration set-points obtained from the above-mentioned control functions; this selection is situation-dependent. Signal filtering is applied to prevent sudden jumps when the system switches from the set-points.

8.2.5. Interference-force estimation

An acceleration or deceleration force has to be calculated so that the prioritized longitudinal acceleration can be implemented using the actuators. Example: when the car is driving up hill the propulsive forces needed in order to achieve a given longitudinal acceleration are higher than when the car is travelling on a flat surface. Deceleration as the car ascends a gradient, on the other hand, requires less braking force than is the case on the flat. If these forces are to be computed correctly, exact values are required not only for the gradient, but also for the mass of the vehicle, rolling resistance, drag and other accelerating forces. There is no adequate system of sensors for all these interfering forces, so an estimated value is derived from a comparison of the following two variables:

- actual motion variables of the vehicle
- expected motion variables of the vehicle, forecast on the basis of the driving and braking forces currently applied.

The magnitude of the interference force estimated in this way is taken into account by addition or subtraction in the subsequent processing of the longitudinal-acceleration set-point.

8.2.6. Activation of the actuators

Driving forces and/or braking forces have to be applied in order to achieve the longitudinal acceleration computed by the control functions and thereby compensate for the acting interference forces. Usually a set-point is given for the drive train to accelerate the vehicle. In the exceptional circumstances that apply going down a steep hill, it might also be necessary to apply the brakes in order to limit the acceleration to a certain value.

If the vehicle needs to be decelerated, first the magnitude of the drive train's potential deceleration percentage is determined, and thus the braking effect of the engine and transmission. This value is sent to the Digital Motor Electronics or the Digital Diesel Electronics and electronic transmission control. If the drive train is unable to achieve this value alone, the additionally required value is sent to the Dynamic Stability Control.

If the brakes are perceptibly actuated to achieve the desired degree of vehicle deceleration, the car's brake lights are also actuated.

F10 Driver Assistance Systems

9. ACC Stop & Go

9.1. Introduction

The optional Active Cruise Control with Stop & Go function (ACC Stop & Go) offers optimum assistance to the driver not only in smoothly flowing traffic but also in traffic jam situations.

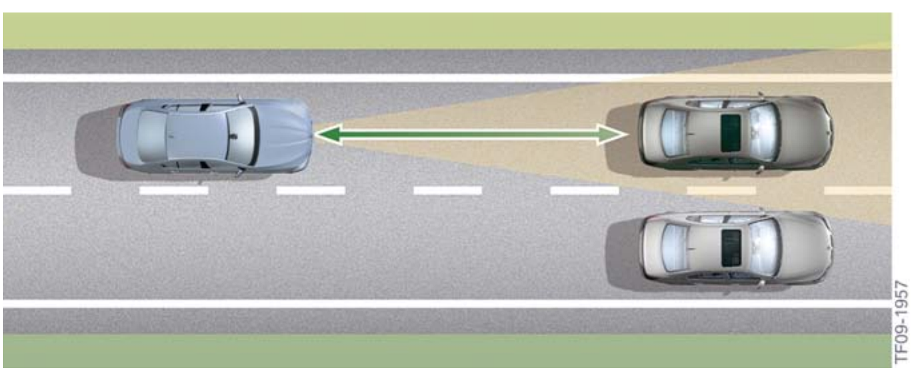
The Active Cruise Control with Stop & Go function (option 5DF) can be ordered only in conjunction with an automatic transmission (option 205 or option 2TB).

The purpose of ACC Stop & Go is to relieve the strain on the driver, therefore, further enhancing comfort and convenience.

The connection between the ACC Stop & Go equipment and the navigation system (as on the E60) is no longer necessary as from the introduction of the F10. In the E60, the navigation data was required in order to switch off the short-range radar sensors of the ACC Stop & Go in the vicinity of radio astronomical telescope/stations. The radar waves of the new ACC Stop & Go sensors no longer disrupt function of these radio telescopes, and therefore they no longer need to be switched off in their vicinity.

Active Cruise Control with Stop & Go function is a system designed to ease the strain on the driver, but it is by no means intended as a system that can relieve the driver of the obligation to exercise due diligence at all times. The driver bears full responsibility at all times for using the system in a practical way. It is self-evident that the driver must remain fully aware of traffic conditions at all times; this system simply makes it easier for the driver to do just that.

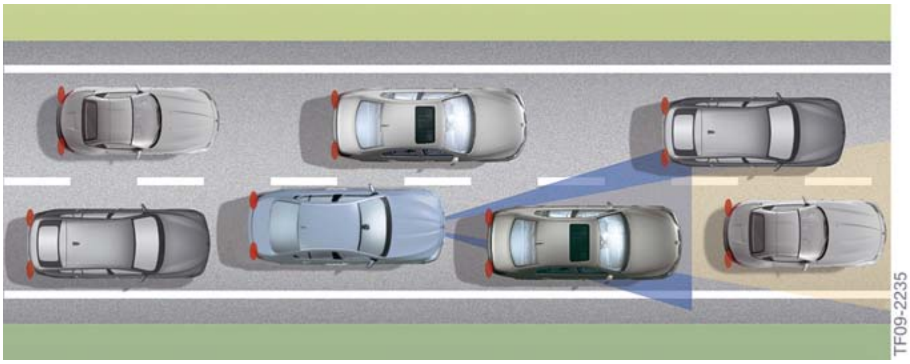
Active Cruise Control with Stop & Go function is designed to operate from high speeds down to a complete standstill. Speed and distance from the vehicle in front are automatically controlled in this speed range.



F10 Active Cruise Control

Active Cruise Control regulates speed when the road ahead is clear and switches automatically to distance control when the sensor for ACC Stop & Go detects a slower moving vehicle in the lane ahead. In this way Active Cruise Control not only assists the driver on little-used roads, but also in heavy traffic. Active Cruise Control takes over the routine of accelerating and braking for precision adjustment of distance and speed to suit other road users.

9. ACC Stop & Go



F10 Active Cruise Control

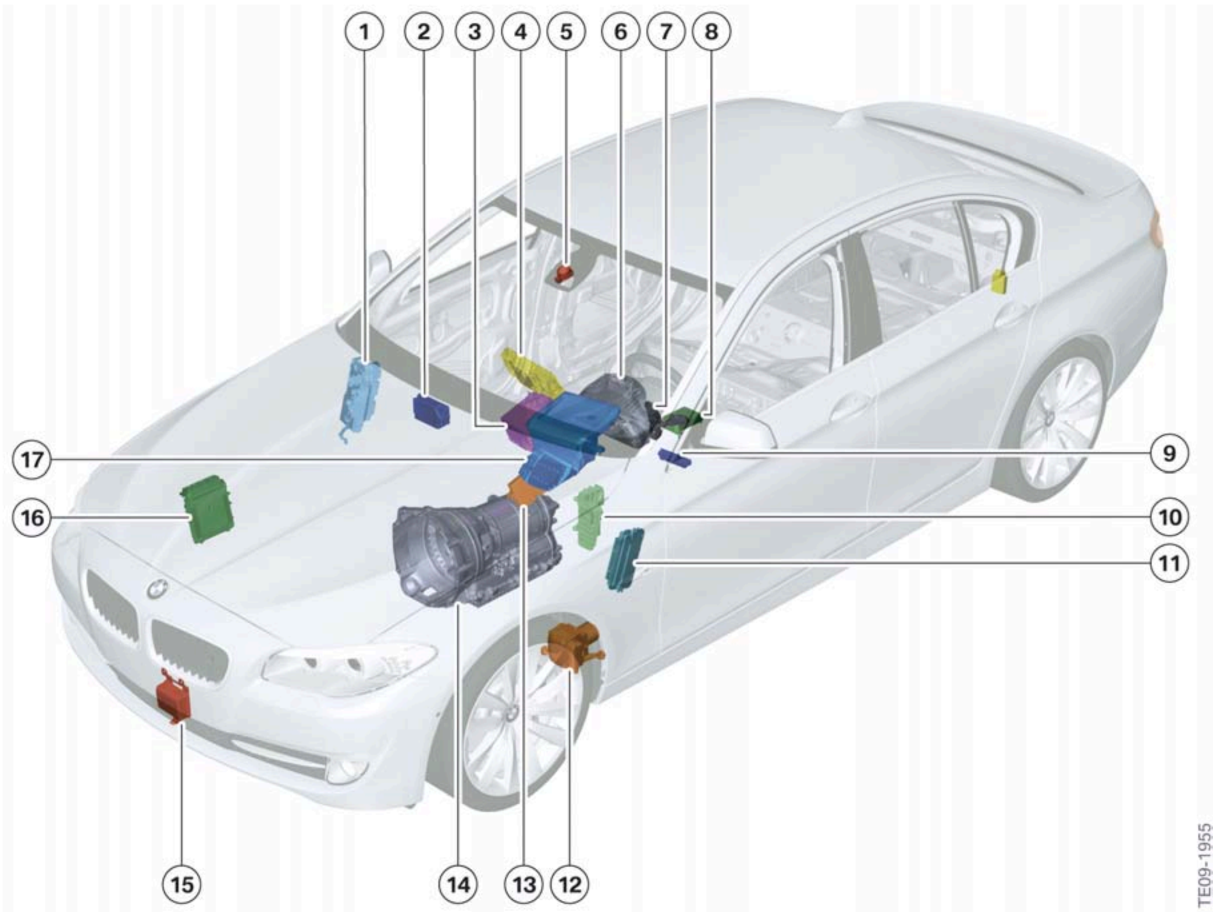
The Stop & Go function of the Active Cruise Control brings the vehicle to a complete stop if necessary. If the vehicle ahead begins to move again after having stopped, the driver is notified. To pull away again, the driver has to acknowledge this message. The pulling-away process is controlled fully automatically by ACC Stop & Go only if the duration of the standstill is very short.

This way ACC Stop & Go assists the driver not only in flowing traffic, but also in traffic jam situations. However, is not suited for use in urban areas for negotiating junctions or traffic lights.

The following aspects of the ACC Stop & Go assist system are considered in more detail here:

- System components
- Information regarding the vicinity of the car in front
- Control functions
- Operation and display
- Behavior in response to driver's intention to exit the vehicle
- Monitoring functions.

9.2. System Components



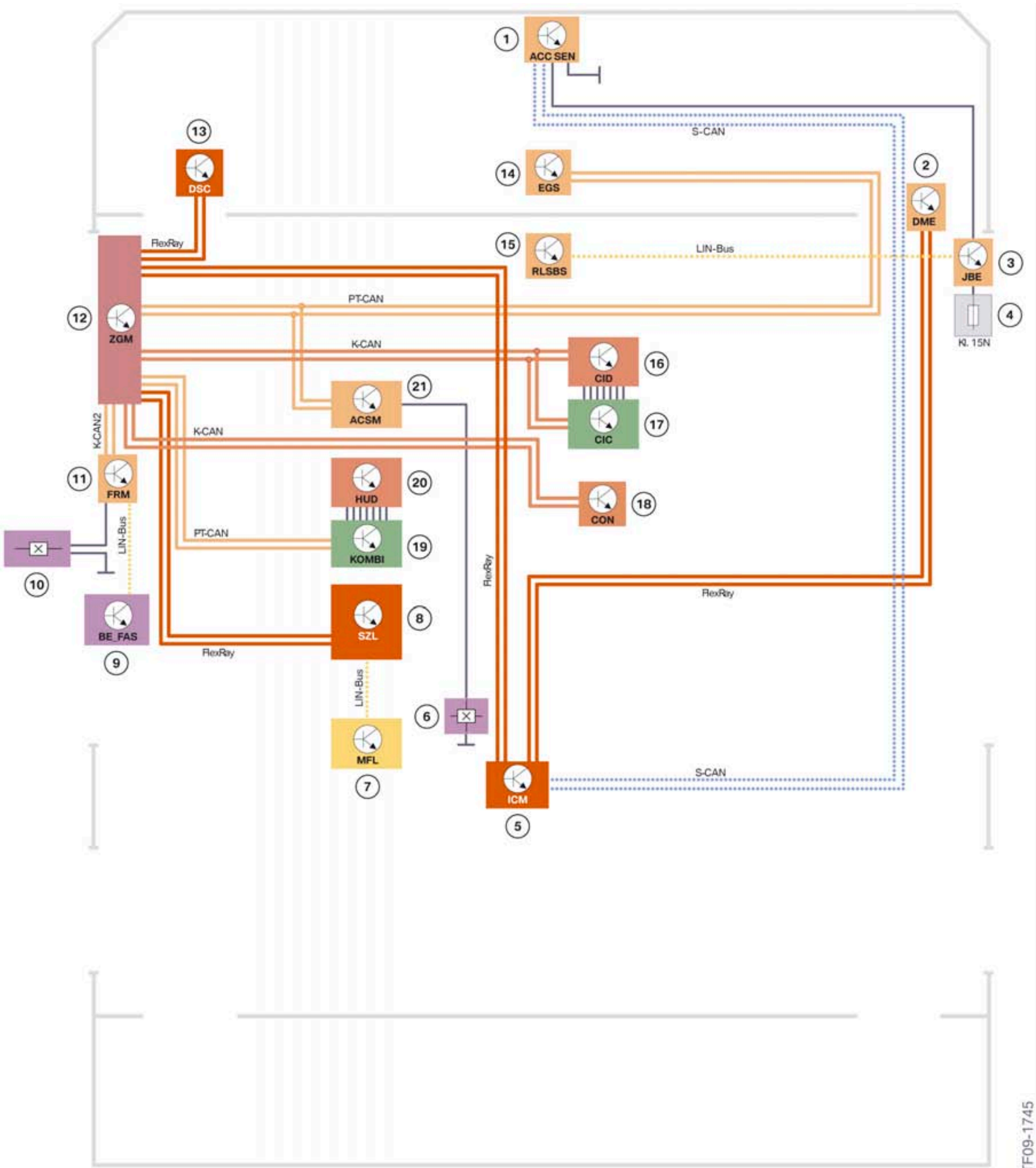
F10 System components for ACC Stop & Go

Index	Explanation
1	Junction box (junction box electronics and front power distribution box)
2	Crash Safety Module
3	Car Information Computer
4	Central Information Display
5	Rain-light-solar-condensation sensor
6	Instrument cluster
7	Steering column switch cluster
8	Integrated Chassis Management
9	Driver assistance systems operating unit
10	Central Gateway Module
11	Footwell module
12	Dynamic Stability Control

Index	Explanation
13	Car Access System
14	Electronic transmission control
15	Sensor for ACC Stop & Go
16	Digital Motor Electronics or Digital Diesel Electronics
17	Head-Up Display

9. ACC Stop & Go

9.2.1. System Wiring Diagram



F10 System wiring diagram for ACC Stop & Go

Index	Explanation
1	Sensor for ACC Stop & Go
2	Digital Motor Electronics or Digital Diesel Electronics
3	Junction box electronics
4	Fuse for the sensor for ACC Stop & Go in the front distribution box
5	Integrated Chassis Management
6	Seat belt buckle contact, driver's seat
7	Multifunction steering wheel
8	Steering column switch cluster
9	Driver assistance systems operating unit
10	Door switch, driver's door
11	Footwell module
12	Central Gateway Module
13	Dynamic Stability Control
14	Electronic transmission control
15	Rain-light-solar-condensation sensor
16	Central Information Display
17	Car Information Computer
18	Controller
19	Instrument cluster
20	Head-Up Display
21	Crash Safety Module

9.2.2. Sensor for ACC Stop & Go

The sensor for ACC Stop & Go is a radar-based sensor for detecting the area ahead of the vehicle. Both the short and long range are detected by a sensor using internal electronic and mechatronic measures. The transmission frequency is 76–77 GHz.

The sensor sends out focused electromagnetic waves. The echoes reflected from objects are received and evaluated by the sensor. In this way, the sensor can gain information about objects in front of it. This information includes size, distance and the speed.

9. ACC Stop & Go

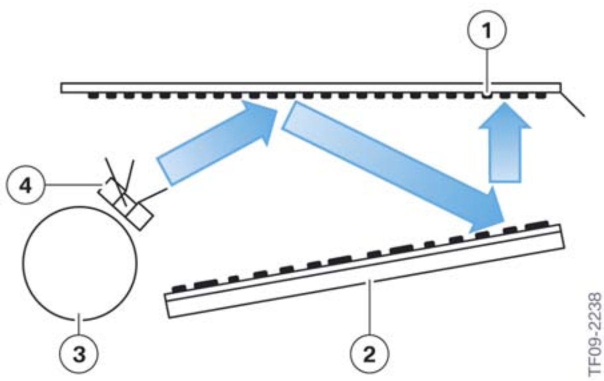
F10 Sensor for ACC Stop & Go

The sensor is located behind a removable grille on the front apron.

F10 Installation location of sensor

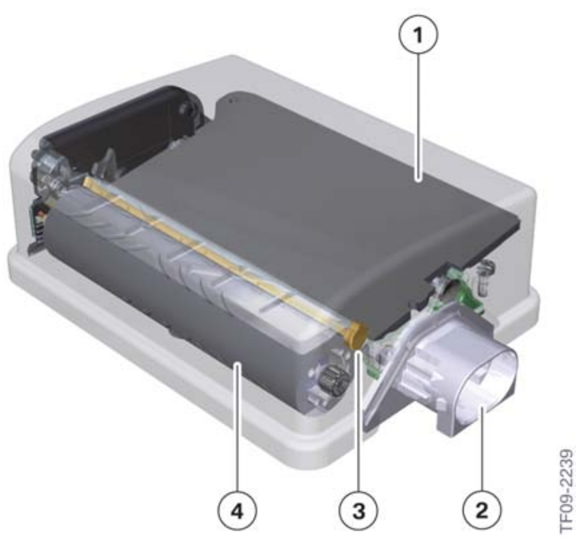
Index	Explanation
1	Sensor for ACC Stop & Go
2	Removable grille

In order to achieve a low overall height for the sensor, complex measures have been taken inside the sensor. There is a continuously rotating roller inside the sensor. The roller has various mouldings and emits electromagnetic waves with various characteristics, depending on the range to be detected. Thus both the short and long range are detected with each revolution of the roller. The roller turns at 900 rpm using a brushless motor. Since the sensor becomes functional only upon reaching this speed, in cold temperatures, it can sometimes take a certain time for the sensor to become available. The cover of the sensor is coated with a transreflective layer. This is permits the penetration and passage of waves at a certain angle to allow beams to enter and exit. The beams are led through the waveguide and reflected on the transreflective layer. At a shallower angle, it is reflective in order to guide beams within the housing to the various components. They strike the mirror, upon which the waves have their phase rotated and are reflected. Then they leave the housing through the transreflective layer. If these beams strike objects, they are reflected from these and travel back to the sensor. The beams are captured and measured in the waveguide. The evaluation electronics within the sensor evaluates these beams and forwards detected objects via the CAN bus to the Integrated Chassis Management.



F10 Schematic structure of the sensor

Index	Explanation
1	Transreflective layer
2	Mirrors
3	Roller (phase-controlled radar)
4	Waveguide (antenna)



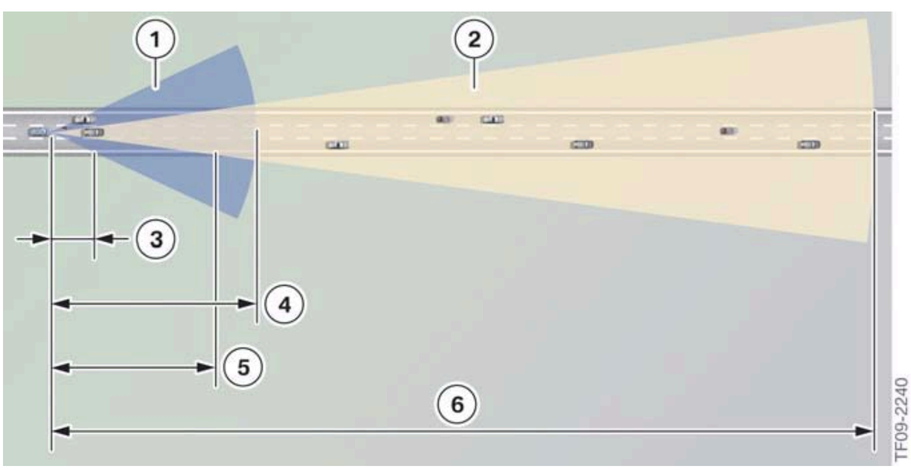
F10 Structure of the sensor for ACC Stop & Go.

Index	Explanation
1	Mirrors
2	Connector
3	Waveguide (antenna)
4	Roller

Note: The cover of the sensor is coated with a transreflective layer that is permits the penetration and passage of waves at a certain angle to allow beams to enter and exit. At a shallower angle, it is reflective in order to guide beams within the housing to the various components.

The sensor for ACC Stop & Go is connected by a waterproof plug connection to the sensor CAN, terminal 15 N, and ground. The sensor for ACC Stop & Go receives its power supply via terminal 15N, so it is switched on and off with this supply. Terminal 15N is tapped off at the front fuse carrier. There is a fault memory in the sensor for ACC Stop & Go. The fault memory can be read out in diagnosis via Integrated Chassis Management. If the sensor is defective, replace it and calibrate the new sensor.

The following graphic shows the working range of the sensor with a large opening angle for short range and a small opening angle for long range detection.



F10 Reception area of the sensor

Index	Explanation
1	Short-range sensing
2	Long-range sensing
3	Distance at which the short-range radar can detect objects over the full width of a three-lane highway (approx. 10.5 m)
4	Range of short-range radar (approx. 50 m)
5	Distance at which the long-range radar can detect objects over the full width of a three-lane highway (approx. 40 m)
6	Range of radar (approx. 200 m)

The sensor uses the data on the objects detected to calculate their speeds relative to our car. These data are pre-processed in the sensor, prepared for post-processing and filtered.

9. ACC Stop & Go

If ACC Stop & Go brings the car to a standstill on account of an object it has detected, the ACC sensor switches to a reduced-power mode (FCC requirement). When driving resumes or automatic drive off is active (set speed LED in the speed reading is green), it is switched back to normal power. Short and long range are permanently scanned and the detected objects are combined.

The following is an overview of faults that can occur when using the ACC Stop & Go.

- **If the ACC Stop & Go Sensor is dirty**
  The sensor can no longer function reliably if the antenna is obscured by snow, slush or ice. If this condition is detected, a corresponding signal is sent to Integrated Chassis Management (ICM) and the ACC Stop & Go function is deactivated as a result. A Check Control message informs the driver about this special case. At the same time a fault entry is stored in the ACC sensor.
- **External disruption of radar-signal processing**
  Radar sensors used by other automobile manufacturers can disrupt the signal evaluation of the ACC sensor. If such a problem is detected, the ACC Stop & Go is deactivated. It can be switched on again by the driver as soon as the car is far enough away from the vehicle causing the interference. This fault is stored in the fault memory of the Integrated Chassis Management and of the ACC sensor . This does not, however, necessitate any repair measures. Instead, the customer should be informed of the cause of the fault, which is external interference.
- **Temporary faults**
  The potential causes of this type of fault include communication faults, overvoltage, undervoltage and thermal overloads in the ACC sensor. In these cases, it is necessary to proceed as instructed by the test plan in the diagnostic system. Do not replace the ACC sensor until the test schedule prompts you to do so.
- **Control unit fault**
  If the ACC sensor is affected by a control unit fault, the only way to rectify the fault is to replace the defective sensor.
- **Misaligned Sensor**
  The interaction between the ACC Stop & Go sensor and the Integrated Chassis Management can detect misalignment caused by an accident (e.g. by bumping something while parking or being bumped when parked). If the computed maladjustment drift exceeds a certain threshold the ACC Stop & Go function is switched off. A fault entry indicates the cause of the fault. To correct the fault, observe the instructions in the diagnostic system and Repair Instructions.

If the ACC Stop & Go sensor is replaced, the diagnosis system must be used to perform a start-up procedure to initialize the sensor. In the course of the start-up procedure, the installation position is entered in the newly installed sensor and it is adjusted. An adjustment may also be required after an accident without damage to the sensor.

Note: Always follow proper repair instructions.

It is essential to observe the following important notes in order to adjust the ACC Stop & Go sensor properly:

- Make sure the measurement setup is exactly in accordance with the repair instructions
- Park the vehicle on a perfectly smooth, level surface
- Connect the ISTA diagnosis system
- Make sure that the reflector for adjusting the ACC Stop & Go sensor is correctly positioned
- Perform the adjustment in accordance with the action plan in diagnosis
- Complete the adjustment and clear fault memory, etc.

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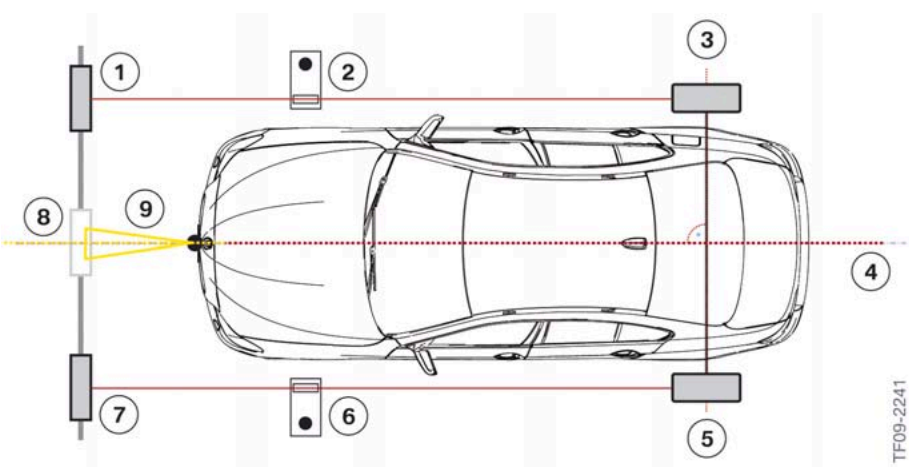
Note: The ACC Stop & Go sensor must not be adjusted mechanically. Only the housing can be mechanically aligned, the fine adjustment occurs within the sensor.

⚠

Extra care must taken while doing repair work on the front end of these vehicles. If the bumper support is deformed or if there are scratches on the cover of the ACC Stop & Go sensor, there is a possibility of the sensor failing to work correctly. It is essential to follow the repair instructions when dealing with these components.



F10 Setting the ACC Stop & Go sensor

Index	Explanation
1	Reflector, right
2	Slotted cover, right
3	Laser pointer right
4	Longitudinal axis of the vehicle
5	Laser pointer, left

Index	Explanation
6	Slotted cover, left
7	Reflector, left
8	Reflector for adjustment
9	Sensor for ACC Stop & Go

9.2.3. Integrated Chassis Management

You will find a precise description of the Integrated Chassis Management (ICM) in the F01 driving stability control training material available on TIS and ICP. The present document provides a brief overview and covers points of interest relating to the topics featured here.

The Integrated Chassis Management in the F10 calculates for the control functions, sensor data and vehicle values that influence the longitudinal and transverse dynamics. The Integrated Chassis Management also includes the control functions of "Cruise control with braking function" and "Active Cruise Control with Stop & Go function" as well as "Collision warning with brake application function". Micro-mechanical sensors that supply signals for the drive dynamics systems are also incorporated into Integrated Chassis Management.

Two different versions of the Integrated Chassis Management are used in the F10. A basic version for vehicles without ACC Stop & Go and a high-end version for vehicles with the optional ACC Stop & Go equipment (or for vehicles with active steering).

The high-end version differs from the basic version in the following ways:

- Larger microprocessor (needed for the calculations involved in Active Cruise Control)
- Redundant sensors for lateral acceleration and yaw rate.

The control unit has a 54-pin plug by which the power supply, sensors, actuators and bus systems are connected. Nor the controller housing or the plug connector are waterproof. This is not necessary as it is installed on the inside of the vehicle.

The FlexRay is carried to the Integrated Chassis Management from the central gateway module and on from there to the Digital Motor Electronics. The Integrated Chassis Management is based on the FlexRay, therefore it is not an end node. This is why it does not have a terminating resistor for the FlexRay.

Another bus system is connected to the Integrated Chassis Management in addition to the FlexRay. The Sensor CAN is used exclusively for communication between the Integrated Chassis Management and the ACC Stop & Go sensor. It transmits traffic condition information that has been detected by the sensor.

The Sensor CAN operates with a transmission speed of 500 kBit/s. There are two terminal resistors for the Sensor CAN, each with 120 ohms. One of them is located in the Integrated Chassis Management, the second terminal resistor is integrated in the ACC sensor.

The Integrated Chassis Management is installed in the center console behind the sensor for the Crash Safety Module. This means that the control unit and its integrated sensor system are ideally positioned (with regard to driving dynamics) near the vehicle's center of gravity. The mounting points on the body are precisely determined and are measured when the vehicle is manufactured and must not be replaced with any other mounting points.

9.3. Obstacle/Vehicle Detection Process

The ACC Stop & Go function requires information on other vehicles in front of the car. This is gained using the ACC sensor and processed in the Integrated Chassis Management.

To do so, the electronics proceed as follows:

- Object detection
- Object-data processing
- Object evaluation

9.3.1. Object detection

Detecting the presence of vehicles in front of the car is one of the most important functions of Active Cruise Control. The introduction of the Stop & Go function entails extending this functionality to include not only long-range detection but also short-range detection right through to the area directly in front of the car's front bumper. This is necessary, since the vehicle will travel very close to the vehicle in front of it, (see the "Distance control" section). The ACC Stop & Go sensor scans the short and long range ahead of the vehicle using radar waves. As well as detecting objects, the ACC sensor also determines the position of the objects in the x and y directions and computes their speed relative to our vehicle. The ACC sensor uses this relative-speed information to compute the acceleration of the objects relative to the car. These values are needed for distance control.

9.3.2. Object-data processing

Initial processing of the object data values for position and motion takes place right in the ACC sensor. Individual objects are grouped and tracked in time in order to bridge measurement gaps. The initial filtering of the object data also takes place at this stage. The second step of the process takes place in Integrated Chassis Management. There, the object data from the ACC sensor are combined, because the long-range and short-range fields overlap. This overlap mainly occurs in short-range detection. The combined object data are subjected to further filtration, which takes into account the special requirements for distance control.

9.3.3. Object evaluation

In order to decide which object is to be used for distance control, an evaluator value is calculated for each object.

The following are the two most important criteria for this calculation:

- Position and movement of the object relative to our vehicle. The closer the object is to our vehicle and/or the faster it is approaching, the higher the evaluator value.
- Presence of the object in our lane. The radar sensors cannot detect the actual lane or the lane markings on the surface of the road. The information from the camera-based system installed for the Lane Departure Warning system is not yet available for ACC Stop & Go. Therefore, ACC Stop & Go computes a probable course for the lane ahead of the car. While the car is on the move, variables are used in this process that describe the motion of the car and the position of motionless objects detected by the sensors. If the car is at a standstill, computation is based primarily on analysis of the signal from the steering angle sensor. This

means that steering wheel movements while the car is at a standstill produce changes in the lane calculated by the ACC Stop & Go function and have a corresponding effect on evaluation of the detected objects.

The object with the highest evaluator value is used for distance control. In this step in processing, the objects are also classified by their evaluation status. A distinction is drawn between moving and stationary objects. The control algorithm has a special way of treating objects which have been classified as stationary after first being detected.

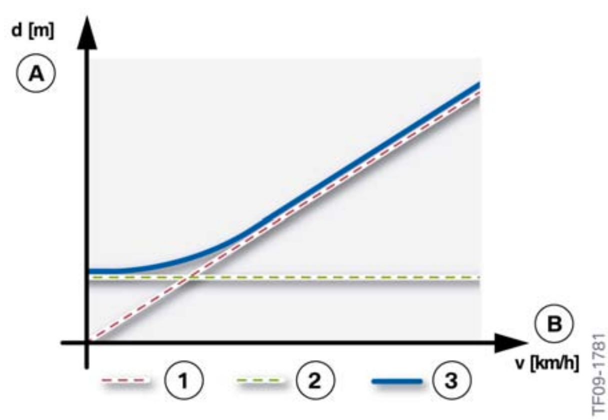
9.4. Control Functions

9.4.1. Cruise control

Cruise control in the ACC Stop & Go system works basically in the same way as in the DCC system.

9.4.2. Distance control

Distance control is the core function of the ACC Stop & Go system and is integrated into Integrated Chassis Management. Two buttons on the multifunction steering wheel enable the driver to select a desired distance from one of four stages. The ACC Stop & Go system uses this preselection to calculate the set-point distance to be used in control.



F10 Distance control

Index	Explanation
A	Set-point distance
B	Vehicle driving speed
1	Set-point distance, vehicle on the move, in proportion to driving speed
2	Set-point distance, vehicle at standstill, constant
3	Resulting set-point distance from the proportions

The set-point distance with the car on the move is proportional to driving speed (1). At low driving speeds and at a standstill, the proportional distance to the driving speed is no longer used for ACC Stop & Go, but instead a fixed value in metres (2). Distance control uses the processed data for the object with the highest evaluator value as its input variables.

Distance control takes the following situations in particular into account:

- **Maximum values for acceleration and deceleration:**
  The maximum values for acceleration and deceleration of the ACC Stop & Go system below approx. 50 km/h/31mph are dynamic values. They correspond to the acceleration values which the driver personally would use and sense as comfortable. Depending on the situation, ACC Stop & Go accelerates at a maximum of up to approximately 2 m/s^2 and decelerates at maximum of up to approximately 4 m/s^2.
- **Congested-traffic stability:**
  In very tight traffic and at very low driving speeds, there is an increased risk of collisions from sharp acceleration and braking. Therefore the ACC Stop & Go distance controller is designed to decelerate as early as possible, but not more than the vehicle ahead. In following mode, the system can decelerate at a maximum of up to 2.5 m/s^2, during a stopping procedure at a maximum of up to 4 m/s^2.

9.4.3. Cruise control in curves

The ACC Stop & Go system's cruise control in curves is based on the counterpart function in Dynamic Cruise Control. The scope has been extended to include the lateral detection range of the sensor for ACC Stop & Go. If an object is lost in turning a curve, the system waits a while to see whether the object reappears (alternating curve). Acceleration begins only when it does not reappear.

9.4.4. Prioritization of the set-points

Set-point prioritization in the ACC Stop & Go system is basically the same as in the Dynamic Cruise Control system. The only major difference is the inclusion of an extra control set-point from the distance control function.

9.4.5. Interference-force estimation

Interference-force estimation as implemented in the ACC Stop & Go system is based on the counterpart function in Dynamic Cruise Control. However, a considerable degree of optimization is necessary, since inaccuracies in the interference-force estimation become much more perceptible in the low range of driving speeds (less than 30 km/h/20mph) than at higher driving speeds. Consequently, the estimation precision is better than that of the Dynamic Cruise Control system and the reaction to changes in interference forces is faster.

9.4.6. Activation of the actuators

Except for the situation that applies when the vehicle is at a standstill, the activation of the actuators in the ACC Stop & Go function is the same as that in Dynamic Cruise Control.

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When ACC Stop & Go causes brake intervention, the brake lights are also activated.

9.5. Operation and Display

9.5.1. Activation and deactivation

ACC Stop & Go and Dynamic Cruise Control are activated and deactivated in nearly the same way. The driver is able to activate ACC Stop & Go not only while the vehicle is in motion, but also when it is stationary, if the system has detected another vehicle ahead of it. To activate ACC Stop & Go at a standstill, the driver has to depress the brake pedal and simultaneously press the SET (if preset) or RES button.

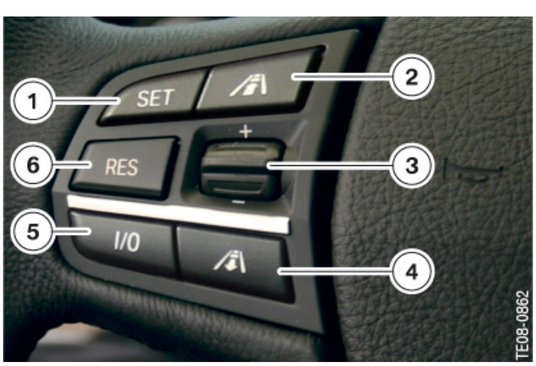
The following additional conditions must also be satisfied:

- Seat belt buckled and door closed
- Drive position “D” engaged
- Engine running
- Parking brake must not be activated
- ACC Stop & Go Sensor operational
- There must be no system fault present.

If the status of Dynamic Stability Control beforehand was DTC or DSC Off, (in the F10) it switches on as soon as ACC Stop & Go is activated. If the vehicle was previously operated in sport+ mode, it automatically switches to sport mode. Dynamic Stability Control always switches automatically to its "Normal" status. If Dynamic Stability Control is set to DTC or DSC Off while ACC Stop & Go is operating, the ACC Stop & Go function is automatically deactivated.

ACC Stop & Go cannot be deactivated by means of the ON/OFF button while the vehicle is stationary unless the brake pedal is depressed at the same time.

The adjustment range for set speed in the F10 is 30 km/h to 180 km/h (20 mph to 115 mph). Compared to DCC, a vehicle with ACC Stop & Go has a keypad on the multifunction steering wheel that additionally features a rocker switch for making distance adjustments.



F10 ACC Stop & Go steering wheel

Index	Explanation
1	SET button to activate
2	Button for reducing the distance
3	Rocker switch to change the set speed
4	Button for increasing the distance
5	Button to activate or deactivate ACC Stop & Go
6	RES button to resume a stored speed

Briefly pressing the respective button to change the distance increases or decreases the desired distance used by ACC Stop & Go for its control process. A total of four increments are available to the driver. The selected distance stage is faded into the instrument panel.

As with Dynamic Cruise Control, the display symbols for ACC Stop & Go are supplemented as needed by notes displayed in the instrument panel. The display symbols are, for example, the set speed and the distance bars. The status indicators are displayed for approx. 3 seconds. Each time the driver operates a control, the symbol reappears and remains visible for another 3 seconds.

In addition, ACC Stop & Go information is displayed in the Head-Up Display.

9.5.2. Changing the set speed

When ACC Stop & Go is switched on, the driver can change the set speed in the same way as with the Dynamic Cruise Control system. This adjustment can be made even when the car is being held stationary by the ACC Stop & Go system. The adjustment range for set speed is 30 to 180 km/h (20 to 115 mph).

9.5.3. Changing the set distance

The desired distance can be changed by briefly pressing the corresponding button on the multifunction steering wheel with the system switched on. The driver has the usual choice of four distance stages, symbolized by bars in the instrument panel. Changing the set distance while the car is on the move immediately produces a perceptible reaction by the vehicle. The car accelerates or decelerates slightly to take up the new set distance. Making this change while at a standstill does not set the car in motion.

If the driver overrides ACC Stop & Go, the desired distance cannot be changed. When the driver overrides the system, the distance bars in the instrument panel disappear.

9.5.4. Stopping and pulling away

Even though the "distance control" function works in principle right down to a speed of zero (complete standstill), the system incorporates additional software functions that control the stopping and pulling away procedures. It is their job to control the drivetrain and the brakes in such a way that the driver and other vehicle occupants perceive driving as a thoroughly comfortable and enjoyable experience. In addition, it would be unacceptable for the vehicle to be permitted to roll backward during these processes.

In order to meet these requirements, drivetrain and brakes are actuated simultaneously and under precision control in the processes of stopping and pulling away. This is very much the same as what the driver does when using the parking brake and the accelerator pedal to pull away on an uphill gradient without allowing the car to roll backward.

Under extreme external circumstances, for example on a particularly steep uphill gradient, ACC Stop & Go might not be able to set the car in motion. If this happens the braking pressure necessary to hold the car stationary is applied and the system remains in this state until the driver switches it off or assumes full manual control for pulling away. This is not a fault; instead, it represents a situation in which the limits defining the operating range of ACC Stop & Go have been exceeded.

The maximum level of support and assistance that a Stop & Go system could offer the driver would be the ability to undertake all actions from stopping through to pulling away in fully automatic mode. The technical implementation of this is a function that automatically brings the car to a complete stop, but automatically drives off only if the vehicle remains motionless briefly. If the car is at a standstill for longer than a few seconds, ACC Stop & Go does not attempt automatic pulling away. Instead, ACC Stop & Go sends the driver a signal in the instrument panel that it has recognized a drive off situation, but will not set the car in motion unless the driver confirms this signal by operating a control.

This acknowledgement of the drive-off prompt ensures that the driver is fully aware of the traffic situation even after a prolonged stop in traffic. Because even with ACC and the Stop & Go function, the driver remains fully and solely responsible for control of the vehicle and the use of the assistance and support functions at his or her disposal.

ACC Stop & Go uses standstill management, a function of Dynamic Stability Control (DSC) for longer stops. Standstill management incorporates a rolling detection function. Rolling detection ensures that the braking pressure needed to keep the vehicle stationary is increased when necessary (if any unintentional movement is detected by the vehicle). Standstill management also monitors the stopping procedure and is aware of ABS action (if it is used in bring the car to a stop). In this case, a slip detector is activated while the vehicle is at a standstill to reduce the pressure at an individual wheel brake. If a wheel at which brake pressure has been reduced starts to turn, standstill management identifies the car is sliding and the ACC Stop & Go is switched off, brake pressure is relieved at all wheel brakes and the driver is notified by a Check Control message. Relieving the brake pressure at all four wheels turns a slide into a situation in which the car is again steerable. Of course, the driver can still decelerate the vehicle back to a standstill by depressing the brake pedal, if the road conditions permit.

9.5.5. Behavior in response to driver's intention to exit the vehicle

ACC Stop & Go uses the DSC hydraulics to slow the vehicle reliably to a halt and keep it stationary. Without a supply of electricity, the DSC hydraulics are, however, unable to indefinitely maintain the braking force necessary to keep the vehicle stationary. The F10 is equipped with an electronic parking brake (EMF).

The EMF is capable of holding the vehicle stationary in the following situations:

- in certain failure events of the Dynamic Stability Control,
- if the driver gets out or
- the engine is switched off.

The ability of the electronic parking brake to hold the vehicle is a comfort enhancement for situations in which the vehicle is at a standstill. In the F10, the lock function of the electronic parking brake is activated automatically whenever the driver is about to exit the vehicle with ACC Stop & Go still active.

9. ACC Stop & Go

The driver's intention to exit the vehicle is detected by the signals of the seat belt buckle contact (driver's side) and door contact (driver's door). A signal from the seat occupancy detector (driver's seat) is not used in the F10 for this function.

While the vehicle is being held stationary by ACC Stop & Go, the DSC unit takes over all monitoring and control processes. The DSC also controls the system's behavior in response to the driver's intention to exit the vehicle. For ACC Stop & Go, this is very similar to that implemented for the DSC-internal Automatic Hold function.

ACC Stop & Go is deactivated automatically if, from the bus signals it receives, it detects that the parking brake function has been activated. Now the vehicle is still held stationary but by the parking brake function instead.

9.6. Monitoring Functions

Integrated Chassis Management monitors the system network to verify that all participating sub-systems are operational, all input signals required for operation are valid, and the electronics of the native control unit are in full working order. When troubleshooting this system, it is important to include all participating systems in the system network and not just the individual components. If a fault occurs, the function is shut down completely. A status indicator in the instrument panel and a Check Control message notify the driver that the system is not available. Reactivation is not possible until the fault is no longer present.

F10 Driver Assistance Systems

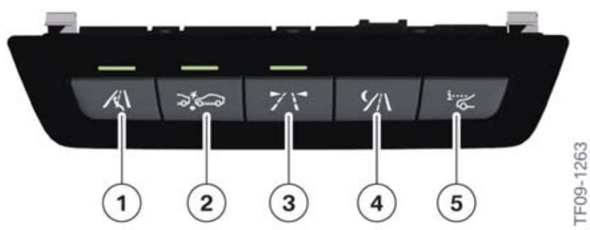
10. Collision Warning w/Brake Application

With the optional ACC Stop & Go equipment (option 5DF) in the F10, the customer automatically receives the collision warning with brake application function. It shares the sensor system and system components with ACC Stop & Go.

10.1. Operation

The collision warning with brake application function is switched on or off with the driver assistance system control panel.

Upon switching on the function, a display opens in the central information display. Here the driver can configure the time of the advance warning in two stages, or deactivate/reactivate the advance warning. The setting selected by the driver is maintained on a key-specific basis via a terminal change.



F10 driver assistance system control panel.

Index	Explanation
1	Active Blind Spot Detection
2	Collision warning with brake application function (adaptive brake assistant)
3	Lane Departure Warning
4	Night Vision with pedestrian detection
5	Head-Up Display

10.2. Functional Principle

The system warns of a possible danger of collision in two stages at speeds of approx. 15 km/h/10mph or higher.

The collision warning is also available when the cruise control is deactivated.

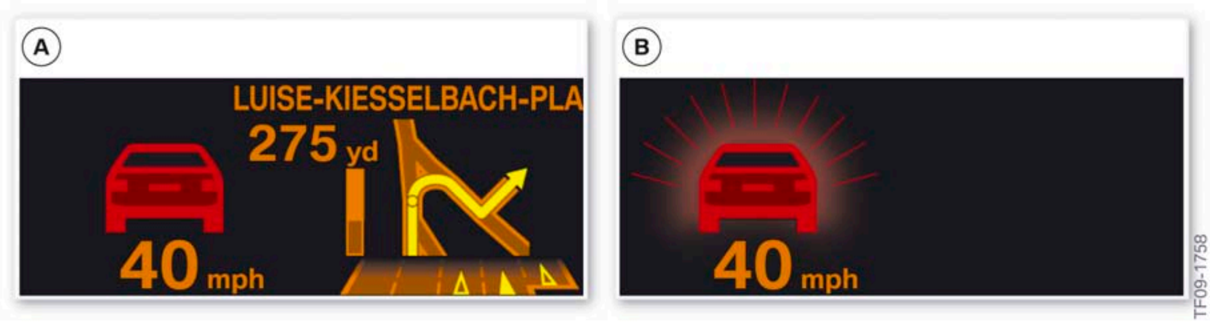
Stationary or moving objects are taken into consideration only if they are in the detection range of the sensor for ACC Stop & Go.

If you purposely approach an object, the collision warning comes later to avoid unwarranted warnings.

10.3. Warning Function

The warning function is divided into two stages. It is displayed in the instrument panel and, if equipped, in the Head-Up Display.

10. Collision Warning w/Brake Application



Collision warning in the head-up display

Index	Explanation
A	1st stage: advance warning, red symbol depicting a car
B	2nd stage: acute warning, red flashing symbol depicting a car

10.3.1. Advance Warning

The advance warning comes e.g. if there is an apparent danger of collision or if there is very little distance to the vehicle driving in front.

The advance warning is signalled by a red-lit vehicle in the instrument panel and, if equipped, in the Head-Up Display.

10.3.2. Acute Warning with Brake Application Function

The acute warning comes if there is an imminent danger of collision, whenever the vehicle approaches another object with a relatively high speed difference.

If there is an acute warning, the driver is shown a red flashing vehicle in the instrument panel and, if present, in the Head-Up Display. Additionally, an audible warning signal sounds. The driver is prompted to brake and, where appropriate, to take evasive action.

The acute warning prompts you to intervene and, if there is a danger of collision, usually assists with brake intervention.

The brake intervention has a maximum brake force of 3 m/s^2 and is only for a limited time. Brake intervention occurs only in the case of detected objects that are moving or have stopped. In the case of objects that were already still when they entered the detection range of the sensor, there is no braking.

The system cannot brake the vehicle to a standstill.

Brake intervention occurs only if the Dynamic Stability Control is switched on.

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Note: The acute warning does not relieve the driver of the responsibility for adjusting the speed and driving style to the traffic conditions.

10. Collision Warning w/Brake Application

The brake intervention can be cancelled by depressing the accelerator pedal or by an active steering wheel movement.

When towing or being towed, switch off the collision warning with braking function in order to avoid malfunctions.

The brake application function is deactivated if the Dynamic Stability Control DSC or Dynamic Traction Control DTC is deactivated.

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Due to system limitations, it can happen that warnings are issued without cause, too late or not at all. For safety reasons, you must be attentive in order to be able to take action at any time.

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