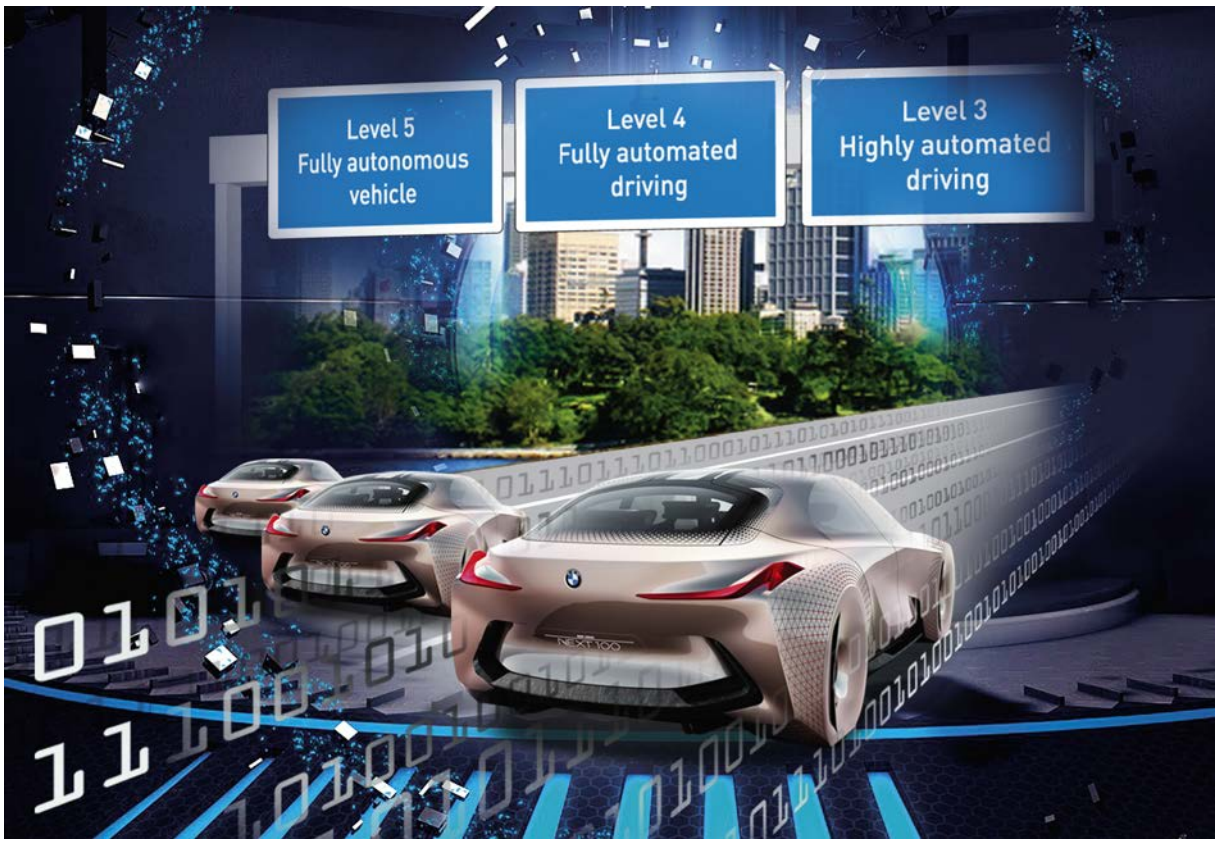
Technical training.
Product information.

Driver Assistance Systems 2018



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BMW Service

General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status: July 2018

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

The information contained in the training course materials is solely intended for participants in this training course conducted by BMW Group Technical Training Centers, or BMW Group Contract Training Facilities.

This training manual or any attached publication is not intended to be a complete and all inclusive source for repair and maintenance data. It is only part of a training information system designed to assure that uniform procedures and information are presented to all participants.

For changes/additions to the technical data, repair procedures, please refer to the current information issued by BMW of North America, LLC, Technical Service Department.

This information is available by accessing TIS at www.bmwcenternet.com.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application
- Aftersales Information Research (AIR)

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1. Introduction

Assistance systems are becoming more and more advanced and also taking on increasing levels of the volume segment. Semi-automated driving (Level 2) is achieved today with the systems currently available at BMW.

Road accidents are frequently caused by human error, however, the individual is also the best preventer of accidents. Current assistance systems are at a very high technical level, but can certainly still not replace the intelligence of a person in certain situations.

To date the driver is responsible for the driving all the time, even if systems allow the driver to take his hands off the steering wheel for a few seconds, therefore relieving the driver considerably especially on long journeys. This also applies to the next levels of automation, which at first do **not** release the driver from his responsibility.

BMW still represents **"The Ultimate Driving Machine"**. This pleasure will become even more diverse in the future. For instance, the customer will have the option to experience both the **"The Ultimate Driving Machine"** or in future also **"The Ultimate Automated Driving Machine"**, depending on the situation.

Today motorists spend many hours every year in congestion in urban areas without being able to make good use of their time. The new way of driving will lead to significantly more comfort. Passengers including the driver can make better use of the journey time and at the same time can, for example, relax, work, read or enjoy modern multimedia and information systems.

The generic term **BMW Personal CoPilot** is becoming increasingly important, as the assistance systems and activities on the road to highly and fully automated driving and autonomous parking are summarized here.

1.1. The road to "Autonomous driving"

The 5 levels of Autonomous driving

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1. Introduction

A classification into different automation levels describes how man and machine interact with each other on the road today and in the future. For instance, with a "Level 5 vehicle" the driver has the option to transfer the driving task to the vehicle.

1.1.1. Assisted driving

Level 1

Current assistance systems support the driver when driving, thus ensuring enhanced safety and comfort. Systems, such as the Active Cruise Control with Stop&Go function, which independently controls the distance to the vehicle ahead, or the Front collision mitigation and Daytime Pedestrian Protection, which can ideally prevent collisions by an automatic braking process, are classified in Level 1.

1.1.2. Semi-automated driving

Level 2

Semi-automated assistance systems, like the Steering Assistant including Traffic Jam Assistant, facilitate life on the road. The systems brake and accelerate automatically. In contrast to Level 1, they are also able to take over at the steering wheel.
With semi-automated driving the driver is still responsible for the vehicle control and cannot ignore traffic conditions.

1.1.3. Highly automated driving

Level 3

In Level 3 the driver is further relieved and gains more and more freedom. Under certain conditions the driver can look away from traffic conditions continuously by delegating the driving tasks completely to the vehicle. From this level the vehicle is already able to drive longer distances and completely independently in certain traffic situations using highly automated systems.
The driver must also be able to resume the driving within a few seconds, e.g. on approaching a construction site or within various system limits.

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1. Introduction

1.1.4. Fully automated driving

Level 4

Level 4 is the precursor to autonomous driving. The vehicle is able to navigate the larger part of its journey independently. From a technical perspective the vehicle is so advanced that it can overcome highly complex urban traffic situations without the intervention of the driver. If certain situations occur, which, for example, push the system to its limits, the driver must still be fit to drive in order to be able to assume driving if necessary. It is certainly conceivable that the driver may, for example, sleep temporarily during the journey. If the driver ignores the warnings, then the systems have the authority to transfer the vehicle to a safe state. This could be done, e.g. with an automatic brake intervention.

1.1.5. Autonomous driving

Level 5

Whereas for Level 3 and 4 both the driver's fitness to drive and a valid driving license are required, this is no longer important with fully autonomous driving. The vehicle assumes the driving task here completely. The steering wheel and the pedal thus become superfluous.
From a technical point of view, the vehicle can also be moved without a driver. The presence of a driver is no longer absolutely necessary.
As the complexity of the technical solutions is extremely high, completely autonomous vehicles will initially be on the road with relatively low speeds, in restricted areas of the urban environment or on selected highway sections.

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1. Introduction

1.2. Future mobility

Future mobility

Digitalization is constantly changing more and more areas of our everyday life – also our individual mobility. Smart assistance systems, as well as digital operating concepts by touchscreen, gestures or voice input, have long become an established reality.

Looking forward to "Future mobility", besides the advancing digitalization in relation to ConnectedDrive, the BMW Group is also increasing its focus on autonomous driving.

Autonomous vehicles must be able to communicate with the environment and respond independently to dangers.

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1. Introduction

Vehicle networking

This is where both the networking of vehicles as well as high-precision and real-time navigation maps set in and form important modules for autonomous driving.

It is for this reason the BMW Group together with two competitors purchased the company HERE. In the future BMW Group vehicles will have the map version "HERE HD Live Map", which is able to combine high-resolution map data with real-time information of other vehicles.

Real Time Traffic Information (RTTI) as well as the Hazard Preview represent an initial attribute of the exchange of real-time information. The Car-to-X-Communication still forms the basis for the data exchange.

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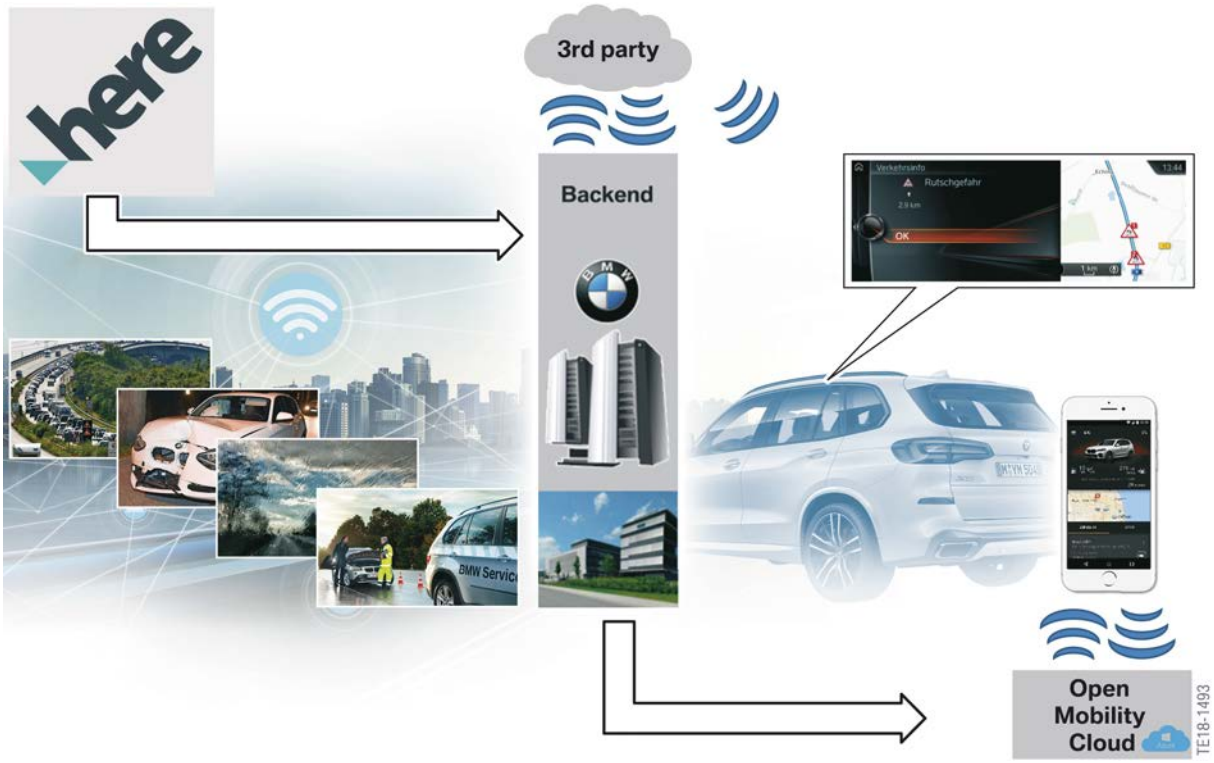
1. Introduction



Hazard Preview

The development of the 5G standard, as well as the creation of an appropriate infrastructure for autonomous vehicles, will substantially influence the next development stages towards autonomous driving.

In the area of communication there is also a need that autonomous vehicles share their intentions with other road users. Besides the technology, the social aspects are important, i.e. the way the vehicle, for example, communicates with a pedestrian.

One approach in this direction may be that an autonomous vehicle projects a virtual pedestrian crossing on the road in order to indicate to a pedestrian that the vehicle stops itself and gives right of way to the pedestrian.

1.2.1. Artificial Intelligence

In the automotive area Artificial Intelligence (AI) is a key topic and is important not only in production.

AI will also play an important role in the future for the use of the vehicles, whether for autonomous driving, mobility services or communication.

How is this to be viewed now in connection with autonomous vehicles? And why is AI so important in the future?

Let's take two examples which show subjects that need to be clarified.

A person has the gift of storing things he has seen once and easily recognizing them again.

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Take the example of a pedestrian crossing, which is easily recognized as such by the person – and independent of the color of the stripes. However, a machine would possibly have a problem here as color changes are not automatically taken into account. Whereas in the traffic environment it is not uncommon that the color of the stripes is always white.

Second example: A shrub or a hedge is recognized as a stationary obstacle – but what happens with shrubs or hedges whose leaves are moving? For the individual actually no problem – whereas the vehicle could misinterpret this and detect a moving object instead of a shrub.

In addition to the networking and communication with the environment, in the future vehicles must also be able to interpret various situations in order to be able to respond accordingly.

Artificial Intelligence

This is where Artificial Intelligence comes into effect, which ultimately makes possible "autonomous driving" at a safe level.

1.2.2. Big data

An autonomous vehicle generates roughly one GB of data per second. Solely on the basis of this figure, it can be deduced that apart from all the aforementioned topics an efficient data management system is indispensable. Intelligent solutions are necessary here as with these data volumes even 5G standard can reach its limits.

1.2.3. BMW CarData

The BMW Group already offers its customers innovative and customized services in the area of individual mobility. BMW CarData was introduced in order to be able to integrate services of third parties.

With BMW CarData the customer has control of his data and can decide what should happen to the data. In his ConnectedDrive account the customer can carry out settings which allow status data such as the odometer reading, usage-based data like the average fuel consumption or event data such as eCall to be transferred to the back end.

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Service providers (so-called third-party providers) can obtain data they need for certain services with the customer's consent. This data is transmitted encrypted in order to guarantee data security.

To sum up, for the customer BMW CarData means security and control of the data from his own vehicle – and this combined with the many benefits of the customized services.

The customer can request a CarData report at any time via the ConnectedDrive portal in the CarData archive. The CarData report provides information about which data has been forwarded. Apart from security, maximum transparency for the customer is also guaranteed.

1.2.4. Mobility Services

Mobility services

The BMW Group is pushing a mobility concept that builds on sustainability and links mobility services together intelligently. For example, for the market introduction of the BMW i3 intermodal route planning was presented, which takes into consideration public transport in the route selection.

Car sharing programs such as DriveNow or mobility services like ChargeNow and ParkNow are also available.

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1.2.5. Legal basic conditions

Legal basic conditions

In addition to the technical challenges, the following years will be characterized by the establishment of a legal framework for the next level in order to ultimately pave the way for "autonomous driving".

With regard to legal basic conditions, ethics committees have already compiled a set of rules, which can be built upon, but do not yet answer all questions thoroughly. Worldwide uniform implementation or control will be something of an illusion here.

As a result, the future offer structure of the assistance systems within the BMW model range will be different, and the operating principle of the systems will also differ in the future depending on the national-market version.

For example, the Automatic Lane Change with vehicle electrical system Service Pack 2018 will be introduced for the first time for the USA as a "new" system, whereas the system will be dropped in the EU owing to a change in legislation.

1.2.6. Light Detection and Ranging (LIDAR) technology

In addition to the subject matter, new sensors are also required in the future to drive vehicle networking for highly automated and fully automated driving.

For example, the familiar optical cameras, as well as the radar and ultrasonic sensors, are extended in the future with Lidar-based sensor technology.

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1. Introduction

Overview of sensor types

	Ultrasonic sensors
	Surround View cameras
	KAFAS camera
	Radar sensors
	Lidar sensor

Even in difficult situations, such as direct sunlight or darkness, sensors which work according to Light Detection and Ranging technology are able to adequately map the vehicle environment.

The designation Lidar is derived from the operating principle and essentially means "Light Detection and Ranging". A Lidar sensor scans the surrounding area and generates a 3D image of the surroundings. The operating principle or principle of a Lidar itself is similar to that of a radar – with the difference that a laser beam is emitted here.

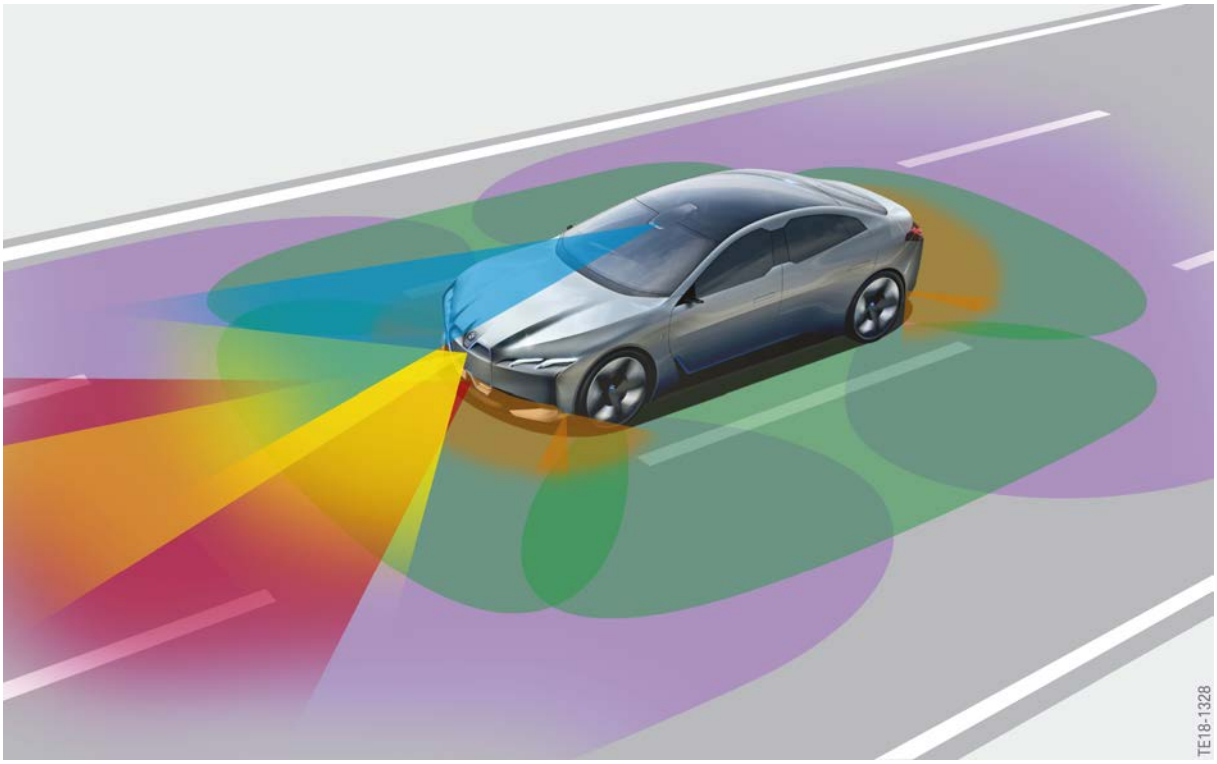
The signals emitted via laser are received by the Lidar by means of multispectral cameras. Multispectral cameras are characterized by the fact that they can absorb the bouncing light of the laser (from the surface of the object) in several wavelengths. The bouncing light of the laser can also be received by means of a special integrated chip. Technically, this would mean that the multispectral cameras could be deleted.

1. Introduction

Example: Lidar sensor with integrated receiver chip

Which reception mode wins through in the end, or whether one solution is used one time and another solution the next time depending on the vehicle model, remains to be seen.

In addition to the pure object detection, the distance to the object as well as its speed can be evaluated using the Lidar technology.



Overview: Sensor types in the network

It appears that the Lidar will become the most important link between the vehicle and vehicle environment in the sensor network.

1. Introduction

1.2.7. Preparation for Level 3

The BMW Group aims to make highly automated driving a reality for customers in the near future.

With the vehicle electrical system Service Pack 2018, the Driver Camera System (DCS) is used for the first time and thus forms a further basis for (semi-)automated driving functions.

A reliable analysis of the situation around the vehicle is one of the prerequisites for highly or fully automated driving and is guaranteed with environment sensors.

Data from six information clusters is required. The clusters are divided up as follows:

- Road users
- Static environment
- Information on traffic regulations
- Reliable driving lane map data
- Exact current position of the vehicle
- Driver status.

Each sensor applies its own approach for the detection and interpretation of the environment. With the fusion of this data the calculation of a circular model is possible in the end.

With the vehicle electrical system Service Pack 2018 new generations of sensors are used. More information about these new sensors can be found in the course of this product information.

New systems also find their way into different BMW derivatives to varying degrees. The optional equipment Active Driving Assistant Professional (SA 5AU) and BMW Live Cockpit Professional (SA 6U3) round off the new alignment.

Whereas Active Driving Assistant Professional represents the spearhead of the available systems, the BMW Live Cockpit Professional makes possible an advanced visualization of the different driving conditions.

1.3. Further information

An extended offer of driver assistance systems is available to the customer with the introduction of the vehicle electrical system Service Pack 2018. New systems as well as components represent yet another stepping stone towards automated driving.

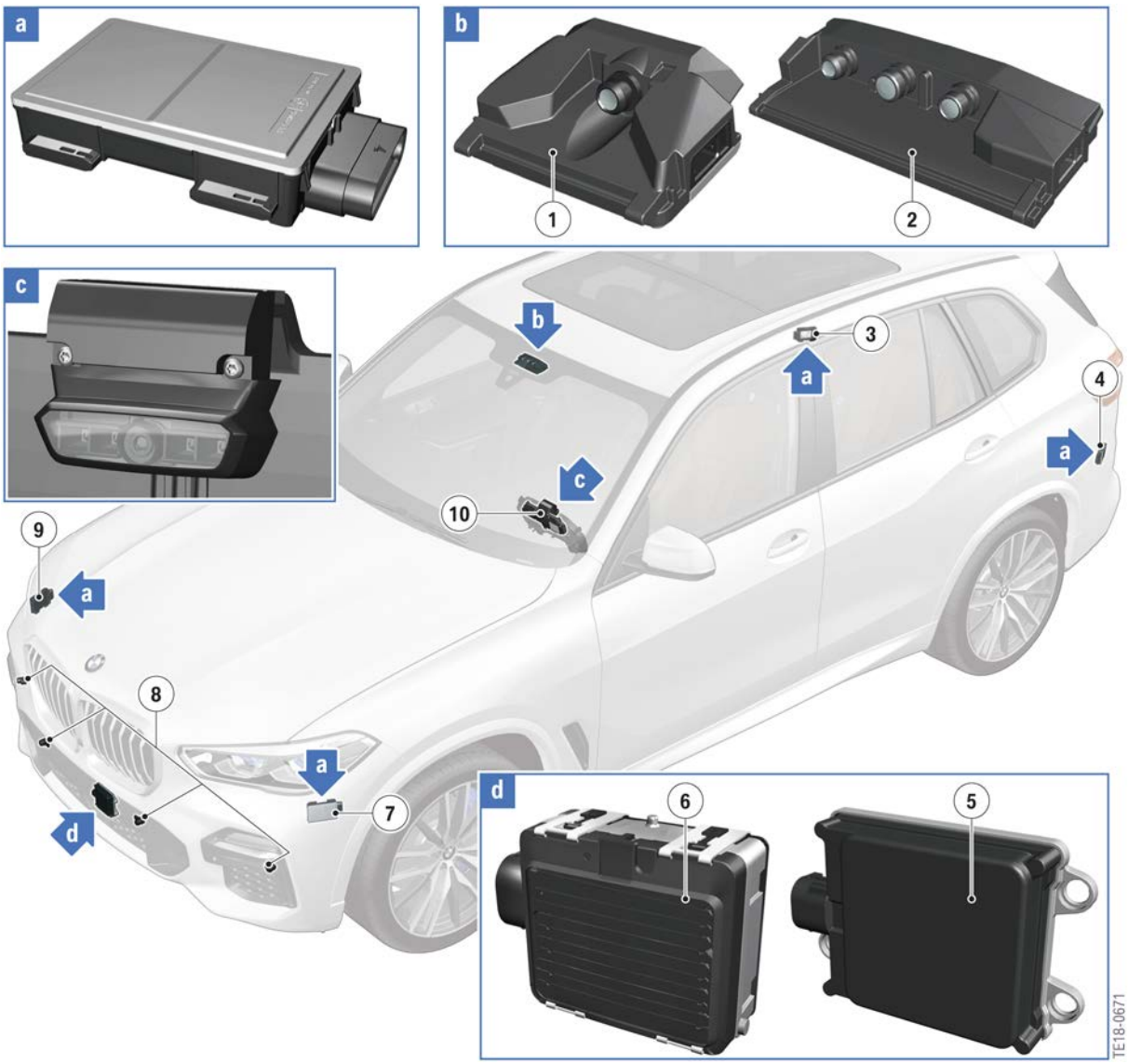
In this product information you find an overview of the new possible assistance systems, as well as changes which are being rolled out with the vehicle electrical system Service Pack 2018. The systems already known from the G12, G30, as well as the G01, are **not** described in this product information. Further information, as well as an overview of the assistance systems of the G05 and the G15, can be found in the individual product information of the respective derivatives.

For more information on the operating concept of the assistance systems, please refer to the Owner's Handbook.

Driver Assistance Systems 2018

2. Sensors

The graphic below shows the installation locations and provides an overview of the main sensors used for the assistance systems using the example of a G05.



G05 Overview of sensors

Index	Explanation
1	KAFAS Mid camera
2	KAFAS High camera
3	Rear radar sensor short range right (HRSNR)
4	Rear radar sensor short range left (HRSNL)
5	Front radar sensor long range (FRSF)
6	Front radar sensor (FRS)

Index	Explanation
7	Side radar sensor short range front left (SRSNVL)
8	Ultrasonic sensors for Park Distance Control (PDC), front
9	Side radar sensor short range front right (SRSNVR)
10	Driver Camera System (DCS)

2.1. KAFAS

Both the KAFAS mono and the KAFAS stereo camera are currently used at BMW with the vehicle electrical system Service Pack 2015, depending on the vehicle model as well as taking into account the optional equipment. The two camera systems are very different:

- The KAFAS mono camera comprises a camera lens and an image sensor and works based on object classification. Distances to the detected object can also be calculated using complex algorithms.

- Whereas, the KAFAS stereo camera has two camera lenses and two image sensors and generates a 3D image from the comparison of the images taken simultaneously. Distances can be measured directly with the 3D image (within the system limits).

As the requirements of the KAFAS camera have increased once again, two new KAFAS camera variants are used with the vehicle electrical system Service Pack 2018.

2.1.1. KAFAS Mid camera

Compared to the previous KAFAS mono cameras used at BMW, the KAFAS Mid camera offers the following advantages:

- Extended range for object detection
- Larger field of view
- Considerably higher computing capacity
- Better performance after dark.

KAFAS Mid camera

2.1.2. KAFAS High camera

The familiar KAFAS stereo camera from the G12 is replaced with the KAFAS High camera. The brand new camera has three camera lenses. There is a fisheye lens for close range, one for medium range and one for the data fusion with radar sensors at distances of up to 250 m.

KAFAS High camera

2.1.3. Functional limitations

The function of the KAFAS camera and thus the function of the corresponding assistance systems may be impaired due to the physical limits of the optical systems, for example in the following situations:

- Heavy fog, rain, spray or snow
- Strong light in the camera lens
- If the viewing aperture of the KAFAS camera or the windscreen is dirty
- On tight bends
- If boundary lines are missing, worn, poorly visible, converging or diverging, or not clearly recognizable, as may be the case when roadworks are being carried out
- If boundary lines are covered by snow, ice, dirt or water

- If boundary lines are covered by objects
- If driving at close proximity to a vehicle driving ahead
- If the windscreen in front of the interior mirror is misted over, soiled or covered by stickers, e.g. inspection stickers, etc.
- Up to 10 seconds after driving readiness is activated via the start/stop button
- During the calibration process for the KAFAS camera immediately after vehicle delivery or a camera change.

⚠

Due to functional limitations and system restrictions it may transpire that warnings and orders are not issued, are issued too late or are unwarranted. Therefore, be attentive in order to be able to actively intervene at any time. Otherwise, there is a risk of an accident.

2.2. Radar sensors

Different types of radar sensors are required for (semi-)automated driving. The radar sensors are responsible for near or distance monitoring. Also with the vehicle electrical system Service Pack 2018 a total of six control units can be used as radar sensors.

In order to create more transparency, the radar sensors were provided with new terminology on the part of diagnosis. The new terminology is explained below.

2.2.1. Front radar sensor

The front radar sensor (FRS) is a new development and is used for the first time with the series launch of the new BMW X5.

Front radar sensor (FRS)

The front radar sensor (FRS) is connected at the K-CAN3.

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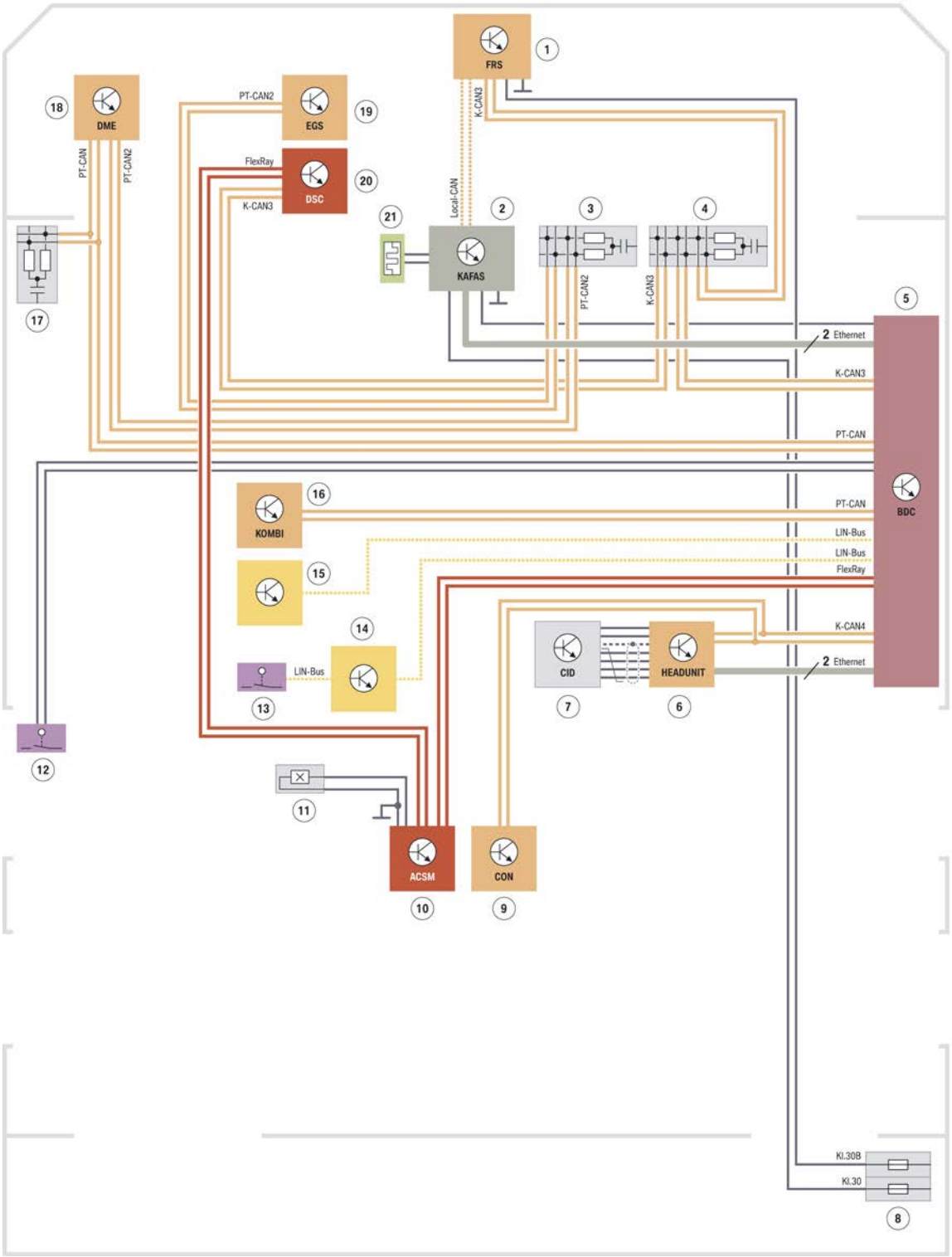
2. Sensors



System wiring diagram for front radar sensor (FRS) using the example of a G05

Index	Explanation
1	Front radar sensor (FRS)
2	KAFAS Mid camera
3	CAN terminator
4	CAN terminator
5	Body Domain Controller (BDC)
6	Head Unit
7	Central Information Display (CID)
8	Fuses in the power distribution box, rear right
9	Controller (CON)
10	Advanced Crash Safety Module (ACSM)
11	Seat belt buckle contact, driver's seat
12	Door contact, driver's door
13	Intelligent Safety button
14	Audio operating unit
15	Steering column switch cluster (SZL)
16	Instrument cluster (KOMBI)
17	CAN terminator
18	Digital Motor Electronics (DME)
19	Electronic transmission control (EGS)
20	Dynamic Stability Control integrated (DSCi)
21	Heating for KAFAS Mid camera

2.2.2. Front radar sensor long range

The front radar sensor long range (FRSF) is **not**, as the name would suggest, a radar sensor for long range, but is a full-range radar sensor already known from the G1x, G3x and G0x.

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2. Sensors

Front radar sensor long range (FRSF) using the example of a G05

The following system wiring diagram shows the Ethernet network in which the front radar sensor long range (FRSF) is also incorporated.

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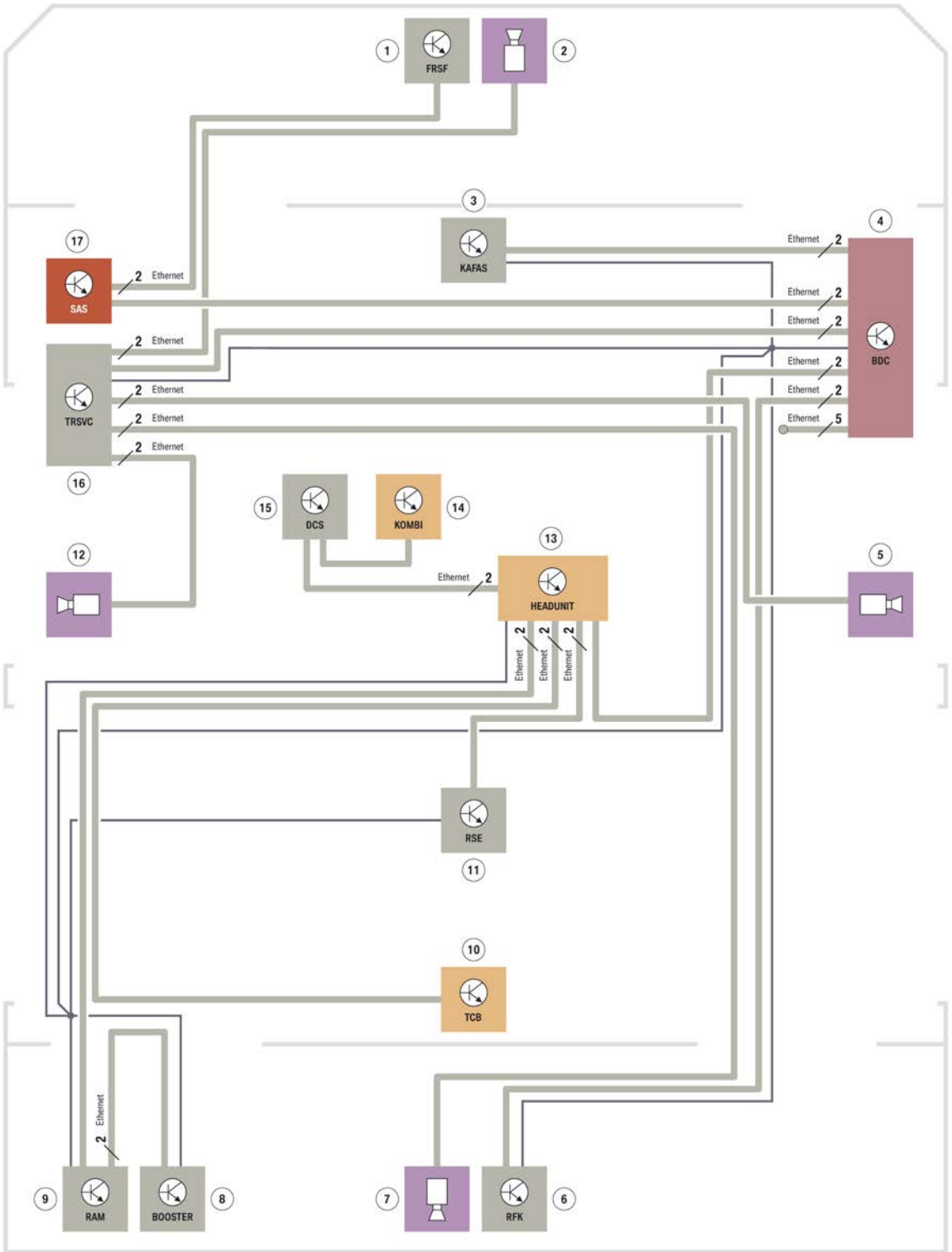
2. Sensors



System wiring diagram for front radar sensor (FRSF) using the example of a G05

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2. Sensors

Index	Explanation
1	Front radar sensor long range (FRSF)
2	Front camera
3	KAFAS High camera
4	Body Domain Controller (BDC)
5	Right side view camera
6	Rear view camera (Rear view camera SA 3AG)
7	Rear view camera (Parking Assistant Plus SA 5DN)
8	Booster
9	Receiver Audio Module (RAM)
10	Telematic Communication Box 2 (TCB)
11	Rear Seat Entertainment system
12	Left side view camera
13	Head Unit
14	Instrument cluster (KOMBI)
15	Driver Camera System (DCS)
16	Top rear side view camera (TRSVC) control unit
17	Control unit for optional equipment system (SAS)

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2. Sensors

2.2.3. Side radar sensors

The side radar sensors were revised and are not visible in the diagnosis as individual sensors.
The sensor at the rear right still assumes the primary function.

The new terminology of the four side radar sensors is:

	Side radar sensor short range front left (SRSNVL)
	Side radar sensor short range front right (SRSNVR)
	Rear radar sensor short range left (HRSNL)
	Rear radar sensor short range right (HRSNR)

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2. Sensors

2.3. Overview of sensors

The following table provides an overview of the sensors in relation to the vehicle equipment using the example of a G05.

Vehicle equipment	KAFAS camera	Front radar sensor	Radar sensor
Active Driving Assistant (SA 5AS)	 KAFAS Mid camera		 Rear radar sensor: (short range front left, HRSNL) (short range front right, HRSNR)
ACC Stop&Go (SA 5DF)	 KAFAS Mid camera	 Front radar sensor (FRS)	 Rear radar sensor: (short range front left, HRSNL) (short range front right, HRSNR)
Active Driving Assistant Professional (SA 5AU)[1]	 KAFAS High camera	 Front radar sensor long range (FRSF)	 Side radar sensor: (short range front left, SRSNVL) (short range front right, SRSNVR)  Rear radar sensor: (short range left, HRSNL) (short range right, HRSNR)

[1]Vehicles with the optional equipment Active Driving Assistant Professional (SA 5AU) also receive the Driver Camera System (DCS). Information about the Driver Camera System (DCS) can be found in chapter 2.4.

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2. Sensors

The following table provides an overview of the sensors in relation to the vehicle equipment using the example of a G15.

Vehicle equipment	KAFAS camera	Front radar sensor	Radar sensor
Active Driving Assistant (SA 5AS)	 KAFAS Mid camera		 Rear radar sensor: (short range left, HRSNL) (short range right, HRSNR)
Active Driving Assistant Professional (SA 5AU)[1]	 KAFAS High camera	 Front radar sensor long range (FRSF)	 Side radar sensor: (short range front left, SRSNVL) (short range front right, SRSNVR)  Rear radar sensor: (short range left, HRSNL) (short range right, HRSNR)

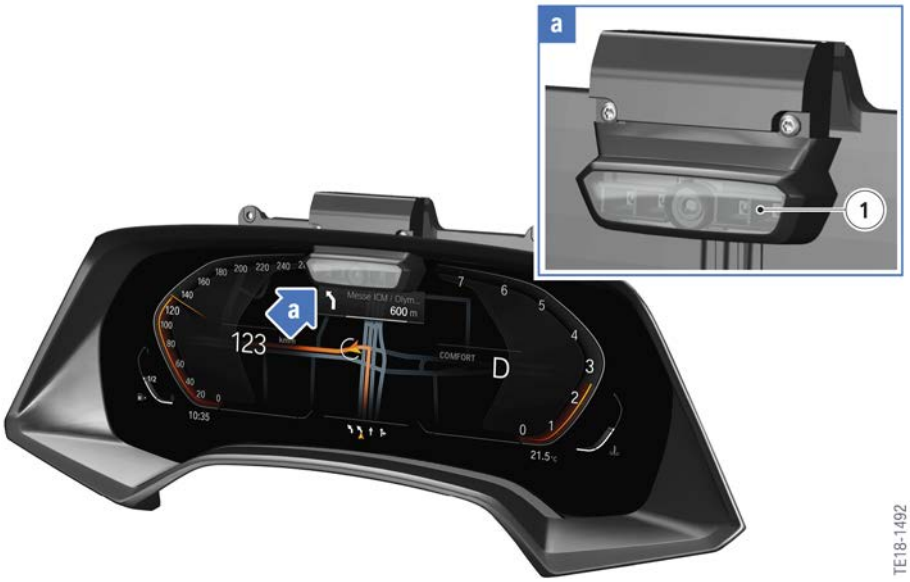
[1]Vehicles with the optional equipment Active Driving Assistant Professional (SA 5AU) also receive the Driver Camera System (DCS). Information about the Driver Camera System (DCS) can be found in chapter 2.4.

Driver Assistance Systems 2018

2. Sensors

2.4. Driver Camera System

The status of the driver must be known in phases of (semi-)automated driving. The Driver Camera System (DCS) attached at the instrument cluster assumes this task.



Driver Camera System (DCS)

Index	Explanation
1	Driver Camera System (DCS)

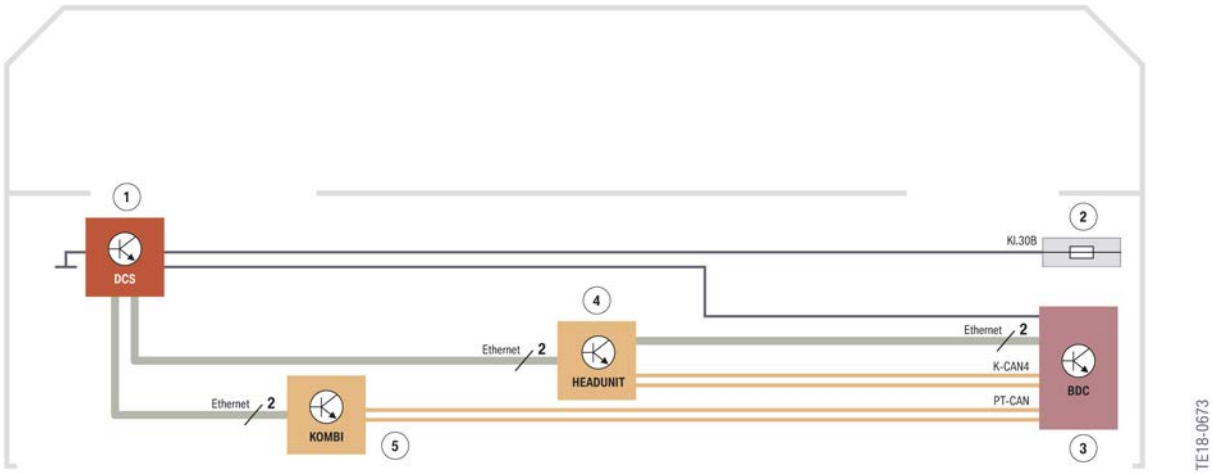
An infrared camera integrated in the Driver Camera System (DCS) makes it possible to detect the driver's viewing direction. Using the detected data, the Driver Camera System (DCS) control unit must be able to assess the status of the driver's alertness.

In addition to the detection of the viewing direction and an assessment of the tiredness of the driver, the driver monitoring also allows an evaluation of the eye opening state. The evaluation has a direct influence on the Fatigue Alert and, if necessary, permits a faster warning, irrespective of the driver's steering behavior.

The Front collision mitigation and Intersection collision warning also use the data provided by the Driver Camera System (DCS) control unit. A driver's inattentiveness detected by the system influences the calculation for the warning levels and the driver warning can take place earlier if need be.

The Driver Camera System (DCS) is another basis for (semi-)automated driving functions. At a later stage the Driver Camera System (DCS) will be used in vehicles with Steering Assistant including Traffic Jam Assistant in order to achieve an unrestricted hands-off time span in certain conditions.

If the driver's alertness is detected, it is no longer necessary that the driver has to touch the steering wheel during driving. In order to ensure that the driver continues to observe the traffic conditions, the system checks whether the driver's gaze is towards the road at certain intervals.



Extract: System wiring diagram for Driver Camera System (DCS)

Index	Explanation
1	Driver Camera System (DCS)
2	Fuse in power distribution box, front right
3	Body Domain Controller (BDC)
4	Head Unit
5	Instrument cluster (KOMBI)

2.4.1. Limits of the system

The function of the Driver Camera System can, for example, be restricted in the following cases:

- When the Driver Camera System (DCS) is covered by, e.g. the steering wheel rim or other objects.
- When the driver is wearing anti-infrared sunglasses.

The Driver Camera System (DCS) does not relieve the driver from his full driving responsibility. There can be functional limitations because of system restrictions.

2.5. System wiring diagrams

2.5.1. Vehicles with optional equipment ACC with Stop&Go function (SA 5DF)

The following system wiring diagram shows the sensors as well as their incorporation in the bus system in vehicles with the optional equipment Active Cruise Control with Stop&Go function (SA 5DF) using the example of a G05.

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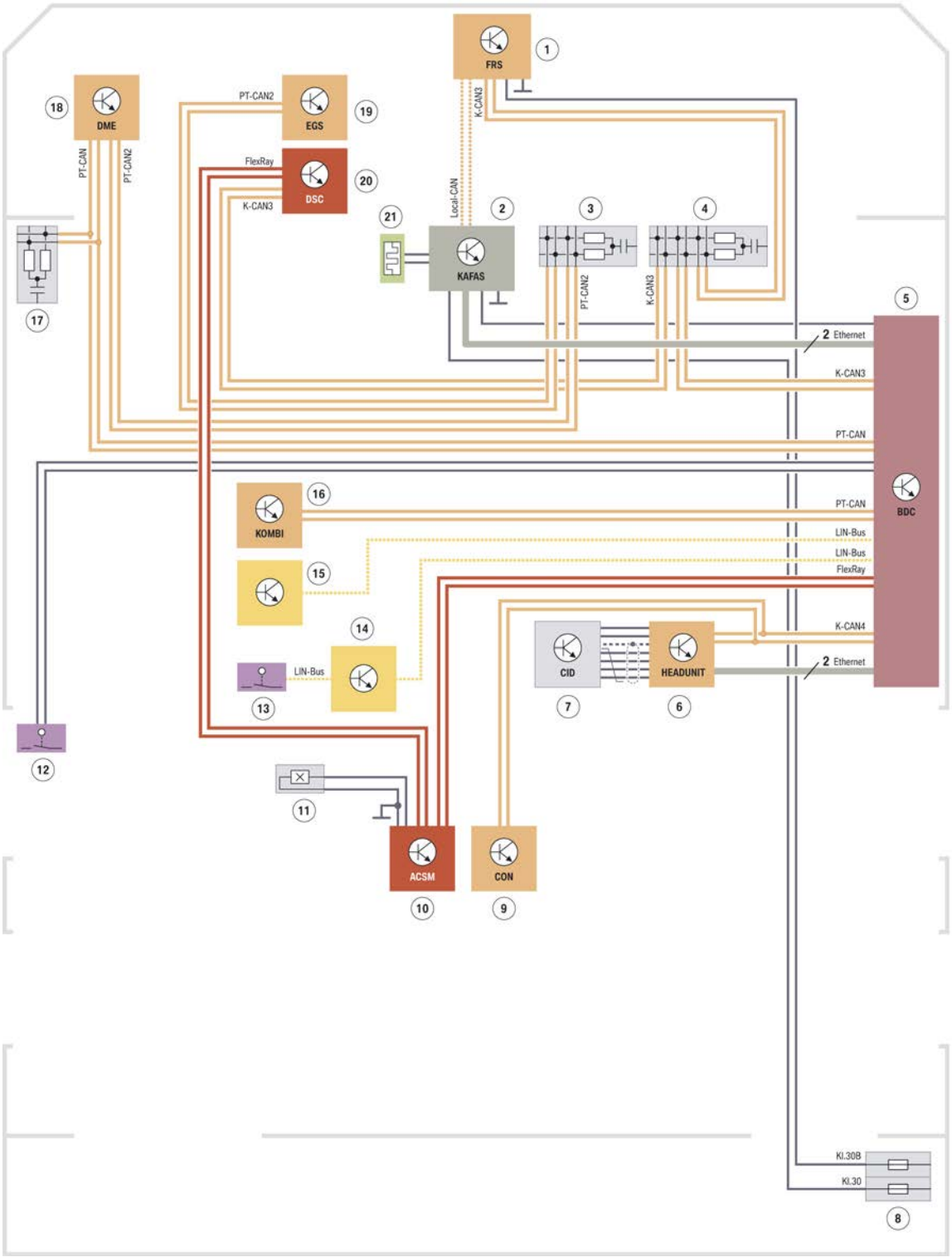
2. Sensors



G05 system wiring diagram for ACC with Stop&Go function (SA 5DF)

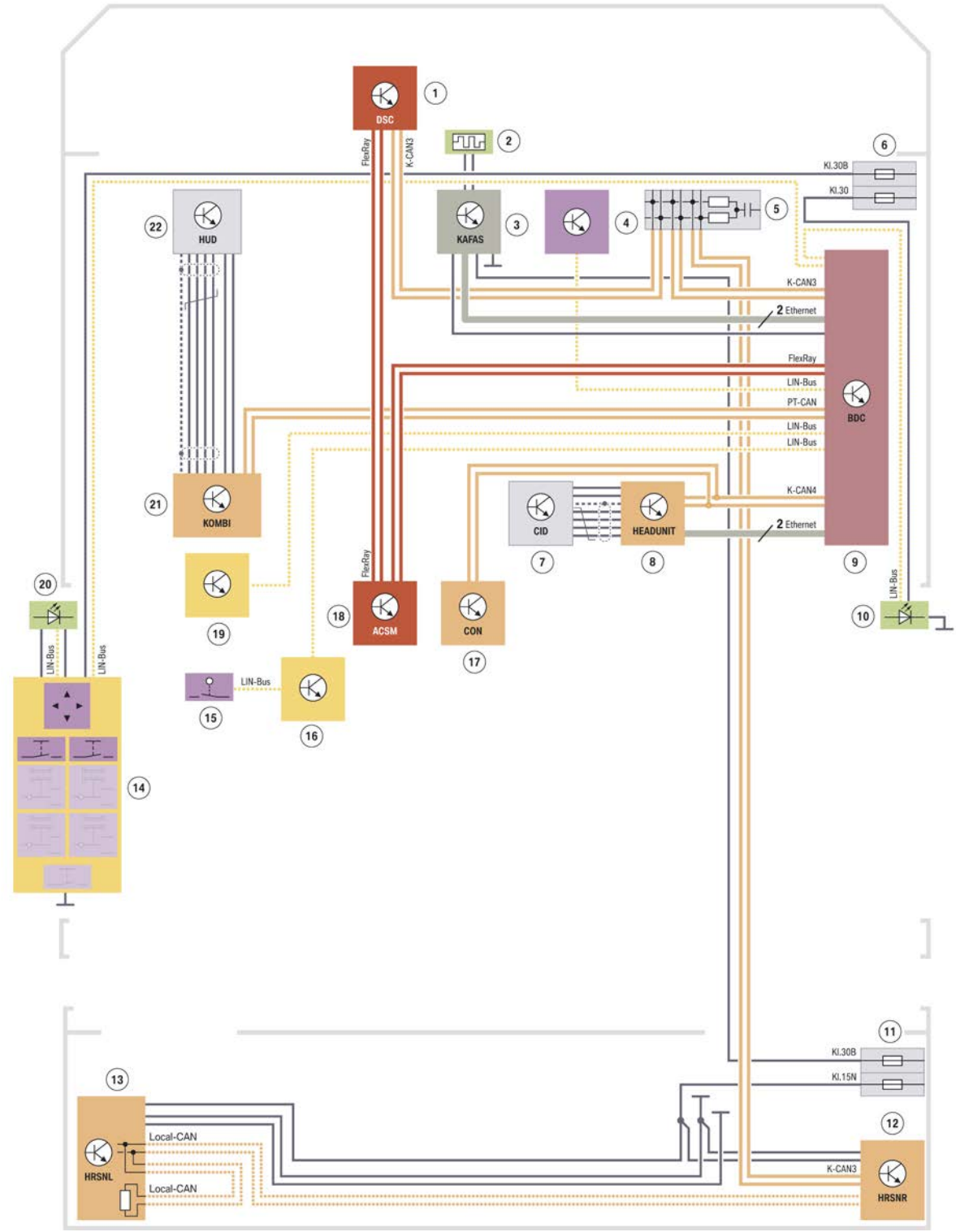
Index	Explanation
1	Front radar sensor (FRS)
2	KAFAS Mid camera
3	CAN terminator
4	CAN terminator
5	Body Domain Controller (BDC)
6	Head Unit
7	Central Information Display (CID)
8	Fuses in the power distribution box, rear right
9	Controller (CON)
10	Advanced Crash Safety Module (ACSM)
11	Seat belt buckle contact, driver's seat
12	Door contact, driver's door
13	Intelligent Safety button
14	Audio operating unit
15	Steering column switch cluster (SZL)
16	Instrument cluster (KOMBI)
17	CAN terminator
18	Digital Motor Electronics (DME)
19	Electronic transmission control (EGS)
20	Dynamic Stability Control integrated (DSCi)
21	Heating for KAFAS Mid camera

2.5.2. Vehicles with optional equipment Active Driving Assistant (SA 5AS)

The following system wiring diagram shows the sensors as well as their incorporation in the bus system in vehicles with the optional equipment Active Driving Assistant (SA 5AS) using the example of a G05.

Driver Assistance Systems 2018

2. Sensors



G05 system wiring diagram for Active Driving Assistant (SA 5AS)

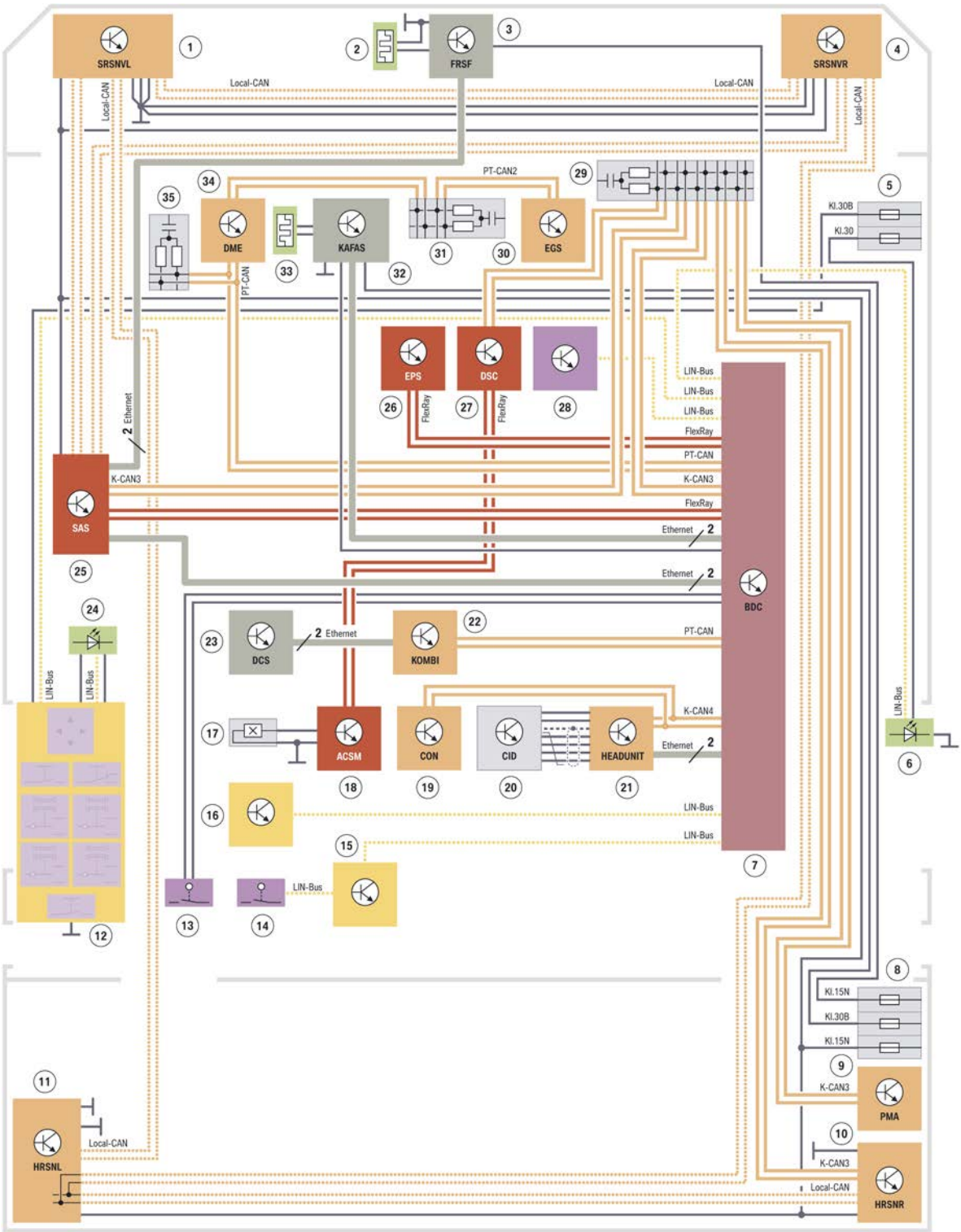
Index	Explanation
1	Dynamic Stability Control integrated (DSCi)
2	Heating for KAFAS Mid camera
3	KAFAS Mid camera
4	Rain-light-solar-condensation sensor (RLSBS)
5	CAN terminator
6	Fuses in the power distribution box, front right
7	Central Information Display (CID)
8	Head Unit
9	Body Domain Controller (BDC)
10	Signal unit (LED) in right mirror glass
11	Fuses in the power distribution box, rear right
12	Rear radar sensor short range right (HRSNR)
13	Rear radar sensor short range left (HRSNL)
14	Switch block, driver's door
15	Intelligent Safety button
16	Audio operating unit
17	Controller (CON)
18	Advanced Crash Safety Module (ACSM)
19	Steering column switch cluster (SZL)
20	Signal unit (LED) in left mirror glass
21	Instrument cluster (KOMBI)
22	Head-Up Display (HUD)

2.5.3. Vehicles with optional equipment Active Driving Assistant Professional (SA 5AU)

The following system wiring diagram shows the sensors as well as their incorporation in the bus system in vehicles with the optional equipment Active Driving Assistant Professional (SA 5AU) using the example of a G05.

Driver Assistance Systems 2018

2. Sensors



G05 system wiring diagram for Active Driving Assistant Professional (SA 5AU)

Driver Assistance Systems 2018

2. Sensors

Index	Explanation
1	Side radar sensor short range front left (SRSNVL)
2	Heating for front radar sensor long range (FRSF)
3	Front radar sensor long range (FRSF)
4	Side radar sensor short range front right (SRSNVR)
5	Fuse for front right power distribution box
6	Signal unit (LED) in right mirror glass
7	Body Domain Controller (BDC)
8	Fuses in the power distribution box, rear right
9	Parking Maneuvering Assistant (PMA)
10	Rear radar sensor short range right (HRSNR)
11	Rear radar sensor short range left (HRSNL)
12	Switch block, driver's door
13	Door contact, driver's door
14	Intelligent Safety button
15	Audio operating unit
16	Steering column switch cluster (SZL)
17	Seat belt buckle contact, driver's seat
18	Advanced Crash Safety Module (ACSM)
19	Controller (CON)
20	Central Information Display (CID)
21	Head Unit
22	Instrument cluster (KOMBI)
23	Driver Camera System (DCS)
24	Signal unit (LED) in left mirror glass
25	Control unit for optional equipment system (SAS)
26	Electronic Power Steering (EPS)
27	Dynamic Stability Control integrated (DSCi)
28	Rain-light-solar-condensation sensor (RLSBS)
29	CAN terminator
30	Electronic transmission control (EGS)
31	CAN terminator
32	KAFAS High camera
33	Heating for KAFAS High camera
34	Digital Motor Electronics (DME)
35	CAN terminator

Driver Assistance Systems 2018

3. Operating Elements "New Features"

3.1. Control panels at the multifunction steering wheel

3.1.1. Visualization

Due to a legal change the visualization of the status detection of some assistance systems had to be changed. This is why in vehicles with the optional equipment Active Driving Assistant Professional (SA 5AU) the control panels of the assistance systems have been redesigned at the multifunction steering wheel. In this case the control panels each have an integrated LED strip.

LED strips at the multifunction steering wheel

Index	Explanation
1	Integrated LED light, left
2	Integrated LED light, right

The two LED strips flash analogously to the assistance system displays in the instrument cluster and thus represent an additional visualization, e.g. if the driver is requested to resume control of the steering.

Note:

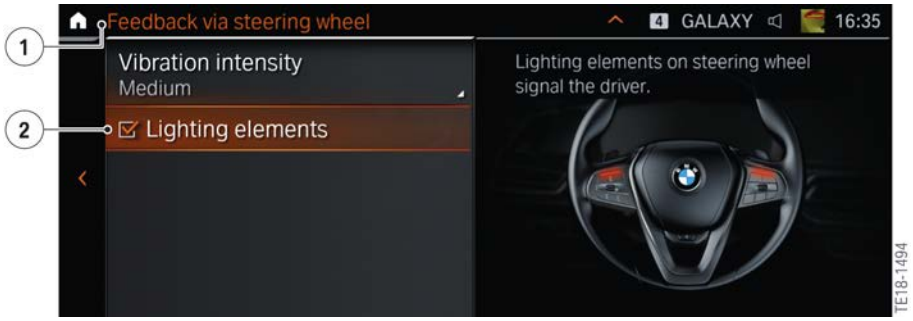
- Green: The assistance system is active and assumes lateral guidance
- Yellow: Interruption of the assistance system pending
- Red: The assistance system is deactivated.

Driver Assistance Systems 2018

3. Operating Elements "New Features"

The two LED strips can be switched on and off via the iDrive menu by making the following selection via the controller:

- "CAR"
- "Settings"
- "Driver Assistance"
- "Feedback via steering wheel"
- "Light elements".



Settings menu: LED lighting elements in the CID

Index	Explanation
1	"Feedback at the steering wheel" menu
2	"Lighting elements" on the multifunction steering wheel (switch on and off)

3.1.2. Operating concept

To be able to facilitate easy operation of the ever-increasing Driver Assistance Systems without additional buttons, the operation of the Driver Assistance Systems has been changed with the optional equipment Active Driving Assistant Professional (SA 5AU). The Assist button is pressed to activate the Driver Assistance System. Then, by pressing the MODE button, the vehicle will cycle between two Driver Assistance Systems: either ACC Stop&Go or ACC Stop&Go **with** Steering Assistant (including Traffic Jam Assistant.) The chosen system is now active. Pressing the Assist button while the system is active will deactivate the system.

Note: Changing the Driver Assistance System mode is only possible when the system is active.

Example: The driver is using ACC Stop&Go and would like to engage the Steering Assistant. Pressing the MODE button would then select the Steering Assistant **with** ACC Stop&Go to be able to use both functions. If the Assist button is pressed now, Steering Assistant is deactivated together with ACC Stop&Go.

The Driver Assistance Systems which can be selected with the MODE button are displayed to the driver in the instrument cluster in the form of a selection list.

Driver Assistance Systems 2018

3. Operating Elements "New Features"

Control panel for assistance systems at the multifunction steering wheel (with optional equipment "Active Driving Assistant Professional" (SA 5AU))

Index	Explanation
1	Rocker button for changing the set speed
2	Integrated LED light
3	Button for activating/deactivating the Speed Limiter function
4	Button for increasing the distance to the vehicle ahead
5	MODE Button for selecting different assistance systems[1]
6	Assist button for activating/deactivating the assistance system selected using the MODE button (ACC Stop&Go and/or Steering Assistant including Traffic Jam Assistant)
7	Button for saving the current speed[2]
8	Button for reducing the distance to the vehicle ahead
9	Resume/Cancel button for resuming a set speed/temporarily deactivating the cruise control

[1]Possible selection:

- ACC Stop & Go only
- ACC Stop&Go with Steering Assistant including Traffic Jam Assistant.

[2]Vehicles with Speed Limit Assistant:

Speed Limit Assistant deactivated:

- Adoption of the suggested speed limit.

Speed Limit Assistant activated:

- Change back to the last speed set.

3.2. Operating unit in the center console

Another new feature in the area of the operating elements is the deletion of the "deadman function" for Automatic Parking. This means that the driver does not have to hold down the parking assistance button during the parking maneuver as before. It is sufficient to press the button once to perform Automatic Parking.

G15 Operating unit in the center console

Driver Assistance Systems 2018

3. Operating Elements "New Features"

Index	Explanation
1	Panorama View button
2	Parking assistance button

Driver Assistance Systems 2018

4. Collision/Pedestrian Warning

Depending on the vehicle equipment, a distinction is made between three different technical variants.

- Vehicles which have the standard equipment Active Driving Assistant (SA 5AS) and without the optional equipment Active Cruise Control with Stop&Go function (SA 5DF) as well as without the optional equipment Active Driving Assistant Professional (SA 5AU) — receive the camera-based Front collision mitigation/Daytime Pedestrian Protection functions.
- The camera-based Front collision mitigation/Daytime Pedestrian Protection functions are realized using the KAFAS Mid camera. The KAFAS Mid camera captures the setting in front of the vehicle and based on the calculated positions, distances and relative speeds of the potential collision objects issues the corresponding warning levels.
  *The maximum attainable drop in speed by the brake intervention is roughly 50 km/h.

- Vehicles which have the optional equipment Active Cruise Control with Stop&Go function (SA 5DF) and without the optional equipment Active Driving Assistant Professional (SA 5AU), receive a KAFAS Mid camera as well as the front radar sensor (FRS).
  The activation of the warning levels is primarily effected based on the data of the front radar sensor (FRS). In addition, the data of the KAFAS Mid camera is used for the plausibility check of stationary objects.
  *The maximum attainable drop in speed by the brake intervention is roughly 60 km/h.

- Vehicles with the optional equipment Active Driving Assistant Professional (SA 5AU) have a KAFAS High camera and a front radar sensor long range (FRSF).
  Here the warning levels are mainly activated based on the data of the front radar sensor long range (FRSF). In addition, the data of the KAFAS High camera is used for the plausibility check of stationary objects.
  *The maximum attainable drop in speed by the brake intervention is roughly 80 km/h.

*The actual maximum drop in speed by the brake intervention is largely dependent on the situation (e.g. by the quality of the road surface).

Note:

Deviations from the aforementioned sensor assignment are possible depending on the different optional equipment / vehicle models, as well as the national-market versions.

Functional enhancement of Daytime Pedestrian Protection:

Daytime Pedestrian Protection now also takes cyclists into consideration with the introduction of the vehicle electrical system Service Pack 2018 for a G05 or G15.

The Front collision mitigation function is dependent on the vehicle's own driving speed. The distance measured for the Front collision mitigation function is significantly lower than the legally required minimum distance. It is therefore the responsibility of the driver to adhere to the legal minimum distance.

Due to functional limitations and system restrictions it may transpire that warnings and orders are not issued, are issued too late or are unwarranted. Therefore, be attentive in order to be able to actively intervene at any time. Otherwise, there is a risk of an accident.

Driver Assistance Systems 2018

4. Collision/Pedestrian Warning

Daytime Pedestrian Protection does not relieve the driver of his responsibility to adapt the speed and driving style to the traffic conditions.

Driver Assistance Systems 2018

5. Intersection Collision Warning

The Intersection collision warning is extended with the city braking function with the introduction of the vehicle electrical system Service Pack 2018. An automatic brake intervention is also effected for the first time if an acute warning was previously issued.

The supporting brake intervention is realized in a speed range from approximately 10 km/h to 80 km/h. The force of the brake intervention is adjusted depending on the situation.

Intersection collision warning

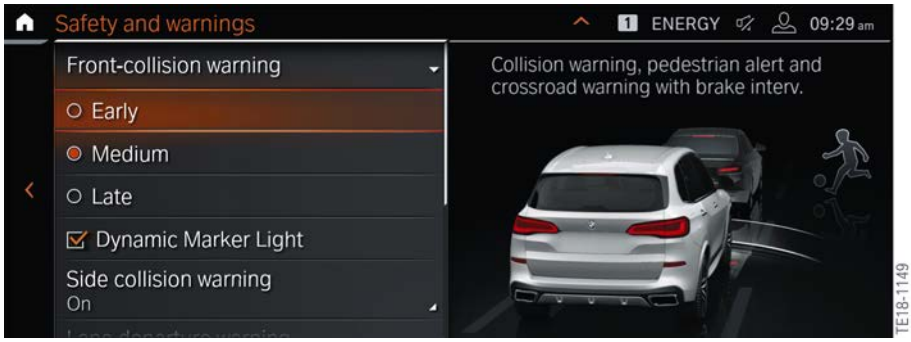
As an extremely exact environment detection is required for this function, the data of the KAFAS High camera, the front radar sensor long range (FRSF), as well as the side radar sensors short range front right and front left, is evaluated.

Apart from the acute warning, the Intersection collision warning now also has an advance warning. This allows the driver to be able to respond to a critical situation in advance.

The warning time of the Intersection collision warning with city braking function can be adjusted together with the Front collision mitigation and Daytime Pedestrian Protection functions in the iDrive menu. The range of adjustment was summarized under the submenu item "Front collision warning".

Driver Assistance Systems 2018

5. Intersection Collision Warning



Adjust warning time "Front collision warning" (example of G05)

A setting can be made in the iDrive menu as follows:

- "CAR"
- "Settings"
- "Driver assistance"
- "Safety and warnings"
- "Front collision warning"

The configuration menu "Safety and warnings" can also be accessed quickly by pressing the Intelligent Safety button.

The Intersection collision warning with city braking function is part of the optional equipment Active Driving Assistant Professional (SA 5AU).

The Intersection collision warning with city braking function does not relieve the driver of personal responsibility for correctly judging the visibility and traffic situation. The driver's driving style should be adapted to the traffic conditions. The driver should check the traffic conditions and react accordingly if required.

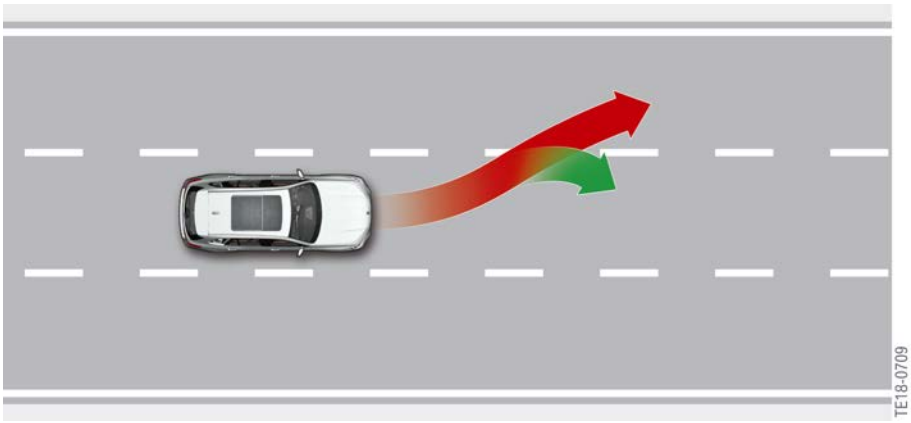
Driver Assistance Systems 2018

6. Lane Departure Warning

The Lane Departure Warning is an element of the standard equipment Active Driving Assistant (SA 5AS) and the optional equipment Active Driving Assistant Professional (SA 5AU).

With the introduction of the vehicle electrical system Service Pack 2018, a steering intervention is now possible if the vehicle is equipped with the standard equipment Active Driving Assistant (SA 5AS). In Service Pack 2015 vehicles, the optional equipment Active Driving Assistant Plus (SA 5AT) was required to initiate steering intervention.

The steering intervention ensures the vehicle is returned to its own lane if necessary.



G05 Lane Departure Warning (active steering intervention)

Driver Assistance Systems 2018

7. Evasion Assistant

The Evasion Assistant is now a component of the new optional equipment Active Driving Assistant Professional (SA 5AU).

With the introduction of the vehicle electrical system Service Pack 2018, pedestrians are now also considered for the first time. The system also provides support when a pedestrian or cyclist must be avoided.

The Evasion Assistant does not release the driver from his full responsibility as the driver. There can be functional limitations because of system restrictions.

Driver Assistance Systems 2018

8. Emergency Stop Assistant

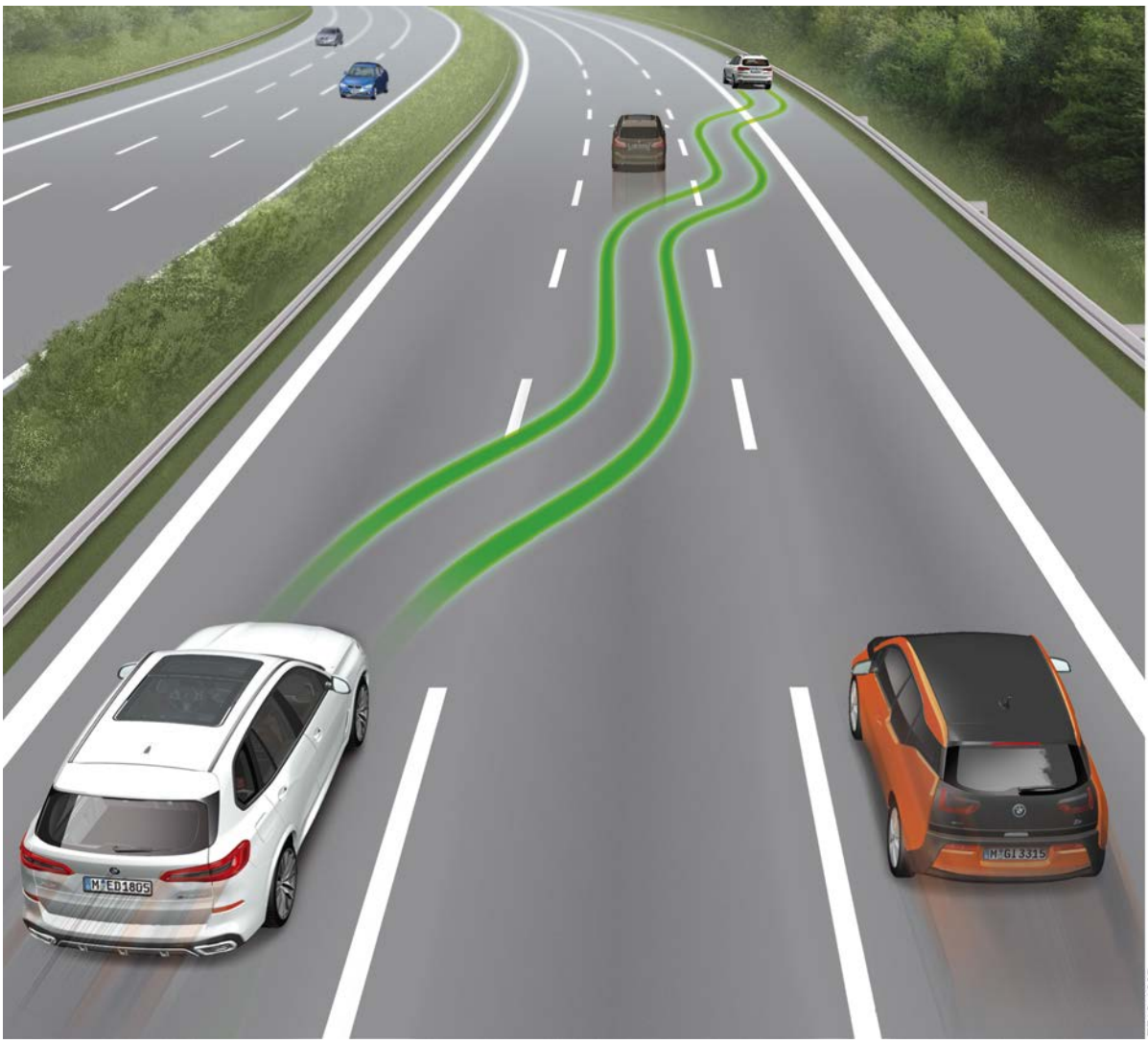
It is a situation which is gladly ignored and not talked about but can happen to anyone. "The driver suffers a blackout at the wheel during the journey".

In this worst case scenario the driver (if possible) can access the Emergency Stop Assistant in order to safely stop the vehicle within the framework of the system limits. Other passengers in the vehicle also have the option to press the Emergency Stop Assistant if needed.

The Emergency Stop Assistant is a component of the optional equipment Active Driving Assistant Professional (SA 5AU) and is used for the first time with the vehicle electrical system Service Pack 2018.

8.1. Operating principle

After manual activation, the Emergency Stop Assistant assumes both the longitudinal and lateral guidance in order to bring the vehicle into a safe state.



G05 Emergency Stop Assistant

8. Emergency Stop Assistant

The assumption of the longitudinal and lateral guidance by the system is restricted to a maximum of approximately 2 minutes.

The characteristics of the lateral guidance are very different depending on the country. While in one version the Emergency Stop Assistant only keeps the vehicle in the lane and introduces a deceleration until the vehicle comes to a standstill, there is another version which also performs an Automatic Lane Change in order to safely stop the vehicle on the hard shoulder or emergency lane.

A possible Automatic Lane Change is realized in a speed range from approximately 70 km/h to 100 km/h.

After activation* of the system via the electromechanical parking brake button, first the hazard-warning lights are automatically activated. At the same time, the emergency call (eCall) is activated via the TCB. Within the first 7 seconds after placing the emergency call there is the option to cancel the call by one of the passengers.

*An activation of the Emergency Stop Assistant is possible from a speed of approximately 10 km/h.

In addition, the environment is interpreted by the vehicle sensor system and a control strategy is calculated using this data – before a possible Automatic Lane Change is effected and the vehicle is stopped by the system.

After the vehicle has decelerated to a standstill, the selector lever position P is automatically engaged, the electromechanical parking brake is activated and the central locking system is unlocked. The interior lighting is also automatically switched on and the hazard-warning lights are still active in order to warn vehicles behind.

The switched-on interior lighting also ensures that other road users can better detect the situation of the driver and if necessary perform first aid.

When the vehicle comes to a standstill the Auto Start/Stop function is suppressed in order to continue to guarantee both the function of the air conditioning and the front and rear seat heating. The parameters previously set by the driver remain unchanged.

During the maneuver the vehicle electrical power system is preconditioned in order to guarantee maximum availability.

8.1.1. Control strategies

The following three control strategies are implemented:

- Bring the vehicle to a standstill at the right edge of the roadway (right-hand traffic).
- Bring the vehicle to a standstill in its own lane.
- Bring the vehicle to a standstill without crosswise direction requirement.

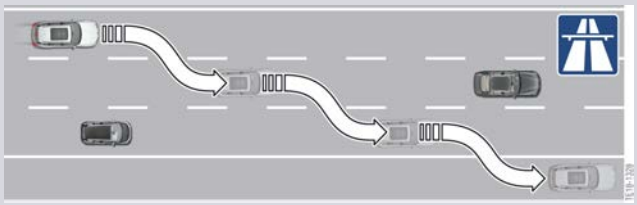
Control strategies on highways

The following graphics show the control strategies on highways with right-hand traffic:

Driver Assistance Systems 2018

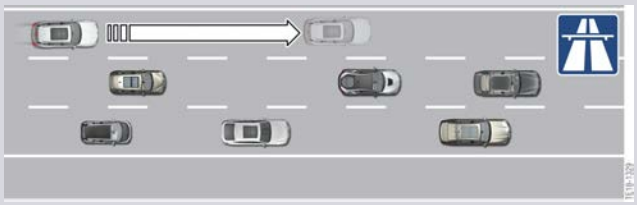
8. Emergency Stop Assistant

The vehicle is decelerated in a controlled manner and an Automatic Lane Change occurs. The vehicle comes to a standstill on the hard shoulder or emergency lane.



Less travelled highway with detected lane boundaries

The vehicle is decelerated in a controlled manner and comes to a standstill in the lane in which it is located.



Heavily travelled highway with detected lane boundaries

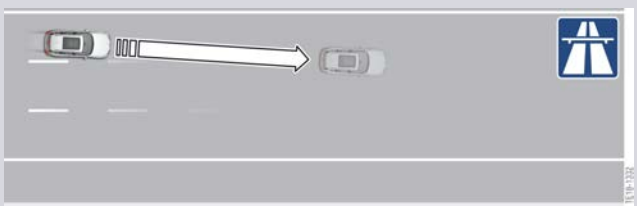
The vehicle is decelerated in a controlled manner and comes to a standstill in the lane.

Heavily travelled highway without detected lane boundaries

The vehicle is decelerated in a controlled manner and comes to a standstill in the lane.

Less travelled highway without detected lane boundaries and with detected vehicle in front

The vehicle is decelerated to a standstill.



Less travelled highway without detected lane boundaries and without detected vehicle in front

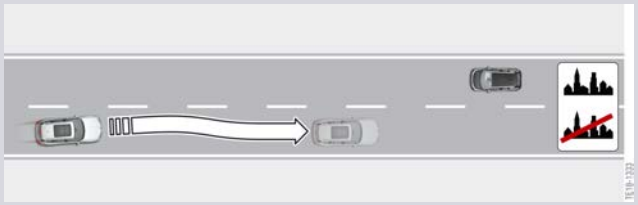
Driver Assistance Systems 2018

8. Emergency Stop Assistant

Control strategies on main roads and in the city

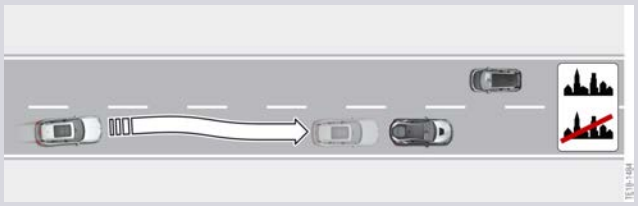
The following graphics show the control strategies on main roads as well as in the urban environment with right-hand traffic:

The vehicle is decelerated in a controlled manner and comes to a standstill in the lane in which it is located.



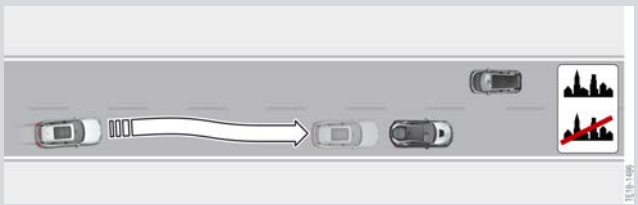
Main road and city with detected lane boundaries

The vehicle is decelerated in a controlled manner and comes to a standstill in the lane in which it is located.



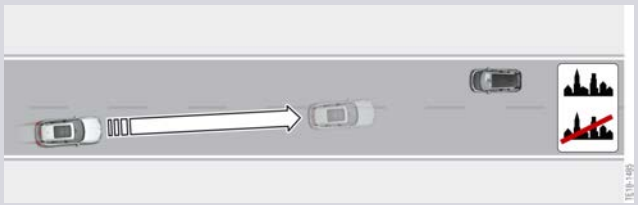
Main road and city with detected lane boundaries and with vehicle detected in front

The vehicle is decelerated in a controlled manner and comes to a standstill in the lane in which it is located.



Main road and city without detected lane boundaries and with vehicle detected in front

The vehicle is decelerated to a standstill.



Main road and city without detected lane boundaries and without vehicle detected vehicle in front

As already mentioned, the control strategy is also dependent on the national-market version of the vehicle.

8.1.2. Country-specific operating principle

The Emergency Stop Assistant is available in the USA, Canada and China. The assistant is not available in other countries initially due to a legal restriction. This means the Emergency Stop Assistant is not offered, e.g. for the European market.

Operating principle in the USA and Canada:

After pressing the button for the electromechanical parking brake, the vehicle is decelerated in a controlled manner and an Automatic Lane Change* is introduced in order to decelerate the vehicle to a standstill on the hard shoulder.

*If this is possible within the framework of the system limits and if the evaluated data of the environment detection is positive (no obstacle detected).

8.2. Deactivation criteria

After the Emergency Stop Assistant is activated the maneuver introduced is automatically deactivated in the following situations:

- The electromechanical parking brake button is pressed again
- The accelerator pedal is operated
- The driver or front passenger intervenes in the steering
- The turn indicator is used
- The function is cancelled in the iDrive menu by a passenger
- A drive position change is carried out by the driver when the vehicle is at a standstill.

Driver Assistance Systems 2018

9. Cruise Control

9.1. Active Cruise Control with Stop&Go function.

With the optional equipment Active Cruise Control with Stop&Go function (SA 5DF), the new front radar sensor (FRS) is used with the vehicle electrical system Service Pack 2018. The adjustment range for the set speed is limited to a maximum of **160 km/h** with this optional equipment. This was implemented as the front radar sensor (FRS) has a lower range in a direct comparison with the front radar sensor long range (FRSF).

In vehicles with the optional equipment Active Driving Assistant Professional (SA 5AU) the set speed is limited as before to maximum **180 km/h**.

9.2. Speed Limit Assistant

Speed Limit Assistant is introduced to the US market with Service Pack 2018. The range of functions of the Speed Limit Assistant is available for the following systems depending on the vehicle equipment:

- Active Cruise Control with Stop&Go function (SA 5DF)
- Active Driving Assistant Professional (SA 5AU).

With Speed Limit Assistant the speed limit can be adopted, after driver confirmation, as the new set speed when the cruise control is activated.

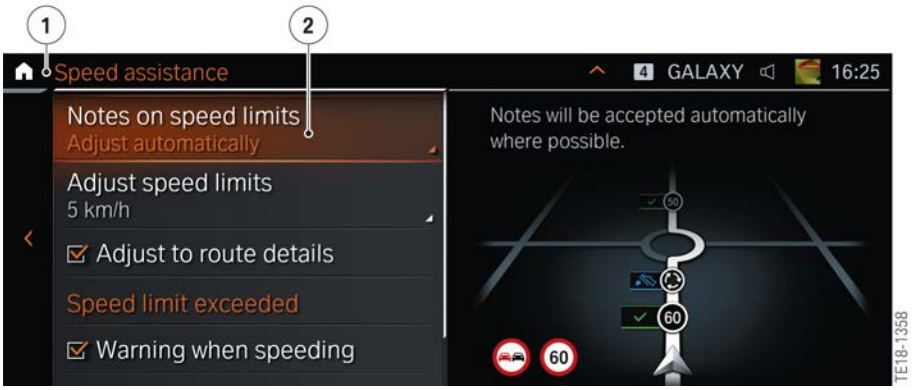
Manual adoption of the speed limit (as indicated by Speed Limit Info) is executed by pressing the “SET button” on the multifunction steering wheel (MFL).

Displays in the instrument cluster when Speed Limit Assistant is activated (automatic and manual)

Index	Explanation
A	Speed Limit Assistant suggested speed adopted
B	Speed Limit Assistant suggested speed available
1	Speed limit is confirmed by pressing the SET button on the MFL
2	Speed limit
3	Speed limit available to be adopted by pressing the SET button on the MFL

9. Cruise Control

Manual adoption of the upcoming speed limit must be activated in the iDrive menu and can also be configured and deactivated in the same place. Manual adoption is executed by pressing the "SET button" on the multifunction steering wheel (MFL). **Automatic** adoption of the upcoming speed limit is not available for the US market.



G05 settings menu, speed assistance in the CID: Speed Limit Assistant

Index	Explanation
1	Settings menu: "Speed Limit Assistant"
2	Speed Limit Assistant switched on

Speed Limit Assistant can be set in the iDrive menu under the following menu items:

- "Settings"
- "Driver assistance"
- "Driving"
- "Speed Limit Assist"

The speed assistance systems do not relieve the driver of personal responsibility for correctly judging visibility and the traffic situation. The driver is solely responsible for the vehicle and the speed at which it is driven.

Driver Assistance Systems 2018

10. Automatic Parking

Automatic Parking was previously known as Parking Maneuvering Assistant (PMA). The control module is still referred to as PMA in technical systems.

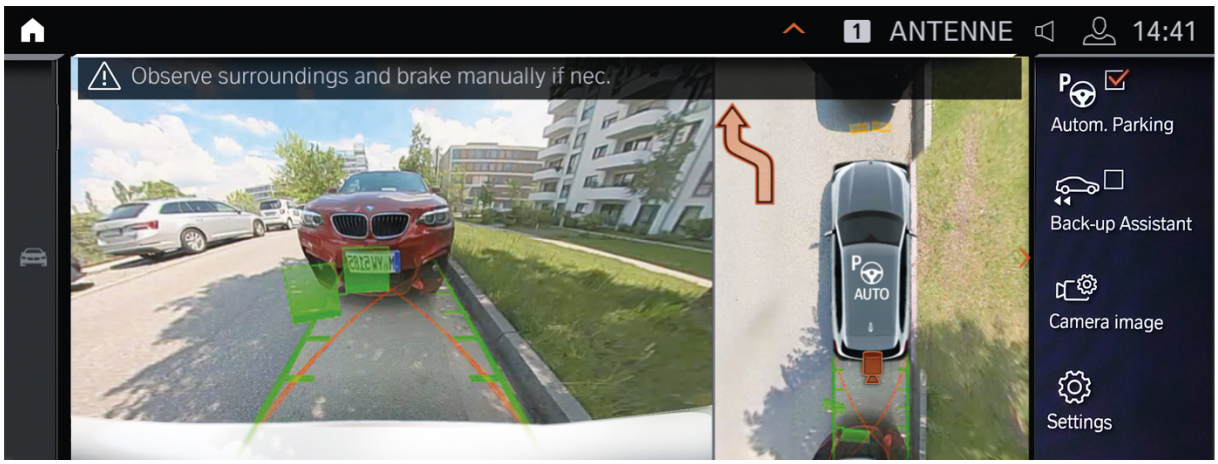
Automatic Parking is included in the optional equipment Parking Assistant Plus (SA 5DN). Until now, the driver was only able to use the system to park the vehicle.

With the introduction of the vehicle electrical system Service Pack 2018, the driver also has the option to use Automatic Parking when leaving the parking space.

Another new feature is the deletion of the "deadman function" for Automatic Parking. This means that the driver does not have to hold down the parking assistance button during the parking maneuver as before. It is sufficient to press the button once to perform Automatic Parking.

10.1. Maneuvering out of a parking space

The parking space exit function is available for parking spaces which are parallel to the roadway (parallel parking).



G05 view, parking space exit function in the CID (leaving parking space by means of Automatic Parking)

A completely automatic leaving parking space maneuver is not realized here.

The system assumes acceleration, braking and steering until the vehicle comes to a stop in such a way that it can be driven by the driver out of the parking space without further steering wheel movement. The necessary drive position changes and switching on the turn indicator are likewise performed by the PMA. The LED lights of the multifunction steering wheel light up green here.

A number of functional requirements must be met to enable Automatic Parking to maneuver out of the parking space automatically:

- The vehicle must have been maneuvered into the parking space with Automatic Parking beforehand
- An obstacle must be detected in front of the vehicle
- The parking space must be at least 0.8 m longer than the vehicle.

10. Automatic Parking

The driver remains responsible for leaving the parking space and entering traffic.

10.2. Parking

Another new feature of Automatic Parking is the fully automatic implementation. The driver no longer has to continuously press the PMA button during the parking maneuver. A once-off activation suffices and the parking maneuver is performed fully automatically from start to finish. The driver also no longer has to activate the turn indicator, it is automatically activated.

The driver still remains responsible for parking in a parking space.

10.3. Deactivation criteria

Automatic Parking is switched off automatically when the following events occur:

- the driver holds on to the steering wheel or steers himself
- a gear is selected that does not correspond to the instruction on the Central Information Display
- when accelerating
- the parking brake is secured
- the turn indicator opposite the required parking side is switched on
- at speeds above approximately 10 km/h
- possibly on snow-covered or slippery roads
- the tailgate is open
- possibly if there are objects which are difficult to overcome, e.g. curbs
- if obstructions suddenly appear
- a maximum number of parking maneuvers or the parking duration has been exceeded.

Automatic Parking cannot replace the driver's personal judgement of the traffic situation. Also check the traffic situation around the vehicle by looking around, otherwise there may be a risk of an accident as a result of road users or objects which lie outside the detection range of the Park Distance Control. Loud sound sources outside and inside the vehicle may mask the acoustic signals of the Parking Maneuvering Assistant (PMA) or the Park Distance Control (PDC).

Driver Assistance Systems 2018

11. Back-up Assistant

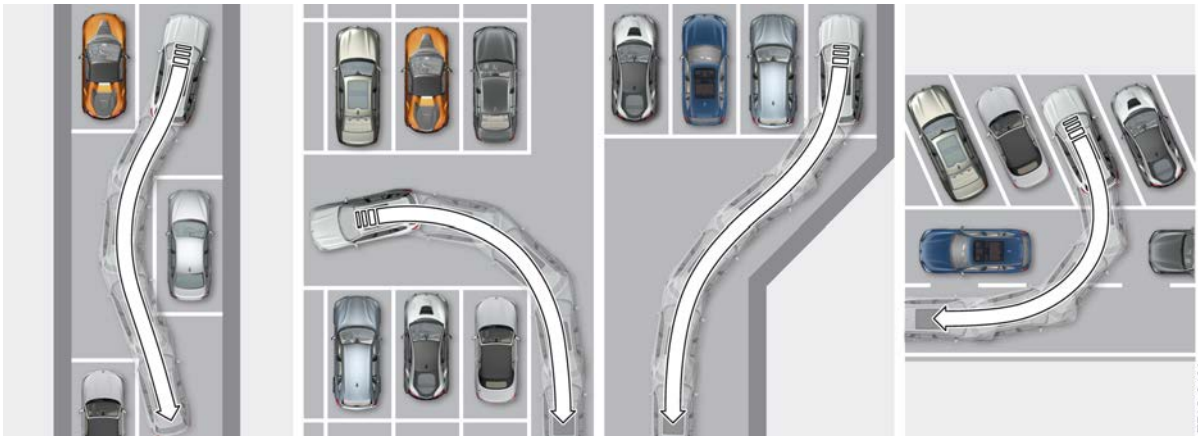
The Back-up Assistant is a component of the optional equipment Parking Assistant Plus (SA 5DN).

The assistant supports the driver when reversing, e.g. from entrances, streets or in multi-story parking garages. The Back-up Assistant assumes the lateral guidance and the driver is responsible for the longitudinal guidance and can concentrate on the surrounding area.

11.1. Operating principle

The Back-up Assistant stores the distance travelled and the steering wheel movements made before the vehicle is parked. This is performed automatically under a speed of approximately 35 km/h for the last 50 meters covered in the forward direction.

After the Back-up Assistant is activated, the vehicle assumes lateral guidance for the stored distance covered. The LED displays on the multifunction steering wheel light up green in the process.



Back-up Assistant (examples of possible applications)

The driver is relieved of the steering effort and can thus fully concentrate on monitoring the surrounding area of the vehicle.

During the automatic steering wheel movements the driver receives feedback from the LED displays on the multifunction steering wheel.

The driver remains responsible for the longitudinal guidance. The speed of the vehicle may be no higher than walking speed, otherwise the Back-up Assistant is deactivated.

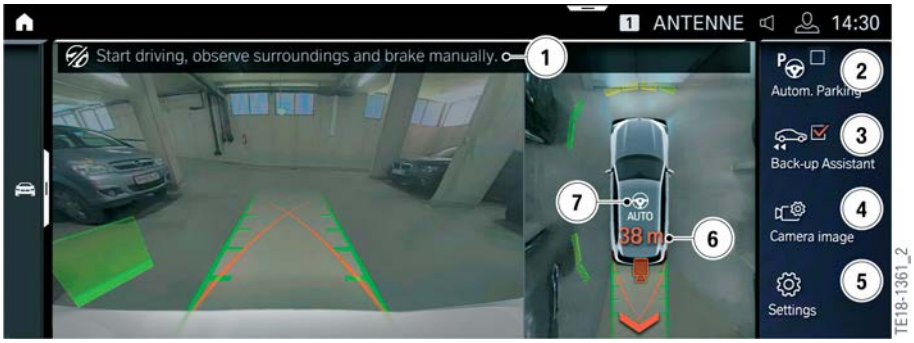
Another prerequisite for using the Back-up Assistant is the consideration of the lane width. This must be approximately a minimum of 30 cm wider than the actual vehicle.

The driver himself remains responsible for accelerating and braking. A change of environment after the distance covered is stored, for example due to a changed parking position of a different vehicle, is not taken into consideration. The driver is thus responsible for monitoring the vehicle environment and must brake or if necessary steer himself accordingly.

After the activation of the Back-up Assistant in the iDrive menu the driver is shown support notes on the Central Information Display (CID). For example, the remaining distance is displayed during the automated reversing maneuver.

Driver Assistance Systems 2018

11. Back-up Assistant



View of Back-up Assistant on the Central Information Display

Index	Explanation
1	Instructions
2	Selection option: "Automatic Parking"
3	Selection option: "Back-up Assistant"
4	Settings menu: "Camera picture" (brightness and contrast)
5	Settings menu: "Parking and maneuvering"
6	Visualization: Remaining distance
7	Visualization: Vehicle assumes lateral guidance

The function menu "Parking" in the Central Information Display (CID) can be called up by pressing the Park Assist button.

Driver Assistance Systems 2018

12. Automatic Lane Change

The G05 introduces the Automatic Lane Change function to the US market. Automatic Lane Change supports the driver when changing lanes, for example when passing on highways. The system offers the driver further convenience with this and can contribute to avoiding possible collisions with another vehicle travelling in the same direction.

If the driver has activated the system and the destination lane is free, the vehicle automatically carries out a steering wheel movement and returns to lane guidance (Steering Assistant) after the lane change is completed.

The system assists the driver in the speed range from approximately 70 km/h to approximately 180 km/h.

12.1. Functional principle

Automatic Lane Change is activated if the driver operates the turn indicator **("one-touch signalling" and holds it for approximately 1 second)** with Steering Assistant activated. This signals to the system that the driver would like to change to the adjacent lane with system support.

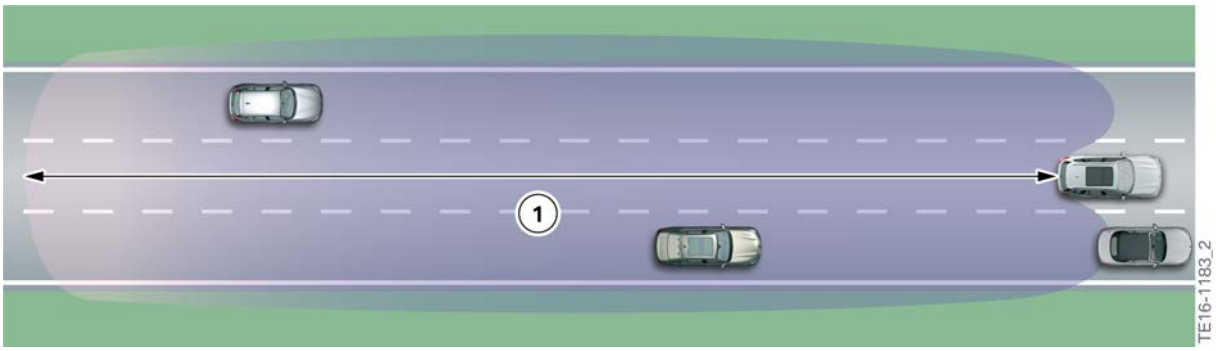
First the system analyzes whether a danger-free lane change is possible, and also whether sufficient room for the maneuver is available. The surroundings are monitored by the side radar sensors and the data from the KAFAS camera. The KAFAS camera is principally used for lane detection.

The radar sensors are not only responsible for the detection of an object, but are also able to take into consideration the speed of vehicles detected nearby.

12.1.1. Monitoring ranges

The monitoring ranges for the radar sensors are as follows:

Sensor monitoring range for vehicles behind the vehicle



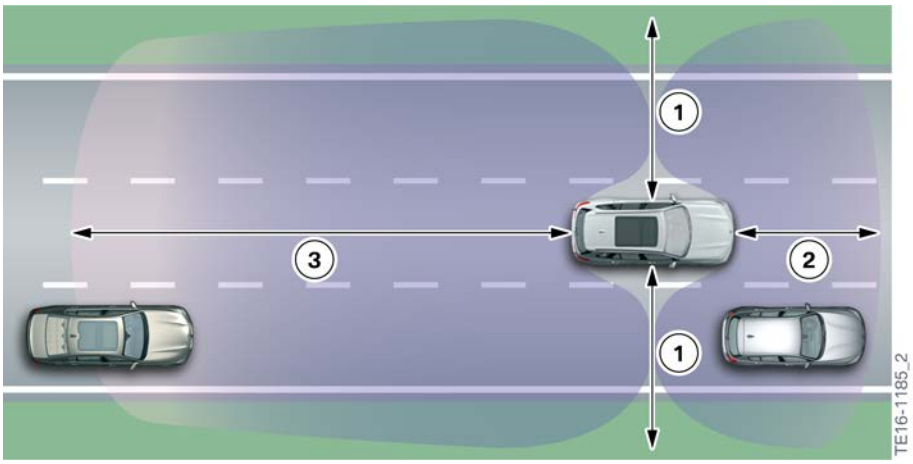
G05 sensor monitoring range for vehicles behind the vehicle

Index	Explanation
1	approximately 70 m

Driver Assistance Systems 2018

12. Automatic Lane Change

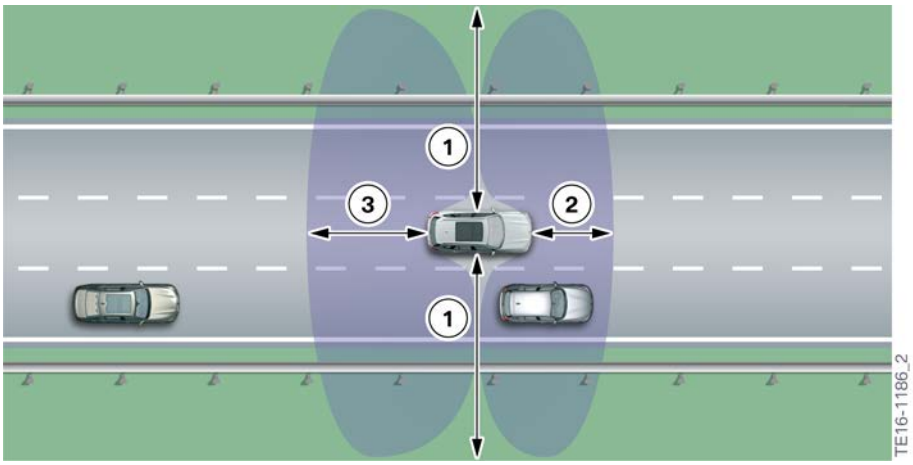
Sensor monitoring range for vehicles to the sides



G05 sensor monitoring range for vehicles to the sides

Index	Explanation
1	approximately 6 m
2	approximately 4.5 m
3	approximately 5 m to approximately 15 m (depending on the road speed)

Sensor monitoring range for stationary objects (roadside structures) to the sides



G05 sensor monitoring range for stationary objects (roadside structures) to the sides

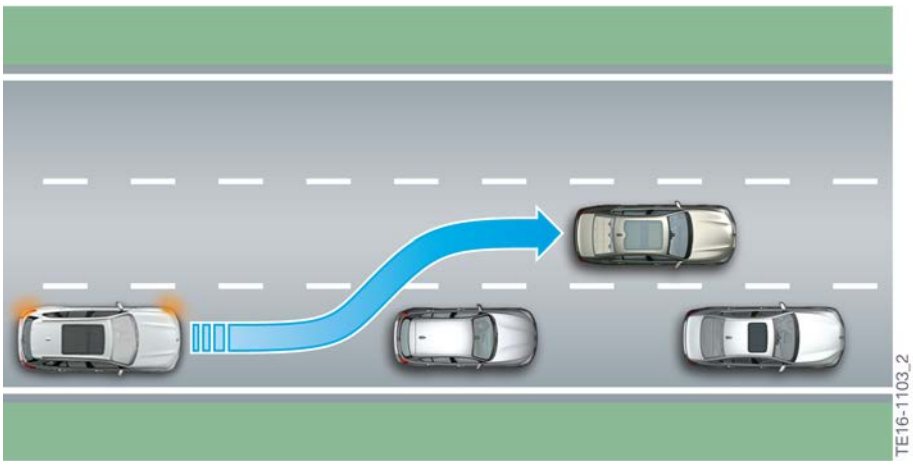
Index	Explanation
1	approximately 10 m
2	approximately 4 m
3	approximately 6 m

Driver Assistance Systems 2018

12. Automatic Lane Change

The vehicle performs the lane change automatically if the sensor system does not detect any vehicles in the relevant safety zone and if there is sufficient room for maneuvering available. It is of no importance whether the vehicle lane change is for passing purposes or whether the driver is simply wishing to change lanes.

The direction of the lane change is determined by the turn indicator which has been previously set.



G05 Automatic Lane Change

The driver merely has to monitor the lane change. This **does not**, however, mean that he is released from his duties as a driver. For instance, the driver is also obliged to check whether a lane change is permissible at all, and has to take account of passing restrictions, solid lines, etc. Automatic Lane Change does not take these circumstances into consideration.

Once the change to the adjacent lane is complete, the vehicle returns to lane guidance (Steering Assistant).

The lane change maneuver will be aborted if, once it has started, the turn indicator lever is released too soon (less than approximately 1 second), a Blind Spot Collision Warning warning is issued or an object is detected to the side of the vehicle. If the lane change maneuver is automatically cancelled before the vehicle has crossed the lane marker, the vehicle is guided back into the original lane.

The driver has full responsibility for the lane change maneuver, including checking that the destination lane is free.

The maximum steering torque has been set in such a way that it can always be overruled by the driver and therefore steering past the maximum steering torque is possible. This means that the driver has the capability at all times to abort the automatic lane change.

Driver Assistance Systems 2018

12. Automatic Lane Change

12.2. Operation

Automatic Lane Change is activated if the driver operates the turn indicator **("one-touch signalling" and holds it for approximately 1 second)** with Steering Assistant activated. A special precondition or individual configuration option for the system is not provided.

Displays in the instrument cluster (KOMBI)

Symbols	Explanation
	Steering wheel symbol and lane marker on right side is green. The left lane marker is grey. The green arrow indicates direction of Automatic Lane Change. • Request to change to left lane detected.
	Steering wheel symbol and lane marker on left side is green. The right lane marker is grey. The green arrow indicates direction of Automatic Lane Change. • Request to change to right lane detected.

Automatic Lane Change cannot replace the driver's personal judgement of the traffic situation. Therefore, check the traffic situation around the vehicle by looking around, otherwise there may be a risk of an accident as a result of road users or objects which lie outside the detection range of the sensors. Approaching vehicles can be detected too late or not at all because of the limits inherent in the system. Automatic Lane Change does not release the driver from his own responsibilities.

12. Automatic Lane Change

12.3. Functional prerequisites

The following basic prerequisites must be met to use Automatic Lane Change:

- Steering Assistant is active.
- The vehicle is traveling on a divided highway.
- The turn indicator lever is held in the “one-touch signalling position” for approximately 1 second.
- The driving lane line to be crossed has been detected.
- “Hands-on” (hands on the steering wheel) must be detected at the start of the maneuver.
- Blind Spot Collision Warning is active and not issuing a warning.
- No vehicles have been detected in the maneuvering space to the side of the vehicle.
- No stationary objects (such as roadside structures, posts, etc.) have been detected in the maneuvering space to the side of the vehicle.
- The vehicle is travelling at a speed between approximately 70 km/h and approximately 180 km/h.

12.4. Deactivation criteria

Automatic Lane Change is automatically deactivated in the following situations:

- Automatic Lane Change is no longer executed if the trigger conditions are not met within approximately 10 seconds from the start of the turn indication.
- Automatic Lane Change will be aborted if, once a lane change maneuver has started, the turn indicator lever is released too soon (less than approximately 1 second), a Blind Spot Collision Warning is issued or an object is detected to the side of the vehicle.
- Automatic Lane Change is also aborted if the driver steers opposite to the steering torque applied by the system.
- If the lane marker on the other side of the destination lane is not detected in sufficient time after passing over the lane marking to be crossed.