Reference Manual

F10
COMPLETE VEHICLE

Technical Training

F10 Introduction

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1002 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: **December 2009**

F10 Introduction
Contents

F10 Introduction

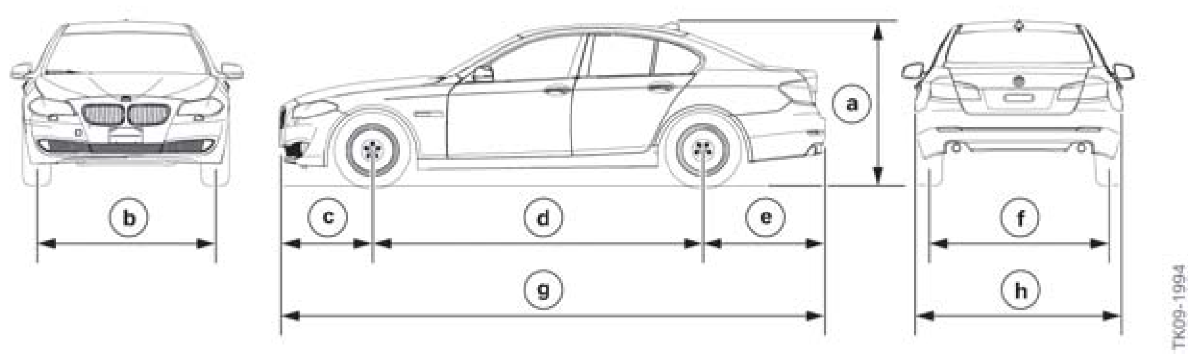
1. Introduction

1.1. The new BMW 5 Series Saloon

The F10 5 Series was introduced in to the US market in March of 2010. The vehicle is available in 528i, 535i and 550i models.

BMW 5 Series Sedan

1.1.1. Dimensions



BMW 5 Series Sedan, exterior dimensions

Index	Explanation
a	Vehicle height, empty (1464 mm)[1]
b	Track width of basic wheels, front (1600 mm)
c	Overhang, front (832 mm)
d	Wheelbase (2968 mm)

1. Introduction

Index	Explanation
e	Overhang, rear (1099 mm)
f	Track width of basic wheels, rear (1627 mm)
g	Vehicle length (4899 mm)
h	Vehicle width without exterior mirrors (1860 mm)

[1] With roof-mounted antenna: 1475 mm.

Comparison of F10 with the E60

		F10	E60
Vehicle height, empty	[mm]	1464	1467
Track width, front	[mm]	1600	1558
Overhang, front	[mm]	832	856
Wheelbase	[mm]	2968	2888
Overhang, rear	[mm]	1099	1111
Track width, rear	[mm]	1627	1582
Vehicle length	[mm]	4899	4855
Vehicle width without exterior mirrors	[mm]	1860	1846
Vehicle width over exterior mirrors	[mm]	2094	2030
Turning circle Ø (at vehicle kerb weight)	[m]	11.95	11.4
Shoulder room, front	[mm]	1480	1455
Shoulder room, rear	[mm]	1427	1454
Elbow room, front	[mm]	1518	1485
Elbow room, rear	[mm]	1485	1496
Maximum headroom, front (without slide/tilt sunroof)	[mm]	1028	1028
Maximum headroom, front (with slide/tilt sunroof)	[mm]	992	992
Maximum headroom, rear (without slide/tilt sunroof)	[mm]	973	967
Maximum headroom, rear (with slide/tilt sunroof)	[mm]	965	955
Luggage compartment capacity	[liters]	520	520

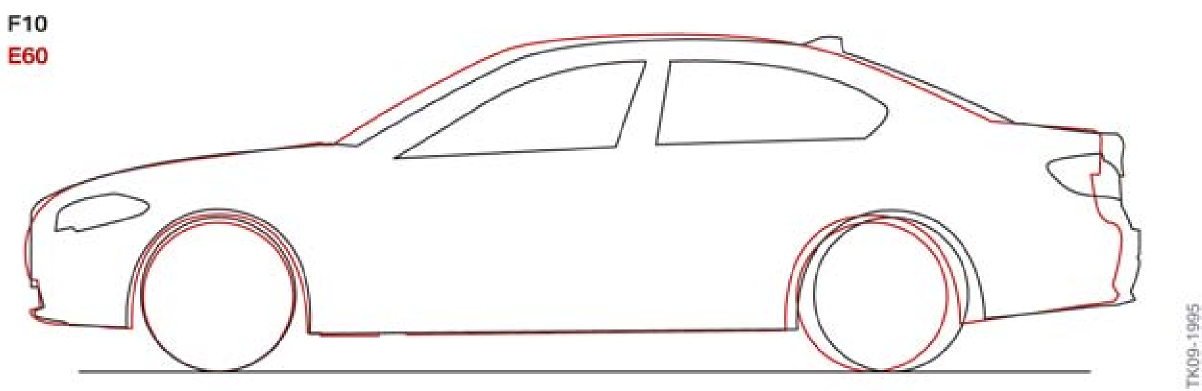
Weight and payload

Refer to the following table for the weight and payload of the F10 with automatic transmission according to the German Standardization Institute (DIN).

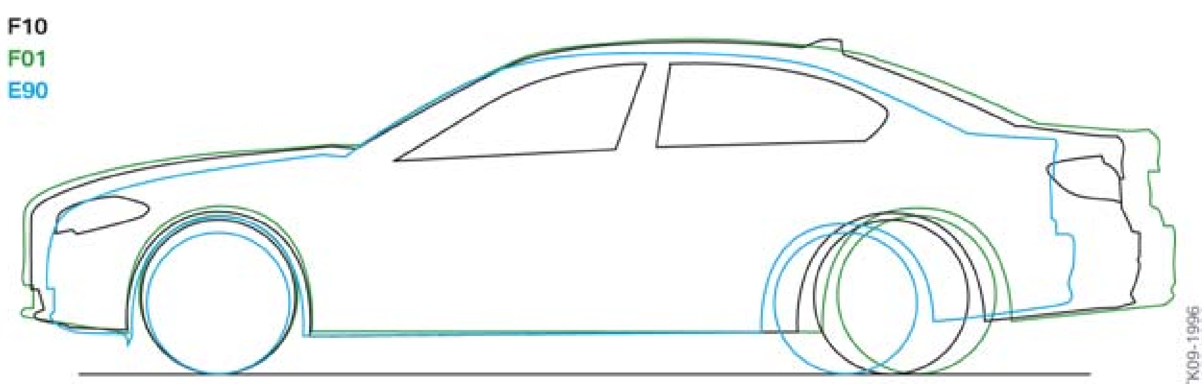
F10 Introduction
1. Introduction

Vehicle	Vehicle curb weight (DIN)	Payload
F10 528i	1730 kg/3814 lb	480 kg/1058 lb
F10 535i	1855 kg/4090 lb	480 kg/1058 lb
F10 550i	1985 kg/4376 lb	450 kg 992 lb

1.1.2. Silhouette comparison



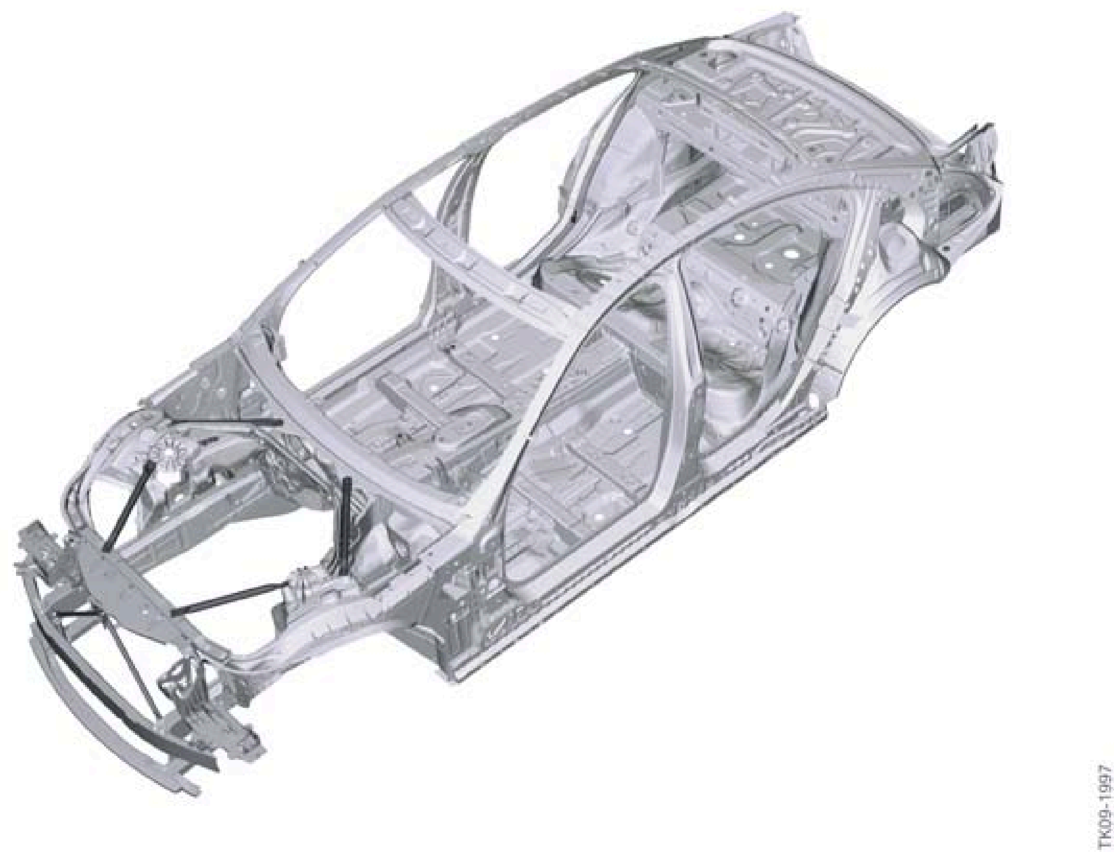
F10 Silhouette comparison with BMW 5 Series Sedan E60



F10 Silhouette comparison with BMW 7 Series Sedan F01 and BMW 3 Series Sedan E90

2. Body

2.1. Bodyshell



F10 Bodyshell (body in white)

2.1.1. Introduction

As with other models, the use of lightweight materials was a major requirement in the F10 design. This involves the intelligent deployment of increased-strength multiphase steels and super high strength (press hardened) steels. In the F10, the average strength of the body materials has increased by 55% compared to the E60.

The lightweight materials contribute significantly to the overall reduction in vehicle weight, and in combination with the rigidity of the body structure.

The lightweight materials used on the F10 body structure contribute directly to its:

- Driving Dynamics
- Reduction of fuel consumption
- Reduction of CO_2 emissions
- Passive safety

2. Body

Weight saving features of the F10 bodyshell

- Strut towers are made of die-cast aluminum
- High proportion of multiphase steels (20 % of the body skeleton weight)
- High proportion of hot-formed steels (14 % of the body skeleton weight)

The die-cast aluminum strut towers reinforce the front section by ensuring the necessary rigidity that the component design requires to withstand the loads. Compared to a conventional steel-shell structure, the more compact design has significantly reduced the installation space and the weight in the front section. This provides a more uniform axle-load distribution, among other benefits.

The increased-strength multiphase steels and super high strength hot-formed steels combine low weight with maximum strength for the safety passenger cell, thus contributing significantly to passive safety.

For hot-formed steels, an innovative further development known as passive corrosion protection is used. Previously, no suitable hot-formed sheet metal materials with cathodic corrosion protection had been available on the market. With the development of press-hardening, a method is now available that enables mass production of galvanized hot-formed components. The components fabricated in this way can be used in the wet area without corrosion of the base material. There is no need for additional corrosion protection measures for this steel.

2.1.2. Materials

A modern vehicle body has to fulfill many different requirements. Despite small exterior dimensions, it is to provide the largest possible passenger compartment . In the event of an accident, it must provide the passengers with the best possible protection. All assemblies, such as the engine and transmission, are supported by the body against the torque they generate. Futhermore, the body must have high static and, above all, dynamic rigidity to guarantee the excellent driving characteristics typical of BMW vehicles.

In addition, the supporting structure of the vehicle must have high fatigue strength and be able to be repaired with reasonable effort and cost in the event of an accident.

To fulfill all these requirements, BMW applies a manufacturing strategy that produces each part from the material that is best suited for its function.

The two terms "aluminum" and "steel" are only the generic terms for the wide variety of alloys used in the construction of the body.

These different alloys have quite different properties.

F10 Introduction

2. Body

F10 Material qualities of the bodyshell

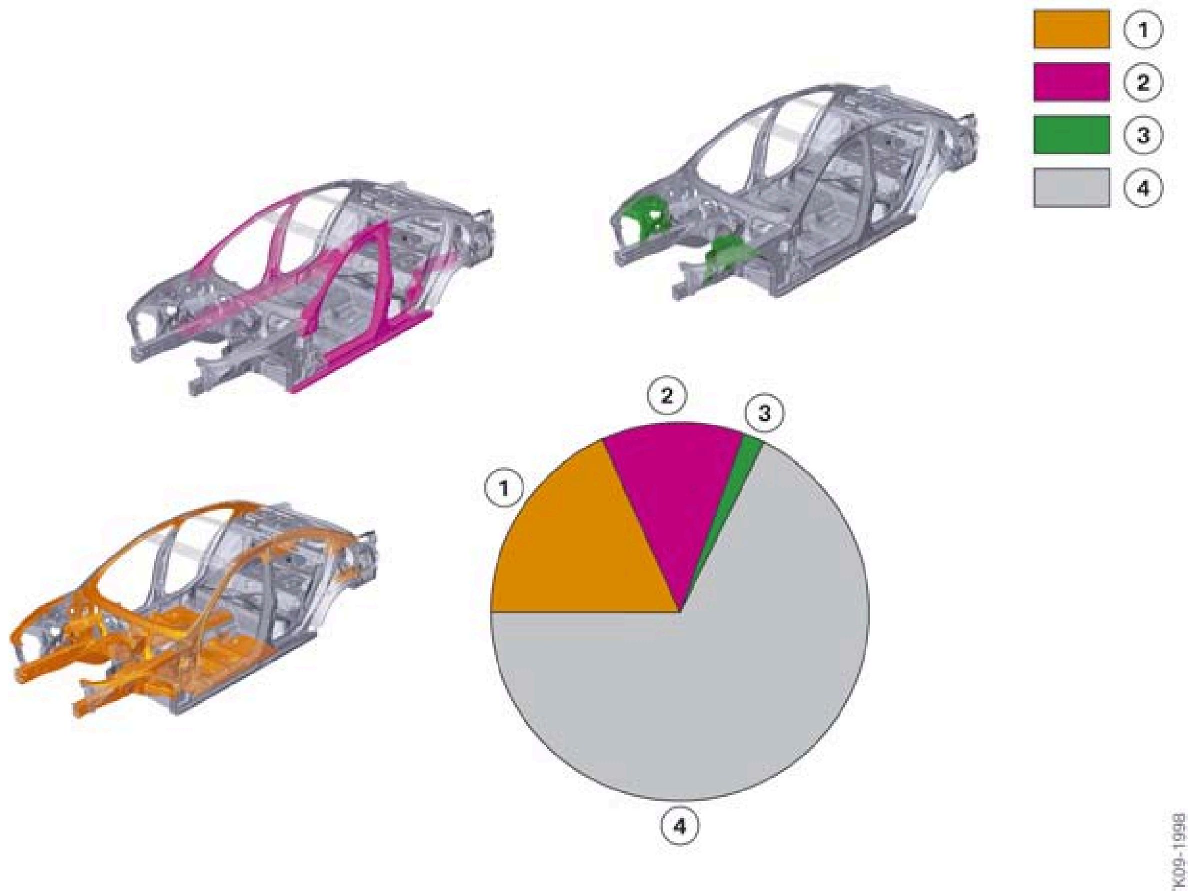
Index	Explanation
1	Multiphase steels (> 300 MPa)
2	Hot-formed steels (> 900 MPa)
3	Aluminum
4	Other steels (< 300 MPa)

Multiphase steels are steels with a structure that consists of multiple phases. Advanced-strength multiphase steels with a yield strength $R_{p0.2}$ of 300 to 600 MPa include, for example, dual-phase steels and TRIP steels. Advanced-strength multiphase steels with a yield strength $R_{p0.2}$ over 600 MPa include, for example, complex-phase steels and martensite-phase steels.

The hot-formed manganese-boron steels are ultra-high-strength steels with a yield strength $R_{p0.2}$ of over 900 MPa.

Weight proportions

The proportion of advanced-strength multiphase steels, super high strength hot-formed steels and aluminum is increasing. These measures decrease the vehicle weight while still guaranteeing maximum strength of the bodyshell.



F10 Bodyshell, distribution of the material qualities

Index	Explanation
1	Multiphase steels (> 300 MPa), proportion 20%
2	Hot-formed steels (> 900 MPa), proportion 12%
3	Aluminum, proportion 2%
4	Other steels (< 300 MPa), proportion 66 %

2.1.3. Corrosion protection and tightness

In order to optimize anti-corrosion protection, the body of the F10 is constructed primarily from galvanized sheet metal and aluminum or aluminum sandwich sheet metals. Welding, adhesive bonding and riveting are the assembly techniques used.

The overlaps of the panels are designed to minimize the joint surfaces, to prevent bondline corrosion. The penetration of water into the body structure is prevented in the design engineering of the vehicle by adhering and sealing the joint surfaces.

In particularly critical areas, expanding foam parts are used to seal the body cavities against moisture. Doubled up sheets in wet zones are double-sealed and, if necessary, they are also treated with wax to ensure a water tight seal.

If necessary, the overlaps of the panels in dry zones are sealed to prevent dust from getting inside.

Corrosion-critical material pairing is avoided. The combinations of material substrates and joining methods were chosen with meticulous care in order to avoid corrosion risks.

Coating process

In the painting process, the bodyshell is dipped and:

- Alkaline-cleaned
- Phosphated (roughening the surface for better adhesion)
- Cathodic-dip coated (anticorrosion coating that coats the insides of all body cavities).

The organic paint coat is then baked on.

Furthermore, the body is sealed with PVC and protected by filler, topcoat and clear coat paints on the outer skin.

Critical parts of the body of the F10 are specially treated with cavity preservation sealant.

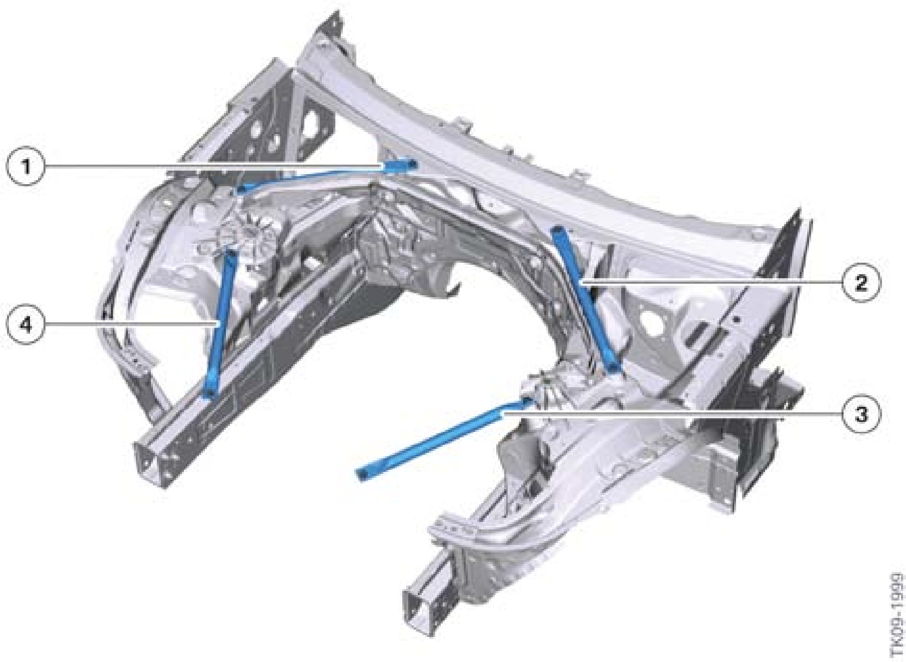
The objectives are:

- Three years without any visible corrosion whatsoever
- Twelve years without rust penetration
- High level of protection against water and dust intrusion.

2.1.4. Front section

Regarding the repair of the F10 front section, compared to the F01, there are no major changes.

As on previous vehicles, body struts are used to increase the rigidity of the front section.



F10 Front section

Index	Explanation
1	Rear right strut
2	Rear left strut
3	Front left strut
4	Front right strut

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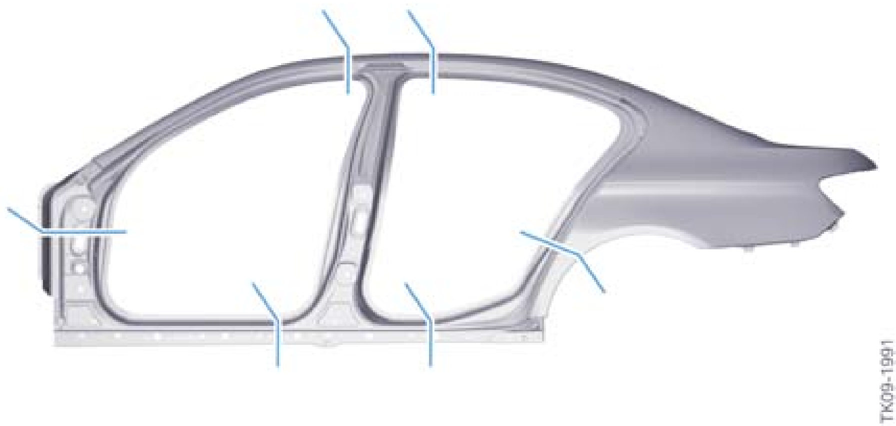
Note: When installing and dismantling the struts, it is mandatory to observe the repair instructions!

2.1.5. Side frame



F10 Separation points for repair

When performing a body repair, the separation points listed above should be used where possible.

F10 Spare part sections

The rear side panel is welded to the bodyshell at the factory. However, if it needs to be replaced in the field, the rear side panel is to be bonded and riveted.

2.1.6. Roof

The roof is welded to the bodyshell at the factory. However, if it needs to be replaced in the field, the roof is to be bonded and riveted.

2.1.7. Rear Section

Regarding the repair of the F10 rear section, compared to the F01, there are no major changes.

F10 Rear section

2.1.8. Rear trim panel

The rear trim panel is welded to the bodyshell at the factory. However, if it needs to be replaced in the field, the rear trim panel is to be bonded and riveted.

F10 Rear trim panel

2.2. Pedestrian Protection

The front section of the bodyshell of the F10 incorporates several pedestrian-protection measures. An impact absorber is installed between the bumper support and the bumper trim to provide protection for leg impact. The hood and the front fenders are made of aluminum and incorporate deformation elements. These design measures are adopted to produce a defined dissipation of energy in the event of an accident.

2.3. Doors

As with the F01, the doors of the F10 are made of aluminum reinforced with sheet-metal intrusion beams.

F10 Front and rear doors

F10 intrusion beams on the doors

Large stamped sheet metal intrusion beams within the doors transfer force to the body and ensure high rigidity and component quality. The implementation of very deep stamping in the fabrication of the inner door panel structure and the clever use of a hinge reinforcement have enable a sophisticated design/contour of the exterior.

The window frame area fulfills the highest requirements for rigidity. It is a single section made of only two sheet-metal parts with minimum dimensions. Even in the visually sensitive window frame area, the intensive BMW exterior design queues where able to be implemented.

Advantages of this design are:

- Reduced CO_2 emissions and increased driving dynamics due to decreased weight (23 kg per vehicle lighter than a comparable steel version)
- Interior impression of an improved spaciousness.
- Allows more light into the passenger compartment
- Improved visibility
- Window frames look lighter and slimmer when the doors are closed
- When the doors are open, the window frames look solid with a high-quality appeal
- Maximum form stability of the separate components provided by one-piece inner door panels
- Lowest possible number of components for the door structure
- Laser welding and structural adhesive bonding as the joining technologies of the door structure.

BMW has already made frequent use of aluminum door structures in the past, e. g. for the E52, E63, E64. However, only since the F01 have aluminum doors been produced for vehicles in large quantities.

The development objective for the F10 door structure, therefore, was to implement the familiar concept for an aluminum door from the F01 as a door that can be manufactured even in larger quantities at acceptable costs.

However, aluminum is not as easy to shape as steel, so aluminum stamping parts are much more difficult to manufacture than their steel counterparts, particularly when the stamping depths are considerable.

With the development of a new structure concept (with large braces to transmit force), manufacturing feasibility was ensured without having to forego the proven metal plate component construction methods.

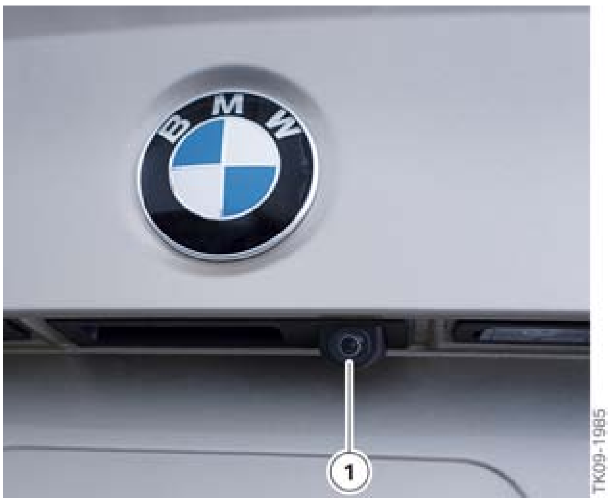
2.4. Trunk lid

Regarding the repair of the F10 trunk lid, there are no major changes, compared to the F01.

Features of the trunk lid:

- Self-opening trunk lid
- Tension springs are located in horizontal position below the water gutter as for the F01
- Spindle drives are used instead of the tension springs for vehicles with automatic trunk lid ("Power tailgate" option 316)
- Trunk lid trim and toolkit as for F01

- Rear lights in the trunk lid, bulb are replaced as on F01
- New trunk lid push-button
- Rear view camera (option 3AG) integrated in the housing of the trunk lid push-button.



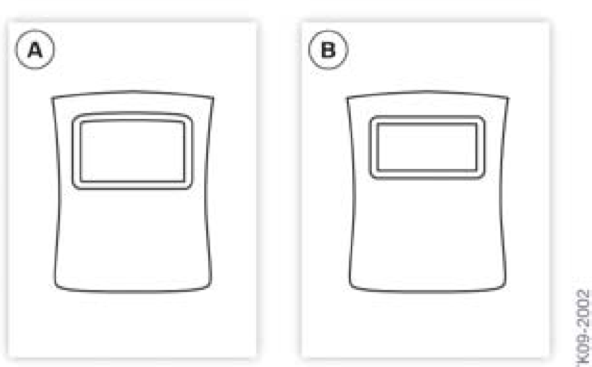
F10 Rear view camera

Index	Explanation
1	Rear View camera

2.5. Sliding/tilting sunroof

An electrical glass sunroof is standard equipment on all F10 models.

It is designed as a slide/tilt sunroof system that is operated from the interior.



Comparison of contour roof and standard slide/tilt sunroof

Index	Explanation
A	Contour roof
B	Standard slide/tilt sunroof

As with the F01, the front edge of the glass panel runs parallel to the windshield/roof edge (contour roof) and thus makes the appearance of the complete vehicle more harmonious. The larger glass area gives the passenger compartment a bright, spacious feeling. Thus the sensation of space is improved.

The glass panel and the sliding trim are all-electric and are operated using a switch in the roof function center (FZD).

The usual control and operation logic for the slide/tilt sunroof is maintained:

- **To open the roof-**
  Push the switch to the rear
- **To close the roof-**
  Push the switch forward
- **Set roof to vent position-**
  Push the switch up.

The operation and control logic for opening the sliding trim is similar to that of the panorama-roof configurations. The operating logic corresponds to the direction of movement of the components and thus can be understood easily by the customer.

The sliding trim is integrated in the interior design of the headlining, providing a high-class interior effect.

To eliminate the risk of possible injuries, an anti-trap mechanism for the glass panel and for the gear mechanism cover is implemented over the entire travel path complying with the local legal requirements.

2.5.1. Dimensions

Dimensions		**F10**	**E60**
Glass panel length	[mm]	Approx. 601	Approx. 487
Glass panel width	[mm]	Approx. 915	Approx. 921

Aperture size		**F10**	**E60**
Glass panel fully opened	[mm]	Approx. 394	Approx. 401

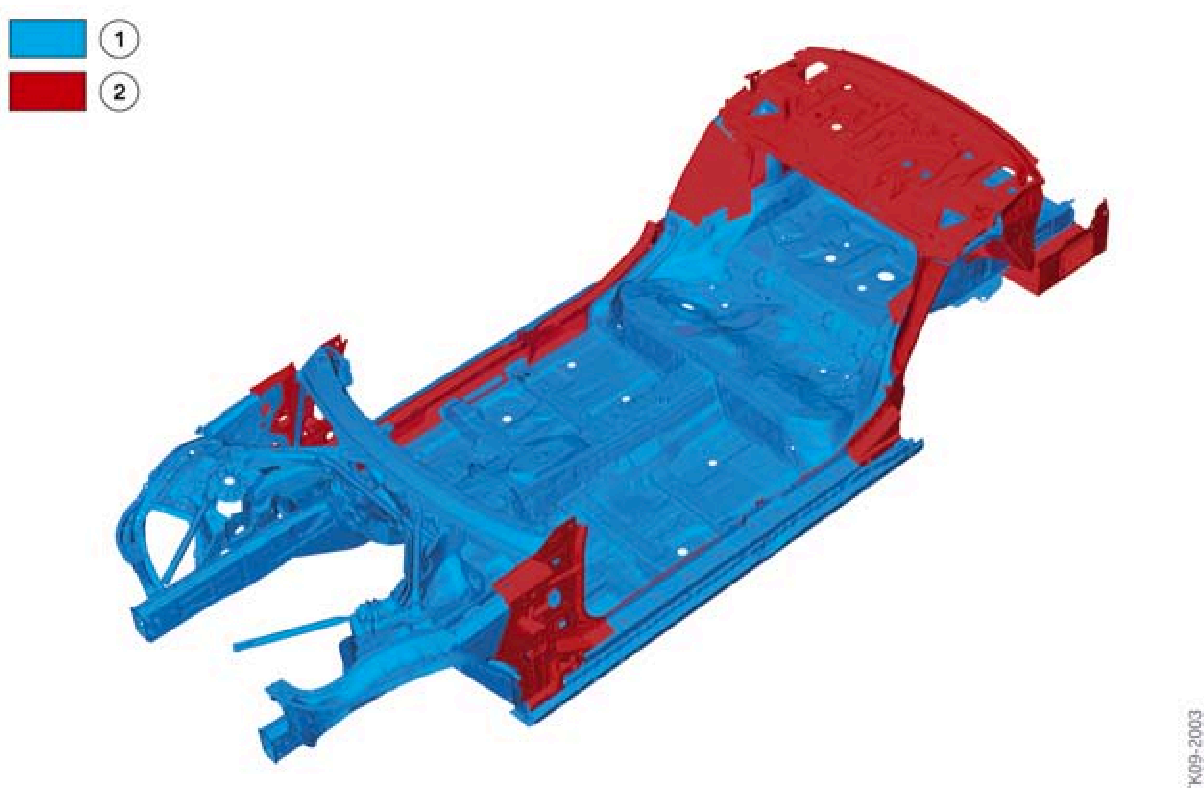
Glass panel in vent position		**F10**	**E60**
Vent gap of glass panel	[mm]	Approx. 22	Approx. 32
Vent gap of sliding trim	[mm]	Approx. 85	Approx. 75

2.5.2. Dismantling/installation and setting

Component	Notes
Glass panel	Possible with installed slide/tilt sunroof unit and installed roofliner
Sliding trim	Possible with glass panel removed
Drive of glass panel	Possible with roof function center removed
Drive of sliding trim	Possible with roofliner removed

2.6. Common parts strategy

The objective of the common parts strategy is to enable the most stringent standards to be implemented at reasonable cost.



F10 Front section, floor assembly and rear section

Index	Explanation
1	Common part
2	New part

F10 Introduction
3. Exterior and Interior Equipment

3.1. Exterior equipment

3.1.1. Front Bumper Carrier

The front bumper carrier of the F10 can be completely separated from the rest of the vehicle. It consists of the bumper, the lights, multiple sensors, and cover panels.

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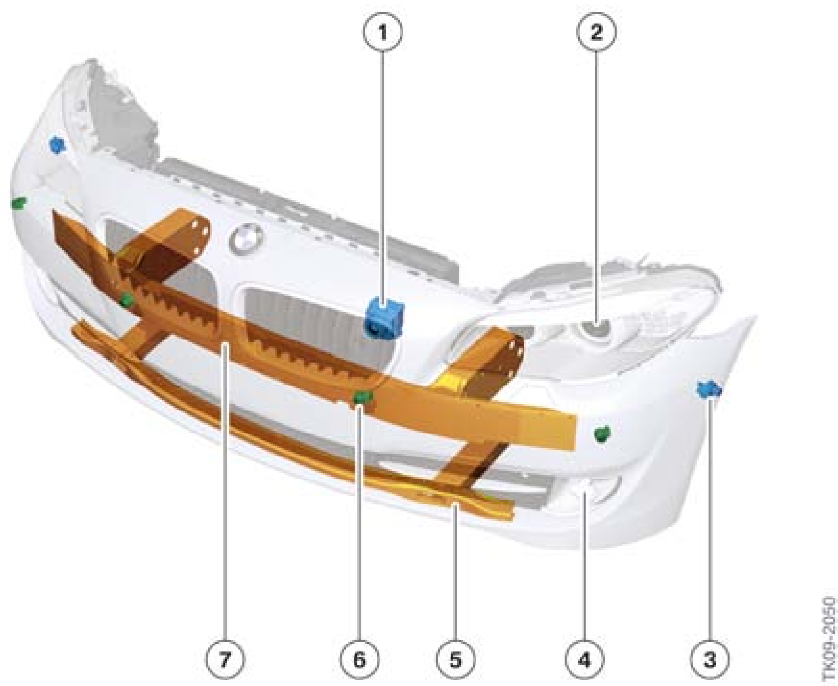
Note: Always follow proper repair instructions!



F10 Front bumper carrier

Index	Explanation
1	Night Vision Camera
2	Xenon headlights
3	Bumper camera
4	Fog lights
5	Lower bumper support
6	Sensor (Park Distance Control)
7	Upper bumper carrier

3.1.2. Rear bumper

The rear bumper carrier (with the impact absorber) is bolted to the bodyshell structure. It can absorb low-speed impacts (at least 4 km/h/2.5 mph) without damage to the bodywork.

The bumper system is a consumer-protection-compliant (low-speed impact) design that prevents damage to the vehicle's body structure. The consumer protection requirements are set forth in Europe by the German "Allianz" center for technology (AZT) and in the USA by the Insurance Institute for Highway Safety (IIHS). Deformation elements are specifically designed to lower repair costs.

3.1.3. Underbody design

The smooth vehicle underbody prevents air turbulence beneath the vehicle, this produces less drag and better road grip.

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Modifying the vehicle underbody or removing the underbody panels will result in changes of the air flow which can have a negative effect on the road grip.

F10 Underbody panels (aerodynamic measures)

3. Exterior and Interior Equipment

Index	Explanation
1	Front bottom cover
2	Engine compartment panel
3	Transmission panel
4	Air guide, flat
5	Underbody side panels
6	Air guide, flat

3.2. Interior equipment

3.2.1. Dimensions

		F10	E60
Shoulder room, front	[mm]	1480	1455
Shoulder room, rear	[mm]	1427	1454
Elbow room, front	[mm]	1518	1485
Elbow room, rear	[mm]	1485	1496
Maximum headroom, front (without slide/tilt sunroof)	[mm]	1028	1028
Maximum headroom, front (with slide/tilt sunroof)	[mm]	992	992
Maximum headroom, rear (without slide/tilt sunroof)	[mm]	973	967
Maximum headroom, rear (with slide/tilt sunroof)	[mm]	965	955
Luggage compartment capacity	[liters]	520	520

3.2.2. Dashboard

As in the F07, a one-piece foam dashboard with a rigid foam support is installed in the F10.

3. Exterior and Interior Equipment

F10 Passenger compartment, dashboard

The dashboard is foam-backed. The upper part is available in black or, for a bright interior color, also in "dark dolomite".

The interior color is continued in the bottom dashboard. This area below the decorative strip is available in the following colors:

- Black
- Everest grey
- Veneto beige
- Oyster
- Cinnamon brown

Highlights

- The cockpit is inclined towards the driver at an angle of approximately 7 degrees, this gives a clear orientation to the driver.
- Enhancement of decorative strips and fresh air grill by means of accentuating strips
- Fold-out DVD changer for 6 DVDs (option 696) in the glove box
- Folding compartment on the driver's side
- Sturdy cup holder in the center console

The attractive decorative strips lift as they terminate where they meet the doors. The decorative strips are available in high-gloss black or, as optional equipment, in finely polished aluminum or various types of wood.

In addition, the appearance of the fresh-air grille is enhanced by a chrome inlay on the adjusting lever for changing the air flow direction. For better operation at night, the F10 has added lighting to the thumbwheel on the center fresh-air grille. With the optional equipment 4-zone climate control (option 4NB), the thumbwheels on the outer fresh-air grille are also illuminated.

With the optional equipment 2-zone (option 534) or 4-zone climate control (option 4NB), the outer louvres and corresponding center bars on the center fresh-air grille have a galvanized finish.

F10 Introduction
3. Exterior and Interior Equipment

For vehicles with the optional equipment 4-zone climate control, various ventilation levels can be selected using the thumbwheels on the center fresh-air grille.

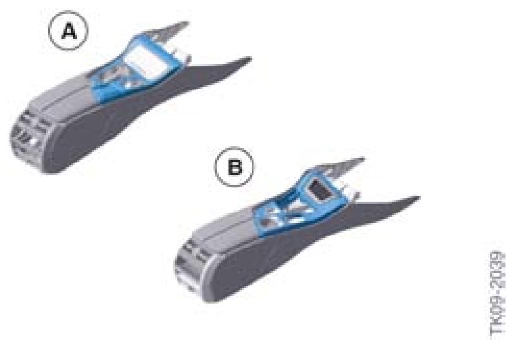
- **Draft-free ventilation:**
  Air flow is fanned out for a lower intensity
- **Maximum amount of air:**
  Air is partially fanned out and bundled. This enables maximum air supply.
- **Direct ventilation:**
  Air is bundled and can be specifically directed at one point.

The steel rod glove box hinge design of the F01 was replaced with a film type hinge on the F10.

F10 Glove box hinge

Index	Explanation
A	Film hinge (F10)
B	Steel rod (F01)

3.2.3. Center console



F10 Center console

Index	Explanation
A	Center console for automatic transmission
B	Center console for manual transmission

Unlike the F01, a two-piece center console is installed in the F10. This consists of the center console carrier and the corresponding functional carrier, depending on the transmission installed (manual or automatic).

According to the equipment selected, the center armrest and the side bar on the driver's side come in either PVC leatherette, Dakota leather or Nappa leather with side double-lap seams.

The decorative areas of the dashboard are reflected in the center console decorative strip.

The rear passenger compartment also features galvanized inlays in the adjusting levers for changing the flow direction of the fresh-air grille. In addition, with the optional equipment 4-zone IHKA the symbols on the thumbwheel are illuminated.

With the optional equipment rear seat entertainment (option 6FG) or 4-zone IHKA, one storage compartment is omitted in each case and replaced by the corresponding operating controls.

3.2.4. Storage options, front

F10 Storage options, front

Index	Explanation
1	Folding compartment
2	Front door storage

The folding compartment on the driver's side provides an additional storage area within the driver's reach.

F10 Storage options, front

Index	Explanation
1	Cup holder/storage/ashtray (depending on the vehicle equipment)
2	Cup holder/storage/ashtray (depending on the vehicle equipment)
3	Center armrest
4	DVD changer
5	Glove box
6	Storage net

The front center armrest can be locked and is available on request with a side snap-in adapter. To connect an external audio device, such as a CD or MP3 player, an AUX-In connector and, on request, a USB audio interface is provided (with option 6FL).

The DVD changer for 6 DVDs (option 696) has been positioned in a fold-out unit in the glove box. This allows the capacity of the glove box to be used, even for vehicles with DVD changer. A handle marked with the relevant information is used for operation. The right side of the glove box contains a USB connection for import and export of data on a USB stick (e. g. Personal Profile or music collections).

Vehicles with automatic transmission

The cup holders are located in the front area of the center console. They have been positioned for optimal ergonomics and equipped with robust mechanisms that provides optimum stability of the cups and beverages placed in them. Between the cup holders, there is a 12V socket.

3. Exterior and Interior Equipment

Behind the controller, there is another storage compartment.

Vehicles with manual transmission

The front area of the center console contains a storage compartment and a 12V socket.

The cup holder is located behind the controller. A second cup holder is below the front center armrest.

3.2.5. Rear storage options

F10 Rear storage options

Index	Explanation
1	Storage compartment in center armrest
2	Remote control (with option 6FG, rear seat entertainment)
3	Cup holder
4	Door panel
5	Storage compartment in front seat backrest

The center armrest contains two cup holders and a storage compartment. With the optional equipment rear seat entertainment (option 6FG), the remote control can be stowed in the storage compartment.

3.2.6. Front seats

The following front seat variants are available for selection in the F10:

- 20-way power front Comfort seats with memory (standard)
- ZAV Active vent seat package

The available ZAV Active vent seat package includes

- Multi contour seats (lumbar support)
- Front ventilated seats
- Active front seats
- Heated front seats

The front seats are largely identical to the front seats in the F07.

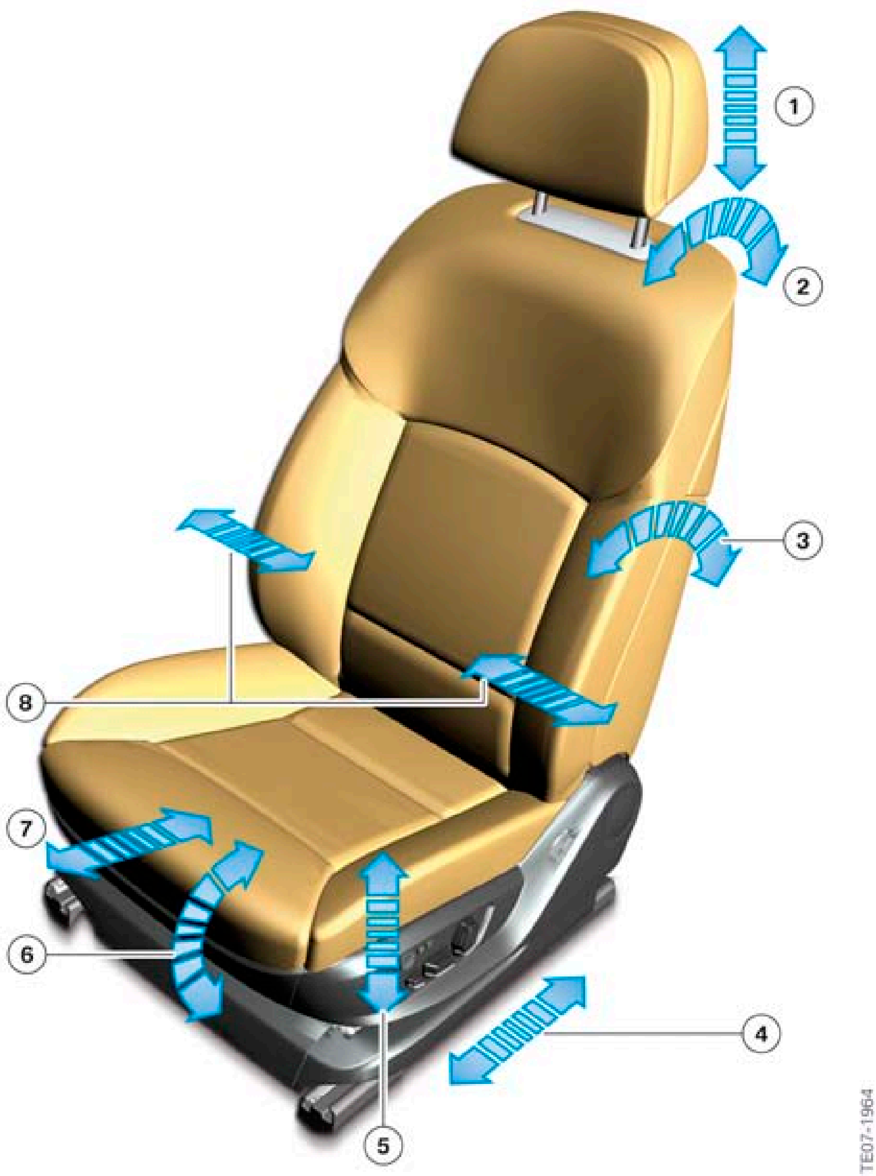
The following table provides an overview of the available optional equipment.

Seat equipment

	Seat adjustment, electrical, with memory (option 459)	Comfort seat, electrically adjustable (option 456)
Seat memory	Standard	Standard
Seat heating for driver/ passenger	Option 494	Option 494
Lumbar support for driver/ passenger	Option 488	Standard
Active seat for driver/front passenger	---	Option 455
Active seat ventilation, front	Option 453	Option 453
Ambient light	Option 4UR	Option 4UR
Rear seat entertainment	Option 6FG	Option 6FG

Seat adjustment

The comfort seat are essentially identical with the front seats in the F01.

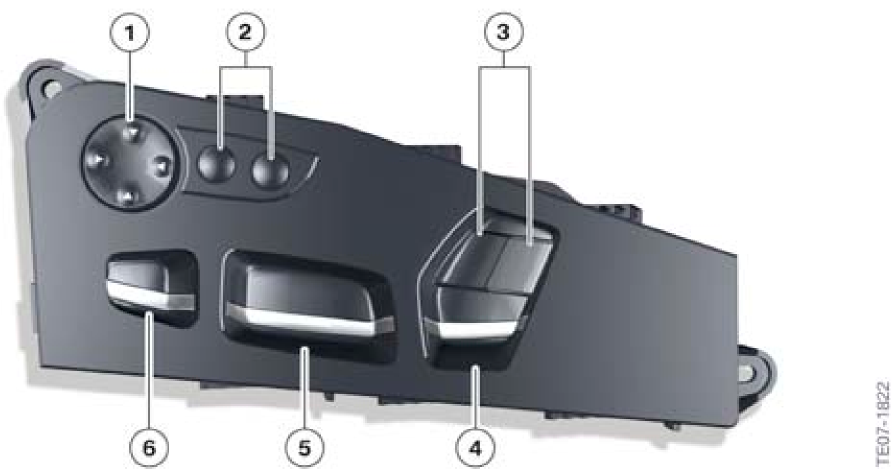


F10 Maximum seat adjustment, example: comfort seat

Index	Explanation
1	Head restraint, height adjustment
2	Upper backrest adjustment
3	Backrest inclination adjustment
4	Forward/back seat adjustment
5	Seat height adjustment
6	Seat angle adjustment
7	Seat depth adjustment
8	Backrest width adjustment

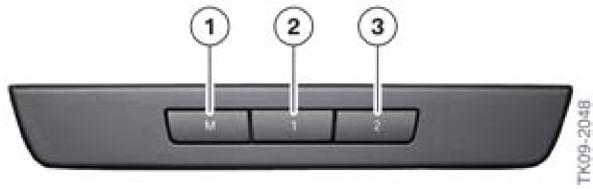
Note: The Lumbar adjustment is not shown on this graphic but it counts for four other adjustments bringing the total adjustments of the Comfort seat to 20.

Seat adjustment options	Seat adjustment, electrical, with memory (option 459)	Comfort seat, electrically adjustable (option 456)
Seat height adjustment	Electrical	Electrical
Forward/back seat adjustment	Electrical	Electrical
Seat angle adjustment	Electrical	Electrical
Backrest inclination adjustment	Electrical	Electrical
Head restraint, height adjustment	Electrical	Electrical
Seat depth adjustment	Manual*	Electrical
Backrest width adjustment	---	Electrical
Upper backrest adjustment	---	Electrical



F10 Switch cluster for driver's seat adjustment (on the seat), comfort seat

Index	Explanation
1	Lumbar support adjustment
2	Backrest width adjustment
3	Upper backrest adjustment
4	Backrest inclination and head restraint height adjustment
5	Longitudinal, seat height and seat inclination adjustment
6	Seat depth adjustment



F10 Switch cluster memory (on the door panel)

Index	Explanation
1	Button M (save current position)
2	Button 1 (call up stored position)
3	Button 2 (call up stored position)

Seat heating

F10 IHKA control panel

Index	Explanation
1	Seat heating button, driver's seat
2	Seat heating button, front passenger seat

Active seat ventilation

F10 IHKA control panel

Index	Explanation
1	Button, active seat ventilation, driver's seat
2	Button, active seat ventilation, front passenger seat

Side airbag

F10 Side airbag

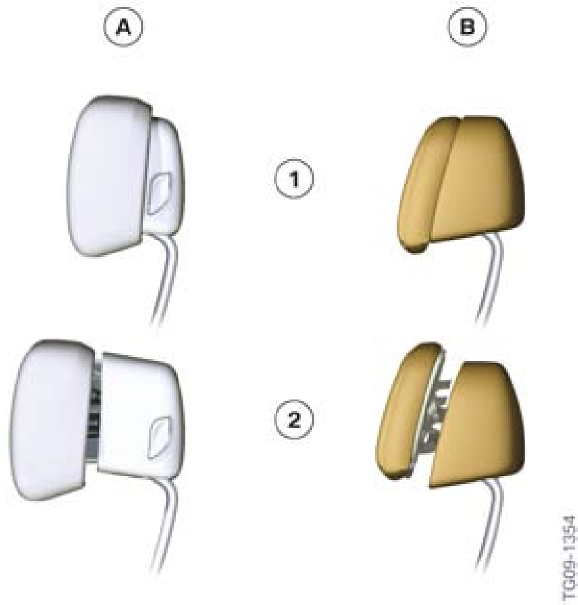
Index	Explanation
1	Airbag module in the backrest

The front side airbag is integrated into the backrest of the driver's and front passenger's seat. The seat back extends into the side of the seat, this is called the "encompassing seat wall". When the airbag is triggered, the side is pushed slightly open, this allows the airbag to open and provide its protective function. The front seats are equipped with seat-occupancy recognition and a belt tensioner.

Crash-active headrest

The front seats are equipped with a crash-active headrest. In the fully electrical seats, the head restraint has a button for adjusting the distance to your head.

In the comfort seat, the distance is adjustable using the upper backrest adjustment.



F10 Crash-active head restraint

Index	Explanation
1	Comfort precision advance
2	Position of activated crash-active head restraint
A	Basic seat/sport seat
B	Comfort seat

Rear display

F10 Rear display

With the optional equipment rear seat entertainment (option 6FG) one 8.2" swivelling display is installed in the headrest of each of the front seats.

3.2.7. Rear seats

In the F10, a seat bench with backrest in sandwich design is installed as standard, or a Split fold-down-rear seat with through-loading with through-loading as optional equipment (option 465).

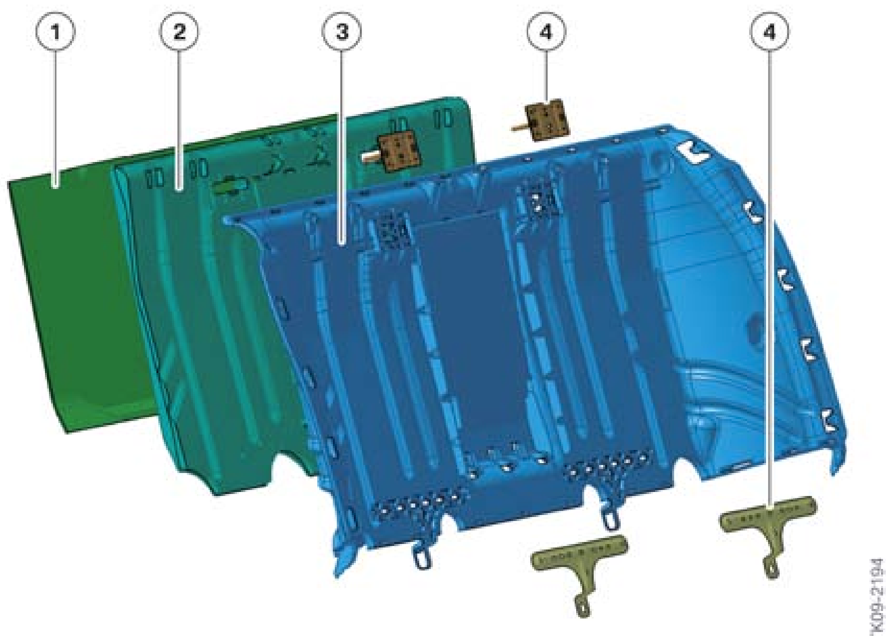
F10 Introduction

3. Exterior and Interior Equipment

Highlights

- Backrest in sandwich design (only basic seat bench)
- Center armrest (folding) with storage compartment and cup holder
- Center head restraint, folding
- Backrests, folding 40 %, 60 % or 100 % (only with through-loading system, option 465)

In the F10, a completely newly developed backrest is installed in the basic seat bench. Unlike the predecessor model, this does not consist of a metal structure, but instead of a composite material.



F10 Sandwich structure of the basic backrest

Index	Explanation
1	Counter support
2	EPP insert
3	Moulded plastic part
4	Holder (embedded in the material)

The front moulded plastic part consists of polypropylene with 30 % glass fiber (PP-GF30, impact resistant). The moulded plastic part is foamed on the rear using expanded polypropylene (EPP), a polypropylene-based particle foam.

The sandwich structure is highly stable, with a lower weight than a conventionally manufactured backrest structure.

Seat equipment

	Basic seat bench	Seat bench with through-loading system (option 465)
Seat heating for rear seats	Option 496	Option 496
Remote control in storage compartment (with rear seat entertainment)	Option 6FG	Option 6FG
Ski bag	---	Standard

Center armrest/head restraint

Another new feature in the F10 is the free-standing center armrest with separate folding head restraint in both seat bench versions.

TK09-2043

F10 Rear seats

Unlike the E60, the center head restraint has been separated from the center armrest and designed as a folding head restraint. When folded, the view towards the rear is improved without the need to actuate the center armrest. This also contributes to active safety.

Because the head restraint is in a far forward position when folded up, it provides the center rear seat passenger a high degree of safety despite a relatively low weight.

Through-loading system

The Split fold-down-rear seat system (option 465) with through-loading makes the F10 the perfect companion to both everyday life and leisure. Thanks to the divided rear seat backrest, even bulky goods can be transported without a problem, and there is still room for occupants in the rear passenger compartment.

The rear seat backrest can be divided and folded in a 60:40 ratio. The rear seat backrest elements are unlocked from the luggage compartment.

3. Exterior and Interior Equipment

Together with the through-loading system, a ski bag (option 464) can also be installed. This allows up to four pairs of skis or two snowboards to be transported neatly and securely. When the ski bag is not in use, it is stowed compactly behind the center armrest.

Seat heating

Seat heating (option 496) can be ordered as parts as ZCW Cold Weather Package option.

F10 Control panel for the rear IHKA

Index	Explanation
1	Seat heating button, left
2	Seat heating button, right

3.2.8. Climate control

For the F10, two versions of the integrated automatic heating / air conditioning system IHKA are available:

- 2-zone IHKA
- 4-zone IHKA (option 4NB)

Equipment

	IHKA 2 zones	IHKA 4 zones
Separate control of temperature, front left/right	X	X
Separate control of amount of air and air distribution, front left/right	X	X
Separate control of temperature, rear passenger compartment left/right	---	X
Independent ventilation	X	X
Residual heat utilization	X	X
Anti-misting	X	X
Fresh air and recirculating air filter (microfilter)	X	X
Ionizer to prevent condenser odors	X	X

F10 Introduction
3. Exterior and Interior Equipment

	IHKA 2 zones	IHKA 4 zones
Individual automatic control with five intensity levels	X	X
Solar compensation	X	X
Automatic recirculated air control (including combination filter[2])	X	X
ALL function (driver's settings are transferred to front passenger side)	X	---
ALL function (driver's settings are transferred to front passenger side and left/rear passenger compartment)	---	X
Separate IHKA controls in rear passenger compartment (center console)	---	X
Comfort nozzle (fresh-air grille on center dashboard) with individual range of adjustment from spot (focused) to diffuse (draught-free)	---	X

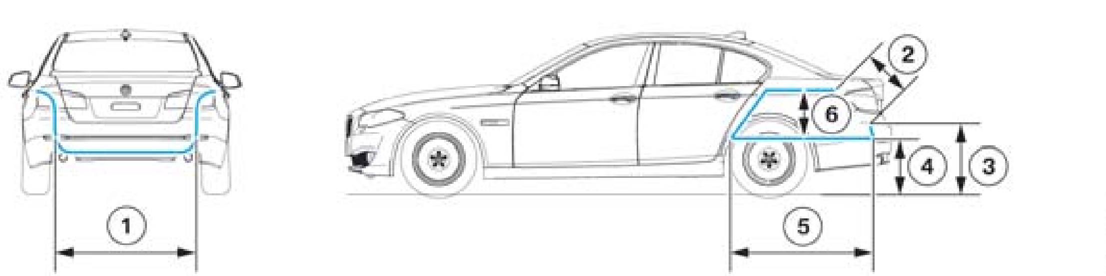
[1] A solar sensor takes into account any external light and/or heat sources that affect the climate in the passenger compartment.

[2] Combination of a carbon filter and microfilter traps dust and pollen protects against unpleasant odors.

3.3. Luggage compartment

The luggage compartment capacity is 520 liters. The luggage compartment has sufficient space for items such as four golf bags (46"), a stroller or four pairs of skis (with optional equipment ski bag, option 464). The optional seat bench with through-loading system (option 465) allows the luggage compartment capacity to be expanded even further.

3.3.1. Dimensions



F10 Luggage compartment dimensions

3. Exterior and Interior Equipment

		F10	E60
(1) Smallest luggage compartment width (between the wheel arches)	[mm]	830 – 906	832 – 907
(2) Diagonal measurement of loading opening	[mm]	487	496
(3) Loading edge height above roadway	[mm]	649	664
(4) Luggage compartment floor height above roadway	[mm]	492	490
(5) Luggage compartment floor length	[mm]	1145	1111
(6) Smallest luggage compartment height	[mm]	516	---
Largest luggage compartment width on the floor	[mm]	1344	1374
Width of rear opening – top	[mm]	1182	1332
Width of rear opening – bottom	[mm]	914	809
Luggage compartment capacity	[l]	520	520

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F10 Powertrain

Edited for the U.S. market by:

BMW Group University

Technical Training

ST1002 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: **December 2009**

F10 Powertrain
Contents

F10 Powertrain
Contents

F10 Powertrain

1. Drive Train Variants

F10 Drive.

1.1. Models

1.1.1. gasoline engines

	535i	550i
Engine	N55B30M0	N63B44O0
Power [kW] HP	[225] 300	[300] 400
Torque [Nm] lb-ft	[400] 300	[600] 450
US exhaust emission standard	ULEVII	ULEVII
Manual transmission	GS6-45BZ	GS6-53BZ
Automatic transmission	GA8HP45Z	GA8HP70Z
Rear axle differential	Rear diff 205AL	HAG 225AL

1.2. Additional information

For the descriptions of the engines and the eight-gear automatic transmission, refer to the following information bulletins:

F10 Powertrain

1. Drive Train Variants

- Information bulletin for N52 engine
- Information bulletin for N55 engine
- Information bulletin for N63 engine
- Information bulletin for GA8HP automatic transmission.

F10 Powertrain
2. Engines

2.1. N52 engine

TA09-2173

N52 engine

Highlights

- Magnesium-aluminum composite crankcase
- Valvetronic II
- Volume controlled oil pump
- Electric coolant pump.
- Three-stage intake manifold (DISA)
- Magnesium cylinder head cover
- Single-belt drive
- Exhaust manifold in lightweight construction.

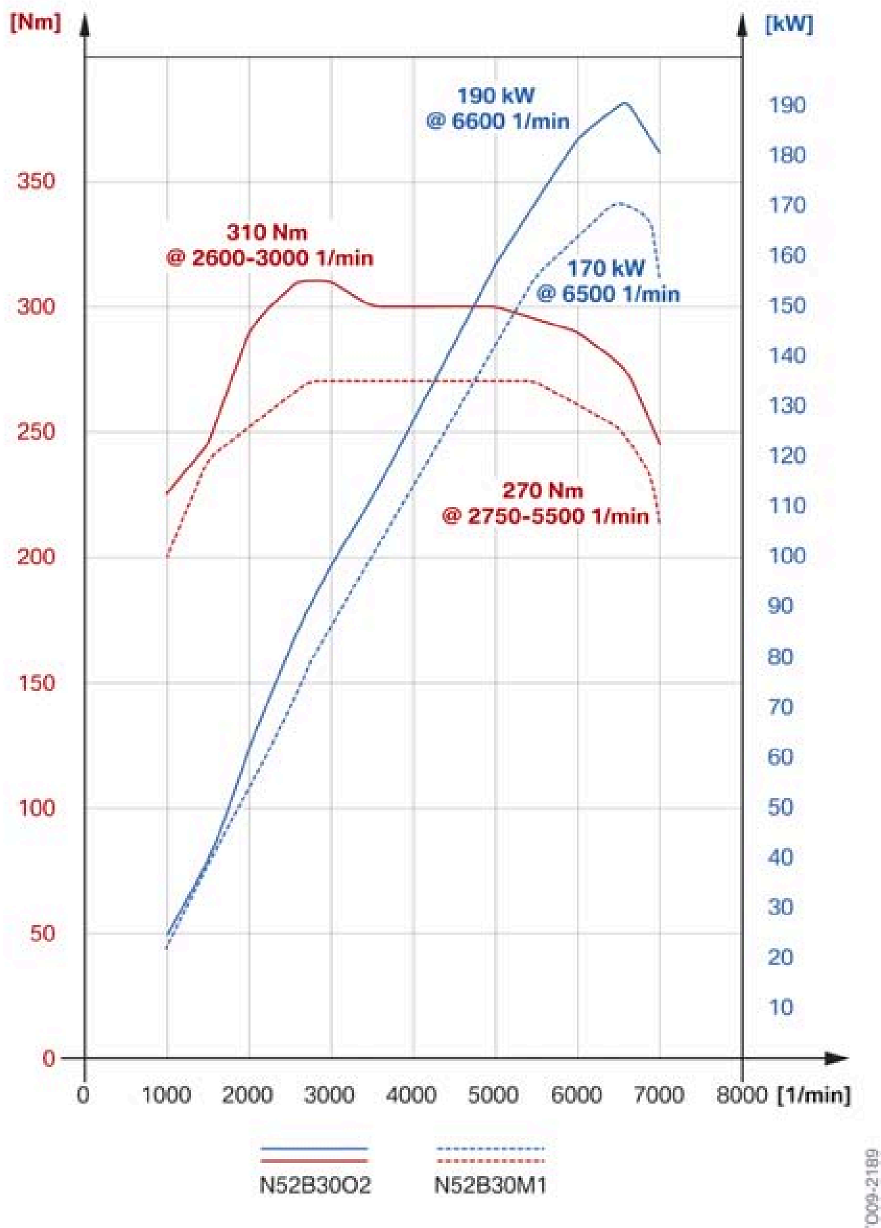
2.1.1. Technical data

		N52B30M1 E60, 528i	**N52B30O2 F10, 528i**
Type		R6	R6
Valves per cylinder		4	4
Engine control system		MSV80	MSV90
Displacement	[cm^3]	2996	2996

F10 Powertrain
2. Engines

		N52B30M1 E60, 528i	N52B30O2 F10, 528i
Stroke/bore	[mm]	88.0/85.0	88.0/85.0
Output at engine speed	[kW] HP [rpm]	[170] 230 6500	[190] 240 6600
Torque at engine speed	[Nm] lb-ft [rpm]	[270] 200 2750	[310] 230 2600 – 3000
Compression ratio	[ε]	10.7 : 1	10.7 : 1
Fuel grade		ROZ 91 – 98	ROZ 91 – 98
Exhaust emission standard		-	ULEVII
Acceleration 0-100 km/h/62mph (Automatic transmission)	[s]	7.6	6.7

2.1.2. Full load diagram



Full load diagram, E60 528i with N52B30M1 engine compared to F10 528i with N52B30O2 engine.

F10 Powertrain
2. Engines

2.2. N55 engine

N55 engine

The N55 engine is the successor to the N54 engine. Technical updates and modifications have made it possible to use only one exhaust turbocharger. The technical data have remained nearly identical, with reduced cost and improved quality.

Highlights

- Single turbocharger (TwinScroll)
- Air-gap-insulated exhaust manifold six in two; catalytic converter close to the engine
- Direct fuel injection with central injector position (solenoid valve injectors)
- Third generation Valvetronic
- Digital Motor Electronics (MEVD17.2 Bosch) engine mounted, integrated into the intake manifold, FlexRay-compatible
- Lightweight construction crankshaft
- Map-controlled oil pump (volume control)
- Standardized single-belt drive across all series
- Initial start-up in F07, afterwards use across all series.

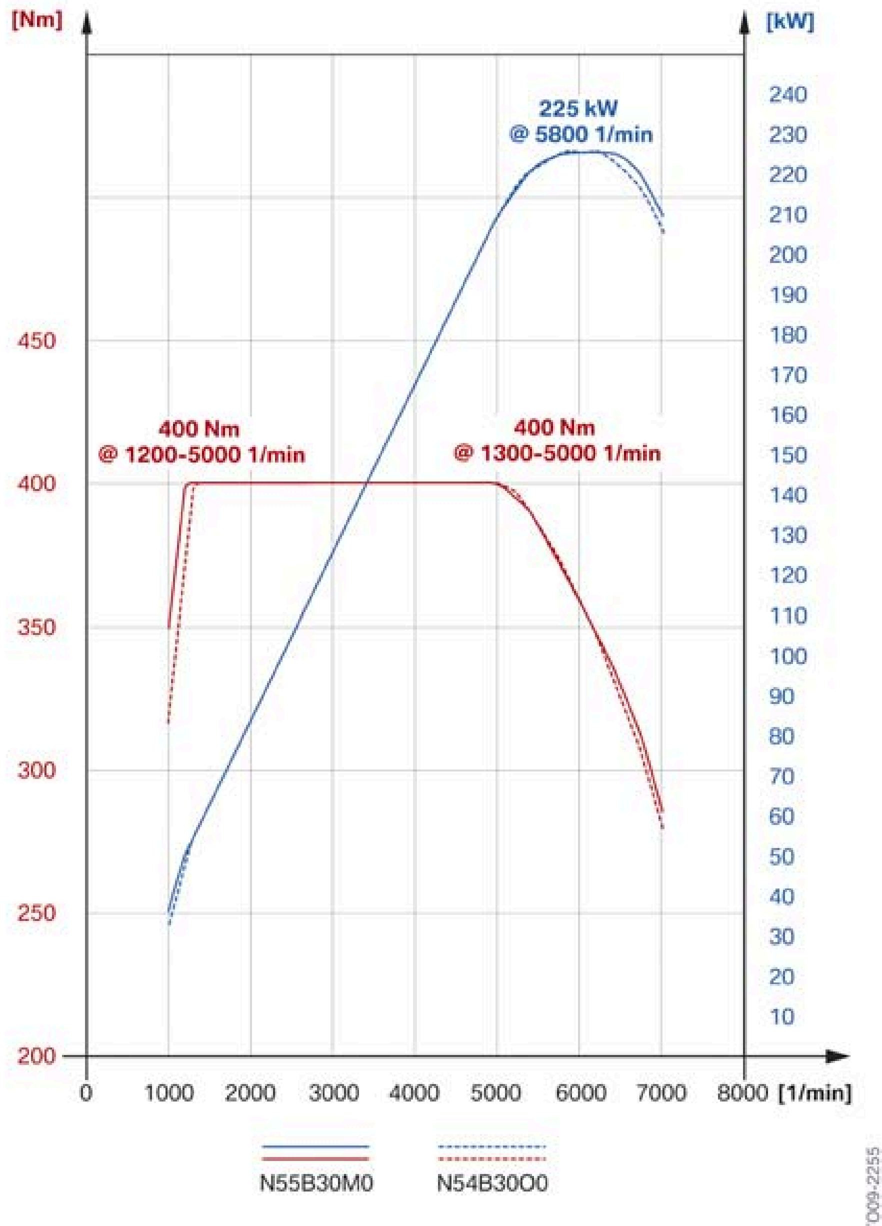
F10 Powertrain
2. Engines

2.2.1. Technical data

		N54B30O0 E60, 535i	N55B30M0 F10, 535i
Type		R6	R6
Valves per cylinder		4	4
Engine control system		MSD80	MEVD17.2
Displacement	[cm^3]	2979	2979
Stroke/bore	[mm]	89.6/84.0	89.6/84.0
Output at engine speed	[kW] HP [rpm]	[220] 300 5800	[225] 300 5800
Torque at engine speed	[Nm] lb-ft [rpm]	[407] 300 1400 – 5000	[400] 300 1200 – 5000
Compression ratio	[ε]	10.2 : 1	10.2 : 1
Fuel grade		ROZ 95 – 98	ROZ 91 – 98
Exhaust emission standard		-	ULEVII
Acceleration 0-100 km/h/62mph (Manual/automatic transmission)	[s]	5.9/6.0	6.0/6.1

2.2.2. Full load diagram

Compared to the predecessor, the outstanding feature of the N55 engine is its lower fuel consumption with equivalent power and torque data.



Full load diagram, E60 535i with N54B30O0 engine compared to F10 535i with N55B30M0 engine.

2.3. N63 engine

N63 engine

The N63 engine is the successor of the N62 engine and the world's first engine with optimized package thanks to the placement of the turbochargers and the main catalytic converters. In order to obtain performance goals with the optimum package and weight, the two turbochargers and the catalytic converters have been placed in the engine V-space between the cylinder banks, which meant reversing the positions of the intake and outlet ports. This arrangement allows short pipe lengths and large cross-sections, which in turn minimizes the pressure losses on the intake and exhaust side.

Highlights

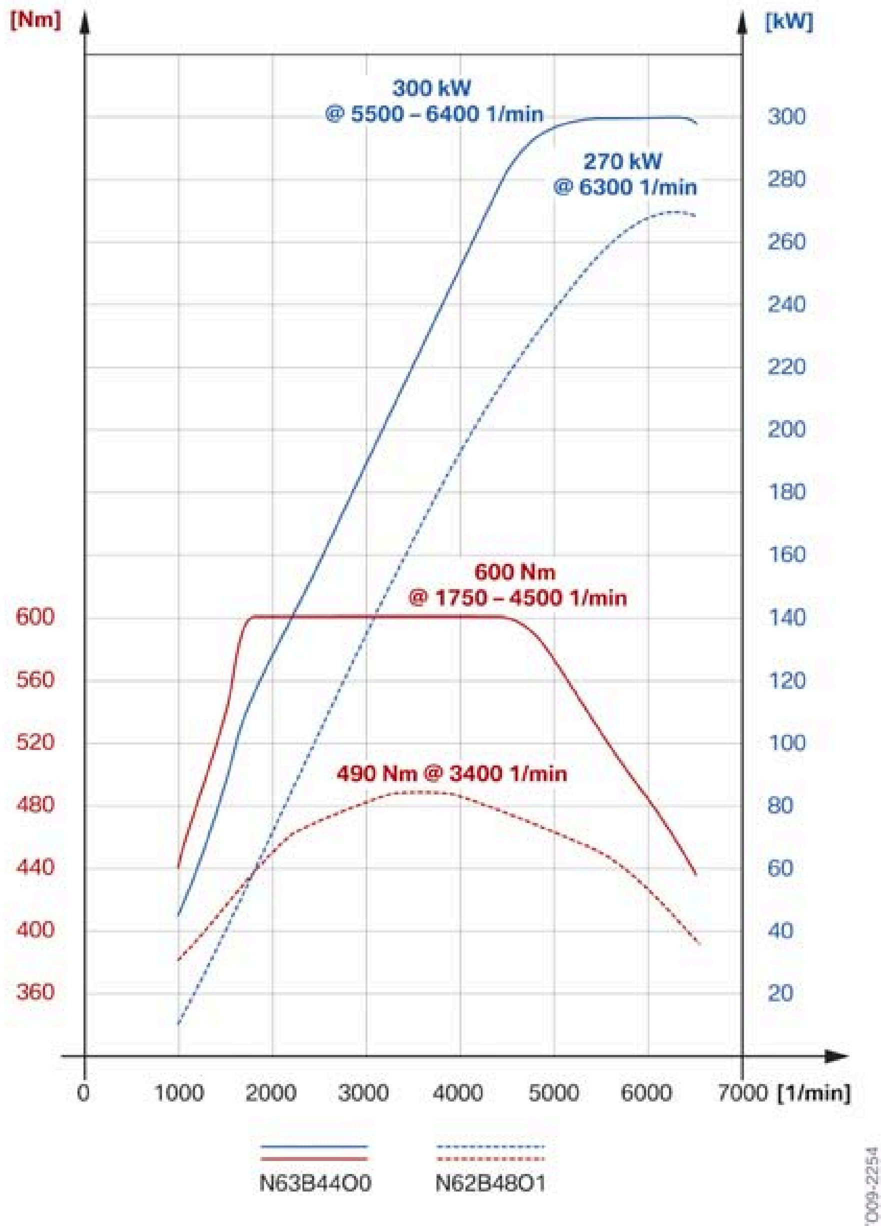
- Use across all series (E71/E72/F01/F02/F04/F07/F10)
- Twin turbochargers placed in the engine V-space
- Catalytic converters close to the engine
- Direct fuel injection piezo-electric injectors
- MSD85 Digital Motor Electronics, liquid-cooled with FlexRay connection
- Indirect charge air cooling

2.3.1. Technical data

		N62B48O1 E60, 550i	N63B44O0 F10, 550i
Type		V8	V8
Valves per cylinder		4	4
Engine control system		ME9.2.3	MSD85
Displacement	[cm^3]	4799	4395
Stroke/bore	[mm]	88.3/93.0	88.3/89.0
Output at engine speed	[kW] HP [rpm]	[270] 367 6300	[300] 400 5500 – 6400
Torque at engine speed	[Nm] lb-ft [rpm]	[490] 361 3400	[600] 450 1750 – 4500
Compression ratio	[ε]	10.5 : 1	10.0 : 1
Fuel grade		ROZ 91 – 98	ROZ 91 – 98
Exhaust emission standard		-	ULEVII
Acceleration 0-100 km/h (Manual/automatic transmission)	[s]	5.2/5.3	-/5.0

2.3.2. Full load diagram

Compared to its naturally aspirated predecessor, the N62 engine, an outstanding feature of the N63 engine is its significantly higher overall power and more ample torque curve due to twin turbocharging.



Full load diagram, E60 550i with N62B48O1 engine compared to F10 550i with N63B44O0 engine.

2.4. Engine type and engine identification

2.4.1. Engine type

In the technical documentation, the engine type is used to ensure the unambiguous identification of engines. Frequently, however, only an abbreviation is used. This short form is used to assign an engine to an engine family.

Position	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW Motorsport BMW M GmbH Third-party engines
2	Engine type	1 4 5 6 7 8	4-cylinder in-line engine (e. g. N12) 4-cylinder in-line engine (e.g. N43) 6-cylinder in-line engine (e.g. N55) V8 engine (e.g. N63) V12 engine (e.g. N74) V10 engine (e.g. S85)
3	Change of the engine block concept	0 1 – 9	Engine block Changes, e.g. combustion process
4	Operating method or fuel and, where applicable, installation position	B D H	Gasoline, longitudinal installation Diesel, longitudinal installation Hydrogen
5 + 6	Displacement in 1/10 liter	30	3.0 liters
7	Power class	K U M O T S	Smallest Lower Center Upper (standard) Top Super
8	Revision relevant to approval	0 1 – 9	New development Revision

2.4.2. Engine identification

To ensure clear identification and classification, the engines have an identification mark on the crankcase.

This engine identification is also necessary for approval by authorities. The N55 engine is accompanied by a further development of this identification and a reduction from the former eight characters to seven characters. The engine number is located on the engine below the engine identification. This consecutive number, in conjunction with the engine identification, permits unique identification of each individual engine.

Position	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW Motorsport BMW M GmbH Third-party engines
2	Engine type	1 4 5 6 7 8	4-cylinder in-line engine (e. g. N12) 4-cylinder in-line engine (e.g. N43) 6-cylinder in-line engine (e.g. N55) V8 engine (e.g. N63) V12 engine (e.g. N74) V10 engine (e.g. S85)
3	Change of the engine block concept	0 1 – 9	Engine block Changes, e.g. combustion process
4	Operating method or fuel and, where applicable, installation position	B D H	Gasoline, longitudinal installation Diesel, longitudinal installation Hydrogen
5 + 6	Displacement in 1/10 liter	30	3.0 liters
7	Type approval requirements (Changes that require a new type approval)	A B – Z	Standard Depending on requirements, e.g. ROZ87

F10 Powertrain
3. Manual Transmission

3.1. Description

In the technical documentation, the transmission designation is used to ensure the clear identification of transmissions. Frequently, however, only an abbreviations are used. Thus we frequently speak of the K transmission or G transmission. For the correct designation, refer to the following table.

Position	Meaning	Index	Explanation
1	Description	G	Transmission
2	Transmission type	S	Manual transmission
3	Number of gears	1 – 9	Number of forward gears
4	Transmission type	- X S W D Y	Manual transmission Four-wheel drive with manual transmission Sequential manual transmission Four-wheel drive with sequential manual transmission Twin-clutch gearbox Four-wheel drive with twin-clutch gearbox
5 + 6	Transmission type	17 26 37 45 53	I transmission D transmission H transmission K transmission G transmission
7	Gear set	B D S P	Gasoline engine gear ratio Diesel engine gear ratio (w)* Sport gear ratio Gasoline engine gear ratio overhauled
8	Manufacturer	G J R Z H	Getrag Jatco GMPT ZF In-house part

3.2. Variants

Model	Engine	Manual transmission	
535i	N55B30M0	K	GS6-45BZ
550i	N63B44O0	G	GS6-53BZ

3.3. K manual transmission

The K manual transmission is a six-gear inline manual transmission in reduction gear design.

Highlights

F10 Powertrain
3. Manual Transmission

- Six gears with optimized ratios
- Intermediate mounting
- Dry sump lubrication
- Fuel consumption reduction (-2 % compared to G manual transmission)
- Weight reduction (-11 kg compared to G manual transmission)
- Synchronization with carbon friction linings
- Use of life-time oil filling
- Zero-gear sensor for automatic engine start-stop function.

Instead of the G transmission used with the N63 engine the smaller, lighter and more cost-efficient K transmission is installed with the N55. The weight advantage is up to 11 kg. This transmission is smaller and lighter due mainly to the intermediate mounting of the main shafts and a modified gear set design.

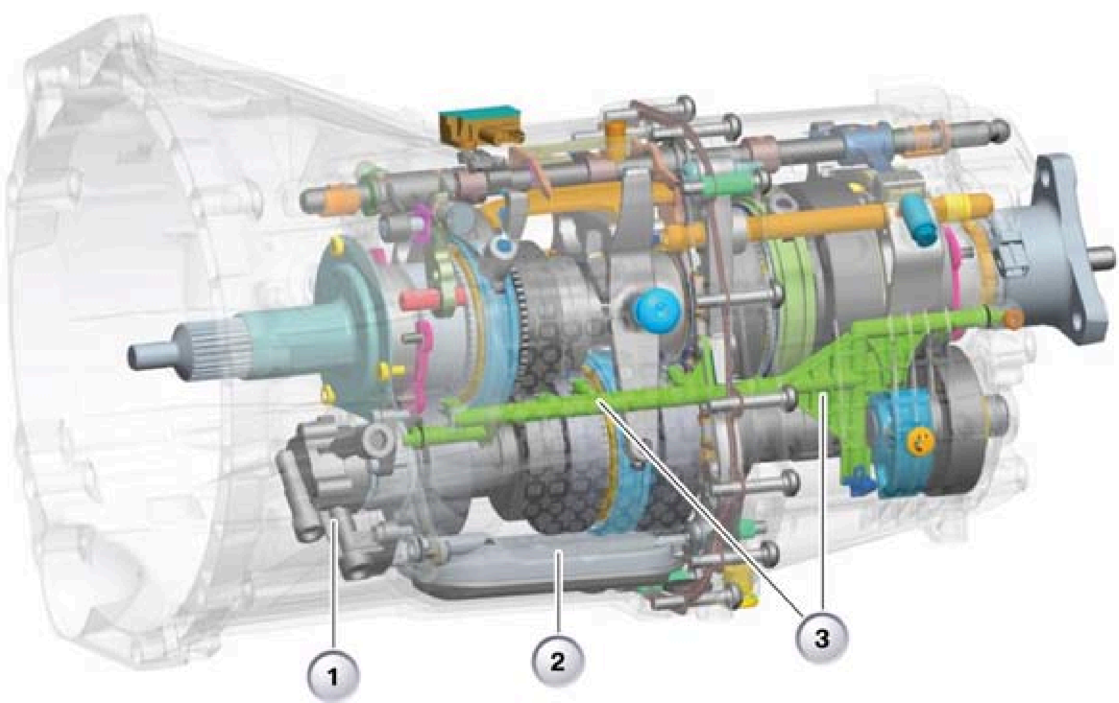
Another advantage is the significantly improved shifting comfort and the low fuel consumption due to low drag losses and high efficiency.

The shift quality is increased substantially by:

- Using a newly developed carbon friction lining in the synchronizer units
- A newly developed and very low-friction gearshift
- The low drag loss of the gear set
- Limiting excessive shift travel

F10 Powertrain

3. Manual Transmission



“K” 6 speed manual transmission (GS6-45BZ)

Index	Explanation
1	Oil pump with pressure relief valve
2	Oil filter
3	Oil injector pipe

To keep the drag loss low, dry sump lubrication is used for the first time. Compared to conventional splash lubrication, this prevents the gear set from splashing about in the oil sump, which causes losses. An additional decrease in losses is attained with the use of redesigned radial shaft seals.

3.3.1. Intermediate mounting

In manual transmissions with reduction gear design, the main shaft is pushed away from the counter shaft by the gearing forces. This causes a deviation of the ideal gear contact pattern, which substantially impairs the strength of the gears and causes noise.

Therefore, in the K transmission, the location of the countershaft significantly restricts the shafts from bending. In this way, higher torque can be transmitted, compared to conventional transmissions, while at the same time reducing gear noise.

3.3.2. Dry sump lubrication

Conventional manual transmissions normally use splash lubrication. During this process, the gears on the countershaft dip into the transmission oil and distribute it throughout the transmission in a disorderly manner as the gear set rotates. Often, additional equipment such as oil partition plates or oil grooves are required to bring the oil to the gears, the bearings or to the synchronizers.

In the K transmission, a dry sump type lubrication system is used (for the first time on a BMW).

The dry sump system consists of:

- An oil filter
- An oil pump
- A fuel injection pipe

Using less energy than a splash lubrication system, the dry sump system lubricates the gears, the bearings and the synchronizers in a more targeted manner. The controlled oil flow also results in an improved temperature balance, as the cooling air is routed directly from the vehicle underbody to the filter intake opening. This provides continuous cooling of the transmission oil.

The oil filter also improves the oil quality and thus the load-carrying capacity of the gear train.

3.3.3. Synchronization

In first and second gear, triple-cone synchronizers are used. In the other gears, single-cone synchronizers are installed. To improve shift quality, these are equipped with a newly developed carbon friction lining.

3.3.4. Connection dimensions

The connection dimensions for the transmission mounting have been taken over from previous series applications. In this way, the integration into the vehicle environment has been simplified greatly, as it is possible continue using existing peripherals.

3.3.5. Technical data

		K transmission GS6-45BZ
Engine applications in the F10		N55B30M0
Maximum drive torque	[Nm]	470
Axle distance	[mm]	80
Weight with oil	[kg]	43.3
Transmission length	[mm]	646
1st gear ratio		4.110
2nd gear ratio		2.315
3rd gear ratio		1.542

	K transmission GS6-45BZ
4th gear ratio	1.179
5th gear ratio	1.000
6th gear ratio	0.846
Reverse gear ratio	3.727
Final drive ratio	3.231

3.4. G manual transmission

The G manual transmission is of the highest precision, operational smoothness and shifting comfort. Due to the total spread, the transmission offers the best possible utilization of the engine performance. The short shift travel of 55 mm contributes to the transmission shifting comfort.

Highlights

- Slip suppression to prevent clutch slipping
- Start-up speed limitation to minimize the friction work of the clutch (in conjunction with N63 engine)
- External transmission oil cooling (in conjunction with N63 engine)
- Use of long-term oil.

To prevent potential overloading of the clutch a slip suppression system is used. This system enables acceleration under full load without the possibility of the clutch slipping. A speed sensor on the intermediate shaft and the crankshaft sensor calculate the clutch slip; if necessary, the engine torque can be reduced to limit clutch slip.

A start-up speed limitation is used with the N63 engine. This limits the engine speed while the vehicle is at a standstill, depending on the mode of the Dynamic Stability Control DSC, to 3500 – 5500 rpm. This prevents a overheating of the drive plate during the starting process.

The external transmission oil cooling is used with the N63 engine, guarantees reliable operation, even under extreme conditions. A transmission oil pump pumps the transmission oil through the transmission oil cooler. A transmission oil temperature sensor is installed in the transmission, which switches the transmission oil pump on (transmission oil temperature > 130 °C/266°F) and off (transmission oil temperature < 110 °C/230°F).

3.4.1. Technical data

		G transmission GS6-53BZ
Engine applications in the F10		N63B44O0
Maximum drive torque	[Nm]	600
Axle distance	[mm]	94.96
Weight with oil	[kg]	57.6

		G transmission GS6-53BZ
Oil quantity	[l]	2.2
Transmission length	[mm]	669
1st gear ratio		4.055
2nd gear ratio		2.396
3rd gear ratio		1.582
4th gear ratio		1.192
5th gear ratio		1.000
6th gear ratio		0.872
Reverse gear ratio		3.677
Final drive ratio		3.08

3.5. Gearshift mechanism

F10 Gear selector switch

Highlights

F10 Powertrain
3. Manual Transmission

- Further development of the typical BMW gearshift
- Improved shifting force curve and shifting precision
- New design of the gearshift arm, matched to the innovative center console design
- New, sporty design with one-piece gearshift lever knob with leather cover
- New leather material "Dakota" with improved durability and appearance
- Ergonomically matched center console and gearshift lever knob position
- Gearshift rod is orbital riveted rather than welded.

The gearshift rod direct connection to the transmission has been maintained.

F10 Powertrain
4. Automatic Transmission

4.1. Description

In the technical documentation, the transmission designation is used to ensure the unambiguous identification of the transmission. Frequently, however, only an abbreviation is used. This short form is used to assign a transmission to a transmission family. For example, we often talk about the GA8HP transmission family, which consists of several transmissions such as the GA8HP45Z, the GA8HP70Z and the GA8HP90Z.

Position	Meaning	Index	Explanation
1	Description	G	Transmission
2	Transmission type	A	Automatic transmission
3	Number of gears	6 8	Six forward gears Eight forward gears
4	Transmission type	HP L R	Hydraulic planetary gear train Designation by GMPT Designation by GMPT
5 + 6	Transferable torque	19 26 32 45 (ZF) 45 (GMPT) 70 90 390	300 Nm gasoline engine 600 Nm gasoline engine 720 Nm gasoline engine 450 Nm gasoline engine, 500 Nm diesel engine 350 Nm gasoline engine 700 Nm gasoline engine and diesel engine 900 Nm gasoline engine 390 Nm, 4th gear 410 Nm gasoline engine
7	Manufacturer	G J R Z H	Getrag Jatco GMPT ZF In-house part

4.2. Variants

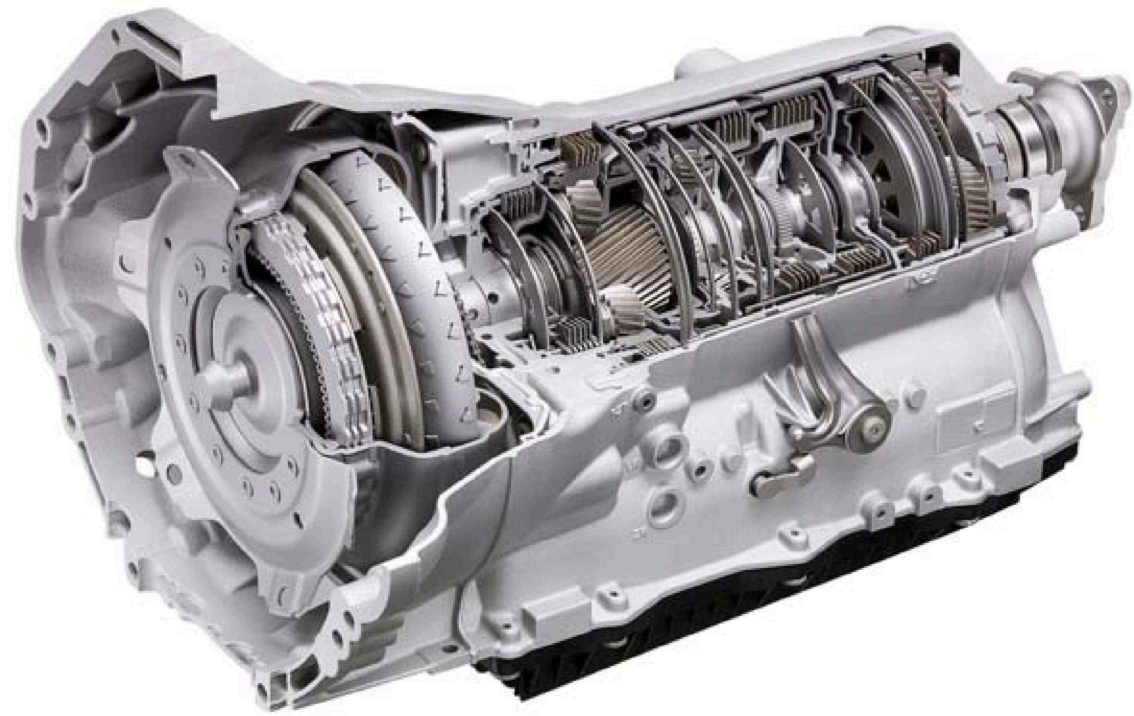
Model	Engine	Transmission	Torque converter
528i	N52B30O2	GA8HP45Z	NW235TTD
535i	N55B30M0	GA8HP45Z	NW235TTD
550i	N63B44O0	GA8HP70Z	NW250TTD

4.3. GA8HP transmission

In the F10, the new automatic transmissions GA8HP45Z and GA8HP70Z with eight forward gears and one reverse gear is used.

F10 Powertrain

4. Automatic Transmission


TA09-1361

Highlights

- Significantly enhanced gearshifts spontaneity
- Greater driving and shifting comfort as a result of a closer gear ratio
- Higher precision control of the converter lockup clutch at low engine loads
- High power transmission of the converter lock-up clutch
- Reduced fuel consumption (-5 to -6 %).

The GA8HP45Z and GA8HP70Z are new developments and will gradually replace the established 6-speed automatic transmissions GA6HP19Z TU and GA6HP26Z TU. The overall gear ratio has been increased from 6.04 to 7.07; the gear to gear ratios have are now closer, thus also reducing the differences in speed when shifting gear. The weight of the transmission has been reduced significantly using a plastic oil pan and other light weight components.

The Electronic Transmission Control (EGS) control unit is integrated in the control unit framework of the electronic immobilizer EWS. This provides better protection against theft.

The operation takes place using the gear selector switch or the shift paddles (option 2TB, sport automatic transmission, via the steering column switch cluster SZL).

In the converter, second-generation mechanical torsional vibration dampers are used:

- Turbine torsional vibration damper (TTD)
- Double-damper converter (ZDW) (Used on diesel X5 and E90 models).

4. Automatic Transmission

The function and structure of the torque converter are described in the "E70 Automatic transmission" training material available on TIS and ICP.

The vibration isolation reduces the proportion of slip on the converter lockup clutch and enables a larger operating range with the converter lockup clutch closed. This reduces the fuel consumption by 5% to 6% in the consumption cycle (KV01) compared to the TU 6-speed automatic transmission used until now.

4.3.1. Technical data

		GA8HP45Z	GA8HP70Z
Maximum power (with gasoline engines)	[kW]	250	380
Maximum power (with diesel engines)	[kW]	180	240
Maximum torque (with gasoline engines)	[Nm]	450	700
Maximum torque (with diesel engines)	[Nm]	500	700
Maximum permitted engine speed, 1st - 7th gear	[rpm]	7200	
Maximum permitted engine speed, 8th gear	[rpm]	5700	
Maximum permitted engine speed, reverse gear	[rpm]	3500	
1st gear ratio		4.714	
2nd gear ratio		3.143	
3rd gear ratio		2.106	
4th gear ratio		1.667	
5th gear ratio		1.258	
6th gear ratio		1.000	
7th gear ratio		0.839	
8th gear ratio		0.667	
Reverse gear ratio		3.295	3.317

4.4. Gear selector switch

The F10 has the familiar gear selector switch from the F01.

F10 Gear selector switch

F10 Powertrain
5. Rear Axle Differential

5.1. Description

Position	Meaning	Index	Explanation
1 – 3	Transmission type	HAG	Rear axle differential
4 – 6	Size	205 225	Crown wheel pitch circle ø in mm
7	Housing	A	aluminum
8	Transmission type	L	Low friction

5.2. Versions

Model	Transmission	Rear axle differential	Gear ratio i
528i	GA8HP45Z	Rear diff 205AL	3.385
535i	GS6-45BZ	Rear diff 205AL	3.231
535i	GA8HP45Z	Rear diff 205AL	3.077
550i	GS6-53BZ	HAG 225AL	3.08
550i	GA8HP70Z	HAG 225AL	2.813

5.3. Rear axle final drive lightweight construction

Like the F01, the F07 has the new HAG 205AL and HAG 225AL rear axle final drives with aluminum housing.

F10 Rear axle final drive lightweight construction

Highlights:

- Lower weight
  Rear axle differential 205AL: 23.6 kg (incl. oil)

5. Rear Axle Differential

Rear axle differential 225AL: 29.7 kg (incl. oil)

- Greater power transmission
- Better efficiency

F10 Powertrain

6. Driveshaft and Axle Shafts

6.1. Driveshaft

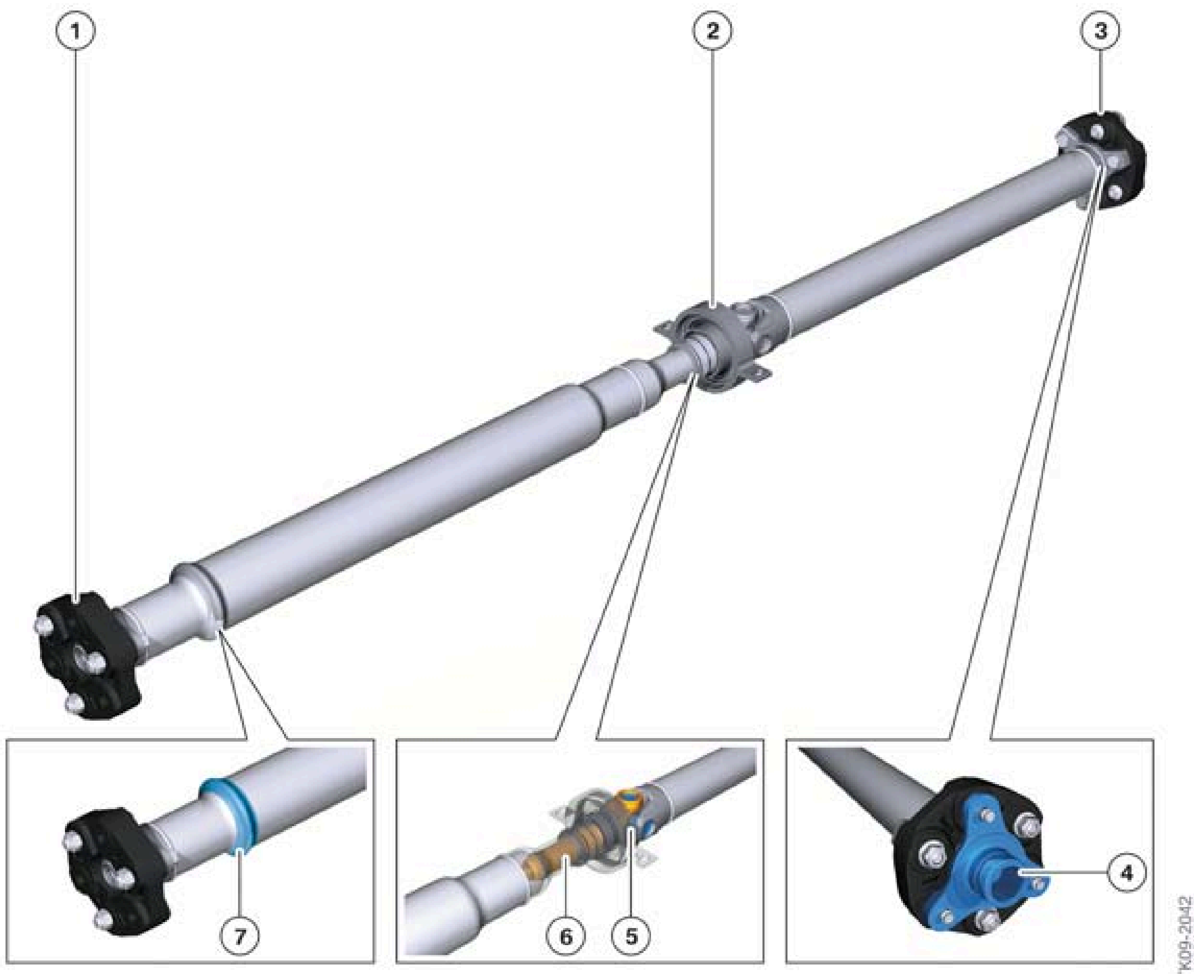
6.1.1. Overview

Each engine-transmission configuration uses a steel driveshaft that is specially adapted to the individual torque requirement.

The main focal points in the design of the driveshaft of the F10 were the torque transfer and comfort requirements with minimal acoustics and vibrations.

The joints, shaft divisions and shaft diameters have been specified in such a way that they do not pass on any disruptive noises or vibrations to the connection points at the body.

On the F10, the driveshafts are connected to the automatic transmission and rear differentials exclusively by means of flexible discs. This minimizes the high-frequency tooth meshing noises on the rear differential.



F10 Propeller shaft

Index	Explanation
1	Flexible disc (on automatic or manual transmission)
2	Center bearing
3	Flexible disc (on rear axle differential)
4	Push-fit connection
5	Universal joint
6	Slide piece connection
7	Crash function

6.1.2. Crash function

The driveshaft absorbs some of the impact energy in the event of a head-on collision. Improvements have been made to the properties of this crash function, which are integrated into the front driveshaft tube. The compression force under which the front driveshaft tube is meant to deform has been further reduced with no effect on torque transfer capability.

6.2. Axle Shafts

6.2.1. Description

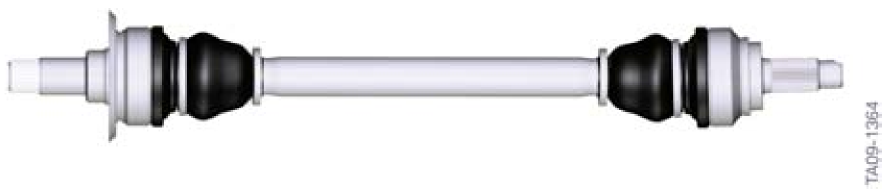
Position	Meaning	Index	Explanation
1 + 2	Joint type	VL	VL disc joint
3 – 7	Description	2600i 3300i 4100i	Identification of the size/power transmission

6.2.2. Versions

Model	Transmission	Rear axle differential	Output shaft
528i	GA8HP45Z	Rear diff 205AL	VL-2600i
535i	GS6-45BZ	Rear diff 205AL	VL-3300i
535i	GA8HP45Z	Rear diff 205AL	VL-3300i
550i	GS6-53BZ	HAG 225AL	VL-4100i
550i	GA8HP70Z	HAG 225AL	VL-3300i

6. Driveshaft and Axle Shafts

6.2.3. Overview



F10 Output shaft

The F10 has output shafts inserted at the wheel and axle differential ends.

The design of the journal at the rear axle differential end depends on the size of the rear axle differential. The journal at the wheel hub end comes in only the one size.

Due to the position of the rear axle differential, the axle shafts on the left and right have different overall lengths.

The shaft between the two joints is designed as a torsionally rigid hollow shaft.

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Technical training.

Product information.

F10 Chassis Dynamics

Edited for the U.S. market by:

BMW Group University

Technical Training

ST1002 6/1/2012

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.

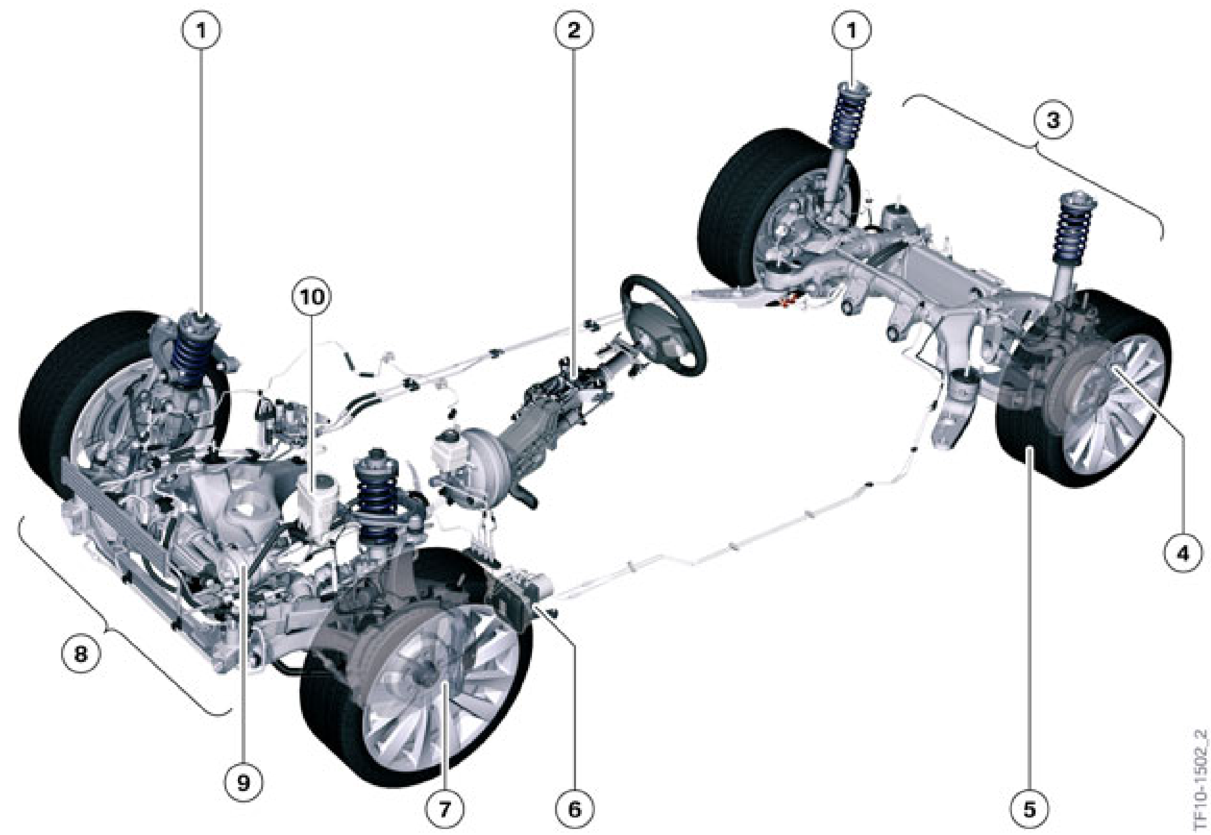
Information status: **December 2009**
VH-23/International Technical Training

F10 Chassis Dynamics
Contents

F10 Chassis Dynamics

1. Introduction

1.1. Driving dynamics and comfort



F10 Chassis and suspension

Index	Explanation
1	Suspension/dampers
2	Electromechanical Power Steering (EPS)
3	Integral V rear axle
4	Electromechanical Parking Brake (EMF)
5	Wheels
6	Dynamic Stability Control (DSC)
7	Brakes
8	Double-wishbone front axle
9	ARS engine driven hydraulic pump
10	ARS system fluid reservoir

The chassis and suspension of the F10 are based on that of the F01, which set new standards in terms of driving dynamics and comfort. The chassis and suspension have been adapted to the F10 requirements resulting in exceptional driving dynamics with a continued very high level of comfort.

F10 Chassis Dynamics

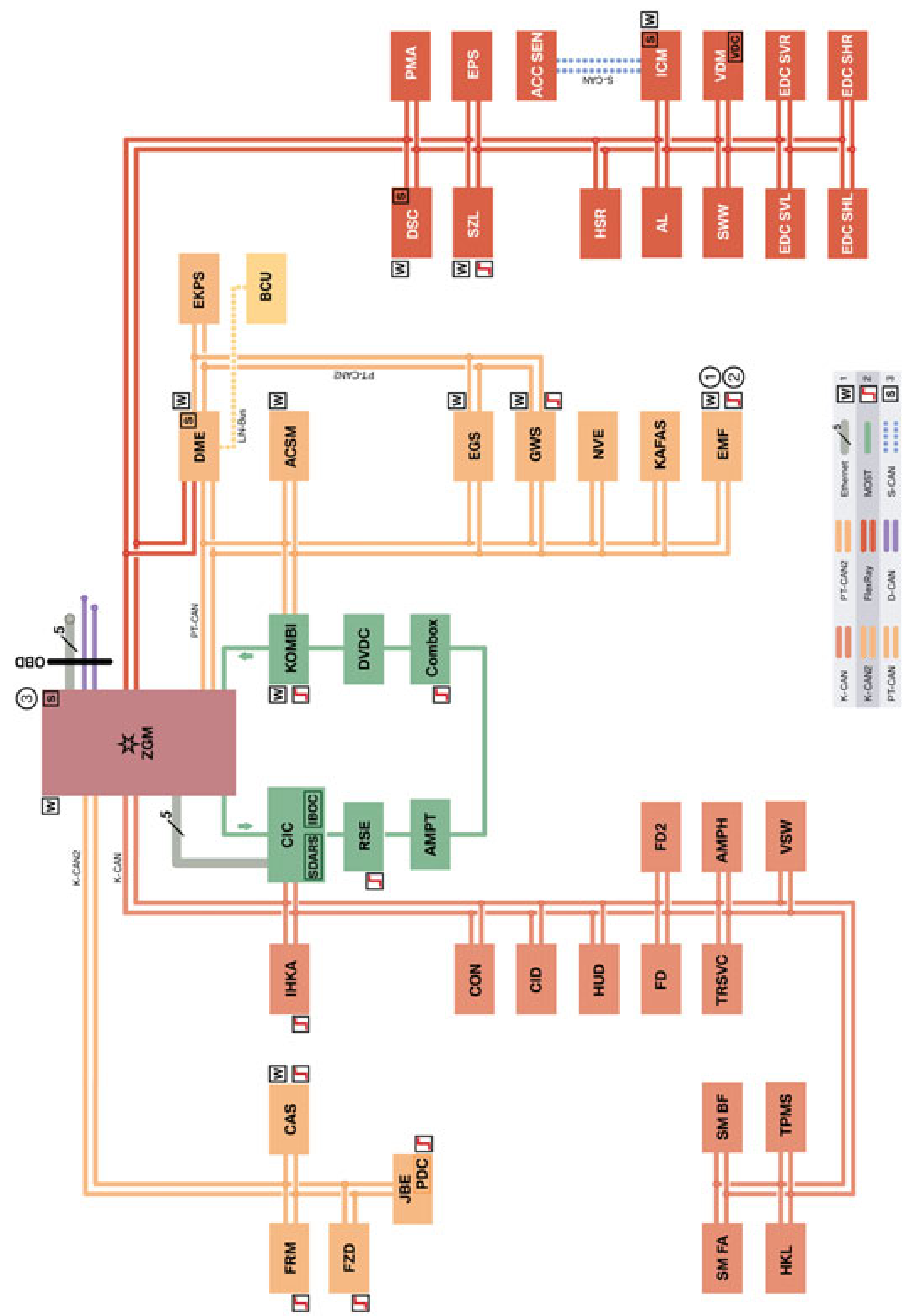
1. Introduction

The familiar technological innovations from the F01 like Integral Active Steering, Integrated Chassis Management ICM, Dynamic Drive and Electronic Damper Control EDC are also installed in the F10.

F10 Chassis Dynamics

1. Introduction

1.2. Bus System Diagram



F10 Bus system diagram

1. Introduction

Index	Explanation
1	Wakeable control units
2	Control units authorized to wake up the vehicle
3	Startup node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety 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
Combox	Combox multimedia with telematics
CON	Controller
D-CAN	Diagnosis on Controller Area Network
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
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications
FRM	Footwell module
FZD	Roof function center

F10 Chassis Dynamics
1. Introduction

Index	Explanation
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 Control Unit
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for reversing camera and side view
VDM	Vertical Dynamics Management
VSW	Video switch
ZGM	Central Gateway Module

F10 Chassis Dynamics
2. Models

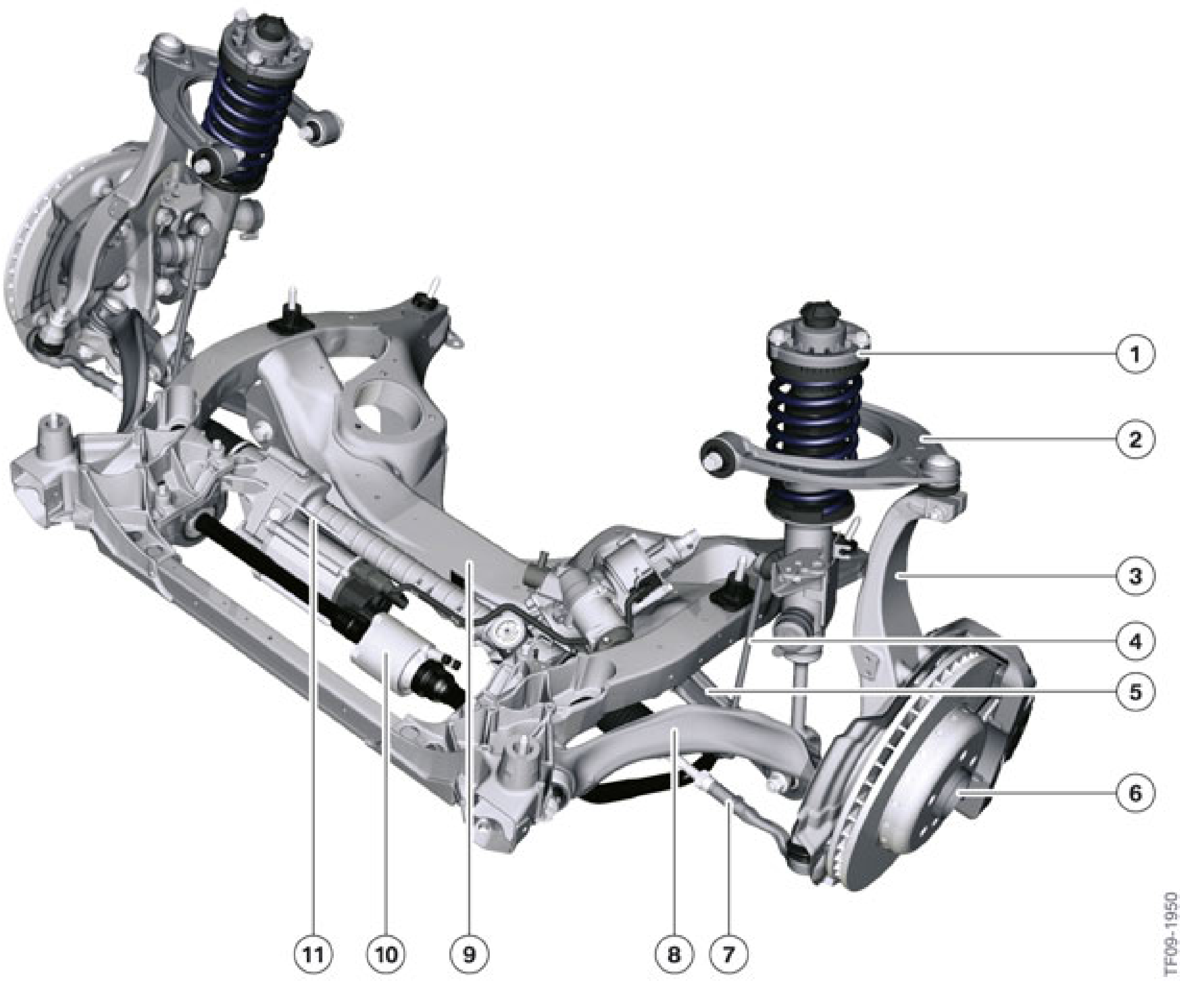
2.1. Comparison

The following table provides an overview of the technical data of the chassis and suspensions of the E60 and F07 compared to the F10.

Description	E60 BMW 535i	F07 BMW 535i Gran Turismo	F10 BMW 535i
Wheelbase	2888 mm	3070 mm	2968 mm
Track width, front	1558 mm	1611 mm	1600 mm
Track width, rear	1581 mm	1654 mm	1627 mm
Basic wheel tires	225/50 R17 94W	245/50 R18 100W AS RSC	245/45 R18 96V RSC
Basic wheel rims	7.5J x 17 IS 20	8J x 18 LM 30	8J x 18 LM 30
Front axle	Two-joint spring strut front axle	Double-wish-bone front axle	Double-wishbone front axle
Suspension/damping, front	Steel spring/con-ventional or EDC	Steel spring/con-ventional or EDC	Steel spring/conven-tional or EDC
Stabilizer bar, front	Mechanical or hydraulic (Dy-namic Drive)	Mechanical or hydraulic (Dy-namic Drive)	Mechanical or hy-draulic (Dynamic Drive)
Brake, front	Brake disc Ø 324 mm	Brake disc Ø 348 mm	Brake disc Ø 348 mm
Steering	Hydraulic steering or active steering	Hydraulic or Integral Active Steering IAL	Electromechanical power steering
Rear axle	Integral IV rear suspension.	Integral V rear axle	Integral V rear axle
Suspension/damping, rear	Steel spring or air spring/con-ventional or EDC	Air spring/con-ventional or EDC	Steel spring/conven-tional or EDC
Stabilizer bar, rear	Mechanical or hydraulic (Dy-namic Drive)	Mechanical or hydraulic (Dy-namic Drive)	Mechanical or hy-draulic (Dynamic Drive)
Brake, rear	Brake disc Ø 320 mm	Brake disc Ø 345 mm	Brake disc Ø 345 mm
Parking brake	Drum brake with park-ing brake lever and automatic ca-ble adjustment	Drum brake with EMF (electromechani-cal parking brake)	Disc brake with EMF (electromechanical parking brake)

3. Chassis and Suspension

3.1. Front axle



F10 Front axle

Index	Explanation
1	Spring strut
2	Top wishbone
3	Swivel bearing
4	Stabilizer link
5	Bottom wishbone
6	Wheel hub
7	Track rod
8	Tension strut with hydraulic mount
9	Front axle subframe
10	Anti-roll bar with hydraulic swivel motor (Dynamic Drive)
11	Steering gear

F10 Chassis Dynamics
3. Chassis and Suspension

The double-wishbone front axle introduced with the E70/E71 is used in a refined version in the F01/F02, F07 and F10. The axle is equipped for the use of an all-wheel drive. EDC or conventional shock absorbers can be installed.

For service, the steering gear can be lowered all the way.

3.1.1. Technical data

Description	F10
Caster angle	7° 0'
Camber	-0° 12' ± 30'
Total toe-in	10' ± 12'
Toe angle difference	≤ 12'
Steering axis inclination	9° 57'
Rim offset IS	30 mm for 17" and 18" 33 mm for 19"
Kingpin offset	2.77 mm for 17" and 18" 5.77 mm for 19"
Track width	1600 mm for 17" and 18" 1594 mm for 19"
Maximum wheel steering lock angle, outer	33° 0'
Maximum wheel steering lock angle, inner	42° 14'

3.1.2. Notes for Service

The following tables show when a wheel alignment at the front axle is necessary.

After replacing the following components:	Wheel alignment required
Front axle subframe	YES
Steering gear	YES
Bottom wishbone	YES
Rubber mount for lower transverse control arm	YES
Tension strut	NO
Rubber mount for tension strut	NO
Top wishbone	NO
Rubber mount for upper transverse control arm	NO
Track rod	YES
Swivel bearing	YES
Wheel bearing	NO

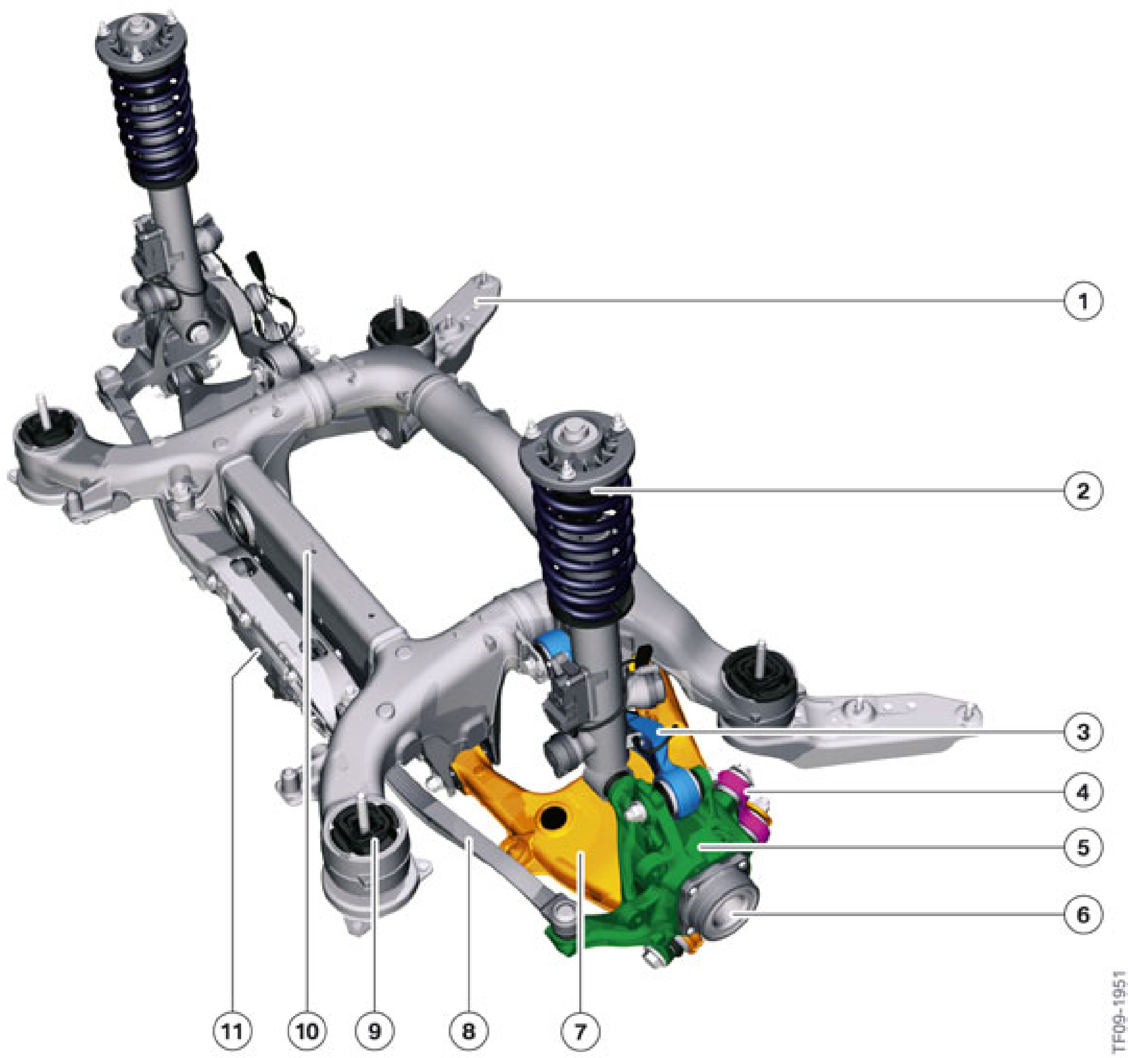
After replacing the following components:	Wheel alignment required
Spring strut	NO
Coil spring	NO
Mount	NO

Undoing or loosening the following connections:	Wheel alignment required
Front axle subframe to body (lowering)	NO
Steering gear unit to front axle subframe	YES
Lower transverse control arm to front axle subframe	YES
Lower transverse control arm to swivel bearing	NO
Tension strut to front axle subframe	NO
Tension strut to swivel bearing	NO
Upper transverse control arm to body	NO
Upper transverse control arm to swivel bearing	NO
Track rod to steering gear	NO
Track rod head to track rod	YES
Track rod head to swivel bearing	NO
Spring strut to lower transverse control arm	NO
Strut mount to body	NO
Lower steering shaft to steering gear	NO
Steering column to lower steering shaft	NO

3.2. Rear axle

The integral V rear axle installed in the F10 is an innovative further development of the Integral IV rear axle from the E60/65. The optimized lightweight construction rear axle made of aluminium has been specifically adapted to the new requirements for more power and torque. It integrates the required chassis control systems such as Integral Active Steering for greater driving dynamics and comfort.

For the exact operating principle of the integral active steering, refer to the information bulletin entitled "Transverse dynamic systems F01/F02".



F10 Integral V rear axle

Index	Explanation
1	Thrust strut
2	Spring strut
3	Top wishbone
4	Integral link
5	Wheel carrier
6	Wheel bearing
7	A-arm (swinging arm)

Index	Explanation
8	Track rod
9	Rubber mount for rear axle
10	Rear suspension subframe
11	HSR actuator

3.2.1. Technical data

Tires	Wheel rims	Total toe-in	Camber	Track width	Rim off-set IS
225/55 R17	8J x 17	14' ± 12'	-1° 50' ± 25'	1627 mm	30 mm
245/45 R18	8J x 18	14' ± 12'	-1° 50' ± 25'	1627 mm	30 mm
275/40 R18	9J x 18	14' ± 12'	-1° 50' ± 25'	1599 mm	44 mm
275/35 R19	9J x 19	14' ± 12'	-1° 50' ± 25'	1599 mm	44 mm

3.2.2. Notes for Service

The following tables show when a wheel alignment at the rear axle is necessary.

After replacing the following components:	Wheel alignment required
Rear suspension subframe	YES
Rubber mount for rear axle	NO
Swinging arm	YES
Integral link	YES
Ball joint in swinging arm	YES
Control arm	YES
Wishbone	YES
Wheel carrier	YES
Wheel bearing	NO
Spring strut	NO
Mount	NO

Undoing or loosening the following connections:	Wheel alignment required
Rear axle support on body	NO
Front compression strut on body	NO
Rear compression strut on body	NO
Front swinging arm on rear axle support	YES

3. Chassis and Suspension

Undoing or loosening the following connections:	Wheel alignment required
Rear swinging arm on rear axle support	YES
Swinging arm on integral link/wheel carrier	YES
Integral link on wheel carrier	NO
Control arm on rear axle support	YES
Control arm on wheel carrier	NO
Wishbone on rear axle support	YES
Wishbone on wheel carrier	YES
Spring strut on wheel carrier/swinging arm	NO

3.3. Wheels

The F10 comes standard equipped with run-flat tires in all the models.

The following tables list the available tire sizes.

	528i	535i	550i
Front tire	225/55 R17 97W	245/45 R18 96V RDC	245/45 R18 96Y RSC
Rear tire	225/55 R17 97W	245/45 R18 96V RDC	245/45 R18 96Y RSC
Front rim	8J x 17 LM IS30	8J x 18 LM IS30	8J x 18 LM IS30
Rear rim	8J x 17 LM IS30	8J x 18 LM IS30	8J x 18 LM IS30
Optional tire available with sport package	275/40 R18	275/35 R19	275/35 R19

Note: The Tire Pressure Monitoring System (TPMS), which was introduced in 2005, continues to be used on the F10

3.4. Suspension/damping

The F10 is equipped as standard with conventional shock absorbers and coil springs on the front and rear axle. EDC/VDC is optional and, depending on the model, is also available combined with ARS in the optional equipment Adaptive Drive (option 2VA).

Electronic Damping Control, Active Roll Stabilization, and Adaptive Drive are available only in combination with the ZDH Dynamic Handling Package on the 535i and 550i. EDC is offered independently as an option on the 528i.

The EDC is the same Vertical Dynamic Control (VDC) introduced with the E70/E71 and later installed on F0x models.

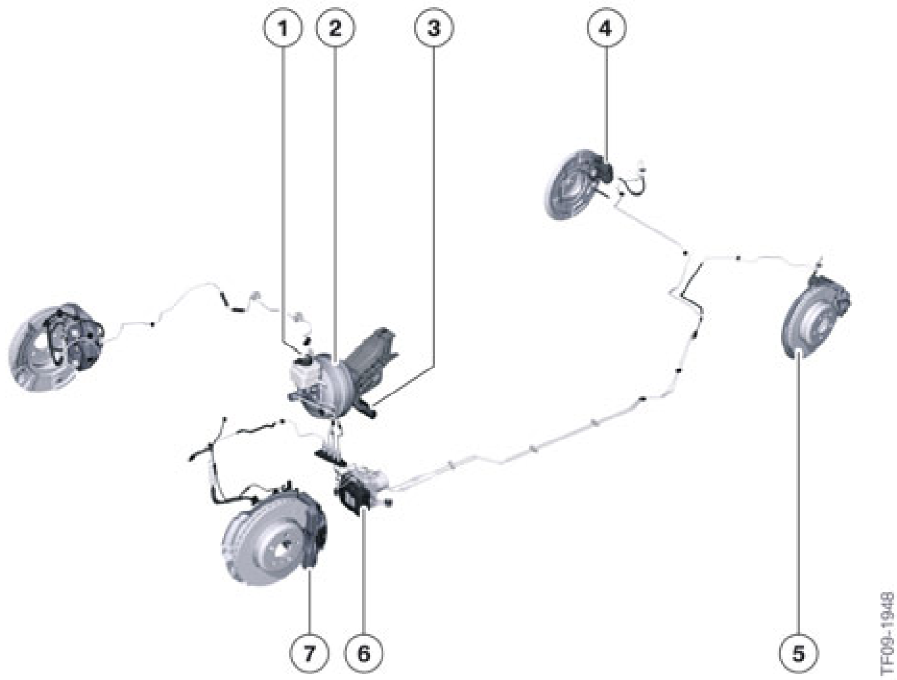
3. Chassis and Suspension

The EDC/VDC is a sub-function of the Vertical Dynamics Management (VDM). The servomotors and sensors on the shock absorbers, referred to as satellites, are connected to the VDM control unit via FlexRay. The drive dynamic control switch in the center console makes it possible to select the damping characteristics, which are stored in the VDM control unit.

Note: The EDC/VDC system is described in the F01/F02 "Vertical Dynamics Systems" training material available on TIS and ICP.

F10 Chassis Dynamics

4. Brakes



F10 Brakes

Index	Explanation
1	Brake fluid expansion tank
2	Brake booster
3	Brake pedal
4	Electromechanical parking brake actuator
5	Brake disc
6	Dynamic Stability Control (DSC)
7	Brake caliper

4.1. Service brake

The F10 has a hydraulic dual-circuit brake system with a "front/rear split". Lightweight brake discs with riveted aluminium hubs are installed on all models. Conventional aluminium floating brake calipers are used on the front axle. Spheroidal graphite (SG iron) cast iron floating brake calipers with integrated EMF actuators (for the electromechanical parking brake) are used on the rear axle.

As on all BMW vehicles the brake pad wear monitoring for the Condition Based Service display is used.

The brake discs are ventilated at both the front and rear axle.

The following tables list the brake dimensions of the various engine versions.

F10 Chassis Dynamics
4. Brakes

Front axle	**528i**	**535i**	**550i**
Brake rotor diameter	348 mm	348 mm	374 mm
Brake rotor thickness	30 mm	30 mm 36 mm	36 mm
Brake piston diameter	60 mm	60 mm	60 mm
Type	Lightweight construction	Lightweight construction	Lightweight construction

Rear axle	**528i**	**535i**	**550i**
Brake rotor diameter	330 mm	330 mm	345 mm
Brake rotor thickness	20 mm	20 mm	24 mm
Brake piston diameter	44 mm	44 mm	44 mm
Type	Lightweight construction	Lightweight construction	Lightweight construction

4.2. Electromechanical parking brake EMF

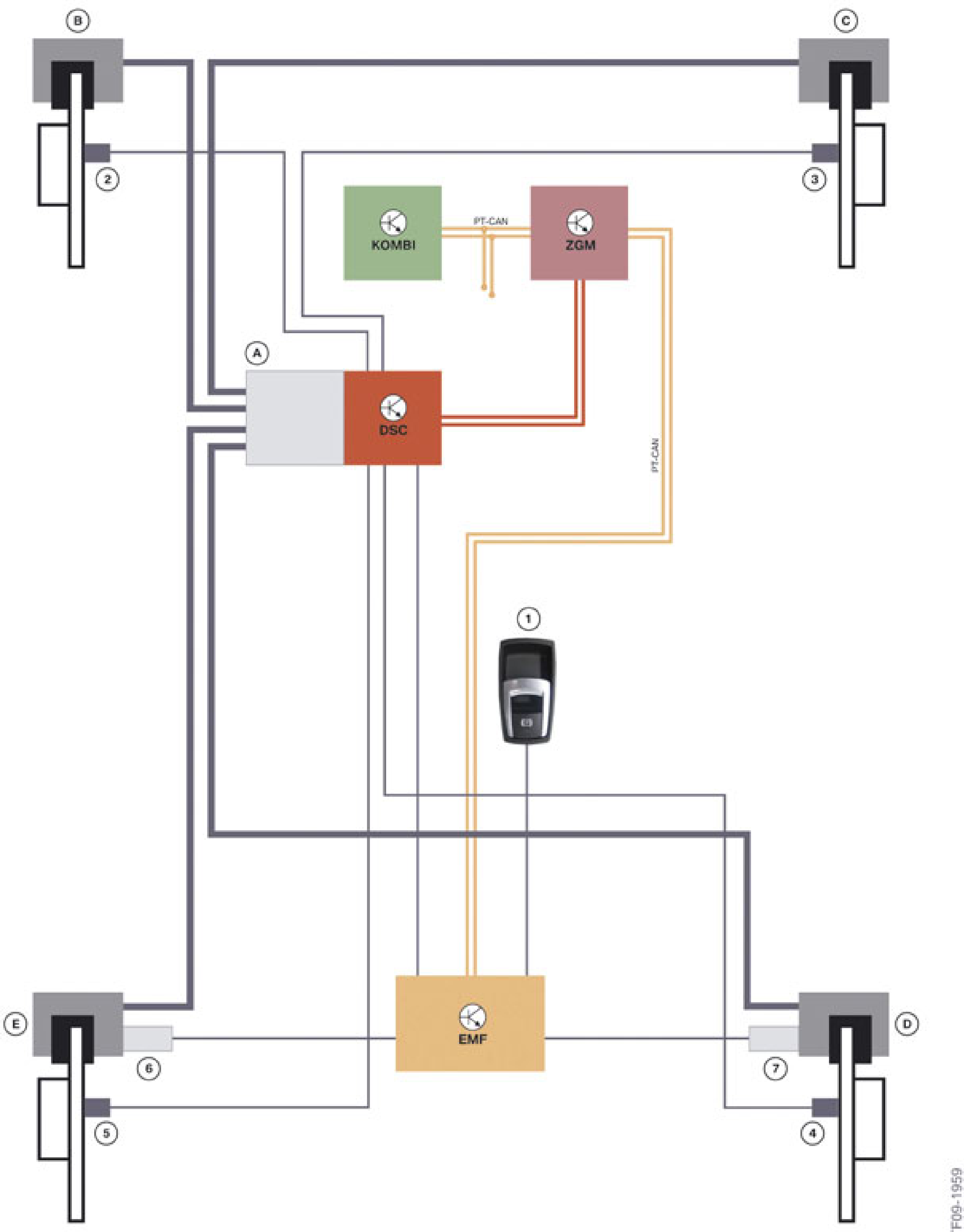
The F10 uses an electromechanical parking brake EMF integrated into the rear brake calipers.

The system is similar to the EMF system introduced in the E89 Z4.

The use of the EMF offers the following advantages:

- Operation via an ergonomic button in the center console
- Reliable engaging and releasing of the EMF under all conditions
- Automatic protection of the hydraulic holding functions (See F10 Automatic Hold Function and Active Cruise Control ACC)
- A dynamic emergency braking function is ensured even with a low coefficient of friction via the (ABS) control systems
- The discontinuation of the parking brake lever in the center console creates space for new equipment features.

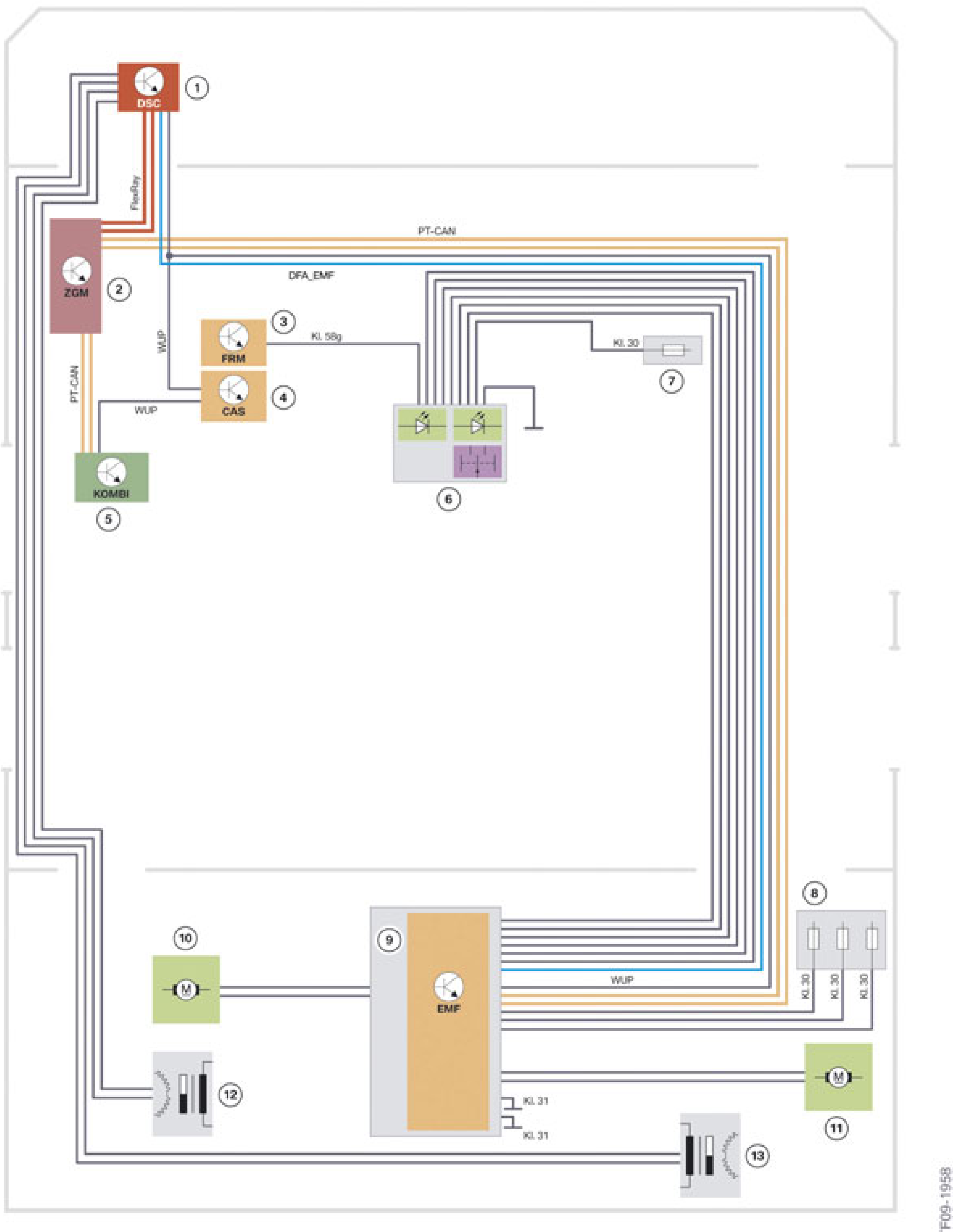
4.2.1. System overview



F10 System overview for electromechanical parking brake

Index	Explanation
A	DSC unit
B	Brake caliper, front left
C	Brake caliper, front right
D	Brake caliper, rear right
E	Brake caliper, rear left
1	Parking brake button
2	Wheel speed sensor, front left (not used for the EMF)
3	Wheel speed sensor, front right (not used for the EMF)
4	Wheel-speed sensor, rear right
5	Wheel speed sensor, rear left
6	EMF actuator, rear left
7	EMF actuator, rear right
EMF	Electromechanical parking brake
DSC	Dynamic Stability Control
JBE	Junction box electronics
KOMBI	Instrument cluster
PT-CAN	Powertrain CAN

4.2.2. System wiring diagram



F10 System wiring diagram for EMF

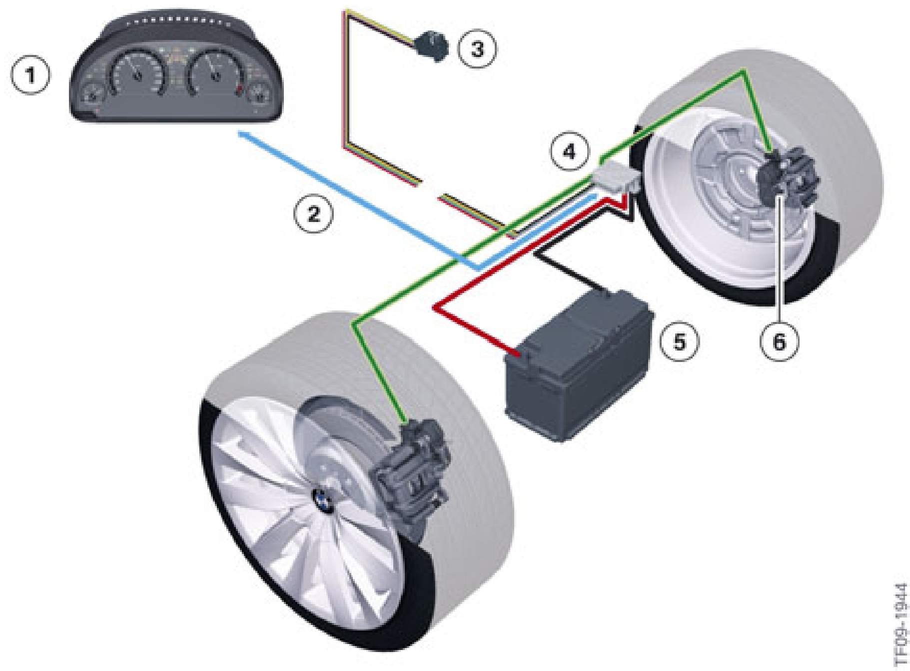
Index	Explanation
1	Dynamic Stability Control (DSC)
2	Central Gateway Module (ZGM)
3	Footwell module (FRM)
3	Instrument cluster (KOMBI)
4	Car Access System (CAS)
5	Instrument cluster (KOMBI)
6	Parking brake button
7	Front distribution box
8	Rear power distribution box
9	EMF control unit
10	EMF actuator, rear left
11	EMF actuator, rear right
12	Wheel speed sensor, rear left
13	Wheel-speed sensor, rear right
PT-CAN	Powertrain Controller Area Network
DFA_EMF	Redundant hard wired speed signal from DSC to EMF

Note: The DFA_EMF is a hard wired signal from DSC to EMF which carries a wheel speed information.

For safety reasons, it is very important, that the EMF NOT be activated as long as the vehicle is moving. Therefore the EMF uses two input signals to confirm vehicle speed: Bus-Signal and the DFA_EMF hard wired signal.

4.2.3. System structure

The EMF control unit receives the driver's command to engage the parking brake through the parking brake button. The vehicle condition is queried/detected via the electrical system connection and the bus systems. The control unit decides whether all conditions for engaging the parking brake are in place. If this is the case, the two EMF actuators on the rear brake calipers are activated.



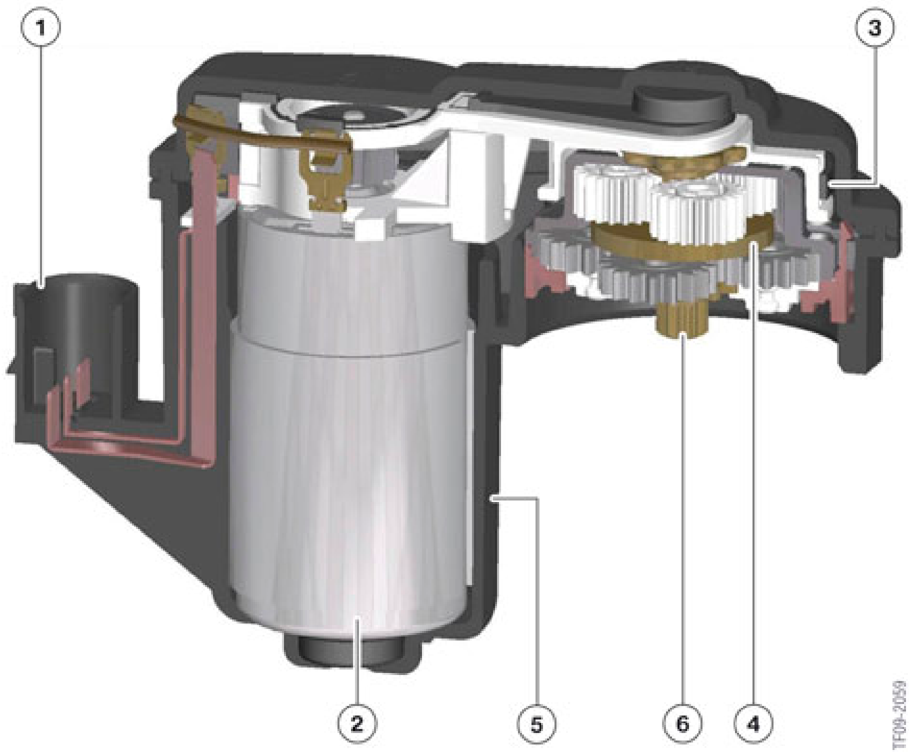
F10 EMF functional principle

Index	Explanation
1	Instrument cluster
2	Flow of information
3	Parking brake button
4	EMF control unit
5	EMF actuator

4.2.4. System function

The self-locking facility in the spindle maintains the tension force even when de-energized, and the vehicle is held securely in place. After the required force is reached, the detected status is indicated by a red indicator light in the instrument panel and an additional red LED in the parking brake button.

F10 Chassis Dynamics
4. Brakes

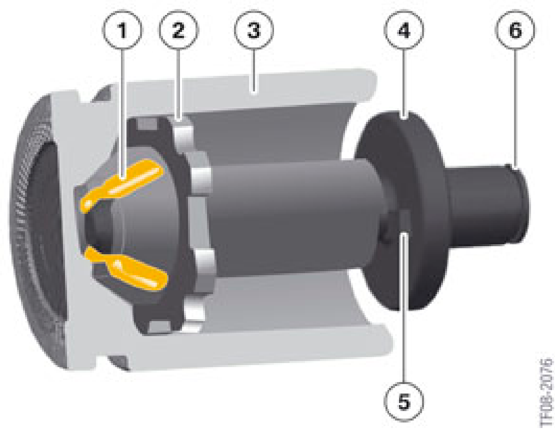


F10 Structure of EMF actuator

Index	Explanation
1	Push-fit connection
2	Electric motor
3	Drive belt
4	Planetary gearing
5	Casing
6	Connection to spindle

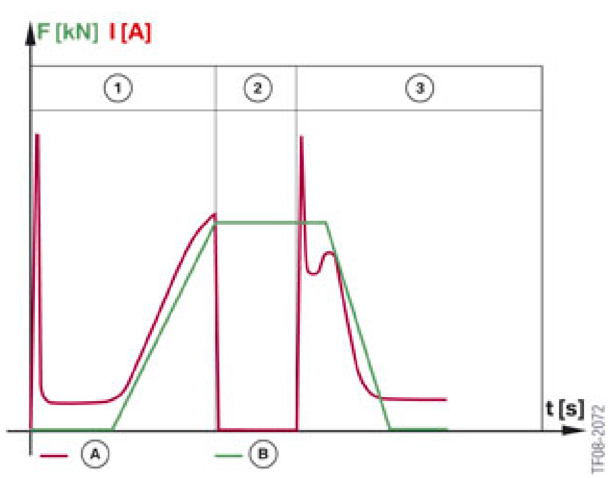
The EMF actuator is fastened to the brake caliper and acts directly on the brake piston.

An electric motor (2) and a drive belt (3) transmit the force to a two-stage planetary gear train (4). The spindle shown in the following graphic is driven via the connection to the spindle (6).



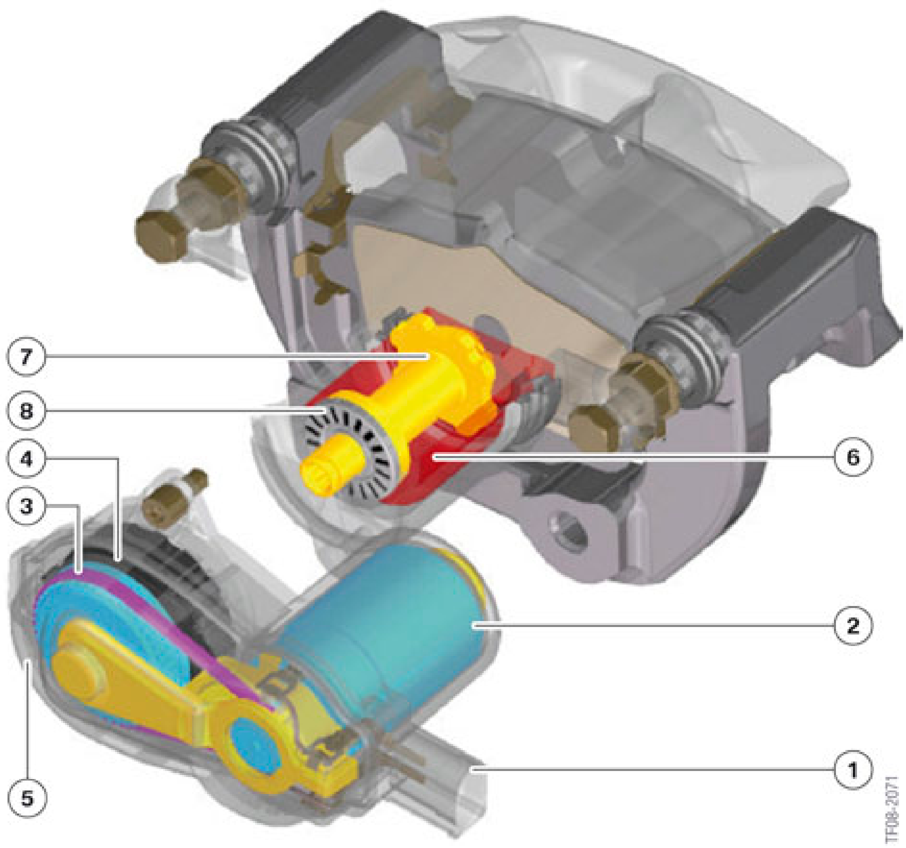
F10 Spindle and spindle nut in the brake piston

Index	Explanation
1	Groove
2	Spindle nut with anti-twist lock
3	Brake piston
4	Spindle
5	Spindle end stop
6	Connection to the planetary gear train



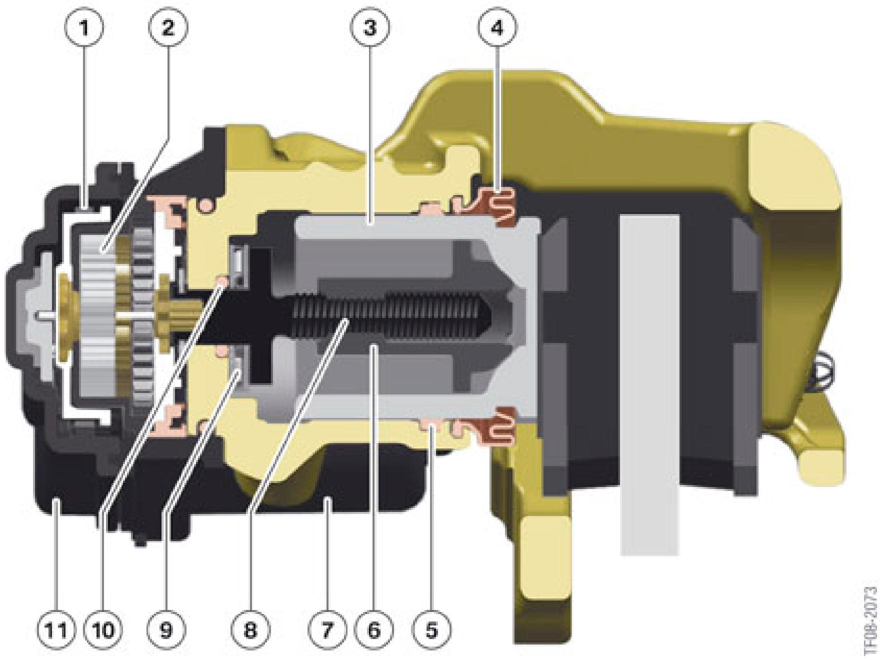
F10 Current-force curve EMF

Index	Explanation
A	Current curve
B	Force curve
1	Engaging the EMF
2	Engaged EMF
3	Disengaging the EMF



F10 Overview of EMF actuator with brake caliper

Index	Explanation
1	Push-fit connection
2	Electric motor
3	Drive belt
4	Planetary gearing
5	Casing
6	Brake piston
7	Spindle with spindle nut
8	Roller bearing



F10 Parking brake engaged with new brake pads

Index	Explanation
1	Drive belt
2	Planetary gearing
3	Brake piston
4	Dust boot
5	Sealing ring
6	Worm nut
7	Electric motor
8	Spindle
9	Roller bearing
10	Sealing ring
11	Casing

The driver can trigger the process of engaging the vehicle's parking brake by pulling the parking brake button. The operating direction is the same as the operating direction of the previously used mechanical parking brake lever. The signal from the parking brake button is read in by the EMF control unit. The EMF control unit activates the EMF actuators on the rear brake calipers individually.

Engaging is possible in every logical terminal status. Engaging at terminal 0 is made possible by integrating terminal 30 into the EMF control unit. If the driver operates the parking brake button at terminal 0, the EMF control unit is woken up. The EMF control unit in turn wakes up the other control units on the vehicle. Only then can the EMF control unit receive the important information relating to vehicle standstill. In addition, the changed status of the parking brake can be displayed after the system has been woken up.

The status "parking brake engaged" is indicated by a red indicator light in the instrument panel and an additional red LED in the parking brake button. Once the parking brake is on, pulling the parking brake button again has no effect.

F10 Indicator light, parking brake engaged display

Rolling monitor with parking brake engaged

The rolling monitor function is intended to prevent the vehicle from rolling with the parking brake engaged. Rolling monitor is engaged whenever a state change of the parking brake from "disengaged" to "engaged" takes place and ends following a defined time after this state change.

A signal from the DSC is used as the input variable for roll-away detection. As soon as this signal indicates that the vehicle has started to roll away, a retensioning of the EMF actuators is carried out immediately. To do so, the EMF actuators are supplied with full current for 100 ms to increase the tension force. Afterwards, the system waits for 400 ms. If the vehicle rolls again, the retensioning process is repeated (a maximum of three times). If rolling of the vehicle is still detected after the third retensioning, the function ends with an entry in the fault memory.

Temperature monitoring

The temperature monitoring ensures compensation for the force reduction that takes effect from when hot brake discs cool off. The temperature monitoring is activated if the temperature exceeds a certain value during the state change of the parking brake from "released" to "engaged".

The temperature of the brake discs is calculated individually for each wheel by the DSC control unit and transmitted to the EMF control unit. During the state change, the higher of the two brake disc temperatures is used for the temperature monitoring. The corresponding temperature ranges are stored in a characteristic map along with the corresponding retensioning times.

Depending on the temperature during the state change, the corresponding retensioning times from the characteristic map are activated. When the first retensioning time is reached, the first retensioning takes place. After the second retensioning time expires, another retensioning takes place; yet another takes place after the third time expires. In the characteristic map, the value 0 can also be stored for one or more specific retensioning times. The respective retensioning operations are then omitted. The function ends when the last retensioning operation is completed.

Disengaging the parking brake

To disengage the parking brake, the parking brake button is pushed. However, for the parking brake to actually released, terminal 15 must also be ON and at least one of the following conditions must be met:

- The brake pedal must be depressed
- The automatic transmission parking lock must be engaged
- The clutch pedal actuated (vehicles with manual transmission only).

This prevents the vehicle rolling if, for example, another occupant of the vehicle (other than the driver) presses in the parking brake button.

Once the parking brake is released, the red indicator lamp in the instrument panel and the red LED in the parking brake button go out.

Activating the EMF actuator sets the spindle in motion. The spindle rotation moves the spindle nut away from the brake piston by a small defined distance.

Dynamic emergency braking

The law requires that vehicles have two means of applying the brakes (with the first being the brake pedal). In the F10, the second is the parking brake button on the center console. If the parking brake button is pulled while the vehicle is in motion, the dynamic emergency braking procedure is applied by the DSC system. This function is intended for emergency situations in which the driver is unable to apply the brakes by pressing the brake pedal. As a safety measure, other occupants of the vehicle can also use this to bring the vehicle to a stop if, for example, the driver suddenly loses consciousness.

Dynamic emergency braking hydraulically applies brake pressure at all four brakes. The DSC functions are fully active and the brake lights are activated. That represents a major advantage over manual parking brakes.

The dynamic emergency braking takes place only while the parking brake button is pulled. The deceleration set by the DSC is increased progressively. During the dynamic emergency braking, the EMF indicator light is activated in the instrument panel. In addition, a Check Control message and an audible warning signal are issued to make the driver aware of the critical situation.

If the driver uses the brake pedal and pulls the parking brake button at the same time to slow down, the DSC control unit prioritizes. The greater braking requirement is put into effect. If dynamic emergency braking is continued to the point of standstill, the vehicle continues to be held stationary after the parking brake button is released. The EMF indicator light on the instrument cluster remains active. The driver can then release the parking brake once again (see "Releasing the parking brake").

Parking brake fault

In the event of a fault of the parking brake, the EMF indicator light is activated and lights up in yellow in the instrument panel. A Check Control message is output.

F10 Indicator light, parking brake fault display

Emergency release

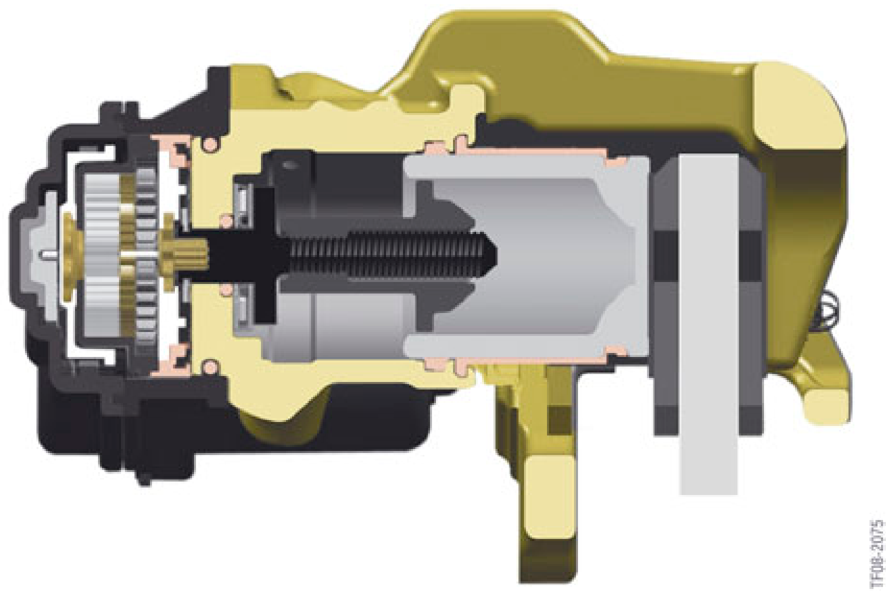
No emergency release of the parking brake is provided for the customer.

The parking brake can be unlocked by unscrewing the EMF actuators and manually turning back the spindles.

Note: No special tools are required to manually release the EMF at the calipers.

Changing the brake pads

To change the brake pads, the EMF actuator must be in the completely open position so that the brake piston can be pushed back. The EMF actuators can be activated and moved into the completely open position with the BMW (ISTA) diagnostics system. This position is necessary to change the brake pads. Once the installation position is reached, the installation mode is set automatically.



F10 Electromechanical parking brake with spindle nut in working position for exchanging the brake linings

Note: For safety reasons, as long as the EMF control unit is in installation mode, the parking brake cannot be activated. If the parking brake button is actuated despite this, the EMF indicator light flashes yellow in the instrument panel.

Installation mode can be cancelled in two ways:

- By running the "Reset installation mode" service function using ISTA
- By driving the car; a programmed minimum speed has to be exceeded.

After being changed, the brake pads must be bedded-in. This is necessary to ensure the brake pad and brake disc pairing assumes the specified friction parameters. Only then will the required braking force be reached.

Note: The exact procedure for bedding-in the service brakes is described in the Repair Instructions. The instructions must be followed exactly.

Brake test stand detection

Based on a plausibility check (wheel speed comparison), the EMF control unit detects the brake test stand and switches to brake test stand mode. Detection takes approximately 6 seconds.

By pulling the parking brake button multiple times in succession, the following target positions are approached:

- Brake pads applied
- Force 1 for the brake test stand
- Force 2 for the brake test stand
- Target force.

Alternatively, the parking brake button can also be pulled for a longer time in brake test stand mode. The individual target positions are then cycled through, spaced 3 seconds apart.

When the brake test stand mode is activated and the EMF actuators are released, the EMF indicator lamp flashes slowly.

When the brake test stand mode is activated and the EMF actuators are partially engaged, the EMF indicator lamp starts flashing quickly.

When the brake test stand mode is activated and the EMF actuators are completely engaged, the EMF indicator lamp is activated continuously.

The parking brake can be disengaged on the brake test stand without the brake pedal or clutch pedal being pressed. The brake test stand mode is terminated automatically when the vehicle leaves the brake test stand. The mode is also deactivated when the parking brake button is pressed or a fault is present.

Check Control messages

Description	Check control message	Central Information Display	Parking brake indicator light	Check Control symbol
Parking brake engaged	-	-		-
Installation mode	-	-		-
Brake test stand detected - actuator released	-	-		-

F10 Chassis Dynamics
4. Brakes

Description	Check control message	Central Information Display	Parking brake indicator light	Check Control symbol
Brake test stand detected - actuator in intermediate position	-	-		-
Retensioning due to rollaway monitoring - vehicle with manual transmission	Parking brake overloaded!	Parking brake Parking brake overloaded. To park, secure the vehicle against rolling away.	-	
Retensioning due to rollaway monitoring - vehicle with automatic transmission	Parking brake overloaded!	Parking brake To park, ensure that selector lever position P is engaged.	-	
Disengaging the parking brake	Disengaging the parking brake	-		
Additionally press foot brake	Additionally press foot brake	-	-	
Additionally engage selector lever position P	Additionally engage transmission P!	Parking brake To release the parking brake, also engage selector lever position P.	-	
Additionally press foot brake or clutch	Additionally press foot brake or clutch	-	-	
Parking brake button sensor fault	-	-		-

F10 Chassis Dynamics
4. Brakes

Description	Check control message	Central Information Display	Parking brake indicator light	Check Control symbol
Redundancy loss, speeds	Parking brake fault!	Parking brake Parking brake malfunctioning. Please ask your nearest BMW Service Center to check this.		
Redundancy loss, parking brake button	Parking brake malfunctioning!	Parking brake Parking brake malfunctioning. Please ask your nearest BMW Service center to check this.		
Electromechanical mode - vehicle with manual transmission	Parking brake malfunctioning!	Parking brake No emergency braking function. When vehicle is at a standstill, parking brake can be engaged and released via button. Ask your nearest BMW Service Center to check this.		

F10 Chassis Dynamics
4. Brakes

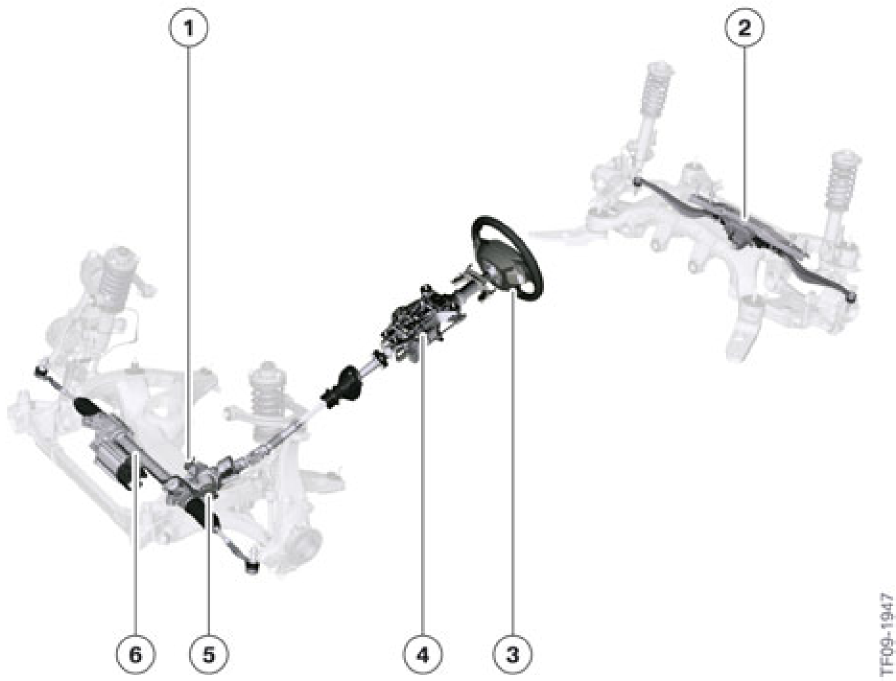
Description	Check control message	Central Information Display	Parking brake indicator light	Check Control symbol
Electromechanical mode - vehicle with automatic transmission	Parking brake malfunctioning!	No emergency braking function. When vehicle is at a standstill, parking brake can be engaged and released via button. Ask your nearest BMW Service Center to check this.		
immobilization - vehicle with manual transmission	Parking brake defective	Parking brake Parking brake defective. To park, secure the vehicle against rolling away. Ask your nearest BMW Service center to check this.		
immobilization - vehicle with automatic transmission	Parking brake defective	Parking brake Parking brake defective. To park, engage selector lever position P. Ask your nearest BMW Service Center to check this.		

F10 Chassis Dynamics

5. Steering

A vehicle's steering plays a central role in the chassis and suspension. The technological innovations introduced by BMW like active steering and rear axle slip angle control, are also used in the F10. Futhermore, the steering is now implemented completely electrically with the use of EPS (Electronic Power Steering) on all rear wheel drive F10 vehicles. The F10 xDrive models still use hydraulic power steering.

This system is a modified and enhanced version of the E89 Z4 EPS.



F10 Steering components

Index	Explanation
1	Active steering lock
2	HSR actuator
3	Steering wheel
4	Steering column
5	Active steering servomotor with motor position angle sensor
6	Electromechanical power steering

⚠

It is important to note that as with F10 all current F12/F13 xDrive models still use hydraulic power steering.

F10 Chassis Dynamics

5. Steering

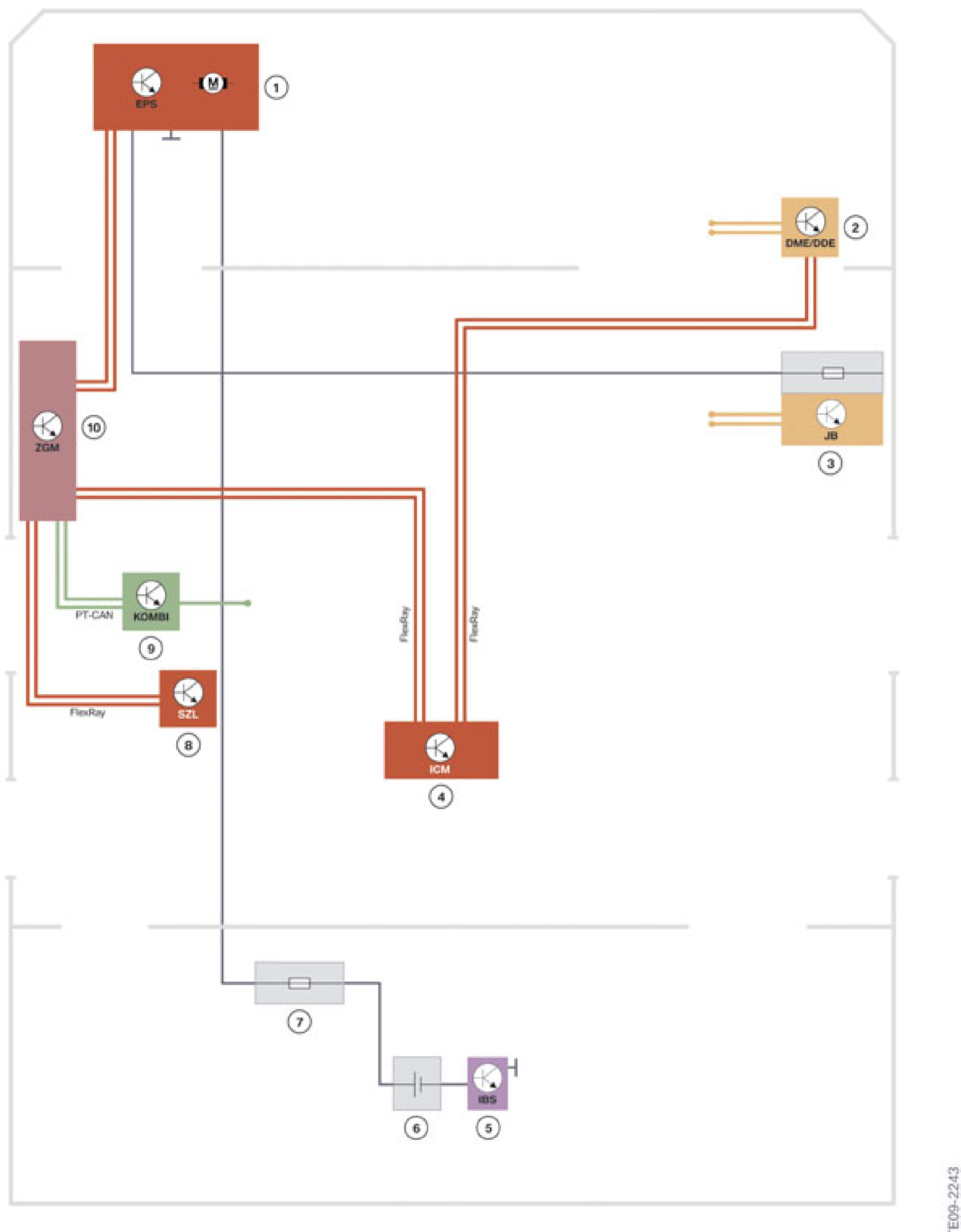
5.1. Basic steering

The F10 is the first BMW mid-range vehicle to be equipped with electromechanical power steering (EPS). The operating principle and structure of the EPS in the F10 is identical to that in the E89 and is explained the E89 Complete Vehicle training material under "Electric power steering with axial parallel arrangement (EPS w/APA)".

F10 Chassis Dynamics

5. Steering

5.1.1. System wiring diagram

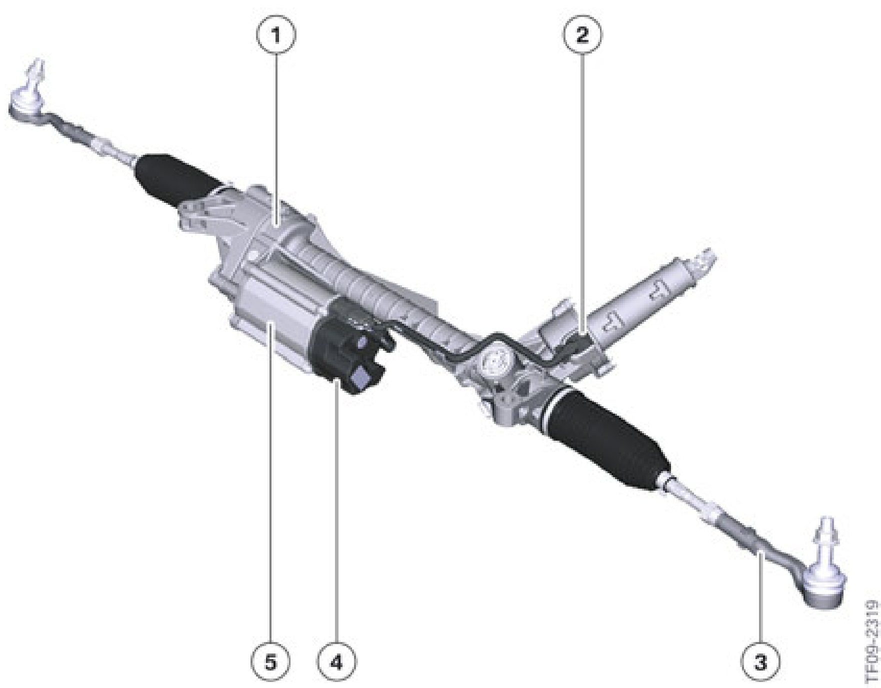


F10 System wiring diagram for basic steering

Index	Explanation
1	EPS
2	Digital Motor Electronics (DME)
3	Junction box electronics with front power distribution box
4	Integrated Chassis Management (ICM)
5	Intelligent battery sensor (IBS)
6	Battery
7	Battery power distribution box
8	Steering column switch cluster (SZL)
9	Instrument cluster (KOMBI)
10	Central Gateway Module (ZGM)

5.1.2. System overview

The EPS enables average fuel consumption to be reduced by approx. 0.3 l/100 km (0.317 quart/62miles) compared to a conventional hydraulic steering system. This contributes to a reduction of CO_2 emissions.



F10 EPS

5. Steering

Index	Explanation
1	Speed reducer
2	Steering-torque sensor
3	Track rod
4	EPS control unit
5	Electric motor with motor position sensor

The EPS steering replaces the conventional hydraulic steering system. EPS is always equipped with the Servotronic function. Using the drive dynamic control switch, two different adjustments can be achieved: "Normal" and "Sporty".

The EPS is less sensitive to disturbance variables such as bumps and steering wheel vibration. It also contributes to the driving safety of the F10 with an active roll damping.

Because there is no oil in the EPS, it is more environmentally friendly than conventional hydraulic steering systems.

The EPS has Active return to center, this delivers optimum drivability. The EPS also makes it possible for the parking assistance to be implemented for the first time in a BMW vehicle.

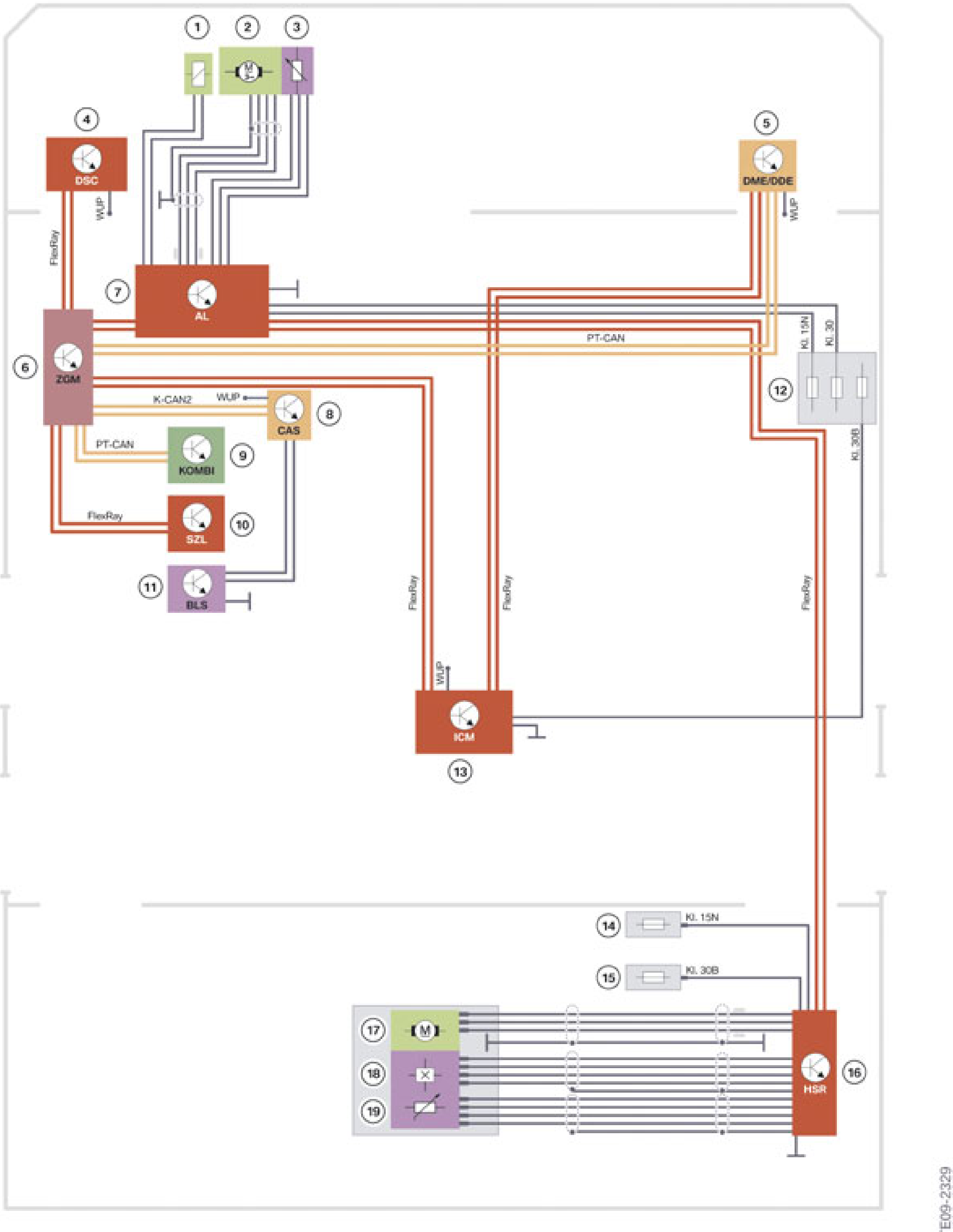
For more information about parking assistance, refer to the "F10 Driver Assistance Systems" section in this training material.

5.2. Integral Active Steering

As with the F01 and F07, the optional equipment Integral Active Steering in the F10 is made up of two components: the rear axle slip angle control HSR and the active steering AL on the front axle. The EPS on the F10 has been especially adapted and modified to work with the active steering on the front axle.

The components of Integral Active Steering, active steering and rear axle slip angle control, cannot be ordered separately, but only as the Integral Active Steering package (option 2VH).

5.2.1. System wiring diagram



F10 System wiring diagram for Integrated Active Steering

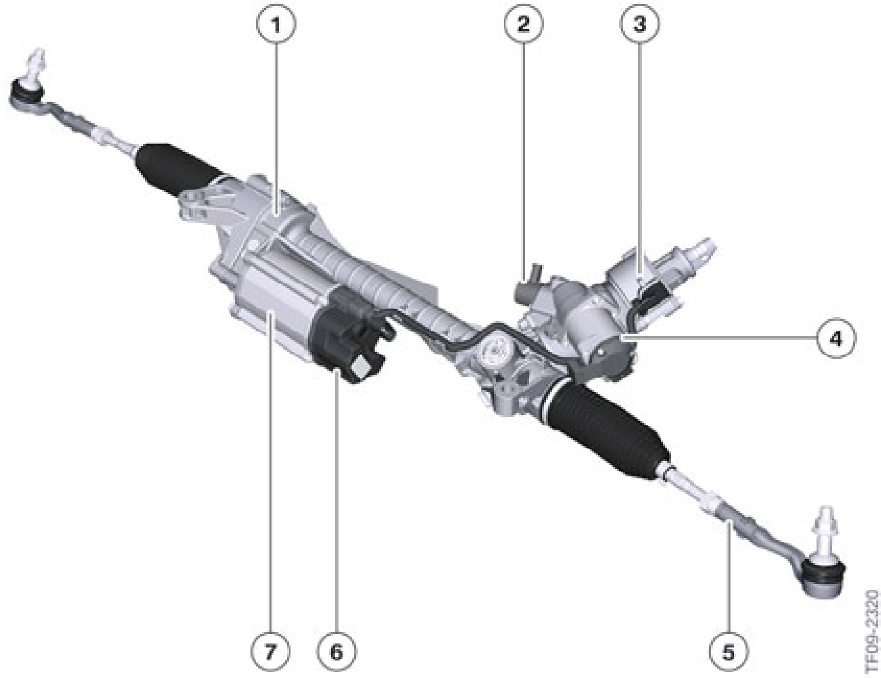
Index	Explanation
1	Active Steering lock
2	Active Steering electric servomotor
3	Active Steering motor angular position sensor
4	Dynamic Stability Control (DSC)
5	Digital Motor Electronics (DME)
6	Central Gateway Module (ZGM)
7	Control unit for Active Steering
8	Car Access System (CAS)
9	Instrument cluster (KOMBI)
10	Steering column switch cluster (SZL)
11	Brake light switch (BLS)
12	Front power distribution box
13	Integrated Chassis Management (ICM)
14	Rear right power distribution box
15	Battery power distribution box
16	Control unit for rear axle slip angle control (HSR)
17	HSR actuator
18	Hall-effect sensor
19	Track-rod position sensor

5.2.2. Active steering

With the optional equipment integral active steering, the steering gear is expanded by adding a planetary gearbox with override function, which implements a speed-dependent steering gear ratio that was already introduced with the E60.

F10 Chassis Dynamics

5. Steering



F10 EPS with active steering

Index	Explanation
1	Speed reducer
2	Active steering lock
3	Steering-torque sensor
4	Active steering servomotor with motor position angle sensor
5	Track rod
6	EPS control unit
7	Electric motor with motor position sensor

In the F10, electromechanical power steering is combined for the first time with the active steering planetary gearbox with override function (already familiar from the F01). As a result, the steering is implemented completely electrically.

Due to the higher weight of some engines and the higher steering forces associated with the greater front axle load, the power of a typical 12V steering system is no longer sufficient. For this reason, a 24V EPS system is installed in the F10, with the N63 engine and in conjunction with the optional Integral Active Steering equipment.

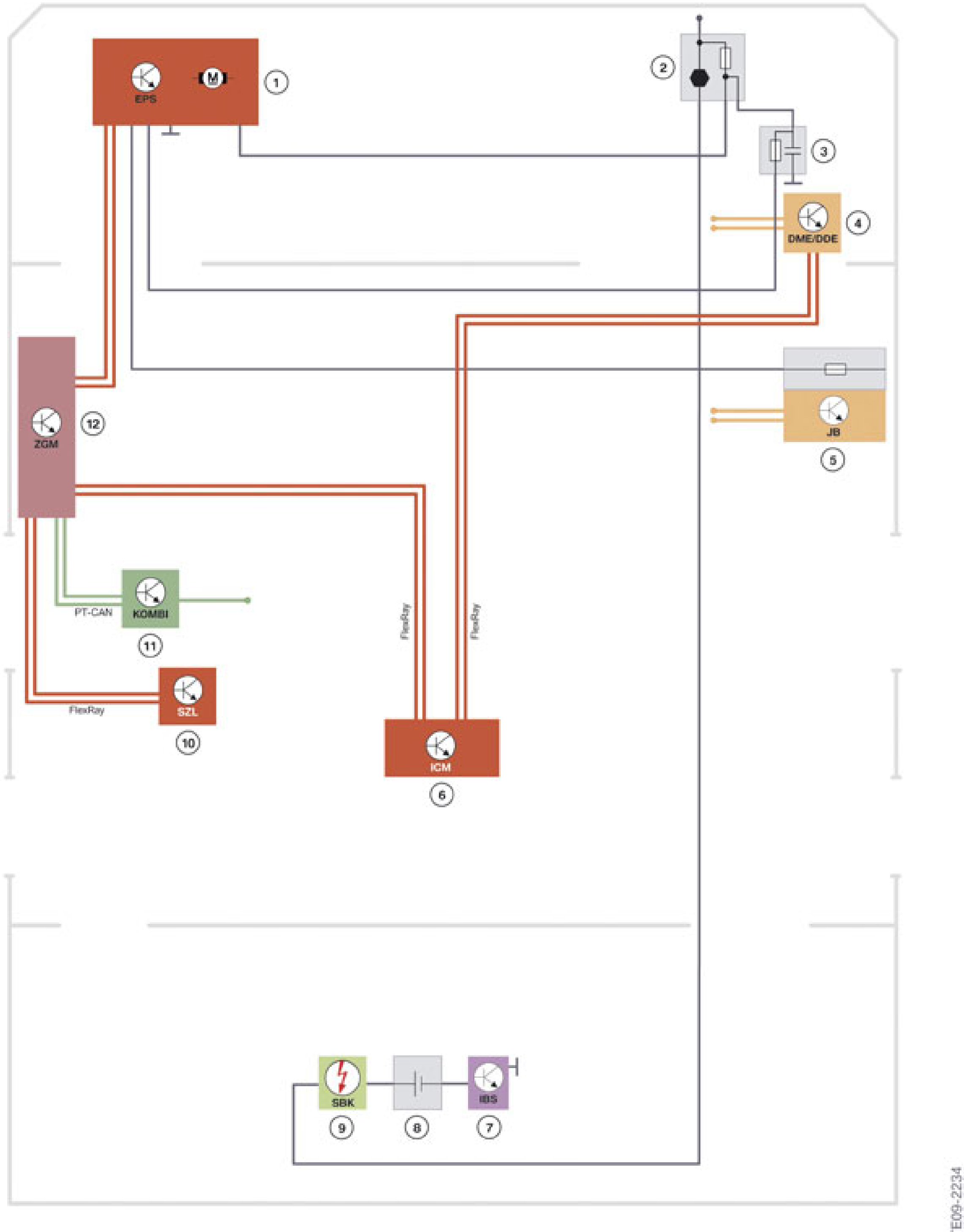
The following table explains when a 24V EPS is installed.

5. Steering

Engine	EPS voltage supply (only in combination with option 2VH)
528i	12V
535i	12V
550i	24V

EPS with 12V

Because active steering demands higher forces from the electromechanical steering, to comply with the higher current draw, when active steering is used in a vehicle with 12V EPS, the voltage is supplied by a separate positive battery connection point.



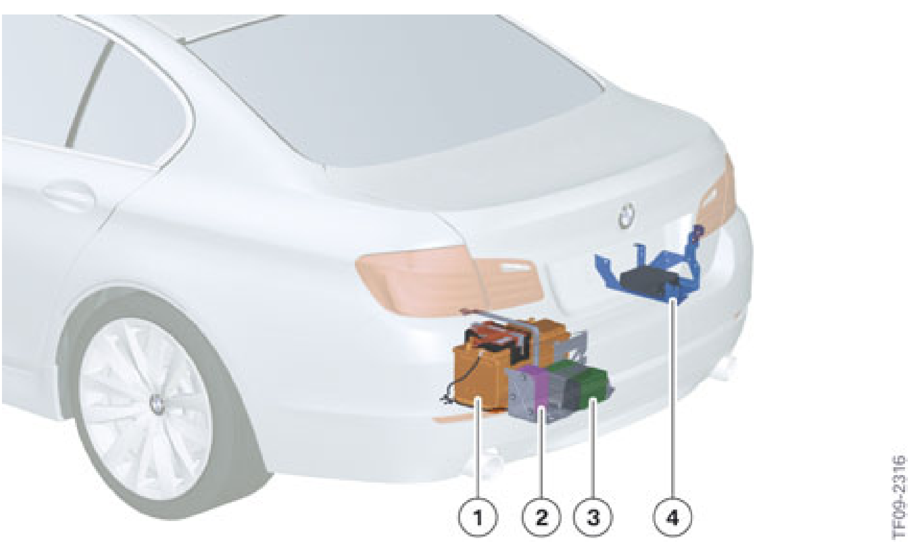
F10 System wiring diagram EPS with 12V and active steering

Index	Explanation
1	EPS
2	Positive battery connection point
3	Capacitor box
4	Digital Motor Electronics (DME)
5	Junction box electronics with front power distribution box
6	Integrated Chassis Management
7	Intelligent battery sensor (IBS)
8	Battery
9	safety battery terminal (SBK)
10	Steering column switch cluster
11	Instrument cluster (KOMBI)
12	Central Gateway Module (ZGM)

EPS with 24V

The higher weight of V8 and Diesel engines result in a higher front axle load. This in turn causes the power required for the steering servo to increase. In conjunction with the active steering, an even higher exertion of force is applied, and therefore even higher current is required for the steering servo. These high current made it necessary to increase the voltage supply of the EPS to 24V.

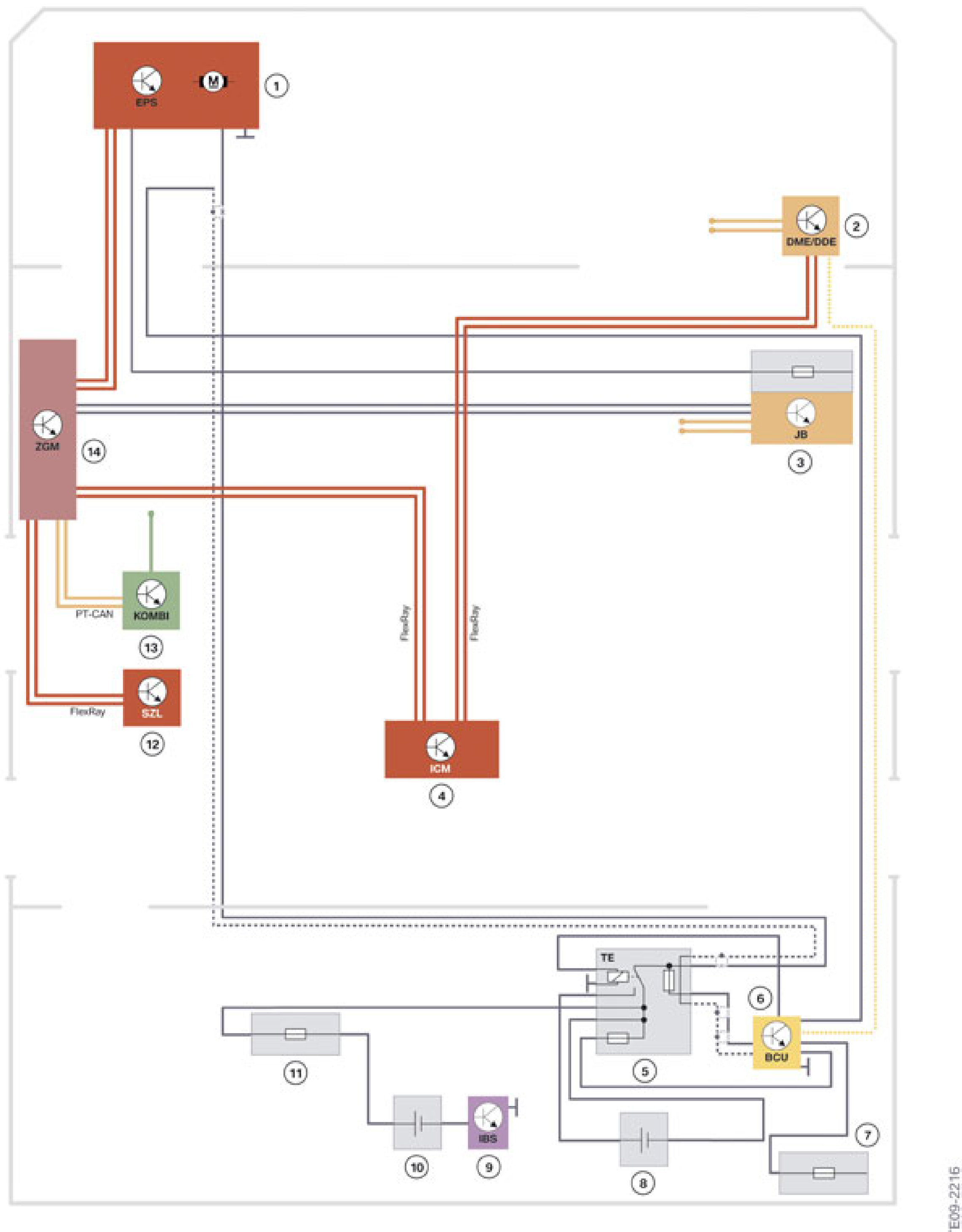
This requires an auxiliary battery, a separator and a charging unit for the auxiliary battery. These components are installed in the luggage compartment of the F10 550i (V8).



F10 550i 24V EPS components

Index	Explanation
1	Battery
2	Separator
3	Auxiliary battery
4	Battery charging unit for auxiliary battery (BCU)

The following system wiring diagram shows the integration of the new components into the vehicle electrical system.



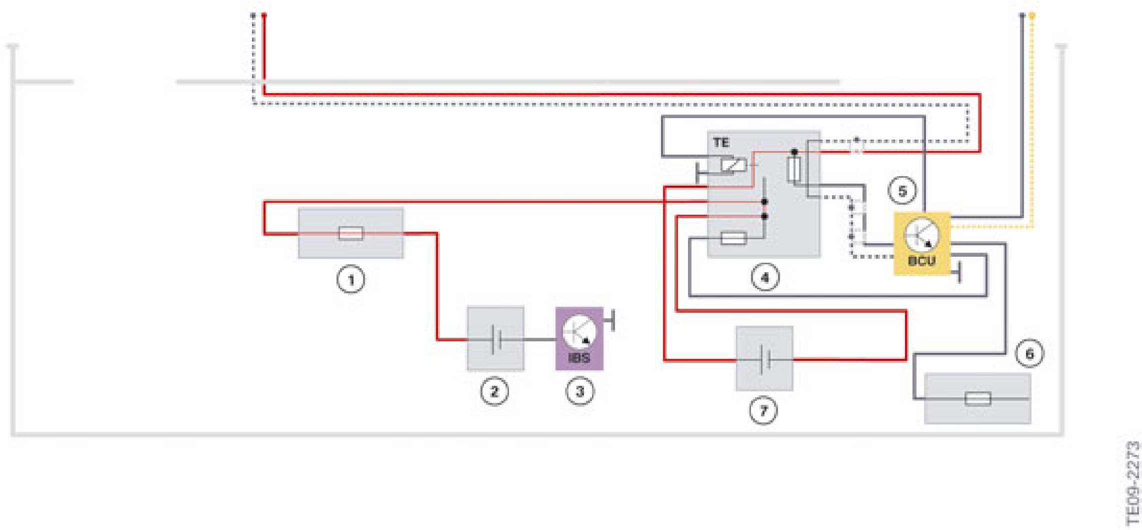
F10 System wiring diagram EPS with 24V and active steering

Index	Explanation
1	EPS
2	Digital Motor Electronics (DME)
3	Junction box electronics with front power distribution box
4	Integrated Chassis Management (ICM)
5	Separator
6	Battery charging unit for auxiliary battery (BCU)
7	Rear right power distribution box
8	Auxiliary battery
9	Intelligent battery sensor (IBS)
10	Battery
11	Battery power distribution box
12	Steering column switch cluster (SZL)
13	Instrument cluster (KOMBI)
14	Central Gateway Module (ZGM)

The BCU (charging unit) takes over the monitoring of the state of charge and the charging of the auxiliary battery with a 150W DC/DC converter. It monitors a cable (isolation) sheathing of the 24V line and it switches the relay in the separator with which the auxiliary battery is integrated into the circuit. The EPS is supplied with 24V only after this relay has been switched on. In the event of a fault, the EPS can also be operated with 12V. If there is no fault, the relay in the separator is switched as of terminal 15.

The 24V line is routed on the vehicle floor and is surrounded by a cable sheath which is monitored by the charging unit (BCU).

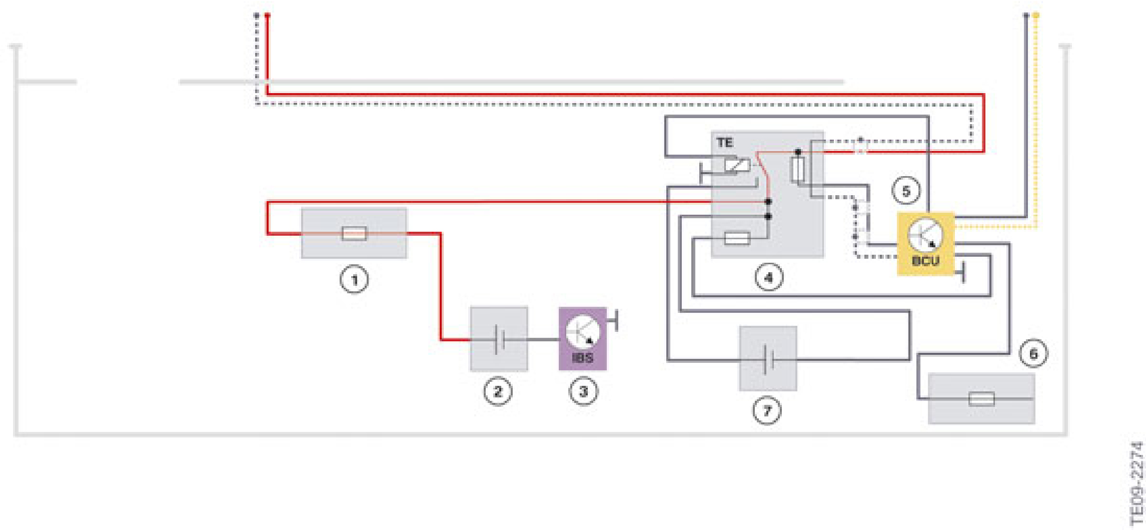
The following system wiring diagram details the various switch situations and the charging of the auxiliary battery.



F10 24V operation of the EPS

Index	Explanation
1	Battery power distribution box
2	Battery
3	Intelligent battery sensor IBS.
4	Separator (here: 24V operation)
5	Charging unit for auxiliary battery (Battery Charge Unit BCU)
6	Rear right power distribution box
7	Auxiliary battery

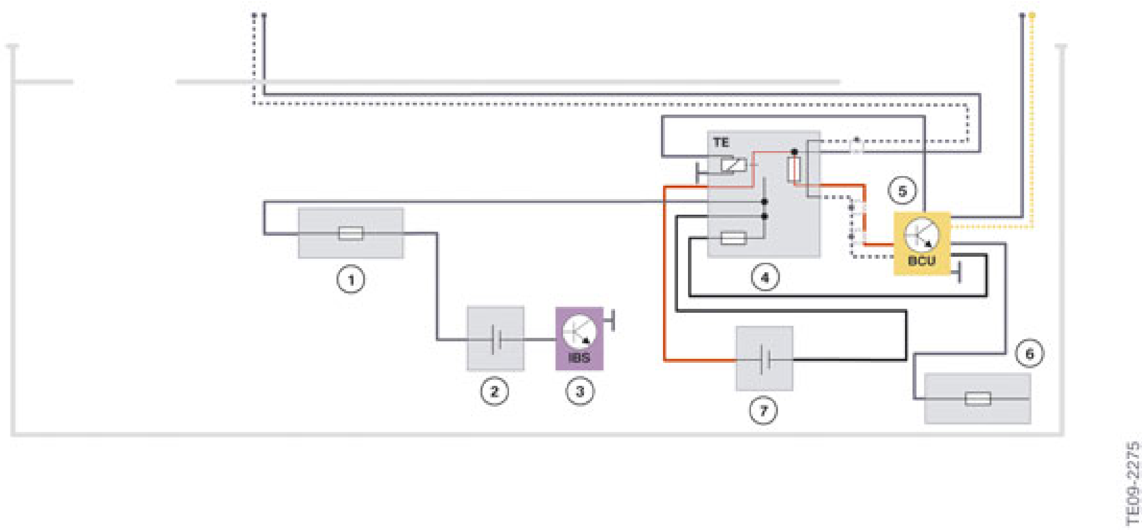
In 24V operation mode, the battery and the auxiliary battery are connected in series by the relay in the separator. As a result, the EPS is operated with 24V.



F10 12V operation in the event of a fault

Index	Explanation
1	Battery power distribution box
2	Battery
3	Intelligent battery sensor (IBS)
4	Separator (here: 12V operation)
5	Charging unit for auxiliary battery (Battery Charge Unit BCU)
6	Rear right power distribution box
7	Auxiliary battery

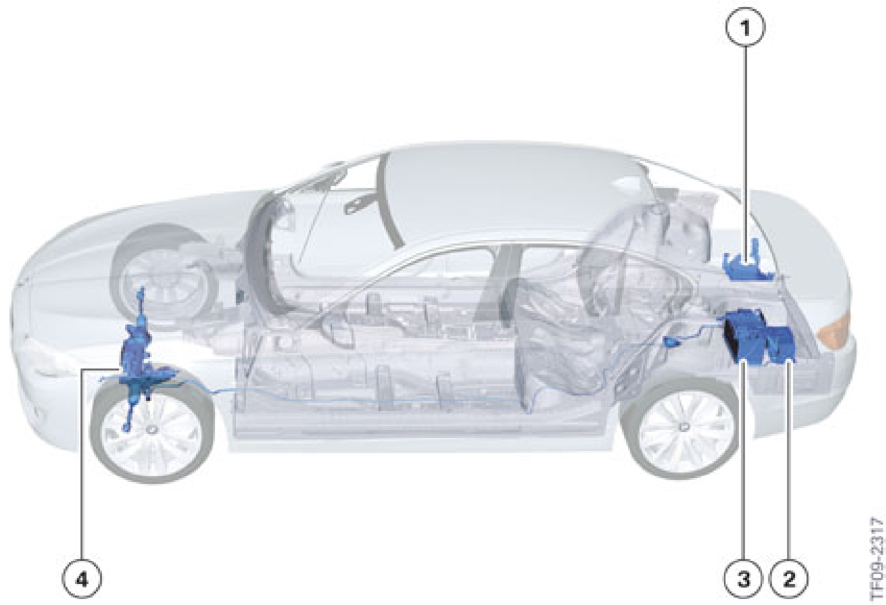
In the event of a fault or before terminal 15, the relay is open and the separator is in the 12V position. The auxiliary battery is no longer connected in series and is no longer in the circuit.



F10 Charging of the auxiliary battery in 24V operation

Index	Explanation
1	Battery power distribution box
2	Battery
3	Intelligent battery sensor IBS.
4	Separator (here: 24V operation)
5	Charging unit for auxiliary battery (Battery Charge Unit BCU)
6	Rear right power distribution box
7	Auxiliary battery

The auxiliary battery can be charged in 24V operation using the battery charging unit for the auxiliary battery. To do so, the charging unit takes the energy it uses for charging the auxiliary battery from the vehicle electrical system via the rear right power distribution box.



F10 24V components and line routing

Index	Explanation
1	Battery charging unit for auxiliary battery (BCU)
2	Separator and auxiliary battery
3	Battery
4	EPS with active steering

5.2.3. Rear suspension slip angle control

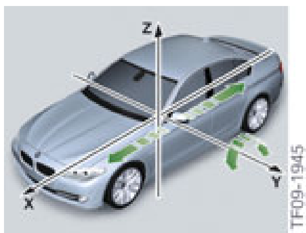
The rear axle is equipped with integral active steering, thus increasing the comfort and driving dynamics. To review the operating principle of the integral active steering, refer to the F01/F02 Chassis and Suspension and Lateral Dynamics System training material available on TIS and ICP. The components of Integral Active Steering include front active steering and rear axle slip angle control. The Integral Active Steering package (option 2VH) cannot be ordered separately on the F10, but only as is part of the (ZDH) Dynamic Handling Package.

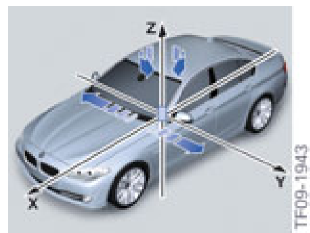
The (ZDH) Dynamic Handling Package also includes: Electronic Damping Control, Active Roll Stabilization and Adaptive Drive.

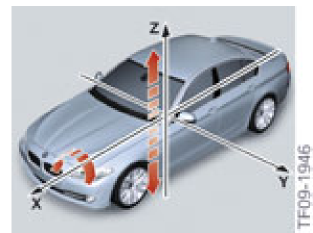
6. Dynamic Driving Systems

6.1. Force-transfer directions

The driving stability control systems can be distinguished by their basic force-transfer directions. Driving stability control systems can act both in and around an axis of the vehicle-fixed coordinate system X, Y and Z.







Force-transfer direction	Longi-tudinal	Pitch	Trans-verse	Yaw	Vertical	Roll
DSC	●			●		
Integral Active Steering			●	●		
VDM		●			●	
DCC	●					
ARS						●

6.2. Dynamic Stability Control

Dynamic Stability Control is standard in all BMW vehicles.

The DSC prevents spinning of the drive wheels when starting up and when accelerating.

The DSC also identifies unstable driving conditions, such as oversteer or understeer. The DSC helps to keep the vehicle on a safe course by applying brake interventions on the individual wheels (within the physical limits) and by reducing the engine output in order to control wheel spin and maintain traction.

⚠

It always remains the responsibility of the driver to adapt his or her driving style.

Even with the DSC, the laws of physics still apply.

Always Drive Safely!

The DSC system control unit is attached to a hydraulic valve block and it includes many individual functions that are listed in the following table.

6. Dynamic Driving Systems

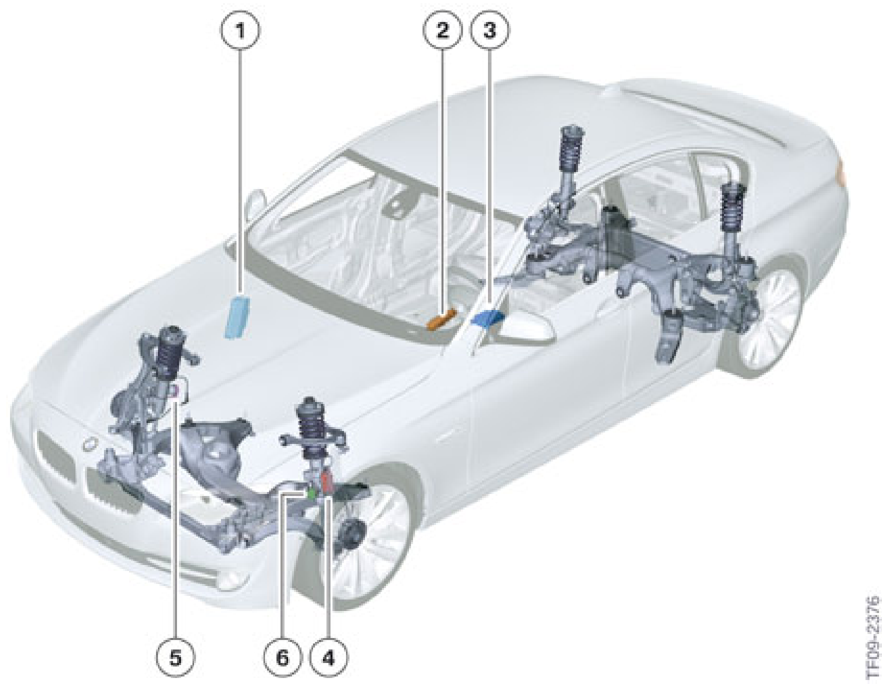
Function	Subfunction	Description
ABS		Antilock Brake System
	EBV	Electronic brake force distribution
	CBC	Cornering Brake Control
	DBC	Dynamic Brake Control
ASC		Automatic Stability Control
	MMR	Engine torque control
	MSR	Engine drag torque control
	BMR	Brake torque control
DSC		Dynamic Stability Control
	GMR	Yaw moment control
	SDR	Thrust differential control
	DTC	Dynamic Traction Control

The DSC can be operated in three modes:

- Normal operation
- Dynamic Traction Control (DTC)
- DSC OFF

6. Dynamic Driving Systems

6.3. Electronic Damper Control (EDC/VDC)



F10 Components of the VDM

Index	Explanation
1	VDM control unit
2	Drive dynamic control switch
3	ICM control unit
4	EDC satellite, front left
5	EDC control valve for rebound
6	EDC control valve for pressure stage

The F10 uses **Vertical Dynamics Management (VDM)** with **Electronic Damper Control (EDC)**.

Beginning with the F01/F02, the EDC is also called **VDC (Vertical Dynamic Control)** and is a function of the VDM.

The VDM was introduced with the E70/E71, enhanced for the F01/F02 and now further developed for the F10.

With Vertical Dynamics Control (VDC), independent electronic damper control for each wheel is possible, whereas EDC is only capable of front to rear adjustments.

During this process, the servomotors and the sensors on the shock absorbers, known as satellites, are connected to the VDM control unit via FlexRay.

The VDC and the Dynamic Drive (ARS for the vehicles BMW 535i, BMW 550i) are available only in combination as Adaptive Drive (option 2VA). EDC can only be ordered individually as optional equipment (option 223) on the BMW 528i.

6. Dynamic Driving Systems

For more information regarding EDC/VDC, refer to the F01/F02 "Vertical Dynamics Systems" training material available on TIS and ICP.

6.4. Dynamic Drive (ARS)

The Active Roll Stabilization (ARS) was introduced for the first time in the E65/E66. With the F10, this is available individually as Dynamic Handling (optional equipment 229). As is the also case with the EDC (VDC), the ARS function is calculated by the VDM control unit

Dynamic Handling Package (ZDH) includes Adaptive Drive (option 2VA) EDC (223) and ARS (229) and is available as and option on the F10 (in the BMW 535i and BMW 550i only)

ARS can bring about a noticeable reduction in the lateral tilt of the body that occurs during fast cornering or avoidance maneuvers. During this process, the ARS reduces the required steering angle and also minimizes the unwanted interference created by the wheels on the axle.

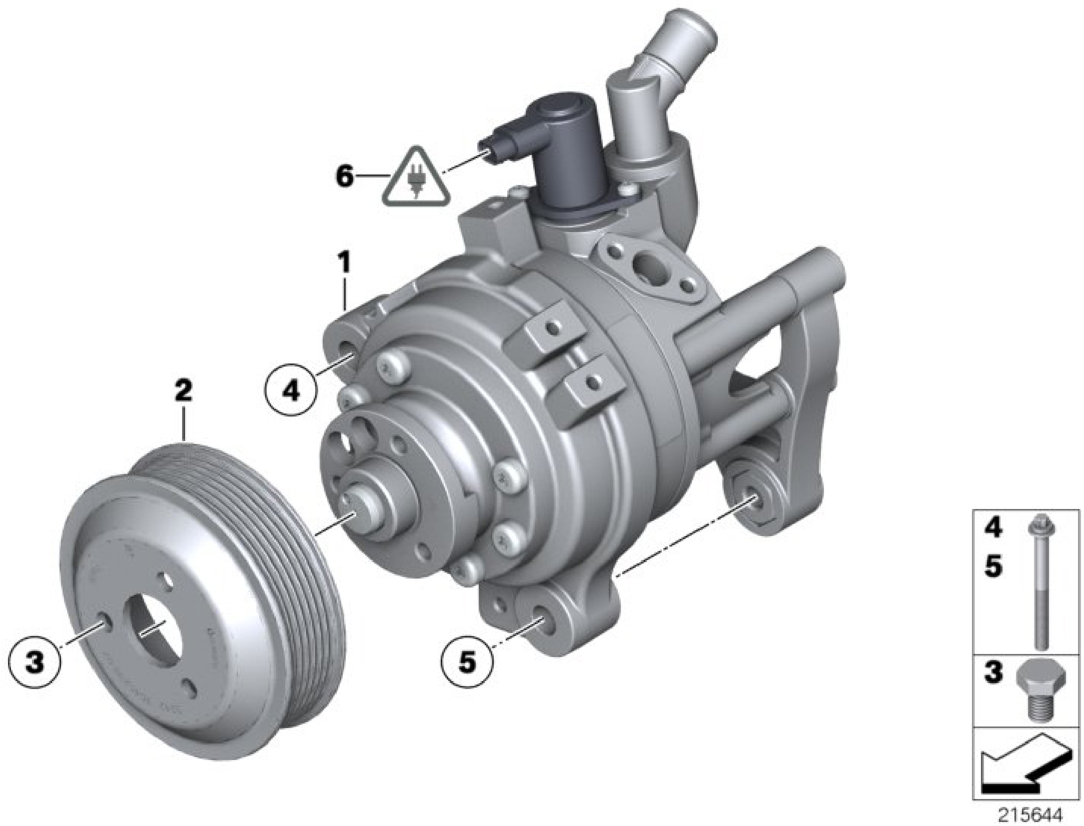
The ARS significantly improves the self-steering response of the vehicle while also enhancing the load change response.

Control commands are sent to the hydraulic swivel motors of the anti-roll bars based on the data acquired in order to counteract the lateral tilting forces.

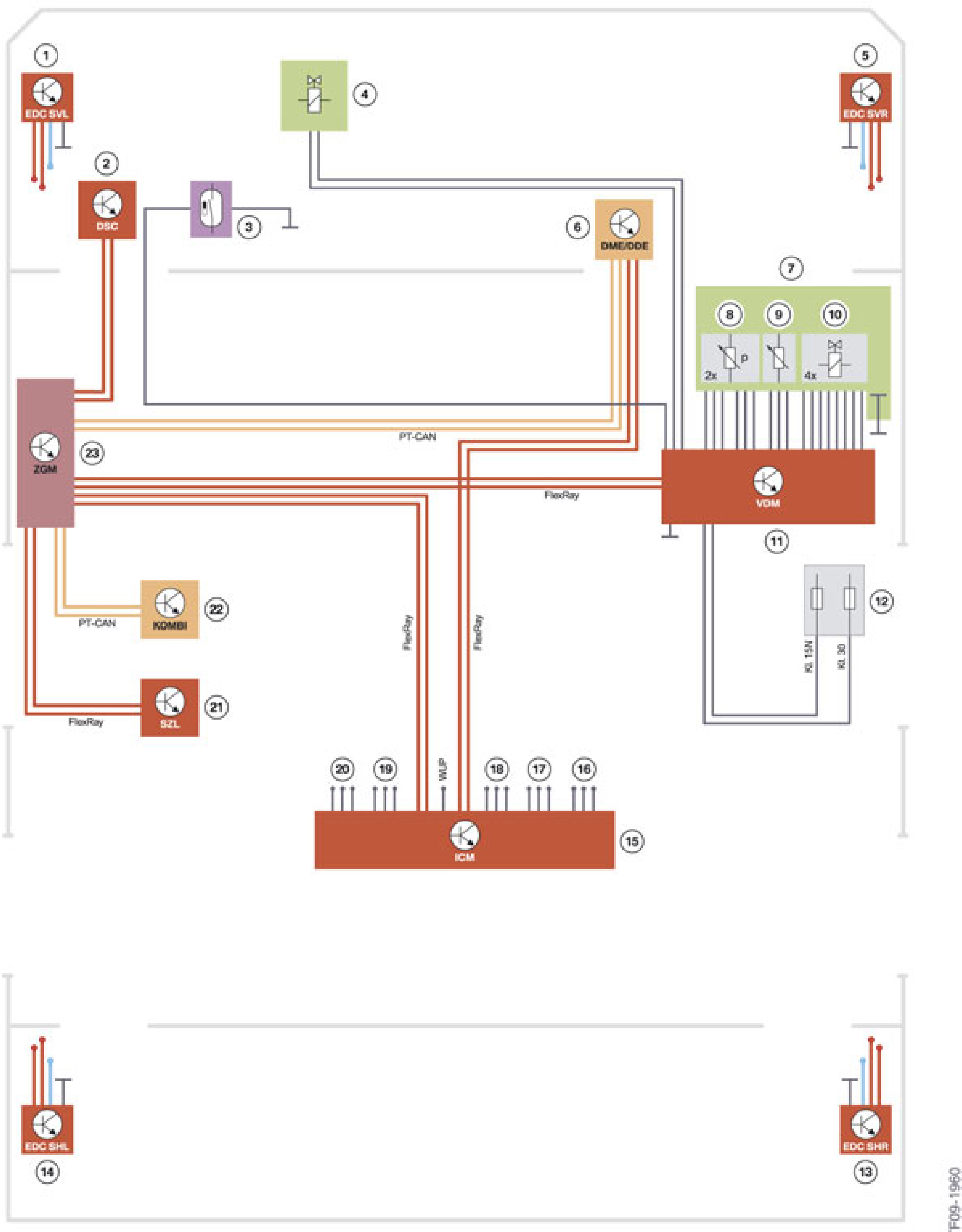
An engine driven hydraulic pump is used exclusively for providing the necessary oil pressure to operate the front and rear (ARS) anti-roll hydraulic swivel motors.

The system has its own hydraulic reservoir filled with BMW power steering fluid.

6. Dynamic Driving Systems



For more information on Dynamic Drive (ARS), refer to the F01/F02 "Vertical dynamics systems" training material available on TIS and ICP.



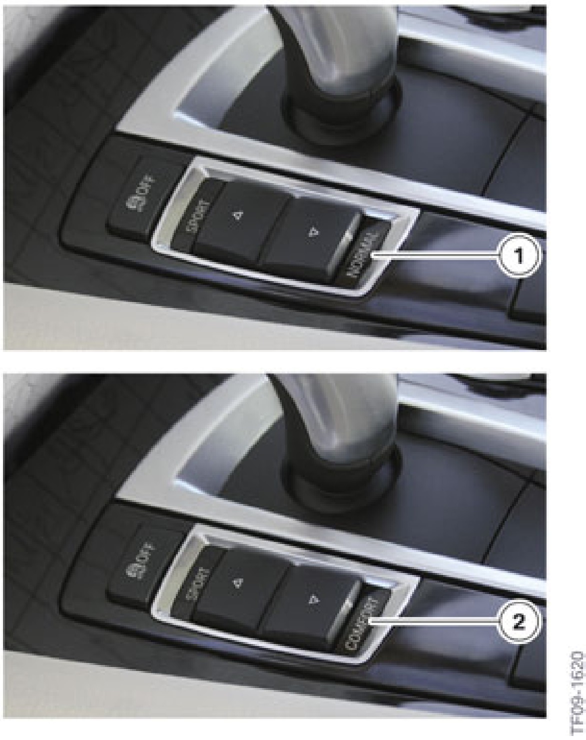
F10 System wiring diagram for Adaptive Drive

Index	Explanation
1	Electronic Damper Control satellite, front left
2	Dynamic Stability Control
3	Hydraulic fluid level sensor
4	Intake restrictor valve
5	Electronic Damper Control satellite, front right
6	Digital Motor Electronics/Digital Diesel Electronics
7	Dynamic Drive valve block
8	Front suspension pressure sensor/rear suspension pressure sensor
9	Shift-position sensor
10	Fail-safe valve, direction valve and low pressure control valve
11	Vertical Dynamics Management
12	Front power distribution box
13	Electronic Damper Control satellite, rear right
14	Electronic Damper Control satellite, rear left
15	Integrated Chassis Management
16	Ride-height sensor, rear left
17	Ride-height sensor, front left
18	Ride-height sensor, front right
19	Ride-height sensor, rear right
20	Connection for driving dynamics control switch
21	Steering column switch cluster
22	Instrument cluster
23	Central Gateway Module

6.5. Handling Setting Switch

F10 Center console

Index	Explanation
1	Driving dynamics control switch
2	Controller



F10 Driving dynamics control switch

Index	Explanation
1	Driving dynamics control switch for equipment without Adaptive Drive
2	Driving dynamics control switch for equipment with Adaptive Drive

In the F10 (as in F01 and F07) we can also control all drive and stability control systems in combination through the driving dynamics control switch. The operating principle is identical to that in the F01. For vehicles with Adaptive Drive (option 2VA), four different modes are available on the driving dynamics control switch. For vehicles without Adaptive Drive (option 2VA), the "Comfort" stage is omitted and only three different modes can be configured. The driving dynamics control switch is then labelled with "Normal" instead of “Comfort”.

Note: Adaptive Drive combines EDC (Electronic Damper Control) with ARS (Active Roll Stabilization).

Sport mode can be adapted using the controller.

F10 Sport mode adaptation

You can determine whether the sport mode is to apply to the chassis and suspension only, to the drive, or to both simultaneously.

6.5.1. Dynamic Driving Programs

For vehicles without Adaptive Drive

	Normal	Sport	Sport+
Drive systems			
Accelerator pedal characteristic	Normal	Sports	Sports
Shift program	Normal	Sports	Sports
Shift speed	Normal	Sports	Sports
Suspension control systems			
Power steering assistance	Normal	Sports	Sports
Integral Active Steering	Normal	Sports	Sports
Dynamic Stability Control	DSC on	DSC on	DTC

For vehicles with Adaptive Drive

	Comfort	Normal	Sport	Sport+
Drive systems				
Accelerator pedal characteristic	Normal	Normal	Sports	Sports
Shift program	Normal	Normal	Sports	Sports

	Comfort	Normal	Sport	Sport+
Shift speed	Normal	Normal	Sports	Sports
Suspension control systems				
Power steering assistance	Normal	Normal	Sports	Sports
Integral Active Steering	Normal	Normal	Sports	Sports
Dynamic Stability Control	DSC on	DSC on	DSC on	DTC
Electronic damper control (EDC)	Comfortable	Normal	Sports	Sports
Dynamic Drive (ARS)	Normal	Normal	Sports	Sports

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F10 General Vehicle Electronics

Edited for the U.S. market by:

BMW Group University

Technical Training

ST1002 7/1/2011

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 European version vehicles. 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: **December 2009**
VH-23/International Technical Training

F10 General Vehicle Electronics
Contents

F10 General Vehicle Electronics
Contents

F10 General Vehicle Electronics

1. Introduction

The vehicle electrical system of the F10 is based on that of the F01/F02. This training material provides an overview of the following vehicle electrical system topics.

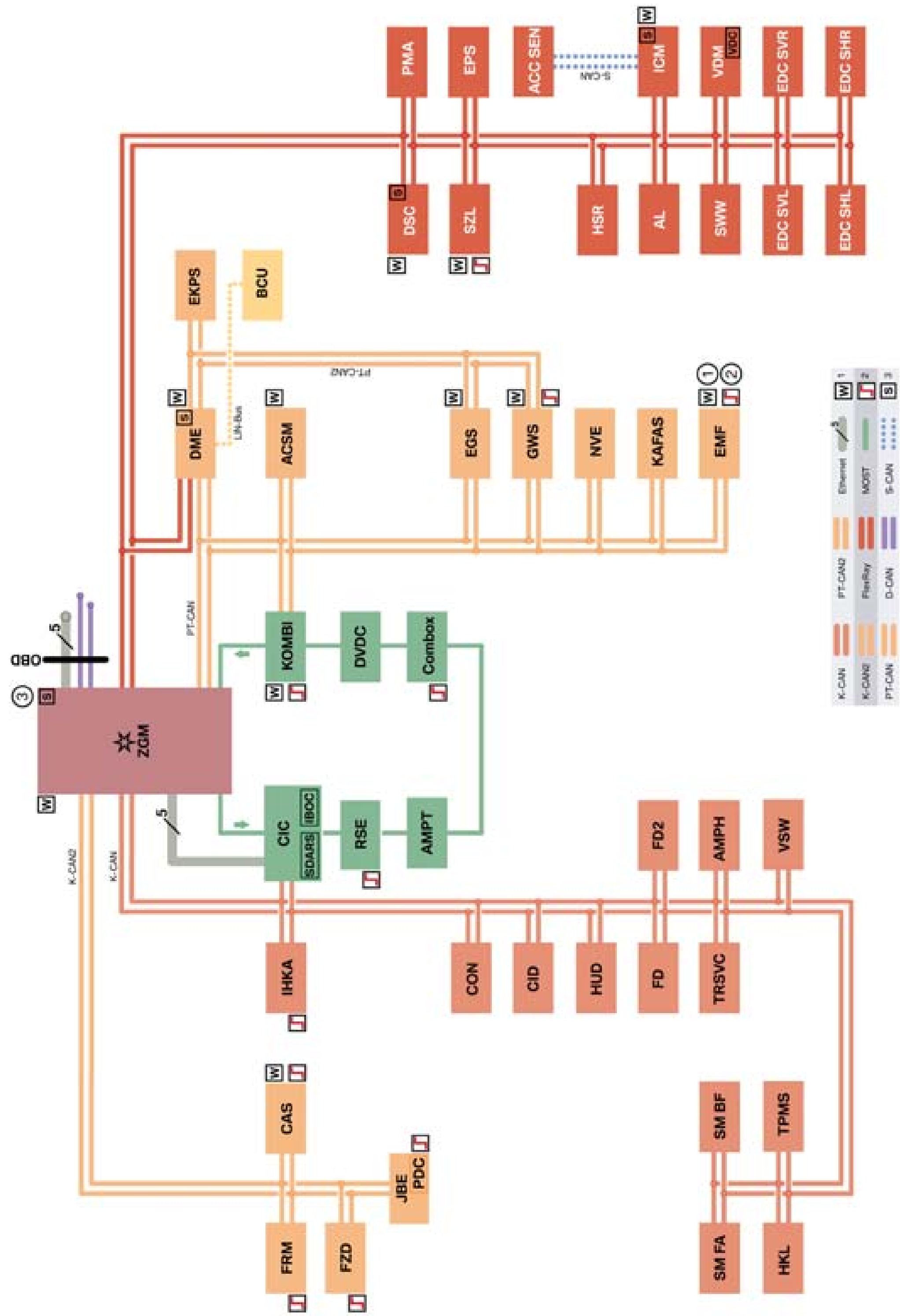
For more information on the respective topics, refer to the F01/F02 training material available on TIS and ICP.

F10 Topic	F01/F02 Training Material
Voltage supply	F01/F02 Voltage supply
Car Access System	F01/F02 Car Access System
Comfort Access	F01/F02 Comfort Access
Central locking system	F01/F02 Central locking system
Automatic Soft Close system	F01/F02 Automatic Soft Close system
Power window regulators	F01/F02 Power windows
Roller sun blinds for side windows	F01/F02 Power windows
Glass sunroof	F01/F02 Slide/tilt sunroof
Alarm system	F01/F02 Alarm system
Luggage compartment lid lift	F01/F02 Automatic operation of tailgate
Exterior lighting	F01/F02 Exterior lights
Interior lighting	F01/F02 Interior lighting
Seats	F01/F02 Seats
Heating and air conditioning systems	F01/F02 Heating and air conditioning systems

F10 General Vehicle Electronics

1. Introduction

1.1. Bus diagram



F10 Bus diagram

1. Introduction

Index	Explanation
1	Wakeable control units
2	Control units authorized to wake up the vehicle
3	Startup node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety 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
Combox	Combox multimedia with telematics
CON	Controller
D-CAN	Diagnosis on Controller Area Network
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
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications
FRM	Footwell module
FZD	Roof function center

F10 General Vehicle Electronics

1. Introduction

Index	Explanation
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 Control Unit
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for reversing camera and side view
VDM	Vertical Dynamics Management
VSW	Video switch
ZGM	Central Gateway Module

F10 General Vehicle Electronics

2. Voltage Supply

The Voltage supply concept of the F10 is based on that of the F01. The components and the structure used are largely the same.

2.1. Components

Due to the steady increase of electrical functions for comfort, communication and safety in BMW vehicles, the voltage supply is becoming ever more important.

In the F10, two separate power distribution boxes with fuse blocks are installed. The front power distribution box with fuse block is near the glove box and the rear power distribution box with fuse block is on the right-hand side of the luggage compartment.

The front power distribution box with fuse block forms the junction box together with the junction box electronics (JBE).

In the graphic below, you can see the layout of the most important components of the voltage supply system in the F10.

In the F10, three main power lines (bolted to on the underbody of the vehicle) are run from the power distribution box on the battery to the engine compartment :

- One of the main power lines runs via the positive battery terminal to the starter motor and to the alternator.
- The second line supplies the electronics box in the engine compartment with voltage for the engine electronics. This line is protected by a high-current fuse in the distribution box at the battery.
- The third line leads to the engine compartment power distribution box. This distribution box supplies the electric fan with power. This line is protected by the high-current fuse in the distribution box at the battery.

In addition, a battery cable is routed through the vehicle interior to the front power distribution box with fuse block. This line is also protected by a high-current circuit breaker.

Depending on the model, different line cross sections are used.

The transfer points for the main power cables are located under the luggage compartment floor. The main power lines on the underbody are laid in a protected area to prevent damage.

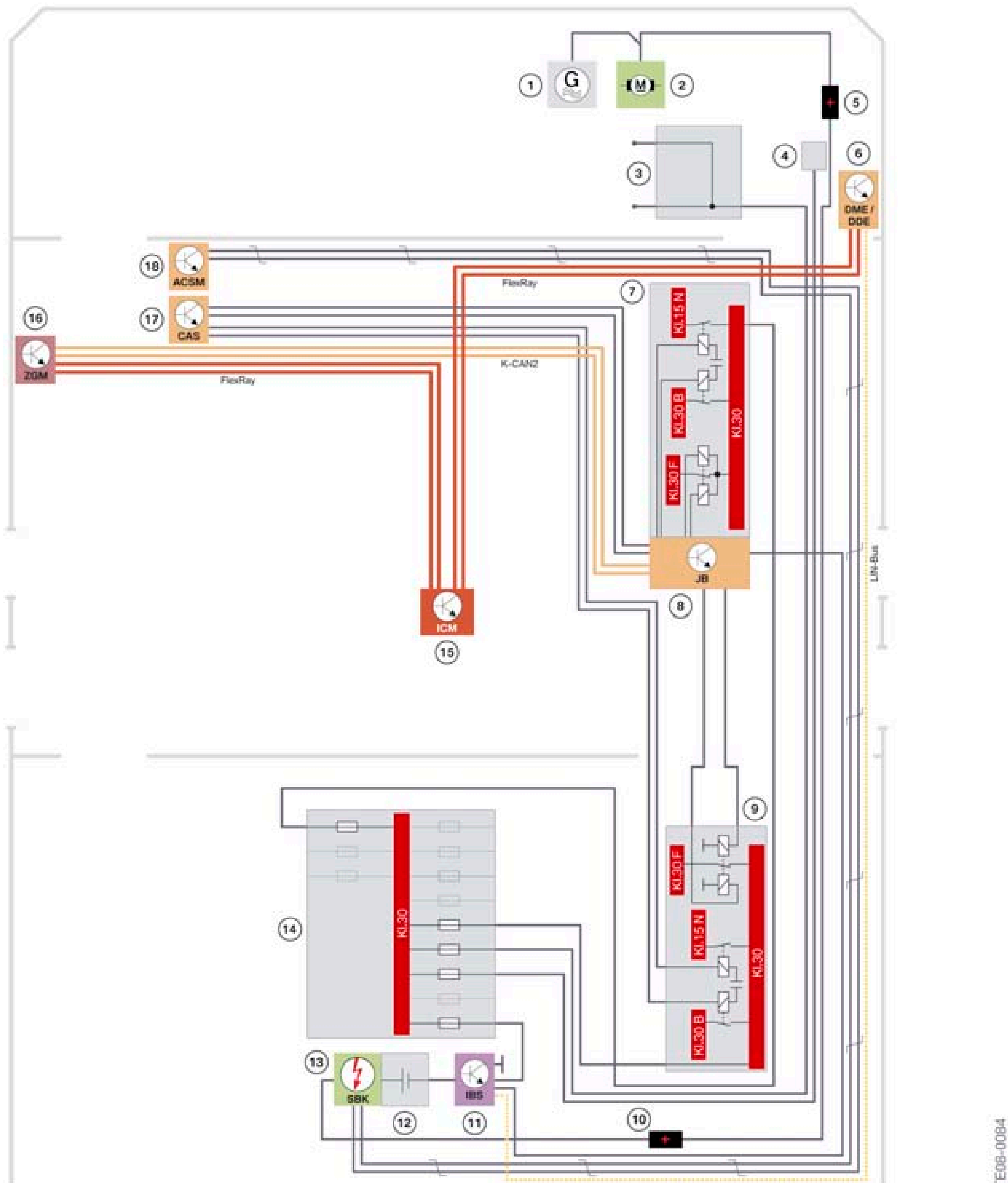
The electromechanical power steering is supplied with voltage differently, depending on equipment and engine.

For more information on the voltage supply, refer to the F01/F02 "Voltage Supply" training material available on TIS and ICP.

F10 General Vehicle Electronics

2. Voltage Supply

2.2. System wiring diagram



F10 System wiring diagram for voltage supply

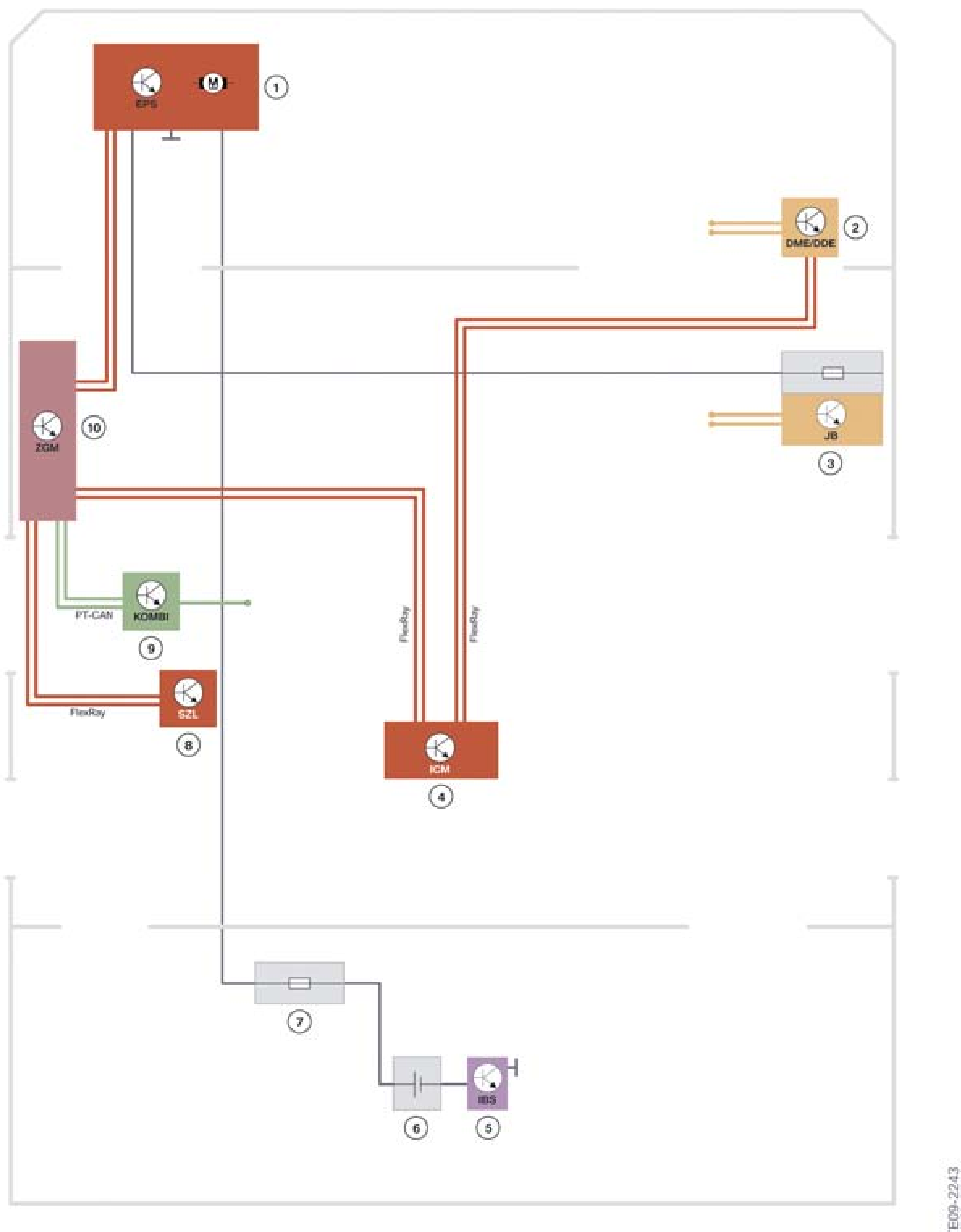
Index	Explanation
1	Alternator
2	Starter
3	Power distribution box in engine compartment
4	Electronics box in the engine compartment
5	Positive battery connection point
6	Digital Motor Electronics (DME)
7	Power distribution box with fuse block in front behind the glove box
8	Junction box electronics
9	Power distribution box with fuse block, rear right in the luggage compartment
10	Transfer point under the luggage compartment floor
11	Intelligent battery sensor (IBS)
12	Battery
13	Safety battery terminal (SBK)
14	Power distribution box on the battery
15	Integrated Chassis Management (ICM)
16	Central Gateway Module (ZGM)
17	Car Access System (CAS)
18	Crash safety module (ACSM)

2.3. EPS Voltage Supply

The electromechanical power steering is supplied with voltage differently, depending on equipment and engine.

In the F10, electromechanical power steering is combined for the first time with the active steering planetary gearbox with override function already familiar from the F01. As a result, the steering is implemented completely electrically.

2.3.1. System wiring diagram



F10 System wiring diagram for basic steering

Index	Explanation
1	EPS
2	Digital Motor Electronics (DME)
3	Junction box electronics with front power distribution box
4	Integrated Chassis Management (ICM)
5	Intelligent battery sensor (IBS)
6	Battery
7	Battery power distribution box
8	Steering column switch cluster (SZL)
9	Instrument cluster (KOMBI)
10	Central Gateway Module (ZGM)

2.3.2. EPS in conjunction with active steering

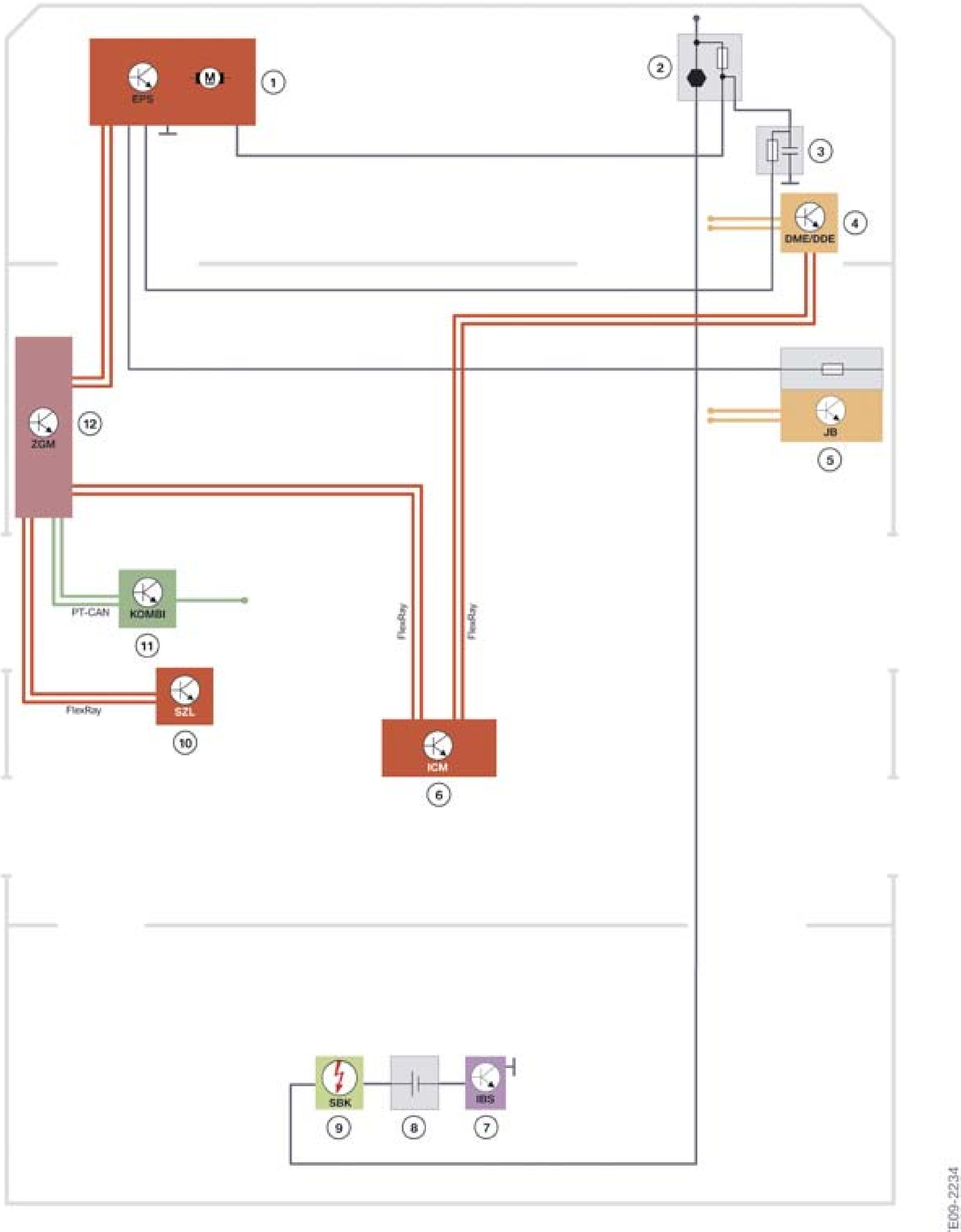
Due to the higher weight of the some engines and the higher steering forces associated with the greater front axle load, the power of a 12V steering system is no longer sufficient. For this reason, on F10 vehicles with the V8 engine a 24V EPS system will be installed in conjunction with the optional Integral Active Steering equipment.

The following table tells you when a 24V EPS is installed.

Engine	EPS voltage supply
528i	12V
535i	12V
550i	24V

EPS with 12V

Since active steering demands higher forces from the electromechanical steering and due to the higher current necessary, the voltage supply can no longer be implemented as in previous systems. If active steering is used in a vehicle with 12V EPS, the voltage is supplied through a separate positive battery connection point.



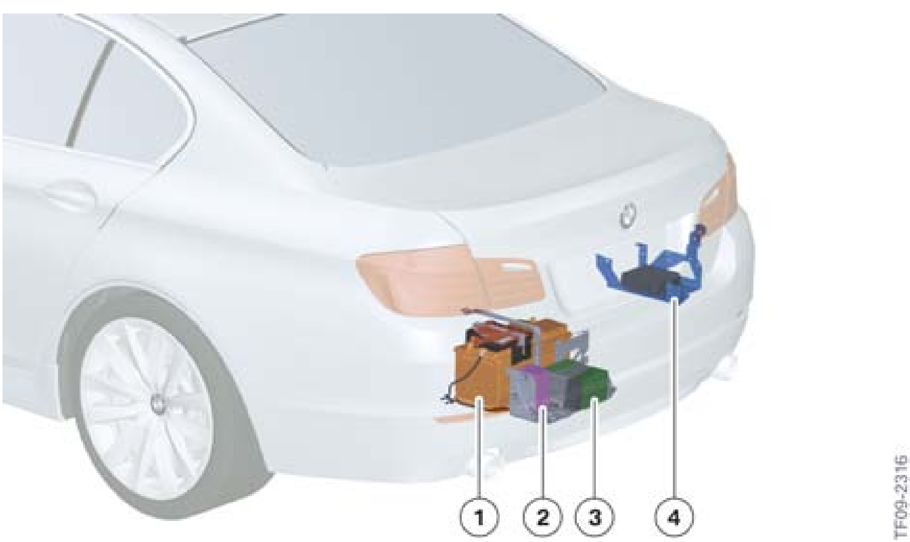
F10 System wiring diagram EPS with 12V and active steering

Index	Explanation
1	EPS
2	Positive battery connection point
3	Capacitor box
4	Digital Motor Electronics (DME)
5	Junction box electronics with front power distribution box
6	Integrated Chassis Management
7	Battery power distribution box
8	Intelligent battery sensor (IBS)
9	Battery
10	Safety battery terminal (SBK)
11	Steering column switch cluster
12	Instrument cluster (KOMBI)
13	Central Gateway Module (ZGM)

EPS with 24V

The higher weight of the V8 engines in the BMW 550i results in a higher front axle load. This in turn causes the power required for the steering system to increase. In conjunction with the active steering, an even higher exertion of force, and therefore an even higher current is required by the steering electrical components. This high current made it necessary to increase the voltage supply of the EPS to 24V.

This system requires an auxiliary battery, a separator and a charging unit for the auxiliary battery. These components are installed in the luggage compartment of the F10.



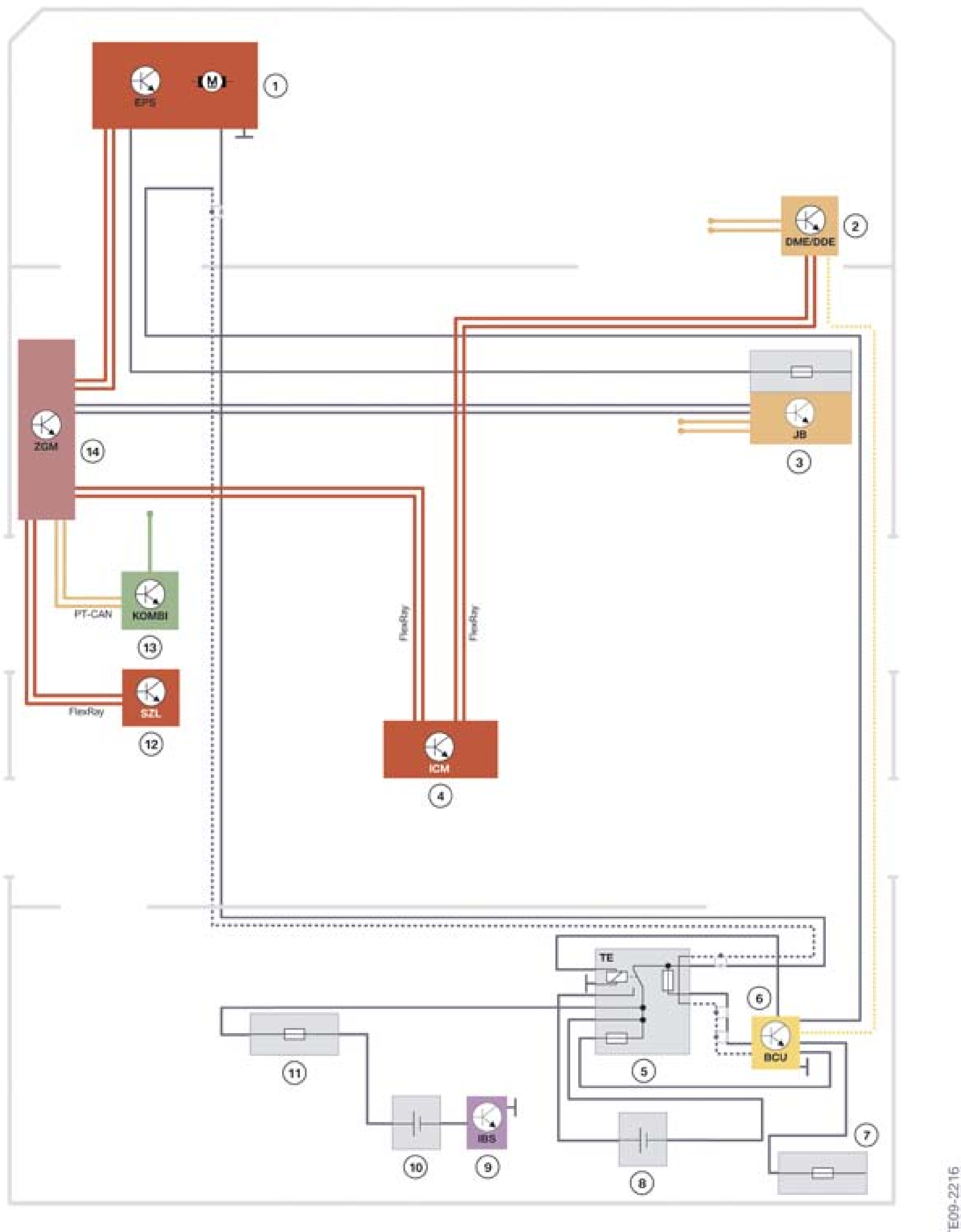
F10 24V components

Index	Explanation
1	Battery
2	Separator
3	Auxiliary battery
4	Battery Charge Unit (BCU) (for auxiliary battery)

The battery charging unit (BCU) takes over the monitoring of the state of charge and the charging of the auxiliary battery with an 150W DC/DC converter. It monitors a cable sheathing of the 24V line (isolation) and among various other preconditions; it also switches the relay in the separator with which the auxiliary battery is integrated into the circuit. The EPS is supplied with 24V only after this relay has been switched (closed). In the event of a fault, the EPS can also be operated with 12V. If there is no fault, the relay in the separator is switched (to close the circuit) as of terminal 15.

F10 General Vehicle Electronics

2. Voltage Supply



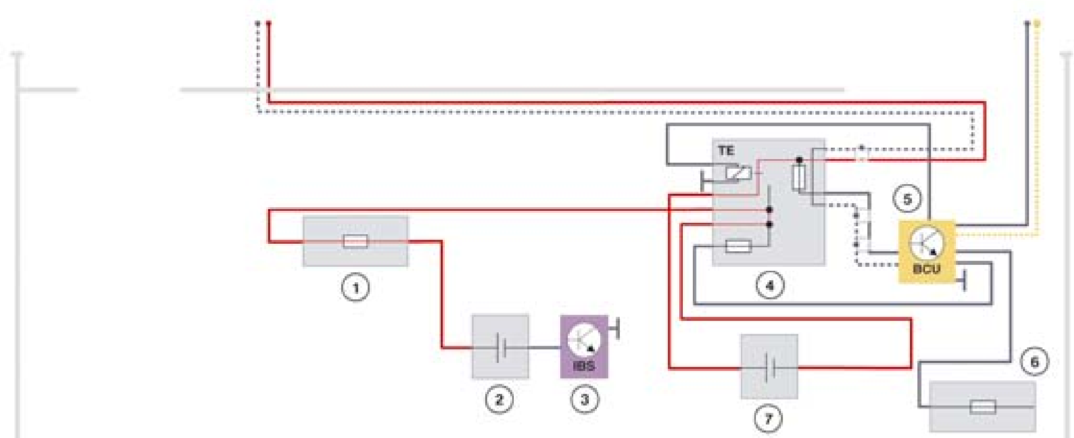
F10 System wiring diagram EPS with 24V and active steering

2. Voltage Supply

Index	Explanation
1	EPS
2	Digital Motor Electronics (DME)
3	Junction box electronics with front power distribution box
4	Integrated Chassis Management (ICM)
5	Separator
6	Battery Charge Unit (BCU) (for auxiliary battery)
7	Rear right power distribution box
8	Auxiliary battery
9	Intelligent battery sensor (IBS)
10	Battery
11	Battery power distribution box
12	Steering column switch cluster (SZL)
13	Instrument cluster (KOMBI)
14	Central Gateway Module (ZGM)

The 24V line is routed on the vehicle floor. It is surrounded by a cable sheathing (isolation) that is monitored by the battery charging unit.

The following system wiring diagram details show the various switch situations and the charging of the auxiliary battery.

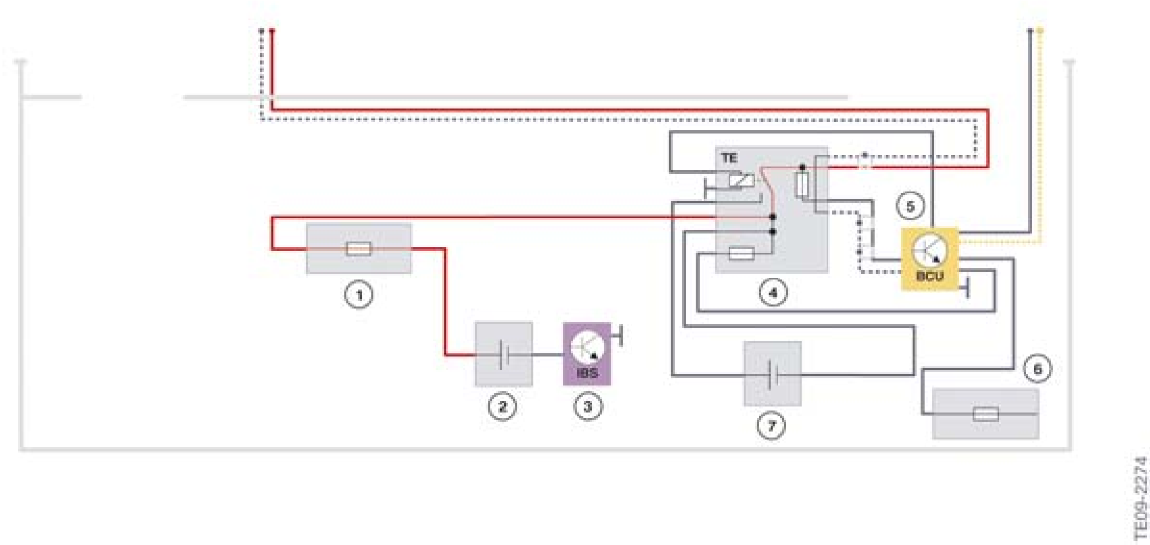


TE09-2273

F10 24V operation of the EPS

Index	Explanation
1	Battery power distribution box
2	Battery
3	Intelligent battery sensor IBS.
4	Separator (here: 24V operation)
5	Battery Charge Unit (BCU)
6	Rear right power distribution box
7	Auxiliary battery

In 24V operation, the battery and the auxiliary battery are connected in series by the relay in the separator. As a result, the EPS is operated with 24V.

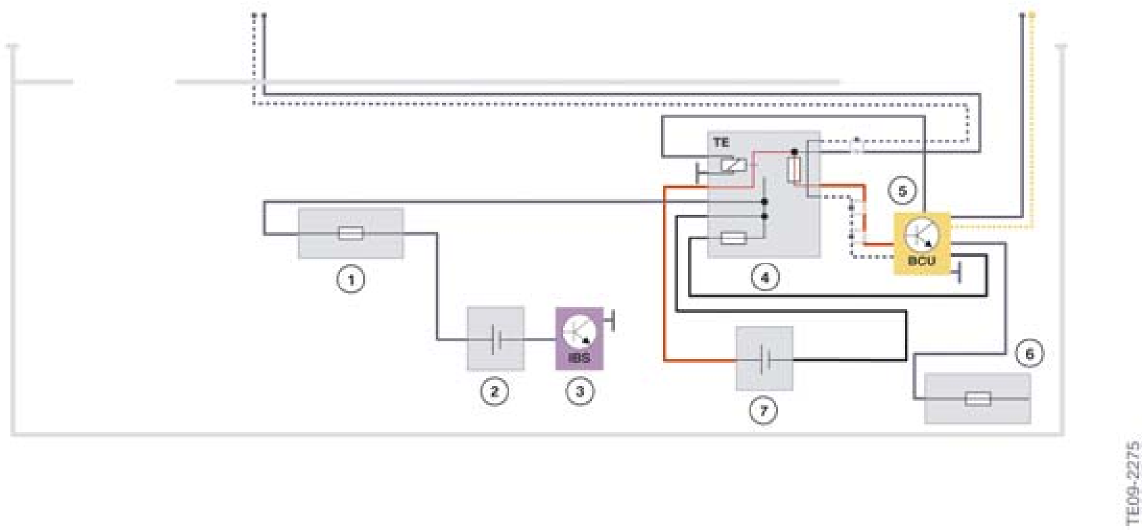


F10 12V operation in the event of a fault

Index	Explanation
1	Battery power distribution box
2	Battery
3	Intelligent battery sensor IBS.
4	Separator (here: 12V operation)
5	Battery Charge Unit (BCU)
6	Rear right power distribution box
7	Auxiliary battery

In the event of a fault or before terminal 15, the relay is open and the separator is in the 12V position. The auxiliary battery is no longer connected in series and is no longer in the circuit.

2. Voltage Supply

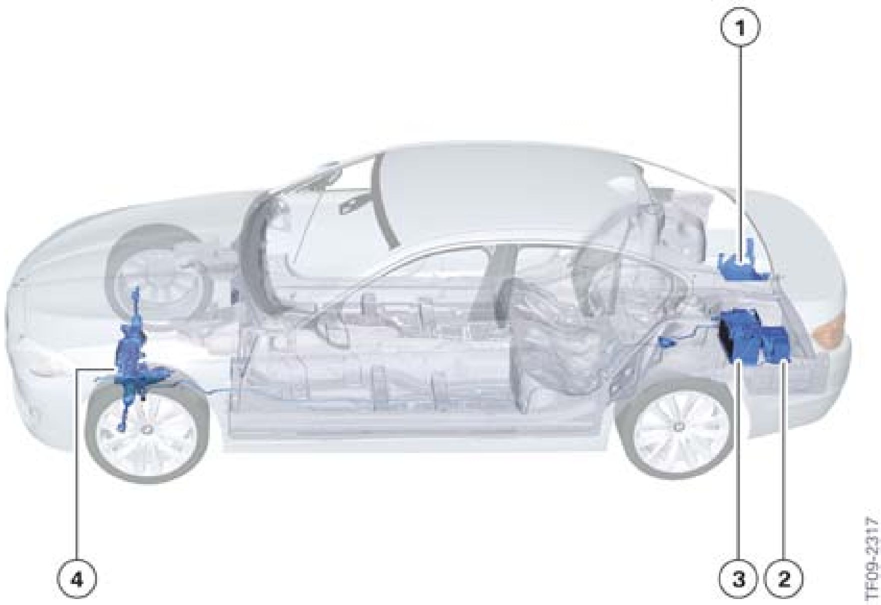


F10 Charging of the auxiliary battery in 24V operation

Index	Explanation
1	Battery power distribution box
2	Battery
3	Intelligent battery sensor IBS.
4	Separator (here: 24V operation)
5	Battery Charge Unit (BCU)
6	Rear right power distribution box
7	Auxiliary battery

The auxiliary battery can be charged in 24V operation using the battery charging unit (BCU) for the auxiliary battery. To do so, the charging unit takes the energy it uses for charging the auxiliary battery from the vehicle electrical system via the rear right power distribution box.

The 24V line is routed on the vehicle floor and is surrounded by a cable sheathing that is monitored by the BCU.



F10 24V components and line routing

Index	Explanation
1	Battery Charge Unit (BCU) (Charging unit for auxiliary battery)
2	Separator and auxiliary battery
3	Battery
4	EPS with active steering

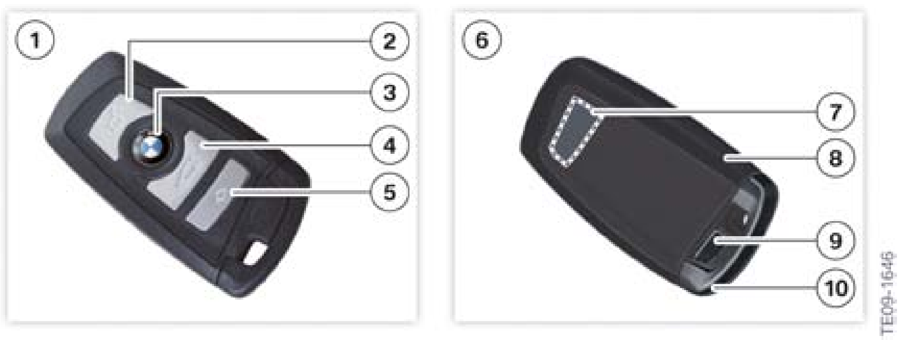
F10 General Vehicle Electronics
3. Car Access System

The Car Access System used in the F10 is the fourth generation of the control unit and the same type as in the F01. The Comfort Access functions are completely integrated into the Car Access System.

All F10 models are equipped with "Passive Go" (drive authorization system) as standard equipment. Drive authorization allows the driver to start the engine without actively using the ID transmitter. Due to the drive authorization (Passive Go), the vehicle does not require any key insertion slot. The ID transmitter only needs to be somewhere inside the passenger compartment for the engine to be started.

The ID transmitter has a battery with a service life of approximately four years.

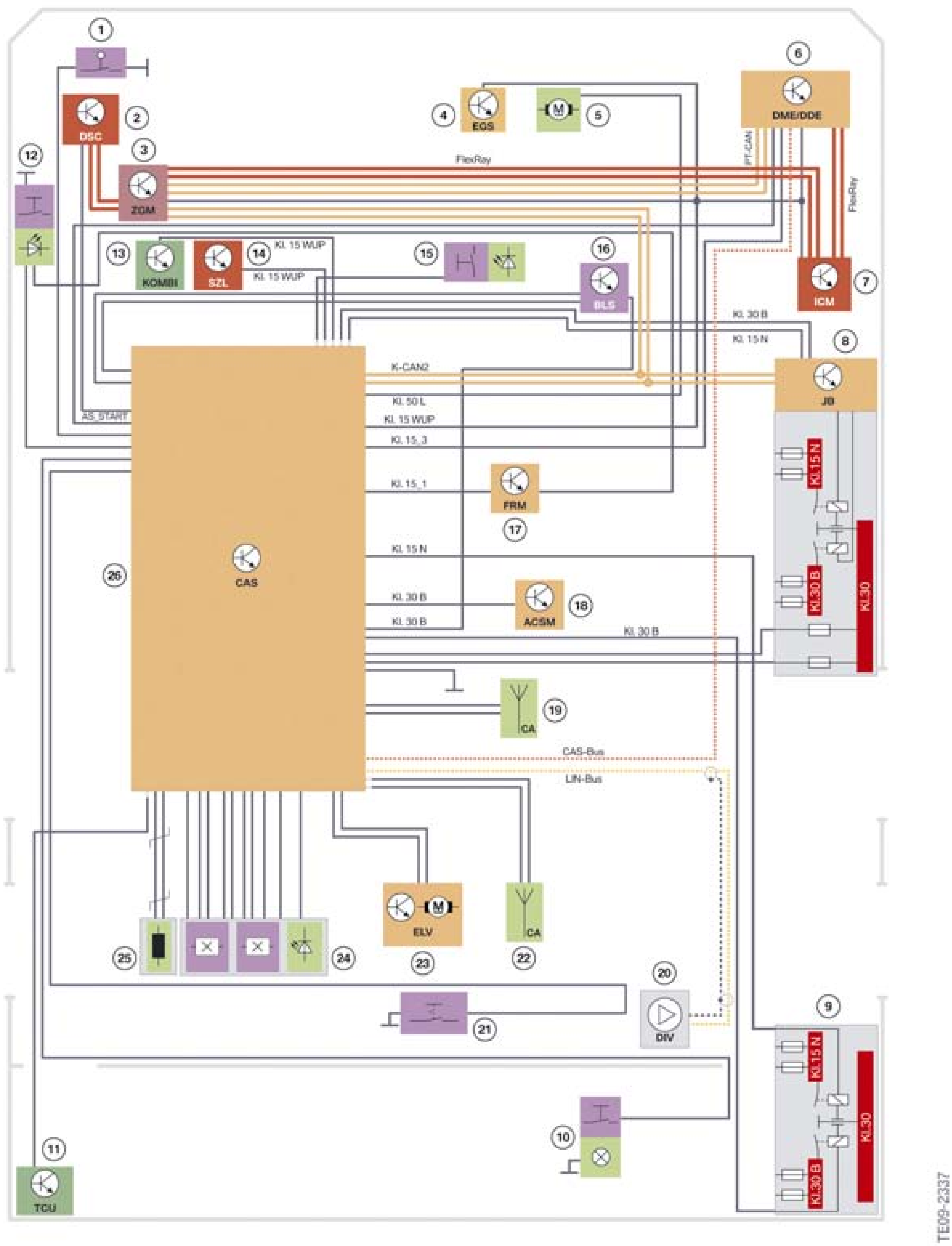
Up to eight ID transmitters can be used for a particular vehicle.



F10 ID transmitter

Index	Explanation
1	ID transmitter top view
2	Unlock Vehicle button
3	Lock Vehicle button
4	Tailgate unlock button
5	Headlight courtesy delay feature or open luggage compartment lid (automatic operation of tailgate, option 316)
6	ID transmitter rear view
7	Area for ring antenna (transponder coil for emergency start)
8	Battery compartment
9	ID transmitter release button
10	ID transmitter

3.1. System wiring diagram



F10 System wiring diagram of Car Access System

Index	Explanation
1	Engine compartment lid contact switch
2	Dynamic Stability Control (DSC)
3	Central Gateway Module (ZGM)
4	Electronic transmission control (EGS)
5	Starter
6	Digital Motor Electronics (DME)
7	Integrated Chassis Management (ICM)
8	Junction box electronics (JBE) and front power distribution box
9	Luggage compartment junction box
10	Tailgate central double-locking button
11	Telematics Control Unit (TCU)
12	Interior tailgate button, A-pillar
13	Instrument cluster (KOMBI)
14	Steering column switch cluster (SZL)
15	Central locking button/hazard warning switch
16	Brake light switch (BLS)
17	Footwell module (FRM)
18	Crash safety module (ACSM)
19	Comfort Access interior antenna
20	Remote control receiver in the diversity module DIV
21	Hotel position switch
22	Comfort Access interior antenna
23	Electric steering lock (not for US)
24	START/STOP button
25	Ring antenna (transponder coil)
26	Car Access System (CAS)
Kl. 15_1	Terminal 15 (output 1)
Kl. 15_3	Terminal 15 (output 3)
Kl. 15 WUP	Terminal 15, wake-up
Term. 15N	Terminal 15 after-run
Kl. 30	Terminal 30
Term. 30B	Terminal 30B, switched
Kl. 50L	Terminal 50 load
CAS bus.	Car Access System bus

Index	Explanation
LIN-Bus	Local Interconnect Network bus
K-CAN2	Body controller area network 2
PT-CAN	Powertrain CAN
AS_ START	Start/start termination DME

3.2. Function overview

The Car Access System provides, among other things, the central control unit for accessing and locking the vehicle. Therefore, the Car Access System has full responsibility for central locking.

The Car Access System incorporates the following functions on the F10:

- Comfort Access
- Central locking system
- Power window regulator
- Glass sunroof
- Terminal control
- Electronic immobilizer

Other functions of the Car Access System include:

- Vehicle data storage
- Data transmission for Conditioned Based Service (CBS)
- Checking plausibility of ID transmitter signals

The Car Access System enables or disables the execution of a number of functions. However, other control units may be involved in the execution of the function:

- Junction box electronics
- Footwell module
- Roof function center
- Central locking system
- Power window regulator
- Glass sunroof

For the purposes of communication with other bus users in the vehicle electrical system, the Car Access System is connected via the K-CAN2, the CAS bus and the LIN-Bus.

The Car Access System analyzes the status of the trunk lid contact switch and broadcasts it for use by the alarm system.

The Car Access System also analyzes the status of the following buttons and initiates the central locking function:

3. Car Access System

- Central locking system button
- Open large trunk button on the A-pillar
- Complete locking of the vehicle with the button in the underside of the open luggage compartment lid.

The Car Access System provides the power supply for the brake light switch and also analyzes its status.

For a more detailed description of the Car Access System functions, refer to the F01/F02 "Car Access System" training material available on TIS and ICP.

F10 General Vehicle Electronics
4. Comfort Access

Using Comfort Access, the customer can unlock and open the vehicle without active use of the ID transmitter. Access to the vehicle can be gained from any point. It is important that the ID transmitter be located in the vehicle's immediate vicinity (approx. 1.5 m). It is sufficient to have the ID transmitter somewhere on your person.

Comfort Access was first introduced on the E65 (03/2002). The system was then gradually introduced on different BMW models. Comfort Access can be ordered as optional equipment (option 322) as part of ZCV Convenience Package (which also includes 316 Power tailgate 323 Soft-close automatic doors.

The benefits of Comfort Access are:

- High level of convenience when unlocking and locking the vehicle
- Convenient and fast access to the vehicle
- Simple engine start/stop procedure
- Maximum comfort for the driver.

Comfort Access in the F10 is based on predecessor systems and is adapted to the F10. However, the complete function continues to be in the Car Access System, just as in the F01. That is why the F10 also has no separate Comfort Access control unit.

The vehicle is unlocked when your hand touches the handle recess of the outer door handle and is opened when you pull the door handle.

The vehicle can be locked simply by touching sensitive surfaces of the outer door handle.

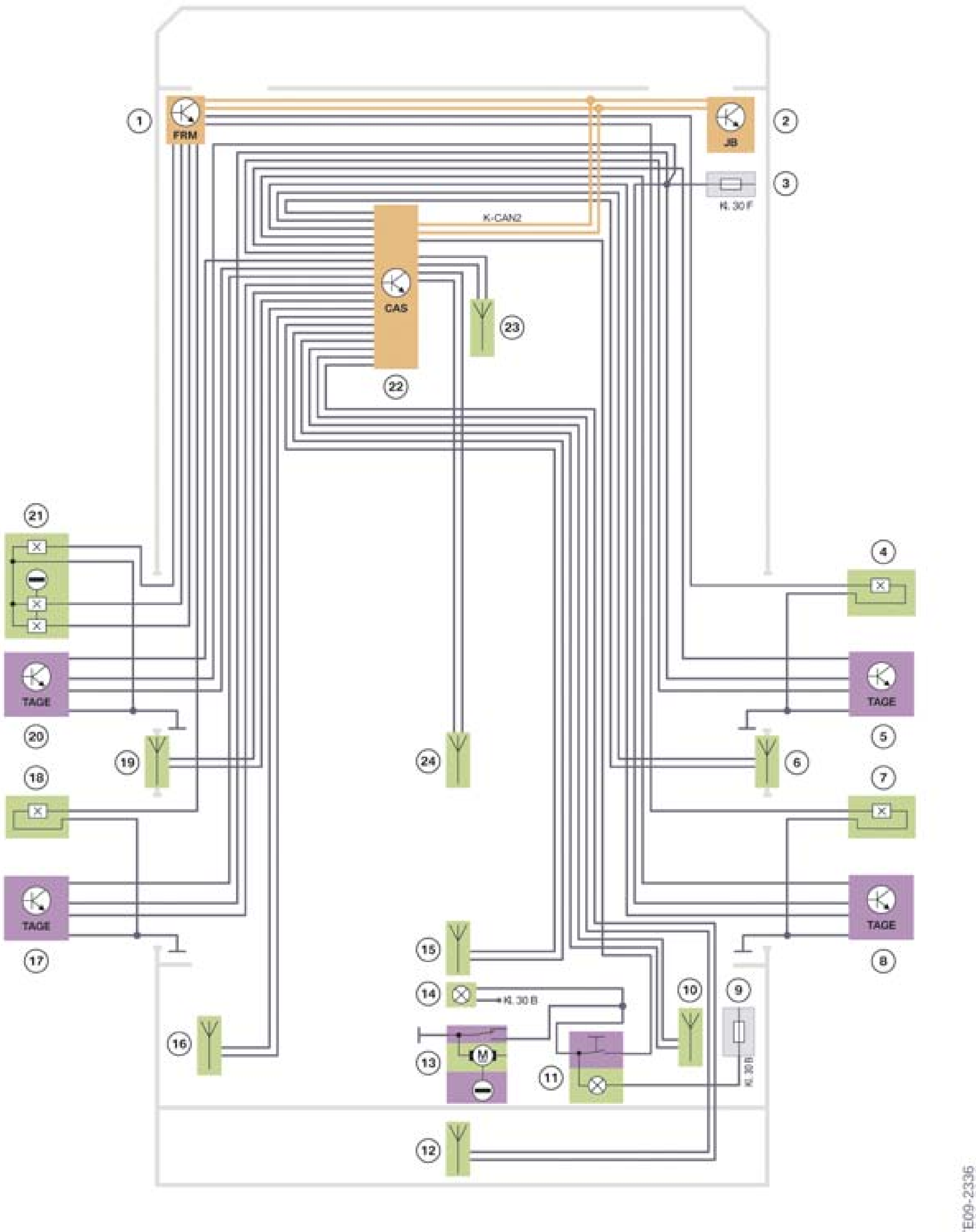
For vehicles fitted with the Automatic Soft Close system (option 323), the drive for the Automatic Soft Close system fully closes the vehicle door. You can then lock the vehicle again by subsequently pressing on the sensitive surface of the outer door handle.

The ID transmitter must be located in the vehicle interior in order for the engine to be started. The engine can now be started by pressing the START-STOP button when the brake pedal is operated and the vehicle is ready to be driven.

F10 General Vehicle Electronics

4. Comfort Access

4.1. System wiring diagram



F10 System wiring diagram for Comfort Access

Index	Explanation
1	Footwell module (FRM)
2	Junction Box (JB)
3	Front distribution box
4	Lock door contact, front-passenger side, front
5	Outside door handle electronics (TAGE), front passenger side
6	Antenna for Comfort Access, door sill, front-passenger side
7	Lock door contact, front-passenger side, rear
8	Outside door handle electronics (TAGE), rear passenger side
9	Luggage compartment junction box
10	Luggage compartment antenna, front-passenger side
11	Central locking system button
12	Antenna for Comfort Access, bumper
13	Tailgate lock
14	Luggage compartment lighting
15	Storage shelf antenna
16	Luggage compartment antenna, driver's side
17	Outside door handle electronics (TAGE), rear driver's side
18	Lock door contact, driver's side, rear
19	Antenna for Comfort Access, door sill, driver's side
20	Outside door handle electronics (TAGE), front driver's side
21	Lock door contact, driver's side, front and locking cylinder in driver's door
22	Car Access System (CAS) with Comfort Access function (CA)
23	Antenna for Comfort Access, interior, front
24	Antenna for Comfort Access, interior, rear
K-CAN2	Body controller area network 2

4.2. Function overview

Comfort Access is divided into the following functions:

- Access authorization (Passive Entry)
- Drive authorization (Passive Go)
- Locking authorization (Passive Exit).

ID transmitters are required for Comfort Access to function.

An ID transmitter incorporates the following:

4. Comfort Access

- A battery
- Remote control function
- Transponder coil for emergency start function
- Spare key
- Receiver unit.

The driver's door can also be unlocked and locked with the spare key.

For a more detailed description of the comfort access functions, refer to the F01/F02 "Comfort Access" training material available on TIS and ICP.

F10 General Vehicle Electronics
5. Central Locking System

The central locking system makes it possible to unlock or lock the vehicle. It is fitted as standard equipment and relates to all vehicle doors, the fuel filler flap and the tailgate.

The central locking can be operated via the following components:

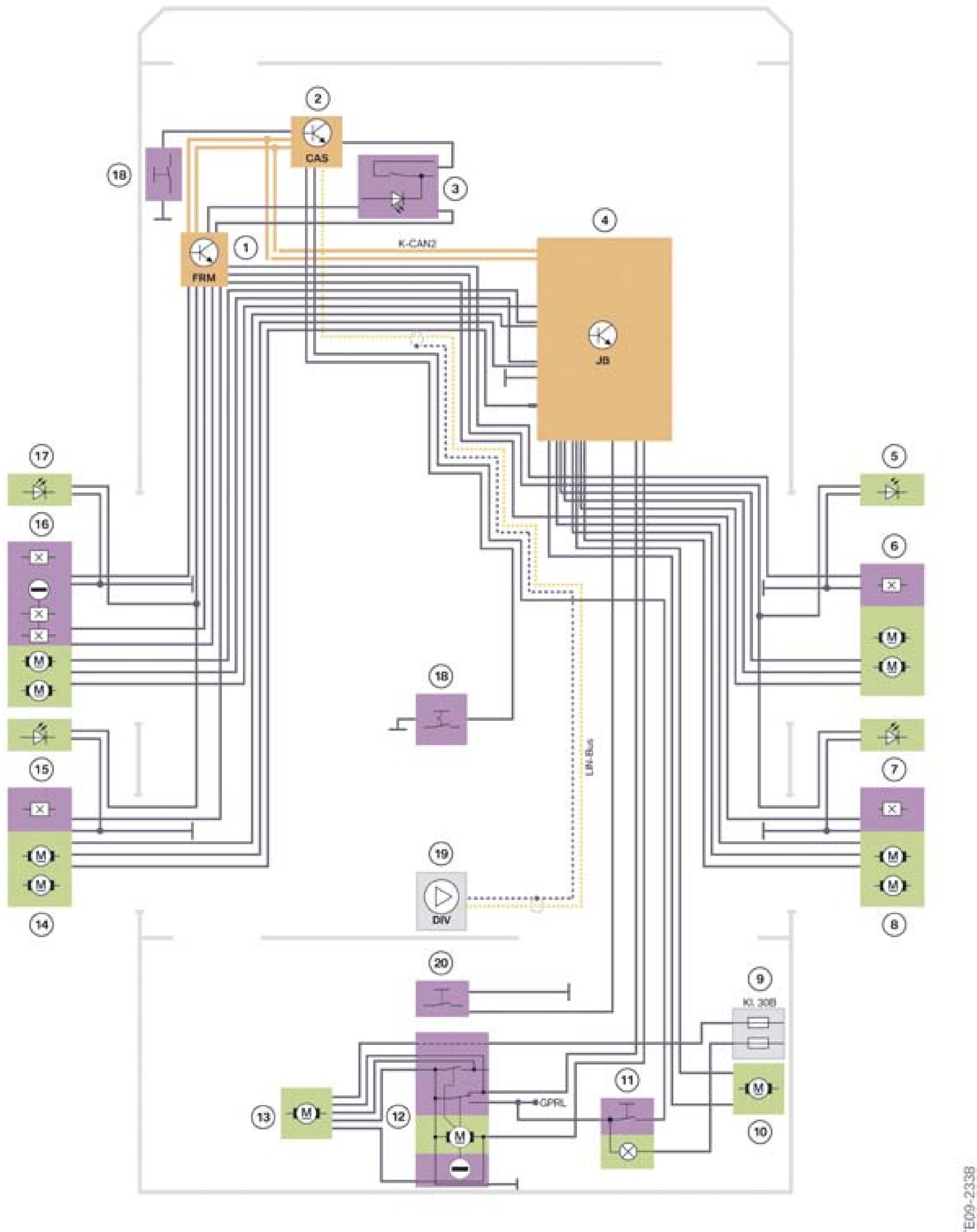
- ID transmitter
- Driver's-door lock barrel (door lock)
- Central locking system button
- Exterior tailgate button
- Interior tailgate button in the A-pillar
- Outer door handle (outside door handle electronics with Comfort Access, option 322)
- Button in the underside of the open luggage compartment lid for central locking system (automatic operation of tailgate, option 316).

The F10 has no lock in the luggage compartment lid for unlocking with the mechanical or spare key.

The central locking system in the F10 is based on previous central locking systems used in, for instance, the E70, E90 or F01.

5. Central Locking System

5.1. System wiring diagram



F10 System wiring diagram for central locking system

Index	Explanation
1	Footwell module (FRM)
2	Car Access System (CAS)
3	Central locking system button
4	Junction Box (JB)
5	Front-passenger-door illuminated entry system
6	Door contact, central locking, front passenger door
7	Rear, passenger-side illuminated entry system
8	Door contact, central locking, rear passenger side
9	Rear power distribution box
10	Central locking, fuel filler flap
11	Central locking button
12	Central locking system for tailgate lock
13	Automatic Soft Close system drive for luggage compartment lid
14	Rear, driver's side central locking system
15	Rear, driver's side illuminated entry system
16	Hall sensors for lock barrel, door contact, driver's-door central locking system
17	Driver's-door illuminated entry system
18	Hotel position switch (only vehicles in US version)
19	Antenna diversity module with antenna amplifier
20	Trunk lid button

5.2. Function overview

The function of the central locking system is basically divided between two control units.

The Car Access System has overall control. The Car Access System is aware of the statuses of the central locking system. Therefore it is the Car Access System which causes the unlocking, locking and central deadlocking of the vehicle.

The junction box electronics execute the request to unlock or lock the vehicle.

It is possible to unlock and lock the vehicle actively or passively.

Active means that the vehicle can be opened after it has been unlocked by pressing the button on the ID transmitter. The vehicle can be locked by pressing the Lock button after the doors have been closed.

Note: The vehicle can only be locked with the driver's door closed.

5. Central Locking System

Passive locking and unlocking requires the optional Comfort Access equipment (option 322).

Passive means that the vehicle is unlocked when the outer door handle is grasped, provided the ID transmitter is located no more than approx. 1.5 metres away from the vehicle. The locking function is triggered by pressing on the sensitive area on the outer door handle.

For a more detailed description of the locking functions, refer to the F01/F02 "Central locking system" training material available on TIS and ICP.

F10 General Vehicle Electronics
6. Automatic Soft Close System

The Automatic Soft Close system (SCA) can be ordered as optional equipment (option 323) on all F10 models as part of the ZCV Convenience Package.

The ZCV Convenience Package also includes, Power tailgate (option 316) and Comfort Access keyless entry (option 322).

The luggage compartment lid is equipped with the Automatic Soft Close system only in conjunction with the Power tailgate (option 316).

The Automatic Soft Close system requires the installation of suitable door locks with drives for the Automatic Soft Close system.

The special feature of the F10's Automatic Soft Close system is that the door lock and the drive for the Automatic Soft Close are no longer combined as a single component. The drive for the Automatic Soft Close system is separate and controls the door lock via a Bowden cable, the same as in the F01.

This means that the lock and the drive can be fitted separately.

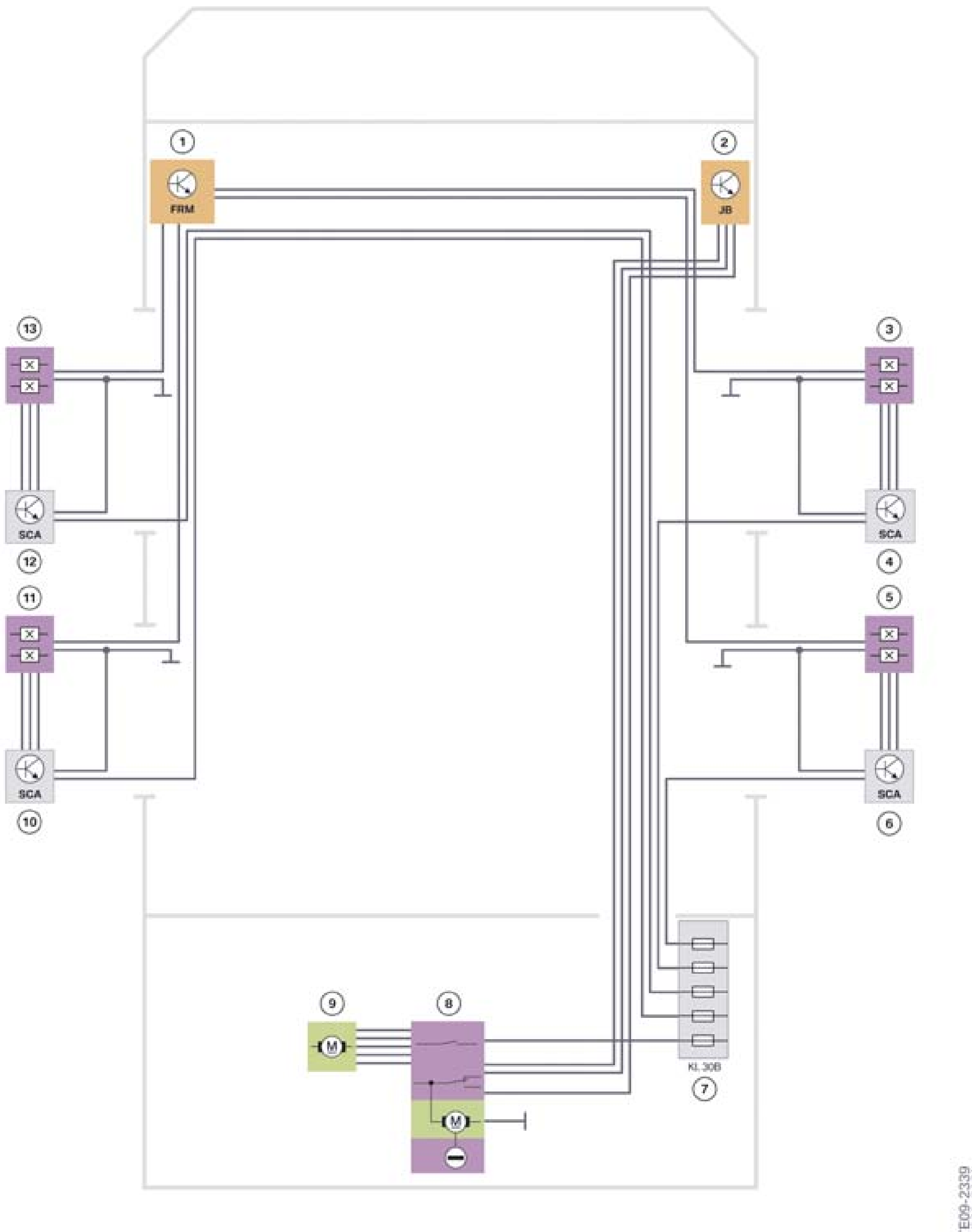
With the Automatic Soft Close system, it is sufficient to press the luggage compartment lid gently into the trunk lid lock. As soon as the locking pawl reaches the pre-locking position, the Automatic Soft Close system fully closes the luggage compartment lid. The locking pawl is then located in the main locking position.

For more information on the Automatic Soft Close system, refer to the F01/F02 "Automatic Soft Close system" training material available on TIS and ICP.

F10 General Vehicle Electronics

6. Automatic Soft Close System

6.1. System wiring diagram

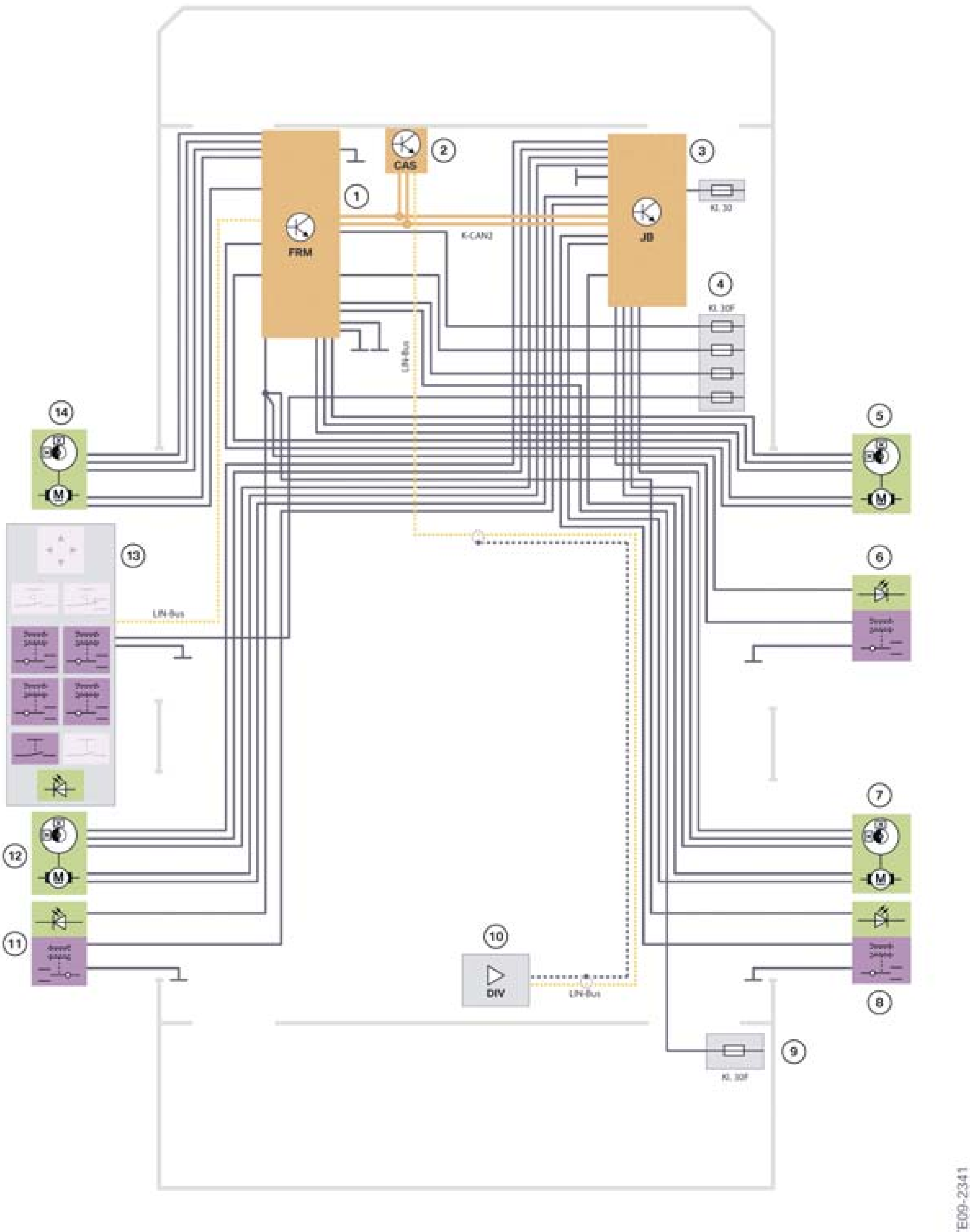


F10 System wiring diagram for Automatic Soft Close system

Index	Explanation
1	Footwell module (FRM)
2	Junction Box (JB)
3	Door contact, central locking system, Hall sensor for front passenger door Automatic Soft Close system
4	Front passenger door Automatic Soft Close system (SCA)
5	Door contact, central locking system, Hall sensor for rear passenger side Automatic Soft Close system
6	Rear passenger side Automatic Soft Close system (SCA)
7	Rear power distribution box
8	Central locking, luggage compartment lid
9	Automatic Soft Close system for luggage compartment lid (only with option 316)
10	Rear driver side Automatic Soft Close system
11	Door contact, central locking system, Hall sensor for rear driver's side Automatic Soft Close system
12	Driver's door Automatic Soft Close system (SCA)
13	Door contact, central locking system, Hall sensor for driver's door Automatic Soft Close system

7. Power Windows

7.1. System wiring diagram



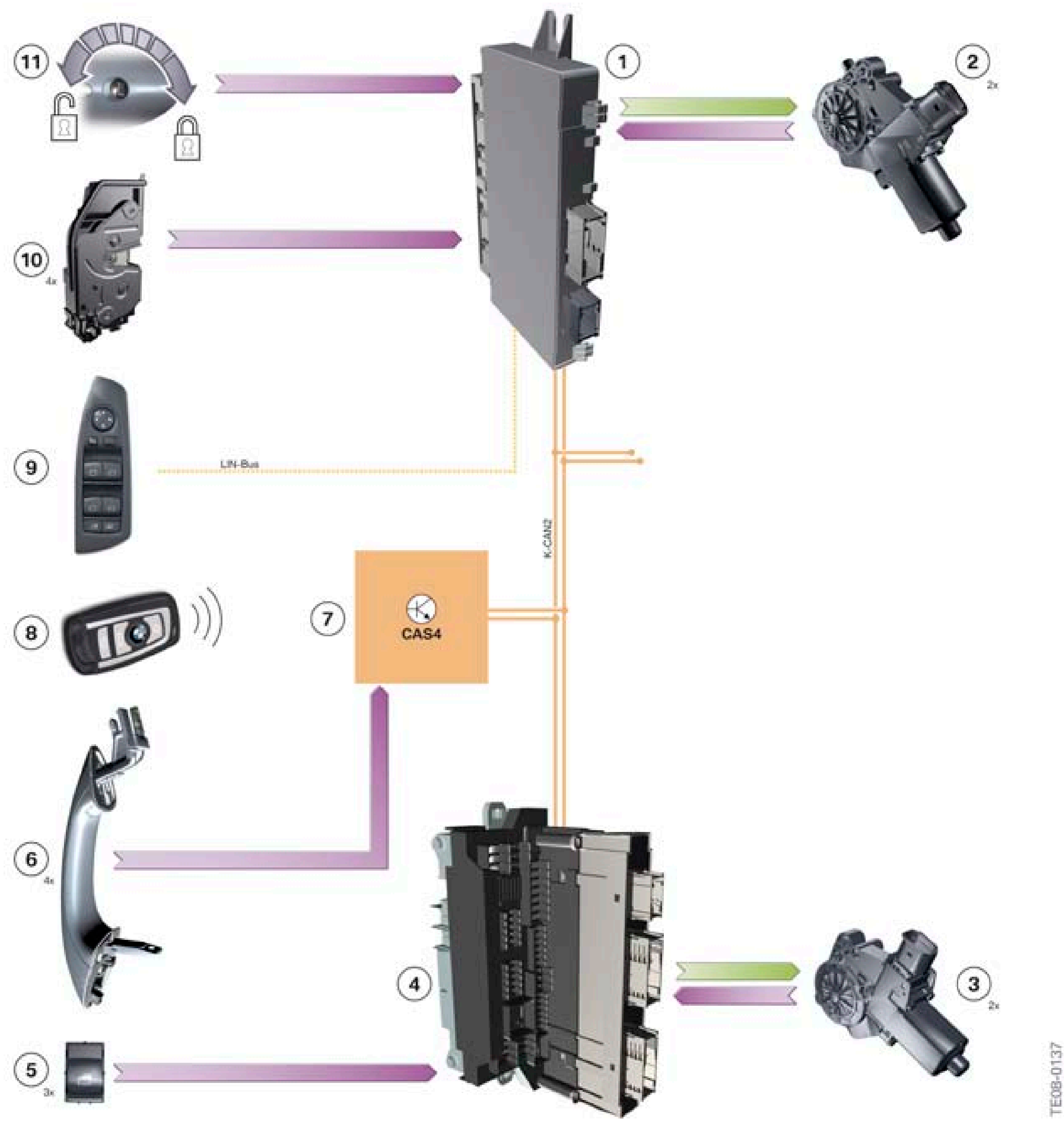
F10 System wiring diagram for power windows

F10 General Vehicle Electronics
7. Power Windows

Index	Explanation
1	Footwell module (FRM)
2	Car Access System (CAS)
3	Junction Box (JB)
4	Front distribution box
5	Power window motor with front right indirect anti-trap mechanism
6	Power window switch, passenger side front
7	Power window motor with indirect anti-trap mechanism, rear right
8	Power window switch, passenger side rear
9	Luggage compartment junction box
10	Aerial diversity module with antenna amplifier
11	Power window switch, driver's side rear
12	Power window motor with indirect anti-trap mechanism, rear left
13	Switch block in the driver's door
14	Power window regulator with front left indirect anti-trap mechanism
K-CAN2	Body controller area network 2
LIN-Bus	Local Interconnect Network bus
Kl. 30	Terminal 30
Term. 30F	Terminal 30 incorrectly switched

7. Power Windows

7.2. Input/output Signals



F10 Power window input/output

Index	Explanation
1	Footwell module (FRM)
2	Power window motor, front doors
3	Power window motor, rear doors
4	Junction box electronics (JBE)

Index	Explanation
5	Power window switch, driver's side rear/passenger side front and rear
6	Outer door handle with Comfort Access (CA)
7	Car Access System (CAS)
8	ID transmitter
9	Switch block in the driver's door
10	Lock with door contact
11	Driver's-door lock barrel
K-CAN.	Body controller area network
LIN-Bus	Local Interconnect Network bus

7.3. Examples of signal paths

The following signal path examples show the paths the signal takes before the power window motors open or close the windows. A requirement is that the Car Access System has issued the enable to operate the power windows.

7.3.1. Driver's door switch cluster

When the power window switch for the driver's window or front passenger's window is operated, the signal is routed via the LIN-Bus to the footwell module. The footwell module activates the corresponding power window motor.

The signal is routed from the driver's door switch cluster via the LIN-Bus to the footwell module when the power window switches for the windows in the rear doors are operated. The footwell module sends the signal via the K-CAN2 to the junction box electronics. The junction box electronics receive the signal and activate the corresponding power window motor.

F10 Driver's door switch cluster

Index	Explanation
1	Button for exterior mirror adjustment
2	Mirror folding button
3	Mirror changeover switch
4	Power window regulator switch, front left
5	Power window regulator switch, front right
6	Power window regulator switch, rear left
7	Power window regulator switch, rear right
8	Safety switch

7.3.2. Power window switch, front passenger's door

The signal is routed to the junction box electronics when the power window switch in the front passenger's door is operated.

The junction box electronics sends the signal to the footwell module on the K-CAN2. The footwell module activates the power window motor.

7.3.3. Power window switch, rear doors

When the power window switches in the rear doors are operated, the signal is routed to the junction box electronics. The junction box electronics drives the power window motor.

F10 General Vehicle Electronics
8. Glass Sunroof

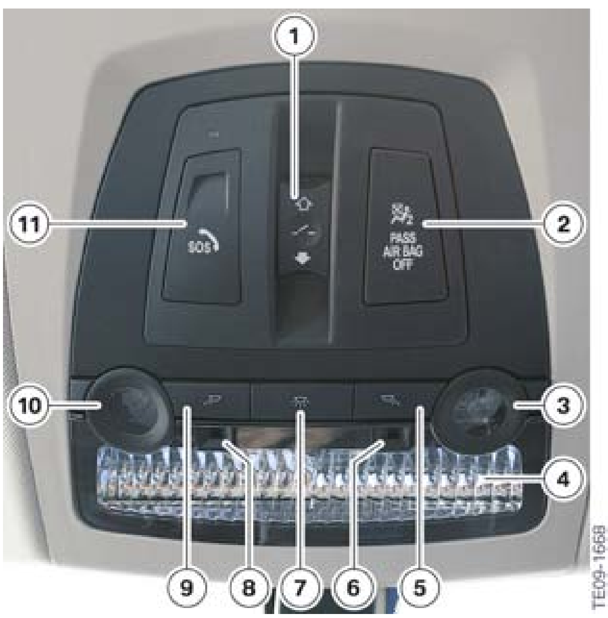
The glass sunroof is standard equipment on all F10 models. Several control units are involved in operating the glass sunroof.

For example, the roof function center (FZD) is linked with the Car Access System (CAS), which enables or disables operation of the glass sunroof.

The footwell module (FRM) supplies the signal from the door contacts. The Junction Box electronics provide the power supply for the motors via terminal 30.

The roof function center controls and monitors the motors of the glass sunroof. The function is identical to that of the slide/tilt sunroof of the F01/F02.

For more information on the operating principle of the glass sunroof, refer to the F01/F02 "Slide/tilting sunroof" training information available on TIS and ICP.

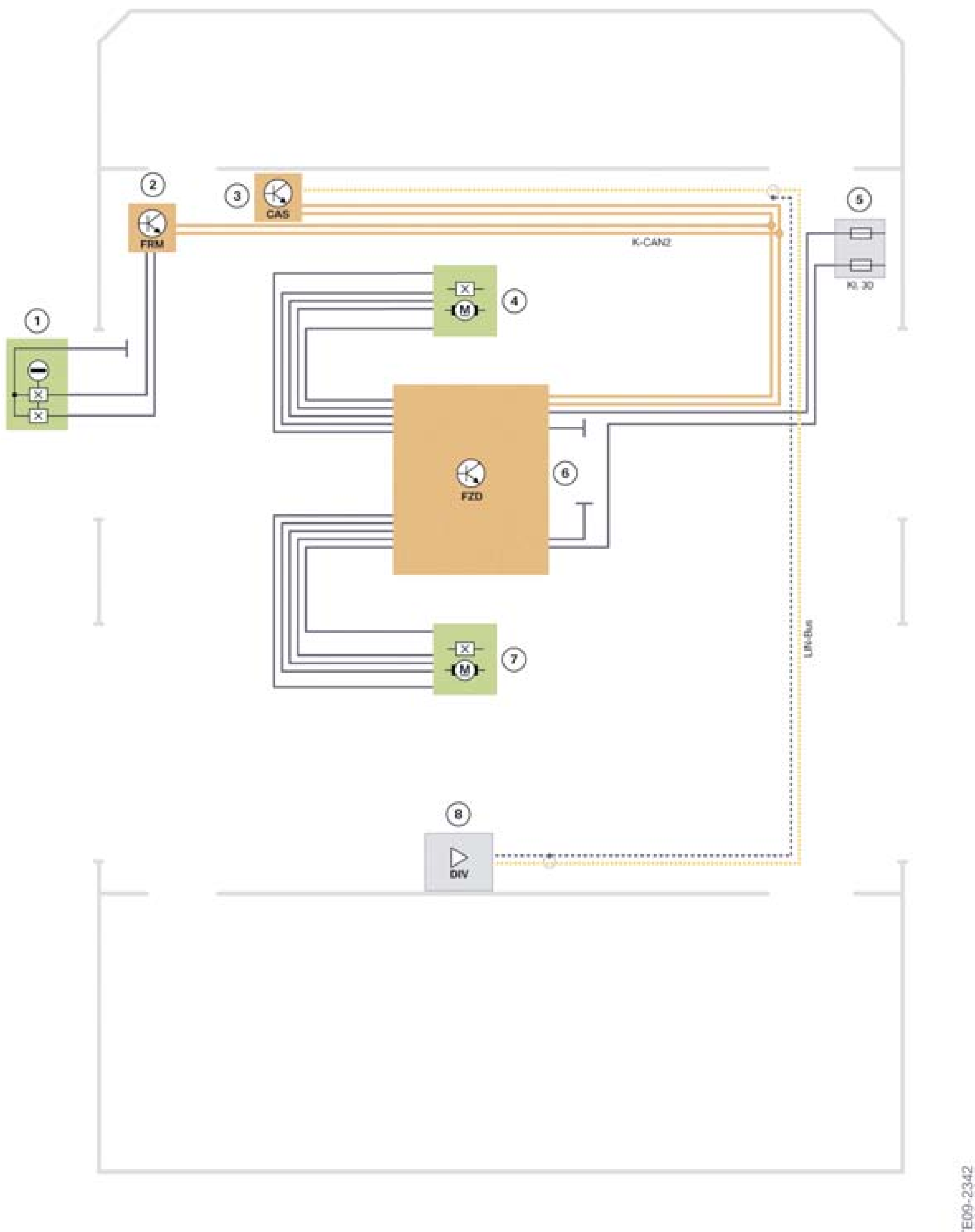


F10 Roof function center

Index	Explanation
1	Glass sunroof switch
2	Indicator lamp for front passenger airbag deactivation
3	Right reading light
4	Interior light
5	Right reading light button
6	Ambient lighting
7	Interior light button
8	Ambient lighting
9	Left reading light button
10	Left reading light
11	Emergency call button

F10 General Vehicle Electronics
8. Glass Sunroof

8.1. System wiring diagram



F10 System wiring diagram for glass sunroof

8. Glass Sunroof

Index	Explanation
1	Hall sensors, driver's door lock barrel
2	Footwell module (FRM)
3	Car Access System (CAS)
4	Glass sunroof motor
5	Front distribution box
6	Roof function center (FZD) with button for glass sunroof
7	Sliding trim motor
8	Aerial diversity module with antenna amplifier
K-CAN2	Body controller area network 2
LIN-Bus	Local Interconnect Network bus
Kl. 30	Terminal 30

F10 General Vehicle Electronics

9. Anti-theft Alarm System

The anti-theft alarm system is standard equipment on all F10 models. As on previous models, the alarm system must be activated. When activated, the alarm monitors the whole of the vehicle interior.

The alarm system monitors the engine compartment and the vehicle's rest position. So that nothing can be stolen from the luggage compartment, the alarm system monitors opening of the trunk lid.

The alarm system also signals an attempt to tamper with the vehicle, e.g. cutting the supply line to the emergency power siren.

An Ultrasonic interior movement detector is integrated in the roof function center.

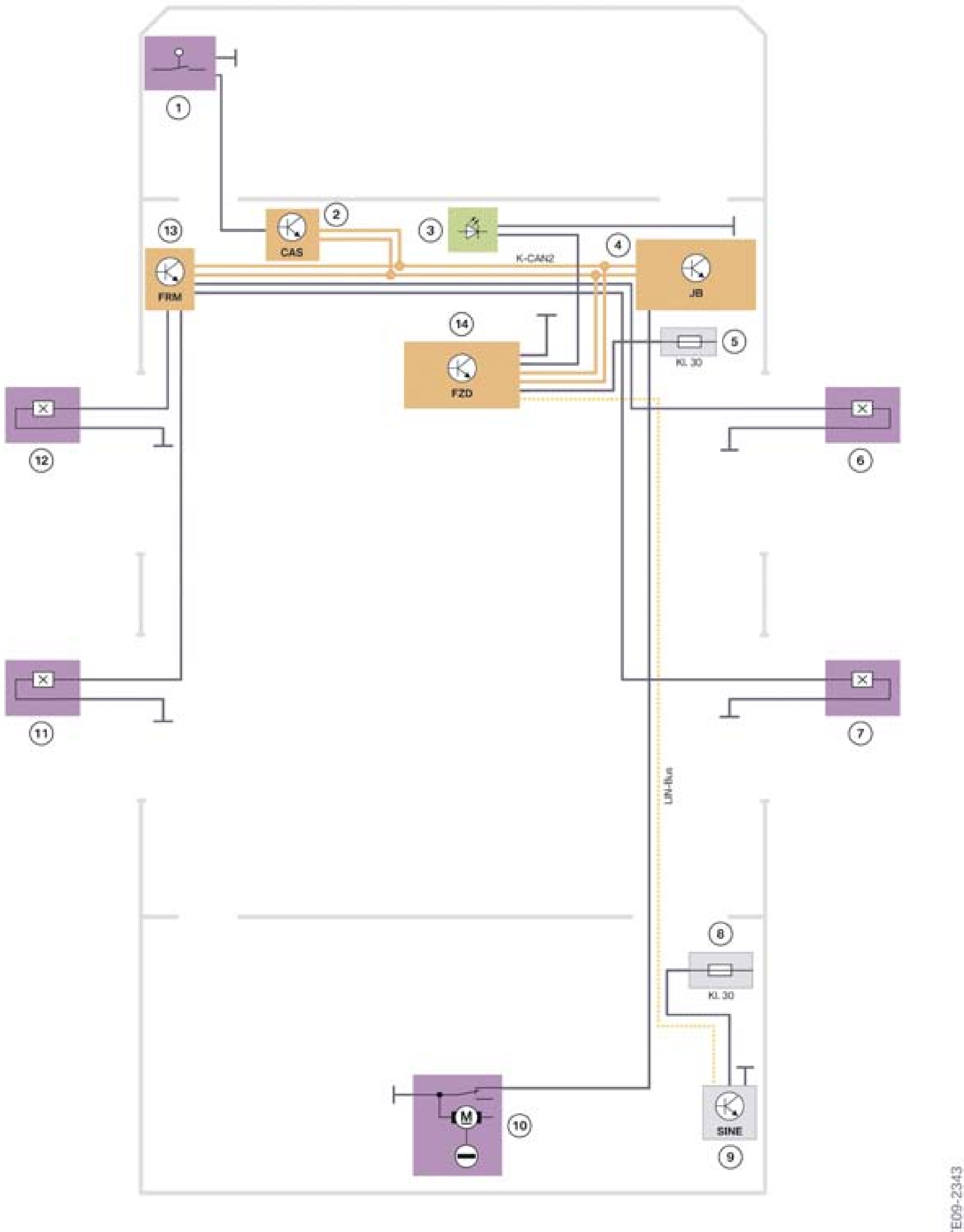
The ultrasonic signal passes into the inside of vehicle through apertures in the grille of the roof function center. The emergency power siren with tilt sensor is located near the rear wheel arch.

For more information on the operating principle of the alarm system, refer to the F01/F02 "Anti theft System" training material available on TIS and ICP.

F10 General Vehicle Electronics

9. Anti-theft Alarm System

9.1. System wiring diagram



F10 Alarm system

F10 General Vehicle Electronics
9. Anti-theft Alarm System

Index	Explanation
1	Hood contact switch
2	Car Access System (CAS)
3	LED alarm system
4	Junction box electronics (JBE)
5	Front distribution box
6	Door contact, passenger's door
7	Door switch, passenger side, rear
8	Luggage compartment junction box
9	Emergency power siren with integrated tilt sensor (SINE)
10	Trunk lock with trunk-lid switch
11	Door switch, driver's side, rear
12	Door switch, driver's door
13	Footwell module (FRM)
14	Roof function center (FZD) with ultrasonic interior movement detector (USIS)
LIN-Bus	Local Interconnect Network bus
K-CAN2	Body controller area network 2
Kl. 30	Terminal 30

The Hall sensors in the doors (6, 7, 11, 12) are monitored by the footwell module (13). As soon as the status of a Hall sensor changes, the ultrasonic interior movement detector (14) receives that information via the K-CAN2. If the anti-theft alarm system is activated, an alarm is triggered.

The hood contact switch (1) is monitored by the Car Access System (2). If the status changes, an alarm is triggered in the same way.

Opening of the trunk is monitored by the junction box electronics (4). If the status of the trunk lid contact switch (10) changes, it triggers an alarm.

10. Automatic Trunk Lid

The “Power Tailgate” option is offered in the F10 as part of the ZCV Convenience Package, which also includes Comfort Access keyless entry and Soft-close automatic doors.

The automatic operation of the trunk lid improves vehicle access by enabling the luggage compartment lid to be opened or closed automatically at the press of a button. A spindle-driven system is used in the F10 for automatic opening or closing of the luggage compartment lid.

With Comfort Access, it is even possible to open the luggage compartment lid while the vehicle is locked.

Pressing the outer trunk lid button opens the luggage compartment lid automatically. The only requirement is that a vehicle-specific ID transmitter must be present in the immediate vicinity of the rear end of the vehicle. The trunk lid can also be opened by pressing the button on the ID transmitter.

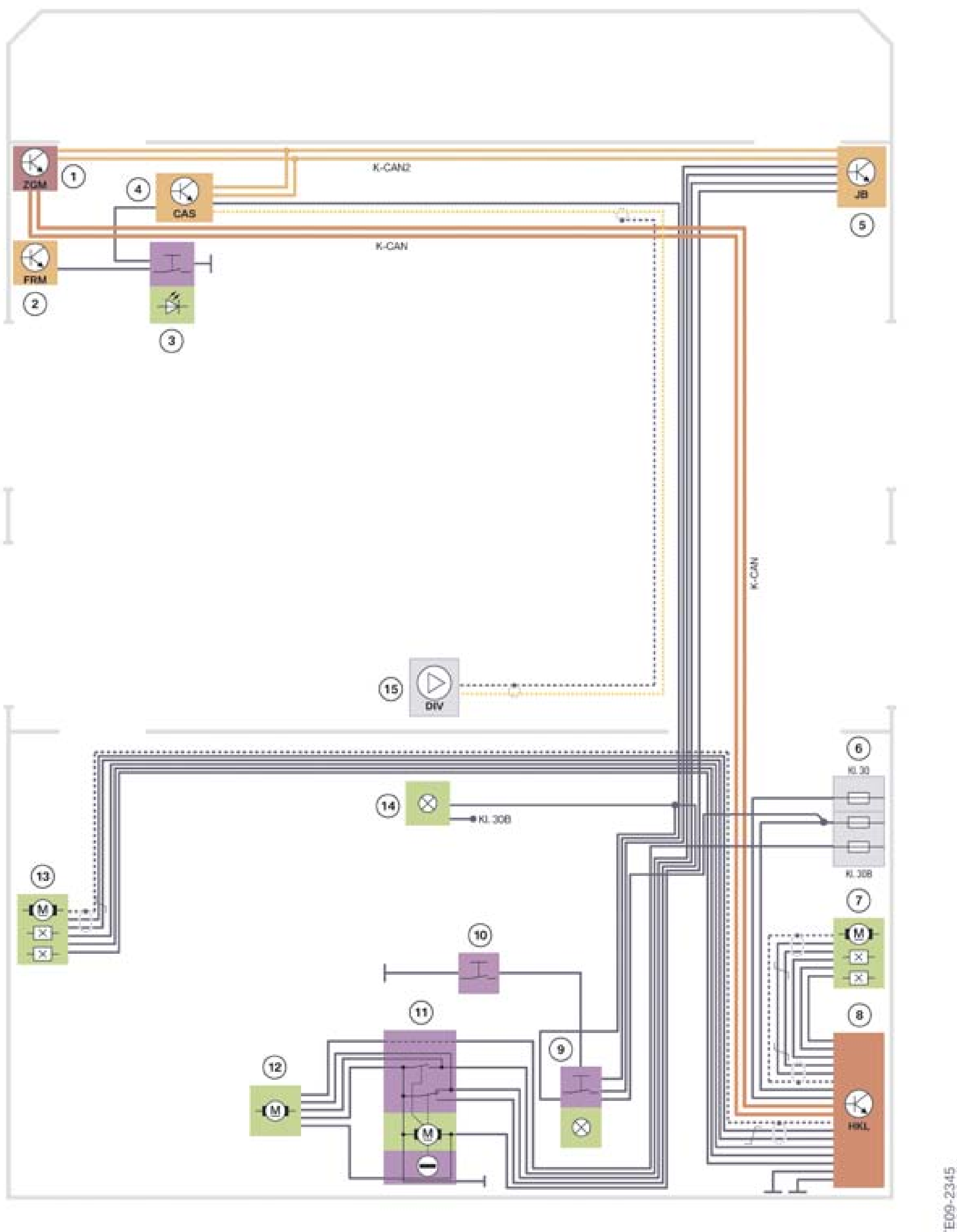
An open luggage compartment lid can be closed by pressing the "close trunk lid" button.

Index	Explanation
1	Close trunk lid button
2	Close and lock trunk lid button (deadlocking)

In connection with Comfort Access, it is now also possible to deadlock the vehicle doors from the trunk lid. The "deadlock" button for this is located in the trunk lid.

10. Automatic Trunk Lid

10.1. System wiring diagram



F10 System wiring diagram for automatic operation of trunk lid

10. Automatic Trunk Lid

Index	Explanation
1	Central gateway module (ZGM)
2	Footwell module (FRM)
3	Trunk lid button, A-pillar
4	Car Access System (CAS)
5	Junction Box (JB)
6	Luggage compartment junction box
7	Spindle drive motor, right
8	Control unit for automatic operation of trunk (HKL)
9	Interior trunk lid button and deadlocking button
10	Exterior trunk lid button
11	Trunk lock with trunk lid contact switch and lock barrel
12	Automatic Soft Close system for trunk lid
13	Spindle drive motor, left
14	Luggage compartment lighting
15	Antenna diversity module with antenna amplifier
K-CAN.	Body controller area network
K-CAN2	Body controller area network 2
Kl. 30	Terminal 30
Term. 30B	Terminal 30 basic operation
LIN-Bus	Local Interconnect Network bus

The radio signal from the ID transmitter is received by the rear window antenna. The remote control receiver in the antenna diversity module (15) forwards the signal to the Car Access System (4). The Car Access System is the master control unit for the central locking function.

Once the signal has been successfully verified, the Car Access System issues a command to activate the central locking in the trunk lid.

The junction box electronics (5) execute the command to activate the central locking system in the trunk lid. The junction box electronics detect the status of the trunk lid contact switch (11) for the automatic operation of trunk lid function. The status of the trunk lid contact switch is sent via the K-CAN to the automatic operation of trunk (8). The status is one of the triggering criteria for trunk lid operation.

The sensors (13) and (7) in the spindle drives monitor the movement of the trunk lid. If the trunk lid is blocked while being closed, the automatic operation of trunk reverses a little if necessary to remove the obstacle.

An obstruction to luggage compartment lid movement during the opening procedure causes the trunk lid to stop and it is not reversed.

The control unit for the automatic operation of trunk lid monitors the power consumption of the spindle drive. A rise in current from the trunk lid being blocked results in the lid movement being stopped or reversed.

F10 General Vehicle Electronics

11. Exterior Lighting

The exterior lights of the F10 are based on those of the F01.

The F10 535i and 550i come standard equipped with bi-xenon headlights (option 522).

The F10 528i is equipped with halogen headlights as standard equipment (bi-xenon headlights option 522 is available).

With bi-xenon headlights, the daytime running lights and the side lights are implemented using light-emitting diodes.

The familiar light switches from the F01 is used on the F10.

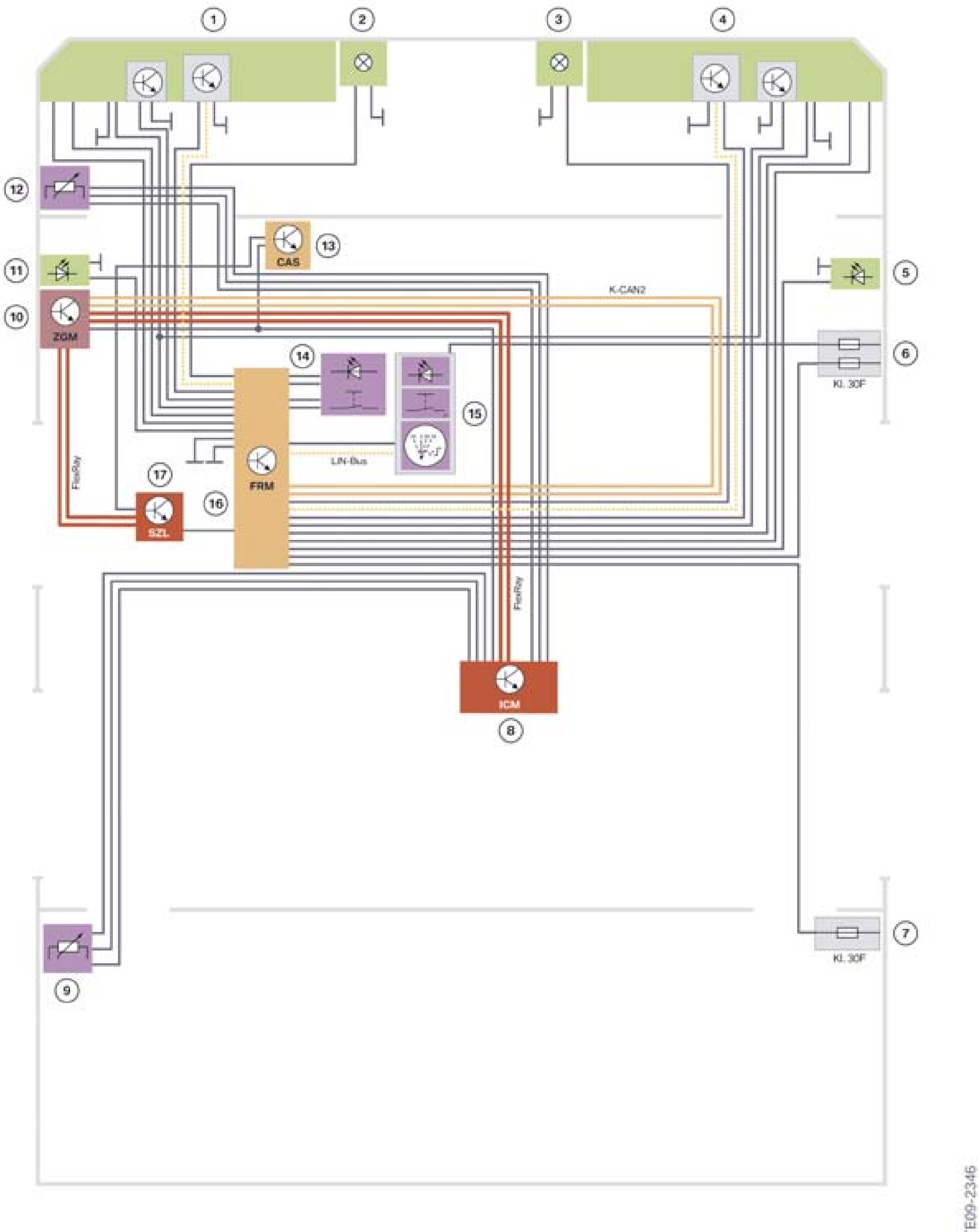
The adaptive headlights are available for the F10 as optional equipment (option 524). It is installed only in conjunction with bi-xenon headlights (option 522).

For more information on the exterior lights, refer to the F01/F02 "Exterior lighting" training material available on TIS and ICP.

F10 General Vehicle Electronics

11. Exterior Lighting

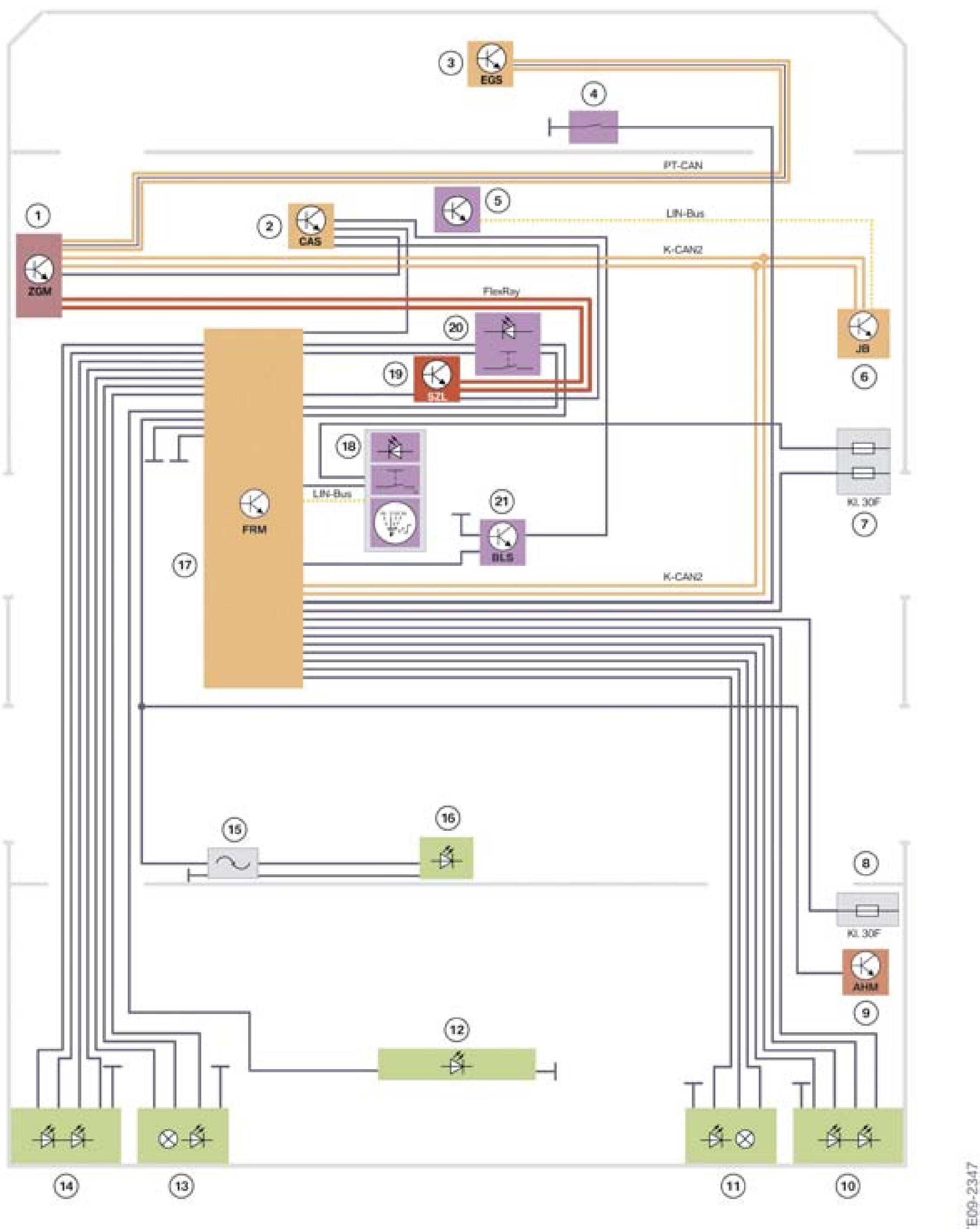
11.1. System wiring diagram



F10 System wiring diagram for front exterior lights

F10 General Vehicle Electronics
11. Exterior Lighting

Index	Explanation
1	Left headlight
2	Front fog light, left
3	Front fog light, right
4	Right headlight
5	Right auxiliary turn indicator
6	Front distribution box
7	Rear power distribution box
8	Integrated Chassis Management (ICM)
9	Rear ride height sensor (only with option 522)
10	Central Gateway Module (ZGM)
11	Left auxiliary turn indicator
12	Front ride height sensor (only with option 522)
13	Car Access System (CAS)
14	Hazard warning switch
15	Control panel, light switch
16	Footwell module (FRM)
17	Steering column switch cluster (SZL)

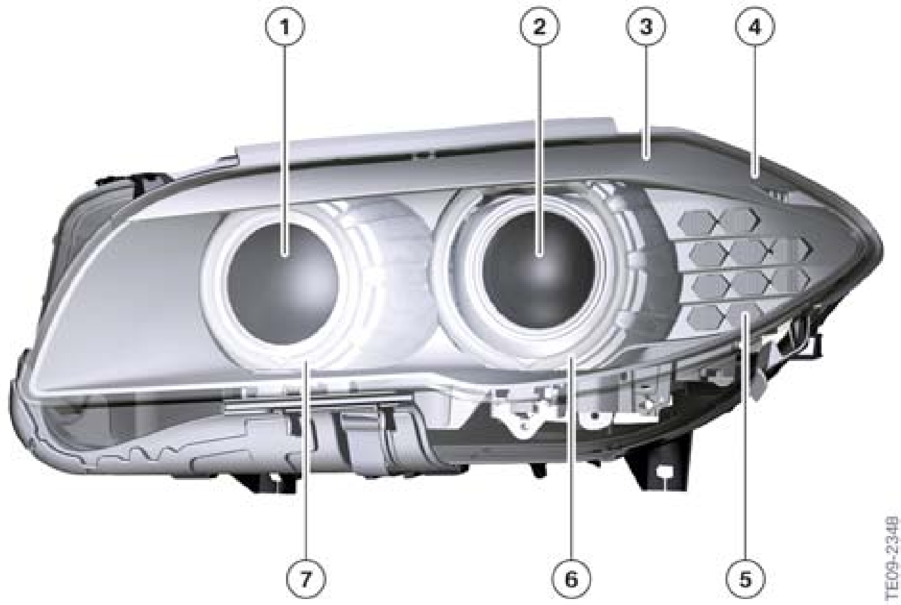


F10 System wiring diagram for rear exterior lights

Index	Explanation
1	Central Gateway Module (ZGM)
2	Car Access System (CAS)
3	Electronic transmission control (EGS) (with automatic transmission)
4	Reverse light switch (with manual transmission)
5	Rain-light-solar-condensation sensor
6	Junction Box (JB)
7	Front distribution box
8	Rear power distribution box
9	Trailer module AHM (Not for US)
10	Outer rear light cluster, right
11	Inner rear light cluster, right
12	Licence plate light
13	Inner rear light cluster, left
14	Outer rear light cluster, left
15	Filter with trap circuit
16	Additional brake light
17	Footwell module (FRM)
18	Control panel, light switch
19	Steering column switch cluster (SZL)
20	Hazard warning switch
21	Brake light switch

11.2. Front Lighting

The structure of the front headlights can be seen in the following graphic.



F10 Front headlight

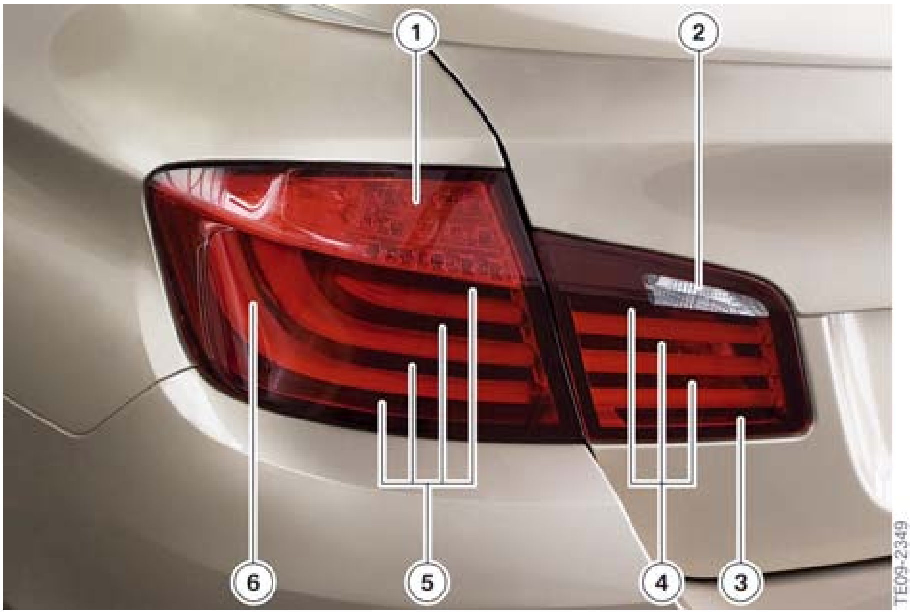
Index	Explanation
1	Turning light (option 524, only available with bi-xenon) or high beam headlight with halogen headlights
2	Bi-xenon low-beam headlight/high beam headlight or low-beam headlight with halogen headlights
3	Decorative lighting (light-emitting diodes)
4	Side marker light (light-emitting diodes)
5	Turn indicator (light-emitting diodes with bi-xenon)
6	Parking light/daytime driving lights corona ring (light-emitting diodes, daytime driving light function only with bi-xenon)
7	Parking light/daytime driving lights corona ring (light-emitting diodes, daytime driving light function only with bi-xenon)

11.3. Rear Lighting

The F10 has a two-piece rear light. The structure of the rear lights can be seen in the following graphic.

F10 General Vehicle Electronics

11. Exterior Lighting



F10 Rear light

Index	Explanation
1	Turn signal indicator light (LEDs)
2	Reverse light
3	Brake light for Brake Force Display
4	Brake light (LEDs)
5	Reflector, side marking
6	Tail light (LEDs)

F10 General Vehicle Electronics

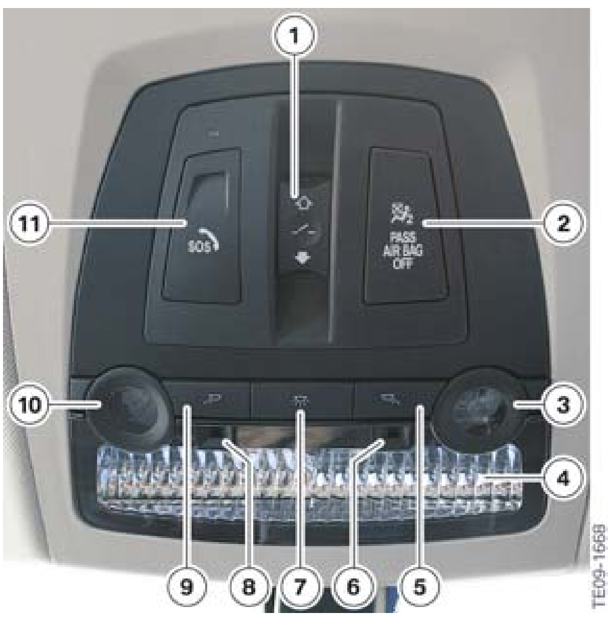
12. Interior Lighting

12.1. Overview

The interior lighting of the F10 is controlled by the footwell module FRM control unit.

The footwell module is the central control unit for the interior lighting. All interior lighting outputs of the footwell module are pulse-modulated. This ensures that the interior light functions at a constant brightness level in the event of voltage fluctuations. The pulse width modulation is also used for the "soft ON/soft OFF" function.

The components for the interior light in the front roof area are integrated in the roof function center and in the sun visors. The footwell lighting is located underneath the dashboard. The rear reading and interior lights are supplied with voltage via the roof function center.



F10 Roof function center

Index	Explanation
1	Glass sunroof switch
2	Indicator lamp for front passenger airbag deactivation
3	Right reading light
4	Interior light
5	Right reading light button
6	Ambient lighting
7	Interior light button
8	Ambient lighting
9	Left reading light button
10	Left reading light
11	Emergency call button

12.2. System wiring diagram

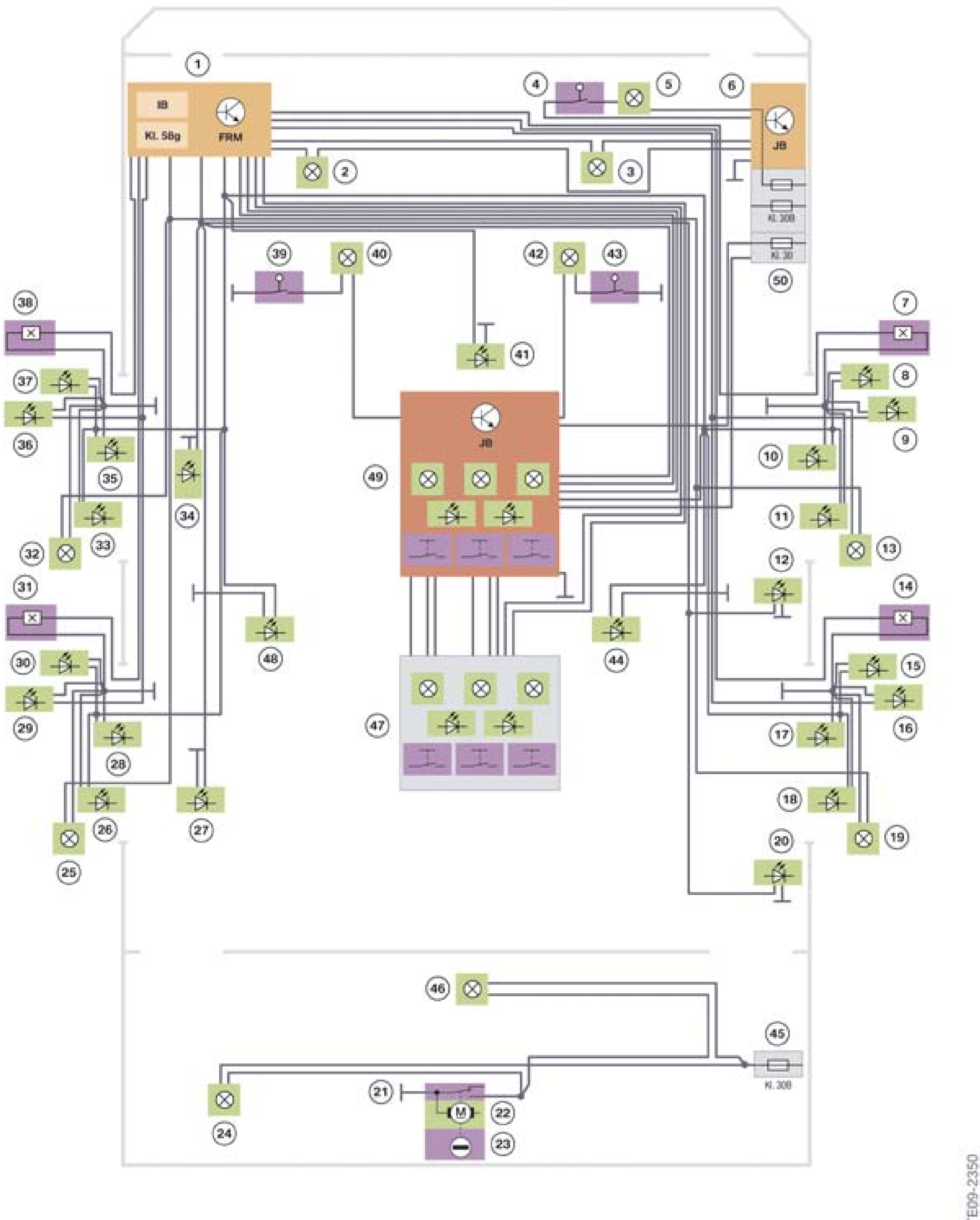
The system wiring diagram follows the description below and provides an overview of the full extent of all possible interior light options.

The following examples describe some switching operations for the interior light.

The status of the door contact (Hall sensor) in the lock (38) changes, for example, when the door is opened with the vehicle unlocked. The footwell module (1) evaluates the status and sends the request to switch on the interior light.

At the same time, the door entry lighting (32) for the door that is open and the footwell lights (2, 3) are switched on by the footwell module. The status of the door contact changes again when the vehicle door is closed. The footwell module initiates the procedure to switch off the interior light.

The luggage compartment lights and the lights in the luggage compartment lid (24, 46) are connected to the voltage supply via terminal 30B. If one of the luggage compartment lids is opened, the status of the tailgate contact switch changes (27). The luggage compartment lights and the luggage compartment lid light are switched on directly via the tailgate contact switch.



F10 System wiring diagram for interior light

F10 General Vehicle Electronics
12. Interior Lighting

Index	Explanation
1	Footwell module (FRM)
2	Footwell light, driver's side
3	Footwell light, front passenger's side
4	Glove compartment switch
5	Glove box light
6	Junction Box (JB)
7	Door contact, front passenger side
8	Exterior door handle light, front passenger side
9	Ground lights, front passenger side
10	Inside door handle light, front passenger side
11	Door pocket lighting, front passenger side
12	Entrance lighting, front passenger side
13	Door entry lighting, front passenger side
14	Door switch, passenger side, rear
15	Exterior door handle light, passenger side, rear
16	Rear, passenger-side illuminated entry system
17	Interior door handle light, passenger side, rear
18	Door pocket light, passenger side, rear
19	Doorway light, passenger side, rear
20	Entrance lighting, rear passenger side
21	Tailgate contact switch
22	Tailgate lock motor
23	Lock barrel, tailgate
24	Luggage compartment light in tailgate
25	Doorway light, driver's side, rear
26	Door pocket light, driver's side, rear
27	Entrance lighting, rear driver's side
28	Interior door handle light, driver's side, rear
29	Rear, driver's side illuminated entry system
30	Exterior door handle light, driver's side, rear
31	Door switch, driver's side, rear
32	Door entry lighting, front driver's side
33	Door pocket lighting, front driver's side
34	Door pocket lighting, front driver's side
35	Inside door handle light, front driver's side

12. Interior Lighting

Index	Explanation
36	Ground lights, front driver's side
37	Outside door handle light, front driver's side
38	Door contact, front driver's side
39	Make-up mirror light switch, front driver's side
40	Make-up mirror light, front driver's side
41	Center console storage compartment light, front
42	Make-up mirror light, front passenger side
43	Make-up mirror light switch, front passenger side
44	Map pocket light, front passenger seat backrest
45	Luggage compartment junction box
46	Luggage compartment light
47	Interior/reading light unit, rear
48	Map pocket light, driver's seat backrest
49	Interior/reading light unit, front
50	Front power distribution box
Kl. 30	Terminal 30
Term. 30B	Terminal 30 basic operation
Kl. 58g	Terminal 58g
IB	Interior lighting control

F10 General Vehicle Electronics
13. Seats

The electrical connection of the front seats and the seats in the rear passenger compartment is the same as in the F01.

For additional information on the seats, refer to the F01/F02 "Seats" training material available on TIS and ICP.

13.1. Front seats

The following front seat variants are available for the F10:

- 20-way power front Comfort seats with memory (standard)
- ZAV Active vent seat package

The available ZAV Active vent seat package includes

- Multi contour seats (lumbar support)
- Front ventilated seats
- Active front seats
- Heated front seats

The front seats are largely identical to the front seats in the F07.

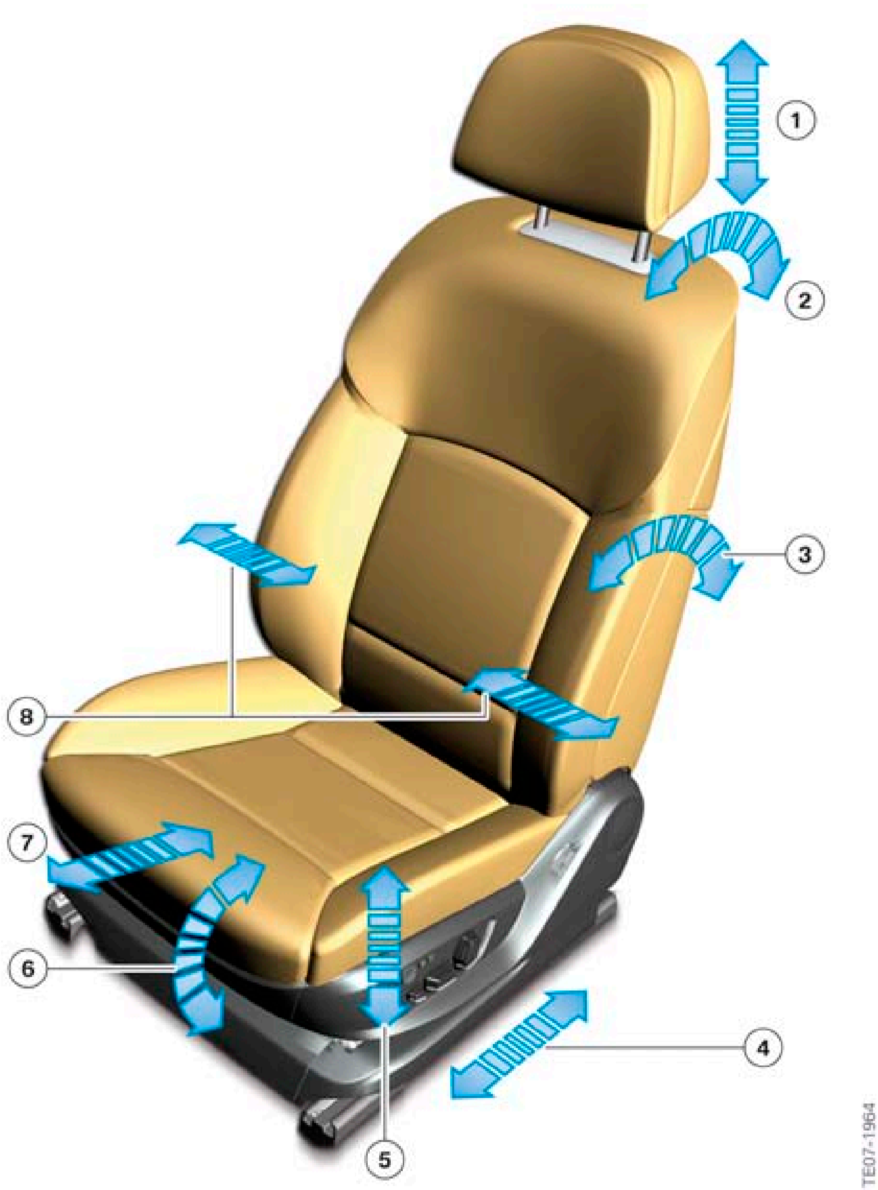
The following table provides an overview of the available optional equipment.

	Seat adjustment, electrical, with memory (option 459)	**Comfort seat, electrically adjustable (option 456)**
Seat memory	Standard	Standard
Seat heating for driver/passenger	Option 494	Option 494
Lumbar support for driver/passenger	Option 488	Standard
Active seat for driver/front passenger	---	Option 455
Active seat ventilation, front	Option 453	Option 453
Ambient light	Option 4UR	Option 4UR
Rear seat entertainment	Option 6FG	Option 6FG

13.1.1. Seat adjustment

With the maximum equipment specification, the F10 seats can be adjusted in eight directions.

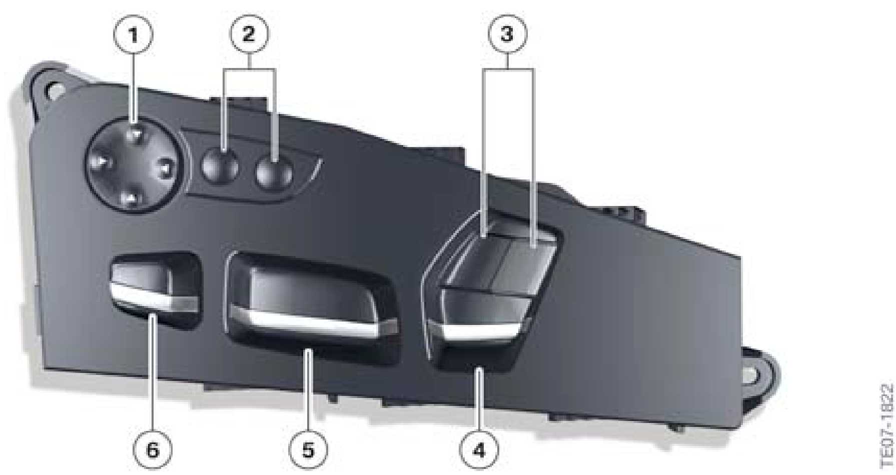
13. Seats



F10 Maximum seat adjustment, example: comfort seat

Index	Explanation
1	Head rest height adjustment
2	Back rest upper section adjustment
3	Back rest angle adjustment
4	Forward/Back seat adjustment
5	Seat height adjustment
6	Seat angle adjustment
7	Seat depth adjustment
8	Back rest width adjustment

Seat adjustment options	Seat adjustment, electrical, with memory (option 459)	Comfort seat, electrically adjustable (option 456)
Seat height adjustment	Electrical	Electrical
Forward/back seat adjustment	Electrical	Electrical
Seat angle adjustment	Electrical	Electrical
Backrest inclination adjustment	Electrical	Electrical
Head restraint, height adjustment	Electrical	Electrical
Seat depth adjustment	Manual*	Electrical
Backrest width adjustment	---	Electrical
Upper backrest adjustment	---	Electrical



F10 Switch block for comfort seat adjustment (on the seat)

Index	Explanation
1	Lumbar support adjustment
2	Back rest width adjustment
3	Back rest upper section adjustment
4	Back rest angle and head rest adjustment
5	Forward/back, seat height and angle adjustment
6	Seat depth adjustment

13.1.2. Seat heating

Seat heating can be ordered for the front seats (option 494) for the F10.

F10 Control panel for integrated automatic heating / air conditioning system

Index	Explanation
1	Seat heating button, driver's seat
2	Seat heating button, front-passenger seat

For more information on seat heating, refer to the F01/F02 "Seats" training information available on TIS and ICP.

13.1.3. Active seat ventilation

Active seat ventilation can be ordered for the front seats (option 453) for the F10.

F10 Control panel for integrated automatic heating / air conditioning system

Index	Explanation
1	Button, active seat ventilation, driver's seat
2	Button, active seat ventilation, front-passenger seat

For more information on seat heating, refer to the F01/F02 "Seats" training information available on TIS and ICP.

13.2. Seats in the rear passenger compartment

In the F10, a seat bench with backrest in sandwich design is installed as standard, or a seat bench with through-loading system as optional equipment (option 465).

Highlights

F10 General Vehicle Electronics
13. Seats

- Backrest in sandwich design (only basic seat bench)
- center armrest (folding) with storage compartment and cup holder
- center head restraint, folding
- Backrests, folding 40 %, 60 % or 100 % (only with through-loading system, option 465)

The following seat equipment is possible in the rear passenger compartment.

	Basic seat bench	**Seat bench with through-loading system (option 465)**
Seat heating for rear seats	Option 496	Option 496
Remote control in storage compartment (with rear seat entertainment or rear seat entertainment Professional)	Option 6FG, option 6FH	Option 6FG, option 6FH
Ski bag	---	Standard

Seat heating can be ordered as an option (option 496).

Control panel for automatic rear air-conditioning system

Index	Explanation
1	Left seat heating button
2	Right seat heating button

F10 General Vehicle Electronics
14. Climate Control Systems

For the F10, 2 versions of the integrated automatic heating / air conditioning system IHKA are available.

- 2-zone IHKA Climate Control (option 534)
- 4-zone IHKA Climate Control (option 4NB)

The following table provides an overview of this of the 2 IHKA systems available:

	2-zone IHKA	4-zone IHKA
Temperature	Left/right	Front: left/right Rear: left/right
Air volume	Left/right	Front: left/right Rear: shared
Air distribution	Left/right	Front: left/right Rear: shared

14.1. Equipment

	IHKA 2 zones	IHKA 4 zones
Separate control of temperature, front left/right	X	X
Separate control of amount of air and air distribution, front left/right	X	X
Separate control of temperature, rear passenger compartment	NA	X
Independent ventilation	X	X
Residual heat utilization	X	X
Anti-misting	X	X
Fresh air and recirculating air filter (microfilter)	X	X
Ionizer to prevent condenser odors	X	X
Individual automatic control with 5 intensity levels	X	X
Solar compensation	X	X
Automatic air recirculation control (including combination filter[2])	X	X

	IHKA 2 zones	IHKA 4 zones
ALL function (driver's settings are transferred to front passenger side)	X	NA
ALL function (driver's settings are transferred to front passenger side and left/rear passenger compartment)	NA	X
Separate IHKA controls in rear passenger compartment (center console)	NA	X
Comfort nozzle (fresh-air grille on center dashboard) with individual range of adjustment from spot (focused) to diffuse (draught-free)	NA	X

[1] A solar sensor takes into account any external light and/or heat sources that affect the climate in the passenger compartment.

[2] A combination of microfilter and carbon filter traps dust and pollen and protects the system against unpleasant odors.

14.2. 2-zone IHKA

2-zone IHKA is standard equipment for all F10 models.

F10 Control panel of the 2-zone IHKA

With the 2-zone IHKA you can adjust the amount of air and air distribution separately for the left and right side.

The driver's current settings for temperature, amount of air and air distribution can be transferred to the front passenger side using the ALL button.

The system is also equipped with the automatic air recirculation control AUC. This feature blocks the fresh air duct if there are odors or pollutants coming into the vehicle. in this situation, the interior air is then recirculated.

The rear seat passengers can only adjust the individual air flow out of the center vents. The rear temperature is dependent on the front passenger settings and can not be adjusted separately nor independently for the rear left and right passengers.

The function, operation and structure of the 2-zone IHKA are the same as the IHKA basic version in the F07. For more information on this IHKA, refer to the F07 "General Vehicle Electronics-Climate Control System" training material available on TIS and ICP.

14.3. 4-zone IHKA

The 4-zone IHKA is available as optional equipment (option 4NB) on all F10 models.

F10 Control panels for the 4-zone IHKA

Index	Explanation
1	Front control panel
2	Control panel in the rear passenger compartment

In the front of the vehicle, the 4-zone IHKA has the same control panel as the 2-zone IHKA.

The 4-zone IHKA has an additional control panel in the rear passenger compartment. The rear seat passengers can use this to adjust the temperature separately for the left and right. The amount of air and air distribution can be controlled together for the rear passenger compartment.

With the 4-zone IHKA, the driver's current settings for temperature, amount of air and air distribution can be transferred to the front passenger side and rear passenger compartment using the ALL button.

F10 Air ducts and zones of the 4-zone IHKA

Index	Explanation
1	Driver zone
2	Front passenger zone
3	Right rear passenger compartment zone
4	Left rear passenger compartment zone

The function, operation and structure of the 4-zone IHKA are the same as the IHKA High version in the F01/F02. For more information refer to the F01/F02 "Climate Control Systems" training material available on TIS and ICP.

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F10 Driver Assistance Systems

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1002 7/1/2011

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**
VH-23/International Technical Training

F10 Driver Assistance Systems

Contents

F10 Driver Assistance Systems
Contents

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:

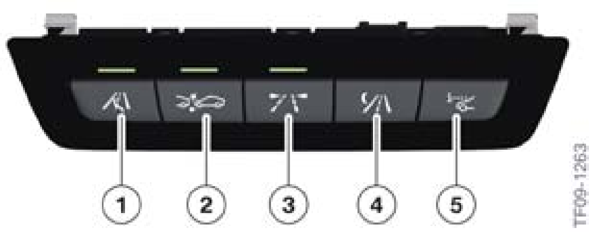
- providing the driver with information,
- prompting the driver how to act or
- actively intervening if necessary in order to ensure maximum performance efficiency and safety.

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

1. Introduction

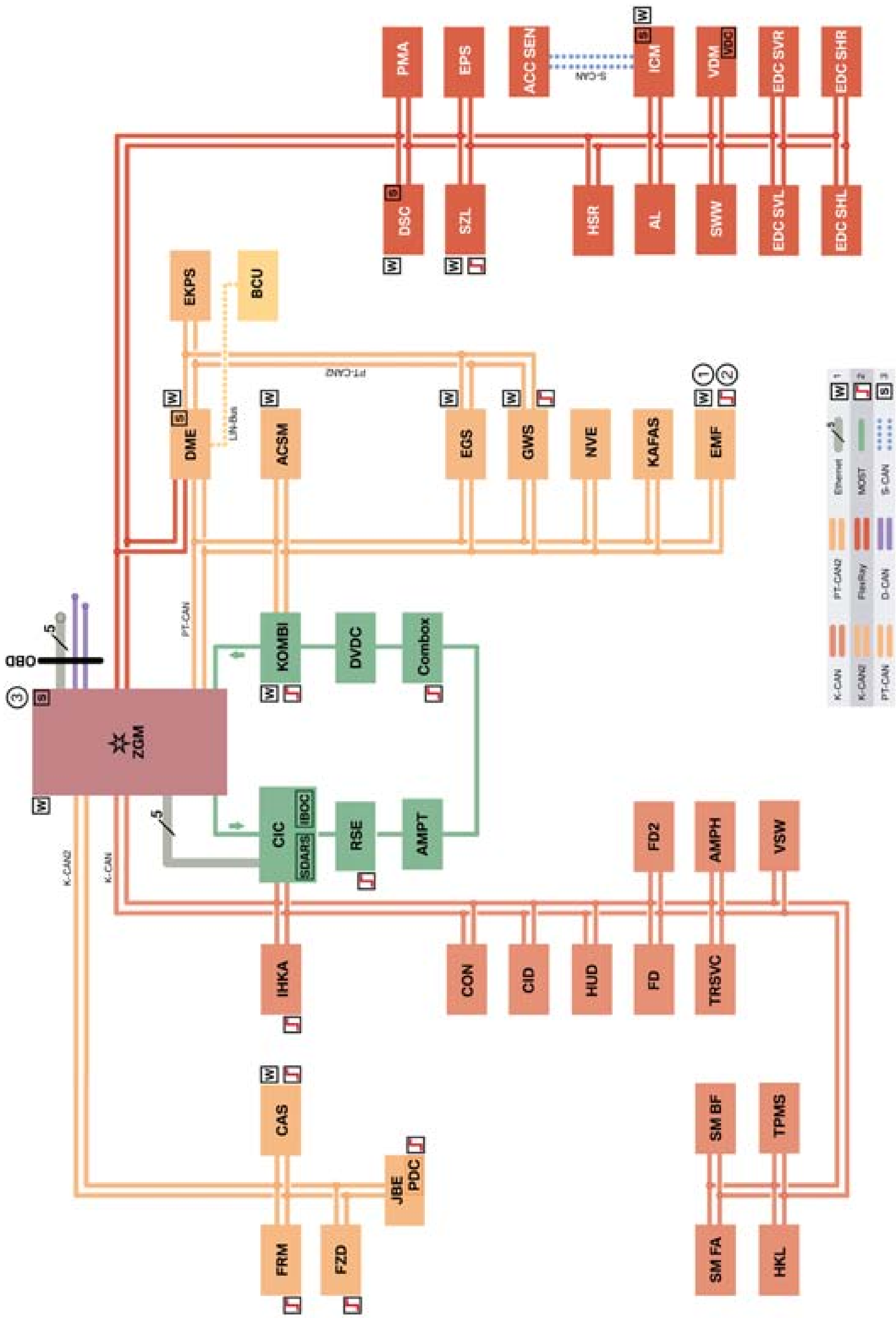
5 Head-up display HUD.

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	Startup node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety 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
Combox	Combox multimedia with telematics
CON	Controller
D-CAN	Diagnosis on Controller Area Network
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
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications
FRM	Footwell module
FZD	Roof function center

F10 Driver Assistance Systems
1. Introduction

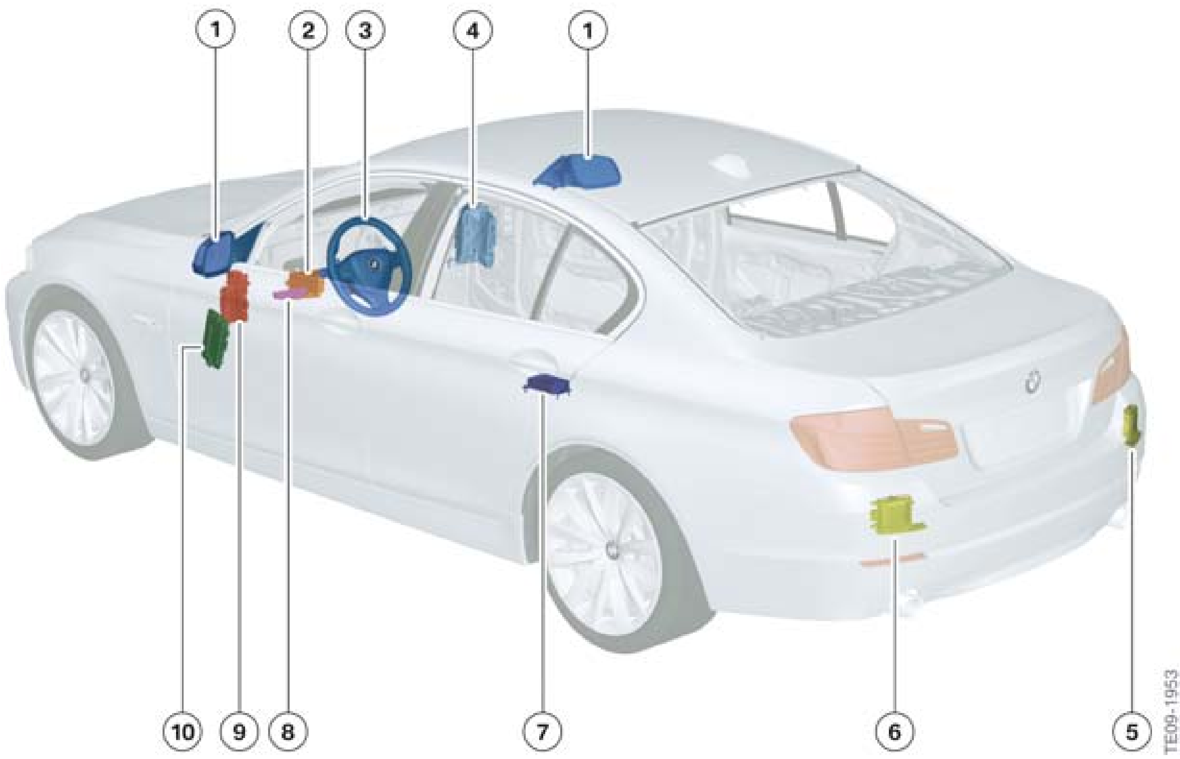
Index	Explanation
GWS	Gear selector switch
HKL	Luggage compartment lid lift
HSR	Rear suspension slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
JBE	Junction box electronics
KAFAS	Camera-based driver assistance system
K-Bus	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 Control Unit
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for reversing camera and side view
VDM	Vertical Dynamics Management
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.

F10 Driver Assistance Systems
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.


TE09-2213

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.

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

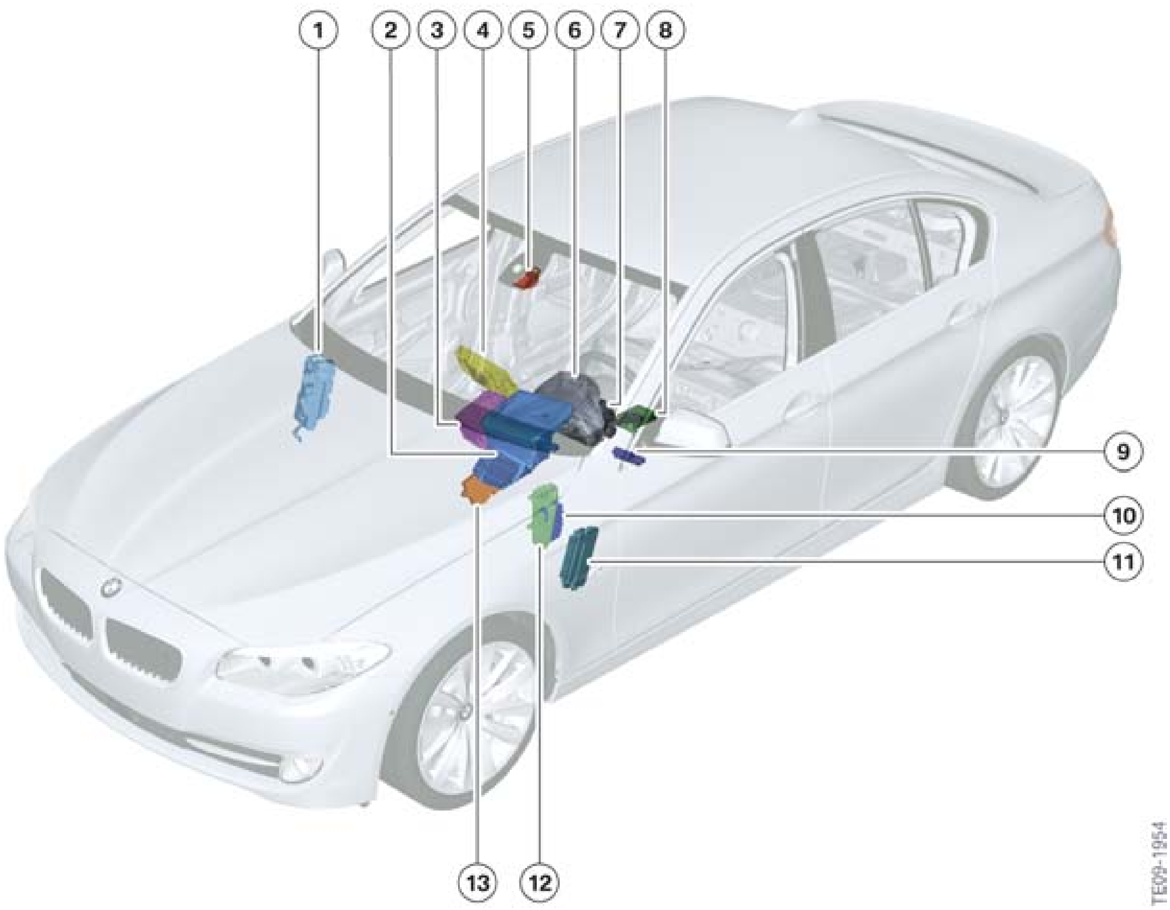
The lane departure warning (option 5AD) warns the driver in the event that the vehicle deviates from the lane it is currently traveling without the driver's intention. For this function to work properly recognizable road and lane markings should be present and detected by the system. The KAFAS control 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.

⚠

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.

F10 Driver Assistance Systems

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

F10 Driver Assistance Systems

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.

F10 Driver Assistance Systems

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.

F10 Driver Assistance Systems

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).

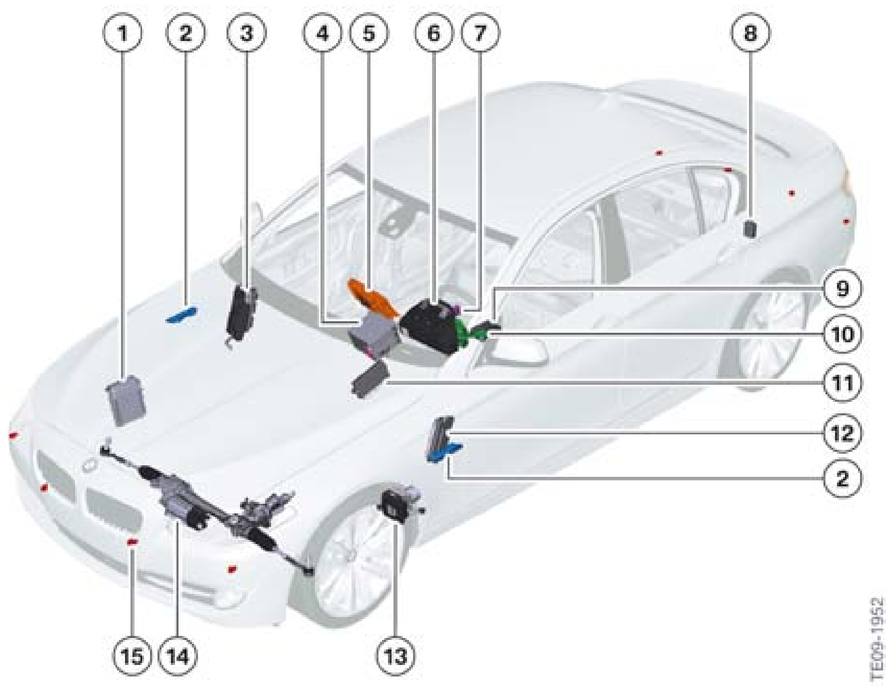
Parking Assistant makes it easier to maneuver the vehicle into parking spaces parallel to the roadway. The system measures potential parking spaces (on both sides of the road) when driving by them at speeds less than 35 km/h/22mph, regardless of whether parking assistant has been activated or not. When 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.

⚠

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



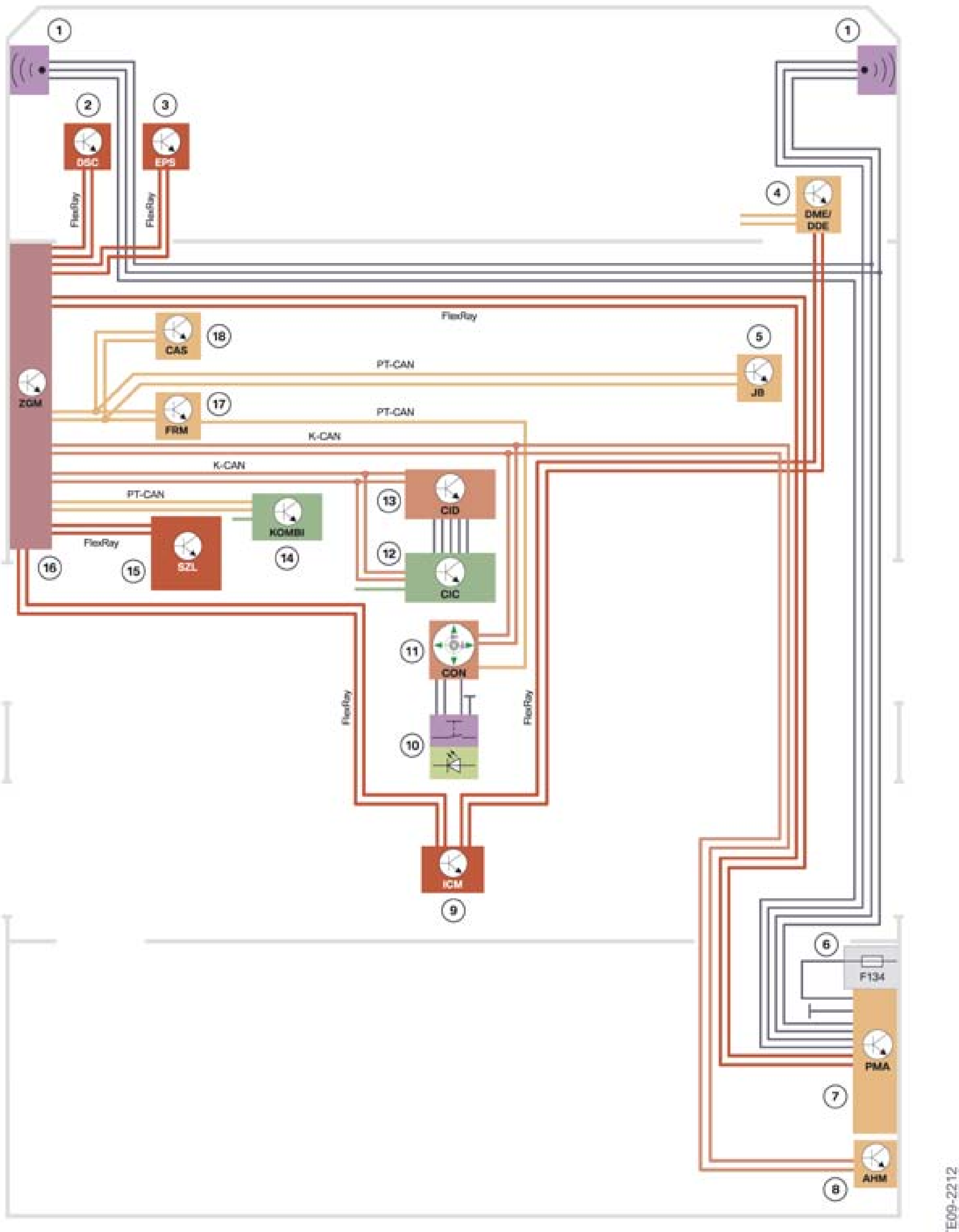
F10 System components of the parking assistant system

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 Driver Assistance Systems

6. Parking Assistant

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

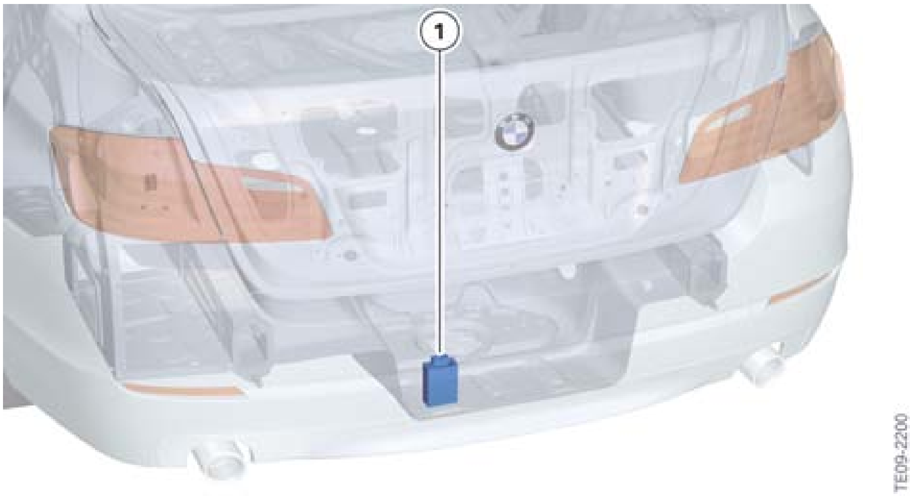
The sensor has a horizontal opening angle of +-10° and a vertical opening angle of +-60°. It has a range of approximately 4.5 m.

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.



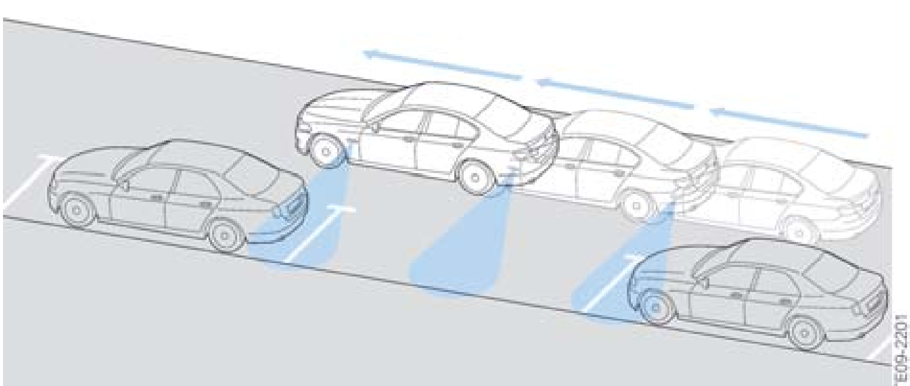
F10 Installation location of Parking Manoeuvring Assistant (PMA)

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

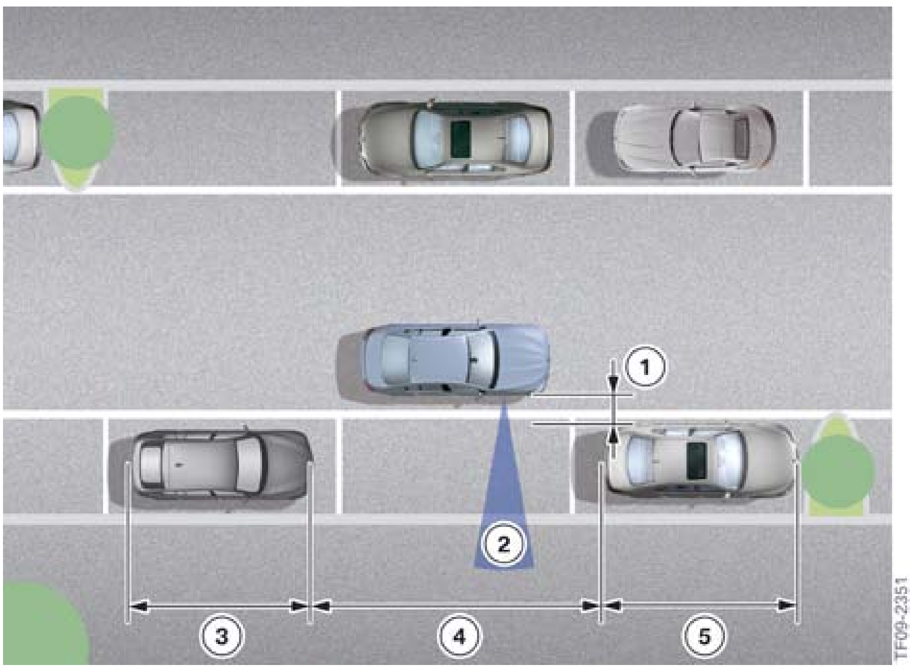
The following preconditions are placed on the parking space:

F10 Driver Assistance Systems

6. Parking Assistant

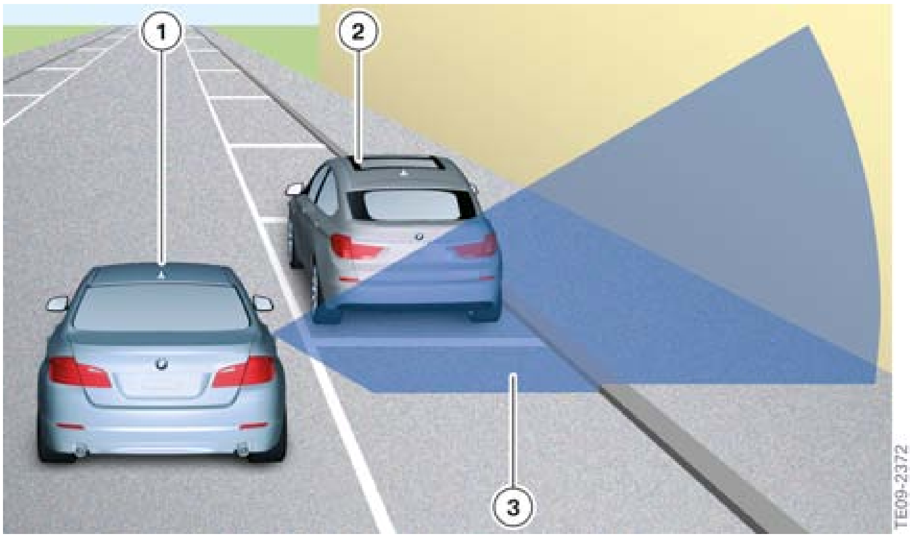
- The parking space must be between two objects each with a minimum length of about 1.5 meters (5 feet).
- The minimum width of the parking space must be about 1.5 meters (5 feet).
- The minimum length of the parking space must be at least the length of your vehicle plus about 1.2 meters (4 feet).

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.)

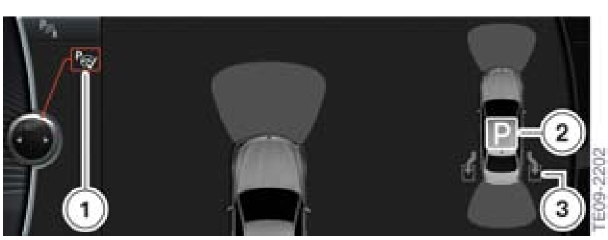
6.2.2. Activation

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.

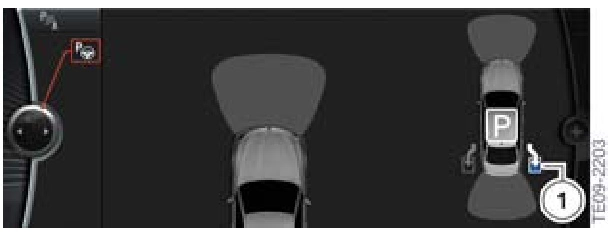


F10 Parking display with the parking assistant activated, and searching for a parking space to the right and left.

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.

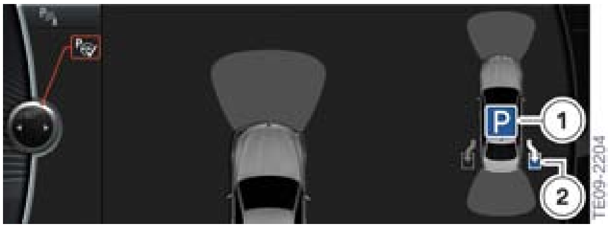
By using the turn indicator, the "parking space search" display or "suitable parking space" on the opposite side disappears from the central information display. Parking spaces on this side continue to be measured in the background.

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.

F10 Driver Assistance Systems

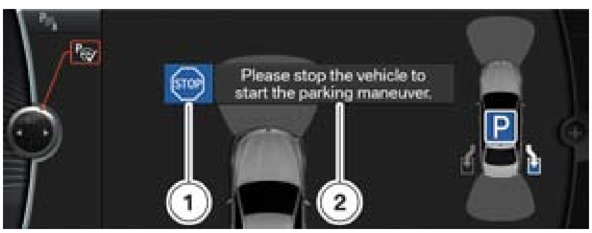
6. Parking Assistant



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.

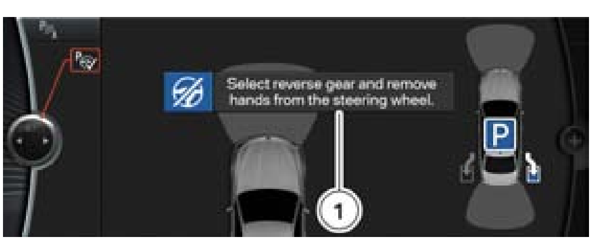


F10 parking assistant prompts to stop the vehicle.

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.

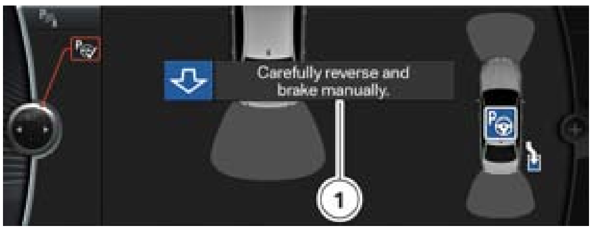


F10 parking assistant prompts the driver to select reverse.

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

F10 Driver Assistance Systems
6. Parking Assistant

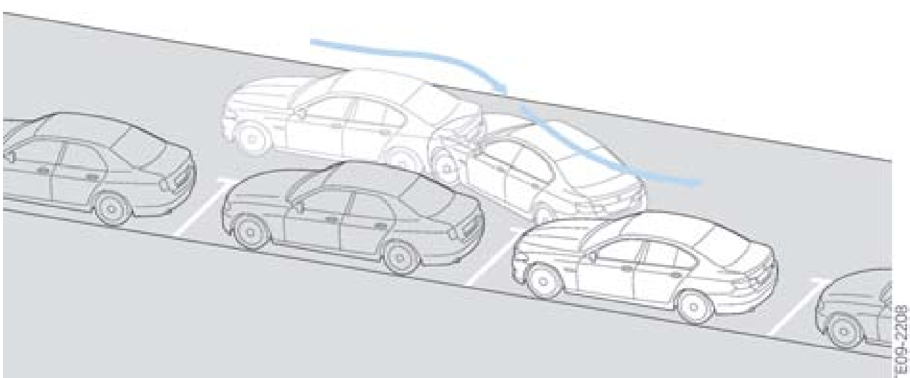
Once the driver has shifted into reverse and lets go of the steering wheel, the parking process can be started with the parking assistant. The parking assistant takes over the control of steering once the vehicle is shifted into reverse. This is indicated by a steering wheel symbol in the central information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

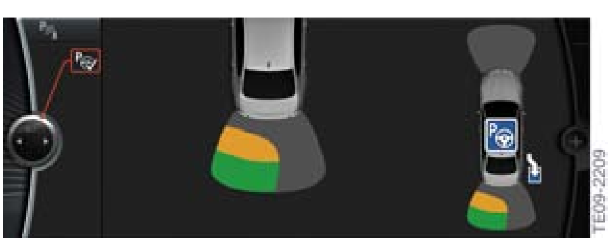
Index	Explanation
1	Carefully reverse and brake manually.

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

F10 Driver Assistance Systems
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

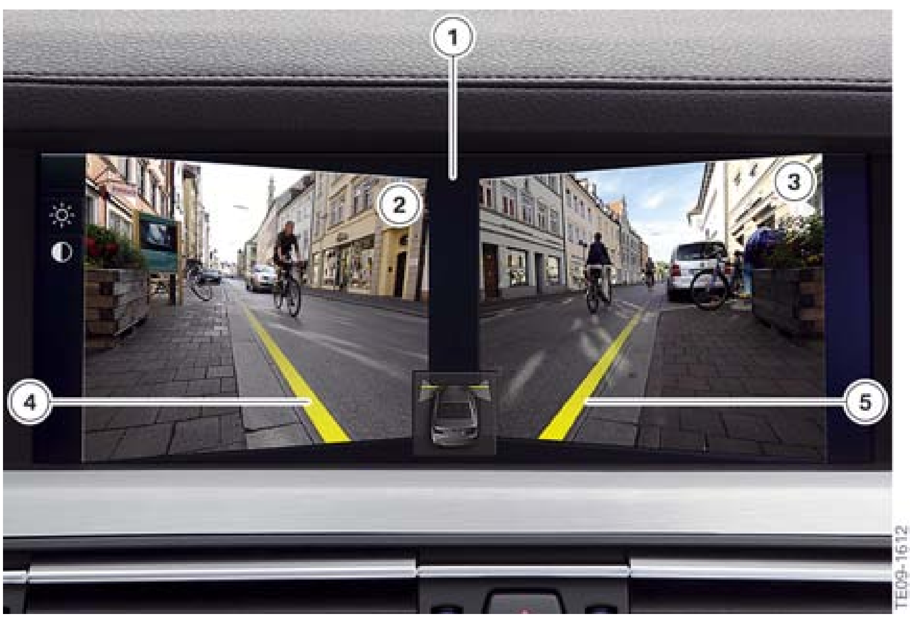
A "Surround View" of the entire vehicle can be displayed in the CID with the combination of the Side View and Top View cameras systems (option 5DL). It can only be ordered as part of the ZCE Camera Package, in conjunction with the rear view camera (option 3AG) and Park Distance Control (option 508).

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.

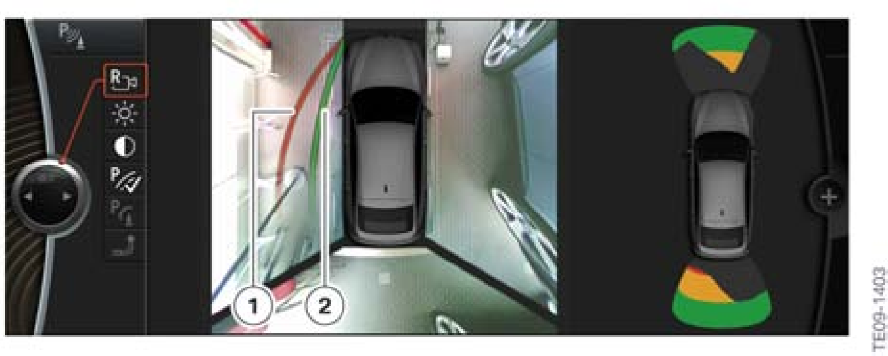
The driver is shown the turning-circle and tracking lines already familiar from the rear view camera system on previous vehicles.

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

7. Surround View

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.

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.

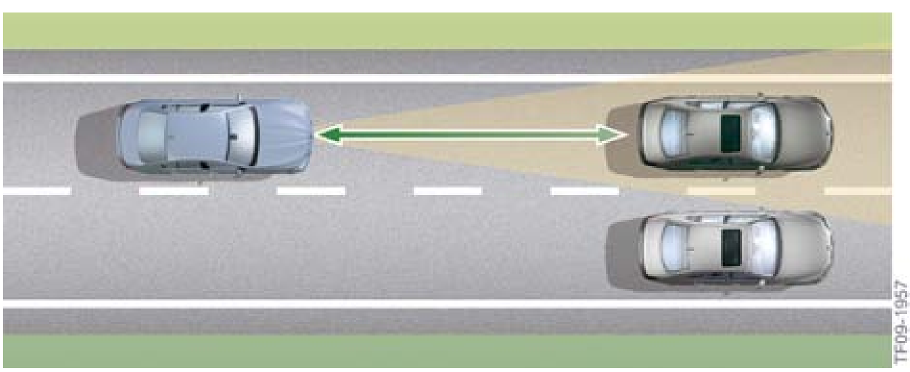
The Active Cruise Control with Stop & Go function (option 5DF) can be ordered only in conjunction with an automatic transmission (option 205 or option 2TB).

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.

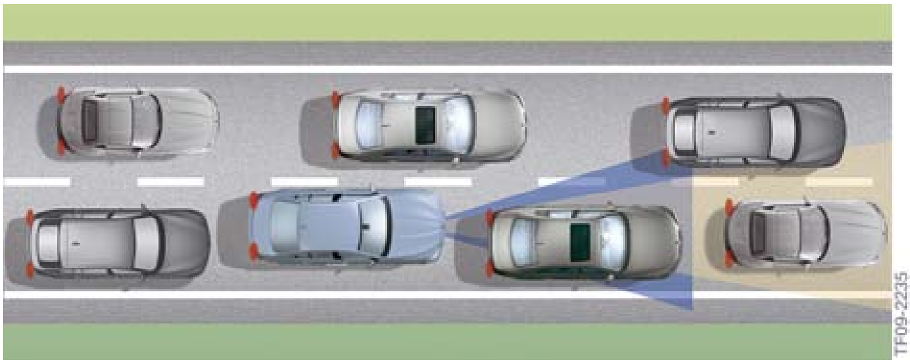


F10 Active Cruise Control

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.

F10 Driver Assistance Systems

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.

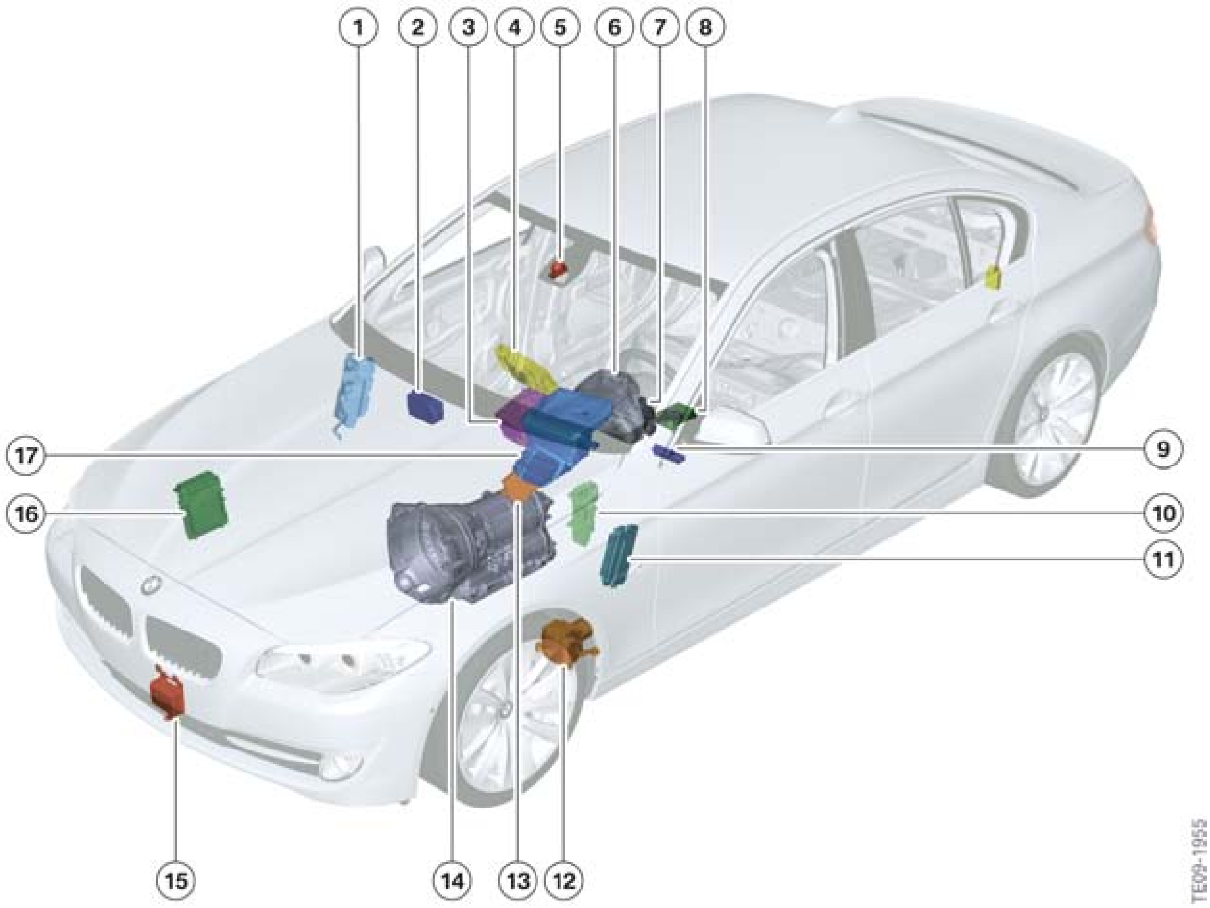
The following aspects of the ACC Stop & Go assist system are considered in more detail here:

- 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.

F10 Driver Assistance Systems

9. ACC Stop & Go

9.2. System Components

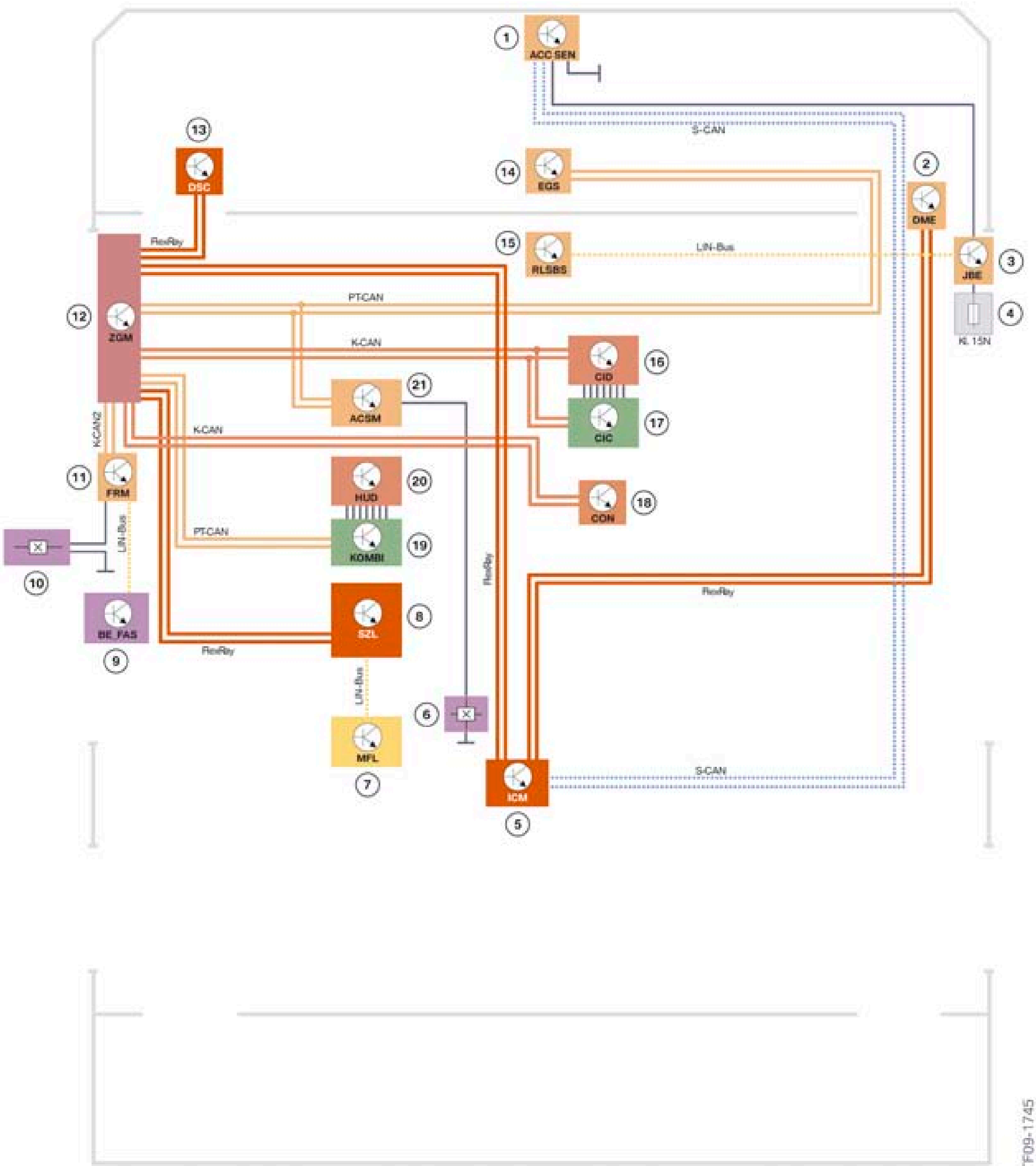


F10 System components for ACC Stop & Go

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

9.2.1. 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.

F10 Driver Assistance Systems

9. ACC Stop & Go

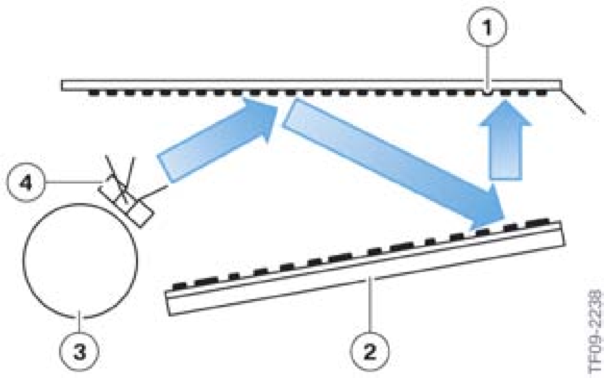
F10 Sensor for ACC Stop & Go

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

F10 Installation location of sensor

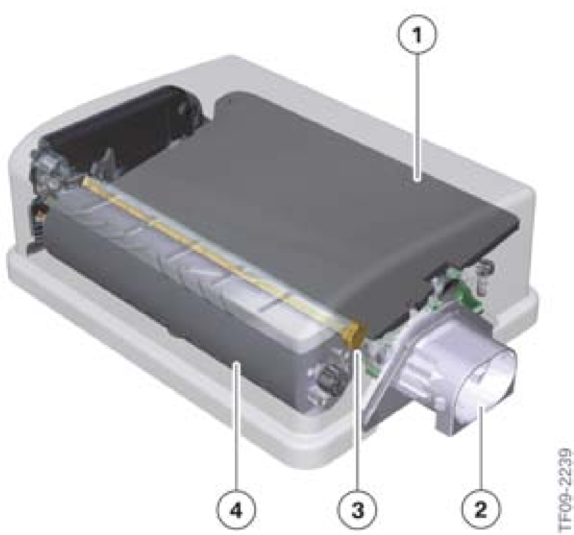
Index	Explanation
1	Sensor for ACC Stop & Go
2	Removable grille

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.

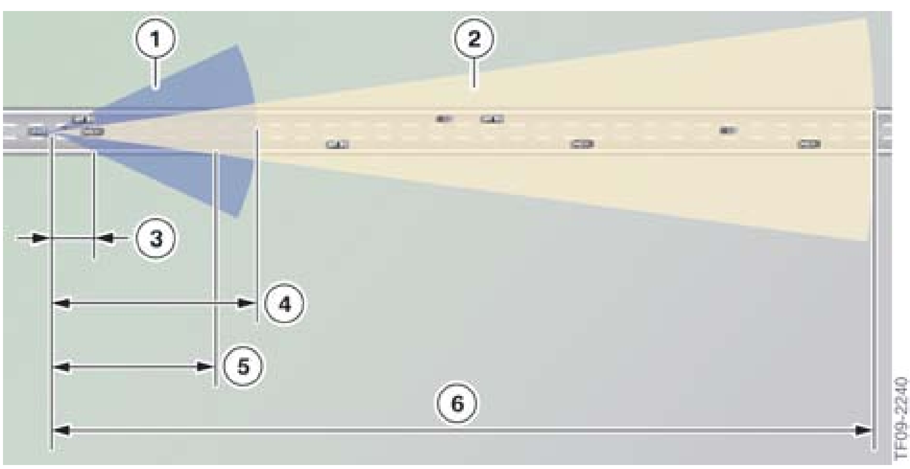
9. ACC Stop & Go

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.

F10 Driver Assistance Systems

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:

9. ACC Stop & Go

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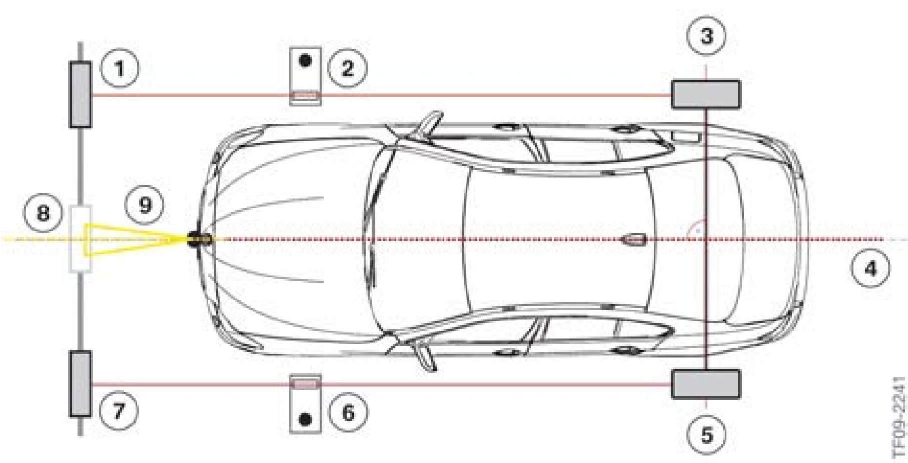
Note: The ACC Stop & Go sensor must not be adjusted mechanically. Only the housing can be mechanically aligned, the fine adjustment occurs within the sensor.

⚠

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.

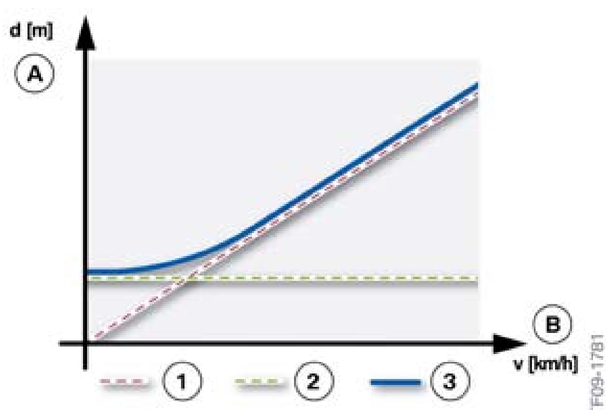
9.4. Control Functions

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.

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.

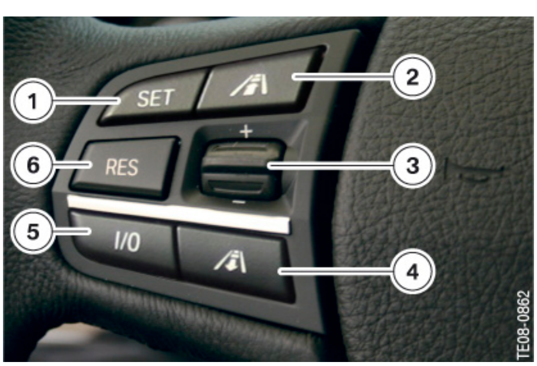
The following additional conditions must also be satisfied:

- 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.

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.

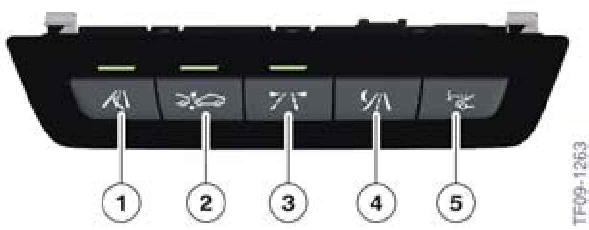
10. Collision Warning w/Brake Application

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.

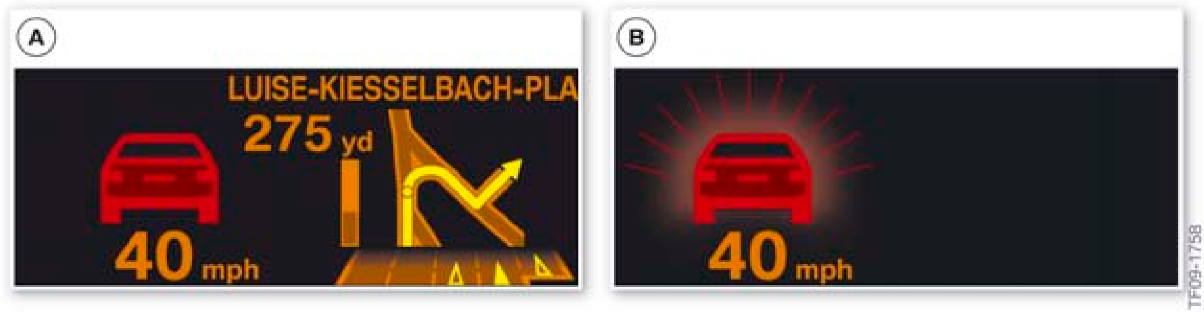
Stationary or moving objects are taken into consideration only if they are in the detection range of the sensor for ACC Stop & Go.

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.

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.

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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F10 Displays, Indicators and Controls

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1002 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: **December 2009**

F10 Displays, Indicators and Controls

Contents

F10 Displays, Indicators and Controls

1. System Overview

1.1. Introduction

As in all other BMW models, the operating and control concept of the new BMW 5 Series F10 is based on clear and optimum structuring of the cockpit. A reduced number of switches simplifies the logical operation. The display, indicator and control elements are organized in a hierarchical arrangement corresponding to their function.

F10 Overview of the display, indicator and control elements

Index	Explanation
1	Head-up display HUD
2	Central Information Display, CID
3	Favorite buttons for individual assignment and operation of the heating and air conditioning system
4	Controller CON
5	Gear selector switch GWS
6	Steering wheel buttons
7	Driver assistance systems operating unit
8	Instrument cluster KOMBI

F10 Displays, Indicators and Controls

2. System Components

2.1. Instrument cluster

The instrument panel receives information on the wiring harness in the form of analog and digital electrical signals. These signals are processed and displayed in the instrument panel or passed on as information to other control units.

As a control unit, the instrument panel is a bus device in the MOST bus and in the powertrain CAN.

2.1.1. Basic instrument panel

The basic instrument panel already familiar from the F07 is used in all versions of the F10. A TFT display with a resolution of 640 x 160 pixels is located in the basic instrument panel under the round instruments. It has a screen diagonal of 5.7". The round instruments are always surrounded by a closed ring.

F10 Basic instrument panel (Not US)

Index	Explanation
1	TFT display
2	Closed instrument ring

2.1.2. Brake energy display

The F10 comes standard with Brake Energy Regeneration. Brake Energy Regeneration transforms the vehicle’s kinetic energy into electricity, and uses this power to charge the battery. As a result, the battery draws less power from the engine, and fuel consumption is reduced.

The kinetic energy of the vehicle is converted into electrical energy while the vehicle is in coasting mode or under braking. The battery is partially charged and the fuel consumption can be reduced.

The blue indicator in the instrument panel below the tachometer, which lights up whenever kinetic energy is converted into electricity (while coasting off the accelerator or under braking). The red section of the display below the “P” is the mile per gallon gauge.

F10 Displays, Indicators and Controls
2. System Components

F10 Current fuel consumption display in coasting (overrun) mode

2.1.3. On-board computer

The on-board computer functions can be called up by briefly pressing the on-board computer button on the steering column switch.

Pressing the on-board computer button again displays information in the following order:

- Range
- Average fuel consumption
- Average speed
- Distance (with activated route guidance)
- Estimated time of arrival (with activated route guidance)
- Date
- Road sign recognition.

F10 Buttons on the steering column switch

2. System Components

Index	Explanation
1	Button for on-board computer
2	High-beam assistant button
3	Steering-column switches

More detailed information can be found in the current vehicle owner's manual for the BMW 5 Series.

2.2. Central Information Display

Depending on the equipment, two different versions of the Central Information Display CID are installed in the F10.

As on all new BMW models, the system is operated by means of the central control element, the controller.

The central information display is an integrated display and operating unit for the following functions:

- Audio functions, for example radio, CD, MP3
- Telephone and data services
- On-board computer, journey computer
- Vehicle info, integrated operating instructions IBA
- Heating and air conditioning system
- Personalized features, for example radio station selection
- Vehicle functions, for example PDC and EDC
- BMW Services.

2.2.1. CID with 10.2" screen diagonal

In conjunction with the Navigation system (option 609), a CID with 10.2" screen diagonal is installed. The resolution of the display is 1280 x 480 pixels.

F10 CID with 10.2" screen diagonal

2. System Components

2.2.2. CID with 7" screen diagonal

In conjunction with a vehicle configuration without a navigation system, a CID with 7" screen diagonal is installed. The resolution of this display is 800 x 480 pixels.

F10 CID with 7" screen diagonal

2.3. Head-Up Display

The very name "Head-Up" describes the principle benefit of this system. The Head-Up Display HUD projects a virtual image into the driver's field of vision. Important information such as cruise control details or arrow displays from the navigation system are projected onto the windscreen and are thus permanently visible within the driver's field of view.

The head-up display (option 610) in the F10 contains various functions aimed at enhancing road safety and driving comfort.

The head-up display includes the following:

- the Dynamic Cruise Control DCC
- the Active Cruise Control with Stop & Go function
- the collision warning with brake application function
- information from the navigation system
- Check Control messages
- road speed.

Having the displays in the driver's direct field of view increases safety, as the eyes are always on the traffic.

2. System Components

F10 Head-up display

For more information on the head-up display, refer to the F01 entitled "Head-Up Display HUD" training material available on TIS and ICP.

2.4. Night Vision 2

The BMW Night Vision 2 system provides the driver with a black-and-white image of the driving environment ahead of the vehicle in the Central Information Display CID.

BMW Night Vision 2 is a 100 % passive system without active infrared illumination. Objects situated ahead of the vehicle are shown in varying degrees of brightness depending on their temperature. This enables the driver to detect in good time heat-emitting objects, such as people, animals and other vehicles.

This information is recorded with a far infrared camera via a special imaging sensor which detects the infrared radiation in a specific wavelength range.

Intelligent algorithms in the control unit makes it possible to automatically detect persons in the image. Following evaluation of distance and direction of movement, a symbol on the central information display and in the head-up display warns the driver of any persons at risk.

F10 Night Vision display in the head-up display

F10 Displays, Indicators and Controls
2. System Components

Night Vision 2 is available for the F10 as the optional equipment BMW Night Vision with pedestrian detection (option 6UK).

As in the F01/F02, the video camera for BMW Night Vision is installed in the F10 behind the radiator grill, on the top left corner.

For more information on Night Vision 2, refer to the F01 "BMW Night Vision 2" training material available on TIS and ICP.

2.5. Controls on the steering wheel

There is a switch block in the steering wheel on the left and right.

The operating elements for cruise control with braking function (Dynamic Cruise Control DCC) and the Active Cruise Control ACC are located on the left side of the steering wheel.

The controls for operation of the radio and telephone functions are on the right.

F10 Controls on the steering wheel

Index	Explanation
1	Reduce distance button (only with option 5DF)
2	± rocker switch, change speed, set speed
3	Knurled wheel, select/set radio station or music track
4	MODE button, switch audio sources
5	Shift up shift paddle (only with option 2TB)
6	+ rocker switch, increase volume
7	- rocker switch, reduce volume
8	Voice control button
9	Telephone button

F10 Displays, Indicators and Controls
2. System Components

Index	Explanation
10	Increase distance button (only with option 5DF)
11	Switch on/off, interrupt ACC/DCC
12	Resume, call up stored speed button
13	Speed limit button or the “SET” speed button in the US
14	Shift down shift paddle (only with option 2TB)

2.6. Operating controls in the center console

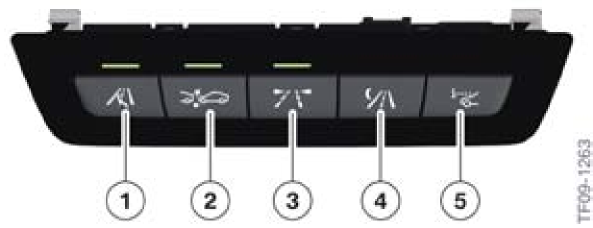
The operating elements in the center console have the same function and arrangement as those in the F01.

F10 Operating controls in the center console

Index	Explanation
1	Gear selector switch
2	Controller
3	Parking brake
4	Automatic Hold
5	Park Distance Control or parking assistance
6	Handling setting switch
7	Dynamic Stability Control

2.7. Driver assistance systems operating unit

The individual assist systems can be activated or deactivated via the assist system operating unit. It is located next to the steering wheel in the dashboard.



F10 Assist system operating unit

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

For more information on the assist systems refer to the "F10 Assist systems" of this training material.

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F10 Entertainment and Communication

BMW Service

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1002 7/1/2011

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: **December 2009**
VH-23/International Technical Training

F10 Entertainment and Communication
Contents

F10 Entertainment and Communication

1. Introduction

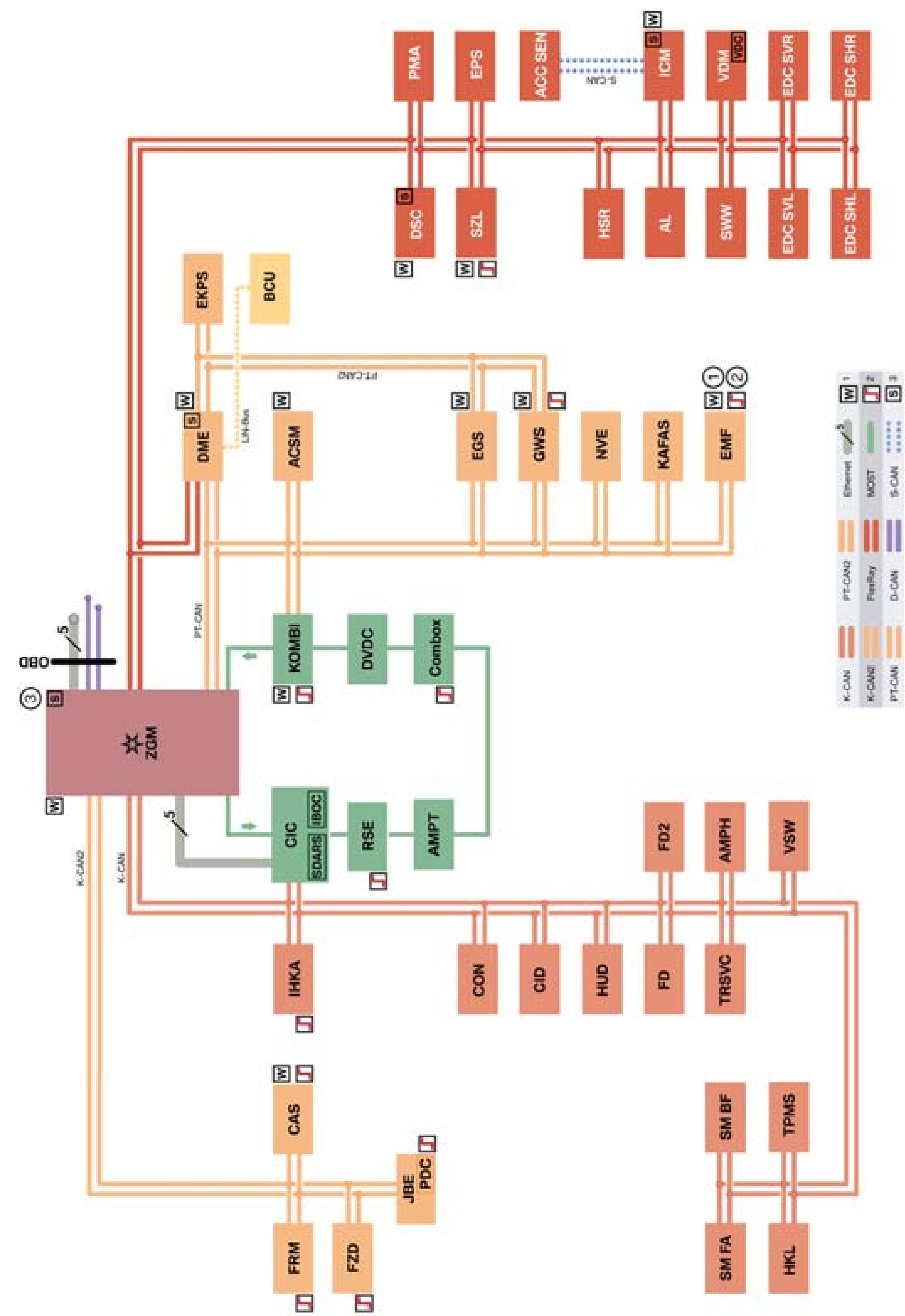
The information and communication system plays a highly important role in the F10. It builds on the very progressive technology from the F01. Thus the driver is offered a very wide range of infotainment systems from which to choose.

This information bulletin is intended to provide an overview of the systems being used.

F10 Entertainment and Communication

1. Introduction

1.1. F10 Bus diagram



F10 Bus diagram

1. Introduction

Index	Explanation
1	Wakeable control units
2	Control units authorized to wake up the vehicle
3	Startup node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety 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
Combox	Combox multimedia with telematics
CON	Controller
D-CAN	Diagnosis on Controller Area Network
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
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications
FRM	Footwell module
FZD	Roof function center

F10 Entertainment and Communication

1. Introduction

Index	Explanation
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 Control Unit
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for reversing camera and side view
VDM	Vertical Dynamics Management
VSW	Video switch
ZGM	Central Gateway Module

2. Head Units

2.1. Car Information Computer

F10 Car Information Computer

The CIC head unit was installed for the first time on BMW 1 Series and 3 Series vehicles with the navigation system (option 609). This further development of the Car Communication Computer CCC is now also being used in the F10.

By storing data on a 80 gigabyte hard disk, the new head unit provides many new functions and options.

The audio systems with CIC added a music collection function. Music files can be converted (ripped) or copied for the music collection on the hard disc. Fast access to these music files, stored on the CIC-dedicated hard disc, is ensured at all times. A selection of up to 3700 music files (12 gigabytes) is possible.

The tuners/decoders of the digital radio systems, (IBOC) digital tuner and satellite tuner (SDARS) are now integrated into the CIC.

A modified base plate adapter extends the connectivity of the music player (option 6NF). This makes it possible to connect to and play back music tracks in the mobile phone.

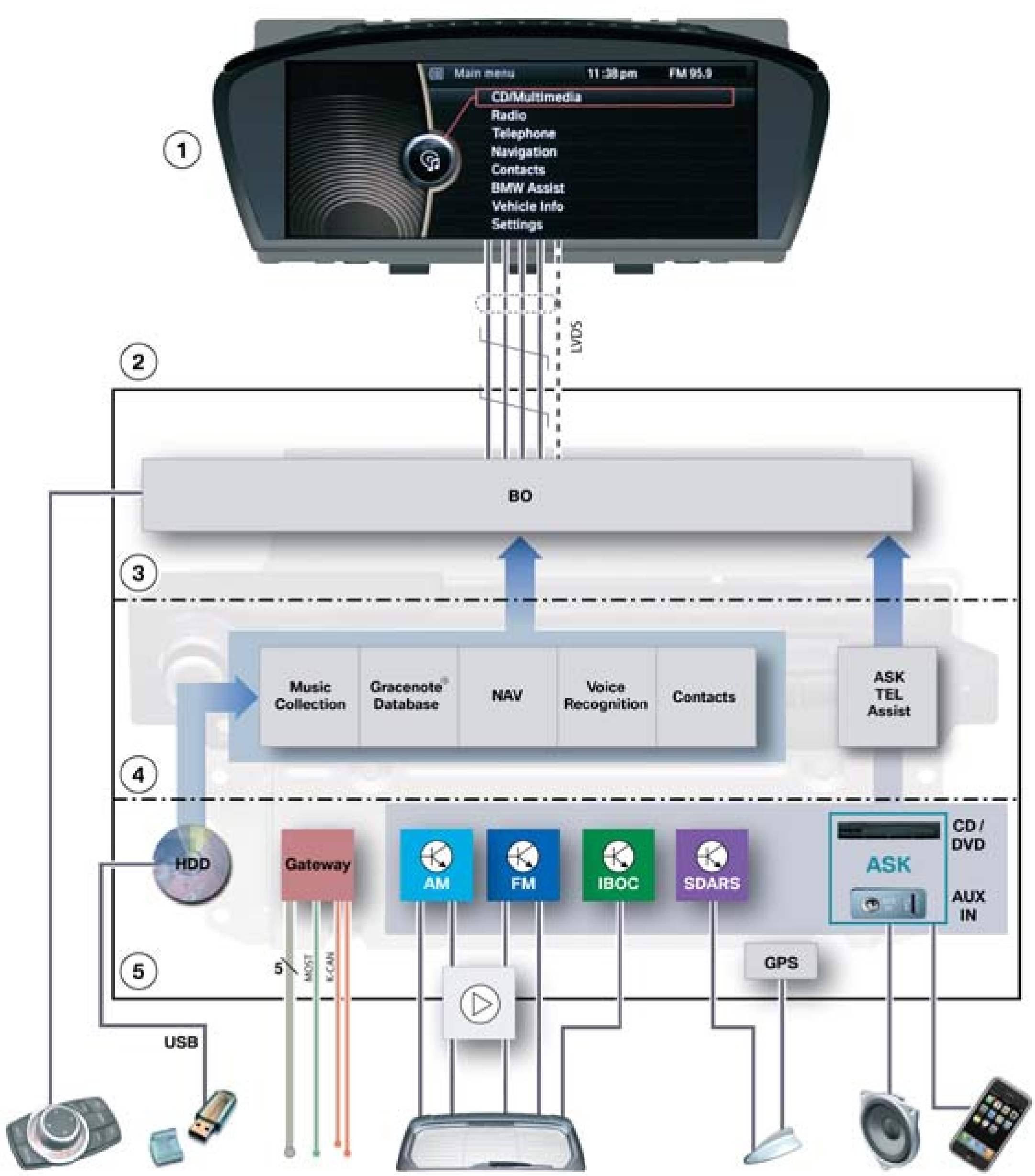
Simple menu navigation and playback of these music tracks can now be controlled via the iDrive.

For additional information about the Car Information Computer, refer to the "Car Information Computer CIC" and “F01/F02 Audio System” training material available on TIS and ICP.

F10 Entertainment and Communication

2. Head Units

2.1.1. Block diagram



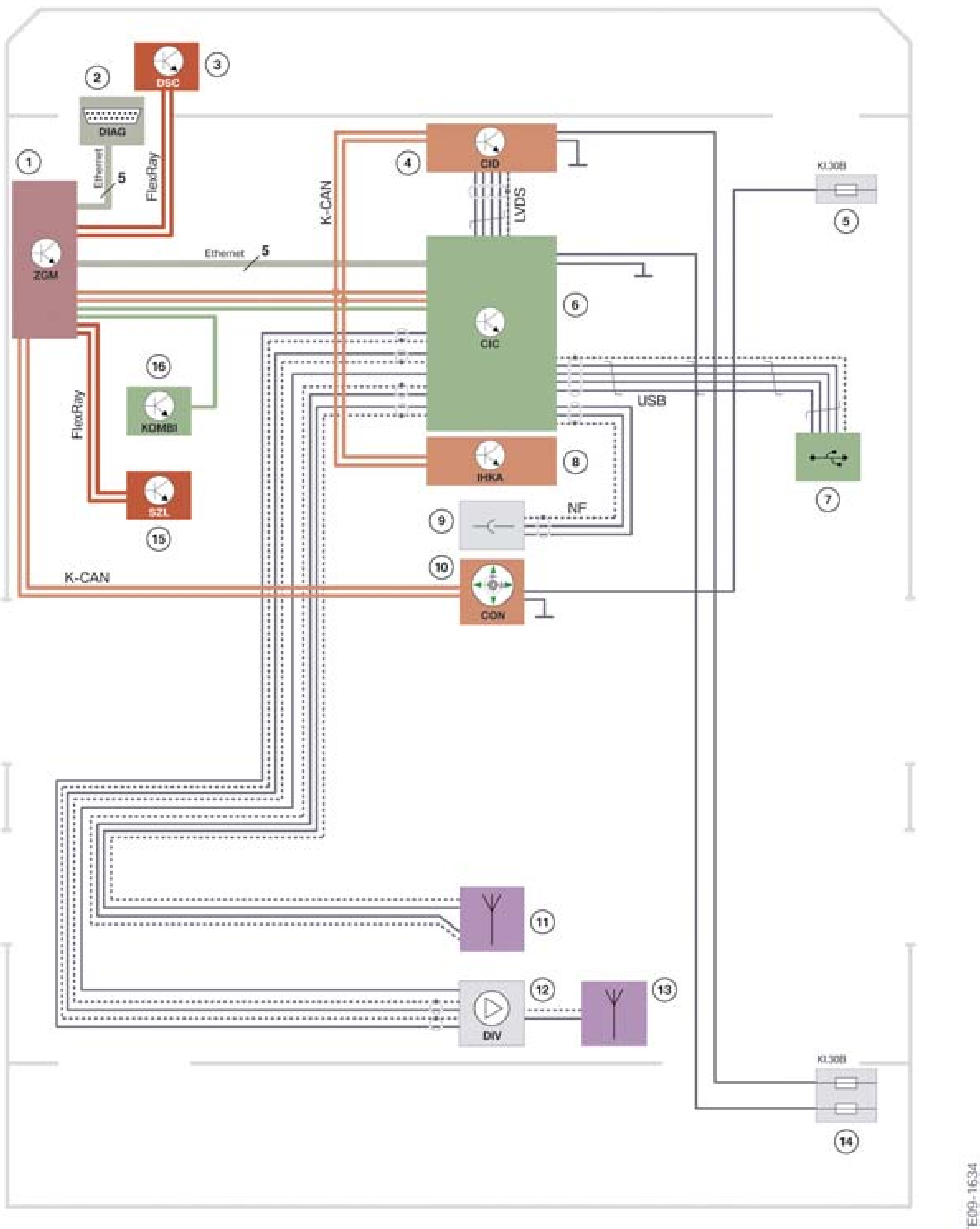
F10 Block diagram of CIC

Index	Explanation
1	Central Information Display
2	Car Information Computer
3	User interface
4	Application software
5	Hardware and interfaces

F10 Entertainment and Communication

2. Head Units

2.1.2. System wiring diagram



F10 System wiring diagram of CIC

F10 Entertainment and Communication

2. Head Units

Index	Explanation
1	Central Gateway Module
2	Diagnosis interface
3	Dynamic Stability Control
4	Central Information Display
5	Front power distribution box
6	Car Information Computer
7	USB connection in glove box
8	Integrated automatic heating / air conditioning
9	Jack plug audio frequency input in the center console for playing back audio files
10	Controller
11	Roof-mounted antenna (GPS, SDARS)
12	antenna diversity module with integrated antenna amplifier
13	Rear window antenna (FM, AM)
14	Rear power distribution box
15	Steering column switch cluster
16	Instrument cluster

iDrive control screen comes in two versions: with a 7.0” diagonal 800 x 480-pixel resolution as standard equipment, or with the optional Navigation system, in a dazzling 10.2”, 1280 x 480-pixel version with a wider range of features and functions as in the new BMW 7 Series.

All F10 come with the 7” CID combined with CIC Basic (without Navigation system) as standard equipment.

The system uses the same iDrive controller as the CIC with Navigation but includes less features like Music Collection or Voice Activation.

F10 CIC (with Navigation) and 10.2” diagonal CID.

F10 Entertainment and Communication

2. Head Units

F10 CIC Basic (non Navigation) and 7” diagonal CID.

CIC Basic comes standard equipped with HD Radio as the IBOC decoder is integrated into the CIC hardware.

SDARS (Satellite radio) however is available as an optional extra (option 655)

F10 Entertainment and Communication

3. Speaker Systems

3.1. Overview

F10 Speakers

The speaker systems in the F10 are offered in two levels:

- HiFi system = HiFi loudspeaker system (standard equipment)
- Top HiFi system = HiFi system Professional (option 677).

The HiFi system standard equipment on all F10 models.

The HiFi system is equipped with an eight-channel amplifier with digital equalizer. However, only seven of the eight channels are used in the HiFi system.

The bass speakers are located under the front seats. They are coupled to the side sills to increases the resonance volume necessary for bass reproduction.

The head-units CIC and Champ 2 can be combined with any of the amplifier/speaker systems available.

The HiFi system and Top-HiFi systems feature separate speakers for the treble and mid-range frequencies.

Even though the diameters of the speakers in the HiFi and Top HiFi System Professional are the same, there are differences in the performance of the speakers. This is achieved by the use of different materials for the diaphragms, coils and magnets.

The Top HiFi system supports playback of multichannel formats. Multichannel audio formats can be played back with the player in the CIC or with the 6x DVD changer.

The HiFi system has twelve speakers while the Top-HiFi system has 16 speakers each with different auxiliary amplifiers.

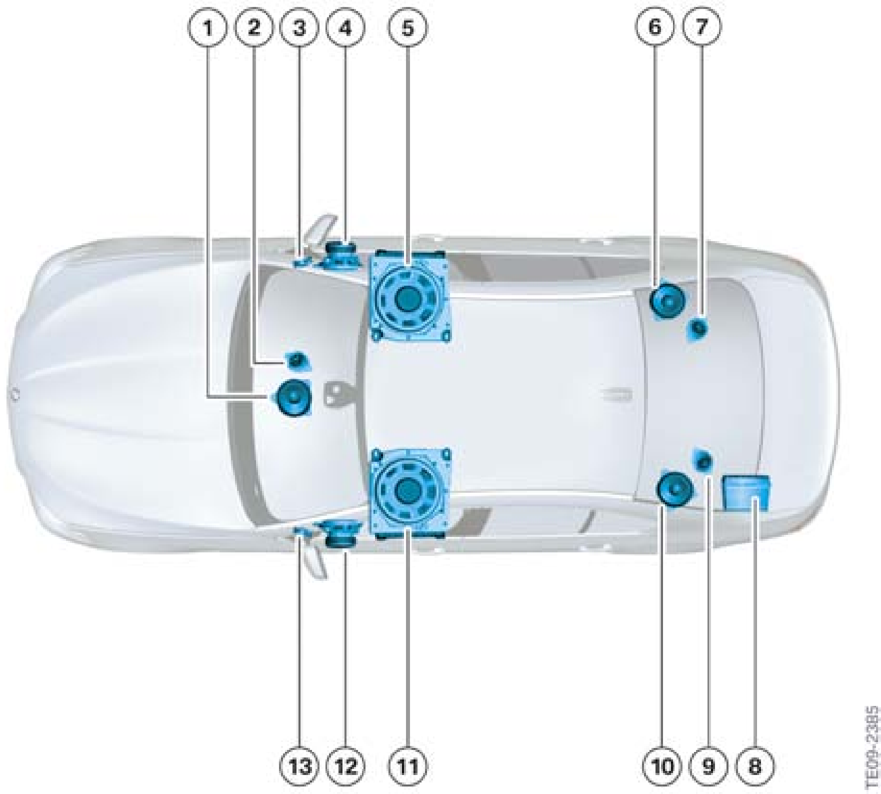
3.2. Components

3.2.1. HiFi system

The following graphic shows the speakers and the amplifier of the HiFi system. The speakers are powered with 5 x 25 watts for the midrange speakers and tweeters and 2 x 40 watts for the bass speakers.

F10 Entertainment and Communication

3. Speaker Systems



F10 HiFi system

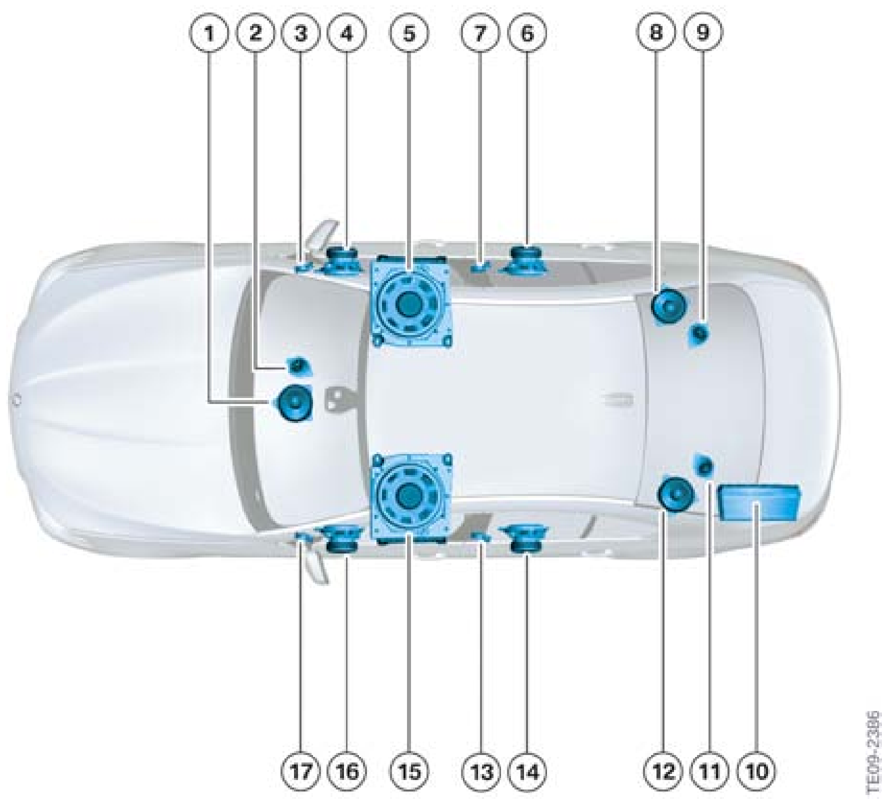
Index	Explanation
1	Tweeter, front center
2	Mid-range speaker, front center
3	Tweeter, front right door
4	Mid-range speaker, front right door
5	Woofer, under right front seat
6	Mid-range speaker, rear window shelf, right
7	Tweeter, rear window shelf, right
8	HiFi amplifier
9	Tweeter, rear window shelf, left
10	Mid-range speaker, rear window shelf, left
11	Woofer, under left front seat
12	Mid-range speaker, front left door
13	Tweeter, front left door

F10 Entertainment and Communication
3. Speaker Systems

3.2.2. Top HiFi system

The following graphic shows the speakers and the amplifier of the HiFi System. The speakers are powered with 7 x 50 watts for the midrange speakers and tweeters and 2 x 125 watts for the bass speakers.

In the F10, the amplifier in the HiFi System is equipped with what is known as a load-logic separation. Here, the electronics of the amplifier are supplied and connected via a separate voltage line. The line is specially protected against short-term voltage dips and thus prevents failure of the electronics in the event of a short-term voltage dip.



F10 Top HiFi system

Index	Explanation
1	Tweeter, front center
2	Mid-range speaker, front center
3	Tweeter, front right door
4	Mid-range speaker, front right door
5	Woofer, under right front seat
6	Mid-range speaker, rear right door
7	Tweeter, rear right door
8	Mid-range speaker, rear window shelf, right
9	Tweeter, rear window shelf, right

Index	Explanation
10	Top-HiFi amplifier
11	Tweeter, rear window shelf, left
12	Mid-range speaker, rear window shelf, left
13	Tweeter, rear left door
14	Mid-range speaker, rear left door
15	Woofer, under left front seat
16	Mid-range speaker, front left door
17	Tweeter, front left door

F10 Entertainment and Communication

4. Telephone Systems

4.1. Overview

F10 Telephone system

The Telematic Control Unit (TCU) familiar from the E70 (option 639) is installed.

BMW ASSIST is standard equipment in combination with the TCU.

The pairing assistant has also been integrated into the F10 to assist the customer in pairing the mobile phone.

For additional information about the telephone systems and their function, refer to the "Telephone systems F01/F02" and "Car Information Computer" training information available on TIS and ICP.

⚠

The specified range of functions will only be achieved with Bluetooth-enabled mobile phones recommended by BMW. A list of currently recommended Bluetooth-enabled mobile phones is posted on the Aftersales Assistance Portal (ASAP) and at http://www.bmw.com/bluetooth/

4.2. General description

The following control units act as the interface between the mobile phone and the vehicle:

- Telematic Control Unit (TCU)

The preconditions under which TCU or TCU and interface box together are installed are listed below:

F10 Entertainment and Communication
4. Telephone Systems

Optional extra	Installed control units
Complete basic fittings for mobile phone (option 639)	TCU
Complete basic fittings for mobile phone (option 639) + USB audio interface (optional 6FL)	TCU ULF-SBX High
Complete basic fittings for mobile phone (option 639) + Smartphone Integration (option 6NF) + USB audio interface (option 6FL)	TCU ULF-SBX High (Base plate and cradle for Smartphone integration

Note: The ULF-SBX High is only used for the USB Audio Interface (option 6FL), the TCU is used for all other telephone and BMW Assist functions.

F10 Entertainment and Communication
5. Rear Seat Entertainment

5.1. Overview

It is possible to watch video from Digital Versatile Disc DVD on the Central Information Display CID in the F10. The picture in the CID is deactivated and replaced with an information text for safety reasons when the vehicle is in motion. If the car is fitted with a rear-seat entertainment system, rear-seat passengers can watch videos while the car is on the move.

The following optional extras are offered:

- DVD changer for 6 DVDs (option 696)
- Rear seat entertainment (optional extra 6FG)

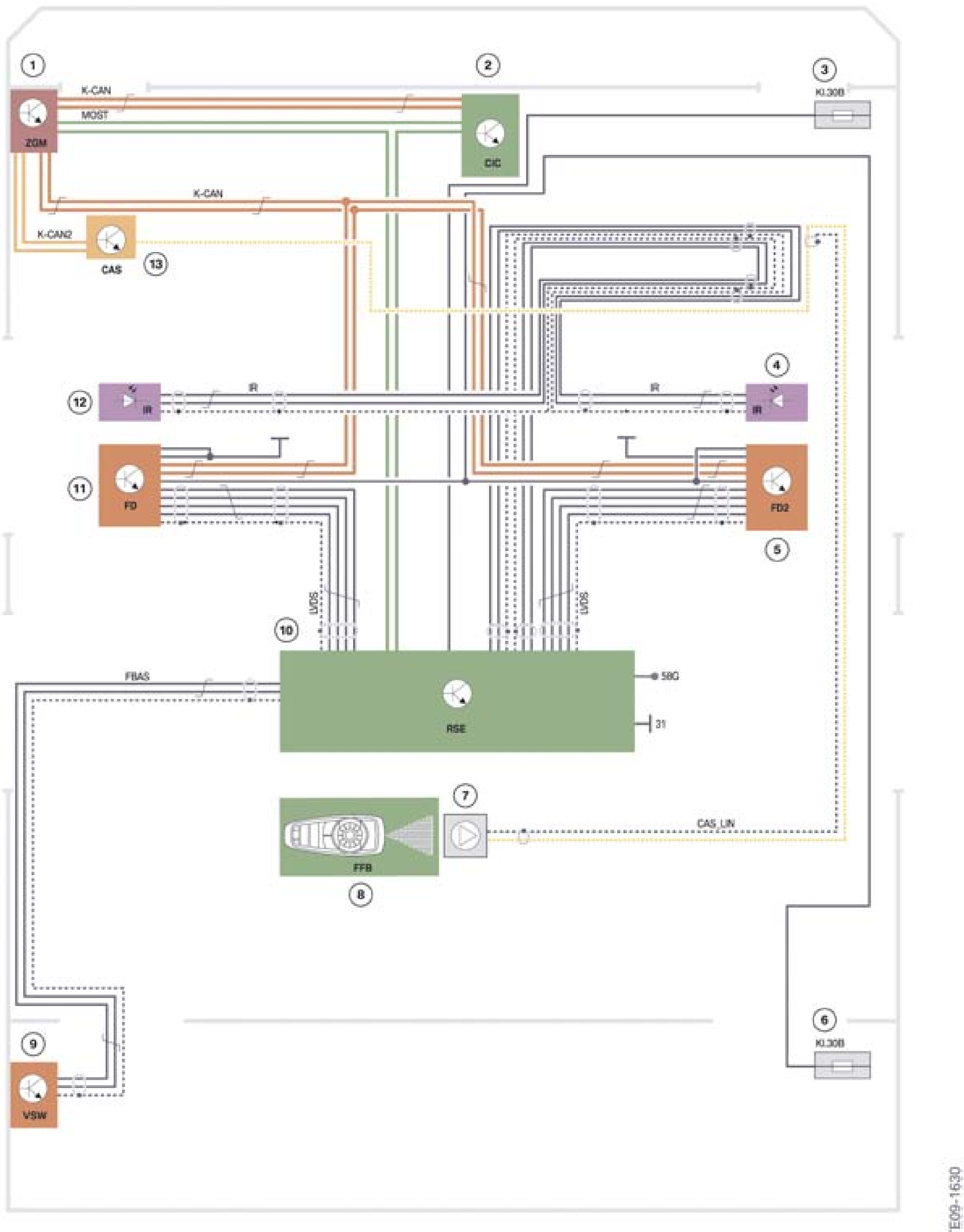
F10 Rear seat entertainment system

The systems can be used for other purposes besides watching films, for example viewing interactive media such as tour guides, databases, catalogues, and so on. In conjunction with the Top HiFi amplifier (rear-seat entertainment professional), multichannel audio formats are supported.

5.2. Rear seat entertainment (optional extra 6FG)

The F10 uses the rear seat entertainment system (option 6FG), which was introduced with the F01.

5.2.1. System wiring diagram

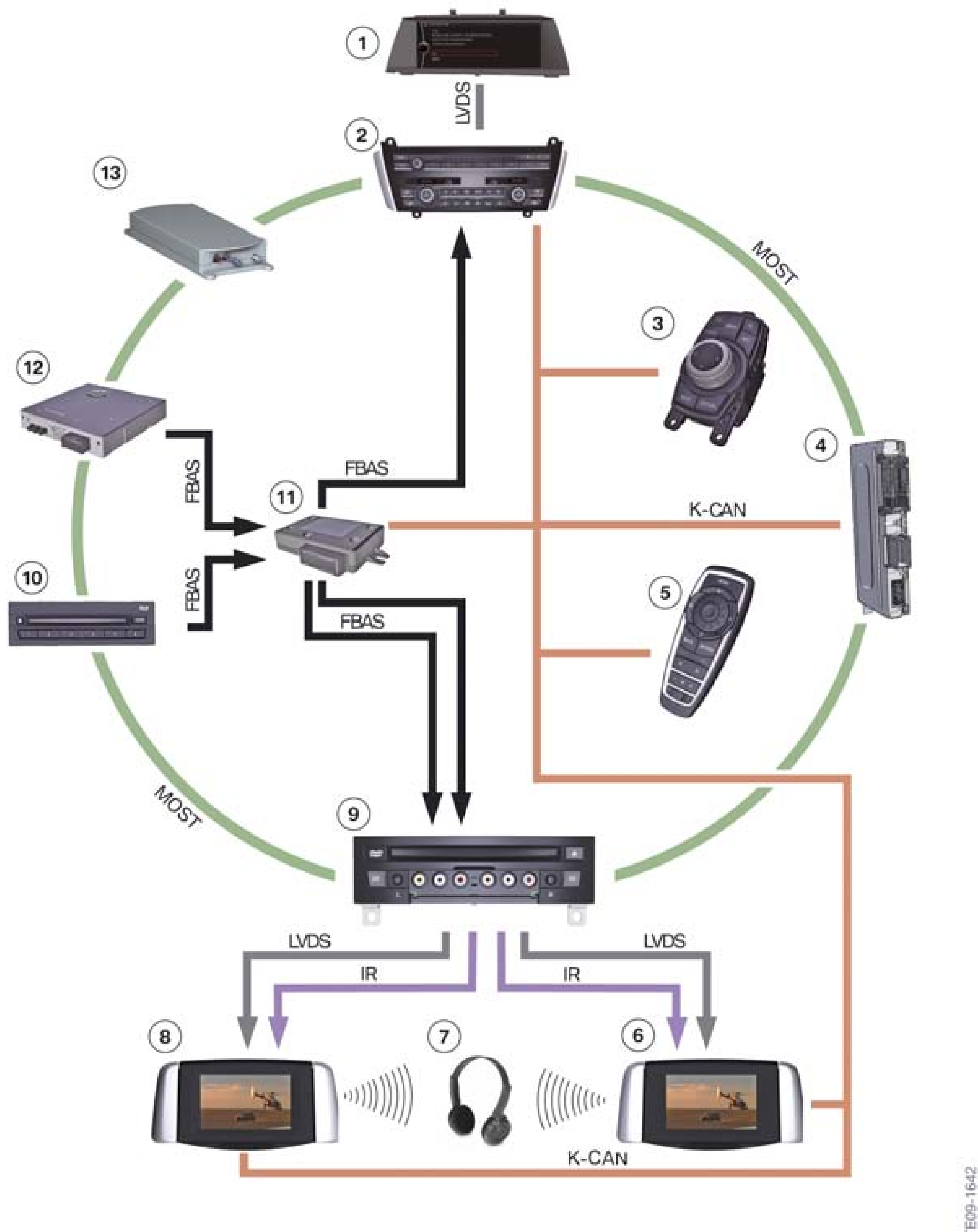


F10 Circuit diagram, rear-seat entertainment

5. Rear Seat Entertainment

Index	Explanation
1	Central Gateway Module
2	Car Information Computer or Car Information Computer Basic
3	Front distribution box
4	Infrared transmitter, right
5	Rear-seat display FD2
6	Rear power distribution box
7	antenna diversity module with antenna amplifier
8	Operation of the remote control system
9	Video switch
10	Rear Seat Entertainment RSE Mid
11	Rear-seat display FD
12	Infrared transmitter, left
13	Car Access System

5.2.2. Function diagram



F10 Function diagram, rear-seat entertainment

5. Rear Seat Entertainment

Index	Explanation
1	Central Information Display, CID
2	Car Information Computer, CIC
3	Controller
4	Central Gateway Module, ZGM
5	Operation of the remote control system
6	Rear-seat display FD2 with infrared transmitter
7	Infrared headphones
8	Rear-seat display FD with infrared transmitter
9	Rear Seat Entertainment RSE-Mid
10	DVD changer for 6 DVDs, in glove box
11	Video switch VSW
12	Video module VM (Not for US)
13	Telematic Control Unit TCU

Sound output takes place either through the vehicle's speakers or via headphones. The volume of the speakers can be adjusted via the multifunction steering wheel, the head unit or with the radio remote control. The volume is controlled speed-dependent during playback through the speakers. The driving speed is registered by the wheel speed sensors.

The tone settings can be adjusted on the Car Information Computer or Car Information Computer Basic or using the radio remote control.

If the sound is output via the headphones, the volume can be adjusted either on the headphones (infrared headphones) or using the radio remote control (hard-wired headphones). The infrared headphones receive their signals from the infrared transmitter.

External devices can be connected via the two AV inputs directly to the RSE control unit or via the AUX-In connection or the USB audio interface (option 6FL) in the center console. The USB audio interface provides an additional jack and a USB connection for a type A USB connector.

Video cannot be transmitted to the rear seat entertainment system when a DVD is played back via the Car Information Computer. Similarly, video is not transmitted to the Car Information Computer when a DVD is played back in the rear seat entertainment control unit. Sound output, however, is possible in both cases. Picture and sound are transmitted to the CIC and the rear seat entertainment system during playback via the DVD changer. For safety reasons, no picture is shown in the Central Information Display while the vehicle is being driven. Sound output continues even when the car is not at a standstill.

An external device (e.g. game console) can be additionally connected via the AV inputs. The corresponding video signal is output on the display of the connected source. The selected DVD can still be viewed on the other display. Prerequisite: see Functions, Connection to external equipment via AV input.

The RSE MID control unit has a FBAS/CVBS (composite video baseband signal) input for the screen of the DVD changer or video module.

The video switch is installed corresponding to the equipment configuration.

Note: (FBAS) Farb-Bild-Austast-Synchron is CVBS (Composite Video Baseband Signal) in which just the video signal is transmitted through a single wire with the audio signal handled separately.

5.2.3. Components, installation locations and functions

F10 System overview (option 6FG)

Index	Explanation
1	Rear-seat display FD
2	Central Information Display
3	Rear-seat display FD2
4	Car Information Computer or Car Information Computer Basic
5	Rear Seat Entertainment RSE-Mid
6	Operation of the remote control system

The rear seat entertainment system (option 6FG) offers the following equipment:

F10 Entertainment and Communication
5. Rear Seat Entertainment

- Radio tuner with RDS
- Sound output via: infrared headphones, wired headphones and audio speakers of the vehicle
- AUX-In connection in center console (analog jack)
- Connection to external equipment via AV input, e.g. video camera, games console or portable playback equipment
- Operation via remote control.

Optional extras:

- DVD changer (option code 696)
- USB/audio interface in center console (option 6FL) for connecting media players (e.g. USB stick and Apple iPod®)
- In Band On Channel (IBOC) HD Radio is standard equipment and Satellite Digital Audio Radio Services (SDARS) is available as an option (SA655).

5.2.4. Operation of the remote control system

F10 Radio remote control for rear seat entertainment

Index	Explanation
1	Menu
2	Knurled wheel
3	Confirmation button
4	Option
5	Battery symbol
6	Selector slide, left/right
7	Volume
8	Track search/track skip
9	Wireless symbol
10	Back
11	Four-way directional controller (four buttons)

5. Rear Seat Entertainment

The remote control features two LED for checking operation and battery voltage. Transmission of a wireless signal is acknowledged by the green send signal lighting. The radio remote control signals are only sent if the rear seat entertainment system is switched on.

If the battery voltage reaches a critical level, the red battery symbol will light instead of the green send symbol each time a button is pressed. The battery in the radio remote control must be replaced to ensure continued operation.

The thumbwheel, the confirmation button and the four-way directional controller make up the iDrive controller functions. Turning the thumbwheel corresponds to turning the iDrive controller. Sliding the iDrive controller to the left, right, forwards or back is replaced by pressing the corresponding button on the four-way directional controller. Pressing the iDrive controller corresponds to pressing the confirmation button.

The entire radio remote control changes over to the selected side by operating the selector slide.

The signals of the radio remote control are received by the antenna for radio remote control services in the rear window.

F10 Entertainment and Communication

6. Antenna Systems

Depending on optional equipment, the F10 is equipped with different antenna systems:

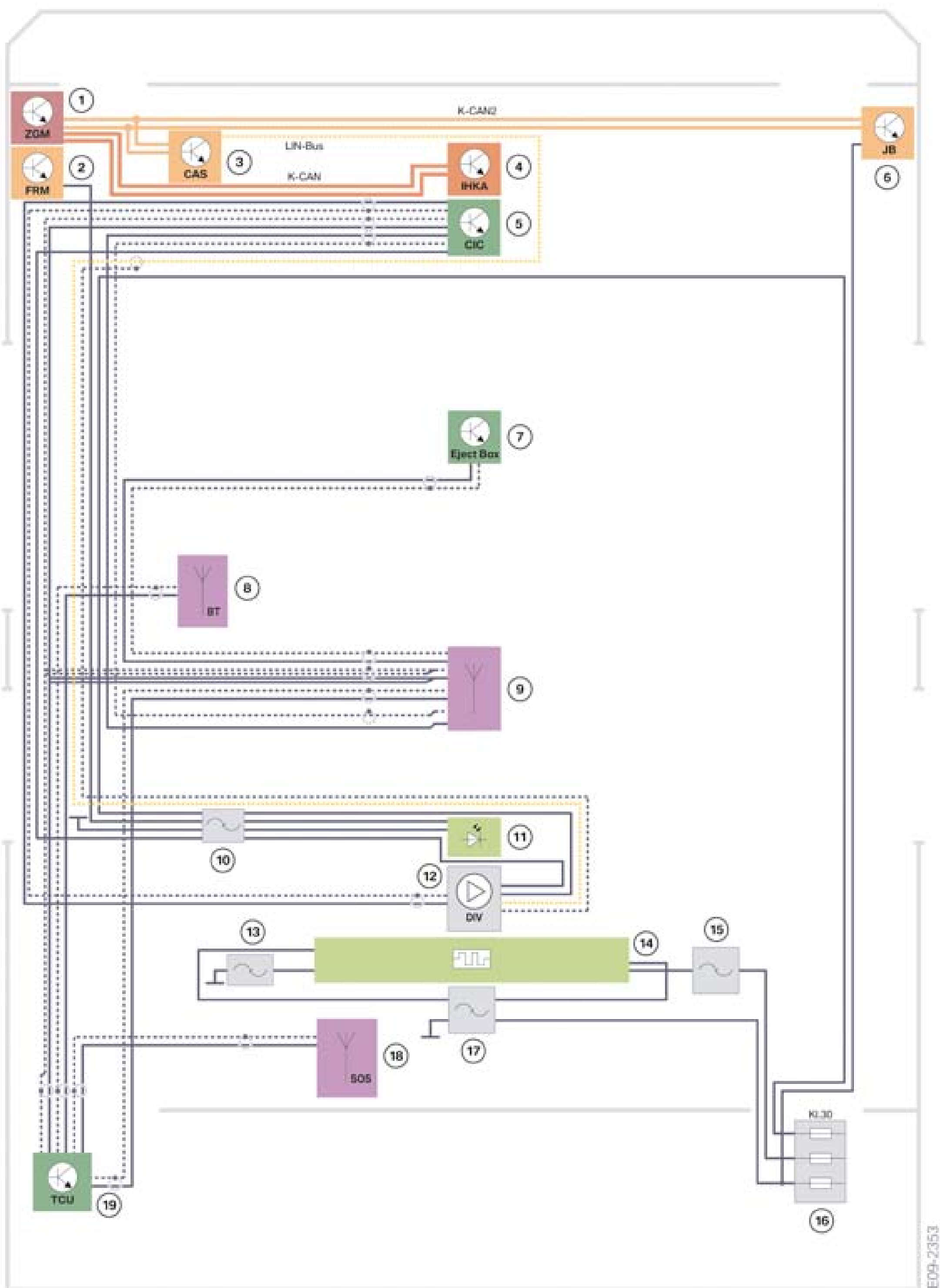
Antenna	System	Location
FM/AM antenna	Radio	Rear window
SDARS antenna	Radio	Roof
Navigation antenna	Navigation system	Roof
Remote control service antenna	CAS (remote control services)	Rear window
Telephone antenna	Telephone.	Roof
Bluetooth antenna	Telephone.	Slide/tilt sunroof area
Emergency GSM antenna	Telematics services	Rear right interior

F10 Entertainment and Communication

6. Antenna Systems

6.1. Antenna systems

6.1.1. System wiring diagram



F10 System wiring diagram for antenna systems

6. Antenna Systems

Index	Explanation
1	Central Gateway Module
2	Footwell module
3	Car Access System
4	Integrated automatic heating / air conditioning
5	Car Information Computer
6	Junction box electronics
7	Base plate of universal charging and hands-free facility
8	Bluetooth antenna
9	Roof-mounted antenna (telephone, SDARS and GPS)
10	Brake light interference suppression filter
11	Rear brake light
12	antenna diversity module with antenna amplifier
13	Rejector circuit, rear window_1
14	Rear window antennas (FM, AM, remote control services FBD)
15	Rejector circuit, rear window_2
16	Rear power distribution box
17	Rejector circuit, rear window defogger for AM range
18	Emergency call antenna (backup)
19	Telematics Control Unit

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F10 Passive Safety Systems

Edited for the U.S. market by:

BMW Group University

Technical Training

ST1002 7/1/2011

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: **December 2009**
VH-23/International Technical Training

F10 Passive Safety Systems

Contents

F10 Passive Safety Systems
Contents

F10 Passive Safety Systems

1. Introduction

1.1. Passive safety system

The passive safety system of the F10 builds on the objectives and characteristics of the F01. The passive safety system fulfils all legislative requirements worldwide.

Extensive measures were taken on the body and on the occupants safety and protection systems. The passive safety system includes, in addition to the restraint systems, a special body structure which offers a excellent crash performance. In the event of an accident, the forces are reduced in a defined manner and therefore have less impact on the occupants.

The restraint systems ensure that the risk of injury is significantly reduced.

The 3rd generation of the Advanced Crash Safety Module ACSM is used on the F10 as the central airbag control unit for the passive safety system. It differs from the previous crash safety modules in that it has an external sensor system.

F10 Passive safety systems

F10 Passive Safety Systems

2. Models

2.1. Overview

The passive safety system installed in the F10 is the third-generation Crash Safety Module. The following illustration provides an overview of the installed versions for the various models:

Model series	Model	Used as of	Design
E60	5 Series Saloon	09/2005	ACSM 1
E61	5 Series Touring	09/2005	ACSM 1
E63	6 Series Coupe	09/2005	ACSM 1
E64	6 Series Convertible	09/2005	ACSM 1
E85	Z4 Roadster	01/2006	ACSM 1
E86	Z4 Coupe	05/2006	ACSM 1
E88	1 Series Convertible	04/2008	ACSM 2
E70	X5 SAV	11/2006	ACSM 2
E71	X6 SAC	04/2008	ACSM 2
E93	3 Series Convertible	03/2007	ACSM 2
F01	7 Series Saloon	11/2008	ACSM 3
F02	7 Series Saloon long version	11/2008	ACSM 3
F07	5 Series Gran Turismo	10/2009	ACSM 3
F10	5 Series Saloon	03/2010	ACSM 3

F10 Passive Safety Systems

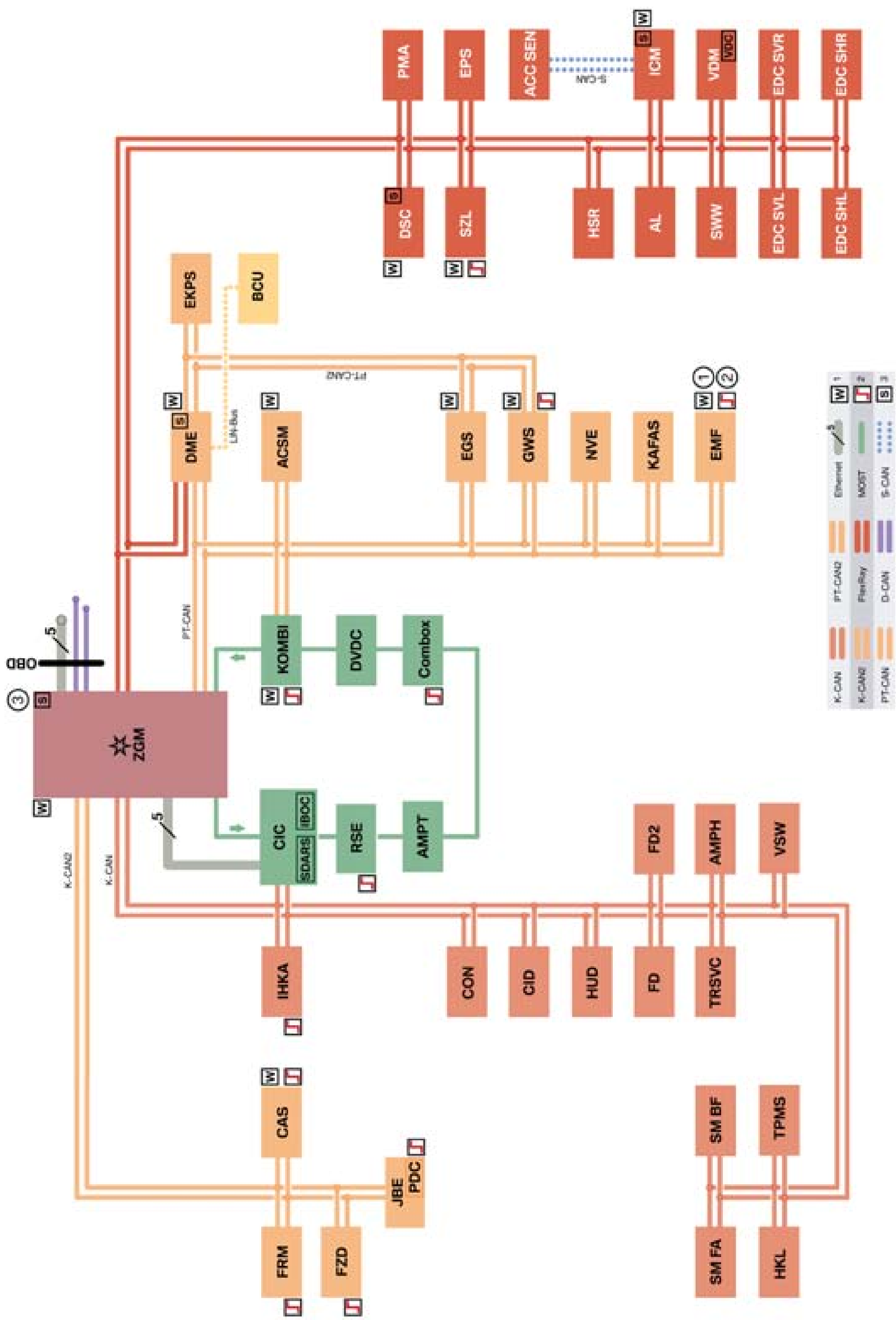
3. System Overview

3.1. System wiring diagrams

The following bus overview provides you with an overview of the F10 vehicle electrical system/network structure and the integration of the modules into the PT-CAN.

F10 Passive Safety Systems
3. System Overview

3.1.1. Bus diagram



F10 Bus overview

Index	Explanation
1	Wakeable control units
2	Control units authorized to wake up the vehicle
3	Startup node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety 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
Combox	Combox multimedia with telematics
CON	Controller
D-CAN	Diagnosis on Controller Area Network
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
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications
FRM	Footwell module
FZD	Roof function center

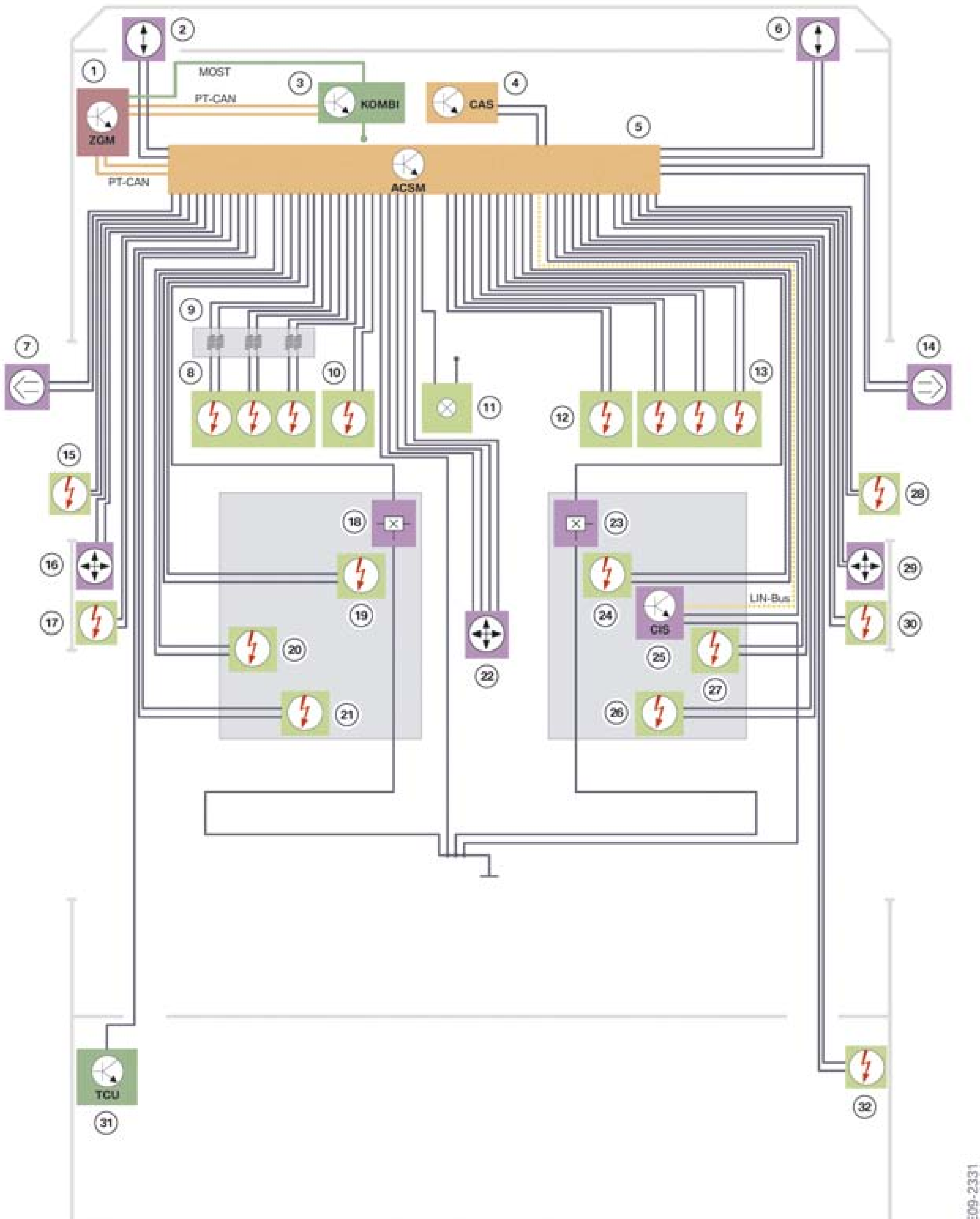
3. System Overview

Index	Explanation
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 Control Unit
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for reversing camera and side view
VDM	Vertical Dynamics Management
VSW	Video switch
ZGM	Central Gateway Module

F10 Passive Safety Systems

3. System Overview

3.1.2. System wiring diagram



F10 System wiring diagram

F10 Passive Safety Systems
3. System Overview

Index	Explanation
1	Central Gateway Module
2	Acceleration sensor, left engine support
3	Instrument cluster
4	Car Access System
5	Crash Safety Module
6	Acceleration sensor, right engine support
7	Door airbag sensor, front left (pressure)
8	Driver's airbag, two-stage with ventilation
9	Clock spring
10	Knee airbag, driver
11	Indicator lamp for front passenger airbag deactivation
12	Knee airbag, passenger
13	Front passenger airbag, two-stage with ventilation
14	Door airbag sensor, front right (pressure)
15	Head airbag, left
16	Acceleration sensor, B-pillar left
17	Automatic reel with adaptive force limiter, driver's side
18	Seat belt buckle contact, driver's seat
19	Seat belt pretensioner, driver
20	Side airbag, driver's side
21	Active head restraint, driver
22	Central sensor
23	Seat belt buckle contact, front passenger side
24	Seat belt pretensioner, front passenger
25	Seat-occupancy mat, CIS mat
26	Active head restraint, passenger
27	Side airbag, passenger side
28	Head air bag, right
29	Acceleration sensor, B-pillar right
30	Automatic reel with adaptive force limiter, front passenger's side
31	Telematics Control Unit for emergency call
32	Safety battery terminal

F10 Passive Safety Systems

4. Functions

4.1. Functions of the crash safety module

The main function of the Crash Safety Module is to constantly evaluate all sensor signals in order to detect a crash situation. As a result of the sensor signals and their evaluation, the crash safety module identifies the direction of the crash and the severity of the impact.

Also included is information on seat occupancy and whether or not the driver and/or front passenger have their seat belts fastened. From this information, measures are taken to selectively trigger the necessary restraint systems.

The crash safety module monitors the system itself and indicates that the system is ready for operation when the airbag indicator light goes out.

In the event of a fault during operation, this is stored in a fault memory, which can be read out for diagnostic purposes.

If a crash situation is detected, this is communicated to the other users in the bus-system network by a crash message. The relevant control units respond to this signal by executing their own functions according to the severity of the crash.

These functions include:

- Opening the central-locking system
- Activating the hazard warning flashers
- Switching on the interior light
- Deactivating the electric fuel pump
- Switching off the auxiliary heating
- Automatic emergency call.

Another function of the Crash Safety Module is the acoustic seat belt warning, which uses visual and audible signals to remind the driver and front passenger to fasten their seat belts.

The functions of the Crash Safety Module are divided into the following areas:

- Crash-relevant functions
- System monitoring functions
- Additional convenience functions.

4.2. Crash-relevant functions

The Crash Safety Module must fulfill the following crash-relevant functions:

- Evaluating the sensor signals
- Detecting crashes
- Determining the triggering time and the triggering sequence
- Triggering the output stages of the firing circuits

F10 Passive Safety Systems
4. Functions

- Sending the crash message to all bus users
- Crash documentation
- Emergency call function

4.2.1. Evaluating the sensor signals

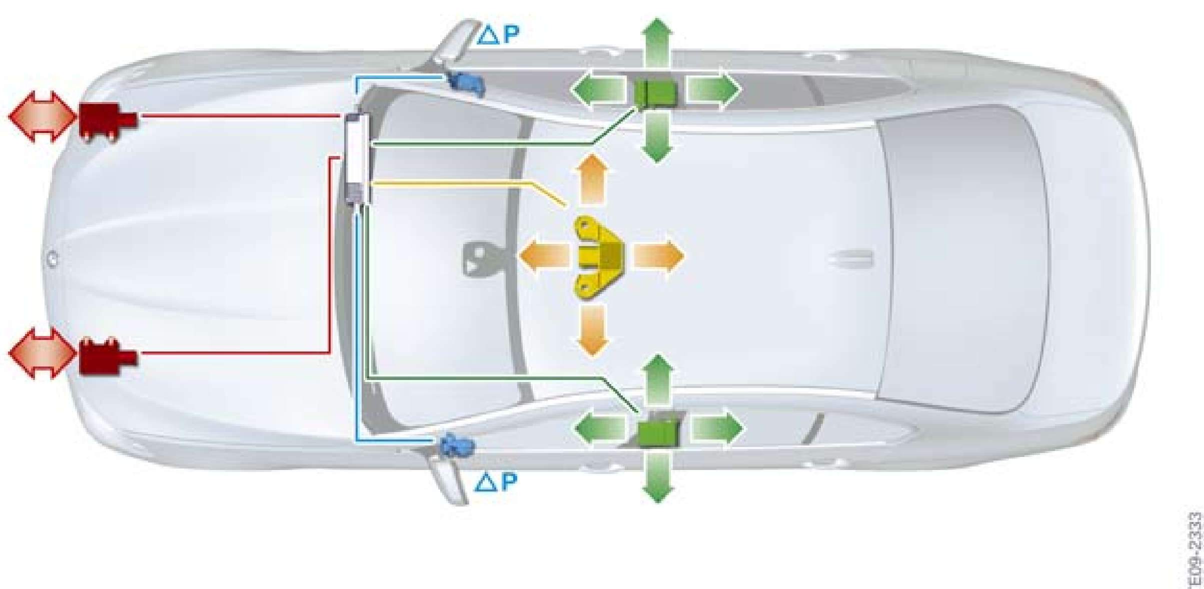
The sensors serve to detect and verify front-end, side-on and rear-end crashes. In addition, the system is also equipped with rollover detection.

The sensors are directly connected to the crash safety module, where its signals are evaluated and processed.

4.2.2. Detecting crashes

European version vehicles are equipped with the following sensors:

- One transverse and longitudinal acceleration sensor in the central sensor (yellow)
- One transverse and longitudinal acceleration sensor in each of the B-pillars (green)
- One airbag sensor for pressure in each of the front doors (blue).
- One longitudinal acceleration sensor on each of the engine supports (red)



F10 ACSM Sensors

The longitudinal acceleration sensors can measure both positive and negative acceleration. Using these signals, a front-end or rear-end crash is detected.

A side-on crash is detected using the lateral acceleration sensors and airbag sensors in the doors.

A crash in which the force-transfer direction is not perpendicular to the vehicle's longitudinal or transverse axis is detected by means of a combined transverse and longitudinal acceleration.

The longitudinal acceleration sensors on the engine supports serve to detect a front-end crash and its severity.

4.2.3. Triggering time and triggering sequence

The Crash Safety Module uses the values transmitted by the sensors to determine the direction and severity of the crash.

In the case of a front-end crash, for example, correspondingly high acceleration values must be detected by the longitudinal acceleration sensor in the B-pillar and by the longitudinal acceleration sensor in the central sensor. Based on the acceleration forces, an algorithm detects the severity and direction of the crash. Using this information, the triggering times and the sequence of the restraint systems to be activated is calculated.

A possible imminent rollover is also detected and the appropriate protection systems are activated.

4.2.4. Triggering the output stages of the firing circuits

The Crash Safety Module is powered by the Car Access System 4 (CAS 4) through terminal 30B. At terminal 30B, the Crash Safety Module is in offline mode. This means that it is active on the data bus and can fulfill all diagnostic functions. The triggering of the ignition circuits is blocked and only possible from terminal 15, on completion of the system self-test. Likewise, the Crash Safety Module is ready for ignition, even if in terminal R the engine turns OFF.

The ignition capacitors are charged via a switching controller. These capacitors make the firing energy available in the event of a crash. If the voltage supply is interrupted during a crash, the firing capacitors serve briefly as an energy reserve.

The output stages of the firing circuits consist of a high-side and a low-side power circuit-breaker. The high-side power circuit-breaker controls the firing voltage, while the low-side power circuit-breaker switches to ground. The output stages of the firing circuits are controlled by a microprocessor.

The high-side and low-side power circuit-breakers also serve the purpose of checking the firing circuits during the system self-test.

4.2.5. Sending the crash message

In the event of a collision involving triggering of the restraint systems, the Crash Safety Module sends a crash message to the users in the bus-system network. Parallel to this, the TCU is informed via a direct single-wire connection to transmit an emergency call.

Then, the respective control units perform the following functions depending on the crash severity:

Function	Control unit
Switch off electric fuel pump	Digital Motor Electronics (DME) Via electronic fuel pump control (EKPS)
Switch off the auxiliary heating	Integrated automatic heating and air conditioning (IHKA) (Not for US)
Release central locking	Junction box electronics (JBE)
Switch on hazard warning flashers	Footwell module (FRM)
Switch on interior lights	Footwell module (FRM)
Transmit emergency call (only when airbag triggered)	Telematics Control Unit (TCU)

4.2.6. Crash entries

In the event of a collision where one or more actuators are triggered, a crash entry is stored in a non-erasable memory. After three crash entries, a non-erasable fault memory entry is stored with the instruction to replace the Crash Safety Module.

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Note: The three crash entries can also be stored during the course of an accident. Each crash entry is assigned a system time.

The electronic control unit remains capable of firing even after three crash entries. The crash entries cannot be erased and are used to diagnose the device. A maximum of three crash entries can be stored. The control unit must then be replaced.

4.2.7. Emergency call function

The emergency call functions are country-dependent and are available to customers in countries with BMW Assist infrastructure. This means an appropriate service provider with a call center must be available. Another precondition for being able to make an emergency call is the availability of a telephone network.

With BMW ASSIST, the customer has a manual and an automatic emergency call as well as other functions.

A manual and an automatic emergency call function is provided as standard. Furthermore, the driver has the option of activating a breakdown call. Irrespective of whether the customer orders a telephone or not, each vehicle is equipped with a telematics control unit TCU, a telephone antenna, an emergency antenna, a handsfree kit and a GPS antenna for determining position.

Manual emergency call

The manual emergency call is intended for customers to request help quickly if they are present when an accident occurs without being involved themselves.

The emergency-call button is located in the roof function Center. The emergency call button is connected directly to the TCU.

Pressing the emergency-call buttons establishes a voice connection with the relevant country provider. The voice connection is indicated by a flashing LED in the switch.

Automatic emergency call

The crash safety module sends a crash telegram to the TCU in the event of an accident of corresponding crash severity. The TCU places an emergency call, which at the same time contains the location of the vehicle.

Parallel to this, attempts are made to set up a voice connection with the vehicle occupants to obtain more information on the accident (severity of the accident, number of injured) so that further rescue operations can be initiated.

Extended automatic emergency call

Vehicles with BMW Assist have an additional function, the extended automatic emergency call (Advanced Automatic Crash Notification).

Using various sensor data of the extended automatic emergency call system, the risk of injury is determined and transmitted to the emergency coordination center.

The emergency call includes additional specific information about the accident. Thus the call center has more accurate information about the accident and the risk of injury, which can be passed on to the emergency coordination center. The emergency coordination center can then initiate the appropriate actions.

4.3. System monitoring functions

The Crash Safety Module has the following system monitoring functions:

- System self-test (pre-drive check)
- Indication of system operability
- Cyclic monitoring
- Fault indication and fault code storage
- Fault output (diagnosis)
- Acoustic and visual seat belt warning
- Deactivation of the front passenger front airbag, the knee airbag and side airbag in via the seat-occupancy detector.

4.3.1. System self-test

The Crash Safety Module performs a system self-test as of terminal 15. The airbag indicator light is activated for approximately five seconds during the system self-test.

When the system self-test is concluded and no fault has been found, the airbag indicator light goes out and the system is ready for operation.

4. Functions

4.3.2. Indication of system operability

Crash Safety Module system operability is indicated by the airbag indicator light going out in the instrument panel.

4.3.3. Cyclic monitoring

Once the system self-test has been successfully concluded and the system is ready for operation, a cyclic monitoring procedure is performed for fault monitoring purposes. Cyclic monitoring serves the purpose of internal diagnosis of the electronic control unit and the overall airbag system. The cyclic monitoring is carried out continuously as of terminal 15 and it is also continued after reaching logical terminal R and after the engine is OFF.

4.3.4. Fault indication and fault code storage

The Crash Safety Module has a non-volatile fault memory. A fault entry is signalled by the airbag indicator light illuminating.

A distinction is made between internal and external faults when entering the fault code. Events such as triggering of an airbag or seat belt pretensioner are also stored in the fault memory.

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Note: The entry of a triggered restraint system in the fault memory does not mean that the restraint system was defective in the crash situation, rather it only means that the ignited restraint system is not available for further triggering.

4.3.5. Fault output (diagnosis)

With the aid of the BMW diagnosis system, Integrated Service Technical Application (ISTA), the fault memory can be read out via the diagnostic interface. After rectifying the faults or after replacing the triggered components, the fault memory can be cleared with the diagnosis command "Clear fault memory".

4.3.6. Acoustic and visual seat belt warning

All vehicles with Crash Safety Module come standard with an acoustic and visual seat belt warning. The Crash Safety Module detects whether the driver and front passenger have fastened their seat belt. If not, a corresponding acoustic and visual indicator reminds them to fasten their seat belt. Both seat belt buckle switches are monitored separately.

For a description of the exact sequence of the acoustic and visual seat belt warning, refer to the information bulletin entitled "Passive safety system F01/F02".

F10 Passive Safety Systems
4. Functions

4.3.7. Deactivation of the airbags

Automatic deactivation of the airbag is provided in order to fulfill the requirements of the National Highway Traffic Safety Administration NHTSA. The child seats listed in the regulation (for an approximately one-year old child on the front passenger seat) must cause deactivation of the airbags.

To do so, a seat-occupancy mat is used to classify the occupant on the front passenger seat. As a further development of the Occupant Classification 3 mat (OC3 mat), the Capacitive Interior Sensing mat (CIS mat) is used in the F10.

The CIS mat consists of two elements: a sensor wire, which runs parallel to the seat heating in the seat cushion and an evaluation unit.

The CIS mat measures the capacitance and ohmic resistance between the sensor wire (anode) and the ground of the vehicle (cathode) at a frequency of 120 kHz. The change in capacitance and resistance enables the CIS mat to determine whether an adult or a child in a child seat is on the front passenger seat.

Measuring procedure of the CIS mat, example: F07

Deactivation of the front passenger airbag, side airbag and knee airbag on the front passenger side is signalled by the indicator lamp for front passenger airbag deactivation.

The indicator lamp for front passenger airbag deactivation in the roof function center is illuminated if a child restraint system tested according to the requirements of the NHTSA with a small child has been detected on the front passenger seat or the front passenger seat is unoccupied.

The brightness of this light is controlled by automatic regulation of the display lighting.

F10 Passive Safety Systems
5. System Components

5.1. Crash Safety Module

The Crash Safety Module is contained in a housing with three sockets.

Two sockets serve to connect the wiring harness. One other socket is provided for the cockpit wiring harness.

F10 Crash Safety Module

The Crash Safety Module is located in the cockpit module behind the glove box, as it was not possible to locate it centrally on the transmission tunnel due to the size of the Crash Safety Module and the wiring harness connection. Only the associated sensor system has remained on the transmission tunnel, close to the center of gravity.

The Crash Safety Module does not contain any sensors. These have been relocated to an additional central sensor on the transmission tunnel.

5.2. Sensors and switches

The following sensors and switches are installed:

- Central sensor for longitudinal and lateral acceleration
- Sensor for transverse and longitudinal acceleration at the B-pillars
- One airbag sensor in each of the front doors (pressure).
- One longitudinal acceleration sensor on each of the engine supports
- CIS mat
- Seat belt buckle switch
- Emergency call button

5.2.1. Central sensor

The central sensor on the transmission tunnel contain a transverse and a longitudinal acceleration sensor.

F10 Central sensor

5.2.2. B-pillar transverse and longitudinal acceleration sensor

The transverse and longitudinal acceleration sensors in the B-pillars serve to detect head-on, side-on and rear-end crashes.

The left and right sensors are identical in design.

F10 B-pillar transverse and longitudinal acceleration sensor

5.2.3. Door airbag sensor, front (pressure)

The airbag sensors in the front doors are used for side impact detection. In addition to the high transverse acceleration values, the pressure in the cavity of the door increases in the event of a side-on crash.

The airbag sensors are located on the inner door panel of the front doors.

F10 Door airbag sensor, front (pressure)

5.2.4. Longitudinal acceleration sensor

Two longitudinal acceleration sensors are installed in the front area of the engine supports. The measured values are transmitted to the Crash Safety Module and evaluated there.

F10 Engine support longitudinal acceleration sensor

5.2.5. CIS mat

A Capacitive Interior Sensing mat (CIS mat) is installed in the front passenger seat for seat-occupancy detection. This replaces the OC3 mat, which was previously installed for this function. The CIS mat detects whether an adult or a child in a child seat is in the front passenger seat. Deactivation of the front passenger airbag, side airbag and knee airbag is signalled by the illumination of the indicator lamp for front passenger airbag deactivation in the roof function center.

The CIS mat consists of two elements, a sensor wire, which runs parallel to the seat heating in the seat cushion, and an evaluation unit. The CIS mat measures the capacity and the ohmic resistance between the sensor wire (anode) and the ground of the vehicle (katode) at a frequency of 120 kHz. The CIS mat uses changes in the capacity and the resistance to determine whether an adult or a child is in the front passenger seat.

5.2.6. Seat belt buckle switch

The seat belt buckle switches are located in the seat belt buckles of the driver's and front passenger's seat.

The seat belt buckle switch detects whether the seat belt buckle tongue is in the seat belt buckle. The supply of power to the sensor and the evaluation are carried out by the Crash Safety Module.

From terminal 15, the seat belt buckle switch is monitored continuously. The signal is used for the visual and acoustic seat belt warning and for determining which restraint systems are to be triggered.

F10 Seat belt buckle switch

5.2.7. Emergency call button

The emergency-call button is located in the roof function center.

F10 Roof function center with emergency call button

F10 Passive Safety Systems
5. System Components

5.3. Actuators

The following actuator are installed in the F10:

- Driver's airbag
- Front-passenger airbag
- Knee airbag, left and right
- Head airbag, left and right
- Side airbag, front left and right
- Belt tensioner, front left and right
- Active head restraints, front left and right
- Safety battery terminal.

In addition, the following indicator lights inform the occupants of the status of the safety systems:

- Airbag indicator light
- Seat belt warning light
- Indicator lamp for front passenger airbag deactivation

The following two graphics show the airbags in non-triggered and triggered status. Depending on the type of the specific crash, only certain airbags are triggered.

F10 Triggered airbags

5.3.1. Adaptive Driver's airbag

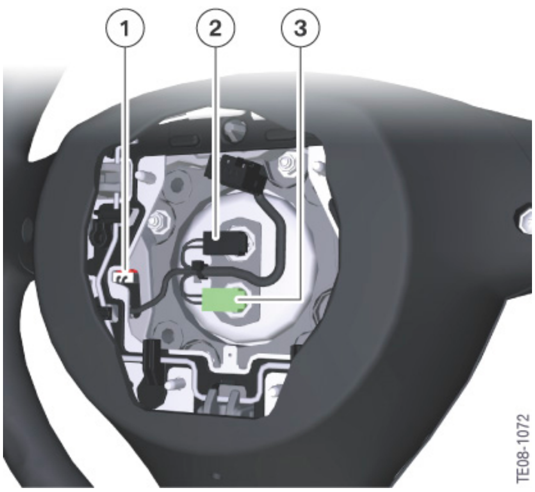
The task of the driver's airbag is to decrease the risk of injury for the driver in the event of a head-on crash. The driver's airbag is located in the impact plate on the steering wheel. The driver's airbag is equipped with a gas generator.

F10 Steering wheel with driver's airbag

An active vent valve and a two-stage generator are installed which, depending on the detected crash severity, the stages can be triggered with different timing.

F10 Adaptive Driver's airbag steering wheel with the airbag removed.

Index	Explanation
1	Gas generator with exhaust vents
2	Actuator for vent valve



F10 Adaptive Driver's airbag, rear view.

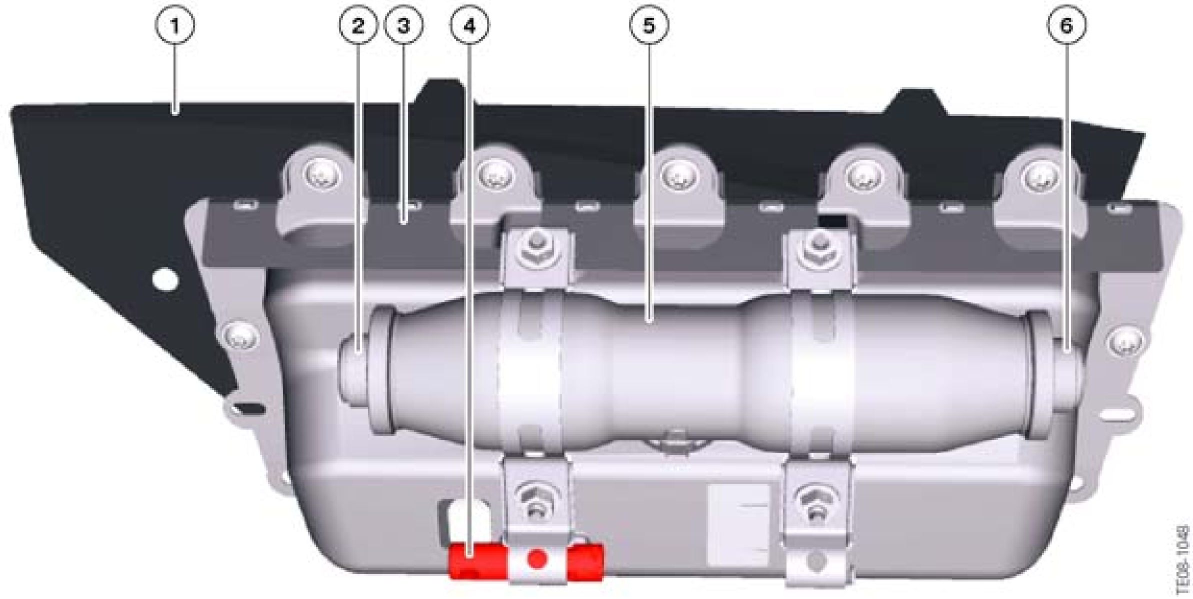
Index	Explanation
1	Connection of the squib for the active vent valve
2	Connection of the ignition squib for the first stage of the driver's airbag
3	Connection of the ignition squib for the second stage of the driver's airbag

Note: The Active driver's and passenger's airbags are equipped with an active vent valves.

5.3.2. Adaptive Front passenger airbag

The task of the front passenger airbag is to reduce the risk of injury to the passenger in the event of a head-on collision. The front passenger airbag is located in the dashboard. When the front passenger airbag unfolds, the dashboard is broken open at pre-defined locations. The front passenger airbag opens in the direction of the windshield, exits towards the top and rests against the windshield and the dashboard. The front passenger airbag is equipped with a two stage generator which, depending on the detected crash severity, the stages can be triggered with a time difference.

5. System Components



F10 Active Front passenger airbag

Index	Explanation
1	Cover
2	First stage squib
3	Airbag housing
4	Actuator for the active vent valve
5	Inflator assembly
6	Second stage ignition squib

Note: The Active driver's and passenger's airbags are equipped with an active vent valves.

5.3.3. Knee airbag

The US legal requirements call for the passive restraint (without seat belt) of the occupants. Therefore, to control the occupant forward displacement in the event of a head-on collision, knee airbags are installed on the driver's side and front passenger side.

F10 Knee airbag

5.3.4. Head airbag

As additional protection of the occupants' head, the F10, uses curtain (head) airbags.

The curtain airbag extends from the A-pillar to the C-pillar and covers the entire area of the side windows. It unfolds between the occupants and the side structure.

System features:

- Extended covered area across all front windows, front and rear
- Reduction of risk of injury to occupants by glass splinters
- Covered area epitomized for occupants of different sizes

5.3.5. Side airbag, front

As in the F01, the front side airbags are triggered from the front seat backrests.

The side airbags and the gas generators are located in a plastic housing referred to as the airbag module. This is built into the front seat backrest and is covered by the rear panel.

In the event of activation, the side airbag emerges between the backrest frame and backrest rear panel as it unfolds between the side structure and occupant.

⚠

Note: It is important that no additional seat covers are installed as they would greatly impair the airbag function or even defeat it entirely.

F10 Seat with side airbag

Index	Explanation
1	Side airbag

5.3.6. Front seat belt tensioner

In the F10, the familiar three-point seat belt is the belt system used on the front seats.

F10 Seat belt

F10 Passive Safety Systems
5. System Components

Index	Explanation
1	Seat belt tensioners
2	Side airbag
3	Automatic reel with adaptive force limiter

Seat belt tensioners

The task of the pyrotechnic belt tensioner is to minimize the seat belt slack in the pelvis and shoulder areas in the event of an impact, thereby improving the restraining action.

The belt tensioners are located on the driver's seat and front passenger seat. The belt tensioners are ignited in certain crash situations.

The seat belt buckle is connected by means of a steel cable to the piston in the tensioning tube. If the squib is triggered, gas pressure is created, which moves the piston in the tensioning tube. At this, the seat belt buckle is pulled down by the cable and the seat belt is tensioned.

F10 Belt tensioner

Index	Explanation
1	Seat belt buckle switch
2	Connection for ignition squib
3	Tensioning tube with piston

Automatic reel with adaptive force limiter

For the driver and front passenger, an automatic reel is installed as on F01/F02.

With the aid of a gas generator, there is a changeover from a high to a low power level during the impact, in order to reduce the belt restraining forces.

With optimal tuning in connection with the airbags, the kinetic energy of the occupant is more uniformly reduced over the duration of the impact. Thus lower occupant stress values are achieved.

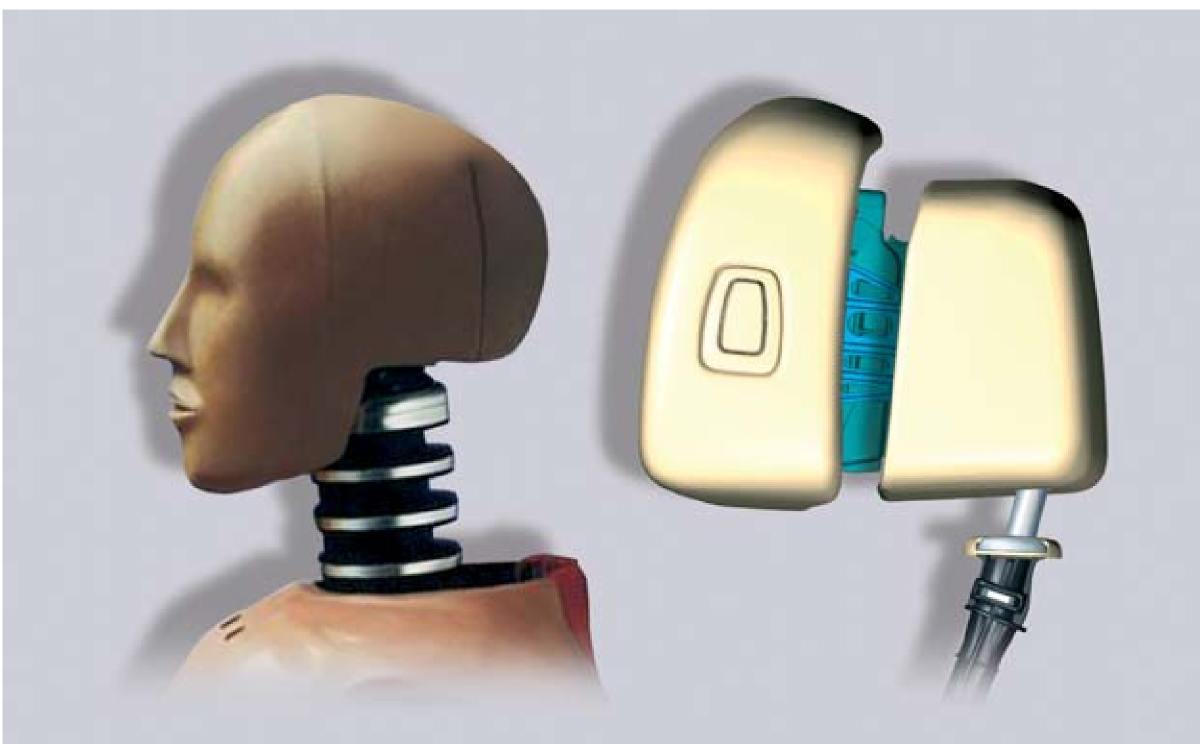
The operating principle of the adaptive force limiters in the F10 are the same as on the F01.

5.3.7. Active head restraints, front

For the F10, there are two versions depending on the installed seat. Both have a head restraint with pyrotechnic actuator which, in the event of a rear-end collision with sufficient severity, optimizes the distance and the height relative to the head. This reduces the load in the cervical spine area in the event of a rear-end collision. The headrest is activated at an early stage, even before the backward displacement of the occupant's head.

In order to offer as much convenience as possible, the front section of the manually adjustable head restraints can be pulled forward or pushed backward approximately 30 mm. It is a two-stage adjustment. This allows for three different positions for the head restraint depth adjustment.

On the multi-function seat, the headrest is adjusted by means of the headrest adjustment.



F10 Manually adjustable head restraint

The active head restraint minimizes the load in the cervical spine area in the event of a rear-end collision. For the occupants in the vehicle, the correct adjustment of the head restraints and the distance of the head from the head restraint are of crucial importance.

In the event of a rear-end collision, the active head restraint reduces the distance between the head and the head restraint before the occupants are displaced backwards. This reduces the risk of injury to the cervical vertebrae, even in the event of a small accident.

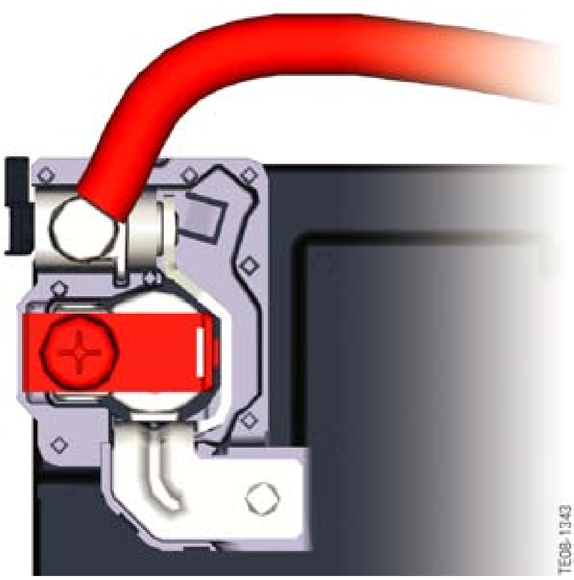
Note: If the active head restraints have been triggered, the pyrotechnic actuators must be replaced in the workshop. It is essential to refer to the repair instructions.

Note: Never use any seat or head restraint covers on the head rest that can impair the protective effect.

5.3.8. Safety battery terminal

The safety battery terminal is triggered at different thresholds when the Crash Safety Module detects a head-on, side-on or rear-end crash of sufficient severity. The connecting cable between the battery and starter/alternator and positive battery connection point is then disconnected pyrotechnically. The safety battery terminal is located directly at the positive terminal of the battery.

Despite the safety battery terminal being blown off, it is guaranteed that all consumers relevant to safety such as hazard warning flashers, interior lighting and telephone will continue to be supplied with voltage.



F10 Safety battery terminal

5.3.9. Airbag indicator light

The airbag indicator light is located in the instrument cluster. Crash Safety Module system operability is indicated by the airbag indicator light lighting up and then going out during the pre-drive check. The airbag indicator light is controlled by means of a message on the PT-CAN from the Crash Safety Module. The instrument panel receives a message on a cyclical basis. If the message fails to arrive, the airbag indicator light is activated.

5. System Components

F10 Airbag indicator light

5.3.10. Seat belt warning light

A visual and audible warning is issued if the seat belt is not fastened or is unbuckled when the vehicle is in motion.

F10 Seat belt warning light

The status of the seat belt buckle contacts of the seat bench is briefly visible in the TFT display of the instrument panel when the vehicle starts or a contact changes.

5.3.11. Indicator lamp for front passenger airbag deactivation

In the F10, the indicator lamp for front passenger airbag deactivation is in the roof function center. The indicator lamp for front passenger airbag deactivation if the CIS mat detects a child seat with a child approximately one year old or if the front passenger seat is not occupied.

The brightness of the indicator lamp for front passenger airbag deactivation is controlled by the automatic brightness control of the display illumination.

5. System Components

F10 Roof function center with indicator lamp for front passenger airbag deactivation

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