Reference Manual

F30
COMPLETE VEHICLE

Technical Training

Technical training.
Product information.

F30 Introduction

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1113 1/1/2012

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Introduction
Contents.

F30 Introduction

1. Body

The sixth edition of the BMW 3-Series will be launched on the market in February 2012. Each generation of these vehicles combine exceptional sporting character and dynamics, maximum comfort and innovation.

The new BMW 3-Series Sedan also offers a well-balanced harmonious design concept. This sporty Sedan with its confident appearance represents the ultimate driving machine, first-class agility and driving dynamics without making any compromises elsewhere.

BMW F30

The characteristic BMW proportions, the short overhang at the front, the long wheelbase or the extended engine compartment lid transmit a dynamic image, even when the vehicle is stationary.

The exceptional efficiency offered by BMW engines was even improved once again in the F30. The new engines are characterized by high power and low consumption at the same time.

For the first time in the BMW 3-Series three different equipment packages are being offered, each with their own independent character.

F30 Introduction

1. Body

1.1. Models

The following models are offered by the compact Sedan:

Model	Engine	Power output [kW (HP)]	Torque [Nm]	Displacement [cm^3]
BMW 328i	N20B20O0	180 (240)	350	1997
BMW 335i	N55B30M0	225 (300)	400	2979

1.2. History

The first 3-Series BMW was introduced in 1975.

The following is a comparison of the 6th generation 3-series. The data is based on the four-door Sedan (with the exception of the two-door E21).

Explanation	E21	E30/4	E36/4	E46/4	E90	F30 Base model*
Sales period	1975 and 1983	1983 and 1990	1991 and 1998	1997 and 2005	since 2005	From 2012
Vehicle length [mm]	4355	4325	4433	4471	4531	4636
Vehicle width excluding exterior mirrors [mm]	1610	1645	1698	1739	1817	1811
Vehicle height, empty [mm]	1380	1380	1393	1415	1421	1429
Wheelbase [mm]	2563	2570	2700	2725	2760	2810
Front track width, basic wheels [mm]	1388	1407	1418	1481	1500 and 1506	1531 and 1537
Rear track width, basic wheels [mm]	1401	1415	1431	1488	1529 and 1535	1572 and 1578
Vehicle curb weight, base model [kg]	1010	1045	1130	1360	1415	1545
Payload [kg]	400	460	460	425	460	410
Luggage compartment capacity [l] (BMW 335i)	- - -	425	435	440	460 (450)	480
Engines	R4 B R6 B	R4 B R6 B	R4 B R6 B	R4 B R6 B	R4 B R6 B	R4 B R6 B

F30 Introduction
1. Body

Explanation	E21	E30/4	E36/4	E46/4	E90	F30 Base model*
Cubic capacity [cm³]	1573 and 2315	1596 and 2495	1596 and 2793	1796 and 2993	1995 and 2996	1995 and 2979
Engine performance, gasoline [kW]	75 and 143	90 and 170	100 and 192	105 and 231	125 and 225	180 and 225
0–100 km/h [s] 0–62 mph	14.8 and 10.6	15.8 and 6.9	12.9 and 7.3	12.4 and 5.7	9.3 and 5.6	8.1 and 5.5
Average consumption [l/100 km]	13.5 and 11.0	12.2 and 6.9	9.5 and 7.8	9.0 and 6.5	8.7 and 4.1	7.9 and 4.1
Maximum speed [km/h]	154 and 190	165 and 218	191 and 236	200 and 250	210 and 250	210 and 250

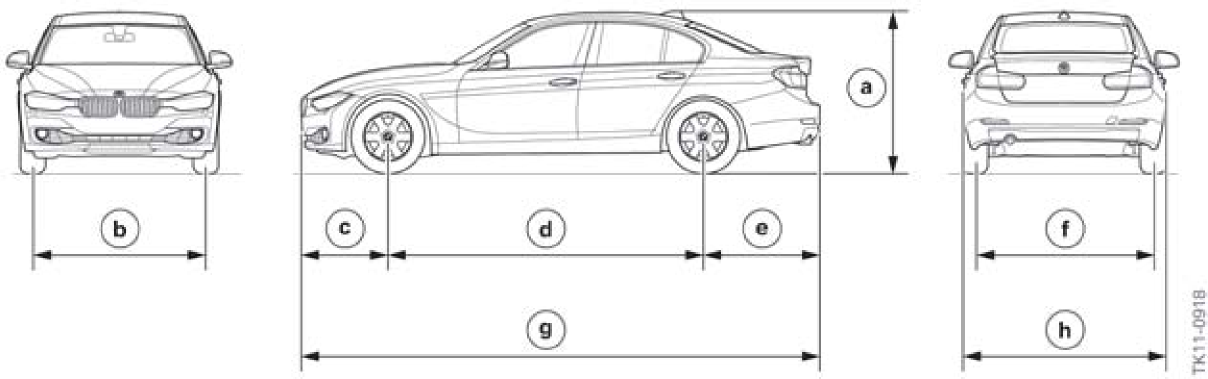
1.3. New technical features

Of the many components which have been altered or newly developed, the following must be mentioned in particular:

- Door hinges
- Engine compartment lid catches
- Underbody panelling
- Side repeaters
- Side sills
- Inside mirror
- Seats.

1. Body

1.4. Dimensions



F30 overall dimensions

Index	Explanation		F30*	E90
a	Vehicle height, empty	[mm]	1429	1421
b	Front track width, basic wheels	[mm]	1531	1506
c	Front overhang	[mm]	788	767
d	Wheelbase	[mm]	2810	2760
e	Rear overhang	[mm]	1038	1014
f	Rear track width, basic wheels	[mm]	1572	1535
g	Vehicle length	[mm]	4636	4541
h	Width excluding exterior mirrors (vehicle width with exterior mirror)	[mm]	1811 (2031)	1817 (1989)

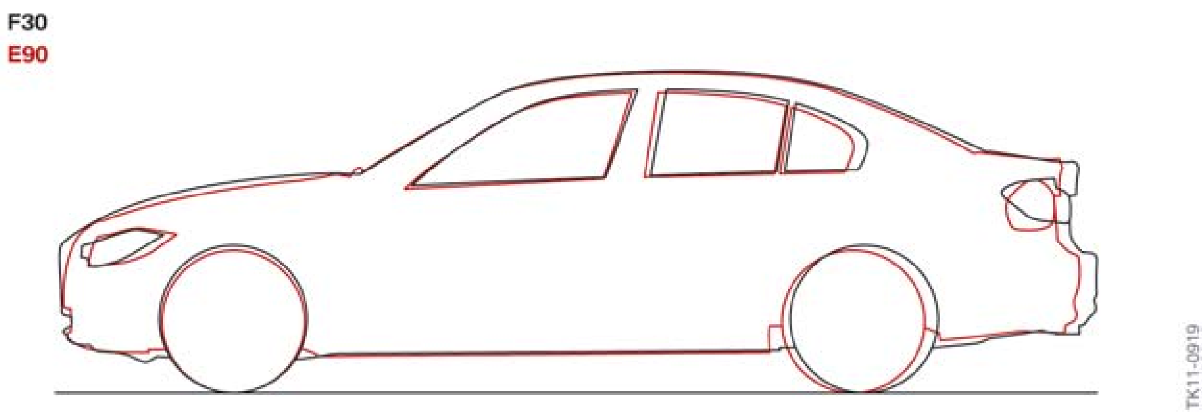
1.5. Weights and load capacities

Model		curb weight (DIN) (manual gearbox) F30	curb weight (DIN) (automatic transmission) F30	Load capacity F30
BMW 328i	kg/ lbs	1545/3406	1570/3461	410/904
BMW 335i	kg/ lbs	1620/3571	1630/3594	410/904

Through the 10 mm forward shift of the front axle while retaining the engine mount, an even more reasonable axle-load distribution was able to be achieved (between 50 and 56% for all load statuses).

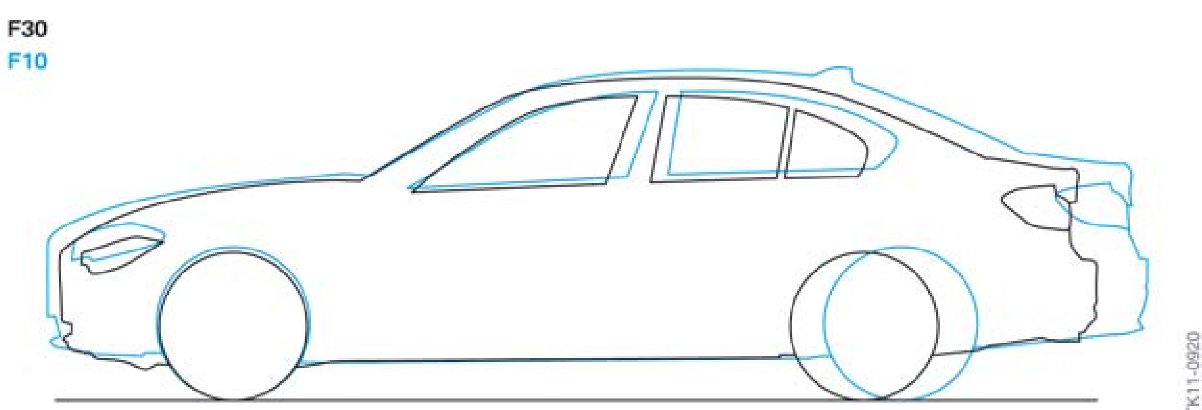
F30 Introduction
1. Body

1.6. Silhouette comparison



F30 Silhouette comparison with BMW E90

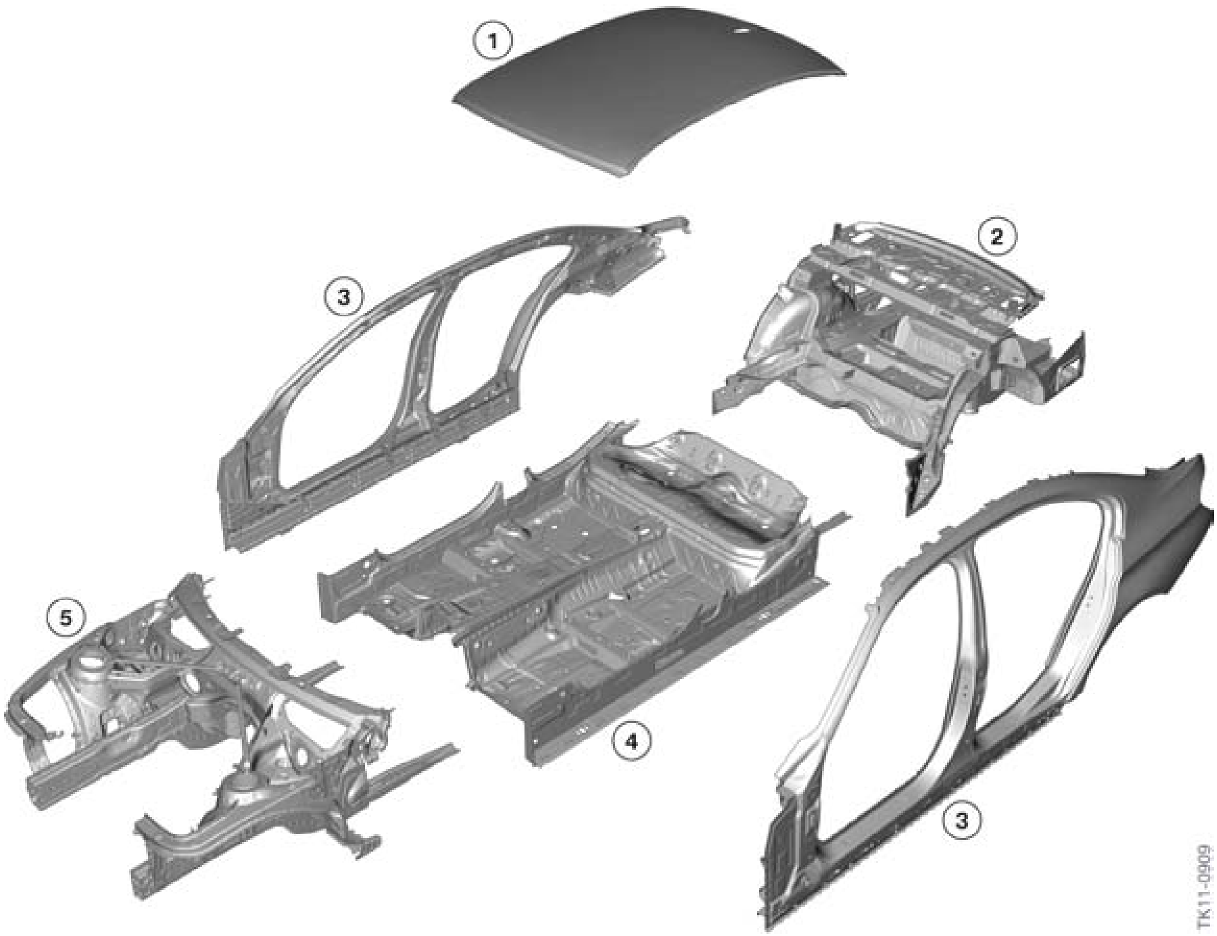
		F30*	E90
Vehicle height, empty	[mm]	1429	1421
Front overhang	[mm]	788	767
Wheelbase	[mm]	2810	2760
Rear overhang	[mm]	1038	1014
Vehicle length	[mm]	4636	4541



F30 Silhouette comparison with BMW F10

		F30*	F10
Vehicle height, empty	[mm]	1429	1464
Front overhang	[mm]	788	832
Wheelbase	[mm]	2810	2968
Rear overhang	[mm]	1038	1099
Vehicle length	[mm]	4636	4899

2. Bodyshell



F30 bodyshell

Index	Explanation
1	Roof
2	Rear end
3	Side frame
4	Floor assembly
5	Front end with bulkhead

2.1. Introduction

For the F30, great importance was attached to construction with lightweight materials. This is achieved with the targeted application of higher-strength multi-phase steels and super-strength hot-formed steels. The F30 sees an increase in the average strength of its body materials of 10% compared with the E90.

The construction with lightweight materials makes a decisive contribution to reducing the vehicle weight. In conjunction with a rigid design of the bodyshell, it makes a significant contribution to

2. Bodyshell

- Driving dynamics
- Reduction of the fuel consumption
- Reducing CO_2 emissions
- Passive safety.

Special features

- High proportion of multi-phase steels (14% of the bodyshell weight)
- High proportion of hot-formed steels (3% of the bodyshell weight).

The higher-strength multi-phase steels and super-strength hot-formed steels ensure maximum safety of the passenger safety cell with low weight. They therefore make a huge contribution to passive safety.

The reinforcements of the B-pillars of the F30 are manufactured from tailored blanks with hot-formed steels.

Tailored blanks are tailor-made printed circuit boards made from sheet steel. Single sheets of varying thickness, strength and surface coating are joined together by laser welding. This prefabricated semi-finished product is then formed to the desired component.

Stronger material is used at places with a higher load. The clever use of material lowers manufacturing costs as the high-quality and expensive materials are only used where necessary. Thanks to the use of customized steel solutions additional reinforcements and overlap connections at the body are superfluous. This saves material and the total weight is reduced further.

With hot-formed steels, an innovative new development – passive corrosion-proofing – is used. In the past, there were no suitable hot-formed sheet metal materials with galvanized corrosion-proofing available on the market. With the development of press-hardening technology, however, there is now a process of manufacturing galvanized hot-formed components that is capable of application in volume production.

It involves initially cold-forming galvanized sheet steel and then heating it to approx. 900 °C. Immediately afterwards it is cooled directly in the moulding die with integrated water cooling within just a few seconds down to approximately 70 °C and thereby hardened. That process gives the components a minimum yield strength of well over 1000 MPa.

The parts produced in that way can be used in areas exposed to moisture without suffering corrosion of the basic material. This type of steel does not therefore require any additional corrosion-proofing measures.

2.2. Materials

A modern vehicle body must meet a great many requirements. Despite small outer dimensions, it should provide an interior that is a large as possible. In the event of an accident, the passengers must be protected against injury as well as possible. The torque that is generated also means that all units, e.g. the engine and transmission, rely on the body for support. Furthermore, the body must have high static and above all dynamic strength in order to guarantee the outstanding driving characteristics that are typical of BMW.

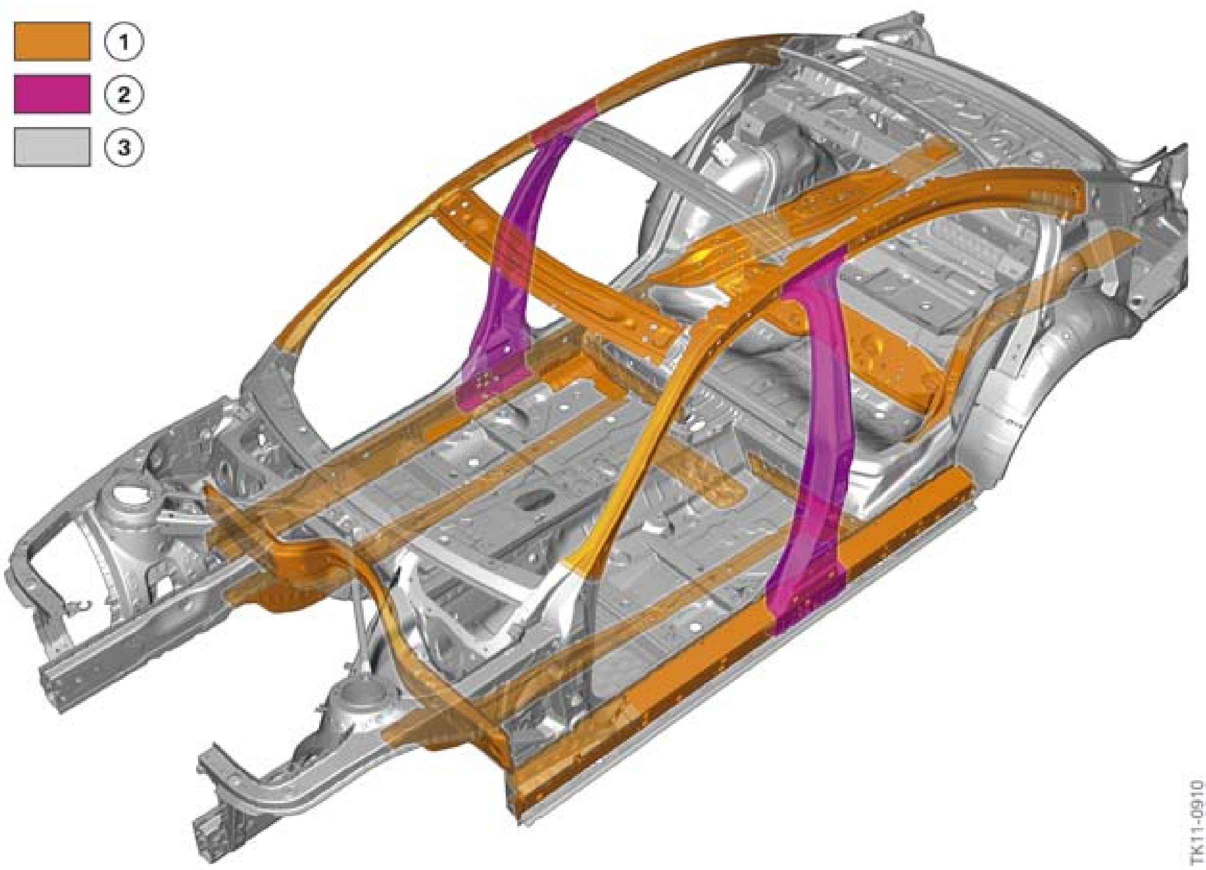
F30 Introduction

2. Bodyshell

Last but not least, the supporting structure of the vehicle must be highly durable and, in the event of an accident, it must be possible for repairs to be carried out at a reasonable cost and without an excessive amount of work.

In order to meet all of these requirements, BMW pursues the strategy of creating each component from the material best suited for its function.

The term steel is merely the generic term for the large number of alloys with very different properties that are deployed.



F30 material grades for bodyshell

Index	Explanation
1	Multi-phase steels (> 300 MPa)
2	Hot-formed steels (> 900 MPa)
3	Other steels (< 300 MPa)

Multi-phase steels are steels where the structure consists of a number of phases. Higher-strength multi-phase steels with a yield strength $R_{p0.2}$ of 300 to 600 MPa are, for example, dual-phase steels or TRIP steels. Super-strength multi-phase steels with a yield strength $R_{p0.2}$ in excess of 600 MPa are, for example, complex-phase steels or martensitic-phase steels.

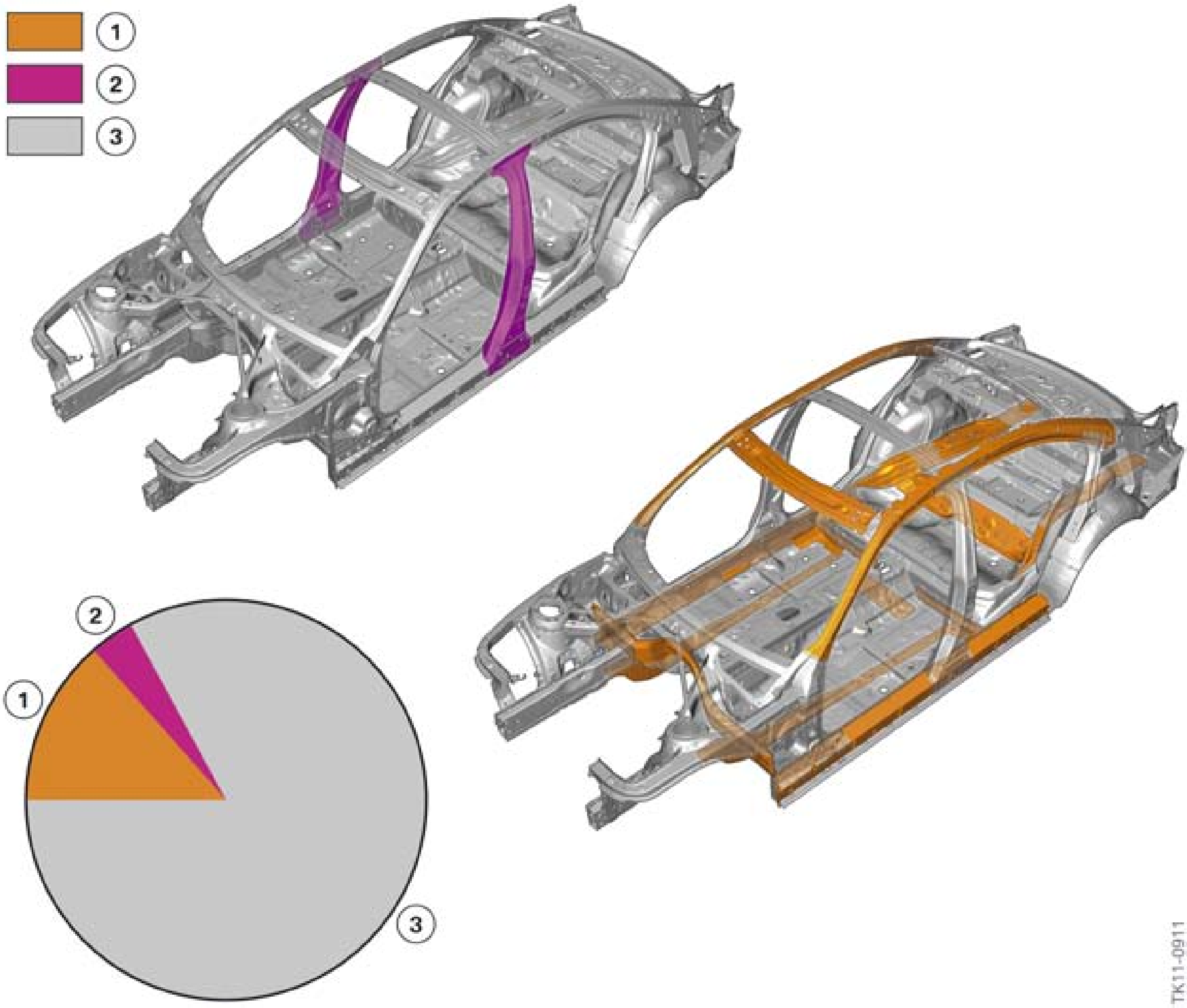
Hot-formed manganese-boron steels are super-strength steels with a yield strength $R_{p0.2}$ in excess of 900 MPa.

F30 Introduction

2. Bodyshell

Weight proportions

In order to reduce the vehicle weight and still ensure maximum strength of the bodyshell, the proportion of higher/super-strength multi-phase steels and super-strength hot-formed steels is growing.



F30 bodyshell, distribution of material grades

Index	Explanation
1	Multi-phase steels (> 300 MPa), proportion 14%
2	Hot-formed steels (> 900 MPa), proportion 3%
3	Other steels (< 300 MPa), proportion 83%

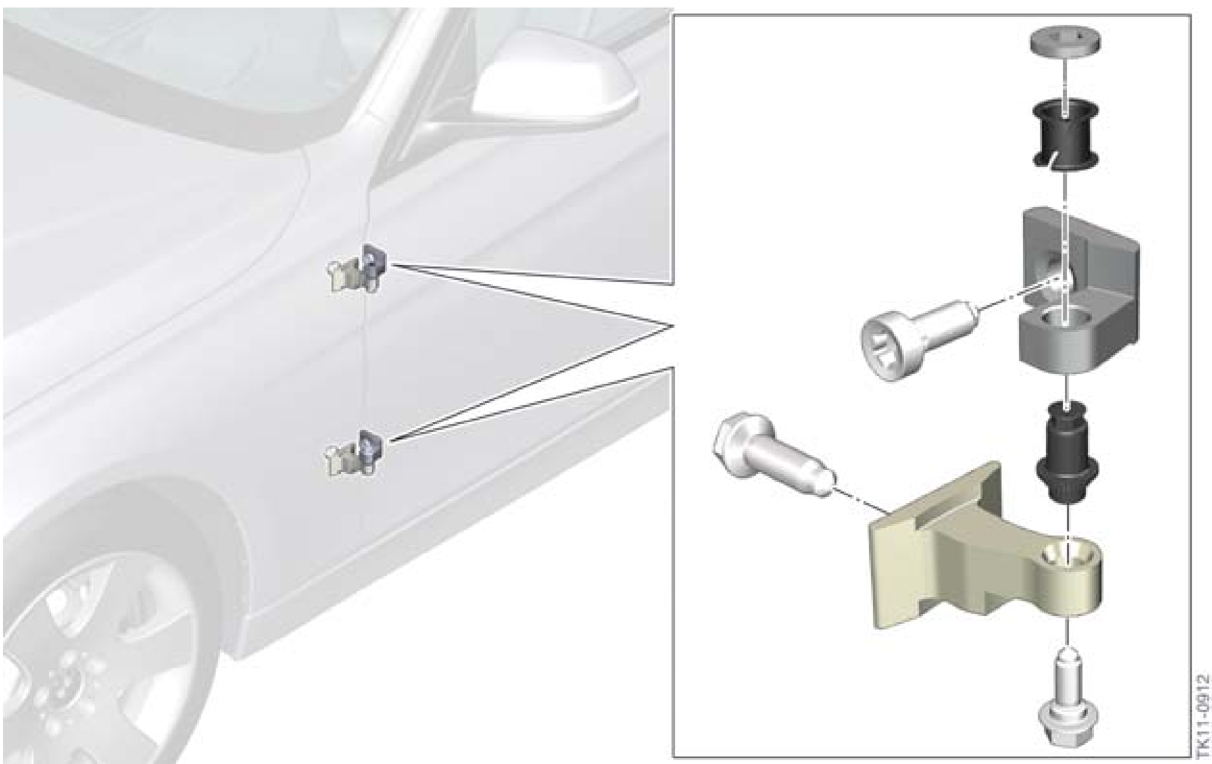
F30 Introduction

3. Doors, Lids and Hatches

In addition to the bodyshell, all doors and flaps for the F30 are also made from steel.

3.1. Doors

The door hinges which are secured to both the door and the A- or B-pillar with one screw in each case are used in the F30. Previously the door hinges were welded to the A- or B-pillar and secured to the door with two screws in each case.



F30 door hinge

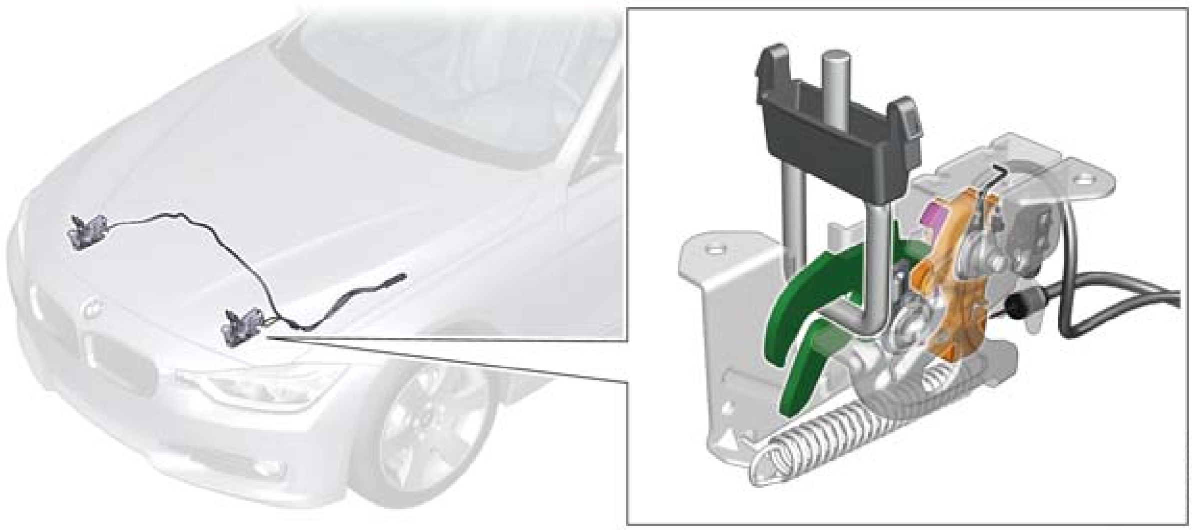
3.2. Engine compartment lid

The F30 is also equipped with a comfort opening for the engine compartment lid. The engine compartment lid can be unlocked completely from the passenger compartment by means of new, two-stroke engine compartment lid catches. The engine compartment lid release lever must be actuated twice in succession for this purpose.

Advantages

- A release lever does not have to be searched for and actuated at the front of the car
- Safety is increased by the use of two retaining hooks
- There is no risk of injury on exposed retaining hooks.

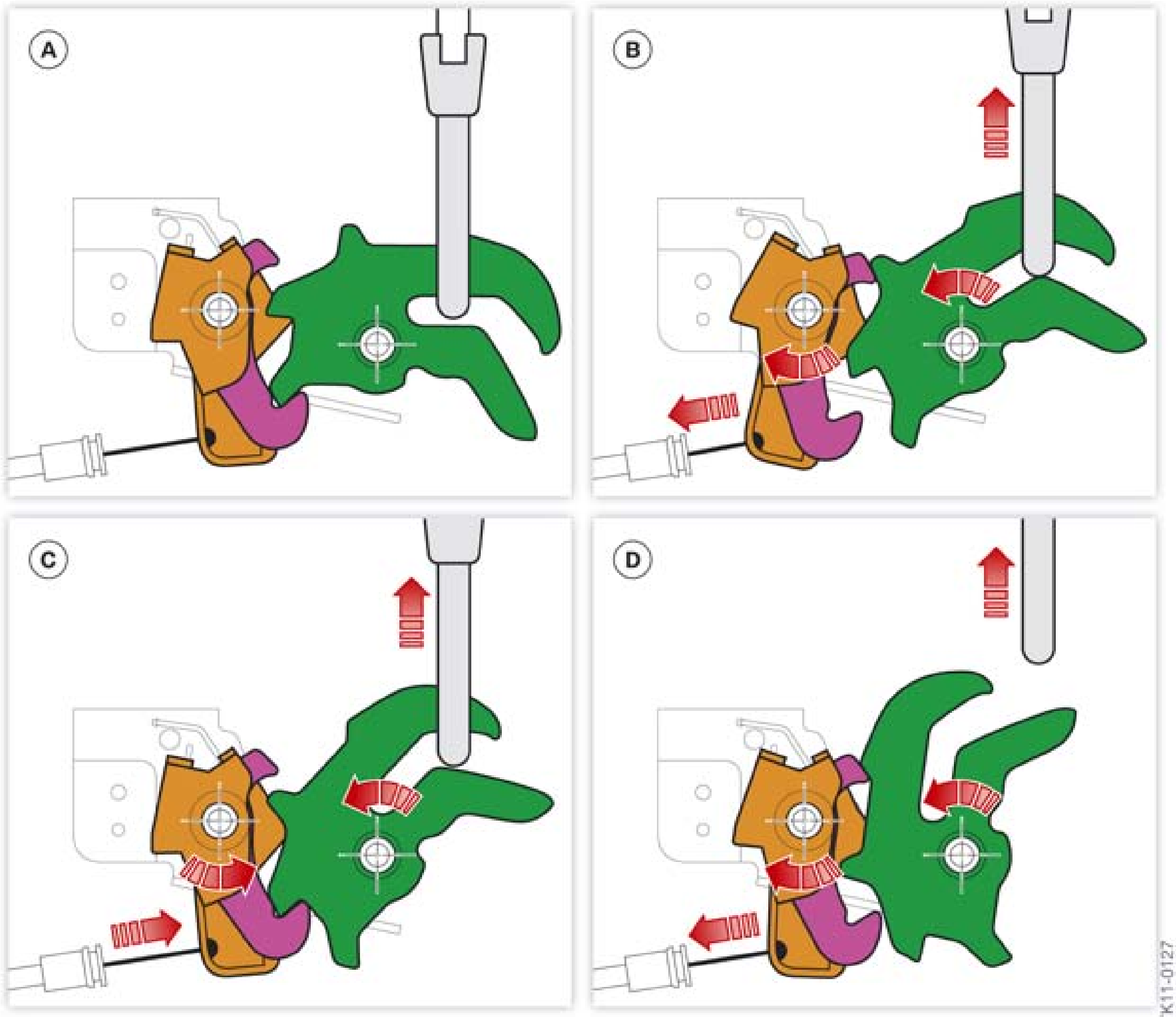
3. Doors, Lids and Hatches



F30 engine compartment lid, engine compartment lid catch

When the engine compartment lid release lever is activated for the first time, this moves the two engine compartment lid catches into the preliminary detent. The engine compartment lid springs upwards by one stage. When the engine compartment lid release lever is released, the engine compartment lid catches are moved into the retaining hook position.

When the engine compartment lid release lever is actuated again, the engine compartment lid is unlocked completely and can be opened by simple lifting.



F30 engine compartment lid catch

Index	Explanation	Position of engine compartment lid release lever
A	Engine compartment lid closed and locked	Not actuated
B	Preliminary detent	Applied
C	Striker in retaining hook position	Applied and released again
D	Engine compartment lid completely unlocked	Applied, released and applied again

If the engine compartment lid is not completely locked, a Check Control message is displayed while the engine is running.

3.3. Tailgate

The tailgate opens automatically when it is actuated via the remote key or the ID transmitter or the button on the tailgate. Depending on the vehicle equipment it can also be actuated with the tailgate pushbutton on the A-pillar or contactless by means of targeted foot movement.

F30 tailgate

The single-joint hinges open automatically in the open position with help of two tension springs and a gas spring damping action. The payload is thus not damaged, the hinge brackets run behind the luggage compartment trim panel. An additional cover ensures a high-quality visible impression and conceals the wiring harness installation arrangement.

The contactless rear lid opening is installed in vehicles with optional equipment "Comfort Access including Smart Opener" (option 322). It is an additional operating element for the tailgate for the customer. The operation is effected by means of targeted foot movement to and back from the bumper. Two sensors identify the movement via a capacitive measurement in a contactless manner.

Further information on the contactless rear lid opening can be found in the training manual "F30 General Vehicle Electrical System".

4. Exterior Equipment

4.1. Front end

The front end of the F30 can be removed completely. It consists of the bumper, the bumper support, the ornamental grille, the lights and trim panels, among others.

It is imperative that the repair instructions are followed when removing and refitting the front end.

F30 Bumper support

The bumper support of the F30 is made from aluminium thus saving on weight compared to a steel version.

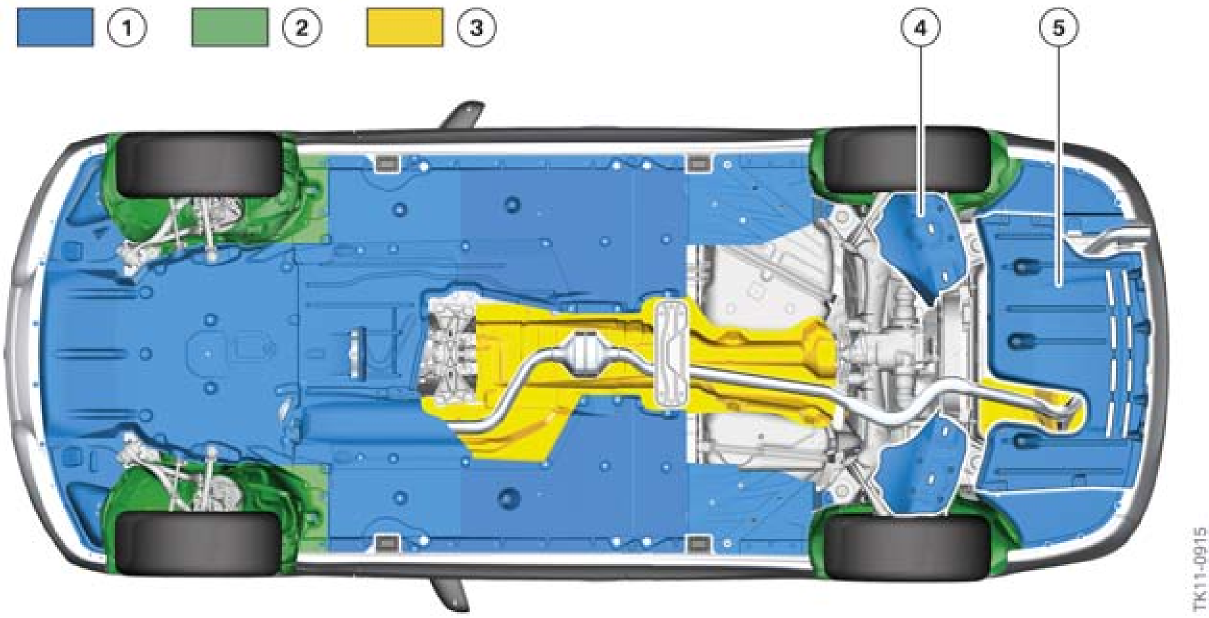
4.2. Underfloor concept

The virtually smooth underbody throughout reduces drag and lift forces. This improves driving dynamics, reduces fuel consumption and thereby reduces CO_2 emissions.

Strategically placed air inlets provide for optimum component cooling. The underbody panelling also improve the acoustics and protect the lines and other components against stone chipping and dirt contamination. In this way, body and components are protected against corrosion.

The aerodynamic covers on the rear axle are new in the F30. These features reduce the rear axle lift, improve the drag and provide protection against stone chipping.

F30 Introduction
4. Exterior Equipment



F30 Underbody panelling

Index	Explanation
1	Underbody panelling
2	Wheel arch panel
3	Heat insulation
4	Aerodynamic cover on the rear axle
5	Diffuser cover (for vehicles with N47 engine) (not US)

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Changes and damage to the underbody or omitting trim panel components leads to changes in the air flow at the underbody. This can influence road grip.

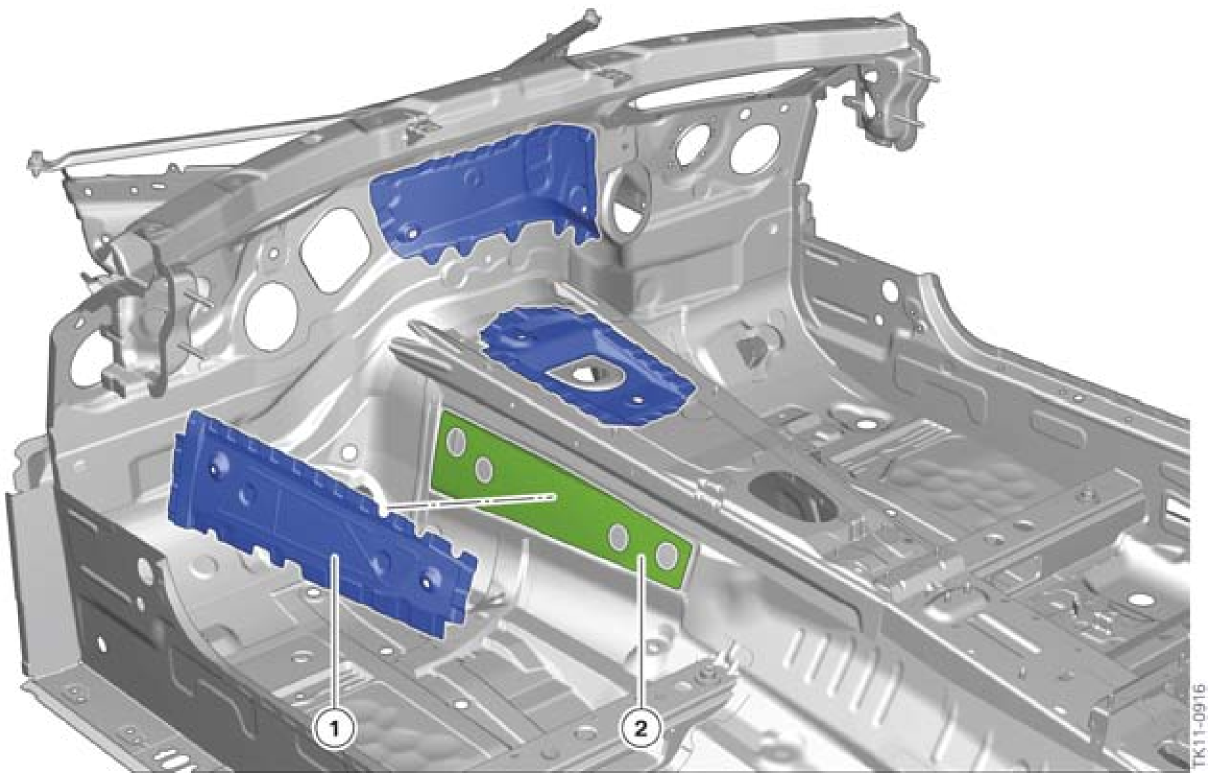
4.3. Sound insulation

Sound insulation has a major impact on passenger compartment acoustics. A heightened use of weight is usually required to achieve a high insulating effect against the noises radiated by the drivetrain components.

In order to keep this increase in weight as low as possible, a new and efficient sound insulation concept is used in the F30 in the area of the transmission tunnel and the bulkhead. This combines high sheet area stiffness with high damping action and simultaneously high fundamental damping.

Here sandwich sheets are specifically connected to each other by means of damping compound.

4. Exterior Equipment



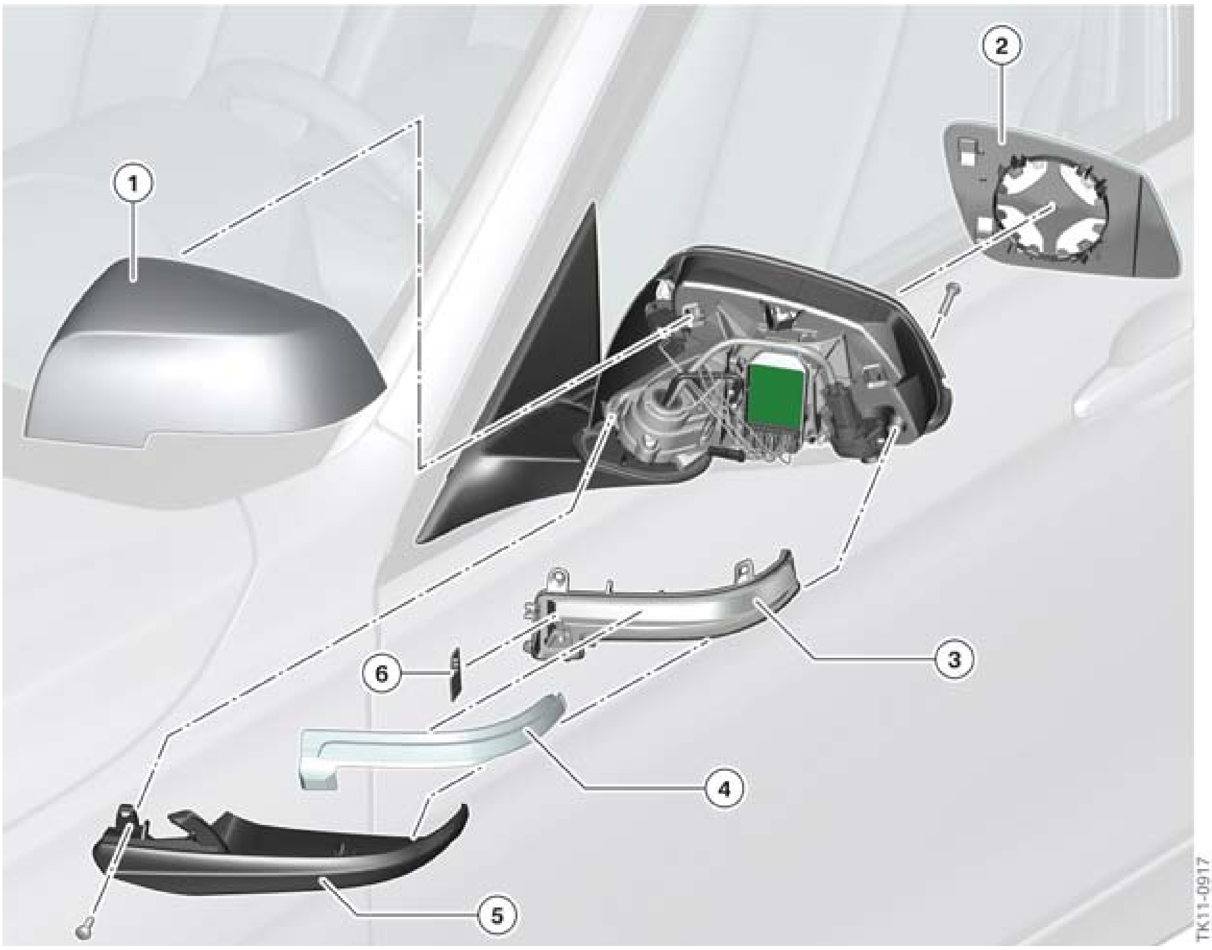
F30 sound insulation concept

Index	Explanation
1	Steel sheet
2	Damping compound

4.4. Attachments

4.4.1. Exterior mirrors

The side repeaters required by law which are now integrated for the first time by BMW in the F30 in the exterior mirrors. They increase road safety. The side repeaters are now omitted from the side panels.



F30 exterior mirror

Index	Explanation
1	Mirror cap
2	Mirror glass
3	Flasher housing
4	Fiber-optic conductor
5	Mirror housing
6	LED module

The side repeaters are each operated with three LEDs and one Fiber-optic conductor. This improves visibility to other road users.

4.4.2. Side sills

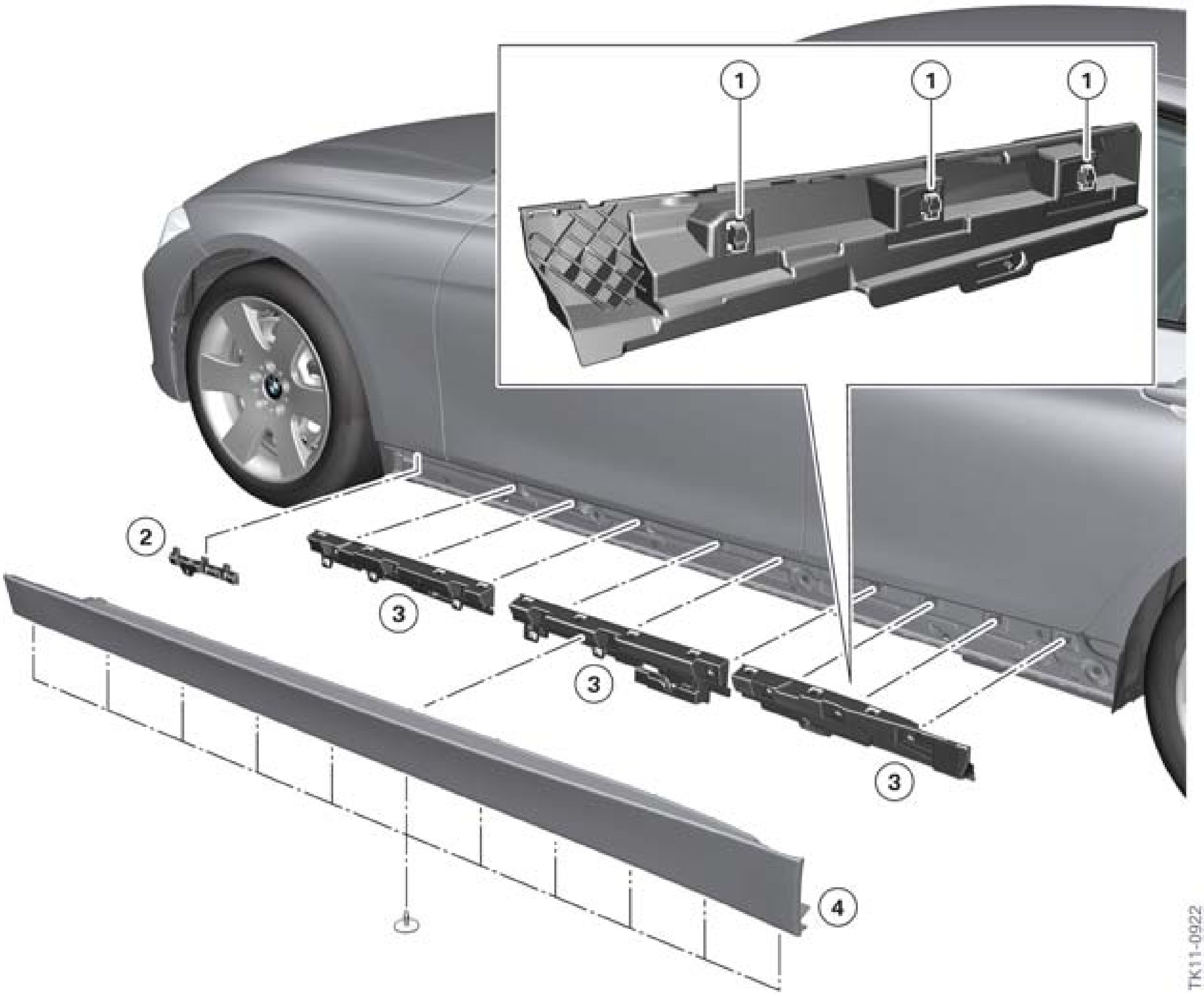
The two side sills of the F30 are screwed to the underbody and inserted at the top into four retaining strips in each case.

The front retaining strips are attached from below to either side panel.

4. Exterior Equipment

The remaining retaining strips are secured with dovetail guides to the outer side frames. To remove them, they must be slid towards the rear and then removed.

Additional retaining elements are no longer needed.

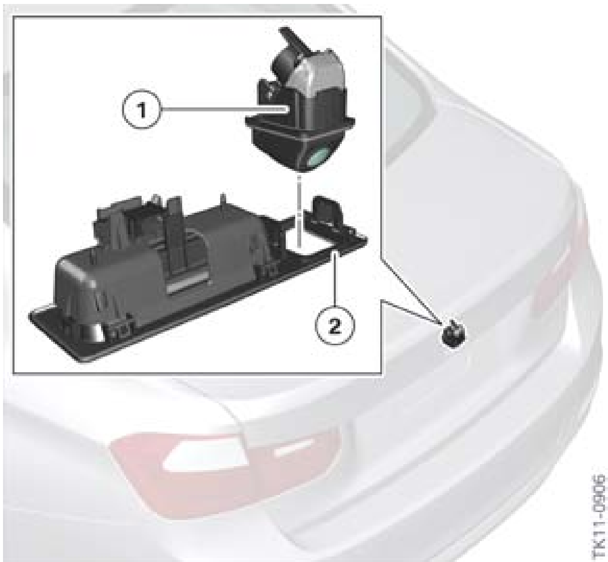


F30 side sill

Index	Explanation
1	Dovetail guide
2	Retaining strip, front
3	Retaining strip
4	Side sills

4.4.3. Reversing camera

In the F30 a reversing camera (option 3AG) can be ordered. The reversing camera is fitted with a holder and is hardly visible beside the tailgate push-button.



F30 reversing camera

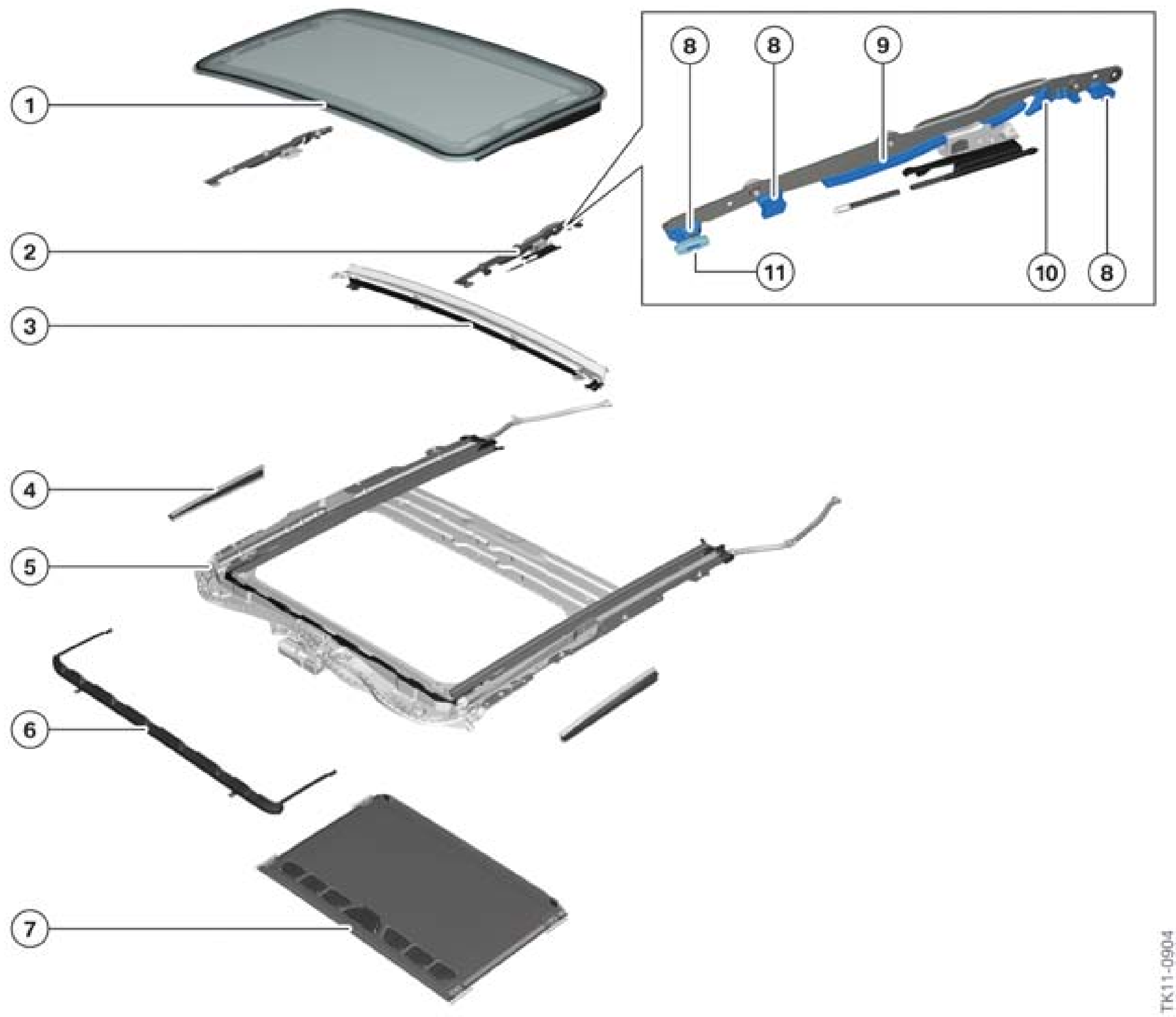
Index	Explanation
1	Reversing camera
2	Tailgate push-button

For further information on the reversing camera, please refer to the "F30 Driver Assistance Systems" production information.

4.5. Glass slide/tilt sunroof

The glass slide/tilt sunroof of the F30 is characterized by optimum sound insulation when closed. The sliding head liner can be operated by hand. Convenience operation consists of vent position and opening and closing of the glass slide/tilt sunroof cover.

The glass slide/tilt sunroof is equipped with an integrated anti-trap mechanism.



F30 glass slide/tilt sunroof

Index	Explanation
1	Glass slide/tilt sunroof cover
2	Slide/tilt sunroof mechanism
3	Water channel
4	Gaiter
5	Slide/tilt sunroof frame with slide/tilt sunroof drive
6	Wind deflector
7	Sliding head liner

Index	Explanation
8	Slider
9	Gate, front
10	Gate, rear
11	Guide

5. Interior Equipment

5.1. Dimensions

Above all, the headroom and legroom in the rear passenger compartment have been increased in the F30.

		F30*	E90
Shoulder room, front	[mm]	1400	1408
Shoulder room, rear	[mm]	1400	1399
Elbow room, front	[mm]	1451	1460
Elbow room, rear	[mm]	1458	1454
Maximum headroom, front - without glass slide/tilt sunroof	[mm]	1023	978
Maximum headroom, front - with glass slide/tilt sunroof	[mm]	992	949
Maximum headroom, rear - without glass slide/tilt sunroof	[mm]	957	953
Maximum headroom, rear - with glass slide/tilt sunroof	[mm]	950	942
Front footwell	[mm]	1068	1054
Rear footwell	[mm]	892	881
Luggage compartment volume	[liters]	480	460[1]

[1] BMW 335i: 450 liters.

To improve the entrance in the rear passenger compartment, the following changes have been made in comparison to the E90:

- the door opening angle of the rear doors has been increased 5.5° to 70°
- the entrance height to the roof edge has been increased by approx. 10 mm
- the B-pillar trim panels have been flattened
- the outer contours of the seat bench have been flatted at the side and rounded at the front
- the width of the door sill has been reduced by 14 mm
- the foot entry freedom between B-pillar and heel panel has been increased 18 mm
- the seat distance between front and rear has been increased 16 mm.

5.2. Material and color concept

In addition to the comprehensive offering of optional equipment, the F30 can also be individualized with the following equipment packages:

- BMW Sport Line (ZSL)
- BMW Modern Line (ZML)
- BMW Luxury Line (ZLL).

The equipment packages contain both general optional equipment and line-specific features.

F30 Introduction

5. Interior Equipment

The content of the equipment packages is partly binding. Individual elements cannot be deselected, creating an excellent price/performance ratio.

F30 Lines, exterior

5. Interior Equipment

F30 Lines, interior

F30 Introduction

5. Interior Equipment

5.2.1. Line package content

Sport Line	Luxury Line	Modern Line
Option 2A5 18" light alloy wheels Double spoke 397	Option 2H2 18" light alloy wheels Multi spoke 416	Option 2P5 18" light alloy wheels Turbine 415
Sports leather steering wheel	Sports leather steering wheel	Sports leather steering wheel
Black Leatherette, or Leather grey/black or red/black or black/red	Black Leather, Beige or Brown	Leather Dakota (oyster/oyster or anthracite/black)
Black high-gloss interior trim finishers with coral red accentuation strip, matt	Fine-wood trim "Fineline" anthracite with accentuation trim in pearl-effect chrome	Interior trim finishers "Pearl" with accentuation trim in pearl-effect chrome
Sports seats for driver and front passenger	Standard	Standard

Scope controlled by package

Sport Line	Luxury Line	Modern Line
Front and rear bumpers, air inlets in Lines-specific design in black high-gloss	Front and rear bumpers, air inlets in Lines-specific design in chrome	Front and rear bumpers, air inlets in Lines-specific design in matt chrome
Exclusively designed radiator grille in black high-gloss	Exclusively designed radiator grille in chrome	Exclusively designed radiator grille in matt chrome
Tailpipe design in black chrome	Tailpipe design in chrome	Tailpipe design in matt chrome
B-pillar in black high-gloss	B-pillar in black high-gloss	B-pillar in black high-gloss
“Sport” lettering	"Luxury" lettering	"Modern" lettering
Sill trim "BMW Sport"	Sill trim "BMW Luxury"	Sill trim "BMW Modern"
Exclusive red trim seams for steering wheel and seats	Enhanced interior color nut brown (only in connection with exclusive nut brown leather)	Sports steering wheel and mounting in exclusive light color
Ambient lighting including ColorSwitch	Ambient lighting including ColorSwitch	Ambient lighting including ColorSwitch
Chrome frame for A/C and radio control panel	Chrome frame for A/C and radio control panel	Chrome frame for A/C and radio control panel
Key in “Sport” design	Key in "Luxury" design	Key in "Modern" design
Instrument cluster with sporty design elements	Chrome link in the center console	Instrument cluster with exclusive design elements
Mirror caps available in plain black, solid paint (option 3BE)	Side window graphic in chrome	

5.3. Dashboard

The upper part of the dashboard is black in the basic version and for the BMW Modern Line (PA 7S1) dark oyster. The surface is coated with a PUR spray (PUR = polyurethane) and has a F30-specific grain.

A different Central Information Display (CID) is installed, depending on the vehicle equipment specification:

- CID with 6.5" screen in the basic version
- CID with 8.8" screen diagonal for Professional navigation system (option 609).

For vehicles with basic equipment a black high-gloss link is installed around the CID.

F30 CID with 6.5" screen diagonal

In vehicles with Professional navigation system (option 609) a CID with anti-reflecting laminated safety glass is used. The glass cover stretches to the edge of the CID.

F30 CID with 8.8" screen diagonal

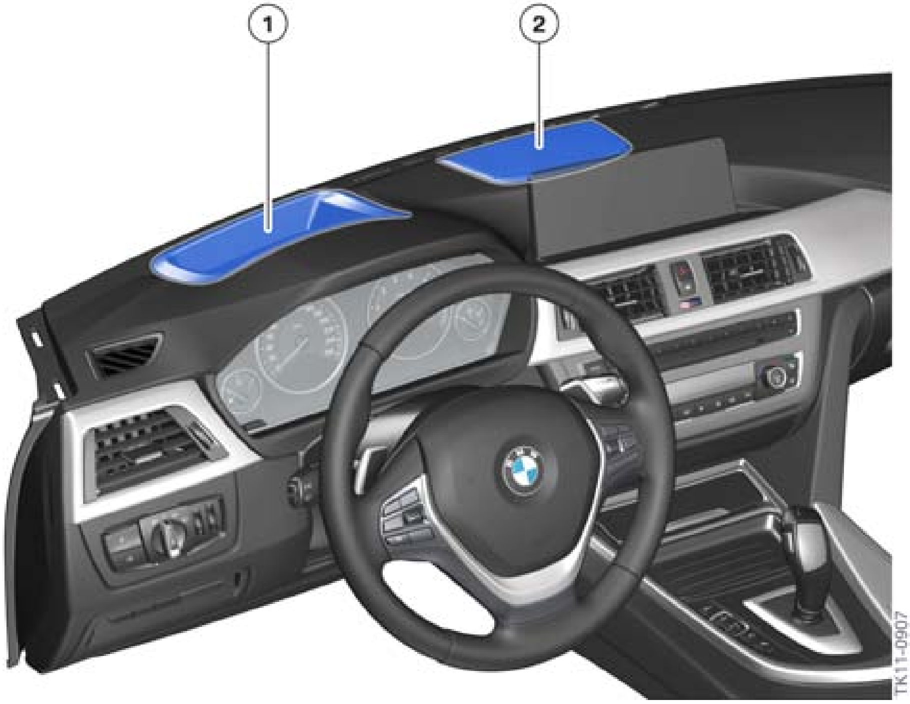
For further information on the Central Information Display (CID), please refer to the “F30 Displays and Controls” product training manual.

In vehicles with then standard HiFi loudspeaker system there is a mid-range speaker on the top side of the dashboard; in vehicles with the optional Harman Kardon Surround Sound system (option 688) there is a mid-range and tweeter on the top side of the dashboard.

Further information on the speaker systems can be found in the product information "F30 Information and Communication".

For the first time in the 3-Series a BMW Head-Up Display (option 610) can be ordered.

Further information on the Head-Up Display can be found in the product information "F30 Displays and Controls".



F30 dashboard

Index	Explanation
1	BMW Head-Up Display (option 610)
2	Cover for mid-range speaker/tweeter (for HiFi loudspeaker system or for Harman Kardon Surround Sound system, option 688)

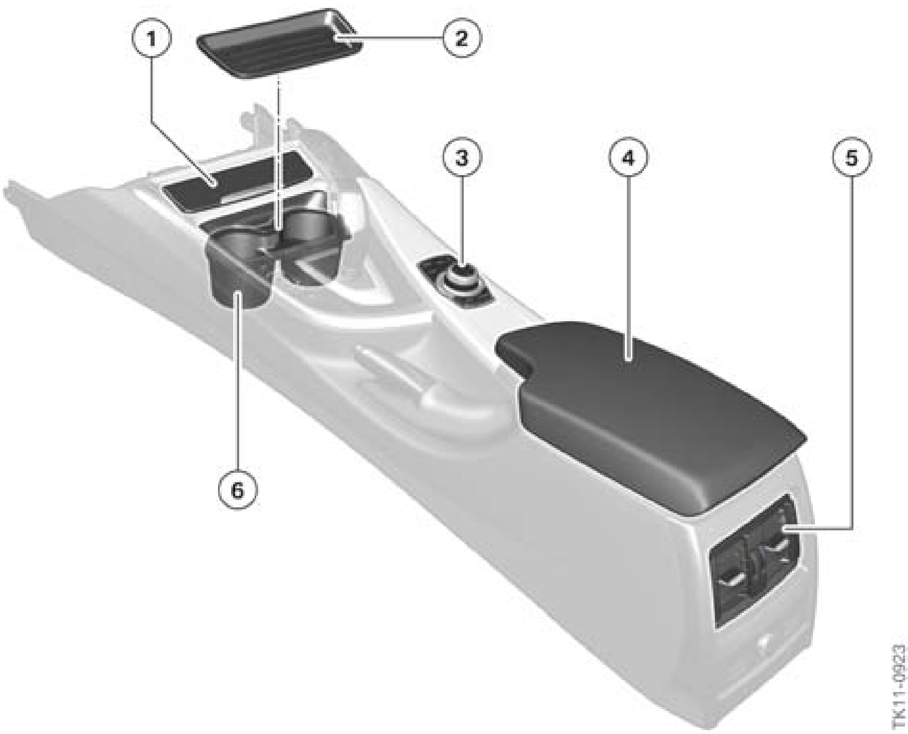
The lower section of the dashboard is available in black, Veneto beige, oyster or nut brown. The surface is coated with a PUR spray (PUR = polyurethane) and has a F30-specific grain. The die-cast panelling is covered with comfort paint, thus improving the optic and haptic elements.

With corresponding vehicle equipment the control box for the assist systems is located under the light switch or for vehicles with a storage compartment package (option 493) an additional storage compartment.

5.4. Center console

The center console is available in the colors black, Veneto beige or oyster.

5. Interior Equipment



F30 center console

Index	Explanation
1	Oddments tray and connector or ashtray and cigarette lighter
2	Removable storage tray
3	Controller
4	Front armrest
5	Rear air outlet
6	Cup holder

The controller is ergonomically embedded next to the gearshift in the decor. Two different controllers are fitted depending on the vehicle equipment:

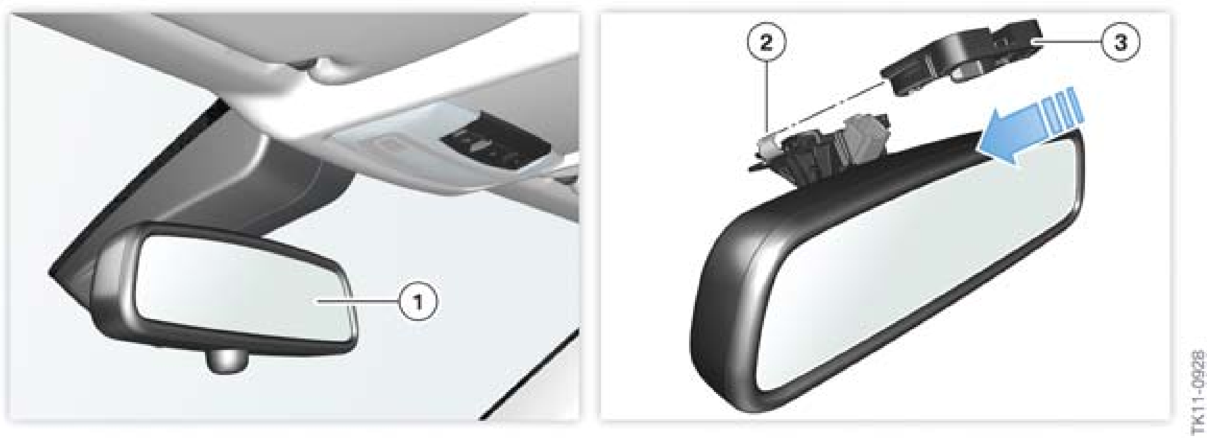
- Controller with 5 buttons (basic)
- Controller with 7 buttons Professional navigation system (option 609).

With the optional equipment light package (option 563) the front oddments tray and the storage compartment under the front armrest are illuminated.

There is a storage tray on the back of the center console or the rear air outlet for IHKA 2/1 zones.

5.5. Inside mirror

In the F30 a new inside mirror fitting is installed. To remove the inside mirror, the mirror base cover must be removed, the plug connection disconnected and then the inside mirror with mirror base and retaining spring pulled down from the guide.



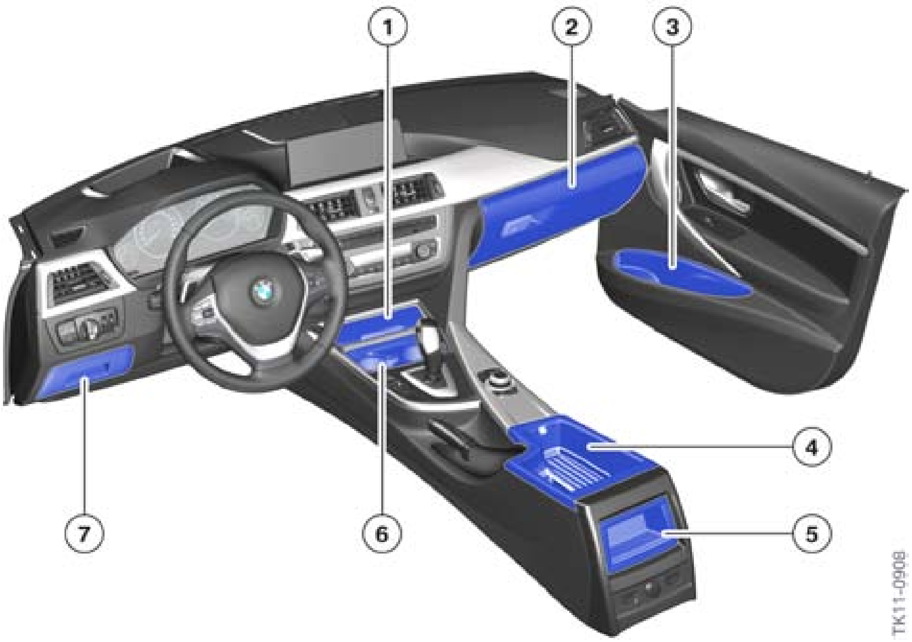
F30 inside mirror

Index	Explanation
1	Inside mirror
2	Retaining spring
3	Guide

5.6. Storage options

The F30 features the following storage options.

5. Interior Equipment



F30 storage options

Index	Explanation
1	Oddments tray
2	Glove box
3	Door pocket
4	Storage compartment, center console
5	Storage tray (not US)
6	Cup holder (with removable storage tray)
7	Storage compartment

A 1-litre bottle can be easily stowed in the front door pockets.

5.7. Front seats

The following front seat variants can be chosen for the F30:

- Basic seat, electrical; driver's seat with memory
- Sports seat, electrical; driver's seat with memory (option 481).

F30 front seat

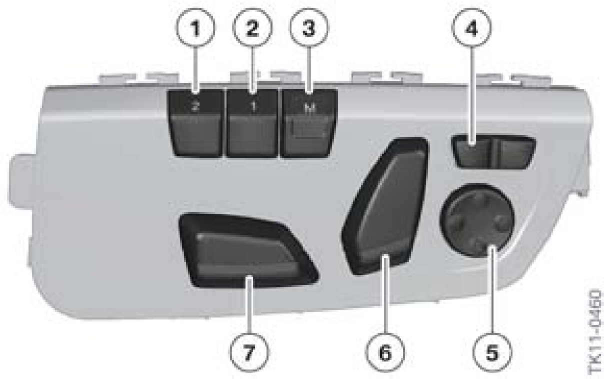
The inclination of the head restraints can be set in three different positions in the F30.

5. Interior Equipment

F30 maximum seat adjustment

Index	Explanation
1	Head restraint angle adjustment
2	Head restraint height adjustment
3	Backrest angle adjustment
4	Backrest width adjustment
5	Forward/back seat adjustment
6	Seat height adjustment
7	Seat angle adjustment
8	Seat depth adjustment
9	Lumbar support adjustment

The seat adjustment options may vary depending on the vehicle equipment.



F30 switch block, driver's seat adjustment

Index	Explanation
1	Button 2 (calls up stored position)
2	Button 1 (calls up stored position)
3	Button M (stores current position)
4	Backrest width adjustment
5	Lumbar support adjustment
6	Backrest angle adjustment
7	Forward / back, seat height and seat angle adjustment

5.8. Rear seats

A through-loading system (option 465) with a separate folding center part can be ordered as optional equipment. The backrest is divided in the ratio 40-20-40. The individual sections can be folded to the front as shown in the following diagrams:

F30 through-loading system

5.9. Climate control

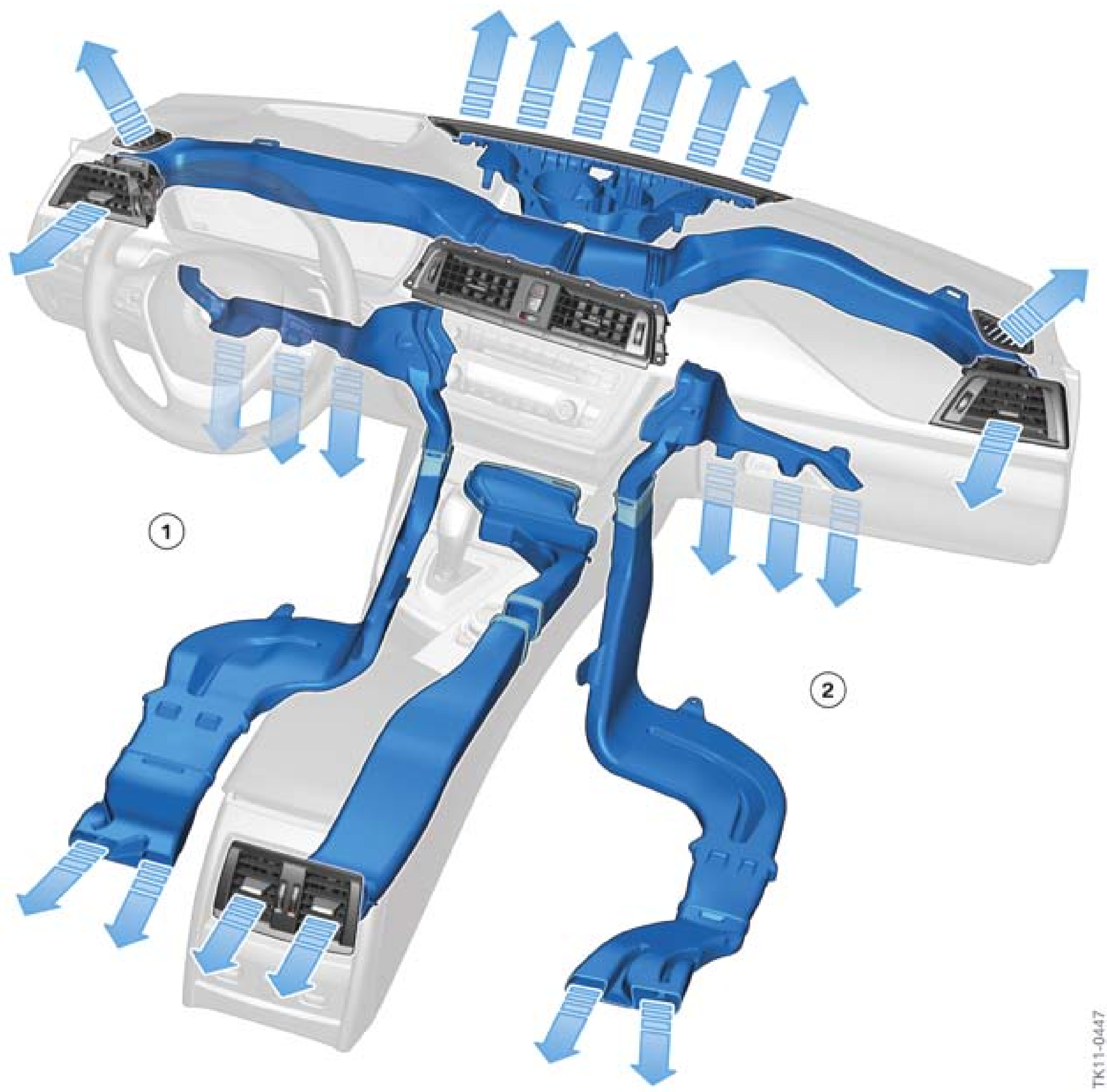
One climate control variant is available for the F30:

- Integrated automatic heating / air conditioning (IHKA), 2/1-zone.

In the zone specification the first number denotes the number of controllable temperature zones (temperature selector wheels) and the second number the number of controllable airflow volume and air distribution zones (separate fan settings).

In the F30 the IHKA control unit is separate from the IHKA controls and is located on the heating and air-conditioning unit.

For further information on the heating and air-conditioning systems, please refer to the "F30 General Vehicle Electrics" product information.



F30 air ducts integrated automatic heating / air-conditioning system IHKA 2/1 zones

Index	Explanation
1	Driver zone
2	Front passenger zone

F30 Introduction
6. Luggage Compartment

Special features

- Luggage compartment floor with flowing transition to the side trim panel
- Luggage compartment floor stop in raised position
- Level side faces with maximum use of space
- Large, depth storage tray on the left
- Cover for toolkit and battery, right
- Tie-down by four lashing eyes
- Enlarged luggage compartment (480 liters)
- Bigger loading opening in both width and height.

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Technical training.
Product information.

F30 Powertrain

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1113 6/1/2012

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Powertrain

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F30 Powertrain
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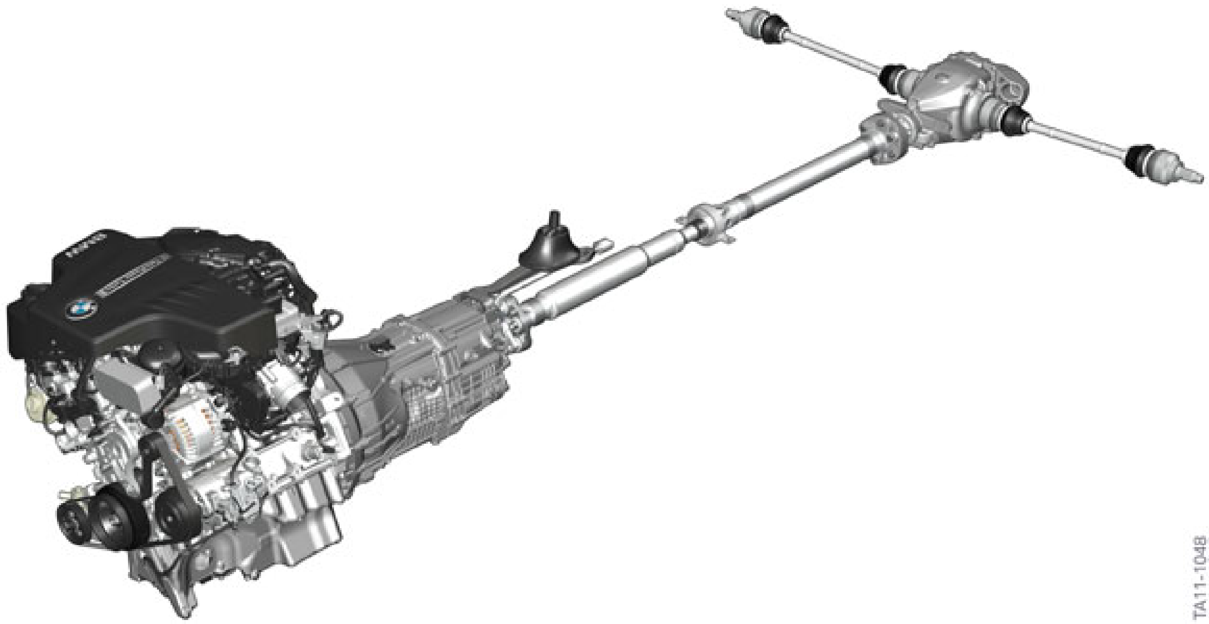
F30 Powertrain

1. Powertrain Variants



F30 powertrain

1.1. Models

The F30 will be launched onto the market in February 2012 in the following models:

- BMW 328i
- BMW 335i

1.1.1. Gasoline engines

		BMW 328i	BMW 335i
Engine		N20B20O0	N55B30M0
Power output	[kW (HP)]	180 (240)	225 (300)
Torque	[Nm (ft lbs)]	350 (255)	407 (300)
Automatic transmission		GA8HP45Z	GA8HP45Z
Manual gearbox		GS6-17BG	GS6-45BZ
Rear axle differential		HAG 188LW	HAG 215LW[1] HAG 188LW[2]

[1] with manual gearbox.

[2] with automatic transmission.

F30 Powertrain

2. Engines

2.1. N20 Engine

The N20 engine is the new generation of the 4-cylinder gasoline engines at BMW and was installed for the first time in the E84. It is gradually replacing both the 4-cylinder engines N46 and N43, as well as the 6-cylinder naturally aspirated engines N52 and N53. The latest technology has been used for the N20 engine such as Turbo-Valvetronic direct injection (TVDI) in connection with a twin-scroll exhaust turbocharger for example.

Special features

- Combination of TwinPower Turbo, direct fuel injection (DI) and Valvetronic
- Reduction of fuel consumption by 15% compared to the N52 engine
- Reduction of the engine weight by 22 kg compared to the N52 engine
- All-wheel drive capability
- Exhaust emission standards
- Global use thanks to homogeneous mixture preparation.

2.1.1. New features/changes

Engine mechanics

- Aluminium crankcase with LDS-coated cylinder barrels
  (The electric arc spraying is a powerful wire spraying for the manufacture of coatings for which electrically conducted materials are sprayed.)
- Friction-optimized crankshaft drive
- Optimized cooling jacket
- Turbo-Valvetronic direct injection (TVDI)
- Twin-scroll exhaust turbocharger
- 3rd generation Valvetronic with new intermediate levers
- New variable camshaft timing control (VANOS) with central valve
- Camshafts (all the components are shrink-fitted onto the shaft pipe)
- Two-part crankcase ventilation
- Forged crankshaft
- Crosswise crankshaft drive (offset of crankshaft axle to cylinder mid level)
- Piston with negative axial offset (offset of piston pin axle from the cylinder mid level)
- Chain drive for counterbalance shafts with chain tensioner
- Counterbalance shafts arranged on top of one another.

F30 Powertrain
2. Engines

Oil supply

- Map-controlled oil pump
- New pendulum-slide oil pump
- Raw oil cooling (engine oil/coolant heat exchanger in oil circuit before oil filter)
- New combined oil pressure and temperature sensor.

Air intake and exhaust emission systems

- Twin-scroll exhaust turbocharger
- Hot film air mass meter 7 in all engine versions
- Three connections for crankcase ventilation
- Different number of connections for tank ventilation (depending on the variant)
- Air-gap-insulated exhaust manifold, six into two
- Upstream catalytic converter.

Vacuum system

- Two-stage vacuum pump
- Vacuum reservoir for the wastegate valve permanently connected to the engine cover.

Fuel preparation/supply

- Direct fuel injection with central injector position and up to 200 bar fuel injection pressure
- Solenoid valve injectors
- Bosch high-pressure pump
- High-pressure lines to the injectors soldered to the rail
- No low fuel-pressure sensor
- Three different tank ventilation variants.

Cooling

- Electric coolant pump
- Established heat management.

Engine electrical system

- Bosch MEVD 17.2.4 engine control unit

For more information please refer to the "N20 Engine" Training Information ST1111

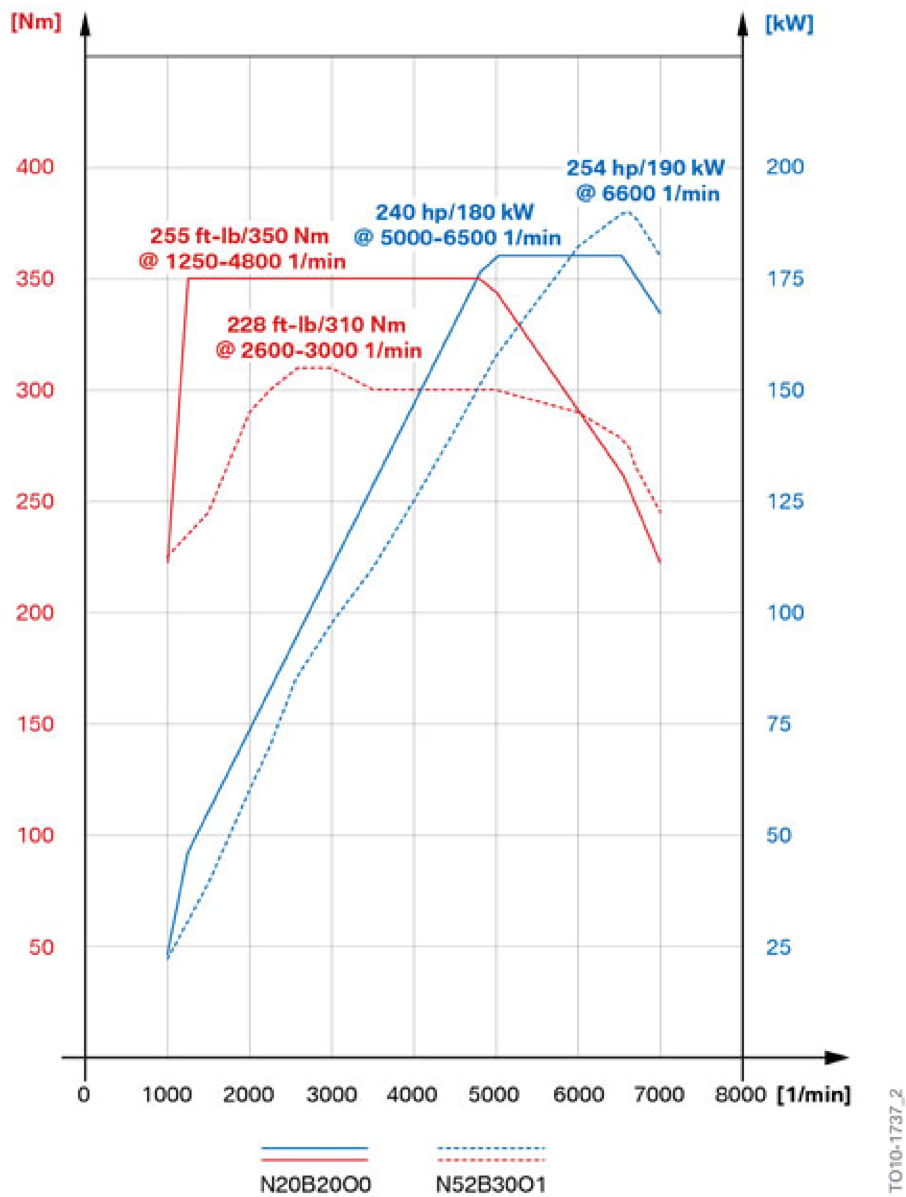
2.1.2. Technical data

		N20B20O0 F30, 328i US version
Design		R4
Valves per cylinder		4
Engine control		MEVD 17.2.4
Displacement	[cm^3]	1997
Stroke/bore	[mm]	90.1/84.0
Power output at speed	[kW (HP)] [rpm]	180 kW (240) 5000 – 6000
Torque at speed	[Nm (ft lbs)] [rpm]	350 Nm (255) 1250 – 4800[1]
Compression ratio	[ε]	10.0 : 1
Fuel grade		RON 91 – 98
Exhaust emission standards		Ultra Low Emission Vehicle (ULEV) II
Fuel consumption (manual/automatic transmission)	[l/100 km]	---
Acceleration 0 – 100 km/h (manual/automatic transmission)	[s]	6.2/6.4

[1] for automatic transmission: 1500 – 4800 rpm

[2] values were still not available at editorial deadline.

2.1.3. Full load diagram



Full load diagram F30, 328i with N20B20O0 engine in comparison to the N52B30O1 engine

2.2. N55 engine

The N55 engine is the successor to the N54 engine and is already in use in numerous BMW models, for example in the F07, F10 and F25. Technical updates and modifications make it possible to use only one exhaust turbocharger. The technical data have remained virtually the same - with reduced costs and improved quality.

2.2.1. New features/changes

Engine mechanics

- Crankcase adapted for twin-scroll exhaust turbocharger
- Cylinder bore changed to 84 mm
- Large longitudinal ventilation bore holes in the crankcase
- Modified oil supply of vacuum pump
- Water duct for injector cooling integrated in the cylinder head
- Crankcase ventilation and blow-by pipe integrated in the cylinder head cover
- Asymmetrical counterweight arrangement of crankshaft and weight reduction
- Profiled bore hole in small connecting rod eye
- Unleaded connecting rod bearing shells.

Valve gear

- Variable camshaft timing control (VANOS)
  - Solenoid valves with integrated non-return valve and 3 strainers
  - Increased adjustment speed and reduced susceptibility to dirt
- Valvetronic VTC
  - Integrated in the cylinder head and revised
  - Brushless servomotor, 3rd generation
  - Position identifier for eccentric shaft integrated in the servomotor.

Belt drive

- Belt drive and vibration absorber newly developed.

Oil supply

- Intake pipe, oil deflector and oil collector integrated in one component
- Oil pump with thermoset slide and map control
- Modified oil filter housing.

Air intake and exhaust emission systems

- Twin-scroll exhaust turbocharger with wastegate valve and electrical blow-off valve
- Air-gap-insulated exhaust manifold, six into two
- Upstream catalytic converter
- Discontinuation of underbody catalytic converter.

Vacuum system

- Revised, similar to N63 engine.

Fuel preparation

- Direct fuel injection with central injector position and up to 200 bar fuel injection pressure
- Solenoid valve injectors.

Cooling

- Coolant channels revised for exhaust turbocharger.

Engine electrical system

- Crankshaft sensor integrated for automatic engine start-stop function
- Engine-related Digital Engine Electronics DME (MEVD 17.2.6) secured to air intake system and cooled using intake air, FlexRay-compatible
- Improved signal quality and temperature resistance of the hot-film air-mass meter HFM
- Adoption of oxygen sensor before catalytic converter from the N63 engine
- New oil pressure sensor for absolute pressure measurement
- Oil temperature sensor screwed into main oil duct
- Ignition coils with higher ignition voltage and improvement of the electromagnetic compatibility
- Spark plugs analogous to N63 engine
- Solenoid valve injectors.

For more information please refer to the "N55 Engine"training material ST916.

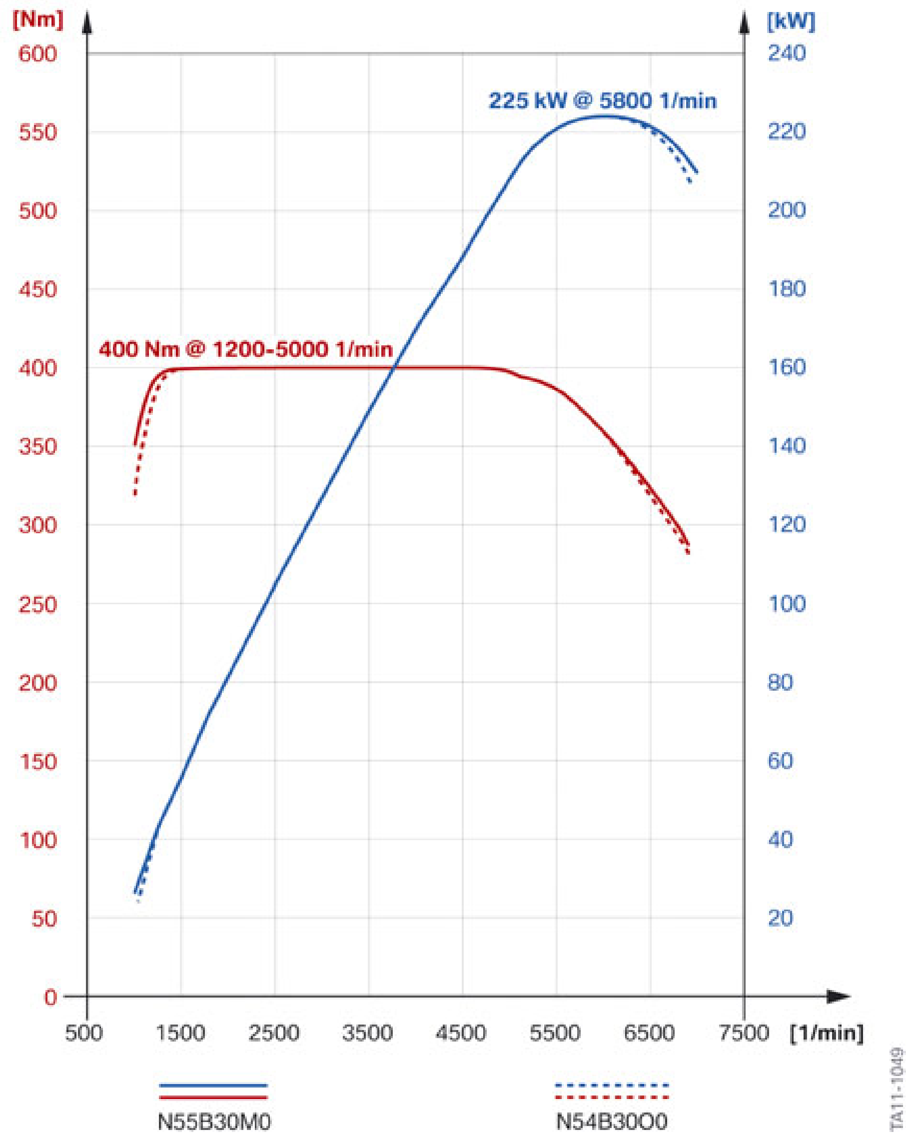
2.2.2. Technical data

		N55B30M0 **F30, 335i US version**
Design		R6
Valves per cylinder		4
Engine control		MEVD 17.2
Displacement	[cm^3]	2979
Stroke/bore	[mm]	89.6/84.0
Power output at speed	[kW (HP)] [rpm]	225 (300) 5800
Torque at speed	[Nm (ft-lbs)] [rpm]	400 (300) 1300 – 5000

		N55B30M0 F30, 335i US version
Compression ratio	[ε]	10.2 : 1
Fuel grade		RON 91 – 98
Exhaust emission standards		Ultra Low Emission Vehicle (ULEV) II
Fuel consumption (manual/automatic transmission)	[l/100 km]	---
Acceleration 0 – 100 km/h (manual/automatic transmission)	[s]	5.7/5.7

2.2.3. Full load diagram

When compared with its predecessor, the N55 engine is characterized by lower fuel consumption with identical power and torque data.



Full load diagram F30, 335i with N55B30M0 engine in comparison to the N54B30O0 engine

2.3. Engine oil level check

The F30 has an engine oil level check. Only the following messages can be displayed while the vehicle is being driven:

- Engine oil level OK
- Engine oil at minimum. Top up with 1 liter engine oil.
- Engine oil level below minimum. Top up with 1 liter of oil.

2.3.1. Detailed measurement

Prerequisites:

- Vehicle standing on a level road with the engine running at normal at operating temperature
- Manual gearbox: gearshift lever in neutral, clutch and accelerator pedals not pressed
- Automatic transmission: selector lever in position N or P and accelerator pedal not pressed.

Measurement must be started from the Vehicle Information menu and takes roughly one minute, in the course of which the idle speed is automatically increased slightly. The engine oil level is then indicated on a scale.

2.4. Engine identification

2.4.1. Engine designation

In the technical documentation, the engine designation is used to ensure unambiguous identification of the engine. However, an abbreviated engine designation (e.g. N20) is often used which only allows the engine type classification.

Position	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW M Sport BMW M GmbH Bought-in engines
2	Engine type	1 2 4 5 6 7 8	4-cylinder in-line engine (e.g. N12) 4-cylinder in-line engine (e.g. N20) 4-cylinder in-line engine (e.g. N43) 6-cylinder in-line engine (e.g. N53) V8 engine (e.g. N63) V12 engine (e.g. N73) V10 engine (e.g. S85)
3	Change to the basic engine concept	0 1 – 9	Basic engine Changes, e.g. combustion process
4	Working method or fuel type and possibly installation position	B D H	gasoline, longitudinally mounted Diesel, longitudinally mounted Hydrogen

Posi-tion	Meaning	Index	Explanation
5 6	Capacity in liters Displacement in 1/10 liter	1 8	1 liters 0.8 liters equals 1.8 liters
7	Performance class	K U M O T S	Lowest Lower Middle Upper (standard) Top Super
8	Revision relevant to approval	0 1 – 9	New development Redesign

2.4.2. Engine identification

The engines have an identification mark on the crankcase to ensure unambiguous identification and classification. This engine identification is also necessary for approval by government authorities.

With the N55 engine, this identification has been subject to a further development, with the previous eight positions being reduced to seven. The engine number can be found on the engine below the engine identification. This consecutive number, in conjunction with the engine identification, permits unambiguous identification of each individual engine.

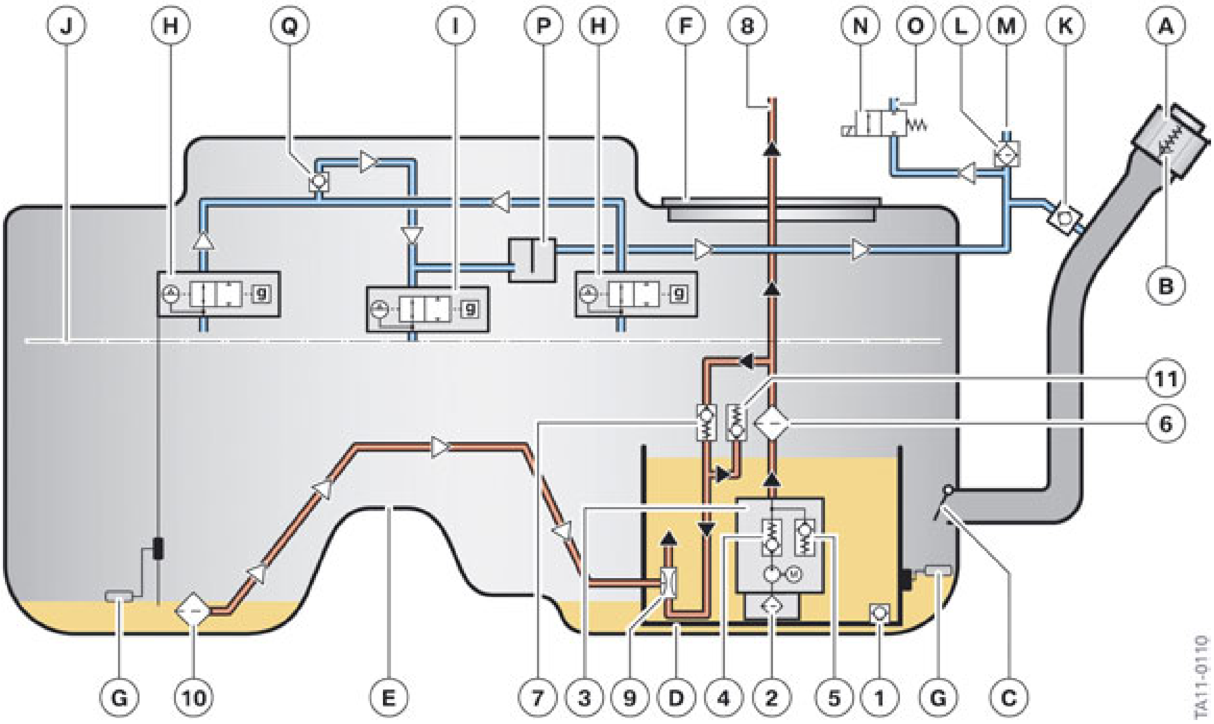
Posi-tion	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW M Sport BMW M GmbH Bought-in engines
2	Engine type	1 2 4 5 6 7 8	4-cylinder in-line engine (e.g. N12) 4-cylinder in-line engine (e.g. N20) 4-cylinder in-line engine (e.g. N43) 6-cylinder in-line engine (e.g. N53) V8 engine (e.g. N63) V12 engine (e.g. N73) V10 engine (e.g. S85)
3	Change to the basic engine concept	0 1 – 9	Basic engine Changes, e.g. combustion process
4	Working method or fuel type and possibly installation position	B D H	gasoline, longitudinally mounted Diesel, longitudinally mounted Hydrogen
5 6	Capacity in liters Displacement in 1/10 liter	1 8	1 liters 0.8 liters equals 1.8 liters
7	Type approval matters (changes which require a new type approval)	A B – Z	Standard as required, e.g. research octane number 87

F30 Powertrain

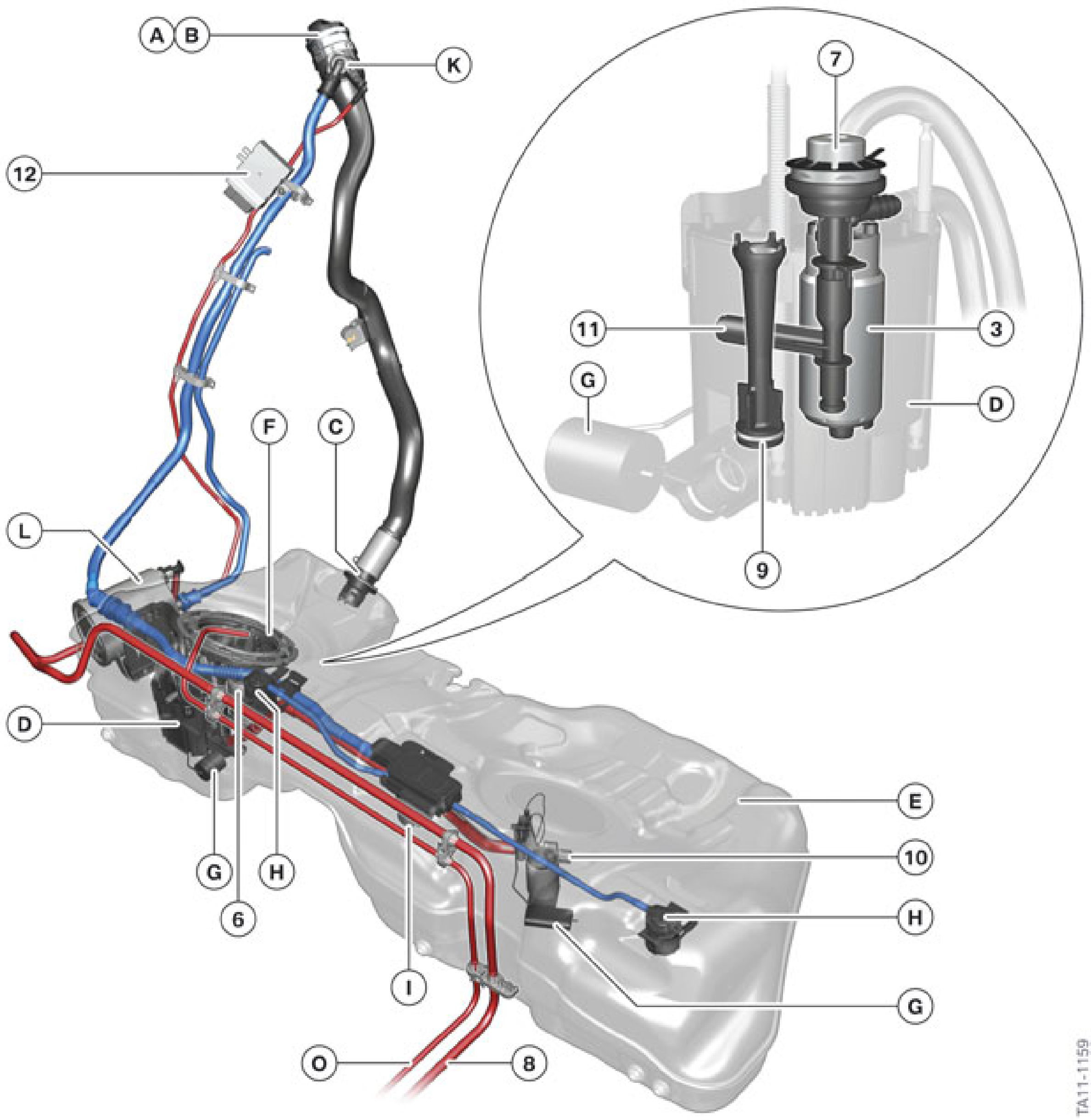
3. Fuel Supply

3.1. Gasoline

3.1.1. System overview



F30 fuel tank for gasoline engine



F30 fuel tank for gasoline engine (European version)

Index	Explanation
A	Fuel filler cap
B	Overpressure protection function (in the fuel filler cap)
C	Non-return valve
D	Surge tank
E	Fuel tank
F	Delivery module
G	Lever sensor

Index	Explanation
H	Service vent valve
I	Refuelling ventilation valve with fuel tank overfill protection facility
J	Maximum fill level (limited by refuelling ventilation valve)
K	Non-return valve (only in US version)
L	Carbon canister
M	Opening to environment
N	Tank vent valve (on engine)
O	Purge air line
P	Liquid trap
Q	Fuel tank overfill protection facility
1	First fill valve and surge tank inlet
2	Suction strainer
3	Electric fuel pump
4	Non-return valve (pressure holding function, delivery pressure)
5	Pressure-limiting valve
6	Fuel filter
7	Pressure regulator
8	Feed line
9	Suction jet pump
10	Intake pipe with coarse filter (suction jet pump transfer)
11	Pressure control valve (for suction jet pump)
12	Electronic fuel pump control EKPS

3.1.2. Fuel delivery

For vehicles with N20 or N55 engine the fuel tank has a volume of 60 liters. It is designed as a saddle tank on account of the installation area in the vehicle. The fuel supply system has a so-called delivery unit and a sensor unit. The delivery unit is accommodated in the right half, and the sensor unit in the left half of the fuel tank. The first fill valve (1) ensures that fuel is introduced into the surge tank during refuelling when the surge tank is completely empty. It also acts as an inlet, in that there is no active filling of the surge tank.

The fuel flows via the suction strainer (2) to the electric fuel pump (3) with non-return valve (4) and pressure limiting valve (5). It flows further via the fuel filter (6) with pressure regulator (7) to the feed line (8). The electric fuel pump sits in the surge tank and is adjusted via the electronic fuel pump control unit EKPS (12). The delivery pressure is configured at 5.8 bar.

The suction jet pump (9) conveys the fuel via an additional line from the left half of the fuel tank to the surge tank. The location of the suction jet pump (9) in the surge tank is new.

When the engine is switched off, the delivery pressure is maintained for a certain amount of time on account of the hot-start response. The feed line cannot run dry, even after the dwell time, because air cannot get in with the system being airtight. The non-return valve (4) prevents the fuel tank from leaking in the event of damage to the lines on the engine or underbody.

3.1.3. Tank ventilation system

An overpressure protection function (B) is integrated in the fuel filler cap (A). The overpressure protection function ensures, in the event of a problem with the tank ventilation system, that any excess pressure that forms can escape and the fuel tank is not damaged. A non-return valve (C) is located at the end of the fuel filler neck. The non-return valve prevents fuel from sloshing back into the fuel filler neck. The non-return valve is closed by a spring so that it is fluid-tight.

The components in the fuel tank are accessible through the service opening on the right, which is an integral part of the delivery module (F).

The fuel level is detected via the two lever sensors (G).

The surge tank (D) ensures that enough fuel is always available to the electric fuel pump (3) for delivery. The surge tank is also an integral part of the delivery module and can thus be changed.

The refuelling ventilation valve with fuel tank overfill protection facility (I) is situated in a high position. The valve closes if the fill level reaches this height during refuelling. The air can no longer escape fast enough from the fuel tank, thereby causing the fuel in the filler pipe to rise and the fuel pump nozzle to cut out.

Ventilation is effected during operation while the refuelling ventilation valve is closed via the service vent valves (H). They have a smaller opening diameter they alone would not allow the air to escape fast enough from the fuel tank during refuelling. The service vent valves are arranged in such a way that ventilation is also possible when the vehicle is at an inclination of 18°.

The integrated fuel tank overfill protection facility is provided by a ball, which closes the vent hole as a result of its own weight. A fuel tank overfill protection facility is necessary to safeguard the compensation volume in the tank. When the refuelling ventilation valve has closed, in order to guarantee the compensating volume maintained in the tank an overpressure is built up in the tank by the integrated fuel tank overfill protection facility. This overpressure causes the fuel level in the fuel filler pipe to rise and thus the fuel pump nozzle to cut out.

During operation the pressure can rise due to the temperature increase. If the pressure in the fuel tank (fill level above the service vent valves) reaches approx. 30 mbar above the ambient pressure, the ball is lifted and the pressure can escape via the liquid trap (P). Entrained fuel is retained in the liquid trap and returned to the tank. In this way, ventilation is possible even when the fuel tank is full without the risk of overfilling.

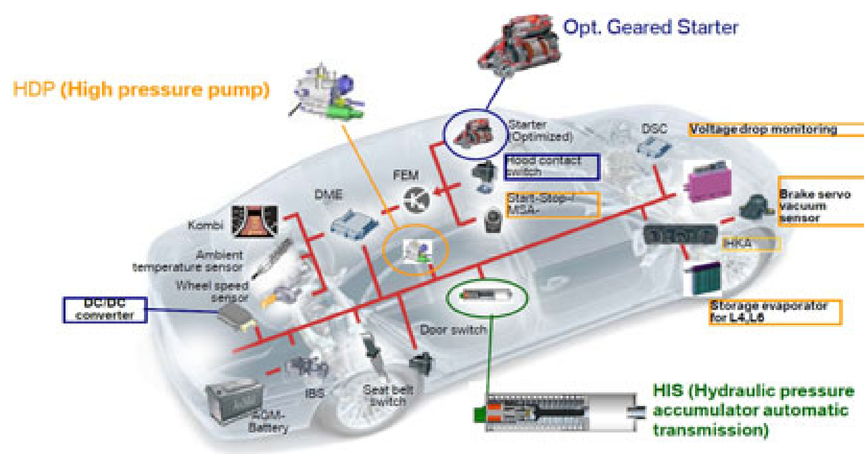
F30 Powertrain

4. Automatic Start/Stop II (MSA II)

The F30 328i (N20), 335i (N55) are available with the MSA II system (as standard equipment) with both the manual and automatic 8 speed transmission.

MSA II system highlights:

- Air conditioning function is enhanced with the cold storage evaporator.
- The hydraulic pressure accumulator allows MSA II to operate with automatic transmissions.
- Driver presence detection via driver's seat belt and driver's door switch.



F30 / N20 AT

MSA II System Components

4.1. System Overview

4.1.1. Automatic start/stop function - Manual transmission

When the car is stopped and the driver engages neutral and releases the clutch pedal, the automatic start/stop function switches the engine off. This means that the vehicle does not use any fuel when it is at a standstill. When the driver depresses the clutch pedal again, the engine is automatically restarted and the driver can continue driving.

4.1.2. Automatic start/stop function - Automatic transmission

The automatic engine start-stop function switches off the engine when the vehicle is brought to a standstill, the selector lever remains in the D position, and the driver depresses the brake pedal to hold the vehicle at a standstill. This means that the car does not use any fuel when it is at a standstill. When the driver releases the brake pedal again, the engine is automatically restarted and the driver can continue driving.

The description that follows therefore deals specifically with the automatic start/stop function in conjunction with the automatic transmission.

4. Automatic Start/Stop II (MSA II)

The engine will NOT automatically turn OFF if:

- Outside temperature below 37.4˚F.
- Outside temperature above 95˚F.
- Vehicle interior is not yet warmed up or cooled down.
- Engine is not yet warmed up.
- Vehicle battery state of charge very low.
- After vehicle was driven in reverse.
- Steering wheel operated after vehicle stopped.
- Stop&Go Traffic.
- GWS selector in Sport/Manual mode.

If MSA is active (ENGINE OFF), the engine will be turned ON automatically if:

- Interior temperature cannot be maintained (cooling and heating).
- Windshield fogging.
- Vehicle battery state of charge drops below a threshold.
- Steering wheel input is detected.
- Change gear lever position from D to N; D to M/S; P to D.
- The accelerator and the brake pedal are pressed at the same time.
- ECO PRO mode activated.

4.1.3. DC/DC converter

The higher frequency of starting operations in vehicles with the automatic start/stop function can lead to voltage dips in the vehicle electrical system. One DC/DC converter is installed in order to protect specific voltage-sensitive components (depending on the vehicle equipment).

The DC/DC converter supplies a constant voltage to the 30B_DC/DC terminals, also during the starting operation.

A DC/DC converter is installed only if the following options are installed:

- Harmon Kardon Surround Sound System (SA 688)
- Navigation system (optional 609)

Note: For a detailed explanation of how the DC/DC converter operates refer to the MSA I section of the ST1112 training material.

4. Automatic Start/Stop II (MSA II)

4.2. Automatic mode

The automatic start/stop function is ready for operation following every engine start.

The function is activated once the vehicle reaches a specific speed:

- Vehicles with manual transmission: > 5 km/h/3 mph.
- Vehicles with automatic transmission: > 9 km/h/5 mph.

The driver presence detection via the seat belt buckle switch and also via the door contact has been introduced as a new feature of MSA II.

When the driver leaves the vehicle, the automatic start/stop function is deactivated, in order to prevent the engine from starting automatically.

The MSA function is always reactivated if:

- the driver's seat belt is fastened and the vehicle is travelling at a speed of > 5 km/h/3 mph
- the driver's door is closed and the vehicle is travelling at a speed of > 5 km/h/3 mph*.

* > 9 km/h/5 mph - vehicles with automatic transmission

The prerequisites for deactivation of the automatic start/stop function vary, depending on which switching mode the seatbelt buckle switch and door contact are in when the automatic start/stop function is activated:

Status during activation of automatic start/stop function	Prerequisites for deactivation of automatic start/stop function
• The driver's seat belt is fastened. • The driver's door is closed.	The driver unfastens the seat belt buckle and opens driver's door.
• The driver's seat belt is **not** fastened. • The driver's door is closed.	The driver opens the driver's door.
• The driver's seat belt is fastened. • The driver's door is opened.	The driver unfastens the seat belt buckle.

The automatic start/stop function is reactivated if:

- the seat belt buckle is fastened and/or the driver's door is closed and the engine has been started
- the seat belt buckle is fastened and/or the driver's door is closed and the vehicle is travelling at a speed of > 5 km/h/3mph*.

* > 9 km/h/5mph - vehicles with automatic transmission

4.2.1. Driving

The purpose of the automatic start/stop function is to switch the engine off when the vehicle is at a standstill. As long as the vehicle is in motion the driver will not be aware of the automatic start/stop function.

Index	Explanation
1	Vehicle moving
2	Selector lever in drive position D, driver operates accelerator pedal
3	Engine running, the driving situation is reflected by the engine speed display and fuel consumption display

4.2.2. Stopping

From the driver's point of view, the stopping process with subsequent engine stop is as follows:

Index	Explanation
1	Vehicle slows to a standstill, e.g. at a red light
2	Selector lever remains in the "D" drive position, driver depresses the brake pedal to decelerate and hold the vehicle at a standstill
3	The engine is switched off after roughly 1 second, "0" engine speed will be displayed on the tachometer with the needle reading “Ready”.

4. Automatic Start/Stop II (MSA II)

In the situation depicted above the driver holds the car at a standstill by depressing the brake pedal.

Alternatively, the driver can select selector lever position "P" and release the brake pedal. The engine remains switched off. If then the drive position "D" is subsequently engaged, the engine starts without delay.

4.2.3. Driving off

The driver indicates his intention to drive off by releasing the brake pedal.

If the driver previously held the car at a standstill by depressing the brake pedal, the engine starts as soon as the driver releases the brake pedal.

Index	Explanation
1	Driver wishes to continue the journey (e.g. green light)
2	The selector lever remains in drive position "D", driver releases the brake pedal
3	Engine is started, revolution counter and fuel consumption display revert back to normal to reflect the driving situation

If the driver moves the selector lever into position "P" after the engine was switched off automatically, the engine starts automatically if the selector lever is now moved to position "D".

During this process, the automatic engine start is not activated automatically via a signal from the brake light switch, but by the DSC control unit that monitors the brake pressure.

4.2.4. Establishing start-up readiness

If the driver wants to start the engine but not yet drive off, he can establish start-up readiness by:

- Pressing the brake pedal briefly, applying more force
- Releasing the brake pedal slightly

Both of these actions will prompt the engine to start automatically.

4.2.5. Automatic hold

If the driver has activated the "Automatic Hold" function, he/she can also release the brake pedal once the vehicle has come to a standstill. The automatic start/stop function also switches the engine off in this case. The car is held at a standstill by the DSC hydraulics. The engine only starts if the driver operates the accelerator pedal.

4.2.6. Preventing automatic engine shutdown

In order to be able to drive off quickly, e.g. at a crossing, the automatic engine shutdown can be actively prevented if within one second after the vehicle comes to a standstill the brake pedal is pressed briefly, applying more force than usual, then immediately held with the usual brake pedal force.

Index	Explanation
1	Vehicle slows to a standstill, e.g. at a red light
2	Immediately after the vehicle comes to a standstill (within one second) the brake pedal is pressed briefly, applying more force than usual, then immediately held with the usual brake pedal force
3	The engine continues running

4.3. Switch-off inhibitors

Under certain conditions it is necessary to suppress the MSA function:

- the vehicle is coasting (vehicles with manual transmission only)
- the brake vacuum is too low (vehicles with manual transmission only)
- the brake pedal is not pressed firmly enough which means the vehicle is detected as not being held sufficiently (vehicles with automatic transmission only)
- the vehicle stops on uphill/downhill gradients > 12%
- the steering angle is > 6°
- the steering wheel movement is not yet complete (as otherwise insufficient support will be provided by the power steering as a consequence)

- the vehicle was not driven at a speed of > 5 km/h/3 mph* following the previous engine shut-down
- the engine is not running at idle speed (accelerator pedal is being pressed)
- the vehicle is being driven in reverse
- the Hill Descent Control (HDC) has been activated
- the operating temperature of the engine is too low
- the carbon canister is being purged
- the fuel grade is insufficient
- the gearbox adaptation is active (vehicles with automatic transmission only)
- the hydraulic pressure accumulator is not charged yet (vehicles with automatic transmission only)
- stop-and-go traffic
- the state of charge is too low
- the ambient temperature is below +3 °C/ 37.4 °F (ice warning)
- the ambient temperature is above +35 °C/ 95 °F (with heating and air conditioning system switched on)
- the condensation sensor of the IHKA detects fogging of the windshield
- the heating and air conditioning system is switched on but the passenger compartment has not yet warmed up or cooled down to the required temperature
- the brakes have been applied via ABS.

* > 9 km/h/5 mph - vehicles with automatic transmission

4.4. Switch-on prompts

Conversely, it may be necessary to start the engine under the following conditions:

- the vehicle is not sufficiently held by the released brake pedal (vehicles with automatic transmission only)
- the steering wheel is moved
- the engine is not running at idle speed (accelerator pedal is being pressed)
- the transmission changes from "P" to "D"; the driver previously shifted from "D" to "P" when the engine was automatically switched off (vehicles with automatic transmission only)
- the transmission changes from "D" to "N" or "R" (vehicles with automatic transmission only)
- the state of charge is too low
- the ambient temperature is above +35 °C/95 °F (with heating and air conditioning system switched on)
- the condensation sensor of the IHKA detects fogging of the windshield
- the evaporator temperature is too low to ensure sufficient climate control.

4.5. Deactivation

If a deactivation condition exists, the automatic start/stop function is deactivated.

The following scenarios arise, depending on when the deactivation condition for the automatic start/stop function occurred:

- the engine continues running and is no longer stopped automatically
- the engine was stopped automatically and starts once again automatically
- the engine was stopped automatically and no longer starts automatically (the Check Control message "MSA off" appears - the start/stop button must be operated in order to the start the engine).

The following deactivation conditions may occur:

- the driver's absence has been detected
- the engine did not start when starting
- the engine compartment lid is unlocked
- a fault related to the automatic start/stop function has been detected at the engine, transmission or components involved in the automatic start/stop function
- the bus communication is faulty
- the automatic start/stop function has been deactivated via the automatic start/stop function button
- the automatic start/stop function was deactivated via the diagnosis system
- the vehicle is in transport mode
- the engine was stalled.

The individual statuses can be read out using the diagnosis system.

An easy-to-follow example of a deactivation with subsequent switch-on request:

- the automatic start/stop function is deactivated via the automatic start/stop function button in the automatic engine shutdown phase
- as a consequence, the engine starts automatically
- after this, no further automatic engine shutdowns occur, the automatic start/stop function remains deactivated.

4.5.1. Deactivation via automatic start/stop function button

F30 automatic start/stop function button location

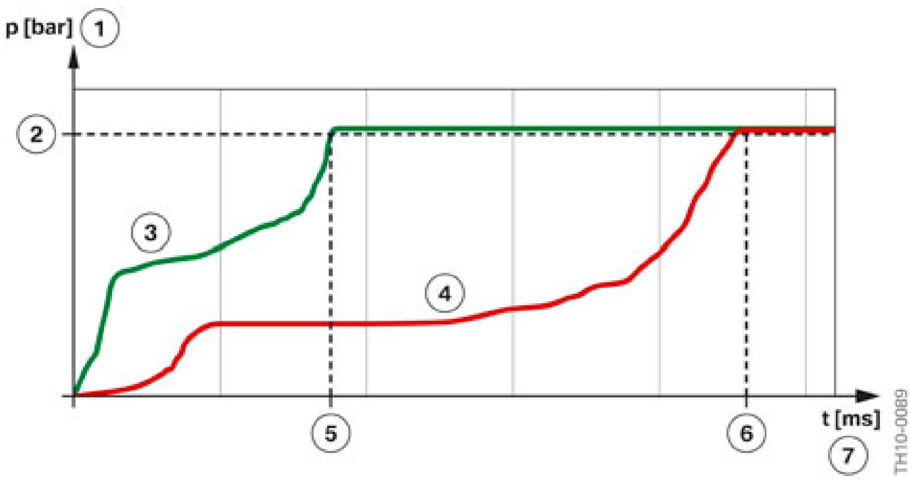
The automatic start/stop function can be deactivated manually via the automatic start/stop function button (1). The LED in the button lights up when the function is deactivated. The automatic start/stop function is reactivated each time the engine is restarted.

4.6. Hydraulic pressure accumulator

When the automatic start/stop function is activated the engine may shut off once the vehicle is at a standstill, the engine restarts automatically as the driver releases the brake to drive off.

In these engine stop phases the transmission oil pump is not driven, thus the fluid pressure supply ceases, the gearshift elements open, and there is no longer a transfer of power in the transmission. Maximum transmission oil pressure is required in order for the drive off process to take place dynamically without a noticeable delay when the automatic start/stop function is activated. However, the mechanically driven transmission oil pump cannot build up pressure quickly enough while the engine is starting.

A hydraulic pressure accumulator is therefore used in the automatic transmission for this purpose (as with F04). With the volume of transmission fluid stored in the hydraulic pressure accumulator, the shift elements can be filled as soon as the engine is started, even before the transmission oil pump has built up the necessary pressure to drive off.



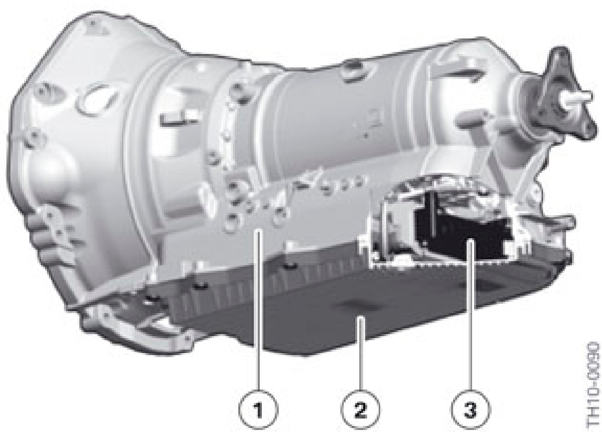
Variation in transmission oil pressure over time at engine start

Index	Explanation
1	Transmission oil pressure
2	Nominal value of the transmission oil pressure which is required to hydraulically actuate the shift elements
3	Characteristic of the transmission oil pressure **with** hydraulic pressure accumulator
4	Characteristic of the transmission oil pressure **without** hydraulic pressure accumulator
5	Point at which the automatic transmission **with** hydraulic pressure accumulator is ready to drive off
6	Point at which the automatic transmission **without** hydraulic pressure accumulator is ready to drive off
7	Time

4.6.1. Installation location

The hydraulic pressure accumulator is integrated in the automatic transmission. It is located in the transmission oil sump, in the direction of travel behind the mechatronics module.

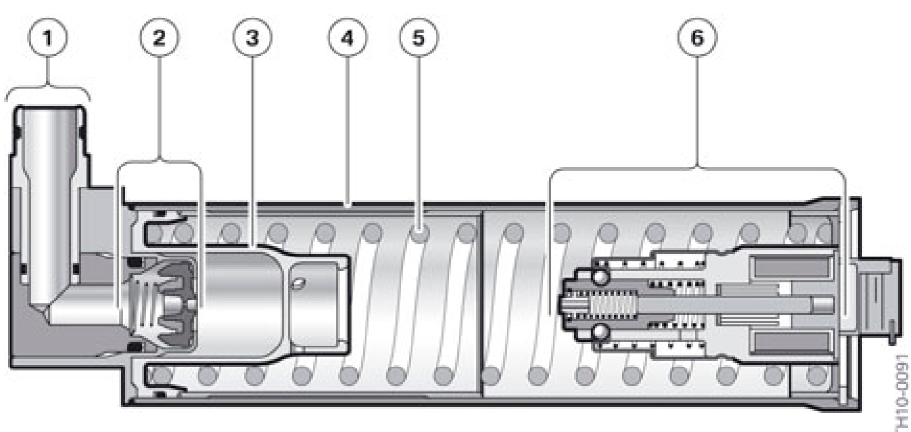
The hydraulic pressure accumulator can be replaced as a separate component.



8–speed automatic transmission cutaway

Index	Explanation
1	Transmission housing
2	Transmission oil sump
3	Hydraulic pressure accumulator

4.6.2. Design



Design of hydraulic pressure accumulator

Index	Explanation
1	Connection to hydraulic system of automatic transmission
2	Throttle and non-return valve
3	Hydraulic piston
4	Hydraulic cylinder
5	Coil spring
6	Electromechanical latch mechanism

The hydraulic pressure accumulator consists of a hydraulic cylinder. This cylinder contains a piston that moves against the force of a spring. The piston can be electromechanically locked in the tensioned end position. The electromechanical latch mechanism incorporates locking balls, a tension spring, a release spring, and a solenoid.

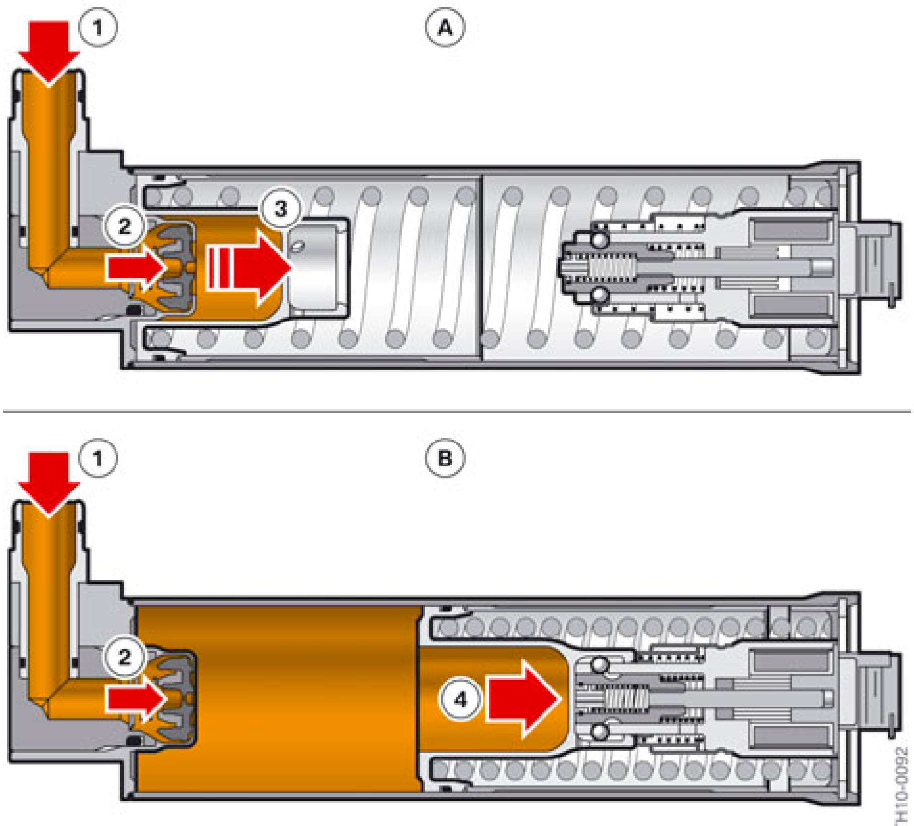
The solenoid is activated and deactivated by the EGS. A corresponding wiring harness to the hydraulic pressure accumulator is laid inside the transmission housing.

The cylinder of the hydraulic pressure accumulator is connected to the transmission's hydraulic system directly (without any valves between them). The hydraulic pressure accumulator in fact contains an element which functions as a throttle and non-return valve. The throttle limits the volumetric flow of the fluid while the hydraulic pressure accumulator is being filled. In general, this filling operation corresponds to the charging operation of the accumulator which is why the expressions "charging" or "discharging" are used in this description.

The non-return valve ensures that the transmission fluid flows into the hydraulic pressure accumulator via the throttle during charging. The transmission fluid does not flow through the throttle during the discharging process, the non-return valve now opens instead to allow an unrestricted flow of transmission fluid back into the hydraulic system. The purpose of the non-return valve is therefore not to maintain the pressure in the charged state. In the charged state, the transmission fluid in the hydraulic pressure accumulator is depressurized and the energy is stored in the tensioned spring.

4.6.3. Charging

The hydraulic pressure accumulator is therefore always charged when the engine is running and the transmission oil pump is working. During charging transmission fluid flows through the throttle into the hydraulic cylinder. In the process only a small volume is drawn from the hydraulic system so that the pressure level does not drop unintentionally. The transmission fluid pushes on the piston which acts against the spring force increasing the tension on the spring.



Charging of the hydraulic pressure accumulator

Index	Explanation
A	Discharged state - charging procedure starts
B	Charged state - charging procedure ends
1	Transmission fluid flows from the hydraulic system of the automatic transmission into the hydraulic pressure accumulator
2	Volumetric flow of the transmission fluid is limited by the throttle
3	The transmission fluid exerts force on the piston which moves and tensions the coil spring
4	Transmission fluid exerts a force on the piston so that it is held in the "charged" end position

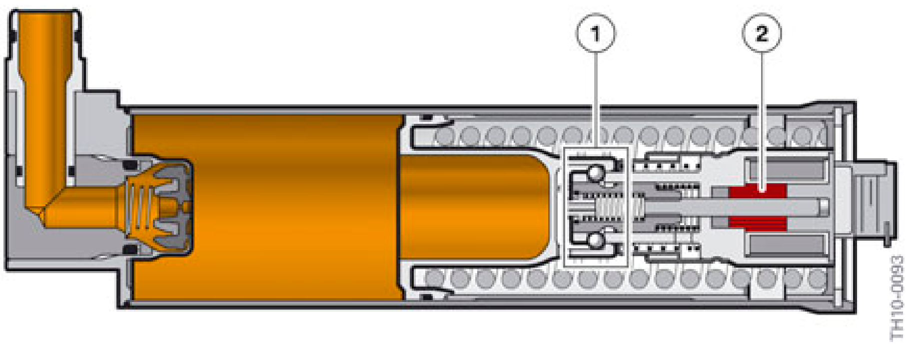
At the end of the charging process the piston travels past the latch mechanism (locking balls) until it reaches the end/stop. The transmission fluid pressure holds the piston against the spring force in the end position.

The latch mechanism does not engage yet. The hydraulic pressure accumulator is fully charged in this end position.

4.6.4. Locking

When the engine is switched off (while the hydraulic pressure accumulator is charged) the transmission oil pressure drops causing the spring to be released slightly. This allows the piston to slide into the locked position where locking balls hold the piston mechanically in place.

The now energized solenoid holds the inner slide in place so that the locking balls cannot enter the channels designated for releasing the lock. The electric power used for this is low (< 10 W) and is only required while the engine is off. Therefor the additional energy consumption of the hydraulic pressure accumulator viewed over an entire driving cycle is very low.



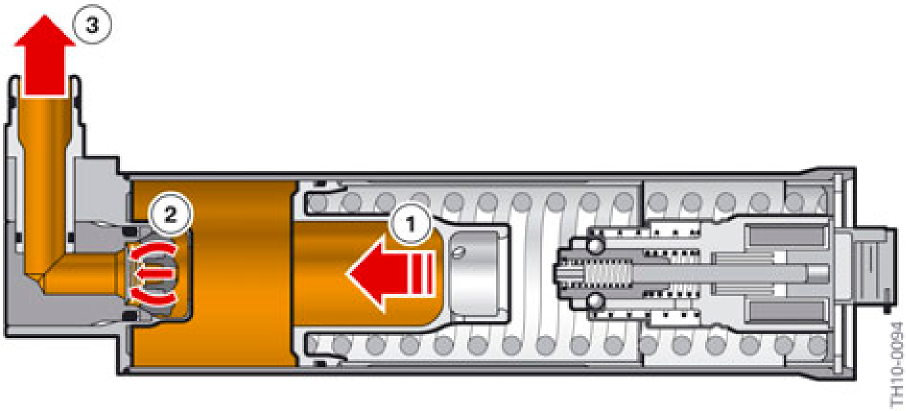
Charged and locked state of the hydraulic pressure accumulator

Index	Explanation
1	Mechanical latch mechanism
2	Solenoid activated

4.6.5. Discharging

When the engine is started, as the driver wants to drive off, the gearshift elements in the automatic transmission for driving off must be engaged. The hydraulic pressure accumulator supplies the transmission fluid pressure required for this during the discharging process.

As the solenoid is deactivated for discharging the inner slide (driven by a small spring) moves in the direction of the locking balls. This allows the balls to enter the channels designated for releasing the lock which in turn releases the piston. The spring (compressed during the charging process) exerts force on the piston which pressurizes the transmission fluid in the cylinder.



Discharging of the hydraulic pressure accumulator

Index	Explanation
1	The large spring pushes on the piston, which in turn, forces the transmission fluid out of the hydraulic cylinder
2	Transmission fluid can now flow through the throttle **and** the opened non-return valve
3	Transmission fluid flows from the hydraulic pressure accumulator back into the hydraulic system of the automatic transmission

The piston moves (in the graphic to the left) and thereby pushes the transmission fluid back into the transmission hydraulic system. The transmission fluid exits the cylinder through the now opened non-return valve and throttle.

The oil volume forced back into the hydraulic system of the transmission is sufficient to engage the gearshift elements needed for the driving off process. This system is designed to provide the initial fluid pressure needed for the transmission to go into "Gear" at the exact moment just before the engine is started. As soon as the engine is started, the transmission fluid pressure is then again generated by the transmission oil pump and the entire process is restarted.

4.7. Service information

For information on servicing/diagnosing the MSA II system, refer to ST1112 Automatic Start/Stop (MSA) training material.

5. Manual Gearboxes

In the F30 all the engine variants are equipped as standard with manual gearboxes.

5.1. Designation

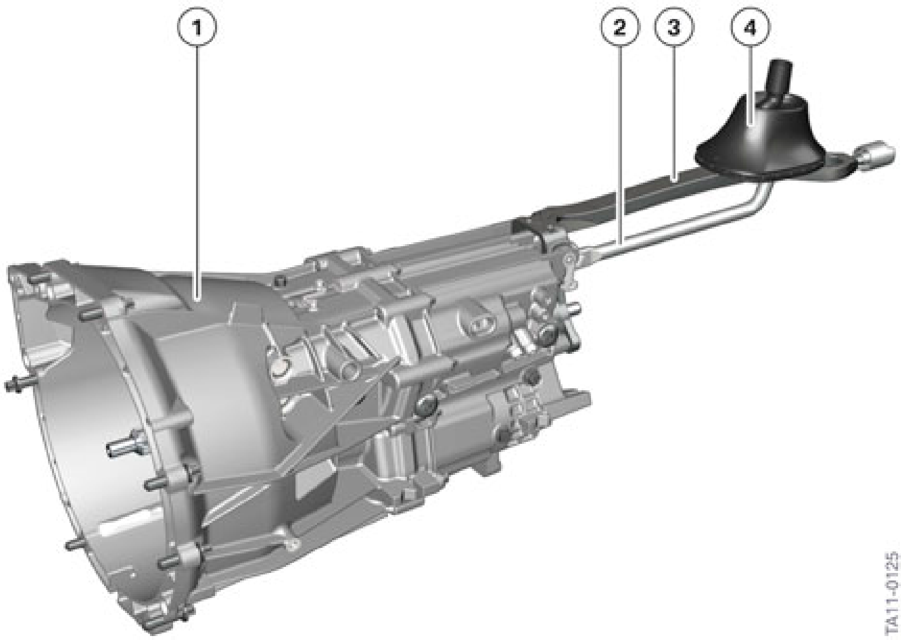
The transmission designation in the technical documentation allows it to be uniquely identified. In frequent cases, however, only a short designation is used. such as I, K, or G is used to identify the transmission. For the correct designation, refer to the following table.

Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	S	Manual gearbox
3	Number of gears	1 – 9	Number of forward gears
4	Type of transmission	- X S W D Y	Manual gearbox All-wheel drive vehicle with manual transmission Sequential Manual Gearbox SMG All-wheel drive vehicle with sequential manual transmission Twin-clutch gearbox All-wheel drive vehicle with twin-clutch gearbox
5 + 6	Transmission type	17 26 37 45 53	I gearbox D transmission H transmission K transmission G transmission
7	Gear train	B D S P	gasoline engine ratio Diesel engine ratio (w) Sport ratio gasoline engine ratio, revised
8	Manufacturer	G J R Z H	Getrag Jatco General Motors Powertrain Zahnradfabrik Friedrichshafen In-house part

5.2. Variants

Model	Engine	Transmission designation	
BMW 328i	N20B20O0	GS6-17BG	I-350 Turbo transmission
BMW 335i	N55B30M0	GS6-45BZ	K transmission

5.3. I gearbox



F30 I gearbox

Index	Explanation
1	GS6-17BG gearbox
2	Gearshift rod
3	Gearshift arm
4	Gaiter

The I transmission is a 6-speed manual gearbox with two-piece die-cast aluminium housing. The different engine applications can be covered with a variation of the clutch housing. The main housing is the same for all variants.

For the I Turbo transmission, the transmission ratio was adapted to the power characteristics of the turbo engines. In the F30 the I Turbo transmission is used. I–350 turbo transmission in the BMW 328i.

5.3.1. I Turbo manual gearbox

New features/changes

- Gear set optimized for turbo engines
- Improvement to behavior of vehicle in the event of a crash through reinforced transmission mounting and a new gear safety bearing
- Clutch housing extended to the fixture of the centrifugal pendulum in the N20 engine
- Screw connection on engine standardized to M10 thread
- Ground connection to the body for the first time.

Gears

To minimize the gearbox noise the running gears have been designed as high gears with a particularly large helix angle and have been optimized in terms of their coverage.

Bearings

The main bearings have a fundamental influence on the operational smoothness and the switching precision of the transmission. Play changes due to temperature fluctuations or an increase in the play during operating time are avoided by the exclusive use of grooved ball bearings and roller bearings.

The main bearings are designed as so-called "clean bearings". They are protected against dirt with a cover and are thus oil-permeable. The operating safety is therefore increased and the use of smaller, lighter bearings is possible.

Lubrication

The use of a life-time oil filling (capacity 1.4 liter). Together with the dirt-resistance of the bearings, an optimal combination of a long service life with no maintenance is achieved.

Synchronization

In the first and second gear double taper synchronizations are used. All other gears are designed as single taper synchronization.

Acoustics

A very precise and smooth gearshift is achieved by:

- The shift gate installed in the transmission
- The low-friction gearshift shaft in a ball sleeve
- The use of gearshift forks.

The passive lock guarantees locking safety with optimized ease of movement.

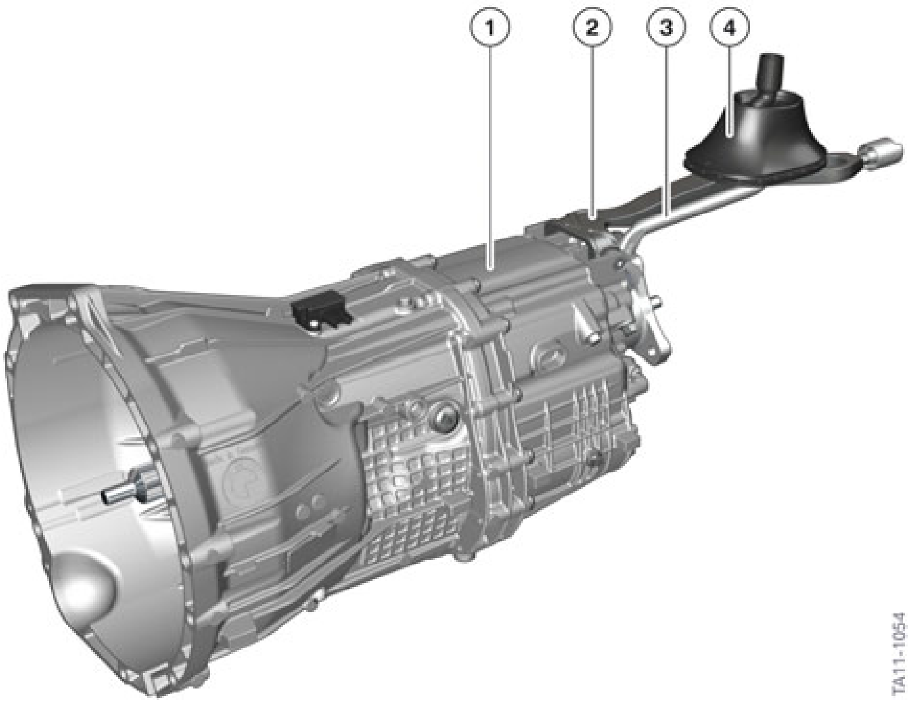
5.3.2. Technical data

		I-350 Turbo
Transmission designation		GS6-17BG
Maximum drive torque	[Nm]	350
Transmission ratio 1st gear		3.6933
Transmission ratio 2nd gear		2.0619
Transmission ratio 3rd gear		1.3134
Transmission ratio 4th gear		1.0000

5. Manual Gearboxes

	I-350 Turbo
Transmission ratio 5th gear	0.8092
Transmission ratio 6th gear	0.6771
Transmission ratio reverse gear	3.3484

5.4. K transmission



F30 K gearbox

Index	Explanation
1	Gearbox GS6-45BZ
2	Gearshift arm
3	Gearshift rod
4	Gaiter

The K transmission is a 6-gear inline manual gearbox in a countershaft design.

Instead of the G gearbox, the smaller, lighter and more cost-effective gearbox can be used in the N55B30M0 engine. The weight advantage is approx. 11 kg depending on the engine application. The gearbox's high transmission capability with at the same time small size and weight is essentially achieved by intermediate mounting of the main shafts and a modified gear train concept.

5.4.1. Special features

- Six-speed gearbox with optimized transmission ratios
- Intermediate bearings
- Dry-sump lubrication
- Reduction in consumption (approx. –2% compared to G manual gearboxes)
- Reduced weight (approx. –11 kg compared to G manual gearboxes)
- Synchromesh units with carbon friction linings
- Life-time oil filling
- Zero-gear sensor for automatic engine start-stop function.

The gearshift quality is significantly improved by

- The use of a newly developed carbon friction lining on the synchromesh units
- Newly developed and very low-friction shift mechanism
- The low drag losses of the gear train
- The minimal overshift travel.

To keep the drag losses low, dry-sump lubrication is used for the first time. Compared with conventional immersion lubrication, this prevents the swash losses from the movement of the gear train in the sump oil. Further reduction of losses is achieved by the friction-optimized radial shaft seals.

5.4.2. Technical data

		K transmission
Transmission designation		GS6-45BZ
Maximum drive torque	[Nm]	470
Wheelbase	[mm]	80
Weight incl. oil	[kg]	43.3
Gearbox length	[mm]	646
Transmission ratio 1st gear		4.110
Transmission ratio 2nd gear		2.315
Transmission ratio 3rd gear		1.542
Transmission ratio 4th gear		1.179
Transmission ratio 5th gear		1.000
Transmission ratio 6th gear		0.846
Transmission ratio reverse gear		3.372

5.4.3. Intermediate bearings

In countershaft-design manual gearboxes the main shaft is pressed away from the countershaft by the gearing forces. This gives rise to a deviation of the ideal gearing contact pattern, which results in a significant deterioration in the strength of the gearing and the acoustics.

The K gearbox therefore makes use of intermediate bearings which significantly limit shaft bending. In this way, compared with conventional gearboxes, higher torques can be transmitted and the gearing acoustics can be simultaneously improved.

5.4.4. Dry-sump lubrication

The lubrication method used in conventional manual gearboxes is usually immersion lubrication. The gear wheels on the countershaft are immersed into the gearbox oil and distribute it as the gear train rotates in an uncontrolled fashion through the entire gearbox. Additional equipment such as oil bulkheads or oil ways is often required to deliver the oil to the gearing, the bearings or the synchromesh units.

The K gearbox uses for the first time a dry-sump lubrication system, consisting of

- Oil filter
- Oil pump
- Injection pipe.

This system utilizes less energy than an immersion lubrication system to deliver lubricating oil specifically to the gearing, the bearings and the synchromesh units. Controlled oil routing also results in improved temperature management, in that cooling air from the underbody area is specifically directed into the area of the filter intake opening. In this way, the gearbox oil is subjected to continuous cooling.

The oil filter also improves the oil quality and with it the load capability of the gearing.

5.4.5. Synchromesh

Triple-band synchromesh units are used in 1st and 2nd gears. Single-band synchromesh units are installed in the other gears. These are equipped with a newly developed carbon friction lining for improving gearshift quality.

5.4.6. Mating dimensions

The mating dimensions for the gearbox mounting have been adopted from established series applications. In this way, integration in the vehicle environment has been significantly simplified, since it is possible to fall back on existing peripherals.

F30 Powertrain
6. Automatic Transmission

The F30 is available in all engine versions also with automatic transmission. The established GA8HP 8-speed automatic transmission is always used.

6.1. Designation

A unique designation is used for the transmission in the technical documentation so it can be clearly identified. In frequent cases, however, only a short designation is used. This short form is used so the transmission can be assigned to a transmission family. The GA8HP transmission family, consisting of the GA8HP45Z, the GA8HP70Z and the GA8HP90Z transmissions for example, are often mentioned.

Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	A	Automatic transmission
3	Number of gears	6 8	Six forward gears Eight forward gears
4	Type of transmission	HP L R	Hydraulic planetary gear train Designation of General Motors Powertrain Designation of General Motors Powertrain
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

6.2. Variants

Model	Engine	Transmission	Torque converter
BMW 328i	N20B20O0	GA8HP45Z	NW235ZDW
BMW 335i	N55B30M0	GA8HP45Z	NW235TDD

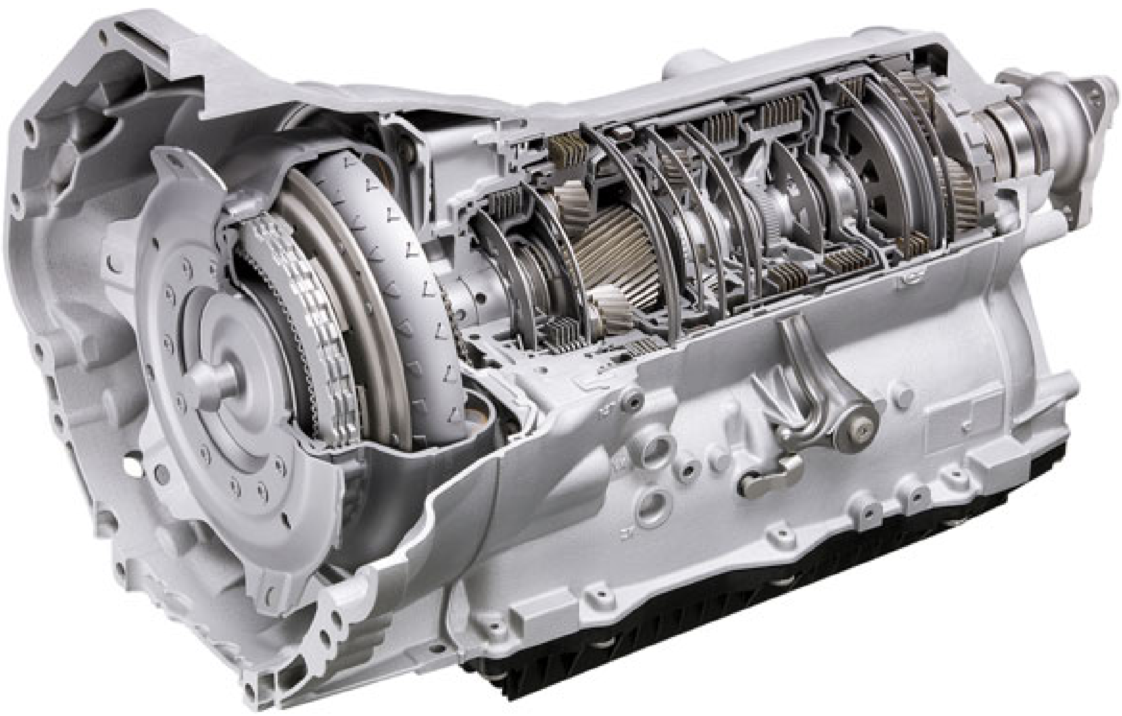
6.3. GA8HP45Z transmission

The GA8HP transmission is already familiar from being used in many BMW models.

There is also a Sport Automatic Transmission option available 2TB, this includes shift paddles on the steering wheel.

6. Automatic Transmission

For a description of the 8-speed automatic transmission, please refer to the "GA8HP Automatic Transmission" Training information.



TA09-1361

automatic transmission GA8HP

6.3.1. Technical data

		GA8HP45Z
Maximum power	[kW]	250
Maximum torque	[Nm]	450
Maximum permissible torque, 1st - 7th gear	[rpm]	7200
Maximum permissible torque, 8th gear	[rpm]	5700
Maximum permissible engine speed, reverse gear	[rpm]	3500
Transmission ratio 1st gear		4.714
Transmission ratio 2nd gear		3.143
Transmission ratio 3rd gear		2.106
Transmission ratio 4th gear		1.667
Transmission ratio 5th gear		1.285
Transmission ratio 6th gear		1.000

6. Automatic Transmission

	GA8HP45Z
Transmission ratio 7th gear	0.839
Transmission ratio 8th gear	0.667
Transmission ratio reverse gear	3.295

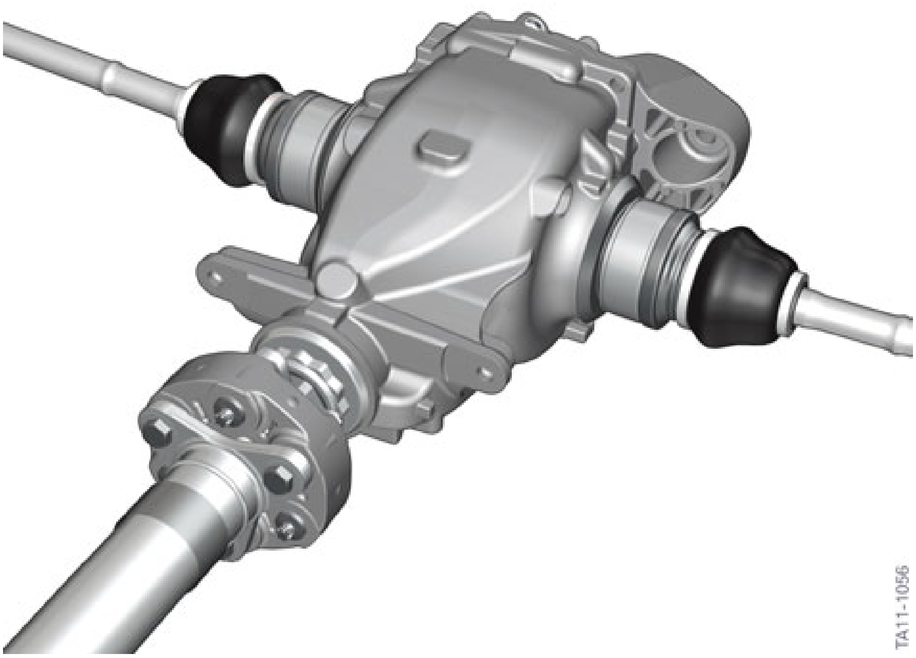
F30 Powertrain

7. Rear Axle Differential

The rear axle differential for the F30 is a further development of the low-friction rear axle differential already familiar from the E90 and F25.

For a description of the rear axle differential, please refer to the following Training Manuals:

- "E90 Complete Vehicle Powertrain" for the rear axle differential HAG 168L
- "F25 Powertrain Complete Vehicle" for the rear axle differential HAG 188LW and the rear axle differential HAG 215 LW.



F30 rear axle differential HAG 188LW

Special features

- Reduced transmission losses
- Optimized efficiency (approx. 1%) by
  - The use of lower-viscosity oil
  - Changing the material used for the radial shaft seals on the powertrain
  - Optimized lubrication of the pinion bearing
  - Crown wheel welded to expansion tank housing (previously screwed on).

F30 Powertrain
7. Rear Axle Differential

7.1. Designation

Position	Meaning	Index	Explanation
1 - 3	Type of transmission	HAG	Rear axle differential
4 - 6	Overall size	168/188/215	Diameter of crown wheel pitch circle in mm
7	Bearing (internal)	L	Low-friction bearing (angular-contact ball bearing)
8	Optimization stage	W	Efficiency-optimized

7.2. Variants

Model	Transmission	Rear axle differential	Gear ratio i
BMW 328i	GS6-17BG	HAG 188LW	3.91
BMW 328i	GA8HP45Z	HAG 188LW	3.15
BMW 335i	GS6-45BZ	HAG 215LW	3.23
BMW 335i	GA8HP45Z	HAG 188LW	3.15

F30 Powertrain
8. Shafts

8.1. Drive shafts

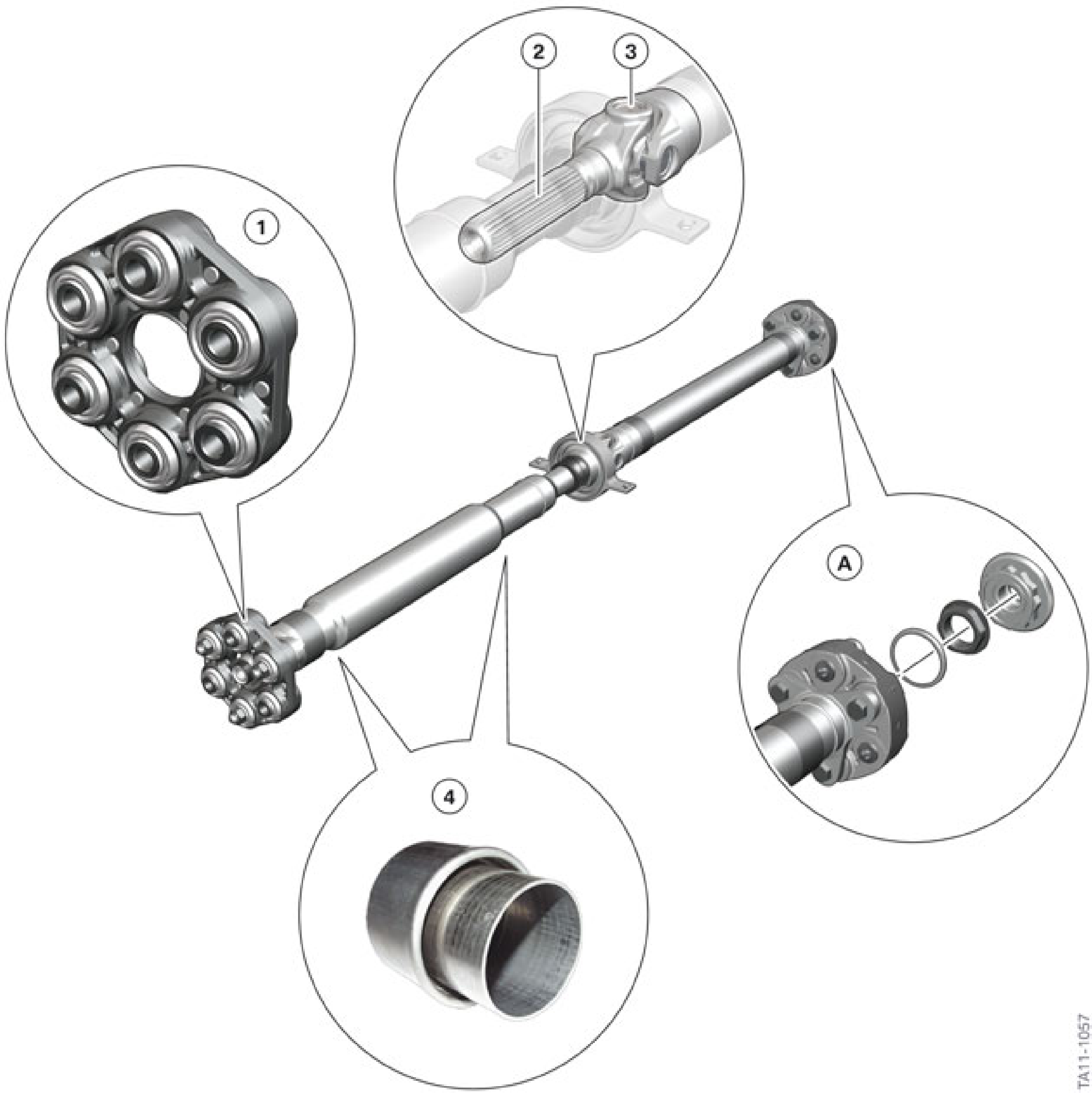
A variant of the drive shaft that is adapted to the torque requests is available for each engine-gearbox configuration.

Focal points in the design of the drive shafts in the were the torque transfer and comfort requirements with regard to acoustics and vibrations.

The joints, shaft divisions and shaft diameters have been designed to prevent disruptive noises or vibrations being passed on to the connection points at the body.

To minimize the high-frequency tooth meshing noise of the rear axle differential, the drive shaft for engines with a torque of over 270 Nm are secured to the rear axle differential with flexible discs. The drive shaft is always secured to the gearbox or automatic transmission using flexible discs.

Depending on the engine/gearbox configuration the steel drive shaft is available in different lengths. It is screwed to the gearbox or automatic transmission, connected to the rear axle differential.



F30 drive shaft

Index	Explanation
1	Flexible disc
2	Sliding piece
3	Universal joint
4	Crash function
A	Connection to rear axle differential

8. Shafts

8.1.1. Variants

Model	Transmission	Front connection	Middle connection	Rear connection
BMW 328i	GS6-17BG	GS 96M12	KG48	GS 96M10
BMW 328i	GA8HP45Z	GS 96M12	KG48	GS 96M10
BMW 335i	GS6-45BZ	GS 105M12	KG60	KFG Z34
BMW 335i	GA8HP45Z	GS 105M12	KG48	KFG Z34

8.1.2. Crash function

In the event of a head-on collision, the drive shaft absorbs a portion of the crash energy. The occupant load is thus reduced and the passive safety increased.

The crash function integrated in the front drive shaft pipe has been optimized. The spring force at which the front drive shaft tube selectively deforms has once again been reduced. The torque transfer capability has remained unchanged.

8.2. Rear axle output shafts

The output shafts for the F30 are designed as a full-length shafts and have different overall lengths on account of the rear axle differential being positioned on the left and right sides. The joints to the rear axle differential and on the wheel side are designed as journals and are mounted by connection.

F30 rear drive shaft

8.2.1. Variants

Model	Transmission	Rear axle differential	Output shaft
BMW 328i	GS6-17BG	HAG 188LW	VL2600i
BMW 328i	GA8HP45Z	HAG 188LW	EBJ95
BMW 335i	GS6-45BZ	HAG 215LW	VL3300i
BMW 335i	GA8HP45Z	HAG 188LW	VL2600i

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Technical training.
Product information.

F30 Chassis Dynamics

BMW Service

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General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Chassis Dynamics
Contents

F30 Chassis Dynamics
Contents

F30 Chassis Dynamics

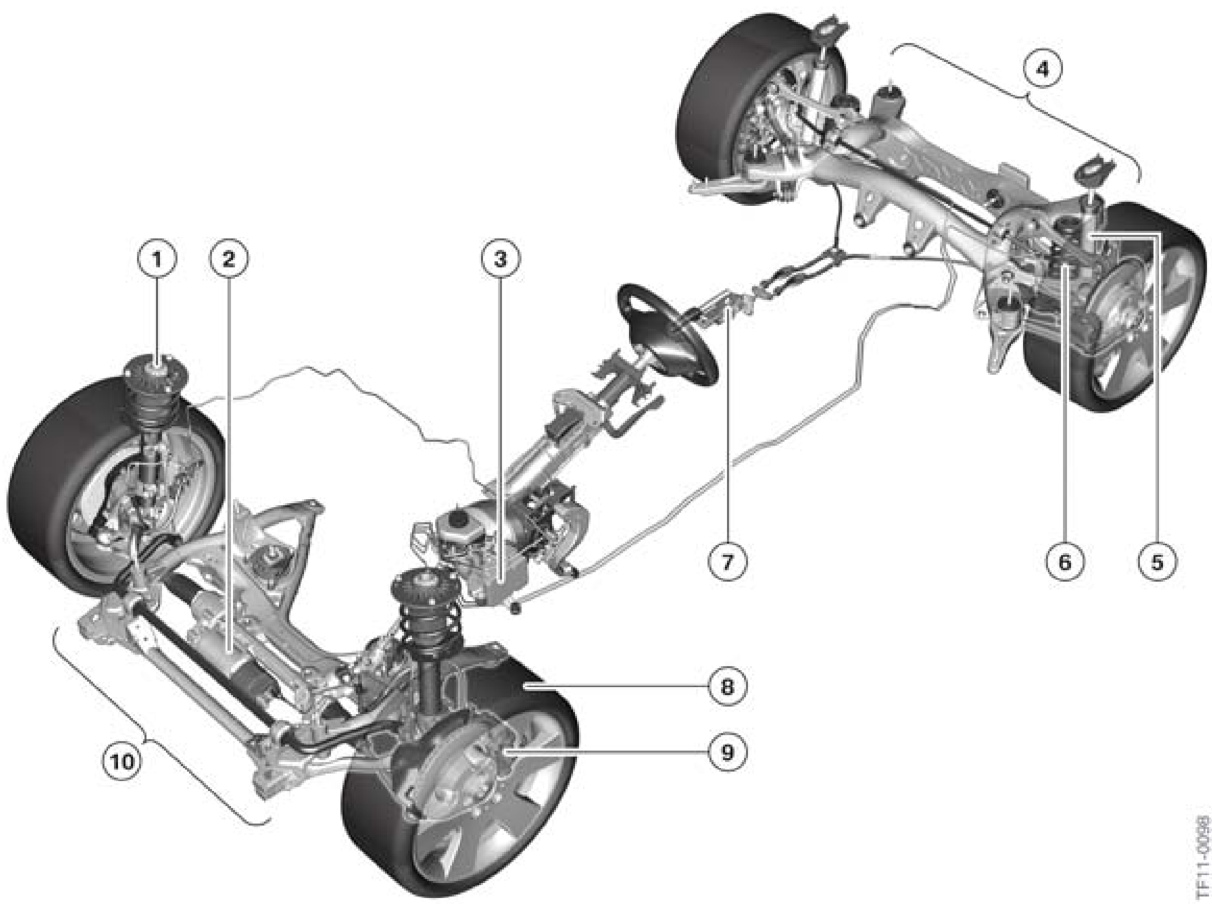
1. Introduction

1.1. Models

The F30 will be launched on the market in the following models in February 2012:

- BMW 328i
- BMW 335i

1.2. Driving dynamics and comfort



F30 Chassis and suspension

Index	Explanation
1	Suspension/dampers
2	Electronic Power Steering EPS
3	Dynamic Stability Control DSC
4	Five-link rear suspension
5	Damping action
6	Suspension

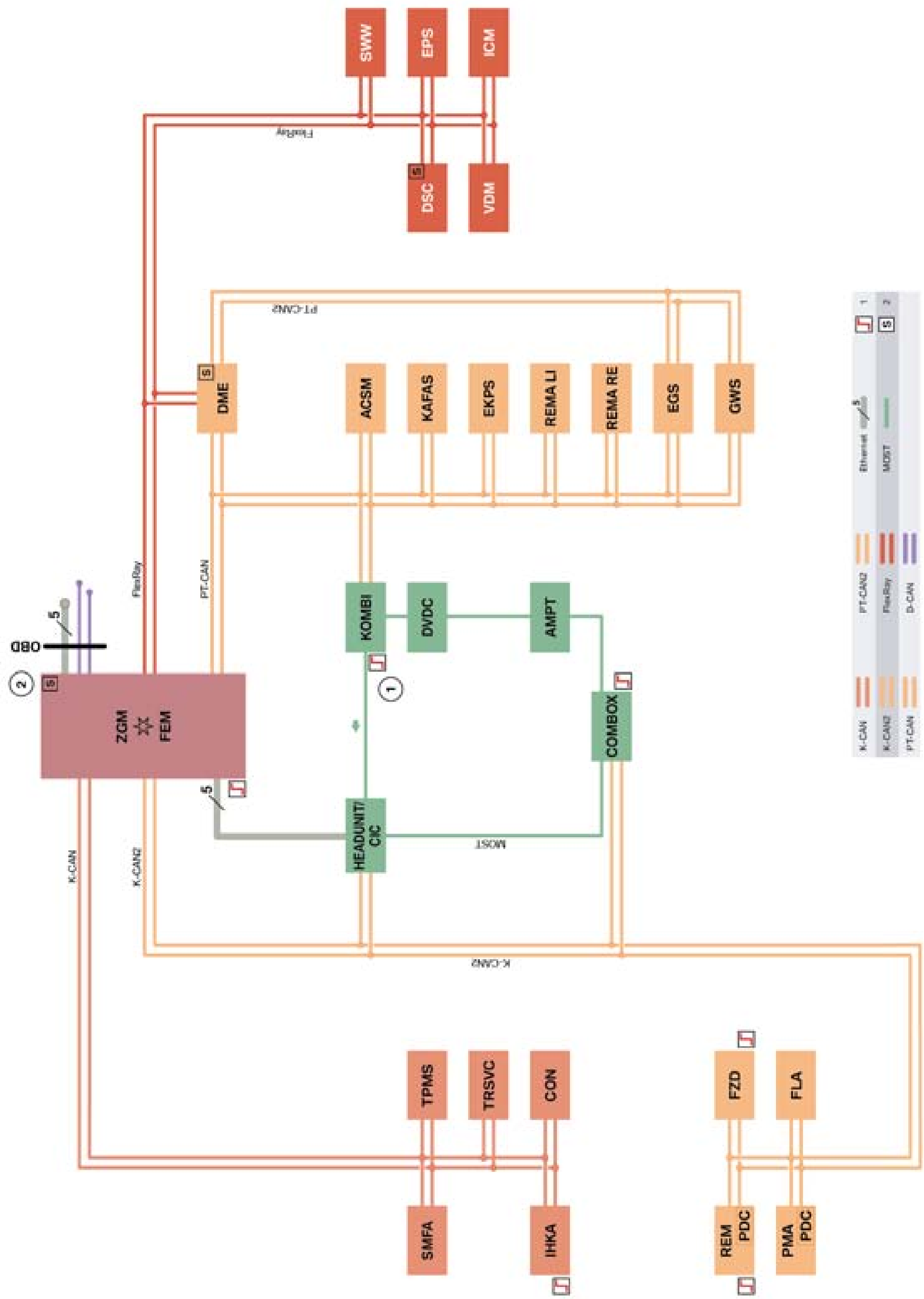
Index	Explanation
7	Parking brake
8	Wheels
9	Brakes
10	Two-joint spring strut front axle with trailing links

The chassis and suspension of the F30 is a further development based on the E90. The front axle is designed as a double pivot spring strut axle. A further improved version of the five-link rear axle HA5 is used on the rear axle. The chassis and suspension system takes driving dynamics and comfort to a new level.

F30 Chassis Dynamics

1. Introduction

1.3. Bus overview



F30 bus overview

F30 Chassis Dynamics

1. Introduction

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top-HiFi amplifier
COMBOX	Combox (Combox emergency call, Multimedia Combox)
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DME	Digital Engine Electronics (DME)
DSC	Dynamic Stability Control
DVDC	DVD changer
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EPS	Electromechanical Power Steering
Ethernet	Cable-based data network technology for local data networks
FEM	Front Electronic Module
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector lever
HEADUNIT/CIC	Headunit (Car Information Computer or Basic headunit)
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
K-CAN	Body controller area network
K-CAN2	Body controller area network 2
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (MOST only with option 6WA)
MOST	Media Oriented System Transport
OBD	On-board diagnosis (diagnostic socket)
PDC	Park Distance Control (with option 5DP, parking manoeuvring assistant: integrated in the parking manoeuvring assistant control unit, otherwise integrated in the Rear Electronic Module control unit)
PMA	Parking manoeuvring assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
RAD	Radio

Index	Explanation
REM	Rear Electronic Module
REMA LI	Reversible electromotive automatic reel, left (not US)
REMA RE	Reversible electromotive automatic reel, right (not US)
SMFA	Seat module, driver
SWW	Lane change warning
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for all-round vision camera
VDM	Vertical Dynamics Management
ZGM	Central gateway module

The FlexRay is shown in a simplified form in the overview of the bus systems. The information bulletin "F30 General vehicle electrical system" contains the actual physical configuration (topology).

F30 Chassis Dynamics
2. Models

2.1. Comparison

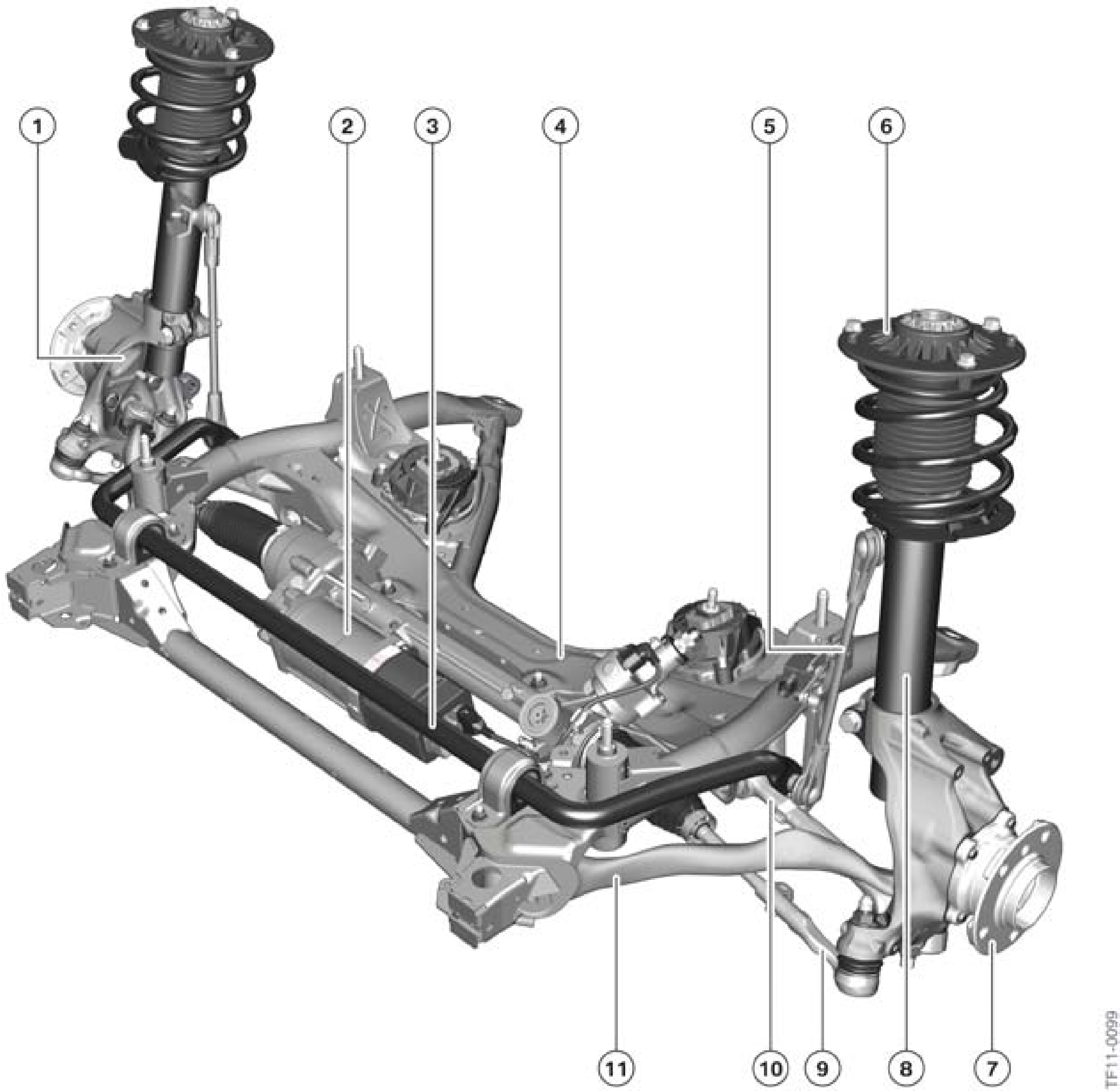
The following table compares the technical data of the chassis and suspension in the F30 with its predecessor E90 using the example of the BMW 328i model.

Designation	F30 328i	E90 328i model
Wheelbase	2810 mm	2761 mm
Front track width	1531 mm	1501 mm
Rear track width	1572 mm	1529 mm
Tires, basic wheels	225/50 R17 AS	205/55 R16 91V
Basic wheel rims	7.5J x 17 LM	7J x 16 I
Front axle	Two-joint spring strut front axle with trailing links	Two-joint spring strut front axle with trailing links
Springs/dampers	Steel spring/conventional or EDC	Steel springs, conventional
Anti-roll bar, front	mechanical	mechanical
Front brake	Brake disc, ventilated	Brake disc, ventilated
Steering	EPS rack	Hydraulic
Rear axle	Five-link rear suspension	Five-link rear suspension
Rear suspension/dampers	Steel spring/conventional or EDC	Steel springs, conventional
Rear anti-roll bar	Mechanical	mechanical
Rear brakes	Brake disc, ventilated	Brake disc, ventilated
Parking brake	Duo-servo parking brake with parking brake lever	Duo-servo parking brake with parking brake lever

F30 Chassis Dynamics

3. Chassis and Suspension

3.1. Front axle



Two-joint spring strut front axle with trailing links in F30

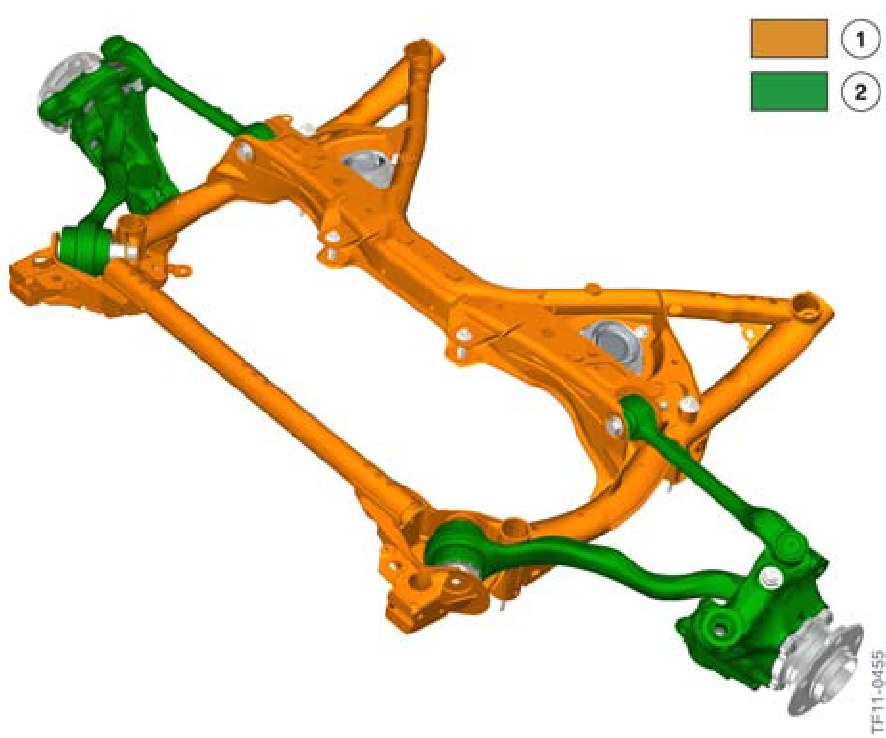
Index	Explanation
1	Swivel bearing
2	Electronic Power Steering EPS
3	Anti-roll bar
4	Front axle support
5	Anti-roll bar link
6	Support bearing

Index	Explanation
7	Wheel hub
8	Spring strut
9	Track rod
10	Wishbone
11	Trailing link

The two-joint spring strut front axle with trailing links in the F30 represents the optimum combination of driving dynamics and ride comfort. The load-bearing function of the steering box housing achieves an extremely high degree of rigidity with the lowest possible weight.

Compared to its predecessor in the E90, the front axle support in the F30 must satisfy more stringent requirements. A second crash load path has now been integrated above the front axle support. In order to guarantee optimum crash behavior, a high-strength welded steel structure has been used instead of an aluminium front axle support.

Improved acoustic properties and maximum rigidity and accompanying increase in ride comfort can be achieved with a small installation space.



Front axle of F30 - viewed from below

Index	Explanation
1	High-strength steel
2	Aluminium

3. Chassis and Suspension

The ball joints of the front axle have been friction-optimized. This has made it possible to improve the response characteristics.

Use of cast aluminium parts (wishbones, trailing links) and aluminium die-cast parts (swivel bearings) reduces the unsprung masses.

The Electronic Power Steering EPS (electromechanical power steering) that features in the F30 makes an important contribution to BMW EfficientDynamics.

For vehicles with an adaptive M sports suspension (optional equipment 2VF) the electronic damper control EDC is also integrated.

3.1.1. Technical data

Designation	Without optional equipment 2VF Adaptive M Suspension or optional equipment 704 Sport Suspension	With optional equipment 2VF Adaptive M Suspension or optional equipment 704 Sport Suspension
Castor angle	7.0°	7.2°
Camber	–20'	–29'
Total toe-in	14'	14'
Toe difference angle at 20°	86'	86'
Maximum wheel lock angle, outer	33.8°	33.4°
Maximum wheel lock angle, inner	40.5°	40.0°

Please refer to the latest Technical Data for alignment specs.

For servicing a camber correction is possible by means of a disconnected swivel bearing available in the spare parts service.

Two versions of this swivel bearing are available:

- Version 1: Camber correction –0° 30'
- Version 2: camber correction 0° 30'.

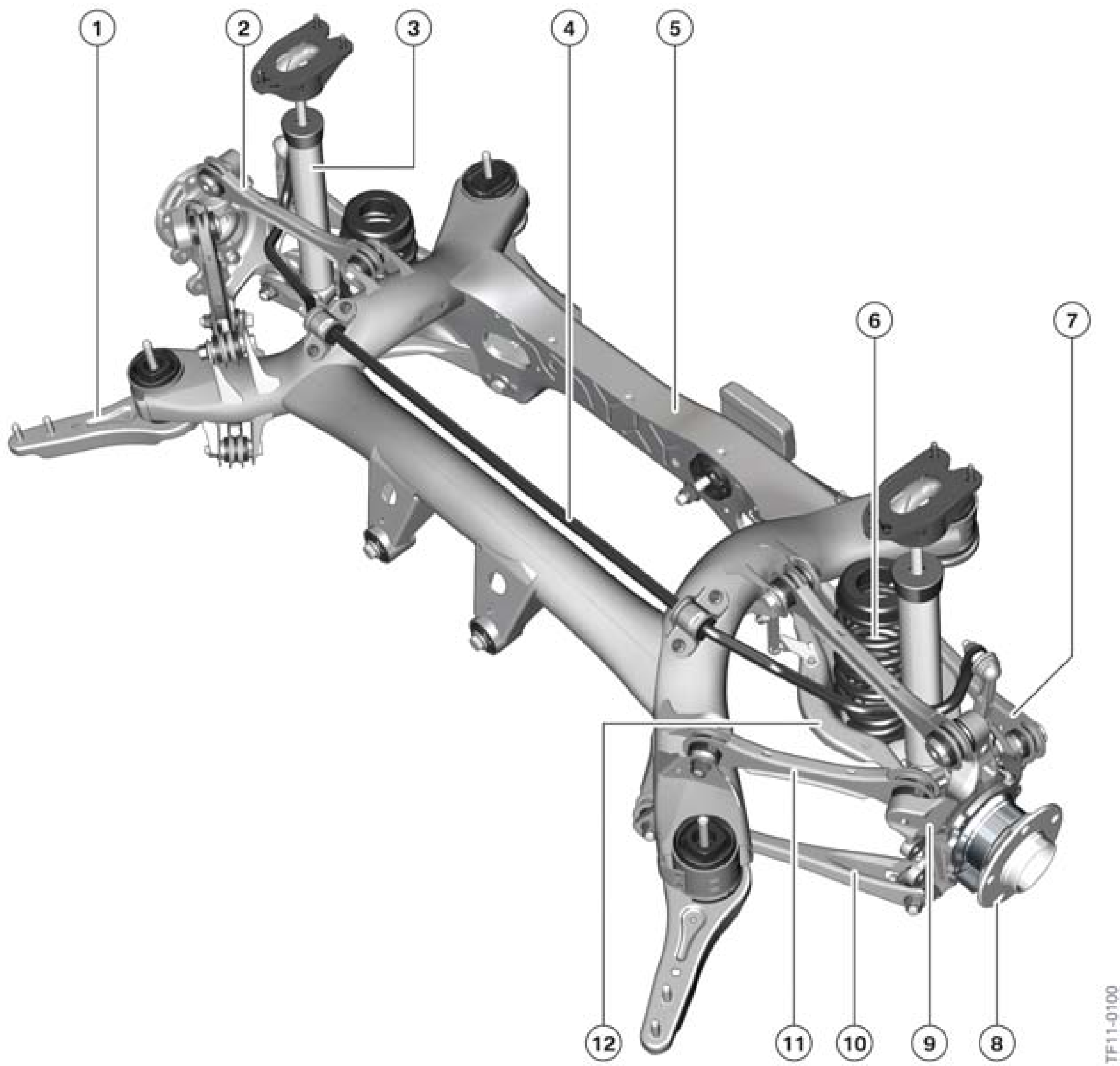
3.1.2. Notes for service

The following tables show when front wheel alignment is necessary.

Component replaced	Wheel alignment required
Front axle support	YES
Steering box	YES
Wishbone	YES
Rubber mount for wishbone	YES
Trailing link	NO
Rubber mount for trailing link	NO
Track rod	YES
Swivel bearing	YES
Wheel bearing	NO
Spring strut	NO
Coil spring	NO
Support bearing	NO

Screw connection unfastened	Wheel alignment required
Front axle support to body	NO
Steering box to front axle support	YES
Wishbone to front axle support	YES
Wishbone to swivel bearing	NO
Trailing link to front axle support	NO
Trailing link to swivel bearing	NO
Track rod to steering box	NO
Track rod end to track rod	YES
Track rod end to swivel bearing	NO
Spring strut to swivel bearing	NO
Support bearing to body	NO
Steering shaft to steering gear	NO
Steering column to steering shaft	NO

3.2. Rear axle



F30 Five-link rear suspension

Index	Explanation
1	Compression strut
2	Wishbone
3	Damping action
4	Anti-roll bar
5	Rear axle support
6	Suspension
7	Camber link

3. Chassis and Suspension

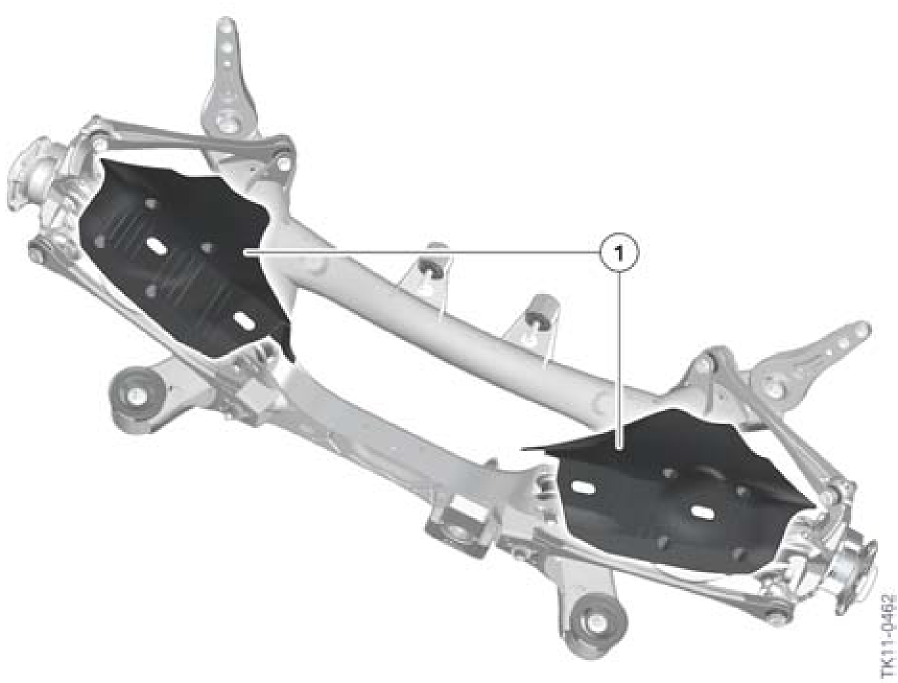
Index	Explanation
8	Wheel hub
9	Wheel carrier
10	Trailing arm
11	Control arm
12	Camber link

In the F30 a five-link rear axle has been used. HA5 This is based on the predecessor but has undergone significant further development and has been implemented as a steel construction.

Elasto-kinematics are installed in the five-link rear axle, which are coordinated specifically to the F30. The precise and superior wheel control in all driving situations has a large spring travel range.

It has been possible to resolve the conflicting objectives of driving dynamics and comfort by:

- A flexible suspension of rear axle differential at rear axle support and a flexible bearing of rear axle support at body (2x flexible bearing), which have been specifically coordinated to the F30
- Maximum support base width for the rear axle support
- Significant increase in track width when compared to E90
- Optimum connection of body suspension and damping.



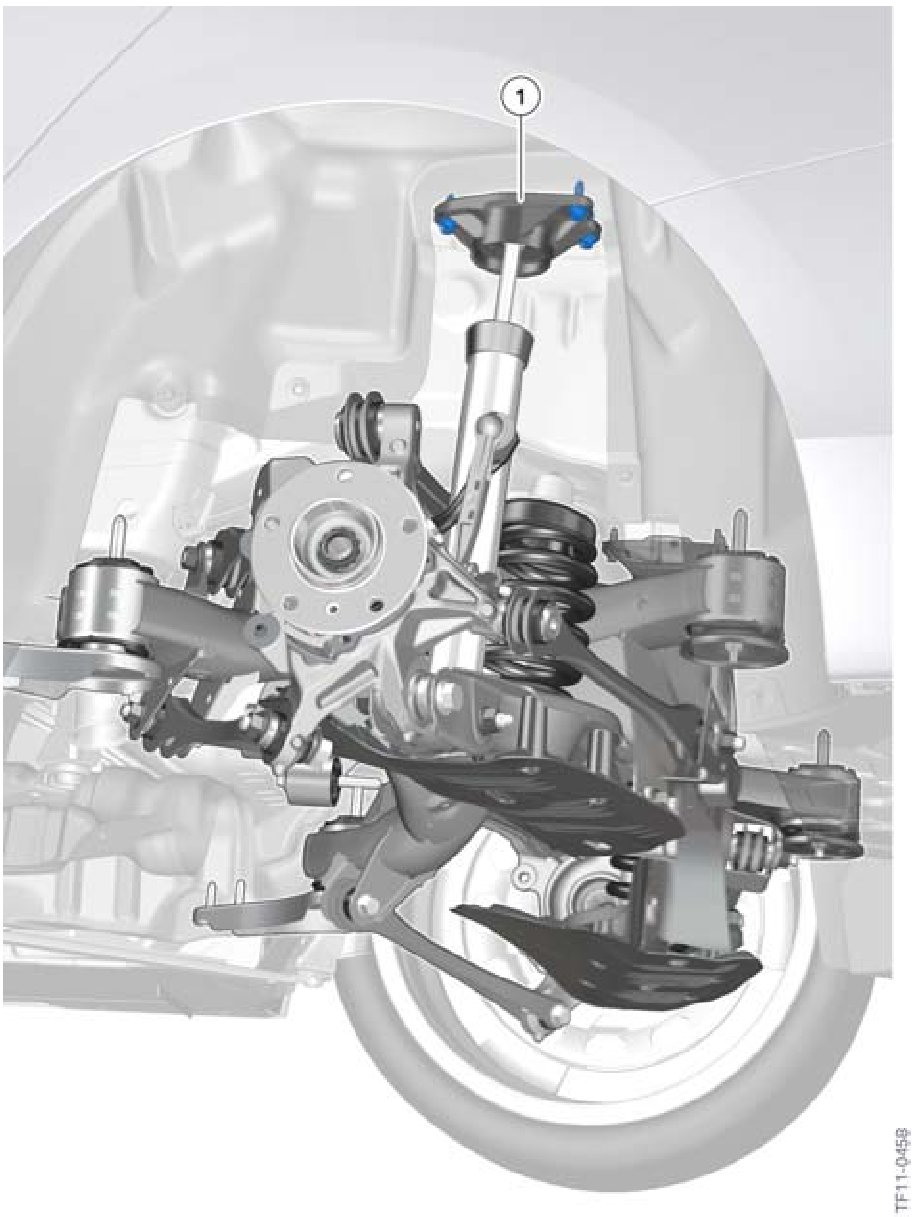
F30 aerodynamic covers

Index	Explanation
1	Aerodynamic covers

F30 Chassis Dynamics
3. Chassis and Suspension

Specific aerodynamic measures improve the lift coefficients and the drag coefficient (Cd), which has a positive impact on consumption and driving dynamics. Thus aerodynamic covers made of fibre-glass-reinforced polyamide has been fitted to the camber links of the F30.

When compared to the E90 , it has been possible to increase the loading width of the luggage compartment and leg room in the rear passenger compartment.



F30 shock absorber, rear axle

Index	Explanation
1	Support bearing with multiple load path

3. Chassis and Suspension

The shock absorber design of the F30 and E90 are different. In the F30, firstly the pivot point of the shock absorber to the camber link was modified, and secondly no more work is necessary in the luggage compartment for dismantling the shock absorber.

The support bearing with single load path for the shock absorber in the E90 is screwed to the body from the inside. The support bearing in the F30 is a multiple-path version and is fastened to the body from the outside.

3.2.1. Technical data

Designation	Without optional equipment 2VF or optional equipment 704	With optional equipment 2VF or optional equipment 704
Total toe-in	18'	18'
Camber	–90'	–105'

Please refer to the latest Technical Data for alignment specs.

3.2.2. Notes for Service

The following tables show when rear wheel alignment is necessary.

Component replaced	Wheel alignment required
Rear axle support	YES
Rubber mount for rear axle support	NO
Wheel carrier	YES
Ball joint and rubber mount in wheel carrier	YES
Control arm	NO
Trailing arm	NO
Wishbone	YES
Camber link	YES
Camber link	YES
Wheel bearing	NO
Shock absorber	NO
Coil spring	NO
Support bearing	NO

Screw connection unfastened	Wheel alignment required
Rear axle support to body	NO
Compression strut to body	NO
Control arm to rear suspension subframe	NO
Control arm to hub carrier	NO

Screw connection unfastened	Wheel alignment required
Trailing arm to rear axle support	NO
Trailing arm to wheel carrier	NO
Wishbone to rear axle support	YES
Wishbone to wheel carrier	NO
Camber link to rear axle support	YES
Camber link to wheel carrier	YES
Camber link to rear axle support	YES
Camber link to wheel carrier	YES
Support bearing to body	NO

3.3. Suspension/dampers

3.3.1. Basic chassis and suspension

Steel springs are mounted to the front and rear axle of the F30.

Damping is provided by conventional shock absorbers as standard. Spring struts are installed at the front axle and springs and dampers are arranged separately at the rear axle.

3.3.2. M Sports suspension

Vehicles with M Sports suspension (optional equipment 704) have a tighter spring/damper design and are positioned 10 mm lower.

3.3.3. Adaptive M chassis and suspension

Vehicles with an adaptive M sports suspension (optional equipment 2VF) are also positioned 10 mm lower.

In addition, the electronic damper control EDC is integrated. Here four continuously adjustable shock absorbers with coupled rebound/compression stage adjustment produce damping forces according to requirements. The shock absorbers can automatically assume a harder setting (more dynamic/sporty) or softer (more comfortable) setting, depending on the driving manoeuvre.

For more information on the EDC refer to Chapter "Electronic Damper Control (EDC)".

3.4. Wheels and Tires

The standard Tire sizes are listed in the following tables.

Model	Tires	Wheel rim	Rim offset IS
BMW 328i	225/50 R17 94V AS	7.5J x 17 LA	37 mm
BMW 335i	225/45 R18 91V AS	8J x 18 LA	34 mm

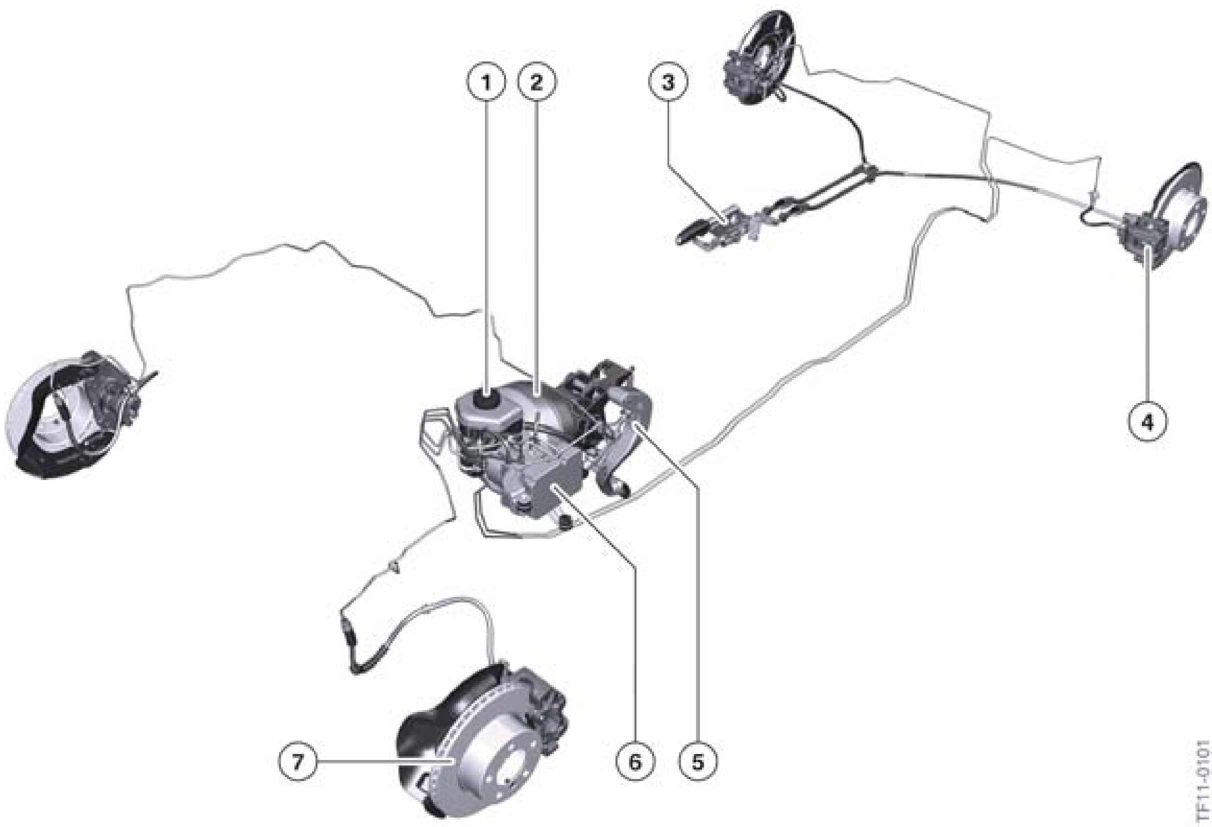
Run-flat tires on the F30 are standard equipment.

3.4.1. Tire Pressure Monitor TPMS

The F30 is equipped with the latest generation of the TPMS (Tire pressure control).

For further information on the TPMS, please refer to the Training Material "F25 Chassis and Suspension".

4. Brakes



F30 Brake system

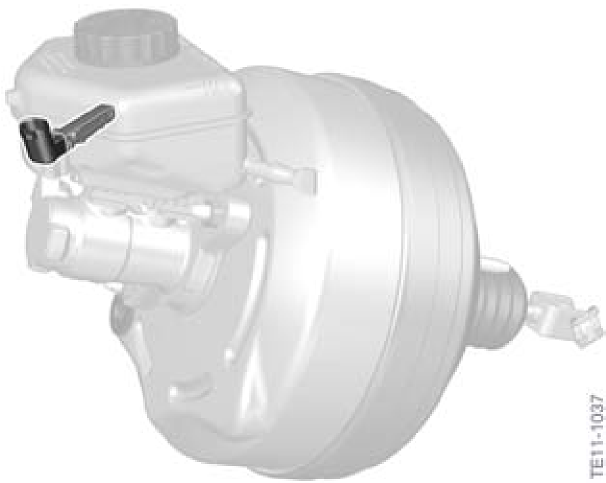
Index	Explanation
1	Brake fluid expansion tank
2	Brake servo
3	Parking brake
4	Brake caliper
5	Brake pedal
6	Dynamic Stability Control DSC
7	Brake disc

4.1. Service brakes

The F30 features a hydraulic 2-circuit brake system with "front/rear split". One brake circuit is intended for both the front and rear axle.

The familiar brake pad wear monitoring function for the Condition Based Service display continues to be used. Single-stage brake pad wear sensors are installed on the front left and rear right wheel brakes for this purpose.

F30 Chassis Dynamics
4. Brakes



F30 level sensor for brake fluid

The brake fluid level sensor in the F30 is no longer integrated into the lid of the tank and is instead inserted into the tank itself.

The brake disc dimensions for the F30 are listed in the following table.

Model	Brake disc, front axle (Ø/thickness) [mm]	Brake disc, rear axle (Ø/thickness) [mm]
BMW 328i	330 x 24	300 x 20
BMW 335i	340 x 30	330 x 20

For all engine versions, internally ventilated, coated brake discs are used on both axles. In the BMW 335i lightweight brake discs with an aluminium brake disc chamber are installed as standard.

In the F30 twor brake caliper variants are used on the front axle and two on the rear axle depending on the model:

Brake caliper, front axle	Models
Single-piston floating caliper, piston Ø 57 mm, aluminium	BMW 328i
Four-piston fixed caliper, piston Ø 40 mm, aluminium	BMW 335i

Brake caliper, rear axle	Models
Single-piston floating caliper, piston Ø 42 mm, cast iron	BMW 328i
Single-piston floating caliper, piston Ø 42 mm, cast iron	BMW 335i

4.2. Parking brake

The parking brake is designed as a duo-servo parking brake with the following dimensions:

- 185 x 20 mm for BMW 328i and 335i.

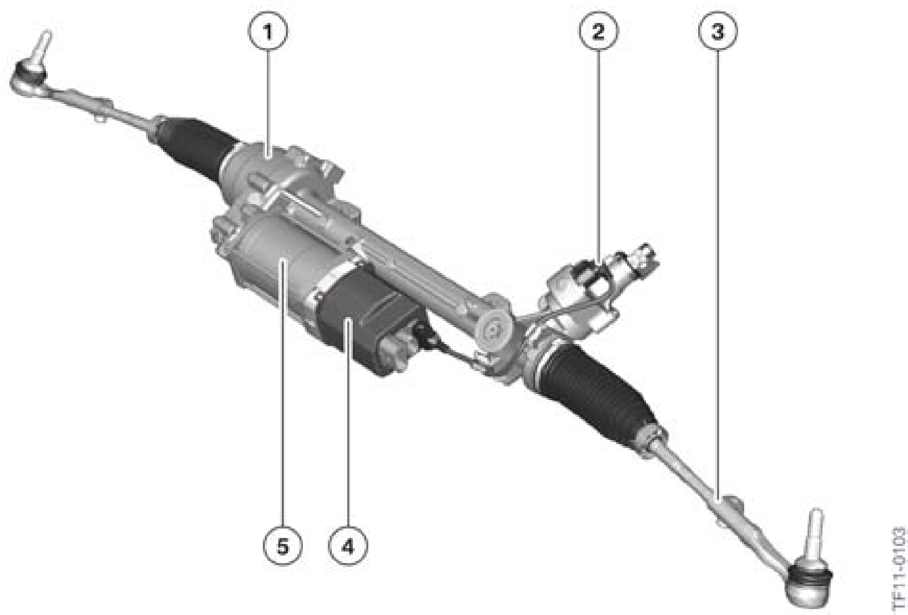
F30 Chassis Dynamics

5. Steering

5.1. Electronic Power Steering EPS

The F30 features Electronic Power Steering EPS (electromechanical power steering) which replaces the conventional hydraulic steering.

When compared to hydraulic steering, with EPS the power assist is applied to the rack via an electric motor and a reduction gear.



Steering gear of EPS in F30

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

Thanks to the supply of condition-based power, the average fuel consumption has been reduced by approx. 3% compared to conventional hydraulic power steering. This helps reduce carbon dioxide emissions.

As there is no oil in an EPS system, it is more environmentally friendly and easier to service than a conventional hydraulic power steering system.

Owing to the compact design of the steering gear with integrated electric motor and control electronics, the installation and maintenance overheads are considerably less than a conventional hydraulic power steering system.

With EPS, both the steering servo (steering force) and return can be freely balanced. Steerability and drivability can therefore be adapted optimally to the relevant driving situation (e.g. when driving in built-up areas or on the highway).

F30 Chassis Dynamics

5. Steering

Servotronic is installed as standard equipment on the F30. The Servotronic controls the steering servo subject to the vehicle speed. Two different settings (“Normal” and “Sporty”) can be accessed via the driving experience switch.

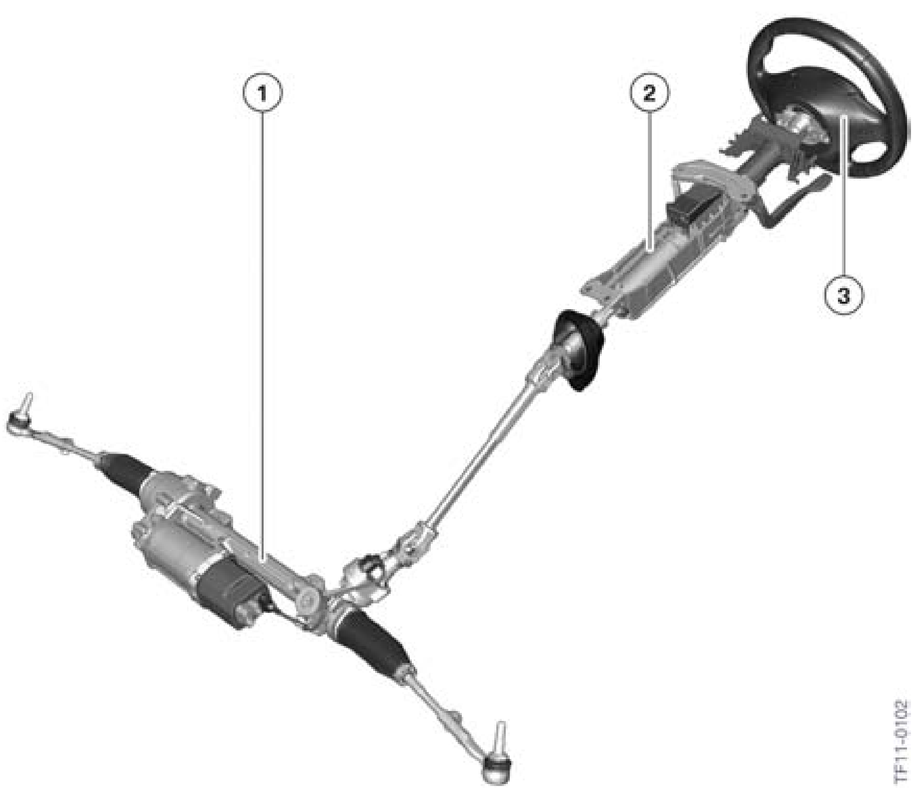
Active steering is not available for the F30, "Variable sports steering" (SA 2VL) is instead available as optional equipment.

The EPS a prerequisite for implementation of the Parking Manoeuvring Assistant PMA.

Depending on the F30 options two variants of steering gear are used:

- EPS basic steering gear for BMW 328i and 335i.
  With this steering gear the housing and the mechanics are designed for higher axle loads. The electrical motor is enhanced and the engine shortened.
  Manufacturer: ThyssenKrupp.
- EPS for variable sport steering (optional equipment 2VL).
  In terms of the housing, this steering gear corresponds to the mechanics and the engine of the EPS for BMW 328i and 335i. However, the electric motor is designed for the higher dynamics of sport steering. In addition, a rack with variable ratio is installed.
  Manufacturer: ThyssenKrupp.

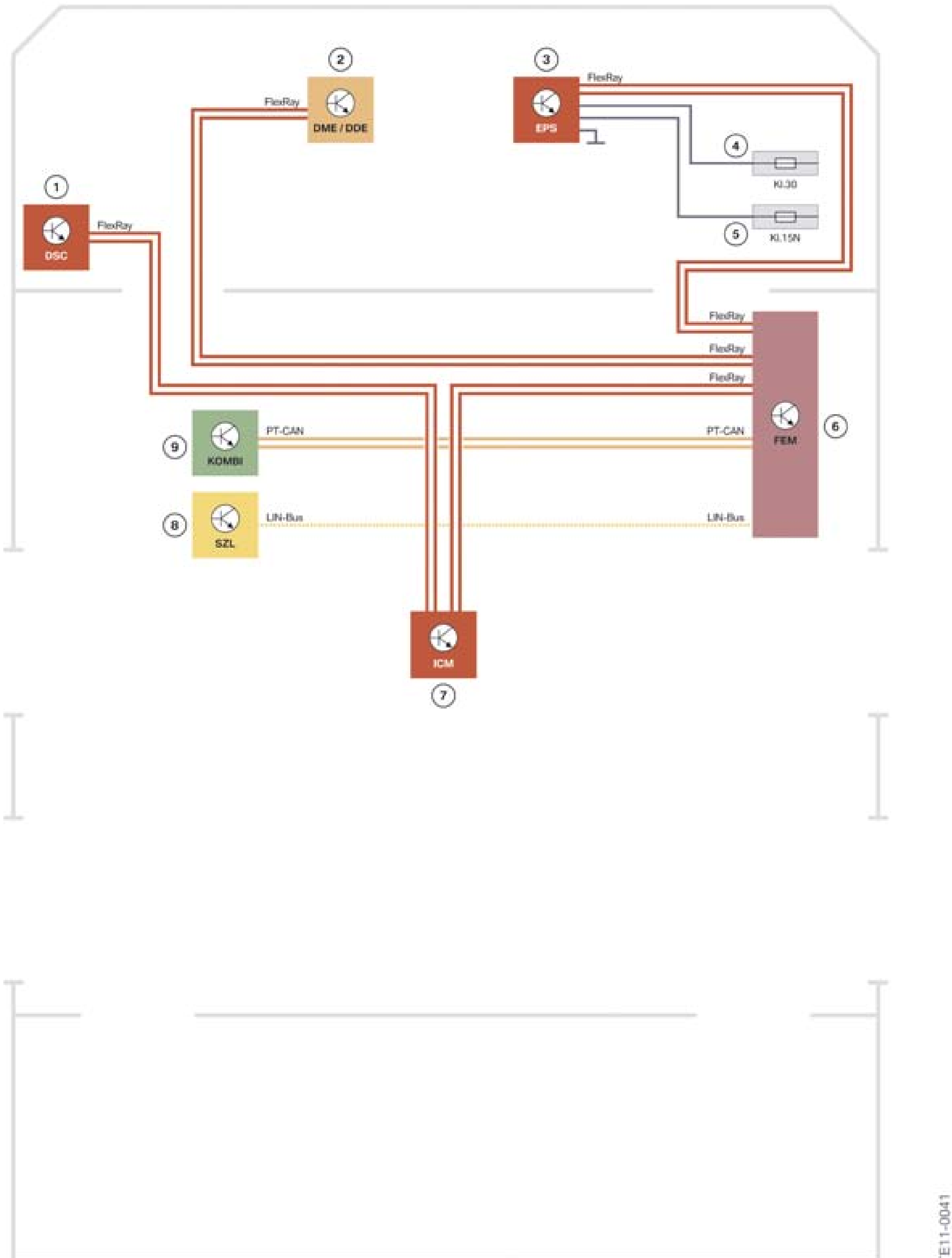
5.1.1. System overview



Steering components of EPS in F30

Index	Explanation
1	Electronic Power Steering EPS
2	Steering column
3	Steering wheel

5.1.2. System wiring diagram



System wiring diagram of EPS in F30

Index	Explanation
1	Dynamic Stability Control DSC
2	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) (not US)
3	Electronic Power Steering EPS
4	Power distribution box, front
5	Power distribution box, engine compartment
6	Front Electronic Module (FEM)
7	Integrated Chassis Management (ICM)
8	Steering column switch cluster (SZL)
9	Instrument cluster (KOMBI)
Kl.15N	Ignition (after-run)
Terminal 30	Terminal 30

5.1.3. Steering angle sensor

The information on the steering angle in the F30 is not recorded by the Electronic Power Steering EPS via a separate sensor on the steering wheel and instead is computed based on the angle of the EPS motor position in relation to the steering wheel.

The EPS transmits the position of the rack to the ICM control unit via FlexRay. During this process, the EPS calculates the absolute position of the rack based on the current rotor position of the EPS motor and the number of complete revolutions performed by the rotor starting from the zero position (straight-ahead driving position).

Taking this position as the starting point, the ICM control unit determines the wheel-specific steering angle among other things using the stored ratio parameters (rack to wheel-specific steering angle) and transmits this via FlexRay. This wheel-specific steering angle is used by the DSC among other things as a reference variable for internal control functions.

In cases where the absolute value is not available from the EPS (loss of Terminal 30, flash process), the absolute value is determined through interaction between the ICM and EPS using a teaching function in which the steering wheel is turned from end stop to end stop (e.g. straight-ahead position -> left -> right -> straight-ahead position).

5.2. Variable sport steering

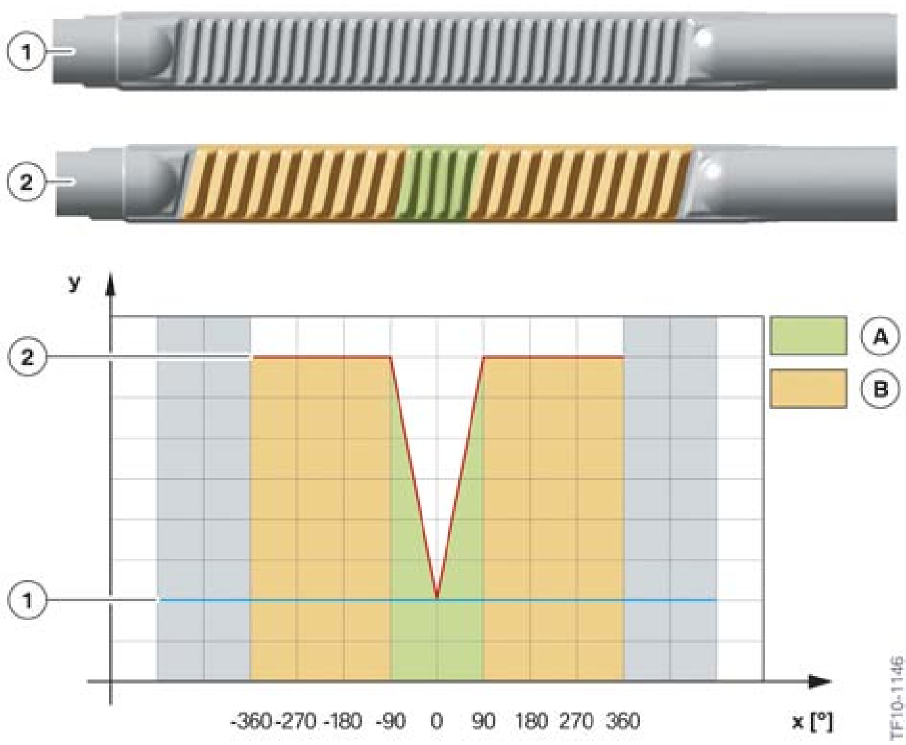
The "Variable sport steering" (optional equipment 2VL) is available for the F30 as an alternative to the basic version of EPS. This is the first steering system on the market to combine the benefits of an extremely direct, variable steering gear ratio and the operating principle of EPS.

The variable sport steering increases both ride comfort and agility. The direct ratio reduces the overall steering angle, i.e. the number of turns of the steering wheel required to turn from one steering stop to the other, by roughly 25%. This therefore helps manoeuvres that require a larger steering angle, e.g. parking, turning off or turning round, to be carried out more comfortably.

5. Steering

The more direct steering gear ratio when compared to the basic version of the EPS and the reduced steering angle which is required as a result achieves a more direct vehicle response and higher agility. This comes in handy during avoidance manoeuvres for example.

The variable steering gear ratio is implemented through the stroke-dependent gear geometry of the rack. Around the center position of the steering gear, the steering system behaves accurately with steady directional stability. As the steering angle moves away from the center position, the ratio becomes increasingly more direct.



Comparison between steering gear ratio of basic EPS version and variable sport steering for F30

Index	Explanation
1	Rack in basic version of EPS (constant gear geometry)
2	Variable sport steering rack (variable gear geometry)
A	More indirect steering gear ratio (variable sport steering)
B	More direct steering gear ratio (variable sport steering)
x	Steering angle
y	Rack stroke

5.3. Steering column

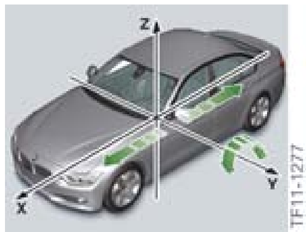
Thanks to an integrated crash system, in the event of an accident the steering column can dissipate additional energy through specific deformation.

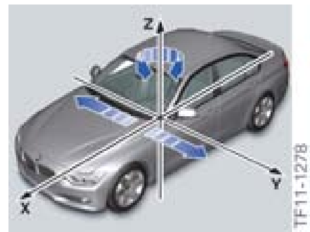
5.3.1. Steering column adjustment

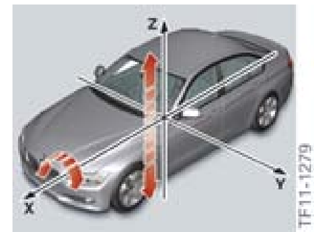
The steering column of the F30 can be adjusted mechanically; a forward/back adjustment of 60 mm and height adjustment of 40 mm is possible. This allows optimum ergonomic positioning of the driver.

6. Driving Stability Control

6.1. Directions of action







Direction of action	Longi-tudinal	Pitch	Lateral	Yaw	Vertical	Roll
DSC	●		●	●		●
EDC	●	●	●		●	●
DCC	●					

Driving stability control systems can be differentiated in terms of their basic effective directions. They can act along as well as around an axis of the vehicle's fixed X, Y or Z coordinate system.

6.2. Integrated Chassis Management (ICM)

6.2.1. System overview

F30 ICM control unit

Index	Explanation
1	ICM control unit

6.2.2. System function

The Integrated Chassis Management ICM coordinates, as monitoring system so to speak, all driving stability control systems and vehicle control systems. The advantage of this structure is that the individual systems can continue processing their immediate functions rapidly and also independently. As the higher-level central control system, the ICM monitors and coordinates interventions and sends instructions to intelligent actuators. This allows braking, steering or torque interventions to be performed, for example.

Influence of ICM control unit on driving stability control

- **Driving dynamics control FDR**
  The driver can activate and deactivate the driving dynamics control (FDR) via the DTC button or the driving experience switch. The function mode is displayed in the instrument cluster KOMBI.
  The ICM control unit evaluates the DTC button and driving experience switch as well as the switching logic, as well as communication between the various systems involved (including DSC). Furthermore, the ICM control unit includes system monitoring of partner functions which switches back to normal mode (DSC ON) if one of the functions being monitored drops out.
- **Dynamic Cruise Control DCC**
  Dynamic Cruise Control DCC is a road speed controller with braking intervention. The DCC function in the ICM control unit acts on the powertrain and brake via corresponding interfaces. In addition, interfaces exist with display and operating elements and the driving dynamics sensor systems.
  Further information on the DCC can be found in the chapter entitled "Dynamic Cruise Control DCC".
- **Active cruise control with Stop&Go function (optional equipment 5DF) Not at start of production.**
  The active cruise control with Stop&Go function (ACC Stop & Go) is a speed regulator with a distance regulator function. The "ACC Stop & Go" function in the ICM control unit acts on the powertrain and brake via corresponding interfaces. In addition, interfaces exist with display and operating elements and the driving dynamics sensor systems.

Sensor system

As the central element, the ICM control unit incorporates the driving dynamics sensors and central airbag sensor system. It is installed near the vehicle's center of gravity via a holder on the center console.

Function	Vehicles without EDC	Vehicles with EDC
Longitudinal acceleration (airbag sensor system)	●	●
Lateral acceleration (airbag sensor system)	●	●
Longitudinal acceleration	●	●

6. Driving Stability Control

Function	Vehicles without EDC	Vehicles with EDC
Lateral acceleration	●	●
Vertical acceleration	–	●
Yaw rate	–	●
Pitch rate	–	●
Yaw rate	●	●

The following signals are calculated from this and made available to the DSC via FlexRay:

- Yaw rate
- Lateral acceleration
- Longitudinal acceleration
- Steering angle.

6.3. Dynamic Stability Control DSC

The Dynamic Stability Control DSC forms the core of the vehicle control systems that enhance active safety. It optimizes driving stability in all driving conditions and also traction when driving off and accelerating. Furthermore, it identifies unstable driving conditions such as understeering or oversteering and helps maintain the vehicle on a steady course.

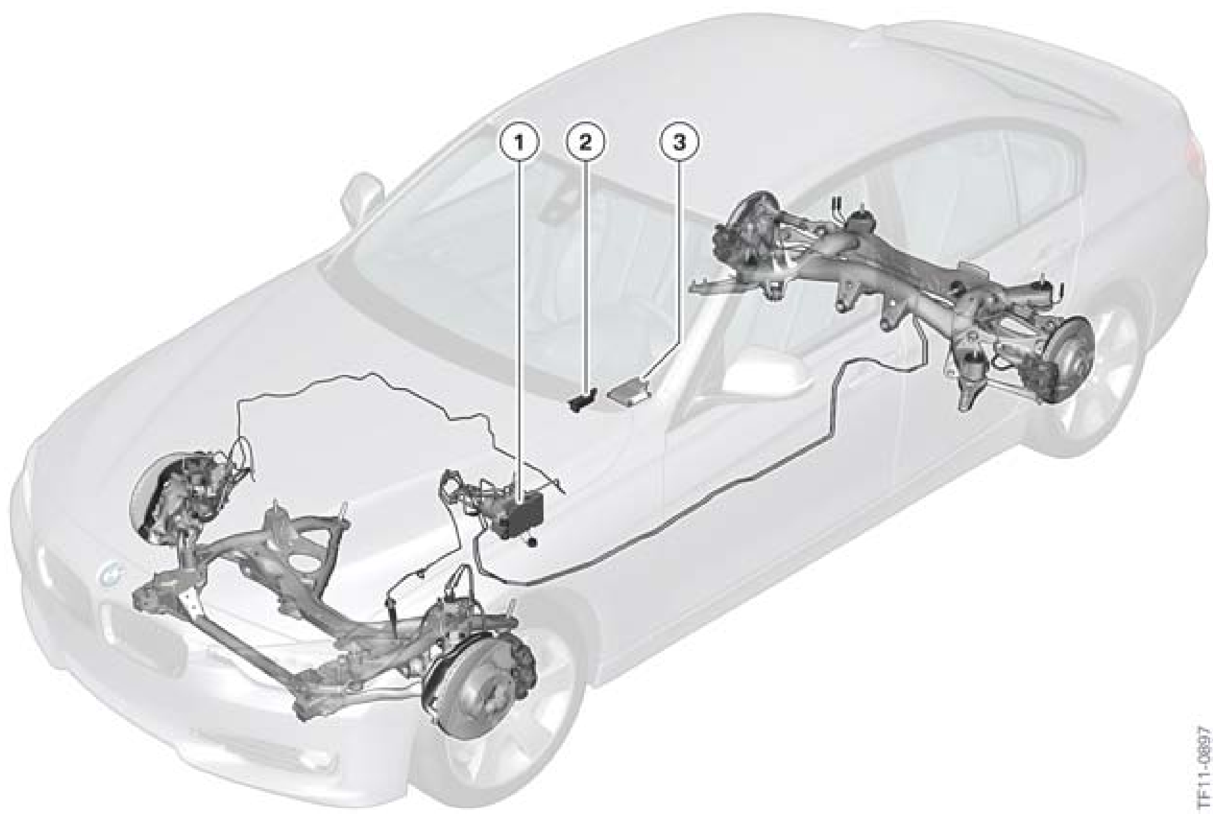
In the F30 two variants of the DSC are used. In the basic version the hydraulic unit has an internal pressure sensor and a double piston pump. For vehicles with active cruise control with Stop&Go function (optional equipment 5DF) “Not at start of production” a version with two additional pressure sensors is installed.

The ultra sensitive sensors of the F30 record the current driving condition permanently. The information comes for example from the wheel speed, steering angle, lateral acceleration, longitudinal acceleration, pressure and yaw sensors (detect rotation on the vehicle's vertical axis). The single-track model calculated by the DSC control unit serves as the basic variable for control interventions in the DSC. During this process, the relevant driver input (steering wheel angle and vehicle speed), in other words "the desired state", and the vehicle sensor data, in other words "the actual state", are compared.

If the calculated desired state and measured actual state do not correspond, stabilizing or traction-enhancing measures are introduced once defined tolerances have been exceeded. Driving stability can once again be ensured or a traction requirement can be implemented by selectively reducing or increasing the engine torque (with active engine drag torque control) or through wheel-specific brake intervention.

F30 Chassis Dynamics
6. Driving Stability Control

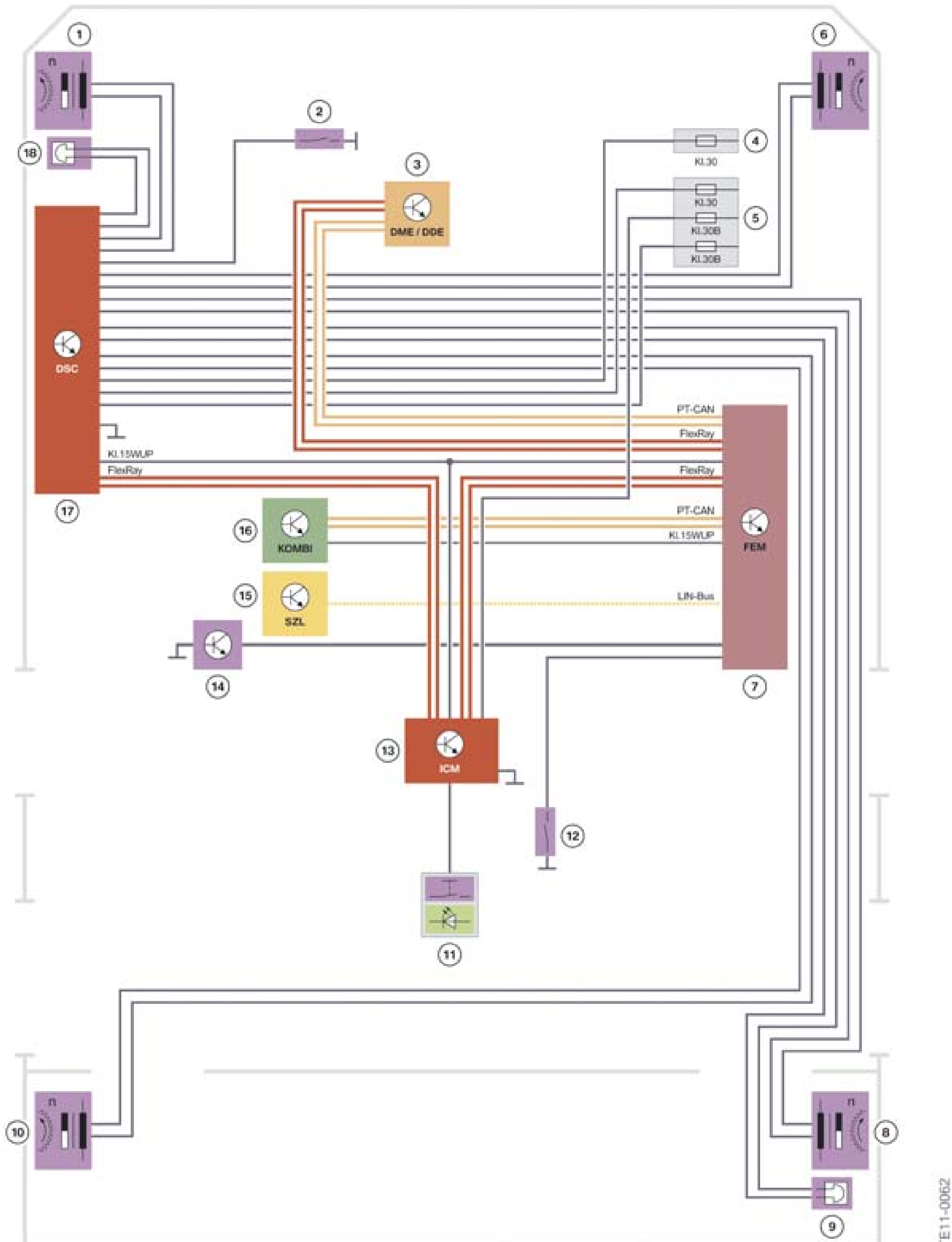
6.3.1. System overview



System overview of DSC in F30

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Driving experience control button
3	Integrated Chassis Management (ICM)

6.3.2. System wiring diagram



System wiring diagram of DSC in F30

Index	Explanation
1	Wheel-speed sensor, front left
2	Brake fluid level switch
3	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) (not US)
4	Power distribution box, engine compartment
5	Power distribution box, front
6	Wheel-speed sensor, front right
7	Front Electronic Module (FEM)
8	Wheel speed sensor, rear right
9	Brake pad wear sensor, rear right
10	Wheel speed sensor, rear left
11	Operating facility, center console
12	Parking brake switch
13	Integrated Chassis Management (ICM)
14	Brake light switch
15	Steering column switch cluster (SZL)
16	Instrument cluster (KOMBI)
17	Dynamic Stability Control (DSC)
18	Brake pad wear sensor, front right
Terminal 15WUP	Wake-up with terminal 15 ON
Terminal 30	Terminal 30
Terminal 30B	Terminal 30 basic operation

6.3.3. System function

Function	Subfunction	Designation
ABS		Antilock Brake System
	EBV	Electronic brake force distribution
	CBC	Cornering Brake Control
	DBC	Dynamic Brake Control
ASC		Automatic Stability Control
	ADB	Automatic Differential Brake (only active in DSC OFF mode)
	MMR	Engine torque control
	MSR	Engine drag control

F30 Chassis Dynamics
6. Driving Stability Control

Function	Subfunction	Designation
	BMR	Braking torque control
DSC		Dynamic Stability Control
	DTC	Dynamic Traction Control

The DSC can be operated in three modes:

- DSC ON
- Dynamic traction control, DTC
- DSC OFF.

F30 DTC button

Index	Explanation
1	DTC button

Function	DSC ON	DTC	DSC OFF
Anti-lock braking system ABS	●	●	●
Electronic brake-force distribution EBV	●	●	●
Cornering Brake Control CBC	●	●	●
Engine drag torque control MSR	●	●	●
Automatic Stability Control ASC	●	X	–

Function	DSC ON	DTC	DSC OFF
Automatic Differential Brake ADB	–	–	●
Driving dynamics control FDR	●	X	–
Brake standby	●	●	●
Dry by applying brake	●	●	●
Drive-off assistant	●	●	●
Fading Brake Support	●	●	●
Dynamic Braking Control DBC	●	●	●
Run Flat Indicator RPA	●	●	●
Condition Based Services CBS	●	●	●
Post Crash	●	●	●

Symbol	Explanation
●	Function active
–	Function inactive
X	Function with modified control thresholds

⚠

Adopting a suitably adapted driving style always remains the responsibility of the driver.

Not even DSC can overcome the laws of physics.

The additional safety features afforded by the system should not be diminished by risky driving.

6.4. Dynamic Cruise Control DCC

Dynamic Cruise Control DCC is a cruise control with comfortable brake intervention. DCC keeps the chosen speed constant above speeds of roughly 30 km/h - when compared to conventional cruise control with the following additional functions:

- **Active brake intervention** - if the engine drag torque is insufficient in coasting (overrun) mode to maintain the chosen speed, the vehicle is decelerated automatically through additional controlled brake intervention.

- **Curve Speed Limiter (CSL)** - Depending on the actual lateral acceleration, the driving speed is reduced during controlled cornering as necessary. When coming out of the bend the speed is adjusted until it once again reaches the desired level.

- **Comfort Dynamic System (CDS)** - Referred to as "Hand-controlled acceleration mode", this feature allows the driver to accelerate or decelerate continuously via an operating element on the steering wheel in two dynamic stages respectively. The driver can thus accelerate or decelerate in the traffic flow without having to estimate the target speed beforehand.
- **Adapted downhill driving** – Maintaining the desired speed during controlled downhill driving is effected by overrun fuel cutoff and adapted gear downshifting. The wheel brakes are relieved and the fuel consumption reduced. With the DSC braking control system, corresponding measures are applied via a substitute temperature model to compensate for leaks and distribute torque between the front and rear axle. This means that any leaks that occur in the braking control circuit can be counteracted.

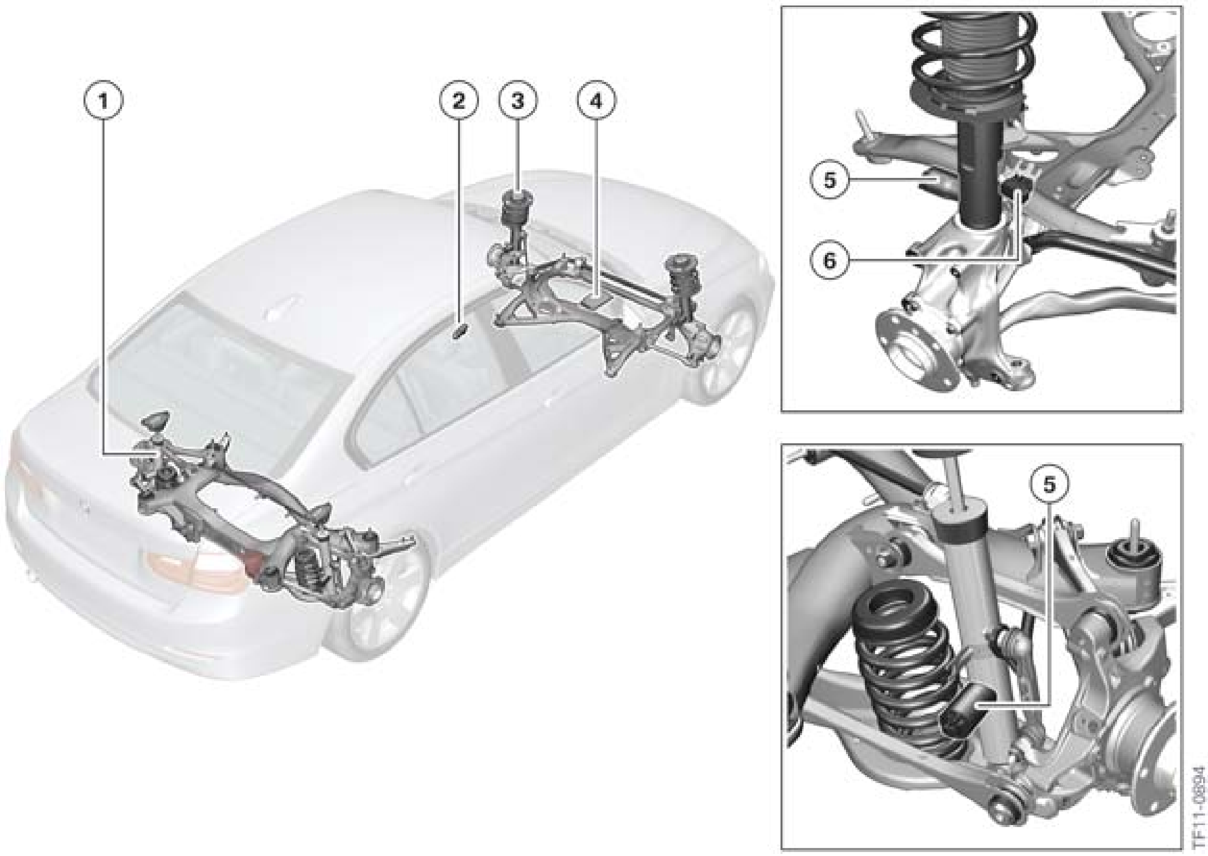
The desired/resume speed is indicated in the instrument cluster KOMBI by a mark that moves round the speed reading. Depending on the system status the marking illuminates in green (active) or orange (system interrupted).

If the desired speed is adjusted, or when the DCC function is activated, the updated digital value appears briefly in the display as acknowledgement for the driver.

6.5. Electronic Damper Control (EDC)

For vehicles with an adaptive M sports suspension (optional equipment 2VF) the electronic damper control EDC is used. Here four continuously adjustable shock absorbers with coupled rebound/compression stage adjustment produce damping forces according to requirements. The shock absorbers can automatically assume a harder setting (more dynamic/sporty) or softer (more comfortable) setting, depending on the driving manoeuvre.

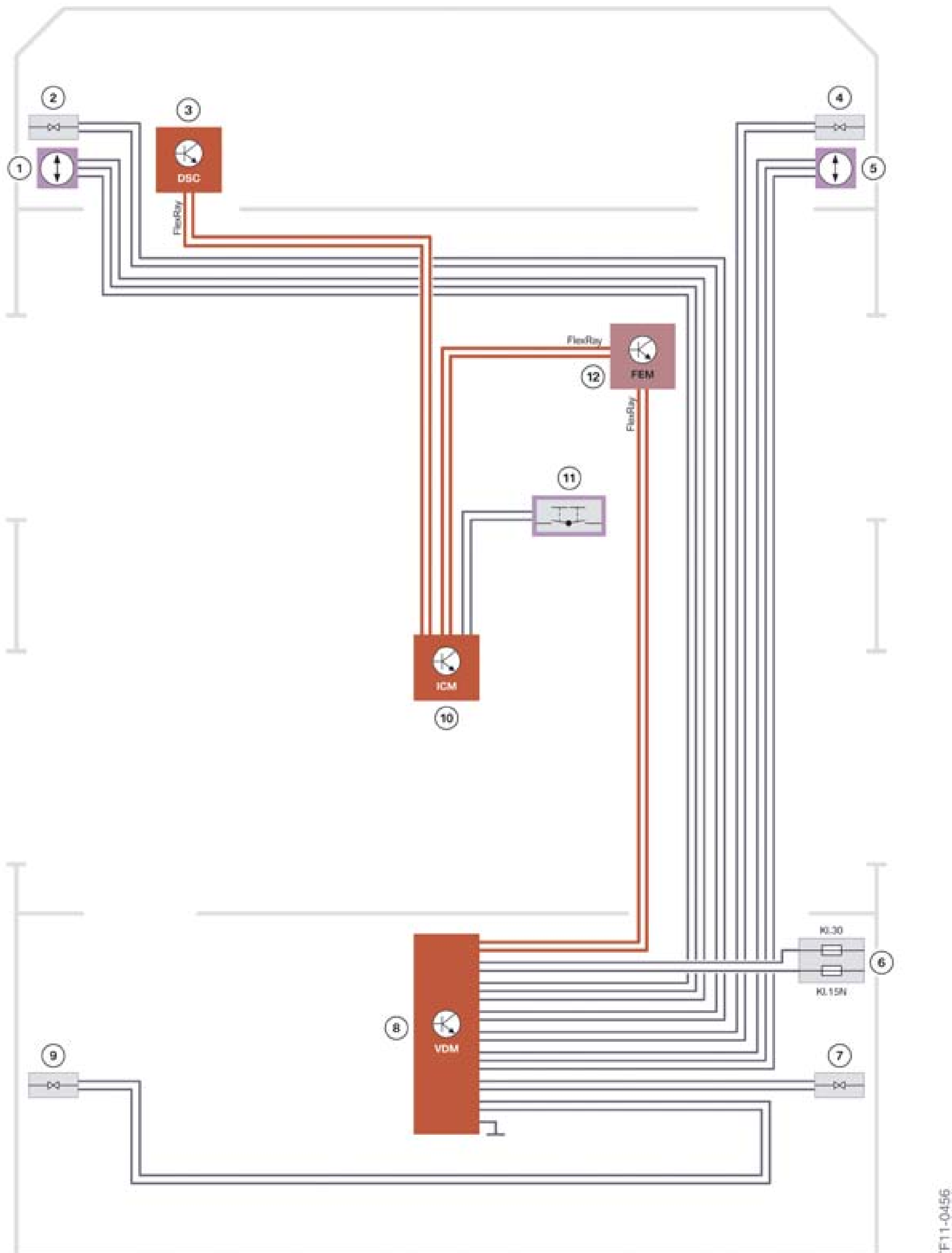
6.5.1. System overview



System overview of EDC in F30

Index	Explanation
1	Electronic adjustable damper, rear
2	Driving experience control button
3	Electronic adjustable damper, front
4	VDM control unit
5	Electromagnetic adjusting valve
6	Wheel acceleration sensor

6.5.2. System wiring diagram



System wiring diagram of EDC in F30

Index	Explanation
1	Vertical wheel acceleration sensor, front left
2	Electromagnetic adjusting valve, front left
3	Dynamic Stability Control DSC
4	Electromagnetic adjusting valve, front right
5	Vertical wheel acceleration sensor, front right
6	Power distribution box, luggage compartment
7	Electromagnetic adjusting valve, rear right
8	Vertical Dynamics Management (VDM)
9	Electromagnetic adjusting valve, rear left
10	Integrated Chassis Management (ICM)
11	Driving experience control button
12	Front Electronic Module (FEM)
Terminal 30	Terminal 30
Terminal 15N	Ignition (after-run)

6.5.3. System function

The Electronic Damper Control EDC is a variable, electronically controlled shock absorber adjustment system that controls the vertical dynamics. The EDC adapts the damping forces of the shock absorber more or less instantly to the changing road or driving conditions.

The Electronic Damper Control (EDC) comes with the optional equipment SA 2VF "Adaptive M sports suspension".

The EDC consists of:

- Four continuously adjustable shock absorbers with coupled rebound/compression stage adjustment
- The VDM control unit
- Two wheel acceleration sensors on the front axle to determine the wheel movement
- Sensor cluster integrated into the ICM control unit which determines the body movements (pitch, vertical, roll).

The sensors in the vehicle permanently measure:

- The body and wheel acceleration
- The current lateral and longitudinal acceleration
- The vehicle speed
- The steering wheel position.

F30 Chassis Dynamics
6. Driving Stability Control

Based on this measured data, the VDM control unit calculates the control commands to be sent to the electromagnetic valves in the shock absorbers for each individual wheel according to the road profile and driving situation. This means that the damping forces will always be applied according to requirements.

This improves ride comfort and also increases driving dynamics.

This improves the vehicle's:

- Suitability for long-distance journeys
- Enhanced body stability and agility
- Improves driving safety by minimizing wheel load fluctuations and reducing the stopping distance.

The driver can choose between the more comfortable or more sporty aspect of the vehicle's character via the driving experience switch.

6.5.4. Notes for Service

Separate lines are still used between the dampers, including the sensors at the front axle and wiring harness. These are not shown in the system wiring diagram and can be replaced individually when carrying out repairs.

6.6. Driving experience control button

F30 driving experience control button

6. Driving Stability Control

Index	Explanation
1	Driving experience control button

The F30 features the driving experience switch in the center console operating facility as standard.

The driver can use the driving experience control button to select different programs which alter various properties of the vehicle depending on the vehicle's equipment specification. The following programs are available:

- SPORT+
  Only in connection with at least one of the following optional equipment:
  - Sport Automatic transmission (optional equipment 2TB)
  - Variable sport steering (optional equipment 2VL)
  - Adaptive M sports suspension (optional equipment 2VF) or
  - BMW Sport Line (PA 7AC)
- SPORT
- COMFORT
- ECO PRO.

Drive systems	SPORT+	SPORT	COMFORT	ECO PRO
Accelerator characteristic	Sports	Sports	Normal	ECO PRO
Shift program (automatic transmission)	Sports	Sports	Normal	ECO PRO
Shift speed	Sports	Sports	Normal	Normal
Shift point display	none	none	Normal	ECO PRO

Chassis and suspension systems	SPORT+	SPORT	COMFORT	ECO PRO
Steering servo	Sport	Sport	Normal	Normal
Dynamic Stability Control	DTC on	DSC on	DSC on	DSC on
Electronic Damper Control	Sports	Sports	Comfortable	Comfortable

The Sports mode can be adapted by means of the Controller. It is possible to specify whether the Sports mode applies only to the chassis and suspension, only to the powertrain, or both.

ECO PRO supports a consumption-friendly driving style. In this regard, the engine control and convenience functions such as air-conditioning/heating are adapted. In addition, situation-dependent information can be shown which helps consumption-optimized driving. The extension of the range achieved can be shown in the instrument cluster.

Further information on ECO PRO can be found in the training information "F30 Display and Operating Elements".

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Technical training.
Product information.

F30 General Vehicle Electronics

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BMW Group University
Technical Training
ST1113 9/1/2013

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
BV-72/Technical Training

F30 General Vehicle Electronics

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F30 General Vehicle Electronics
1. Introduction

The vehicle electrical system of the F30 is based for the most part on the current BMW models. This product information bulletin provides an overview of the most important topics relating to the vehicle electrical system.

For more information on the various topics, please refer to the following documents covering the F01/F02:

Topic F30	Training information F01/F02
Bus systems	Bus Systems F01/F02
Voltage supply	Voltage Supply F01/F02
Energy management	Energy Management F01/F02
Car Access System	Car Access System F01/F02
Comfort Access	Comfort Access F01/F02
Central locking system	Central Locking System F01/F02
Power window regulators	Power Window Regulators F01/F02
Exterior mirrors	Exterior Mirrors F01/F02
Glass slide/tilt sunroof	Slide/Tilt Sunroof F01/F02
Alarm system	Alarm System F01/F02
Exterior lights	Exterior Lights F01/F02
Interior lighting	Interior Light F01/F02
Seats	Seats F01/F02
Heating and air conditioning systems	Heating and Air Conditioning Systems F01/F02

In the F30 the centralization of several control units. Two control units are installed in the F30 for this purpose:

- Front Electronic Module (FEM) and
- Rear Electronic Module (REM).

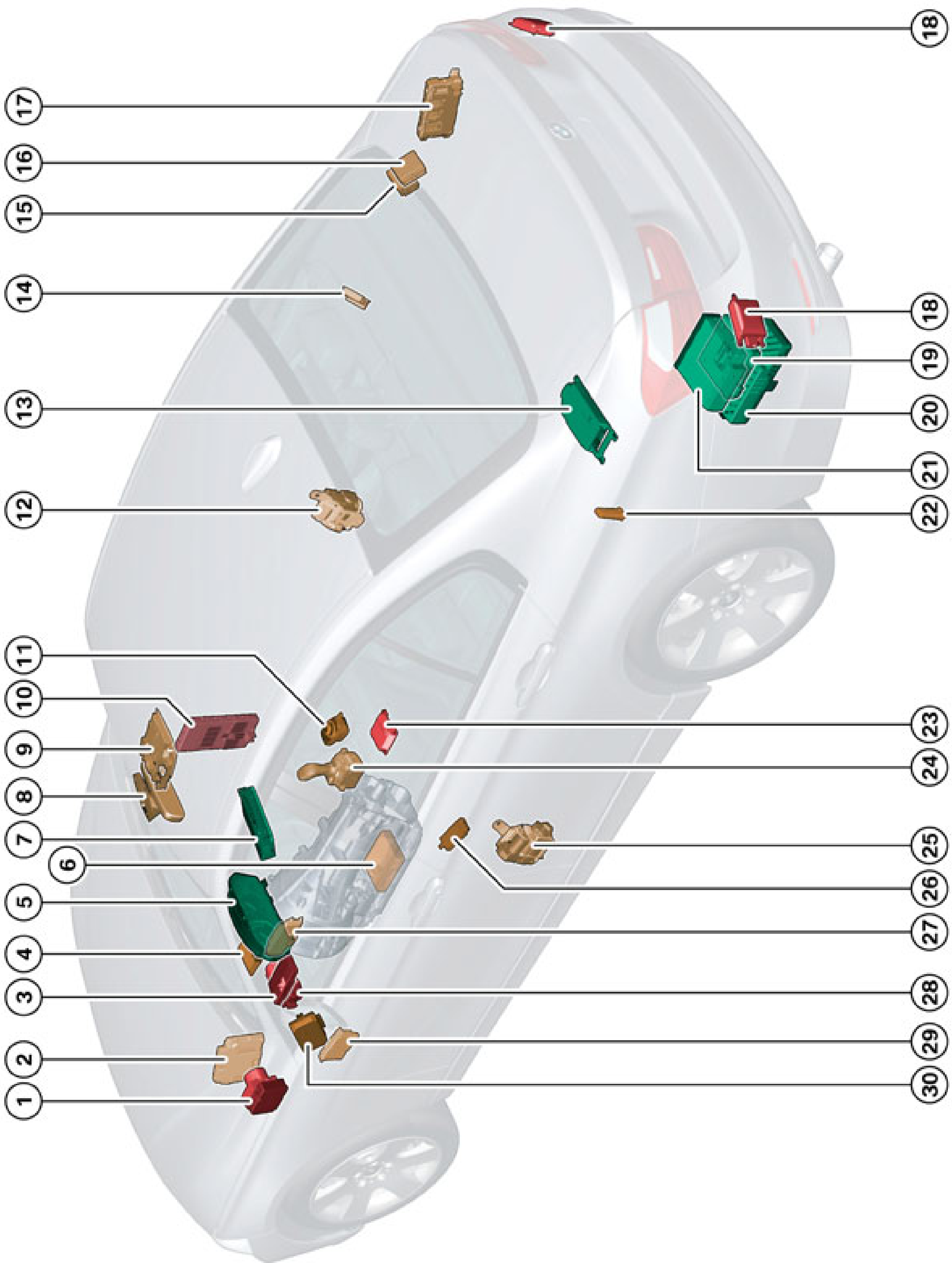
The FEM and REM control units replace the following control units previously used in the E90:

- Junction box (JB)
- Footwell module (FRM)
- Car Access System (CAS)
- Comfort Access (CA)
- Park Distance Control (PDC).

F30 General Vehicle Electronics

2. Vehicle Electrical System

2.1. Control units



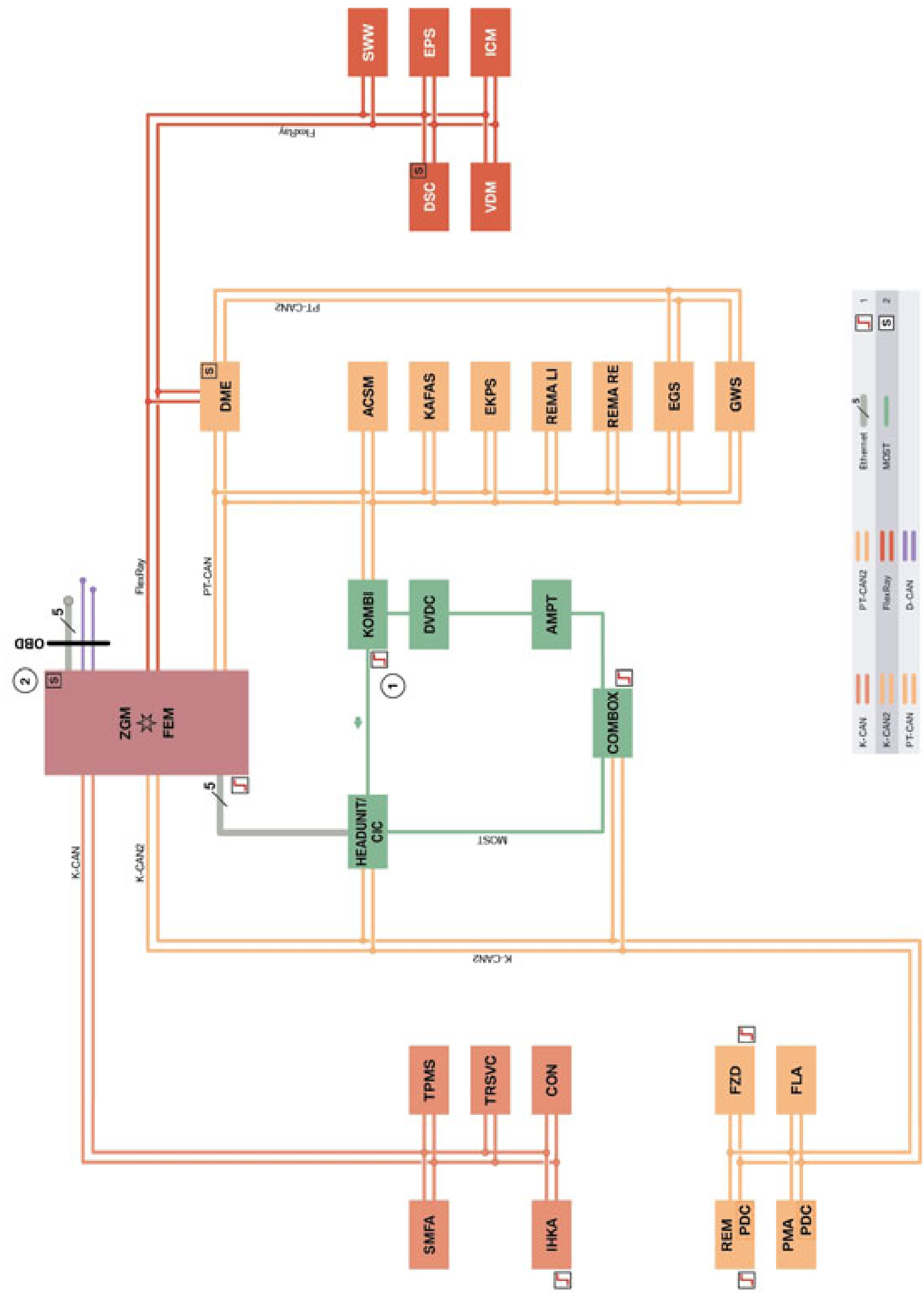
F30 control unit locations

F30 General Vehicle Electronics
2. Vehicle Electrical System

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Digital Motor Electronics (DME)
3	Vertical Dynamics Management (VDM)
4	Integrated automatic heating / air conditioning (IHKA)
5	Instrument panel (KOMBI)
6	Electronic transmission control (EGS)
7	Head unit
8	High-beam assistant (FLA)
9	Roof function center (FZD)
10	Front Electronic Module (FEM)
11	Controller (CON)
12	Reversible electric automatic reel right (REMA RE) (not for US)
13	Combox
14	Electronic fuel pump control (EKPS)
15	Parking Manoeuvring Assistant (PMA)
16	DC/DC converter
17	Rear Electronic Module (REM)
18	Blind spot detection (SWW)
19	Video module VM (not for US)
20	Hi-Fi amplifier AMP/Top-HiFi amplifier (AMPT)
21	DVD changer (DVDC)
22	Tire Pressure Monitoring System (TPMS)
23	Integrated Chassis Management (ICM)
24	Gear selector switch (GWS)
25	Reversible electric automatic reel left (REMA LI) (not for US)
26	Driver's seat module (SMFA)
27	Advanced Crash Safety Module (ACSM)
28	Electronic Power Steering (electromechanical power steering) (EPS)
29	Camera-based driver support systems (KAFAS)
30	Control unit for camera systems (TRSVC)

F30 General Vehicle Electronics
2. Vehicle Electrical System

2.2. Bus overview



F30 bus overview

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top-HiFi amplifier
COMBOX	Combox (Combox emergency call, Multimedia Combox)
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DME	Digital Engine Electronics (DME)
DSC	Dynamic Stability Control
DVDC	DVD changer
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EPS	Electromechanical Power Steering
Ethernet	Cable-based data network technology for local data networks
FEM	Front Electronic Module
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector lever
HEADUNIT/CIC	Headunit (Car Information Computer or Basic headunit)
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
K-CAN	Body controller area network
K-CAN2	Body controller area network 2
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (MOST only with option 6WA)
MOST	Media Oriented System Transport
OBD	On-board diagnosis (diagnostic socket)
PDC	Park Distance Control (with option 5DP, parking manoeuvring assistant: integrated in the parking manoeuvring assistant control unit, otherwise integrated in the Rear Electronic Module control unit)
PMA	Parking manoeuvring assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
RAD	Radio

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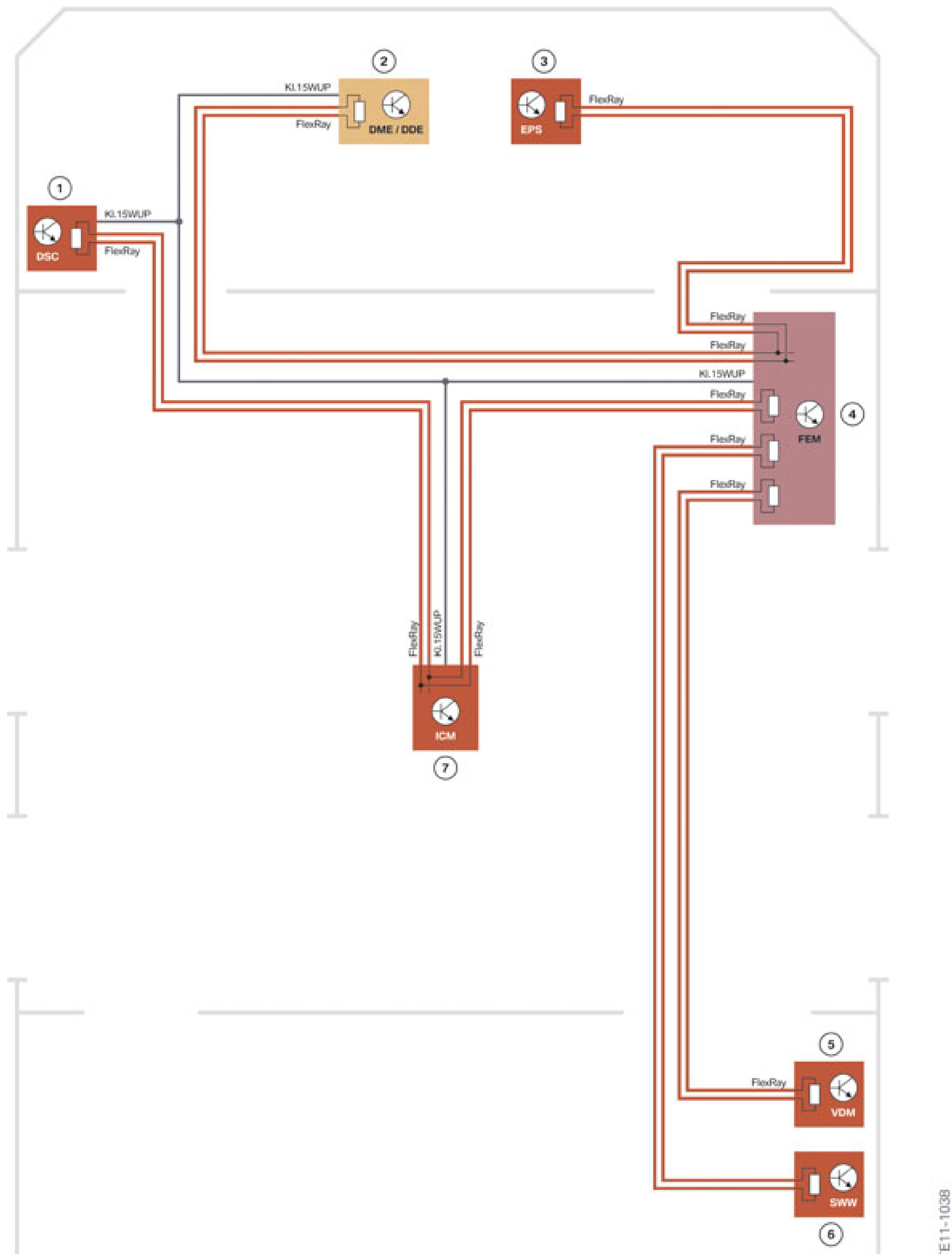
2. Vehicle Electrical System

Index	Explanation
REM	Rear Electronic Module
REMA LI	Reversible electromotive automatic reel, left (not US)
REMA RE	Reversible electromotive automatic reel, right (not US)
SMFA	Seat module, driver
SWW	Lane change warning
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for all-round vision camera
VDM	Vertical Dynamics Management
ZGM	Central gateway module

The FlexRay is shown in a simplified form in the overview of the bus systems. The following system wiring diagram shows the actual physical layout (topology).



F30 system wiring diagram, FlexRay

F30 General Vehicle Electronics
2. Vehicle Electrical System

Index	Explanation
1	Dynamic Stability Control DSC
2	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) (not US)
3	Electronic Power Steering (electromechanical power steering) EPS
4	Front Electronic Module (FEM)
5	Vertical Dynamics Management (VDM)
6	Lane change warning SWW
7	Integrated Chassis Management (ICM)

FlexRay is used in the F30 as the system bus for networking of the systems that control the dynamic handling characteristics and engine control. A so-called star coupler with four bus drivers is located in the central gateway module (ZGM), which is integrated in the new Front Electronic Module (FEM). The bus drivers forward the data of the control units via the communication controller to the ZGM. The FlexRay control units are connected to these bus drivers.

Terminating resistors are used on both ends of the data lines to avoid reflections on the lines.

The body controller area network 2 (K-CAN2) facilitates communication between control units with a high data transfer rate (500 kBit/s). The K-CAN2 is also connected to the other bus systems via the central gateway module (ZGM).

The powertrain controller area network 2 (PT-CAN2) creates a redundancy to the powertrain controller area network (PT-CAN) in the area of engine and transmission control.

The F30 has Ethernet access in order to be able to program the complete vehicle quickly. Due to the very high data transfer rate of the Ethernet (100 MBit/s), the programming access via the MOST system could be discontinued. The headunit also obtains an Ethernet connection, via which the programming for MOST devices is effected.

The FEM/ZGM assumes the task in the F30 of distributing the telegrams internally within the vehicle to the buses and of forwarding to the headunit via K-CAN2. The headunit then provides for distribution on the MOST.

The navigation data of the CIC High (Navigation Professional option 609) are stored on its hard disk. These navigation data are updated via the Ethernet access at the OBD II connection and the internal vehicle Ethernet connection between ZGM and CIC.

The D-CAN at the OBD II connection is used in the dealer organization to program vehicles at "authorized third parties". Legal provisions stipulate that all control units must be able to be programmed via the D-CAN. HDD update is an exception.

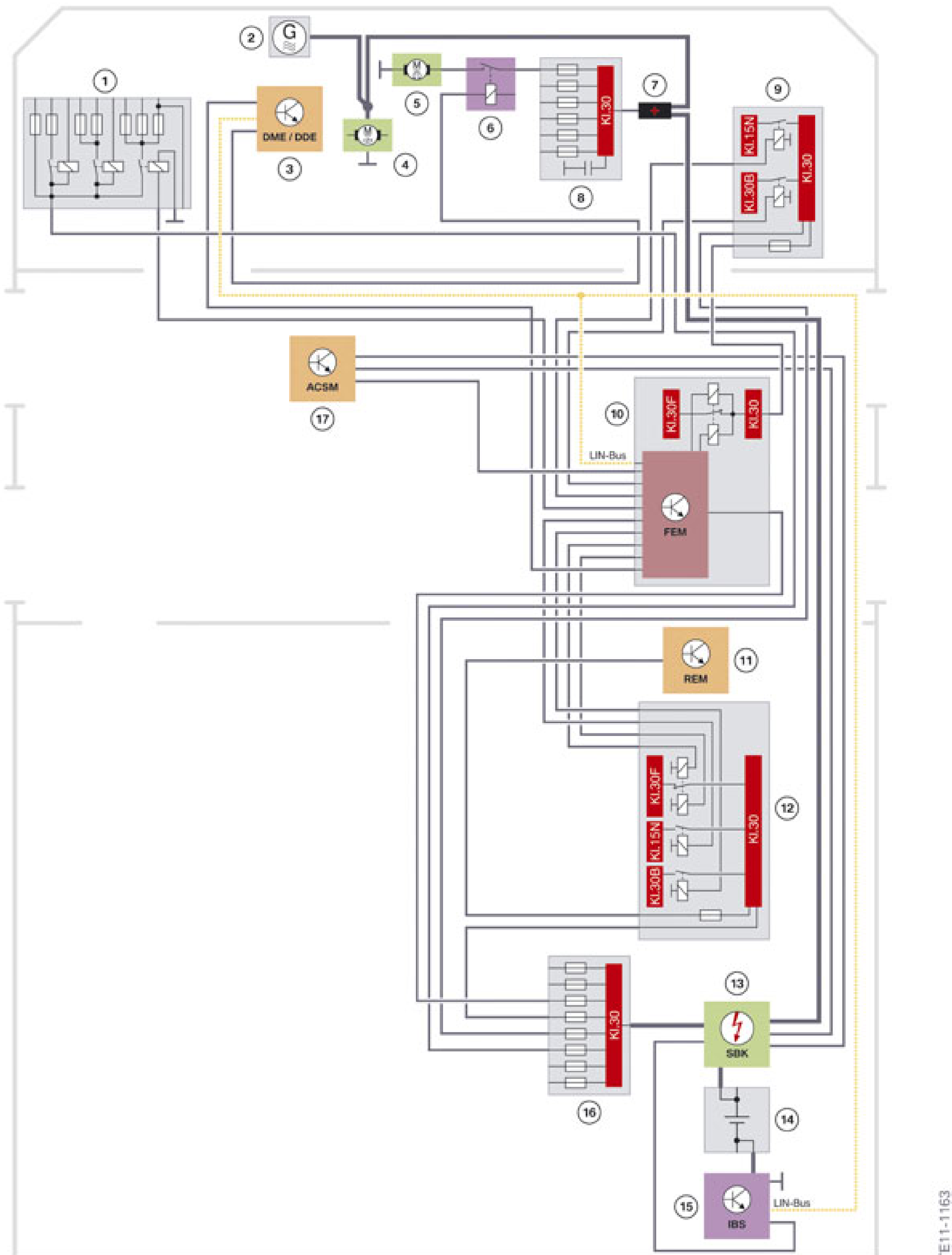
2.3. OBD II diagnostic access

The diagnostic socket is situated as in other BMW vehicles on the left A-pillar. Both vehicle diagnosis via the D-CAN and programming access via the Ethernet to the vehicle are made available via the OBD II interface.

F30 General Vehicle Electronics

3. Voltage Supply

3.1. System wiring diagram



F30 system wiring diagram, voltage supply

3. Voltage Supply

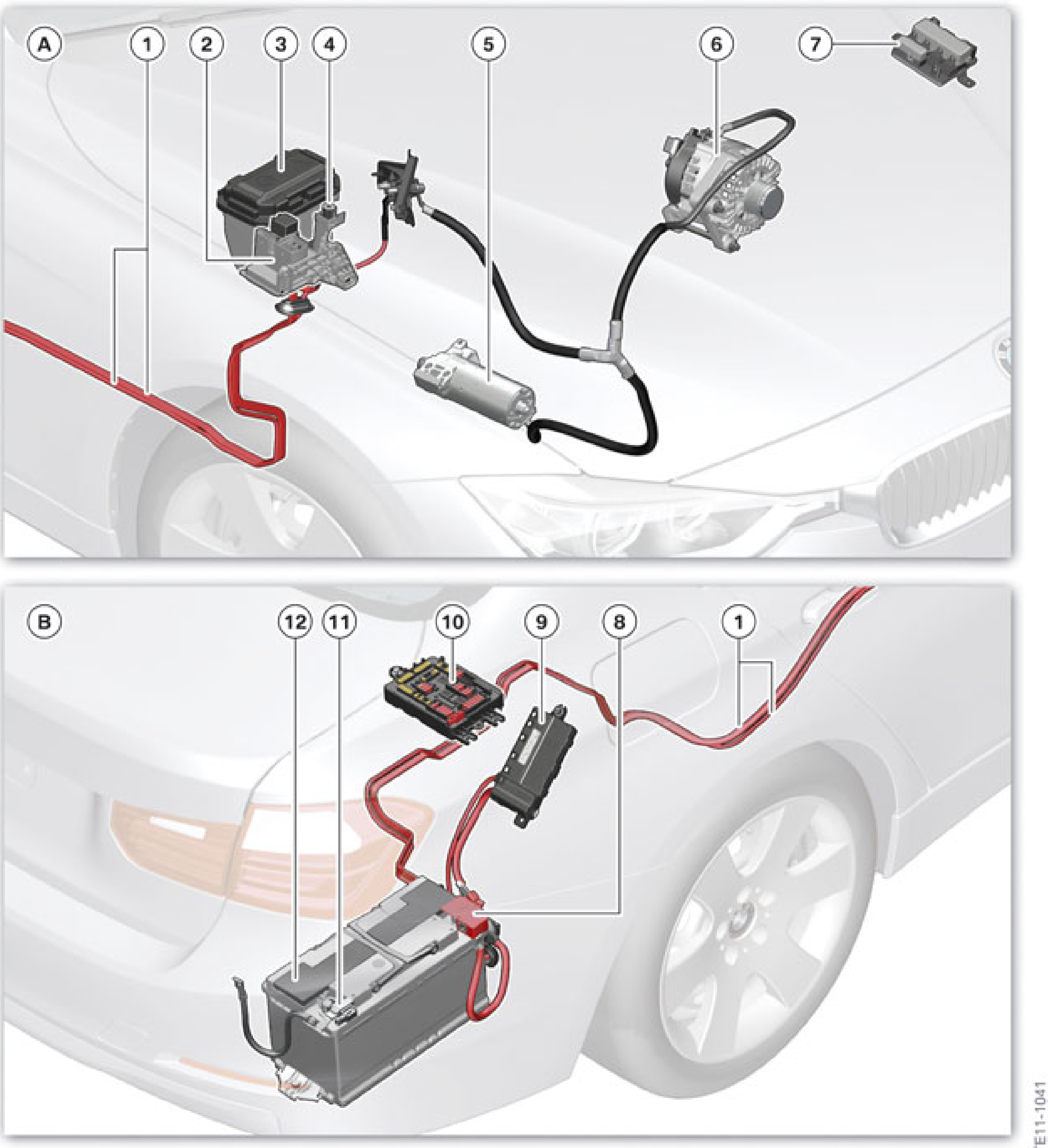
Index	Explanation
1	Power Distribution Module (PDM)
2	Alternator
3	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) not US
4	Starter motor
5	Electric fan
6	Relay for electric fan
7	B+ jump start terminal point
8	Power distribution box, front
9	Power distribution box, engine compartment
10	Front Electronic Module (FEM)
11	Rear Electronic Module (REM)
12	Power distribution box, luggage compartment
13	Safety battery terminal (SBK)
14	Battery
15	Intelligent battery sensor (IBS)
16	Battery power distribution box
17	Crash Safety Module (ACSM)
Kl.30	Terminal 30
Kl.30B	Terminal 30 basic operation
Kl.15N	Ignition (after-run)
Kl.30F	Terminal 30, fault-dependent

3.2. Components

The voltage supply of the F30 comprises the following components:

- Battery
- Intelligent battery sensor (IBS)
- Safety battery terminal (SBK)
- Power Distribution Module (PDM)
- Power distribution box, front, with B+ jump start terminal point
- Power distribution box, engine compartment
- Power distribution box, luggage compartment
- Battery power distribution box

- Battery cables
- Starter motor
- Alternator.



Voltage supply components

Index	Explanation
A	Voltage supply components, front
B	Voltage supply components, rear
1	Main battery cables
2	Power distribution box, front
3	Power distribution box, engine compartment
4	B+ jump start terminal point
5	Starter motor
6	Alternator
7	Power Distribution Module (PDM)
8	Safety battery terminal (SBK)
9	Battery power distribution box
10	Power distribution box, luggage compartment
11	Intelligent battery sensor (IBS)
12	Battery

3.2.1. Battery

The battery is located in the luggage compartment to the right behind a removable oddments tray. It is a wear-resistant 90 Ah AGM battery.

Index	Explanation
1	Removable oddments tray
2	Battery

3.2.2. Wiring harness

There is an increasing use of aluminium lines for the voltage supply in the F30. Lower weight and lower costs are the reason for the increased use of aluminium. The B+ underfloor cable made from solid aluminium with a flat 59 mm² profile section runs from the B+ transfer terminal point (rear) to the B+ jump start terminal point (front).

Connectors with a secondary lock (CPA, Connector Position Assurance) are used at both the engine compartment power distribution box and the luggage compartment power distribution box. This provides for significantly more reliable contacting. Thinner cables with a cross-section of just 0.22 mm² are used in the F30.

The following tables shows the distribution of copper and aluminium cables in the vehicle:

Location	Copper cables	Aluminium cables
Supply, battery power distribution box to luggage compartment power distribution box	10 mm²	
Supply, battery power distribution box to REM	6 mm²	
Supply, battery power distribution box to FEM		27 mm²
Supply, battery power distribution box to engine compartment power distribution box		27 mm²
Supply, battery power distribution box to units compartment partition wall (PDM line)		17 mm²

The cross-section of the line from the power distribution box at the front to the EPS and the ground line EPS depends on the steering of the vehicle:

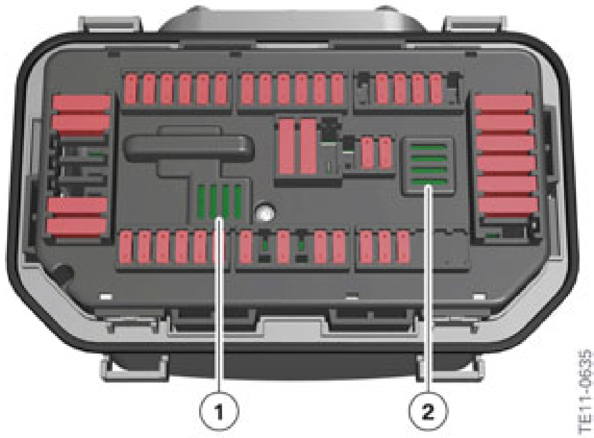
- 27 mm² aluminium lines for EPS High (for BMW 328i and 335i) or for EPS+ (for vehicles with variable sport steering (option 2VL).

For more information on the Electronic Power Steering EPS, please refer to the training information “F30 Chassis and Suspension".

3.2.3. Power distribution boxes

Two separate power distribution boxes - adapted to the FEM/REM concept - are installed. The engine compartment power distribution box is located on the right side of the engine compartment directly on the front bulkhead. The battery power distribution box is no longer located at the battery, but is secured in front of the battery at the wheel arch.

A few functions where load relays are integrated in the FEM/REM are fuse-protected directly in the FEM or REM. This also applies to the terminal 30F controlled exclusively by the FEM.

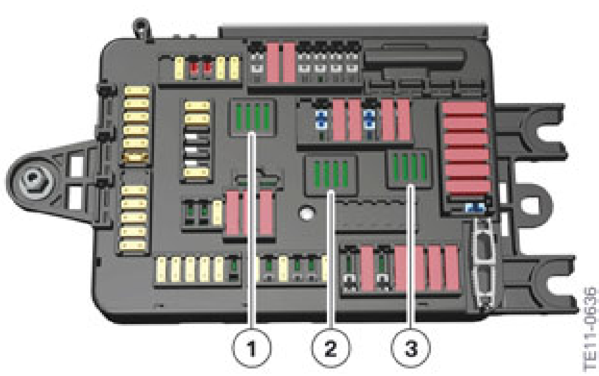


Power distribution box, engine compartment

Index	Explanation
1	Terminal 15N
2	Terminal 30B

⚠

When working on the engine compartment power distribution box, it is essential to ensure when closing the cover that the four fastenings engage correctly so that the power distribution box is safely protected against leaks.



Power distribution box, luggage compartment

Index	Explanation
1	Terminal 15N
2	Terminal 30F
3	Terminal 30B

3.3. Stabilization of the vehicle electrical system

In vehicles equipped with the automatic engine start-stop function (MSA), starting operations, and therefore voltage dips in the vehicle electrical system, occur more frequently. A DC/DC converter is installed in these vehicles, depending on the vehicle equipment specification, to protect specific voltage-sensitive electrical components.

The DC/DC converter supplies a constant voltage to terminals 30B_DC/DC, also during the starting operation.

One DC/DC converter is installed in conjunction with one of the following items of optional equipment:

- Navigation system Professional (optional extra 609)
- Harman Kardon Surround Sound System (option 688).

3.4. Energy management

The energy management of the F30 has been extended to include the functions already added in the F25.

3.4.1. Charge state indicator

If the F30 is in transport mode, the battery's state of charge is continuously displayed when in operation. The carrier can therefore charge the battery on time in order to prevent deep discharging of the battery, and therefore damage to the battery. Before the vehicle is handed over, the dealer can check whether the battery is sufficiently charged or whether it needs to be replaced.

3.4.2. Influence of steering power

The power consumption of the electronic power steering (electromechanical power steering) EPS is extremely high. In order to avoid a brief reduction in the steering servo availability, the energy management of the F30 anticipates and responds to steering-intensive driving manoeuvres (parking or three-point turns). To do this, specific input variables (e.g. driving speed, brake pedal operation and steering angle) are evaluated. The energy management can implement the following measures:

- Raise the idling speed and adjust the ignition timing to increase the engine torque
- Increase the vehicle voltage via the alternator
- Turn off convenience functions (heated rear window, outside mirror heating system and seat heating).

3.4.3. Power distribution box, front

A condenser is installed in the front power distribution box to reduce the harmonic content in the vehicle voltage caused by the alternator.

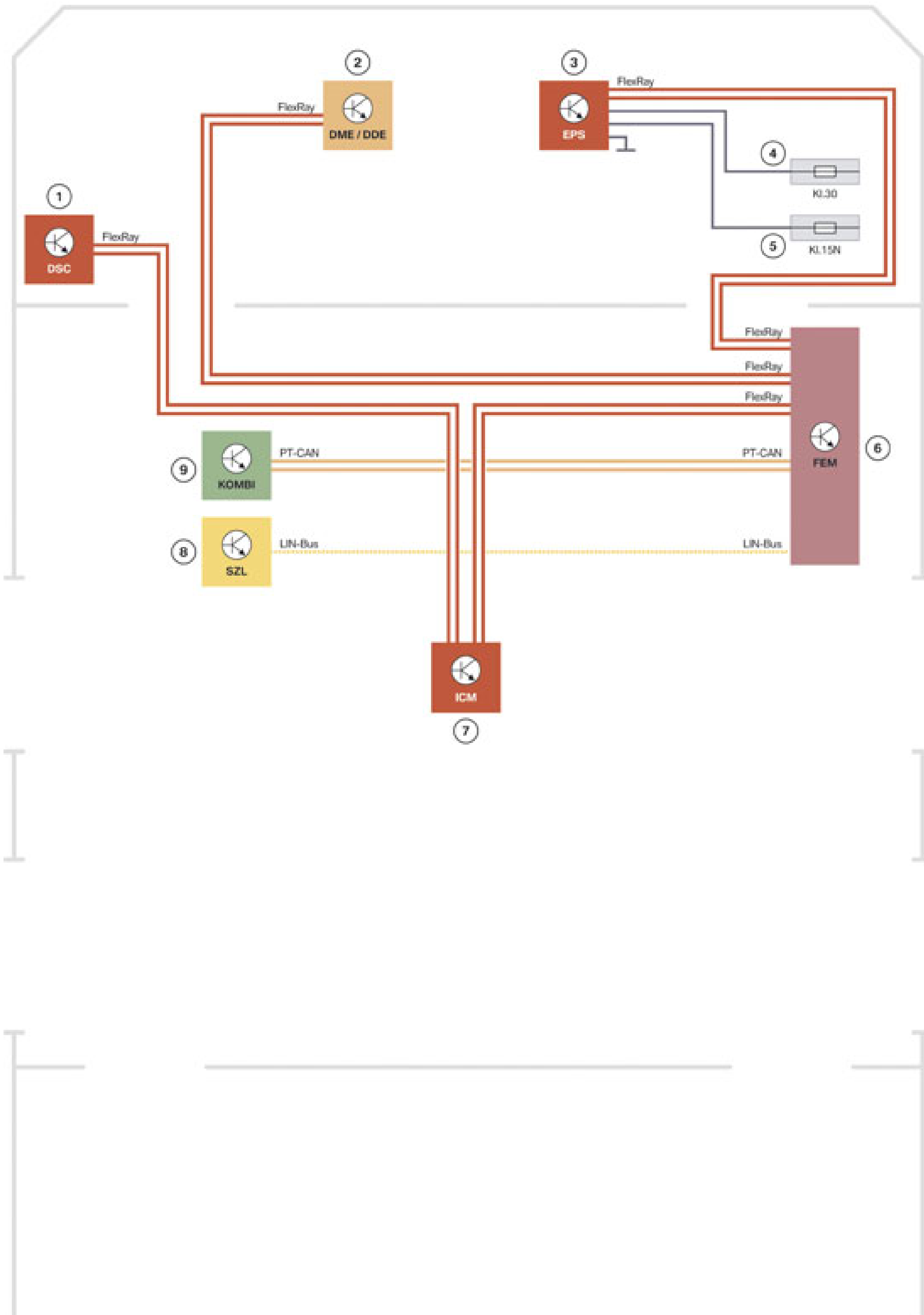
If a faulty electric fan is replaced, the harmonic content of the voltage must also be measured. If the harmonic content is too high, this indicates that a condenser is faulty and must be replaced.

3.5. Supply to EPS

The F30 is equipped as standard with electromechanical power steering (EPS) with servotronic or variable sport steering (option 2VL) which can be ordered as optional equipment.

The EPS makes possible a reduction of the average fuel consumption by approx. 3 % in comparison to conventional hydraulic steering. This helps reduce carbon dioxide emissions.

3.5.1. System wiring diagram



TE11-0041

F30 System wiring diagram, EPS (electromechanical power steering)

Index	Explanation
1	Dynamic Stability Control DSC
2	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) not US
3	Electronic Power Steering (electromechanical power steering) EPS
4	Power distribution box, front
5	Power distribution box, engine compartment
6	Front Electronic Module (FEM)
7	Integrated Chassis Management (ICM)
8	Steering column switch cluster (SZL)
9	Instrument cluster (KOMBI)
KI.30	Terminal 30
KI.15N	Ignition (after-run)

3.6. Battery Guard

The Battery Guard function detects critical states of charge which could jeopardize engine starting and sends this relevant information directly to the BMW Service authorized workshop. The customer is then notified by BMW Service department (via phone or email) of the required service.

The optional equipment BMW Assist with enhanced Bluetooth and USB (option 6NL) and an active BMW ConnectedDrive agreement are required for the Battery Guard function.

The BMW TeleServices Battery Guard Call is automatically activated by the vehicle under the following conditions:

- If the battery voltage reaches the bottom of the starting ability limit because a bus wake-up signal is present, sleep mode is prevented or there is a standby current violation the BMW TeleServices Battery Guard informs the BMW Service authorized workshop in defined cases at the next vehicle start-up (terminal 15 active). It can then proactively contact the customer and arrange a service appointment to eliminate the cause. This function is available for the series launch of the F30 in Germany, the Netherlands and Austria, the USA and Canada.

F30 General Vehicle Electronics

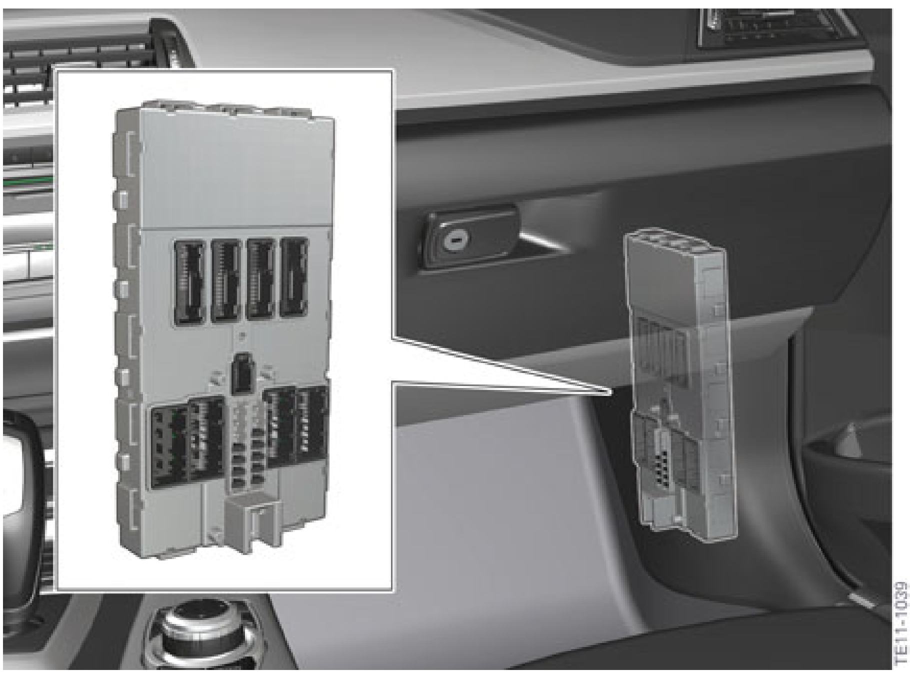
4. Front Electronic Module (FEM)

The Front Electronic Module FEM is used in the F30, similar to the F20. The FEM replaces the following control units:

- Junction box (JB)
- Car Access System (CAS)
- Comfort Access (CA)
- Footwell module (FRM).

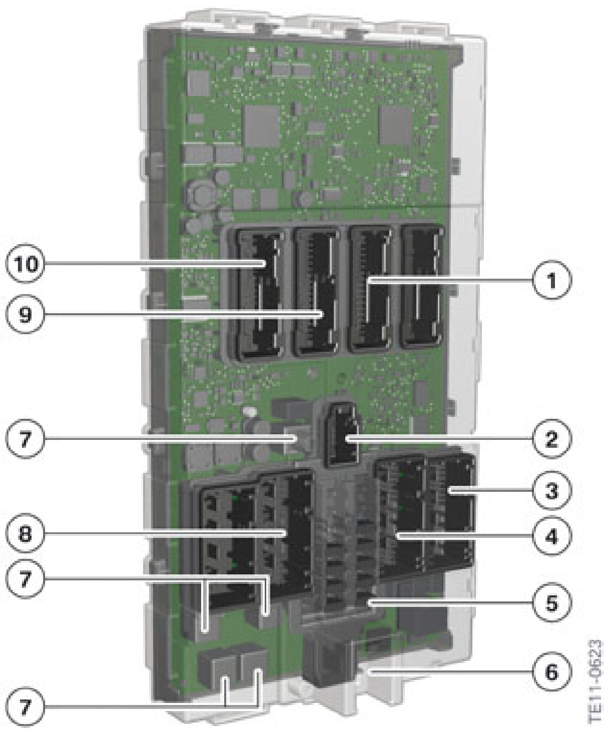
The ZGM is integrated as an independent control unit in the FEM.

The FEM is located at the A-pillar of the front passenger side.



F30 FEM installation location

4. Front Electronic Module (FEM)



Front Electronic Module (FEM)

Index	Explanation
1	Connector (54-pin)
2	Connector (12-pin)
3	Connector (42-pin)
4	Connector (54-pin)
5	Fuses
6	Connector (1-pin, B+ supply)
7	Relay
8	Connector (54-pin)
9	Connector (54-pin)
10	Connector (54-pin)

The following functions are protected by fuses in the FEM:

- Steering column switch cluster (SZL), operating facility for driver assistance systems, operating facility for lights
- Headlight driver module for LED, Rear Electronic Module (REM)
- OBD II connector, IHKA

- Outside door handle electronics
- Power window regulator
- Central lLocking system.

The following functions are switched by relays in the FEM:

- Power window regulator, driver
- Power window regulator, front passenger
- Central locking system
- Headlight cleaning system
- Starter motor
- Horn
- Wiper speed 1/2.

The following table provides an overview of the FEM functions when compared with the relevant control units:

Function in FEM	Control unit in E90
A/C activation (actuators, sensors)	JB
Wash/wipe system	JB
Steering column switch cluster (SZL)	JB
Central locking system (ZV)	JB
Rain-light-solar-condensation sensor	JB
Inside mirror	FZD
Interior lighting	FRM
Exterior lights	FRM
Headlight beam throw adjustment	FRM
Power window regulators, front	FRM
Exterior mirrors	FRM
Switch block, driver's door	FRM
Mirror heating	FRM
Comfort Access (CA)	CAS
Remote control services (FBD)	CAS
Electronic immobilizer (EWS)	CAS
Terminal control	CAS
Intelligent battery sensor (IBS)	CAS
Central gateway module (ZGM)	ZGM

4. Front Electronic Module (FEM)

4.1. Central gateway module (ZGM)

The task of the ZGM is to connect all the data bus systems to each other. By connecting them in this way, it is possible to use information from the individual bus systems on a generalized level. The ZGM is able to implement different protocols and speeds on other bus systems. The programming data are transmitted by Ethernet to the vehicle via the ZGM.

The ZGM is integrated as a module in the FEM in the electrical system architecture 2020. It is viewed as a control unit within a control unit.

The ZGM has its own complete software unit, comprising bootloader and application, and its own diagnosis address. The ZGM is not codable. The bootloader and the application software can be flashed independently of the FEM.

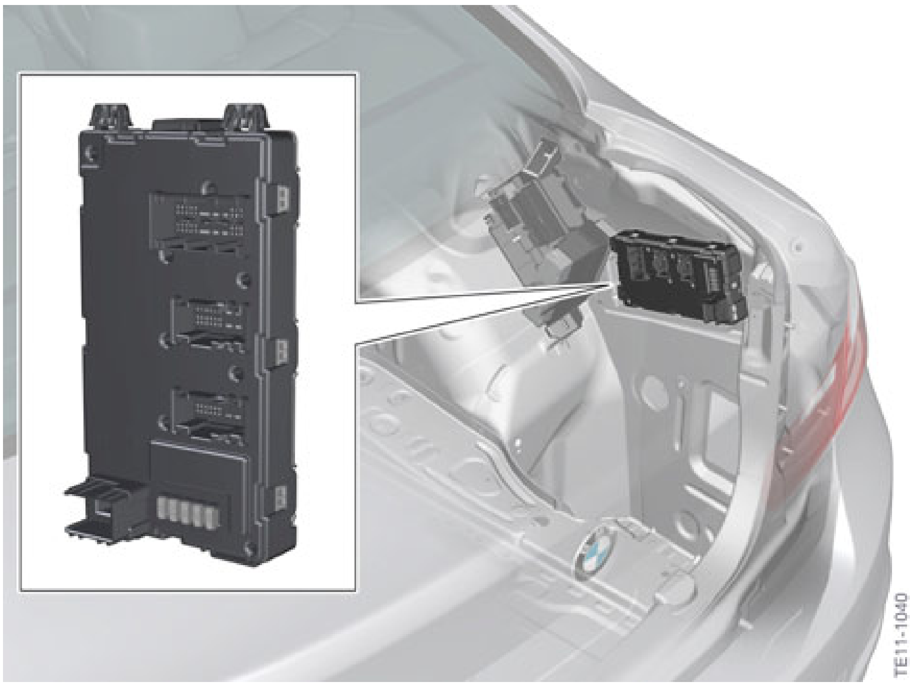
4.2. Control unit replacement

A counter exchange with control units from other vehicles is not possible. A control unit can only be ordered as a spare part. It is important to bear in mind in this respect that the FEM and the DME are supplied already coded to the vehicle. The advantage of this is that only the control unit is replaced and there is no need to adjust the electronic immobilizer.

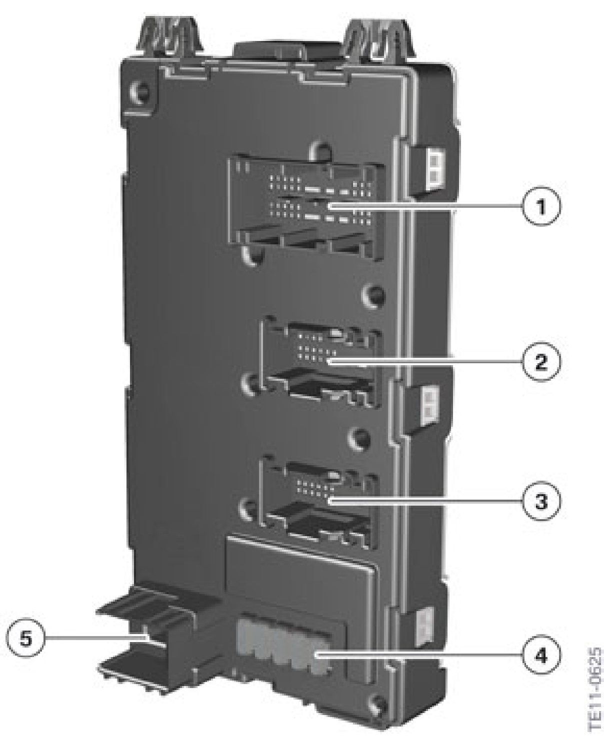
In contrast, an adjustment must be made to the electronic transmission control after the control unit is replaced. In the course of this adjustment the FEM transmits the individual code to the electronic transmission control unit.

F30 General Vehicle Electronics
5. Rear Electronic Module (REM)

The Rear Electronic Module (REM) assumes the functions of JB and PDC in the right of the luggage compartment of the F30.



F30 REM installation location



Rear Electronic Module (REM)

5. Rear Electronic Module (REM)

Index	Explanation
1	Connector (54-pin)
2	Connector (26-pin)
3	Connector (26-pin)
4	Fuses
5	Connector (1-pin, B+ supply)

The following table provides an overview of the REM functions when compared with the relevant control units:

Function in REM	Control unit in E90
Fill level sensor	JB
Heated rear window	JB
Power window regulators, rear	JB
Seat heating	JB
Rear lights	FRM
Park Distance Control (PDC)	PDC

The following functions are protected by fuses in the REM:

- Heated rear window
- Power window regulators, rear
- Roller sunblind.

The following functions are switched by relays in the REM:

- Heated rear window
- Power window regulators, rear
- Roller sunblind.

6. CAS Functions

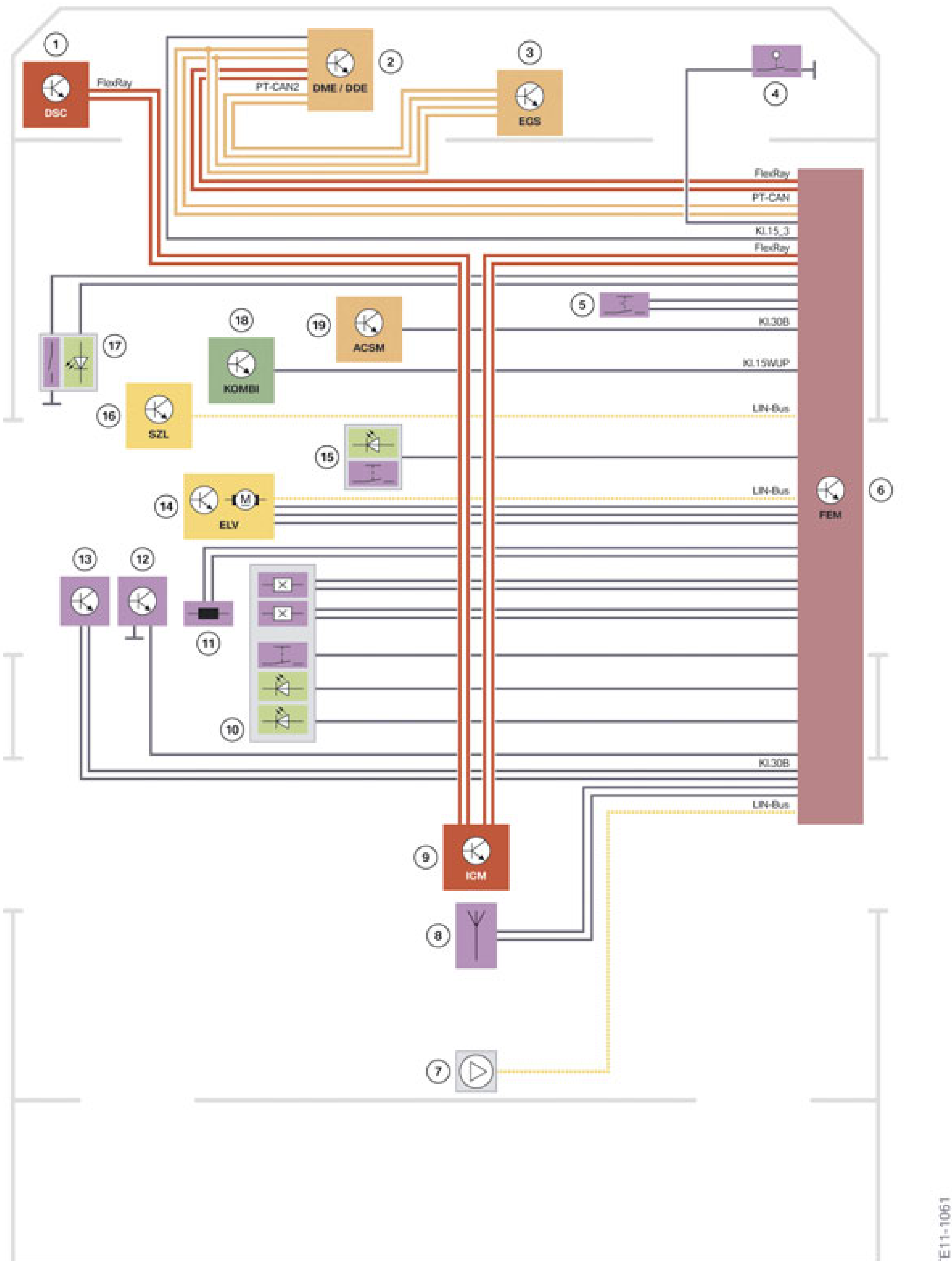
There are two distinct systems concerned with vehicle access:

- Basic access, central locking system
- Comfort Access (option 322).

The entire access control of the previous CAS control unit is integrated entirely in the FEM. Mechanical access to the vehicle is confined to opening the driver's door lock. Complete locking of the vehicle is thus not possible (except with option 302 Alarm system).

6. CAS Functions

6.1. System wiring diagram

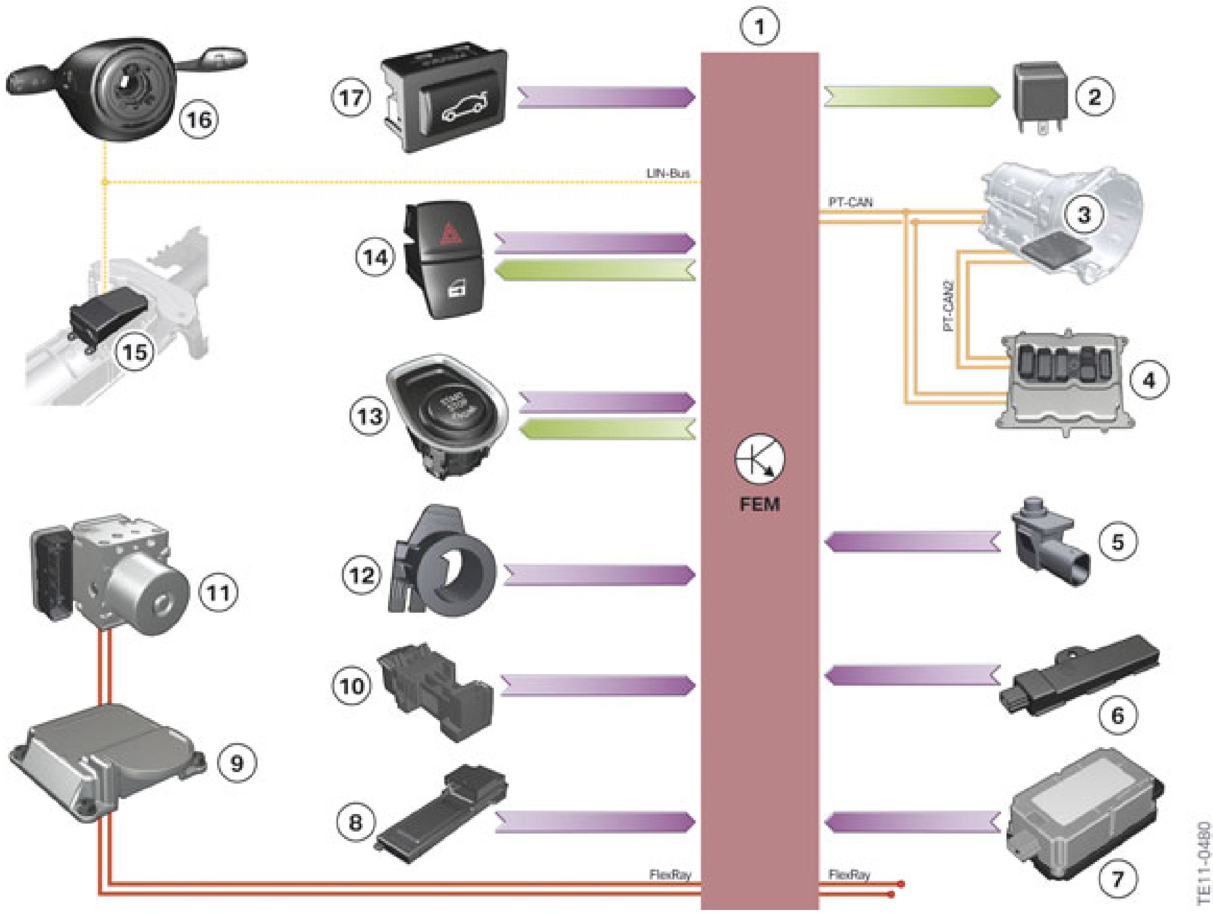


F30 system wiring diagram, Car Access System

6. CAS Functions

Index	Explanation
1	Dynamic Stability Control DSC
2	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) not US
3	Electronic transmission control (EGS)
4	Engine compartment lid contact switch
5	Hotel position switch (only in US version)
6	Front Electronic Module (FEM)
7	Remote control receiver
8	Interior antenna (front)
9	Integrated Chassis Management (ICM)
10	START-STOP button
11	Ring antenna (transponder coil)
12	Brake light switch
13	Clutch switch (with manual gearbox only)
14	Electronic steering lock (ELV) not US
15	Button for central locking system/hazard warning switch
16	Steering column switch cluster (SLZ)
17	Trunk pushbutton
18	Instrument cluster (KOMBI)
19	Crash Safety Module (ACSM)

F30 General Vehicle Electronics
6. CAS Functions



F30 Input/output, Car Access System

Index	Explanation
1	Front Electronic Module (FEM)
2	Relay, term. 15N, term. 30B, term. 30F
3	Electronic transmission control (EGS) (start enable)
4	Digital Engine Electronics (DME) or Digital Diesel Electronics not US (DDE) (start enable)
5	Engine compartment lid contact switch
6	Interior antenna (front)
7	Remote control receiver
8	Clutch switch (with manual gearbox only)
9	Integrated Chassis Management (ICM)
10	Brake light switch (BLS)
11	Dynamic Stability Control DSC
12	Ring antenna (transponder coil)
13	START-STOP button

Index	Explanation
14	Button for central locking system/hazard warning switch
15	Electronic steering lock (ELV) (start enable) not US
16	Steering column switch cluster (SZL)
17	Trunk pushbutton
Kl.15N	Ignition (after-run)
Kl.30B	Terminal 30 basic operation
Kl.30F	Terminal 30, fault-dependent

6.2. Overview of functions

There is no longer an insertion slot in the F30. The vehicle can already be started without a key as standard. This function is called "Passive Go" (drive authorization). However, to gain access to the vehicle, it is still necessary to actuate the ID transmitter.

The following CAS functions are integrated in the F30:

- Comfort Access
  The optional equipment Comfort Access contains the "Comfort Entry" and "Comfort Exit" functions. The "Passive Go" function comes as standard.
- Central locking system
- Power window regulators
- Slide/tilt sunroof
- Terminal control
- Electronic immobilizer.

Further CAS functions are among others:

- Vehicle data storage
- Data transfer for Condition Based Service (CBS).

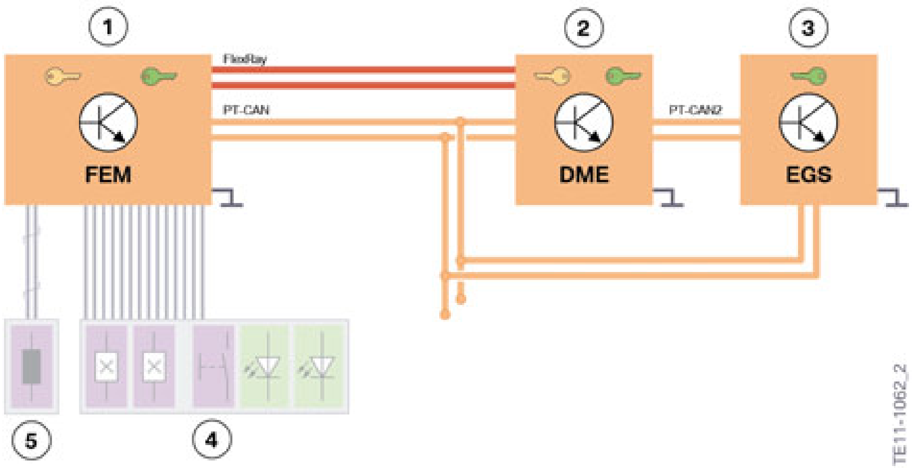
The CAS functions correspond to those in the F01 and are described in the "Car Access System F01/ F02" training information.

With regard to start enable by the electronic immobilizer (also called Challenge Response), some changes have been made from the F01. What is new is the omission of the CAS bus, because PT-CAN and FlexRay already provide redundancy of data transfer between FEM and DME.

The emergency-start function (stopping the ID transmitter at the ring antenna on the steering column) is already known from the F01.

F30 General Vehicle Electronics

6. CAS Functions



F30 Redundancy in data transfer

Index	Explanation
1	Front Electronic Module (FEM)
2	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) not US
3	Electronic transmission control (EGS)
4	START-STOP button
5	Ring antenna (transponder coil)

F30 General Vehicle Electronics

7. Comfort Access

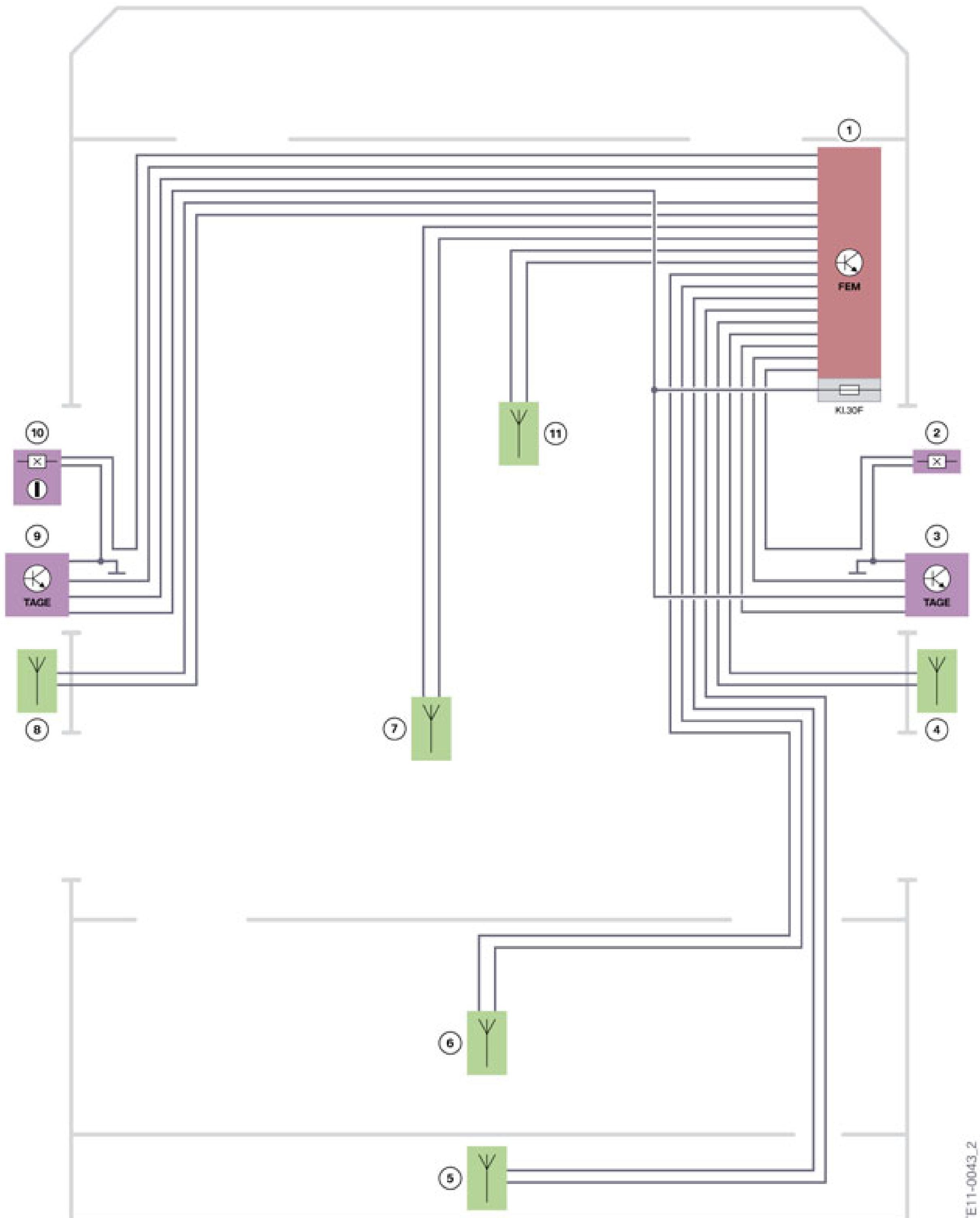
The Comfort Access function is integrated in the Front Electronic Module (FEM).

Comfort Access contains the following functions:

- Passive Entry (access authorization)
  facilitates access to the vehicle without active use of the ID transmitter
- Passive Go (drive authorization)
  enables the vehicle to be started when there is a valid ID transmitter in the passenger compartment
- Passive Exit (locking authorization)
  enables the vehicle to be locked without active use of the ID transmitter
- Hands-free trunk lid opening
  makes it possible for hands-free opening of the trunk lid by a foot movement under the rear bumper.

7. Comfort Access

7.1. System wiring diagram

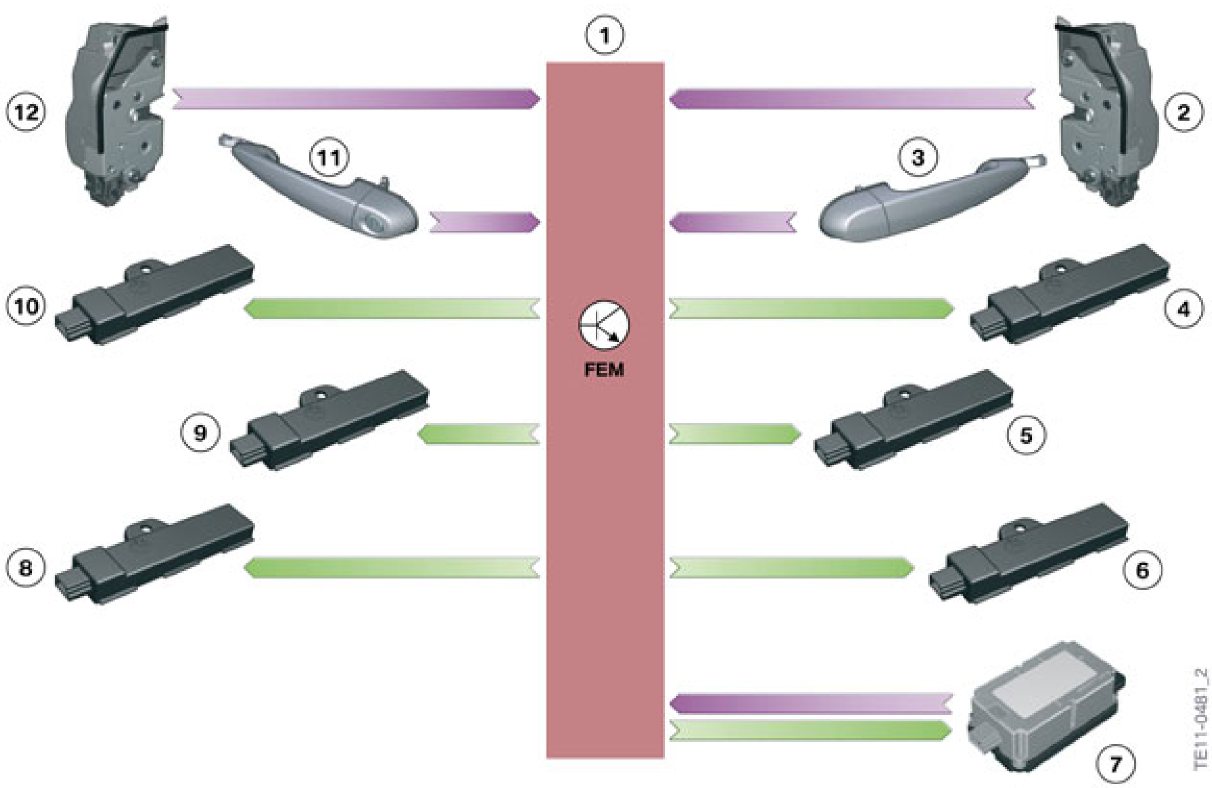


F30 system wiring diagram, Comfort Access

Index	Explanation
1	Front Electronic Module (FEM)
2	Door contact, front passenger side
3	Outside door handle electronics (TAGE) on front passenger side
4	Comfort Access antenna, side sill, right
5	Comfort Access antenna, bumper, rear
6	Comfort Access antenna, luggage compartment
7	Remote control receiver
8	Comfort Access antenna, passenger compartment, rear
9	Comfort Access antenna, side sill, left
10	Outside door handle electronics (TAGE) on driver's side
11	Door contact, driver's side
12	Comfort Access antenna, passenger compartment, front
Kl.30F	Terminal 30, fault-dependent

For the Comfort Access function the Front Electronic Module (FEM) activates the transmitter antennae for the exterior and passenger compartment.

The outside door handle electronics (TAGE) are also read in by the FEM.



Input/output, Comfort Access

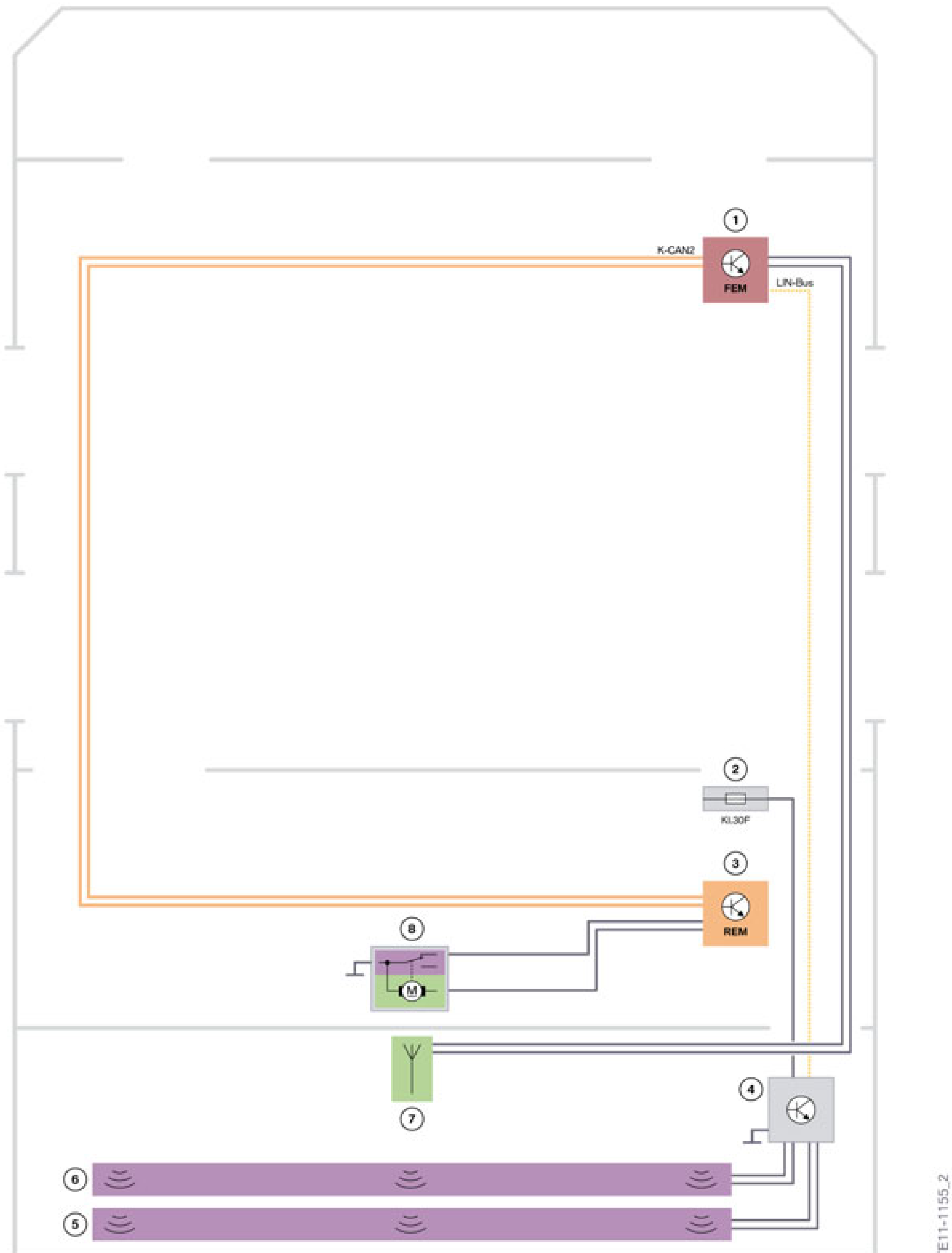
F30 General Vehicle Electronics
7. Comfort Access

Index	Explanation
1	Front Electronic Module (FEM)
2	Door contact, front passenger side
3	Outside door handle electronics (TAGE) on front passenger side
4	Comfort Access antenna, side sill, right
5	Comfort Access antenna, passenger compartment, rear
6	Comfort Access antenna, luggage compartment
7	Comfort Access antenna, bumper, rear
8	Comfort Access antenna, passenger compartment, front
9	Comfort Access antenna, side sill, left
10	Outside door handle electronics (TAGE) on driver's side
11	Door contact, driver's side

The components and functionality of Comfort Access are familiar from the current BMW models.

7.2. Hands-free trunk lid opening

7.2.1. System wiring diagram



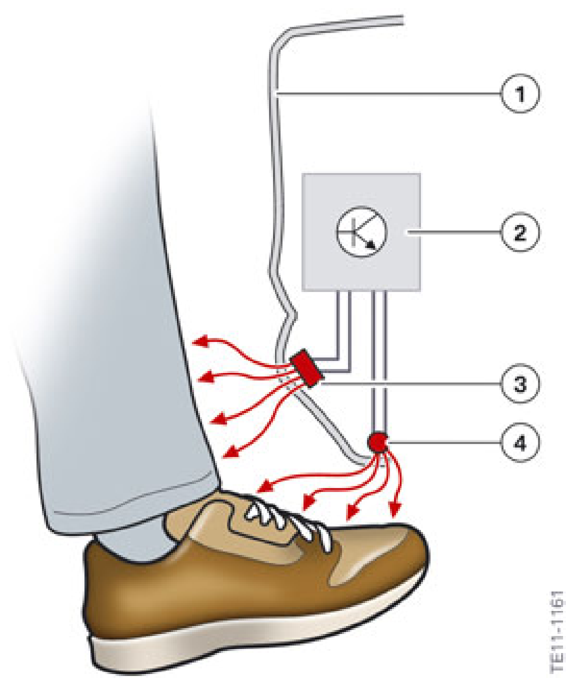
F30 system wiring diagram for hands-free trunk lid opening

Index	Explanation
1	Front Electronic Module (FEM)
2	Power distribution box, luggage compartment
3	Rear Electronic Module (REM)
4	Control unit for hands-free trunk lid opening
5	Sensor at top for hands-free trunk lid opening
6	Sensor at bottom for hands-free trunk lid opening
7	Comfort Access antenna, bumper, rear
8	Trunk lock
Kl.30F	Terminal 30, fault-dependent

7.2.2. Functional description

The hands-free trunk lid opening is another operating element for the trunk for the customer.

The operation is effected by means of targeted foot movement to and from the bumper. Two sensors detect the movement via a capacitive measurement.



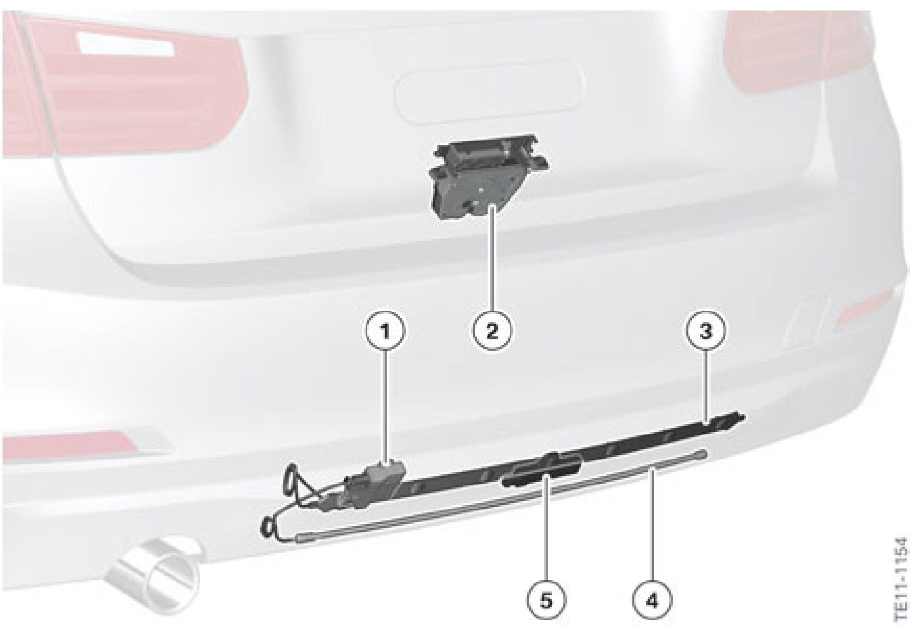
F30 hands-free trunk lid opening by foot movement

F30 General Vehicle Electronics
7. Comfort Access

Index	Explanation
1	Rear bumper
2	Control unit for hands-free trunk lid opening
3	Sensor at top for hands-free trunk lid opening
4	Sensor at bottom for hands-free trunk lid opening

The following components are involved in the function:

- FEM
- REM
- Trunk lock
- Control unit for hands-free trunk lid opening
- Comfort Access antenna, bumper, rear
- Two sensors.



F30 sensor for hands-free trunk lid opening

Index	Explanation
1	Control unit for hands-free trunk lid opening
2	Trunk lock
3	Sensor at top for hands-free trunk lid opening
4	Sensor at bottom for hands-free trunk lid opening
5	Comfort Access antenna, bumper, rear

The two sensors are connected to the evaluation electronics and constantly measure the capacity. A comparison of the time characteristic of the measured capacities permits the identification of a certain movement pattern.

A targeted foot movement to and from the bumper can be detected herefrom. The top sensor detects the shin, the bottom sensor the toes.

The detection range is between the rear lights.

The sensors are secured in the inside of the rear bumper.

The trunk opens regardless if it was locked or unlocked.

⚠

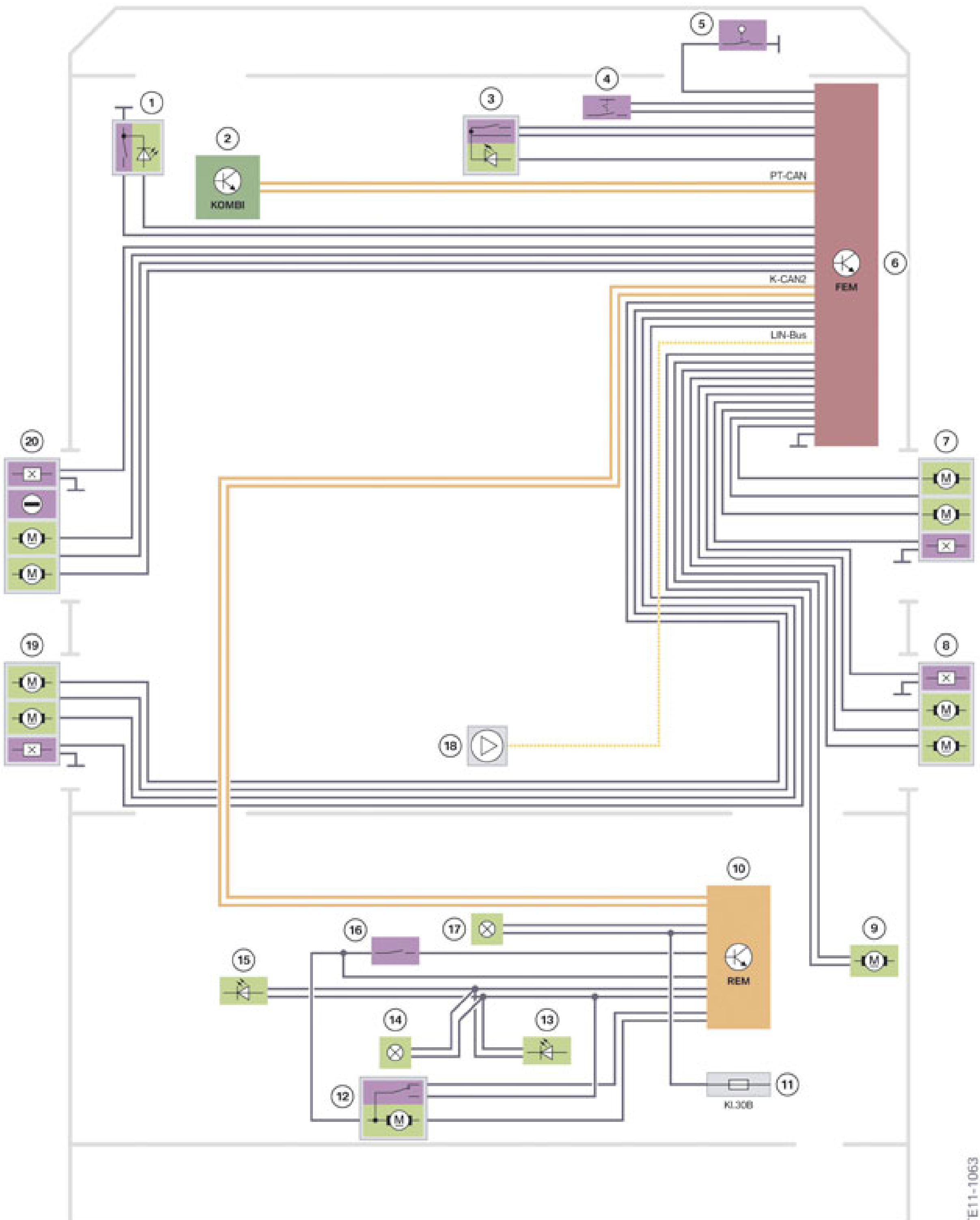
This system might also be referred to in ISTA as:

- Smart Opener
- Contact-less Tailgate
- Contact-free Tailgate
- Non-contact Rear Lid
- Touch-less Tailgate Opening
- Hands-free Trunk Lid Opening

F30 General Vehicle Electronics

8. Central Locking System

8.1. System wiring diagram



F30 system wiring diagram, central locking system

F30 General Vehicle Electronics
8. Central Locking System

Index	Explanation
1	Trunk pushbutton (fitted as standard, depending on version)
2	Instrument cluster (KOMBI)
3	Button for central locking system/hazard warning switch
4	Hotel position switch (only in US version)
5	Engine compartment lid contact switch
6	Front Electronic Module (FEM)
7	Door contact, central locking system on front passenger side, front
8	Door contact, central locking, passenger side, rear
9	Central locking system, fuel filler flap
10	Rear Electronic Module (REM)
11	Power distribution box, luggage compartment
12	Trunk contact with trunk lock
13	Trunk light
14	Trunk light
15	Trunk light
16	Trunk pushbutton on the outside of the trunk
17	Luggage compartment light
18	Remote control receiver
19	Door contact, central locking system, driver's side, rear
20	Door contact, central locking system, driver's side, front
KI.30B	Terminal 30 basic operation

The radio signal from the ID transmitter is received by the remote control receiver.

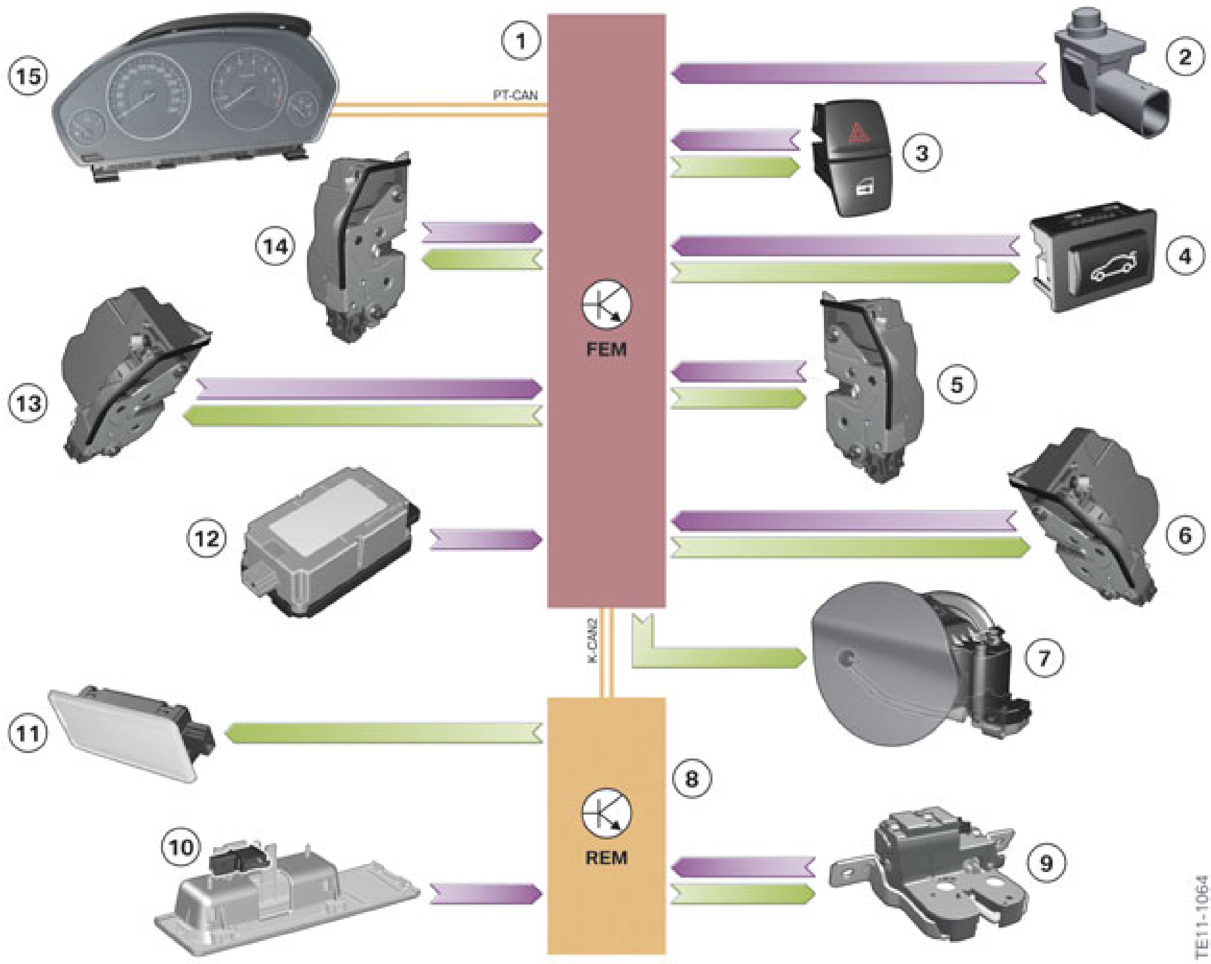
After the remote control receiver has verified the signal, it forwards it to the Front Electronic Module FEM. The signal causes the FEM to activate the central locking system and the interior lighting.

The FEM evaluates the status of all door contacts. In this way, for example, the vehicle can be prevented from being locked while the driver's door is open.

The status of the central locking system button/hazard warning switch is also evaluated by the FEM. The FEM activates the central locking system, depending on the status.

The Rear Electronic Module (REM) is responsible for sensing the status and activating the central locking system in the trunk. The FEM is responsible for the activation of the fuel filler flap.

8. Central Locking System



Input/output, central locking system

Index	Explanation
1	Front Electronic Module (FEM)
2	Engine compartment lid contact switch
3	Button for central locking system/hazard warning switch
4	Trunk pushbutton
5	Door contact, central locking system, front passenger side, front
6	Door contact, central locking system, front passenger side, rear
7	Central locking system, fuel filler flap
8	Rear Electronic Module (REM)
9	Trunk contact with trunk lock
10	Trunk pushbutton on the outside of the trunk
11	Luggage compartment light

8. Central Locking System

Index	Explanation
12	Remote control receiver
13	Door contact, central locking system, driver's side, rear
14	Door contact, central locking system, driver's side, front
15	Instrument cluster (KOMBI)

The remote control receiver checks the data telegrams of the ID transmitter and transmits them when identified correctly via the LIN bus to the FEM. The FEM evaluates the signal and causes the vehicle to be unlocked or locked.

The central locking system functions for the doors and the trunk are controlled by the FEM. The REM controls the trunk central locking system.

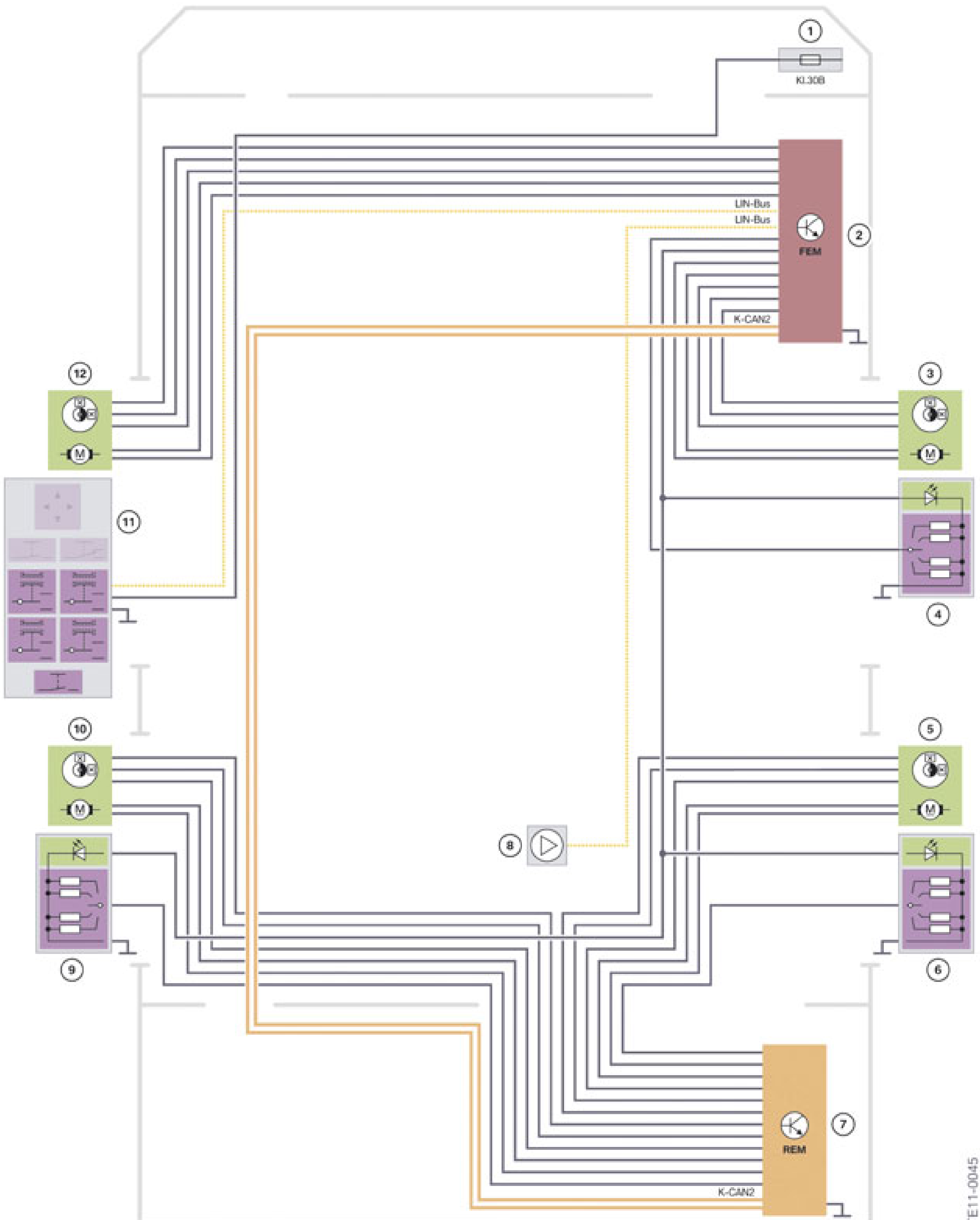
The central locking system can be operated from various positions:

- inside the vehicle
  via the central locking system button on the dashboard
- outside the vehicle
  via the ID transmitter or
  via the door handle on the driver or front passenger door or
  the trunk pushbutton on the outer trunk, for Comfort Access including Smart Opener (option 322).

F30 General Vehicle Electronics

9. Power Window Regulators

9.1. System wiring diagram



F30 system wiring diagram, power window regulators

9. Power Window Regulators

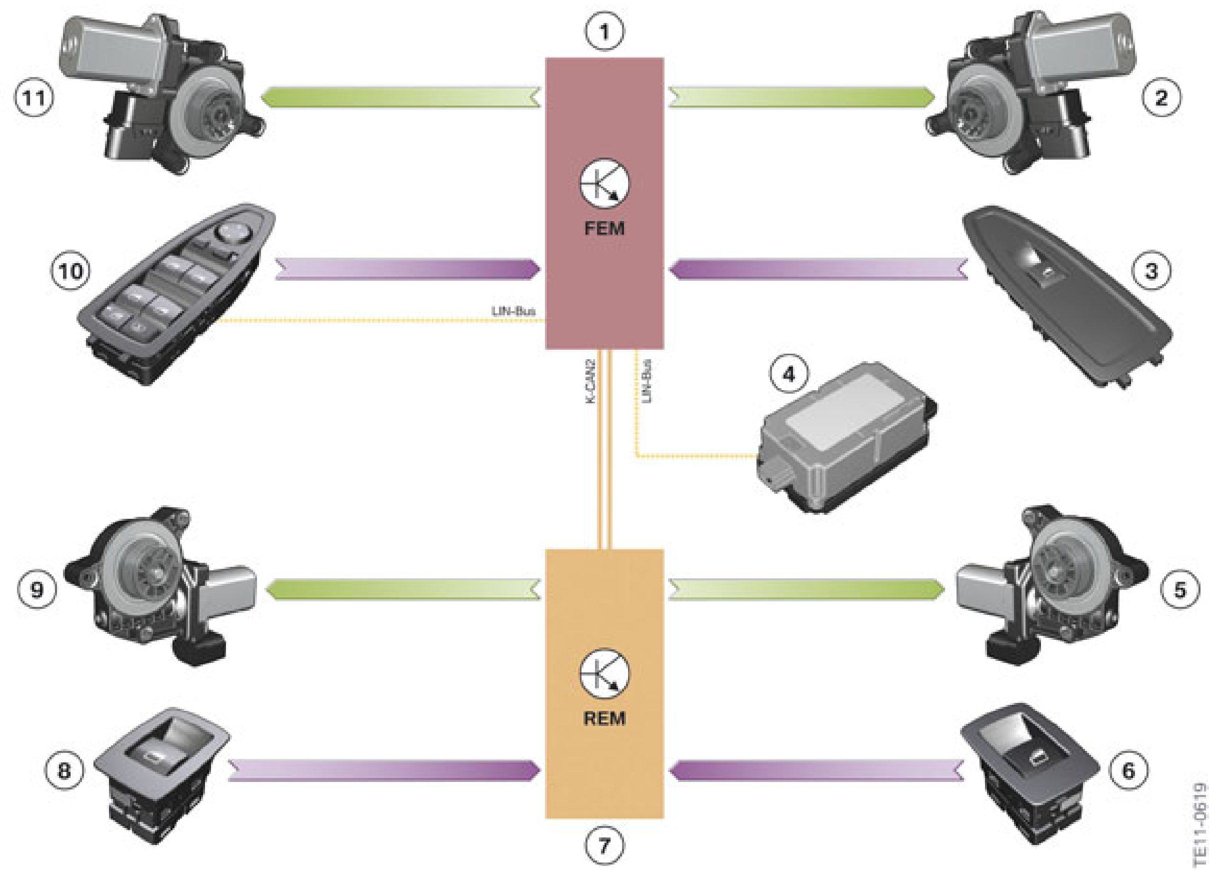
Index	Explanation
1	Power distribution box, engine compartment
2	Front Electronic Module (FEM)
3	Power window motor with indirect anti-trap mechanism, passenger side, front
4	Power window switch, front passenger side, front
5	Power window motor with indirect anti-trap mechanism, passenger side, rear
6	Power window switch, front passenger side rear
7	Rear Electronic Module (REM)
8	Remote control receiver
9	Power window switch driver's side, rear
10	Power window motor with indirect anti-trap mechanism, driver's side, rear
11	Switch block, driver's door
12	Power window motor with indirect anti-trap mechanism, driver's side, front
Kl.30B	Terminal 30 basic operation

The front power window regulators are activated by the FEM. The REM assumes the activation of the rear power window regulators. The power window regulators at the front are protected directly via the FEM and the power window regulators at the rear are protected directly via the REM. The relevant load relays are integrated directly in the FEM/REM. There is therefore no need for power to be supplied via a power distribution box.

The functions with regard to comfort and anti-trap protection are already familiar from the E90.

F30 General Vehicle Electronics

9. Power Window Regulators

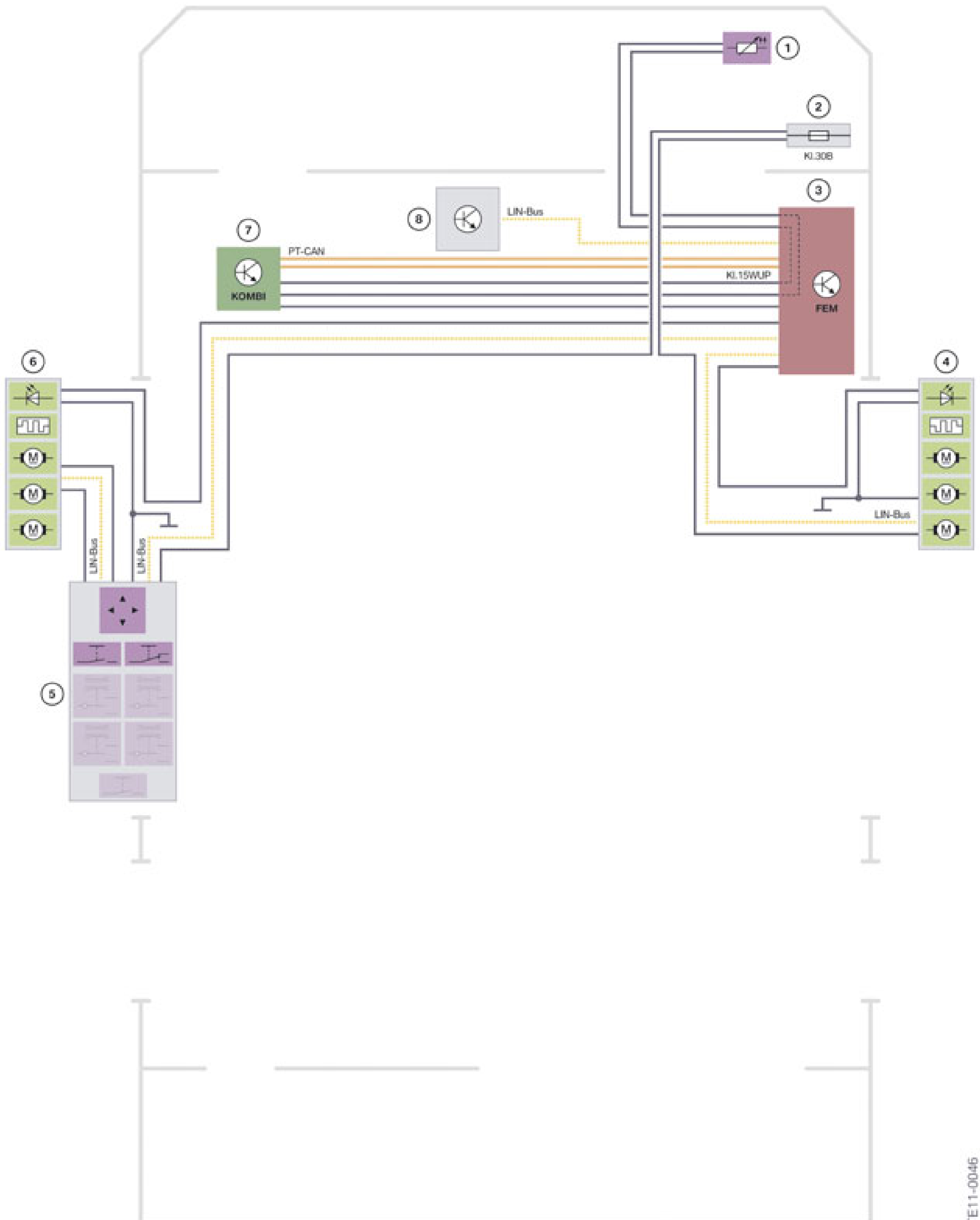


Input/output, power window regulators

Index	Explanation
1	Front Electronic Module (FEM)
2	Power window motor with indirect anti-trap mechanism, passenger side, front
3	Power window switch, front passenger side, front
4	Remote control receiver
5	Power window motor with indirect anti-trap mechanism, passenger side, rear
6	Power window switch, front passenger side rear
7	Rear Electronic Module (REM)
8	Power window switch driver's side, rear
9	Power window motor with indirect anti-trap mechanism, driver's side, rear
10	Switch block, driver's door
11	Power window motor with indirect anti-trap mechanism, driver's side, front

10. Exterior Mirrors

10.1. System wiring diagram



F30 system wiring diagram, exterior mirrors

F30 General Vehicle Electronics
10. Exterior Mirrors

Index	Explanation
1	Outside temperature sensor
2	Power distribution box, engine compartment
3	Front Electronic Module (FEM)
4	Exterior mirror, front passenger side (turn indicator light, mirror heating, motors for folding up and down and for adjustment)
5	Switch block, driver's door
6	Exterior mirror, driver's side (turn indicator light, mirror heating, motors for folding up and down and for adjustment)
7	Instrument cluster (KOMBI)
8	Inside mirror
KI.30B	Terminal 30 basic operation

The additional side turn indicator is already integrated as standard in the exterior mirror. The side repeater is operated using a LED fibre-optic conductor.

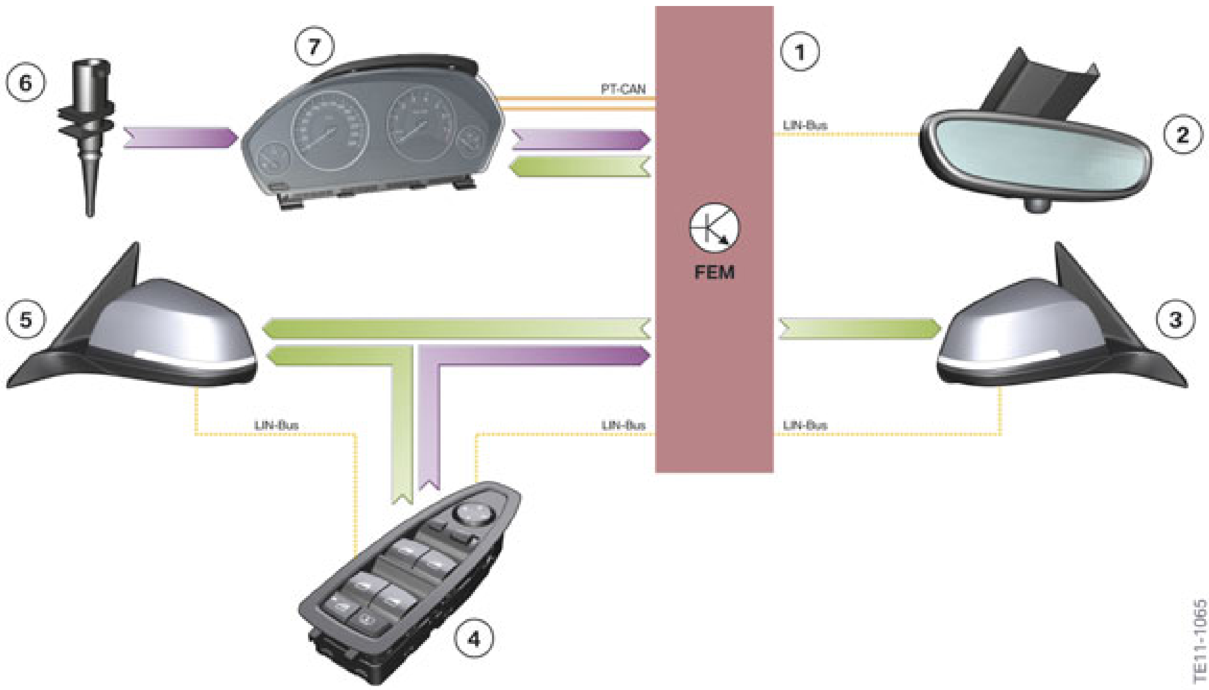
The exterior mirror of the F30 is equipped without a local interconnect network bus connection in the standard equipment.

The exterior mirror with a local interconnect network bus connection is available in the F30 with the following optional equipment:

- Interior and exterior mirrors with automatic anti-dazzle function (option 430)
- Electrical seat adjustment with memory (option 459)
- Surround View (option 5DL)
- Lane change warning (option 5AG)

F30 General Vehicle Electronics

10. Exterior Mirrors



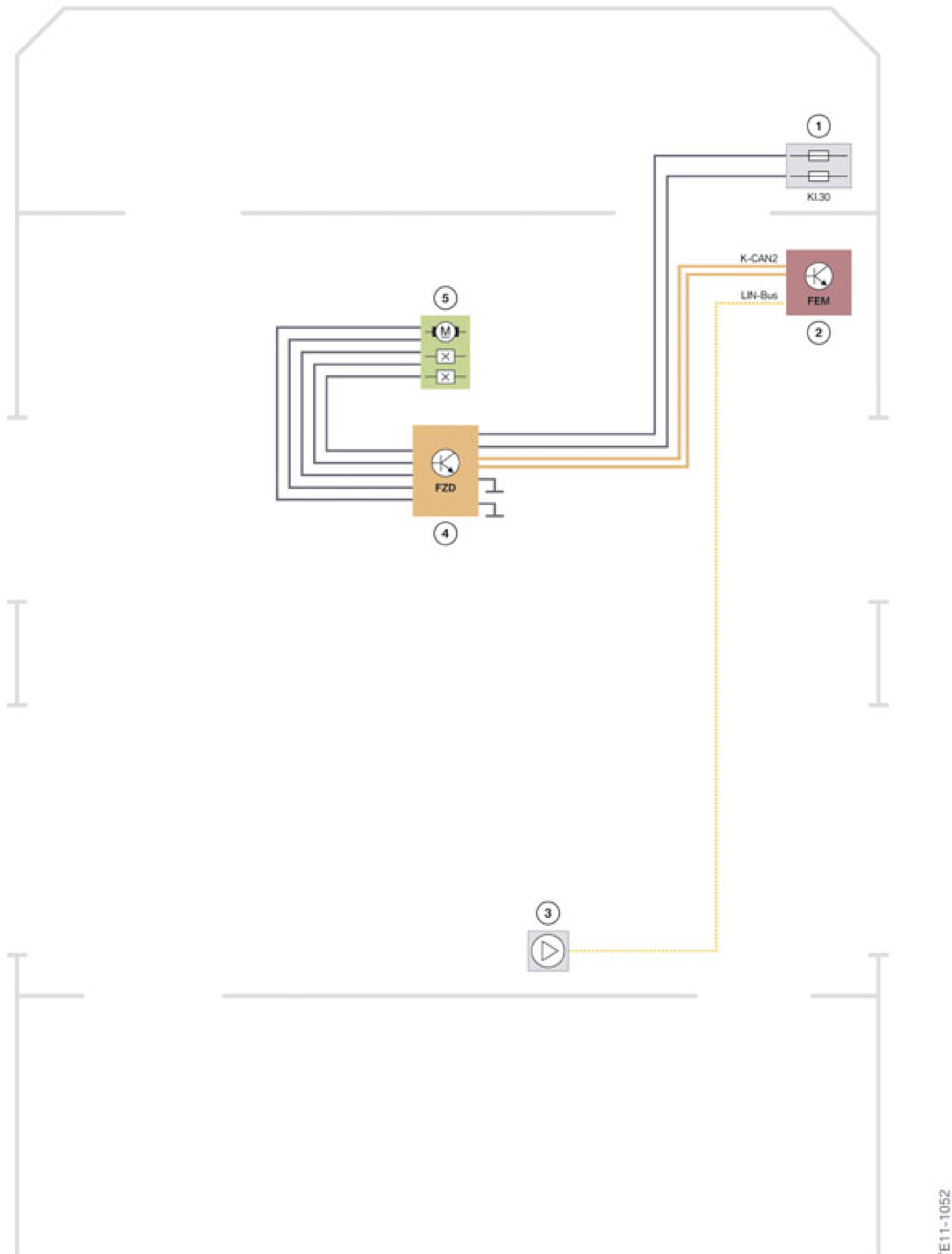
F30 Input/output, exterior mirrors

Index	Explanation
1	Front Electronic Module (FEM)
2	Inside mirror
3	Exterior mirror, front passenger side
4	Switch block, driver's door
5	Exterior mirror, driver's side
6	Outside temperature sensor
7	Instrument cluster

F30 General Vehicle Electronics

11. Glass Slide/Tilt Sunroof

11.1. System wiring diagram



F30 system wiring diagram, glass slide/tilt sunroof

11. Glass Slide/Tilt Sunroof

Index	Explanation
1	Power distribution box, engine compartment
2	Front Electronic Module (FEM)
3	Remote control receiver
4	Roof function center (FZD)
5	Glass slide/tilt sunroof motor
Kl.30	Terminal 30

The control and monitoring of the motors of the slide/tilt sunroof takes place in the roof function center FZD.

The FZD is connected to the Front Electronic Module (FEM), which enables or disables operation of the slide/tilt sunroof. The engine compartment power distribution box delivers the voltage supply to the motors via terminal 30.

F30 Input/output, glass slide/tilt sunroof

Index	Explanation
1	Front Electronic Module (FEM)
2	Remote control receiver
3	Roof function center (FZD)
4	Glass slide/tilt sunroof motor

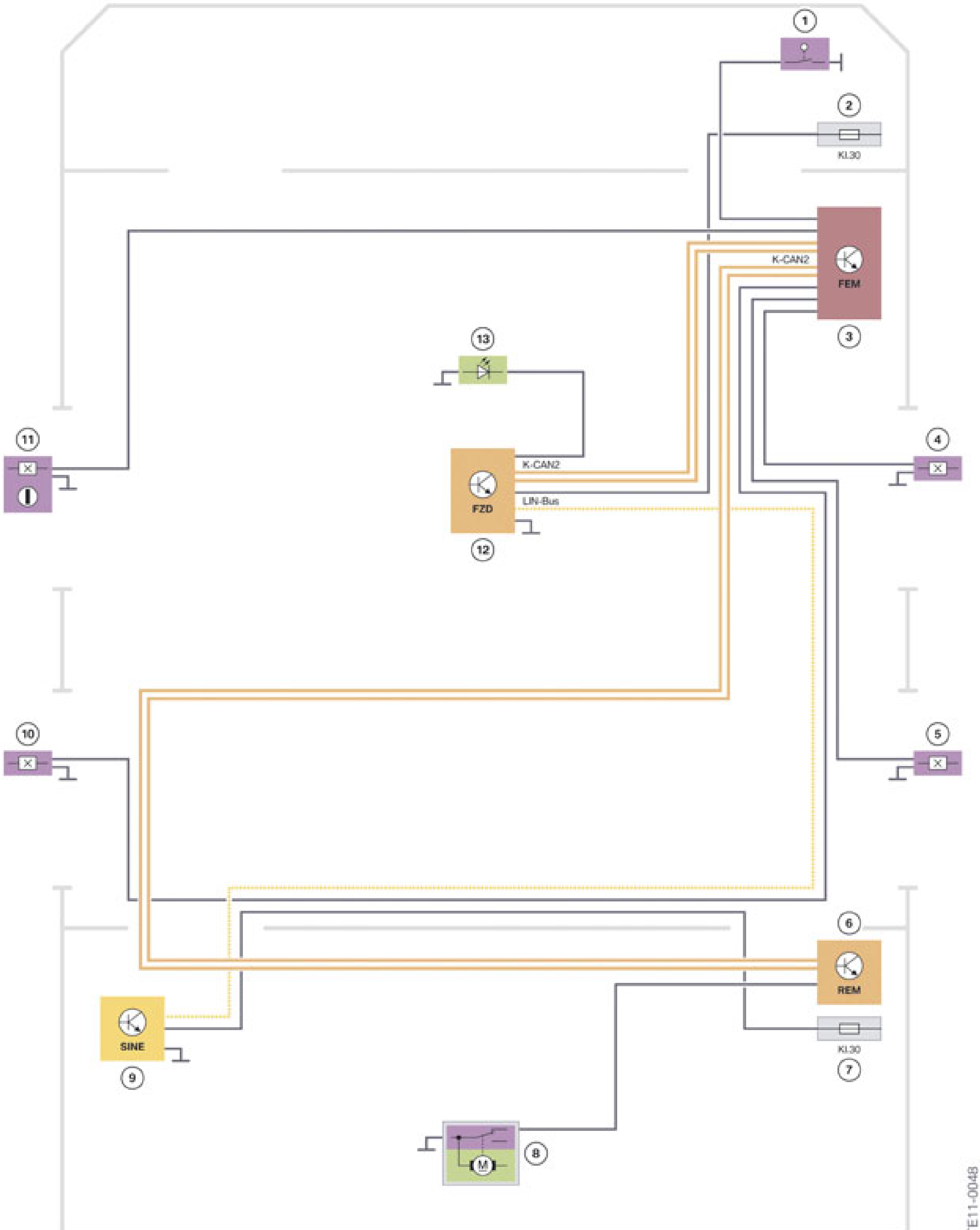
F30 General Vehicle Electronics

12. Alarm System

In addition to the monitoring of doors and the engine compartment lid and the trunk, the passenger compartment is also monitored in the F30 with the alarm system. Together with an ultrasonic interior movement detector (USIS), it is fully integrated in the roof function center (FZD).

12. Alarm System

12.1. System wiring diagram



F30 system wiring diagram, alarm system

12. Alarm System

Index	Explanation
1	Engine compartment lid contact switch
2	Power distribution box, engine compartment
3	Front Electronic Module (FEM)
4	Door contact, front passenger side, front
5	Door contact on front passenger side, rear
6	Rear Electronic Module (REM)
7	Power distribution box, luggage compartment
8	Trunk contact with trunk lock
9	Siren with tilt alarm sensor SINE
10	Door contact on driver's side, rear
11	Door contact, driver's side, front
12	Roof function center (FZD) USIS
13	Alarm system LED in the inside mirror
Kl.30	Terminal 30

The status of the following components is monitored:

- Door contacts, from Front Electronic Module FEM
- Engine compartment lid contact switch, from Front Electronic Module FEM
- Rear lid contact switch, from Rear Electronic Module REM.

As soon as a status changes, the control unit for the ultrasonic interior movement detector USIS receives a corresponding signal via the K-CAN2. If the alarm system is activated, an alarm is triggered.

F30 General Vehicle Electronics

13. Exterior Lights

The exterior lights of the F30 are based on the current BMW models.

The F30 is equipped with halogen headlights as standard. Bi-xenon headlights are available as optional equipment (option 522).

With the optional equipment bi-xenon headlight, LEDs are used for the daytime running lights, side lights and positioning lights.

With halogen headlights, the headlight beam throw is regulated manually.

Adaptive headlights are available as optional equipment (option 524) for the F30. This is only available in conjunction with bi-xenon headlights (option 522).

The FEM as the master control unit is responsible for the exterior light functions. It decides which lighting functions have to be activated or deactivated and makes this information available to the REM via the K-CAN2. The REM in turn signals the status of the activated function in each case back to the FEM.

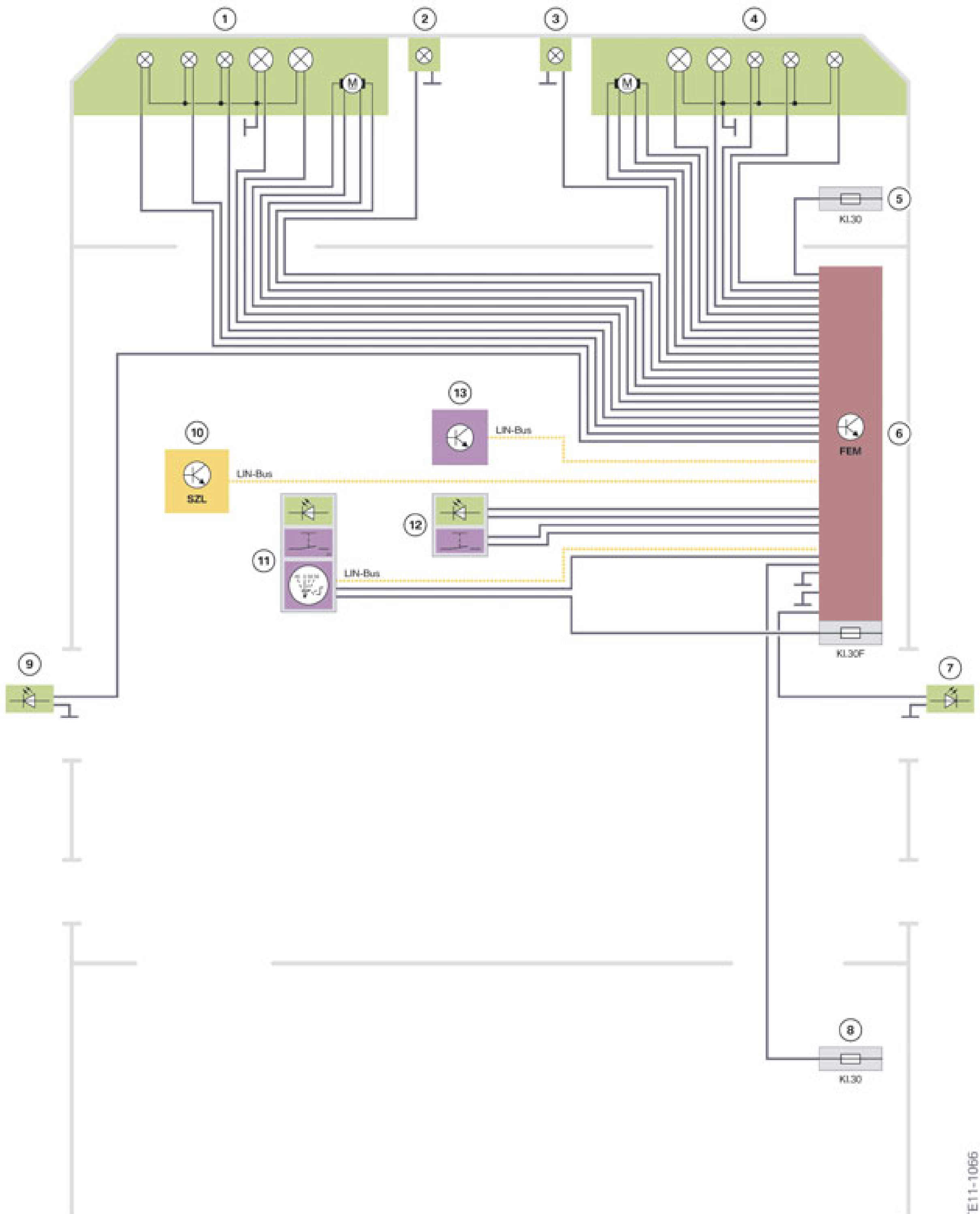
The additional LED turn indicators are in the exterior mirror. The additional turn indicators in the side panel are therefore omitted.

For more information on exterior lights, please refer to the "Exterior Lights F01/F02" training information.

F30 General Vehicle Electronics

13. Exterior Lights

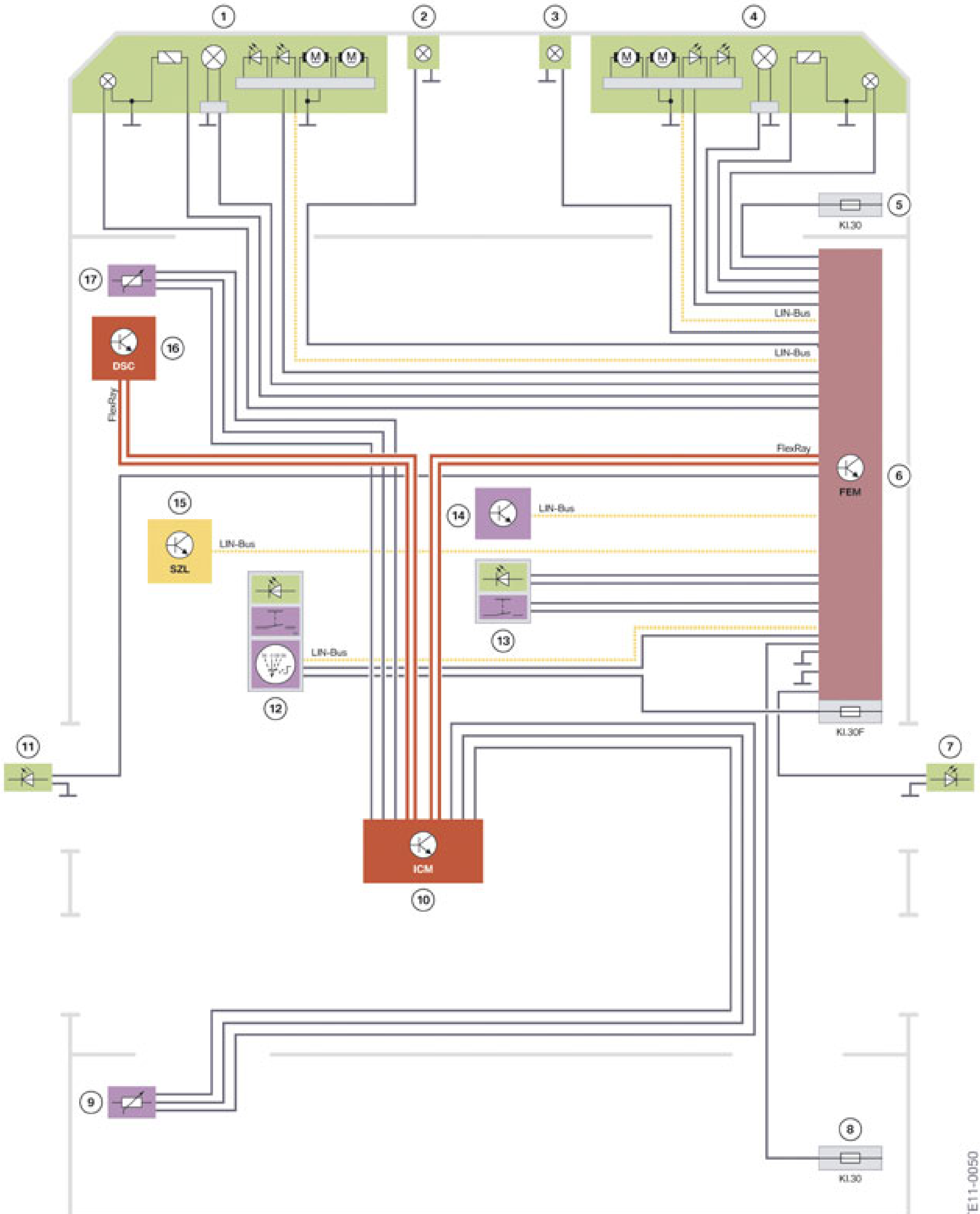
13.1. System wiring diagram



F30 system wiring diagram, front exterior lights (with halogen headlights)

13. Exterior Lights

Index	Explanation
1	Headlight, left
2	Fog light, left)
3	Fog light, right
4	Headlight, right
5	Power distribution box, engine compartment
6	Front Electronic Module (FEM)
7	Additional turn indicator, exterior mirror, front passenger side
8	Battery power distribution box
9	Additional turn indicator, exterior mirror, driver's side
10	Steering column switch cluster (SZL)
11	Operating facility, light switch
12	Button for central locking system/hazard warning switch
13	Rain-light-solar-condensation sensor
Kl.30	Terminal 30
Kl.30F	Terminal 30, fault-dependent



F30 system wiring diagram, front exterior lights (with xenon light, option 522)

F30 General Vehicle Electronics

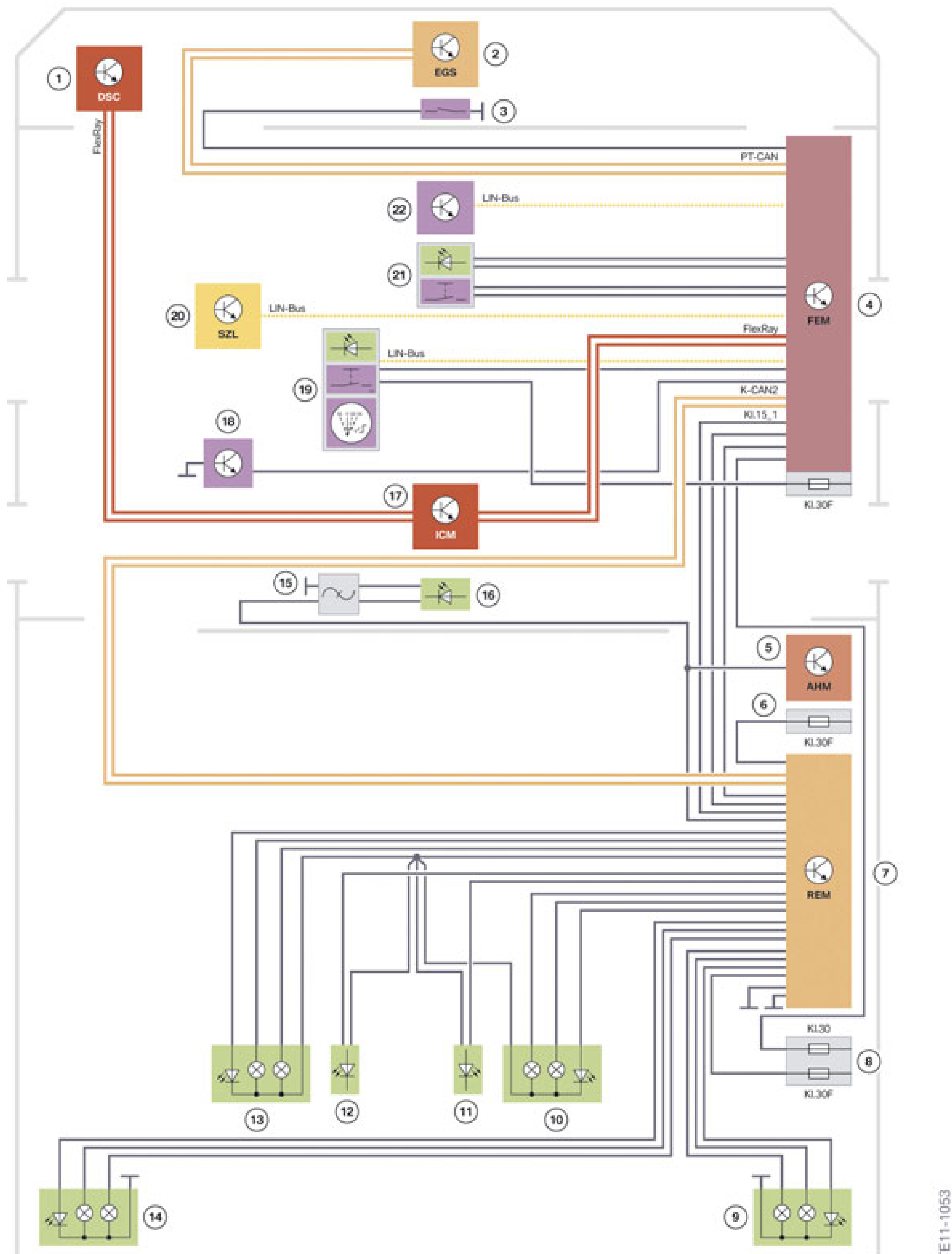
13. Exterior Lights

Index	Explanation
1	Headlight, left[1]
2	Fog light, left
3	Fog light, right
4	Headlight, right[1]
5	Power distribution box, engine compartment
6	Front Electronic Module (FEM)
7	Additional turn indicator, exterior mirror, front passenger side
8	Battery power distribution box
9	Ride height sensor, rear
10	Integrated Chassis Management (ICM)
11	Additional turn indicator, exterior mirror, driver's side
12	Operating facility, light switch
13	Button for central locking system/hazard warning switch
14	Rain-light-solar-condensation sensor
15	Steering column switch cluster (SZL)
16	Dynamic Stability Control DSC
17	Ride height sensor, front

[1] Second stepper motor only with adaptive headlight (option 524).

F30 General Vehicle Electronics

13. Exterior Lights



F30 system wiring diagram, rear exterior lights

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Electronic transmission control (EGS)
3	Reversing light switch
4	Front Electronic Module (FEM)
5	Trailer module (AHM) not US
6	Power distribution box, luggage compartment
7	Rear Electronic Module (REM)
8	Battery power distribution box
9	Outer rear light, right
10	Inner rear light, right (in trunk)
11	Number-plate light, right
12	Number-plate light, left
13	Inner rear light, left (in trunk)
14	Outer rear light, left
15	Interference suppression filter
16	Additional brake light
17	Integrated Chassis Management (ICM)
18	Brake light switch
19	Operating facility, light switch
20	Steering column switch cluster (SZL)
21	Button for central locking system/hazard warning switch
22	Rain-light-solar-condensation sensor
KI.30	Terminal 30
KI.30F	Terminal 30, fault-dependent

13.2. Adaptive headlights

In the F30 the adaptive headlight (option 524) is only available with the following optional equipment:

- Rain sensor (option 521)
- Xenon light (option 522)
- High-beam assistant (option 5AC).

The adaptive headlight enables dynamic lighting of the roadway thanks to a variable headlight control unit.

So as not to dazzle oncoming traffic the adaptive headlight is not active when reversing or when steering in stationary mode to the left (for left-hand drive vehicles).

The high-beam assistant/automatic high-beams (option 5AC) is dazzle-free with the adaptive headlight optional equipment. More information on the dazzle-free high-beam assistants can be found in the training information "Driver Assist Systems of the F30".

13.2.1. Function

The headlight follows the course of the road depending on the steering angle and other parameters.

For further information on the adaptive headlight, please refer to the training information "F01/F02 Exterior Lights".

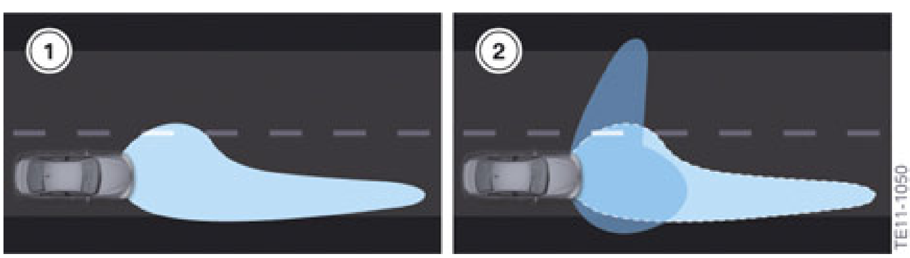
13.2.2. Operation

The adaptive headlight is activated in switch position "A" when the ignition is switched on.

The cornering light is automatically activated depending on the steering angle or turn indicator.

13.2.3. Cornering light

The cornering light function is included in the adaptive headlight optional equipment. At narrow bends or when turning, one of the two fog lights is activated as a cornering light up to a speed of 65 km/h. This illuminates the inner area of the bend better. So as not to dazzle oncoming traffic, the adaptive headlight points to the front passenger side when the vehicle is stationary.



Index	Explanation
1	Without cornering light
2	With cornering light

13.2.4. Malfunction

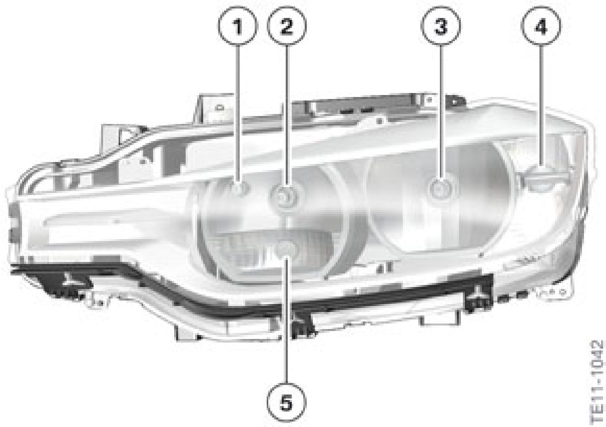
If there is a fault with the function, the following Check Control message is displayed:

Adaptive headlight is faulty or has failed. Have the system checked as soon as possible.

For further information on the adaptive headlight, please refer to the training information "F01/F02 Exterior Lights".

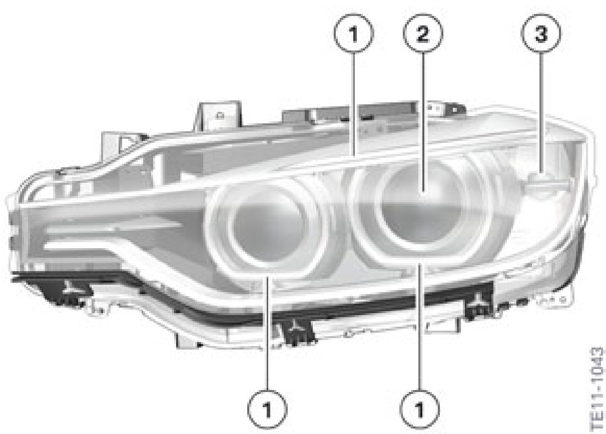
13.3. Front lights

The following graphic shows the layout of the front headlight.



F30 halogen headlight, front

Index	Explanation
1	Side lights
2	High-beam headlight
3	Low-beam headlight
4	Turn indicator
5	Daytime lights



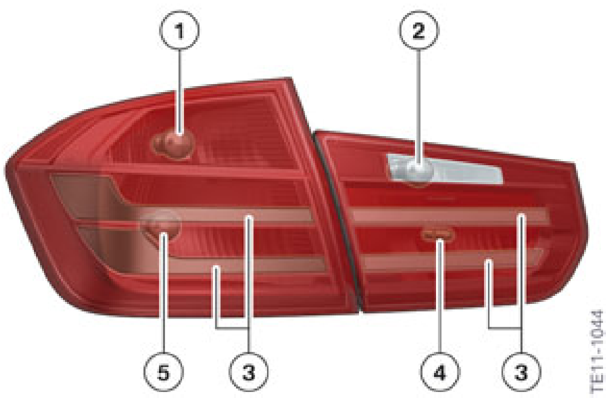
F30 bi-xenon headlight, front

Index	Explanation
1	LED for side light/daytime driving light
2	Low-beam and high-beam headlight
3	Turn indicator

For vehicles with a xenon light (option 522) the side lights/daytime driving lights are realized via LED-operated corona rings.

13.4. Rear lights

The F30 features a two-part rear light. One part is located in the quarter panel, the other in the trunk. The layout of the rear lights is shown in the following graphic.



F30 rear light

Index	Explanation
1	Turn indicator
2	Reversing light
3	Tail light
4	Rear fog light (not US)
5	Brake light

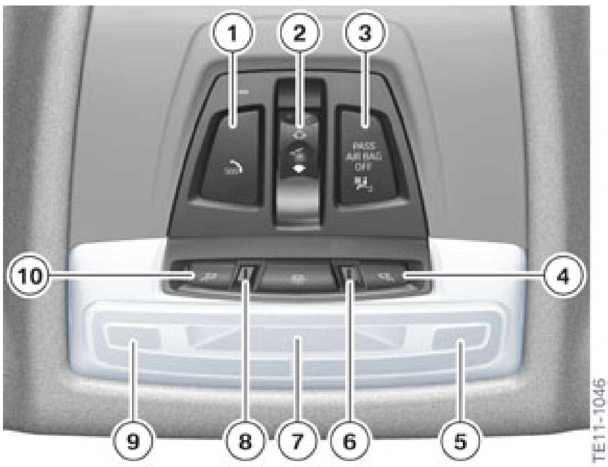
The bulbs of the rear light in the side wall are replaced by removing the lights from the vehicle. Access is done via an opening in the panel of the water channel.

F30 General Vehicle Electronics

14. Interior Lighting

The ambient light package which is standard. The luggage compartment lights are controlled by the REM. The FEM is responsible for the activation of all interior lighting.

The components of the interior lighting in the front roof area are integrated in the roof function center and in the sun visors. The footwell lighting is located on the underside of the dashboard. Voltage is supplied to the rear interior lighting via the roof function center.



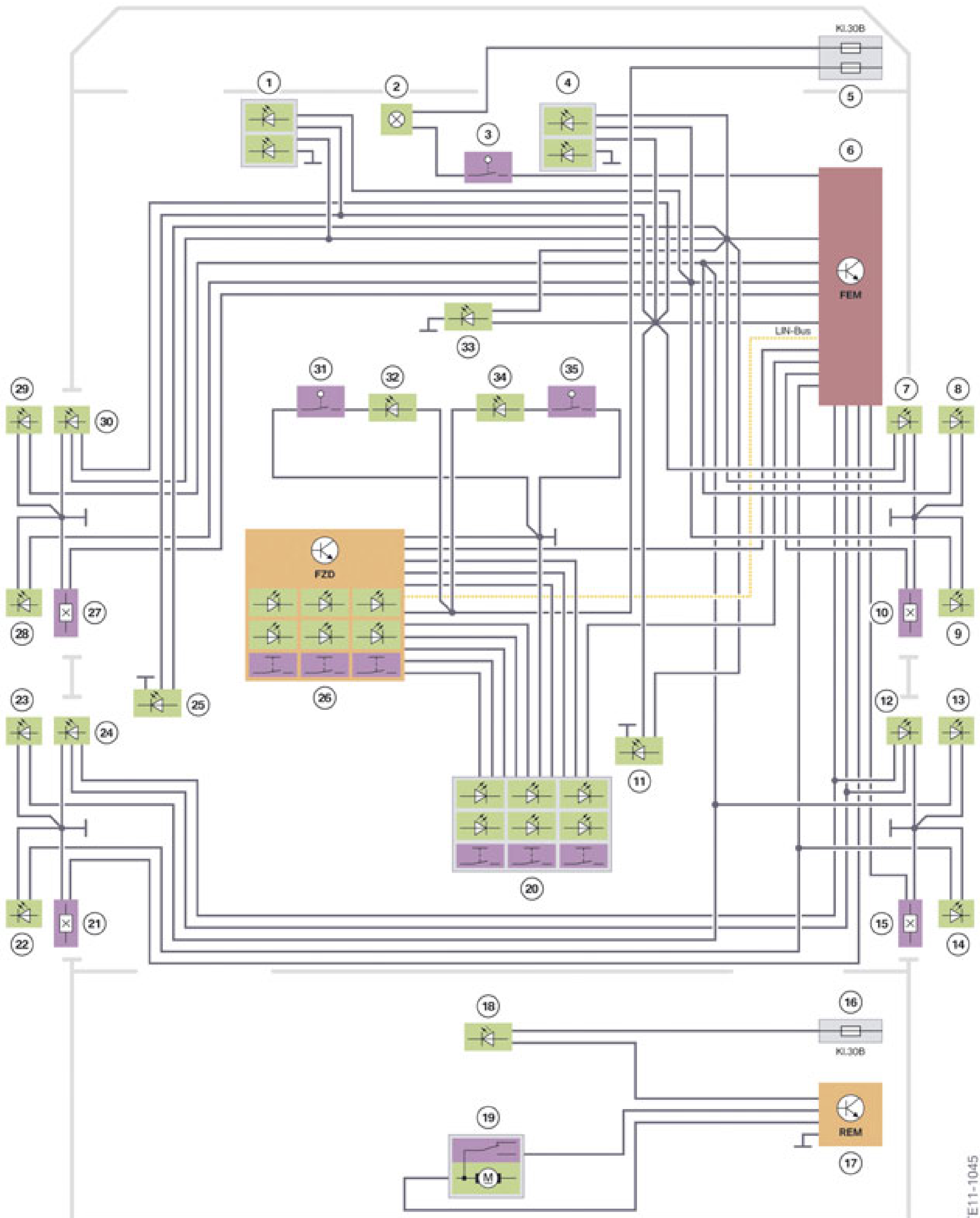
F30 roof function center

Index	Explanation
1	Emergency call button (only with option 6NL)
2	Switch for panorama glass roof
3	Indicator lamp for front passenger airbag deactivation
4	Reading light button, right
5	Reading light, right
6	Ambient lighting
7	Interior light
8	Ambient lighting
9	Reading light on left
10	Reading light button, left

In connection with the line package BMW Line Sport (PA 7AC), BMW Line Luxury (PA 7S2) or BMW Line Modern (PA 7S1), the color of the ambient lighting can be changed depending on the line. The changeover of the color and the brightness of the ambient lighting are effected in a menu in the CID. Depending on the vehicle line some of the lights are installed as switchable two-colored LEDs.

14. Interior Lighting

14.1. System wiring diagram



F30 system wiring diagram for interior lighting

F30 General Vehicle Electronics
14. Interior Lighting

Index	Explanation
1	Footwell light on driver's side, front
2	Glove box light
3	Glove box switch
4	Footwell light on front passenger side, front
5	Power distribution box, engine compartment
6	Front Electronic Module (FEM)
7	Inside door handle light on front passenger side
8	Ground lights on outer door handle on front passenger side
9	Entrance lighting on front passenger side, front
10	Door contact, front passenger side, front
11	Lighting, B-pillar, front passenger side
12	Inside door handle light on rear passenger side
13	Ground lights on outer door handle on rear passenger side
14	Entrance lighting passenger's side, rear
15	Door contact on front passenger side, rear
16	Power distribution box, luggage compartment
17	Rear Electronic Module (REM)
18	Luggage compartment light
19	Trunk contact with trunk lock
20	Interior light unit, rear
21	Door contact on driver's side, rear
22	Entrance lighting driver's side, rear
23	Ground lights on outer door handle on rear driver's side
24	Inside door handle light on rear driver's side
25	Lighting, B-pillar, driver's side
26	Roof function center (FZD) with front interior light unit
27	Door contact, driver's side, front
28	Entrance lighting on driver's side, front
29	Ground lights on outer door handle on front driver's side
30	Inside door handle light on front driver's side
31	Switch for vanity mirror light on driver's side
32	Vanity mirror light on driver's side

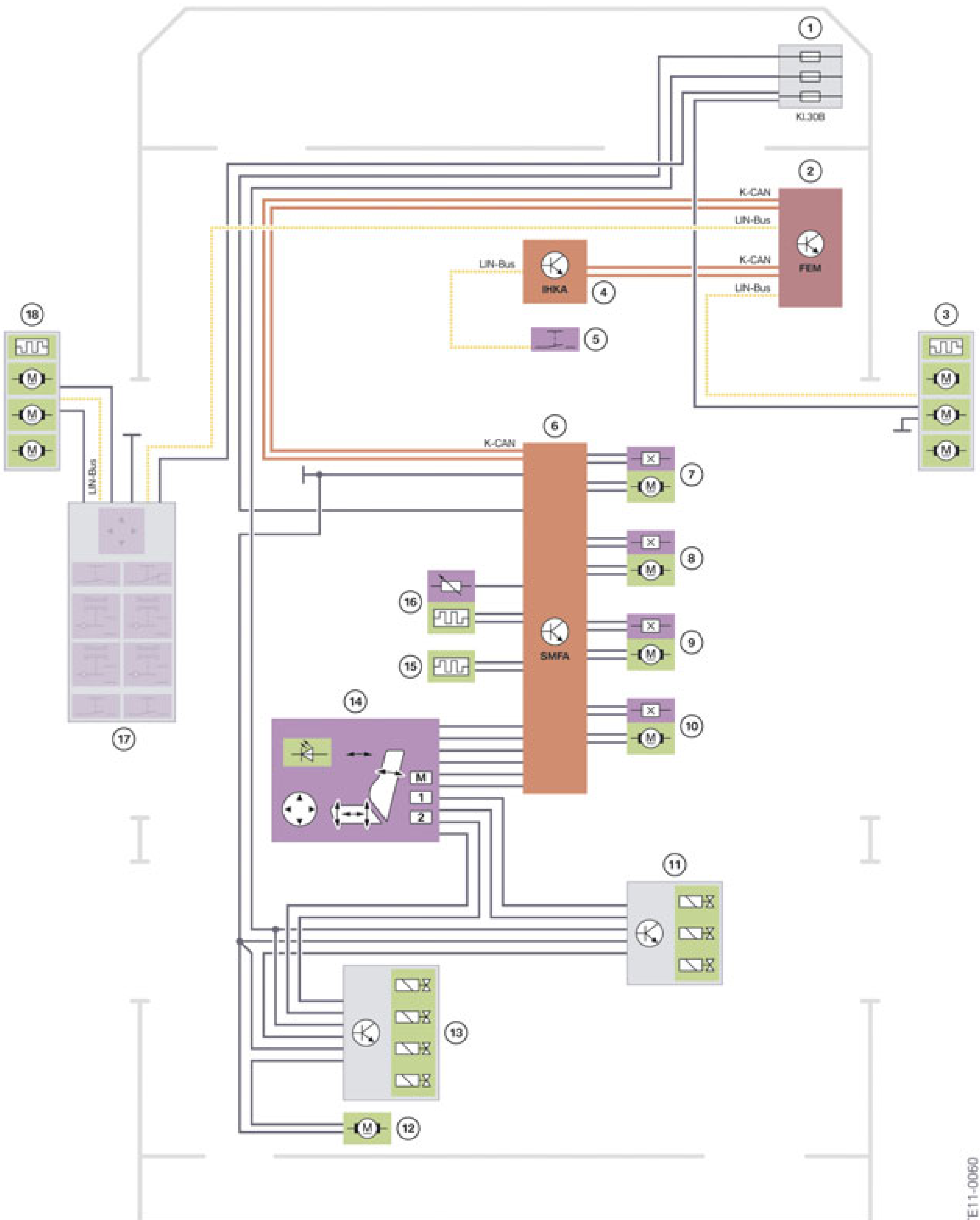
Index	Explanation
33	Lighting, dashboard
34	Vanity mirror light on passenger side
35	Switch for vanity mirror light on passenger side
Kl.30B	Terminal 30 basic operation

15. Seats

15.1. Front seats

15.1.1. System wiring diagram

[4] Only with seat heating for driver and front passenger (option 494).



F30 system wiring diagram, front seat, driver's side (with electric seat adjustment, with memory, option 459)

Index	Explanation
1	Power distribution box, engine compartment
2	Front Electronic Module (FEM)
3	Exterior mirror, front passenger side
4	Integrated automatic heating / air conditioning (IHKA)
5	Seat heating switch, driver's side[4]
6	Driver's seat module (SMFA)
7	Electric motor, forward/back seat adjustment
8	Electric motor, seat angle adjustment
9	Electric motor, seat height adjustment
10	Electric motor, backrest angle adjustment
11	Solenoid valves, backrest width adjustment[1]
12	Lumbar support pump[2]
13	Solenoid valves, lumbar support adjustment[3]
14	Switch block, seat adjustment
15	Seat heating, backrest[4]
16	Seat heating, seat surface[4]
17	Switch block, driver's door
18	Exterior mirror, driver's side
Kl.30B	Terminal 30 basic operation

[1] Only with sports seats for driver and front passenger (option 481).

[2] Only with sports seats for driver and front passenger (option 481) or with lumbar support for driver and front passenger (option 488).

[3] Only with lumbar supports for driver and front passenger (option 488).

[4] Only with seat heating for driver and front passenger (option 494).

F30 General Vehicle Electronics

16. Heating/Air Conditioning Systems

In the F30 an integrated heating and air-conditioning system (IHKA) is used as standard equipment for the heating and air-conditioning system. In the E90 an integrated heating / air-conditioning regulation (IHKR) was used as standard equipment.

With an integrated heating / air-conditioning regulation the duct temperature is adjusted to the value set using the control panel. In contrast, with an integrated heating / air-conditioning system the interior temperature of the vehicle is also taken into consideration when controlling the duct temperature. If the interior temperature deviates greatly from the set temperature, the duct temperature is then controlled at a lower or higher value than the set temperature in order to quickly reach the set temperature.

The IHKA of the F30 therefore has an additional interior temperature sensor installed in the control panel. The sensor data is digitized in the control panel and the information transmitted to the IHKA control unit via the local interconnect network bus. Thanks to a computer model integrated in the IHKA controls, the forced ventilation of the interior temperature sensor in the F30 could be discontinued. The duct temperature is measured using sensors in the ventilation system, which are connected directly to the IHKA control unit.

- Integrated automatic heating / air conditioning (IHKA), 2/1-zone.

In the zone specification the first number denotes the number of controllable temperature zones (temperature selector wheels) and the second number the number of controllable airflow volume and air distribution zones (separate fan settings).

16.1. Sensors and actuators

Sensors and actuators which are connected to the FEM control unit are involved in the function of the heating and air conditioning system in the F30. The following list provides an overview of these components:

- Refrigerant circuit pressure sensor
  The FEM evaluates the pressure sensor signal and makes it available to the IHKA control unit via K-CAN
- Blower
  The IHKA control unit request is sent via the LIN bus to the blower
- A/C compressor
  The A/C compressor is controlled via a pulse-width modulated signal by the FEM. The FEM can also actuate the A/C compressor clutch. The request is always effected however through the IHKA control unit. In the event of a fault, a fault entry is made by the FEM.
- Heat exchanger water valve
- Stepper motors
  - Nine stepper motors for IHKA 2/1 zones
- Rear-seat area ventilation sensor
  The FEM evaluates the signal from the rear-seat area ventilation sensor and makes it available to the IHKA control unit via the K-CAN.

16.2. Features

16.2.1. IHKA features

- Improved protection of the blower motor through closed area of the blower wheel
  - Protection of the blower motor against water and contaminants
- One-piece microfilter on the pressure side of the blower
  - Air filtering also in air recirculation function, thus improved air quality
  - Reduced build-up of odors, as well as less corrosion on evaporator
- Separation of IHKA controls and IHKA control unit
  - The IHKA control unit is now located at the heating and air-conditioning unit
  - Communication between IHKA controls and IHKA control unit by means of local interconnect network bus via the audio control panel
- Air-conditioning with clutch
  In the case of a switched-off air-conditioning system the compressor is separated from the belt drive by a clutch, the load on the engine is therefore less thus saving on fuel
- ECO PRO function
  - Climate control
    Less air-drying and cooling, thus less drive power required for A/C compressor
    A/C compressor is switched off if required temperature is reached also without cold-air generation
  - Heating mode
    Dispensed with operating mode of combustion engine with increased heat dissipation.

16.2.2. Additional Functions of the IHKA

- Operable stratification
- Air flaps are individually activated using 9 stepper motors
- Temperature for rear-seat area ventilation can be adjusted
  The FEM evaluates the signal from the rear-seat area ventilation sensor and makes it available to the IHKA control unit via the K-CAN.

F30 General Vehicle Electronics

16. Heating/Air Conditioning Systems

16.3. 2/1-zone IHKA

16.3.1. Control panel

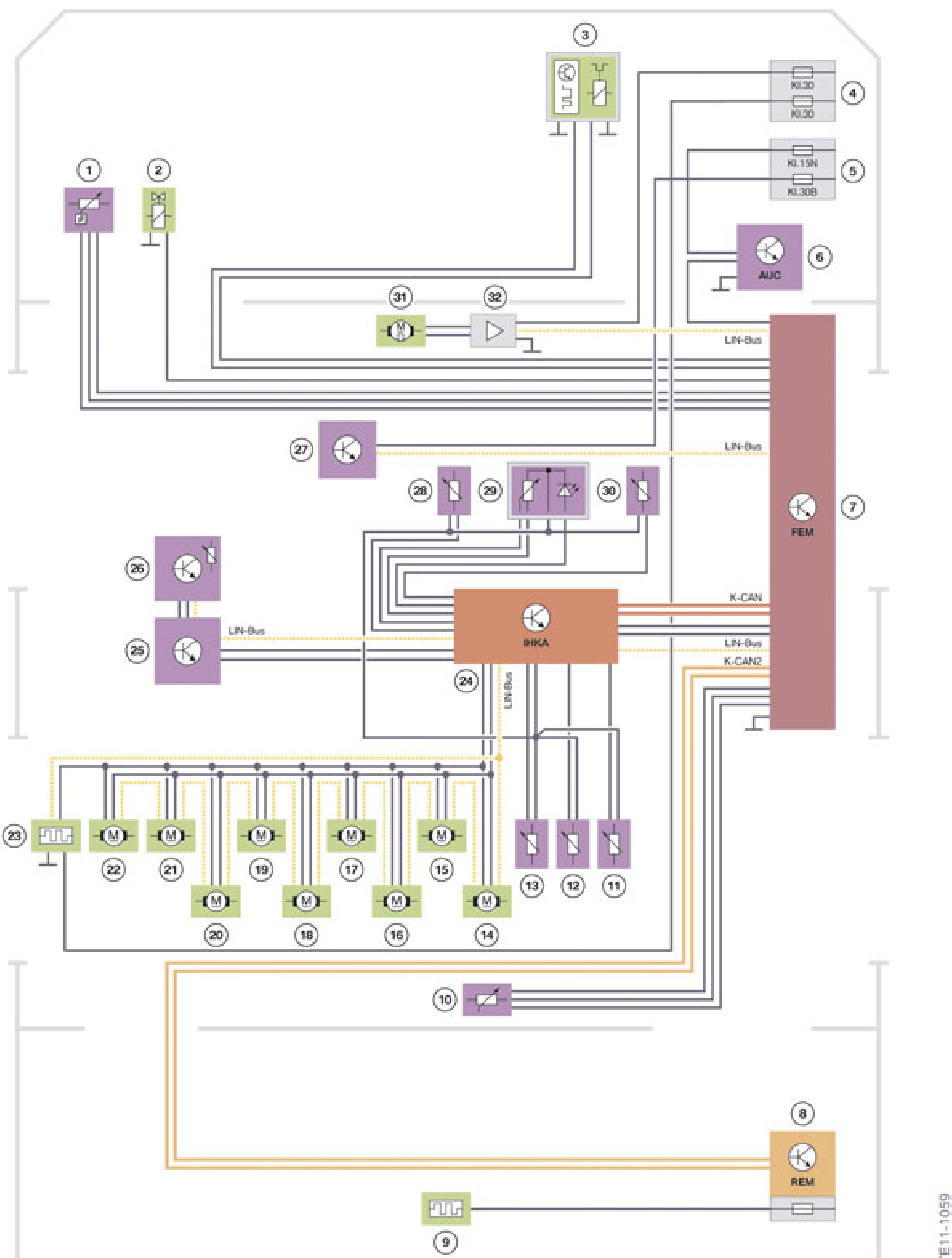
In the F30 the IHKA 2/1 zones control panel is installed.

F30 control panel, IHKA 2/1 zones

F30 General Vehicle Electronics

16. Heating/Air Conditioning Systems

16.3.2. System wiring diagram



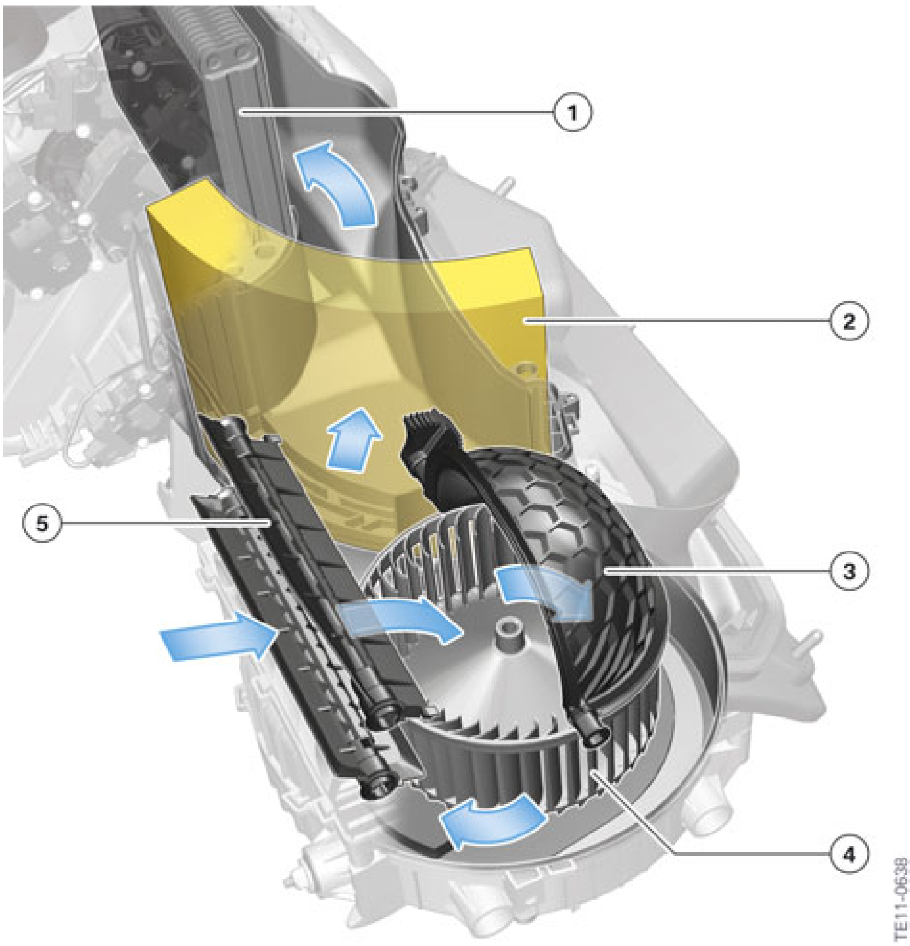
F30 system wiring diagram, IHKA 2/1 zones

F30 General Vehicle Electronics
16. Heating/Air Conditioning Systems

Index	Explanation
1	Refrigerant circuit pressure sensor
2	Heat exchanger water valve
3	A/C compressor
4	Power distribution box, front
5	Power distribution box, engine compartment
6	Automatic air recirculation control sensor
7	Front Electronic Module (FEM)
8	Rear Electronic Module (REM)
9	Heated rear window
10	Stratification potentiometer for rear-seat area ventilation
11	Temperature sensor for evaporator
12	Temperature sensor, footwell, front right
13	Temperature sensor, footwell, front left
14	Stepper motor, mixing air flap, left
15	Stepper motor, mixing air flap, right
16	Stepper motor, fresh air/ram air/recirculated air
17	Stepper motor, stratification, front right
18	Stepper motor, stratification, front left
19	Stepper motor, temperature, air quantity, rear passenger compartment
20	Stepper motor, footwell, right
21	Stepper motor, footwell, left
22	Stepper motor, defrost
23	Electric auxiliary heater (only for diesel fuel vehicles)
24	IHKA control unit
25	Audio control panel
26	IHKA controls with interior temperature sensor
27	Rain-light-solar-condensation sensor
28	Ventilation temperature sensor, left
29	Stratification potentiometer for front ventilation
30	Ventilation temperature sensor, right
31	Blower
32	Blower output stage
Kl.30	Terminal 30
Kl.30B	Terminal 30 basic operation
Kl.15N	Ignition (after-run)

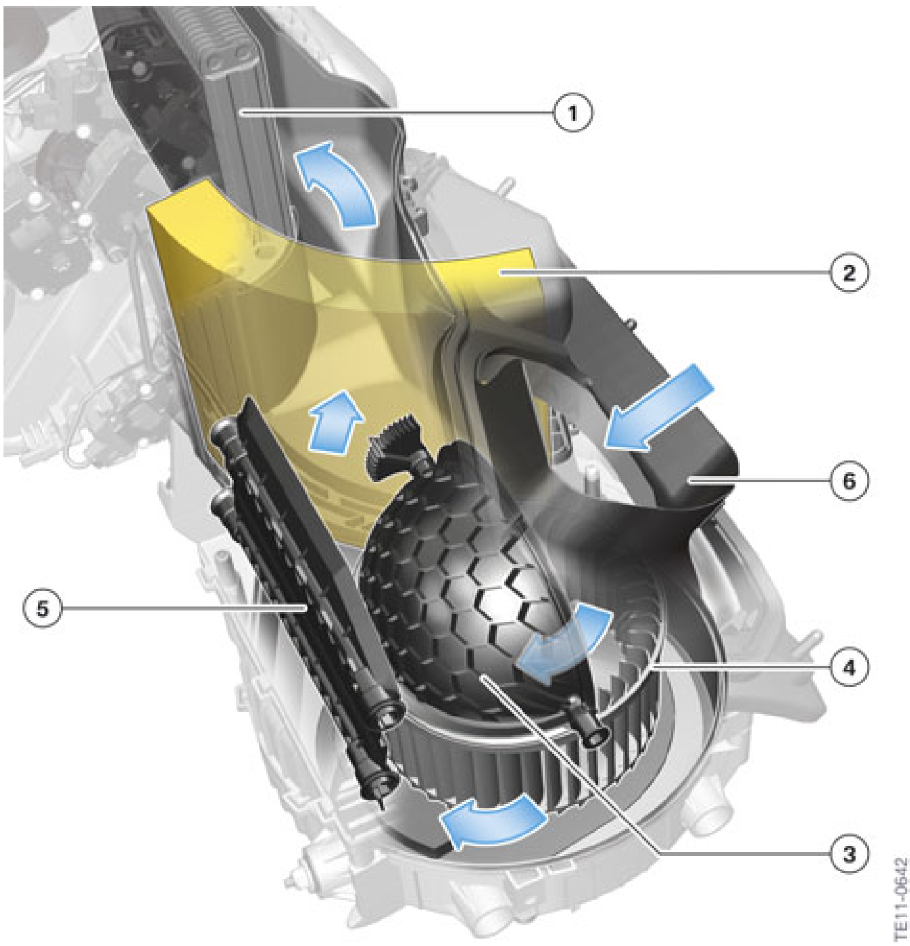
16.4. Microfilter

The microfilter is installed on the pressure side of the blower. This reduces air contaminants in both fresh-air and air recirculation modes. Evaporator corrosion and the build-up of odors are also reduced.



Air route in the heating and air conditioning system (air recirculation mode)

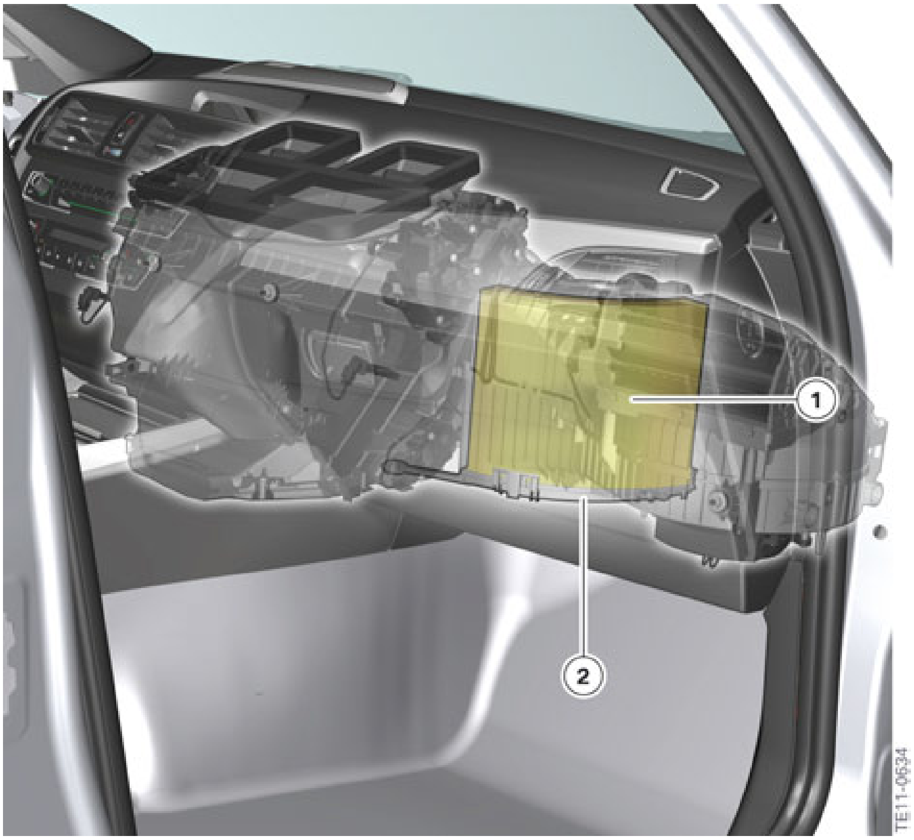
Index	Explanation
1	Evaporator
2	Filter
3	Recirculated air flap
4	Blower
5	Recirculated air inlet flap (opened)



Air route in the heating and air conditioning system (fresh-air mode)

Index	Explanation
1	Evaporator
2	Filter
3	Recirculated air flap
4	Blower
5	Recirculated air inlet flap (closed)
6	Fresh air inlet

The one-part microfilter is located in the F30 behind the glove box and can be easily replaced through the footwell on the passenger side.



Microfilter

Index	Explanation
1	Microfilter
2	Filter cover

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Technical training.
Product information.

F30 Driver Assistance Systems

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BMW Group University
Technical Training
ST1113 5/1/2012

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Driver Assistance Systems
Contents

F30 Driver Assistance Systems
Contents

F30 Driver Assistance Systems

1. Introduction

BMW has long since offered a comprehensive range of driver assist systems. The driver assist systems facilitate driving of the vehicle by

- Providing the driver with information
- Giving the driver suggestions
- Automatically intervening in the driving process.

This section contains an overview of all driver assist systems available in the F30. There are also new features such as lane change warning.

The centralization of many control units in the FEM and REM. However, the basic principle and the functions of the driver assist systems correspond for the most part to the counterpart systems in the current BMW models.

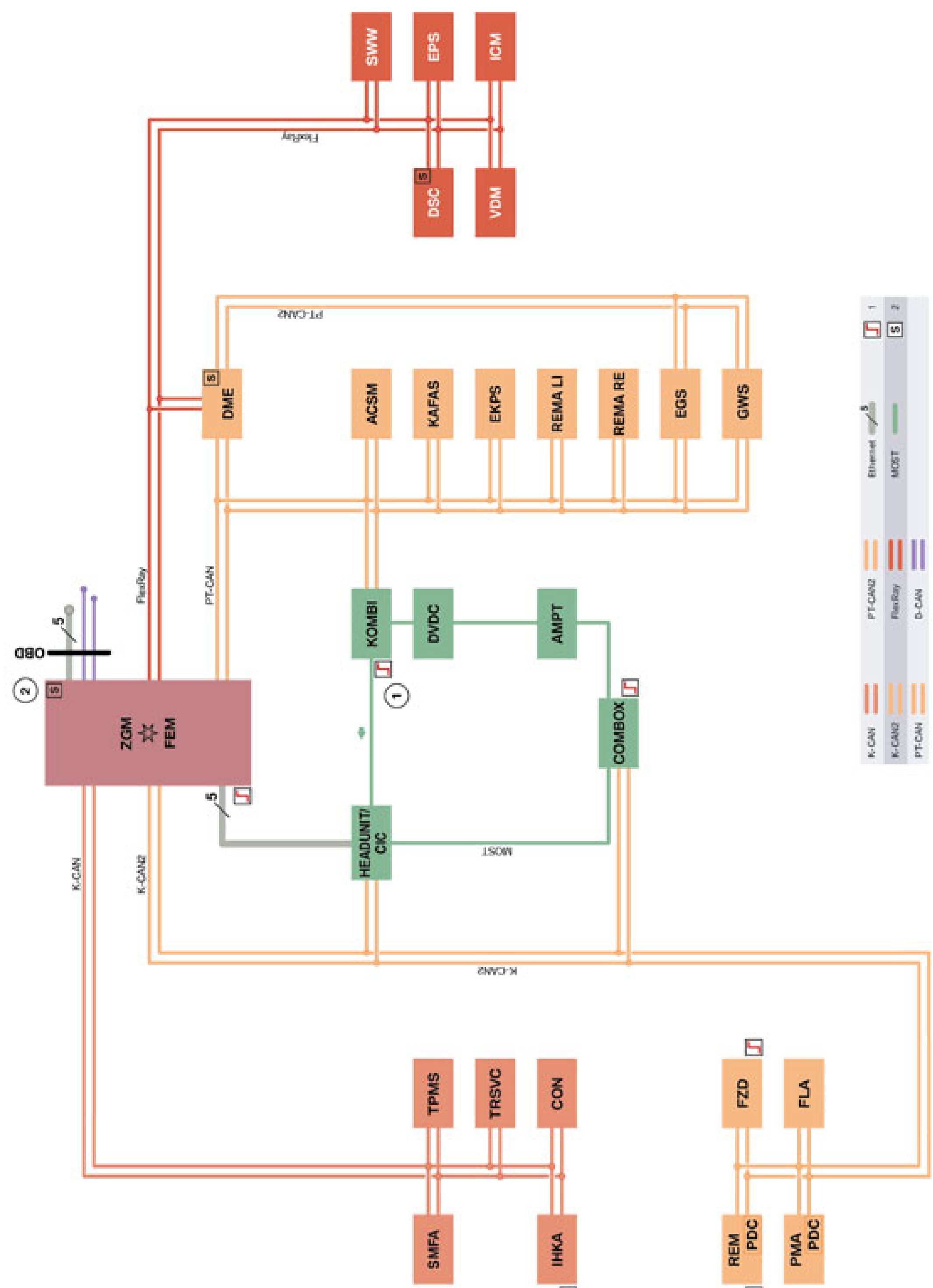
For further information on the individual systems, please refer to the training material for the F01/F02:

- DCC F01/F02
- KAFAS F01/F02.

F30 Driver Assistance Systems

1. Introduction

1.1. Bus overview



F30 Bus overview

F30 Driver Assistance Systems
1. Introduction

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top-HiFi amplifier
COMBOX	Combox (Combox emergency call, Multimedia Combox)
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DME	Digital Engine Electronics (DME)
DSC	Dynamic Stability Control
DVDC	DVD changer
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EPS	Electromechanical Power Steering
Ethernet	Cable-based data network technology for local data networks
FEM	Front Electronic Module
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector lever
HEADUNIT/CIC	Headunit (Car Information Computer or Basic headunit)
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
K-CAN	Body controller area network
K-CAN2	Body controller area network 2
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (MOST only with option 6WA)
MOST	Media Oriented System Transport
OBD	On-board diagnosis (diagnostic socket)
PDC	Park Distance Control (with option 5DP, parking manoeuvring assistant: integrated in the parking manoeuvring assistant control unit, otherwise integrated in the Rear Electronic Module control unit)
PMA	Parking manoeuvring assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
RAD	Radio

Index	Explanation
REM	Rear Electronic Module
REMA LI	Reversible electromotive automatic reel, left (not US)
REMA RE	Reversible electromotive automatic reel, right (not US)
SMFA	Seat module, driver
SWW	Lane change warning
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for all-round vision camera
VDM	Vertical Dynamics Management
ZGM	Central gateway module

F30 Driver Assistance Systems
2. KAFAS

The following camera-based driver support systems are available as optional equipment in the F30:

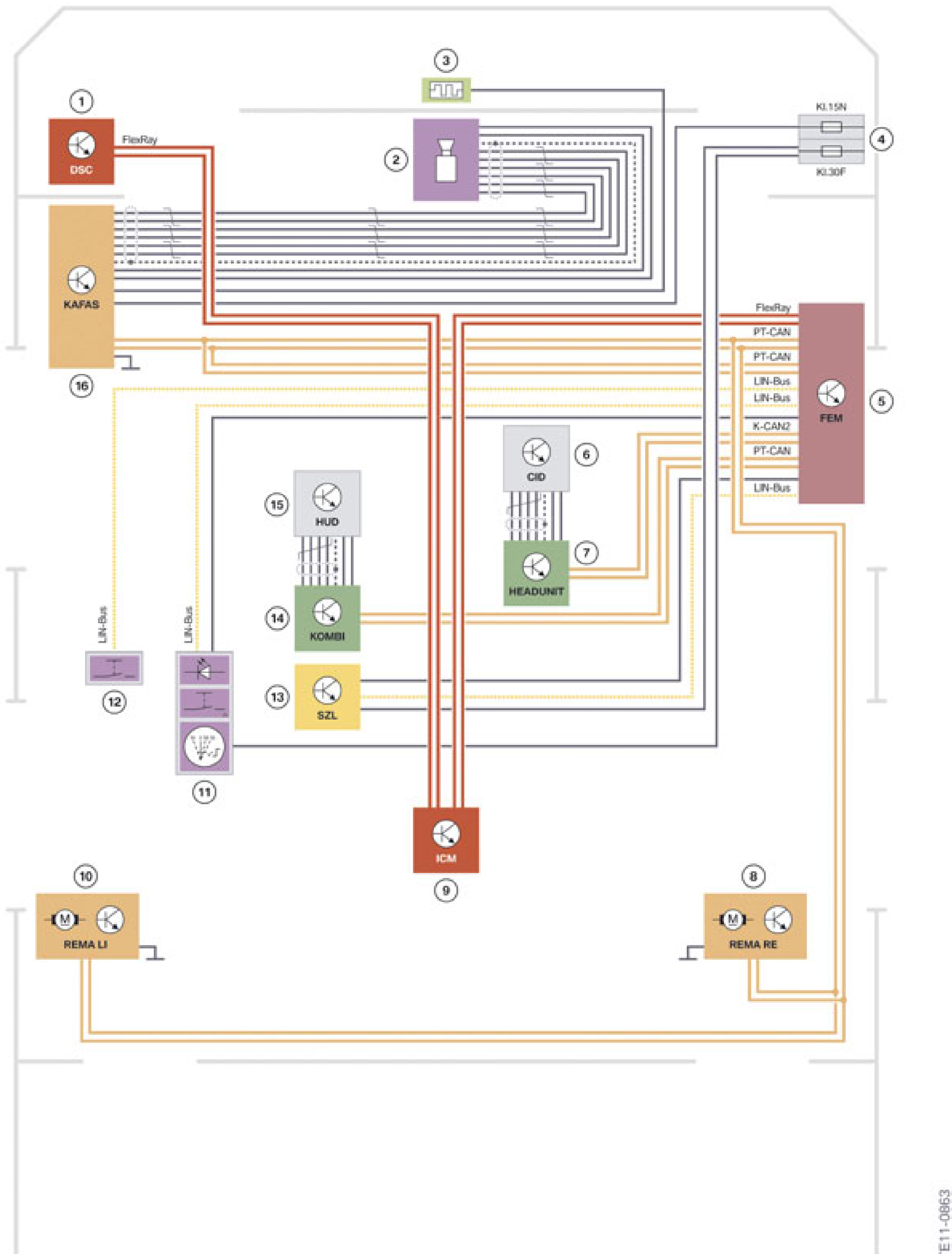
- Lane departure warning including collision warning (option 5AD)
- Road sign recognition (option 8TH Speed Limit Information)
- High-beam assistant (FLA) (option 5AC)

If the customer chooses exclusively the high-beam assistant (FLA) from the optional equipment range, the system is implemented with its own FLA video camera and its own FLA control unit electronics in the inside mirror.

F30 Driver Assistance Systems

2. KAFAS

2.1. System wiring diagram



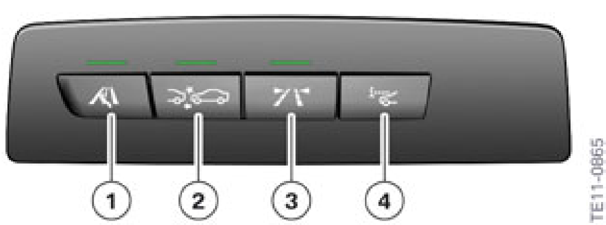
F30 System wiring diagram, KAFAS

F30 Driver Assistance Systems

2. KAFAS

Index	Explanation
1	Dynamic Stability Control (DSC)
2	KAFAS video camera
3	Video camera heater
4	Power distribution box, front
5	Front Electronic Module (FEM)
6	Central information display (CID)
7	Headunit
8	Reversible electromotive automatic reel, right REMABF (not US)
9	Integrated Chassis Management (ICM)
10	Reversible electromotive automatic reel, left REMAFA (not US)
11	Operating facility, light switch
12	Operating facility, driver assist systems
13	Steering column switch cluster (SZL)
14	Instrument cluster (KOMBI)
15	Head-Up Display HUD
16	KAFAS control unit
Kl.15N	Ignition (after-run)
Kl.30F	Terminal 30, fault-dependent

2.2. Operating facility



F30 Operating facility, driver assist systems

Index	Explanation
1	Lane change warning
2	Collision warning
3	Lane departure warning
4	Head-Up Display (HUD) button not installed, now in the CIC under “Settings” “Head-Up Display”

2.3. Lane departure warning

The lane departure warning (option 5AD) warns the driver by vibrations in the steering wheel of the inadvertent departure from a given lane. The prerequisite for this is the presence of suitable roadway or lane markings, that can be recognized with the KAFAS video camera of the control unit. The KAFAS video camera is accommodated in the mirror base.

The system can thus support the driver in maintaining his attention. The responsibility for the vehicle remains exclusively with the driver.

The system is designed to support the driver on highways and high-quality country roads. Warnings are therefore only issued at speeds greater than 70 km/h or 43 mph.

The system is activated or deactivated by pressing the button "Lane change warning" in the operating facility of the driver assist systems:

- Activate: LED lights up over the button
- Deactivate: LED goes out over the button.

The state is saved for the ID transmitter currently used.

You can obtain more information on the lane departure warning system in the "KAFAS F01/F02" training information.

⚠

The system cannot replace a personal assessment of the roads and traffic situation. If the warning is issued, do not respond by moving the steering wheel with unnecessary force as this could result in control over the vehicle being lost.

2.4. Collision warning

The collision warning for equipment without ACC is an integral part of the lane departure warning system (option 5AD) and warns the driver of a possible risk of collision. The collision warning is realized with help of the KAFAS system.

2.4.1. Operation

The system is activated or deactivated by pressing the button "Collision warning" in the operating facility of the driver assist systems:

- Activate: LED lights up over the button
- Deactivate: LED goes out over the button.

The state is saved for the ID transmitter currently used.

A display on the CID is opened upon activation of the function. Here the driver can configure the time of the early warning in two stages, or deactivate and reactivate the early warning. The state is saved for the ID transmitter currently used.

2.4.2. Operating principle

The system warns of a possible collision from a speed of approx. 15 km/h or 10 mph in two stages.

The KAFAS video camera records the scenery ahead of the vehicle and uses image processing to detect vehicles and stationary objects in the field of view. The corresponding warning stages are output in critical situations on the basis of the calculated positions, distances and relative speeds of the other vehicles. In addition to the warnings, the vehicle's brakes are prepared for emergency braking in the event of an acute warning. In contrast to forward collision warning with braking function, there is, however, no brake intervention by the system.

When an object is deliberately approached/driven into, the collision warning is issued later so as to avoid unauthorized warnings.

2.4.3. Warning function

The warning function corresponds to the collision warning with brake function. The warning function is divided into two stages. It is displayed in the instrument cluster.

Collision warning display in the instrument cluster

Early warning

The early warning is issued for example in the event of an approaching risk of collision or if the vehicle is very close to the vehicle in front.

The early warning is indicated by a vehicle permanently illuminated in red in the instrument cluster.

The time of the early warning can be configured in the CID.

Acute warning

The acute warning is issued in the event of an immediate risk of collision when the vehicle is approaching another object at a relatively high differential speed. The acute warning cannot be deactivated.

An acute warning is indicated to the driver by a red flashing vehicle in the instrument cluster. In addition, an acoustic warning signal is sounded. The acute warning is a prompt for braking intervention and if necessary for an evasive maneuver.

⚠

The acute warning does not relieve the driver of their responsibility to adapt their driving speed and driving style to the road and traffic conditions.

⚠

System limitations mean that warnings may under certain circumstances not be issued or are issued too late or without authorization. The driver must therefore always remain alert and observant so that they can actively intervene at any time so as to avoid the risk of an accident.

2.5. Speed Limit Information

The Speed Limit Detection system is introduced for the first time to the US market with the launch of the F30 in 2012. The option 8TH Speed Limit Information is only available in combination with ZDA option.

Note: The Driver Assistance (ZDA) option is necessary because it includes the KAFAS control unit. The KAFAS system also incorporates LDW, SLI, Front Collision Warning and High Beam Assistant.

The current posted speed limit signs are displayed in the instrument cluster and in the Head-Up Display in order to remind the driver not to exceed the legal speed limit. Speed Limit Information function works in combination with the Navigation system (option 609).

Note: Remember that the driver assumes full responsibility for the vehicle and the speed at which it is operated at all times.

The control unit for the Speed Limit Information function is the KAFAS control unit.

The KAFAS video camera monitors the road signs at the side of the road and takes into account the information from the Navigation system (when necessary). The display of the top speed limit signs is based on the evaluation of data from the navigation system and the evaluation of image data recorded by the KAFAS video camera.

The KAFAS unit will request the speed limit information from the Navigation only if there are no speed limit signs detected. If the data is not available 3 dashes will be displayed.

The maximum speed allowed of the road currently driven is displayed in the instrument cluster and in the Head-Up Display. If the vehicle does not have HUD, the end user can display the speed limit info by using the BC button. This is similar to how the mpg or miles to empty is displayed (in the same cluster display). If the vehicle has HUD, then it has to be activated in the HUD menu via iDrive. It is important to note here that the option 8TH Speed Limit Information pertains only to the maximum or top speed limit posted on the highway. This has nothing to do with ACC or the speed limit warning which can be set via the iDrive.

F30 Driver Assistance Systems
2. KAFAS

Option 8TH Speed Limit Information displayed in HUD

Option 8TH Speed Limit Information displayed in Kombi

⚠

The system cannot replace the driver's personal assessment of the road and traffic situation. Speed Limit Information supports the driver and does not replace the human eye.

This system was specially adapted to the US market to recognize road speed signs only and thus **will not** recognize stop signs, yield signs or any other signs.

F30 Driver Assistance Systems

3. High-beam Assistant

The high-beam assistant FLA (option 5AC) assists the customer in the use of the high-beam headlights. Depending on the traffic situation, the prevailing ambient light conditions and which lights on the vehicle have been switched on, the FLA switches on the high-beam headlights automatically and thereby relieves the driver of having to switch on the high-beam headlight manually.

The high-beam headlight can still be switched on and off manually as usual. The driver always has the capability, and indeed the obligation, to override the system whenever the situation requires it.

The high-beam assistant is only activated in the F30 if the light switch is in the switch position "A".

The identification of other road users for automatic dipping of the high-beam headlight is effected with help of a video camera. The video camera or control used depends on whether other KAFAS system components are installed:

- In the combination with a lane departure warning , the high-beam assistant function is realized with the KAFAS video camera and the KAFAS control unit.
- If the customer only selects the high-beam assistant option, this functionality is implemented with a separate FLA video camera and a separate FLA control unit. The video camera and the control unit are installed in a shared housing in the inside mirror.

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

For more information on the high-beam assistant system, please refer to the "KAFAS F01/F02" training information.

The high-beam assistant cannot replace a personal decision on the use of the high-beam headlight. In some situations, manual dipping is required as otherwise there is a safety risk.

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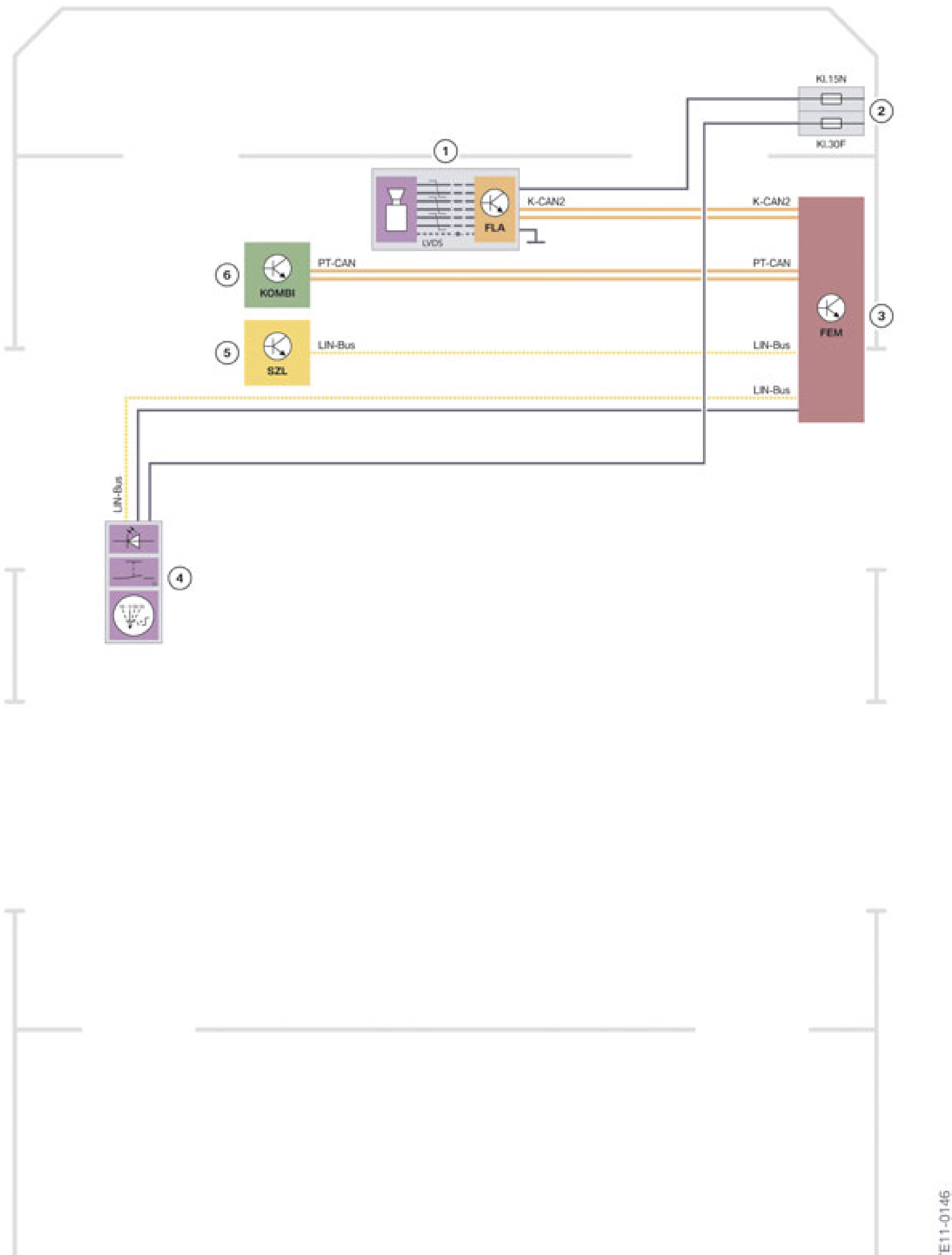
3. High-beam Assistant

3.1. System wiring diagram, high-beam assistant without KAFAS control unit



F30 System wiring diagram, high-beam assistant without KAFAS control unit

F30 Driver Assistance Systems
3. High-beam Assistant

Index	Explanation
1	FLA video camera and FLA control unit in the inside mirror
2	Power distribution box, front
3	Front Electronic Module (FEM)
4	Operating facility, light switch
5	Steering column switch cluster (SZL)
6	Instrument cluster (KOMBI)
Kl.15N	Ignition (after-run)
Kl.30F	Terminal 30, fault-dependent

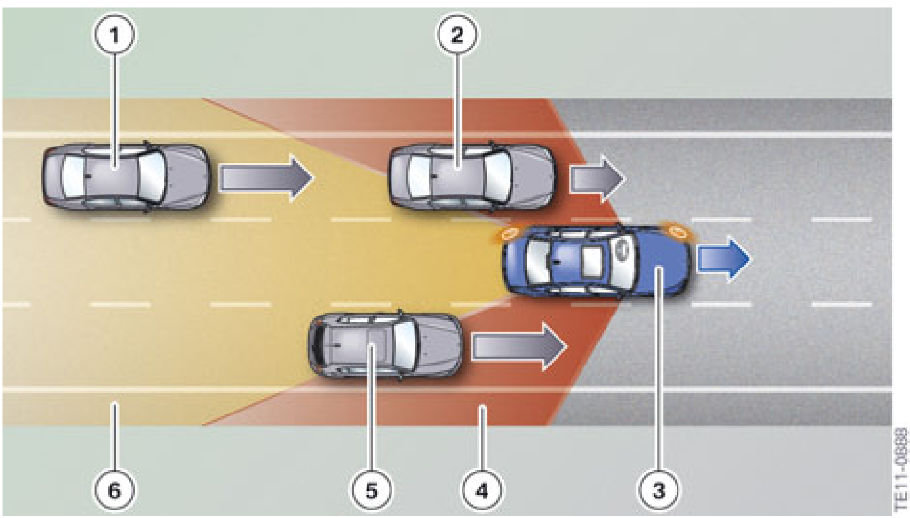
The system wiring diagram for the high-beam assistant function with KAFAS is included in the KAFAS system wiring diagram in this training information.

F30 Driver Assistance Systems
4. Lane Change Warning

The lane change warning (option 5AG) informs the driver at speeds above 50 km/h or 31 mph of possible collisions in the event of a lane change.

4.1. Operating principle

Two 24 GHz radar sensors located under the rear bumper monitor at speeds above 50 km/h or 31 mph the space behind and beside the vehicle. The radar sensors are largely weather-dependent and can reliably identify vehicles up to a distance of approx. 60 m. In the blind spot range, the radar sensors for the lane change warning identify other vehicles on the Neighboring lane up to roughly the center of own vehicle.



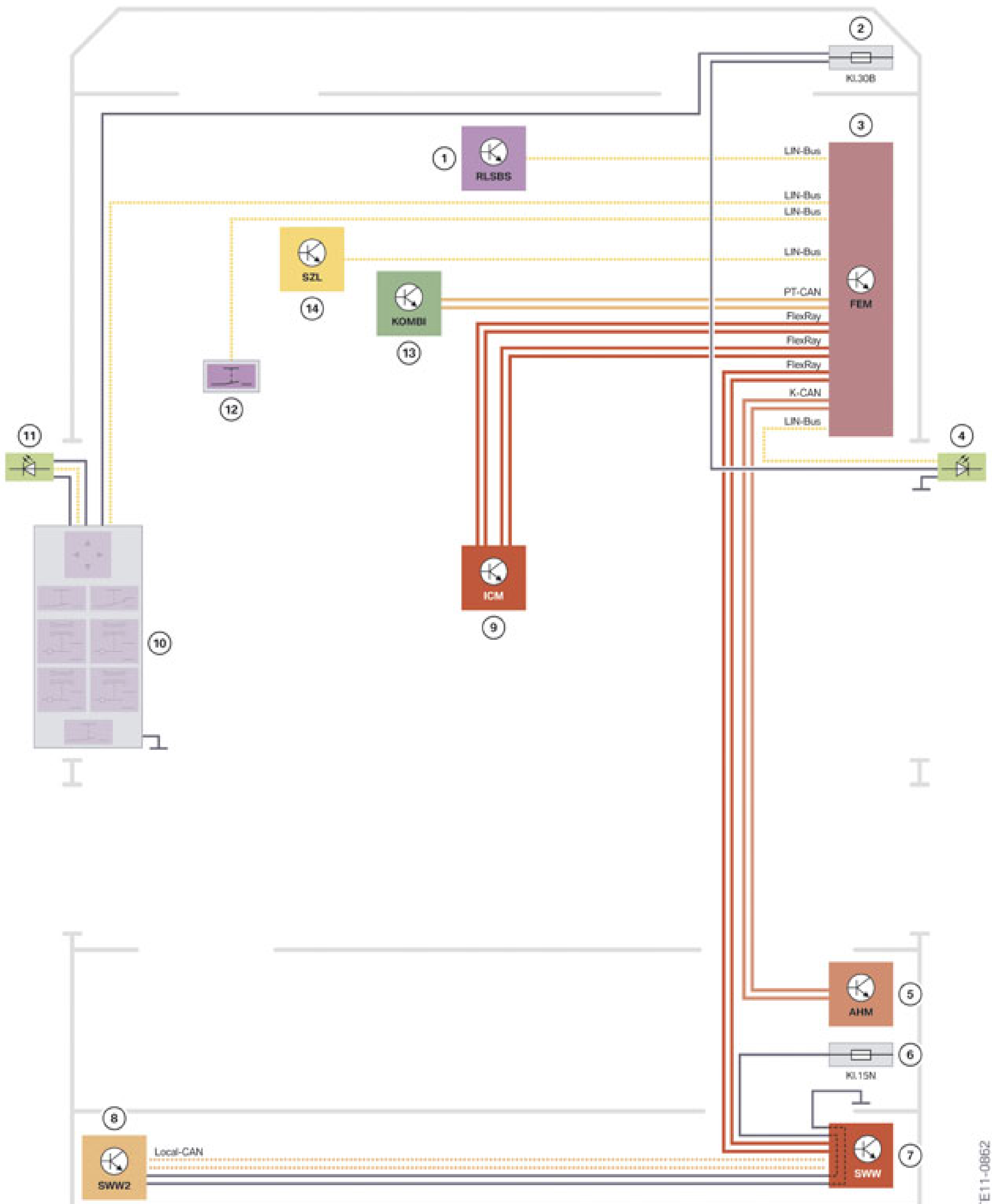
Typical traffic situation for lane change warning

Index	Explanation
1	Approaching vehicle in the left neighboring lane
2	Vehicle in the left neighboring lane driving at the same speed
3	Own vehicle planning to change lane to the left
4	Identification range of the lane change warning in the area of the blind spot (left/right)
5	Faster vehicle in the neighboring lane to the right
6	Identification range of the lane change warning behind the F30

F30 Driver Assistance Systems

4. Lane Change Warning

4.2. System wiring diagram



F30 System wiring diagram for lane change warning

4. Lane Change Warning

Index	Explanation
1	Rain-light-solar-condensation sensor (RLSBS)
2	Power distribution box, front
3	Front Electronic Module (FEM)
4	Light in the exterior mirror on front passenger side
5	Trailer module AHM (not US)
6	Power distribution box, luggage compartment
7	Lane change warning radar sensor, SWW master control unit
8	Lane change warning radar sensor, slave control unit SWW2
9	Integrated Chassis Management (ICM)
10	Switch block for driver's side door
11	Light in the exterior mirror on driver's side
12	Operating facility for driver assist systems
13	Instrument cluster (KOMBI)
14	Steering column switch cluster (SZL)
Kl.15N	Ignition (after-run)
Kl.30B	Terminal 30 basic operation

4.3. Operation

The system is activated or deactivated by pressing the button "Lane change warning" in the operating facility of the driver assistant systems:

- Activate: LED lights up over the button
- Deactivate: LED goes out over the button.

The state is saved for the ID transmitter currently used.

4.4. Warning function

4.4.1. Information level

The LED warning light in the mirror housing displays if vehicles are in the blind spot or are approaching from behind.

4. Lane Change Warning

LED warning light in the mirror housing

4.4.2. Warning

If the turn indicator is set, while a vehicle is in the critical area, the steering wheel vibrates temporarily and the light in the mirror housing flashes brightly. The warning ends if the turn indicator is reset to the initial position or the other vehicle leaves the critical area.

4.5. System limits

⚠

The system cannot replace the driver's personal assessment of the road and traffic situation.

If warnings are issued, do not respond by moving the steering wheel with unnecessary force as this could result in control over the vehicle being lost.

The function can be restricted in the following situations for example:

- Sharp bends or on narrow roadways
- Heavy fog, rain or snow
- Dirty or frozen bumper
- Labels are attached to the bumper
- The speed of the approaching vehicle is a great deal higher than own speed.

5. TRSVC

Surround View provides support for parking, manoeuvring and for complex exits and junctions. In the F30 the Surround View optional equipment (option 5DL) is only available in conjunction with the following optional equipment (option 3AG, option 430 and option 508).

The Surround View optional equipment comprises the following systems:

- Reversing camera
- Side View
- Top View.

Top View and Side View are part of the Surround View (option 5DL) optional equipment and are not available individually. The reversing camera can be ordered separately as optional equipment (option 3AG).

The video cameras are connected to the TRSVC control unit via 4-pole low-voltage differential signalling lines. The control unit is connected to the FEM via K-CAN.

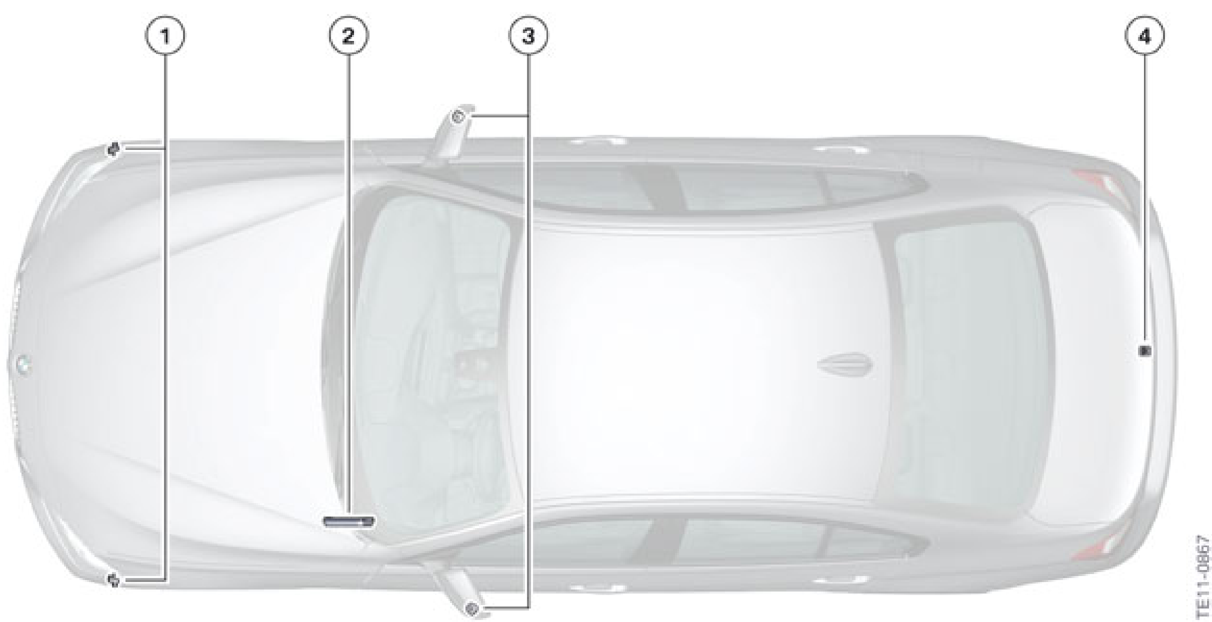
The TRSVC control unit in integrated in the dashboard.

There are two variants of the TRSVC control unit:

- Control unit with a connection for reversing camera
- Control unit with five connections.

The Surround View (SA5DL) optional equipment with five video cameras requires the control unit with five connections. If only one reversing camera (option 3AG) without Surround View (option 5DL) is installed, a control unit with one connection is used.

5.1. Installation locations

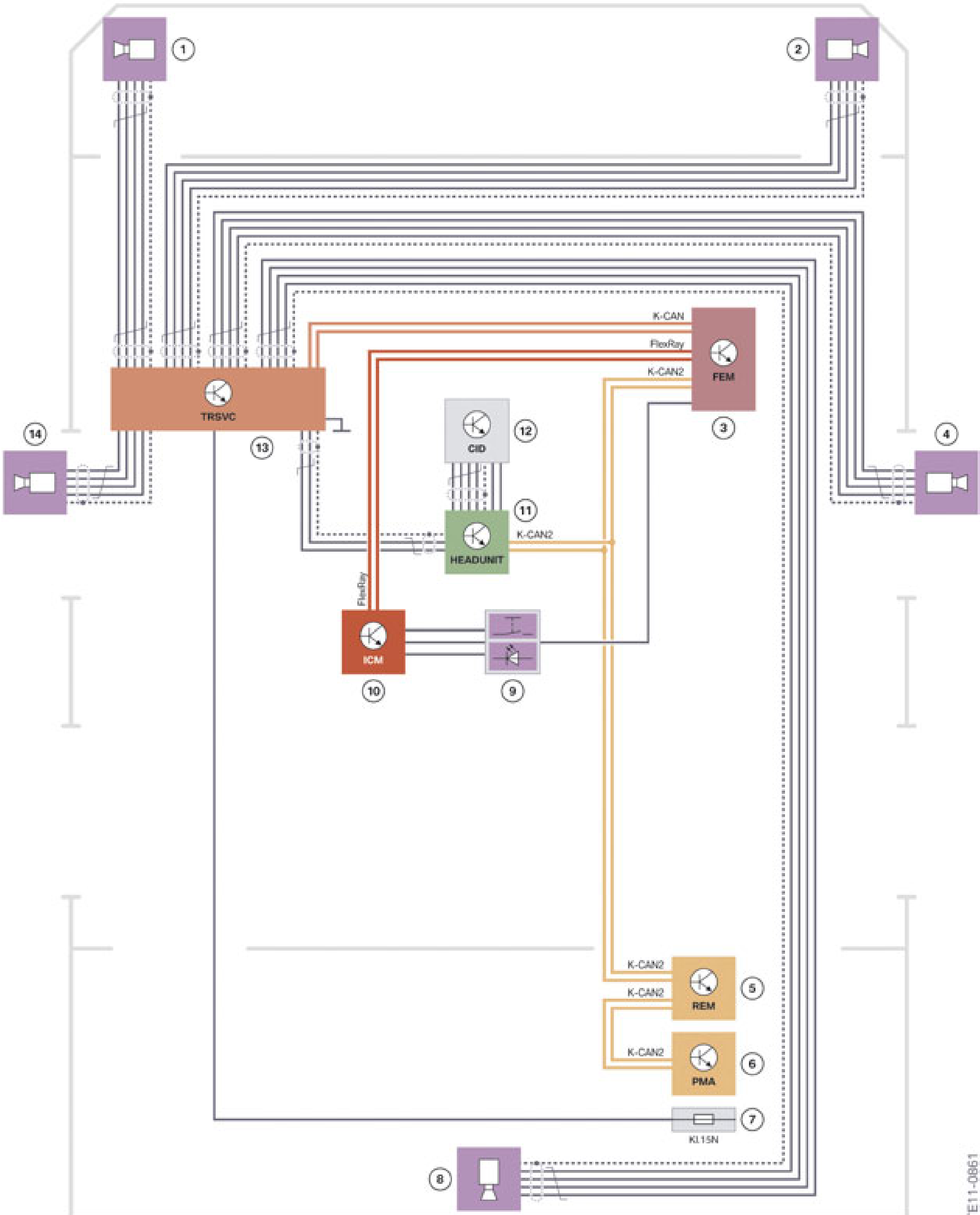


Installation places of TRSVC components

5. TRSVC

Index	Explanation
1	Bumper camera
2	TRSVC control unit
3	Exterior mirror camera
4	Reversing camera

5.2. System wiring diagram



System wiring diagram for Surround View

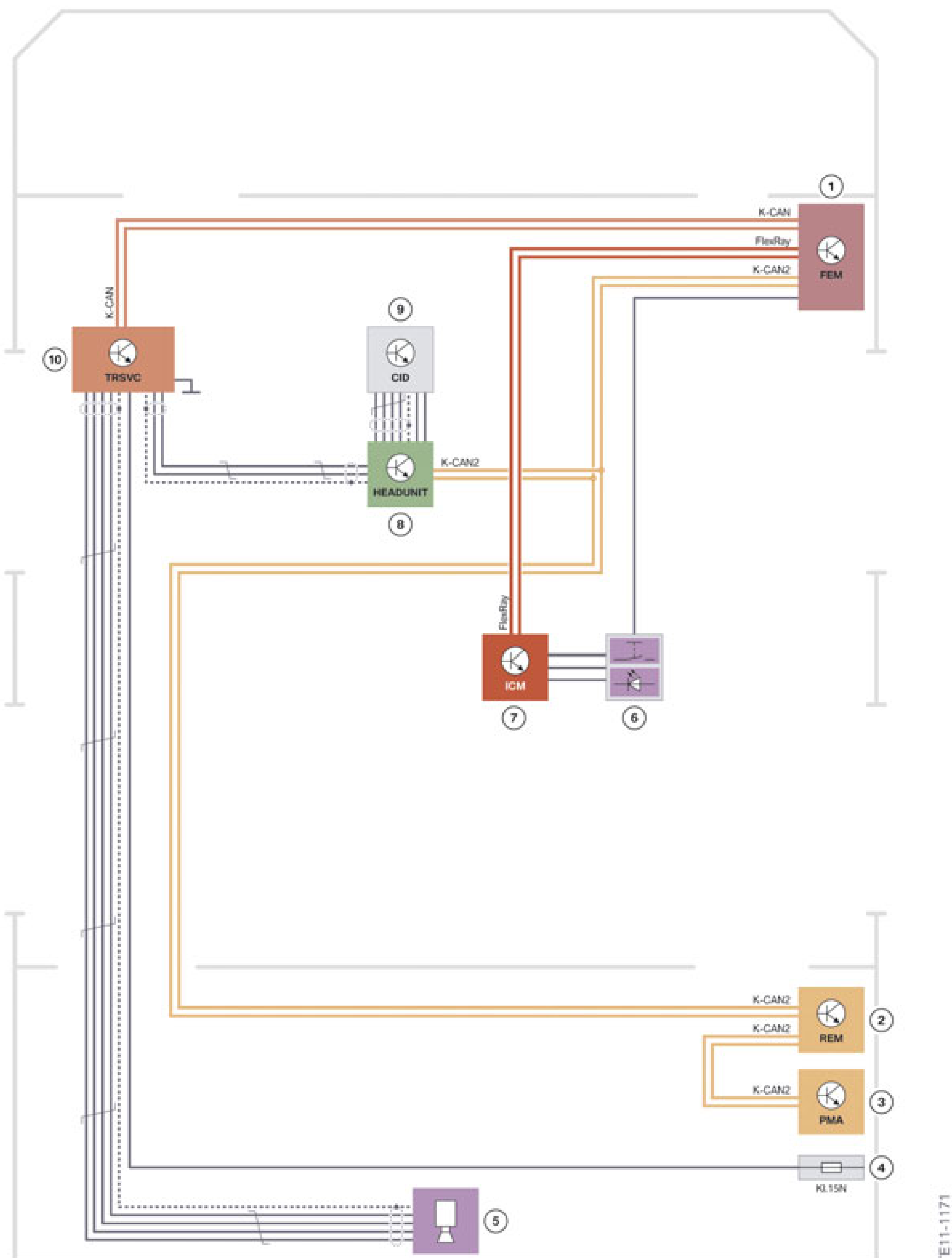
Index	Explanation
1	Bumper camera, right
2	Bumper camera, left
3	Front Electronic Module (FEM)
4	Exterior mirror camera, right
5	Rear Electronic Module (REM)
6	Parking Manoeuvring Assistant (PMA)_ control unit (only vehicles with option 5DP Parking Manoeuvring Assistant)
7	Power distribution box, luggage compartment
8	Reversing camera
9	Parking assistance button in the center console
10	Integrated Chassis Management (ICM)
11	Headunit
12	Central Information Display (CID)
13	TRSVC control unit
14	Exterior mirror camera, left
Kl.15N	Ignition (after-run)

5.3. Reversing camera

The reversing camera (option 3AG) supports the driver in parking and manoeuvring. The reversing camera is only available in connection with the Park Distance Control PDC (option 508).

The image from the reversing camera is displayed with additional extension lines in the CID.

5.3.1. System wiring diagram



System wiring diagram, reversing camera

Index	Explanation
1	Front Electronic Module (FEM)
2	Rear Electronic Module (REM)
3	Parking Manoeuvring Assistant (PMA) control unit (only vehicles with option 5DP Parking Manoeuvring Assistant)
4	Power distribution box, luggage compartment
5	Reversing camera
5	Parking assistance button in the center console
7	Integrated Chassis Management (ICM)
8	Headunit
9	Central Information Display (CID)
10	TRSVC control unit
Kl.15N	Ignition (after-run)

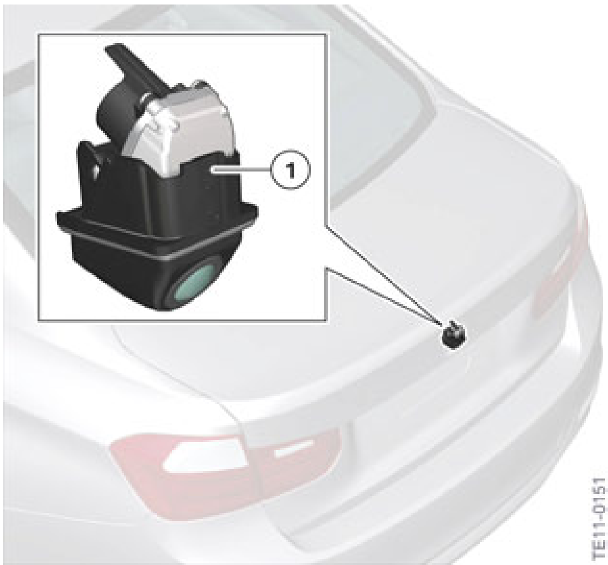
5.3.2. Camera replacement

These must be taught in after the reversing camera is replaced. The reversing camera of the F30 does not need to be calibrated after teaching-in, as it is self-calibrating. The calibration is effected during the journey by the TRSVC control unit by means of a steering angle sensor and known road markings. Calibration compensates for installation tolerances by shifting and rotating the image.

The maximum time required for a full calibration is five hours. A Check Control message is displayed in the CID if the reversing camera could not be successfully calibrated. Reasons for failed calibration may be incorrect installation, dirt contamination or a defect with the reversing camera. The reversing camera is also constantly readjusted after a full calibration in order to ensure an optimum image.

The opening angle of the reversing camera's lens is 130°.

5.3.3. Installation location



Installation location, reversing camera

Index	Explanation
1	Reversing camera

5.4. Top View

Top View provides support when parking and manoeuvring. For this the door and road area of the vehicle is shown on the CID.

The Top View function is realized with the reversing camera and the two exterior mirror cameras.

The opening angle of the lens of the exterior mirror camera, which is installed in the two exterior mirrors, is 173°.

5.4.1. Operation

The operation is effected similar to the reversing camera. The function is automatically switched on if the reverse gear is engaged when the engine is running. The images of the exterior mirror camera and PDC are shown when the system has been switched on via iDrive. The system automatically switches off after 20 m travelled or a speed above 20 km/h or 12 mph. The function can also be manually switched on and off via the PDC button.

5.4.2. Display

The images of the reversing camera and the exterior mirror camera are shown on the CID. In addition, the turning circle lines and driving lane lines known from the reversing camera view are also shown.

⚠

Also check the traffic situation around the vehicle by looking directly. Otherwise there is a risk of accidents for example from road users or objects that lie outside the image range of the camera.

5.4.3. Camera replacement

These must be taught in after the exterior mirror camera is replaced. The exterior mirror camera of the F30 does not need to be calibrated after teaching-in, as it is self-calibrating. The calibration is effected during the journey by the TRSVC control unit. Installation tolerances are compensated by the calibration.

5.5. Side View

Side View makes possible an early view of the transverse traffic at complex exits and junctions.

Two bumper cameras, which are installed in the wheel arches of the front bumper, record the traffic space at the front side. The two video images of these bumper cameras are shown at the same time on the CID (split screen display). Extension lines on the lower edge of the image show the position of the front of the vehicle.

The bumper camera is a common part for the exterior mirror camera with another lens. The opening angle of the lens is 55°.

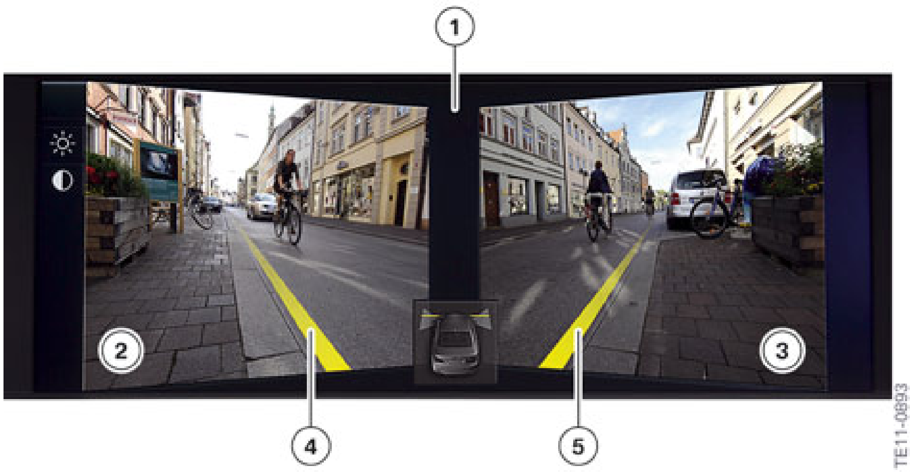
5.5.1. Operation

To activate the function press the Side View button of the controller. To deactivate press the button again. At speeds above 20 km/h or 12 mph the Side View function is automatically deactivated.

Side View button

Index	Explanation
1	Side View button

5.5.2. Display



F30 screen Side View on the CID

Index	Explanation
1	Split Screen display of the bumper cameras
2	Screen display of the bumper camera, left
3	Screen display of the bumper camera, right
4	Projected front of vehicle in the left view
5	Projected front of vehicle in the right view

⚠

Objects may be outside the range of the bumper camera.

For this reason, also check the traffic situation at exits in complex locations by taking a direct look.

5.5.3. Camera replacement

These must be taught in after the bumper camera is replaced. The bumper camera of the F30 does not need to be calibrated after teaching-in, as it is self-calibrating. The calibration is effected during the journey by the TRSVC control unit. Installation tolerances are compensated by the calibration.

6. Park Distance Control

Park Distance Control (PDC) assists the driver when manoeuvring in and out of a parking space. The current distance from an obstruction is indicated by acoustic signals and on a visual display. PDC is available in the F30 in two variants:

- The PDC front and rear (option 508) utilizes the measured data from four ultrasonic sensors on both the front and rear bumpers.

For vehicles with Parking Manoeuvring Assistant (option 5DP) the PDC sensors are evaluated by the PMA control unit and not the REM.

The PDC is activated by engaging the reverse gear or by operation of the PDC button next to the gear selector switch.

The driver obtains the results of the distance measurement and the distance warning acoustically via the speaker system and optically via the display in the CID.

Further information on the PDC can be found in the training information titled "PDC, TRSVC F01/F02".

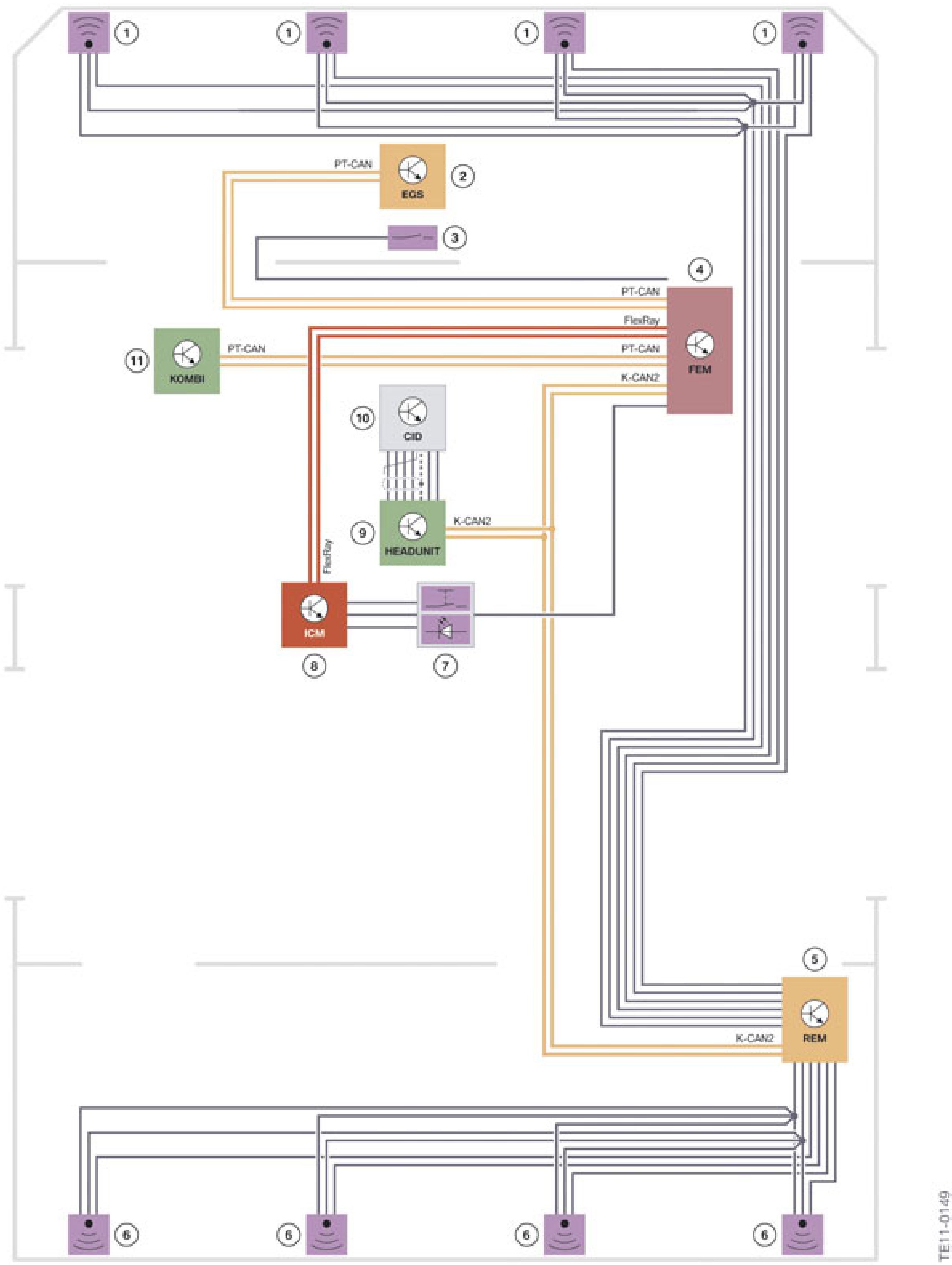
⚠

The PDC cannot replace the driver's personal judgement of the traffic situation. Also check the traffic situation by taking a look around the vehicle. Otherwise there is a risk of accidents occurring, due to other road users or objects that are outside the detection range of the PDC for example. Loud sound sources outside and inside the vehicle could drown out the PDC signal.

F30 Driver Assistance Systems

6. Park Distance Control

6.1. System wiring diagram



System wiring diagram, PDC

6. Park Distance Control

Index	Explanation
1	Ultrasonic sensors, front
2	Electronic transmission control (EGS) (automatic transmission)
3	Reversing switch (manual gearbox)
4	Front Electronic Module (FEM)
5	Rear Electronic Module (REM)
6	Ultrasonic sensors, rear
7	Parking assistance button in the center console
8	Integrated Chassis Management (ICM)
9	Headunit
10	Central information display (CID)
11	Instrument cluster (KOMBI)

F30 Driver Assistance Systems

7. Parking Manoeuvring Assistant

In the F30 the Parking Manoeuvring Assistant (PMA) is available as optional equipment (option 5DP) in association with the optional equipment Park Distance Control front and rear (option 508).

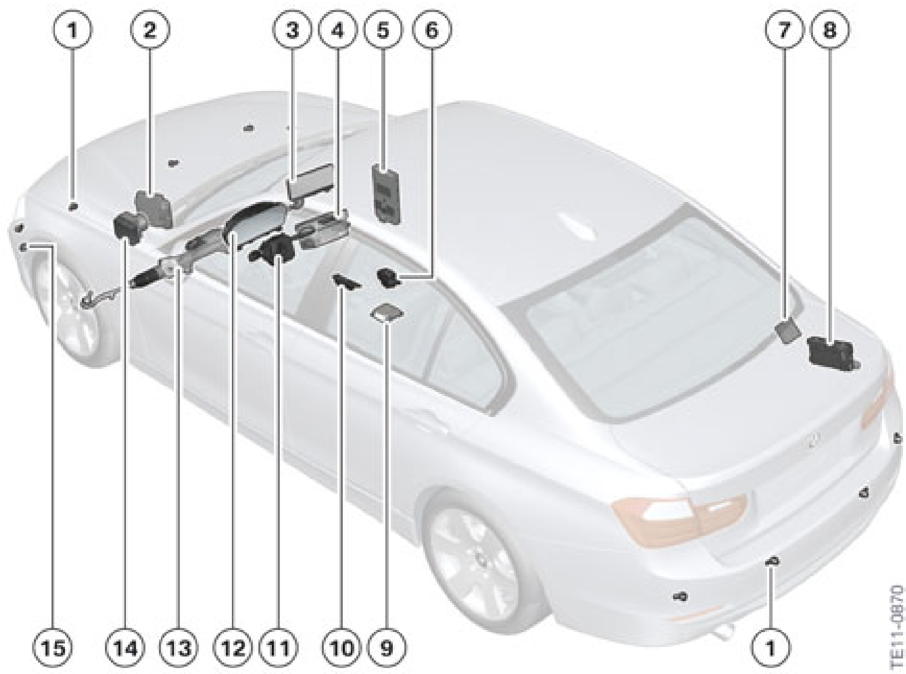
The Parking Manoeuvring Assistant facilitates parking in gaps between cars parallel to the roadway. In the case of straight forwards travel up to approx. 35 km/h or 22 mph, parking spaces are measured regardless if the PMA is activated or deactivated. As soon as a parking space that is approx. 1.2 m longer than the vehicle length is found and the system is already activated, this space is shown to the driver on CID. Later on in the parking process, the Parking Manoeuvring Assistant takes over the steering, with the driver remaining responsible for the acceleration and braking of the vehicle. With instructions and if applicable additional acoustic acknowledgements, the driver is guided through the parking procedure.

⚠

The Parking Manoeuvring Assistant does not relieve the driver of personal responsibility during parking.

Directly monitor gaps and the parking procedure and intervene if necessary, as otherwise there is a risk of accidents.

7.1. System components



F30 System components of the Parking Manoeuvring Assistant (PMA)

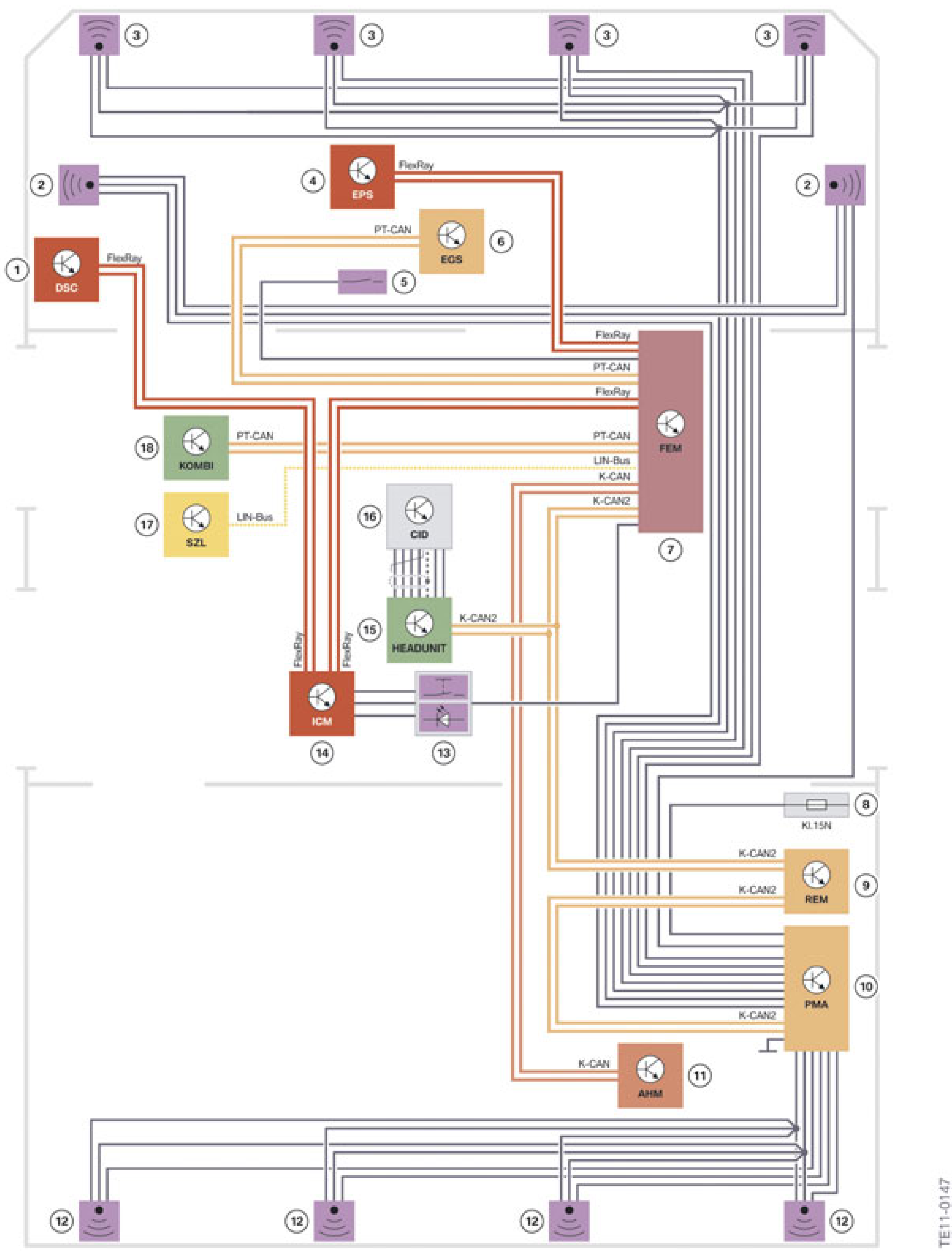
7. Parking Manoeuvring Assistant

Index	Explanation
1	Ultrasonic sensors of Park Distance Control
2	Digital Engine Electronics (DME)
3	Central information display (CID)
4	Car Information Computer
5	Front Electronic Module (FEM)
6	Controller
7	Parking Manoeuvring Assistant (PMA)
8	Rear Electronic Module (REM)
9	Integrated Chassis Management (ICM)
10	Operating facility, center console
11	Steering column switch cluster
12	Instrument cluster (KOMBI)
13	Electromechanical power steering
14	Dynamic Stability Control (DSC)
15	Ultrasonic sensor of PMA in wheel arch

F30 Driver Assistance Systems

7. Parking Manoeuvring Assistant

7.1.1. System wiring diagram



F30 System wiring diagram for Parking Manoeuvring Assistant

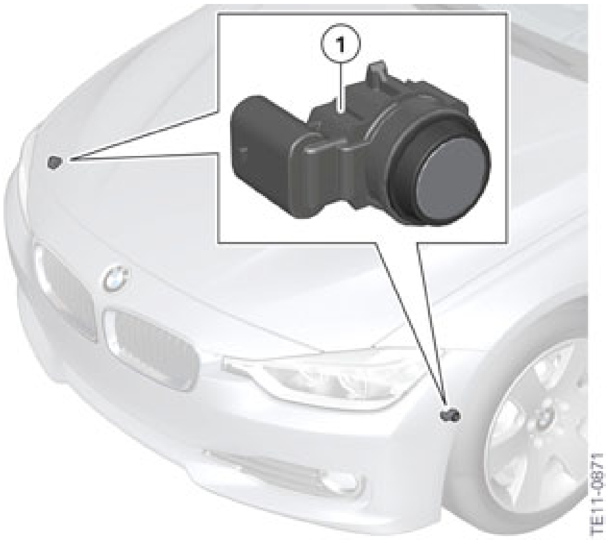
Index	Explanation
1	Dynamic Stability Control (DSC)
2	Ultrasonic sensor of Parking Manoeuvring Assistant in wheel arch
3	Ultrasonic sensors, Park Distance Control, front
4	Electronic Power Steering (electromechanical power steering) EPS
5	Reversing switch (manual gearbox)
6	Electronic transmission control (EGS) (automatic transmission)
7	Front Electronic Module (FEM)
8	Power distribution box, luggage compartment
9	Rear Electronic Module (REM)
10	Parking Manoeuvring Assistant (PMA)
11	Trailer module (AHM)
12	Ultrasonic sensors, Park Distance Control, rear
13	Parking assistance button in the center console
14	Integrated Chassis Management (ICM)
15	Headunit
16	Central information display (CID)
17	Steering column switch cluster (SZL)
18	Instrument cluster (KOMBI)
KI.15N	Ignition (after-run)

7.1.2. Sensors

The two ultrasonic sensors for the PMA are integrated in the front wheel arches.

The function of the two ultrasonic sensors is similar to that of the PDC. Ultrasonic pulses are transmitted and echo signals are received. The signals are evaluated by the PMA. The length and width of the gap is calculated from the distance travelled data from the DSC.

In the F30 the ultrasonic sensors for the Parking Manoeuvring Assistant are connected individually to the PMA.

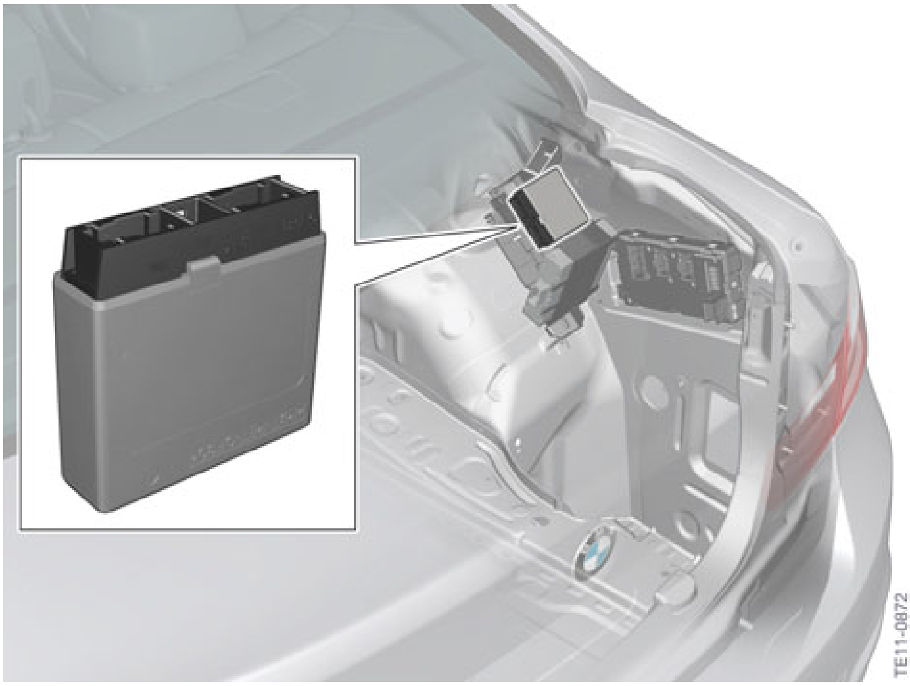


F30 Installation location of ultrasonic sensor for Parking Manoeuvring Assistant

Index	Explanation
1	Ultrasonic sensor for Parking Manoeuvring Assistant

7.1.3. Control unit

The control unit for the Parking Manoeuvring Assistant is the PMA. The PMA is located in the luggage compartment behind the side trim panel. It evaluates signals from the sensor and thus identifies possible parking gaps. It also calculates the optimum path into a gap and monitors the parking process. In addition, it controls the electromechanical steering via the ICM.



F30 Installation location of PMA

7.2. Notes for Service

After the PMA or an ultrasonic sensor has been replaced no start-up is necessary. However, the PMA checks with every start-up procedure whether the sensor software is compatible with the control unit software. If this is not compatible, a corresponding fault code is set in the PMA control unit. In this case the service function "update software of ultrasonic sensors" must be performed.

The PMA itself monitors faults and if required makes the corresponding fault code entries. In exceptional cases, this is not always possible. Thus the control unit cannot determine if the ultrasonic sensors (including of the sealing ring) are incorrectly installed or connected, of if there is damage in the vicinity of the ultrasonic sensors. This can lead to customer complaints without fault entries:

- Small gaps are rarely identified
- During parking, the vehicle drives too close or far away from the vehicle in front
- The vehicle is either too far away, too close or against the kerb after the parking procedure
- The vehicle is parked in the gap at an angle.

In this case it must be ensured that the ultrasonic sensors are correctly installed and the possibility of damage of the bumper panel in the vicinity of the ultrasonic sensors must be excluded.

F30 Driver Assistance Systems
7. Parking Manoeuvring Assistant

The Parking Manoeuvring Assistant relieves the driver in two ways. On the one hand, from the task of having to estimate the size of the gap and on the basis of this estimate of deciding whether the gap is large enough. On the other hand, from the task of having to steer into the gap itself. The vehicle is directed solely by the driver. When looking for a parking space and during the actual parking process, all relevant information is made available to the driver via the PDC picture in an integrated screen mask. This includes:

- Results of the parking space measurement
- Status of the Parking Manoeuvring Assistant and corresponding handling information
- Distances to other objects.

This makes it especially easy to monitor the parking procedure and at the same time to check the acceleration.

F30 Driver Assistance Systems
8. DCC

The cruise control with braking function has been used in many BMW models since the BMW 3 Series (E9x). It is also referred to as "Dynamic Cruise Control" (DCC). It relieves the burden on the driver on quiet roads by maintaining a constant speed regardless of the resistance to vehicle motion (gradient, payload). The driver is still responsible for driving the vehicle when using this support. The driver can override the DCC function at any time by braking or accelerating.

The operation is effected via a keypad in the left steering wheel spoke. The current speed is saved by pressing the SET button. The speed is increased or reduced by 1 km/h or .6 mph by touching the rocker switch. Each time the rocker switch is pressed above the pressure point the speed is increased or reduced by 10 km/h or 6 mph

DCC constantly maintains a selected speed from approx. 30 km/h or 18 mph

The brakes are activated during steep downhill driving if sufficient deceleration is not achieved by engine drag torque alone.

In the F30 the cruise control with braking function is implemented in the ICM control unit.

9. Head-Up Display

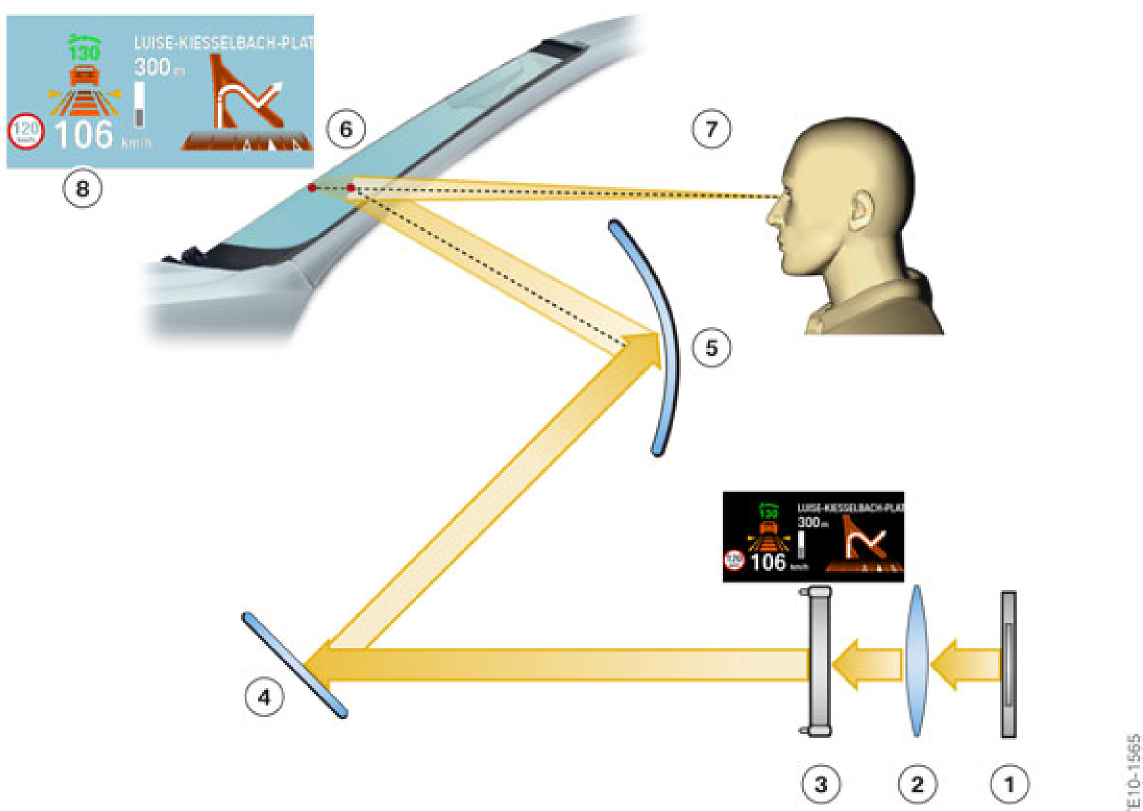
The name "Head-Up" describes the principle benefit of this system. The Head-Up Display (HUD) projects a virtual image into the driver's field of view.

The Head-Up Display (option 610) offers the driver the option of viewing all information relevant for driving directly in the field of view freely floating over the roadway.

the Head-Up Display used in the F30 can project the colors red, green and blue and by mixing these colors enables the projection of image content in all colors of the red/green/blue spectrum. The HUD is not a slave in the K-CAN in the F30, but has no data bus systems. The HUD receives the control signals and the image content from the instrument cluster via an APIX interface. The power supply of the HUD is also effected in the F30 by the instrument cluster.

9.1. Operating principle

The HUD is similar to a projector. A light source is required to project the HUD information. Using 15 white LEDs the information is shown on a one color, transparent red/green/blue 1.8" display. The resolution is 480x240 pixels. The image obtained is projected into the area of vision of the driver using several deflection mirrors and the windshield.



HUD operating principle

F30 Driver Assistance Systems

9. Head-Up Display

Index	Explanation
1	Light source
2	Lens
3	TFT projection display
4	Plane mirror
5	Curved mirror
6	Windshield
7	Observer's point of vision
8	Projected image

The screen mask appears freely floating over the roadway.

F30 HUD screen mask

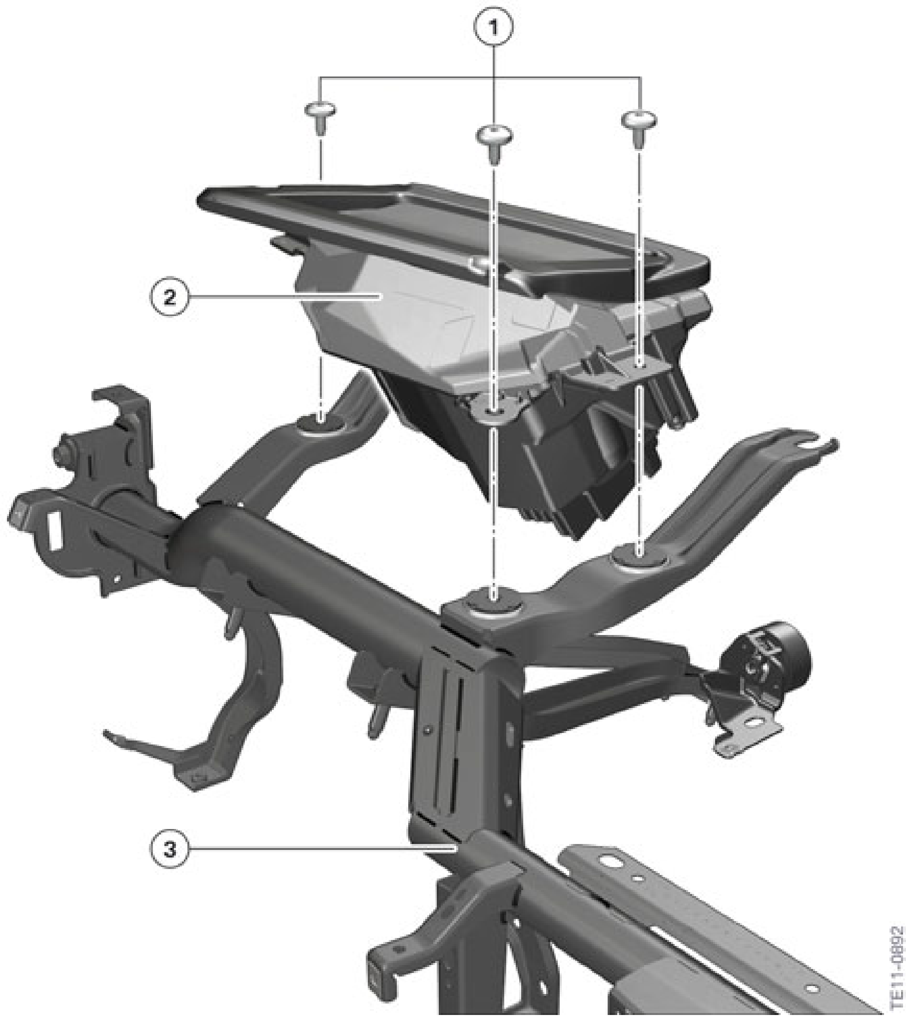
A special windshield is required for the system, whose form enables precise representation. A wedge-shaped windshield prevents the illustration of double images. If the standard windshield was used, double images would be displayed.

9.2. Installation location

The head-up display is fitted above the steering column, immediately behind the instrument cluster. It is secured to the bulkhead supporting structure using three screws.

F30 Driver Assistance Systems

9. Head-Up Display



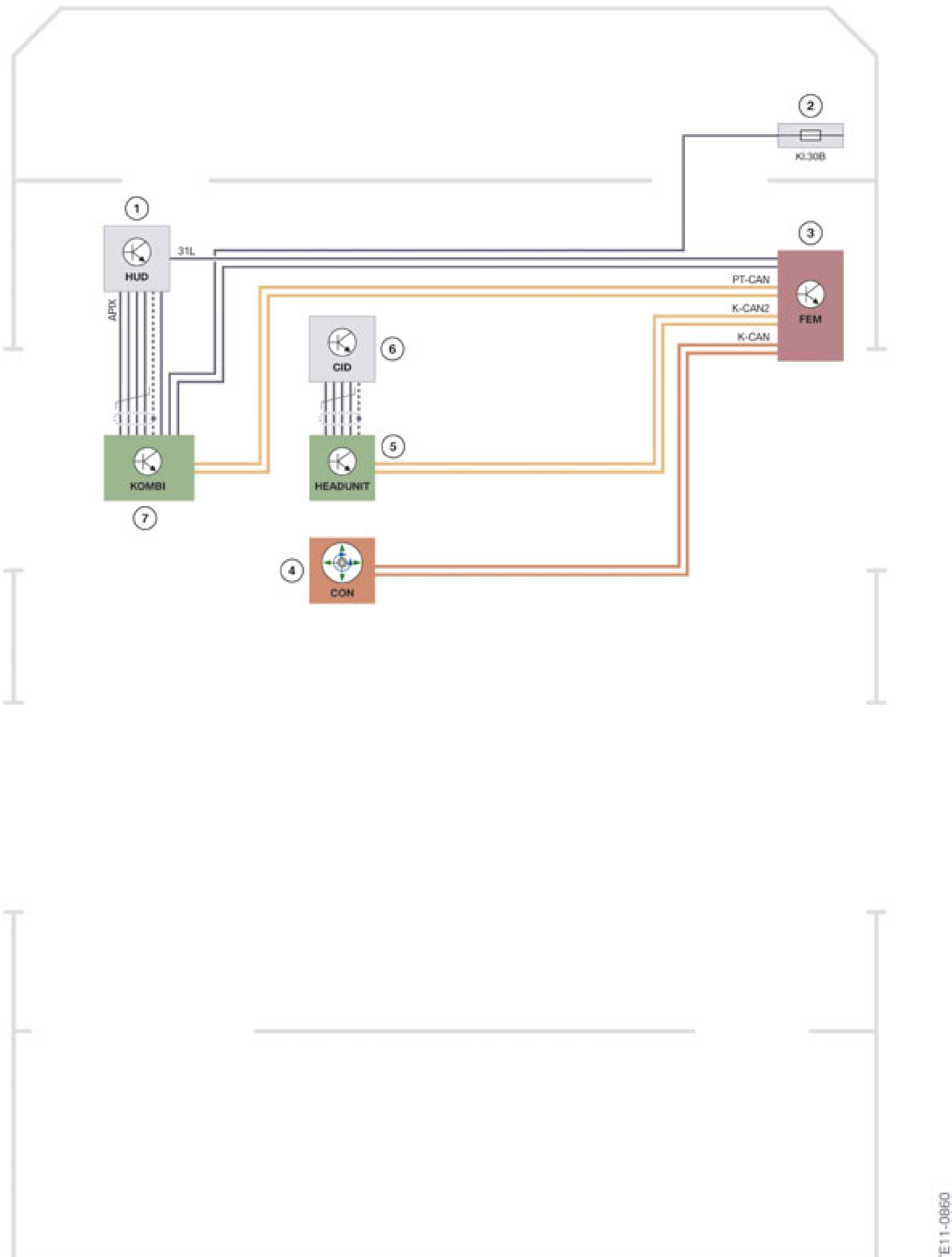
F30 Installation location of HUD

Index	Explanation
1	Screw
2	Head-Up Display (HUD)
3	Carrier bracket

F30 Driver Assistance Systems

9. Head-Up Display

9.3. System wiring diagram



System wiring diagram of Head-Up Display

9. Head-Up Display

Index	Explanation
1	Head-Up Display (HUD)
2	Power distribution box, front
3	Front Electronic Module (FEM)
4	Controller (CON)
5	Headunit
6	Central Information Display (CID)
7	Instrument cluster (KOMBI)
Kl.30B	Terminal 30 basic operation

9.4. Operation

9.4.1. Switching on/off

The system is activated or deactivated by accessing Settings then "Head-Up Display" in the CIC :

- Activate: with tick mark
- Deactivate: tick mark removed.

9.4.2. Settings

The following settings can be changed using the controller:

- Head-Up Display ON/OFF
- Brightness of display
- Rotation of display
- Height of display
- Displayed information.

9.5. Display

The changeover of day design to night design is the same for the display in the instrument cluster.

The following content can be displayed:

- Speed
- Speed setting control of DCC
- Collision warning
- Navigation system
- Check Control messages

- Speed limit information
- Lane departure warning.
- Entertainment lists.

With the exception of the current vehicle speed and the driver assist warning messages, the information displayed can be deselected by the controller.

9.5.1. Recognizability of the display

The recognizability of the displays in the Head-Up Display is influenced by:

- The seat position
- Objects on the cover of the Head-Up Display
- Sunglasses with certain polarizing filters
- Wet roadway
- Inadequate lighting conditions.

If the image is displayed blurred, the basic setting should be checked.

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Technical training.
Product information.

F30 Displays, Indicators and Controls

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Technical Training
ST1113 12/1/2011

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

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VH-23/International Technical Training

F30 Displays, Indicators and Controls
Contents

F30 Displays, Indicators and Controls

1. System Overview

1.1. Introduction

As with all other BMW models, the operating concept of the new BMW 3-Series center is based on a clear and optimized layout of the driving area. The number of switches has been reduced in order to simplify logical operation. The display and operating elements are organized corresponding to their function.

F30 overview of displays and operating elements

Index	Explanation
1	Instrument cluster (KOMBI)
2	Head-Up Display
3	Central Information Display (CID)
4	Favorite buttons for individual assignment
5	Gear selector lever (GWS)
6	Controller (CON)
7	Driving experience switch
8	Control buttons, steering wheel
9	Operating facility for driver assistance systems

F30 Displays, Indicators and Controls

2. System Components

2.1. Instrument cluster

The central display unit with speedometer, rev counter, fuel gauge, engine oil temperature, and indicator and warning lights is referred to as the instrument cluster.

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

Depending on the equipment, two different instrument cluster versions are used in the F30.

As a control unit, the basic version of the instrument cluster is a bus user on the PT-CAN.

As a control unit, the high version of the instrument cluster is a bus user on the MOST bus and on the PT-CAN.

F30 versions of instrument clusters

Index	Explanation
A	Basic version of instrument cluster
B	High version of instrument cluster

In addition, there are different versions of the two variants of the instrument cluster depending on the vehicle line. In the following image you see the instrument cluster of the different lines using the example of the high-version instrument cluster.

F30 line versions, instrument cluster, high-version

Index	Explanation
A	Instrument cluster without line package or with BMW Luxury Line package PA 7S2
B	Instrument cluster with BMW Modern Line package PA 7S1
C	Instrument cluster with BMW Sport Line package PA 7AC

2.1.1. Basic version of instrument cluster

F30 basic instrument cluster

Index	Explanation
1	TFT display

The basic instrument cluster in the F30 has five analogue instrument dials in four tubes. The basic version of the instrument cluster incorporates a TFT display with a resolution of 320 x 120 pixels at the bottom between the round instruments. It has a screen diagonal of 2.7“.

The basic instrument cluster is installed in the F30 for vehicles without Professional navigation system (optional equipment 609), without Lane departure warning (optional equipment 5AD), without Head-Up Display (optional equipment 610), and without speed limit information (optional equipment 8TH).

The two large round instruments show the road speed and engine speed. The indication of the status of the automatic engine start-stop function (MSA) (READY/OFF) is integrated in the rev counter. The current fuel consumption is displayed at the bottom of the rev counter.

The two small round instruments on the left- and right-hand side show the fuel tank capacity and engine oil temperature respectively.

The indicator lights are located centrally at the top between the two large round instruments and below the speedometer.

2. System Components

2.1.2. Instrument cluster, high version

F30 instrument cluster, high version option 6WA

Index	Explanation
1	TFT display

The instrument cluster high-version has been designed for the F30 and has four analogue instrument dials in four tubes. Each of the scales in the instrument cluster is specific to the country, vehicle and engine.

The two large round instruments show the road speed and engine speed. The indication of the status of the automatic engine start-stop function (MSA) (READY/OFF) is integrated in the rev counter. The current consumption is shown on the display under the rev counter and the energy recovery is shown in the coasting (overrun) mode.

The two small round instruments on the left- and right-hand side show the fuel tank capacity and engine oil temperature respectively.

The high version of the instrument cluster is available as the optional equipment instrument cluster with extended functional scope (optional equipment 6WA). The high version of the instrument cluster incorporates a TFT display with a resolution of 640 x 160 pixels below the round instruments. Its diagonal screen size is 5.7“.

The high version of the instrument cluster is required for some items of optional equipment. This includes the Professional navigation system (optional equipment 609), the Lane departure warning (optional equipment 5AD), the Head-Up Display (optional equipment 610) and the speed limit information (optional equipment 8TH). A variant of the instrument cluster is used in connection with the Head-Up Display and has an APIX interface.

F30 Displays, Indicators and Controls

2. System Components

2.1.3. On-board computer

The F30 is equipped as standard with an 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 consumption
- Average speed
- Distance (with activated route guidance)
- Arrival time (with activated route guidance)
- Arrow display of the navigation system (for activated route guidance and deactivated display in the Head-Up Display)
- Date
- Speed limit information.
- ECO PRO bonus range.

The functions to be displayed in the CID can be selected via "Settings" -> "Information Display".

F30 buttons on steering column switch

Index	Explanation
1	On-board computer button
2	High-beam assistant button
3	Steering column switches

More detailed information can be obtained from the current Owner's Handbook for the BMW 3-Series sedan.

F30 Displays, Indicators and Controls
2. System Components

2.2. Central Information Display

Depending on the equipment installed, two different versions of a freestanding Central Information Display (CID) are installed in the F30. .

The Central Information Display (CID) in the F30 no longer has a bus connection. The CID is directly connected to the headunit via an APIX interface. APIX (Automotive Pixel Link) is a bit-serial 1 Gbit/s video link with just one copper core pair. The CID is connected by 2 APIX video links to the headunit. The APIX link is an EMC-optimized physical layer for real time video transfer via copper cables. The CID can be supplied with power via two leads directly by the headunit.

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

The Central Information Display is an integrated display and operating facility for the following functions:

- Audio functions, such as radio, CD, MP3
- Telephone
- Navigation
- On-board computer, journey computer
- Vehicle information, Interactive Owner's Handbook IBA
- Vehicle settings
- Vehicle functions, such as PDC for example
- BMW Services.

2.2.1. CID with 6.5“ screen diagonal

A CID with 6.5" screen diagonal is installed in conjunction with out navigation. The display resolution is 800 x 480 pixels.

A CID with a black high-gloss clasp is used in vehicles with BMW Professional radio (standard equipment).

F30 CID with 6.5“ screen diagonal

2.2.2. CID with 8.8“ screen diagonal

A CID with 8.8“ screen diagonal is installed in conjunction with the Professional navigation system (option 609). The display resolution is 1280 x 480 pixels. The CID with 8.8“ screen diagonal also has a cover made from anti-reflecting laminated safety glass which stretches to the edge of the CID.

TK11-0905

F30 CID with 8.8“ screen diagonal

2.3. Head-Up Display

The 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 view. Important information, e.g. from the cruise control or navigation system with activated arrow display, is reflected on the windscreen and is therefore permanently available in the driver's field of view.

The Head-Up Display (optional equipment 610) in the F30 contains various functions aimed at enhancing road safety and ride comfort. This includes display of:

- Speed
- Speed setting control of DCC
- Collision warning
- Navigation system
- Check Control messages
- Speed limit information
- Lane departure warning.
- Entertainment lists.

The HUD used in the F30 has been developed further to include the following functions:

- Intersection view
- Road symbol in the junction view.

The HUD in the F30 can now also project the color blue, in addition to red and green. Contents can be displayed in all colors of the RGB color spectrum, as is the case with an LCD monitor, by mixing the three colors.

Having the displays in the driver's direct field of view increases safety, as this allows the driver to keep his eyes on the road at all times.

F30 Head-Up Display

Further information on the Head-Up Display can be taken from the training information F30 Assist Systems.

2.4. Operating elements on the steering wheel

A switch block is integrated into the steering wheel on the left- and right-hand side respectively.

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

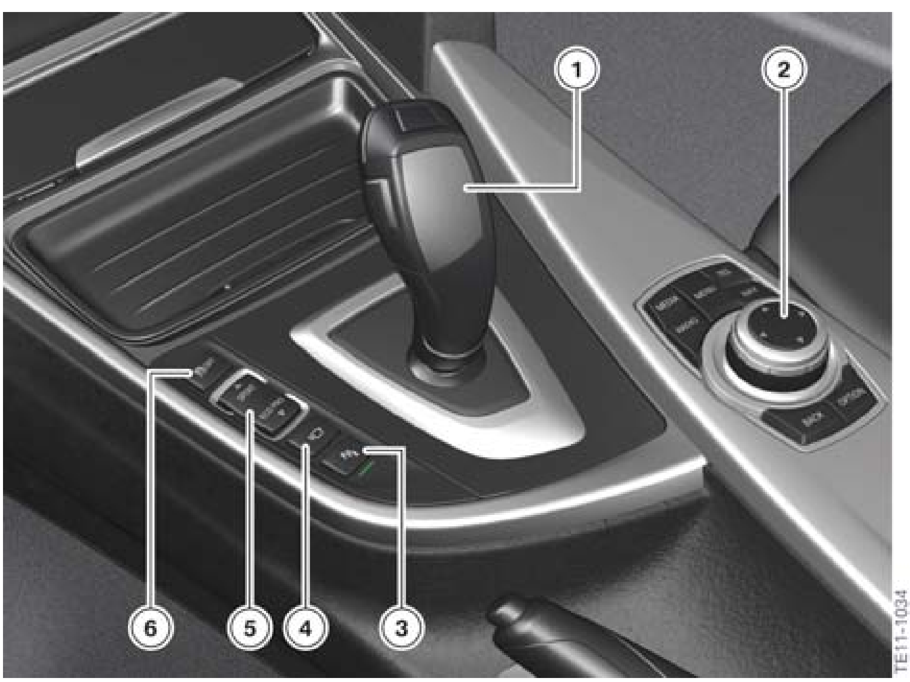
The operating elements for operation of the radio and telephone functions are on the right.

F30 operating elements on the steering wheel

Index	Explanation
1	Increase distance button (only with optional equipment 5DF ACC) not US
2	Rocker switch ±, change speed, set speed
3	Knurled wheel, select/set radio station or track
4	MODE button, change between audio sources
5	Shift paddle for upshifting (only with SA 2TB)
6	Rocker switch +, increase volume
7	Rocker switch -, reduce volume
8	Voice recognition system button
9	Telephone button
10	Reduce distance button (only with optional equipment 5DF ACC) not US
11	Switch DCC on/off, interrupt
12	Resume button, call-up stored speed
13	Set speed button
14	Shift paddle for downshifting (only with SA 2TB)

2.5. Operating elements in the center console

The center console of the F30 features the following operating elements:



F30 operating elements in the center console

Index	Explanation
1	Gear selector switch
2	Controller
3	Park Distance Control / Reversing camera / Top view
4	Side View
5	Driving experience switch
6	Dynamic Stability Control

2.5.1. Driving experience switch

The F30 is equipped as standard with the driving experience switch.

F30 driving experience switch

Index	Explanation
1	Driving experience switch

The driver can use the driving experience switch to select different programs which alter various properties of the vehicle depending on the vehicle's equipment specification. The following programs are available:

- SPORT+ (only in vehicles with sport automatic transmission option 2TB, variable sport steering option 2VL or Sport Line PA 7AC)
- SPORT
- COMFORT
- ECO PRO.

When the driver switches to a different program, the selected program is displayed in the instrument cluster. In vehicles with CID a pop-up also appears for the selected program.

SPORT mode

In conjunction with the optional equipment Professional navigation (option 609) additional SPORT mode displays can be called up in the CID.

SPORT mode displays in the CID

Index	Explanation
1	Power output
2	Torque

ECO PRO mode

The ECO PRO mode supports the driver in adopting an optimized-consumption driving style and reduces fuel consumption through intelligent control of energy and A/C management. Essentially the following measures help to reduce fuel consumption:

- The driver is supported in adopting an optimized-consumption driving style by means of an alteration of the accelerator pedal characteristic and the shift program in automatic transmissions or the shift point indicator in manual gearboxes.
- The A/C system is placed in the ECO PRO operating state. Here the A/C system operates at reduced air drying and cooling. If the required temperature can be achieved without cold production, the A/C compressor is switched off. During heating mode the engine operating mode with increased heat dissipation is to the greatest possible extent dispensed.

The ECO PRO operating condition of the heating/air-conditioning unit can be reset by the driver in the COMFORT operating condition. The setting of the operating state of the heating and A/C system is stored and re-established when the ECO PRO mode is called up again.

- The exterior mirror heating is switched off and the seat heating temperature is limited to 37.5 °C instead of 42 °C. These measures are allied to the ECO PRO operating state of the heating and A/C program.
- The driver is prompted by various displays to adopt an optimized-consumption driving style and is supported in optimizing their driving style.

Displays of the ECO PRO mode in the instrument cluster with extended functional scope (extended cluster function optional equipment 6WA)

Index	Explanation
1	ECO PRO display
2	ECO PRO driving instructions
3	Display of the bonus range

The bonus range is the actual additional range which was achieved through your ECO PRO driving style. The bonus range is calculated in the BC according to the personal driving style and the resulting consumption. The BC gets to know the personal long-term consumption of the driver. To determine the range the current consumption in ECO PRO mode is compared to your 'learnt' consumption in the instrument cluster outside of the ECO PRO mode. This creates a difference in liters which is recalculated into the bonus range.

ECO PRO mode displays in the CID

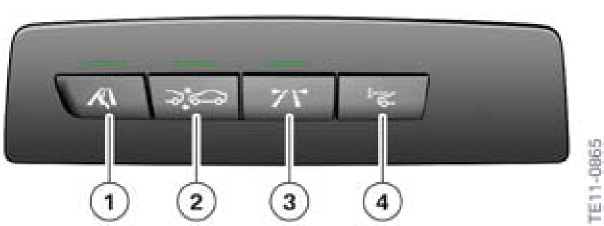
Index	Explanation
1	ECO PRO information in the EfficientDynamics menu
2	Configure ECO PRO mode
3	Consumption history in the EfficientDynamics menu (only with optional equipment 6WA)
4	Technology experience monitor in the EfficientDynamics menu

Through these measures a reduction of the practical consumption of up to 20% can be reached depending on the driving style

Upon activation of the ECO PRO mode the automatic engine start-stop function is automatically switched on.

2.6. Operating facility for driver assistance systems

The individual driver assistance systems can be activated or deactivated via the driver assistance systems operating facility, which is located next to the steering wheel in the dashboard.



F30 operating facility for driver assistance systems

Index	Explanation
1	Lane change warning
2	Collision warning
3	Lane departure warning
4	Head-Up Display (HUD) button not installed, now in the CIC under “Settings” “Head-Up Display”

F30 Displays, Indicators and Controls
2. System Components

2.7. Service functions

2.7.1. Resetting the scope of maintenance work

If the service has been carried out for one or more scopes of maintenance work, replacement of front brake pads for example, the full service interval must be reset for these scopes.

When resetting the scopes of maintenance work, a differentiation is made between two types:

- Statutory scopes of maintenance work, such as the vehicle inspection, area specific, which can only be reset in the "Service" menu.
- All service-related scopes of maintenance work, such as changing the spark plugs for example, are reset via the reset mode in the instrument cluster or via the BMW workshop system.

Activating reset mode

- Terminal 15 ON
- Press and hold down the reset button in the instrument cluster for between five and ten seconds.

Keep the reset button pressed for longer than ten seconds to call up the test functions.

Press the reset button briefly once to scroll through the scopes of maintenance work. Keep the reset button pressed for longer to access the reset menu for the selected scope of maintenance work. Press and hold the button again to reset the scope of maintenance work. It is only possible to reset the scopes of maintenance work once thresholds for specific scopes of maintenance work have been undercut.

Exiting reset mode

- Terminal 15 OFF
- Start engine
- Do not press button for 15 seconds.

2.7.2. Test functions

The test functions are shown in the TFT display of the instrument cluster. The test functions also provide BMW Service with help in troubleshooting without a BMW diagnosis system.

To start functional check

- Terminal 15 ON
- Press and hold down the reset button in the instrument cluster for ten seconds.

2. System Components

Locking and unlocking the test functions (test function 04)

Only the first four test functions are freely accessible. All test functions are locked from the fifth test function onwards. The test functions can be unlocked via test function 04.

The test functions are unlocked by entering the cross total of the last five digits of the vehicle identification number.

Display of test functions

The test functions are faded into the center of the TFT display, between the two round instruments.

The main test functions are listed below. In addition to the majority of test functions, there are further equivalent functions for which a similar display appears in the instrument cluster.

Test function	Description
01	Identification
02	System test
03	Test end
04	Unlock test functions
05	Current consumption
06	Range / Consumption
07	Fuel gauge values
08	Coolant temperature, ambient temperature, engine oil temperature
09	On-board computer average values
10	Speedometer / Rev counter
11	Display of vehicle voltage
12	Acoustics, triggering of audio signals
13	Read fault codes (“DTC”)
14	Dim LCD
15	Dim PWM signal
16	Condition Based Service
17	Check Control
18	Correction factor, consumption figures
19	Software reset / RAM reload

Operation of test functions

The test functions are operated with the assistance of the reset button in the instrument cluster.

Press the reset button briefly once to scroll through the test functions. Keep the reset button pressed down for longer to access the selected test function.

Exit test functions

- Terminal 15 OFF
- Keep reset button pressed for longer than ten seconds.
  The main menu fades into the instrument cluster
- Call up test function 03 (end test)
- Call up test function 19 (RESET).

To protect against unauthorized access, all but the first four test functions are locked again when the test functions are exited.

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Technical training.
Product information.

F30 Entertainment and Communication

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1113 2/1/2012

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Entertainment and Communication
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F30 Entertainment and Communication
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F30 Entertainment and Communication

1. Introduction

The information and communication system plays a significant role in the F30. It can access the highly advanced technology available in the BMW module. which provides the driver with a wide selection of Infotainment systems.

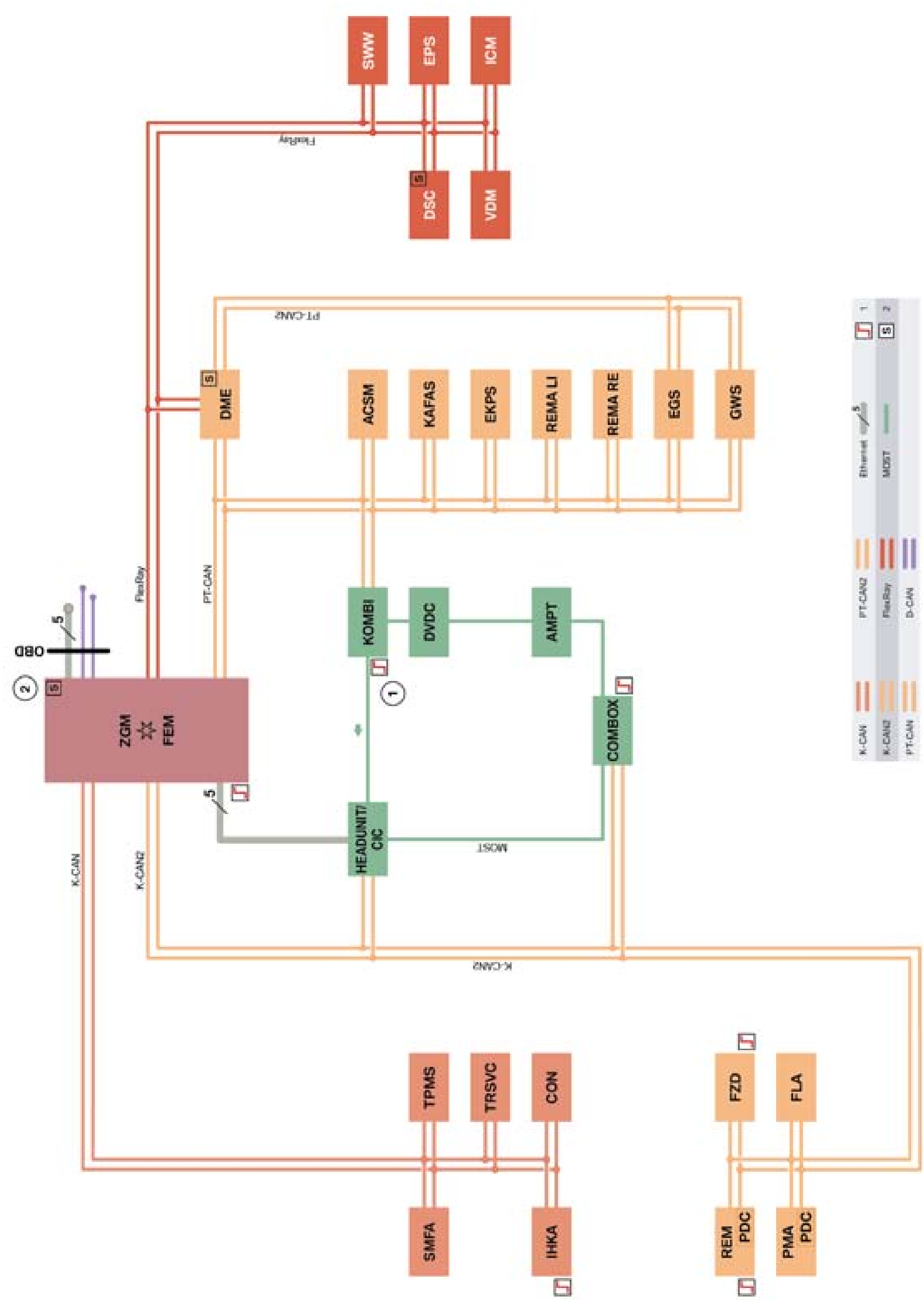
The purpose of this information bulletin is to provide an overview of the following systems:

- Radio and headunits
- Speaker systems
- Telephone systems
- BMW ConnectedDrive
- Antenna Systems.

F30 Entertainment and Communication

1. Introduction

1.1. F30 bus overview



F30 bus overview

1. Introduction

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top HiFi amplifier
COMBOX	Combox (Combox emergency call, Multimedia Combox)
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DME	Digital Engine Electronics (DME)
DSC	Dynamic Stability Control
DVDC	DVD changer
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EPS	Electromechanical Power Steering
Ethernet	Cable-based data network technology for local data networks
FEM	Front Electronic Module
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector lever
HEADUNIT/CIC	Headunit (Car Information Computer or Basic headunit)
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
K-CAN	Body controller area network
K-CAN2	Body controller area network 2
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (MOST only with option 6WA)
MOST	Media Oriented System Transport
OBD	On-board diagnosis (diagnostic socket)
PDC	Park Distance Control (with option 5DP, parking manoeuvring assistant: integrated in the parking manoeuvring assistant control unit, otherwise integrated in the Rear Electronic Module control unit)
PMA	Parking manoeuvring assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
RAD	Radio

F30 Entertainment and Communication
1. Introduction

Index	Explanation
REM	Rear Electronic Module
REMA LI	Reversible electromotive automatic reel, left (not US)
REMA RE	Reversible electromotive automatic reel, right (not US)
SMFA	Seat module, driver
SWW	Lane change warning
TPMS	Tire pressure control
TRSVC	Control unit for all-round vision camera
VDM	Vertical Dynamics Management
ZGM	Central gateway module

F30 Entertainment and Communication

2. Radio and Headunits

2.1. Overview of headunits F30

Optional equipment	Headunit	CID	Controller	Navigation
Radio (standard)	Basic headunit	6.5"	5-button	No
Navigation system (option 609)	Car Information Computer (CIC)	8.8"	7-button	Yes

2.2. Basic headunit

F30 Basic headunit

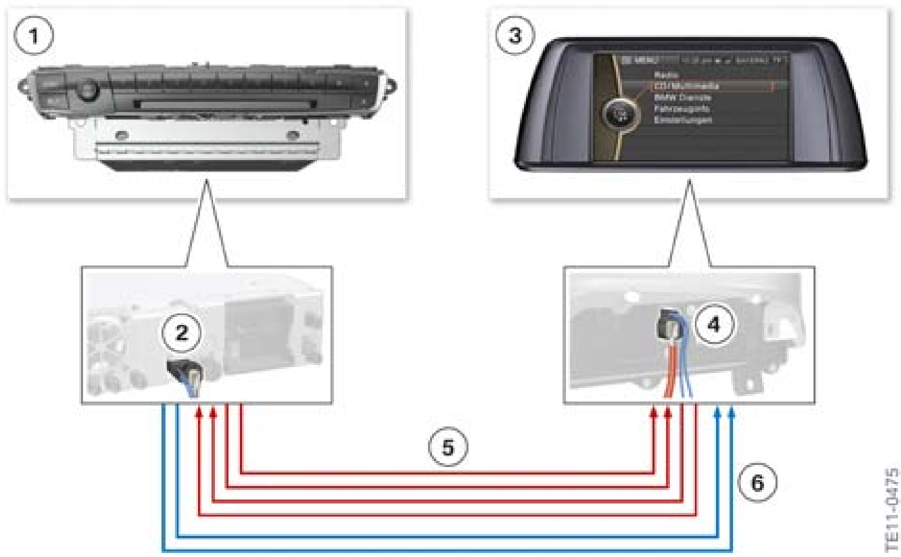
Index	Explanation
1	CID
2	Audio system operating facility
3	Basic headunit
4	Controller

The entry level radio for F30 (w/o navigation) is the Basic headunit (HU-B) and is offered as standard equipment.

The controller of the Basic headunit has only five function buttons and can only be toggled to the left and right. The Favorite buttons only have a touch sensor system.

2. Radio and Headunits

The Basic headunit comes with a central information display (CID) with 6.5” screen.



APIX connection, CID to headunit

Index	Explanation
1	Basic headunit
2	APIX jack to Basic headunit
3	Central information display (CID)
4	APIX jack to central information display (CID)
5	APIX data connection lines
6	Power supply

The CID in the F30 is not connected to a bus. The CID is directly connected to the headunit via an APIX interface. APIX (Automotive Pixel Link) is a bit-serial data transfer system with a data transfer rate of 1 Gbit/s on just one copper core pair. Each APIX video link also has a bidirectional reverse channel. Data transfer via the APIX interface has been optimized with regard to electromagnetic compatibility and power consumption.

Because of the CID's low power consumption, the CID can be supplied with power via 2 separate current leads directly by the headunit, and there is no need for a separate power supply to the CID. Because of the high data transfer rate with low electromagnetic emissions, it is also possible to use copper wiring for applications with a high bandwidth requirement and to dispense with fiber optic networking.

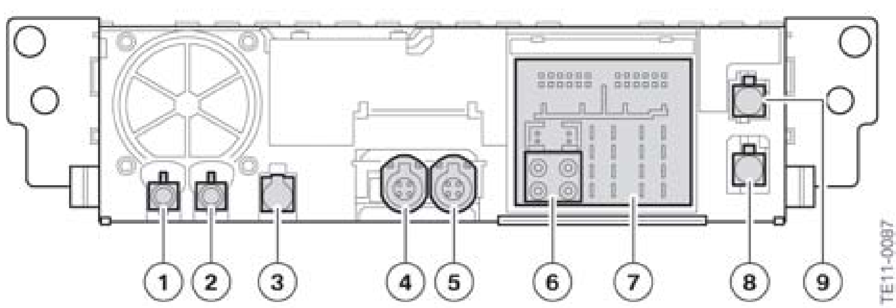
The CID is connected via two APIX links to the headunit. The two copper core pairs and the two power supply leads are connected by a common connector to the headunit and the CID. An APIX video link serves to transfer the screen content to the CID. The bidirectional reverse channels of the APIX video links serve to transfer status information (such as e.g. CID operating temperature), diagnostic information and control signals.

F30 Entertainment and Communication
2. Radio and Headunits

In the radio systems area, in addition to an AM/FM double tuner, are integrated in the Basic headunit. In conjunction with the Basic headunit, phase diversity is used instead of the previously customary antenna diversity for FM radio reception. For further information on phase diversity, please refer to the chapter entitled antenna Systems.

In the F30 the Basic headunit has - in conjunction with a mobile phone preparation with connection for Bluetooth and USB devices (option 6NL) - a voice recognition system.

The Telephone function is realized in the headunit and the Contact information is stored on internal memory as there is no removable SD Card.



F30 connections, Basic headunit

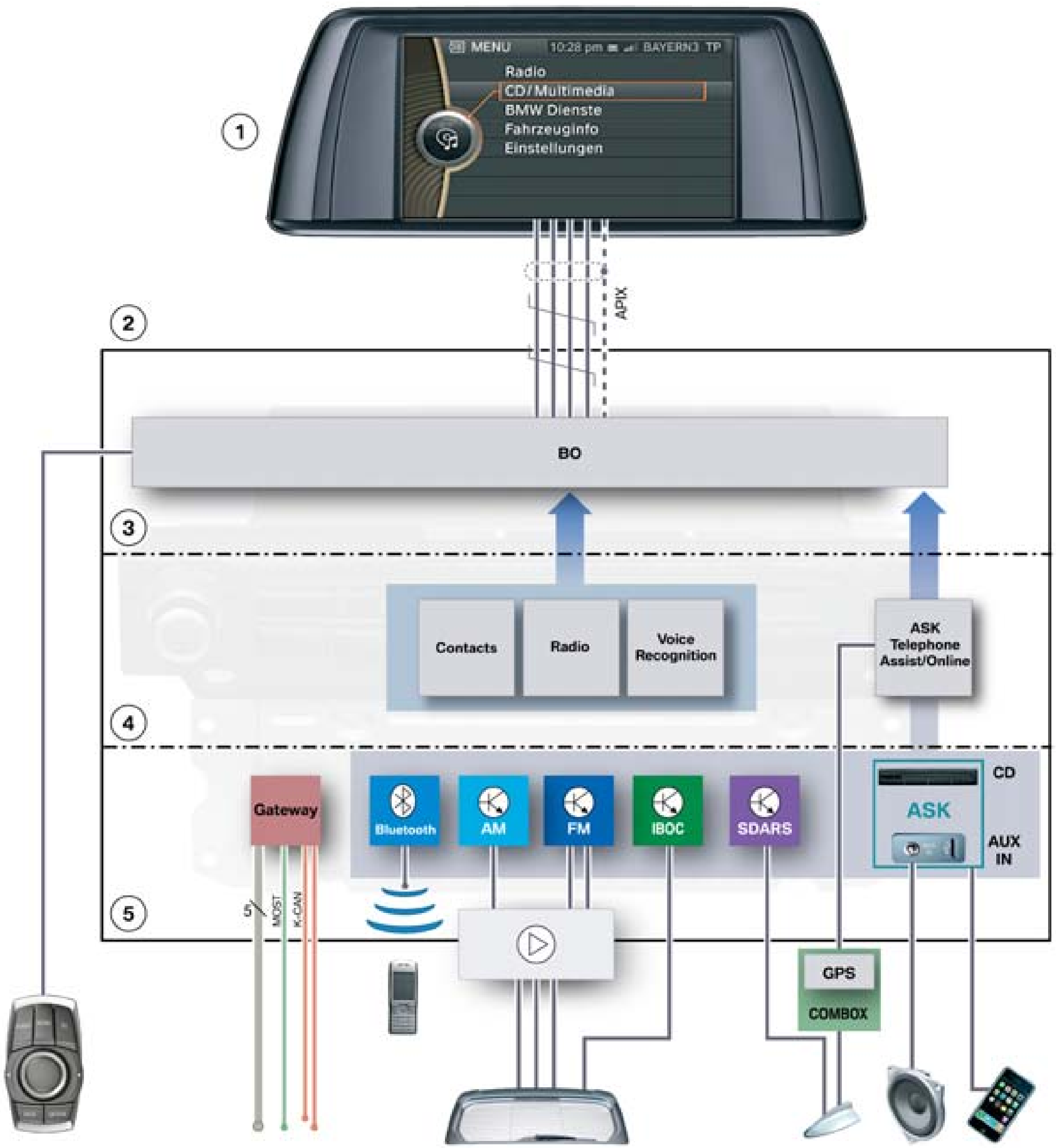
Index	Explanation
1	AM/FM
2	AM/FM
3	Bluetooth
4	APIX and CID power supply
5	USB
6	MOST
7	Main connector
8	DAB L Band (not US)
9	DAB Band III (not US)

The Basic headunit does not contain any components that are replaceable by a BMW Service agent and has to be replaced completely if defective. The Ethernet connection from the FEM to the headunit is used solely to update the headunit's software.

F30 Entertainment and Communication

2. Radio and Headunits

2.2.1. Block diagram



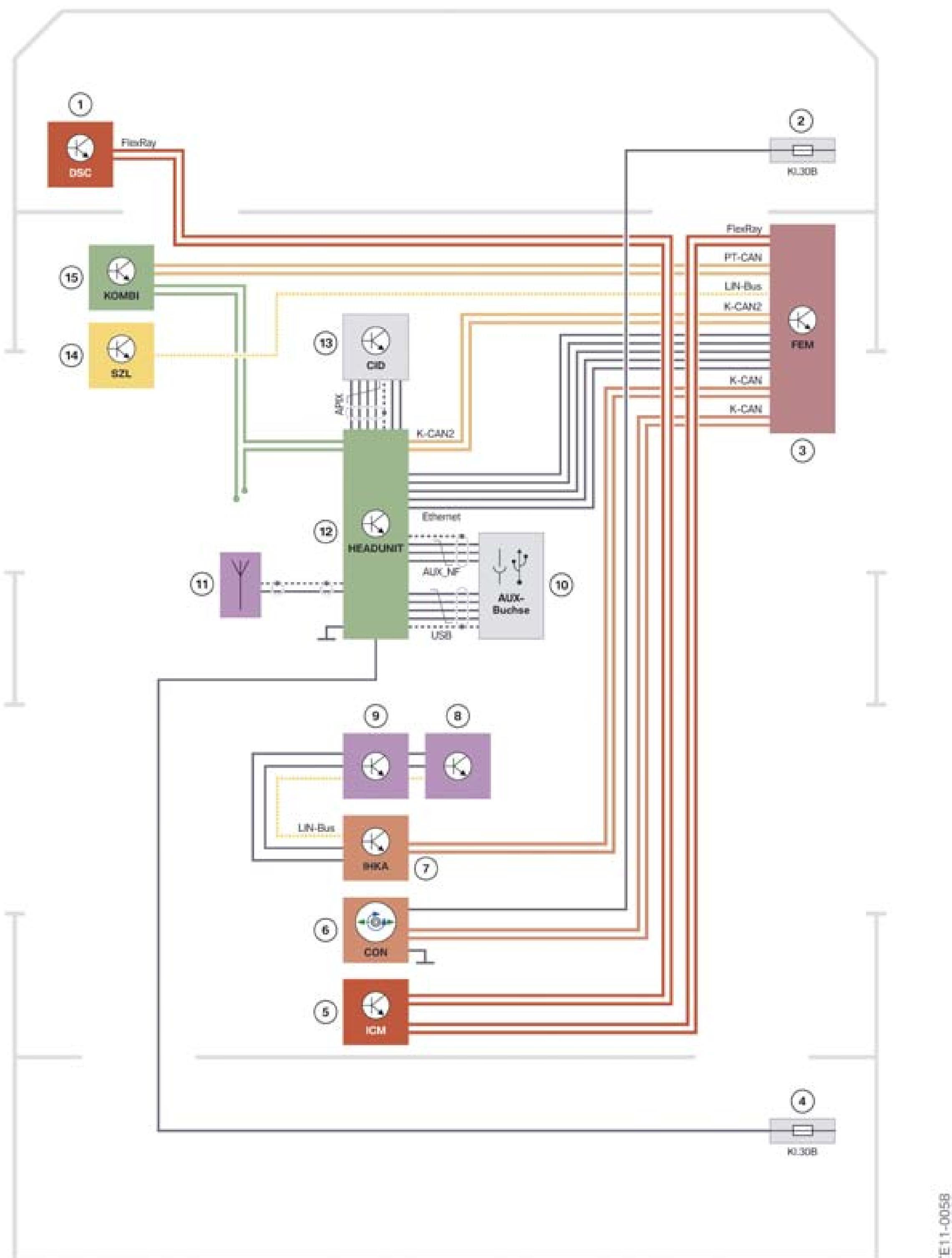
F30 block diagram, Basic headunit

Index	Explanation
1	Central information display
2	Basic headunit
3	User interface
4	Application software
5	Hardware and interfaces

F30 Entertainment and Communication

2. Radio and Headunits

2.2.2. System wiring diagram



F30 system wiring diagram, Basic headunit

2. Radio and Headunits

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Power distribution box, front
3	Front Electronic Module (FEM)
4	Power distribution box, luggage compartment
5	Integrated Chassis Management (ICM)
6	Controller (CON)
7	Integrated automatic heating / air conditioning
8	Audio operating facility
9	IHKA operating facility
10	AUX-In connection with USB audio interface in center console[1]
11	Bluetooth antenna in wiring harness
12	Basic headunit
13	Central information display (CID)
14	Steering column switch cluster (SZL)
15	Instrument cluster (KOMBI)

[1] In vehicles with mobile phone preparation with connection for Bluetooth and USB devices (option 6NL) the AUX-In connection with USB audio interface is connected to the Combox.

F30 Entertainment and Communication

2. Radio and Headunits

2.3. Car Information Computer (CIC)

F30 Car Information Computer

Index	Explanation
1	CID
2	Audio system operating facility
3	Car Information Computer (CIC)
4	Controller

The CIC headunit was installed for the first time in 2008 in the BMW 1 and 3 Series vehicles in conjunction with the Navigation system (option 609). This is now also used in the F30.

The CID in the F30 is not connected to a bus. The CID is, as with the Basic headunit, directly connected to the headunit via an APIX interface. The CID can be supplied with power via two leads directly by the headunit.

In the F30 the CIC always has a voice recognition system. To be able to operate the voice recognition system with the buttons on the steering wheel, it is necessary for the Multifunction for steering wheel to be installed as standard.

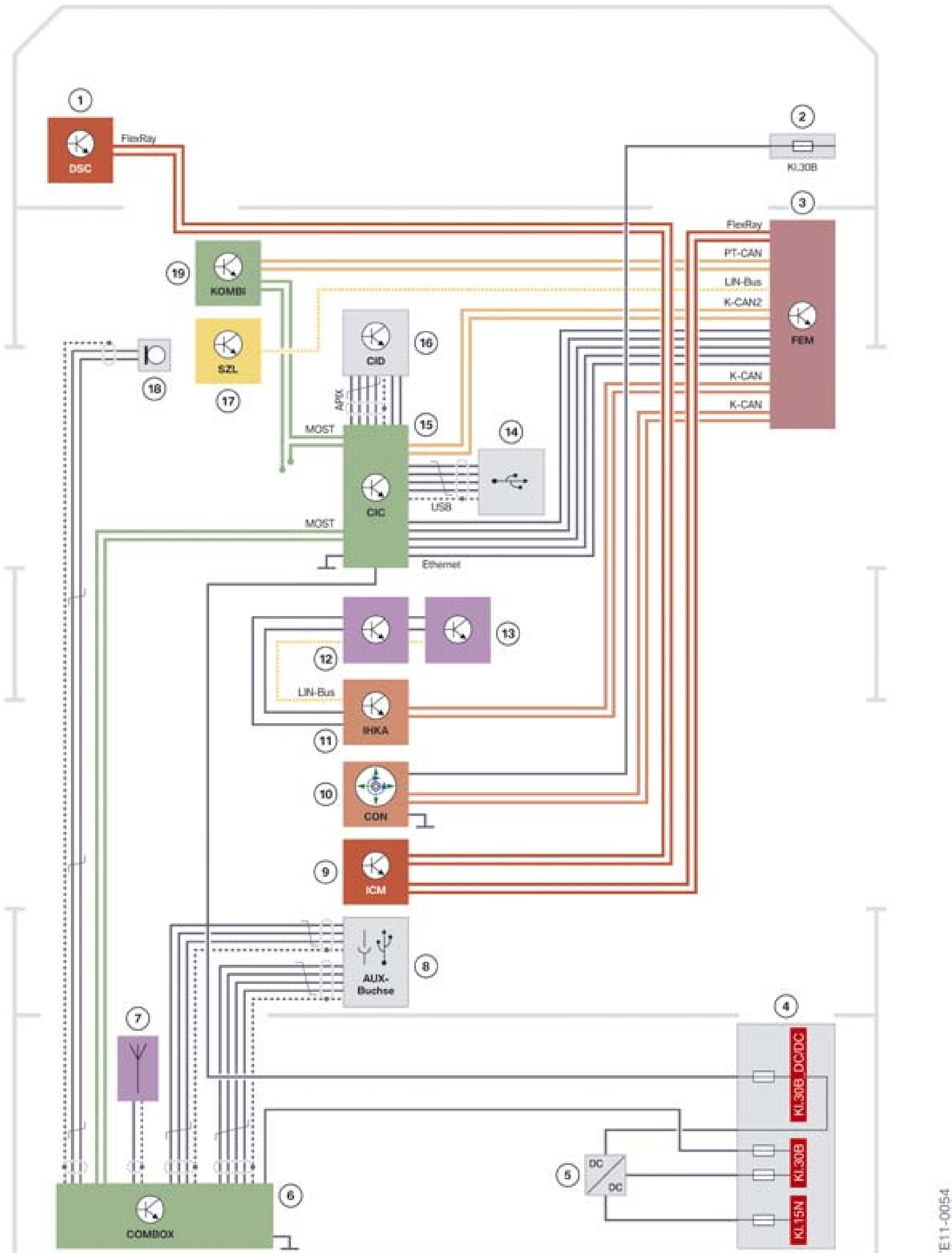
The headunit provides, through data management on an 80 GB hard disk, for a multitude of new possibilities.

2. Radio and Headunits

This is clearly shown in the audio field particularly with the compiling of music. Music files can be converted (ripped) or copied for compiling music on the hard disc. Stored on the CIC-dedicated hard disk, fast access to these music files is ensured at all times. A choice of up to 3700 music files (12 GB) is possible here.

For further information on the Car Information Computer, please refer to the “Car Information Computer CIC” training information.

2.3.1. System wiring diagram



F30 system wiring diagram, Car Information Computer (CIC)

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Power distribution box, front
3	Front Electronic Module (FEM)
4	Power distribution box, luggage compartment
5	DC/DC converter
6	Combox
7	Bluetooth antenna in wiring harness
8	AUX-In connection with USB audio interface in center console
9	Integrated Chassis Management (ICM)
10	Controller (CON)
11	Integrated automatic heating / air conditioning
12	IHKA operating facility
13	Audio operating facility
14	USB connection in glove box
15	Car Information Computer
16	Central information display (CID)
17	Steering column switch cluster (SZL)
18	Microphone
19	Instrument cluster (KOMBI)

F30 Entertainment and Communication

3. Speaker Systems

3.1. Overview

The speaker systems in the F30 are available in three specification levels:

- HiFi system = HiFi loudspeaker system
- Top HiFi system = HiFi loudspeaker system Harman Kardon (optional equipment 688).

This means the HiFi system is standard equipment.

The speaker and amplifier from the F30 have a similar design to the systems currently used in the 5-Series and 7-Series. The amplifier and headunits have been optimally adapted to the passenger compartment of the F30 through vehicle-specific equalizing.

The two central basses, like in all the current BMW vehicles, are positioned under the front seats, whereby a consistent bass reproduction is possible in the entire vehicle. The necessary housing volume is achieved by connecting the central basses to the side sill.

All systems have an adjustable, speed-dependent volume adjustment, whereby the higher driving noise level is compensated at higher driving speeds.

3.2. Components

3.2.1. HiFi system

The HiFi loudspeaker system consists of nine speakers. A seven-channel amplifier is integrated in the HiFi loudspeaker system. The amplifier of the HiFi system has no bus connection and receives the switch-on signal instead via a separate line.

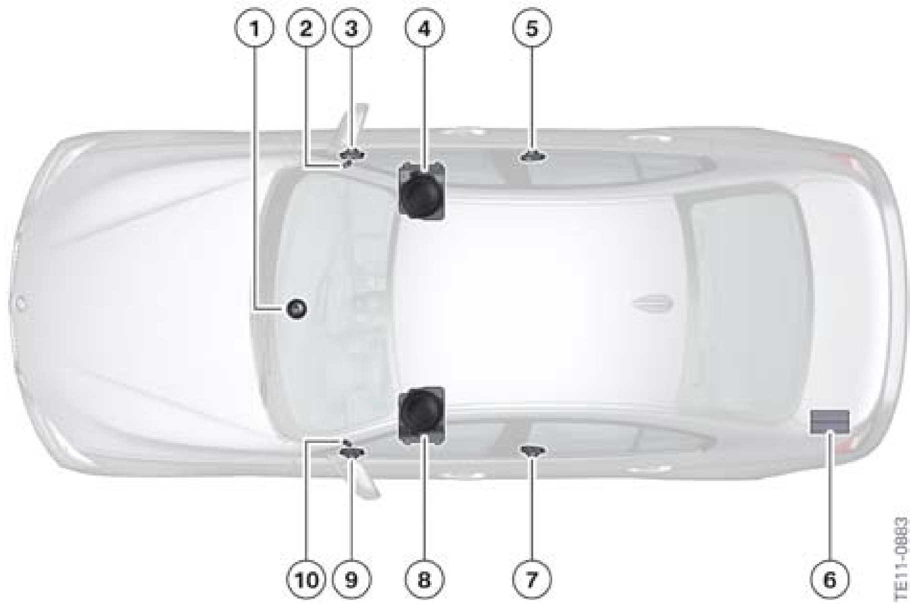
Separate speakers are installed in the HiFi system for the treble and mid-tone ranges.

The HiFi system also has a significantly louder center bass speaker and a mid-range speaker positioned centrally in the instrument cluster as a center speaker.

The speakers and the amplifier of the HiFi system are illustrated in the following graphic. The speakers are operated with a power output of 5 x 25 watts for the mid-range speakers and tweeters and 2 x 40 watts for the bass speakers.

F30 Entertainment and Communication

3. Speaker Systems



F30 HiFi loudspeaker system

Index	Explanation
1	Mid-range speaker, front center
2	Tweeter, exterior mirror cover, front right
3	Mid-range speaker, front right door
4	Bass speaker under the front right seat
5	Mid-range speaker, rear right door
6	HiFi amplifier
7	Mid-range speaker, rear left door
8	Bass speaker under the front left seat
9	Mid-range speaker, front left door
10	Tweeter, exterior mirror cover, front left

3.2.2. Top HiFi system

F30 tweeter, exterior mirror cover

The Harman Kardon HiFi loudspeaker system (optional equipment 688), which has been further optimized in comparison to the HiFi loudspeaker system, is complemented with two additional mid-range speakers and five additional tweeters. The Top HiFi system thus comprises a total of 16 speakers. Incorporated in the Top HiFi system is a nine-channel amplifier with digital equalizing. The AMPT of the Top HiFi system is a bus user in Media Oriented System Transport (MOST).

The mid-range speakers and tweeters of the Top HiFi system have high-quality aluminium diaphragms for a clearly differentiated acoustic pattern. Thanks to the additional use of hexagonally structured metal covers the damping and resonances of the covers are minimized.

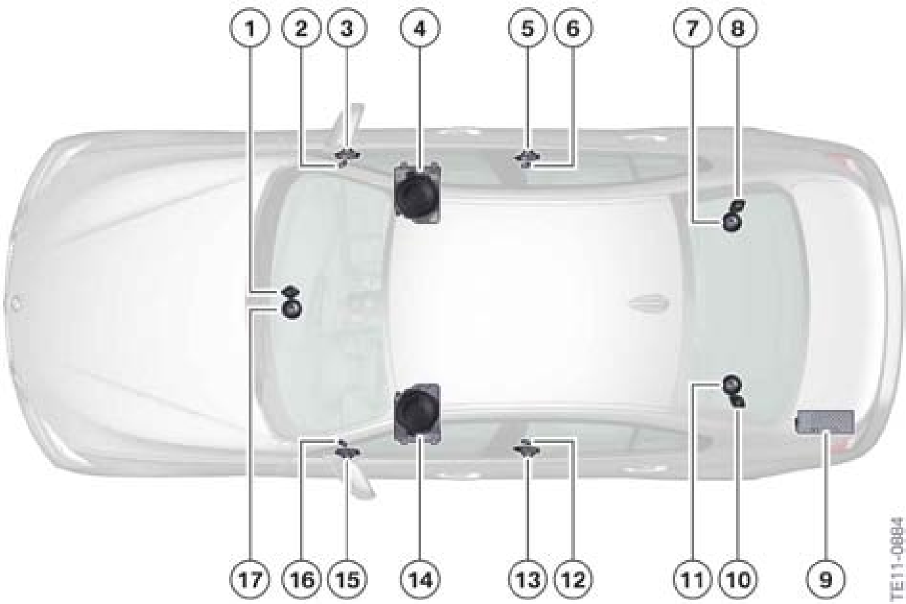
The high-quality panels with lettering, which are made from anodized aluminium, in the mirror triangles are a notable visible difference.

The amplifier of the Top HiFi system is equipped with a so-called load logic separator in the F30. Here the amplifier electronics are supplied and connected with a separate voltage line. This is specially protected against brief voltage dips which in turn prevents failure of the electronics if a voltage dip occurs briefly.

The speakers and the amplifier of the Top HiFi system are illustrated in the following graphic. The speakers are operated with a power output of 7 x 50 watts for the mid-range speakers and tweeters and 2 x 125 watts for the bass speakers.

F30 Entertainment and Communication

3. Speaker Systems



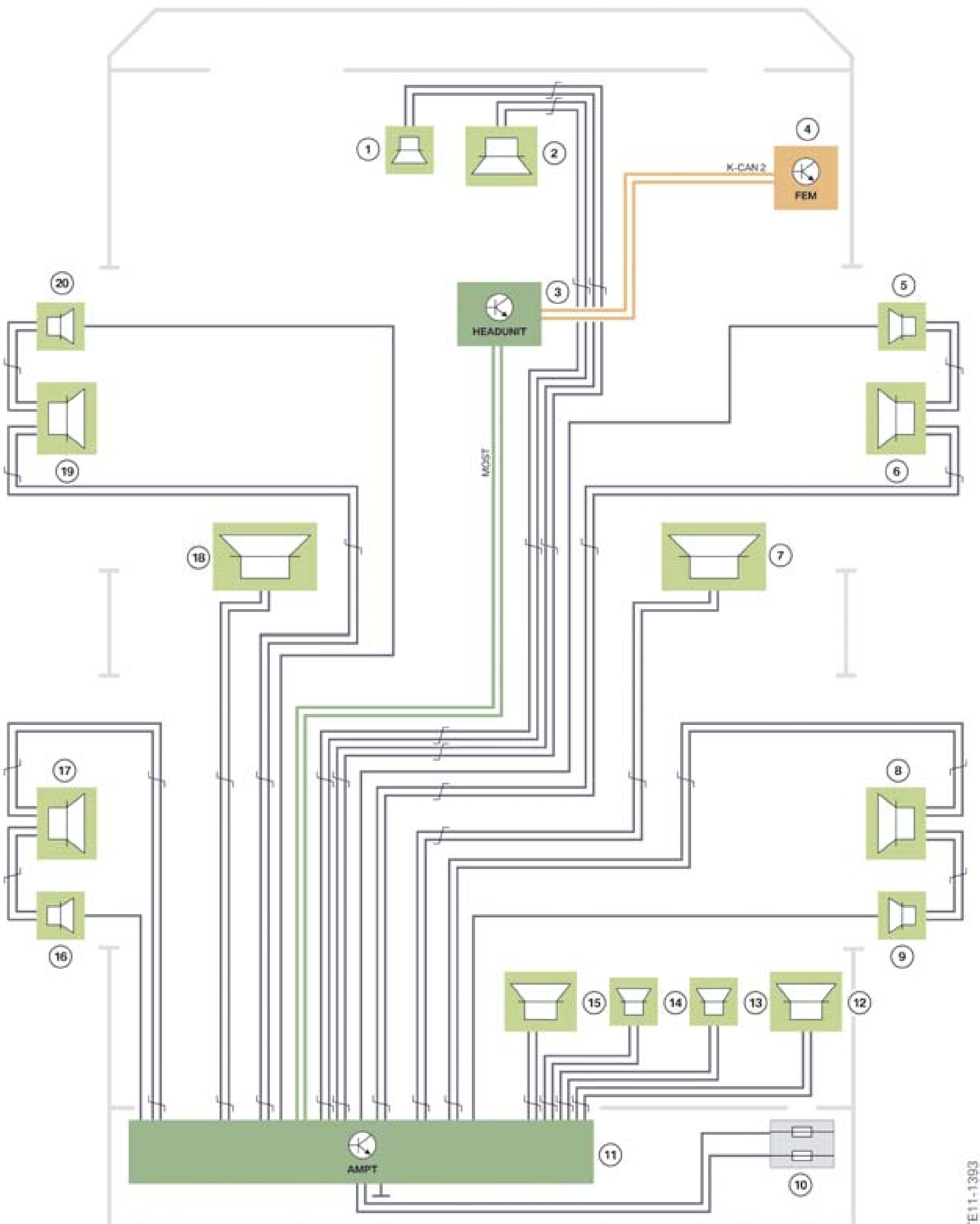
F30 Top HiFi loudspeaker system Harman Kardon

Index	Explanation
1	Tweeter, front center
2	Tweeter, exterior mirror cover, front right
3	Mid-range speaker, front right door
4	Bass speaker under the front right seat
5	Mid-range speaker, rear right door
6	Tweeter, rear right door
7	Mid-range speaker, luggage compartment capping, right
8	Tweeter, luggage compartment capping, right
9	Top HiFi amplifier
10	Tweeter, luggage compartment capping, left
11	Mid-range speaker, luggage compartment capping, left
12	Tweeter, rear left door
13	Mid-range speaker, rear left door
14	Bass speaker under the front left seat
15	Mid-range speaker, front left door
16	Tweeter, exterior mirror cover, front left
17	Mid-range speaker, front center

F30 Entertainment and Communication

3. Speaker Systems

System wiring diagram



F30 system wiring diagram, Top HiFi system

3. Speaker Systems

Index	Explanation
1	Tweeter, front center
2	Mid-range speaker, front center
3	Headunit
4	Front Electronic Module
5	Tweeter, exterior mirror cover, front right
6	Mid-range speaker, front right door
7	Bass speaker under the front right seat
8	Mid-range speaker, rear right door
9	Tweeter, rear right door
10	Power distribution box, luggage compartment
11	Top HiFi amplifier
12	Mid-range speaker, luggage compartment capping, right
13	Tweeter, luggage compartment capping, right
14	Tweeter, luggage compartment capping, left
15	Mid-range speaker, luggage compartment capping, left
16	Tweeter, rear left door
17	Mid-range speaker, rear left door
18	Bass speaker under the front left seat
19	Mid-range speaker, front left door
20	Tweeter, exterior mirror cover, front left

4. Telephone Systems

4.1. Overview

Three different items of optional equipment are available for the F30 telephone systems:

- Hands-free system with USB interface (standard)
- Mobile phone preparation with connection for Bluetooth and USB devices (option 6NL with telematics).

⚠

The specified range of functions is only achieved with BMW-recommended Bluetooth-capable mobile phones. A list of currently recommended Bluetooth-capable mobile phones can be called up through the Aftersales Assistance Portal (ASAP) or at http://www.bmwusa.com/bluetooth.

4.2. System components

System components, telephone

4. Telephone Systems

Index	Explanation
1	Emergency call speaker (only with option 6NL)
2	Microphone, driver's side
3	Central information display
4	Headunit
5	Controller
6	Base plate (only with option 6NL)
7	Microphone, front passenger side (only with option 6NL)
8	Roof antenna
9	Combox (only with option 6NL or with option 609)
10	Emergency call antenna (only with option 6NL)

The Bluetooth antenna is located in the audio wiring harness of the F30. In the case of a telephone-supported headunit, it is located in the center console. In vehicles with the Combox control unit, it is located in the C-pillar area.

4.3. General information

The telephone functions in the F30 are provided by either the headunit or the Combox. The following table summarizes this information:

Standard/Optional equipment	In conjunction with	Telephone-supported headunit	Combox
Hands-free Bluetooth system with USB interface	Standard equipment (6NH)	Yes	No
BMW Assist with enhanced Bluetooth and USB (option 6NL)	Option 609	No	Combox telematics
BMW Assist with enhanced Bluetooth and USB (option 6NL)	Standard equipment (6NH)	No	Combox telematics with GPS

The optional equipment Navigation System (option 609) always contains telephone functionality in the F30.

The telephone functions contained in the Hands-free Bluetooth system with USB interface (standard equipment 6NH) is installed and realized in the Basic headunit for the standard equipment radio option. In the Basic headunit the Contact information is stored internally as there is no removable SD card installed.

4.3.1. Compatibility

The range and diversity of mobile phones available on the market is steadily increasing. Not every Bluetooth-enabled mobile phone is automatically compatible with a hands-free system. The Internet site http://www.bmwusa.com/bluetooth has been completely revised to enable the customer to make as easy and clear an enquiry as possible.

The customer can now obtain information regarding the compatibility of specific mobile phones with his vehicle (by entering the vehicle identification number for example). A prospective BMW customer can also find out which mobile phones are compatible with specific BMW models.

BMW Bluetooth Internet page

4.4. Hands-free system with USB interface

A telephone-supported headunit is used in conjunction with radio (standard equipment) in the F30. With this, no additional control unit is required in order to provide telephone functions in the vehicle.

In vehicles with Navigation System (option 609) a Combox is installed as well as the headunit to achieve the telephone function. In this case, the microphone, the Bluetooth antenna and the AUX-In connection with USB audio interface are connected not to the headunit, but to the Combox.

The functionality and operation of the telephone function follow the established BMW logic. Business Connectivity can be used to pair a wide range of mobile phones via Bluetooth. A list of compatible devices is available at http://www.bmwusa.com/bluetooth.

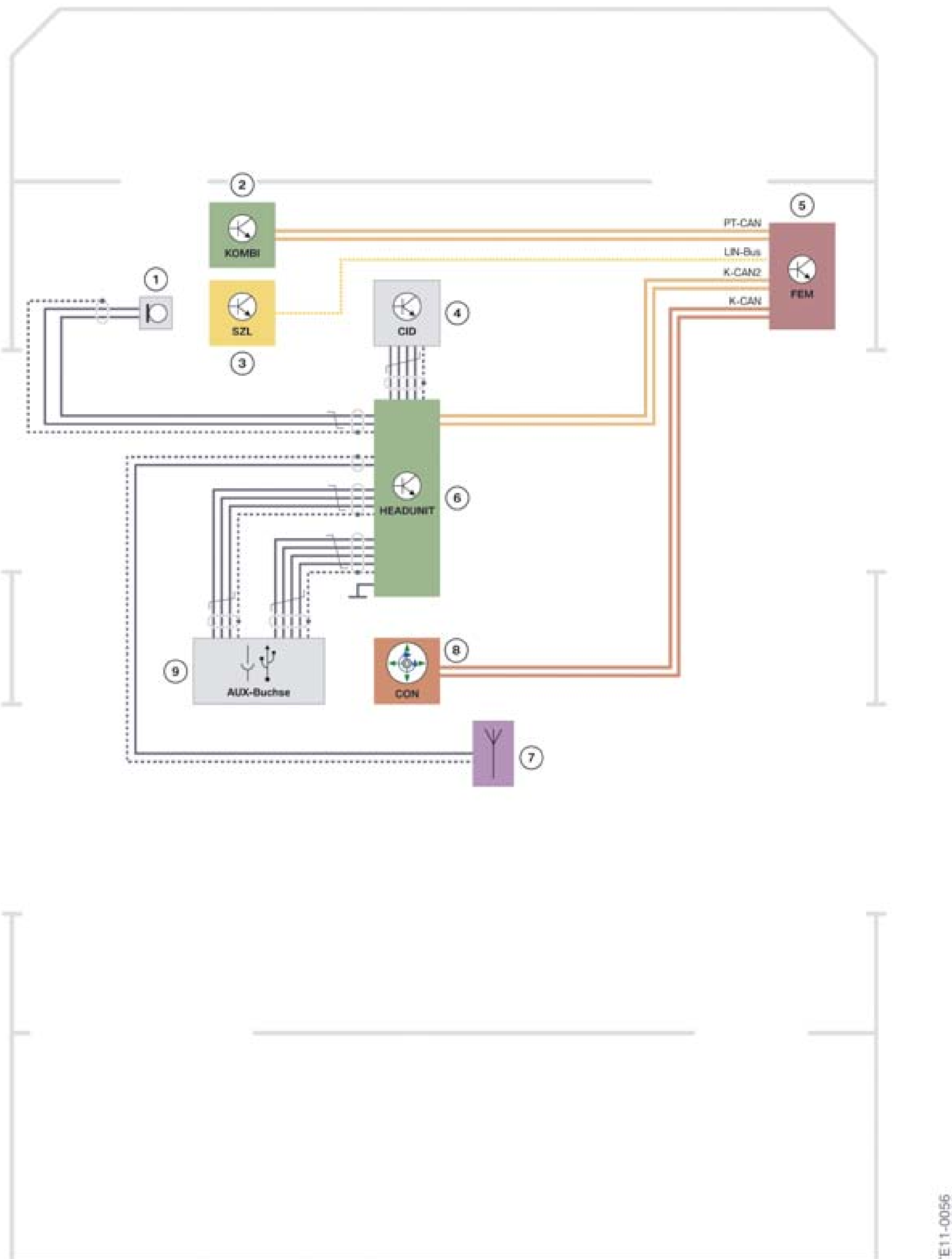
The phone book and lists of callers are transferred from the mobile phone. Contacts can be stored in the address memory of the headunit in addition to the mobile phone's phone book.

During the call the telephone function allows calls to be held or extended (conference call), DTMF tones to be transmitted, and the microphone to be muted.

4.4.1. System wiring diagram

The system wiring diagram for Business Connectivity in conjunction with Navigation System (option 609) is depicted in the system wiring diagram in the section entitled Car Information Computer (CIC).

4. Telephone Systems



F30 system wiring diagram, Hands free and Bluetooth/USB standard equipment

Index	Explanation
1	Microphone
2	Instrument cluster (KOMBI)
3	Steering column switch cluster (SZL)
4	Central information display (CID)
5	Front Electronic Module (FEM)
6	Headunit
7	Bluetooth antenna in wiring harness
8	Controller (CON)
9	AUX-In connection with USB audio interface in center console

4.5. Mobile phone preparation with connection for Bluetooth and USB devices

F30 mobile phone preparation with AUX-In connection with USB audio interface

Vehicles are equipped with a Multimedia Combox. The Multimedia Combox with telematics board (option 6NL) in conjunction with the Mobile phone preparation with connection for Bluetooth and USB devices. Vehicles have a USB audio interface and two microphones. In addition, a base plate with charger function is used for the connection of the telephone antenna on the roof. In vehicles with the optional equipment Music interface for smartphones (optional equipment 6NF) the base plate is also extended to include a USB data connection to the Combox.

In vehicles with the standard radio equipment the Combox also has a GPS receiver.

F30 Entertainment and Communication
4. Telephone Systems

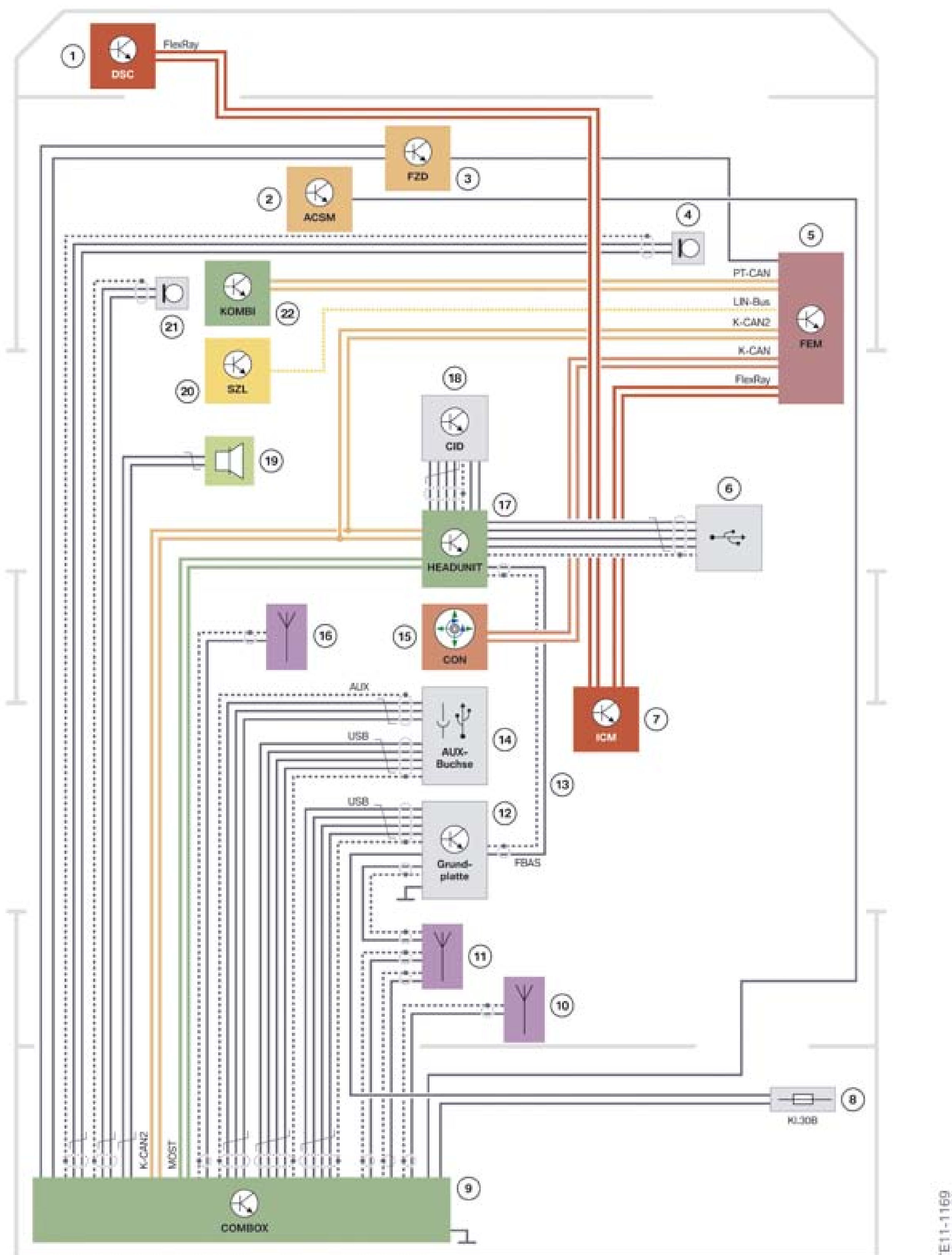
The following functions are available in the F30 with the Combox:

- Connection of external audio players (e.g. smartphones) via Bluetooth
- Simultaneous pairing of several mobile phones and audio devices via Bluetooth
- Contacts with pictures
- Software updating directly by customer
- Connection of certain iPods via a cable (omission of Y-cable)
- Album cover display (with iPod/MTP player/MP3 via USB)
- Office with email, calendar and notes from mobile phone

F30 Entertainment and Communication

4. Telephone Systems

4.5.1. System wiring diagram



F30 system wiring diagram, Connectivity

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Crash Safety Module (ACSM)
3	Emergency call button in roof function center FZD (option 6NL only)
4	Microphone 1
5	Front Electronic Module (FEM)
6	USB connection in glove box
7	Integrated Chassis Management (ICM)
8	Power distribution box, luggage compartment
9	Combox
10	Emergency GSM antenna (option 6NL only)
11	Roof antenna
12	Base plate (USB data connection and antenna connections only with option 6NF)
13	CVBS video connection to headunit (only in conjunction with option 6NR and option 609)
14	AUX-In connection with USB audio interface
15	Controller (CON)
16	Bluetooth antenna in wiring harness
17	Headunit
18	Central information display (CID)
19	Emergency call speaker (option 6NL only)
20	Steering column switch cluster (SZL)
21	Microphone 2
22	Instrument cluster (KOMBI)

4.5.2. Office

With the optional equipment Mobile phone preparation with connection to Bluetooth and USB devices (6NL), the Combox allows the customer to use the Office function.

The customer can use the Office function to access the SMS, calendar, notes, aimless, tasks and reminders in a compatible mobile phone. The Contacts menu item has been replaced by the Office menu item in the central information display.

The data on the mobile phone can only be read. This means that the data on the mobile phone cannot be modified by the Combox.

The "Office update" display tells the user about the number of new messages, which tasks are active and forthcoming deadlines.

Office update display

The calendar can display deadlines of the last 30 days and for the next 90 days.

If an appointment contains phone numbers or email addresses, they can be used directly or saved to the Contacts.

Appointment view

SMS, aimless, appointment entries, tasks and notes can be read out.

Information on the Office functions supported on your mobile phone can be found online at http://www.bmwusa.com/bluetooth.

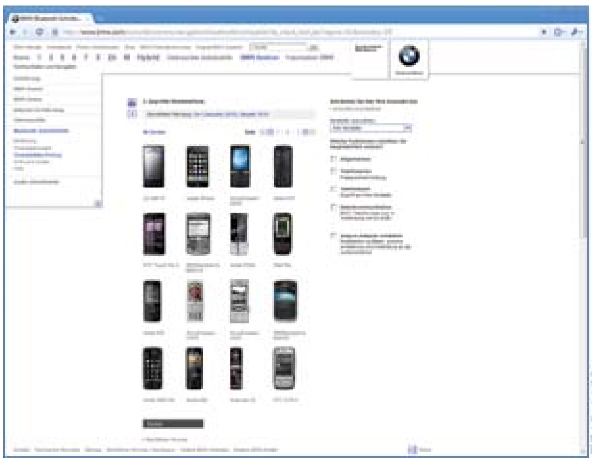
Office for iPhone

On an iPhone the Office functions calendar and email are not supported. The calendar display is currently only possible using an App in connection with optional equipment BMW Apps (optional equipment 6NR).

Office for Blackberry

When using the Office function on Blackberry devices please take note of the following four points:

1) Office functions must be supported by the mobile phone. More information is available online at http://www.bmwusa.com/bluetooth.



TE10-1158

BMW Bluetooth Internet page

2) Office function must be activated in the headunit.

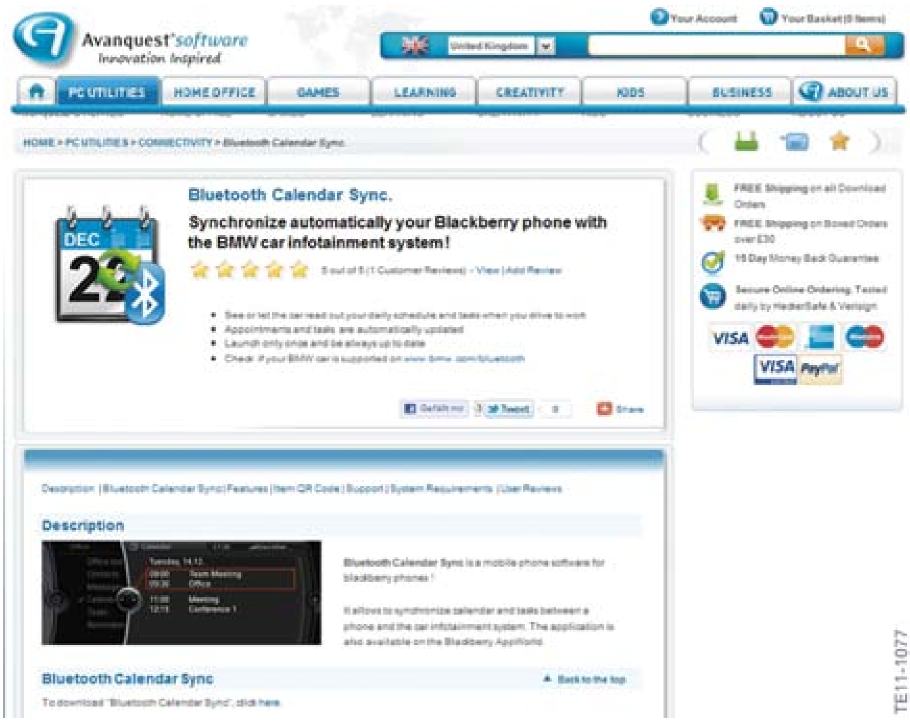
TE11-1168

Activation of Office function in Central Information Display (CID)

3) The coding setting of the Blackberry must be deactivated.

4) There must be no more than 500 emails in the inbox of the Blackberry.

When using the calendar function an App also has to be installed for the Blackberry.



App for calendar function with Blackberry

If the Office functions are not available although all known points are fulfilled, deactivate the Bluetooth connection in the headunit and on the mobile phone. Then reactivate the Bluetooth connection. Information on deactivating and activating the Bluetooth connections is available in the Owner's Handbook and online at http://www.bmwusa.com/bluetooth.

F30 Entertainment and Communication

5. Video System

Video from Digital Versatile Disc (DVD) can be viewed in the Central Information Display (CID) of the F30. For safety reasons, the video picture in the CID is switched off during the journey and a note is displayed instead.

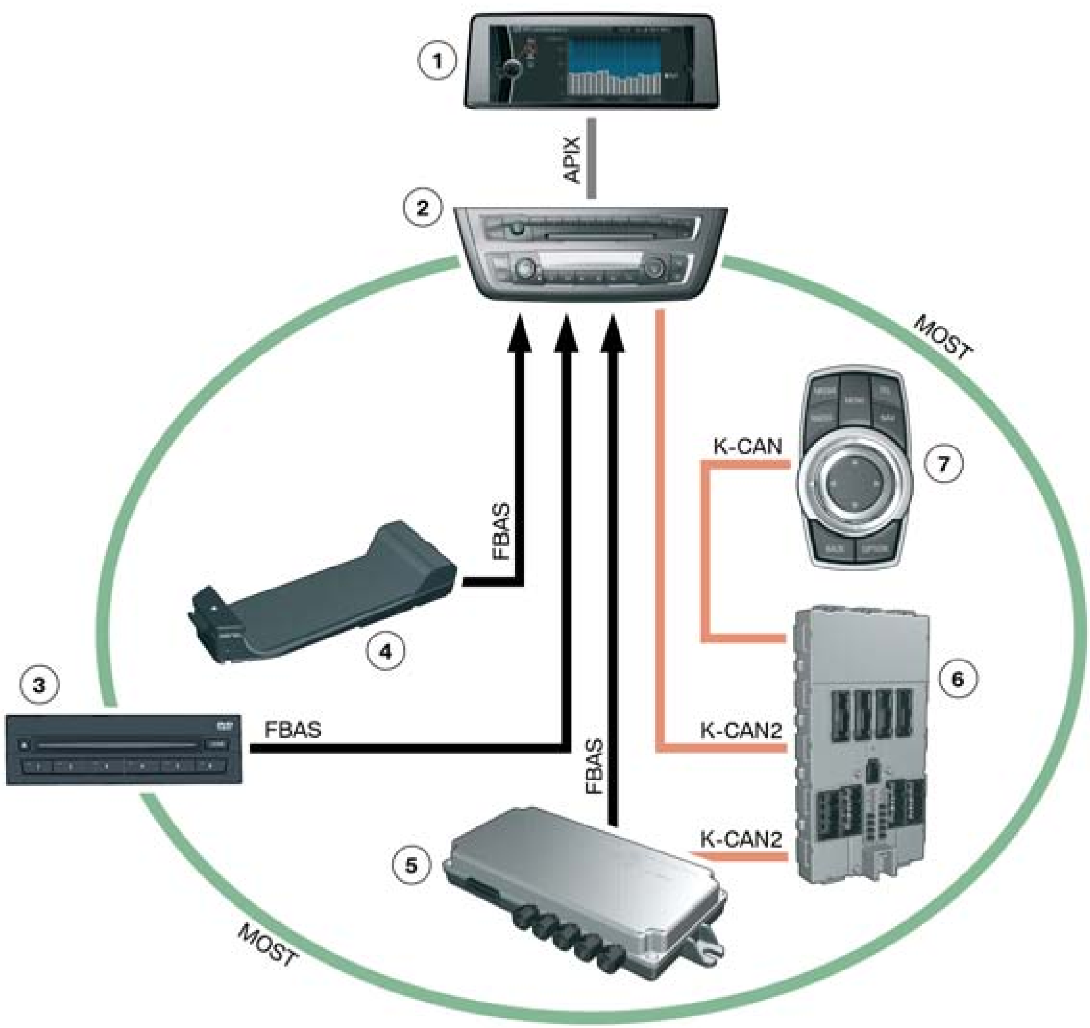
The following optional equipment is offered:

- DVD changer for 6 DVDs.

Playing video DVDs with the DVD changer for 6 DVDs is only possible in connection with Navigation System (optional equipment 609).

As well as playing back films, interactive media such as travel guides, reference works, catalogues, etc. can be displayed. Multiple channel audio formats are supported in conjunction with the Top HiFi amplifier (optional equipment 688 HiFi loudspeaker system Harman Kardon).

5.1. Functional diagram



F30 system wiring diagram video function

5. Video System

Index	Explanation
1	Central information display (CID)
2	Car Information Computer (CIC)
3	6-disc DVD changer, in glove box
4	Base plate with video integration
5	TRSVC control unit
6	Front Electronic Module (FEM)
7	Controller

Three systems are involved as video sources in connection with the Navigation headunit (optional equipment 609) in the F30:

- DVD changer
- TRSVC control unit (with optional equipment 3AG reversing camera or optional equipment 5DL Surround View)
- Base plate with video integration (with optional equipment 6NR BMW Apps).

The transmission of the video data is realized via color Video Blanking Signal (FBAS). The Car Information Computer (CIC) headunit with optional equipment 609 used in the F30 only has three (FBAS) Signal connections, however. As no video switch is available in the F30 only three video sources can be installed.

F30 Entertainment and Communication

6. BMW ConnectedDrive

BMW ConnectedDrive is effectively a personal assistant to the driver. It utilizes the latest technologies with the aim of supplying the driver with all the information that he/she wants and needs. With the market introduction of the F01 the BMW ConnectedDrive has been enhanced with a further innovation: use of the Internet inside the vehicle.

In the F30 many of the BMW ConnectedDrive functions already familiar from current BMW models are used, such as e.g.:

- “BMW Assist” (option 6NL) adds BMW Online service (option 615)
- “Apps” (option 6NR) adds “BMW Assist” (option 6NL)
- “BMW Online service” (option 615)

For some BMW ConnectedDrive services the optional equipment Mobile phone preparation with connection for Bluetooth and USB devices with telematics services (option 6NL) and an active BMW ConnectedDrive agreement are required.

For further information on the optional equipment “Apps” (option 6NR) and the associated video connection of smartphones, please refer to the “Apps/ConnectedDrive” training information.

6.1. BMW Online formally BMW Search

A new improved interface for the service is used in the F30 with the optional equipment BMW Online. The interface can be personalized by the customer better than before and new features and services can be added by the customer.

The optional equipment Mobile phone preparation with connection for Bluetooth and USB devices with telematics services (option 6NL) and an active BMW ConnectedDrive agreement are required for BMW Online functionality.

BMW Online display in the CID

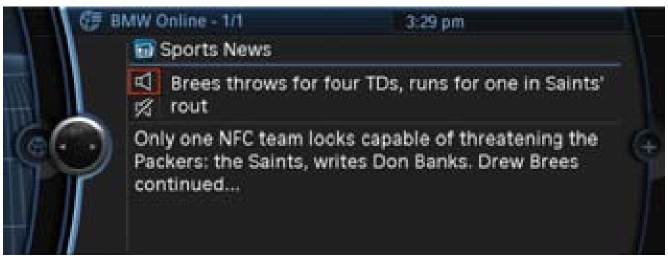
The ConnectedDrive Services team is pleased to announce exciting changes to the BMW Online experience! The BMW Online service brings the latest Stock Indexes, News, Weather, Google Local Search results, Send to Mail, and Fuel Prices to your vehicle’s navigation system. These will be available in the basic view depending on the vehicle equipment. Other applications are available under "Applications".

6. BMW ConnectedDrive

The respective information is transferred to the vehicle by means of an Internet connection via an online portal developed and made available by BMW and shown on the control display of the iDrive operating system. The enhanced offering is available without any additional cost to not only future customers, but also to a variety of customers already registered for BMW ConnectedDrive.

SERVICES INCLUDED:

Stock Indexes - Want to know the Dow Jones, S&P 500 or NASDAQ indices? BMW Online provides these indices right on your control display. News – With BMW Online, the latest US, Business, World, Sports, Entertainment, and BMW news headlines are available to you. They can even be read out automatically by the vehicle's Text-to-Speech feature.

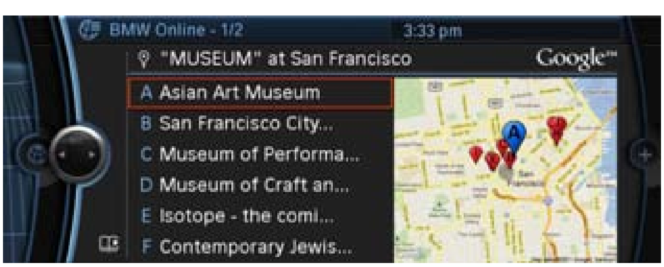


BMW Online News display in the CID

Weather - BMW Online provides the latest 5-day weather forecast and even provides weather advisories and warnings. You can search for weather at your current location, your destination, or any other location in the US.

BMW Online Weather display in the CID

Google Local Search - With Google Local Search, you can search for a business listing to get important information like the address and phone number. Then, you can set the address as a destination in your navigation or call the business via your Bluetooth-connected phone.



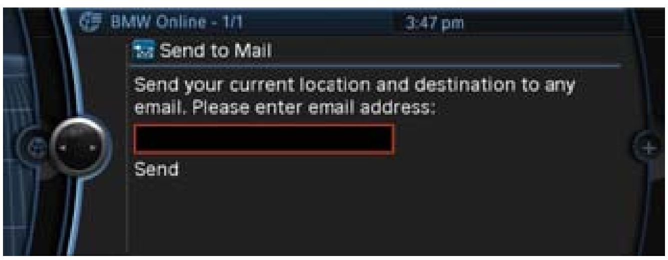
BMW Online Google display in the CID

F30 Entertainment and Communication
6. BMW ConnectedDrive

Fuel Prices - The latest fuel price information is just a few clicks away! With BMW Online, you can search for fuel stations nearby and sort by price or distance.

BMW Online Fuel price display in the CID

Send to Mail - With the Send to Mail application, you can email your vehicle's current location and destination to any email address.



BMW Online Send to Mail display in the CID

The F30 will have the updated BMW Online display screen from the start of production. All current BMW vehicles with this option will have these new screens starting December 1, 2011. This will be automatically updated when opening the online features after December 1st on all vehicles.

Changes Starting December 1, 2011

Display Before December 1, 2011

Display Starting December 1, 2011

F30 Entertainment and Communication
6. BMW ConnectedDrive

HOW TO START BMW ONLINE:

For all cars produced before March 2011, and X vehicles produced before April 2011:

Step 1: From the main iDrive menu, select BMW Assist

Step 2: Once in the BMW Assist menu, select BMW Search

Step 3: After a brief moment, the vehicle connects to the BMW Online service

Step 4: You may now see a Welcome screen. If so, select the “Now” text to proceed. Then, you will now be connected to BMW Online

Step 5: Please allow a moment for the service to connect, and then you will see the main menu screen

For all cars produced after March 2011, and X vehicles produced after April 2011:

Step 1: From the main iDrive menu, select ConnectedDrive

Step 2: Once in the ConnectedDrive menu, select BMW Online

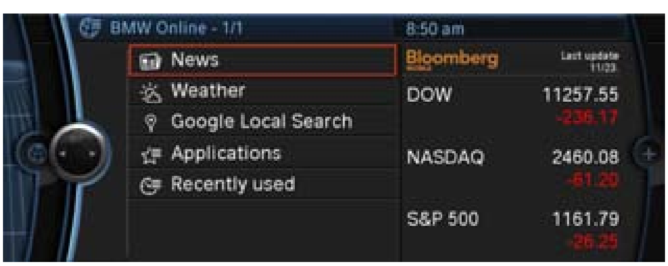
Step 3: After a brief moment, the vehicle connects to the BMW Online service

Step 4: You may now see a Welcome screen. If so, select the “Now” text to proceed. Then, you will now be connected to BMW Online

Step 5: Please allow a moment for the service to connect, and then you will see the main menu screen

6.2. HOW TO ACCESS THE SERVICES

News, Weather, and Google Local Search Once you are connected to the BMW Online service, you will be able to access News, Weather, and Google Local Search directly from the main menu.



BMW Online Main Menu display in the CID

Other Applications (Fuel Prices, Send to Mail) Some Applications are not shown on the main menu and instead are available via the Applications menu. To use these applications, you must add them to your Applications menu.

F30 Entertainment and Communication

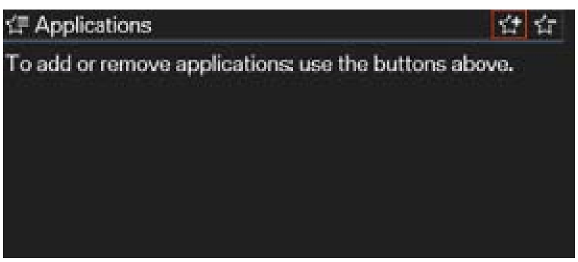
6. BMW ConnectedDrive

HOW TO ADD AN APPLICATION

New applications will be added periodically to BMW Online. In order to get these applications, you must add them via the Applications menu.

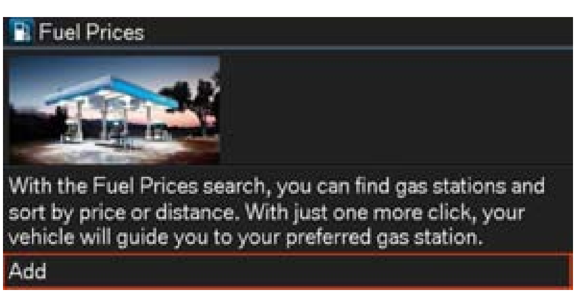
Step 1: Select the Applications menu

Step 2: Select the Applications button from the upper-right corner



Step 3: On the "Add application" menu, select the application to add

Step 4: On the next screen, you will see a description of the application. Select "Add" to add the application.

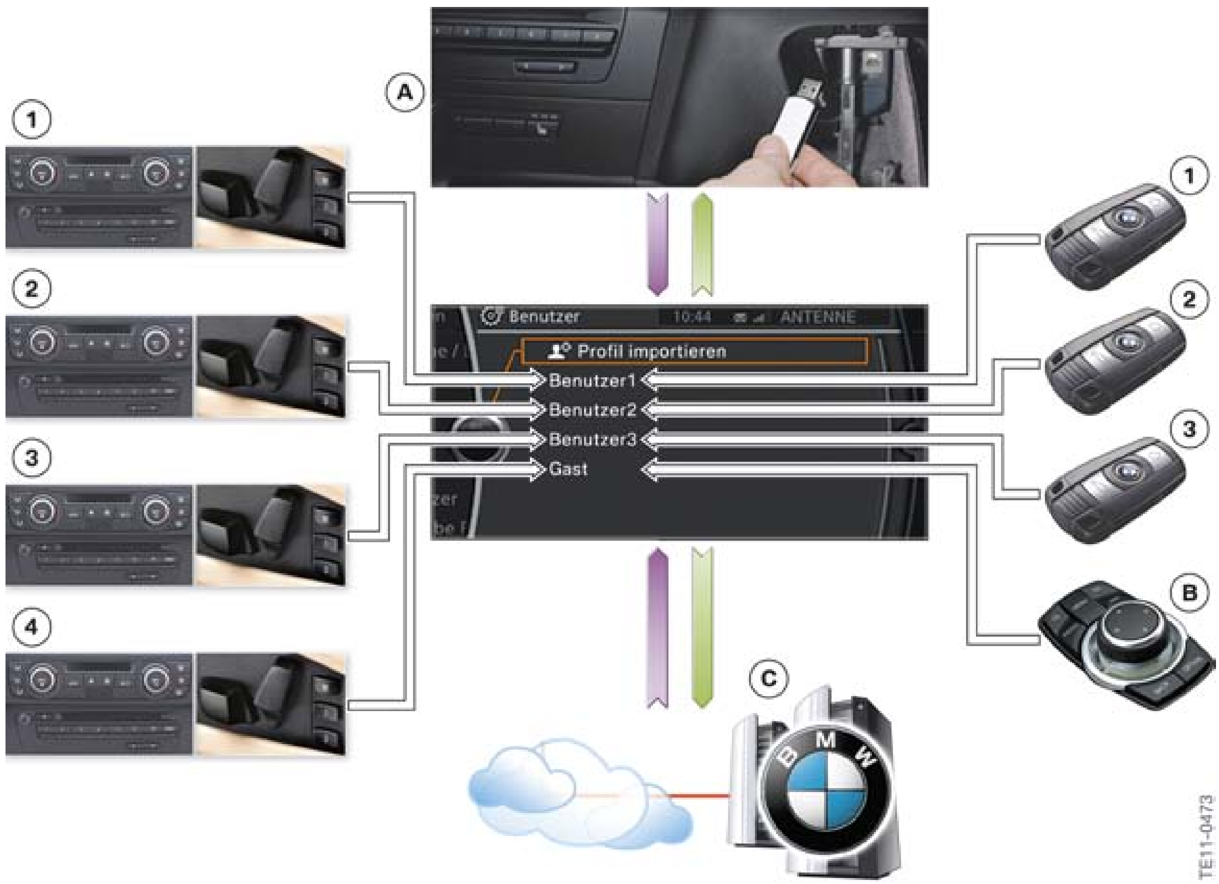


Step 5: You will now be able to access the application, under the "Applications" menu in the main menu.

F30 Entertainment and Communication

7. Personal Profile

Personal Profile stores personally input data, such as e.g. the automatic setting of the exterior mirrors or the speed-dependent volume, in the corresponding control units.



Personal Profile operating principle

Index	Explanation
A	Import/export via USB interface
B	Controller
C	Import/export via BMW Online
1	User profile 1 connected with an ID transmitter
2	User profile 2 connected with an ID transmitter
3	User profile 3 connected with an ID transmitter
4	Guest profile can only be selected via the controller

There is a total of four profiles in the vehicle. Three of these can be adapted for different persons and assigned to different ID transmitters. Once the vehicle is unlocked via the ID transmitter, the system recognizes the profile assigned to the ID transmitter and activates it.

A guest profile can be activated in addition to the three profiles which can be assigned to ID transmitters. The guest profile can be used to make individual settings without affecting the three personal profiles. The guest profile can be activated in the Settings menu in the CID.

F30 Entertainment and Communication

7. Personal Profile

Information for Service:

When receiving a vehicle with Personal Profile, it is important to ensure that the guest profile is activated. In this way, the settings made by the vehicle user are not altered.

Profiles can be imported and exported by means of the USB interface or BMW Online. Which USB port can be used to import and export the profiles is dependent on the vehicle's equipment specification:

Optional equipment	In conjunction with	USB port
Navigation System (option 609)	-	Glove box
Radio (standard)	Hands-free system with USB interface (option 6NH)	Center console
Radio (standard)	Mobile phone preparation with connection for Bluetooth and USB devices (option 6NL)	No import/export via USB possible

Personal profile is always stored in the headunit. Vehicles with navigation (option 609) have a USB port in the glovebox to perform import/export of data.

With the standard radio in combination with the Hands-free system with USB interface (option 6NH), personal profile can be imported/exported through the USB connection in the center console because this is connected to the headunit.

With the standard radio in combination with the Mobile phone preparation with connection for Bluetooth and USB devices (option 6NL) it is not possible to import/export through the USB connection in the center console because this is connected to the Combox and not the headunit.

Exported profiles can also be imported to other vehicles. Which settings of the profiles are adopted during import to another vehicle is dependent on the vehicle model and its equipment specification. During import only settings of functions which are identical in both vehicles are adopted. If a setting cannot be imported, the current setting of the existing profile is retained.

Personal Profile settings in the CID

F30 Entertainment and Communication

8. Navigation

Map updating for navigation is performed in the F30 via a USB interface which is connected to the headunit. The USB port in glove box must be used for map updating. In vehicles with the USB port in the center console, this cannot be used for map updating since the USB is connected to the COM-BOX.

Optional equipment	In conjunction with	Map updating
Navigation System (option 609)	-	USB connection in glove box

F30 Entertainment and Communication

9. Antenna Systems

The F30 has different antenna systems, depending on the national-market version and optional equipment used:

Antenna	System	Location
FM/AM antenna	Radio	Lower
SDARS antenna	Radio	Roof
GPS antenna	Navigation system or Combox	Roof antenna
Remote control services antenna	CAS (remote control services)	Partition wall of luggage compartment, top
Bluetooth antenna	Telephone	Wiring harness
Emergency call antenna	Telematics services	Partition wall of luggage compartment, top

Antenna diversity is used in vehicles with Navigation system (optional equipment 609), while phase diversity is used in vehicles with the standard radio equipment.

The remote control service Antenna and the emergency call antenna are located above at the partition wall to the luggage compartment in the F30.

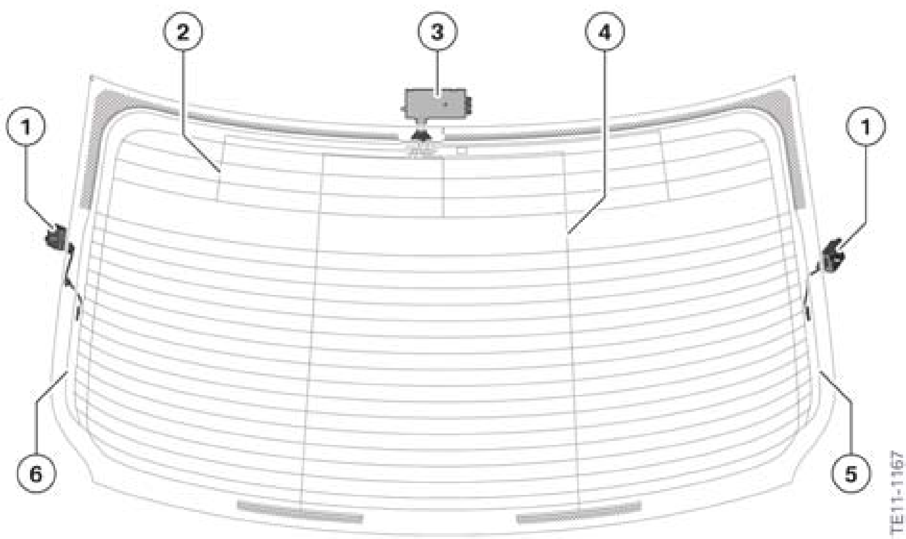
The following graphic provides an overview of the antenna system components.

F30 Antenna system

9. Antenna Systems

Index	Explanation
1	Roof antenna
2	Antenna diversity/Phase diversity
3	Wave trap, heated rear window
4	Emergency call antenna
5	Remote control services antenna
6	Interference suppression filter, audio/additional brake light

You can see the layout of the antennas in the rear window on the following graphic.

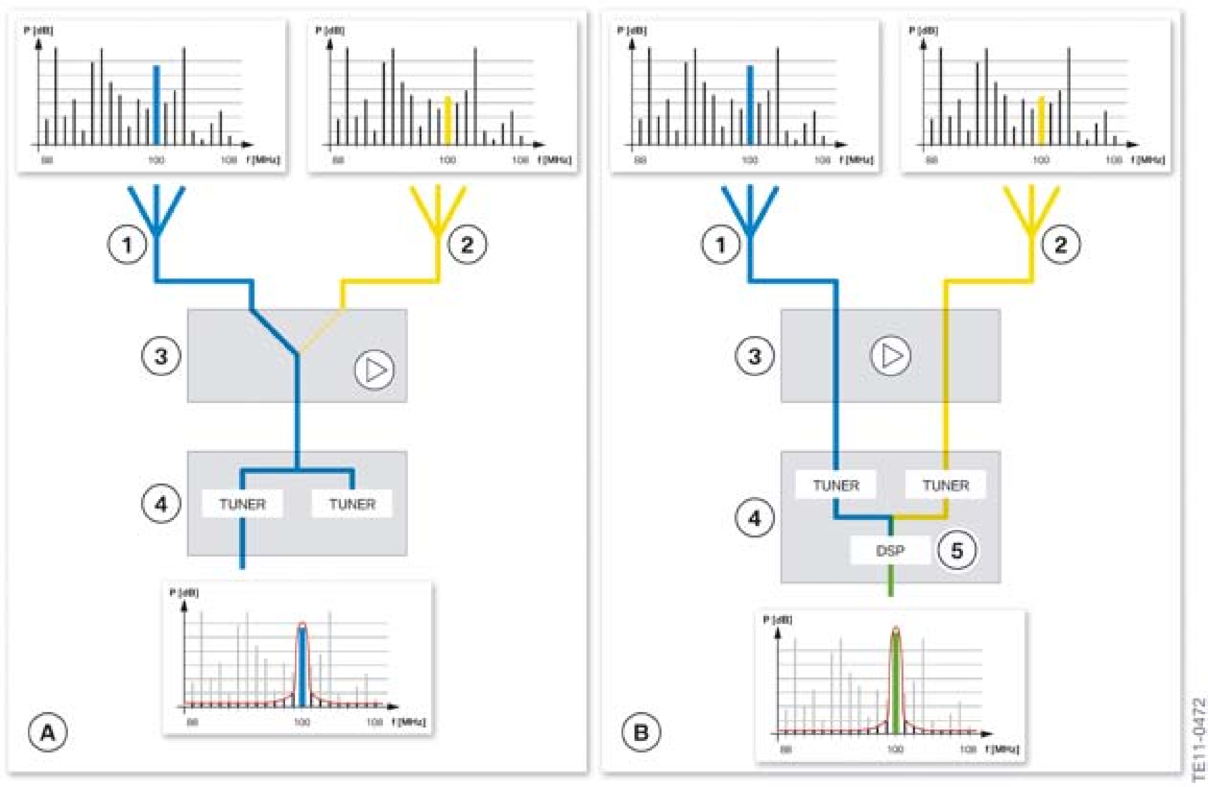


F30 Antenna system, rear window

Index	Explanation
1	Connection of heated rear window to wave trap
2	AM antenna
3	Antenna diversity/Phase diversity
4	DAB Band III antenna (not US)
5	Antenna FM1
6	Antenna FM2

9. Antenna Systems

9.1. Antenna and phase diversity



Operating principle, antenna and phase diversity

Index	Explanation
A	Antenna diversity with (option 609) Navigation
B	Phase diversity (standard radio)
1	Antenna signal strong
2	Antenna signal weak
3	Diversity including amplifier
4	Tuner module in headunit
5	Digital signal processor (DSP)

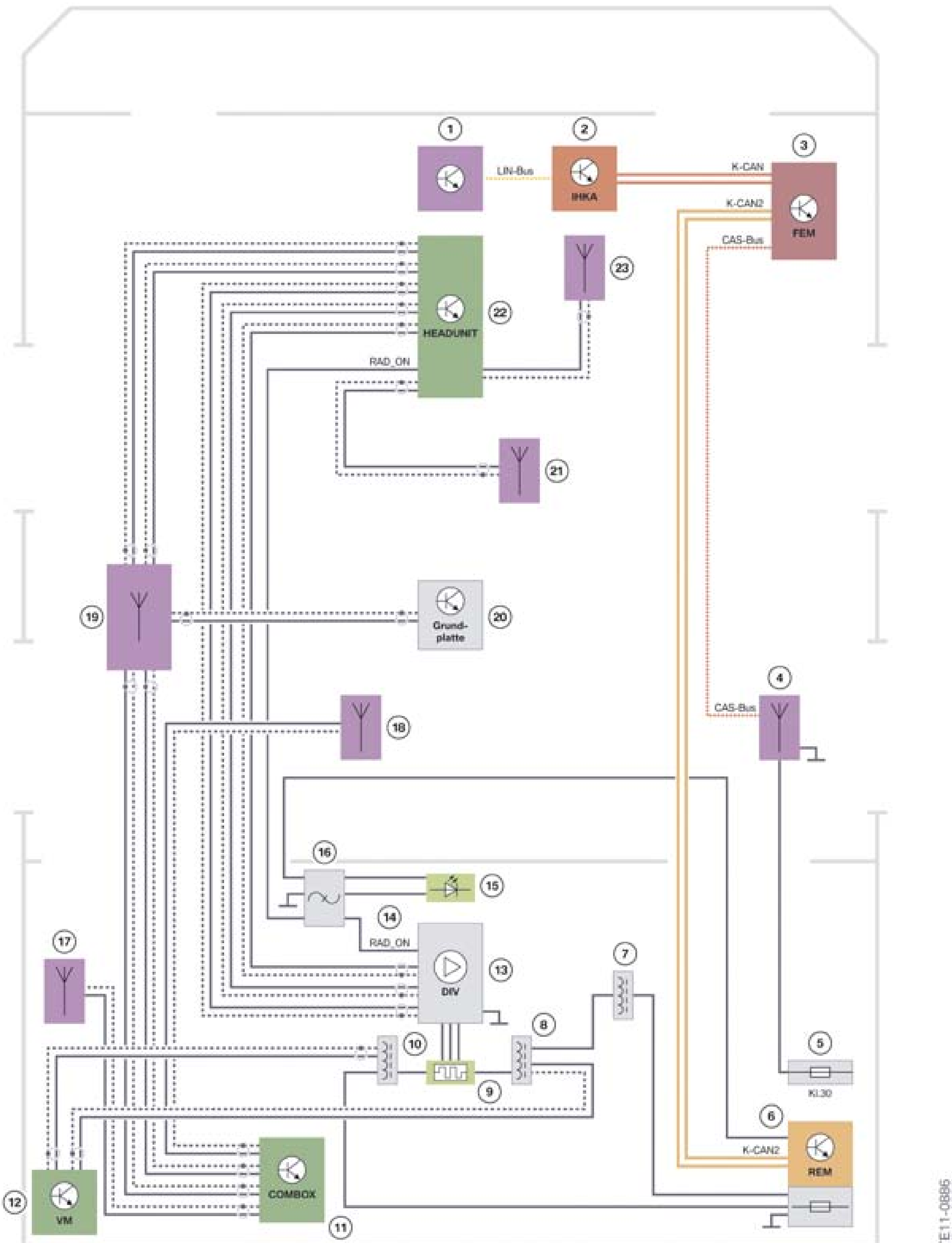
Vehicles with Navigation (option 609) are equipped with antenna diversity. The antenna diversity boosts the signals of the two FM antennas and evaluates the signal levels of the two radio signals. The antenna with the better input signal is used for radio reception. The system switches to the other FM antenna if the signal quality of the received radio station is inadequate in terms of quality and field strength. The switch-on signal for the antenna diversity and the power supply is made available to the antenna diversity via the interference suppression filter of the additional brake light.

Vehicles with the standard radio equipment are equipped with phase diversity. The radio signals of the two FM antennas are boosted in the phase diversity module and transmitted to the Basic headunit. The radio signals are digitized in the Basic headunit. An improved signal is then calculated from the two radio signals with the aid of an algorithm in a digital signal processor (DSP). The switch-on signal for the phase diversity and the power supply is made available by the headunit. For updating the list of stations only the signal from one antenna is used briefly for radio reception and the signal from the other antenna is used for scanning the frequencies. The interval for updating the list of stations depends on the signal quality of the stronger antenna, but occurs at the latest every four minutes.

9.2. Bluetooth Antenna

The Bluetooth antenna for the F30 is conceived as an open item and supplied as part of the wiring harness. A non-connected antenna can no longer be identified by this design. In vehicles which do not have a Combox the Bluetooth antenna is located under the center console. In vehicles which do have a Combox the Bluetooth antenna is located in the area of the left C-pillar

9.3. System wiring diagram



System wiring diagram, antennas in the F30

9. Antenna Systems

Index	Explanation
1	Operating facility, integrated automatic heating / air conditioning (IHKA)
2	Integrated automatic heating / air conditioning (IHKA)
3	Front Electronic Module (FEM)
4	Remote control services antenna
5	Power distribution box, luggage compartment
6	Rear Electronic Module (REM)
7	Wave trap, heated rear window
8	Connection of heated rear window to wave trap
9	Heated rear window
10	Connection of heated rear window to wave trap
11	Combox
12	Video Module (not US)
13	Antenna/phase diversity (with amplifier)
14	Line for switch-on signal (only in vehicles with antenna diversity)
15	Additional brake light
16	Interference suppression filter, additional brake light
17	Bluetooth antenna in vehicles with COMBOX
18	Emergency call antenna
19	Roof antenna (telephone, SDARS and GPS)
20	Base plate
21	Bluetooth antenna in vehicles without COMBOX
22	Headunit
23	Antenna in inside mirror (VICS) (for Japan only)

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Technical training.
Product information.

F30 Passive Safety Systems

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BMW Group University
Technical Training
ST1113 12/1/2011

BMW Service

General information

Symbols used

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

⚠

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

Information status and national-market versions

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

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

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

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Passive Safety Systems
Contents

F30 Passive Safety Systems

Contents

F30 Passive Safety Systems

1. Introduction

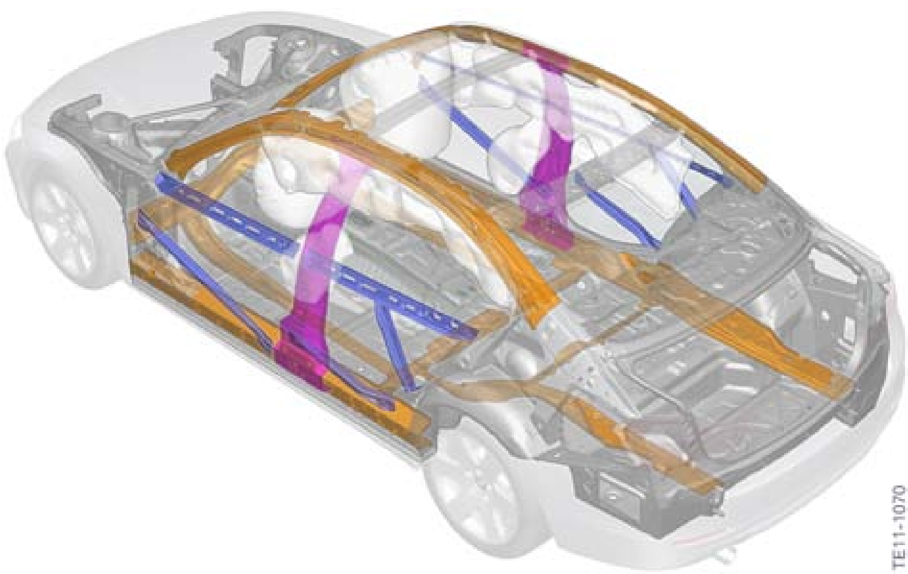
1.1. The hidden protector

The passive safety system of the F30 is based on the objectives and characteristics of current BMW models. The passive safety system fulfils all legislative requirements worldwide.

For this, extensive measures were performed on the body and on the occupants' safety and protection systems. In addition to the restraint system, a special body structure with a defined crash behavior is also part of the passive safety system. In the event of an accident, the forces introduced are reduced in a defined manner and therefore have less of an impact on the occupants.

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

The 4th generation Advanced Crash Safety Module ACSM is used as the central airbag control unit for the passive safety system in the F30. The central sensor system is incorporated in the ICM.



F30 Passive safety system

F30 Passive Safety Systems
2. Models

2.1. Overview

In the 4th generation, the passive safety system is installed as a Crash Safety Module in the F30. The following table provides an overview of the versions installed for different models:

Series	Model	Used as of	Version
E60	5-Series Sedan	09/2005	ACSM 1
E61	5-Series Touring	09/2005	ACSM 1
E85	Z4 Roadster	01/2006	ACSM 1
E86	Z4 Coupé	05/2006	ACSM 1
E87	1-Series 5-door	04/2004	MRS 5
E88	1-Series Convertible	04/2008	ACSM 2
E90	3-Series Sedan	03/2005	MRS 5
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 Sedan	11/2008	ACSM 3
F02	7-Series Sedan long version	11/2008	ACSM 3
F07	5-Series Gran Turis-mo	10/2009	ACSM 3
F10	5-Series Sedan	03/2010	ACSM 3
F25	X3 SAV	11/2010	ACSM 4
F12	6-Series Convertible	03/2011	ACSM 4
F20	1-Series 5-door	09/2011	ACSM 4
F30	3-Series Sedan	02/2012	ACSM 4

F30 Passive Safety Systems

3. System Overview

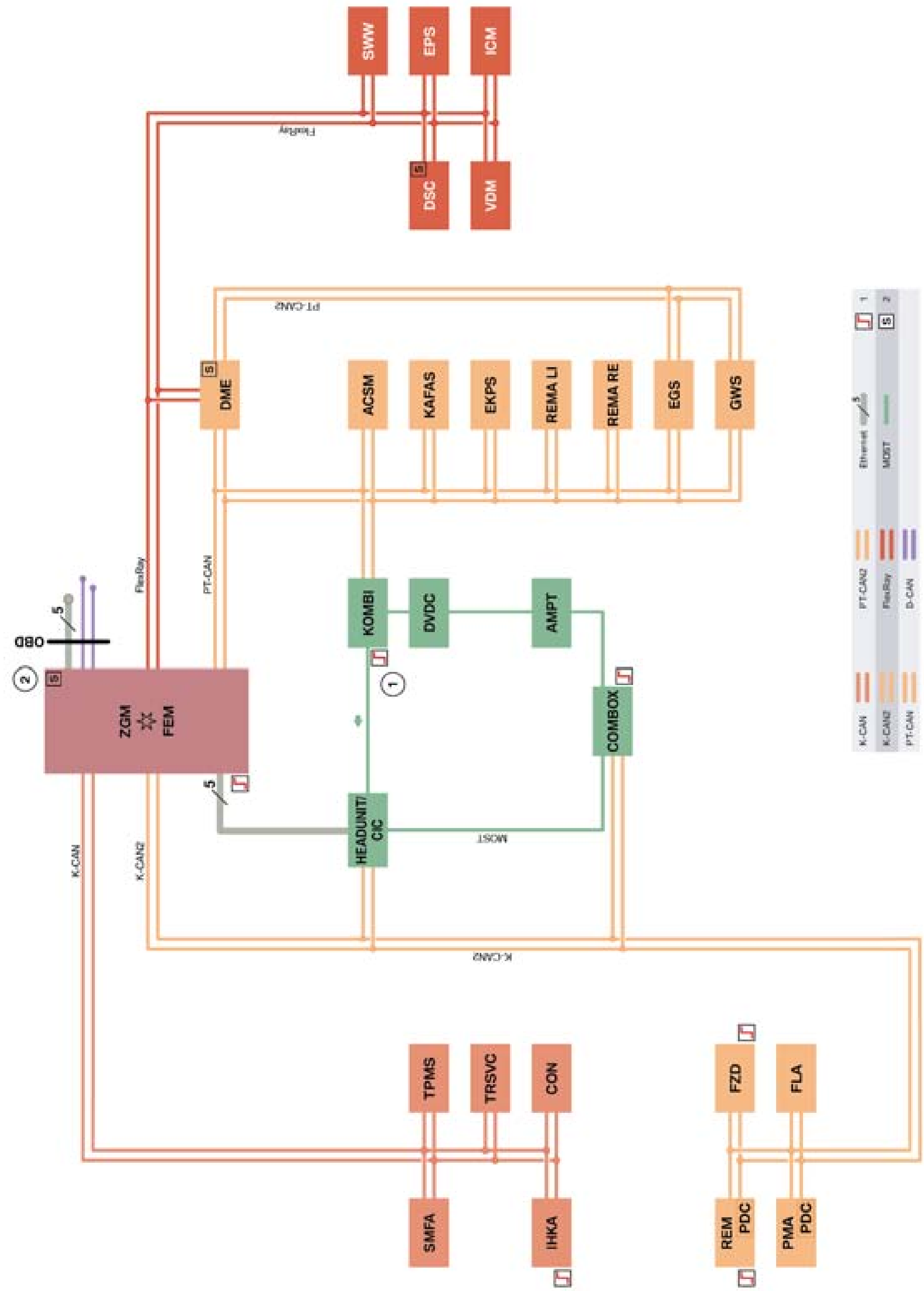
3.1. System wiring diagrams

The following bus overview shows the vehicle circuit structure of the F30 and incorporation of the modules on the PT-CAN.

F30 Passive Safety Systems

3. System Overview

3.1.1. Bus overview



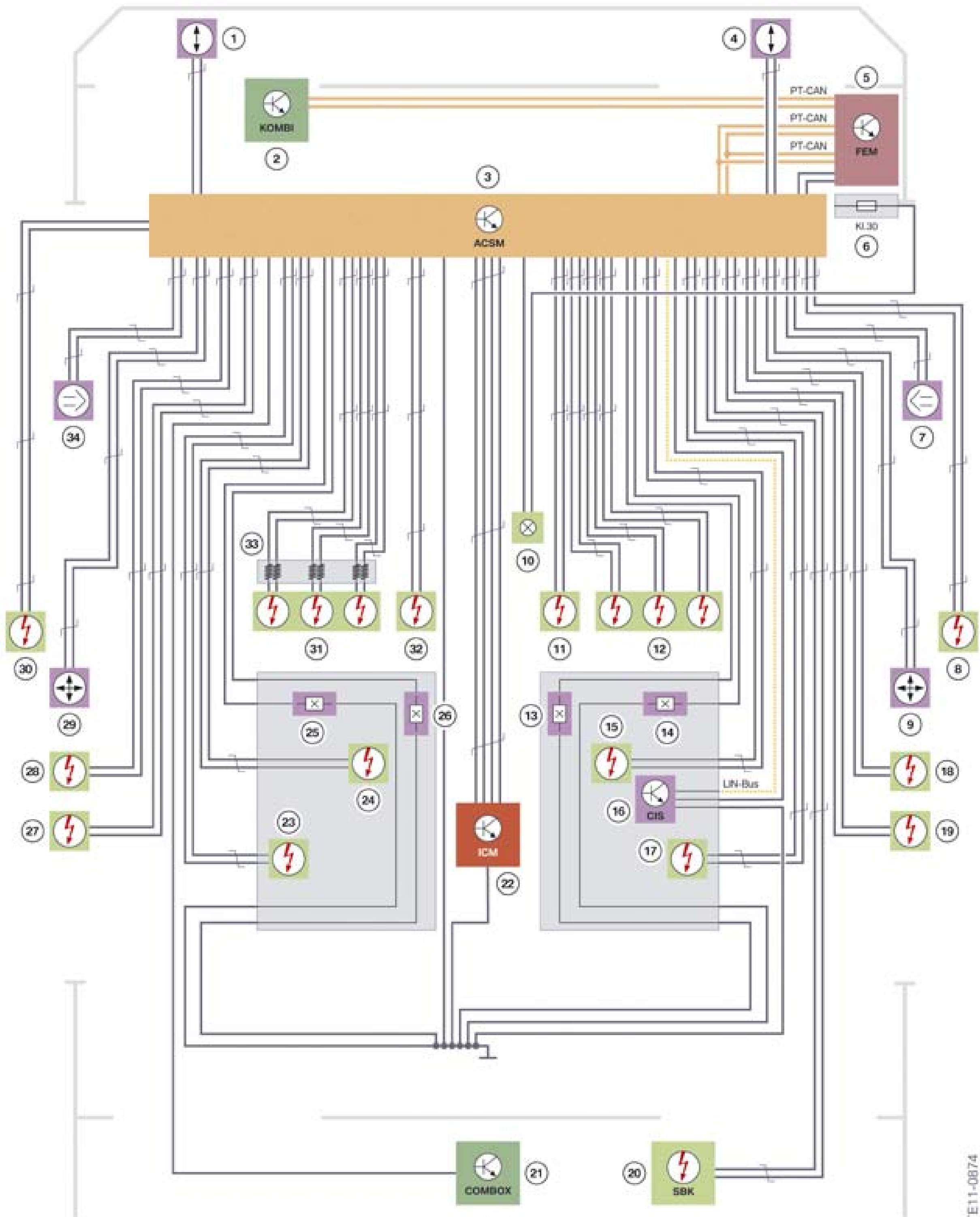
F30 Bus overview

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top-HiFi amplifier
COMBOX	Combox (Combox emergency call, Multimedia Combox)
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DME	Digital Engine Electronics (DME)
DSC	Dynamic Stability Control
DVDC	DVD changer
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EPS	Electromechanical Power Steering
Ethernet	Cable-based data network technology for local data networks
FEM	Front Electronic Module
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector lever
HEADUNIT/CIC	Headunit (Car Information Computer or Basic headunit)
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
K-CAN	Body controller area network
K-CAN2	Body controller area network 2
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (MOST only with option 6WA)
MOST	Media Oriented System Transport
OBD	On-board diagnosis (diagnostic socket)
PDC	Park Distance Control (with option 5DP, parking manoeuvring assistant: integrated in the parking manoeuvring assistant control unit, otherwise integrated in the Rear Electronic Module control unit)
PMA	Parking manoeuvring assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
RAD	Radio

3. System Overview

Index	Explanation
REM	Rear Electronic Module
REMA LI	Reversible electromotive automatic reel, left (not US)
REMA RE	Reversible electromotive automatic reel, right (not US)
SMFA	Seat module, driver
SWW	Lane change warning
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for all-round vision camera
VDM	Vertical Dynamics Management
ZGM	Central gateway module

3.1.2. System wiring diagram



F30 System wiring diagram

3. System Overview

Index	Explanation
1	Front sensor, left engine support
2	Instrument cluster
3	Crash Safety Module
4	Front sensor, right engine support
5	Front Electronic Module (FEM)
6	Terminal 30
7	Airbag sensor, door, right (pressure)
8	Head airbag, front passenger
9	Acceleration sensor, B-pillar on right
10	Indicator lamp for front passenger airbag deactivation in roof function center
11	Knee airbag, front passenger
12	Front passenger airbag, two-stage with ventilation
13	Seat belt buckle contact, front passenger
14	Seat-position sensor, front passenger
15	Seat belt buckle tensioner, front passenger
16	Seat occupancy mat, CIS mat
17	Side airbag, front passenger
18	Automatic tensioner, front passenger
19	Adaptive belt force limiter, front passenger (not US)
20	Safety battery terminal
21	COMBOX
22	Integrated Chassis Management
23	Side airbag, driver's side
24	Seat belt buckle tensioner, driver
25	Seat-position sensor, driver (not US)
26	Seat belt buckle contact, driver
27	Adaptive belt force limiter, driver (not US)
28	Automatic tensioner, driver
29	Acceleration sensor, B-pillar on left
30	Head airbag, driver
31	Driver's airbag, two-stage with ventilation
32	Knee airbag, driver
33	Clock spring
34	Airbag sensor, door, left (pressure)

F30 Passive Safety Systems

4. Functions

4.1. Functions of Crash Safety Module

The function of the Crash Safety Module is to permanently evaluate all sensor signals in order to identify 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.

The ACSM evaluates the information from the sensors and then forwards corresponding measures for selective activation of the necessary restraint systems.

The Crash Safety Module monitors the system itself and indicates when it is ready for operation by switching off the airbag indicator light.

If an error occurs during operation this is stored in a fault memory. and can be read out for diagnosis purposes.

If a crash situation is detected, a crash message is sent to the other bus users in the data bus network as notification. The relevant control units respond to this signal by executing their own activities according to the severity of the crash.

The activities include:

- Opening the central locking system
- Activating the hazard warning flasher
- Switching on the interior light
- Deactivating the electric fuel pump
- Making an emergency call.

An additional function of the Crash Safety Module is the acoustic seat belt warning that reminds the driver and front passenger using visual and acoustic signals to fasten their seat belts. Seat belt buckle switches are used to identify whether the driver and/or the front passenger have their seat belts fastened. Information on occupancy of the front passenger seat is also included for the acoustic seat belt warning. Furthermore the position of the driver and the front passenger seat is monitored.

The functions of the Crash Safety Module generally belong to one of the following areas:

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

4.2. Crash-relevant functions

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

- Evaluating the sensor signals
- Crash detection
- Determining actuators to be activated
- Specifying the trigger time and trigger sequence

- Activation of the ignition circuit output stages
- Sending the crash message to all bus users
- Crash documentation
- Emergency call function.

4.2.1. Evaluating the sensor signals

The sensors serve to identify and verify head-on, side-on and rear-end crashes and also as roll-over detection.

The sensors are directly connected to the Crash Safety Module where their signals are evaluated and processed.

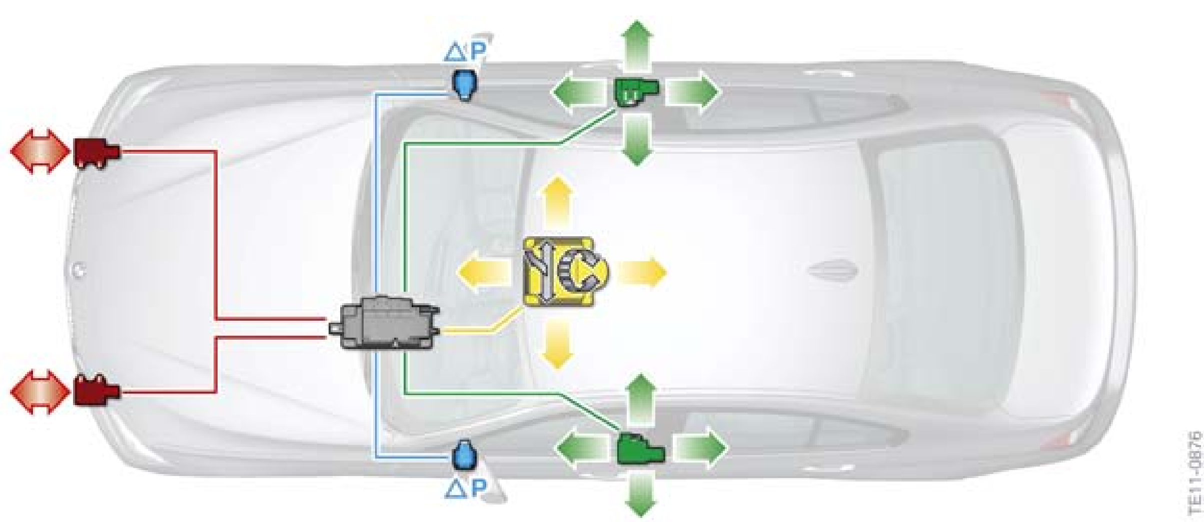
4.2.2. Crash detection

All F30 vehicles are equipped with the following sensors:

- One lateral and one longitudinal acceleration sensor in the B-pillars (green)
- One airbag sensor to monitor the pressure in each of the front doors (blue)
- One lateral and one longitudinal acceleration sensor in the ICM (yellow)
- One roll rate sensor in the ICM (yellow)
- One vertical acceleration sensor in the ICM (yellow)
- One front sensor on each of the engine supports (red).

The airbag sensors in the car doors assist with the identification of a side-on crash.

The front sensors on the engine supports assist with the identification of a head-on crash and the corresponding severity.



F30 Sensors

4.2.3. Trigger time and trigger 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 head-on crash, corresponding high acceleration values from the longitudinal acceleration sensors in the B-pillar and ICM respectively must be detected for example. An algorithm uses the accelerations to calculate the severity and direction of the crash. This information is used to assist calculation of the trigger times and sequence in which the restraint systems are activated.

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

4.2.4. Activation of the ignition circuit output stages

The Crash Safety Module is supplied by the FEM with terminal 30B. The Crash Safety Module is in offline mode with terminal 30B. This means that it is active on the data bus and can perform all diagnostic functions. Triggering of the ignition circuits is blocked and is only enabled as of terminal 15 once the system self-test is complete. The Crash Safety Module is also ready for ignition, even with the logical terminal R after engine off.

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

The ignition circuit output stages consist of a high-side and a low-side power switch. The high-side power switch connects the ignition voltage, while the low-side power switch connects to the ground. The ignition circuit output stages are controlled by a microcontroller.

The high-side and low-side power switches also serve to check the ignition circuits during the system self-test.

4.2.5. Sending the crash message

In the event of a collision involving activation of the restraint systems, the Crash Safety Module sends a crash message to the bus users in the bus-system network. In tandem with this, the Combox is prompted to send an emergency call via a direct single-wire connection.

As a result, 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
Release central locking system	Front Electronic Module (FEM) All Doors Rear Electronic Module (REM) Tailgate/Trunk
Switch on hazard warning flashers	Front Electronic Module (FEM) Rear Electronic Module (REM)
Switch on interior light	Front Electronic Module (FEM) Rear Electronic Module (REM)
Send emergency call	Combox

4.2.6. Crash documentation

In the event of a collision where one or more actuators are activated, a crash entry is stored in a non-erasable memory. After three crash entries, a non-erasable fault entry is stored in the fault memory together with the information that the three crash messages have been saved. The airbag indicator light also lights up continuously.

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The three crash entries could also be stored during the course of an accident. Each crash entry is assigned a system time. The control unit remains capable of firing even after three crash entries. The crash entries cannot be erased and serve the purpose of subsequent device diagnosis. 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 with the BMW Assist. This means an appropriate service provider with a call center must be available. A telephone network must also be available in order to be able to make an emergency call.

The BMW Assist optional equipment (option 6NL) must be installed for the emergency-call function to be available.

Manual emergency call

Drivers who are not directly involved in the accident can use the manual emergency call to request assistance.

The emergency call button is located in the roof function center and is connected to the Combox directly.

Voice contact with the relevant service provider for the country is established by pressing the emergency call button. The voice contact is indicated by a flashing LED in the switch.

Automatic emergency call

The Crash Safety Module sends a message to the Combox in the event of an accident with corresponding crash severity. The Combox sends an emergency call, and also the location of the vehicle if available.

Attempts are made at the same time to establish a voice contact with the occupants of the vehicle in order to obtain more detailed verbal information about the accident (e.g. condition of occupants). Further rescue operations can be initiated accordingly.

Advanced Automatic Crash Notification

In addition, the Advanced Automatic Crash Notification function features in vehicles with BMW Assist.

The data from different sensors is transferred to the call center in the case of an emergency call, for example the status of the belt contacts to determine the number of persons in the vehicle or sensor data on the severity of the crash to obtain the probability of risk of injury.

The emergency call contains additional specific information on the circumstances of the accident. This means that more precise information regarding the accident and risk of injury is therefore available at the call center and can be forwarded to the emergency coordination center. The emergency coordination center can then initiate appropriate measures.

4.3. System-monitoring functions

The Crash Safety Module has the following system-monitoring functions:

- System self-test (pre-drive check)
- Display of system operability
- Cyclic monitoring
- Fault display and fault storage
- Output of faults (diagnosis)
- Acoustic and visual seat belt warning
- Deactivation of the front passenger airbag and side airbag and knee airbag on the front passenger side.

4.3.1. System self test

The Crash Safety Module performs a system self test from terminal 15. The airbag indicator light is energized for roughly five seconds during the system self test.

Once the system self test is complete and no faults have been identified, the airbag indicator light goes out and the system is ready to operate.

4.3.2. Display of system operability

The airbag indicator light in the instrument panel goes out to indicate that the Crash Safety Module is ready for operation.

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. This cyclical monitoring serves the internal diagnosis of the control unit and overall airbag system. Cyclical monitoring takes place continuously from terminal 15. This also continues when logical terminal R is reached after the engine is switched off.

4.3.4. Fault display and fault storage

The Crash Safety Module has a non-volatile fault memory. The airbag indicator light lights up to indicate a fault entry.

Events, such as the activation of an airbag or seat belt buckle tensioner, are also stored in the fault memory.

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If the fault memory contains the entry that the restraint system has been activated, this only means the ignited restraint system is not available for further activation and not that it malfunctioned during the crash.

4.3.5. Output of faults (diagnosis)

The fault memory can be read out via the diagnostic interface with the assistance of the Integrated Service Technical Application ISTA in the BMW diagnosis system. After rectifying the faults or after renewing activated components, the fault memory can be cleared with the diagnosis command "Clear fault memory".

4.3.6. Acoustic and visual seat belt warning

An acoustic and visual seat belt warning is a standard feature of all vehicles equipped with the Crash Safety Module. The Crash Safety Module records whether or not the driver or front passenger have fastened their seat belts. If they have not, an acoustic and visual warning is output to remind them to fasten their seatbelts. Both seat belt buckle switches are monitored separately.

4.3.7. CIS Mat

Provision is made in the F30 for the airbag to be deactivated automatically in order to satisfy the regulations of the National Highway Traffic Safety Administration NHTSA. When the child seats listed in the regulation are occupied by a child this must lead to deactivation of the airbag.

To do so, a seat occupancy mat is used on the front passenger seat for the purpose of occupancy detection and classification of occupants in the front passenger seat. A further development of the Occupant Classification 3 mat (OC3 mat), the Capacitive Interior Sensing Mat (CIS mat) is used in the F30.

The CIS mat is made up 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 ohmic resistance between the sensor wire (anode) and the vehicle ground (cathode) at a frequency of 120 kHz. The CIS mat determines from the change in capacity and resistance whether the front passenger seat is occupied by an adult or a child in a child seat.

The deactivation of the front passenger airbag, the 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 lights up if a child seat with child for e.g. a child restraint system that has been tested in accordance with the NHTSA regulations and is holding a small child is detected on the front passenger seat or if the front passenger seat is unoccupied.

The display brightness is controlled by automatic regulation of the display illumination.

5. System Components

5.1. Crash Safety Module

The Crash Safety Module is accommodated in a housing with two sockets.

The wiring harness is connected via one of the sockets. An additional socket is provided for the cockpit wiring harness.

F30 Crash Safety Module

The Crash Safety Module is located in the F30 on the supporting structure of the cockpit module on the driver's side.

The Crash Safety Module no longer contains any sensors. The sensors are located in the ICM on the transmission tunnel.

5.2. Sensors and switches

The following sensors and switches are installed:

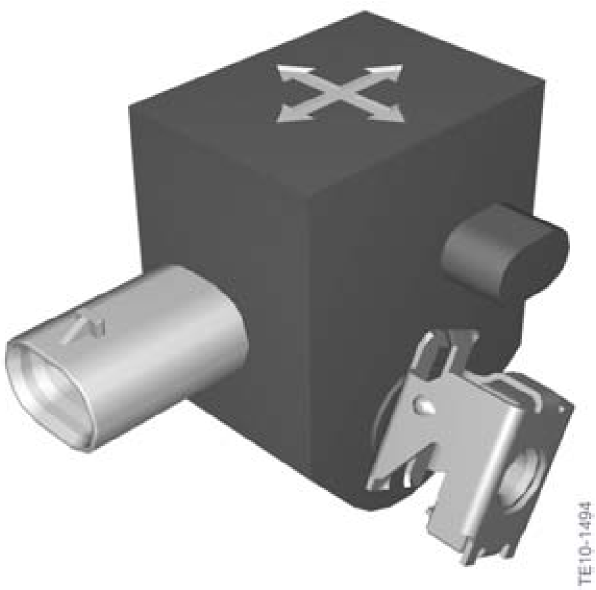
- Lateral and longitudinal acceleration sensors in ICM
- Roll rate sensor in the ICM
- Vertical acceleration sensor in the ICM
- Lateral and longitudinal acceleration sensors on the B-pillars
- One airbag sensor for pressure in each of the front doors (blue)
- One front sensor on each of the engine supports
- CIS mat with occupant classification

- Seat belt buckle switch
- Seat-position sensor, front passenger
- Emergency call button

5.2.1. Lateral and longitudinal acceleration sensor, B-pillar

The lateral and longitudinal acceleration sensors in the B-pillars assist with the identification of head-on crashes, side-on crashes and rear-end crashes.

The B-pillar airbag sensor consists of a longitudinal acceleration sensor and a lateral acceleration sensor. The acceleration sensors measure both the acceleration and the deceleration in the X and Y directions. The resultant from the X and Y signals is decisive in identifying the direction of the crash. The airbag sensors in the B-pillar assist with the identification of head-on, side-on and rear-end crashes. The B-pillar airbag sensors on the left and right are of identical design and are allocated by way of mechanical coding during installation.

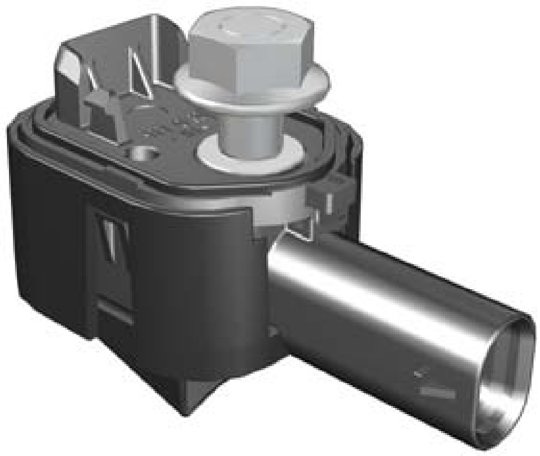


F30 Lateral and longitudinal acceleration sensor, B-pillar

5.2.2. Door airbag sensor (pressure)

Pressure sensors are installed in the driver and front passenger doors. Side crashes are identified with the assistance of the airbag sensors. In addition to the lateral acceleration values that are present, the pressure in the door cavity also increases in the event of a side-on crash.

The airbag sensors in the doors serve to verify the plausibility of the acceleration signals from the B-pillar airbag sensors and the ICM when a side crash is detected. The airbag sensors are situated in the inner panel of the doors and measure the increase in pressure in the event of a side collision. In the event of a side collision with the door, the outer panel is pressed inward, thus reducing the volume and increasing the pressure in the door interior. This pressure change is measured by the airbag sensors. The airbag sensor also includes electronics, in addition to the pressure sensor, that digitize the pressure readings and transmit them cyclically to the Crash Safety Module. The data is transferred in the same way as the B-pillar airbag sensors. The pressure readings are evaluated in the Crash Safety Module.


TE11-1068

F12/F13 door airbag sensor (pressure)

5.2.3. Front sensor

Two front sensors are installed in the front area of the engine support. The measured values are forwarded to the Crash Safety Module where they are evaluated.

The sensors in the front area of the side member on the left and right assist with identification of a head-on crash.

They deliver additional information to the crash safety module on the characteristics and severity of the collision. Each sensor contains an acceleration sensor for recording the deceleration, signal processing technology and an ASIC for data transfer. The measured values are sent in the form of a data telegram to the crash safety module and are used in the calculation of the algorithm.


TE08-1056

F30 Up-front sensor engine support

5.2.4. Sensors in the ICM

The ICM control unit is located centrally on the transmission tunnel. In addition to the driving dynamics control sensors, the ICM in the F30 also incorporates longitudinal and lateral acceleration sensors for crash detection.

In order for the ICM to be able to transmit the sensor data directly to the ACSM 4, it is connected to the latter via two lines. The transmitted data is evaluated in the ACSM 4.

The sensor data of the roll rate sensor and the vertical acceleration sensor is transmitted to the ACSM via the two additional lines.

The sensor data of the ICM helps the ACSM 4 identify side-on, rear-end or head-on crashes and assists with roll-over detection.

F30 ICM

Index	Explanation
1	ICM control unit

5.2.5. CIS mat

The capacitive interior sensing mat (CIS mat) is fitted in the front passenger seat instead of the seat occupancy mat. The CIS mat can detect whether the front passenger seat is occupied by an adult or a child in a child seat. The deactivation of the front passenger airbag and side airbag and knee airbag on the front passenger side is signalled by the indicator lamp for front passenger airbag deactivation.

5.2.6. Seat belt buckle switch

The seat belt buckle switch detects whether the seat belt buckle tongue is in the seat belt buckle. The Crash Safety Module supplies power to the sensors and performs the evaluation.

From terminal 15, the seat belt buckle switch is permanently monitored and used for the visual and acoustic seat belt warning and also to determine which restraint systems are triggered.

F30 Seat belt buckle switch

5.2.7. Emergency call button

The emergency call button is located in the roof function center.

F30 Roof function center with emergency call button

5.2.8. Seat-position sensors

In accordance with the US legal requirement (FMVSS208), a height identification for the person in the driver and front passenger seat must be effected. This height identification is effected via the adjustment travel of the forward/back seat adjustment. In US-version vehicles, the exact position is identified using the seat-position sensors for the driver and front passenger seats. For vehicles with an electric seat adjustment with memory (option 459), the seat position on the driver's side is transferred from the seat module on the driver's side to the ACSM.

The job of the seat-position detector is to distinguish between a relatively small person and a person of normal height within the lengthways adjustment range of the seat. This detection is another technical feature aimed at increasing the safety of the occupants. The deployment of the two airbag stages and the adaptive vent valve is then adjusted to the driver's/front passenger seat position.

The seat-position detector takes the form of a 2-wire Hall-effect sensor and is supplied with power via the ACSM control unit. The current level of the seat-position sensor changes depending on the seat position or the distance of the seat-position sensor to the permanent magnet.

5.3. Actuators

5.3.1. Overview

The following actuators are installed in the F30:

- Two-stage driver's airbag with active vent valve
- Two-stage driver's airbag with active vent valve
- Knee airbag on front left and right
- Head airbag on left and right
- Side airbag on front left and right
- Seat belt buckle tensioner on front left and right
- Automatic tensioner with linear force limiter
- Automatic tensioner with adaptive force limiter
- Safety battery terminal.

In addition, the following indicator lights inform the vehicle occupants about the condition of the safety systems:

- Airbag indicator light
- Seat belt warning light
- Indicator lamp for front passenger airbag deactivation.

F30 Passive Safety Systems

5. System Components

The following graphic shows the airbags in the activated state. Depending on the type of crash, only specific airbags are activated.

F30 Airbags

The familiar three-point seat belts are used as the seat belt systems in the F30.

F30 Seat belt

Index	Explanation
1	Seat belt buckle tensioner
2	Reversible motor-driven reel ReMA (not US)
3	Automatic reel/Automatic tensioner

The following table provides an overview of the actuators of the seat belt systems:

	Seat belt tensioner	Automatic reel	Force limiter	Reversible motor-driven reel
F30 Vehicles	Yes	Yes	Linear	No

5.3.2. Driver's airbag

The purpose of the driver's airbag is to reduce the risk of injury to the driver in combination with the seat belt when a head-on crash occurs. The driver's airbag is located in the steering wheel impact plate. The driver's airbag is equipped with a gas generator.

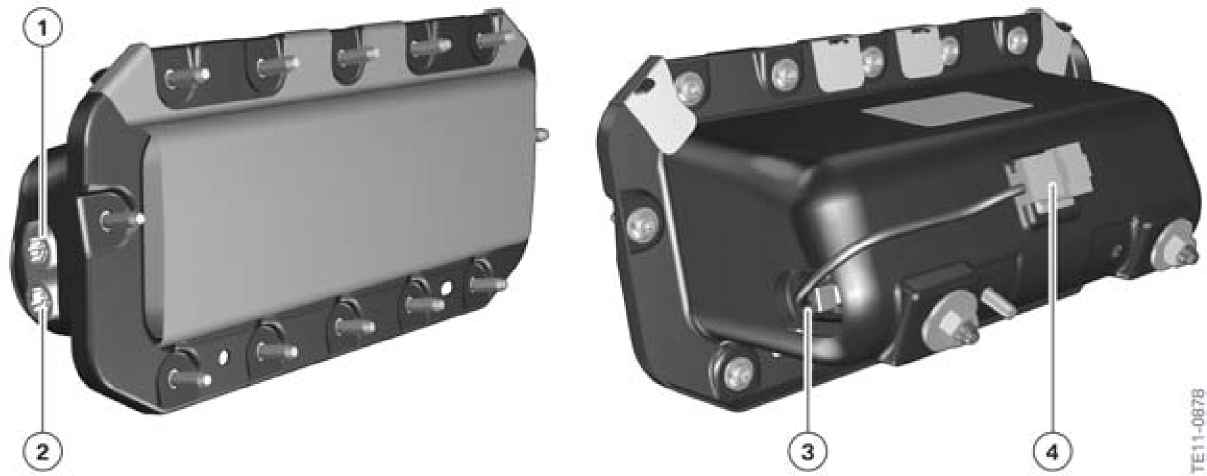
A two-stage generator is installed which can be used to activate the stages at short or long time differences, depending on the severity of the crash detected and taking into consideration the seat position.

Furthermore, the driver's airbag features an active vent valve.

5.3.3. Front passenger airbag

The purpose of the front passenger airbag is to reduce the risk of accident to the front passenger in the event of a head-on crash. The front passenger airbag is located in the dashboard. When the front passenger airbag expands, the dashboard tears open at defined points. The front passenger airbag opens towards the windscreen, emerges in the upwards direction and is supported on the windscreen and dashboard. The front passenger airbag is equipped with a gas generator.

A two-stage generator is installed which can be used to activate the stages at short or long time differences, depending on the severity of the crash detected and taking into consideration the seat position.



F30 Front passenger airbag

Index	Explanation
1	Ignition squib
2	Ignition squib
3	Vent valve
4	Vent valve connection

Furthermore, the front passenger airbag features an active vent valve.

5.3.4. Knee airbag

The driver's side knee airbag and front passenger side control the forwards displacement of the occupant(s) in the event of a head-on crash.

F30 Knee airbags

Index	Explanation
1	Knee airbag, driver's side
2	Knee airbag, front passenger side

5.3.5. Head airbag

Head airbags are installed in the F30 to protect the occupants' heads in the event of a side collision.

The head airbag extends from the A-pillar to the C-pillar and covers the entire area of the side windows. It expands between the occupants and side structure.

System features:

- Extended covered area across all front and rear side windows
- Protection of occupants from glass splinters
- Covered area for different-sized occupants optimized.

F30 Head airbag

5.3.6. Side airbag, front

As with all current models, the side airbag at the front ignites out of the front seat backrest.

The side airbags and gas generators are accommodated in a plastic housing, the airbag module. This is installed in the front seat backrest and is concealed by the seat cover.

If activated, the side airbag emerges outwards from the backrest frame and spreads between the side structure and occupant.

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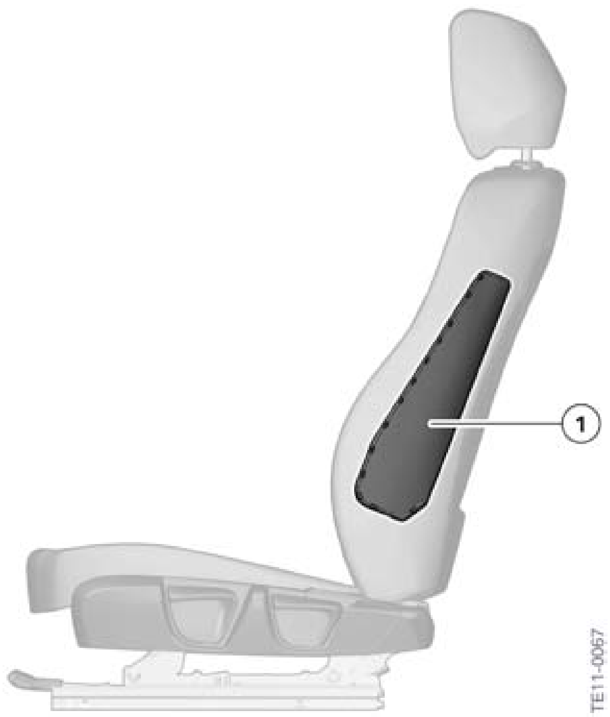
It is important to ensure that no additional seat covers are fitted as they would greatly impair the function of the side airbag, or even immobilize it altogether.



F30 Seat with side airbag

Index	Explanation
1	Side airbag

5.3.7. Seat belt buckle tensioner

The task of the pyrotechnic seat belt buckle tensioner is to minimize the belt slack in the pelvis and shoulder regions in the event of a crash, thereby improving the restraining effect.

The seat belt buckle tensioners are located at the driver's seat or the front passenger seat. The seat belt buckle tensioners are ignited in specific crash situations.

The seat belt buckle is connected by means of a steel cable to the piston in the tensioning tube. If the ignition squib is triggered, gas pressure is created, which moves the piston in the tensioning tube. This causes the cable to pull the seat belt buckle down and the seat belt is tensioned.

5. System Components

F30 Seat belt buckle tensioner

Index	Explanation
1	Seat belt buckle switch
2	Tensioning tube with piston

5.3.8. Automatic tensioner with linear mechanical force limiter

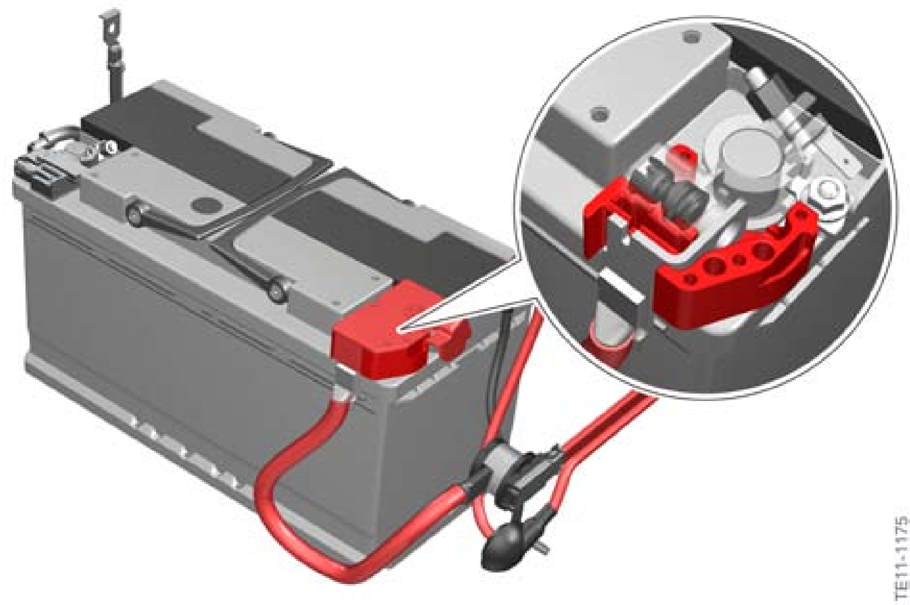
An automatic tensioner with linear mechanical force limiter for the driver and front passenger is used in the F30. In addition to force limitation effected by a torsion bar spring, the seat belt strap is retracted with the assistance of a gas generator in order to reduce belt slack prior to forwards displacement of the occupant.

By harmonizing the individual passive safety components, seat belt tensioner, automatic tensioner, force limiter and airbag, the kinetic energy acting on the occupants is dissipated more evenly for the duration of the crash. Thus lower occupant stress values are achieved.

5.3.9. 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 line that connects the battery to the starter motor/alternator and positive battery connection point is then severed by means of pyrotechnics. The safety battery terminal is located directly at the positive terminal of the battery. The safety battery terminal is encased completely in plastic so that in the event of separation no sparks get outside the case.

Even though the safety battery terminal has been disconnected, a voltage supply to all safety-relevant consumers such as hazard warning flashers, interior light, airbag and telephone (including emergency call) is ensured.



F30 Safety battery terminal

5.3.10. Airbag indicator light

The airbag indicator light is located on the instrument panel. The airbag indicator light lights up then goes out during the pre-drive check to signal readiness of the Crash Safety Module and passive safety systems. The airbag indicator light is controlled via a message on the PT-CAN from the Crash Safety Module to the instrument panel. The instrument panel receives a message cyclically. If the message remains off, the airbag indicator light is activated.

F30 Airbag indicator light

5. System Components

5.3.11. Seat belt warning light

A visual and audible warning is issued if the seat belt is not fastened or is unbuckled during the journey.

F30 Seat belt warning light

The status of the seat belt contacts of the rear seat bench is visible for a short period in the instrument cluster TFT display during starting or if a contact is changed.

5.3.12. Indicator lamp for front passenger airbag deactivation

The indicator lamp for front passenger airbag deactivation in the F30 is in the roof function center. The indicator lamp for front passenger airbag deactivation is activated if the CIS mat detects a small child in a child seat or if the front passenger seat is unoccupied.

The brightness of the indicator lamp for front passenger airbag deactivation is controlled via the automatic brightness control of the display illumination.

F30 Roof function center with indicator lamp for front passenger airbag deactivation

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