Reference Manual

F15
COMPLETE VEHICLE

Technical Training

Reference Manual

www.bmwcenternet.com

The Ultimate Driving Machine®

BMW
Technical Training

F15 Complete Vehicle

BMW of North America, LLC
Technical Training
ST1312
10/1/13

Information Status: October 01, 2013

Course Code: ST1312 F15 Complete Vehicle

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

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

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

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

Technical training.
Product information.

F15 Introduction and Body

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1312 11/1/2013

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 the 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: **July 2013**
BV-72/Technical Training

F15 Introduction and Body

Contents

F15 Introduction and Body

1. Introduction

In fall of 1999 BMW presented the first generation of the X5, the E53, at the North American International Auto Show, and in doing so justified the segment of off-road vehicles (SAV). The second generation, the E70, followed at the end of 2006 and from October 2013 the third generation F15 X5 will be available.

BMW F15

The appearance characteristic of BMW X models combines design features typical of the BMW brand with clear signals for presence, robustness and diversity. The resulting design was further developed for the new BMW X5 in a modern and distinctive way.

Special features

- “sDrive35i” rear wheel drive model available for the 1st time in the X5
- Shorter front overhang
- Upright A-pillars
- Minimal distance between front axle and dashboard
- Enlarged kidney grille that extends to the headlight assemblies
- X-shaped contour lines of front bumper
- Twin circular headlights integrated into the front fenders
- Two-piece, L-shaped rear tail lights

F15 Introduction and Body

1. Introduction

1.1. Models

The following models will be offered from October 2013 with an automatic transmission:

Model	Engine	Power output [kW (HP)]	Torque [Nm (lb-ft)]	Displacement [cm^3]
BMW X5 xDrive35i	N55B30MO	225 (300)	400 (300)	2979
BMW X5 sDrive35i	N55B30MO	225 (300)	400 (300)	2979
BMW X5 xDrive50i	N63B44O1	330 (445)	650 (480)	4395

The F15 X5 diesel will also be available in December of 2013:

- BMW X5 xDrive35d with N57D30O1 engine; 190kW/255hp with 560Nm/413 lb-ft of torque and 2993 [cm^3] displacement.

1.2. New technical features

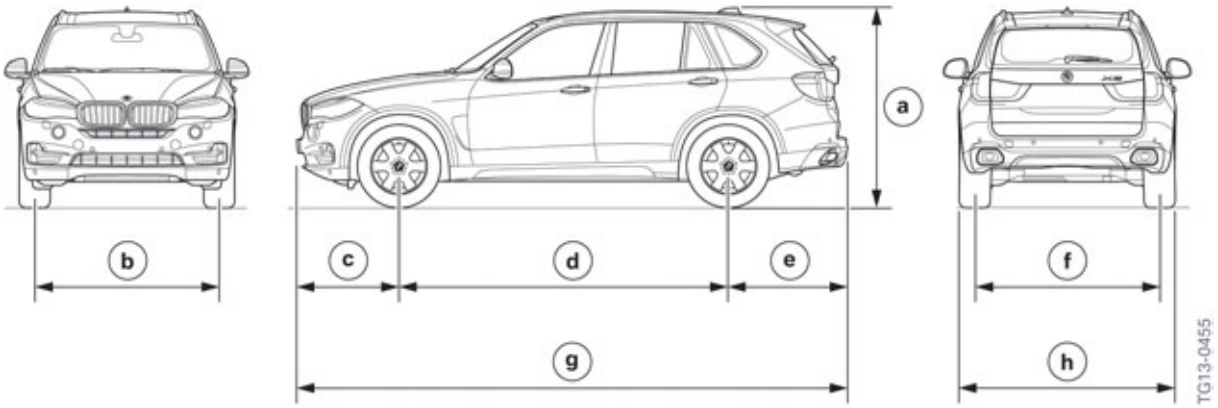
- Material and component optimizations at the bodyshell
- Improved noise generation in the vehicle
- Weight and aerodynamics measures to reduce the CO_2 emissions
- Improved pedestrian protection due to design of the hood and front bumper design

F15 Introduction and Body

1. Introduction

1.3. Dimensions

In the following you see the outer dimensions of the F15 in comparison to the E70 using the example of the X5 xDrive50i:



F15 outer dimensions

Index	Explanation		F15 X5 xDrive50i	E70 X5 xDrive50i
a	Vehicle height, empty	[mm (inches)]	1762 (69.4)	1776 (69.9)
b	Front track width, basic wheels	[mm (inches)]	1644 (64.7)	1640 (64.5)
c	Front overhang	[mm (inches)]	890 (35.0)	864 (34)
d	Wheelbase	[mm (inches)]	2933 (115.5)	2933 (115.5)
e	Rear overhang	[mm (inches)]	1063 (41.8)	1060 (41.7)
f	Rear track width, basic wheels	[mm (inches)]	1650 (65.0)	1646 (64.8)
g	Vehicle length	[mm (inches)]	4908 (193.2)	4857 (191.2)
h	Width excluding exterior mirrors (vehicle width with exterior mirror)	[mm (inches)]	1938 (76.3) 2184 (85.9)	1933 (76.1) 2197 (86.4)

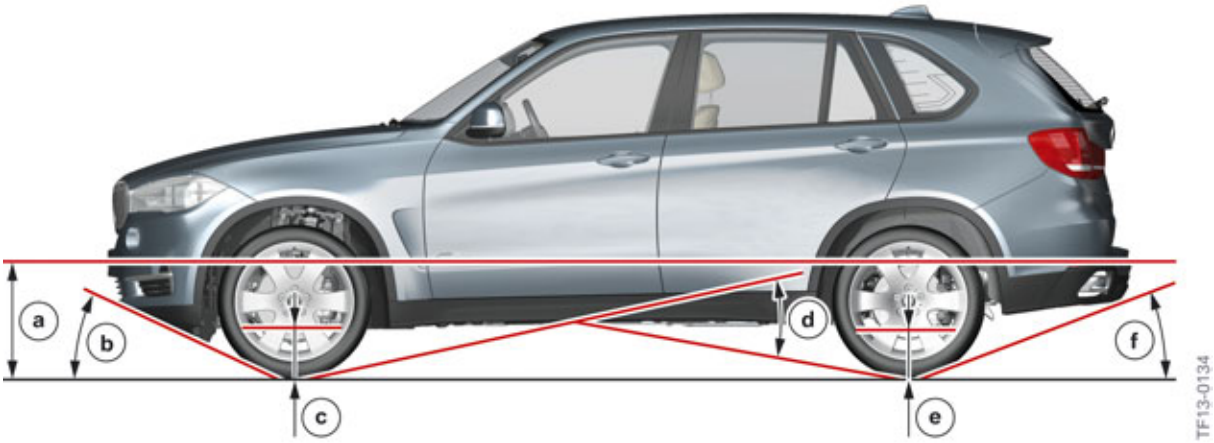
Due to the modified requirements for the pedestrian protection the front overhang of the F15 has been increased 26 mm in comparison to the E70.

The F15 has a turning radius of 12.7 m / 41.7 feet compared to that of the E70 (12.8 m / 41.9 feet).

F15 Introduction and Body

1. Introduction

The ground clearances of the F15 in comparison to the E70 using the example of the X5 xDrive50i:



F15 ground clearances

Index	Explanation		F15 X5 xDrive50i	E70 X5 xDrive50i
a	Wading depth	[mm (inches)]	500 (19.6)	500 (19.6)
b	Front overhang angle	[degree]	25	25.5
c	Axle clearance, front	[mm (inches)]	194 (7.6)	186 (7.3)
d	Ramp angle	[degree]	20	19.8
e	Axle clearance, rear	[mm (inches)]	200 (7.8)	197 (7.7)
f	Rear overhang angle	[degree]	22.5	22.7

1.4. Vehicle Weights

The vehicle curb weight of the F15 was able to be reduced in comparison to the E70, despite enhanced safety and more comfort.

Vehicle curb weights as per US specifications of the F15 and the E70 are in the following table.

Model		Vehicle curb weight (US)	
		F15	E70
BMW X5 xDrive50i	[kg (lbs)]	2336 (5150)	2440 (5379)
BMW X5 xDrive35i	[kg (lbs)]	2173 (4790)	2250 (4960)
BMW X5 sDrive35i	[kg (lbs)]	2123 (4680)	Not available

In the F15 the optimal axle-load distribution of 50% was achieved through a weight-optimized vehicle concept, as well as a lightweight design. Slight differences arise depending on the model.

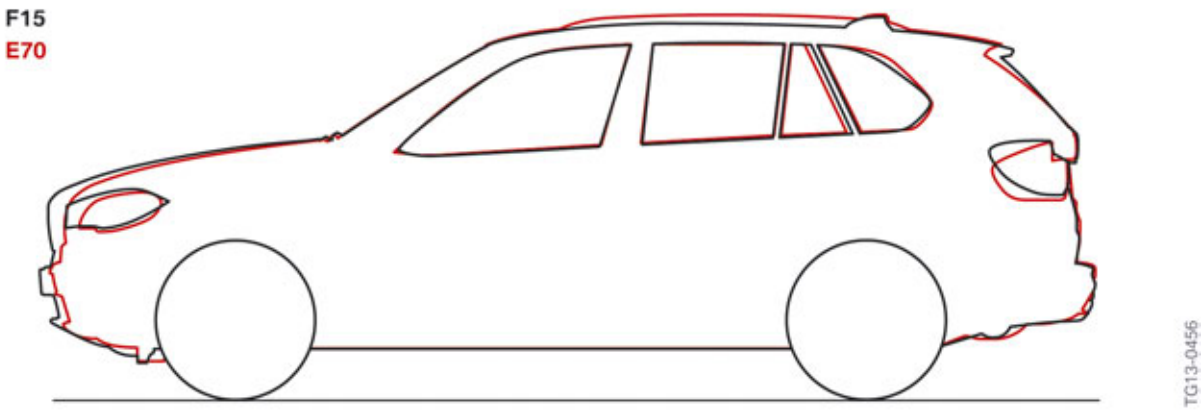
The luggage compartment capacity was also enlarged by 30 liters / 1.0 cubic feet to 650 liters / 23 cubic feet. This was achieved by reducing the depth of the rear seat backrests.

F15 Introduction and Body

1. Introduction

1.5. Silhouette comparison

A silhouette comparison with the E70 shows the modified dimensions of the F15.



F15 silhouette comparison with BMW E70

		F15	E70
Vehicle height, empty	[mm (inches)]	1762 (69.4)	1776 (69.9)
Front overhang	[mm (inches)]	890 (35.0)	864 (34)
Wheelbase	[mm (inches)]	2933 (115.5)	2933 (115.5)
Rear overhang	[mm (inches)]	1063 (41.8)	1060 (41.7)
Vehicle length	[mm (inches)]	4908 (193.2)	4857 (191.2)

1.6. Package contents

Three Lines are available for an individual configuration of the exterior trim and interior equipment, alternative to the basic equipment.

1.6.1. M Sport

The M Sport (option ZMM) includes the following features, some of which were able to be individualized even further:

Exterior trim

- Six select paintwork types (exclusive for the M sport package: carbon black metallic)
- 19" M BMW light-alloy wheels, double spoke 467 M with mixed run flat tires or 20” M BMW light-alloy wheels, double spoke 469 M with performance run flat tires
- Adaptive M suspension
- Sport automatic transmission
- Front bumper in vehicle color with larger air inlets
- Rear bumper in vehicle color
- Trim panels of side sill in vehicle color
- BMW Individual high-gloss Shadow Line
- BMW Individual roof rails high-gloss Shadow Line
- Exhaust tailpipe, chrome (8-cylinder engine optics)
- M model inscription in "light chrome" on the front fender

Interior equipment

- Upholstery: Alcantara/Leather combination including M identification (anthracite/black, exclusive for M sport package)
- Electrical seat adjustment with memory
- Sports seats for driver and front passenger or multi-contour seats (option 456)
- BMW Individual Anthracite roofliner
- M leather steering wheel (with shift paddles)
- Interior strips in aluminium hexagon
- M driver footrest (only left-hand drive vehicles)
- Door sill cover strip with M model inscription
- Remote key/ID transmitter, M-specific

1.6.2. xLine (ZXD)/ Luxury Line (ZLL)

Alternative to the standard equipment, two new design worlds are offered for the exterior trim and the interior equipment of the new BMW X5, which add individual character. The respective scopes are harmoniously matched in terms of design, color and material selection.

The design worlds for the exterior trim and the interior equipment can be selected independent of each other. They can be freely combined with each other and with the standard equipment. The two interior equipment designs are also available with the M sports package.

F15 Introduction and Body

1. Introduction

Exterior trim

xLine exterior	Luxury Line exterior
Air inlet grille with modified geometry	Air inlet grille with chrome surfaces
Longitudinal bar of the kidney grille in titanium color	Longitudinal bar of the kidney grille with chrome surface
Rear bumper with titanium-colored trim strip	Trim strip at rear bumper with chrome surface
Frame of exterior mirror, mirror base and mirror triangle in high-gloss black	Frame of exterior mirror, mirror base and mirror triangle in high-gloss black
Cover of B- and C-pillar in high-gloss black	Cover of B- and C-pillar in high-gloss black
Buttons for remote key/ID transmitter in chrome with pearl effect	Buttons for remote key/ID transmitter in chrome with pearl effect
Clasp for remote key/ID transmitter in high-gloss black	Clasp for remote key/ID transmitter in high-gloss black
Exhaust tailpipe in matt chrome (engine-specific)	Wheel arch trim in vehicle color

Interior equipment

Mocha Nappa leather interior (option 7S6[1])	Ivory White Nappa Leather interior (option 7S5[2])
Upholstery: Exclusive "nappa" leather with extended scopes (mocha/black)	Upholstery: Exclusive "nappa" leather with extended scopes (ivory-white/ivory-white)
Leather dashboard in nappa leather finish, black (hazel-colored contrasting-color stitching)	Leather dashboard in nappa leather finish, atlas grey (parchment contrasting-color stitching)
Dashboard at bottom in mocha	Dashboard at bottom in ivory-white
Leather shoulder of door trim panel with nappa leather finish, black (hazel-colored contrasting-color stitching)	Leather shoulder of door trim panel with nappa leather finish, atlas grey (parchment contrasting-color stitching)
Buttons for remote key/ID transmitter in chrome with pearl effect[3]	Buttons for remote key/ID transmitter in chrome with pearl effect[3]
Clasp for remote key/ID transmitter in high-gloss black[3]	Clasp for remote key/ID transmitter in high-gloss black[3]

[1] In conjunction with M sport package: Option 7S8.

[2] In conjunction with M sport package: Option 7S7.

[3] In conjunction with M sport package: M-specific remote key/ID transmitter.

F15 Introduction and Body
1. Introduction

1.6.3. Other packages

Smoker's package (standard equipment)

- An ashtray in the center console in the front and an ashtray in each of the rear door trims.
- One cigarette lighter in the front and rear center console

Storage compartment package (standard equipment)

- Eyewear compartment in front of roof operating unit
- Storage net for glove box cover for holding smaller objects
- Center armrest with tensioning strap, left
- Two mats in the door pockets of the front doors
- A mat in the door pockets of the rear doors

Luggage compartment:

- Luggage compartment net
- Multifunction hook
- Hook for luggage compartment net
- Storage net for covering the left side trim panel
- Tensioning strap, left
- Securing rails with lashing eyes

Ambiance Lighting (standard equipment)

- Lighting, front seat backrest
- Lighting, rear footwell
- Rear reading light
- Welcome light
- Door entry lighting
- Door sill strip light
- Ground lights

Predefined, selectable light designs with 3-color LEDs:

- Lighting, front footwell
- Lighting, dashboard
- Door lighting (decorative strip, door trim panel and door pocket)

F15 Introduction and Body

1. Introduction

Shadow Line Exterior (standard with M Sport package ZMM)

Equipment range in high-gloss black:

- Trim strip, side frame
- Weather strip
- Cover of window frame
- Cover of B- and C-pillar
- Mirror triangle

F15 Introduction and Body

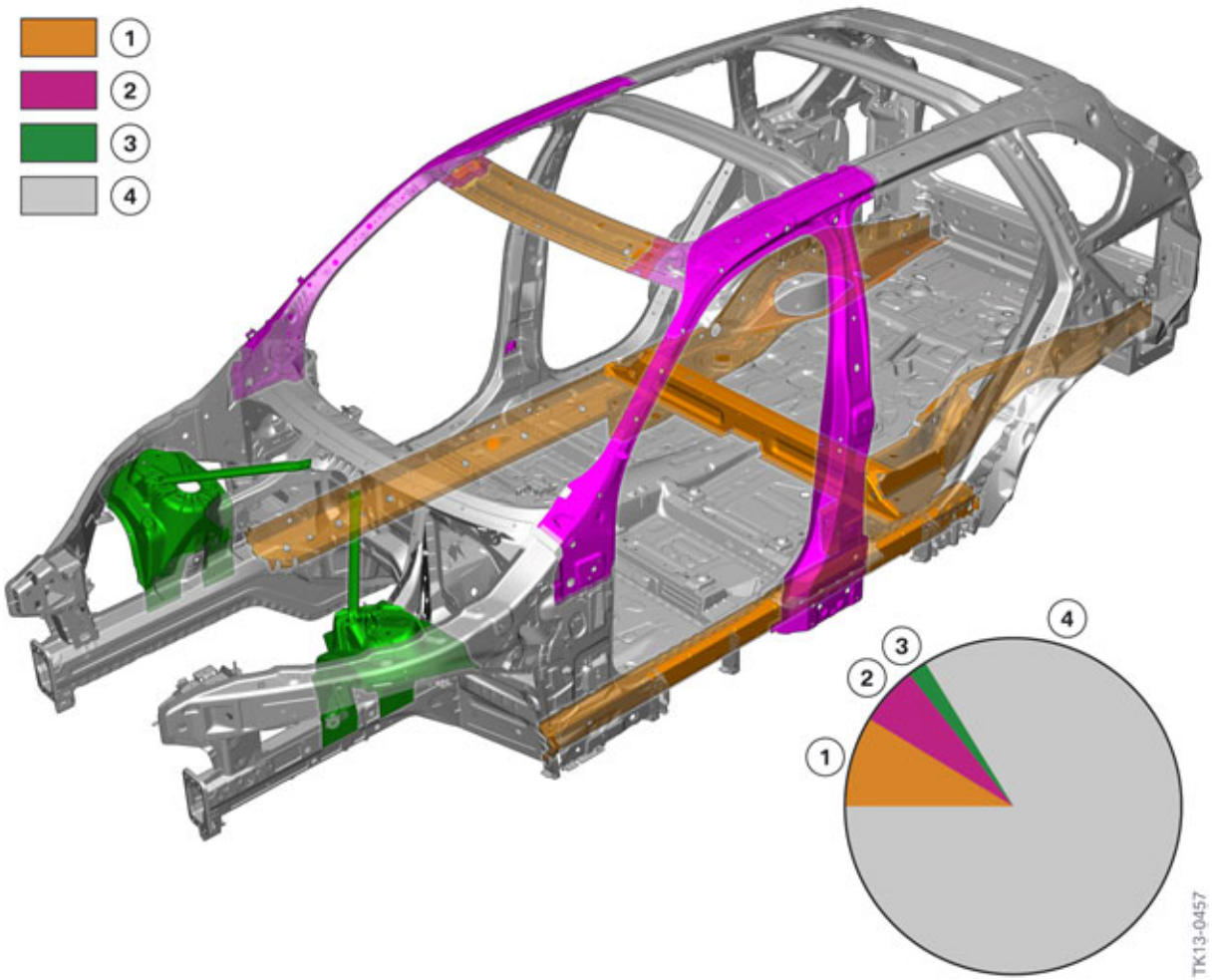
2. Bodyshell

2.1. Materials

The bodyshell of the F15 is manufactured using steel and aluminium. The two expressions aluminium and steel are merely generic terms for the large number of alloys with very different properties that are used.

Through the targeted use of high-strength aluminium and extremely high-strength multiphase steels, as well as extremely high-strength, hot-formed steels has achieved the following:

- A maximum contribution to passive safety
- The vehicle weight is reduced
- A decisive contribution is made to BMW EfficientDynamics with dynamic driveability



F15 material qualities, body frame

F15 Introduction and Body

2. Bodyshell

Index	Explanation
1	Multi-phase steels (> 300 MPa), proportion 9%
2	Hot-formed steels (> 900 MPa), proportion 5%
3	Aluminium, proportion 2%
4	Other steels (< 300 MPa), proportion 84%

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.

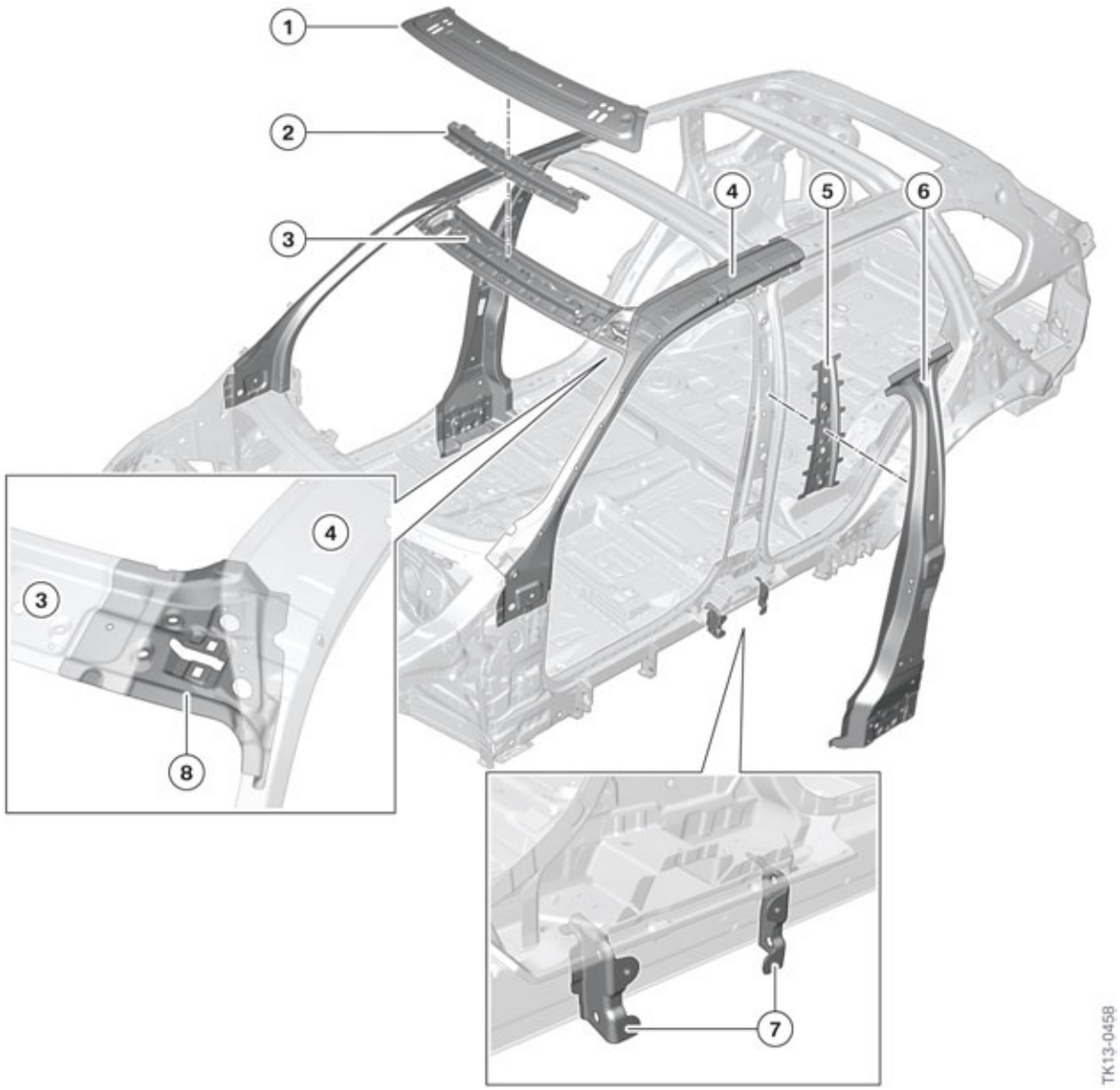
Hot-formed manganese-boron steels are super-strength steels with a yield strength $R_{p0.2}$ in excess of 900 MPa.

F15 Introduction and Body

2. Bodyshell

2.2. Passive safety

Several new or modified components are used at the bodyshell of the F15 in comparison to the E70. As a result, the high requirements in the event of a side collision in the different crash tests are satisfied and the highest evaluation in the rollover test, according to the US-IIHS (INSURANCE INSTITUTE FOR HIGHWAY SAFETY), is achieved.



F15 changes to the body frame

F15 Introduction and Body

2. Bodyshell

Index	Explanation
1	Cowl panel (upper part)
2	Bulkhead
3	Cowl panel (lower section)
4	A-pillar
5	Support, B-pillar, inner
6	B-pillar, outer
7	Bulkhead
8	Connection, A-pillar, top

The following measures for increasing the passive safety were adopted at the bodyshell of the F15:

- The cowl panel with optimized geometry is made from a steel with high yield strength. A new bulkhead is also used between the upper and lower part of the cowl panel.
- The A-pillar and the connection of the A-pillar at the top are made from extremely high-strength, hot-formed steel.
- The outer B-pillar consists of extremely high-strength, hot-formed steel similar to the E70, but it has a greater panel thickness. A support at the inner B-pillar is also used.
- Two new bulkheads ensure a more stable connection of the B-pillar and the floor assembly.
- The panel thickness of the upper part of the frame has been increased on all vehicles with a panorama glass roof.

Maximum safety was able to be achieved with a lightweight design through the following structural measures:

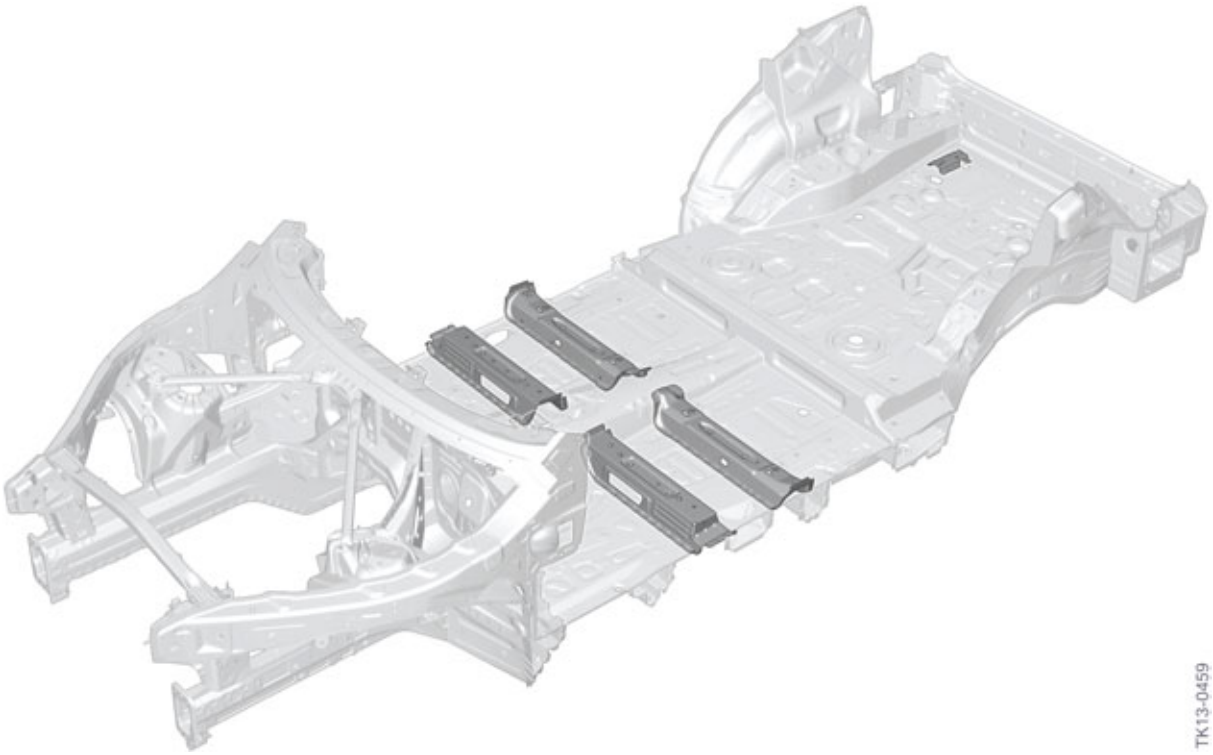
- Optimal design and use of deformations for generating intended vehicle deceleration.
- Extremely rigid design of the passenger compartment.
- Implementation of tested load path for head-on collisions with full or low covering for optimized absorption of energy or discharge of forces exerted.

F15 Introduction and Body

2. Bodyshell

2.3. Common-part concept

The common-part concept satisfies the highest quality requirements at a reasonable cost. For instance, the same floor assembly is used in the F15 as in the E70, with some minor adaptations:



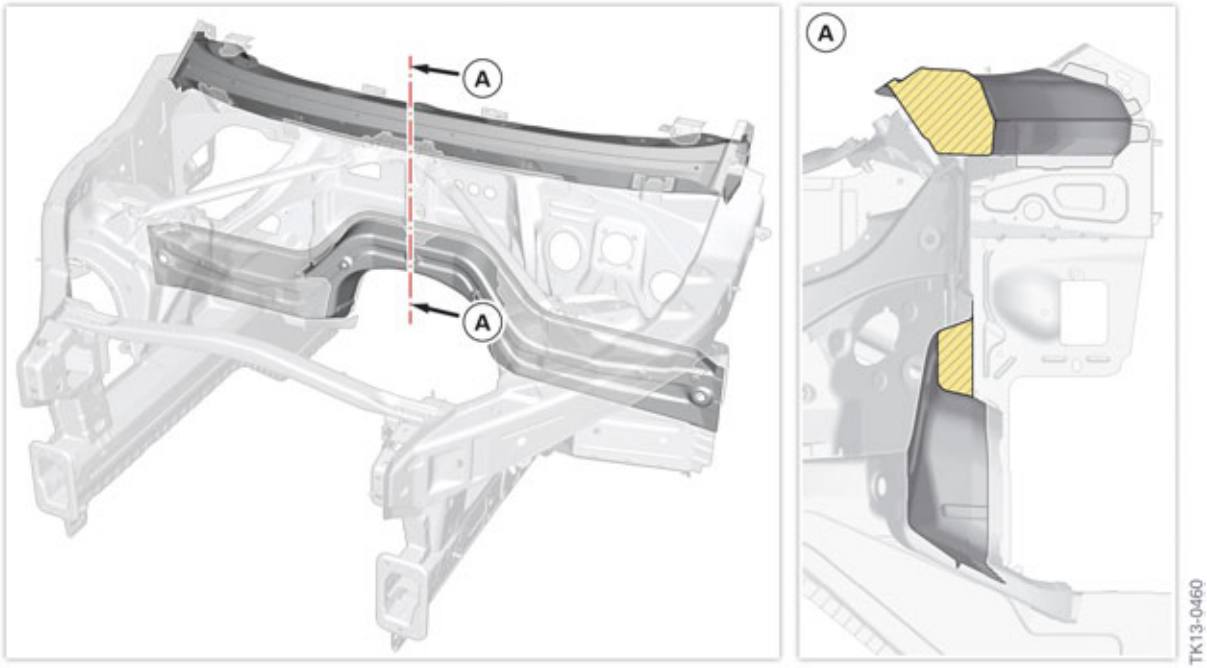
F15 floor assembly

The modified front seats meant the seat cross members had to be adapted and the integration of the hybrid elements required an additional battery holder.

F15 Introduction and Body

3. Acoustic Measures

In the F15 the noise generation in the vehicle was reduced through various measures.



F15 bulkhead

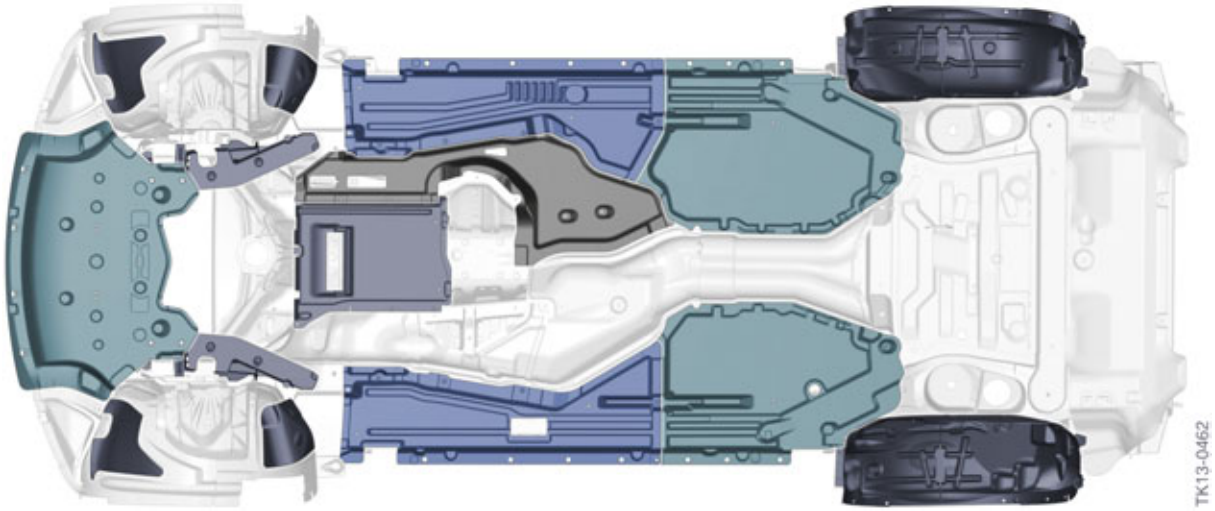
Both the upper and lower cross member sections of the bulkhead are filled with acoustic foam.

F15 additional door seal

An additional sealing level is used at the doors in order to reduce the wind noises. An additional seal is therefore used in the lower area of each vertical door gap.

F15 Introduction and Body

3. Acoustic Measures



F15 underbody panelling made from textile material

In comparison to its predecessor, the E70, the F15 underbody panelling, the rear wheel arch covers, as well as parts of the front wheel arch covers, are made from a fabric material. In addition to acoustic optimization, significant weight savings are also achieved with this change.

F15 acoustic sealing in the engine compartment

The air cleaner with an opening to the passenger compartment is acoustically decoupled from the engine compartment and the wheel arch. As well as the familiar sealings for the engine compartment lid, additional cavity sealings are also used in the area of the front side panels and the side frame.

Acoustic glazing of the windscreen is also part of the standard equipment of the F15. The impact of noises from outside is reduced in comparison to the normal laminated safety glass. This is achieved using an acoustically effective film between the two glass panes. The thickness of the rear side windows was also increased from 4.0 mm (E70) to 4.8 mm (F15).

F15 Introduction and Body

4. Emissions Reduction

The CO_2 emissions of the F15 were reduced significantly in comparison to the E70. In addition to the measures in the engine and chassis and suspension area, the weight reduction of the body and the aerodynamic measures also play a significant part here.

4.1. Weight reduction

In comparison to the predecessor, the vehicle weight was reduced despite the enhanced safety and added comfort.

The following measures help enhance the comfort:

- Front side panels made from plastic (thermoplastic) – as in the E70
- Engine compartment lid made from aluminium
- Textile underbody panelling
- Multiple use of high-strength and extremely high-strength multiphase steels and extremely high-strength, hot-formed steels
- Optimized door structure:
  - Additional and larger recesses in the reinforcing rails and the end plates and inner door panel of the front door
  - Smaller panel thickness of side impact support

4.2. Aerodynamics measures

The drag of a vehicle has a decisive impact on fuel consumption as it is the largest outer driving resistance at speeds above 80 km/h (50 mph).

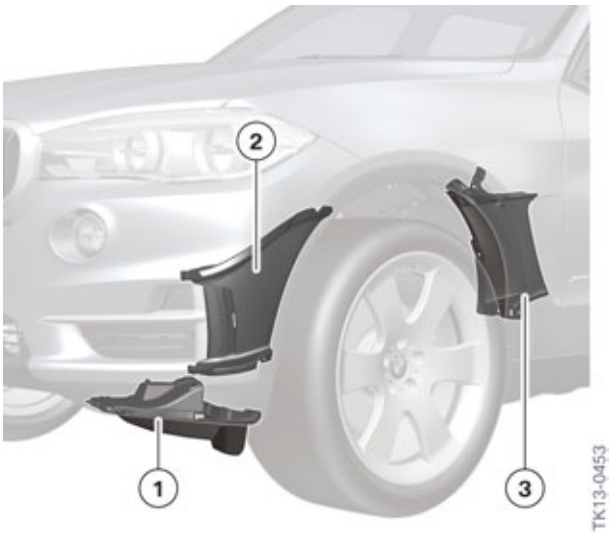
In comparison to the predecessor, the drag of the F15 was able to be reduced by approx. 10% through the following measures:

- Air ducts in front of and behind the front wheel arches ("Air Curtain" and "Air Breather")
- Aeroblades and air guides at the front wheels
- Rear spoiler and aeroblades at the side at the tailgate

F15 Introduction and Body

4. Emissions Reduction

4.2.1. Air ducts at the front wheel

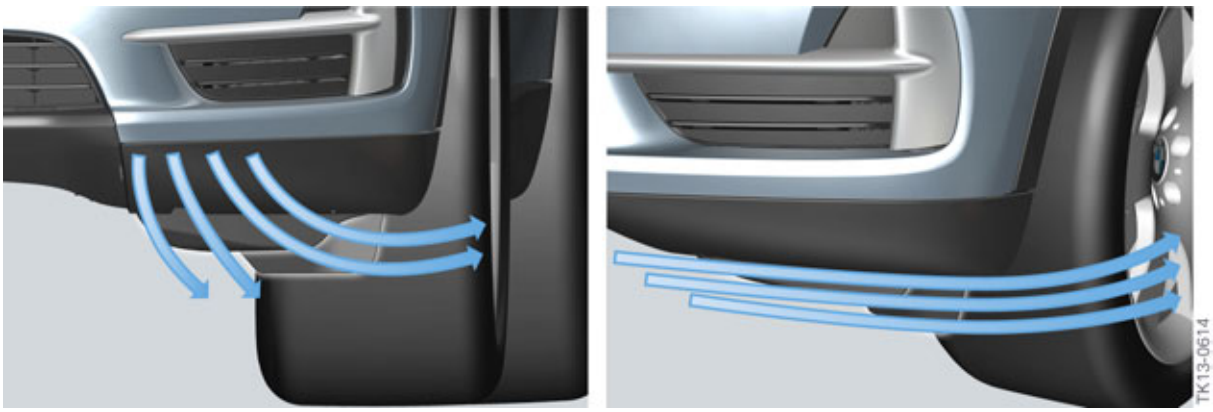


F15 air ducts at the front wheel

Index	Explanation
1	Aeroblades with air guide ("diffuser")
2	Air duct before wheel arch ("Air Curtain")
3	Air duct behind wheel arch ("Air Breather")

The "diffuser", an aeroblade with air guide, guides the flow past the front wheel. This way the direct "impact" of the flow on the front wheel is avoided.

Below the aeroblade the flow accelerates and leads to a reduction of the vehicle boost.
This contributes to improved driving dynamics.



F15 air flows at the aeroblade with air guide

F15 Introduction and Body

4. Emissions Reduction

The "Air Curtain" accelerates the energy-rich flow before the front apron and guides it past the side of the wheel arch. The resulting so-called "air curtain" reduces the turbulences at the wheel arch.

F15 air flows at the "Air Curtain"

The "Air Breather", which was used for the first time in the F34, guides the energy-rich air flow, which flows into the front wheel arch, via a vertical air inlet to the side wall. It reduces the inflow in the rear area of the wheel arch and thus also the turbulences in the wheel arch area.

F15 air flows at the "Air Breather"

F15 Introduction and Body

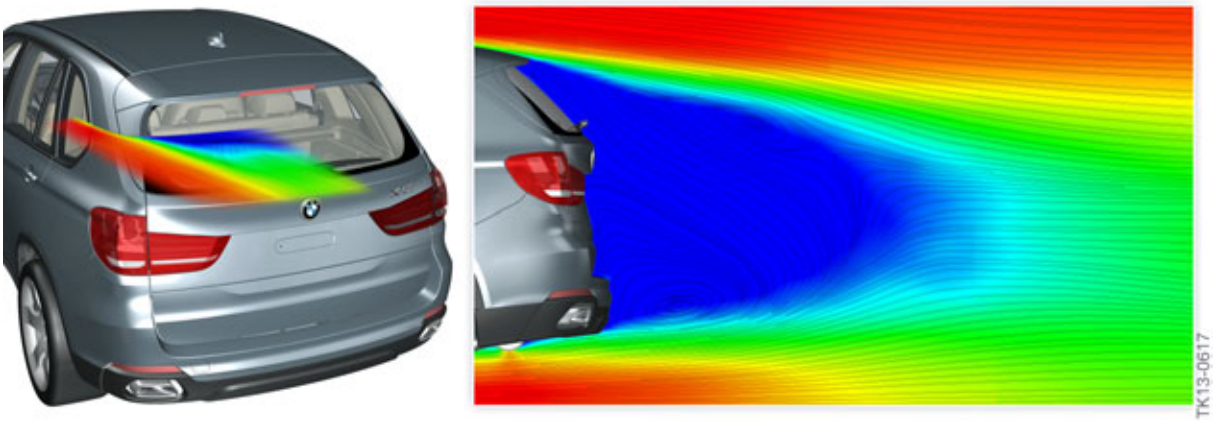
4. Emissions Reduction

4.2.2. Air ducts at the tailgate

F15 air ducts at the tailgate

Index	Explanation
1	Aeroblade
2	Rear spoiler

Tear-off edges arise at the side at the tailgate and the rear spoiler as a result of the aeroblades. These aeroblades cause the flow to stall at the D-pillar. The vacuum range at the rear end is thus reduced and the drag lowered.



F15 air flows at the rear end

F15 Introduction and Body

5. Exterior Equipment

5.1. Tailgate

F15 wedging of tailgate

The tailgate of the F15 has a two-piece design similar to the E70 and has a wedge on both sides for stabilization. The extended range of adjustment of the wedge in a lateral and vertical direction is new. Interference noises are avoided in combination with the adjustment buffers made from noise-absorbing material.

F15 Introduction and Body

6. Interior Equipment

6.1. Materials

F15 dashboard/door shoulder

By using a high-quality TPO foam material (material made from thermoplastic polyolefin with foam back) at the dashboard and the upper door panels the value was increased in comparison to the E70.

F15 Introduction and Body

6. Interior Equipment

6.2. Front seat

The following front seat variants can be chosen for the F15:

- Power front seats with drivers side memory (standard)
- Power front sports seat with memory (option 481)
- Power front multi-contour seats with memory (option 456), and standard with xDrive50

Seat adjustment options	**Power front seats (Standard)**	**Sports seat (option 481)**	**Multi-contour seats (option 456)**
Forward/back seat adjustment	Electric	Electric	Electric
Seat height adjustment	Electric	Electric	Electric
Seat angle adjustment	Electric	Electric	Electric
Backrest angle adjustment	Electric	Electric	Electric
Backrest upper section adjustment	–	–	Electric
Backrest width adjustment	–	–	Electric
Head restraint depth adjustment	Manual	Manual	Manual
Head restraint height adjustment	Electric	Electric	Electric
Comfort head restraint with lateral adjustment	–	–	Manual
Memory function	Driver	Driver	Driver and front passenger

Seat equipment	**Power front seats (Standard)**	**Sports seat (option 481)**	**Multi-contour seats (option 456)**
Seat heating	Standard	Standard	Standard
Lumbar support	Standard	Standard	Standard
Professional rear seat entertainment system (option 6FH)	Option	Option	Option
Ambiance lighting	Standard	Standard	Standard
Active seat ventilation (option 453 stand alone or with ZLS Luxury Seating Package)	Option	Option	Option

6.2.1. Active seat ventilation

Through the active seat ventilation (option 453) and the optimized upholstery layout of the seats, the physical well-being of the occupants is increased.

The operation is effected using a button in the control panel of the IHKA. The air distribution between the seat and backrest padding can also be set to three levels using the controller.

Four axial fans integrated in the seat and backrest padding distribute the interior air throughout the seat. The air flows through the breathable intermediate plate of the seat heating and through the perforated leather upholstery. The seat heating is automatically switched on by the control unit and prevents the occupant's body temperature from dropping.

The active seat ventilation can only be ordered in conjunction with the following optional equipment:

- Multi-contour seats front, electrically adjustable (option 456)
- Dakota leather or exclusive nappa leather

6.3. Rear seat

A new operating concept for the partial or complete folding down of the rear seat backrest is part of the standard equipment of the F15. The rear seat backrest can be split in the ratio 40/20/40, whereby the backrest angle is 25° in the middle and 27° on the outside. The three sections can be folded down either individually or together in order to gradually increase the luggage compartment capacity up to 1870 liters / 66.0 cubic feet.

In the folding center part a fixed head restraint is integrated, as well as a center armrest with cup holder.

The outer head restraints of the rear seat can be adjusted manually.

The following rear seat variants are also available to choose from:

- Comfort rear seats (option 4FF)
- 3rd row seats (option 4UB) – cannot be ordered with comfort seat (option 4FF)

F15 Introduction and Body
6. Interior Equipment

6.3.1. Comfort seat in the rear passenger compartment

Special features

- Six-stage backrest angle adjustment by total of 10° (9° for E70)
- Comfort position of the backrest angle using two detents (29° and 31°)
- Forward/back seat adjustment by 80 mm / 3 inches (same as E70)
- Rear easy-entry facility (same as E70)
- Center armrest with cup holder and additional storage compartment with lid
- Enhanced comfort 15 mm / .5 inches thicker intermediate plate (8 mm / .3 inches E70)
- Locking of folded down outer headrest sections, possible child seat mounting in the 3rd seat

6.3.2. Third seat

The 3rd row of seat is integrated in the luggage compartment. The seats are suitable for persons up to approx. 150 cm / 5 feet tall and can be lowered individually if required so that there is even space in the luggage compartment.

The optional equipment 3rd row of seats (option 4UB) is only available from the factory and retrofitting is not possible.

F15 third row of seats

Armrests are integrated in the side trim panels. Handle recesses are located at the C-pillar, which facilitate the entry of occupants. There are two cup holders in the center console, as well as the ventilation and heating grills.

The blower is switched on and off using the button in the center console. The blower draws in air under the seats and blows it via two fixed ventilation grilles between the seats of the third row. Using the knurled wheel an electric auxiliary heater (PTC) is activated and, at the same time, the air flow is redirected through the lower air outlets in the footwell.

F15 Introduction and Body

6. Interior Equipment

6.4. Storage options

F15 door pocket

Bottle holders for 1.0 to 1.5 liter bottles were able to be integrated thanks to the ergonomic design of the door pockets.

No fragile objects such as glass bottles should be stored in the storage compartments. Otherwise there is an increased danger of injury in the event of an accident.

In vehicles without a 3rd row of seats (option 4UB) there is a large storage compartment under the luggage compartment floor, which is also suitable for housing a Space-Saver Spare (option 300). Opening the luggage compartment floor is supported by a gas pressure spring.

A combination roller blind with load area net is included.

F15 Introduction and Body

6. Interior Equipment

F15 eyewear compartment

The eyeglass compartment is located between the roof function center and the inside mirror. The opening is effected using a push-button and is cushioned with a silicone brake.

In order to protect the eyeglass the eyeglass compartment is equipped with a TPU insert (TPU = thermoplastic polyurethane). The eyeglass can be optimally removed through the large opening angle of 120°.

Bayerische Motorenwerke Aktiengesellschaft
Qualifizierung und Training
Röntgenstraße 7
85716 Unterschleißheim, Germany

Technical training.
Product information.

F15 Powertrain and Chassis Dynamics

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1312 11/1/2013

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: **July 2013**
BV-72/Technical Training

F15 Powertrain and Chassis Dynamics

Contents

F15 Powertrain and Chassis Dynamics

Contents

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.1. Powertrain variants

F15 Drive train

1.1.1. Models

The F15 will be launched on the market in October 2013 in the following models:

Model	Engine	Power output [kW (HP)]	Torque [Nm (lb-ft)]	Displacement [cm^3]
BMW X5 sDrive35i	N55B30MO	225 (300)	400 (300)	2979
BMW X5 xDrive35i	N55B30MO	225 (300)	400 (300)	2979
BMW X5 xDrive50i	N63B44O1	330 (445)	650 (480)	4395

The F15 X5 diesel will also be available in December of 2013:

- BMW X5 xDrive35d with N57D30O1 engine (190kW/255hp with 560Nm/413 lb-ft of torque and 2993 [cm^3] displacement).

With the BMW X5 sDrive35i, this will be the first rear wheel drive only X5.

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.1.2. Further information

The descriptions of the engines can be found in the following Training Reference Manuals:

- Training Reference Manual "ST916 N55 Engine"
- Training Reference Manual "ST1209 N63TU Engine"
- Training Reference Manual "ST1306 N57TU Engine"

The descriptions of the eight-speed automatic transmission can be found in the following Training Reference Manual:

- Training Reference Manual "ST1002 F10 Complete Vehicle" (Powertrain section).

1.2. Engines

For US compliance with the exhaust emission standards the following modifications have been developed for the F15. Modifications to the charging and injection systems (multiple fuel injection), the catalytic converters, as well as the engine controls. In the diesel engines the Selective Catalytic Reduction 2 system (SCR 2) is now used.

1.2.1. N55 engine

The N55 engine is known from other series.

Special features

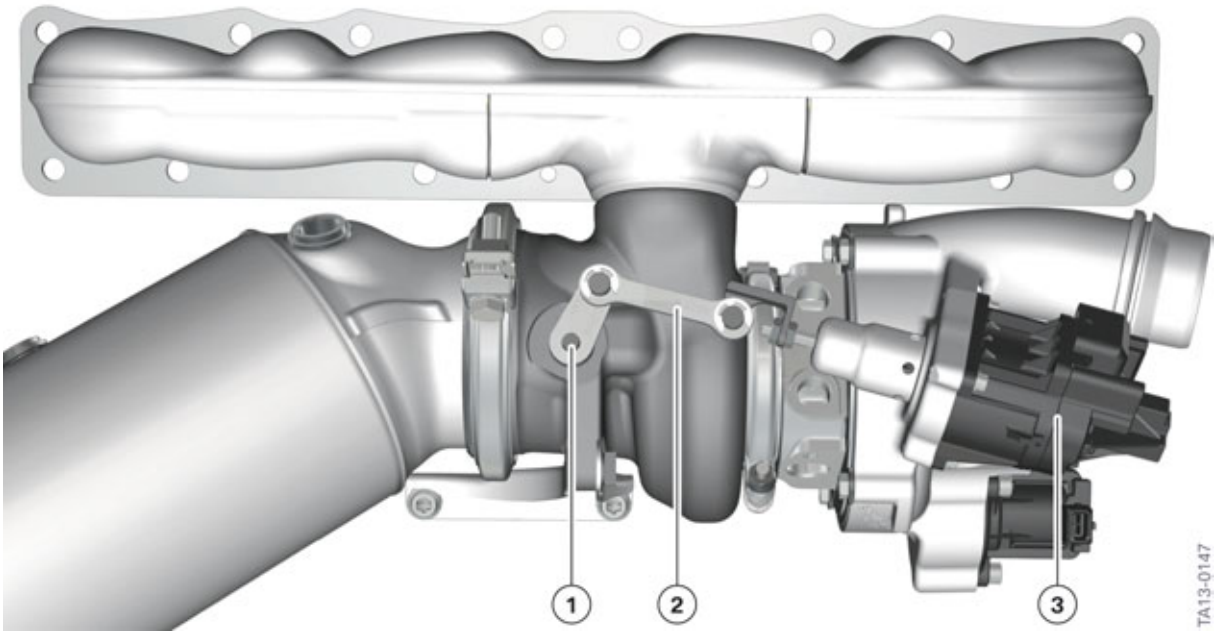
- Air-gap-insulated exhaust manifold, six into two.
- Catalytic converter located close to the engine as a result of the shortened turbine housing of the exhaust turbocharger.
- Improved DME for even more precise metering of the pre-injection.
- New injectors with different diameters of injection bore holes.
- Rear muffler assembly with electric exhaust flap.
- New post-catalyst oxygen sensor LSF Xfour with improved signal stability and quicker operating readiness thanks to controlled heater.

The changes to the injection system of the N55 are the same as the changes to the N63 engine and are described in the following chapter.

F15 Powertrain and Chassis Dynamics

1. Powertrain

Measures at the exhaust turbocharger



E-wastegate valve at the N55 engine

Index	Explanation
1	Wastegate valve
2	Linkage with adjustment option
3	Actuator, wastegate valve

The wastegate valve prevents excessive charging and turbine pressure at high engine speeds. Due to exhaust emission standards, an electrically activated wastegate valve is used in the N55 engine.

The DME controls and monitors the actuator of the wastegate valve. It contains a direct current motor for adjusting the linkage and a potentiometer for determining the traverse path.

The wastegate valve can be controlled quicker and more precisely with the electrical activation. It is no longer exposed to the influences of the air pressure fluctuations and can be diagnosed better, e.g. by detection of the flap angle for fresh air and the power consumption.

The catalytic converter heating period was reduced by the larger opening angle of the wastegate valve. This is also supported by the shortening of the turbine housing, whereby the catalytic converter could be positioned closer to the wastegate valve.

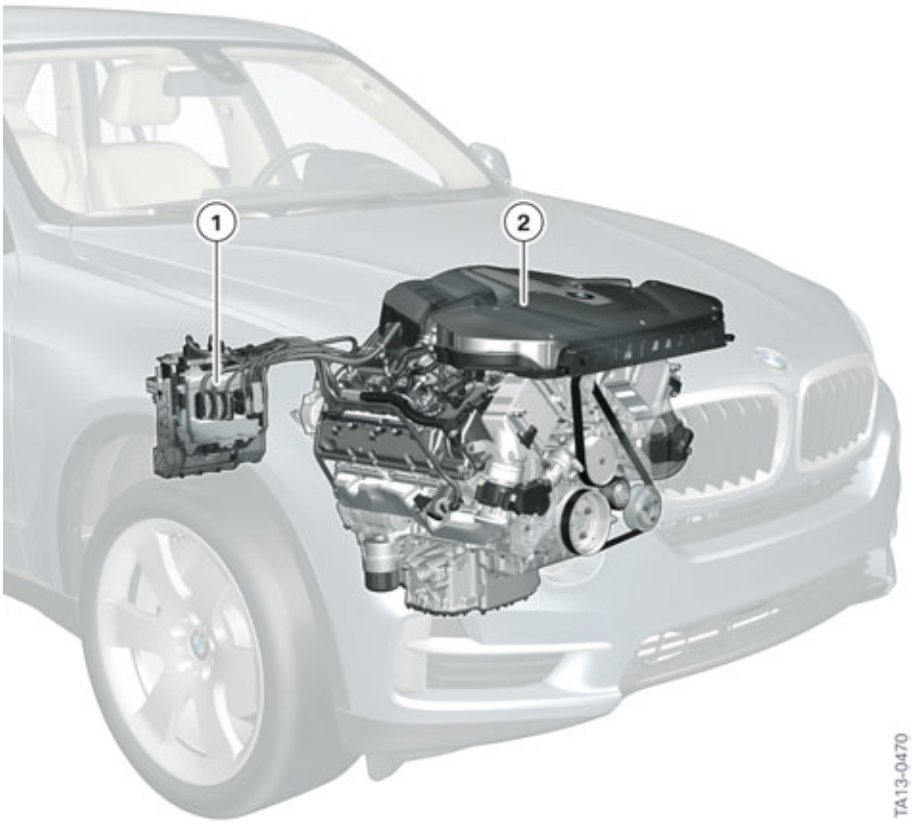
1.2.2. N63 engine

In the F15 the N63TU engine is used in the N63B44O1 variant. The N63B44O1 has already been in use since 2012 across all series. In comparison to the N63B44O0 engine, the power was increased by 30 kW (40 hp) and the carbon dioxide emissions were reduced.

The engine control units are located in the compartment similar to an E box on the passenger's side and are cooled using a low-temperature cooling circuit.

F15 Powertrain and Chassis Dynamics

1. Powertrain



Installation location of the engine control units in the F15 with N63 engine

Index	Explanation
1	Engine control units
2	N63TU engine

Technical data

		N63B44O0 E70, X5 xDrive 50i	N63B44O1 F15, X5 xDrive 50i
Design		V8	V8
Valves per cylinder		4	4
Engine control		MSD 85.1	MEVD 17.2.8
Displacement	[cm^3]	4395	4395
Stroke/Bore hole	[mm]	88.3/89.0	88.3/89.0
Power output at engine speed	[kW (HP)] [rpm]	300 (405) 5500 - 6400	330 (445) 5500 – 6000
Torque at engine speed	[Nm (lb-ft)] [rpm]	600 (442) 1750 – 4500	650 (480) 2000 – 4500
Compression ratio	[ε]	10.0 : 1	10.0 : 1

F15 Powertrain and Chassis Dynamics

1. Powertrain

		N63B44O0 E70, X5 xDrive 50i	N63B44O1 F15, X5 xDrive 50i
Fuel grade		RON 91 – 98	RON 91 – 98
Exhaust emission standards		ULEV II	ULEV II
Fuel consumption	[l/100 km]	12.5	10.4
Acceleration 0 – 100 km/h (60 mph)	[s]	5.5	4.9

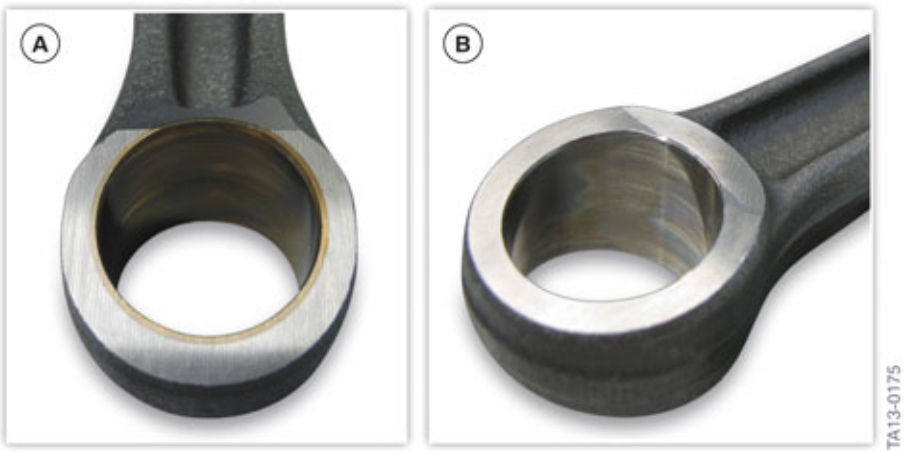
Measures for CO_2 reduction

By 2015 the fleet average of all newly registered passenger cars in the EU must observe the emission limit of 120 gram of CO_2/km. This equates to fuel consumption of approx. 5 liters of gasoline/100 km or 4.5 liters of diesel fuel/100 km. As a result, new technologies are constantly being introduced at BMW to reduce fuel consumption and thus the carbon dioxide emissions.

Already before the market introduction of the new X5 the N63TU engine was revised in order to reduce the CO_2 emissions.

Wider piston rings with an optimized coefficient of friction made from a softer material were installed. As these piston rings require lower piston ring grooves, the pistons were also modified accordingly.

In addition, connecting rods with out wrist pin bushings are used, the wrist pins with a special carbon coating are also used (DLC – Diamond-like carbon). The designation DLC refers to the diamond-like properties of this coating, which further optimized the coefficient of friction.



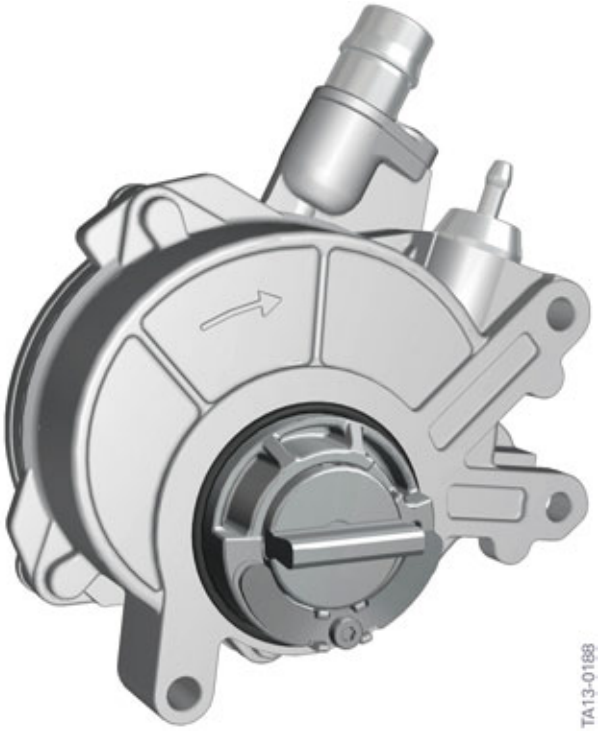
Comparison of connecting rods

Index	Explanation
A	Connecting rod with bushing
B	Friction optimized connecting rod without bushing

F15 Powertrain and Chassis Dynamics

1. Powertrain

A friction-optimized vacuum pump reduces fuel consumption by approximately 0.5%.



Vacuum pump, N63TU engine

The automatic start-stop function in the F15 also contributes to the reduction of the CO_2 emissions.

Emission reduction measures in gasoline engines

In addition to the particulate matter (PM), the limit value for the particle concentration (PN) is also stipulated for US exhaust emission standards for gasoline passenger cars, as already stated for diesel fuel passenger cars.

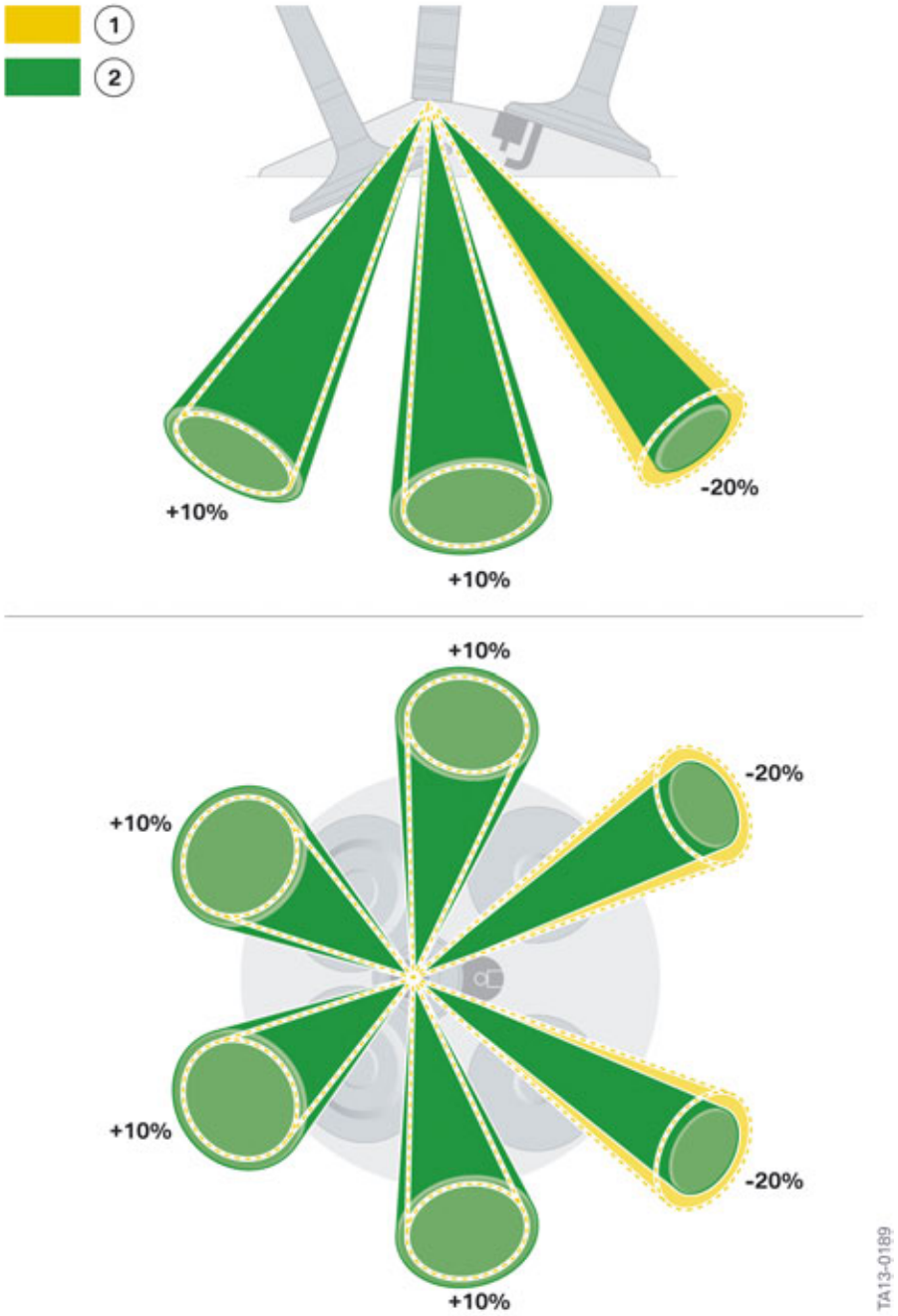
The reason for this is that in modern gasoline engines with direct injection no homogeneous fuel/air mixture arises in comparison to engines with intake manifold fuel injection. There are therefore more particles in the exhaust gas (particulate matter).

Thanks to various measures the particulate concentration in gasoline engines was reduced significantly and they now satisfy the exhaust emission standards EURO 6 which is valid from 2014.

For instance, new injectors with different diameters of the laser-produced bore holes are used. The fuel quantity of the two spray jets in the exhaust direction is reduced by 20%, which increases the other four spray jets by 10% respectively.

F15 Powertrain and Chassis Dynamics

1. Powertrain



Comparison of injection system of injectors EURO 5/EURO 6

Index	Explanation
1	Spray jets EURO 5
2	Spray jets EURO 6

Changes to the DME enable a more precise metering of the pre-injection. A better atomization of the fuel and thus a reduction of the particulate concentration is achieved.

In addition, the ignition timing is adjusted to the "late" direction during the warm-up phase. Some of the combustion energy can therefore be used to heat up the catalytic converter, which in turn reaches its operating temperature quicker.

1.2.3. N57 engine

The N57 engine replaces the M57 engine that was previously used in the E70. The new N57 engine sets the standard in its displacement class in terms of dynamics, performance and consumption.

Special features

- Increased power and torque values
- Reduction of CO_2 emissions
- Improvement in acoustics
- Full compliance with the exhaust emission standards

Technical data N57TU engine

		M57D30T2 E70 LCI, X5 xDrive 35d	N57D30O1 F15, X5 xDrive 35d
Design		R6	R6
Valves per cylinder		4	4
Engine control		DDE 7.3	DDE 7.41
Displacement	[cm^3]	2993	2993
Stroke/Bore hole	[mm]	90.0/84.0	90.0/84.0
Power output at engine speed	[kW (HP)] [rpm]	198 (265) rpm 4200	190 (258) 4000
Torque at engine speed	[Nm (lb-ft)] [rpm]	580 (427) 1750 – 3000	560 (413) 1500 – 3000
Compression ratio	[ε]	16.5 : 1	16.5 : 1
Fuel grade		Diesel	Diesel
Exhaust emission standards		ULEV II	ULEV II
Acceleration 0 – 100 km/h	[s]	7.6	6.9

SCR 2

The abbreviation SCR stands for **S**elective **C**atalytic **R**eduction. This is currently the most effective system for the reduction of nitrogen oxides in the exhaust gas.

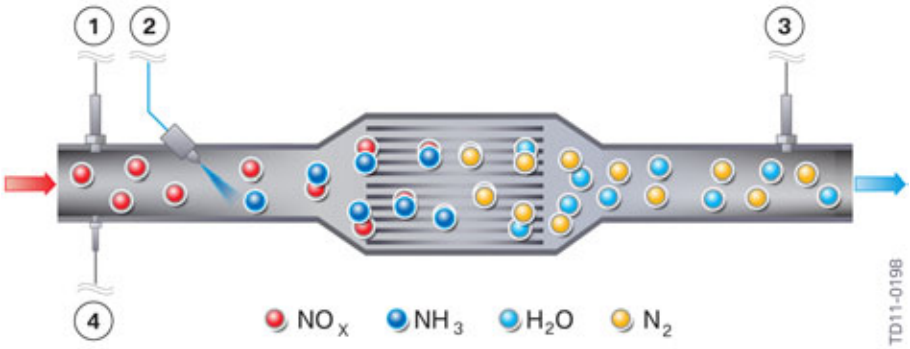
F15 Powertrain and Chassis Dynamics

1. Powertrain

This system is model-specific and is now being used for all current BMW diesel engines in USA as well as in other markets. It is necessary to comply with the EURO 6 exhaust emission standards (in Europe) as well with the US EPA and CARB emission regulations. Although the new US market diesels are certified to the more stringent ULEVII (California) standard in some states the requirement is still Tier 2, Bin 5 (LEV II). Compliance with these regulations has been possible by combining SCR, the already known emission systems, such as NSC (NOx storage catalytic converter), EGR (low-pressure exhaust-gas recirculation) and DPF (diesel particulate filter) and the internal engine measures. Therefore the requirements of the CARB and EURO 6 exhaust emission standards are also fulfilled in the cold-start phase, when the SCR system is not yet operational.

The special feature of the SCR system is the additional used of the urea/water mixture (AdBlue®), a supply of which is stored and carried in the vehicle. This urea/water mixture is generally known under the brand name **"AdBlue®"** and also referred to as **Diesel Exhaust Fluid (DEF)**.

The system is managed at BMW under the marketing name **"BMW BluePerformance"**.



Function of the SCR 2

Index	Explanation
1	NO_x sensor before the SCR catalytic converter
2	Dosing valve
3	NO_x sensor after the SCR catalytic converter
4	Temperature sensor after the diesel particulate filter

The urea/water mixture (AdBlue®) is injected into the exhaust pipe via the dosing valve before the SCR catalytic converter. The Digital Engine Electronics (DDE) calculates how much has to be injected. The nitrogen oxide content in the exhaust gas is calculated via the NO_x sensor before the SCR catalytic converter. Using this value the exact required amount of urea/water mixture (AdBlue®) is injected in order to completely reduce the nitrogen oxides.

The urea/water mixture (AdBlue®) transforms into ammonia in the exhaust pipe. The ammonia reacts in the SCR catalytic converter with the nitrogen oxides and nitrogen (N_2) and water (H_2O) are created.

Behind the SCR catalytic converter there is a second NO_x sensor which monitors the function.

A temperature sensor located in the exhaust pipe behind the diesel particulate filter (before the SCR catalytic converter and the dosing valve) also influences the function because the injection of the urea/water mixture (AdBlue®) begins only once 170 °C (338 °F) is reached.

F15 Powertrain and Chassis Dynamics

1. Powertrain

A detailed description of the SCR 2 system can be found in the Training Reference Manual "ST1307 SCR 2".

1.2.4. Cooling

In the F15 an optimized radiator, in terms of power, is used. Recesses in the flat cooler lines ensure turbulences in the coolant, whereby the cooling power is increased. The optimized radiator is used in all US version vehicles with a diesel engine or gasoline engines.

1.3. Engine identification

1.3.1. Engine designation

In the technical documentation, the engine designation is used to ensure unambiguous identification of the engine. However, an abbreviated engine identification (e.g. N55) 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 External engines
2	Engine type	1 2 4 5 6 7 8	4-cylinder in-line engine (z. B. N12) 4-cylinder in-line engine (e.g. N20) 4-cylinder in-line engine (e.g. N47) 6-cylinder in-line engine (e.g. N55) 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	Displacement 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 Revision

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.3.2. 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 was 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.

Position	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW M Sport BMW M GmbH External engines
2	Engine type	1 2 4 5 6 7 8	4-cylinder in-line engine (z. B. N12) 4-cylinder in-line engine (e.g. N20) 4-cylinder in-line engine (e.g. N47) 6-cylinder in-line engine (e.g. N55) 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	Displacement 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

1.4. Automatic start/stop function (MSA)

The automatic start-stop function, already known from other series, will come as standard equipment on the F15. The operating logic corresponds to that of the 5 Series LCI.

Detailed information on the automatic start-stop function can be found in the Training Reference Manual "ST1309 5 Series LCI".

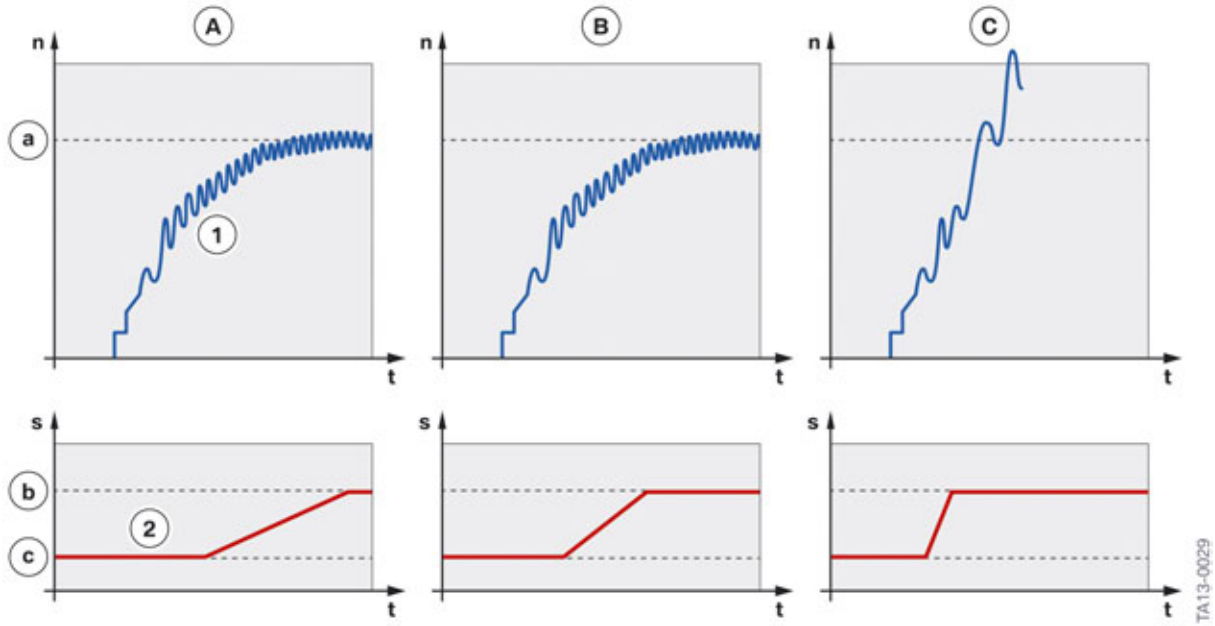
Distinctive feature

New to the F15 is the use of different start strategies to improve the comfort and dynamics of the system.

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.4.1. Start strategies



Automatic start-stop function start strategy

Index	Explanation
A	System start
B	Convenient starting
C	Dynamic start
1	Engine speed
2	Position of multidisc clutch
a	Idle speed
b	Multidisc clutch closed
c	Multidisc clutch open

Up to now an automatic start by the MSA increased engine speed in every situation as quickly as possible to reach idle speed.

F15 Powertrain and Chassis Dynamics

1. Powertrain

However, on the one hand in order to guarantee quick drive-off, and, on the other hand, in order to start the engine with fewer vibrations, the automatic start in the F15 was optimized depending on the situation:

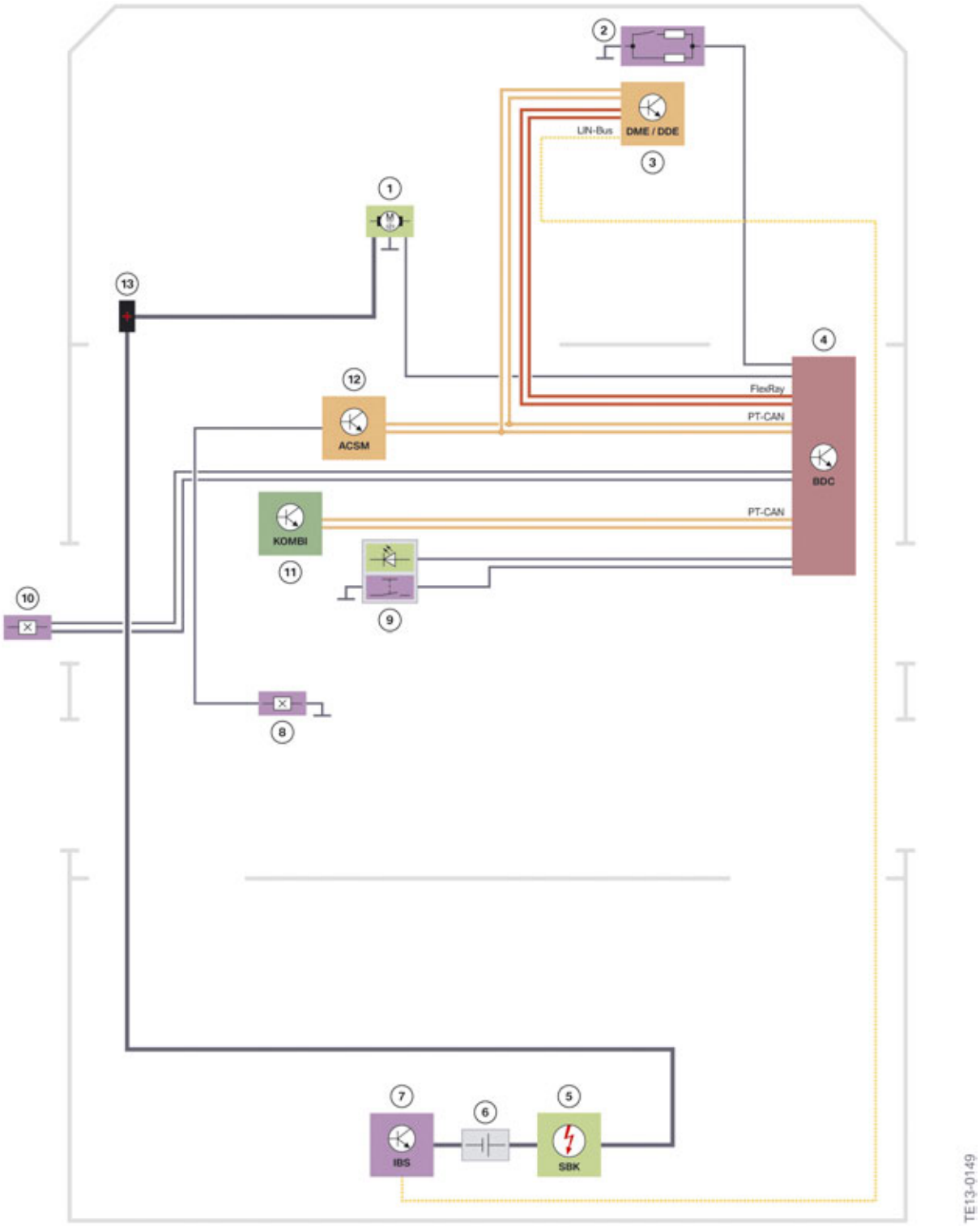
System start	Convenient starting	Dynamic start
The automatic start is signaled by a system switch-on request (e.g. by the heating and air conditioning system), the brake pedal remains pressed.	The automatic engine start is signaled by releasing the brake, the accelerator pedal is not pressed.	The automatic engine start is signaled by releasing the brake, the accelerator pedal is pressed for drive off.
The engine speed is slowly increased until it reaches the idle speed.	The engine speed is slowly increased until it reaches the idle speed.	The engine speed is increased quickly.
The multidisc clutch in the automatic transmission closes very slowly.	The multidisc clutch in the automatic transmission closes slowly.	The multidisc clutch in the automatic transmission closes quickly.
A longitudinal jolt noticeable to the driver is avoided.	Smooth and comfortable drive-off is made possible.	Quick drive-off is possible.

For an engine start with fewer vibrations, the system start and convenient starting, the engine speed is initially increased quickly and then slower until it reaches the idle speed. The ignition timing is adjusted to the "late" direction for this.

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.4.2. System wiring diagram



F15 wiring diagram for automatic start-stop function

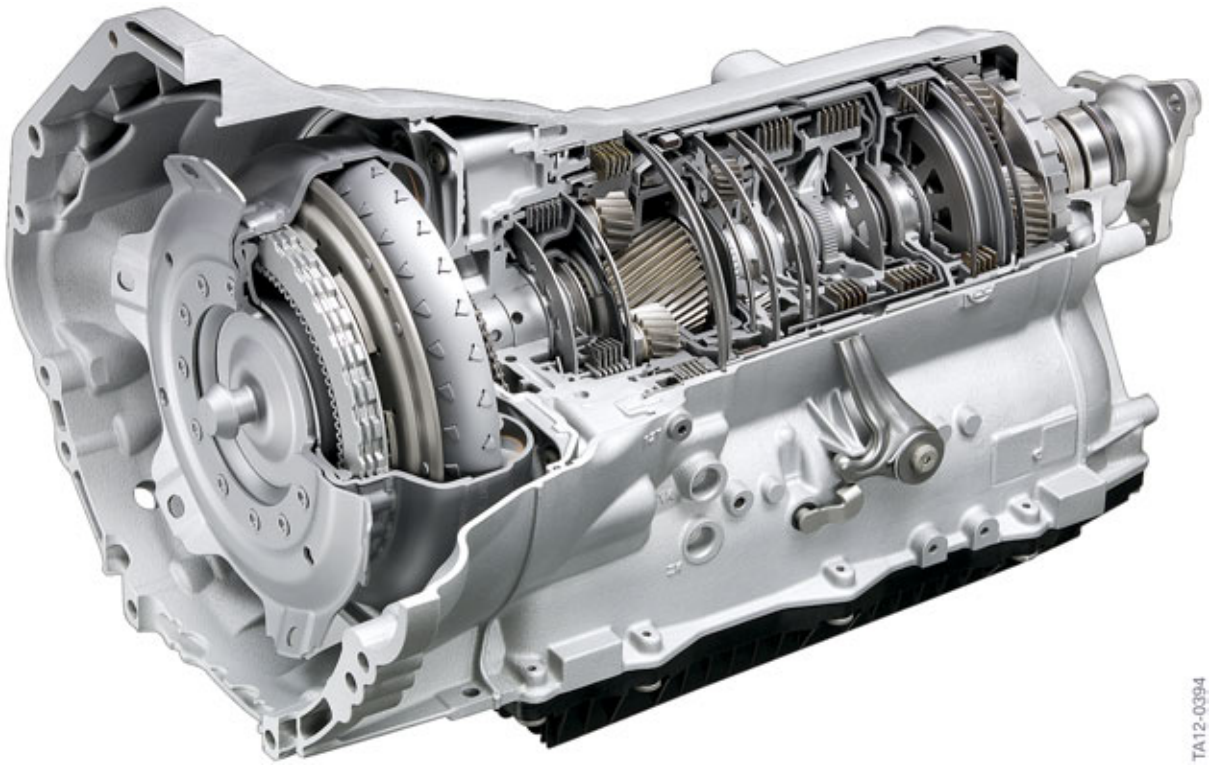
F15 Powertrain and Chassis Dynamics

1. Powertrain

Index	Explanation
1	Starter motor
2	Engine compartment lid contact switch
3	Digital Engine Electronics/Digital Diesel Electronics
4	Body Domain Controller
5	Safety battery terminal
6	Battery
7	Intelligent battery sensor
8	Seat belt buckle contact, driver
9	START-STOP button
10	Door contact, driver
11	Instrument cluster
12	Advanced Crash Safety Module
13	B+ positive battery connection point

1.5. Automatic transmission

1.5.1. The 8HP automatic transmission



GA8HP automatic transmission

F15 Powertrain and Chassis Dynamics

1. Powertrain

In the F15 the 8HP automatic transmission is installed. Depending on the engine used two variants are available.

Engine	Automatic transmission
N55B30	8HP45
N63B44 and N57D30	8HP70

1.5.2. Sports automatic transmission with shift paddles

The Sports automatic transmission with shift paddles is included in the ZMM Sport Package as optional equipment.

Additional functions are available for the Sports automatic transmission with the model change:

- Three different shift speeds, depending on the driving dynamics setting.
- Suppression of automatic gear shifts:
  Automatic gear shifts, e.g. at maximum speed, are not performed if one of the following preconditions is satisfied:
  - Dynamic Stability Control (DSC) deactivated
  - Dynamic Traction Control (DTC) activated
  - SPORT+ activated.

  The kickdown is also deactivated.
- Launch Control:
  Launch Control enables optimal acceleration when driving off on a smooth roadway. For this purpose, the system calculates an engine torque, at which a slip of approx. 10 to 15% at the differential is achieved on a smooth roadway.

Activation of Launch Control

Step	Activity
1	Briefly press the DSC switch or select Sport+ using the driving experience switch. > DTC activated and DSC restricted.
2	Selector lever in position S.
3	Firmly press the brake using the left foot.
4	Press the accelerator pedal beyond the resistance at the kick-down pressure point. > Flag symbol appears in the instrument cluster and the engine speed for pulling away is adjusted.
5	Release the brake within 3 seconds and hold the accelerator pedal. > Vehicle accelerates quickly.

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.5.3. ConnectedShift

ConnectedShift uses navigation data for a forward-thinking shift strategy of the automatic transmission. If, for example, a sharp bend is detected, the automatic transmission shifts down early and the gear is retained in the bend.

The route guidance of the navigation system does not need to be activated for the function. However, the identification of a turn-off request, for example by the active route guidance or operating the turn indicator, helps to control the system more accurately. Up-to-date navigation map data also influences the control accuracy.

A prerequisite for ConnectedShift is the navigation system with Touchpad which is standard in all F15's.

Advantages

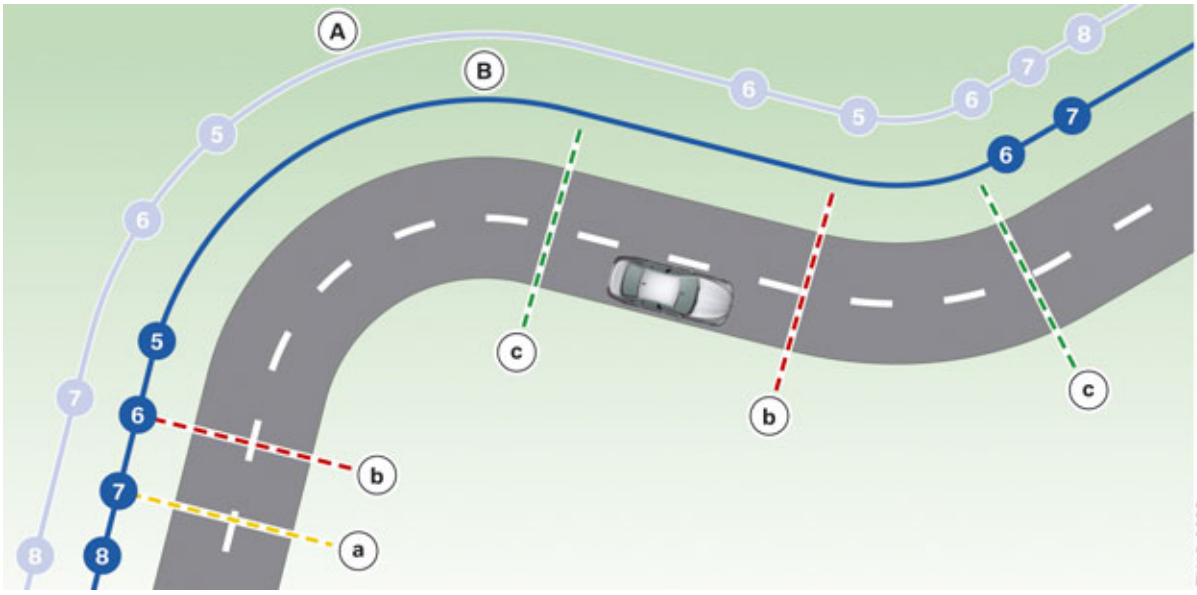
ConnectedShift offers various advantages depending on the route:

Traffic guidance	Advantages
Bend/Subsequent bend	• Higher engine braking effect before the bend • Driving force reserve for accelerating from the bend • Optimized shift characteristics in the bend
Crossroads	Upon recognized turn-off request by active route guidance or operation of the turn indicator: • Higher engine braking effect before crossroads • Optimized shift characteristics in the crossroads
Highway entrance/exit ramp	• Higher engine braking effect before ramp • Driving force reserve when merging
Roundabout	• Higher engine braking effect before the roundabout • Driving force reserve before entry • Optimized shift characteristics in the roundabout and in the exit

F15 Powertrain and Chassis Dynamics

1. Powertrain

Shift example for a vehicle with and without ConnectedShift



ConnectedShift shift example

Index	Explanation
A	Shift points without ConnectedShift
B	Shift points with ConnectedShift
a	Taking the foot off the gas (coasting (overrun) mode)
b	Slight brake control
c	Accelerator pedal is operated

ConnectedShift can choose downshifts before bends and avoid up and down shifts between consecutive bends. A higher engine braking effect before bends is thus achieved, as well as a reduction of the shift frequency in bends and optimal passage from the bends.

Characteristics and availability

In SPORT and COMFORT modes the characteristics of ConnectedShift are adapted to the respective driving program, in ECO PRO mode ConnectedShift is not available. ConnectedShift is also not available during control operation of cruise control.

A prerequisite is that the navigation map data and the required additional information for the country are available. This is dependent on the navigation map provider and is not available worldwide for all countries.

1.5.4. Coasting in idle

For the F15 the "Coasting in idle position" function is available. Under certain prerequisites the engine is automatically disconnected from the transmission in gear selector switch position D. The engine runs here at idle speed.

Further information on "Coasting" is available in the Training Reference Manual “ST1212 F01/F02 LCI”, chapter Displays and Controls".

1.6. Differential

1.6.1. Front axle differential

The front axle differential VAG 170AL and VAG 178AL of the F15 are carried over from the E70 with the following changes:

- Adapted axle ratio for the F15
- Optimization of oil flow for lower oil temperatures and reduction of heat entering the axle transmission
- Weight reduction thanks to welding instead of bolting of the gears and case

As a result of these measures, it was possible to increase the efficiency of the front axle differential.

1.6.2. Rear axle final drive

The rear axle differential HAG 188LW and HAG 215LW for the F15 were carried over from the F25. The connection at the rear axle support was taken over from the E70.

The descriptions of the rear axle differential can be found in the Training Reference Manual "ST931 F25 Complete Vehicle".

The following changes were made:

- Adapted axle ratio
- Material change of the radial shaft seal at the powertrain
- Use of thin oil
- Weight reduction thanks to welding instead of bolting of the gears and case

As a result of these measures, it was possible to increase the efficiency of the rear axle differential.

The rear axle differential HAG 225QMV is installed in conjunction with dynamic performance control.

Further information can be found in the chapter Dynamic Performance Control under Driving Stability Controls.

F15 Powertrain and Chassis Dynamics

1. Powertrain

1.7. Transfer box

1.7.1. ATC45L

The transfer box ATC45L is a further development of the module transfer box ATC450 for the BMW xDrive powertrains, and is a common part for the F25 xDrive.

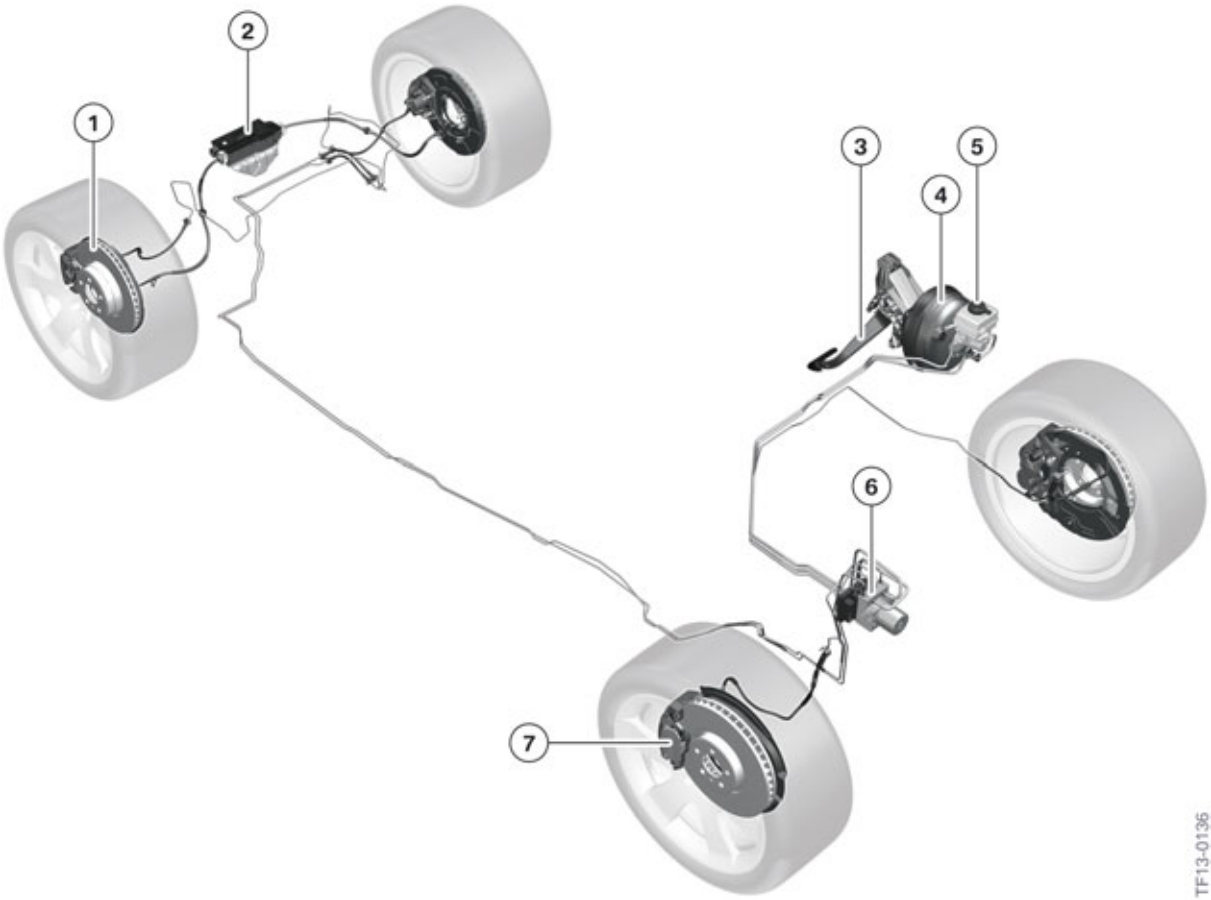
Detailed information on the structure and function of the transfer box is provided in the Training Reference Manual "ST931 F25 Complete Vehicle".

Special features

- 100% distribution of the powertrain torque to front and rear axle
- Number of coupling components and their actuators are minimized
- 1.4 kg weight saving in comparison to the ATC450
- Efficiency optimized by new oil line system

F15 Powertrain and Chassis Dynamics

2. Brakes



F15 Brake system

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

F15 Powertrain and Chassis Dynamics

2. Brakes

2.1. Service brakes

The F15 features a hydraulic 2-circuit brake system with "front/rear split".

The brake design was carried over from the E70.

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.

2.2. Parking brake

In the F15 the EMF known from the E70 is used. It is operated using the EMF button in the center console. Similar to other models, in the F15 braking controlled in the DSC can also be introduced using the EMF button, in addition to the normal parking brake and releasing the parking brake.

A functional enhancement of the electromechanical parking brake EMF enables an automatic release of the parking brake as soon as the drive-off request by the driver is recognized. Smooth and comfortable drive-off is made possible.

In other series with automatic transmission this function has already been in use since 2011 in the F10, or since 2012 in the F07.

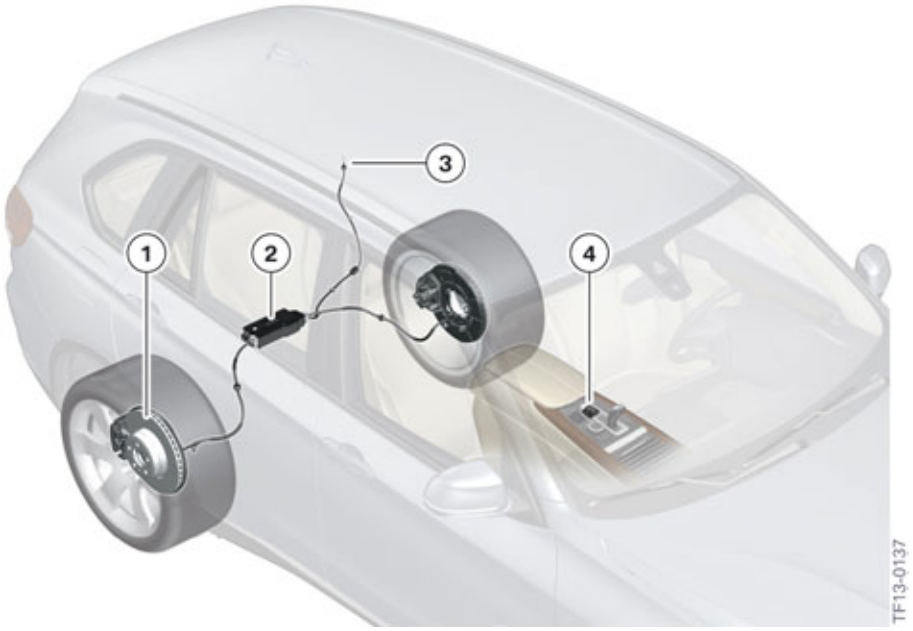
The parking brake is automatically released as soon as there is a corresponding drive torque. The accelerator pedal must be operated.

The following preconditions must also be satisfied:

- Driver presence is identified via seat belt
- Drivers door closed
- Engine running
- Drive position engaged
- Engine torque present via accelerator pedal

The driver's absence is detected via the seat belt buckle switch and via the door contact.

A cable for the emergency release is accessible from the luggage compartment.



F15 Electromechanical parking brake

Index	Explanation
1	Duo-servo parking brake
2	Actuator, parking brake
3	Emergency release
4	EMF button

2.3. Dynamic Stability Control (DSC)

The Dynamic Stability Control is installed in the F15 with the latest variant, the DSC 9.

The coordination of the DSC to the Dynamic Performance Control, Launch Control and the optimization of the Dynamic Traction Control, is new.

F15 Powertrain and Chassis Dynamics

3. Chassis and Suspension

3.1. Further information

Detailed information on the chassis and suspension and driving stability controls can be found in the following Training Reference Manual:

- Training Reference Manual "ST605 E70 Complete Vehicle"
- Training Reference Manual "ST710 E71 Complete Vehicle"

3.2. Front axle

In the F15 a revised version of the E70 front axle is used.

3.2.1. Front axle support

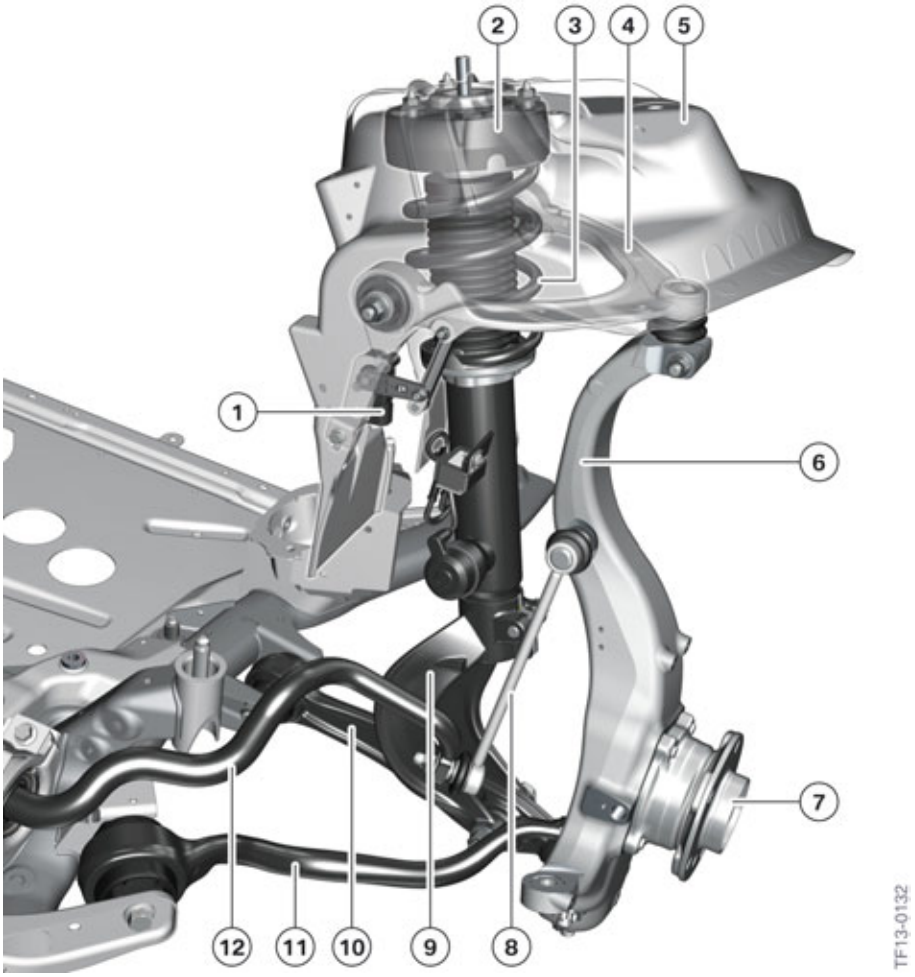
The axle support was optimized in terms of weight through design measures and, at the same time, the use of Electronic Power Steering was adapted.

3.2.2. Double-wishbone front axle

The double-wishbone front axle, known from the E70 with double joint principle, was improved in terms of ride comfort and straight-ahead driving by means of softer rubber mounts and changes to the front axle kinematics, without compromising the driving dynamics. For the reduction of the fuel consumption and thus the CO_2 emissions, wheel bearings with optimized rolling resistance are installed.

F15 Powertrain and Chassis Dynamics

3. Chassis and Suspension



F15 double-wishbone front axle with basic chassis and suspension

Index	Explanation
1	Ride height sensor
2	Support bearing
3	Spring strut
4	Control arm, top
5	Spring strut support
6	Swivel bearing
7	Wheel bearing
8	Anti-roll bar link
9	Spring strut rest
10	Wishbone, bottom
11	Trailing link with hydro mount
12	Anti-roll bar

F15 Powertrain and Chassis Dynamics

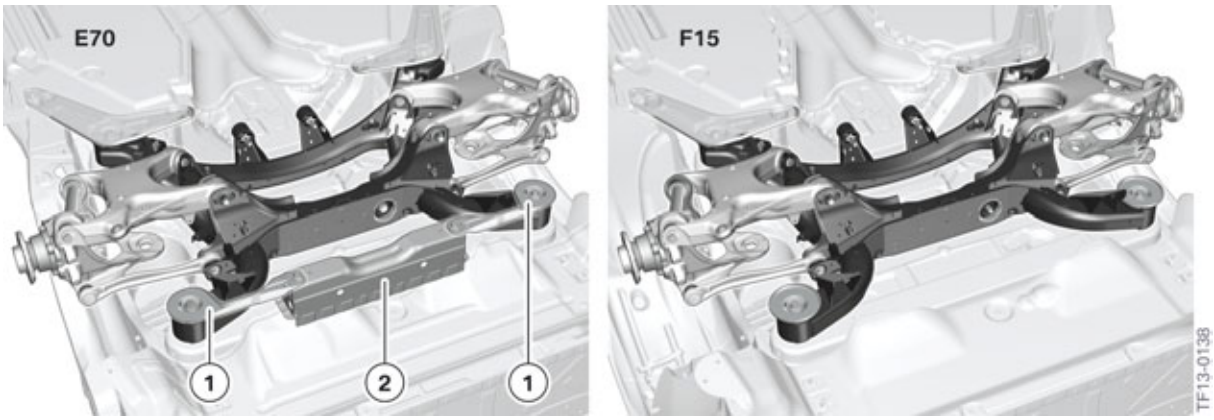
3. Chassis and Suspension

3.3. Rear axle

The rear axle is also already known from the E70 and was only modified slightly.

3.3.1. Rear axle support

Based on the more convenient remapping in comparison to the predecessor, the connection of the rear axle support at the body of the F15 was able to be constructed without rear compression struts, thereby dispensing with the support block on the body side.



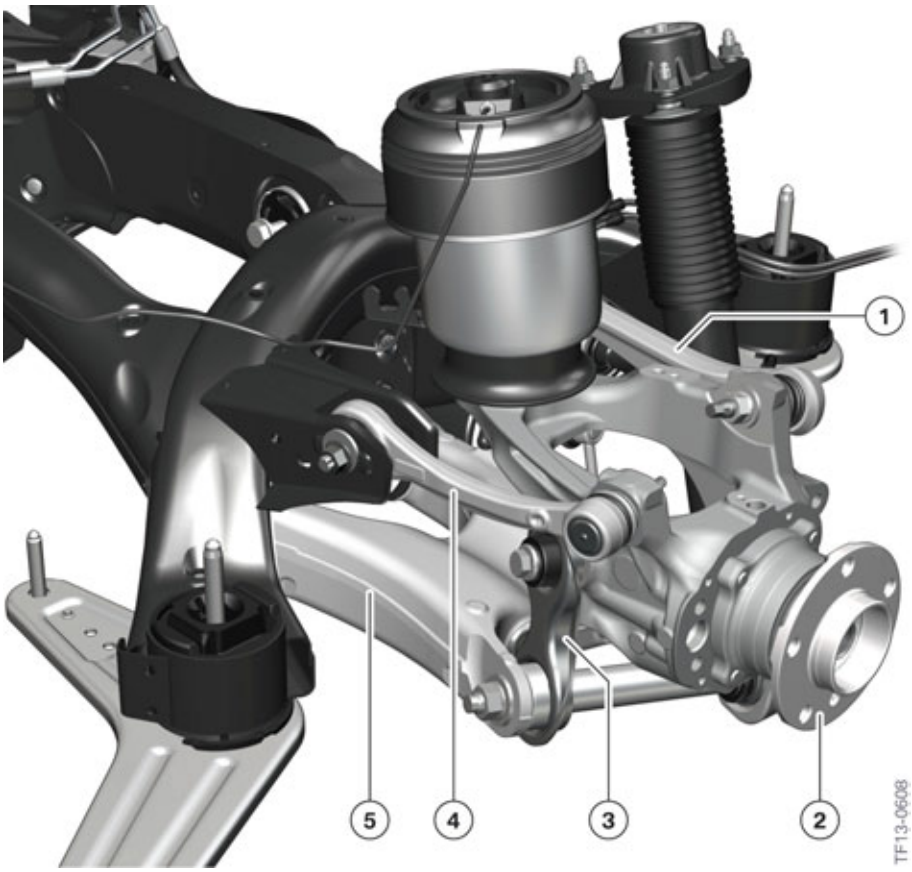
F15 deletion of the rear compression strut rear axle

Index	Explanation
1	Rear compression strut
2	Support stand

F15 Powertrain and Chassis Dynamics
3. Chassis and Suspension

3.3.2. Integral IV rear axle

Wheel bearings with optimized rolling resistance are also used at the rear axle.

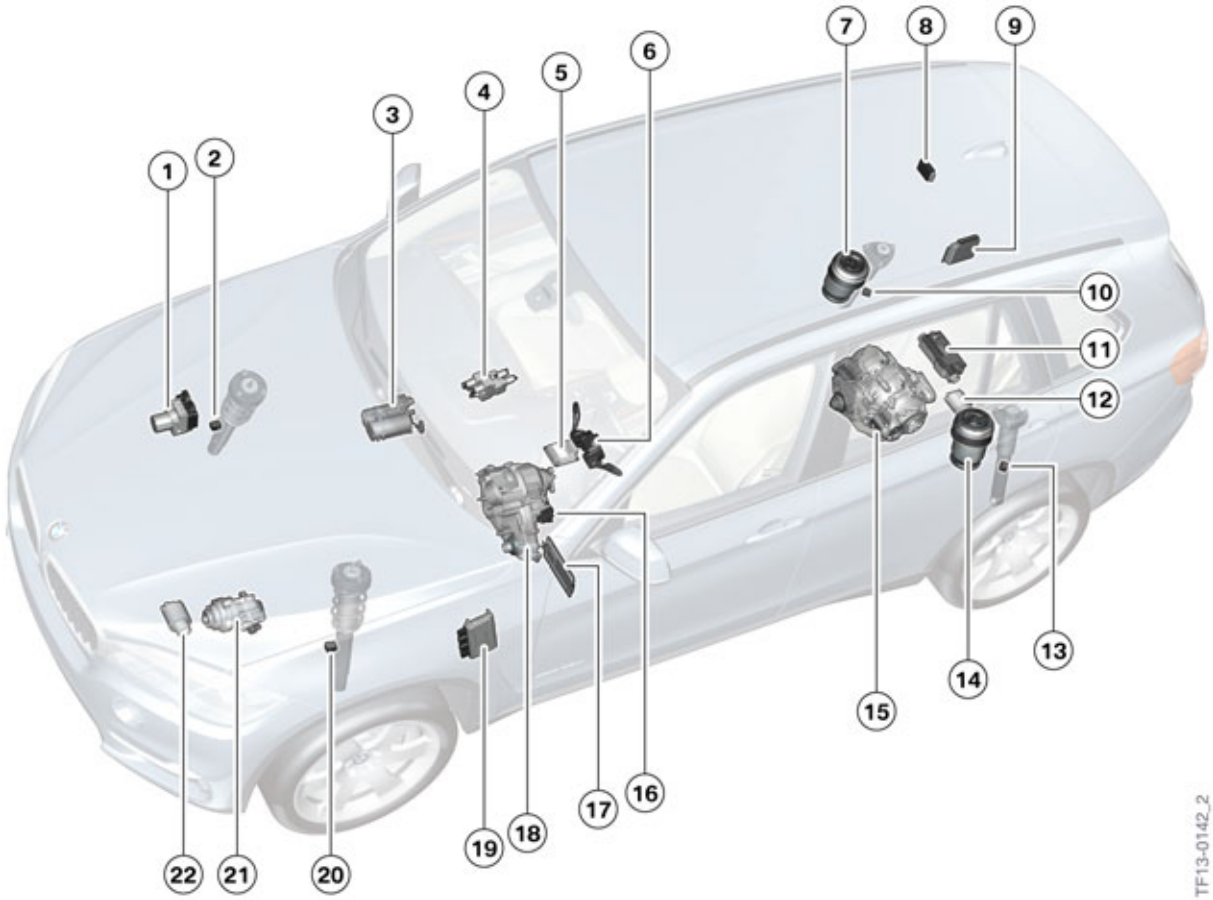


Index	Explanation
1	Wishbone
2	Wheel carrier
3	Integral link
4	Upper control arm
5	Swinging arm

F15 Powertrain and Chassis Dynamics

3. Chassis and Suspension

3.4. Driving stability controls



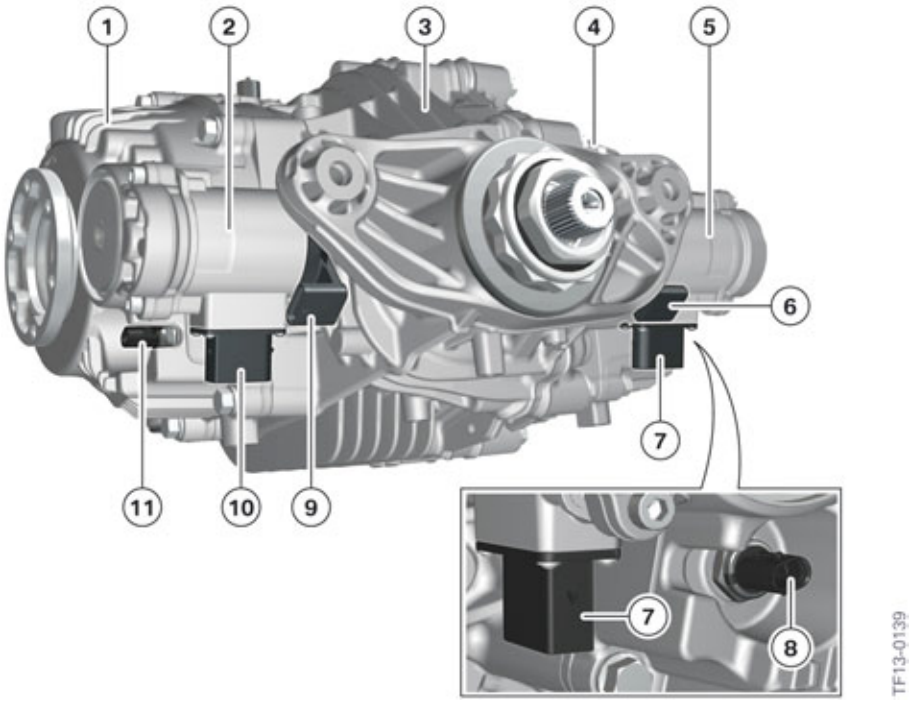
F15 Driving stability controls

Index	Explanation
1	Dynamic Stability Control
2	Wheel acceleration sensor, front right (for vehicles with VDM)
3	EHC air supply system
4	ARS valve block
5	ICM control unit
6	Steering column switch cluster with steering angle sensor
7	Air spring, rear right
8	EHC control unit
9	QMVH control unit
10	Wheel acceleration sensor, rear right (for vehicles with VDM)
11	Actuator, parking brake
12	ARS swivel motor, rear axle

Index	Explanation
13	Wheel acceleration sensor, rear left (for vehicles with VDM)
14	Air spring, rear left
15	Rear axle differential with variable ratio transmission (QMVH)
16	Transfer box control unit with actuator
17	VDM control unit
18	Transfer box
19	AL control unit
20	Wheel acceleration sensor, front left (for vehicles with VDM)
21	Power steering pump
22	ARS swivel motor, front axle

3.4.1. Dynamic Performance Control

Dynamic Performance Control is the further development of the intelligent four-wheel drive xDrive. To date, the drive torque could only be distributed between front and rear axle. Dynamic Performance Control now also allows a distribution of the drive torque at the rear axle. The familiar rear axle differential is extended with two variable ratio transmissions, each comprising of a double planetary gear and an electric multiple disc brake. The system is already known from the E71.



F15 rear axle differential with Dynamic Performance Control

Index	Explanation
1	Variable ratio transmission, right
2	Servomotor, right
3	Rear axle differential
4	Variable ratio transmission, left
5	Servomotor, left
6	Plug connection, rotor position sensor, left
7	Plug connection, servomotor, left
8	Transmission oil temperature sensor, left
9	Plug connection, rotor position sensor, right
10	Plug connection, servomotor, right
11	Transmission oil temperature sensor, right

Irrespective of the applied or requested drive torque of the engine, a differential torque of up to 1800 Nm (1328 ft/lbs) can be actively adjusted at any time between the left and right rear wheel.

This difference brings about a yaw moment around the vertical axis, which is used for stabilization in the event of an understeer (counteractive inward yaw moment) or oversteer (counteractive outward yaw moment) of the vehicle. The system also serves for the dynamics, as during cornering the torque can be directed to the outer cornering wheel. In the case of a normal axle drive the unloaded inner cornering wheel would restrict the maximum transmissible torque.

With Dynamic Performance Control corners can be taken in a more agile manner with reduced steering and extended limit range.

The Dynamic Stability Control has a superior role in the complete system and is active in the limit range in a familiar way.

The torque distribution is also used for traction during acceleration. If the wheels on different surfaces are at varied coefficients of friction, the torque is applied to the wheel with the higher potential of traction.

The advantages are summarized as follows:

- Increase in driving safety
- Optimal directional stability with reduced steering effort
- Improvement in traction capacity

For detailed information on the Dynamic Performance Control function please refer to the Training Reference Manual "ST710 E71 Complete Vehicle".

F15 Powertrain and Chassis Dynamics
3. Chassis and Suspension

In the F15 for the first time it is possible to have the xDrive status displayed in the central information display CID with the following information:

- Compass direction
- Angle of vehicle in longitudinal direction, with specification of percentage and degree
- Inclination of the vehicle in transverse direction with specification of degree

The steering angle, as well as the angle and inclination of the vehicle are also shown in 3D.

F15 status display of xDrive in the central information display

The drive torque distribution can also be shown instead of the xDrive status. The current drive torque distribution is displayed using arrows at the corresponding wheels.

F15 display of drive torque distribution xDrive in the central information display

3.4.2. Dynamic Drive

The system for ARS was used for the first time in the E65 and was already used in the predecessor E70.

The anti-roll bars on the front and rear axles are separate but can work together using a hydraulic swivel motor. ARS can very quickly generate a torque at the anti-roll bars in order to stabilize the vehicle. For straight-ahead driving the anti-roll bars are inactive.

Advantages

- The roll tendency of the vehicle occurring in the event of quick cornering or avoidance maneuvers is reduced.
- The required steering angle is reduced.
- The bounce of the wheels on an axle, in the event of uneven road surfaces, is minimized and the ride comfort enhanced.
- The self-steering and load change behavior are significantly improved.
- There is more driving pleasure, less tiring driving is made possible and the F15 can steer more accurately overall and in a more agile manner than its predecessor.

3.4.3. Vertical Dynamics Management (VDM)

The VDM is an electronic, variable shock absorber adjustment system for controlling the vertical dynamics. The VDM control unit calculates individual control commands for the electromagnetic valves in the shock absorber, based on the information input about:

- The body and wheel acceleration
- Current lateral and longitudinal acceleration
- Driving speed
- Steering wheel position

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.

The system is based on the Vertical Dynamics Management used in the F25. In contrast to the E70, no FlexRay satellites are used.

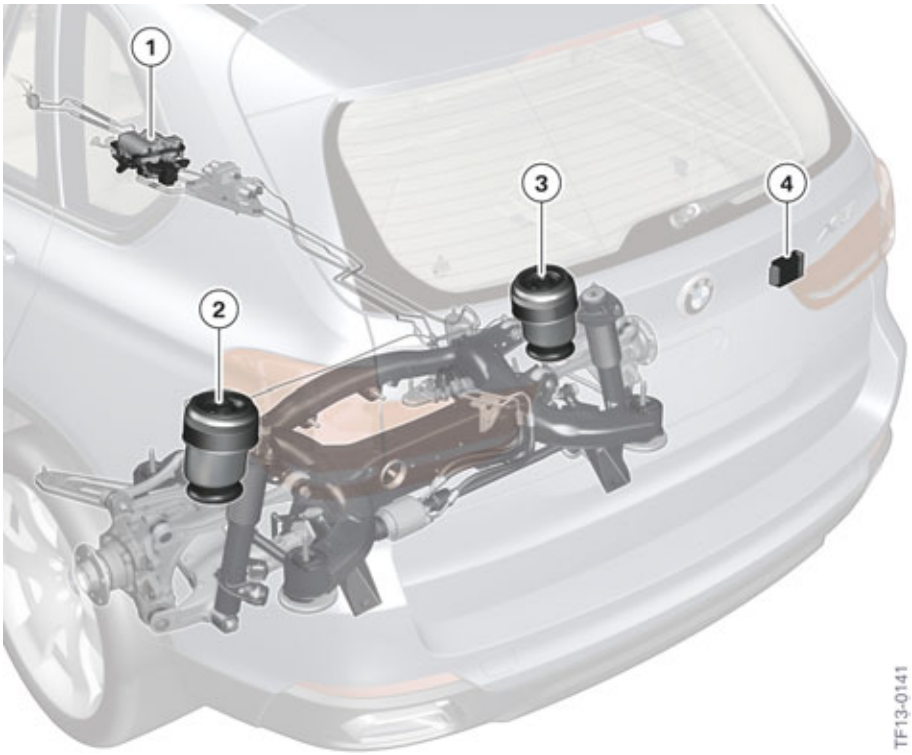
Advantages

- The tire comfort is improved with a parallel increase in the driving dynamics.
- The long-distance suitability is improved.
- The body stability is increased.
- The driving safety is improved by minimizing the wheel load fluctuations and the stopping distance.
- For the driver, VDM means added driving pleasure and makes possible less tiring driving.

3.4.4. Air suspension at rear axle (EHC)

In order to be able to maintain the ride comfort, the ground clearance and the spring travel independent of the vehicle load or trailer load, a self-levelling suspension can be used at the rear axle.

For detailed information on the air suspension at the rear axle please refer to the Training Reference Manual "ST605 E70 Complete Vehicle".



F15 air suspension at rear axle

Index	Explanation
1	EHC air supply system
2	Air spring, rear left
3	Air spring, rear right
4	EHC control unit

3.5. Chassis and suspension packages

In the F15 three chassis and suspension packages are available, in addition to the standard suspension, these are available as optional equipment. The chassis and suspension packages include useful combinations of the suspension control systems.

With the driving experience switch, the damper identifications can be switched between Comfort and Dynamic in the chassis and suspension packages with VDM .

3.5.1. Standard suspension (standard ZSU)

The standard chassis and suspension offers significantly improved ride comfort in comparison to the predecessor with the usual driving dynamics properties of BMW. It is made up of conventional shock absorbers and steel springs at the front and rear axle. With the optional equipment third row of seats (option 4UB) air springs instead of steel springs are installed at the rear axle for the self-levelling suspension.

3.5.2. Dynamic damper control + rear axle air suspension (option 2VM)

This chassis and suspension package offers an increased level of ride comfort with similar driving dynamics properties of the standard chassis and suspension. The VDM system is used. Steel springs are used on the front axle and air suspension is used on the rear axle.

3.5.3. Adaptive M suspension (option 2VF)

The adaptive M sports suspension is only available with the M sport package as an additional option. The same damper components used in the adaptive chassis and suspension package are installed, however, with more sporty damper characteristics. This results in a more sporty chassis and suspension with increased dynamics.

3.5.4. Dynamic Handling Package (option ZDH)

With this chassis and suspension package the cornering behavior of the F15 is optimally influenced and offers a high degree of dynamic handling characteristics. This package includes, dynamic damper control + rear air suspension, dynamic performance control + active role stabilization. This option is not available with the X5 sDrive35.

3.5.5. Overview

Optional chassis and suspension packages	Dynamic Damper Control + Rear Axle Air Suspension (2VM)	Adaptive M Suspension (2VF)	Dynamic Handling Package (ZDH)
Dynamic Performance Control (QMVH)	–	–	X
Dynamic Drive (ARS)	–	–	X
VDM	X	X	X
Air suspension at rear axle	X	X	X

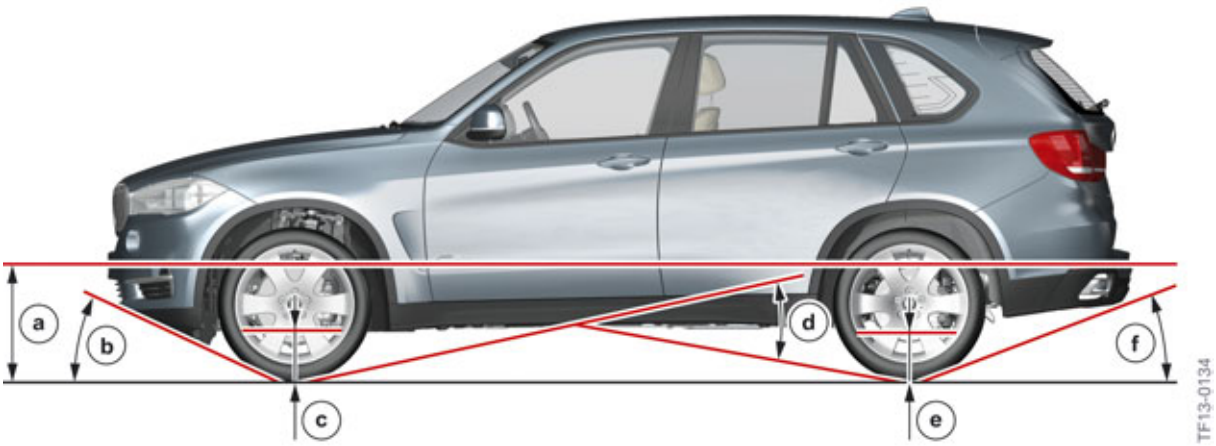
F15 Powertrain and Chassis Dynamics
3. Chassis and Suspension

3.6. Other-road mobility

The F15 satisfies other-road vehicle use.

- Ground clearance of body 200 mm (7.8 inches)
- Ground clearance of axles 180 mm (7.0 inches)
- Overhang angle at front 25°
- Overhang angle at rear 20°
- Ramp angle 20°

At 7 km/h (4 mph) the F15 is designed for up to 500 mm (19.6 inches) wading depth.



F15 other road mobility

Index	Explanation
a	500 mm (19.6 inches) wading depth
b	Overhang angle at front 25°
c	Ground clearance of body 200 mm (7.8 inches)
d	Ramp angle 20°
e	Ground clearance of axles 180 mm (7.0 inches)
f	Overhang angle at rear 20°

3.7. Tire Pressure Control TPMS

The TPMS of the F15 is calculated in the DSC and no longer has its own control unit. The radio signals of the wheel electronics are forwarded from the remote control receiver via the BDC to the DSC.

⚠

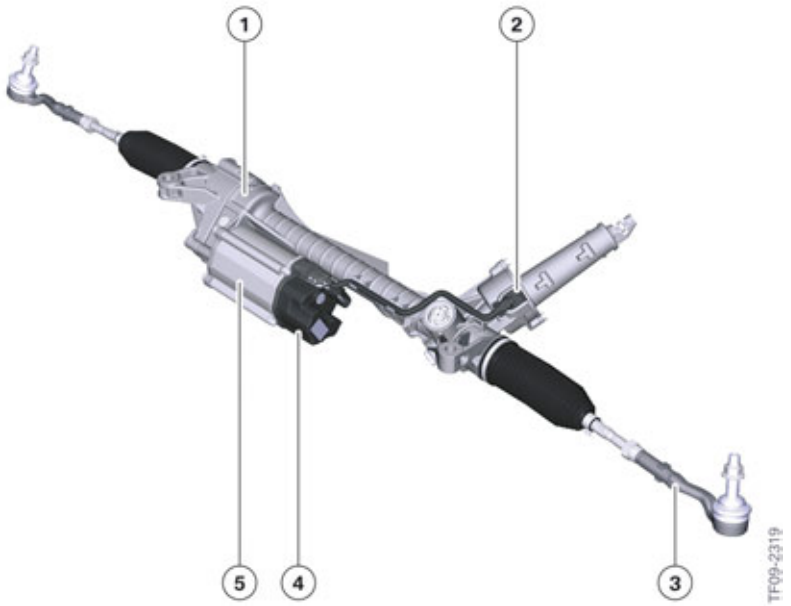
Please note that in vehicles with TPMS, after a wheel change, it is imperative an initialization period of at least 8 minutes be observed. Otherwise, the wheel electronics cannot be properly calibrated.

F15 Powertrain and Chassis Dynamics

4. Steering

The F15 will now come with Electronic Power Steering as standard equipment. With the optional equipment Active Steering a hydraulic steering gear is used. The function of the Servotronic is a fixed element of both systems.

4.1. Electronic Power Steering (EPS)



Electronic Power Steering (electromechanical power steering)

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

Electronic Power Steering reduces fuel consumption when compared to conventional hydraulic power steering. This helps reduce CO_2 emissions.

As there is no oil in an EPS, it is environmentally cleaner than conventional hydraulic power steering.

For reasons inherent in the system, EPS is always equipped with the Servotronic function. Two different settings ("Normal" and "Sport") can be accessed via the dynamic drive control switch.

The EPS is less sensitive to external disturbance variables such as steering wheel vibration. It also features active roll damping which enhances the driving safety of the F15.

The return characteristics of the EPS are fully adaptable. That means that optimum driveability can be guaranteed. The Parking Maneuver Assistant can also be installed with EPS.

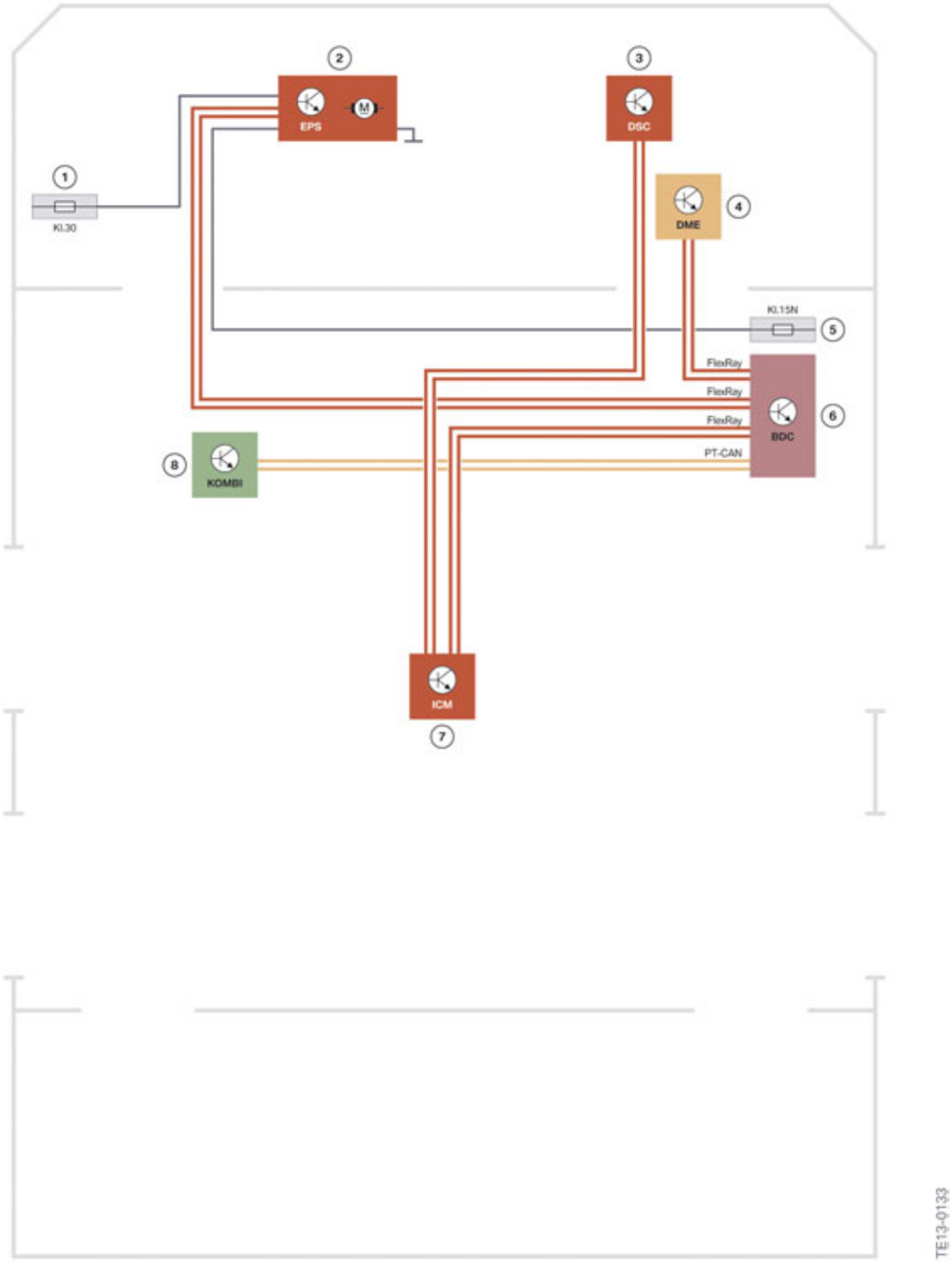
The steering angle can be reduced via the variable rack transmission ratio.

F15 Powertrain and Chassis Dynamics

4. Steering

4.1.1. System overview

4.1.2. System wiring diagram



F15 EPS system wiring diagram

Index	Explanation
1	Terminal 30, terminal 30
2	Electronic Power Steering
3	Dynamic Stability Control
4	Digital Motor Electronics
5	Power distribution box, front
6	Body Domain Controller
7	Integrated Chassis Management
8	Steering column switch cluster
9	Instrument cluster

4.1.3. Steering angle detection

The steering angle information in vehicles with Electronic Power Steering is not detected by a steering angle sensor, but is calculated using the motor position angle of the EPS motor.

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). The EPS transmits the position of the rack to the ICM control unit via FlexRay.

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 an adaptation function in which the steering wheel is turned from end stop to end stop (e.g. straight-ahead position > left > right > straight-ahead position).

4.2. Active steering (AL)

With the optional active steering, the steering angle is detected using a separate steering angle sensor at the steering column.

The active steering enables variable steering angle transmission and uses a hydraulic steering gear.

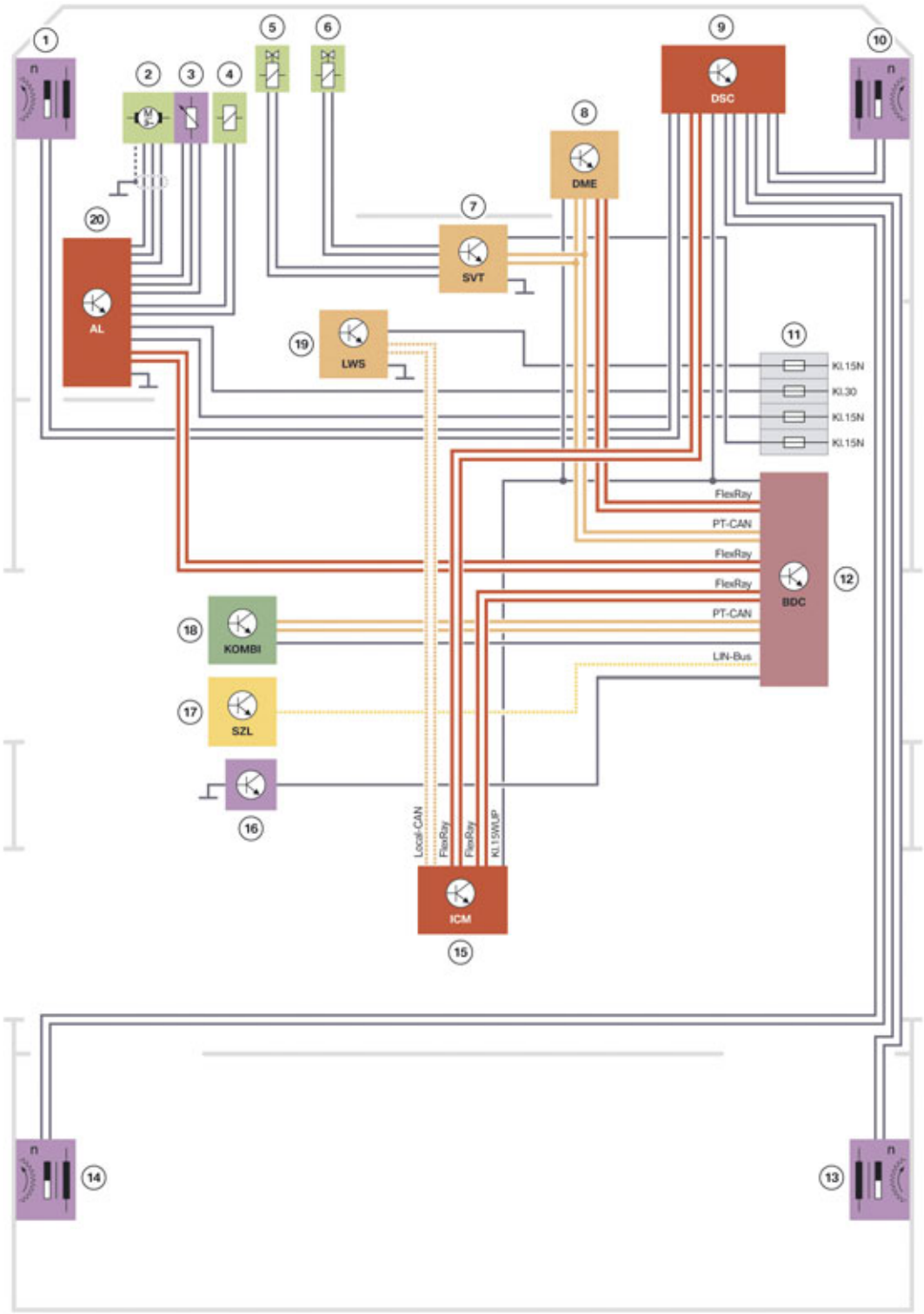
Parking Maneuver Assistant cannot be ordered with active steering.

Detailed information on active steering can be found in the Training Reference Manual "ST605 E70 Complete Vehicle".

F15 Powertrain and Chassis Dynamics

4. Steering

4.2.1. System wiring diagram



F15 system wiring diagram for active steering (AL)

Index	Explanation
1	Wheel-speed sensor, front left
2	Servomotor
3	Rotor position sensor
4	Servomotor lock
5	Servotronic valve
6	ECO valve
7	Servotronic
8	Digital Motor Electronics
9	Dynamic Stability Control
10	Wheel-speed sensor, front right
11	Power distribution box, front
12	Body Domain Controller
13	Wheel speed sensor, rear right
14	Wheel speed sensor, rear left
15	Integrated Chassis Management
16	Brake light switch
17	Steering column switch cluster
18	Instrument cluster
19	Steering angle sensor
20	Active steering

4.3. Servotronic

The Servotronic uses a variable steering servo, this means the steering force supportive function is controlled depending on speed and requirement.

Enhanced support is beneficial when parking or driving at slow speed. In contrast, at faster speeds reduced support conveys a more direct driving feeling and guarantees optimal straight-ahead driving.

In vehicles with EPS this function is combined directly with the electric motor at the steering gear. For hydraulic steering gears a valve is activated electromagnetically in order to adjust the active oil pressure.

Bayerische Motorenwerke Aktiengesellschaft
Qualifizierung und Training
Röntgenstraße 7
85716 Unterschleißheim, Germany

Technical training.
Product information.

F15 General Vehicle Electronics

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1312 5/1/2015

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 the 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: **July 2013**
BV-72/Technical Training

F15 General Vehicle Electronics

Contents

F15 General Vehicle Electronics

Contents

F15 General Vehicle Electronics

1. Introduction

The vehicle electrical system of the F15 is based for the most part on the current BMW models. This document provides an overview of the most important topics relating to the vehicle electrical system.

For detailed information on the respective topics, please refer to the following Technical Training Reference Manual covering the F01/F02:

Topic F15	ST811 F01/F02 Complete Vehicle
Bus systems	Bus systems
Voltage supply	Voltage supply
Energy management	Energy management
Car Access System	Central locking system
Comfort Access	Comfort Access
Central locking system	Central locking system
Power window regulator	Power windows
Exterior mirrors	Exterior rear view mirrors
Glass slide/tilt sunroof	Sliding tilting sunroof
Alarm system	Anti-theft system
Exterior lights	Exterior lighting
Interior lighting	Interior lighting
Seats	Seats
Heating and air-conditioning systems	Climate control

F15 General Vehicle Electronics

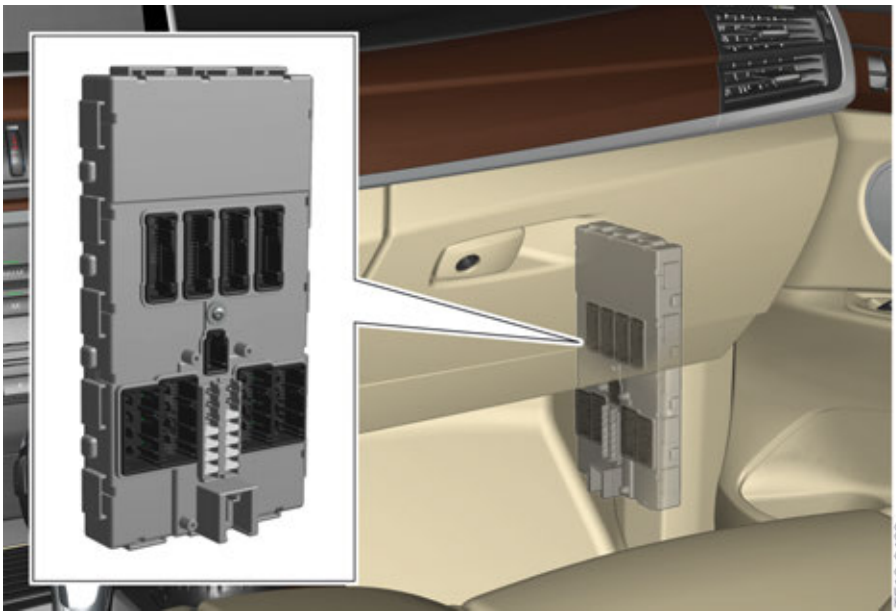
2. Vehicle Electrical System

2.1. Special features

2.1.1. Body Domain Controller BDC

In the F15 the Body Domain Controller replaces the previous control units Front Electronic Module and Rear Electronic Module.

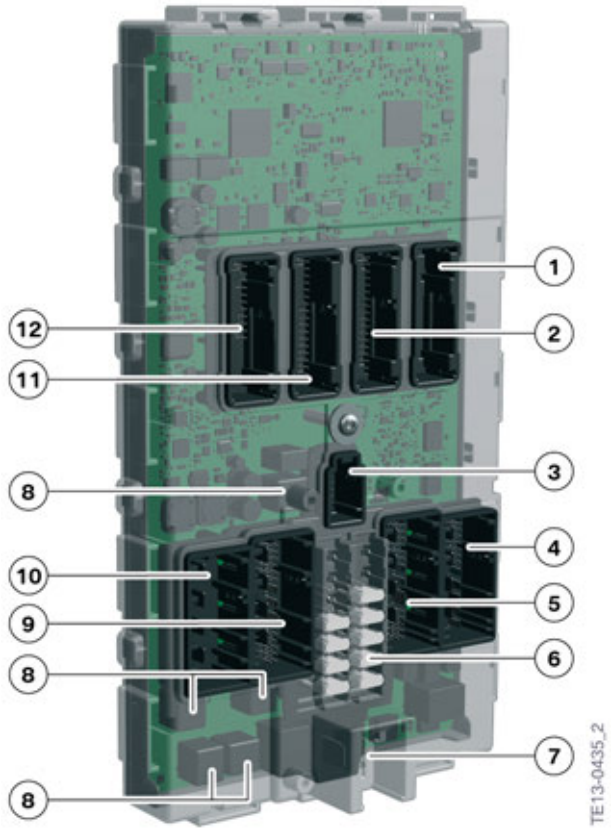
The Body Domain Controller is located at the A-pillar on the front passenger side of the vehicle, behind the footwell trim.



F15 installation location of the Body Domain Controller BDC

F15 General Vehicle Electronics

2. Vehicle Electrical System



F15 Body Domain Controller BDC

Index	Explanation
1	Connector (24–pin) / A258*6B
2	Connector (54-pin) / A258*7B
3	Connector (12-pin) / A258*10B
4	Connector (42-pin) / A258*2B
5	Connector (54-pin) / A258*3B
6	Fuses
7	Connector (1-pin, B+ supply) / A258*1B
8	Relay
9	Connector (54-pin) / A258*4B
10	Connector (42–pin) / A258*5B
11	Connector (54-pin) / A258*8B
12	Connector (54-pin) / A258*9B

The central gateway module is integrated into the BDC and is responsible for connecting all the main data bus systems to each other. By connecting them together using a star coupler, it is possible to use information from the individual bus systems on a generalized level. The central gateway module is able to implement different protocols and speeds on other bus systems. Programming data is transmitted

by Ethernet to the vehicle via the ZGM. The ZGM is integrated as a module in the BDC for use with electrical system boardnet 2020. It is viewed as a control unit within a control unit, in that the ZGM in the BDC behaves like an individual control unit.

The following table provides an overview of the BDC functions when compared with the relevant control units in vehicles of development series E70 and F15:

Function in the BDC	Control units in the E70	Control units in the F15
A/C activation (actuators, sensors)	IHKA, junction box	BDC
Wash/wipe system	Junction box	BDC
Steering column switch cluster	Junction box	BDC
Central locking system	CAS, FRM, junction box	BDC
Rain-light-solar-condensation sensor	FZD	BDC
Inside mirror	FRM	BDC
Interior light	Junction box, FRM	BDC
Exterior lights	FRM	BDC
Headlight beam throw adjustment	FRM	BDC
Power window regulator	Junction box, FRM	BDC
Exterior mirrors	FRM	BDC
Switch block, driver's door	FRM	BDC
Mirror heating	Junction box, FRM	BDC
Comfort Access	Junction box, FRM, CAS, CA	BDC
Remote control services	CAS	BDC
Electronic immobilizer	CAS	BDC, DME/DDE
Terminal control	Junction box, CAS	BDC
Intelligent battery sensor	CAS, DME/DDE	BDC, DME/DDE
Central gateway module	Junction box	BDC

The following functions are protected by fuses in the BDC:

- Steering column switch cluster
- Intelligent Safety button
- Operating unit for light
- Headlight driver module
- OBD II socket
- DSC control unit
- IHKA
- Outside door handle electronics

- Telematic Communication Box
- Power window regulator
- Central locking system
- Heated rear window

The following functions are switched by relays in the BDC:

- Power window regulator
- Central locking system
- Wiper speed 1/2
- Horn
- Heated rear window

The LIN controllers for the following components are located in the BDC:

- Electrical steering column adjustment eLSV
- Steering column switch cluster
- Steering wheel module
- Multifunction steering wheel
- Rain-light-solar-condensation sensor
- Interior rear-view mirror
- Roof function center
- Hazard warning switch/Intelligent Safety button
- Operating unit for light
- Exterior mirror, left
- Exterior mirror, right
- Switch block, driver's door
- Seat-heating electronics
- Frontal Light Electronics Left
- Front Light Electronics Right
- Remote control receiver
- Ambient lighting

2.1.2. ICM

The Integrated Chassis Management is located on the transmission tunnel behind the controller.

The ICM calculates the control functions, sensor data and vehicle values used to influence longitudinal and transverse dynamics and the yaw rate. Also integrated in the ICM are micromechanical sensors which supply driving dynamics signals. In the second generation of the ICM (series introduction in the F01) a networking of active and passive safety was implemented for the first time. The airbag sensors (High-g and rollover) are located in the ICM control unit and the data recorded for the active safety is also available to the passive safety for optimizing the function.

Depending on the optional equipment selected, the ICM in the basic version or in the high equipment version is used for vehicles with active cruise control with Stop&Go function.

For a detailed description of the Integrated Chassis Management, please refer to Technical Training Reference Manual ST811 F01/F02 Dynamic Driving Systems.

2.1.3. ACSM

The Advanced Crash Safety Module is located on the transmission tunnel in front of the controller.

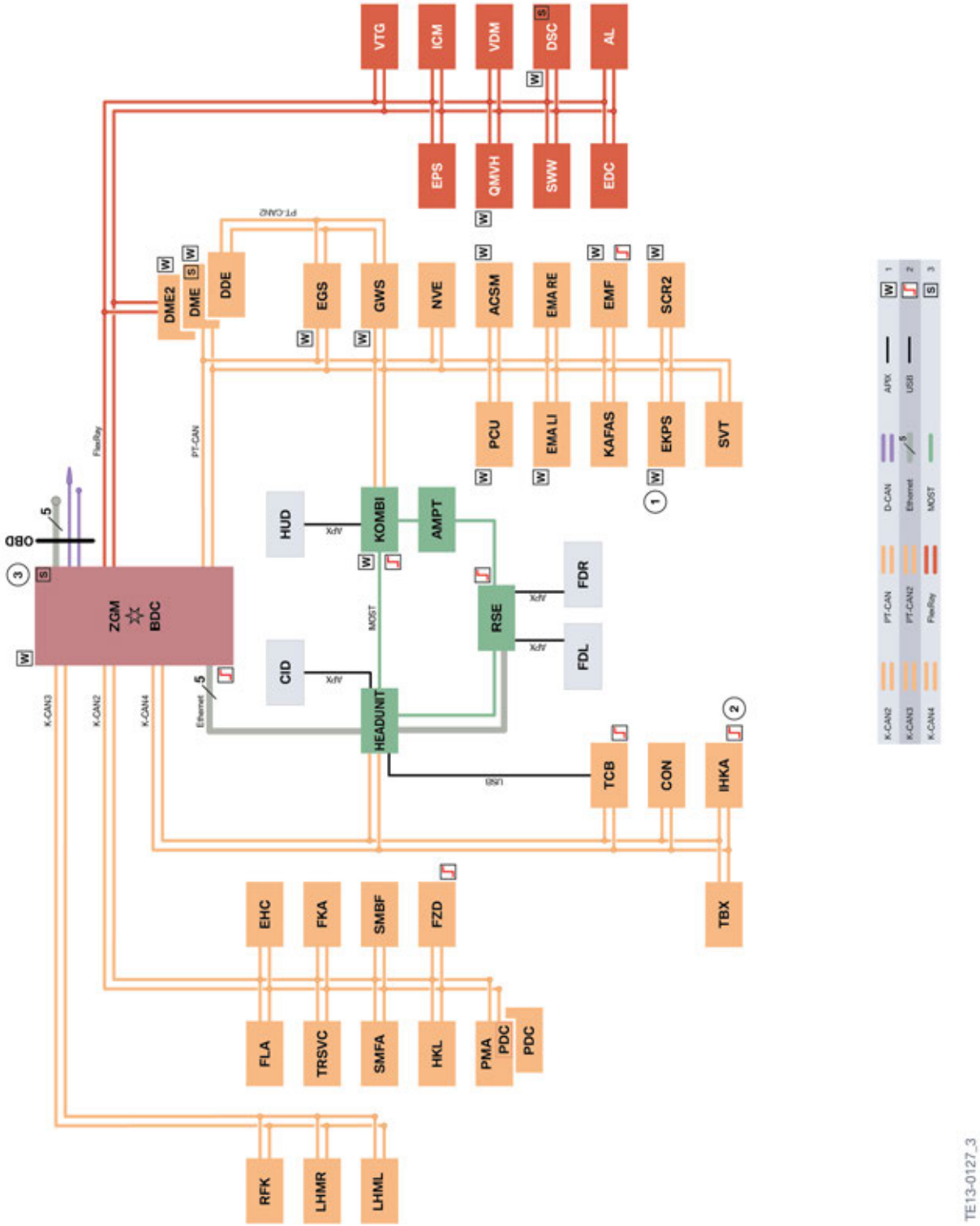
The function of the ACSM is to permanently evaluate all sensor signals in order to identify a crash situation. The ACSM evaluates the information from the sensors and then forwards corresponding measures for selective activation of the necessary restraint systems.

For a detailed description of the ACSM, please refer to Technical Training Reference Manual ST811 F01/F02 Passive Safety Systems.

F15 General Vehicle Electronics

2. Vehicle Electrical System

2.2. Bus overview



F15 bus overview

F15 General Vehicle Electronics

2. Vehicle Electrical System

Index	Explanation
1	Control unit with wake-up line
2	Control units with wake-up authorization
3	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top HiFi amplifier
AL	Active steering control unit
CID	Central Information Display
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DDE	Digital Diesel Electronics
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
EDC	Electronic Dampening Control
EGS	Electronic transmission control
EHC	Electronic ride height control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic Power Steering
Ethernet	Cable-based data network technology for local data networks
FLA	High-beam assistant
FKA	Automatic rear air-conditioning system
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector switch
HEADUNIT	Headunit High
HKL	Automatic luggage compartment lid actuation
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air-conditioning
K-CAN2	Body Controller Area Network 2
K-CAN3	Body Controller Area Network 3
K-CAN4	Body Controller Area Network 4
KAFAS	Camera-based driver support systems
KOMBI	Instrument cluster

F15 General Vehicle Electronics
2. Vehicle Electrical System

Index	Explanation
LHMR	LED main light module on the right
LHML	LED main light module on the left
MOST	Media Oriented System Transport bus
NVE	Night Vision Electronics
OBD	On-board Diagnosis
PCU	Power Control Unit
PDC	Park Distance Control (Stand alone control module if PMA not equipped. Integrated into PMA control module if PMA installed)
PMA	Parking Maneuver Assistant
PT-CAN	Powertrain Controller Area Network
PT-CAN2	Powertrain Controller Area Network 2
QMVH	QMVH
EMAFA	Electric-driven reel, left
EMABF	Electric-driven reel, right
RFK	Reversing camera
RSE	Rear Seat Entertainment system
SCR	Selective Catalytic Reduction 2
SMFA	Driver's seat module
SMBF	Front passenger seat module
SVT	Servotronic
SWW	Lane change warning
TBX	Touchbox
TCB	Telematic Communication Box
TRSVC	Top Rear Side View Camera
VDM	Vertical Dynamics Management
VTG	Transfer case control module

F15 General Vehicle Electronics

2. Vehicle Electrical System

2.3. Bus systems

2.3.1. K-CAN

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

The following K-CAN are used in the F15:

- K-CAN2
- K-CAN3
- K-CAN4

All K-CAN data buses have a data transfer rate of 500 kBit/s. The K-CAN with a 100 kBit/s data transfer rate is **not** used in the F15.

CAN terminator

As with most bus systems terminating resistors are also used for termination for the K-CAN to avoid reflections on the data lines. These are located for the K-CAN2, K-CAN3 and K-CAN 4 in the rear of the vehicle in so-called CAN terminators. The CAN terminator in the rear of the vehicle functions as a star coupler and can integrate many different control units in the rear of the vehicle in the K-CAN depending on the optional equipment.

A maximum of the following control units are connected at the CAN terminator of the K-CAN 2:

- Electronic ride height control
- Automatic luggage compartment lid actuation
- Parking Maneuver Assistant

The control unit for reversing camera is connected at the CAN terminator of the K-CAN 3

A maximum of the following control units are connected at the CAN terminator of the K-CAN 4:

- Headunit High
- Telematic Communication Box
- Touchbox

In the CAN terminator the terminating resistor for the corresponding CAN-Bus is installed. A measuring tap against ground with a resistor and capacitor for the reduction of high-frequency faults is also installed. Ferrite beads are installed for all bus lines in the CAN terminator. Ferrite beads suppress high-frequency faults on the CAN data lines, thus making possible line lengths of up to 5 m in the wiring harness.

2.3.2. PT-CAN

Like with many current BMW models two PT-CAN data buses are also used in the F15:

- PT-CAN
- PT-CAN2

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 gateway for the PT-CAN2 is located in the DME. All PT-CAN lines have a data transfer rate of 500 kBit/s and are designed with an additional wake-up line.

2.3.3. FlexRay

The FlexRay with a data transfer rate of 10 MBit/s is used in the F15 as the system bus for networking of the systems that control the dynamic handling characteristics and engine control. The star coupler with three drivers is located in the Body Domain Controller. The FlexRay control units are connected to these bus drivers independent of their termination type.

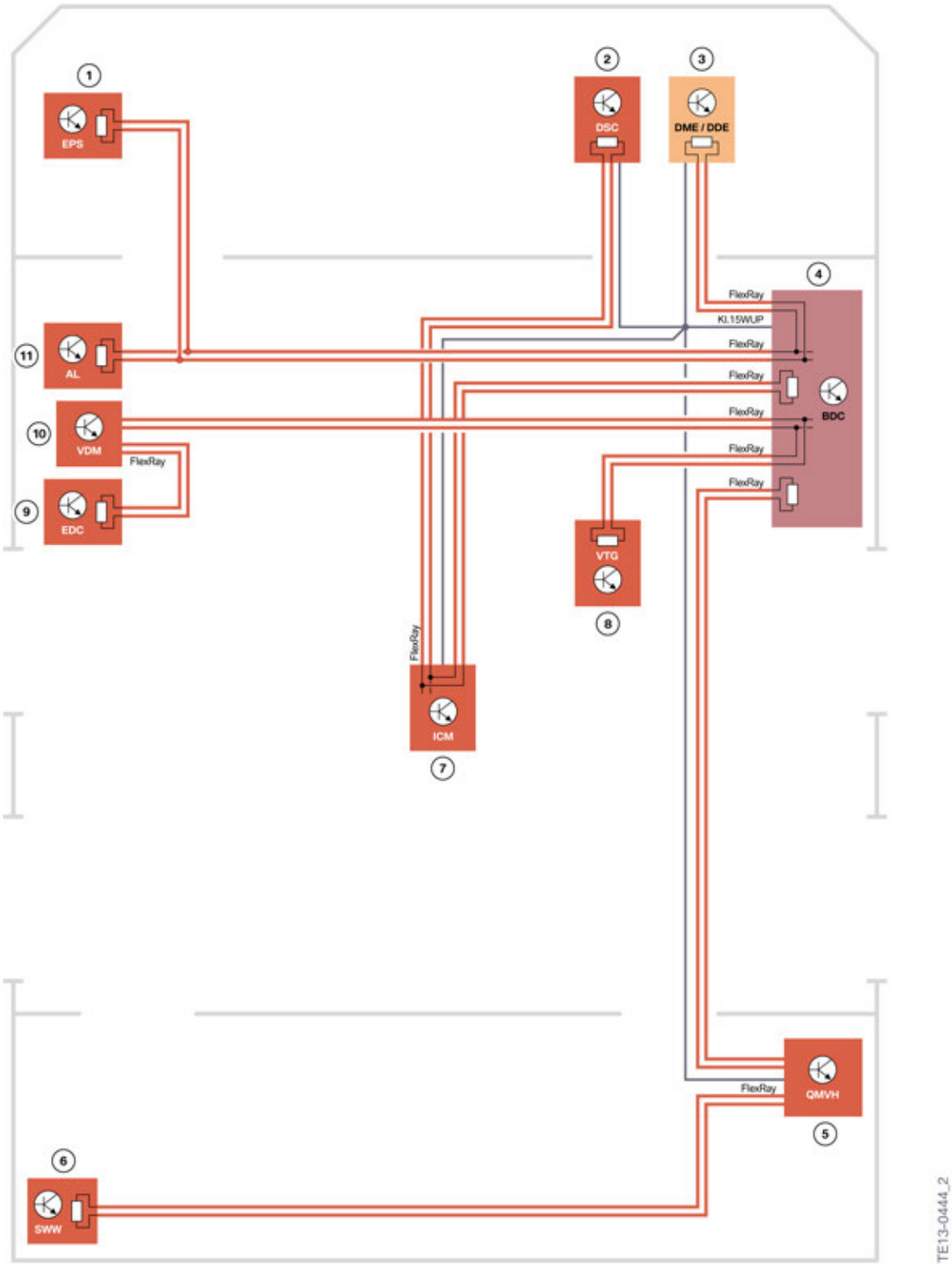
As with most bus systems, resistors are also used for termination of the FlexRay to avoid reflections on the data lines at both ends of the data lines. The value of these terminating resistors is calculated from the data transfer speed and the cable lengths. The terminating resistors are located in the control units. In the F15 the terminating resistors have a value of 90 ohm (total resistance 45 ohm).

For a detailed description of the FlexRay data bus, please refer to Technical Training Reference Manual ST811 F01 Bus Systems.

F15 General Vehicle Electronics

2. Vehicle Electrical System

System wiring diagram



F15 system wiring diagram for FlexRay

Index	Explanation
1	Electronic Power Steering
2	Dynamic Stability Control
3	Digital Motor Electronics or Digital Diesel Electronics
4	Body Domain Controller
5	QMVH
6	Lane Change Warning
7	Integrated Chassis Management
8	Transfer case control module
9	Electronic Dampening Control
10	Vertical Dynamics Management
11	Active Steering
Terminal 15WUP	Terminal 15 wake-up

2.3.4. D-CAN

The D-CAN for the vehicle diagnosis has a data transfer rate of 500 kBit/s.

2.3.5. Ethernet

The F15 has Ethernet access in order to be able to program the complete vehicle quickly. It has been possible to discontinue access via the Media Oriented System Transport bus system for programming purposes thanks to the extremely high data transfer rate of the Ethernet (100 MBit/s).

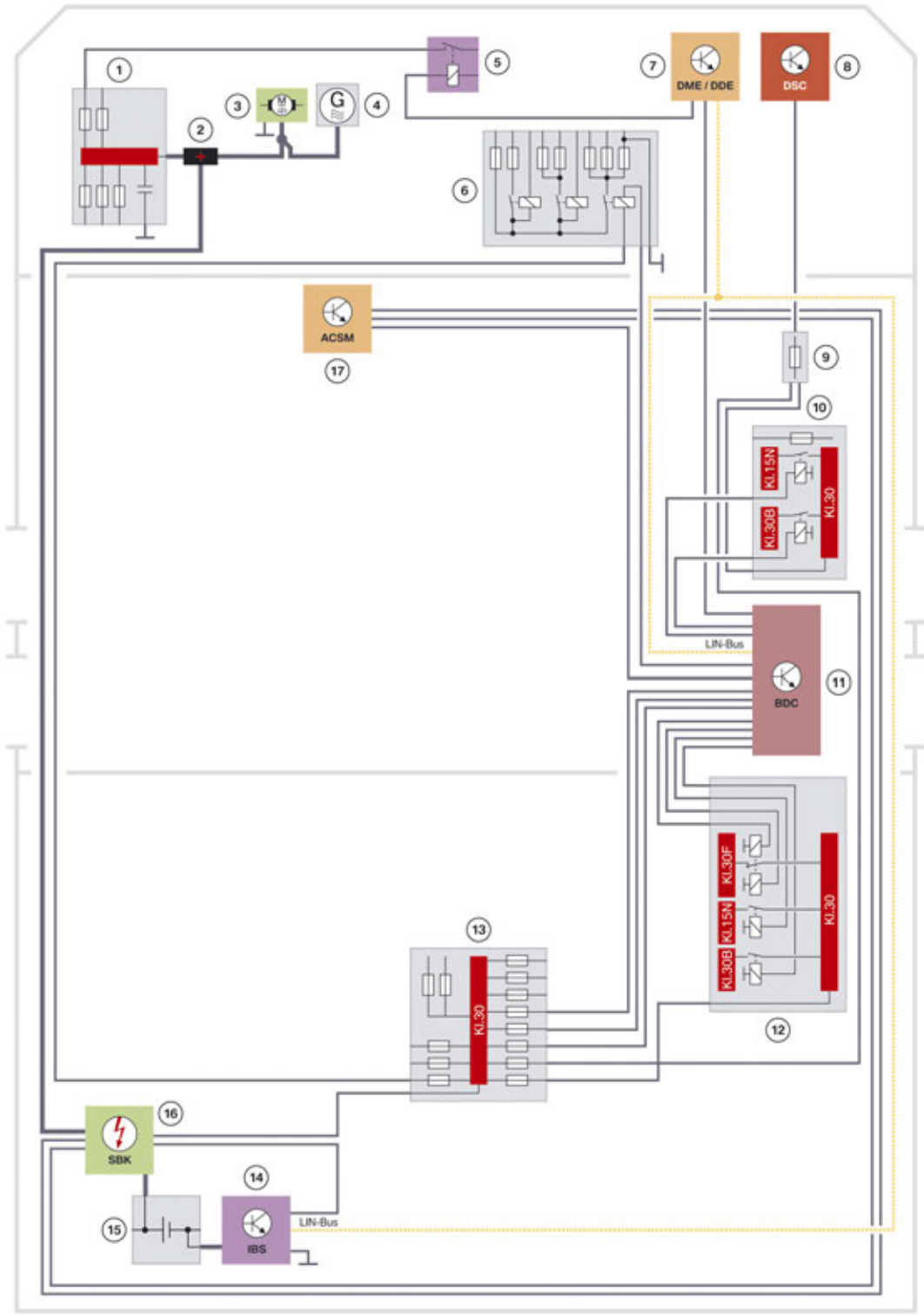
The BDC assumes the task in the F15 of distributing the telegrams internally within the vehicle to the buses and for forwarding the telegrams to the headunit via K-CAN4. The headunit then provides telegram distribution on the MOST.

Updating of the map data, for the navigation, is also performed over the Ethernet interface.

F15 General Vehicle Electronics

3. Voltage Supply

3.1. System wiring diagram



F15 system wiring diagram for voltage supply

F15 General Vehicle Electronics

3. Voltage Supply

Index	Explanation
1	Power distribution box, engine compartment
2	B+ jump start terminal point
3	Starter motor
4	Alternator
5	Relay for electric fan
6	Power Distribution Module
7	Digital Motor Electronics or Digital Diesel Electronics
8	Hydraulic pump of the Dynamic Stability Control
9	Power distribution box, footwell
10	Power distribution box, front
11	Body Domain Controller
12	Power distribution box, luggage compartment
13	Battery power distribution box
14	Intelligent battery sensor
15	Battery
16	Safety Battery Terminal
17	Advanced Crash Safety Module
Terminal 30	Terminal 30
Terminal 30B	Terminal 30 basic operation
Terminal 15N	Ignition (after-run)
Terminal 30F	Terminal 30, fault-dependent

F15 General Vehicle Electronics

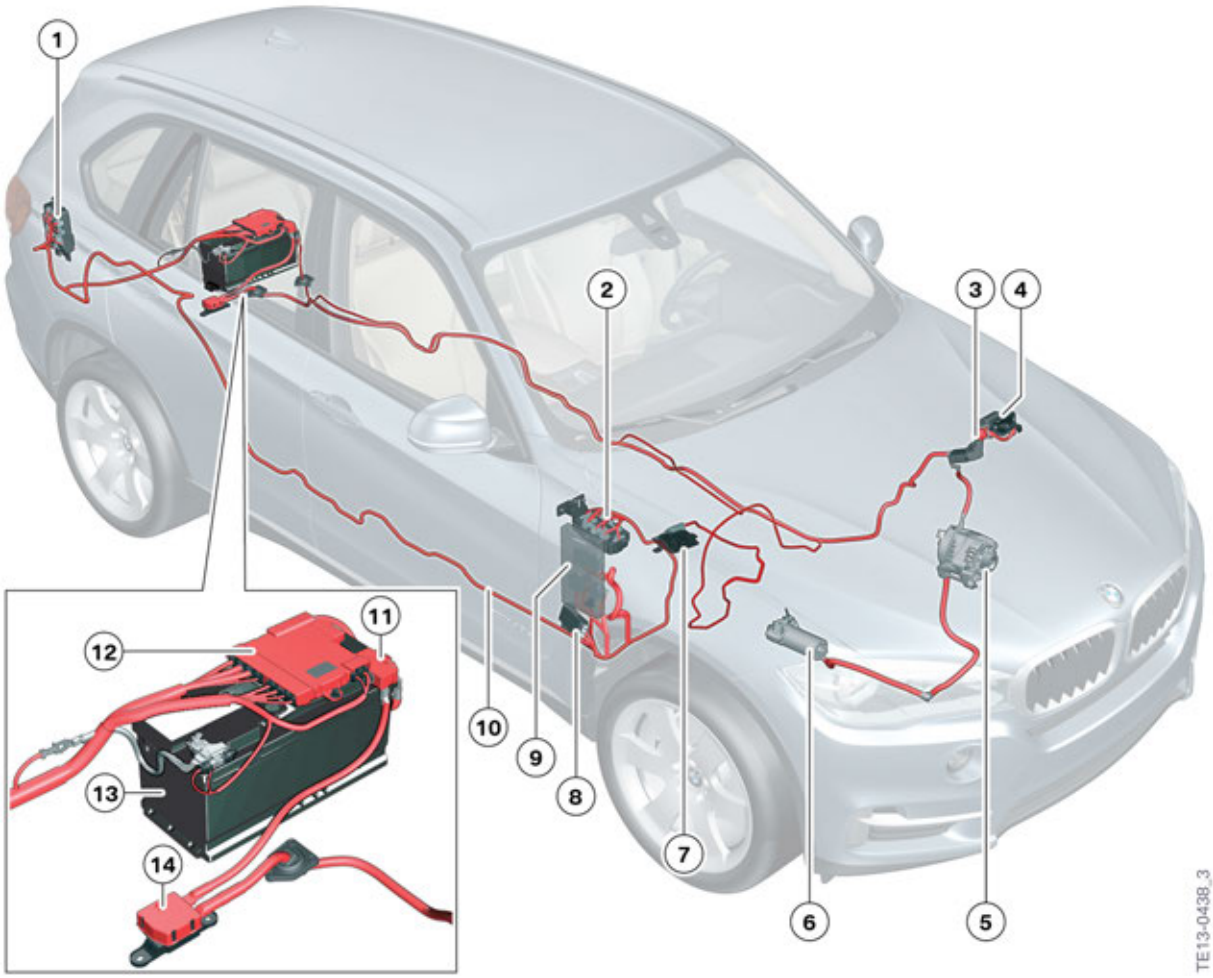
3. Voltage Supply

3.2. Components

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

Seven separate power distribution boxes are installed in the F15:

- Power distribution box, engine compartment
- Power distribution box, front
- Power distribution box, footwell
- Power distribution box in the BDC
- Power distribution box, luggage compartment
- Battery power distribution box
- Power Distribution Module in the engine compartment



Overview of power distribution boxes

F15 General Vehicle Electronics

3. Voltage Supply

Index	Explanation
1	Power distribution box, luggage compartment
2	Power distribution box, front
3	B+ jump start terminal point
4	Power distribution box, engine compartment
5	Alternator
6	Starter motor
7	Integrated supply module
8	Power distribution box, footwell
9	Body Domain Controller (with integrated power distribution box)
10	Battery cable
11	Safety battery terminal
12	Battery power distribution box
13	Battery
14	Transition connection point

In the F15 three main power lines run in the cable ducts at the vehicle underbody, as far as the engine compartment:

- A 35 mm² copper line runs via the positive battery connection point to the starter motor, the alternator and the power distribution box in the engine compartment.
- A copper line with 16 mm² for gasoline cars or 10 mm² for diesel-engine cars supplies the electronics box in the engine compartment for the engine electronics with voltage.
- A 27 mm² aluminium line runs in the passenger compartment to the power distribution box with fuse block at the front. This cable is also protected by a high-current circuit breaker.

Depending on the vehicle version, different line cross-sections and materials are used.

Under the luggage compartment floor are the transfer points for the main power cables. The main power cables are laid in a protected area in the vehicle underbody to protect them from damage.

F15 General Vehicle Electronics

3. Voltage Supply

3.2.1. Battery

The battery is a AGM battery (90 Ah-105 Ah) and is located on the left in the luggage compartment below the toolkit.

AGM battery

F15 General Vehicle Electronics

3. Voltage Supply

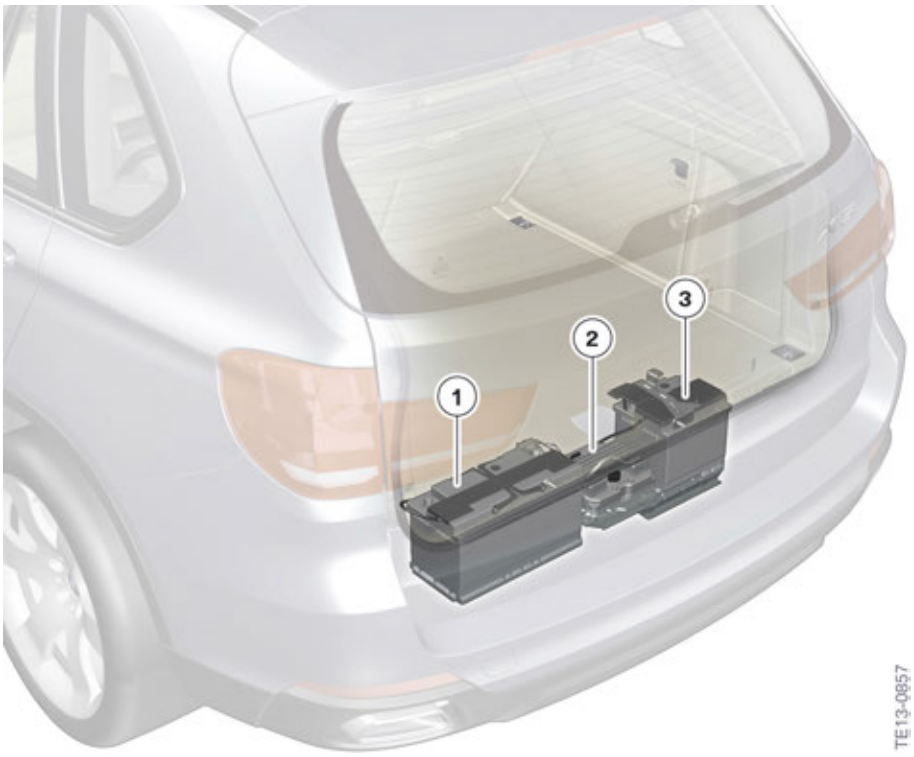
3.3. Vehicle electrical system support

Modern vehicles have a high energy consumption due to the many electrical consumers used. As a result, there is a high demand on the battery particularly in phases in which the combustion engine is not running and the alternator supplies no energy (e.g. engine start-stop phases).

In order to protect the battery, a DC/DC converter is installed in the Power Control Unit and a 50 Ah AGM auxiliary battery is installed in the F15, depending on the vehicle equipment.

The preconditions for the direction of the energy management are calculated from the use of the vehicle. When the engine is running the auxiliary battery is charged from the conventional vehicle electrical system. During the phases in which the combustion engine is not running, e.g. automatic start-stop function, the energy is supplied from the auxiliary battery in the conventional vehicle electrical system.

The Power Control Unit is connected to the PT-CAN and a DC/DC converter with a power rating of 500 watt.



F15 vehicle electrical system support

Index	Explanation
1	Battery
2	Power Control Unit
3	Auxiliary battery

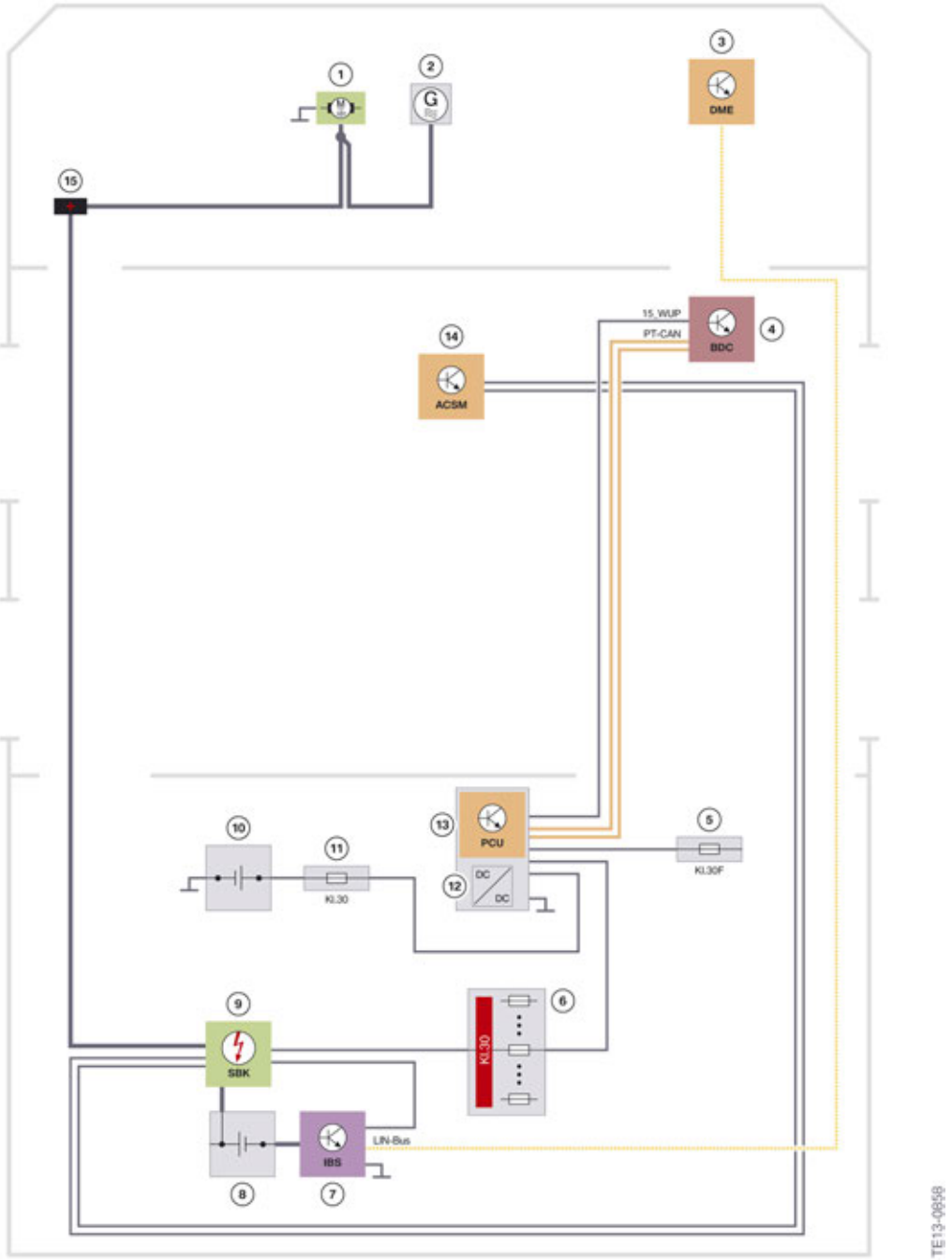
F15 General Vehicle Electronics

3. Voltage Supply

3.3.1. Optional Equipment

In US version vehicles the Power Control Unit and the auxiliary battery are always installed with the N63TU. In vehicles with the N55 or N57 engine the listed optional equipment applies.

- Seat heating in the rear passenger compartment (option 496)
- Rear Seat Entertainment (option 6FH)



System wiring diagram for vehicle electrical system with Power Control Unit

F15 General Vehicle Electronics

3. Voltage Supply

Index	Explanation
1	Starter motor
2	Alternator
3	Digital Motor Electronics
4	Body Domain Controller
5	Power distribution box, luggage compartment
6	Battery power distribution box
7	Intelligent battery sensor
8	Battery
9	Safety battery terminal
10	Auxiliary battery
11	Fuse
12	Integrated DC/DC converter
13	Power Control Unit
14	Advanced Crash Safety Module
15	Jump start terminal point

3.4. Supply to EPS

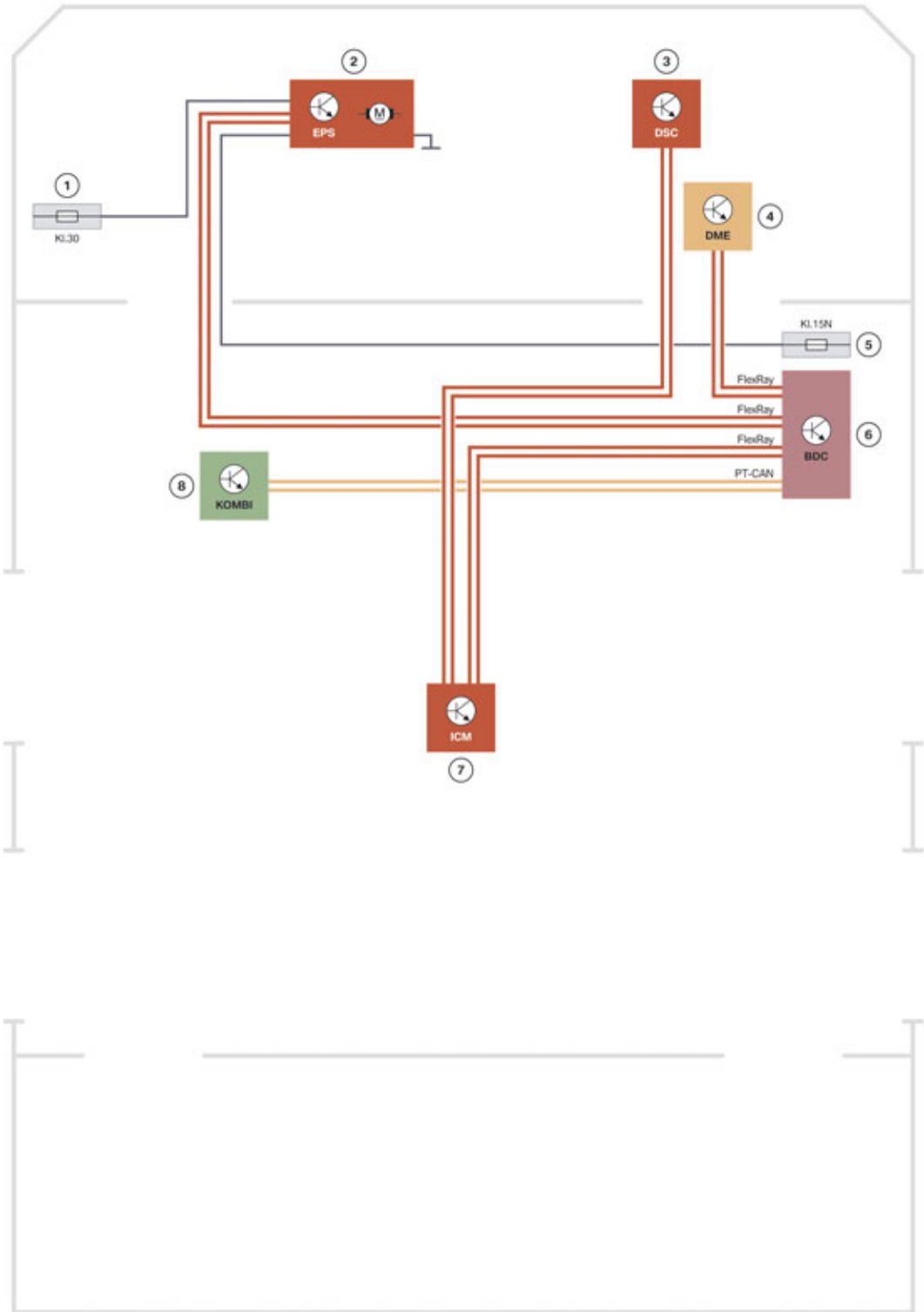
The F15 will come equipped with electronic power steering, as well as Servotronic.

EPS can reduce fuel consumption by roughly 1 - 2% on average when compared with conventional hydraulic steering. This helps reduce CO_2 emissions.

F15 General Vehicle Electronics

3. Voltage Supply

3.4.1. System wiring diagram



F15 System wiring diagram, EPS (electronic power steering)

F15 General Vehicle Electronics

3. Voltage Supply

Index	Explanation
1	Power distribution box, engine compartment
2	Electronic Power Steering
3	Dynamic Stability Control
4	Digital Motor Electronics or Digital Diesel Electronics
5	Power distribution box, front
6	Body Domain Controller
7	Integrated Chassis Management
8	Steering column switch cluster
9	Instrument cluster
Terminal 30	Terminal 30
Terminal 15N	Ignition (after-run)

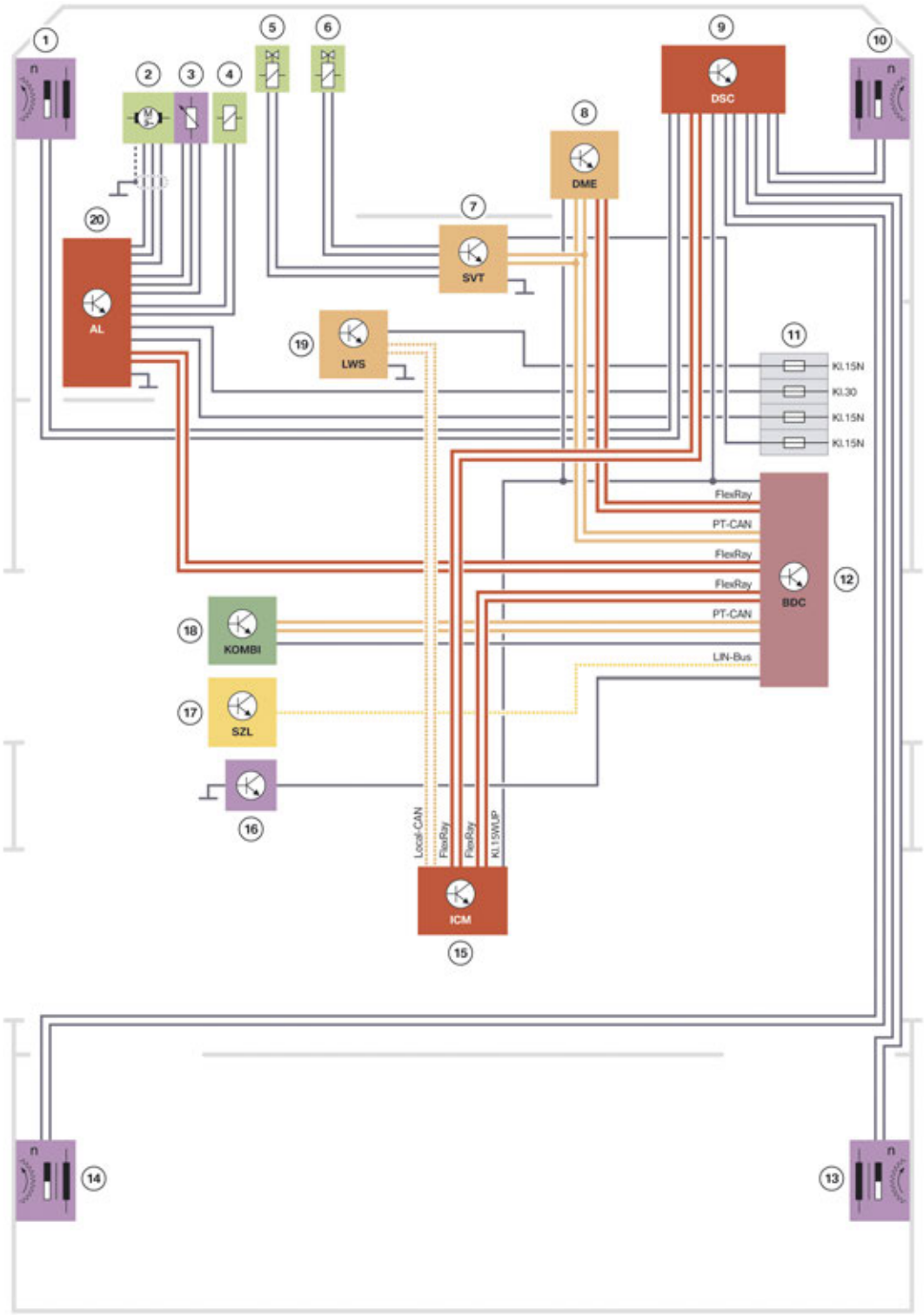
3.5. Supply of active steering

In vehicles with the optional Active Steering, conventional hydraulic steering is used, which is supplemented by a variable ratio transmission with electric motor. The active steering also includes the Servotronic.

F15 General Vehicle Electronics

3. Voltage Supply

3.5.1. System wiring diagram



F15 system wiring diagram for active steering

F15 General Vehicle Electronics

3. Voltage Supply

Index	Explanation
1	Wheel speed sensor, front left
2	Servomotor for active steering
3	Rotor position sensor
4	Servomotor lock
5	Servotronic valve
6	ECO valve
7	Servotronic
8	Digital Motor Electronics or Digital Diesel Electronics
9	Dynamic Stability Control
10	Wheel speed sensor, front right
11	Power distribution box, front
12	Body Domain Controller
13	Wheel speed sensor, rear right
14	Wheel speed sensor, rear left
15	Integrated Chassis Management
16	Brake light switch
17	Steering column switch cluster
18	Instrument cluster
19	Steering angle sensor
20	Active steering
Terminal 30	Terminal 30
Terminal 15N	Ignition (after-run)

F15 General Vehicle Electronics

4. Car Access System

There are two distinct systems concerned with vehicle access:

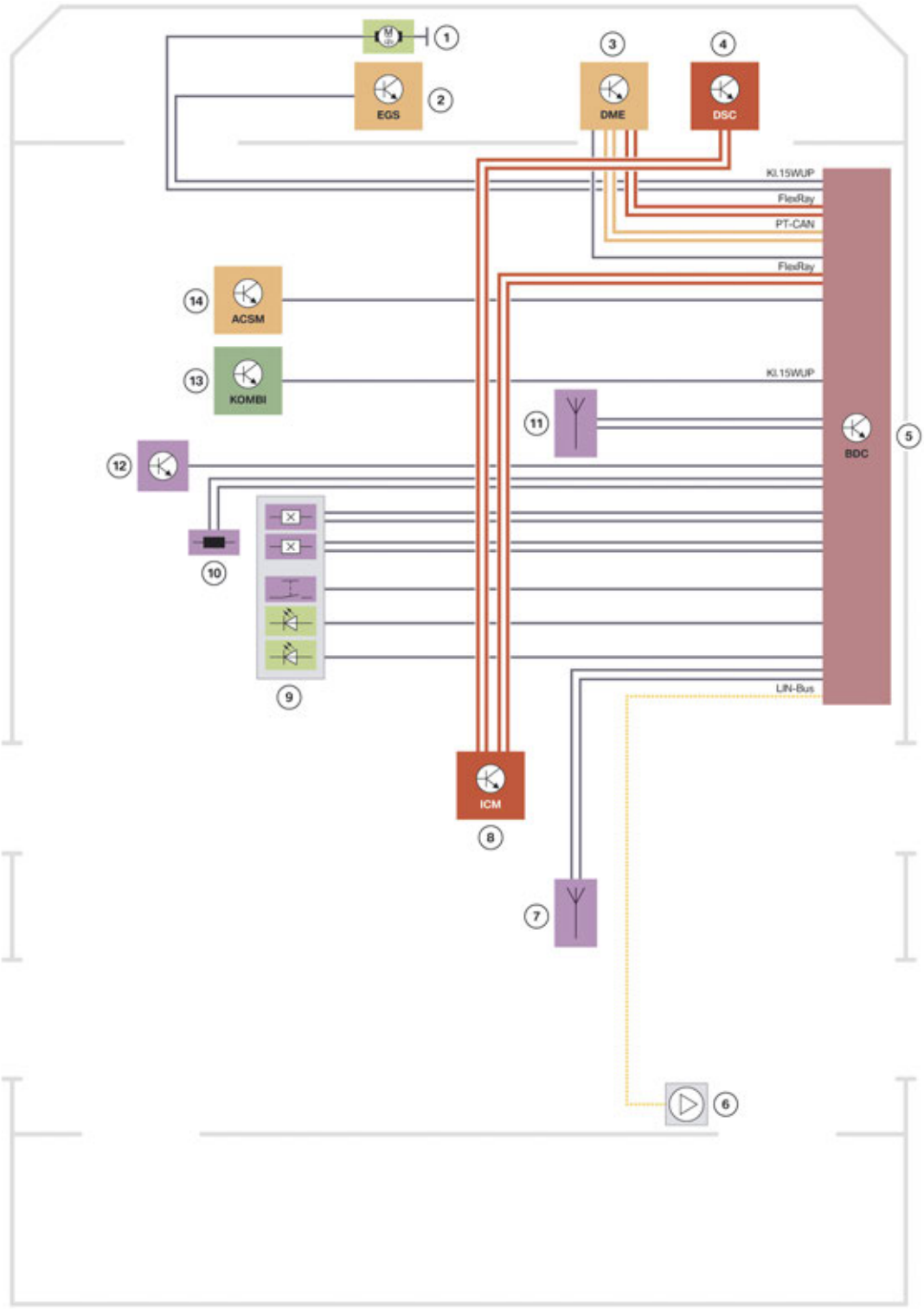
- Basic access with central locking system
- Comfort Access

The entire access control of the previous CAS control unit is integrated entirely into the BDC.

F15 General Vehicle Electronics

4. Car Access System

4.1. System wiring diagram



F15 system wiring diagram for Car Access System

Index	Explanation
1	Starter motor
2	Electronic transmission control
3	Digital Motor Electronics or Digital Diesel Electronics
4	Dynamic Stability Control
5	Body Domain Controller
6	Remote control receiver
7	Interior antenna (rear)
8	Integrated Chassis Management
9	START-STOP button
10	Ring antenna (transponder coil)
11	Interior antenna (front)
12	Brake light switch
13	Instrument cluster
14	Advanced Crash Safety Module

4.2. Overview of functions

In the F15 there is no insertion slot for the key remote. The vehicle can be started at any point with a valid key remote inside the vehicle. This function is called "Passive Go" (drive authorization). However, to gain access to the vehicle, it is still necessary to actuate the button on the key remote if the vehicle is not equipped with comfort access.

The following CAS functions are integrated in the BDC:

- Comfort Access
- Central locking system
- Power window regulator
- Panorama glass roof
- Terminal control
- Electronic steering column lock
- Electronic immobilizer

Further CAS functions include:

- Vehicle data storage
- Data transfer for Condition Based Service

The CAS functions correspond to those in the F01/F02 and are described in ST811 Comfort Access.

F15 General Vehicle Electronics

5. Central Locking System

The central locking system locks and unlocks all doors, the fuel filler flap and tailgate. The central locking button has been relocated from the center of the dashboard and is now integrated into the door panels on the front doors. The operation was also changed. The "Lock" and "Unlock" functions now have a separate button in the F15. The button for operation of the tailgate has also been relocated and is now on the switch block of the drivers door panel.

F15 Central locking system

Index	Explanation
1	Button for central locking system (unlocking)
2	Button for central locking system (locking)
3	Tailgate push button

The central locking system in the F15 can be operated using the following components:

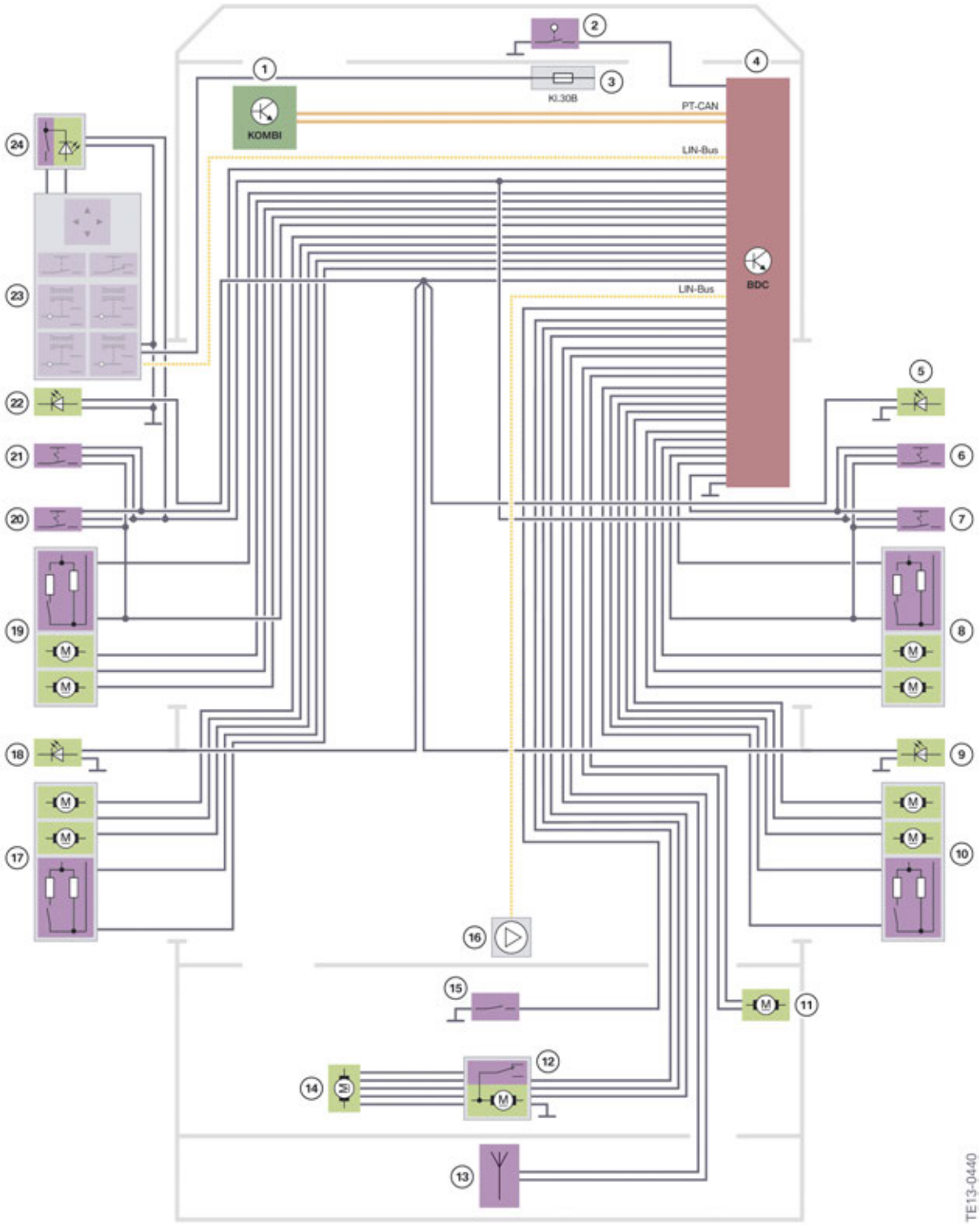
- Key remote/ID transmitter
- Outer door handle (only with Comfort Access)
- Central locking buttons at the door openers in the passenger compartment
- Button for central locking system on inside of tailgate (only with Comfort Access)
- Tailgate push button at the switch block on door (automatic luggage compartment lid actuation)
- Driver's door lock barrel (door lock)

The central locking system in the F15 is based on the central locking system known from the F01/F02.

F15 General Vehicle Electronics

5. Central Locking System

5.1. System wiring diagram



F15 system wiring diagram for central locking system

F15 General Vehicle Electronics

5. Central Locking System

Index	Explanation
1	Instrument cluster
2	Engine compartment lid contact switch
3	Power distribution box, front
4	Body Domain Controller
5	Ground lights, front right
6	Central locking system (unlocking), front right
7	Central locking system (locking), front right
8	Door contact, central locking system, front right
9	Ground lights, rear right
10	Door contact, central locking system, rear right
11	Central locking system, fuel filler flap
12	Tailgate contact with tailgate lock
13	Interior antenna
14	Automatic Soft Close system
15	Tailgate push button on the outside of the tailgate
16	Remote control receiver
17	Door contact, central locking system, rear left
18	Ground lights, rear left
19	Door contact, central locking system, front left
20	Central locking system (locking), front left
21	Central locking system (unlocking), front left
22	Ground lights, front left
23	Switch block, driver's door
24	Tailgate push button
Terminal 30B	Terminal 30 basic operation

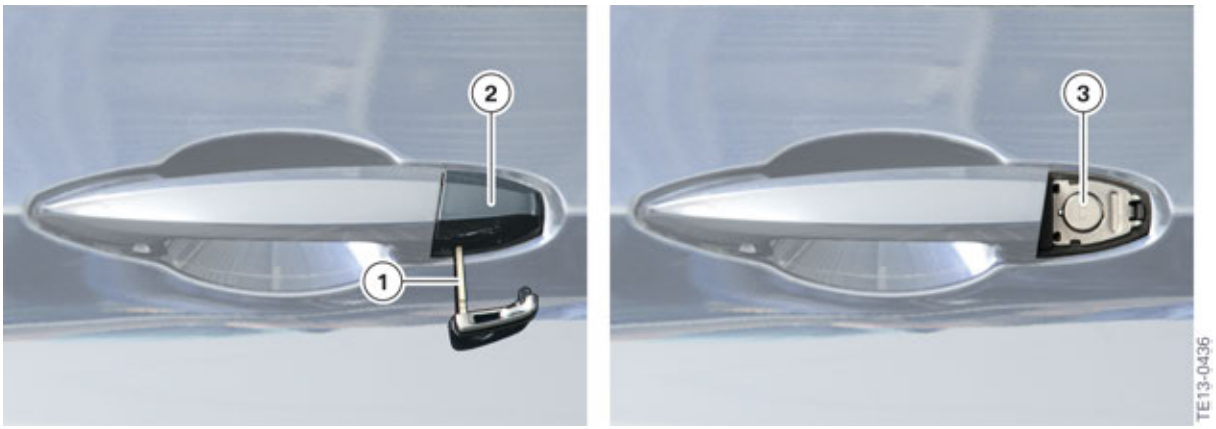
F15 General Vehicle Electronics

5. Central Locking System

5.2. Outer door handle

The lock barrel at the outer door handle (driver's side) is protected by a cover and is therefore only visible to the customer in the event of an emergency release. There is an opening on the bottom for the mechanical ignition key for removal of the cover.

In the F15 a new lock type is installed. Now, on the front doors, the double stroke is no longer required when a locked door is being opened from the inside. However, a double stroke is still required when opening a locked door from inside the rear passenger compartment.



F15 outer door handle

Index	Explanation
1	Ignition key
2	Cover
3	Lock barrel

F15 General Vehicle Electronics

6. Comfort Access

The Comfort Access function is integrated into the Body Domain Controller. In addition to the transmitter antennas for the outer area and passenger compartment, the BDC also activates the outside door handle electronics.

Comfort Access contains the following functions:

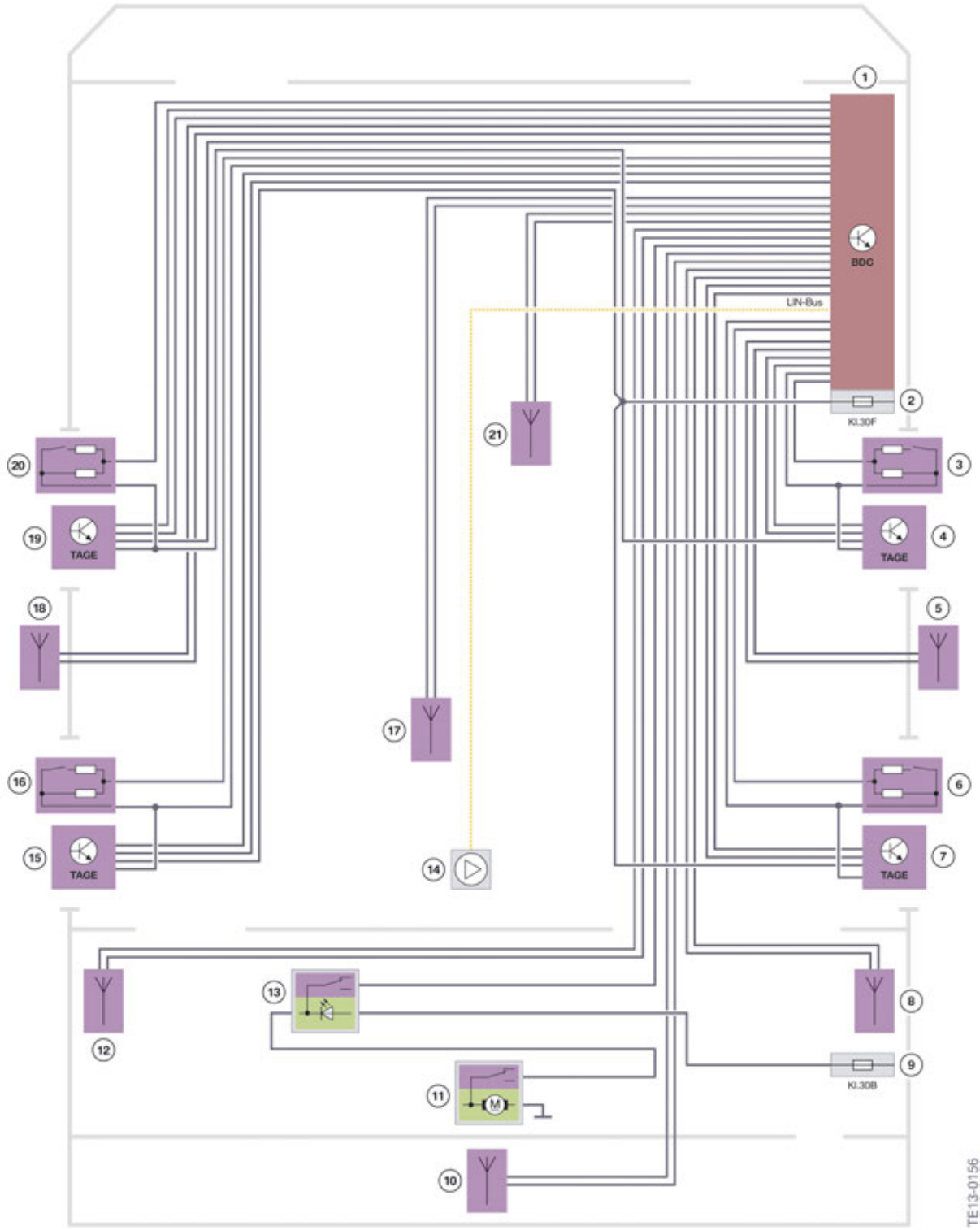
- **Passive Entry (access authorization)**
  Facilitates access to the vehicle without active use of the key remote.
- **Passive Go (drive authorization)**
  Enables the vehicle to be started when there is a valid key remote in the passenger compartment.
- **Passive Exit (locking authorization)**
  Enables the vehicle to be locked without active use of the key remote.

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

F15 General Vehicle Electronics

6. Comfort Access

6.1. System wiring diagram



F15 system wiring diagram for Comfort Access

F15 General Vehicle Electronics

6. Comfort Access

Index	Explanation
1	Body Domain Controller
2	Power distribution box in the BDC
3	Door contact, front passenger's side
4	Outside door handle electronics, front right
5	Comfort Access antenna, side sill, right
6	Door contact on rear passenger's side
7	Outside door handle electronics, rear right
8	Comfort Access antenna, rear right bumper
9	Power distribution box, luggage compartment
10	Comfort Access antenna, luggage compartment
11	Tailgate lock
12	Comfort Access antenna, rear left bumper
13	Tailgate push button, Centerlock
14	Outside door handle electronics, rear left
15	Door contact on driver's side, rear
16	Antenna Comfort Access passenger compartment, rear
17	Comfort Access antenna, side sill, left
18	Outside door handle electronics, front left
19	Door contact, driver's side, front
20	Antenna Comfort Access passenger compartment, front
Terminal 30B	Terminal 30 basic operation
Terminal 30F	Terminal 30, fault-dependent

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

F15 General Vehicle Electronics

7. Exterior Mirrors

As is known from other BMW models, the F15 has integrated the side turn indicators into the exterior mirrors. The side turn signals in the front fenders are no longer used. This gives the F15 a more sleek look while also making the side turn indicators more visible when active. The exterior mirrors will also have the glass heating function and auto dimming as standard features.

The standard equipment of the exterior mirror includes:

- Heating function
- Electrical adjustment
- Side turn indicator with LED fibre optic conductor
- Exterior mirror with automatic dimming function
- Exterior mirror with memory function **(standard with N63 only)**

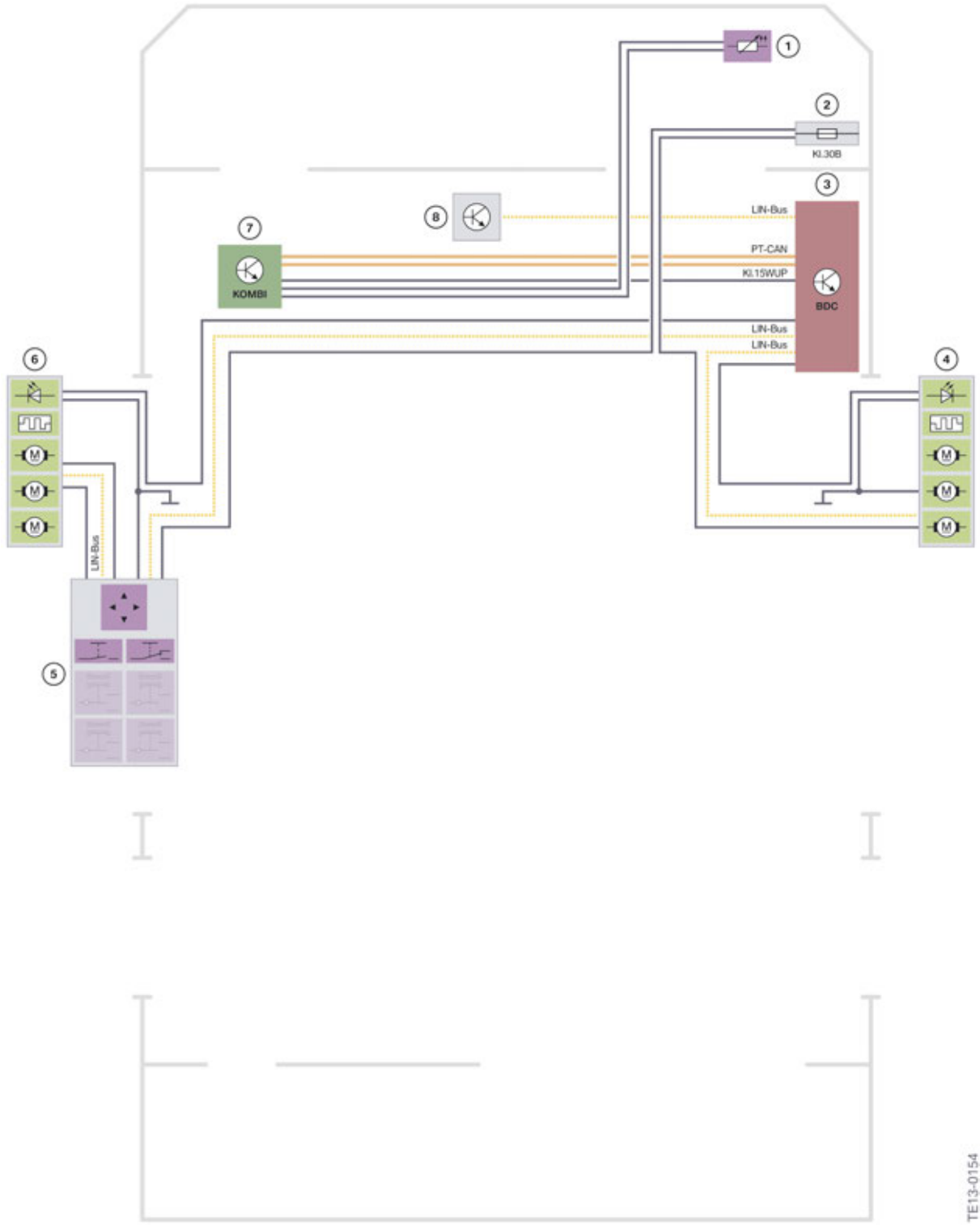
The following optional equipment is also available:

- Exterior mirror with memory function
- Surround View
- Lane change warning

F15 General Vehicle Electronics

7. Exterior Mirrors

7.1. System wiring diagram



F15 system wiring diagram for exterior mirror with Local Interconnect Network connection

F15 General Vehicle Electronics

7. Exterior Mirrors

Index	Explanation
1	Outside temperature sensor
2	Power distribution box, front
3	Body Domain Controller
4	Exterior mirror, passenger's 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
8	Inside mirror
Terminal 30B	Terminal 30 basic operation

F15 General Vehicle Electronics

8. Exterior Lights

For the F15 two versions of headlights are available:

- Bi-xenon front light combination with Adaptive Headlights (standard equipment)
- Adaptive LED headlight (optional equipment)

The Body Domain Controller is responsible for the function of the exterior lights:

- **Bi-xenon headlights**
  The BDC activates the headlights directly and is connected to the headlight driver modules via a local interconnect network bus.
- **Adaptive LED headlight**
  The BDC is connected via the K-CAN3 to the LED main light modules LHML and LHMR. The BDC is also connected to the headlight driver modules via a local interconnect network bus.

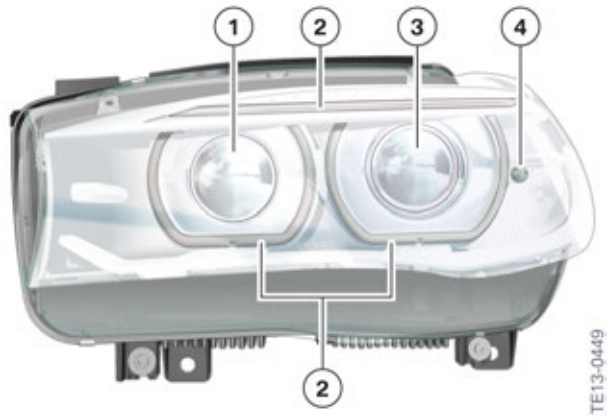
The turn indicators in the front fenders are no longer used. The LED turn indicators are used instead in the exterior mirror.

For vehicles with bi-xenon headlights the side lights/daytime driving lights use LEDs.

The adaptive LED headlight of the F15 has more or less the same function and structure as the LED headlight of the F10, with a few exceptions.

8.1. Low-beam headlight

8.1.1. Bi-xenon headlight, front



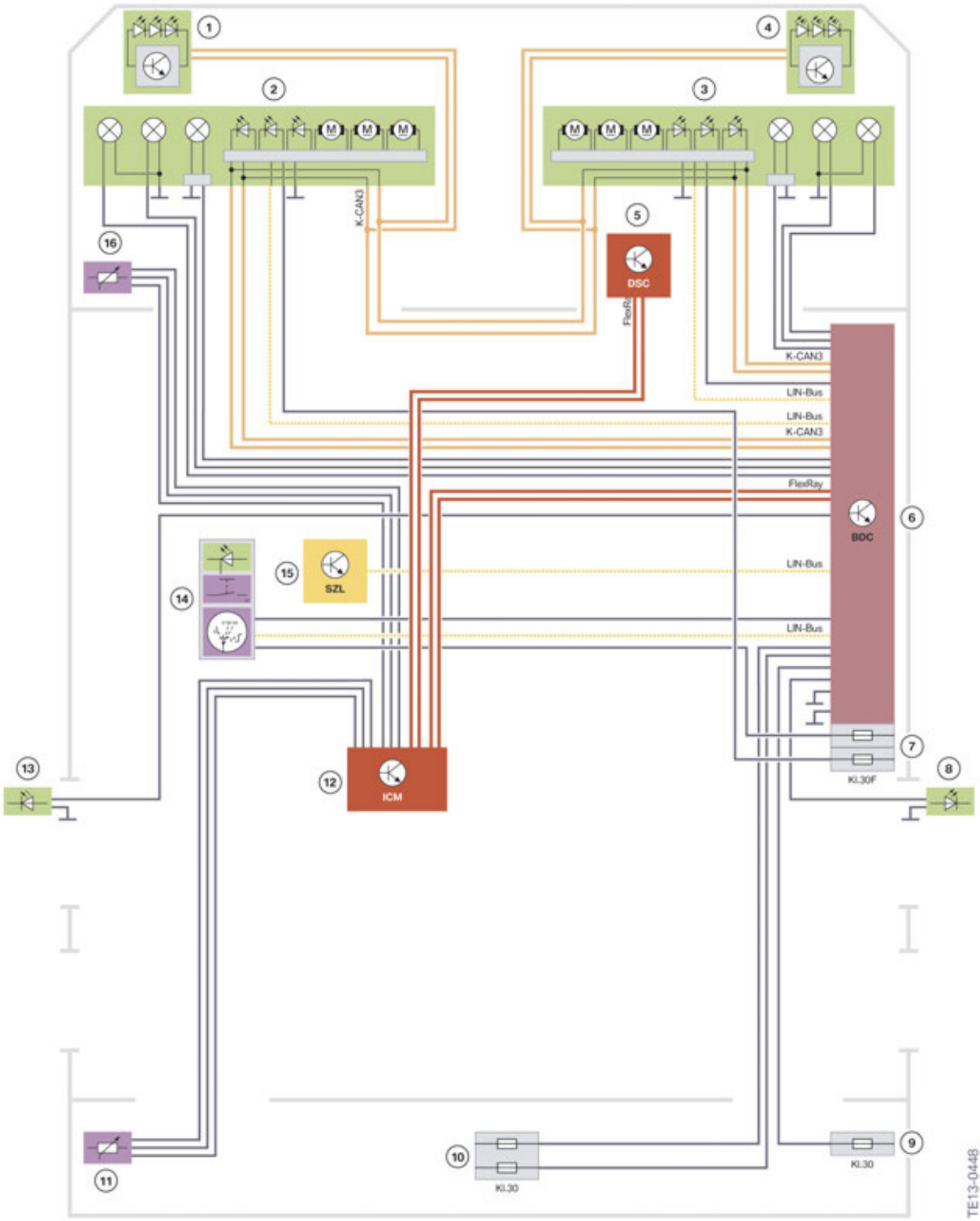
F15 bi-xenon headlights

Index	Explanation
1	Cornering light (This location is not for US) The cornering light for the US is integrated into the fog light.
2	Daytime driving lights/Side lights
3	Low-beam headlight/High-beam headlight
4	Turn indicator

F15 General Vehicle Electronics

8. Exterior Lights

8.1.2. System wiring diagram for bi-xenon headlight with adaptive head light, front



F15 system wiring diagram for bi-xenon exterior lights with adaptive head light, front

F15 General Vehicle Electronics

8. Exterior Lights

Index	Explanation
1	Left fog light
2	Headlight, left
3	Headlight, right
4	Right fog light
5	Dynamic Stability Control
6	Body Domain Controller
7	Power distribution box in the BDC
8	Additional turn indicator, exterior mirror, passenger's side
9	Additional brake light
10	Battery power distribution box
11	Ride height sensor, rear
12	Interference suppression filter
13	Integrated Chassis Management
14	Additional turn indicator, exterior mirror, driver's side
15	Brake light switch
16	Hazard warning switch/Intelligent Safety button
17	Rain-light-solar-condensation sensor
18	Operating unit for light
19	Steering column switch cluster
20	Ride height sensor, front
Terminal 30F	Terminal 30, fault-dependent
Terminal 30	Terminal 30

F15 General Vehicle Electronics

8. Exterior Lights

8.1.3. Adaptive LED headlight, front

For the F15 adaptive LED headlights are available as an option. They are similar to daylight color temperature which allows the LED light to appear even brighter and therefore ensures even greater comfort and safety. Particularly traffic signs and other reflective objects appear higher in contrast and can be subjectively better perceived. The technology is known from other models such as the F12 and F13.

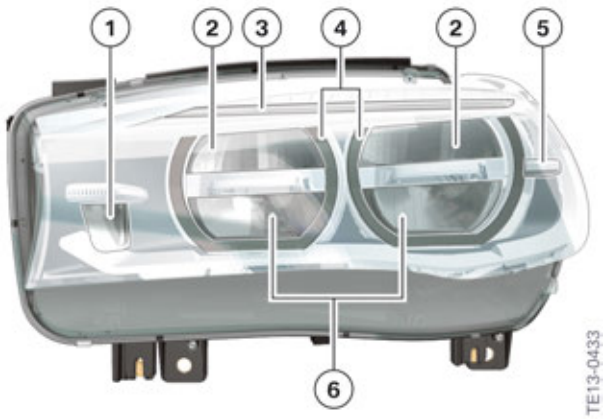
The LED full headlight has a low-beam headlight which is made from numerous LEDs and an additional reflector. In contrast to bi-xenon, the cornering light has the same light color as the low-beam headlight and impresses with its very bright and clear illumination of the entire turning area.

Both the outer and inner reflectors of the headlight are used for the high-beam headlight. The high-beam headlight arises from the superimposition of two partial areas. The outer reflector generates a vertical light/dark boundary, the partial high-beam headlight. The light distribution of this reflector is restricted inwards. The inner reflector provides flat lighting for the entire high-beam area.

The optional equipment LED headlight includes the following equipment:

- Automatic high-beam assistant
- LED fog light
- Adaptive lights

The function of the automatic high-beam assistant is unchanged. For more information please refer to the "F15 Assist Systems".



F15 LED headlight, front

Index	Explanation
1	Cornering light
2	Low-beam headlight
3	Positioning light
4	Corona ring for side light/daytime driving light
5	Turn indicator
6	High-beam headlight and headlight flasher

F15 General Vehicle Electronics

8. Exterior Lights

LED main light module

The LED main light module is installed at the bottom of the LED headlight and controls the following lighting functions:

- Low-beam headlight
- High-beam headlight
- Headlight flasher
- Cornering lights

The LED main light module additionally controls the fans for the temperature control in the LED headlights. After switching off the lighting functions an after-run of the fans of up to 60 s is possible.

In the case of a failure of a temperature sensor the fans are switched on at full power to protect the components in the LED headlight. The data from the LED main light module is transferred to the Body Domain Controller (BDC) for the diagnosis of the fans and temperature sensors.

Headlight driver module

The headlight driver module is installed as a printed circuit board in the LED headlight. The following lighting functions are controlled:

- Side lights
- Daytime lights
- Side marker light
- Turn indicator
- Positioning light
- Control of the stepper motors

Cornering light LED module

The cornering light LED module is installed as an additional light source in the LED headlight.

The modular design allows the interchangeability of the cornering light LED module in the existing LED headlight.

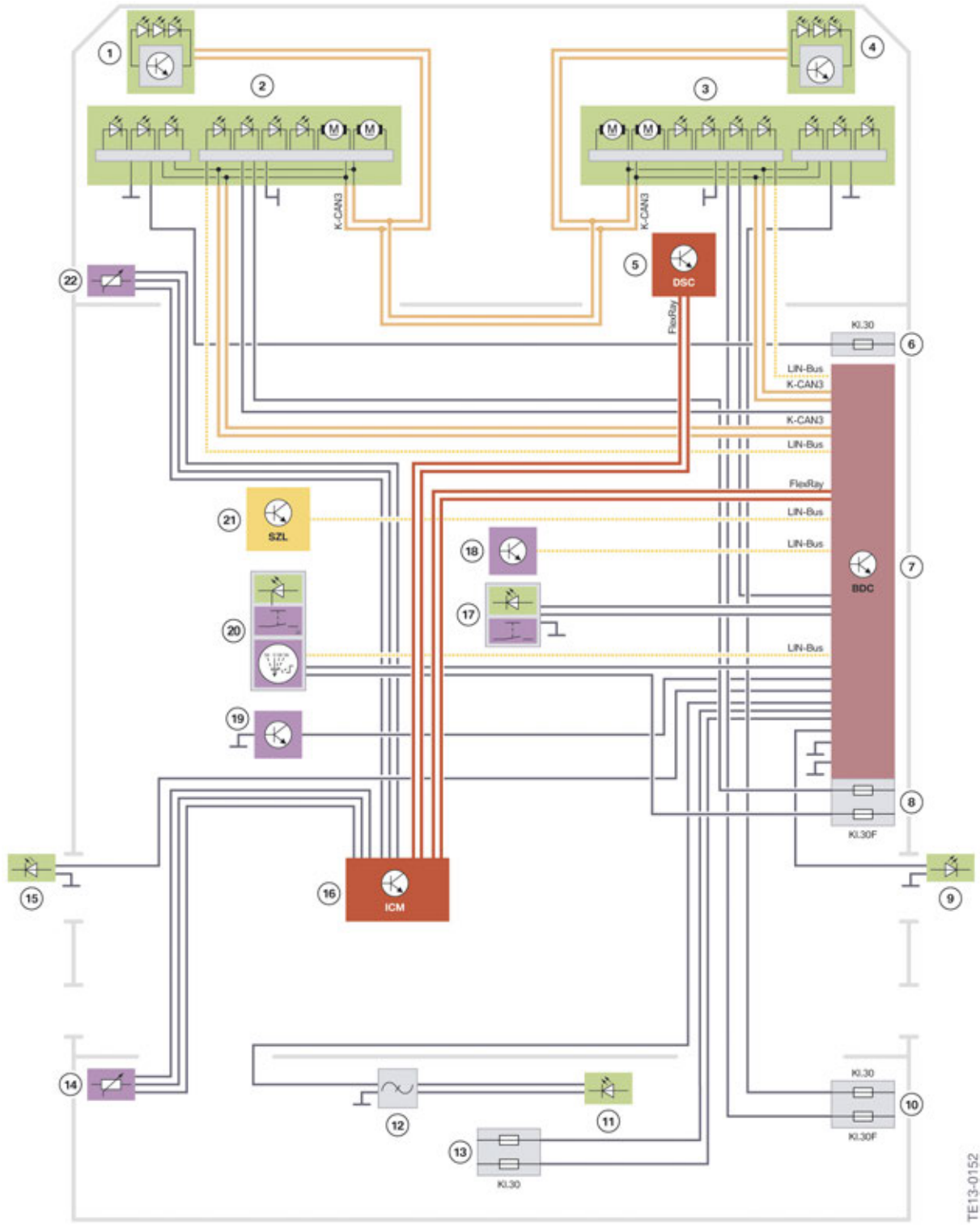
Emergency operation

If there is a fault in the Body Domain Controller that could lead to the failure of an LED headlight then an emergency operation is activated via the LED main light module. In the case of a fault in the LED main light module the emergency operation is activated via the Body Domain Controller. The driving light remains switched on until the vehicle is stopped. The driver is given a displayed malfunction indication in the instrument cluster as a Check Control message.

F15 General Vehicle Electronics

8. Exterior Lights

8.1.4. System wiring diagram for LED headlight, front



F15 system wiring diagram for exterior lights, front (for LED headlights, option 552)

F15 General Vehicle Electronics

8. Exterior Lights

Index	Explanation
1	LED fog light, left
2	Headlight, left
3	Headlight, right
4	LED fog light, right
5	Dynamic Stability Control
6	Power distribution box, front
7	Body Domain Controller
8	Power distribution box in the BDC
9	Additional turn indicator, exterior mirror, passenger's side
10	Power distribution box, luggage compartment
11	Additional brake light
12	Interference suppression filter
13	Battery power distribution box
14	Ride height sensor, rear
15	Additional turn indicator, exterior mirror, driver's side
16	Integrated Chassis Management
17	Hazard warning switch/Intelligent Safety button
18	Rain-light-solar-condensation sensor
19	Brake light switch
20	Operating unit for light
21	Steering column switch cluster
22	Ride height sensor, front
Terminal 30F	Terminal 30, fault-dependent
Terminal 30	Terminal 30

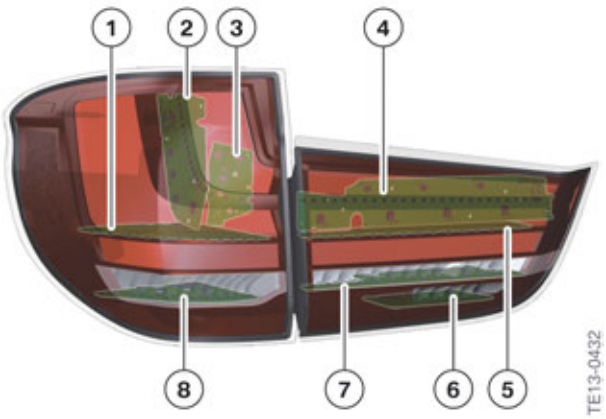
F15 General Vehicle Electronics

8. Exterior Lights

8.2. Rear lights

8.2.1. LED rear light cluster

The F15 features a two-part LED rear light. One part is located in the rear quarter panel, the other in the tailgate. The layout of the rear lights is shown in the following graphic.



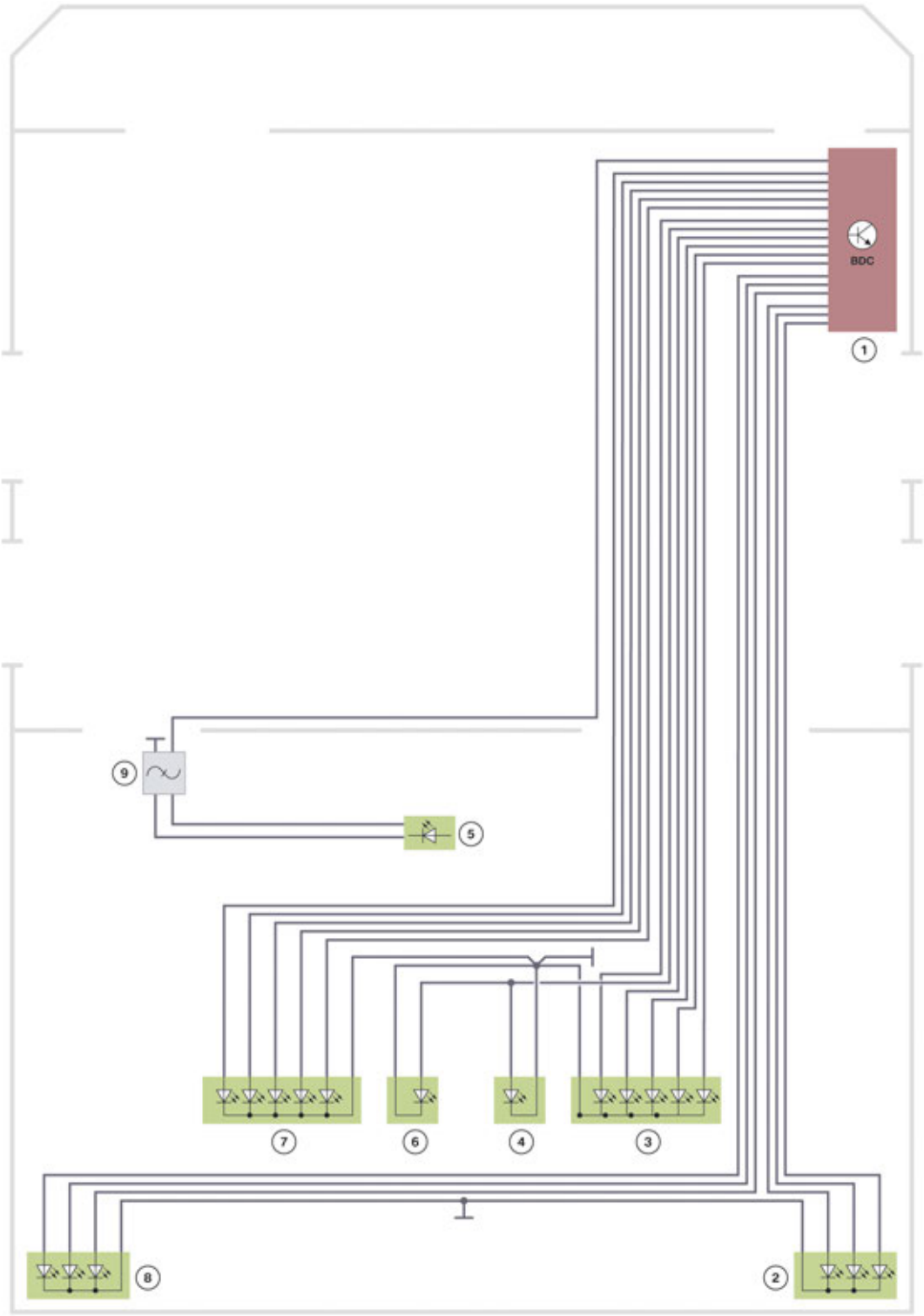
F15 LED rear light

Index	Explanation
1	Turn indicator
2	Tail light
3	Tail light
4	Brake light
5	Tail light
6	Reversing light
7	Reversing light
8	Rear fog light

F15 General Vehicle Electronics

8. Exterior Lights

8.2.2. System wiring diagram for rear light cluster



F15 system wiring diagram for rear exterior lights

F15 General Vehicle Electronics

8. Exterior Lights

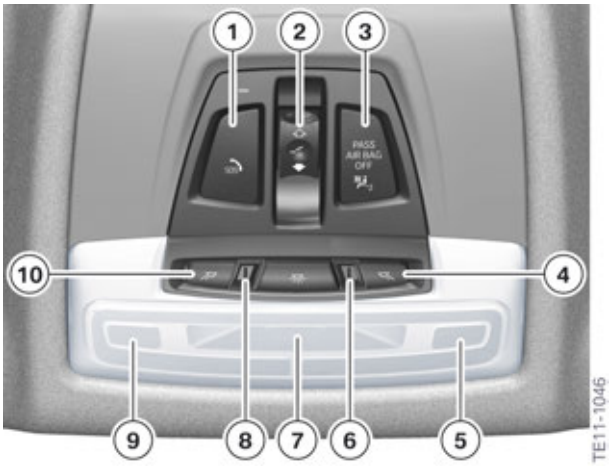
Index	Explanation
1	Body Domain Controller
2	Outer rear light, right
3	Inner rear light, right (in tailgate)
4	Number plate light, right
5	Additional brake light
6	Number plate light, left
7	Inner rear light, left (in tailgate)
8	Outer rear light, left
9	Interference suppression filter

F15 General Vehicle Electronics

9. 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. The ambient lighting feature of the interior lights on the F15 is comprised entirely of LEDs.

The Body Domain Controller is connected to the FZD via a local interconnect network bus. The BDC is responsible for the activation of all interior lighting. The interior lighting is supplied with voltage by the BDC.



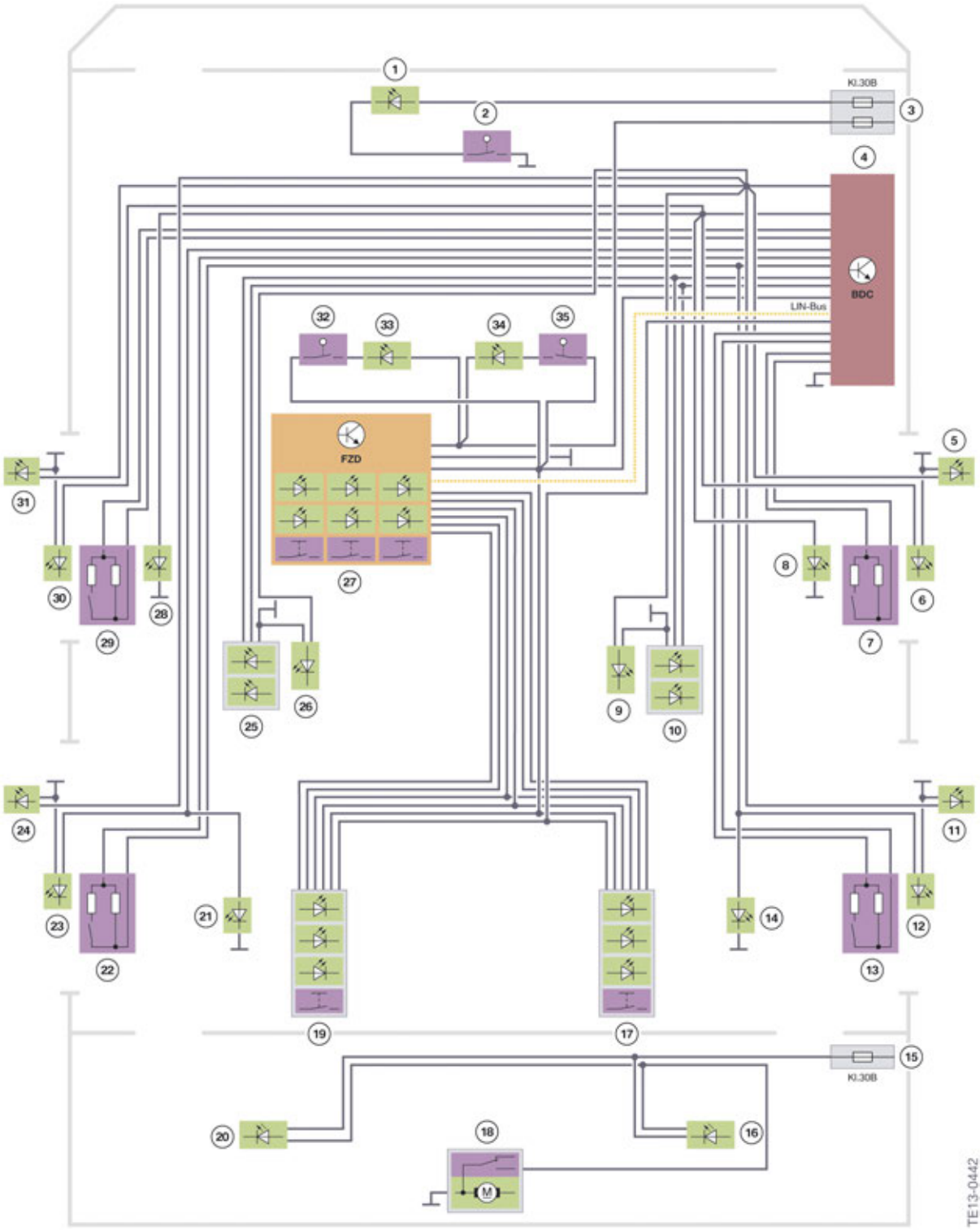
F15 roof function center

Index	Explanation
1	Emergency call button
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

F15 General Vehicle Electronics

9. Interior Lighting

9.1. System wiring diagram



F15 system wiring diagram for interior lighting

F15 General Vehicle Electronics

9. Interior Lighting

Index	Explanation
1	Glove box light
2	Glove box switch
3	Power distribution box, front
4	Body Domain Controller
5	Ground lights, front right
6	Door sill cover strip, front right
7	Door lock, front right
8	Lighting, door sill cover strip, front right
9	Seat beam lighting, front right
10	Backrest lighting, front right
11	Ground lights, rear right
12	Door sill cover strip light, rear right
13	Door lock, rear right
14	Footwell light, rear right
15	Power distribution box, luggage compartment
16	Lighting, tailgate, right
17	Interior lighting, rear right
18	Tailgate lock
19	Interior lighting, rear left
20	Lighting, tailgate, left
21	Footwell light, rear left
22	Door lock, rear left
23	Door sill cover strip, rear left
24	Ground lights, rear left
25	Backrest lighting, front left
26	Seat beam lighting, front left
27	Roof function center
28	Lighting, door sill cover strip, front left
29	Door lock, front left
30	Door sill cover strip, front left
31	Ground lights, front left
32	Make-up light switch, left

F15 General Vehicle Electronics

9. Interior Lighting

Index	Explanation
33	Make-up light, left
34	Make-up light, right
35	Make-up light switch, right
Terminal 30B	Terminal 30 basic operation

9.2. Ambient lighting

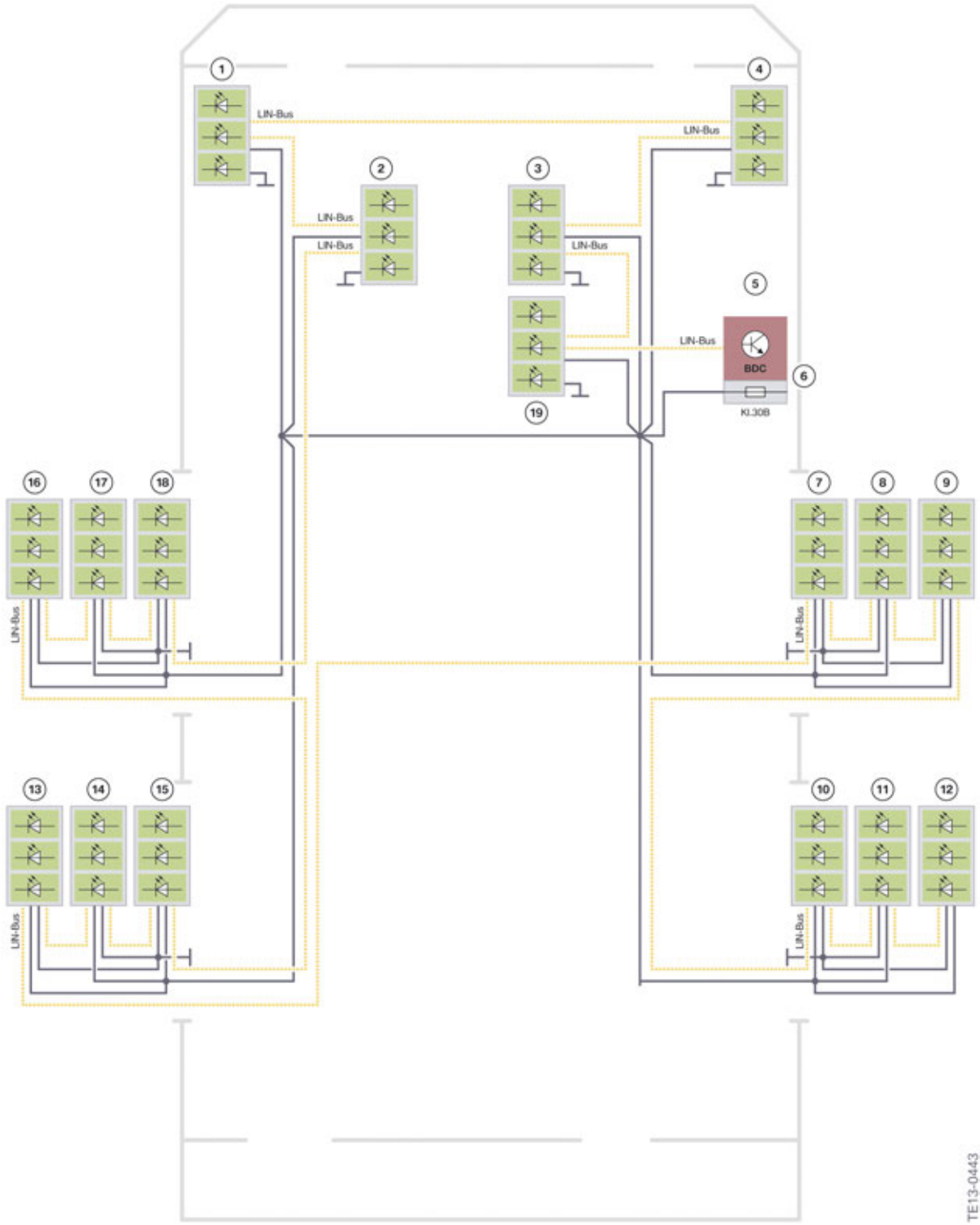
The ambient lighting in the F15 can be adjusted in the central information display using the controller. In addition to the familiar orange and white colors, blue is now also available for selection. The ambient lighting was divided into 3 areas, which makes it possible for different light colors for each lighting area. The selection of the color sets is effected by adjusting the ensembles in the CID. In addition to the color and area, the brightness of the lighting can also be adjusted. The brightness setting takes priority over the adaptation to the instrument lighting.

F15 ambient lighting in the CID

F15 General Vehicle Electronics

9. Interior Lighting

9.2.1. System wiring diagram



F15 system wiring diagram for FI-LIN

F15 General Vehicle Electronics

9. Interior Lighting

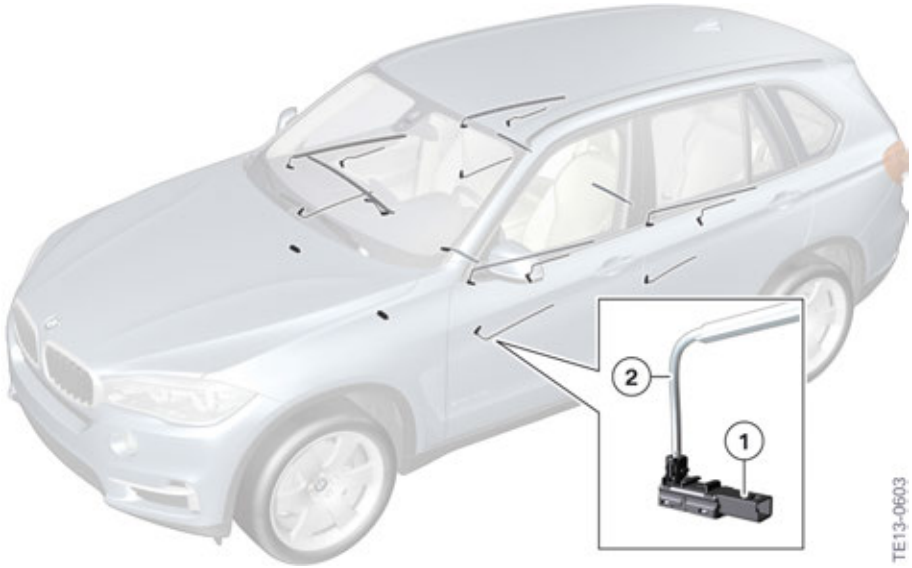
Index	Explanation
1	Footwell light, front left
2	Ambient lighting, dashboard
3	Ambient lighting, dashboard
4	Footwell light, front right
5	Body Domain Controller
6	Power distribution box in the BDC
7	Ambient lighting at door pocket, front right
8	Ambient lighting at exterior mirror, front right
9	Ambient lighting at decorative strip, front right
10	Ambient lighting at door pocket, rear right
11	Ambient lighting at exterior mirror, rear right
12	Ambient lighting at decorative strip, rear right
13	Ambient lighting at decorative strip, rear left
14	Ambient lighting at exterior mirror, rear left
15	Ambient lighting at door pocket, rear left
16	Ambient lighting at decorative strip, front left
17	Ambient lighting at exterior mirror, front left
18	Ambient lighting at door pocket, front left
19	Ambient lighting, dashboard
Terminal 30B	Terminal 30 basic operation

F15 General Vehicle Electronics

9. Interior Lighting

9.2.2. System components

In the F15 the ambient lighting is controlled for the first time via its own local interconnect network bus. The individual LED modules are connected via the local interconnect network bus. The modules, equipped with three different colored LEDs, are activated by the BDC. The switching mode, as well as the brightness and color, are transmitted via Local Interconnect Network. The Local Interconnect Network connection of the LED modules is connected in series around the vehicle.



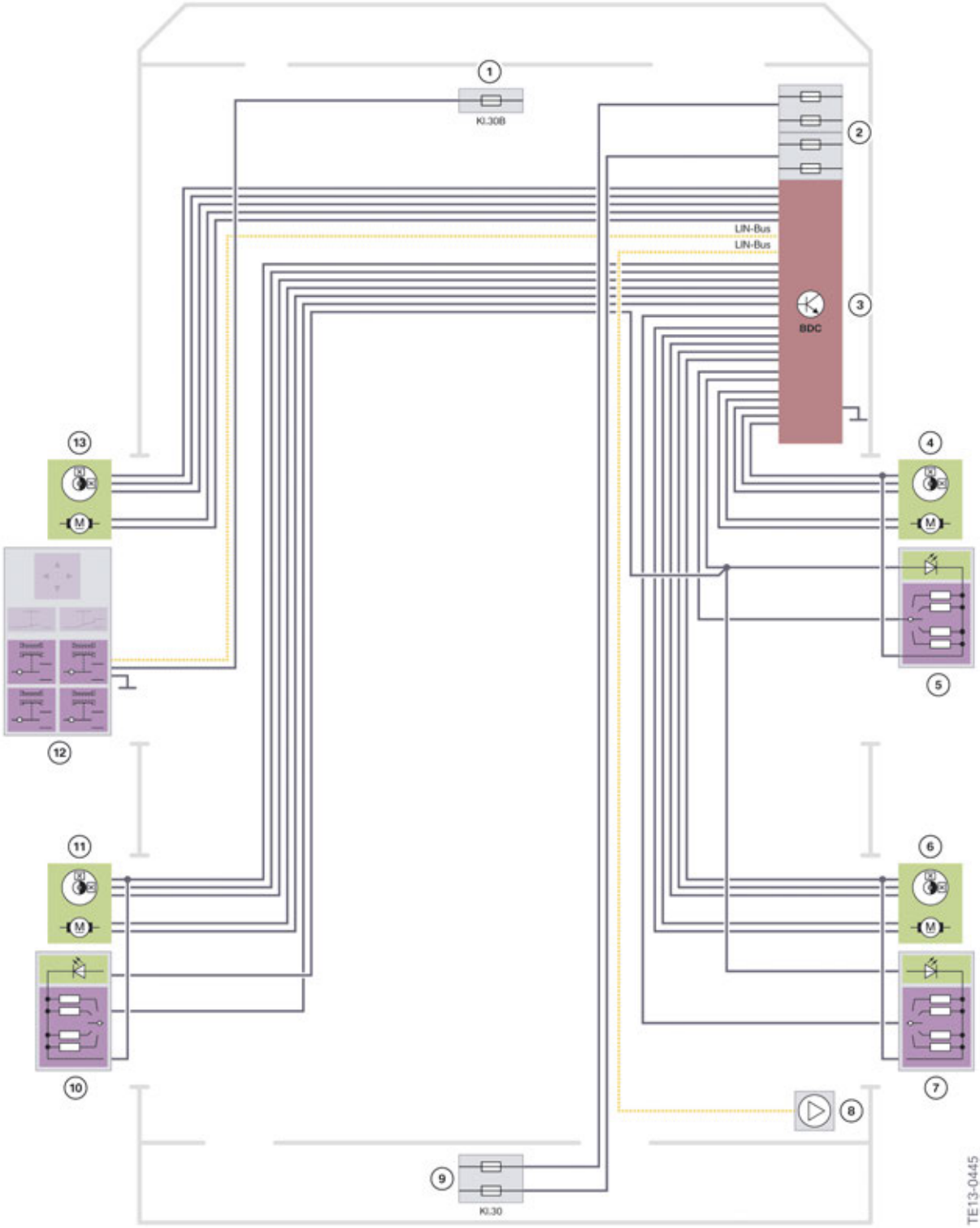
F15 components of ambient lighting

Index	Explanation
1	LED module
2	LED optical fibre

F15 General Vehicle Electronics

10. Power Window Regulator

The front power window regulators are activated by the BDC.



F15 system wiring diagram for power window regulators

F15 General Vehicle Electronics

10. Power Window Regulator

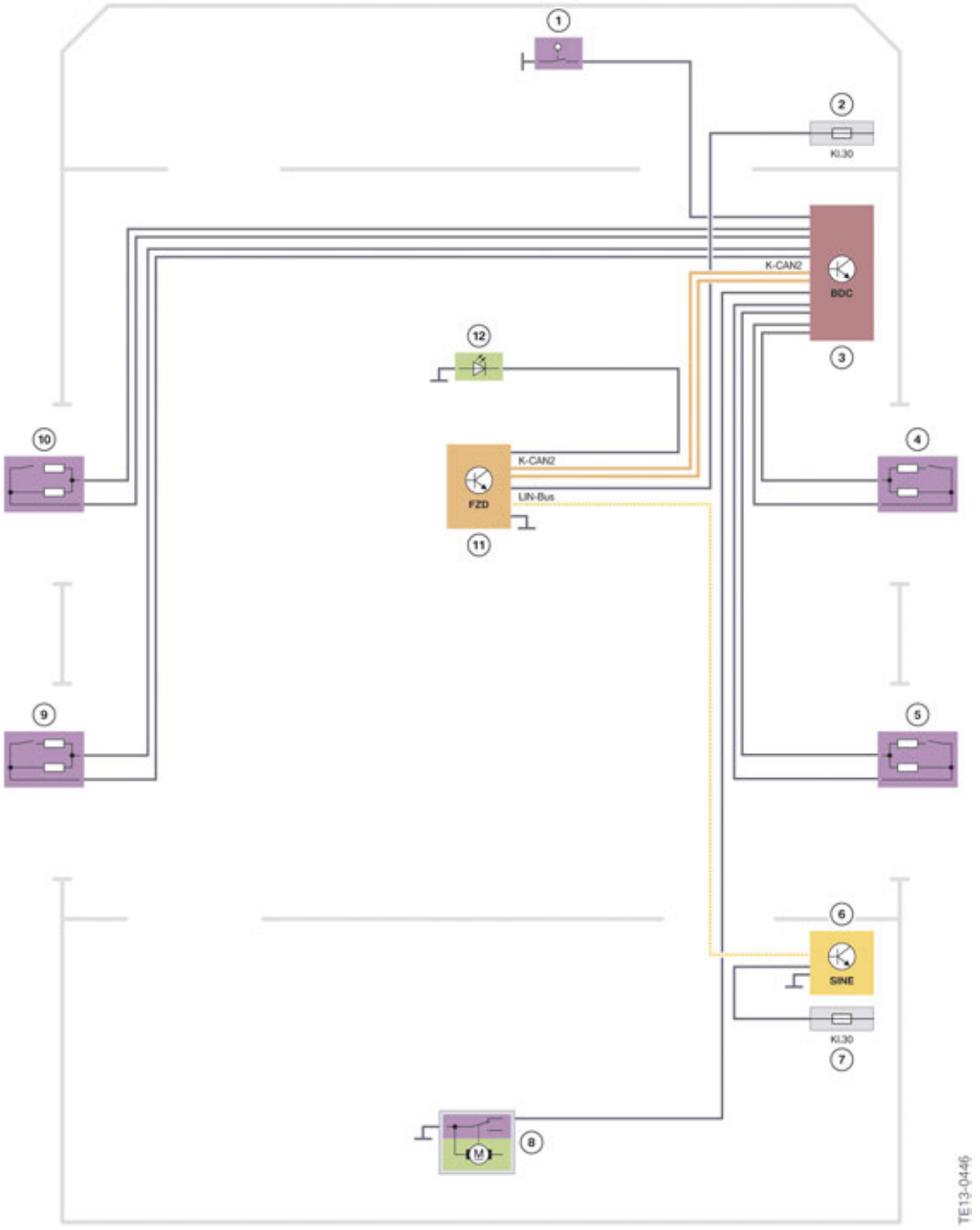
Index	Explanation
1	Power distribution box, front
2	Power distribution box in the BDC
3	Body Domain Controller
4	Power window motor with indirect anti-trap protection, front right
5	Power window switch, front right
6	Power window motor with indirect anti-trap mechanism, rear right
7	Power window switch, rear right
8	Remote control receiver
9	Battery power distribution box
10	Power window switch, rear left
11	Power window motor with indirect anti-trap mechanism, rear left
12	Switch block, driver's door
13	Power window motor with indirect anti-trap protection, front left
Terminal 30	Terminal 30
Terminal 30B	Terminal 30 basic operation

F15 General Vehicle Electronics

11. Alarm System

In addition to the monitoring of the doors, engine compartment lid and the tailgate, the passenger compartment is also monitored in the F15 with the alarm system. An ultrasonic interior movement sensor (USIS), is also fully integrated into the FZD.

11.1. System wiring diagram



F15 system wiring diagram for alarm system

F15 General Vehicle Electronics

11. Alarm System

Index	Explanation
1	Engine compartment lid contact switch
2	Power distribution box, front
3	Body Domain Controller
4	Door contact, front right
5	Door contact, rear right
6	Siren with tilt alarm sensor
7	Power distribution box, luggage compartment
8	Tailgate contact with tailgate lock
9	Door contact, front right
10	Door contact, front left
11	Roof function center
12	Alarm system LED in the inside mirror
Terminal 30	Terminal 30

The status of the following components are monitored:

- Door contacts
- Engine compartment lid contact switch
- Rear lid contact switch

As soon as a status changes, the control unit for the ultrasonic interior movement detector receives a corresponding signal via the local interconnect network bus. If the alarm system is activated, an audible alarm is triggered.

The tilt sensor and the interior monitoring can be deactivated by pressing the key remote locking button again after initially locking the vehicle. The systems are switched off until the next unlocking.

F15 General Vehicle Electronics

12. Entertainment and Communication

12.1. Headunits

The following headunit is available for the F15:

Standard equipment	Headunit	CID	Controller	Navigation
Navigation System	Headunit High	10.25"	7-button with touchpad	Yes

The Headunit High with Navigation System will come as standard equipment on the F15.

More information on the Headunit High can be found in the Training Reference Manual “ST1211 Headunit High”.

12.1.1. New features of Headunit High

In the F15 a further developed version of the Headunit High is used. The following new functions are available:

- In the F15 the Personal Profile can be imported and exported using the BMW Connected app. This gives the user a simple option of transporting and updating his Personal Profile in several BMW vehicles without having to use a USB stick.
- With the audio playback via Bluetooth one can navigate through the directory structure the same way as for the audio playback via USB. The Bluetooth profile AVRCP in version 1.4 is used here.
- With the volume control the current volume is displayed as a bar in the central information display. The labelling of the volume bars clarifies which source is changed in the volume (for example entertainment, call or announcement of navigation system).
- SDARS radio was extended with a timeshift function. The current playback is recorded for up to 45 minutes. The user can rewind, for example to play a news broadcast again.

New features of Headunit High

Index	Explanation
1	Volume bars with labelling "Entertainment"
2	SDARS timeshift function

F15 General Vehicle Electronics

12. Entertainment and Communication

The following new features are available in the navigation area:

In the navigation system, areas can be marked which are avoided during the route planning. For example, an area blocked for an extended period due to construction work can be excluded from the route planning.

Route planning

Index	Explanation
1	Define areas to be avoided
2	Rectangle of area to be avoided
3	Storage process of area to be avoided

The destination input can now also be input using GPS coordinates.

Destination input using GPS coordinates

Index	Explanation
1	Destination input using GPS coordinates
2	Input screen for GPS coordinates

The Special destinations area was also improved. For instance, it is now possible to select historical monuments as special destinations. Rest stations are now also offered as a possible destination directly with the message of the alertness assistant.

Special destinations

Index	Explanation
1	Message of alertness assistant with link to special destinations
2	Special destinations: Rest stations
3	Special destinations: Historical monuments

F15 General Vehicle Electronics

12. Entertainment and Communication

12.2. Speaker systems

The speaker systems in the F15 are available in three specification levels:

Name	Optional equipment	System	Speakers
HiFi speaker system	Standard	HiFi system	9
Harman Kardon Surround Sound system	Option 688	Top HiFi system	16
Bang & Olufsen High-End Surround Sound System	Option 6F2	Top HiFi system	16

Harman Kardon Surround Sound System (option 688)

Bang & Olufsen High-End Surround Sound System (optional equipment 6F2)

F15 General Vehicle Electronics

12. Entertainment and Communication

12.3. Rear seat entertainment system

In the F15 only one variant of the rear seat entertainment system is offered. The rear seat entertainment system in the F15 is operated via a radio remote control. The activation of the freestanding rear displays is adopted from the F01 LCI and they are connected via an APIX link (Automotive Pixel Link).

Rear passenger compartment entertainment

More information on the rear seat entertainment system is available in the Training Reference Manual “ST1211 Headunit High”.

F15 General Vehicle Electronics

12. Entertainment and Communication

12.4. ConnectedDrive realignment

In the F15 the optional equipment structure of the telephone functions and the telematics service of ConnectedDrive have changed in comparison to the previous versions. This is already known from other current BMW models such as the BMW F10 LCI and the F01 LCI.

The following adaptations have been made to the equipment for telephone functions:

- Introduction as standard equipment: Enhanced USB and Bluetooth plus Smartphone Integration.

The following equipment was introduced for the control of telematics services:

- **BMW TeleServices:** Basic content for networked vehicle, control of telematics hardware.
- **BMW Assist eCall:** Enables automatic and manual emergency call without restriction on the operating time. An internal backup battery is installed in the control unit to ensure the voltage supply for the emergency call.
- **BMW Online:**
  The following equipment comes standard with ConnectedDrive services:
  - Real Time Traffic Information
  - Remote Services
  - BMW Apps
  - Weather in the navigation map
  - BMW Send to Car

  The following function is included in the optional equipment BMW Online:
  - Concierge Services

F15 General Vehicle Electronics

12. Entertainment and Communication

12.5. BMW Apps

For the F15 the functions of BMW Apps are available for both iOS and Android. The BMW Connected app is only supported from Android version 4.2.2. At the editorial deadline, this version is only offered in conjunction with the smartphones Samsung Galaxy S III and Galaxy Nexus.

BMW Apps on the smartphone Galaxy S III

App	Android version 2.2	Android version 4.2.2
My BMW Remote	X	X
BMW Connected		X

The BMW Connected app for Android is being rolled out with a smaller range of functions than the iOS version. The range of functions is gradually being adjusted through regular updates.

The apps for Android are automatically started using a USB upon connection of the smartphone and run in the background. The web radio function is currently not supported for the Android app.

F15 General Vehicle Electronics

12. Entertainment and Communication

12.6. Audio playback with Android

Audio files on Android smartphones are played differently depending on the connection mode. However, the operating principle and the appearance in the central information display do not differ.

Connection mode	Audio playback using
USB via "external devices"	Headunit High
BMW app for Android ("connection assistant")	Android smartphone

It is not possible to play music via the two connection modes at the same time. In order to access the mass storage device of the Android smartphone, the USB mode must be activated if necessary and the device disconnected from the headunit and connected again via USB.

Activation of USB mode for Android app

F15 General Vehicle Electronics

12. Entertainment and Communication

12.7. Snap-in adapter

By the end of 2013 new snap-in adapters are being introduced for the connection of smartphones to BMW vehicles. The following new variants are planned:

Snap-in adapter

Index	Explanation
1	Snap-in adapter for Samsung smartphones
2	Snap-in adapter for iPhone 5

- "Basic" snap-in adapter for iPhone 5
- "Music" snap-in adapter for iPhone 5
- "Media" snap-in adapter for iPhone 5 with fan
- Snap-in adapter for Samsung smartphones
- Generic snap-in adapter for Android smartphones.

F15 General Vehicle Electronics

13. Display, Indicators and Controls

13.1. Controller with touch pad

Controller with touch pad

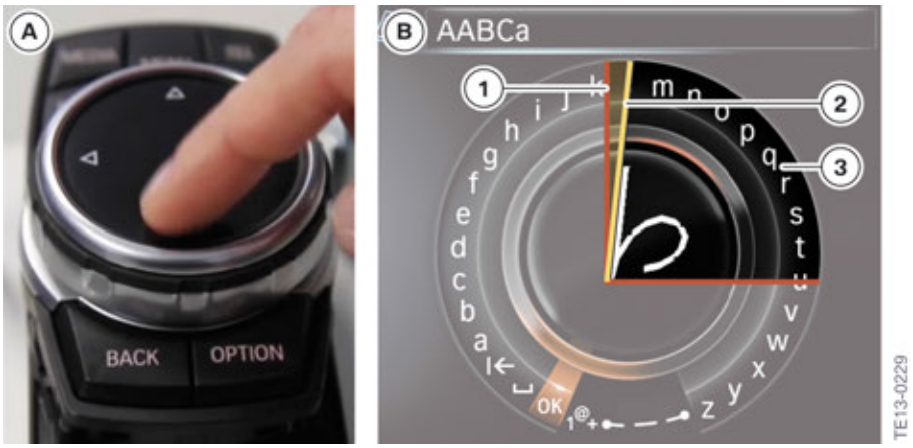
All vehicles will have a navigation system standard with the touchpad controller with touch control panel above the turn and press controller. Using the touch control panel the customer can input location information for the navigation system or telephone numbers and contact details. In the map operation, the map section for example can be moved and enlarged or reduced by finger movement. Using the touch control panel, the mouse pointer can also be moved for the Internet function.

The touchpad controller supports nine gestures during the input. This means that it is now possible to adjust controller settings in the central information display by lateral movements on the touchpad.

F15 General Vehicle Electronics

13. Display, Indicators and Controls

The gesture input can now also be used for other functions such as the operation of the Internet. Characters entered using the word match principle are now also recognized with an input at an angle between 0° and 90°.



Angular range of input using wordmatch principle with touchpad

Index	Explanation
A	Input using controller with touchpad
B	Displays in central information display
1	Edge of angular range for input
2	"Angle" of input
3	Angular range for input

For the evaluation of inputs an additional control unit "Touch box" is used in separate country versions.

Touch box TBX control unit

The Touch box control unit is required for interpreting the contact sensors of the touch controller for the Headunit High user interface. The Touch box is connected to the controller and Headunit High via the K-CAN4.

F15 General Vehicle Electronics

13. Display, Indicators and Controls

13.2. Instrument cluster (standard)

All F15 vehicles will come equipped with an instrument cluster that has a TFT display. It uses 4 analog round instrument displays and a 5.7" TFT display. The display has a resolution of 640 x 160 pixels and is integrated in the bottom area of the round instruments.

Standard cluster

Index	Explanation
1	TFT display
2	Closed instrument rings

13.3. Instrument cluster (optional)

F15 vehicles with the Heads-Up Display (option 609) are installed with a instrument cluster with extended functions similar to the F01. It has 4 analogue round instruments and a 9.2" TFT display. The display has a resolution of 960 x 160 pixels and is integrated in the bottom area of the round instruments

F15 General Vehicle Electronics

13. Display, Indicators and Controls

Optional cluster

13.4. Head-Up Display

The name "Head-Up" describes the principle benefit of this system. The optional Head-Up Display 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 in the F15 contains various functions aimed at enhancing road safety and ride comfort. That includes display of:

- Speed
- Set speed regulation by the cruise control with braking function
- Active cruise control with Stop&Go function
- Navigation system
- Check Control messages
- Road sign recognition
- Lane departure warning
- Night Vision with person and animal recognition

Similar to current BMW vehicles, the Head-Up Display can also project the color blue, as well as 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.

F15 General Vehicle Electronics

13. Display, Indicators and Controls

HUD display (example)

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.

Bayerische Motorenwerke Aktiengesellschaft
Qualifizierung und Training
Röntgenstraße 7
85716 Unterschleißheim, Germany

Technical training.
Product information.

F15 Driver Assistance Systems

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1312 11/1/2013

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: **July 2013**
BV-72/Technical Training

F15 Driver Assistance Systems

Contents

F15 Driver Assistance Systems

Contents

F15 Driver Assistance Systems

1. Introduction

In the F15 a comprehensive selection of assistance systems facilitates the driver when driving the vehicle by:

- providing the driver with information
- giving the driver suggestions or
- automatically intervening in the driving process.

The basic principle of centralization is now followed with the assist systems. Multiple buttons have been deleted in favor of one Intelligent Safety button, which enables comfortable and simplified operation.

The principle and the functions of the assist systems correspond to current BMW models.

In this Training reference manual you will find an overview of the following assist systems available in the F15:

- BMW Night Vision with person and animal recognition
- Lane departure warning
- Camera-based collision warning (incl. pedestrian warning with city braking function and collision warning with city braking function)
- Radar-based collision warning with braking function
- Speed limit information
- Active cruise control with Stop & Go function
- Reversing camera
- Surround View
- Park Distance Control
- BMW Head-Up Display
- Parking Maneuver Assistant

Further information on the following topics of the assist systems can be found in the Training Reference Manual ST1212 F01–F02 LCI:

- "BMW Night Vision 2 F01/F02"
- "Camera-based Driver Support Systems F01/F02"
- "DCC, ACC F01/F02"
- "F01 Driving Stability Control"

F15 Driver Assistance Systems

1. Introduction

1.1. Overview of optional equipment

With the introduction of the optional equipment Active Driving Assistant (SA 5AS) and ACC Stop & Go + Active Driving Assistant (SA 5AT) the assist systems are sometimes available separately or as part of the two new options. The following table provides an overview.

Optional equipment	Function
5AS (Active Driving Assistant)	Lane departure warning Camera-based collision warning Forward collision warning with city braking function Pedestrian warning with city braking function
5AT (ACC Stop & Go + Active Driving Assistant)	Lane departure warning Forward collision warning with city braking function (radar and camera-based) Pedestrian warning with city braking function ACC Stop & Go Distance information (only in conjunction with SA 610)
5AG	Active blind spot detection
8TH	Speed limit information
610	BMW Head-Up Display Distance information (only with SA 5AT)
5DP	Parking Maneuver Assistant
5AC	High-beam assistant
6UK	BMW Night Vision with person and animal recognition
3AG	Reversing camera
5DL	Surround View camera

F15 Driver Assistance Systems

1. Introduction

1.2. Overview of sensors

The following table provides an overview of the assist systems are used with radar sensor, KAFAS camera and Night Vision camera. Depending on the equipment the same system can be utilized with different sensors. Please note the information in the descriptions of the individual systems.

Function/Sensor system	KAFAS camera	Radar sensor	Night Vision camera
Lane departure warning	×		
Active blind spot detection		×	
Speed limit information	×		
ACC Stop & Go	×	×	
Collision warning with braking function	×	×	
Camera-based collision warning	×		
Collision warning with city braking function	×		
Pedestrian warning with city braking function	×		
High-beam assistant	×		
BMW Night Vision with person and animal recognition			×

F15 Driver Assistance Systems

2. Intelligent Safety Button (SARA)

In the F15 the Intelligent Safety button (SARA) is used for the first time in BMW vehicles as a central operating element for the assist systems. The Intelligent Safety button replaces the need for multiple buttons to operate these functions.

F15 Intelligent Safety button

Index	Explanation
1	Intelligent Safety button

Depending on the equipment of the vehicle Intelligent Safety consists of one or several of the following systems, which may help avoid a collision:

- Camera-based collision warning or collision warning with braking function
- Pedestrian warning (pedestrian warning with city braking function and pedestrian warning with BMW Night Vision)
- Lane change warning
- Lane departure warning

2.1. Controls

The operation is performed by pressing the Intelligent Safety button. A menu for the configuration of the Intelligent Safety systems appears in the CID.

F15 Driver Assistance Systems

2. Intelligent Safety Button (SARA)

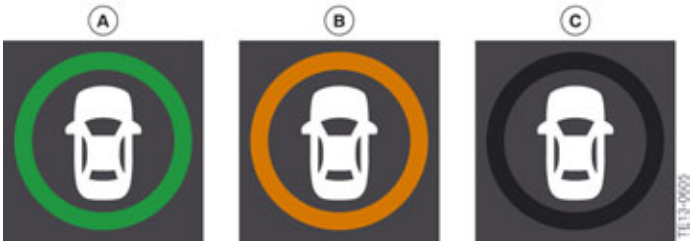
Press button	A menu is displayed in the CID. Settings can be made using the controller. The individual settings are stored for the ID transmitter currently used.
Press and release button	**When all Intelligent Safety systems are not switched on:** Intelligent Safety systems are switched off individually depending on the individual setting. The LED illuminates orange or goes out, depending on the individual setting. **When all Intelligent Safety systems are switched on:** All Intelligent Safety systems are switched on. The LED illuminates green.
Press button for an extended period	All Intelligent Safety systems are switched off. The LED goes out.

F15 Intelligent Safety menu in the CID

Index	Explanation
1	Collision warning
2	Pedestrian warning
3	Lane departure warning
4	Lane change warning
5	Configuration menu
A	All Intelligent Safety systems are switched on
B	Some of the Intelligent Safety systems are switched on
C	All Intelligent Safety systems are switched off

F15 Driver Assistance Systems

2. Intelligent Safety Button (SARA)



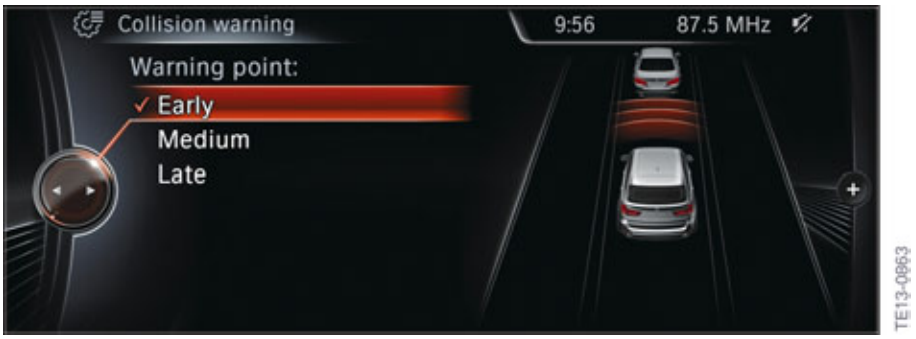
F15 Colors of Intelligent Safety button

Index	Explanation
A	All Intelligent Safety systems are switched on
B	Some of the Intelligent Safety systems are switched on
C	All Intelligent Safety systems are switched off

The Intelligent Safety systems are automatically active after each engine start via the START-STOP button.

The following additional settings for the Intelligent Safety systems can be made via the configuration menu in the CID.

2.1.1. Warning time of collision warning



Warning time of collision warning in CID

Here the warning time for the camera-based collision warning or the collision warning with braking function can be set.

The driver can set the time for the warning in three stages when the collision warning is active. The "late" setting corresponds to the time of the acute warning.

The setting is made in the CID using the controller and selecting on of the following:

- "Settings"
- "Collision warning"
- Set desired warning time using controller at the central information display (CID)

The setting for the warning time is stored for the current driving profile or for the ID transmitter currently used.

F15 Driver Assistance Systems

3. Park Distance Control

Park Distance Control assists the driver when maneuvering in and out of a parking space. The current distance from an obstruction is indicated by acoustic signals and on a visual display. In the F15 the Park Distance Control is standard equipment. The measurement is carried out using four ultrasonic sensors at the front bumper and four ultrasonic sensors at the rear bumper.

In vehicles with the optional Parking Assistant (SA 5DP) the Park Distance Control function is integrated into the PMA control unit. The PMA control unit is installed in the same location as the PDC control unit. In comparison to the PDC control unit, the PMA control unit has a more efficient processor and adapted software.

The automatic activation of the Park Distance Control is new in the F15. In previous BMW models the automatic activation of the Park Distance Control was only done when drive position R was engaged. It is now also activated when drive position D is engaged.

3.1. Active Park Distance Control

In vehicles with Parking Assistant the Park Distance Control function has been extended with the active Park Distance Control function in the F15. This automatically brakes the vehicle to a standstill in the event of an obstruction when the accelerator pedal is not pressed and at a speed below approx. 6 km/h / 3.7 mph.

The automatic brake intervention can be overridden by operating the accelerator pedal.

After the automatic braking to a standstill, the vehicle can start to move again only by gently pressing the accelerator pedal.

The active Park Distance Control function can be switched on and off in the CID.

Symbol for active Park Distance Control in the CID

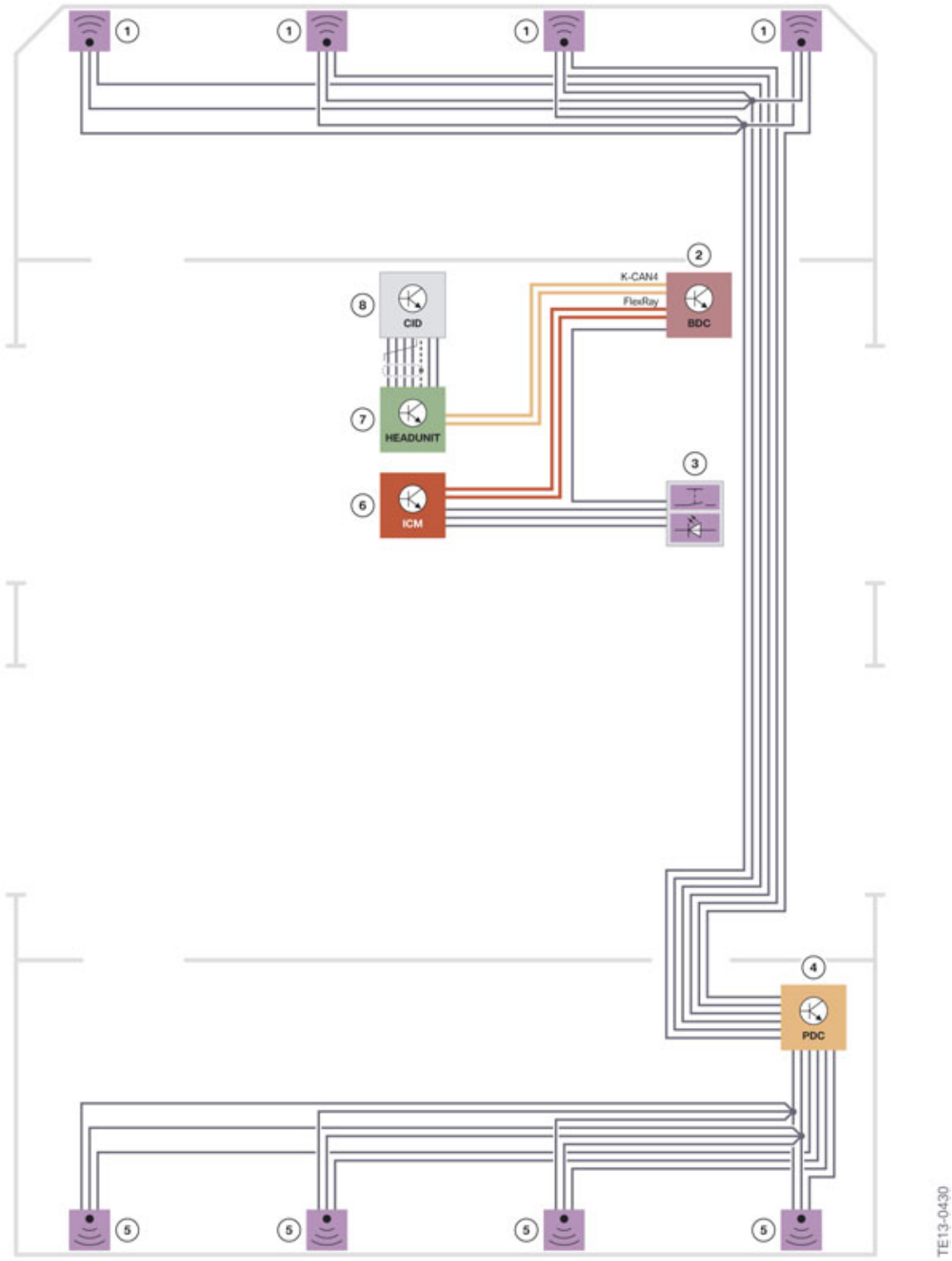
Index	Explanation
1	Symbol for active Park Distance Control in the CID

If the Dynamic Stability Control (DSC) is switched off, then the active Park Distance Control is also switched off. If the active Park Distance Control is switched on when the DSC is switched off, the DSC is also automatically switched on.

F15 Driver Assistance Systems

3. Park Distance Control

3.2. System wiring diagram



System wiring diagram for PDC

F15 Driver Assistance Systems

3. Park Distance Control

Index	Explanation
1	Ultrasonic sensors for Park Distance Control, front
2	Body Domain Controller
3	Operating unit, center console
4	Control unit for Park Distance Control
5	Ultrasonic sensors for Park Distance Control, rear
6	Integrated Chassis Management
7	Headunit
8	Central information display

3.3. Controls

The Park Distance Control system is activated in the following situations:

- When the engine is switched on the drive position R is engaged.
- When the engine is switched on the drive position D is engaged.
- When the engine is switched on and the PDC button in the switch block beside the controller is pressed.
- If obstructions in the rear or in front of the vehicle are identified by the Park Distance Control and the speed is less than approx. 3 km/h / 2 mph, in the automatic activation mode.

Switch block with PDC button

F15 Driver Assistance Systems

3. Park Distance Control

Index	Explanation
1	PDC button

The automatic switching-on upon the identification of obstructions can be switched on and off in the "Settings" menu using a controller. The settings are stored for the ID transmitter currently used.

Switching on automatic Park Distance Control in the CID

The results of the distance measurements or the distance warnings are conveyed to the driver audibly with help of the audio loudspeaker and visually by a display in the central information display. The approach to an object is reflected by an intermittent tone using the loudspeaker. If, for example, an object is detected at the rear left of the vehicle, the acoustic signal sounds from the speaker at the rear left. A continuous alarm is sounded if the distance to the object is less than approx. 25 cm. The volume of the acoustic warning from the Park Distance Control system can be adjusted, in the volume settings menu in the CID.

Volume control menu in the CID

Deactivation criteria

Similar to other BMW models, there are distance and speed limit switches. The switch-off is performed after driving approx. 50 m or at a speed over 36 km/h / 22 mph.

In the event of a fault a Check Control message (PDC has failed. Have system checked.) is displayed in the central information display. In addition, the detection range of the sensors are shown greyed out in the central information display.

F15 Driver Assistance Systems

3. Park Distance Control

The Park Distance Control cannot replace the personal assessment of the traffic situation. Also check the traffic situation around the vehicle with a direct glance, otherwise, a risk of an accident may arise as a result of road users or objects which lie outside the detection range of the Park Distance Control. Loud sound sources outside and inside the vehicle could drown out the PDC signal.

3.4. Restricting the system

Due to the physical limitations during the ultrasonic measurement, it may transpire that obstructions are not identified by the Park Distance Control system. Some examples are shown below to highlight this possibility:

- Thin or wedge-shaped objects
- Low objects
- Objects with corners or sharp edges
- Snow

It is also possible that a warning is displayed although there is no obstruction in the detection range. This may be the case in the following situations:

- Heavy rain
- Heavy dirt contamination or sensors are frozen
- Sensors are covered in snow
- Rough road surfaces
- Bumps, e.g. speed ramps
- In large, right-angled buildings with smooth walls, e.g. underground car parks
- Thick exhaust gas
- Other ultrasonic sources, e.g. neon tubes

In order to ensure full operability, the ultrasonic sensors must be kept clean and free of ice. When cleaning the sensors using a high pressure cleaner, avoid using direct high-pressure water jets for an extended period. Also keep a distance of at least 30 cm to the sensors when using high-pressure cleaners.

F15 Driver Assistance Systems

4. Surround View Camera

The optional equipment Surround View (SA 5DL) provides support when parking or reversing, as well as navigating unclear exits and intersections. In the F15 Surround View is only available in conjunction with the following optional equipment:

- Rear view camera (SA 3AG)

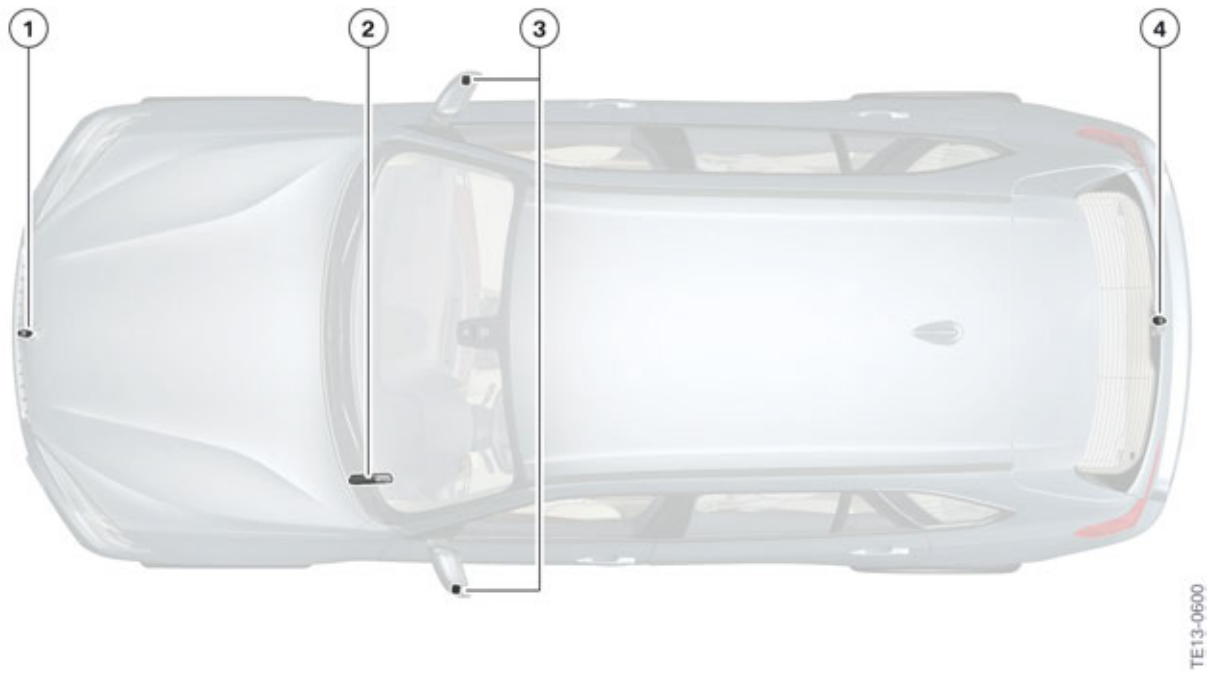
The optional equipment Surround View includes the following systems:

- Panorama view
- Top view
- Reversing camera

Panorama View is part of the Surround View option. The reversing camera can be ordered separately as optional equipment.

The video cameras are connected to the TRSVC control unit via Ethernet. The video signals are transmitted from the TRSVC control unit via CVBS line to the headunit. From there the video signal is transmitted to the CID via an Automotive Pixel Link line.

4.1. Installation locations



F15 Installation locations of Surround View components

F15 Driver Assistance Systems

4. Surround View Camera

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

The TRSVC control unit is installed in the footwell on the driver's side. All four cameras installed for the Surround View function are similar. The opening angle of the front camera lens is approx. 190°.

Instead of the two bumper cameras at the side of the vehicle a front camera is installed for the F15 at the center between the kidney grill and bumper.

F15 Installation location of front camera

Index	Explanation
1	Front camera

F15 Driver Assistance Systems

4. Surround View Camera

The reversing camera is still installed in the release handle strip in the tailgate.

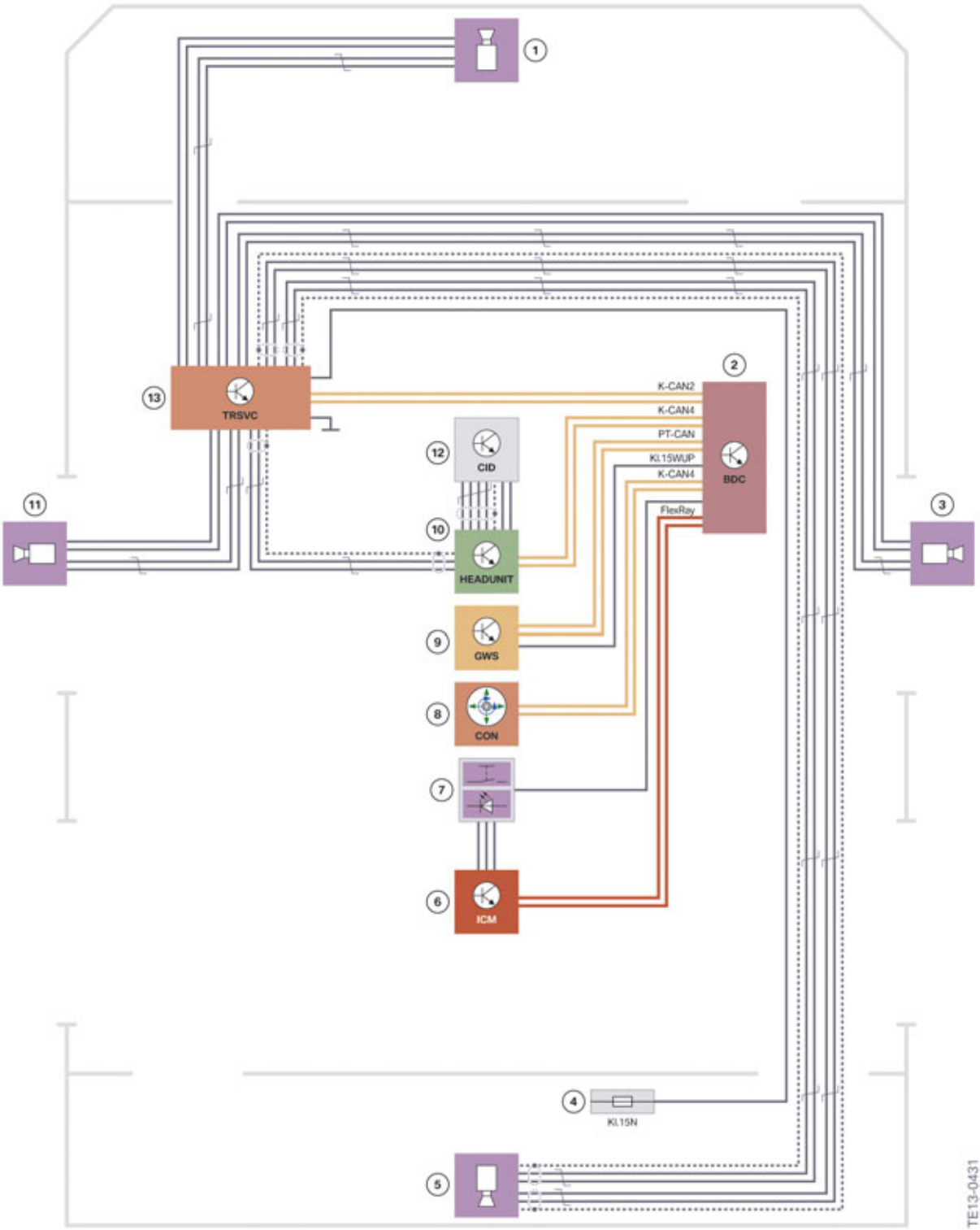
F15 Installation location of reversing camera

Index	Explanation
1	Reversing camera

F15 Driver Assistance Systems

4. Surround View Camera

4.2. System wiring diagram



F15 System wiring diagram for Surround View

F15 Driver Assistance Systems

4. Surround View Camera

Index	Explanation
1	Front camera
2	Body Domain Controller
3	Exterior mirror camera, right
4	Power distribution box, luggage compartment
5	Reversing camera
6	Integrated Chassis Management
7	Operating unit in the center console
8	Controller
9	Gear selector switch
10	Headunit
11	Central Information Display
12	TRSVC control unit
13	Exterior mirror camera, left
Terminal 15N	Ignition (after-run)

4.3. Rear view camera

The reversing camera supports the driver during parking and maneuvering.

The reversing camera is available as optional equipment (SA 3AG).

In vehicles with the reversing camera without Surround View (SA 5DL) an integrated control unit is installed in the camera. As a result, in these vehicles an additional TRSVC control unit is not required for the reversing camera function.

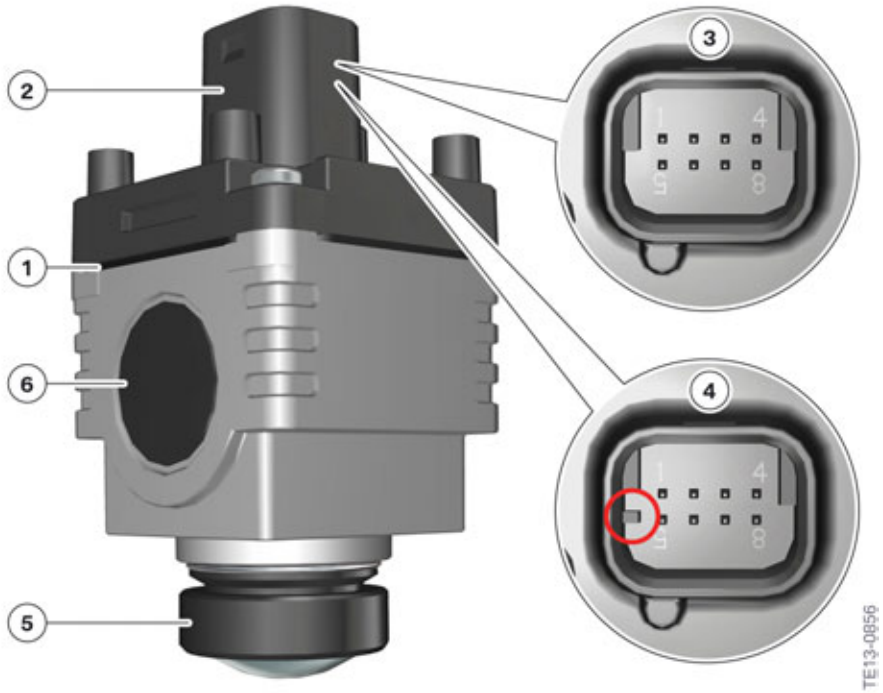
The RFK control unit is connected to the K-CAN3. The transmission of the video signals is done by a CVBS line directly to the headunit.

In vehicles with Surround View a reversing camera without an integrated control unit is installed in conjunction with the TRSVC control unit. The reversing camera is connected to the TRSVC control unit via Ethernet.

F15 Driver Assistance Systems

4. Surround View Camera

The two variants of the reversing camera are distinguished by their encoding of the connector housing.



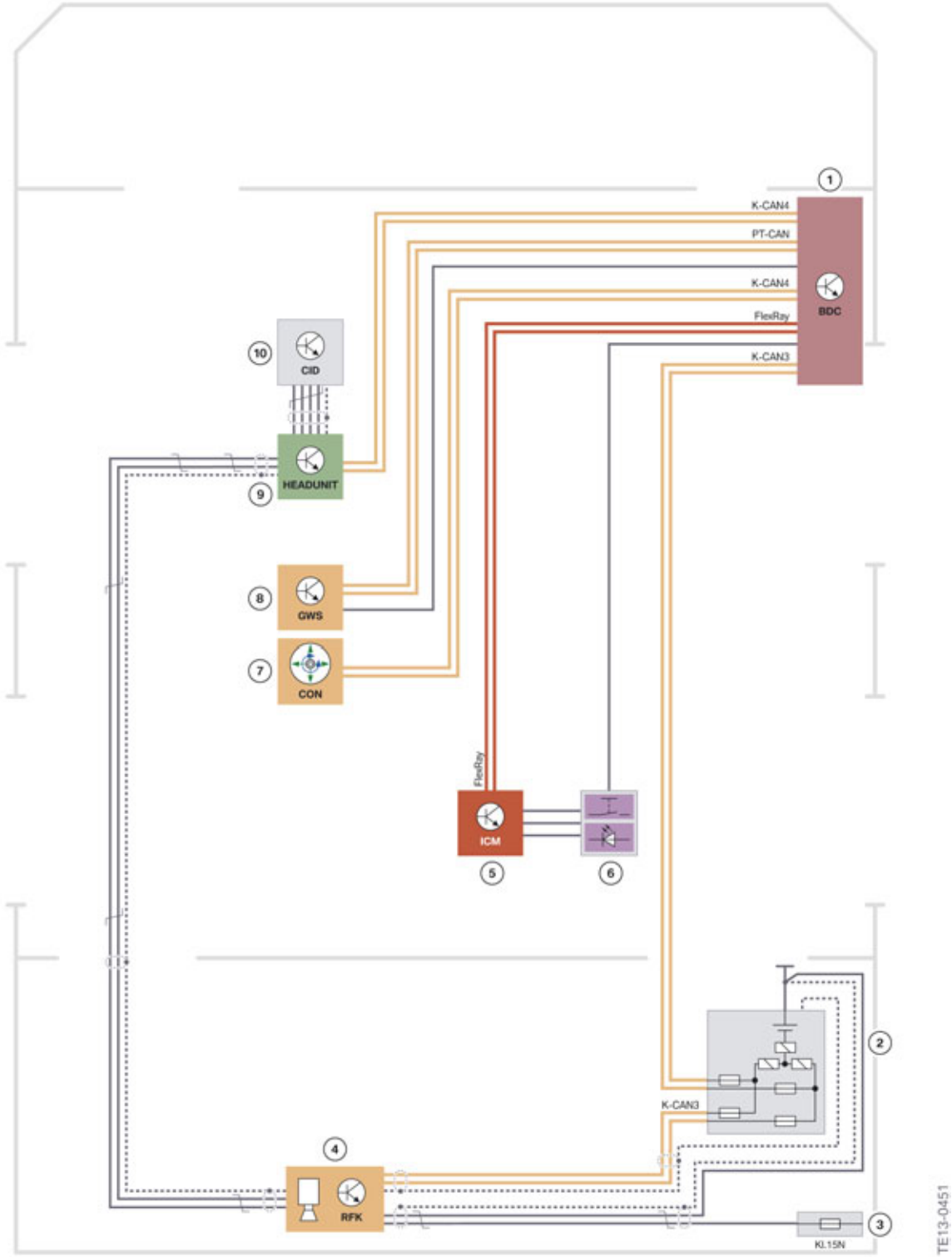
Distinction between variants of reversing camera

Index	Explanation
1	Reversing camera
2	Plug connection
3	Encoding on connector housing of reversing camera with Surround View
4	Encoding on connector housing of reversing camera without Surround View
5	Lens
6	Ventilation

F15 Driver Assistance Systems

4. Surround View Camera

4.3.1. System wiring diagram for reversing camera without Surround View



F15 System wiring diagram for reversing camera without Surround View

Index	Explanation
1	Body Domain Controller
2	CAN terminator
3	Power distribution box, luggage compartment
4	Reversing camera
5	Operating unit in the center console
6	Integrated Chassis Management
7	Controller
8	Gear selector switch
9	Headunit
10	Central Information Display
Terminal 15N	Ignition (after-run)

4.3.2. Display

The images of the reversing camera are displayed in the CID. The already familiar turning radius and driving lane lines can also be faded in. The turning radius and driving lane lines are only displayed when drive positions D and R are shown.

Schematic diagram of reversing camera in the CID

Also check the traffic situation around the vehicle by taking a direct glance. Otherwise, a risk of an accident may arise, for example by road users or objects lying outside the image range of the camera.

4.3.3. Controls

The function is automatically switched on when reverse gear is engaged and the engine is running. In vehicles with Surround View the last selected function (Top View or reversing camera) is always displayed. The images of the reversing camera and the PDC displays are shown. When the Parking Maneuver Assistant is activated a switch to the Top View or PDC screen mask is automatically performed. The system automatically switches off after driving 10 m or at a speed above 15 km/h / 9 mph. If the Parking Maneuver Assistant is activated, there is no automatic shutdown depending on the distance travelled. The function can also be switched on and off manually pressing the PDC button.

F15 Driver Assistance Systems

4. Surround View Camera

4.4. Top View

Top View provides support when parking and maneuvering. The door and roadway area around the vehicle are shown on the CID.

The Top View function is done with the front camera, the two exterior mirror cameras and the reversing camera.

4.4.1. Display

The images of the reversing camera and the exterior mirror cameras are displayed in the CID.

Screen mask for Top View in the CID

Turning radius and driving lane lines are also faded in for Top View. Also for Top View the turning radius and driving lane lines are only displayed when drive positions D and R are shown.

Also check the traffic situation around the vehicle by taking a direct glance. Otherwise, a risk of an accident may arise, for example by road users or objects lying outside the image range of the camera.

4.4.2. Controls

The operation is performed similar to that of the reversing camera. The function is automatically switched on when reverse gear is engaged and the engine is running. The last selected function (Top View or reversing camera) is always displayed. The images of the exterior mirror camera and PDC are displayed when the system has been switched on using the controller. The system automatically switches off after 50 m or at a speed above 32 km/h / 20 mph. The function can also be switched on and off manually using the PDC button.

4.5. Panorama View

Panorama View is a further development of the previous Side View function and enables an early view of the cross-traffic at unclear exits and intersection. The Panorama View function on the E70 used two cameras fitted at the side of the vehicle, the F15 uses only one front camera which is installed in the center between the kidney grilles.

F15 Driver Assistance Systems

4. Surround View Camera

4.5.1. Display

Depending on the gear engaged a panorama view of the front or rear vehicle area is shown. The video image of the camera is displayed in the CID. In contrast to the previous schematic diagram, the left and right area are not shown separately in two images, but a panorama image of the entire area in front of or behind the vehicle is shown.

Screen mask for Panorama View/Side View in the CID

Index	Explanation
1	Previous split screen graphic E70
2	New panorama view, front F15
3	New panorama view at rear F15

Another new feature of the Panorama View function is the identification of objects which move from the side to the area in front of or behind the vehicle. If a moving object is detected, which based on the current speed would be in the area in front of or behind the vehicle in approx. the next three seconds, a warning is shown in the CID as a yellow bar.

Warning of approaching object

Index	Explanation
1	Warning of approaching object (yellow triangle)
2	Approaching object (yellow bar)

The automatic identification is not available at speeds greater than 3 km/h / 2 mph, as well as in the dark or if the camera is dirty. The non-availability is displayed by a crossed-out white triangle in the two upper corners of the screen.

Objects may be located outside the range of the camera.

Therefore, check the traffic situation for exits at unclear locations with an additional direct glance.

4.5.2. Controls

Press the Panorama View button to activate the function. Press the button again to deactivate the function. At speeds above 15 km/h / 9 mph the Panorama View function is automatically deactivated.

Depending on the drive position engaged a panorama view of the front or rear vehicle area is shown.

F15 Panorama View button

Index	Explanation
1	Panorama View button

F15 Driver Assistance Systems

4. Surround View Camera

4.6. Camera replacement

After the replacement of a camera, coding must be carried out using the BMW workshop system. A manual calibration of the cameras in the F15 is not necessary as the cameras are self-calibrating. The calibration is performed during initialization by the TRSVC control unit or the RFK control unit. Installation tolerances are balanced with the calibration by shifting and rotating the image.

The calibration is performed within a few minutes if the following preconditions are satisfied:

- Speed below 45 km/h / 28 mph
- Sufficient brightness
- Straight-ahead driving
- Clean camera

If one or several of the preconditions are not satisfied, the calibration procedure takes longer. In general, the duration of a full calibration takes less than five hours. The cameras are also constantly readjusted after a full calibration in order to guarantee optimal representation.

If the camera was not able to be calibrated successfully, a Check Control message is displayed in the CID. Causes for a failed calibration may be incorrect installation or a faulty camera.

F15 Driver Assistance Systems

5. Parking Maneuver Assistant

In the F15 the Parking Maneuver Assistant is available as optional equipment (SA 5DP). In the F15 the Parking Maneuver Assistant also assumes the tasks of acceleration, braking and gear change, as well as steering, during parallel parking.

5.1. Functional principle

The Parking Maneuver Assistant facilitates parking in spaces between cars parallel to the roadway. For straight-ahead travel up to approx. 35 km/h / 21 mph, parking spaces are measured using the ultrasonic sensors, even if the Parking Maneuver Assistant is activated or deactivated.

As soon as a parking space the length of the vehicle plus approx. 1.2 m has been detected and the system is already activated, this parking space is displayed to the driver in the CID. The Parking Maneuver Assistant then assumes the entire vehicle guidance with steering, braking and gearshifts. The driver is responsible for monitoring the parking procedure. The driver is guided through the parking procedure with handling instructions and if necessary additional acoustic messages. At the end of the parking procedure the P gear is engaged.

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

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

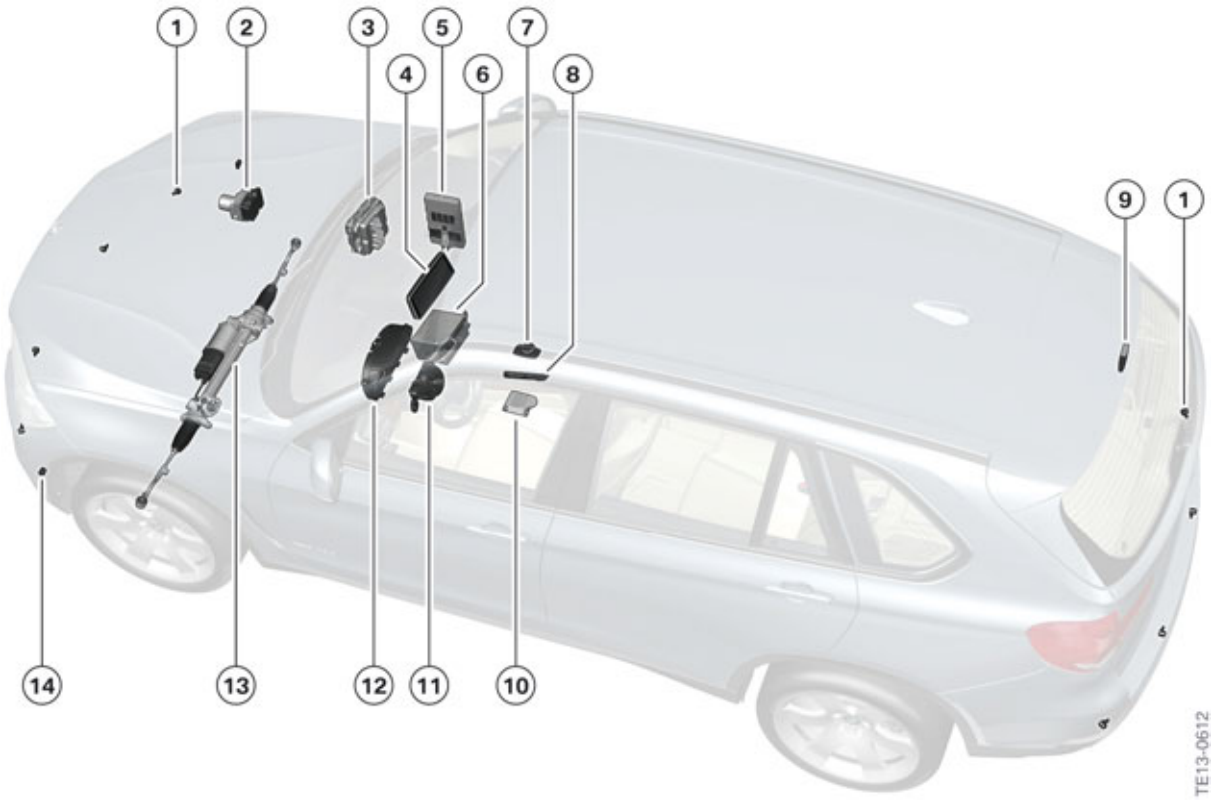
5.2. System components

5.2.1. Overview

The components in the following graphic are involved in the function of the Parking Maneuver Assistant.

F15 Driver Assistance Systems

5. Parking Maneuver Assistant



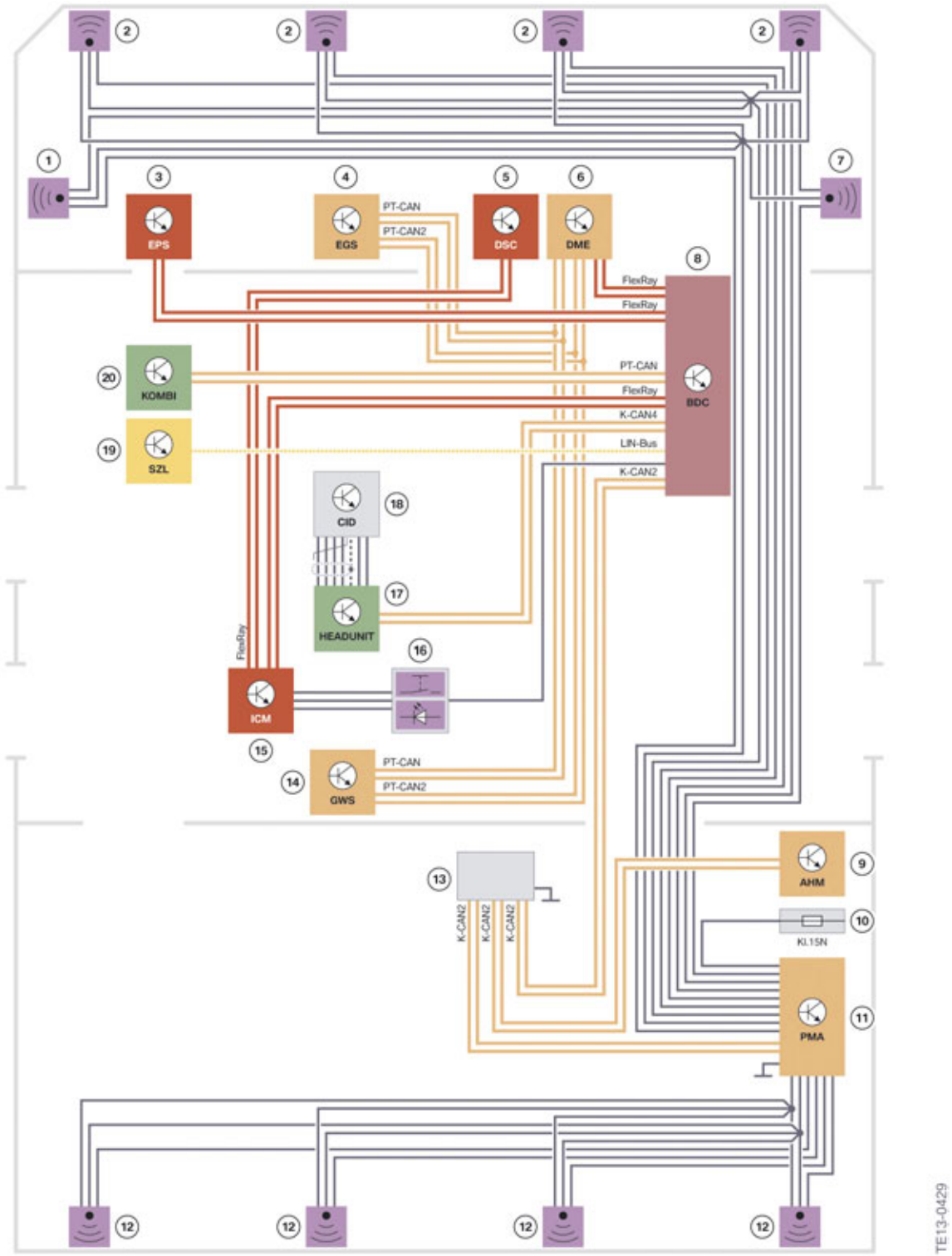
F15 System components of Parking Maneuver Assistant

Index	Explanation
1	Ultrasonic sensors for Park Distance Control
2	Dynamic Stability Control
3	Digital Motor Electronics or Digital Diesel Electronics
4	Central Information Display
5	Body Domain Controller
6	Headunit
7	Controller
8	Operating unit in the center console
9	Control unit for Parking Maneuver Assistant
10	Integrated Chassis Management
11	Steering column switch cluster
12	Instrument cluster
13	Electronic Power Steering
14	Ultrasonic sensor, Parking Maneuver Assistant, left

F15 Driver Assistance Systems

5. Parking Maneuver Assistant

5.2.2. System wiring diagram



F15 System wiring diagram for Parking Maneuvering Assistant

Index	Explanation
1	Ultrasonic sensor, Parking Maneuver Assistant in wheel arch, left
2	Ultrasonic sensors for Park Distance Control, front
3	Electronic Power Steering
4	Electronic transmission control
5	Dynamic Stability Control
6	DME/DDE
7	Ultrasonic sensor, Parking Maneuver Assistant in wheel arch, right
8	Body Domain Controller
9	Trailer module (Not US)
10	Power distribution box, luggage compartment
11	Parking Maneuver Assistant
12	Ultrasonic sensors for Park Distance Control, rear
13	CAN terminator
14	Gear selector switch
15	Integrated Chassis Management
16	Operating unit in the center console
17	Headunit
18	Central Information Display
19	Steering column switch cluster
20	Instrument cluster
Terminal 15N	Ignition (after-run)

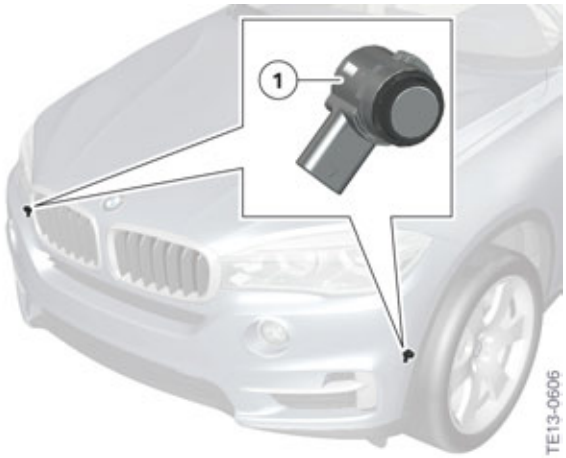
5.2.3. Sensors

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

The function of the two ultrasonic sensors is similar to those in the PDC. Ultrasonic pulses are sent and echo impulses are received. The signals are evaluated by the Parking Maneuver Assistant control unit. The length and width of the parking space is calculated from this with help of the route information from the DSC.

In the F15 the ultrasonic sensors of the Parking Maneuver Assistant are connected separately to the PMA control unit.

F15 Driver Assistance Systems
5. Parking Maneuver Assistant



F15 Installation location of ultrasonic sensor for Parking Maneuver Assistant

Index	Explanation
1	Ultrasonic sensor for Parking Maneuver Assistant

5.2.4. Control unit

The function of the Parking Maneuver Assistant is performed by the PMA control unit. The PMA control unit 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 parking space and monitors the parking procedure. In addition, it controls the electronic power steering via the ICM.

F15 Installation location of the Parking Maneuver Assistant

F15 Driver Assistance Systems

5. Parking Maneuver Assistant

5.3. Procedure

The Parking Maneuver Assistant can be activated using the PDC button in the center console or by engaging reverse gear with subsequent operation of the controller.

The Parking Maneuver Assistant is displayed to the driver in the central information display by a tick at the right under the Parking Maneuver Assistant symbol.

If the Parking Maneuver Assistant is activated using the PDC button, the driver is informed about the parking space search in the central information display. When a parking space is found it appears on the corresponding page in the CID.

A handling instruction asks the driver to stop the vehicle now.

The driver should confirm the parking space by pressing the turn indicator in the corresponding direction.

F15 Driver Assistance Systems

5. Parking Maneuver Assistant

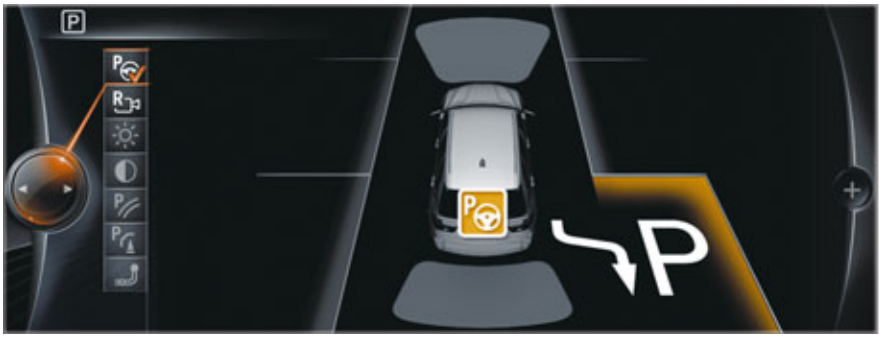
Then a warning must be confirmed using the controller. The driver is responsible at all times during the parking procedure.

The parking procedure is started by pressing the PDC button. For this the PDC button must be pressed and held down. Then the driver must release the brake.

The Parking Maneuver Assistant now performs the parking procedure.

F15 Driver Assistance Systems

5. Parking Maneuver Assistant



After the parking procedure is completed the driver is informed about the status by an acoustic signal and a message. The Parking Maneuver Assistant engages the P gear, this secures the vehicle against rolling away.

5.4. Information for Service

After the PMA control unit or an ultrasonic sensor is replaced, no start-up is required. During each start-up procedure the PMA control unit checks whether the software of the sensor is compatible with the control unit software. If the software is not compatible a corresponding fault code is set in the PMA control unit. In this case the service function "Update software for ultrasonic sensors" is performed using the BMW workshop system.

The PMA control unit monitors for faults and enters corresponding fault code entries if required. In exceptional cases, this is not always possible. For instance, the control unit is unable to identify when the ultrasonic sensors (incl. the sealing ring) are installed or connected incorrectly, or if there is damage in the area of the ultrasonic sensors. This may cause the following customer complaints without fault code entries:

- Small parking spaces 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 curb after the parking procedure.
- The vehicle is parked in the parking space at an angle.

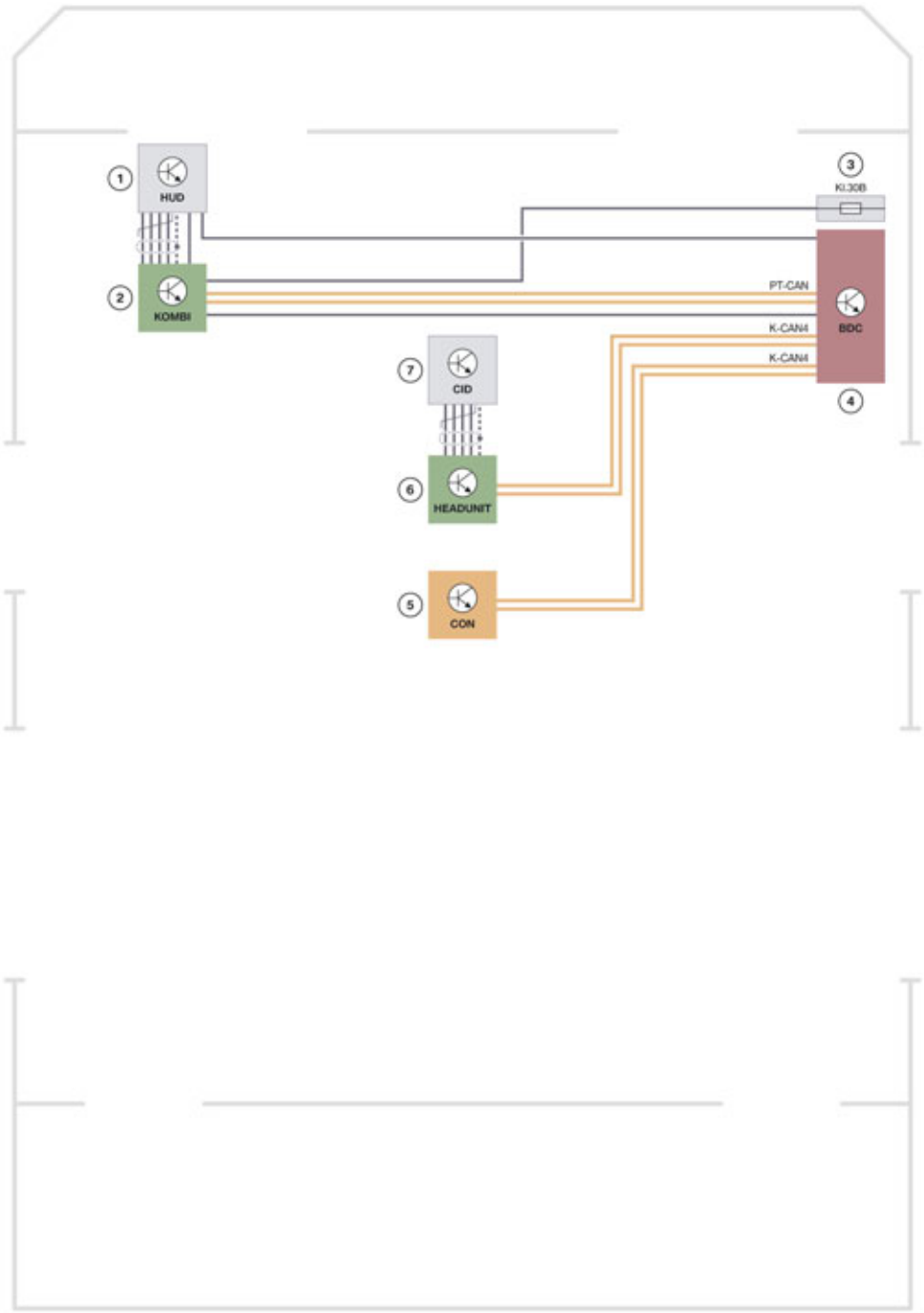
In this case the correct installation of the ultrasonic sensors must be checked and damage to the bumper panel in the area of the ultrasonic sensors ruled out.

F15 Driver Assistance Systems

6. BMW Head-Up Display

For the F15 a Head-Up Display (SA 610) is also available as optional equipment. Unlike in the current BMW models, in the F15 the Head-Up Display is not on the K-CAN, but is activated by the instrument cluster via an Automotive Pixel Link connection. The operating principle corresponds to the current BMW models.

6.1. System wiring diagram



F15 System wiring diagram for Head-Up Display

F15 Driver Assistance Systems

6. BMW Head-Up Display

Index	Explanation
1	Head-Up Display
2	Instrument cluster
3	Power distribution box, front
4	Body Domain Controller
5	Controller
6	Headunit
7	Central Information Display

F15 Driver Assistance Systems

7. BMW Night Vision

In optimal conditions BMW Night Vision identifies people and animals at night up to a distance of approx. 100 m / 328 ft.

F15 Night Vision camera

Index	Explanation
1	Night Vision camera

7.1. BMW Night Vision with person and animal recognition

The operation and warning function of the BMW Night Vision with person and animal recognition is new. Details on the new features can be found in the sections that follow.

F15 Driver Assistance Systems

7. BMW Night Vision

7.1.1. Operation

The person detection is automatically switched on each time the engine is started via the START-STOP button.

F15 Night Vision button

Index	Explanation
1	Night Vision button

By pressing the Night Vision button, beside the light switch operating unit, the image of the Night Vision camera is displayed in the central information display. Here the driver is able to adjust the brightness and the contrast.

F15 Night Vision display with identified people

The pedestrian warning is switched on and off via the Intelligent Safety button.

F15 Intelligent Safety button

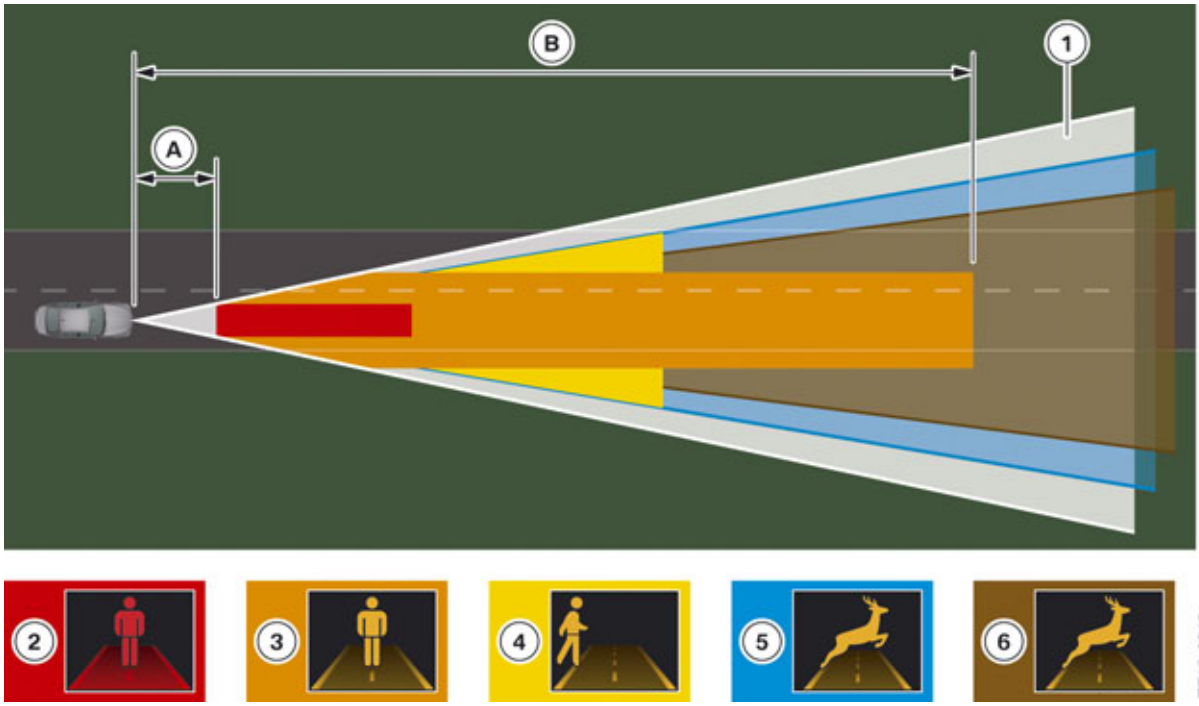
Index	Explanation
1	Intelligent Safety

7.1.2. Warning function

If BMW Night Vision identifies a person or an animal inside the warning range the system triggers a warning. The warning range is dependent on the driving speed and the steering angle. The warning threshold values are also dependent on whether the person or the animal is moving or standing still. This is highlighted in the following graphic.

F15 Driver Assistance Systems

7. BMW Night Vision



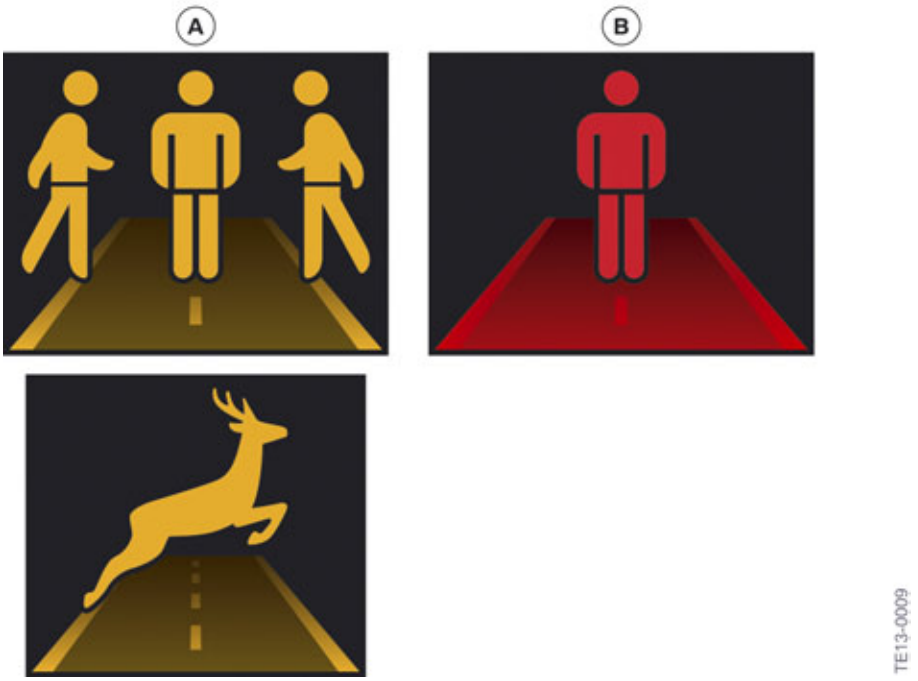
F15 Night Vision warning ranges

Index	Explanation
A	Minimum distance approx. 10 m
B	Maximum distance for warning of people approx. 100 m
1	Detection range of the Night Vision camera (opening angle approx. 24°)
2	Warning range, acute warning
3	Warning range, early warning (person on the roadway)
4	Warning range, early warning (person crosses the roadway)
5	Warning range, early warning (animal moving or crosses the roadway)
6	Warning range, early warning (animal is beside or on the roadway)

F15 Driver Assistance Systems

7. BMW Night Vision

The pedestrian or animal warning is displayed in the instrument cluster and in the Head-Up Display.



F15 Pedestrian or animal warning in the display of the instrument cluster and in the Head-Up Display

Index	Explanation
A	1st stage: Early warning, pedestrian or animal is on the roadway or crosses the roadway. The symbol shows on which side the pedestrian or animal is located.
B	2nd stage: Acute warning, flashing person in red and acoustic warning signal. The brake system is precharged and the brake assistant is adapted. There is no acute warning for animals

The early warning is triggered if a person or animal is detected inside the warning range. The early warning shows, depending on the location of the person or animal, a person or animal in yellow which is located inside the actual lane or is moving into the lane. Animals from a certain height can be detected, e.g. deer.

The acute warning is only triggered in the case of immediate danger of a collision. The time of the acute warning is measured so that a collision can only be avoided by immediate emergency braking or by swerving. With the acute warning the brakes of the vehicle are precharged and prepared for emergency braking.

The acute warning in the instrument cluster and in the Head-Up Display shows a flashing person in red on the roadway. An acoustic warning signal also sounds.

There is no acute warning for animals.

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

F15 Driver Assistance Systems

7. BMW Night Vision

The pedestrian or animal warning is triggered regardless of the representation of the Night Vision camera image in the central information display.

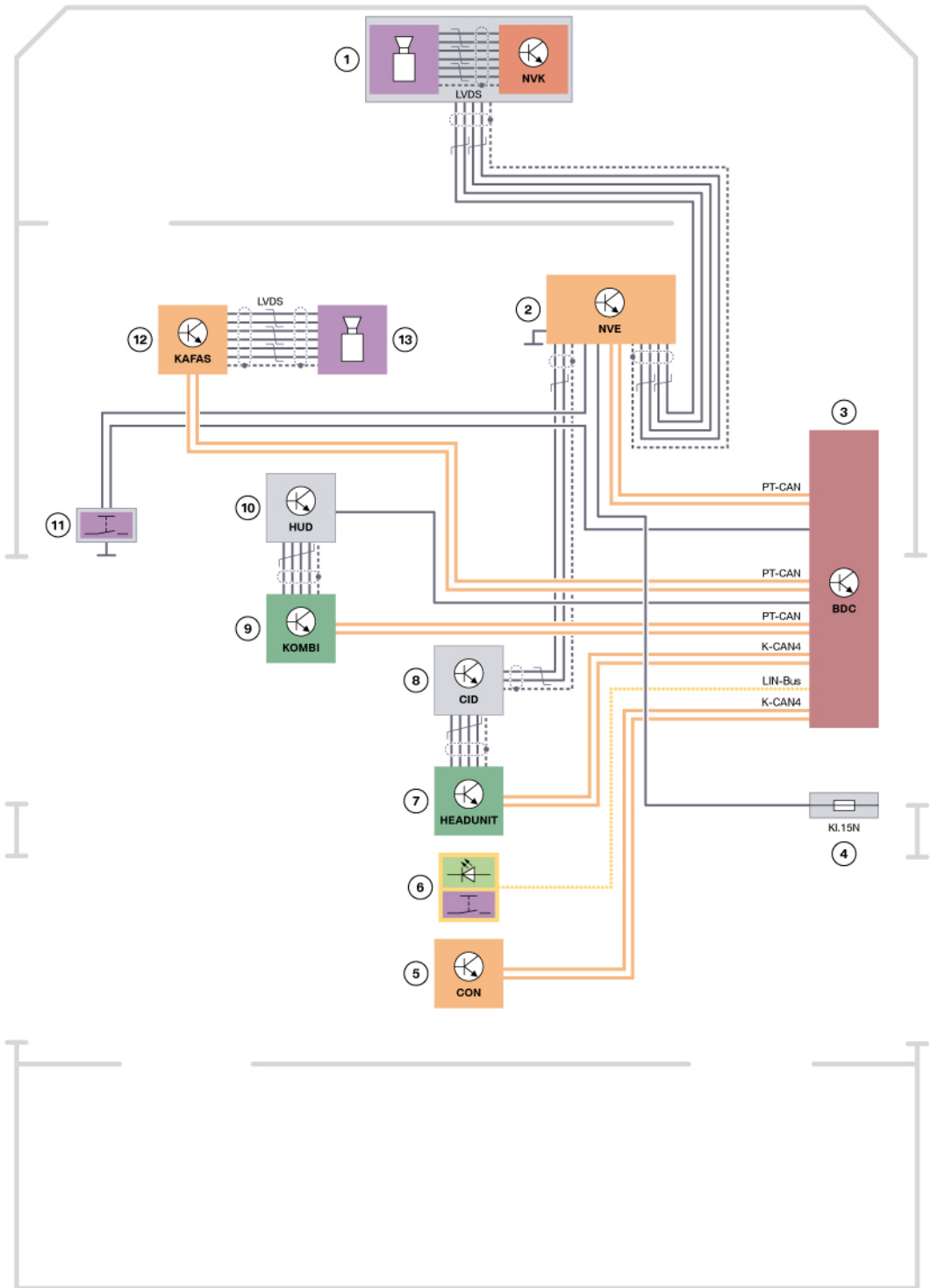
The warning is no longer shown in the CID, but instead appears exclusively in the instrument cluster or in the Head-Up Display. If the Night Vision camera image is active both identified pedestrians and animals are shown in yellow.

F15 Night Vision camera image for detected animals in the CID

F15 Driver Assistance Systems

7. BMW Night Vision

7.1.3. System wiring diagram



F15 System wiring diagram for Night Vision camera and headlight for targeted illumination with KAFAS control unit

F15 Driver Assistance Systems

7. BMW Night Vision

Index	Explanation
1	Night Vision camera with Night Vision camera control unit
2	Control unit for night vision electronics NVE
3	Body Domain Controller BDC
4	Power distribution box, front
5	Controller
6	Intelligent Safety button
7	Headunit
8	Central information display CID
9	Instrument cluster KOMBI
10	Head-Up Display HUD
11	Night Vision button
12	KAFAS control unit
13	KAFAS camera

In vehicles without the optional equipment Driving Assistant (SA 5AS) or Driving Assistant Plus (SA 5AT) the FLA camera and the FLA control unit are installed in the inside mirror instead of the KAFAS control unit and the KAFAS camera.

F15 Driver Assistance Systems

8. Lane Departure Warning

The lane departure warning is an element of the optional equipment Active Driving Assistant (SA 5AS) and the optional equipment ACC Stop & Go + Active Driving Assistant (SA 5AT). The lane departure warning warns the driver if a lane is left unintentionally by vibrating the steering wheel. A prerequisite for this is available roadway or lane markings, which can be detected by the KAFAS control unit using the KAFAS camera.

F15 Lane departure warning

The system does not replace the personal assessment of the road and the traffic situation.
The lane departure warning is only a support for the driver.

Observe the information in the section "Functional limitations".

Further information on the lane departure warning can be found in the Training Reference Manual "ST1212 F01–F02 LCI".

8.1. Functional limitations

The KAFAS camera function and thus also the function of the corresponding assist systems may be restricted in the following situations:

- Heavy fog, rain, rain spray or snow.
- Strong backlight.
- If the field of view of the KAFAS camera or the windscreen is dirty or covered.
- At sharp bends.
- Up to 10 seconds after the engine start via the START-STOP button.
- During the calibration process for the KAFAS camera immediately after vehicle delivery or a camera change.

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

F15 Driver Assistance Systems

9. Collision Warning

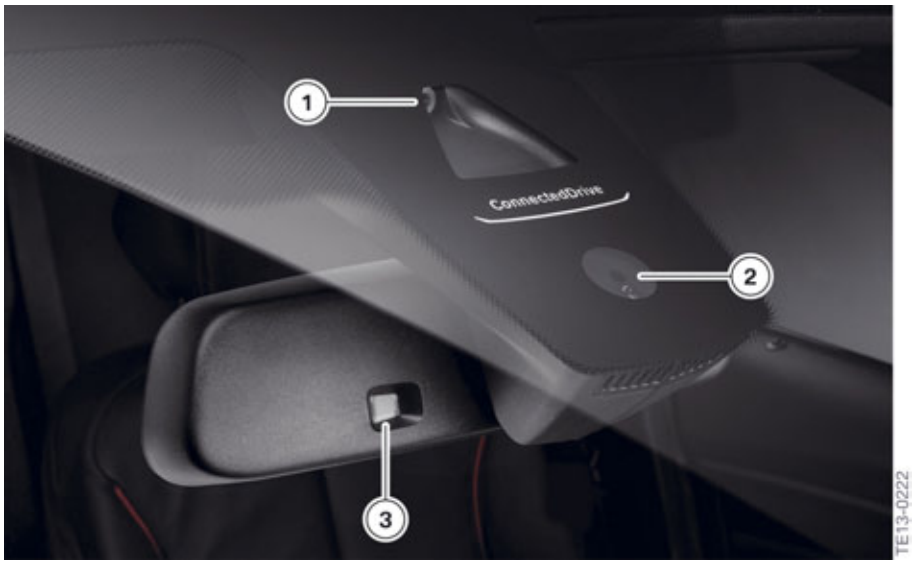
In the F15 there are two variants of collision warning available. The camera-based collision warning is an element of the optional equipment Active Driving Assistant (SA 5AS) and is done with help of the KAFAS camera. The collision warning with braking function is an element of the optional equipment ACC Stop & Go + Active Driving Assistant (SA 5AT) and is done with help of the radar sensor and the KAFAS camera.

9.1. Camera-based collision warning

The camera-based collision warning is an element of the optional equipment Driving Assistant (SA 5AS). The collision warning warns the driver of a possible risk of collision and is identified with help of the KAFAS system. The camera-based collision warning was extended in the F15 with the functions collision warning with city braking function and pedestrian warning with city braking function.

9.1.1. Functional principle

The KAFAS camera captures the scene in front of the vehicle and detects moving and stationary vehicles in the field of view using “machine vision” (The definition of Machine vision is: To receive information about the environment by using a video camera that is then processed by a computer to identify objects).

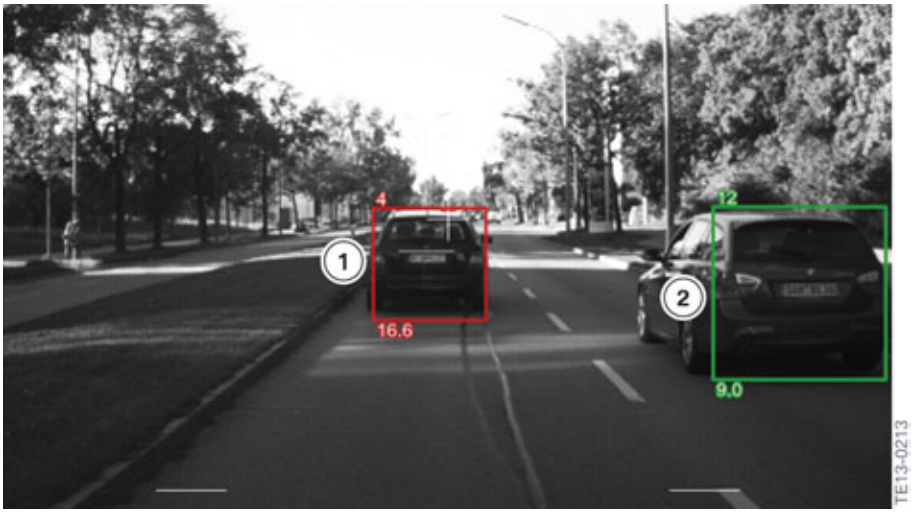


F15 KAFAS camera

Index	Explanation
1	KAFAS camera
2	Rain-light-solar-condensation sensor
3	Photosensor for brightness of front for the automatic-dim feature of the electrochromic inside mirror

F15 Driver Assistance Systems

9. Collision Warning



Example of vehicle identification by KAFAS camera

Index	Explanation
1	Vehicle in same lane
2	Vehicle in different lane

Based on the calculated positions, distances and relative speeds of other vehicles, the corresponding warning stages, early warning or acute warning, are output in critical situations. For the early warning the brakes of the vehicle are precharged for emergency braking and the activation thresholds of the Dynamic Brake Control are reduced.

The system sensitivity is reduced for intentional tailgating of a vehicle in order to avoid false and therefore annoying warnings.

Collision warning with city braking function

The collision warning with city braking function extends the camera-based collision warning with a braking function from a speed of approx. 5 km/h / 3 mph up to a maximum speed of 60 km/h / 37 mph. If there is still no response from the driver in this speed range after an acute warning, the vehicle is decelerated at an acceleration of maximum 4 m/s².

The brake intervention is restricted to approx. 1.5 seconds. Additional dangers for the traffic behind are therefore avoided.

At speeds over 60 km/h / 37 mph there is a warning without brake intervention as before.

Pedestrian warning with city braking function

The pedestrian warning with city braking function is designed to prevent possible collisions with pedestrians in urban areas or reduce the effects of an accident. The system identifies a potential collision with a pedestrian in sufficient daylight, warns the driver early and introduces automatic hazard braking in the event of a collision which cannot be avoided by the driver, in order to take as much kinetic energy as possible from the vehicle.

The system warns of a possible collision with pedestrians from a speed of approx. 10 km/h / 6 mph up to a maximum speed of 60 km/h / 37 mph.

F15 Driver Assistance Systems

9. Collision Warning

The KAFAS camera captures the scene in front of the vehicle and detects pedestrians in the field of view using machine vision. Based on the calculated positions, distances and the movement of the detected pedestrians, an acute warning is issued in critical situations. An early warning is not issued for the pedestrian warning with city braking function. If there is still no response from the driver after an acute warning, the vehicle is decelerated at an acceleration of maximum 4 m/s².

At night the pedestrian warning with city braking function in vehicles with BMW Night Vision is automatically switched off and replaced with the pedestrian warning of BMW Night Vision. Therefore, at night in vehicles with BMW Night Vision only a warning function for pedestrians is available, there is no braking function. The driver is not alerted to the change of the systems.

In vehicles without BMW Night Vision the pedestrian warning with city braking function also remains activated at night. The identification of pedestrians using the KAFAS camera is, however, strongly restricted at night due to light conditions.

9.1.2. Operation

The collision warning and pedestrian warning are switched on and off via the Intelligent Safety button.

F15 Intelligent Safety button

Index	Explanation
1	Intelligent Safety button

From the information pages on Intelligent Safety you are also directed to the menus for setting the warning time for the collision warning.

The driver can set the time for the warning in three stages when the collision warning is active. The setting of the time for the early warning is stored for the current driver profile. The warning time for the pedestrian warning cannot be adjusted.

F15 Driver Assistance Systems

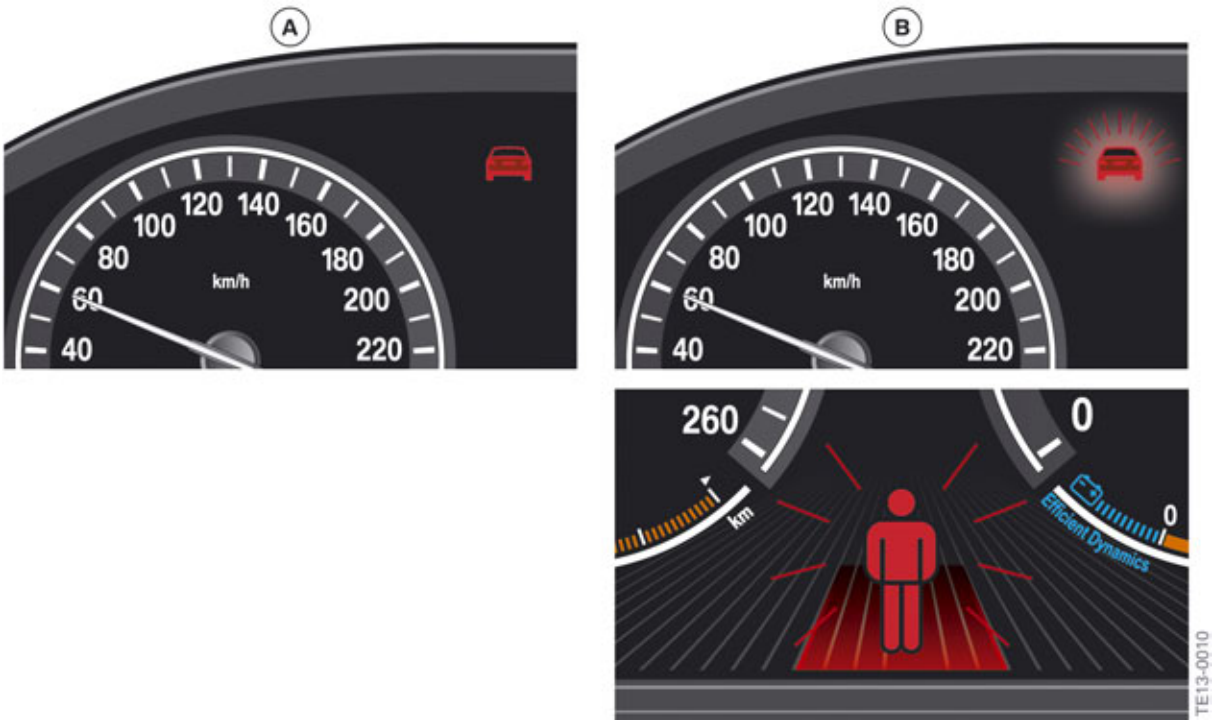
9. Collision Warning

9.1.3. Warning and braking function

The function is a camera-based assist system and is able to avoid accidents with pedestrians or vehicles or reduce the effects of an accident in the event of a collision. The operating principle is based on a detection and warning algorithm. Machine vision detects pedestrians and vehicles in the detection range of the camera. Based on the current movement of the detected objects their probable next movement is determined, and considering the movement of the vehicle, a risk of collision is determined. If a situation is evaluated as critical by the warning algorithm, a warning is issued and braking is introduced based on a multistage warning concept. The warnings and brake interventions differ for pedestrians and vehicles.

Displays

The warning function is displayed in the instrument cluster or in the Head-Up Display.



F15 Collision warning in the instrument cluster

Index	Explanation
A	1st stage: Early warning, vehicle in red
B	2nd stage: Acute warning, flashing vehicle or person in red and acoustic warning signal

F15 Driver Assistance Systems

9. Collision Warning

F15 Collision warning in the Head-Up Display

Index	Explanation
A	1st stage: Early warning, vehicle in red
B	2nd stage: Acute warning, flashing vehicle or person in red and acoustic warning signal

Early warning

The early warning is only issued for vehicles and not for pedestrians. The early warning is triggered, in the event of a looming risk of collision due to a high differential speed to the vehicle ahead or at a very low distance to the vehicle ahead.

The early warning is indicated by a red vehicle in the instrument cluster or in the Head-Up Display.

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

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

Acute warning

The acute warning is issued for vehicles and pedestrians. The acute warning indicates a potential dangerous situation to the driver visually and acoustically. The acute warning is triggered by the system as late as possible and only in the event of a direct risk of collision, if the vehicle is approached at a relatively higher differential speed to the vehicle ahead or if a pedestrian is in direct risk of collision. The time of the acute warning is measured so that a collision can only be avoided by immediate emergency braking or by swerving. The acute warning can therefore not be introduced or controlled intentionally.

If the vehicle is approaching the vehicle ahead very slowly, no acute warning is triggered.

9. Collision Warning

This intentional driving situation only triggers the early warning. This way there are fewer meaningless and annoying acute warnings issued by the system.

The acute warning for vehicles cannot be deactivated individually. The time for the acute warning also cannot be adjusted. If the acute warning is not triggered, the front protection function collision warning must be deactivated.

In the event of an acute warning the driver is shown a flashing red vehicle or flashing red pedestrian in the instrument cluster. An acoustic warning signal also sounds.

The acute warning is only triggered for pedestrians at speeds between 10 km/h / 6 mph and 60 km/h / 37 mph. For vehicles, the acute warning is triggered at speeds above 5 km/h / 3 mph.

At the same time as the acute warning, the brake system is preconditioned, in order to build up quicker and stronger deceleration. With these measures the driver also receives specific support at the same time as the warning in order to be able to respond effectively.

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

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

The collision warning must be switched off for towing in order to avoid malfunctions.

Brake intervention

If the driver no longer has the option to avoid the accident with his own response, automatic brake intervention is performed as a last step. The brake intervention is set at a brake force of approx. 4 m/s² and has the ability of avoiding a collision up to a differential speed of approx. 18 km/h / 11 mph. At higher differential speeds the impact speed is reduced by a smaller amount. The driver also has the option at any time to oversteer the automatic hazard braking with a steering wheel movement or by accelerating and thus cancelling it.

The brake intervention of the collision warning can be overridden by the following actions:

- Heavy acceleration of the vehicle by the driver.
- Introduction of an avoidance manoeuvre by the driver.
- Sharp brake intervention by the driver.

Brake intervention is only active with the Dynamic Stability Control switched on.

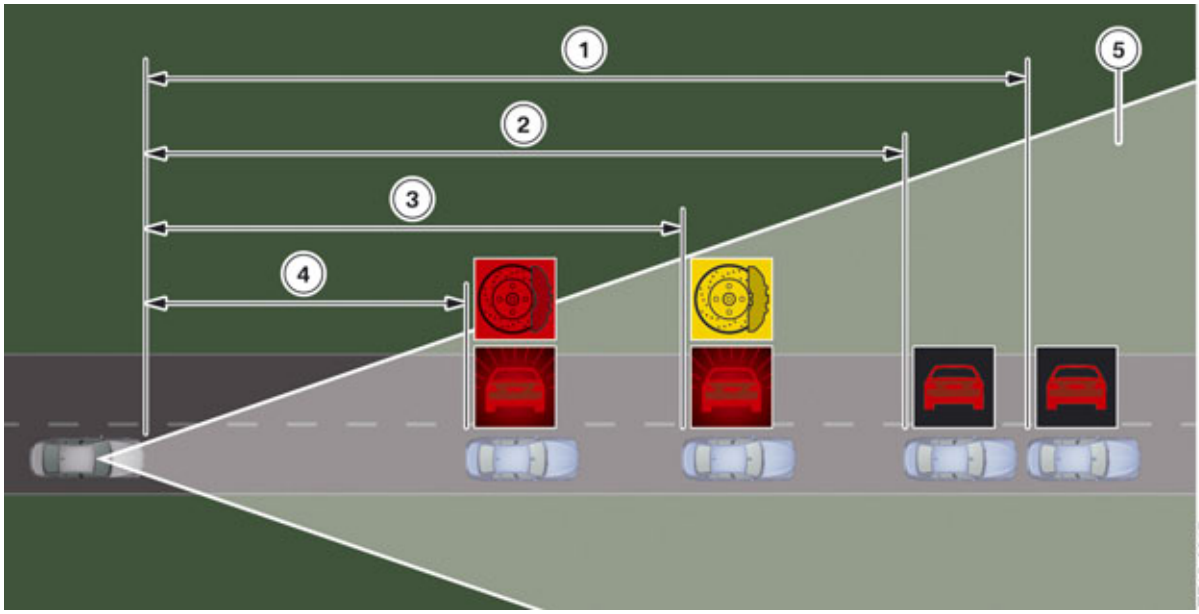
Brake intervention is triggered for pedestrians in the speed range between 10 km/h / 6 mph and 60 km/h / 37 mph and for vehicles in the speed range between 5 km/h / 3 mph and 60 km/h / 37 mph.

F15 Driver Assistance Systems

9. Collision Warning

9.1.4. Timeplan for collision warning with city braking function

The timeplan of the warnings and braking is demonstrated in the following graphic. If an avoidance measure by the driver is detected, there is no brake intervention.



Timeplan for the camera-based collision warning

Index	Explanation
1	Collision warning (early)
2	Collision warning (late)
3	Acute warning (acoustic warning signal, brake system is precharged and brake assistants are adapted)
4	Braking at 4 m/s² is introduced (city braking function only in the range between 5 km/h /3 mph and 60 km/h / 37 mph)
5	Detection range of KAFAS camera

9.1.5. Restricting the system

⚠

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

Detection range

The detection capability of the collision warning is limited.

As a result, incorrect or delayed warnings may occur.

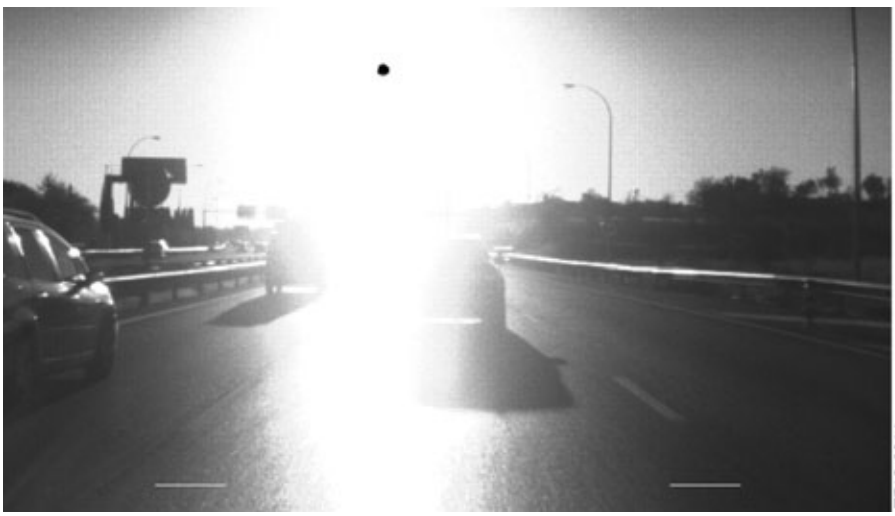
It is possible the following vehicles are not detected:

- A slow vehicle when driving off at high speed
- Sudden swerving or heavy decelerating vehicles
- Vehicles with an unusual rear view or with insufficiently visible rear lights
- Partially covered vehicles
- Bicycles ahead.

9.1.6. Functional limitations

The KAFAS camera function and thus also the function of the corresponding assist systems may be restricted in the following situations:

- Heavy fog, rain, rain spray or snow
- Strong backlight
- If the field of view of the KAFAS camera or the windscreen is dirty or covered
- At sharp bends
- Up to 10 seconds after the engine start via the START-STOP button
- During the calibration process for the KAFAS camera immediately after vehicle delivery or a camera change.



Example of functional limitation by backlight

F15 Driver Assistance Systems

9. Collision Warning

The pedestrian warning with city braking function is only available to the driver under the following conditions:

- Speed between 10 km/h / 6 mph and 60 km/h / 37 mph
- Sufficient brightness
- For people taller than 80 cm and standing upright

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

9.1.7. Check Control messages

If the system fails, corresponding Check Control messages are issued.

Check Control message	Symbol	Additional note	Cause
Pedestrian warning failed		Pedestrian warning failed. Have vehicle checked by your BMW Service authorised workshop.	KAFAS camera or control unit faulty or failed
Pedestrian warning restricted		Pedestrian warning restricted during the day. There is no brake intervention for an acute pedestrian warning. Warnings are still effected visually and acoustically. Have vehicle checked by your BMW Service authorised workshop.	Braking function has failed. Full scope of function is not available.
Pedestrian warning. Check field of view		Pedestrian warning during the day. Check field of view of the front camera. Restricted functionality of the pedestrian warning. See Owner's Handbook.	Field of view of the camera restricted, e.g. by dirt contamination, backlight or weather conditions

F15 Driver Assistance Systems

9. Collision Warning

Check Control message	Symbol	Additional note	Cause
Collision warning deactivated!		Collision warning. You have deactivated the collision warning. No warning is issued for tailgating.	Collision warning was deactivated by the driver.
Collision warning failed		Collision warning failed. No warning is issued for tailgating. Have vehicle checked by your BMW Service authorised workshop.	KAFAS camera or control unit faulty or failed.
Collision warning deactivated		Collision warning deactivated. No warning is issued for tailgating. Person recognition restricted. Check field of view of sensor and clean sensor if req., see operating instructions.	Field of view of the camera restricted, e.g. by dirt contamination, backlight or weather conditions.

9.2. Collision warning with braking function

The collision warning with braking function is an addition to the Active Cruise Control with Stop & Go function (ACC) and uses its sensor system and system components. It is an element of the optional equipment ACC Stop & Go + Active Driving Assistant (SA 5AT).

The collision warning with braking function warns the driver of a possible risk of a collision and supports the driver in an emergency through automatic brake intervention. The operation and warning function are set in the same way as the camera-based collision warning.

In the F15 the generation of the collision warning with braking function introduced with the F01/F02 LCI is used, permitting higher braking deceleration as a result of the fusion of radar and image data.

Similar to the camera-based collision warning, in the F15 the collision warning with braking function is extended with the function pedestrian warning with city braking function. Also for the collision warning with braking function, the detection of pedestrians is only performed using the image data of the KAFAS camera.

The braking function of collision warning with city braking function is included in the collision warning with braking function. The maximum deceleration of the braking function is greater than that of the camera-based collision warning and is available in a larger speed range.

F15 Driver Assistance Systems
9. Collision Warning

9.2.1. Functional principle

The system warns of a possible collision from a speed of approx. 5 km/h / 3 mph with an early warning first and then in the event of continuous danger with an acute warning.

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

Stationary and moving vehicles are taken into consideration.

In addition to the warnings, the brakes of the vehicle are prepared for emergency braking and the activation thresholds of the brake assistants are reduced. There is automatic brake intervention by the system in the event of an emergency.

The system sensitivity is reduced for intentional tailgating of a vehicle in order to avoid unfounded and therefore annoying warnings.

Pedestrian warning with city braking function

The pedestrian warning with city braking function is designed to prevent possible collisions with pedestrians in urban areas or reduce the effects of an accident. The system identifies a threatening collision with a pedestrian in sufficient daylight, warns the driver early and introduces automatic hazard braking in the event of a collision which cannot be avoided by the driver, in order to take as much kinetic energy as possible from the vehicle.

The system warns of a possible collision with pedestrians from a speed of approx. 10 km/h / 6 mph up to a maximum speed of 60 km/h / 37 mph.

The KAFAS camera captures the scene in front of the vehicle and detects pedestrians in the field of view using machine vision. Based on the calculated positions, distances and the movement of the detected pedestrians, an acute warning is issued in critical situations. An early warning is not available for the pedestrian warning with city braking function. If there is still no response from the driver after an acute warning, the vehicle is decelerated at an acceleration of maximum 4 m/s^2.

At night the pedestrian warning with city braking function in vehicles with BMW Night Vision is automatically switched off and replaced with the pedestrian warning of BMW Night Vision. Therefore, at night in vehicles with BMW Night Vision only a warning function for pedestrians is available, there is no braking function. The driver is not alerted to the change of the systems.

In vehicles without BMW Night Vision the pedestrian warning with city braking function also remains activated at night. The identification of pedestrians using the KAFAS camera is, however, strongly restricted at night due to light conditions.

F15 Driver Assistance Systems

9. Collision Warning

9.2.2. Operation

The collision warning and pedestrian warning are switched on and off via the Intelligent Safety button.

F15 Intelligent Safety button

Index	Explanation
1	Intelligent Safety button

From the information pages on Intelligent Safety you are also directed to the menus for setting the warning time for the collision warning with braking function.

The driver can set the time for the warning in three stages when the collision warning is active. The setting of the time for the early warning is stored for the current driver profile.

9.2.3. Warning and braking function

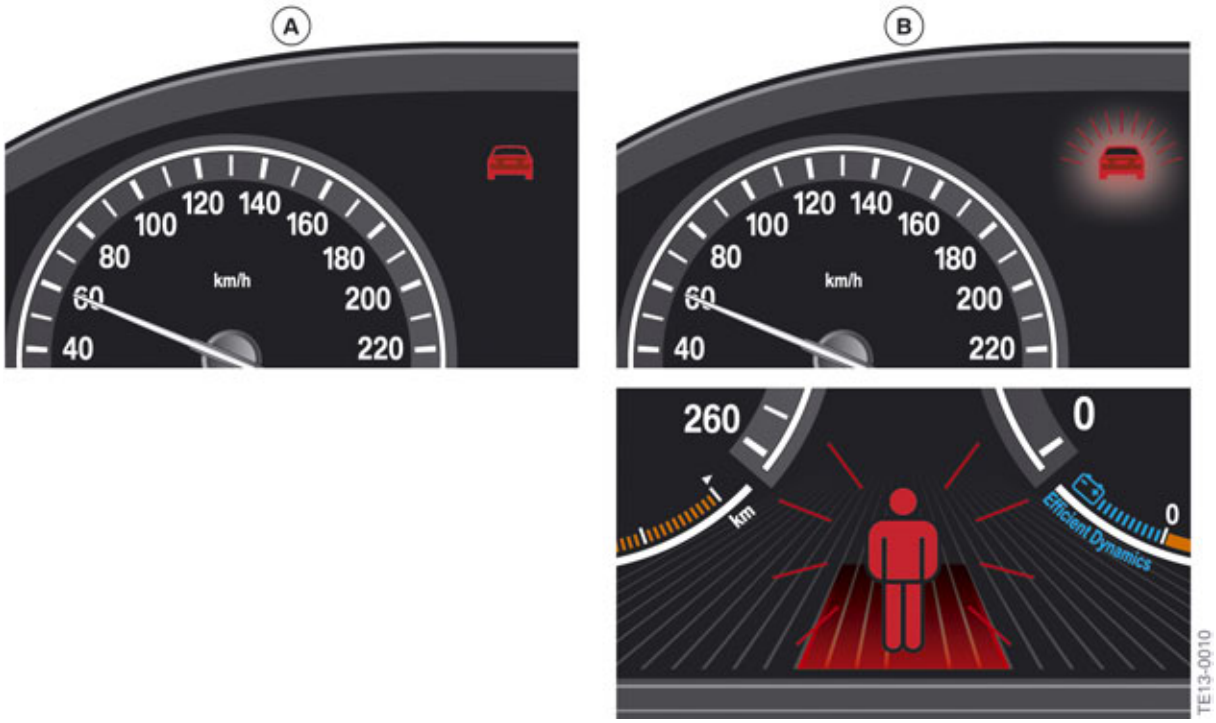
The function is a camera and radar-based assist system and is able to avoid accidents with pedestrians or vehicles or reduce the effects of an accident in the event of a collision. The operating principle is based on a detection and warning algorithm. Machine vision detects pedestrians and vehicles in the detection range of the camera. Vehicles can also be detected using the radar sensor. A risk of a collision is determined via a motion prediction, taking into consideration the vehicle's motion. If a situation is evaluated as critical by the warning algorithm, a warning is issued and braking is introduced based on a multistage warning concept. The warnings and brake interventions differ for pedestrians and vehicles.

F15 Driver Assistance Systems

9. Collision Warning

Displays

The warning function is displayed in the instrument cluster or in the Head-Up Display.



F15 Collision warning in the instrument cluster

Index	Explanation
A	1st stage: Early warning, vehicle in red
B	2nd stage: Acute warning, flashing vehicle or person in red and acoustic warning signal

F15 Collision warning in the Head-Up Display

F15 Driver Assistance Systems

9. Collision Warning

Index	Explanation
A	1st stage: Early warning, vehicle in red
B	2nd stage: Acute warning, flashing vehicle or person in red and acoustic warning signal

Early warning

The early warning is only issued for vehicles and not for pedestrians. The early warning is triggered, in the event of a looming risk of collision due to a high differential speed to the vehicle ahead or at a very low distance to the vehicle ahead or a stationary vehicle.

The early warning is indicated by a red vehicle in the instrument cluster or in the Head-Up Display.

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

Acute warning

The acute warning is issued for vehicles and pedestrians. The acute warning indicates a potentially dangerous situation to the driver visually and acoustically. The acute warning is triggered by the system as late as possible and only in the event of a direct risk of collision, if the vehicle is approached at a relatively higher differential speed to the vehicle ahead or if a pedestrian is in direct risk of collision. The time of the acute warning is measured so that a collision can only be avoided by immediate emergency braking or by swerving. The acute warning can therefore not be introduced or controlled intentionally.

If the vehicle is approaching another vehicle or person ahead very slowly, no acute warning is also issued at very little distance. This intentional driving situation only triggers the early warning. This way there are fewer meaningless and annoying acute warnings issued by the system.

The acute warning cannot be deactivated. The time for the acute warning also cannot be adjusted. If the acute warning is not triggered, the front protection function collision warning must be deactivated.

In the event of an acute warning the driver is shown a flashing red vehicle or flashing red pedestrian in the instrument cluster. An acoustic warning signal also sounds.

The acute warning is only triggered for pedestrians at speeds between 10 km/h / 6 mph and 60 km/h / 37 mph. For vehicles the acute warning is triggered at speeds above 5 km/h / 3 mph.

At the same time as the warning the brake system is preconditioned, in order to build up quicker and stronger deceleration. With these measures the driver also receives specific support at the same time as the warning in order to be able to respond effectively.

The acute warning does not relieve the driver of his responsibility to adapt the speed and driving style to the traffic conditions and adhere to the prescribed safety distance.

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

F15 Driver Assistance Systems

9. Collision Warning

Brake intervention

If the driver no longer has the option to avoid the accident with his own response, automatic brake intervention is performed as a last step. The brake intervention is limited to approx. 3 seconds and must end when the vehicle was decelerated by approx. 50 km/h / 31 mph. Additional dangers for the traffic behind are therefore avoided.

In the lower speed range up to approx. 50 km/h / 31 mph the brake intervention is set for vehicles initially at a brake force of approx. 5 m/s². If the target object is verified by the camera data, the brake intervention is triggered after roughly 0.5 seconds with maximum 8 m/s². The vehicle can therefore be braked to a standstill in the lower speed range.

At a driving speed greater than 50 km/h / 31 mph the brake intervention is set for vehicles initially at a brake force of approx. 4 m/s². If the target object is verified by the camera data, the brake intervention is triggered after roughly 0.5 seconds with maximum 6 m/s².

At a driving speed greater than 210 km/h / 130 mph the speed reduction is limited to 10 km/h / 6 mph.

In the speed range between 10 km/h / 6 mph and 60 km/h / 37 mph the brake intervention is triggered for pedestrians at a brake force of approx. 4 m/s².

The brake intervention is also triggered when the driver does not step on the brake enough.

The brake intervention is only active when the Dynamic Stability Control is on.

The brake intervention of the collision warning can be oversteered by the following actions:

- Heavy acceleration of the vehicle by the driver
- Introduction of an avoidance manoeuvre by the driver
- Sharp brake intervention by the driver

The collision warning with braking function must be switched off for towing in order to avoid malfunctions.

The braking function is deactivated when the Dynamic Stability Control or Dynamic Traction Control is deactivated.

If the KAFAS camera fails, the brake intervention for vehicles is still only set at a brake force of maximum 4 m/s² and exclusively for detected moving or stationary vehicles. There is no braking for vehicles which are already stationary upon entry into the detection range of the radar sensor. If the radar sensor fails, the collision warning with braking function is switched off. In both cases the driver is informed about the malfunction by means of a display in the instrument cluster and a Check Control message.

F15 Driver Assistance Systems

9. Collision Warning

9.2.4. History

The collision warning with braking function, formerly the adaptive brake assistant, was introduced for the first time in 2007 with the E60 LCI. The following table shows the different development stages, their features and their series introduction in BMW models.

Features	Adaptive brake assistant	Adaptive brake assistant with warning function	Collision warning with braking function.	Collision warning with braking function. Latest generation
Series introduction	03/2007 E60 LCI	08/2009 F01	01/2010 F10	07/2012 F01/F02 LCI
Prefilling of brake system	X	X	X	X
Adaptation of the brake assistants	X	X	X	X
Early and acute warning				
Moving/stationary targets		X	X	X
Stationary targets			X	X
Initial braking				
Moving/stationary targets			X	X
Stationary targets				X
At max. 3 m/s²			X	
At v ≤ 50 km/h, 31 mph At max. 8 m/s², Two-stage Until in stationary mode				X
At v ≤ 50 km/h, 31 mph At max. 6 m/s², Two-stage				X

F15 Driver Assistance Systems

9. Collision Warning

9.3. Comparison of the collision warnings

Due to the radar and image data and the resulting improved person recognition the collision warning with braking function makes possible higher braking decelerations. The following two tables provide an overview of the differences between the two systems:

9.3.1. Collision warning (vehicles)

	Camera-based collision warning	**Collision warning with braking function**
Sensors	KAFAS camera	Radar sensor and KAFAS camera
Speed range for braking function	5-60 km/h, 3–37 mph	from 5 km/h, 3mph
Maximum braking deceleration	4 m/s²	8 m/s²

9.3.2. Pedestrian warning

	Camera-based collision warning	**Collision warning with braking function**
Sensors	KAFAS camera	KAFAS camera
Speed range for braking function	10-60 km/h, 6–37 mph	10-60 km/h, 6–37 mph
Maximum braking deceleration	4 m/s²	4 m/s²

F15 Driver Assistance Systems

10. ACC Stop & Go

The Active cruise control with Stop & Go function (ACC Stop & Go) is an element of the optional equipment ACC Stop & Go + Active Driving Assistant (SA 5AT) and its functionality has improved.

The ACC Stop & Go in the F15 identifies not only slow-stopping, but also stationary vehicles and can react to these. The identification of stationary vehicles is to date unique. The application range is also extended to country roads and beltways.

The response to transverse motion was also improved. As a result, the system is able to respond quicker to vehicles pulling in and out and turning.

These improvements are achieved through the connection of the KAFAS video camera installed in the vehicle to the system. In addition to radar data, the ACC Stop & Go also evaluates the image data of the video camera. This fusion of image and radar data makes possible the clear identification of lane markings and the distinction between stationary vehicles and other fixed objects.

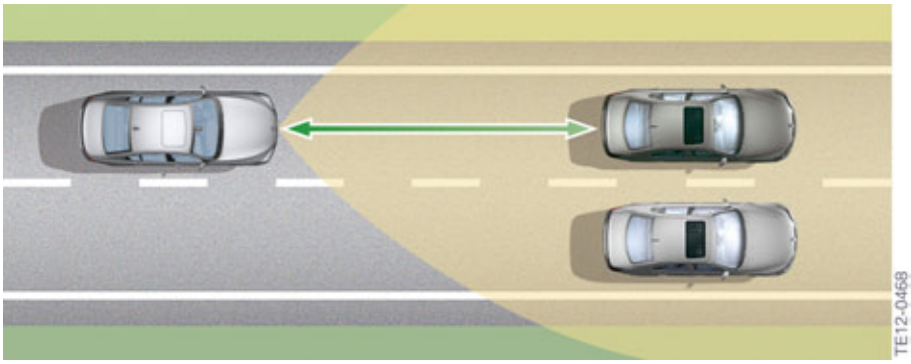
In addition, the adjustment range for the set speed has been increased from 180 km/h / 111 mph to 210 km/h / 130 mph.

The acceleration behavior of ACC Stop & Go is adapted for ECO PRO mode. ACC Stop & Go accelerates the vehicle smoother in ECO PRO mode with optimized consumption at the same time. The ECO PRO notes with regard to the pedal sensor position are suppressed when the ACC Stop & Go is activated.

10.1. Introduction

ACC Stop & Go offers the driver optimal support not only in flowing traffic, but also in traffic jam situations.

The application range of ACC Stop & Go ranges from high speeds to standstill.
The distance and the speed are automatically adjusted in this range.



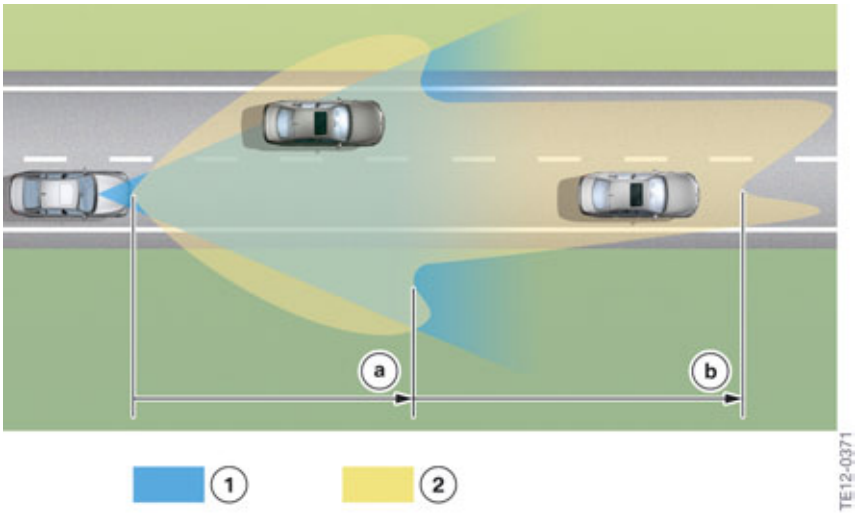
F15 Active cruise control

ACC Stop & Go controls the speed if there is no vehicle driving directly ahead and automatically switches to distance control if the radar sensor detects a slower vehicle in its lane.

A 77 GHz radar sensor of the system can identify vehicles ahead up to a distance of 200 m, to a large extent irrespective of weather conditions. Thanks to the improved detection capability of the radar sensor and the adjustment using image data of the KAFAS video camera, vehicles in neighboring lanes are also detected. If these vehicles are driving in their own lane, then ACC Stop & Go adapts the speed to the vehicle pulling in or vehicle ahead. As a result, a time lag selected by the driver is constantly maintained.

F15 Driver Assistance Systems

10. ACC Stop & Go



F15 Schematic diagram for the monitoring ranges

Index	Explanation
a	Close range
b	Long distance
1	Detection range of the KAFAS video camera
2	Detection range of the radar sensor

The field of view of the radar sensor is roughly 60 m wider in close range as comparison to long distance. As a result, a wider lane coverage is attained. Inside this range the radar data or detected objects are verified using the image data of the KAFAS video camera.

The KAFAS control unit can better detect transverse motion, assign lanes and clearly identify vehicles. As a result, close-range vehicles pulling in and out can be detected sooner and quicker. The fusion of the radar and video data also makes possible the clear identification of stationary vehicles.

The system's Stop & Go function brings the vehicle to a complete standstill if necessary. If the vehicle ahead drives off again after a standstill, the driver is informed thereof with a note. To drive off again the driver must confirm this note. Only if the duration of the standstill is very short, is the starting process effected fully automatically by ACC Stop & Go.

ACC Stop & Go thus supports the driver not only in flowing traffic, but also in traffic jam situations, both on multilane motorways and national roads, as well as on urban approach and ring roads.

More details are provided here on the following areas of the assist system ACC Stop & Go:

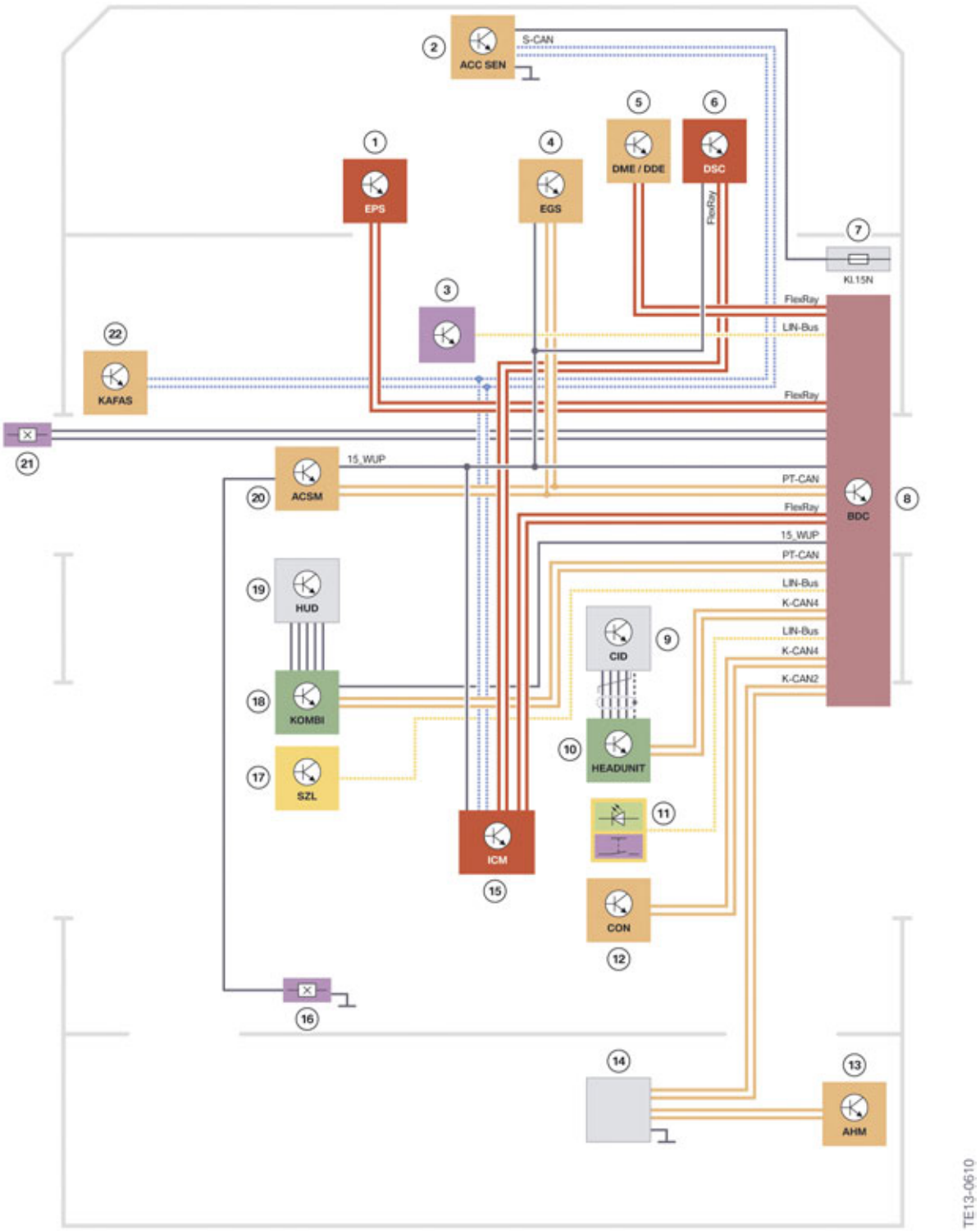
- System components
- Information from the surrounding area of the vehicle
- Control functions
- Operation and display
- Behavior when the driver intends to exit
- Monitoring functions

F15 Driver Assistance Systems

10. ACC Stop & Go

10.2. System components

10.2.1. System wiring diagram



F15 System wiring diagram for ACC Stop & Go

F15 Driver Assistance Systems
10. ACC Stop & Go

Index	Explanation
1	Electronic Power Steering
2	Radar sensor for ACC Stop & Go
3	Rain-light-solar-condensation sensor
4	Electronic Transmission Control
5	Digital Motor Electronics or Digital Diesel Electronics
6	Dynamic Stability Control
7	Power distribution box, front
8	Body Domain Controller
9	Central Information Display
10	Headunit
11	Intelligent Safety button
12	Controller CON
13	Trailer module (Not US)
14	CAN terminator
15	Integrated Chassis Management
16	Seat belt buckle contact, driver
17	Steering column switch cluster
18	Instrument cluster
19	Head-Up Display
20	Advanced Crash Safety Module
21	Door contact driver's door
22	Camera-based driver support systems

10.2.2. Radar sensor

The radar sensor emits bundled electromagnetic waves. The echoes reflected by objects are received and evaluated by the radar sensor. Information about objects located in front of the radar sensor can be obtained. This information includes size, distance and the deduced speed.

Similar to the F01/F02 LCI, the radar sensor receives additional information from the KAFAS control unit via a separate Local-CAN. This information includes driving lane information, information on transverse motion and for the identification of other vehicles. The information supports the radar sensor during the object detection and evaluation and makes possible clear identification of objects as vehicles. This video data is imperative for the response to stationary vehicles.

F15 Radar sensor for ACC Stop & Go

The radar sensor is located behind a removable grid of the front apron.

10.2.3. KAFAS video camera and control unit

The KAFAS control unit detects vehicles clearly when their rear is identified by the video camera. The KAFAS control unit supplies additional driving lane information and helps the radar sensor to determine the vehicle position and motion quicker. The data is sent to the radar sensor via the sensor data bus.

10.2.4. Integrated Chassis Management ICM control unit

For a detailed description of the Integrated Chassis Management (ICM), please refer to the product information bulletin "F01 Driving Stability Control". A brief overview is provided here and details given on the special features which connect the topics presented here.

The ICM in the F15 calculates the control functions, sensor data and vehicle values used to influence longitudinal and transverse dynamics. Also integrated in ICM are micro mechanical sensors which supply driving dynamics signals.

Two different versions of the ICM are used in the F15. A basic version for vehicles without ACC Stop & Go and a High version for vehicles with ACC Stop & Go.

F15 Driver Assistance Systems

11. Speed Limit Information

The optional equipment Speed limit information (SA 8TH) is available in the F15. Current speed limitations are displayed in the instrument cluster or in the optional Head-Up Display. The speed limit information helps the driver not to exceed the permissible maximum speed.

Speed limit info display in cluster

Speed limit info in Heads up display (F30 shown)

The responsibility for the vehicle and the speed driven lies solely with the driver.

The control unit for the speed limit information function is the KAFAS control unit.

The display of the top speed limitation is based on the evaluation of data from the navigation system and the evaluation of image data used from the KAFAS camera.

The permissible maximum speed on the current road is displayed in the instrument cluster or in the Head-Up Display.

The KAFAS camera monitors the traffic signs at the side of the road and takes into consideration information from the navigation system. For instance, the valid maximum speed in built-up areas is displayed, also without noticeable control by traffic signs.

Further information on the road sign recognition system can be found in the Training Reference Manual ST1309 5 Series LCI.

F15 Driver Assistance Systems

11. Speed Limit Information

11.1. Functional limitations

The KAFAS camera function of the corresponding assist systems may be restricted in the following situations:

- Heavy fog, rain, rain spray or snow.
- Strong backlight.
- If the field of view of the KAFAS camera or the windscreen is dirty or covered.
- At sharp bends.
- Up to 10 seconds after the engine start via the START-STOP button.
- During the calibration process for the KAFAS camera immediately after vehicle delivery or a camera change.

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

F15 Driver Assistance Systems

12. High-beam Assistant

The function of the FLA (SA 5AC) remains unchanged with two stages. The high-beam headlight is automatically switched on and off.

Further information on the FLA is available in the Training Reference Manual ST811 F01 Complete Vehicle.

The FLA does not replace the personal decision to use the high-beam headlight.
Therefore, in certain situations manually dip the headlight; otherwise, there is a safety risk.

Bayerische Motorenwerke Aktiengesellschaft
Qualifizierung und Training
Röntgenstraße 7
85716 Unterschleißheim, Germany