

Technical training.
Product information.

G30 Voltage Supply and Bus Systems



BMW Service

Edited for the U.S. market by:
BMW Group University
Technical Training

ST1604

11/1/2016

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.

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

Information status: **September 2016**
Technical training.

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G30 Voltage Supply and Bus Systems

1. Introduction

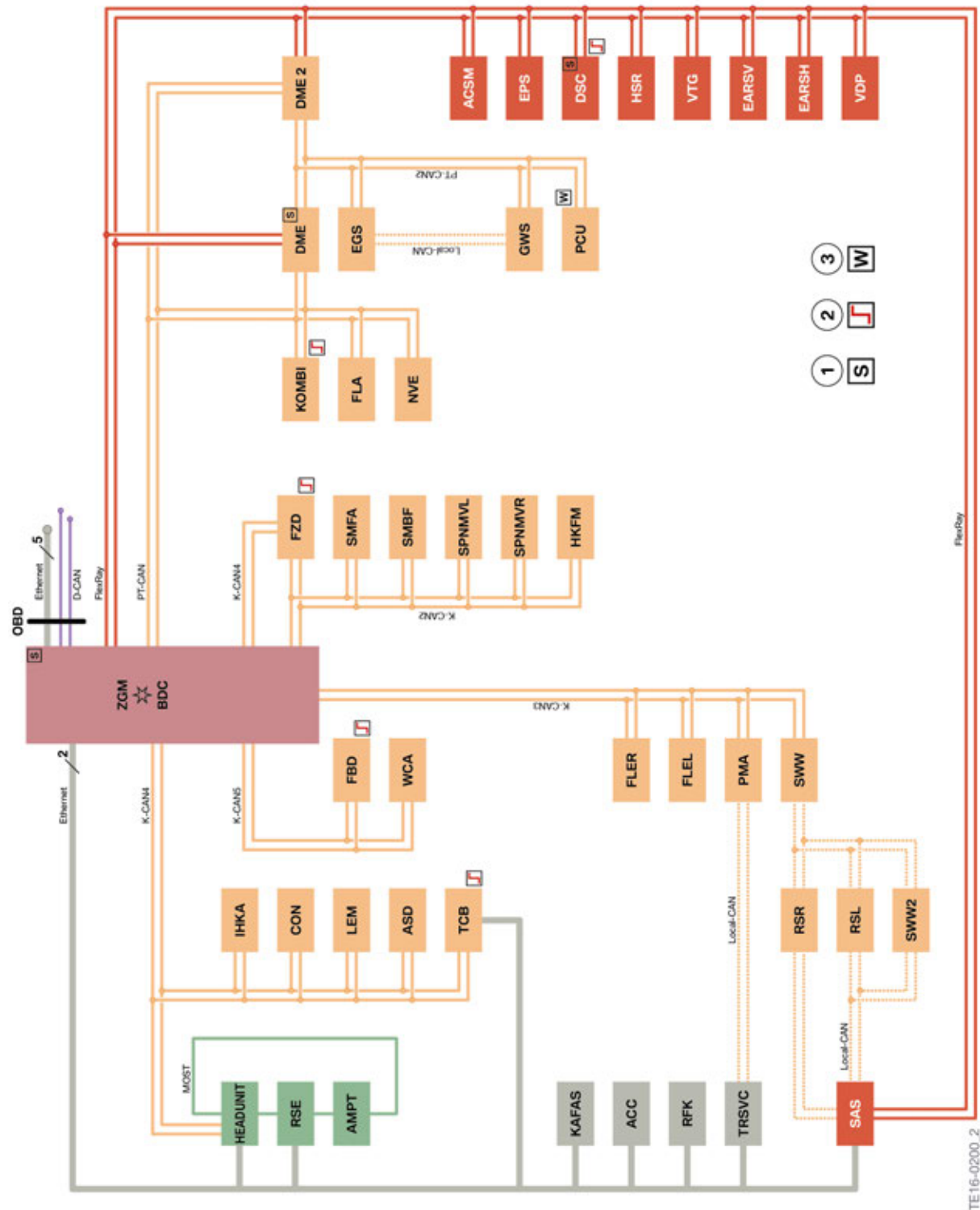
The electrical system of the new BMW 5 Series is based on the G12. The following topic is described in the Technical Reference Material for “ST1501 G12 Complete Vehicle”.

Topic	“ST1501 G12 Complete Vehicle”
Ethernet	“G12 General Vehicle Electronics”

G30 Voltage Supply and Bus Systems

2. Bus Systems

2.1. Bus overview



Bus overview

G30 Voltage Supply and Bus Systems

2. Bus Systems

Index	Explanation
ACC	Active Cruise Control also known as Long Range Radar sensor (LRR)
ACSM	Advanced Crash Safety Module
AMPT	Top HiFi amplifier
ASD	Active Sound Design
BDC	Body Domain Controller
CON	Controller
DME	Digital Motor Electronics
DME2	Digital Motor Electronics 2
DSC	Dynamic Stability Control
EARSH	Electric active roll stabilization rear
EARSV	Electric active roll stabilization front
EGS	Electronic transmission control
EPS	Electromechanical Power Steering
FBD	Remote control receiver
FLA	High-beam assistant
FLER	Frontal Light Electronics Right
FLEL	Frontal Light Electronics Left
FZD	Roof function center
GWS	Gear selector
HEADUNIT	Head Unit
HKFM	Trunk function module
HSR	Rear axle slip angle control
IHKA	Integrated automatic heating / air conditioning
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel
LEM	Light Effect Manager
NVE	Night Vision Electronics
PCU	Power Control Unit
PMA	Parking Maneuver Assistant
RFK	Reverse camera
RSE	Rear Seat Entertainment
RSL	Radar Sensor, Left (Evasion Aid)
RSR	Radar Sensor, Right (Evasion Aid)
SAS	Optional equipment system
SMBF	Seat module, passenger

G30 Voltage Supply and Bus Systems

2. Bus Systems

Index	Explanation
SMFA	Seat module, driver
SPNMVL	Seat pneumatics module front left
SPNMVR	Seat pneumatics module front right
SWW	Lane change warning (primary) also known as the Short Range Radar Sensor (SRR)
SWW2	Lane change warning (secondary) also known as the Short Range Radar Sensor (SRR2)
TCB	Telematic Communication Box
TR SVC	Top rear side view camera
VDP	Vertical Dynamic Platform
VTG	Transfer case
WCA	Wireless charging tray
ZGM	Central Gateway Module
1	Start-up node control units for starting and synchronizing the FlexRay bus system
2	Control units with wake-up authorization
3	Control units also connected at terminal 15 WUP

2.2. Main bus systems

2.2.1. K-CAN

In the G30 the following K-CAN's are used:

- K-CAN2
- K-CAN3
- K-CAN4
- K-CAN5

The control units on the K-CAN5 are not displayed in the bus overview by the BMW diagnosis system ISTA. Diagnosis is performed via the Body Domain Controller.

All K-CAN data buses have a data transfer rate of 500 kBit/s.

G30 Voltage Supply and Bus Systems

2. Bus Systems

2.2.2. PT-CAN

In the G30 the following PT-CAN are used:

- PT-CAN
- PT-CAN2

The gateway for the PT-CAN2 is located in the DME.

Both PT-CAN data buses have a data transfer rate of 500 kBit/s.

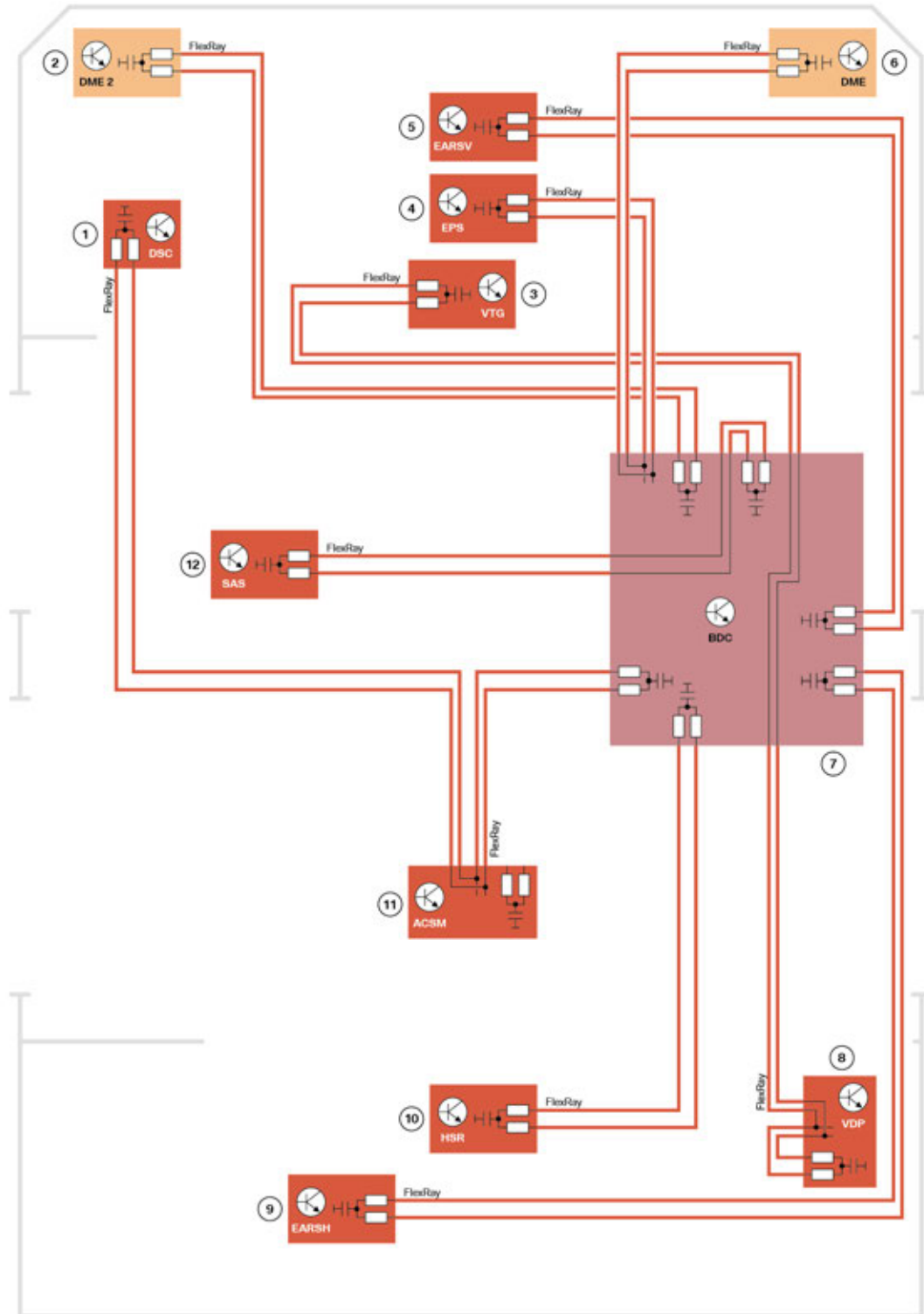
2.2.3. MOST

On the G30 the MOST system known from other BMW models with a data transfer rate of 22.5 MBit/s is used. The gateway for the MOST system is located in the HEADUNIT.

G30 Voltage Supply and Bus Systems

2. Bus Systems

2.2.4. FlexRay



TE14-1184_2

FlexRay

G30 Voltage Supply and Bus Systems

2. Bus Systems

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Digital Motor Electronics (DME2) (8-cylinder engine)
3	Transfer case
4	Electronic Power Steering (EPS)
5	Electric active roll stabilization front (EARSV)
6	Digital Motor Electronics (DME) (4 & 6-cylinder engine)
7	Body Domain Controller (BDC)
8	Vertical Dynamics Platform (VDP)
9	Electric active roll stabilization rear (EARSH)
10	Rear axle slip angle control (HSR)
11	Advanced Crash Safety Module (ACSM)
12	Optional equipment system (SAS)

The FlexRay overview includes all engine versions and optional equipment. The DME (item 6) is used for 4 & 6-cylinder engines. On 8-cylinder engines the DME2 (item 2) is used. The terminating resistors for line termination are located in the DME control units and in the Body Domain Controller.

The FlexRay has a data transfer rate of 10 MBit/s.

2.2.5. Ethernet

On the G30 the 2-wire OABR Ethernet (OPEN Alliance BroadR-Reach) from the G12 is used.

The Ethernet variant with 5 lines (4 data lines and 1 activation line) is still used on the G30 by the OBD2 interface to the Body Domain Controller.

Use of 2-wire OABR Ethernet on the G30

The following control units are connected to the vehicle electrical system via 2-wire OABR Ethernet in the G30:

- Active Cruise Control (ACC)
- Camera-based driver support systems (KAFAS)
- Top Rear Side View Camera (TRSVC)
- Rear view camera (RFK)

G30 Voltage Supply and Bus Systems

2. Bus Systems

The following control units are additionally connected via 2-wire OABR Ethernet in the G30:

- Head unit
- Rear Seat Entertainment (RSE)
- Optional equipment system (SAS)
- Telematic Communication Box

Ethernet in the vehicle

The standard "Open Alliance BroadR-Reach" (OABR Ethernet) has been specially developed as a new data transmission layer for use in vehicles. OABR Ethernet only requires an unshielded twisted two-wire connection. OABR Ethernet supports bidirectional 100 MBit/s communication between 2 nodes. This means that both nodes can simultaneously send and receive at a data transfer rate of 100 MBit/s. OABR Ethernet requires point-to-point networking. This means that the bus system is not split up between multiple nodes, as is the case e.g. with Controller Area Network (CAN) systems. Instead, Ethernet switches are used for the connection of further nodes. Today, Ethernet switches are integrated in the following control units: Body Domain Controller (BDC), Head Unit (HU), optional equipment system (SAS), Top Rear Side View Camera (TRSVK). An Ethernet switch (ENS) is used on the G30 depending on the vehicle equipment. In the event of failure of an Ethernet switch, all bus users connected by it are disconnected from the rest of the network and are no longer able to communicate via Ethernet.

Depending on the vehicle equipment, the control units are connected to the vehicle electrical system in different ways.

On vehicles with Navigation, the data transfer takes place from the Head Unit High to the instrument cluster via an APIX data cable.

Depending on the vehicle equipment an Ethernet switch may in some cases be required.

A wake-up line may be required for control units that are only connected to the Ethernet and are not additionally connected to a body CAN.

Control units on the Ethernet cannot be woken up via the bus. Instead, the control units are activated via the wake-up line or switched directly via terminal 15. As a result of the activation via a wake-up line, so-called partial network operation is also possible. In partial network operation, individual control units can switch to a rest state in different vehicle conditions.

The Ethernet topology of the G30 is listed below.

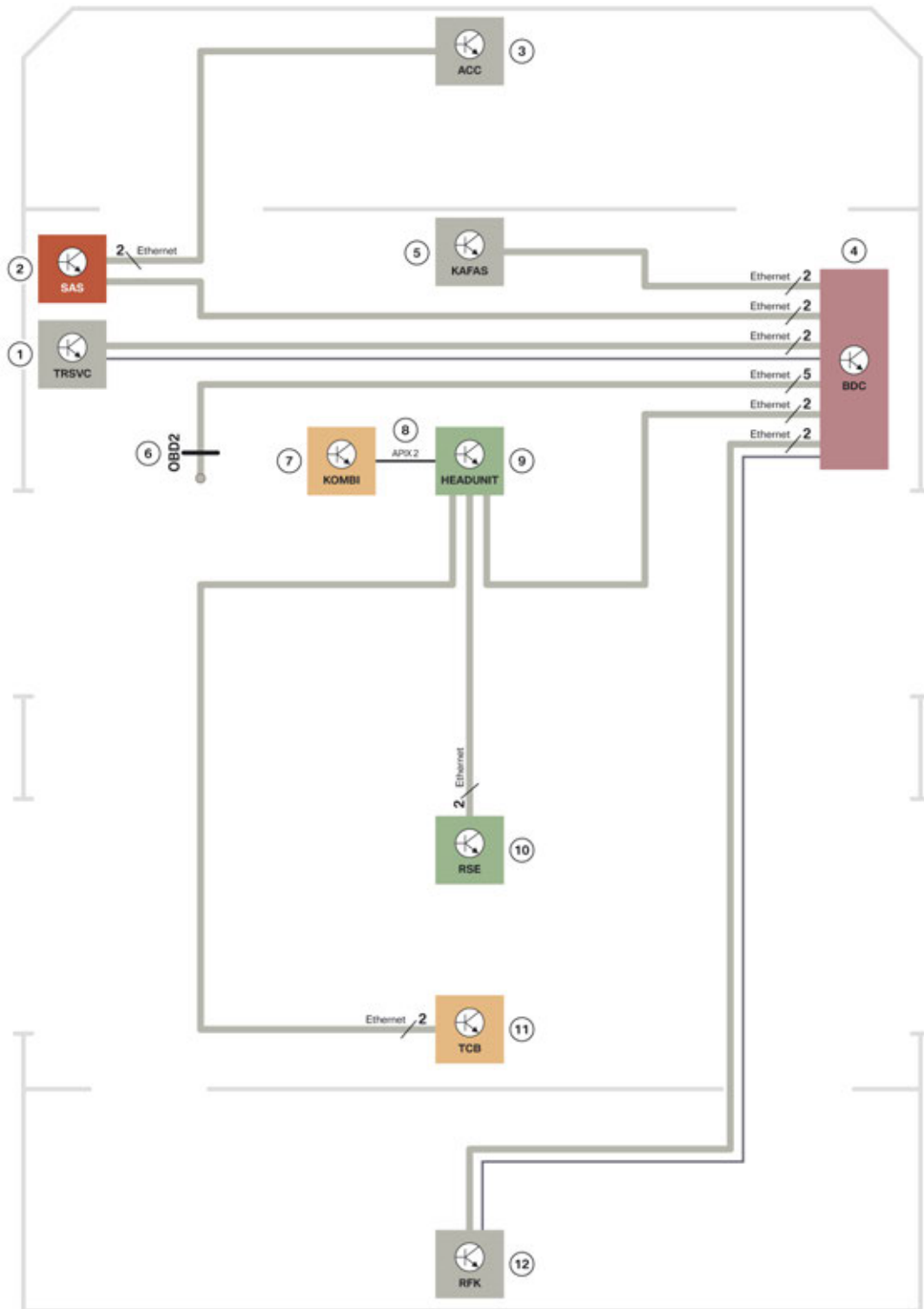
Ethernet topology with Head Unit High

In the wiring diagram the connection of the Top Rear Side View Camera (TRSVK) control unit and rear view camera (RFK) is shown. In the vehicle, either TRSVK is installed for a vehicle with multiple cameras, or RFK for a vehicle with a rear view camera (standalone).

On vehicles with Head Unit High, the Telematic Communication Box (TCB) and the Rear Seat Entertainment are directly connected to the head unit. The data transfer from the Head Unit High to the instrument cluster takes place via APIX. The instrument cluster does not require Ethernet. As a result, the Ethernet interfaces on the Body Domain Controller are sufficient, and no Ethernet switch (ENS) is required.

G30 Voltage Supply and Bus Systems

2. Bus Systems



Ethernet topology on vehicles with Head Unit High

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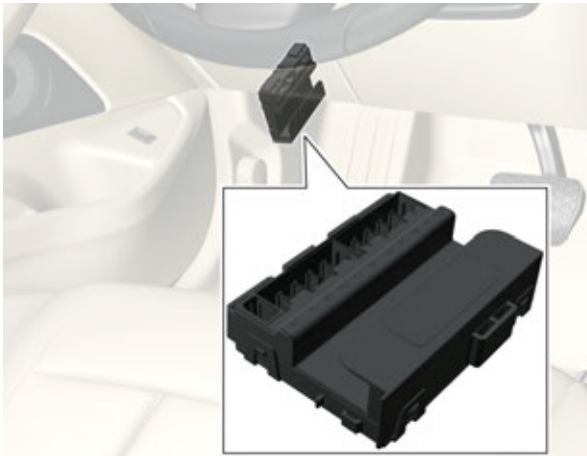
G30 Voltage Supply and Bus Systems

2. Bus Systems

Index	Explanation
1	Top Rear Side View Camera (TR SVC)
2	Optional equipment system (SAS)
3	Active Cruise Control (ACC) Long Range Radar (LRR)
4	Body Domain Controller (BDC)
5	Camera-based driver support systems (KAFAS)
6	OBD2 interface (Ethernet with 5 lines)
7	Instrument panel (KOMBI)
8	APIX data line
9	Head Unit (HEADUNIT)
10	Rear Seat Entertainment
11	Telematic Communication Box (TCB)
12	Rear view camera (RFK)

The data transfer takes place from the Head Unit High to the instrument cluster via APIX connection.

Ethernet switch



Ethernet switch

The Ethernet switch is required for expansion of the Ethernet network. It connects the control units and forwards their data packages accordingly.

The Ethernet switch is not displayed in the bus overview by the BMW diagnosis system ISTA.

G30 Voltage Supply and Bus Systems

2. Bus Systems

2.2.6. D-CAN

The D-CAN has a data transfer rate of 500 kBit/s.

2.3. Sub-bus systems

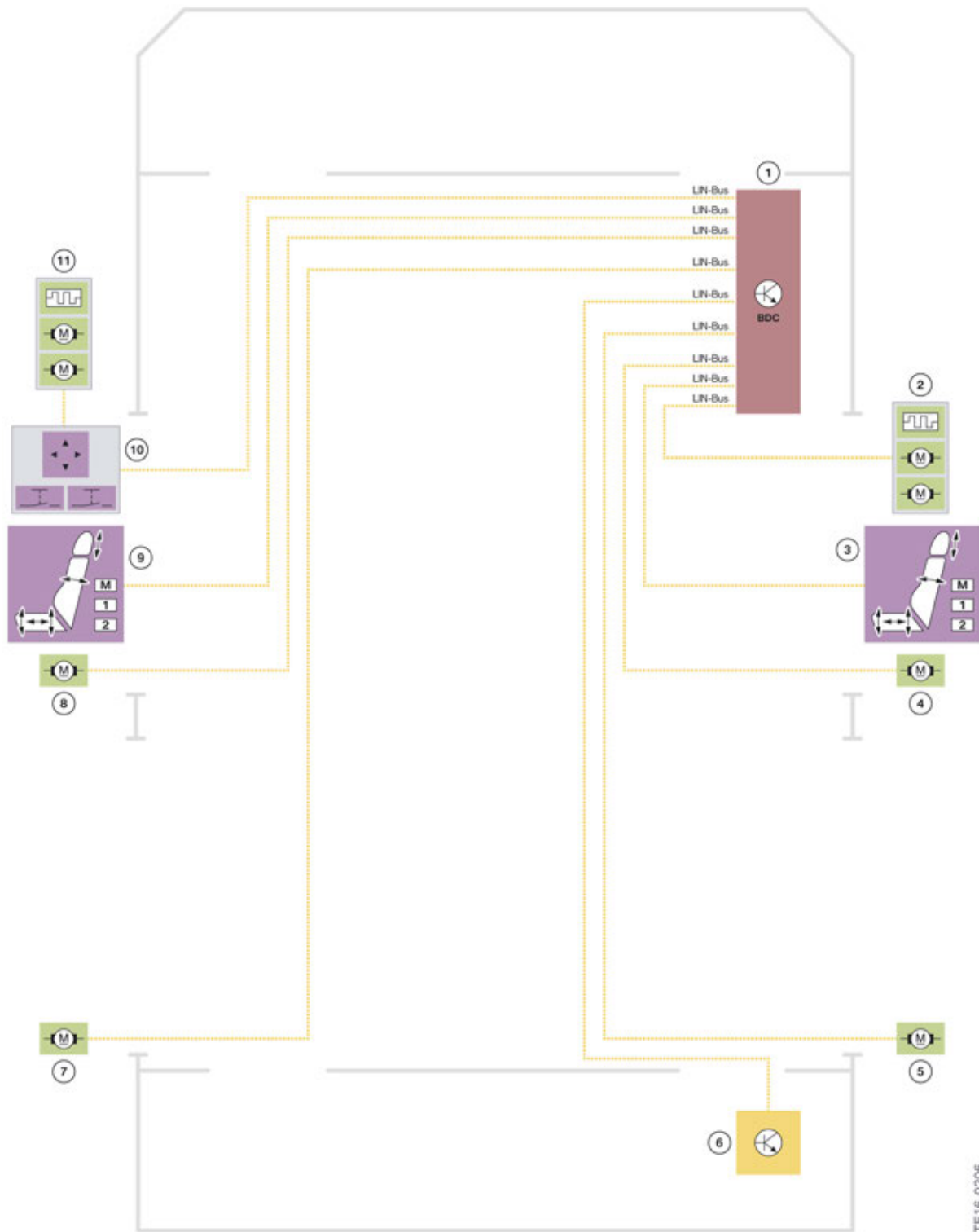
2.3.1. LIN-Bus

For a better overview, the LIN buses are divided up between several wiring diagrams for the G30.

G30 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview in the door area



TE16-0206

LIN-Bus

G30 Voltage Supply and Bus Systems

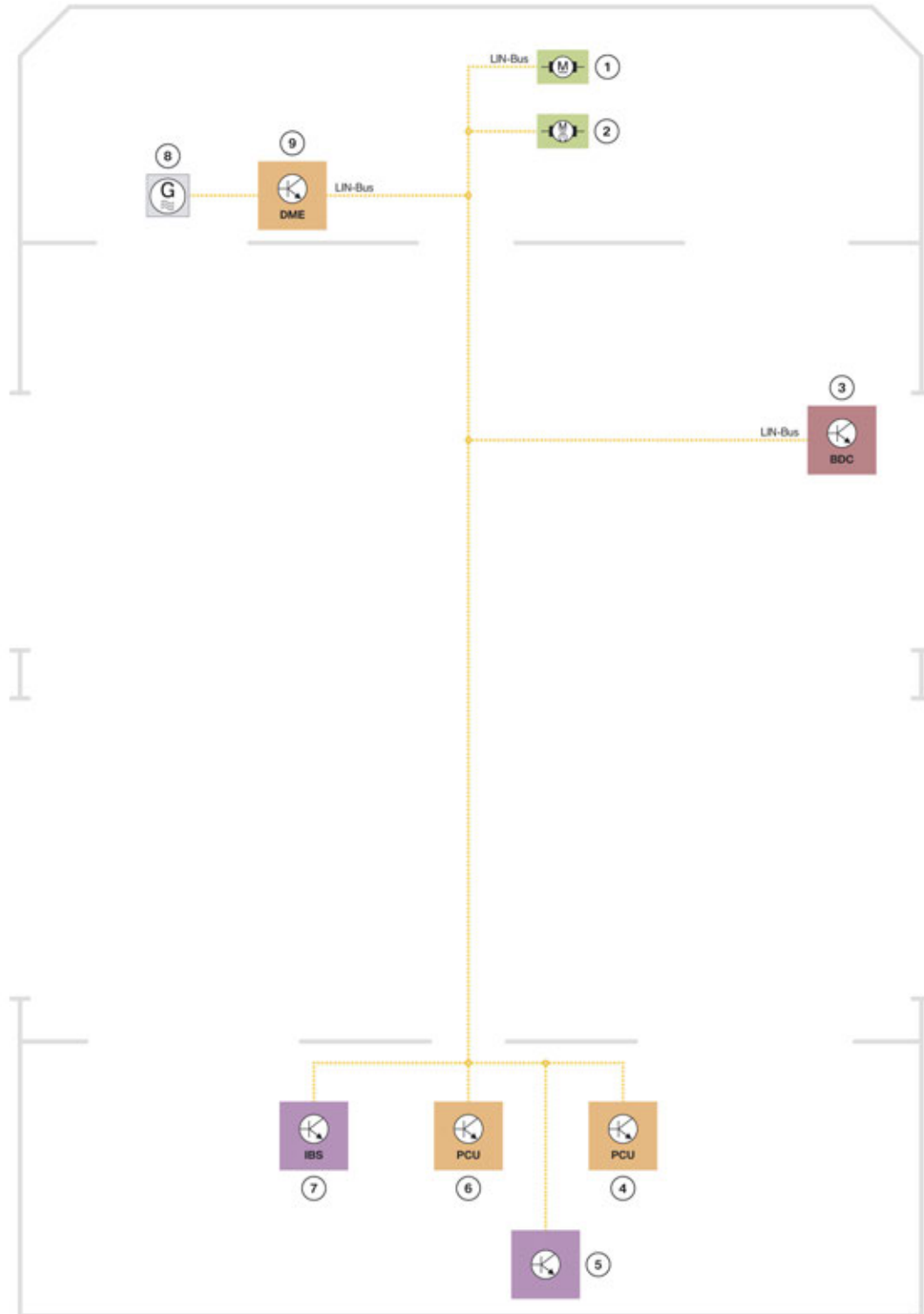
2. Bus Systems

Index	Explanation
1	Body Domain Controller (BDC)
2	Exterior mirror, front passenger side
3	Memory seat, front passenger's side
4	Power window electronics, passenger's side front
5	Power window electronics, passenger's side rear
6	Hands free trunk opening
7	Power window electronics, driver's side rear
8	Power window electronics, driver's side front
9	Memory switch, driver's side front
10	Switch block, driver's door
11	Exterior mirror, driver's side

G30 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview for engine electrical system and voltage supply



TE16-0207

LIN-Bus

G30 Voltage Supply and Bus Systems

2. Bus Systems

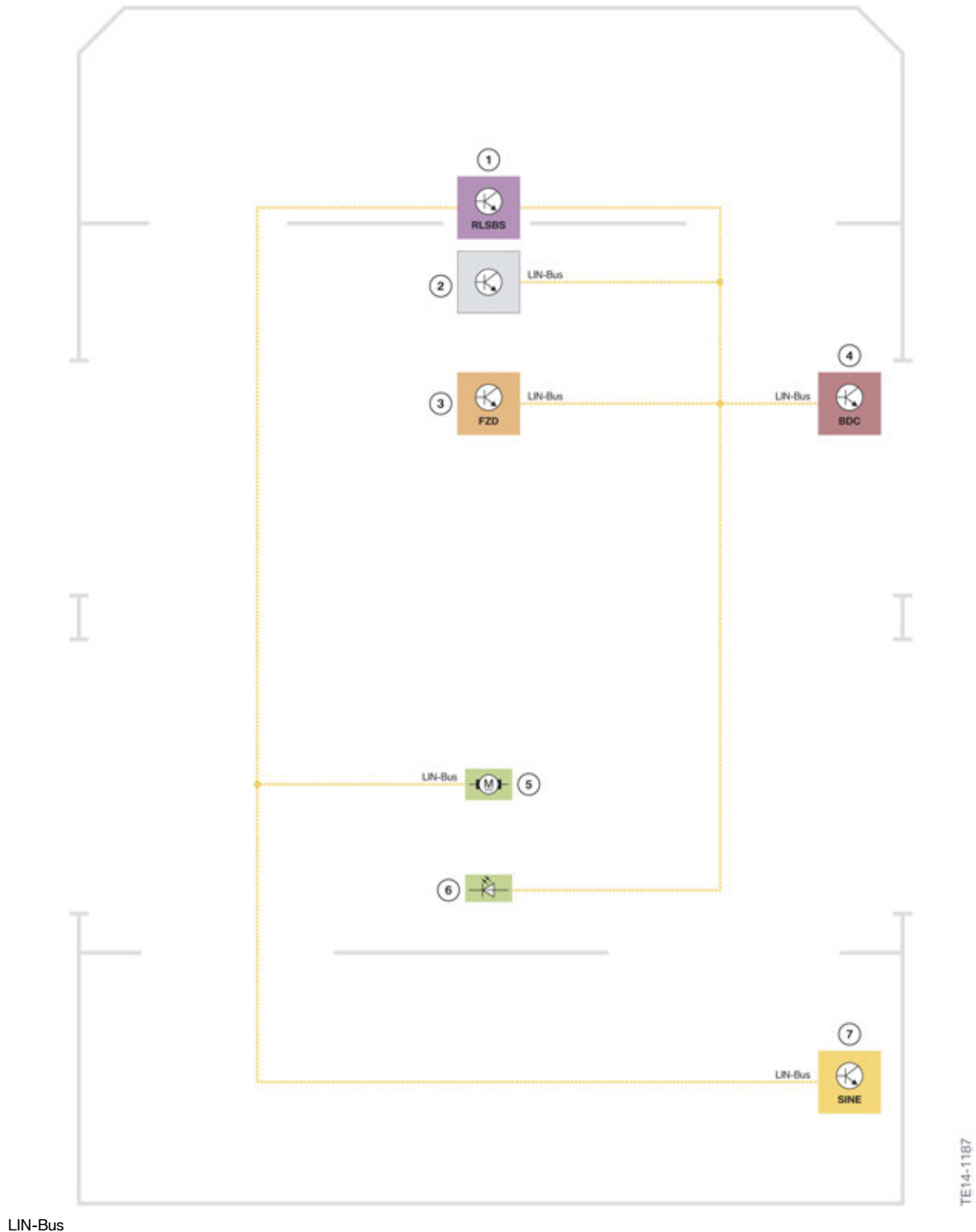
Index	Explanation
1	Air damper control
2	Electric fan
3	Body Domain Controller (BDC)
4	Power Control Unit (PCU) 500W
5	Rear right power distribution box
6	Power Control Unit (PCU) 150 W ¹
7	Intelligent Battery Sensor (IBS)
8	Alternator
9	Digital Motor Electronics (DME)

¹The Power Control Unit PCU 150 W is installed in vehicles with 24 V steering.

G30 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview for roof function center



G30 Voltage Supply and Bus Systems

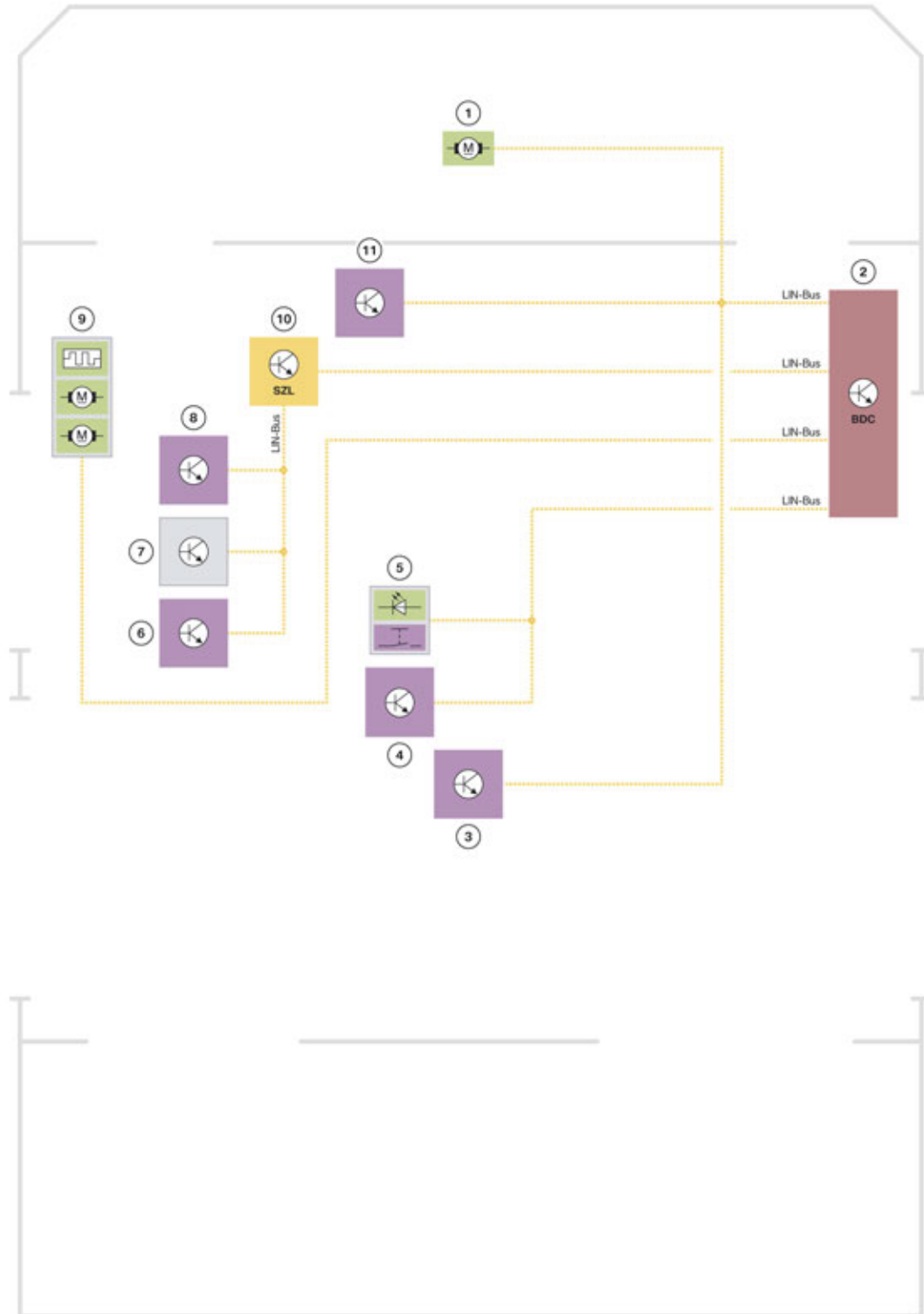
2. Bus Systems

Index	Explanation
1	Rain-light-solar-condensation sensor
2	Inside mirror
3	Roof function center (FZD)
4	Body Domain Controller (BDC)
5	Sliding roofliner motor
6	Interior lighting, rear
7	Siren with tilt alarm sensor (SINE)

G30 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview for steering column switch cluster and operating units



TE14-1189

LIN-Bus

G30 Voltage Supply and Bus Systems

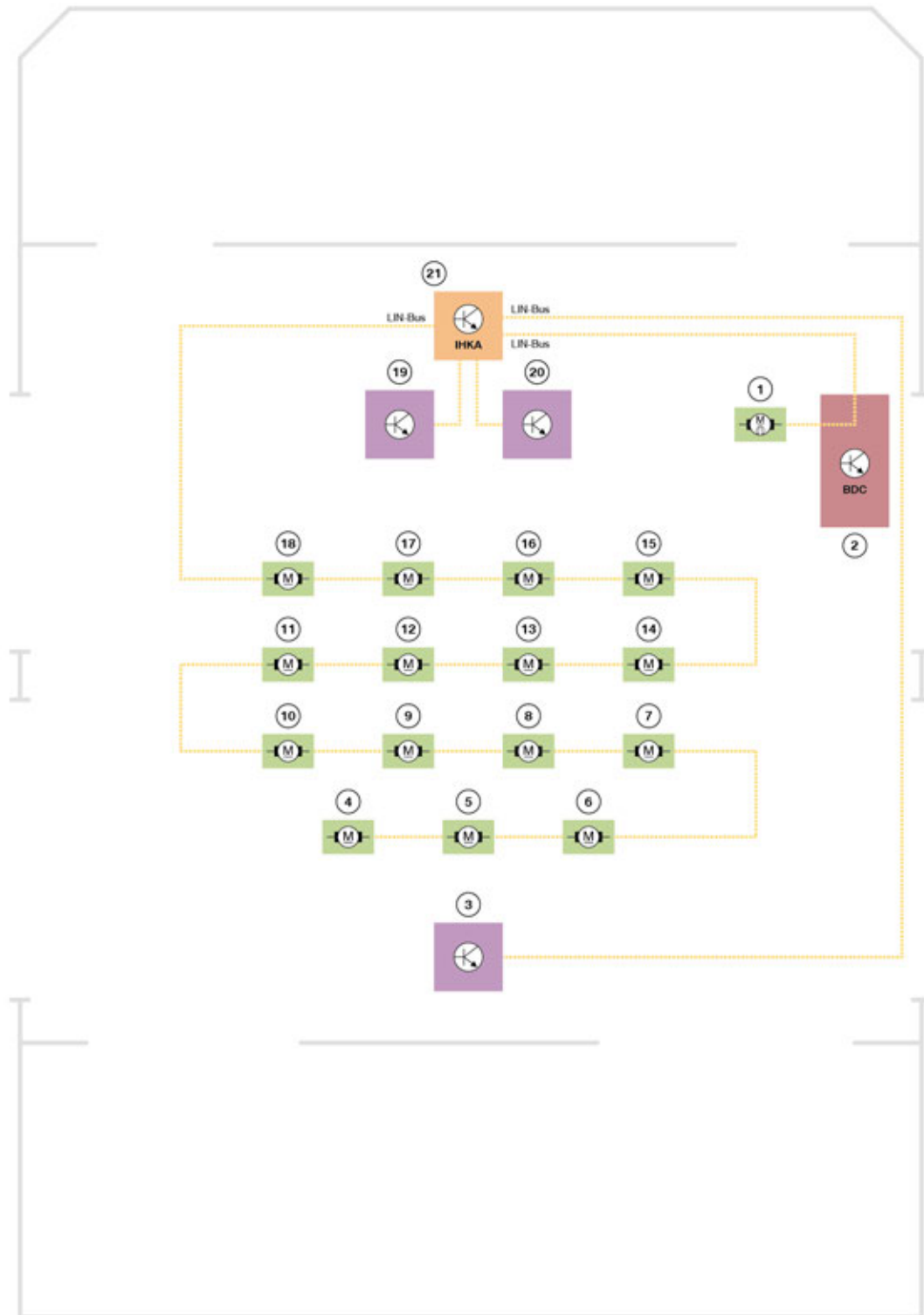
2. Bus Systems

Index	Explanation
1	Wiper motor
2	Body Domain Controller (BDC)
3	Operating unit, center console
4	Audio operating facility
5	Hazard warning switch/Intelligent Safety button
6	Touch detection HOD (Hands Off Detection)
7	Steering wheel module
8	Multifunction steering wheel buttons, right
9	Operating unit for light
10	Steering column switch cluster (SZL)
11	Steering column adjustment

G30 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview for integrated automatic heating/air conditioning system



TE16-0210_2

LIN-Bus

G30 Voltage Supply and Bus Systems

2. Bus Systems

Index	Explanation
1	Blower motor
2	Body Domain Controller (BDC)
3	Operating unit, rear passenger compartment
4	Stepper motor for blending flap, right rear passenger compartment
5	Stepper motor for blending flap, left rear passenger compartment
6	Stepper motor for blending flap, right
7	Stepper motor for blending flap, left
8	Stepper motor for air distribution, right rear passenger compartment
9	Stepper motor for air distribution, left rear passenger compartment
10	Stepper motor for footwell, right
11	Stepper motor for footwell, left
12	Stepper motor for stratification, right
13	Stepper motor for stratification, left
14	Stepper motor for ventilation, right
15	Stepper motor for ventilation, left
16	Stepper motor for defrost function
17	Stepper motor for air recirculation function
18	Stepper motor for fresh air
19	Operating unit, air conditioning
20	Touch operating unit in the center grill (Not for the US)
21	Integrated Automatic Heating / Air conditioning (IHKA)

The LIN bus overview shows the Integrated Automatic Heating/Air conditioning system (IHKA) with the maximum possible LIN bus components.

G30 Voltage Supply and Bus Systems

2. Bus Systems

2.3.2. Local CAN

In the G30 the following Local Controller Area Networks are available with the corresponding equipment:

- Local CAN from electronic transmission control (EGS) to the gear selector switch (GWS).
- Local CAN from the camera-based driver assistance system KAFAS to the Parking Maneuver Assistant (PMA).
- Local CAN from the optional equipment system (SAS) to the radar sensor, front right (RSR).
- Local CAN from the optional equipment system (SAS) to the radar sensor, front left (RSL) and lane change warning (secondary) (SWW2).
- Local CAN from the lane change warning (primary) (SWW) also known as the Short Range Radar Sensor (SRR) to the radar sensor, right (RSR), to the radar sensor, left (RSL), and to the lane change warning (secondary) (SWW2) also known as the Short Range Radar Sensor (SRR2).

The control units on the local CAN are not displayed in the bus overview by the BMW diagnosis system ISTA. Diagnosis takes place via the corresponding primary control unit.

The local CAN buses have a data transfer rate of 500 kBit/s.

2.3.3. USB

The following USB interfaces are provided in the G30 depending on the vehicle equipment:

- In the center console (standard)
- In the center armrest
- In the base plate
- USB interface in Rear Seat Entertainment

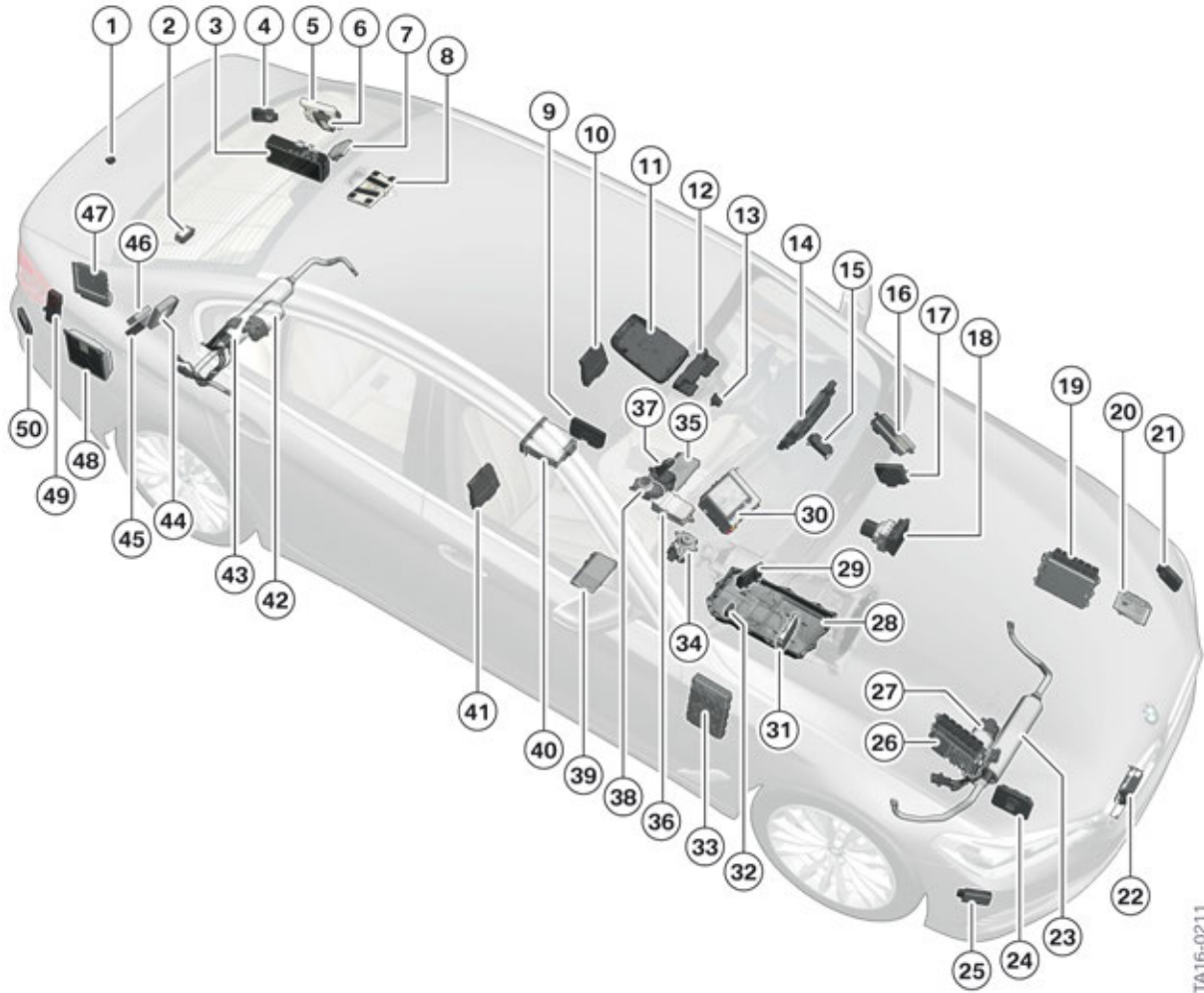
2.4. Diagnosis access OBD2

The vehicle diagnosis via D-CAN is effected using the OBD2 interface. The Ethernet access for the vehicle programming is also located in the OBD2 interface.

G30 Voltage Supply and Bus Systems

3. Control Units

3.1. Installation locations of control units



Installation locations of control units

Index	Explanation
1	Rear view camera (RFK)
2	Remote control receiver (FBD)
3	Top HiFi amplifier (AMPT)
4	Lane change warning (secondary) (SWW2)
5	Video module (VM) (Not for the US)
6	Light Effect Manager (LEM)
7	Active Sound Design (ASD)
8	Telematic Communication Box (TCB)
9	Wireless charging tray (WCA)
10	Seat pneumatics module front left (SPNMVL)

G30 Voltage Supply and Bus Systems

3. Control Units

Index	Explanation
11	Roof function center (FZD)
12	Camera-based driver support systems (KAFAS)
13	High-beam assistant (FLA)
14	Instrument panel (KOMBI)
15	Electronic steering lock (ELV) (Not for the US, manual transmission vehicles only)
16	Control unit for rear view camera and SideView (TRSVc)
17	Optional equipment system (SAS)
18	Dynamic Stability Control (DSC)
19	Digital Motor Electronics (DME)
20	Frontal Light Electronics Left (FLEL)
21	Radar Sensor Left (RSL)
22	Active Cruise Control (ACC) Long Range Radar (LRR)
23	Electric active roll stabilization front (EARSV)
24	Frontal Light Electronics Right (FLER)
25	Radar Sensor Right (RSR)
26	Digital Engine Electronics 2 (DME2)
27	Electronic Power Steering (EPS)
28	Electronic transmission control (EGS)
29	Integrated automatic heating / air conditioning (IHKA)
30	Head Unit (HEADUNIT)
31	Night vision electronics (NVE)
32	Near Field Communication (NFC) (Not for the US)
33	Body Domain Controller (BDC)
34	Transfer case
35	Driver's seat module (SMFA)
36	Advanced Crash Safety Module (ACSM)
37	Gear selector switch (GWS)
38	Controller (CON)
39	Front passenger seat module, (SMBF)
40	Rear Seat Entertainment (RSE)
41	Seat pneumatics module front right (SPNMVR)
42	Rear axle slip angle control (HSR)
43	Electric active roll stabilization rear (EARSH)
44	Selective Catalytic Reduction (SCR) (Currently not available for the US)

G30 Voltage Supply and Bus Systems

3. Control Units

Index	Explanation
45	Trailer module AHM (Not for the US)
46	Parking Maneuver Assistant (PMA)
47	Vertical dynamic platform
48	Power Control Unit
49	Trunk function module (HKFM)
50	Lane change warning SWW (primary) also know as the Short Range Radar Sensor (SRR)

3.2. Gateway

3.2.1. Body Domain Controller (BDC)



Body Domain Controller (BDC)

G30 Voltage Supply and Bus Systems

3. Control Units

BDC functions

The Body Domain Controller BDC is responsible for the following functions:

- Gateway
- Electronic immobilizer
- Terminal control
- Central locking system
- Exterior lights
- Power windows
- Horn
- Interior light
- Wash/wipe system
- Vehicle data storage
- Data transfer for Condition Based Service (CBS)

Fuses in the BDC

The following components are protected by fuses in the BDC:

- Audio operating facility
- Operating facility for assist systems
- Operating unit for light
- Power windows
- Heated rear window
- Trunk function module
- Integrated automatic heating / air conditioning
- OBD2 interface
- Power Control Unit
- Rain-light-solar-condensation sensor
- Steering column switch cluster
- Telematic Communication Box
- Outside door handle electronics
- Vertical dynamics platform (electronics)
- Central locking system

G30 Voltage Supply and Bus Systems

3. Control Units

Relay in the BDC

The following relays are located in the BDC:

- Terminal 30F
- Power window regulators
- Central locking system
- Heated rear window
- Headlight cleaning system

Gateway in the BDC

The central gateway module (ZGM) is integrated in the BDC. It is a control unit within a control unit. The task of the ZGM is to connect all the data bus systems to each other. By connecting them in this way, it is possible to use information from the individual bus systems on a generalized level. The central gateway module is able to implement different protocols and speeds on other bus systems. The programming data for the control units is transmitted by Ethernet to the vehicle via the ZGM.

LIN controller in the BDC

The BDC is the gateway for the following components at the local interconnect network bus:

- Exterior mirror, left and right
- Switch block, driver's door, front passenger door
- Steering column switch cluster
- Light switch
- Intelligent Safety button
- Audio operating facility
- Inside mirror
- Rain-light-solar-condensation sensor
- Roof function center (interior lighting)
- Comfort seat, rear passenger compartment, left and right
- Electrical steering column adjustment
- Wiper
- Operating unit, center console
- Power distribution box, rear

G30 Voltage Supply and Bus Systems

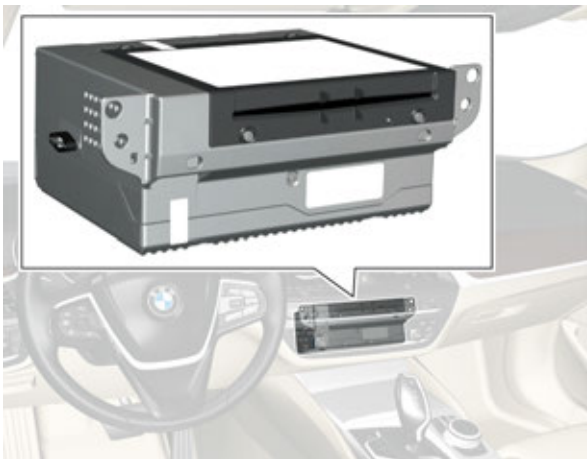
3. Control Units

The following control units are connected to the BDC via LIN, but the BDC has only a wake-up function and not a gateway or primary function:

- Battery charging unit
- Intelligent battery sensor
- Electric fan
- Active air flap control
- Digital Motor Electronics

3.3. Control units on the MOST bus

3.3.1. Head unit



Head unit

On the G30, the head unit can be operated by touch at the CID in addition to operation via the controller. In the case of optional equipment with gesture control, selected functions can also be operated by means of gestures.

3.3.2. Hi-fi amplifier with MOST bus

The following amplifiers are used in the G30 depending on the audio systems:

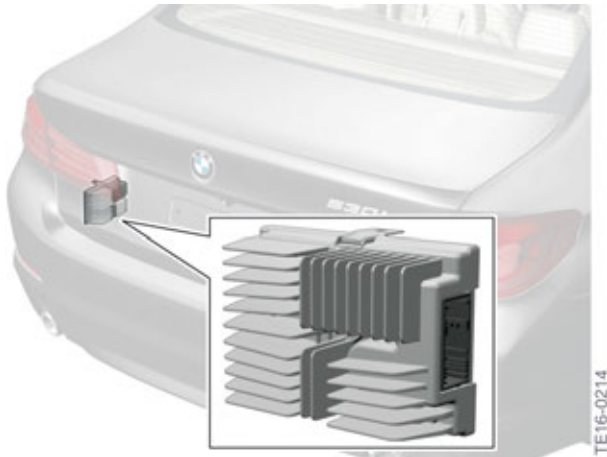
- Standard 8-channel amplifier without bus connection for HiFi audio system.
- Optional 9-channel amplifier for Top HiFi audio system.
- Optional 10-channel amplifier for High End audio system.

G30 Voltage Supply and Bus Systems

3. Control Units

HiFi amplifier

8-channel amplifier without bus connection with a power of 205 W.



HiFi amplifier

Top Harmon Kardon HiFi amplifier

9-channel amplifier with MOST bus and a power of 600 W.



Top HiFi amplifier

G30 Voltage Supply and Bus Systems

3. Control Units

High End Bowers & Wilkins amplifier

10-channel amplifier with MOST bus and a power of 1400 W.



High End amplifier

3.3.3. Rear seat entertainment (RSE)



Rear Seat Entertainment (RSR)

The Rear Seat Entertainment (RSE) on the G30 is equipped with a Blu-ray drive.

G30 Voltage Supply and Bus Systems

3. Control Units

3.4. Control units on the K-CAN2

3.4.1. Roof function center (FZD)



Roof function center (FZD)

Depending on the vehicle equipment the roof function center FZD includes the corresponding components for:

- Alarm system
- Control, slide/tilt sunroof
- Gesture recognition camera
- Emergency call button

On vehicles with gesture control, the gesture recognition camera is installed in the FZD. The gesture recognition camera is not shown as a control unit by the BMW diagnosis system. Diagnosis takes place via the FZD. The gesture recognition camera is connected to the PT-CAN4. As a result, the bus signals do not have to be forwarded to another CAN bus by the Body Domain Controller.

The FZD is not responsible for the control of the interior light. The interior light unit and the FZD electronics are located in the same housing.

G30 Voltage Supply and Bus Systems

3. Control Units

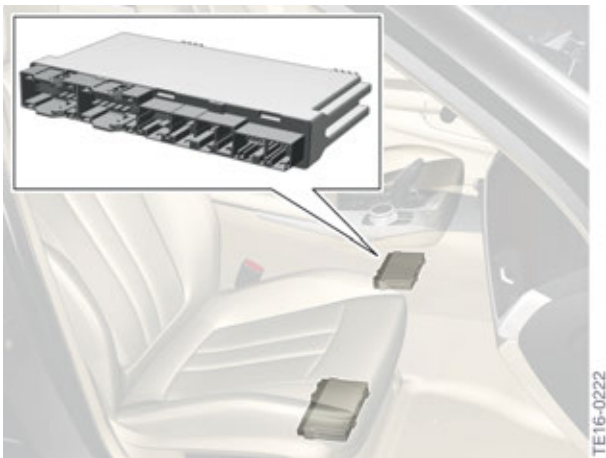
3.4.2. Trunk function module (HKFM)



Trunk function module (HKFM)

The control unit for the power trunk function module (HKFM) is responsible for control of the lift.

3.4.3. Seat modules



Seat module

The following seat modules are present corresponding to the vehicle equipment:

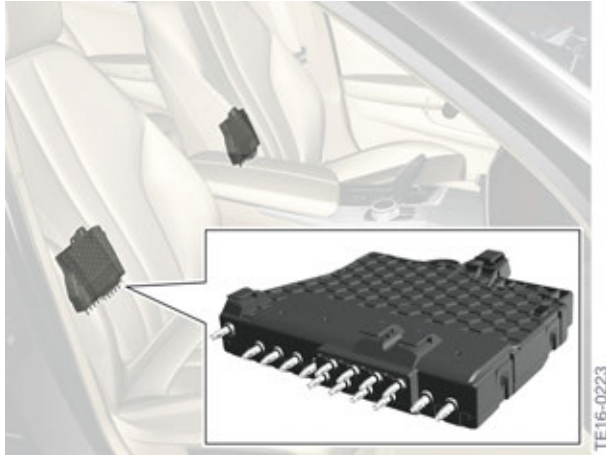
- Driver's seat module (SMFA)
- Front passenger seat module (SMBF)

The seat modules are responsible for actuation of the servomotors in the corresponding seat. Depending on the equipment, there may be 2 identical seat modules installed in the vehicle. Encoding of the control units takes place by connection to the wiring harness. The control unit is assigned correspondingly in the vehicle depending on the additional ground encoding.

G30 Voltage Supply and Bus Systems

3. Control Units

3.4.4. Seat pneumatics modules



Seat pneumatics module back right SPNMHR

The following seat pneumatics modules are present corresponding to the vehicle equipment:

- Seat pneumatics module front left (SPNMVL)
- Seat pneumatics module front right (SPNMVR)

The seat pneumatics modules are responsible for the massage function in the corresponding front seat. Depending on the equipment, there may be 2 identical seat pneumatics modules installed in the vehicle. Encoding of the control units takes place by connection to the wiring harness. The control unit is assigned correspondingly in the vehicle depending on the additional ground encoding.

G30 Voltage Supply and Bus Systems

3. Control Units

3.5. Control units on the K-CAN3

3.5.1. Frontal Light Electronics



Frontal Light Electronics Right and Left

The control units Frontal Light Electronics Right (FLER) and Frontal Light Electronics Left (FLEL) are installed in the corresponding headlight.

The Frontal Light Electronics includes:

- LED activation in the corresponding headlight.
- Actuation of the bulb for the turn indicator (depending on the headlight variant).
- Activation of the stepper motor for the headlight beam adjustment.
- Actuation of the fans.