Technical training.
Product information.

G01 Voltage Supply and Bus Systems

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BMW Group University
Technical Training
ST1701 9/1/2017

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 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: **June 2017**
Technical training.

G01 Voltage Supply and Bus Systems

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1. Introduction

In terms of technology, the new BMW X3 is based on the G12 and G30.

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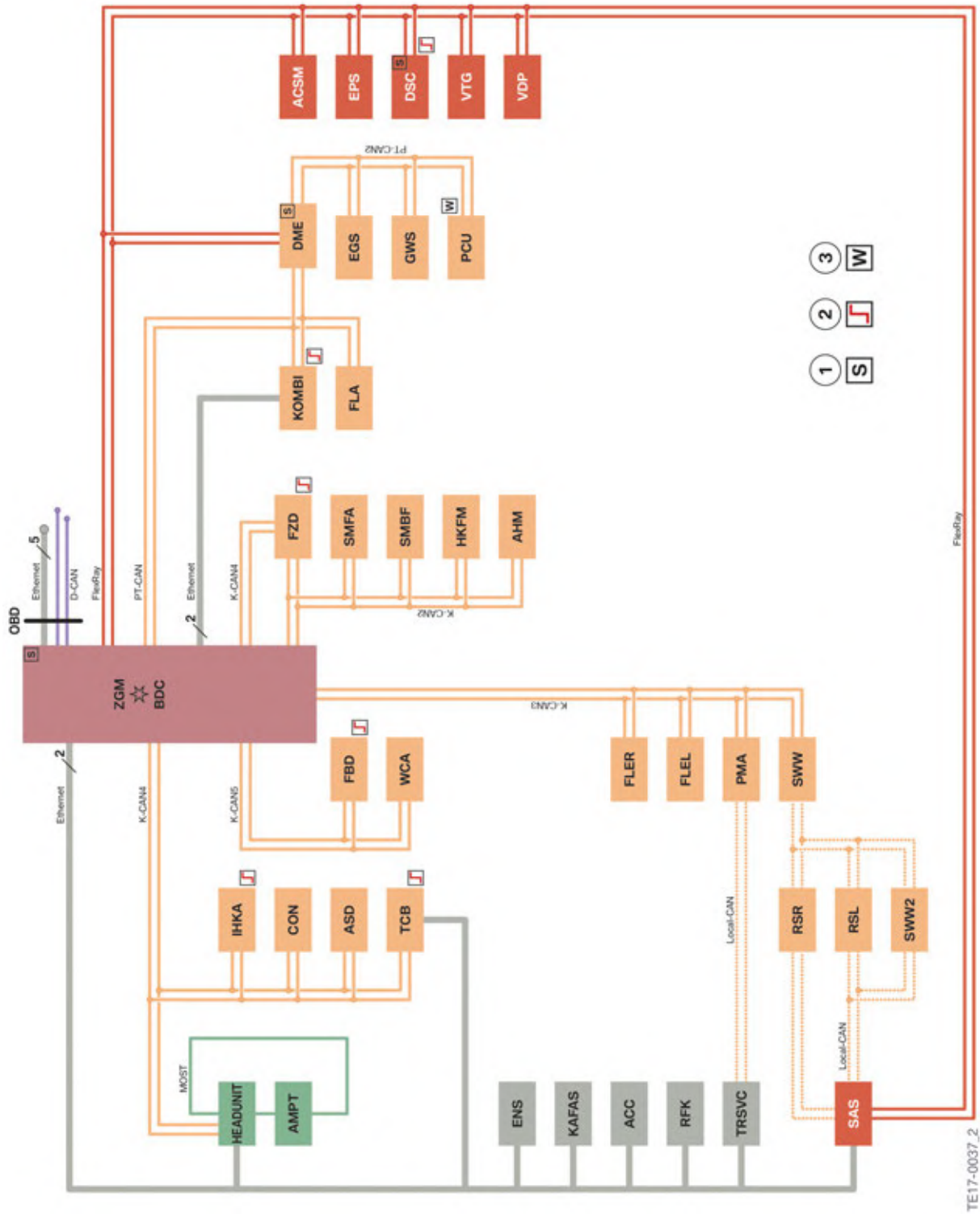
2. Bus Systems

2.1. Bus overview



Bus overview

G01 Voltage Supply and Bus Systems

2. Bus Systems

Index	Explanation
ACC	Active Cruse Control
ACSM	Advanced Crash Safety Module
AHM	Trailer module
AMPT	Top HiFi amplifier
ASD	Active Sound Design
BDC	Body Domain Controller
CON	Controller
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
EGS	Electronic transmission control
ENS	Ethernet switch
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	Tailgate function module
IHKA	Integrated automatic heating / air conditioning
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel
PCU	Power Control Unit
PMA	Parking Manoeuvring Assistant
RFK	Rear view camera
RSL	Radar Sensor, Left (avoidance assistant)
RSR	Radar Sensor, Right (avoidance assistant)
SAS	Optional equipment system
SMBF	Seat module, passenger
SMFA	Seat module, driver
SWW	Lane change warning (primary)
SWW2	Lane change warning (secondary)
TCB	Telematic Communication Box
TRSVC	Top Rear Side View Camera

G01 Voltage Supply and Bus Systems
2. Bus Systems

Index	Explanation
VDP	Vertical Dynamic Platform
VTG	Transfer box
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 15WUP

2.2. Main bus systems

2.2.1. K-CAN

In the G01 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.

2.2.2. PT-CAN

In the G01 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.

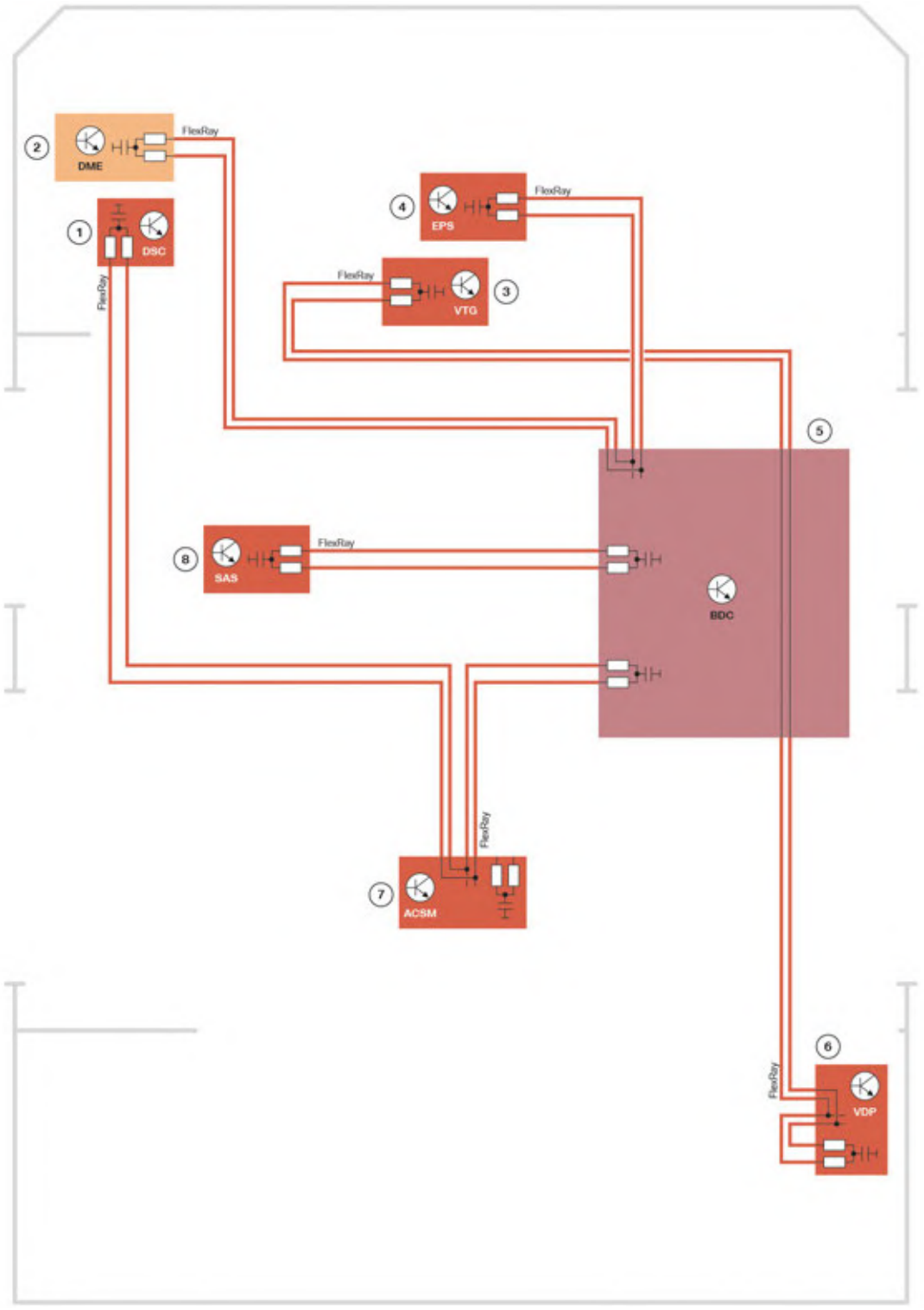
2.2.3. MOST

On the G01 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 HEAD UNIT.

G01 Voltage Supply and Bus Systems

2. Bus Systems

2.2.4. FlexRay



FlexRay

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Digital Motor Electronics (DME)
3	Transfer box
4	Electronic Power Steering (electromechanical power steering) (EPS)
5	Body Domain Controller (BDC)
6	Vertical Dynamics Platform (VDP)
7	Advanced Crash Safety Module (ACSM)
8	Optional equipment system (SAS)

The FlexRay overview includes all engine versions and optional equipment. The terminating resistors for line termination are located in the control units and in the Body Domain Controller.

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

2.2.5. Ethernet

The G01 features the two-wire OABR Ethernet (OPEN Alliance BroadR-Reach) which is familiar from the G12.

The Ethernet variant with 5 lines (4 data lines and 1 activation line) is still used on the G01 by the OBD2 interface to the Body Domain Controller.

Use of the two-wire OABR Ethernet on the G01

The following control units are connected to the vehicle electrical system via two-wire OABR Ethernet in the G01:

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

The following control units are additionally connected via two-wire OABR Ethernet in the G01:

- Head unit
- 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

2. Bus Systems

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 CAN (Controller Area Network) 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)
- Optional equipment system (SAS)
- Top Rear Side View Camera (TRSVC).

An Ethernet switch (ENS) is used on the G01 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 without navigation, the data transfer takes place from the Headunit Basic to the instrument cluster via Ethernet.

On vehicles with Navigation, the data is transferred from the Headunit 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.

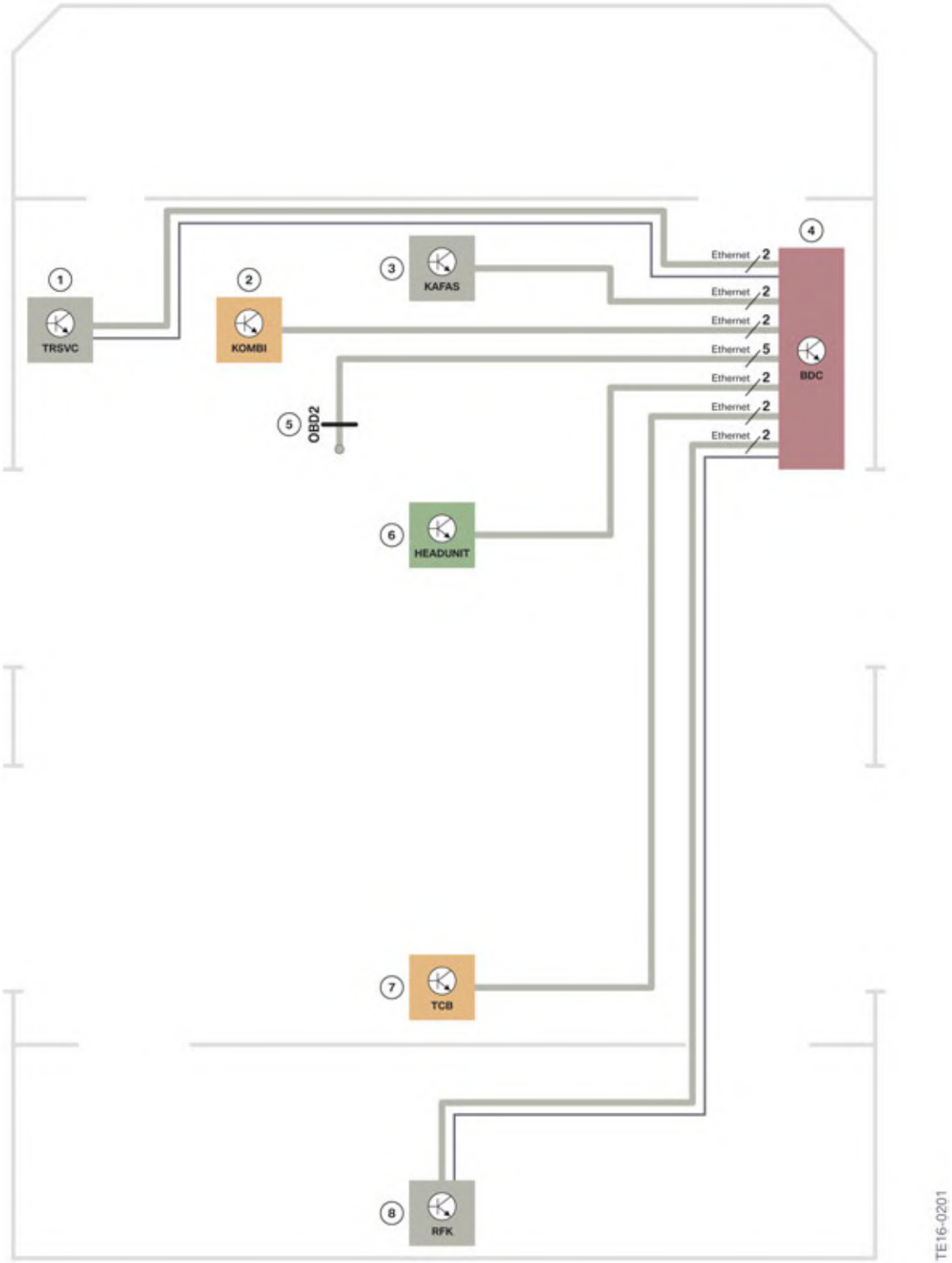
The different versions of the Ethernet topology of the G01 are listed below:

Ethernet topology without Ethernet switch on vehicles with Headunit Basic

The wiring diagram shows the connection of the top rear side view camera (TRSVC) control unit and rear view camera (RFK). In the vehicle, either TRSVC is installed for a vehicle with multiple cameras, or RFK for a vehicle with a rear view camera (standalone).

G01 Voltage Supply and Bus Systems

2. Bus Systems



Ethernet topology without Ethernet switch

Index	Explanation
1	Top Rear Side View Camera (TRSVC)
2	Instrument cluster (KOMBI)
3	Camera-based driver support systems (KAFAS)
4	Body Domain Controller (BDC)
5	OBD2 interface (Ethernet with 5 lines)
6	Headunit (HEADUNIT)
7	Telematic Communication Box (TCB)
8	Rear view camera (RFK)

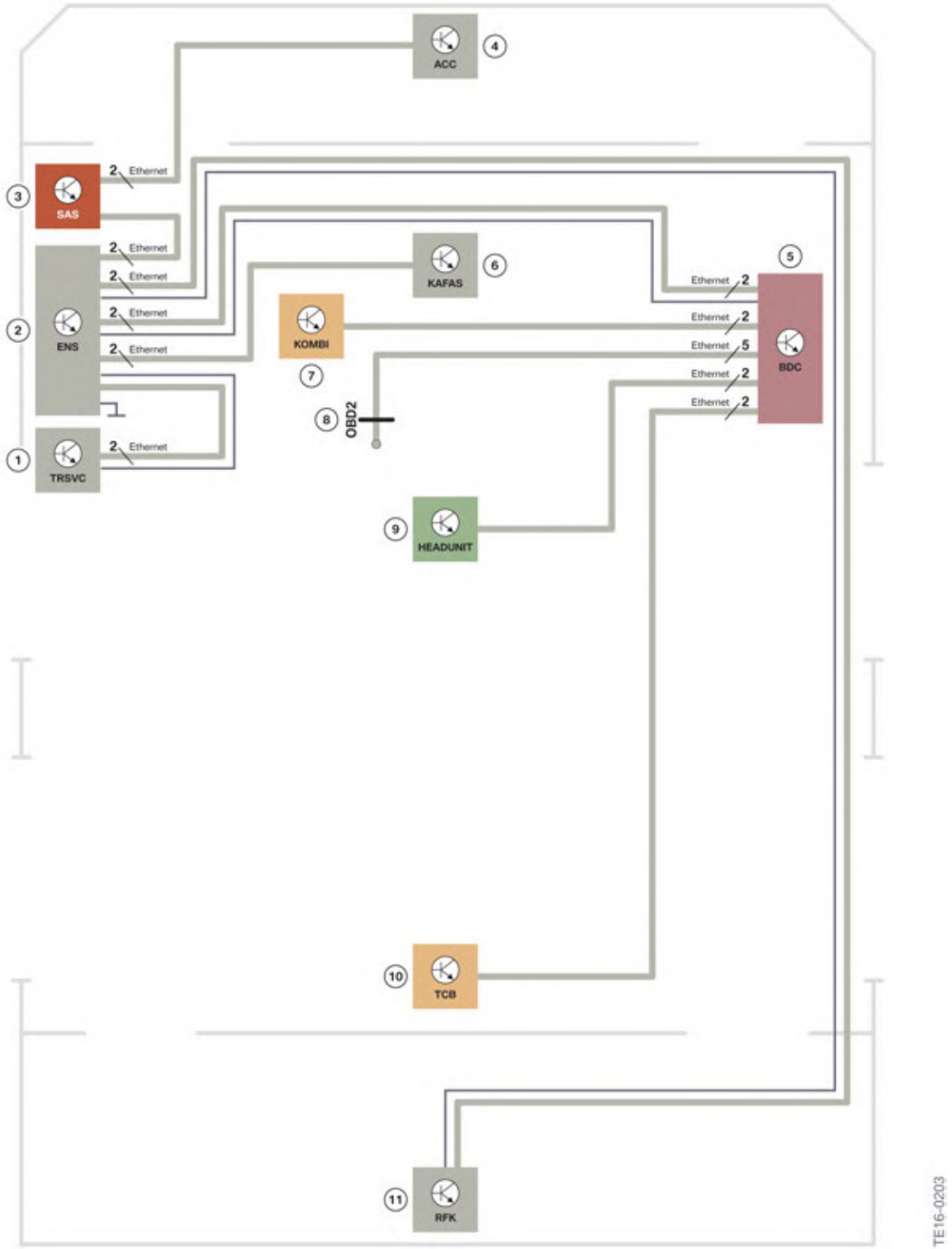
On vehicles without navigation, the data transfer takes place from the Headunit Basic to the instrument cluster via Ethernet.

Ethernet topology with Ethernet switch on vehicles with Headunit Basic

The wiring diagram shows the connection of the top rear side view camera (TRSVC) control unit and rear view camera (RFK). In the vehicle, either TRSVC is installed for a vehicle with multiple cameras, or RFK for a vehicle with a rear view camera (standalone).

G01 Voltage Supply and Bus Systems

2. Bus Systems



Ethernet topology with Ethernet switch

Index	Explanation
1	Top Rear Side View Camera (TRSVC)
2	Ethernet switch (ENS)
3	Optional equipment system (SAS)
4	Active Cruise Control (ACC)
5	Body Domain Controller (BDC)
6	Camera-based driver support systems (KAFAS)
7	Instrument cluster (KOMBI)
8	OBD2 interface (Ethernet with 5 lines)
9	Headunit (HEADUNIT)
10	Telematic Communication Box (TCB)
11	Rear view camera (RFK)

On vehicles without navigation, the data transfer takes place from the Headunit Basic to the instrument cluster via Ethernet.

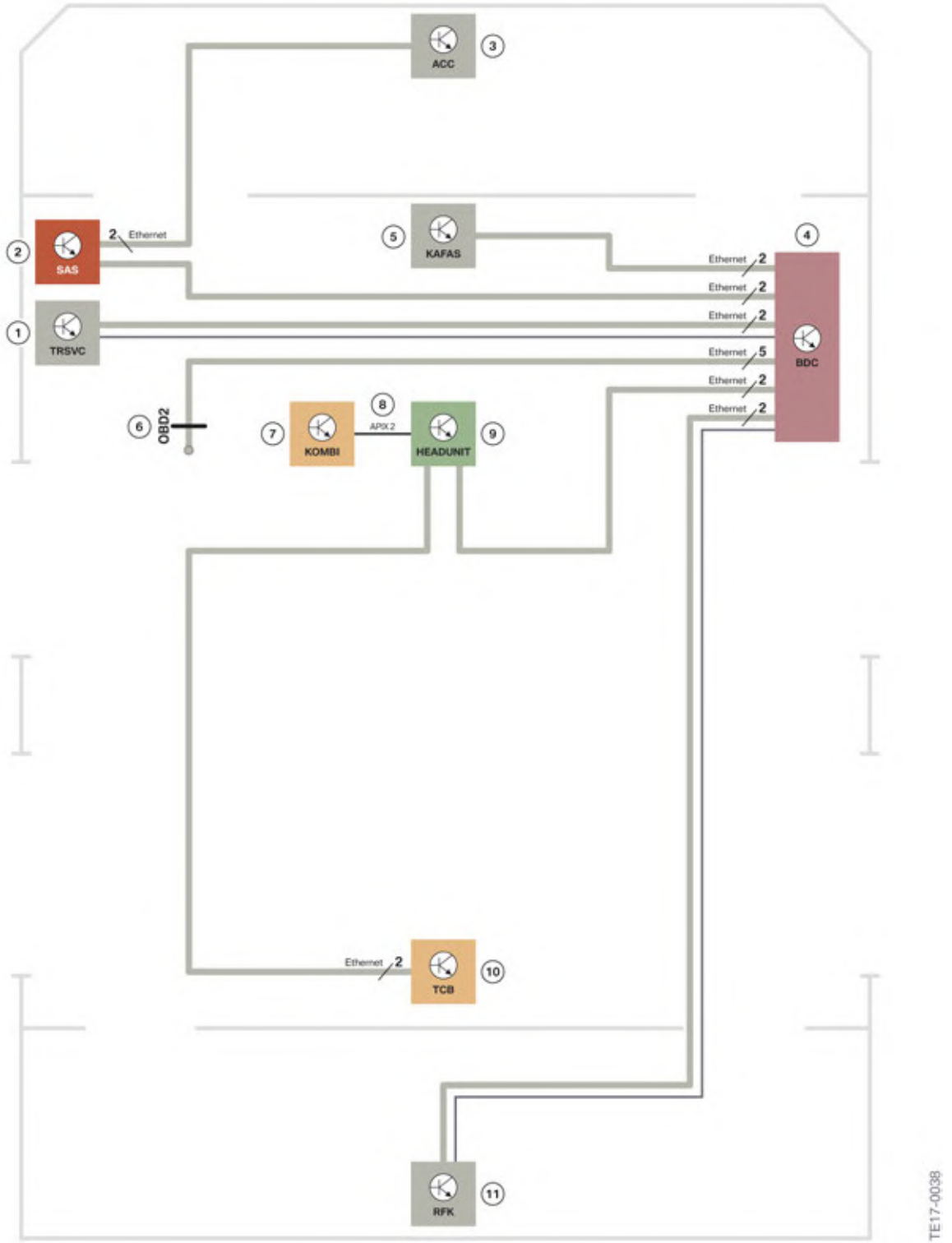
Ethernet topology on vehicles with Headunit High

The wiring diagram shows the connection of the top rear side view camera (TRSVC) control unit and rear view camera (RFK). In the vehicle, either TRSVC is installed for a vehicle with multiple cameras, or RFK for a vehicle with a rear view camera (standalone).

On vehicles with the Headunit High, the Telematic Communication Box (TCB) is directly connected to the headunit. The data is transferred from the Headunit High to the instrument cluster 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.

G01 Voltage Supply and Bus Systems

2. Bus Systems



Ethernet topology on vehicles with Headunit High

Index	Explanation
1	Top Rear Side View Camera (TRSVC)
2	Optional equipment system (SAS)
3	Active Cruise Control (ACC)
4	Body Domain Controller (BDC)
5	Camera-based driver support systems (KAFAS)
6	OBD2 interface (Ethernet with 5 lines)
7	Instrument cluster (KOMBI)
8	APIX data line
9	Headunit (HEADUNIT)
10	Telematic Communication Box (TCB)
11	Rear view camera (RFK)

On vehicles with Navigation, the data is transferred from the Headunit High to the instrument cluster via APIX.

Ethernet switch

Ethernet switch

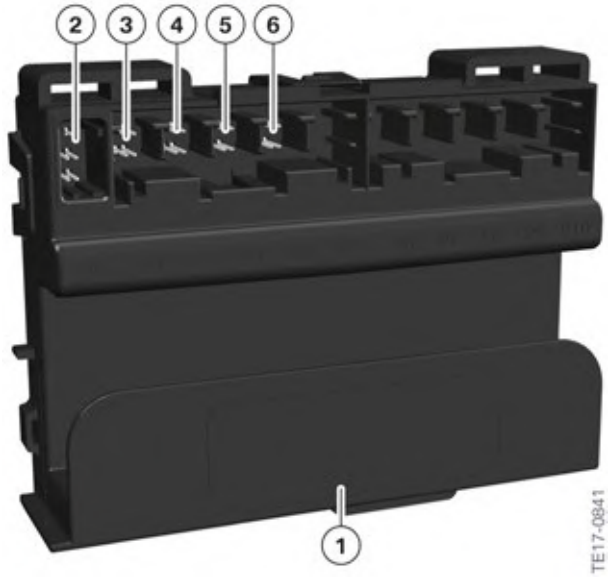
The Ethernet switch is required for expansion of the Ethernet network. It connects the control units and forwards their data packages accordingly.

The Ethernet switch is displayed as a control unit in the bus overview by the diagnosis system ISTA.

G01 Voltage Supply and Bus Systems

2. Bus Systems

Connections on the Ethernet switch



Ethernet switch connections

Index	Explanation
1	Labelling of ports
2	Port 0
3	Port 1
4	Port 2
5	Port 3
6	Port 4

The Ethernet switch has a maximum of 5 ports. The Ethernet cable to the Body Domain Controller (BDC) is connected to port 0. In addition, voltage for the Ethernet switch is supplied to port 0. The other Ethernet control units are connected to ports 1 to 4. The connectors for ports 1 to 4 are identical, so the other Ethernet control units can be connected as required. It does not matter which control unit is connected to which port as this does not affect the function. However, for diagnosis and troubleshooting, it is important to know which control unit is assigned to which port. If the Ethernet switch is exchanged or the Ethernet cables in ports 1 to 4 have been connected in a different order, a port configuration must be carried out with the diagnosis system ISTA.

Without a port configuration, Ethernet errors cannot be detected and errors can therefore not be stored.

2.2.6. D-CAN

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

2.3. Sub-bus systems

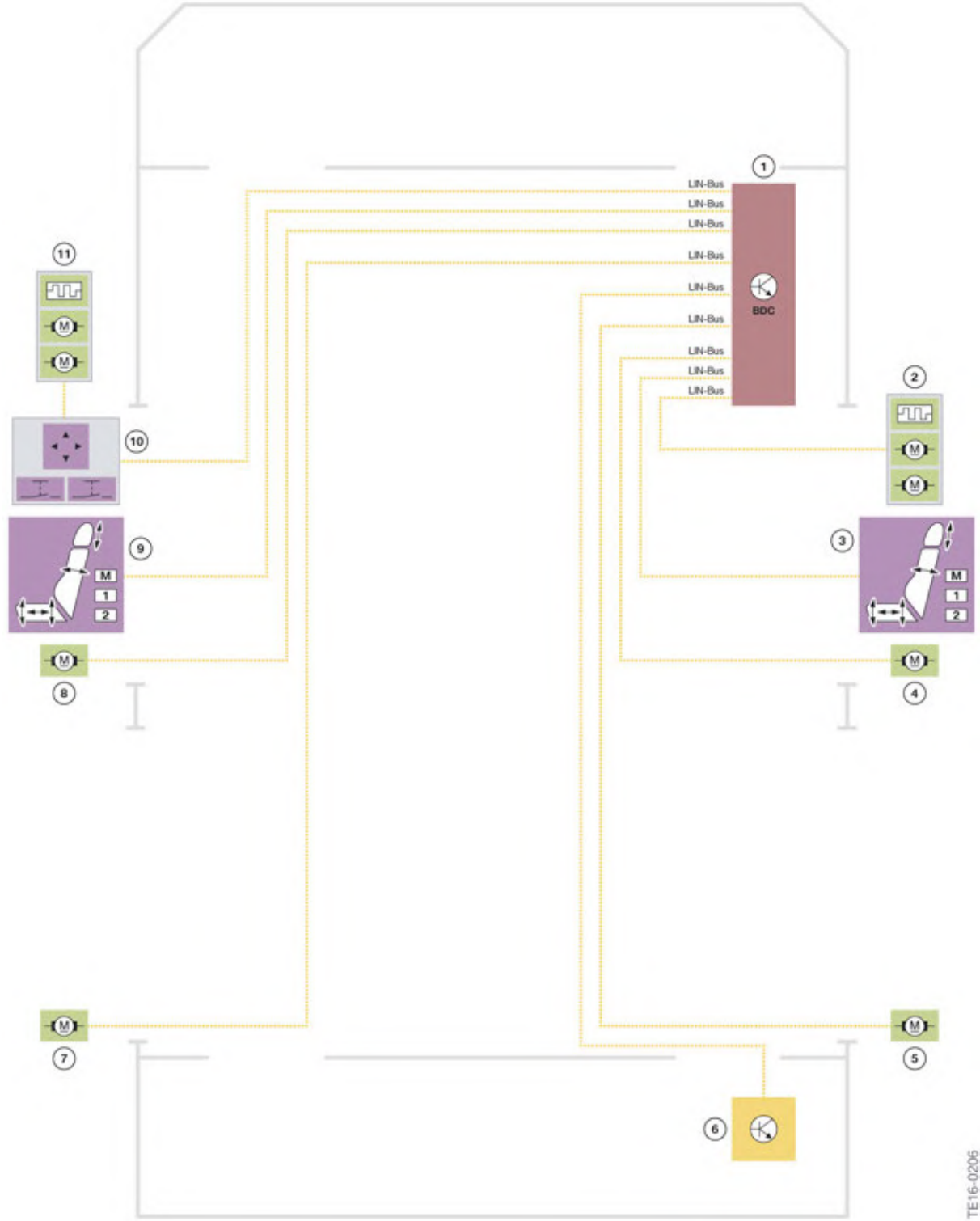
2.3.1. LIN-Bus

For a better overview, the LIN buses are divided up between several wiring diagrams for the G01.

G01 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview in the door area



LIN-Bus

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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	Non-contact tailgate 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

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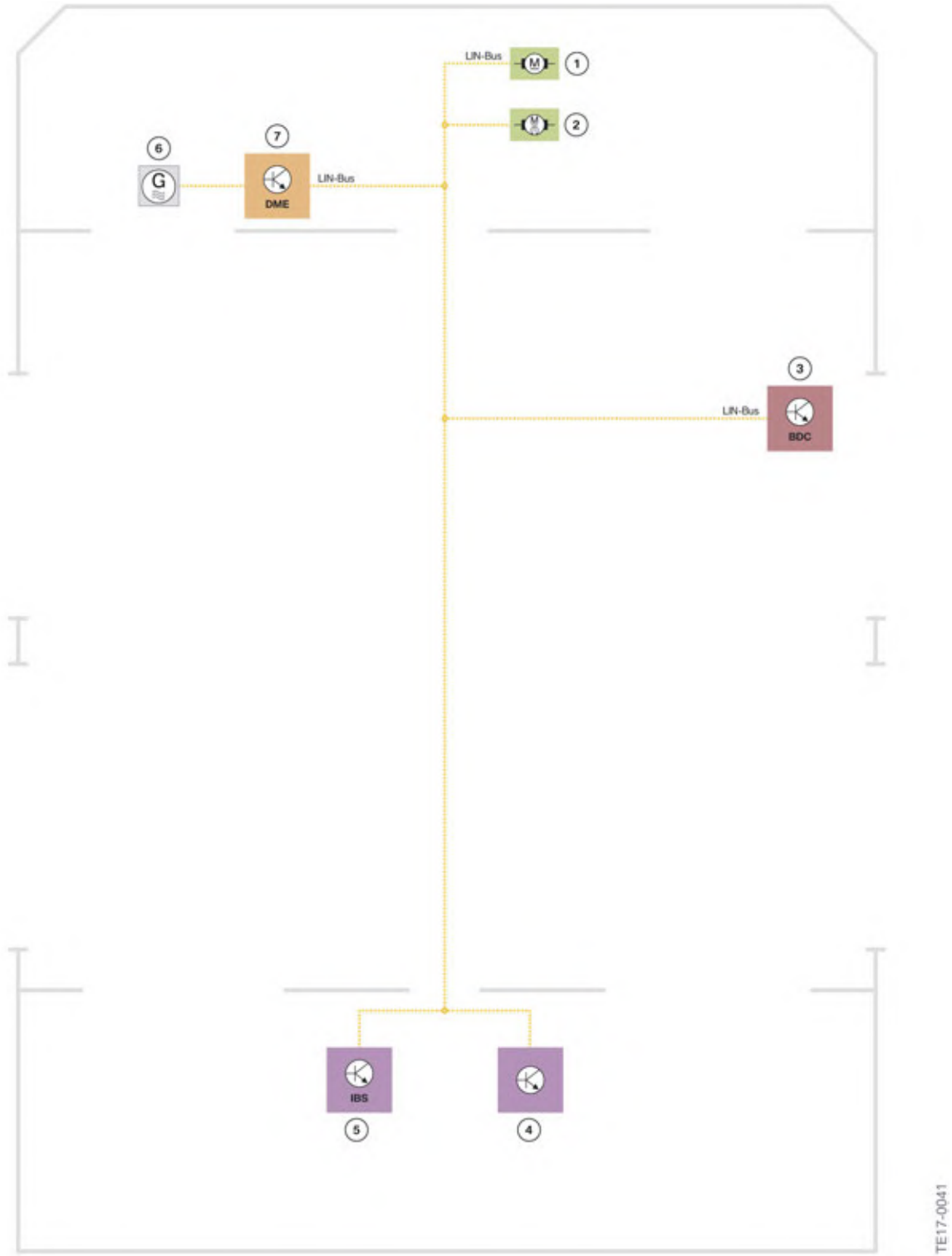
2. Bus Systems

LIN bus overview for engine electrical system and voltage supply



LIN-Bus

2. Bus Systems

Index	Explanation
1	Active kidney grills
2	Electric fan
3	Body Domain Controller (BDC)
4	Rear right power distribution box
5	Intelligent Battery Sensor (IBS)
6	Alternator
7	Digital Motor Electronics (DME)

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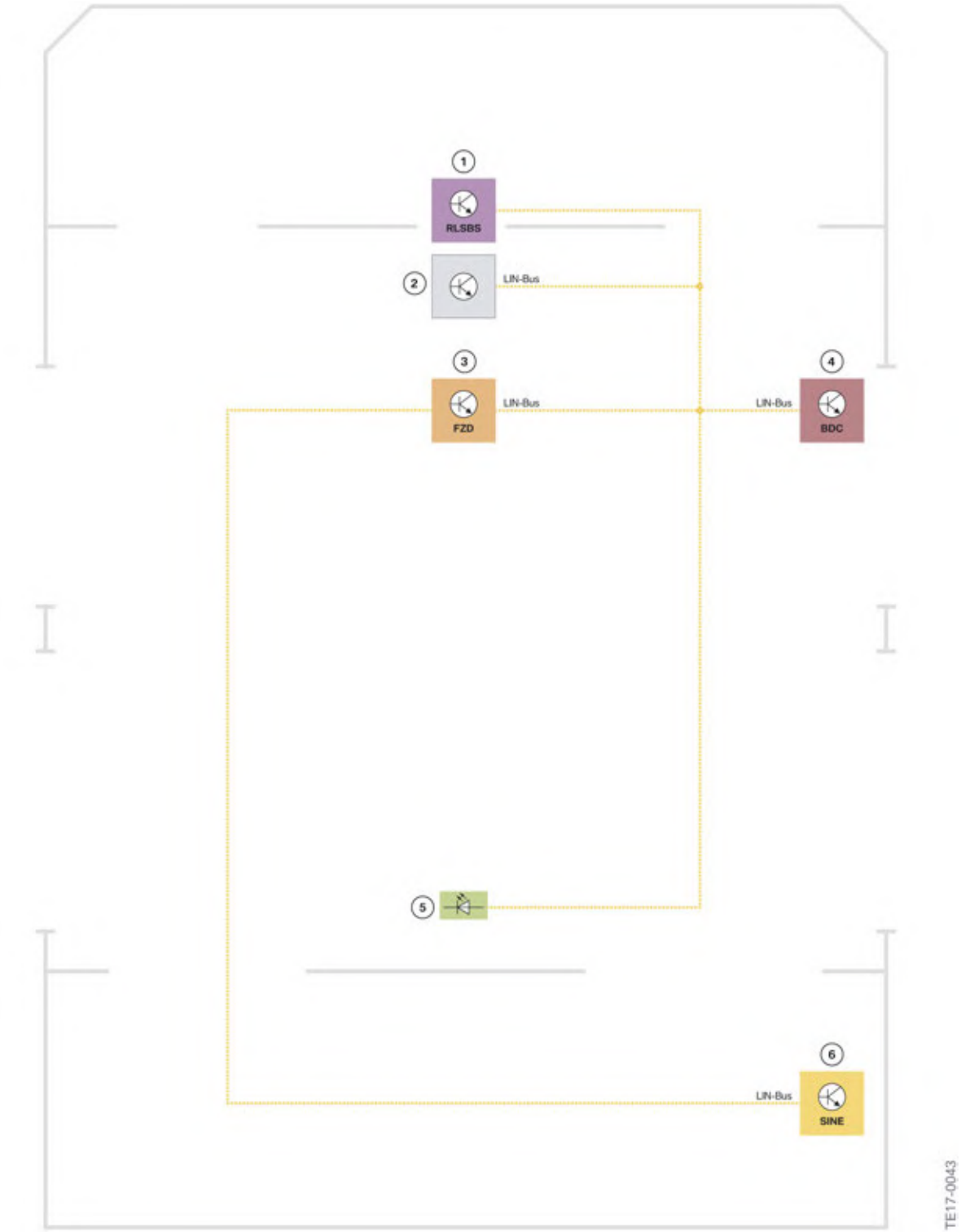
2. Bus Systems

LIN bus overview for roof function center



LIN-Bus

2. Bus Systems

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

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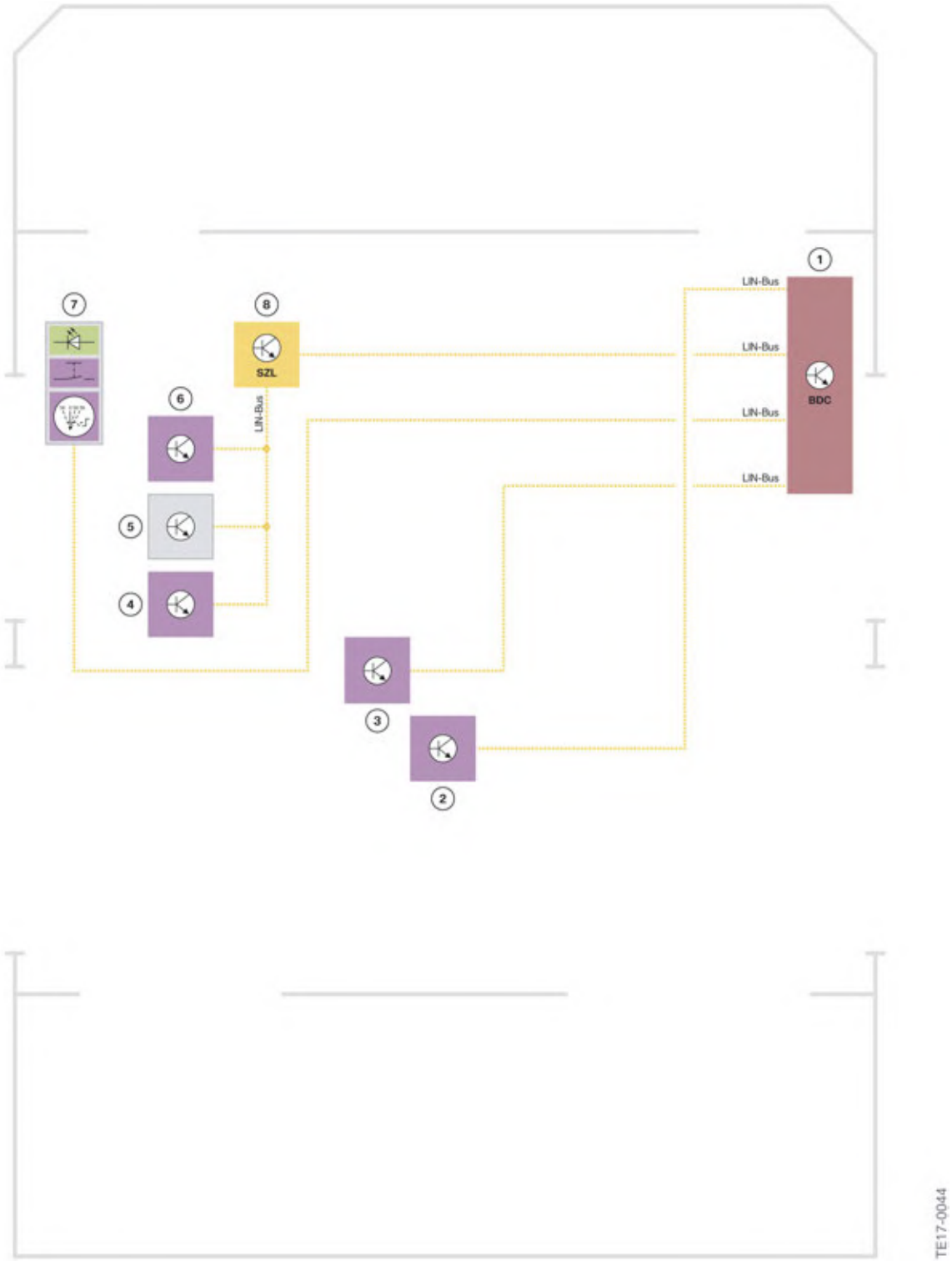
2. Bus Systems

LIN bus overview for steering column switch cluster and operating units



LIN-Bus

G01 Voltage Supply and Bus Systems

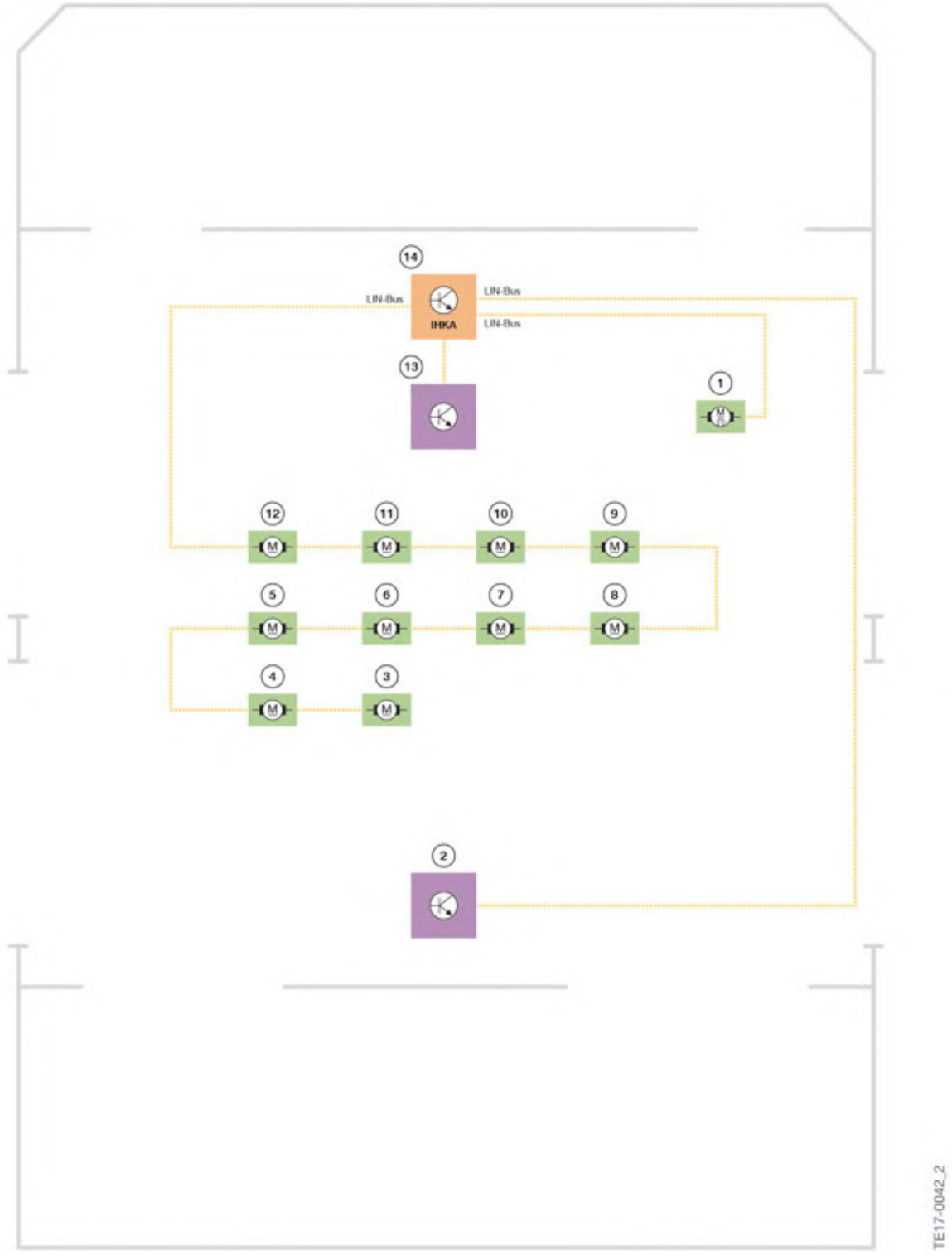
2. Bus Systems

Index	Explanation
1	Body Domain Controller (BDC)
2	Operating unit, center console
3	Audio operating facility
4	HOD touch detection (Hands Off Detection)
5	Steering wheel module
6	Multifunction steering wheel buttons, right
7	Operating unit for light
8	Steering column switch cluster (SZL)

G01 Voltage Supply and Bus Systems

2. Bus Systems

LIN bus overview for integrated automatic heating/air conditioning system



LIN-Bus

Index	Explanation
1	Blower motor
2	Operating unit, rear passenger compartment
3	Stepper motor for air distribution, rear passenger compartment
4	Stepper motor for air distribution, left
5	Stepper motor for stratification, left
6	Stepper motor for mixed air, left
7	Stepper motor for temperature, rear passenger compartment
8	Stepper motor for mixed air, right
9	Stepper motor for stratification, right
10	Stepper motor for air distribution, right
11	Stepper motor for defrost function
12	Stepper motor for fresh air/air recirculation function
13	Operating unit, air conditioning
14	Integrated automatic heating / air conditioning (IHKA)

2.3.2. Local CAN

In the G01 the following Local Controller Area Networks are available with the corresponding equipment:

- Local CAN from the camera-based driver assistance system (KAFAS) to the Parking Manoeuvring 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) to the radar sensor, right (RSR), to the radar sensor, left (RSL), and to the lane change warning (secondary) SWW2.

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 G01 depending on the vehicle equipment:

- USB interface in the center console (standard)
- USB interface in the center armrest

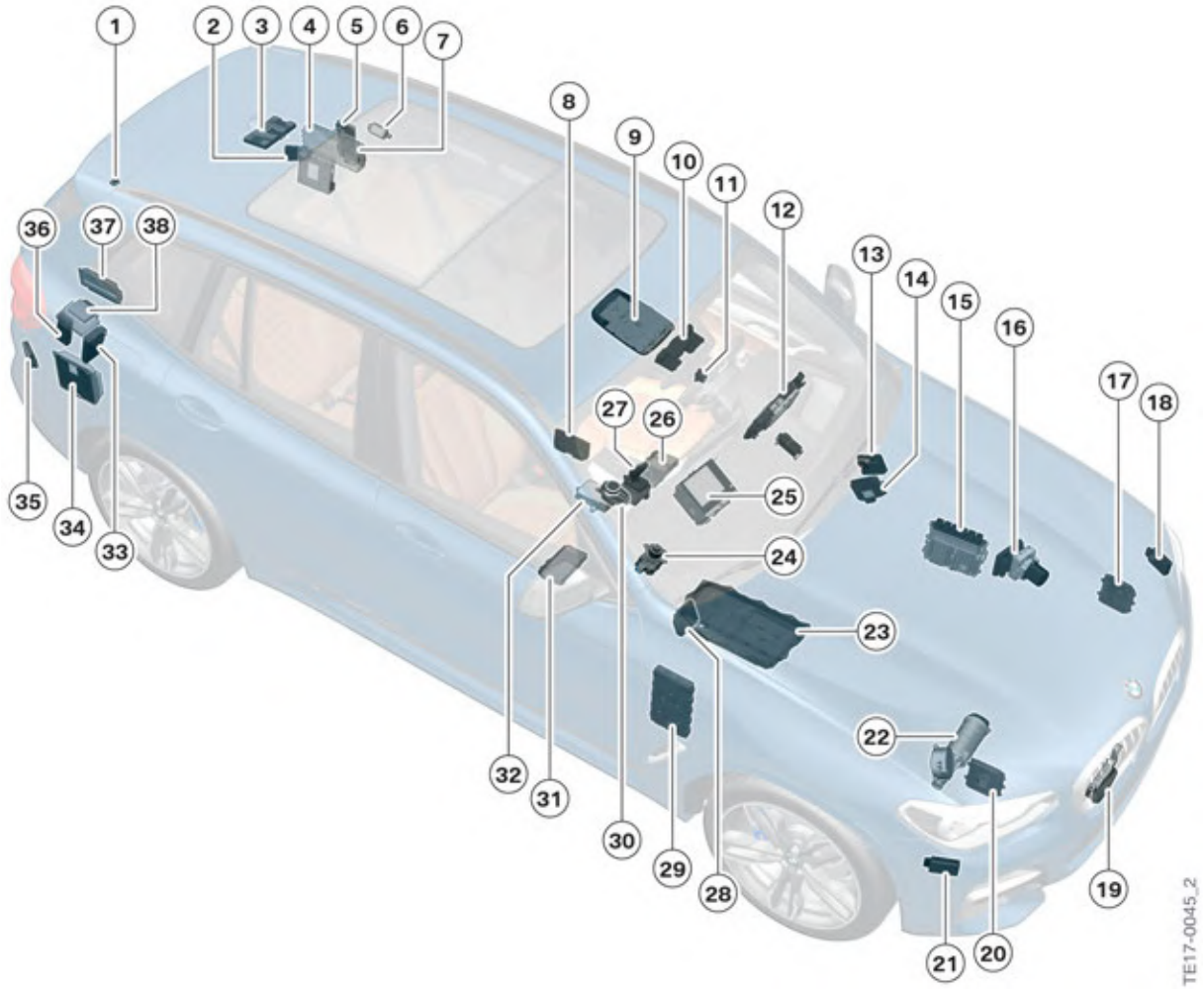
2.4. Diagnosis access OBD2

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.

G01 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	Lane change warning (secondary) (SWW2)
3	Telematic Communication Box (TCB)
4	Top HiFi amplifier (AMPT)
5	Control unit for rear view camera and side view (TRSVC)
6	Remote control receiver (remote control service)
7	Active Sound Design (ASD)
8	Wireless Charging Station (WCA) (Location moved in front of cup holders in center console, not under center arm rest)
9	Roof function center (FZD)

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3. Control Units

Index	Explanation
10	Camera-based driver support systems (KAFAS)
11	High-beam assistant (FLA)
12	Instrument cluster (KOMBI)
13	Ethernet switch (ENS)
14	Optional equipment system (SAS)
15	Digital Motor Electronics (DME)
16	Dynamic Stability Control (DSC)
17	Frontal Light Electronics Right (FLER)
18	Radar Sensor Left (RSL)
19	Active Cruise Control (ACC)
20	Frontal Light Electronics Right (FLER)
21	Radar Sensor Right (RSR)
22	Electronic Power Steering (EPS)
23	Electronic transmission control (EGS)
24	Transfer box (VTG)
25	Headunit
26	Driver's seat module (SMFA)
27	Gear selector switch (GWS)
28	Integrated automatic heating / air conditioning (IHKA)
29	Body Domain Controller (BDC)
30	Controller (CON)
31	Front passenger seat module, (SMBF)
32	Advanced Crash Safety Module (ACSM)
33	Trailer module (AHM)
34	Power Control Unit (PCU)
35	Lane change warning (SWW) (primary)
36	Tailgate function module (HKFM)
37	Vertical Dynamic Platform (VDP)
38	Parking Manoeuvring Assistant (PMA)

G01 Voltage Supply and Bus Systems
3. Control Units

3.2. Gateway

3.2.1. Body Domain Controller (BDC)

Body Domain Controller (BDC)

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
- Tailgate 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
- Wiper motor.

Relay in the BDC

The following relays are located in the BDC:

- Terminal 30F
- Power window regulator
- Central locking system
- Heated rear window
- Wiper motor
- Headlight cleaning system.

Gateway in the BDC

The central gateway module (ZGM) is integrated in the BDC. It is viewed as a control unit within a control unit, in that the ZGM in the BDC. 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

3. Control Units

- Audio operating facility
- Inside mirror
- Rain-light-solar-condensation sensor
- Roof function center (interior lighting)
- Comfort seat, rear passenger compartment, left and right
- Operating unit, center console
- Power distribution box, rear.

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.

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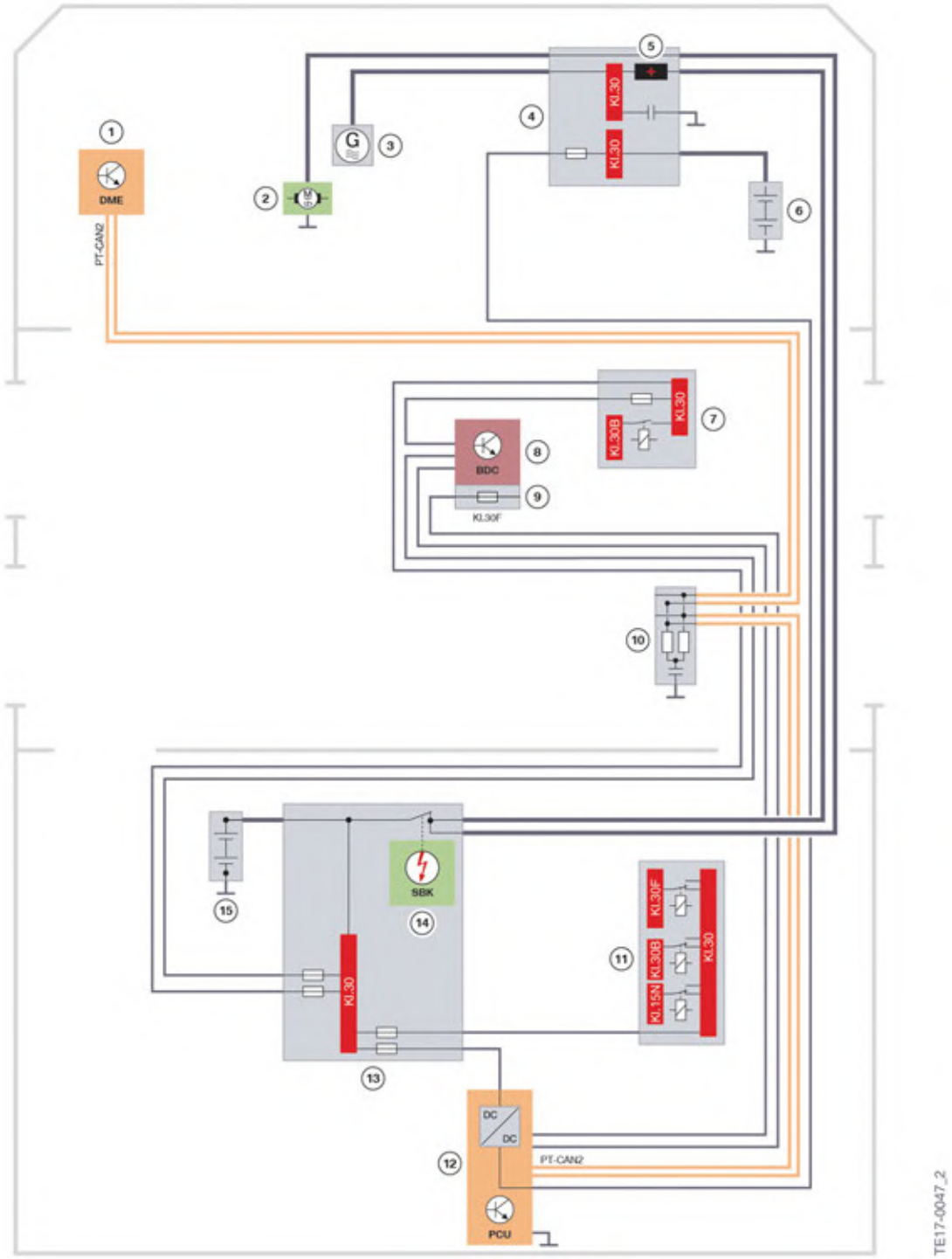
4. Voltage Supply

4.1. Overview of voltage supply

4.1.1. System wiring diagram



Voltage supply

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4. Voltage Supply

Index	Explanation
1	Digital Motor Electronics (DME)
2	Starter motor
3	Alternator
4	Power distribution box, engine compartment
5	Jump start terminal point
6	Auxiliary battery, engine compartment
7	Power distribution box, front right
8	Body Domain Controller (BDC)
9	Fuse in the Body Domain Controller
10	CAN terminator
11	Power distribution box, rear
12	Power Control Unit (PCU) 500 W
13	Battery power distribution box
14	Safety battery terminal
15	Battery

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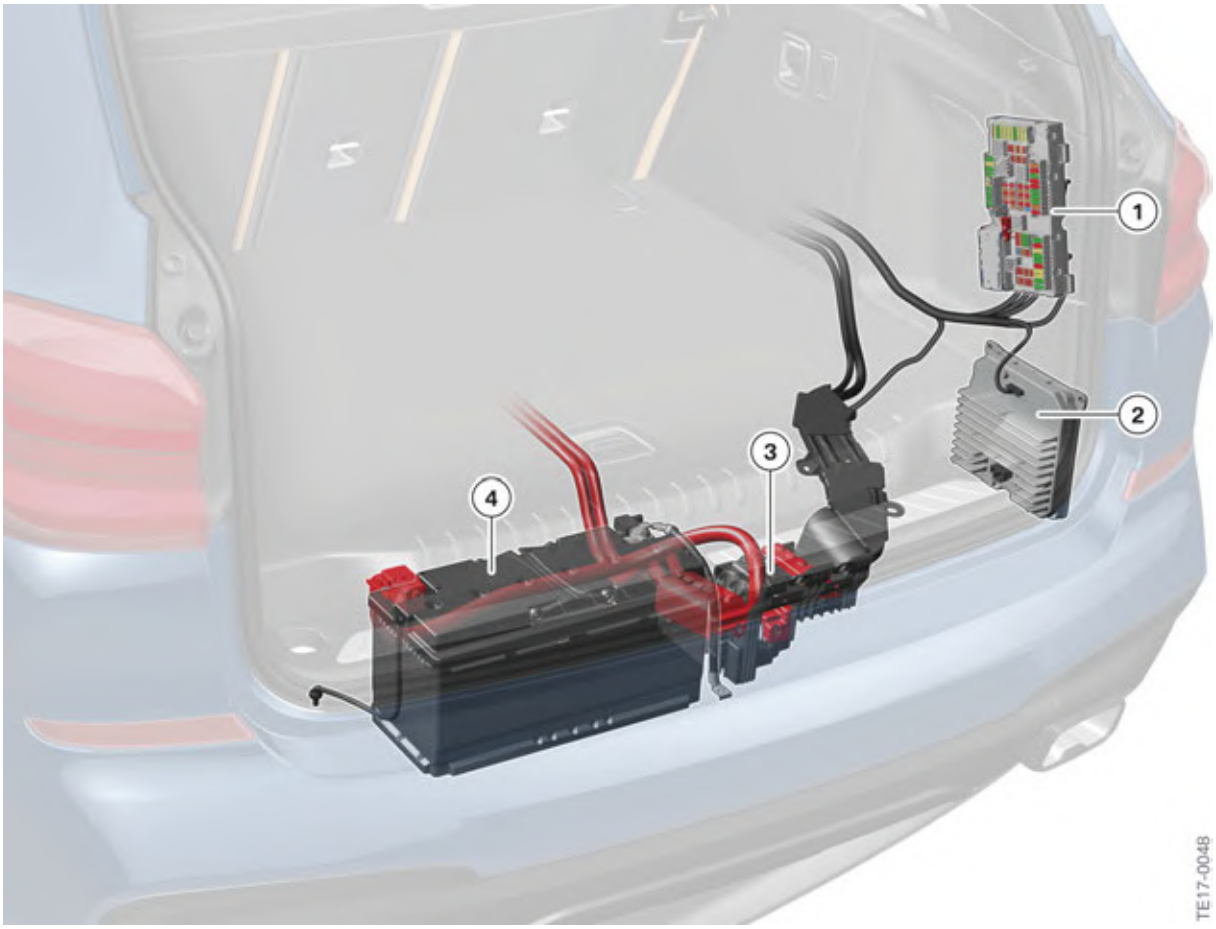
4. Voltage Supply

4.2. Components

4.2.1. Overview of luggage compartment

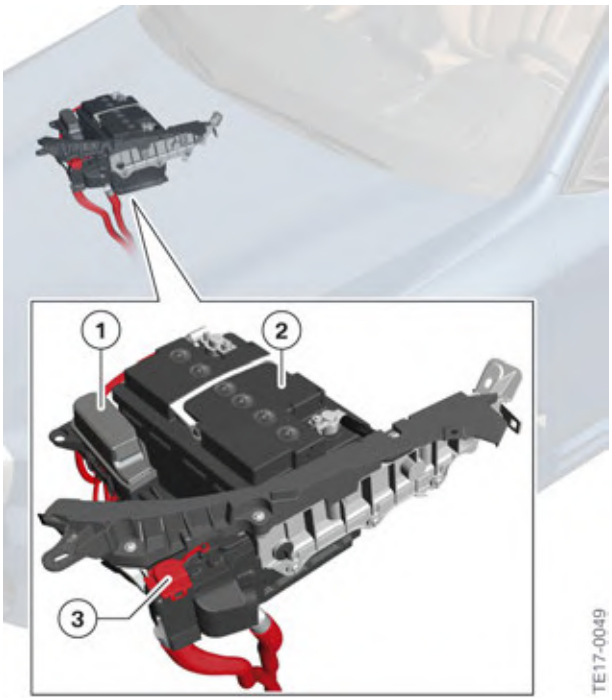


Battery

Index	Explanation
1	Power distribution box, rear
2	Power Control Unit (PCU) 500 W
3	Power distribution box with safety battery terminal
4	Battery

The vehicle battery in the G01 is an AGM battery with 90 Ah.

4.2.2. Overview of engine compartment



Auxiliary battery, engine compartment

Index	Explanation
1	Power distribution box, engine compartment
2	Auxiliary battery, engine compartment
3	Jump start terminal point

The auxiliary battery in the engine compartment of the G01 is an AGM battery with 50 Ah.

4.2.3. Battery

AGM batteries are used for the voltage supply in the G01.

There may be 1 or 2 batteries in the vehicle depending on the engine version and vehicle equipment.

- Starter battery in the luggage compartment with 90 Ah
- Auxiliary battery in the engine compartment with 50 Ah.

An auxiliary battery in the engine compartment is used to provide assistance for the vehicle electrical system.

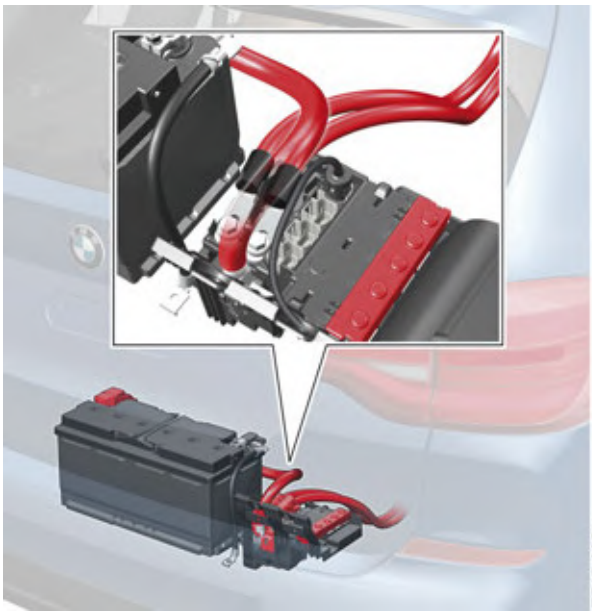
4.2.4. Intelligent battery sensor

The IBS records the following data of the 12 V battery:

- Voltage
- Current
- Pole temperature

The IBS performs the calculation and the evaluation of the information. The results are then forwarded to the DME and BDC via LIN bus .

4.2.5. Safety battery terminal



Safety battery terminal

The safety battery terminal (SBK) is activated in the event of an accident of corresponding severity. The voltage supply to the positive battery connection point in the engine compartment is interrupted and the consumers connected to this are de-energized. The safety battery terminal is installed in the power distribution box next to the battery.

4.2.6. Alternator

An alternator with increased efficiency is used in the G01. The increase in alternator efficiency is achieved by reducing the losses in the rectifier. The loss-causing diodes are replaced by actively activated MOSFET transistors. A reduction in fuel consumption is achieved by increasing the efficiency.

Different alternators are used depending on the engine type and vehicle equipment.

4.2.7. Integrated supply module

Integrated supply module

The engine control and its components are supplied with a 12 V voltage via the integrated supply module.

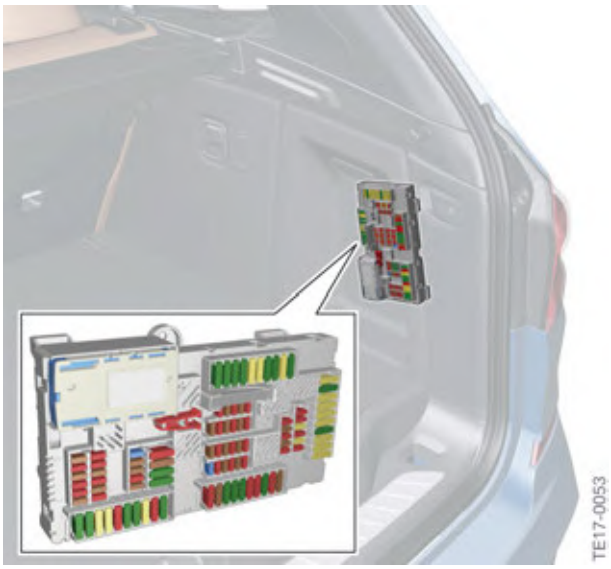
4.2.8. Power distribution box, front right

Power distribution box, front right

A relay for terminal 30B is installed in the front right power distribution box.

Consumers are supplied with terminal 30 and terminal 30B and provided with corresponding fuse protection by the front right power distribution box.

4.2.9. Power distribution box, rear



Power distribution box, rear

The following relays are installed in the rear power distribution box:

- 2 Relay, terminal 30F
- 2 Relay, terminal 30B
- Relay, terminal 15N
- Relay for rear window heating.

All relays are bi-stable relays. The relays are activated by the Body Domain Controller via LIN. The terminal 30B relay in the front right power distribution box is activated by the rear power distribution box.

4.2.10. Body Domain Controller

The Body Domain Controller (BDC) is responsible for the terminal control.

A terminal 30F relay is installed in the BDC.

A number of consumers are supplied with terminal 30 and terminal 30F and provided with corresponding fuse protection via the BDC.

4.2.11. PCU with vehicle electrical system assistance measure

BMW vehicles have a high energy consumption due to the many electrical consumers. 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 vehicle battery, a DC/DC converter is installed in the Power Control Unit (PCU) and an auxiliary battery in the engine compartment in the G01.

G01 Voltage Supply and Bus Systems

4. Voltage Supply

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 engine start-stop function, the energy is supplied from the auxiliary battery into the conventional vehicle electrical system.

The Power Control Unit (PCU) contains a control unit which is connected to the PT-CAN2 and the DC/DC converter with a power of 500 W.

G01 Voltage Supply and Bus Systems

5. Terminal Control

5.1. Introduction

The terminal control in the G01 is identical to the terminal control of the G12. In the G01, the vehicle is always in the right condition from the point of view of the customer. The terminals are controlled via a customer-oriented condition management. The terminal control is dependent on the driving conditions.

5.2. Vehicle conditions

The G01 vehicle may be in the following conditions:

- Parking
- Residing
- Driving

The different vehicle functions are possible depending on the relevant conditions.

Parking

- Customer not in the vehicle
- Vehicle secured or not used for a certain time
- Vehicle functions cannot be operated.

Residing

- Customer in the vehicle
- No driving readiness
- Functions that are relevant when the vehicle is stationary can be operated.

Driving

- Customer in the vehicle
- Driving readiness established
- All functions are available.

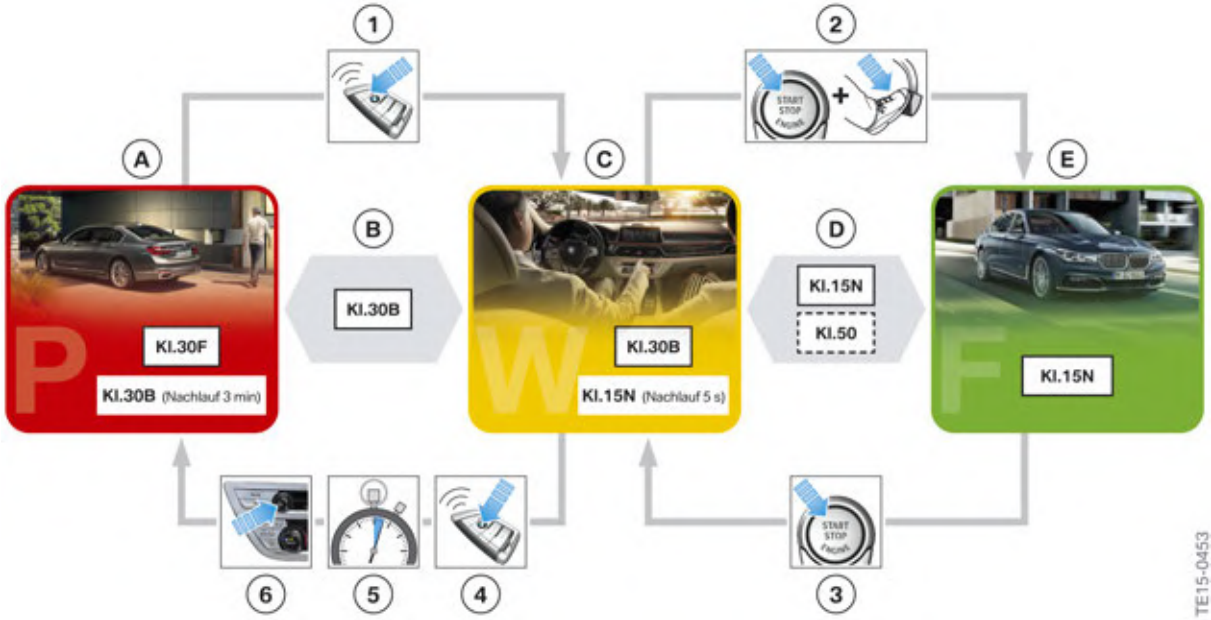
The driving conditions are changed by condition management, taking into account the customer behavior. Additional information is also evaluated that may help to determine the vehicle condition, e.g.:

- Door opening
- Door closing
- Operations in the vehicle.

G01 Voltage Supply and Bus Systems

5. Terminal Control

The following diagram shows the changes between the vehicle conditions.



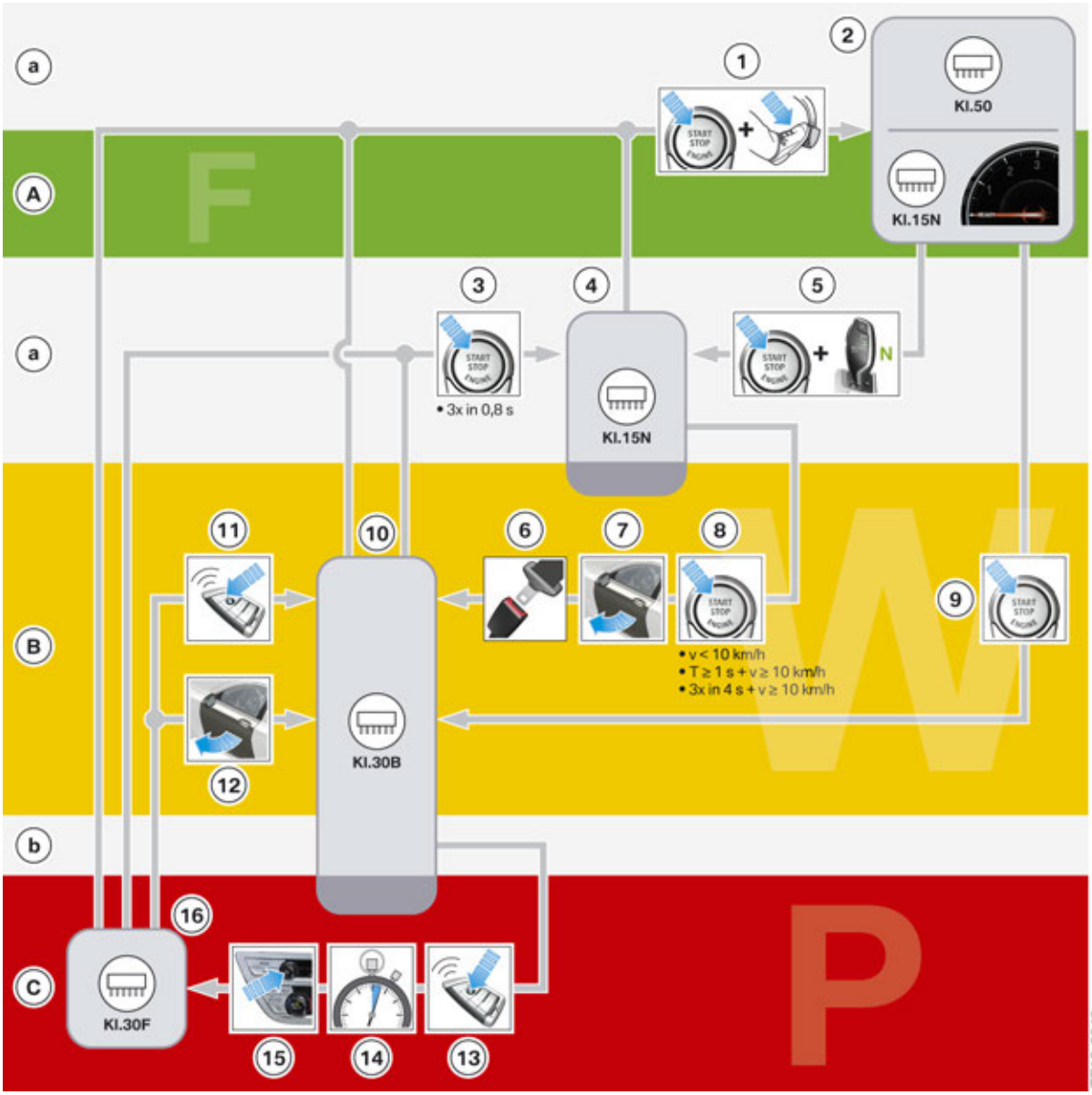
Vehicle conditions

Index	Explanation
A	Vehicle condition PARKING
B	Transitional condition with stationary functions
C	Vehicle condition RESIDING
D	Transitional condition for establishing driving readiness, ending driving readiness or Testing/Analysis/Diagnosis
E	Vehicle condition DRIVING
1	Unlock vehicle
2	Operation of start/stop button + brake pedal
3	Press START-STOP button
4	Locks vehicle
5	No activity of a vehicle user detected for 10 min
6	Extended press

G01 Voltage Supply and Bus Systems

5. Terminal Control

Detailed overview of vehicle conditions.



Overview of vehicle conditions

Index	Explanation
A	Vehicle condition DRIVING
B	Vehicle condition RESIDING
C	Vehicle condition PARKING
a	Transitional condition for ESTABLISHING/ENDING DRIVING READINESS, CHECK/ANALYSIS/DIAGNOSIS
b	Transitional condition with STATIONARY FUNCTIONS

G01 Voltage Supply and Bus Systems

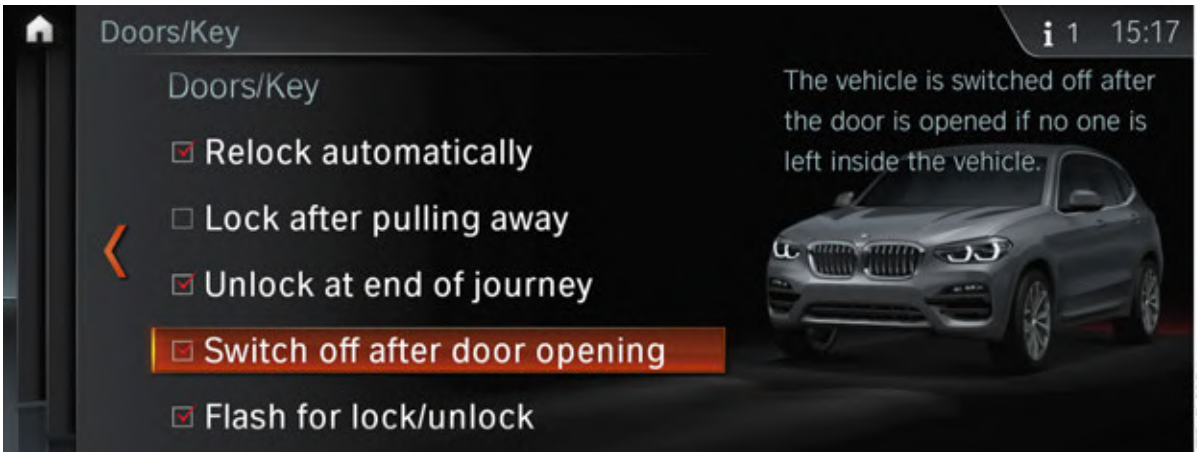
5. Terminal Control

Index	Explanation
1	Operation of start/stop button + brake pedal + valid remote control or valid ID transmitter in the vehicle interior
2	Driving readiness established, terminal 15N (terminal 50)
3	Operation of start/stop button (three times within 0,8 s) + valid remote control or valid ID transmitter in the vehicle interior
4	Terminal 15N
5	Operation of start/stop button + selector lever in Neutral
6	Undoing driver's seat belt (v < 0.1 km/h, driver's door opened, selector lever not in Neutral, brake not pressed, low beam off, no OBD communication, no diagnosis mode, no assembly mode)
7	Door contact change (v < 0.1 km/h, driver's seat belt undone, selector lever not in Neutral, brake not pressed, low beam off, no OBD communication, no diagnosis mode, no assembly mode)
8	Press start/stop button + vehicle is stationary or press start/stop button for at least 1 s + driving speed ≥ 10 km/h (6 mph) or press start/stop button at least three times within 4 s + driving speed ≥ 10 km/h (6 mph)
9	Press START-STOP button
10	Terminal 30B
11	Unlock vehicle
12	Residing interaction or stationary function interaction
13	Locks vehicle
14	No customer interaction for ten minutes
15	Extended press of headunit media button
16	Terminal 30F

G01 Voltage Supply and Bus Systems

5. Terminal Control

Automatic switch-off



Automatic switch-off

Switch off after door opening:

In the menu "Doors/Keys", an immediate change from the vehicle condition RESIDING to the vehicle condition PARKING can be activated.

If this option is activated, then the system will immediately change to the vehicle condition PARKING when the driver's door is opened. The elimination of the after-running period in the residing vehicle condition saves energy.

5.3. Power supply terminals

Control units in the vehicle must be supplied with power only when they are needed. The following terminals are used in the G01:

- Terminal 15N
- Terminal 30B
- Terminal 30F
- Terminal 30

Terminal 15N supplies control units which are needed only when driving and which may be needed to safely end a journey. After-run of 5 s starts at the transition from DRIVING to RESIDING.

Terminal 30B is used to supply control units that are needed in the stationary mode RESIDING and for stationary functions where the customer is not in the vehicle. An after-run of 6 minutes starts at the transition from RESIDING to PARKING, and terminal 30B is then switched off.

Terminal 30F is used to supply control units which must perform functions in PARKING condition. Terminal 30F is normally switched on in PARKING condition, but may be switched off due to faults in the vehicle electrical system. The terminal is switched off with an after-running period of 1 min if a fault is detected.

Terminal 30 control units (e.g. alarm system) are always supplied with voltage and are also not switched off in the event of a fault.

	Terminal 30F	Terminal 30B	Terminal 15N
PARKING, vehicle electrical system not OK (fault in vehicle electrical system)	off	off	off
PARKING, vehicle electrical system OK	on	off	off
Stationary functions (customer not in vehicle)	on	on	off
RESIDING	on	on	off
DRIVING	on	on	on

Testing-analysis-diagnosis (PAD) mode

The vehicle condition testing-analysis-diagnosis is still present for diagnosis. All terminals are switched on in this mode. This ensures that diagnosis can be performed with all control units. This vehicle condition is displayed in the BMW diagnosis system ISTA.

Activation of the PAD mode:

- Operation of the start/stop button (three times within 0.8 s) + valid remote control or valid ID transmitter in the vehicle interior
- By the BMW diagnosis system ISTA.

The PAD mode is exited by pressing the start/stop button or by closing the diagnosis with the diagnosis system ISTA.

5.4. Partial network operation

Today's premium vehicles contain up to 70 control units with well over 100 microcontrollers which are networked with each other. However, depending on the current vehicle condition or the vehicle user requirement, not all convenience and assistance systems may always be needed.

It is possible to save energy, relieve the load on the battery and also prolong the battery life by targeted deactivation and activation on control units which are not needed, so-called selective partial network operation.

In vehicles with combustion engine, the electrical energy consumption is indirectly linked to the fuel consumption via the alternator. As a result, selective deactivation of control units that are not currently needed can contribute to reducing fuel consumption and thus also CO_2 emissions.

5.4.1. Partial network operation when driving

If functions are not used or needed when driving, e.g.:

- Seat adjustment
- Trailer lighting (no trailer attached)

the corresponding control units can be switched off.

5.4.2. Prerequisites for partial network operation

The partial network primary in the Body Domain Controller calculates a partial network status on the basis of the current vehicle condition and the required functions. The control units that are not required are switched off by means of the corresponding bus messages.

5.4.3. Prerequisites of control units for partial network operation

Different transceivers are used in order to realize partial network operation in control units. These transceivers are able to evaluate and interpret messages. This control unit remains switched off as long as any bus communication takes place without a valid wake-up event for the corresponding control unit being present. If a valid wake-up event for the corresponding control unit is sent on the bus, the transceiver can activate the voltage regulator of the microcontroller and the control unit starts up. The control unit is switched off by deactivation of the voltage regulator.

5.4.4. Partial network operation when the vehicle is stationary and the engine is switched off

For example, if only the radio function is required when the engine is switched off, the bus systems which are not required are switched off. If an operation is then carried out with the controller, for example, the buses are woken up again. Once the operation has been carried out, the bus systems which are not required are switched off again. Switching off the bus systems which are not required along with the corresponding control units saves energy. The reduced energy consumption means, for example, that it is possible to play the radio for significantly longer before it is switched off due to the battery being too drained.

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