

Technical training.
Product information.

G30 Passive Safety Systems



BMW Service

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General information

Symbols used

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



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

Information status and national-market versions

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

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

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G30 Passive Safety Systems

1. Introduction

1.1. The hidden protector

The passive safety system of the G30 is based on the objectives and characteristics of current BMW models. The passive safety system fulfils all legislative requirements worldwide.

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

The 5th generation Advanced Crash Safety Module (ACSM) is used as the central airbag control unit for the passive safety system in the G30. With the passive safety system of the G30, the central sensor system is integrated in the ACSM control unit, which is installed in the center of vehicle.

The ACSM of the G30 is a bus user in the FlexRay. This allows the sensor data of the central sensor system to be transferred to the Dynamic Stability Control (DSC).

G30 Passive Safety Systems

2. System Overview

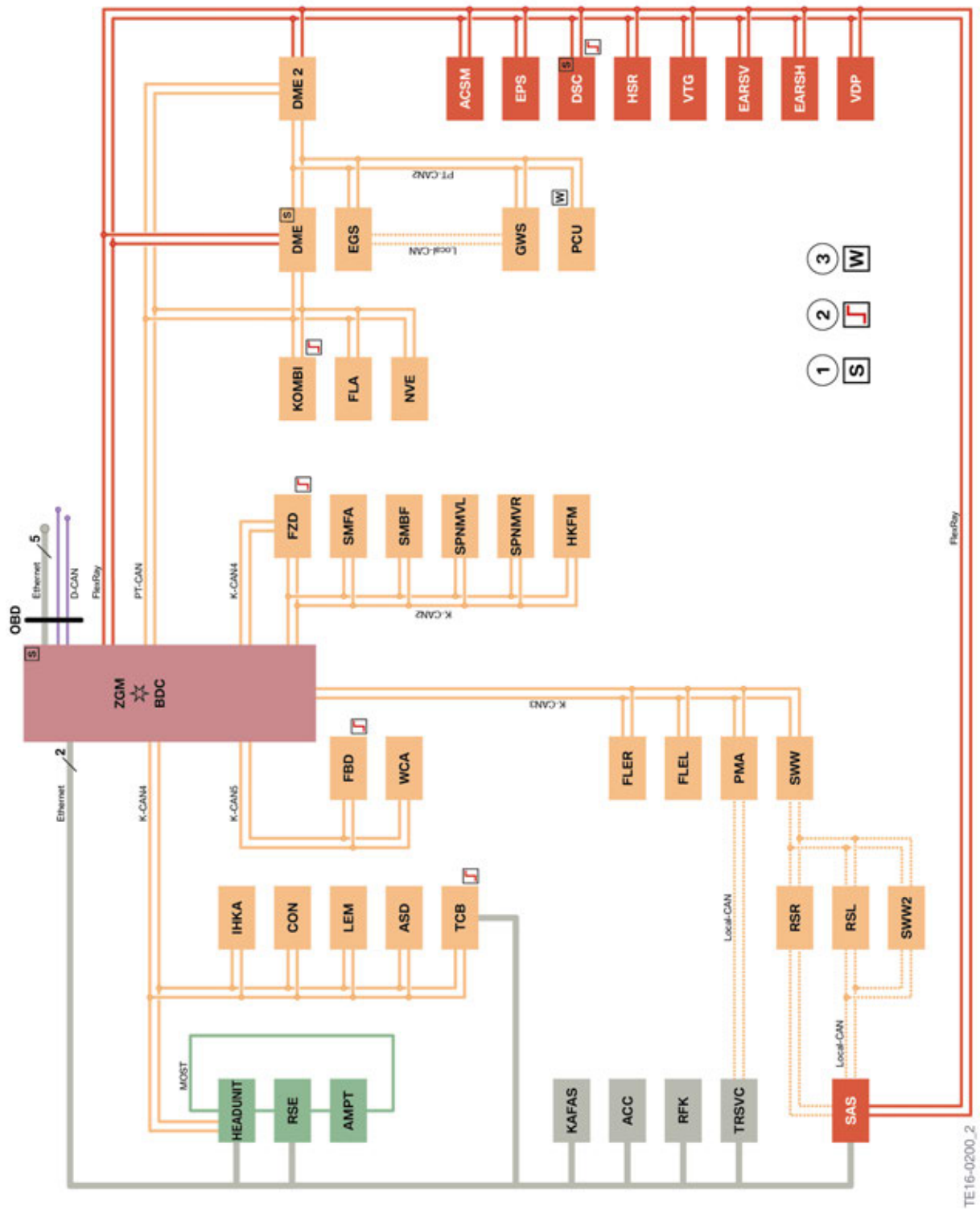
The following bus overview shows an overview of the G30 vehicle electrical system structure and the incorporation of the Advanced Crash Safety Module (ACSM) in the FlexRay.

2.1. System wiring diagrams

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2. System Overview

2.1.1. Bus overview



G30 Bus overview

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2. System Overview

Index	Explanation
ACC	Active Cruise Control
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 Engine 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
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
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 Manoeuvring Assistant
RFK	Reversing camera
RSE	Rear Seat Entertainment
RSL	Radar sensor, left (avoidance assistant)
RSR	Radar sensor, right (avoidance assistant)
SAS	Optional equipment system
SMBF	Seat module, passenger
SMFA	Seat module, driver

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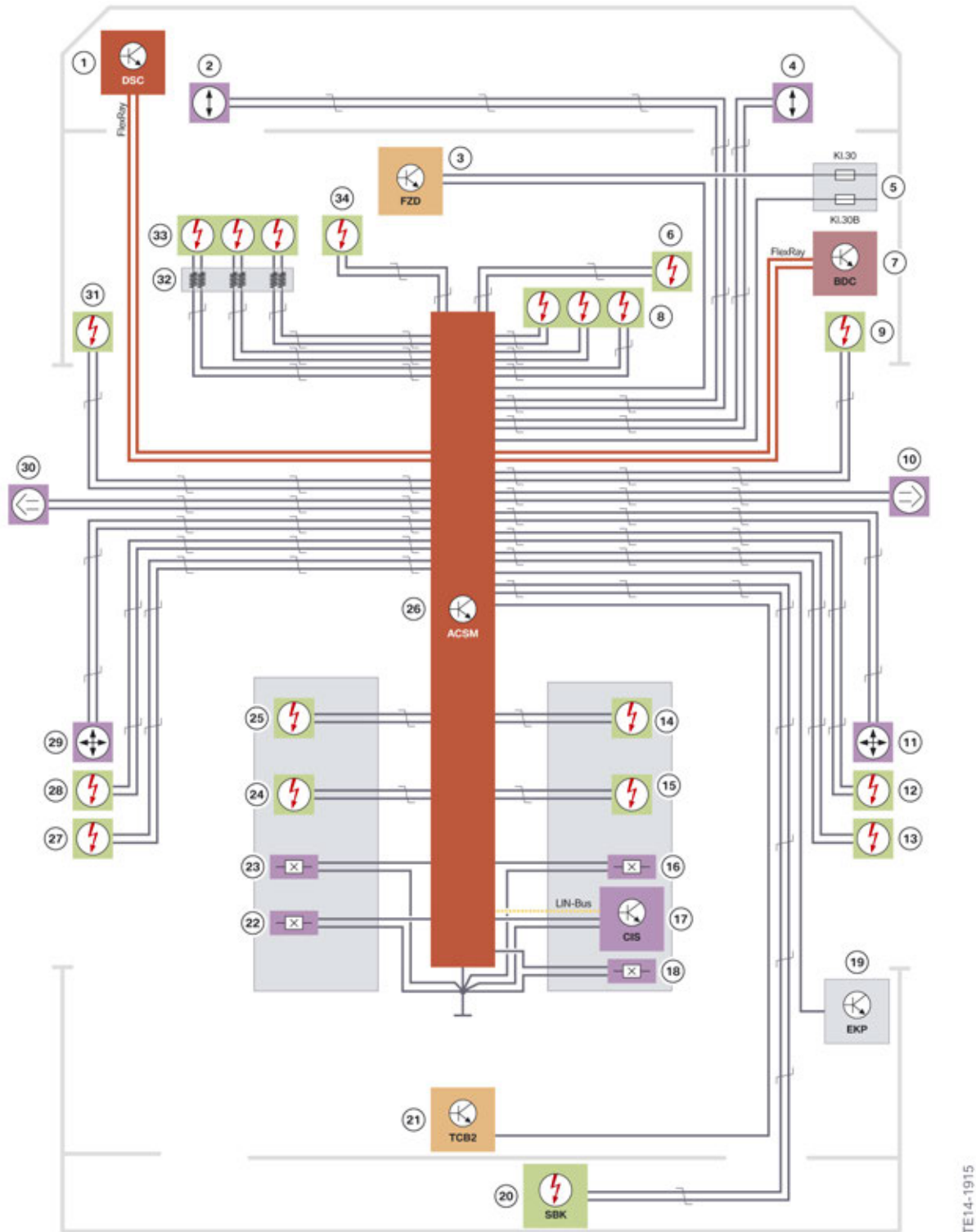
2. System Overview

Index	Explanation
SPMVL	Seat pneumatics module front left
SPMVR	Seat pneumatics module front right
SWW	Lane change warning (primary) also know as Short Range Radar (SRR)
SWW2	Lane change warning (secondary) also know as Short Range Radar (SRR2)
TCB	Telematic Communication Box
TR SVC	Control unit for rear view camera and SideView
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 authorisation
3	Control units also connected at terminal 15WUP

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2. System Overview

2.1.2. System wiring diagram



G30 System wiring diagram

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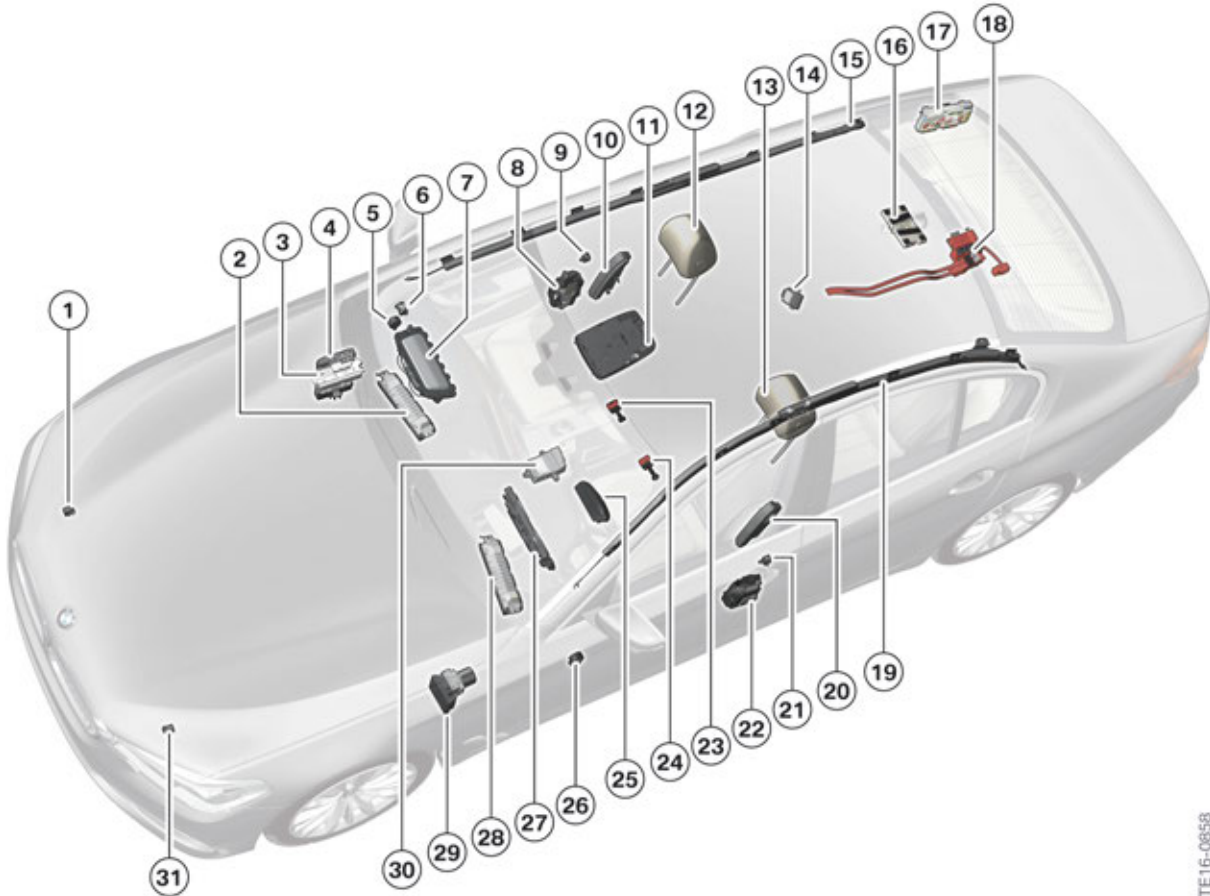
2. System Overview

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Airbag front sensor, left
3	Roof function center (FZD)
4	Airbag front sensor, right
5	Fuses in power distribution box, front right
6	Knee airbag, front passenger
7	Body Domain Controller (BDC)
8	Front passenger airbag
9	Head airbag, right
10	Airbag sensor, door, right (pressure)
11	Acceleration sensor, B-pillar on right
12	Adaptive belt force limiter, passenger's side
13	Reel pretensioner, front passenger
14	Crash-active headrest, front passenger
15	Side airbag, front passenger
16	Seat-position sensor, front right
17	Seat occupancy mat (CIS mat)
18	Seat belt buckle switch, front passenger
19	Electronic fuel pump control
20	Safety battery terminal (SBK)
21	Telematic Communication Box 2 (TCB2)
22	Seat belt buckle switch, driver
23	Seat-position sensor, front left
24	Side airbag, driver's side
25	Crash-active headrest, driver
26	Advanced Crash Safety Module (ACSM)
27	Reel pretensioner, driver
28	Adaptive belt force limiter, driver's side
29	Acceleration sensor, B-pillar on left
30	Airbag sensor, door, left (pressure)
31	Head airbag, left
32	Clock spring
33	Driver's airbag
34	Knee airbag, driver

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2. System Overview

2.2. System overview



G30 System overview

TE16-0658

Index	Explanation
1	Airbag front sensor, right
2	Knee airbag, front passenger
3	Power distribution box, front right
4	Body Domain Controller (BDC)
5	Switch for front passenger airbag deactivation (European version; Korean version)
6	Airbag sensor, door, right (pressure)
7	Front passenger airbag
8	Automatic tensioner, front passenger
9	Acceleration sensor, B-pillar on right
10	Side airbag, front passenger
11	Roof function center (FZD)
12	Crash-active headrest, front passenger

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2. System Overview

Index	Explanation
13	Crash-active headrest, driver
14	Electronic fuel pump control
15	Head airbag, left
16	Telematic Communication Box 2 (TCB2)
17	Power distribution box, luggage compartment
18	Safety battery terminal (SBK)
19	Head airbag, right
20	Side airbag, driver's side
21	Acceleration sensor, B-pillar on left
22	Automatic tensioner, driver
23	Seat belt buckle switch, front passenger
24	Seat belt buckle switch, driver
25	Driver's airbag
26	Airbag sensor, door, left (pressure)
27	Instrument cluster (KOMBI)
28	Knee airbag, driver
29	Dynamic Stability Control (DSC)
30	Advanced Crash Safety Module (ACSM)
31	Airbag front sensor, left

G30 Passive Safety Systems

3. Functions

3.1. Functions of the Advanced Crash Safety Module

The function of the Advanced Crash Safety Module is to permanently evaluate all sensor signals in order to identify a crash situation. Based on the sensor signals and their evaluation, the Advanced Crash Safety Module (ACSM) identifies the direction of the crash and the severity of the impact.

The Advanced Crash Safety Module (ACSM) evaluates the sensor information and then initiates the relevant measures for selective activation of the necessary restraint systems.

At the same time the Advanced Crash Safety Module (ACSM) monitors the system itself and indicates when it is ready for operation by switching off the airbag indicator light.

If an error occurs during operation this is stored in a fault memory. The fault memory can be read out for diagnosis purposes.

If a crash situation is detected, a crash message is sent to the other bus users in the data bus network as notification. The relevant control units respond to this signal by executing their own activities according to the severity of the crash.

The activities include:

- Opening the central locking system
- Activating the hazard warning flasher
- Switching on the interior light
- Switching off the fuel pump control electronics
- Making an emergency call

An additional function of the Advanced Crash Safety Module is the acoustic seat belt warning that reminds the driver using visual and acoustic signals to fasten his seat belt. Seat belt buckle switches are used to identify whether the driver and the front passenger have their seat belts fastened. On motor vehicles in European version, the seat belt buckles in the rear passenger compartment are also monitored. In addition, for vehicles, the position of the driver's and the front passenger seat is monitored.

The functions of the Advanced Crash Safety Module generally belong to one of the following areas:

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

G30 Passive Safety Systems

3. Functions

3.2. Crash-relevant functions

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

- Evaluating the sensor signals
- Impact detection
- Determining actuators to be activated
- Specifying the trigger time and trigger sequence
- Activation of the ignition circuit output stages
- Sending the crash message to all bus users
- Crash documentation
- Emergency call function

3.2.1. Evaluating the sensor signals

The sensors serve to identify and verify front-end, side-on and rear-end crashes and also as roll-over detection.

The sensors are located in the Advanced Crash Safety Module (ACSM) or are directly connected to the Advanced Crash Safety Module, where their signals are evaluated and processed.

3.2.2. Impact detection

The G30 is equipped with the following sensors:

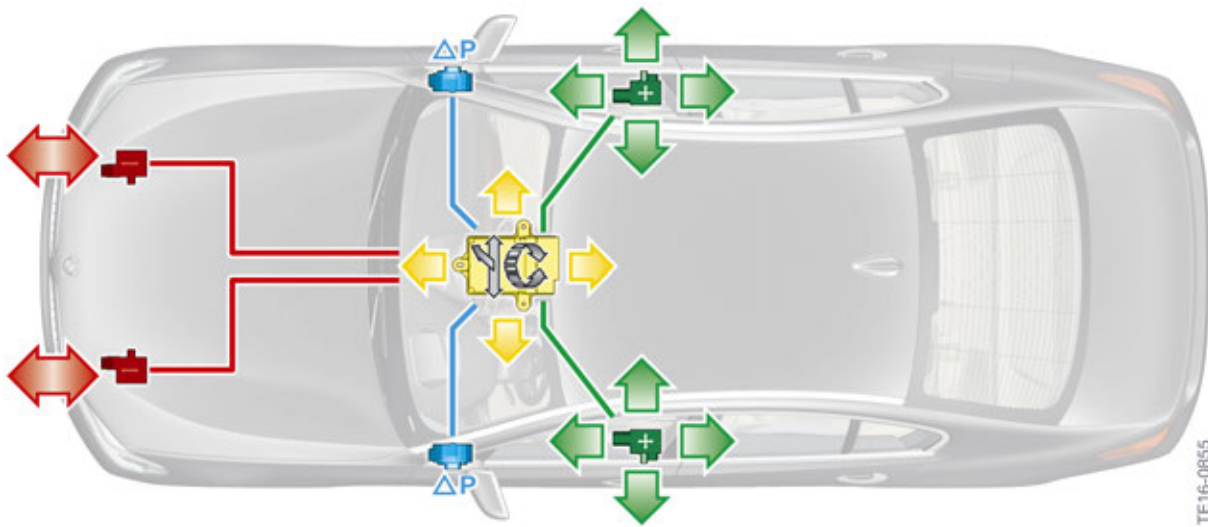
- One lateral and one longitudinal acceleration sensor in the B-pillars (green)
- One airbag sensor to monitor the pressure in each of the front doors (blue)
- One lateral and one longitudinal acceleration sensor in the ACSM (yellow)
- One roll rate sensor in the ACSM (yellow)
- One vertical acceleration sensor in the ACSM (yellow)
- One airbag front sensor each on the engine supports (red)

The airbag sensors in the doors assist with the identification of a side-on crash.

The airbag front sensors assist with the identification of a head-on crash and its corresponding severity.

G30 Passive Safety Systems

3. Functions



G30 Sensors

3.2.3. Trigger time and trigger sequence

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

In the event of a head-on crash, for example, the correspondingly high acceleration values from the longitudinal acceleration sensors in the rear doors and Advanced Crash Safety Module (ACSM) respectively must be detected. An algorithm determines the severity and direction of the crash based on the accelerations. This information is used to assist calculation of the activation times and sequence in which the restraint systems are activated.

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

3.2.4. Activation of the ignition circuit output stages

The Advanced Crash Safety Module is supplied by the power distribution box on the rear right using terminal 30B. The Advanced Crash Safety Module (ACSM) is in offline mode with terminal 30B. This means that it is active on the data bus and can perform all diagnostic functions.

Activation of the ignition circuits is blocked and is available as of the "Driving" driving condition once the system self-test is complete.

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

The ignition circuit output stages consist of a high-side and a low-side power switch. The high-side power switch connects the ignition voltage, while the low-side power switch connects to the ground. The ignition circuit output stages are controlled by a microcontroller.

The high-side and low-side power switches also serve to check the ignition circuits during the system self-test.

G30 Passive Safety Systems

3. Functions

3.2.5. Sending the crash message

In the event of a collision involving activation of the restraint systems, the Advanced Crash Safety Module (ACSM) sends a crash signal to the bus users in the data bus network.

The Telematic Communication Box 2 (TCB2) is actuated in parallel via a direct single-wire connection.

The TCB2 serves as a data modem in the vehicle. The emergency GSM antenna is integrated in the TCB2. This can be used to establish a telephone connection via the connected vehicle microphone even if the vehicle has rolled over. A built-in SIM card inside the control unit makes these emergency calls possible.

As a result, the respective control units perform the following functions depending on the crash severity:

Function	Control unit
Switch off electric fuel pump	Digital Motor Electronics (DME) via electronic fuel pump control module (EKPS)
Release central locking system	Body Domain Controller (BDC)
Switch on hazard warning flashers	Body Domain Controller (BDC)
Switch on interior light	Body Domain Controller (BDC)
Transmit emergency call	Telematic Communication Box 2 (TCB2)

3.2.6. Crash documentation

In the event of a collision where one or more actuators are activated, a crash entry is stored in a non-erasable memory. After 5 crash entries, a non-erasable fault memory entry is stored together with the information that the 5 crash signals have been saved. The airbag indicator light also lights up continuously.



The 5 crash entries are also able to be stored during the course of an accident. Each crash entry is assigned a system time. The control unit remains ignitable even after 5 crash entries. The crash entries cannot be erased and serve the purpose of subsequent device diagnosis. A maximum of 5 crash entries can be saved. The control unit must then be replaced.

G30 Passive Safety Systems

3. Functions

3.2.7. Emergency call function

The emergency call functions are country-specific and are available to customers in countries with ConnectedDrive Services infrastructure. An emergency call requires an active SIM card in the Telematic Communication Box 2 (TCB2) and an available mobile phone network.

The emergency call button is connected directly with the TCB2.

The manual emergency call allows the driver to request assistance in the event of a medical emergency.

The next chapters provide detailed information on which functions the G30 receives with the standard equipment BMW Assist eCall.

3.2.8. BMW Assist eCall

The standard equipment BMW Assist eCall always includes the option of a manual or automatic emergency call (voice call **and** data transmission). A voice contact is initiated and data, such as the current position, is transmitted. The emergency call is made to a BMW Call center or an emergency coordination center, depending on the national-market version.

In the event of an accident with corresponding crash severity, the Advanced Crash Safety Module (ACSM) sends a message to the TCB2. The TCB2 initiates an emergency call.

With this automatic emergency call, the presumed number of people in the vehicle and sensor data, among other things, are transmitted to the BMW Call center, in order to identify the severity of the crash.

The information about the accident available at the call center can be forwarded to the emergency coordination center. The emergency coordination center can then initiate appropriate measures.

Attempts are made at the same time to establish a voice contact with the occupants of the vehicle in order to obtain more detailed verbal information about the accident (e.g. condition of occupants).

The following tables provides information on which functions are available in the case of an emergency call with BMW Assist eCall:

Equipment	Manual emergency call	Automatic emergency call
BMW Online with BMW Assist eCall	<ul style="list-style-type: none">• Voice call (BMW Call center)• Data transfer (location)	<ul style="list-style-type: none">• Voice call (BMW Call center)• Data transfer (location)• Sensor data transmission

If, for various reasons, a connection to the BMW Call center cannot be established, the emergency call is automatically forwarded to the emergency coordination center.

The Intelligent Emergency Call can be ordered subsequently via the ConnectedDrive Store, if the vehicle already has the ConnectedDrive Services (OE 6AK) and the TCB2.

G30 Passive Safety Systems

3. Functions

3.3. System monitoring functions

The Advanced Crash Safety Module has the following system monitoring functions:

- System self-test (pre-drive check)
- Display of system operability
- Cyclic monitoring
- Fault display and fault storage
- Output of faults (diagnosis)
- Acoustic and visual seat belt warning
- Deactivation of the front passenger airbag and side airbag and knee airbag on the passenger's side and the knee airbag

3.3.1. System self test

The Advanced Crash Safety Module (ACSM) performs a system self-test after a terminal change has been made as of the "DRIVING" driving condition. The airbag indicator light is activated for roughly 5 seconds during the system self test.

Once the system self test is complete and no faults have been identified, the airbag indicator light goes out and the system is ready to operate.

3.3.2. Display of system operability

The airbag indicator light in the instrument panel goes out to indicate that the Advanced Crash Safety Module is ready for operation.

3.3.3. Cyclic monitoring

Once the system self-test has been successfully concluded and the system is ready for operation, a cyclic monitoring procedure is performed for fault monitoring purposes. This cyclical monitoring serves the internal diagnosis of the control unit and overall airbag system. Cyclical monitoring takes place continuously as of the "RESIDING" driving condition. It is only performed completely after a terminal change has been made as of the "DRIVING" driving condition.

3.3.4. Fault display and fault storage

The Advanced Crash Safety Module (ACSM) has a non-volatile fault memory. The airbag indicator light lights up to indicate a fault entry.



If the fault memory contains the entry that the restraint system has been activated, this only means the ignited restraint system is not available for further activation and not that it malfunctioned during the crash.

G30 Passive Safety Systems

3. Functions

3.3.5. Output of faults (diagnosis)

Using the BMW diagnostic system, the fault memory can be read out via the diagnostic interface. After rectifying the faults or after renewing activated components, the fault memory can be cleared with the diagnosis command "Clear fault memory".

3.3.6. Acoustic and visual seat belt warning

An acoustic and visual seat belt warning is a standard feature of all vehicles equipped with the Advanced Crash Safety Module (ACSM). The Advanced Crash Safety Module (ACSM) records whether or not the driver or front passenger have fastened their seat belts. If they have not, an acoustic and visual warning is output to remind them to fasten their seatbelts. Both seat belt buckle switches are monitored separately. Depending on the national-market version, seat belt buckle switches are also installed in the rear passenger compartment and a seat belt warning is issued accordingly for the rear seat passengers.

3.3.7. Deactivating the passenger airbag

US vehicles

A seat occupancy mat is used on the front passenger seat for the purpose of occupancy detection and classification of occupants in the front passenger seat. A Capacitive Interior Sensing mat (CIS mat) is used in the G30.

The CIS mat is made up of 2 elements: A sensor wire, which runs parallel to the seat heating in the seat cushion and an evaluation unit. The CIS mat measures the capacity and ohmic resistance between the sensor wire (anode) and the vehicle ground (cathode) at a frequency of 120 kHz. The CIS mat determines from the change in capacity and resistance whether the front passenger seat is occupied by an adult or a child in a child seat.

The deactivation of the front passenger airbag, the side airbag and knee airbag on the passenger's side is signalled by the indicator lamp for front passenger airbag deactivation.

The indicator lamp for front passenger airbag deactivation in the roof function center lights up if a child seat with child, for e.g. a child restraint system that has been tested in accordance with the NHTSA regulations and is holding a small child, was detected on the front passenger seat or if the front passenger seat is unoccupied.

G30 Passive Safety Systems

3. Functions

3.4. Active protection

The standard equipment of the G30 already includes the Active Protection safety package.

The Active Protection safety package comprises the following 3 functionally independent subsystems:

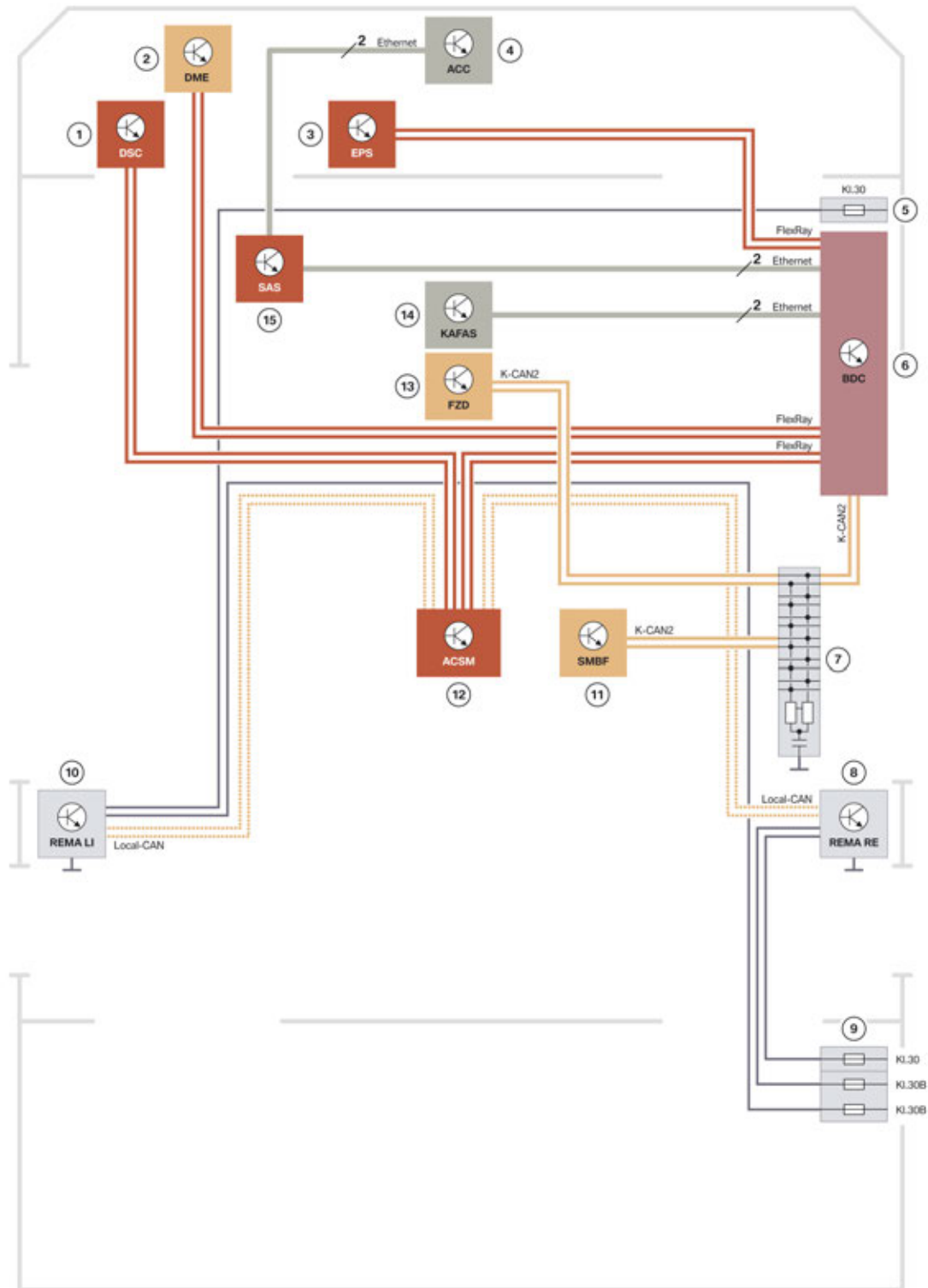
- PreCrash
- PostCrash
- Alertness assistant

The Active Protection safety package increases the safety of the occupants through preventative measures in the event of critical driving situations (PreCrash) and through measures after a crash (PostCrash). The attention assist monitors the driving style of the driver during the journey and encourages the driver to take breaks if necessary.

G30 Passive Safety Systems

3. Functions

3.4.1. System wiring diagram for Active Protection



TE16-0853

G30 System wiring diagram for Active Protection

G30 Passive Safety Systems

3. Functions

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Digital Motor Electronics (DME)
3	Electronic Power Steering (EPS)
4	Radar sensor for Active Cruise Control (ACC)
5	Fuse for front right power distribution box
6	Body Domain Controller (BDC)
7	CAN terminator
8	Reversible electromotive reel right, (REMARE)
9	Fuses in the power distribution box, rear right
10	Reversible electromotive reel left, (REMALE)
11	Front passenger seat module, (SMBF)
12	Advanced Crash Safety Module (ACSM)
13	Roof function center (FZD)
14	Camera-based driver support systems (KAFAS)
15	Control unit for optional equipment system (SAS)

G30 Passive Safety Systems

3. Functions

3.4.2. PreCrash

The PreCrash subsystem introduces preventative protective measures for the occupants in known critical driving situations which may lead to an accident.

Identification of critical driving situations

Critical driving situations are identified with help of the inertial sensor system installed in the vehicle. Critical driving situations include:

- Emergency braking initiated
- Strong understeer
- Strong oversteer
- Rollover of the vehicle

Imminent collisions are detected with the assistance of the camera-based driver assistance systems (KAFAS) stereo camera. On vehicles with the optional equipment active cruise control with Stop&Go function (OE 5DF) or Driving Assistant Plus (OE 5AT) the data of the radar sensor system is additionally evaluated. For the PreCrash detection, separate threshold values are made available for the triggering of the PreCrash functions are made available by the camera-based driver assistance systems or the radar system.

Convenience functions

- When the seat belt is fastened, the front seat belts are automatically pre-tensioned once when driving starts.

Safety functions

In detected situations that are critical for driving dynamics (for example, emergency braking, strong understeer, skidding) the following individual functions become active as needed:

- Automatic pre-tensioning of front seat belts
- Automatic closing of windows up to a gap
- Positioning the front passenger backrest
- Closing of the sunroof

G30 Passive Safety Systems

3. Functions

3.4.3. PostCrash

The PostCrash subfunction includes the automatic braking function after an accident, which brakes the vehicle to a standstill in certain accident situations without intervention from the driver. The risk of another collision can thus be reduced. The driver may oversteer the automatic braking after a crash by pressing the brake pedal or accelerator pedal.

The automatic braking after a crash is activated if a crash with sufficient severity has been identified in the Advanced Crash Safety Module (ACSM). The Advanced Crash Safety Module (ACSM) then sends a signal to the fuel pump control electronics to switch off the electric fuel pump. The same signal is evaluated by the DSC. The DSC then brakes the vehicle to a standstill.

The DSC generates a maximum setpoint deceleration of 5 m/s^2 for braking. During automatic braking the accelerator pedal and brake pedal are monitored. The automatic braking is interrupted if the accelerator pedal is pressed or if the brake pedal is pressed for a longer period by the driver. Pressing the accelerator pedal only causes the braking process to stop. Acceleration of the vehicle is not possible as the fuel pump is switched off.

Also during automatic braking the ABS prevents the wheels from blocking and the DSC stabilises the vehicle. If the DSC is in DSC OFF mode during automatic braking, a forced activation of the DSC is carried out.

Approx. 1.5 seconds after reaching standstill, the brake is automatically released and the vehicle must be secured against rolling away.

If a crash is detected, which leads to activation of the safety battery terminal, then automatic braking cannot be activated as the DSC pump is no longer supplied with power.

Automatic braking is not activated under the following conditions:

- The DSC has failed before the crash.
- The ABS has failed before the crash.
- The brake fluid level is too low.

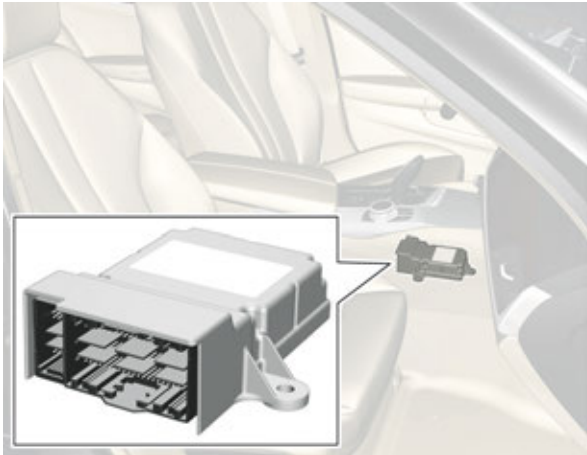
If these faults occur during or after the crash, the control is led to the end as these faults are then interpreted as consequences of the crash.

G30 Passive Safety Systems

4. System Components

4.1. Advanced Crash Safety Module

The Advanced Crash Safety Module (ACSM) in the G30 is located centrally in the vehicle under the center console between the two front seats. The central sensor system is integrated in the Advanced Crash Safety Module (ACSM).



G30 Advanced Crash Safety Module (ACSM)

4.2. Sensors and switches

The following sensors and switches are installed in the G30:

- Lateral and longitudinal acceleration sensors in ACSM
- Yaw rate sensor in the ACSM
- Vertical acceleration sensor in the ACSM
- Lateral and longitudinal acceleration sensors in the B-pillars
- Airbag sensors (pressure) in the front doors
- Airbag front sensors on the engine supports
- Seat occupancy mat for seat belt warning
- CIS mat with passenger classification
- Seat belt buckle switch
- Seat-position sensor, driver and front passenger
- Switch for front passenger airbag deactivation

G30 Passive Safety Systems

4. System Components

4.2.1. Lateral and longitudinal acceleration sensor, B-pillar

The lateral and longitudinal acceleration sensors assist with the identification of head-on crashes, side-on crashes and rear-end crashes.

The airbag sensor consists of a longitudinal acceleration sensor and a lateral acceleration sensor. The acceleration sensors measure the positive and negative acceleration in the X and Y direction. The result from the X and Y signals is decisive in identifying the direction of the crash. The airbag sensors on the left and right are of identical design and are allocated by way of mechanical encoding during installation.



G30 Lateral and longitudinal acceleration sensor

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4. System Components

4.2.2. Door airbag sensor (pressure)

In the G30, pressure sensors are installed in the driver's door and front passenger door. The airbag sensor in the doors are no longer secured with a screw as was previously the case. The airbag sensor are screwed into the bracket. The electrical attachment elements resp. the plug connections can only be connected after installation of the respective sensors.

Side crashes are identified with the assistance of the airbag sensors. In addition to the lateral acceleration values that are present, the pressure in the door cavity also increases in the event of a side-on crash.

The airbag sensors in the doors are used to verify the plausibility of the acceleration signals from the B-pillar airbag sensors and the Advanced Crash Safety Module (ACSM) when a side-on crash is detected. The airbag sensors are situated in the inner panel of the doors and measure the pressure increase in the event of a side-on collision. In the event of a side-on collision at the door the outer skin is pushed inwards. The door interior is reduced in size and the inner pressure increases. This pressure change is measured by the airbag sensors. The airbag sensor also includes electronics, in addition to the pressure sensor, that digitise the pressure readings and transmit them cyclically to the Advanced Crash Safety Module (ACSM). The data transfer is effected analogue to the airbag sensors in the B-pillars. The pressure readings are evaluated in the Advanced Crash Safety Module (ACSM).



G30 Door airbag sensor (pressure)

G30 Passive Safety Systems

4. System Components

4.2.3. Airbag front sensor

Two airbag front sensors are installed in the front area of the engine supports. The measured values are forwarded to the Advanced Crash Safety Module (ACSM) where they are evaluated.

The airbag front sensors on the left and right assist with the identification of a head-on crash.

The sensors deliver additional information to the Advanced Crash Safety Module (ACSM) on the characteristics and severity of the collision. Each sensor contains an acceleration sensor for recording the deceleration, signal processing technology and electronics for data transfer. The measured values are sent in the form of a message to the Advanced Crash Safety Module (ACSM) and are used in the calculation of the algorithm.



G30 airbag front sensor

TE16-0862

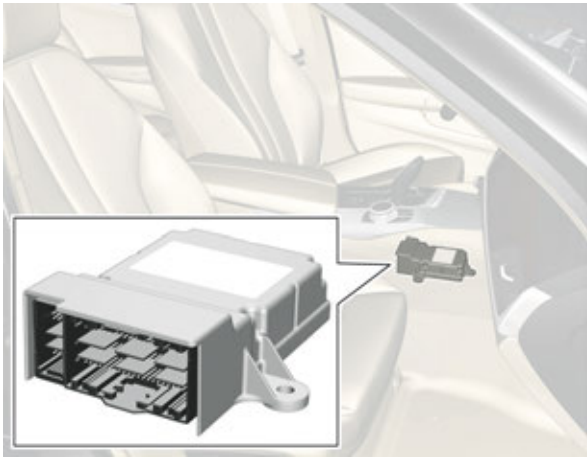
G30 Passive Safety Systems

4. System Components

4.2.4. Sensors in the ACSM

In the G30, the central sensor system is integrated in the ACSM. The ACSM contains a longitudinal and lateral acceleration sensor, a vertical acceleration sensor and a roll rate sensor (with the Dynamic Damper Control (OE 223)) for the impact detection. The ACSM also includes a longitudinal and lateral acceleration sensor and a yaw sensor for the driving dynamics control.

The sensor data for impact detection are evaluated in the ACSM and help identify side-on, rear-end or head-on crashes and assists with roll-over detection. The sensor data not yet evaluated for the driving dynamics control is sent to the DSC via FlexRay where it is processed.



G30 Advanced Crash Safety Module (ACSM)

4.2.5. CIS mat

The capacitive interior sensing mat (CIS mat) is fitted in the front passenger seat. The CIS mat detects whether the front passenger seat is occupied by an adult or a by child in a child seat. The deactivation of the front passenger airbag, the side airbag and the knee airbag on the passenger's side is signalled by the indicator light for front passenger airbag deactivation.

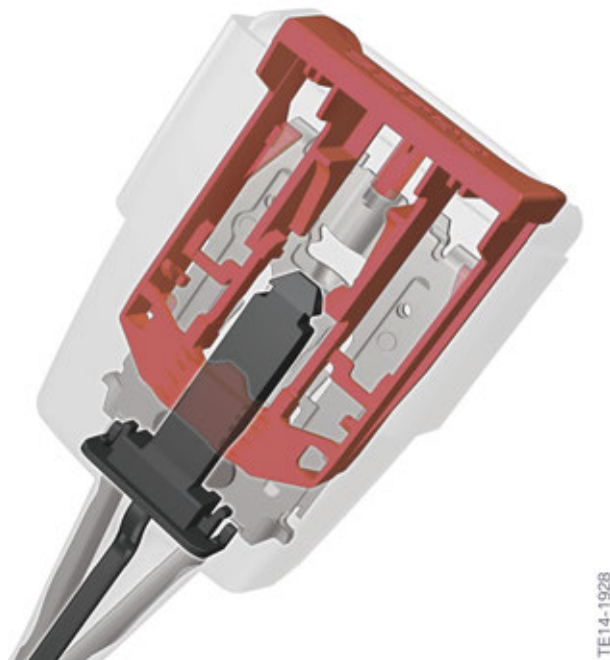
4.2.6. Seat belt buckle switch

The seat belt buckle switches are located in the seat belt buckles of the driver and front passenger seat. European version vehicles are additionally equipped with seat belt buckle switches on the rear seat bench.

The seat belt buckle switch detects whether the seat belt buckle tongue is in the seat belt buckle. The supply of the sensors and the evaluation occurs through the ACSM. As of the driving condition RESIDING, the seat belt buckle switch is continuously monitored and used for the visual and acoustic seat belt warning and also to determine which restraint systems are to be triggered. The seat belt warning is active as of the DRIVING driving condition.

G30 Passive Safety Systems

4. System Components



G30 Seat belt buckle switch

4.2.7. Emergency call button

The emergency call button is located in the roof function center.



G30 Roof function center (FZD) with emergency call button

Index	Explanation
1	Emergency call button

G30 Passive Safety Systems

4. System Components

4.2.8. Seat-position sensors

In accordance with the US legal requirement (FMVSS208), a height identification for the person in the driver and front passenger seat must be effected. This height identification is effected via the adjustment travel of the forward/back seat adjustment. In US-version vehicles, the exact position is identified using the seat-position sensors for the driver and front passenger seats.

The job of the seat-position detector is to distinguish between a relatively small person and a person of normal height within the lengthways adjustment range of the seat. This detection is another technical feature aimed at increasing the safety of the occupants. The deployment of the 2 airbag stages is then adjusted to the driver's/front passenger's seat position.

The seat-position detector takes the form of a 2-wire hall effect sensor and is supplied with voltage via the ACSM. The current level of the seat-position sensor changes depending on the seat position.

4.3. Actuators

4.3.1. Overview

The following actuators are installed in the G30:

- Two-stage driver's airbag
- Two-stage front passenger airbag
- Knee airbag on front left and right
- Head airbag on left and right
- Side airbag on front left and right
- Reel pretensioner with adaptive force limiter
- Safety battery terminal

In addition, the following indicator lights inform the vehicle occupants about the condition of the safety systems:

- Airbag indicator light
- Seat belt warning light for driver and passenger
- Seat belt warning light, rear passenger compartment
- Indicator lamp for front passenger airbag deactivation

The familiar three-point seat belts are used as the seat belt systems for all seats in the G30.

G30 Passive Safety Systems

4. System Components



G30 Seat belt

Index	Explanation
1	Seat belt buckle
2	Belt tensioner

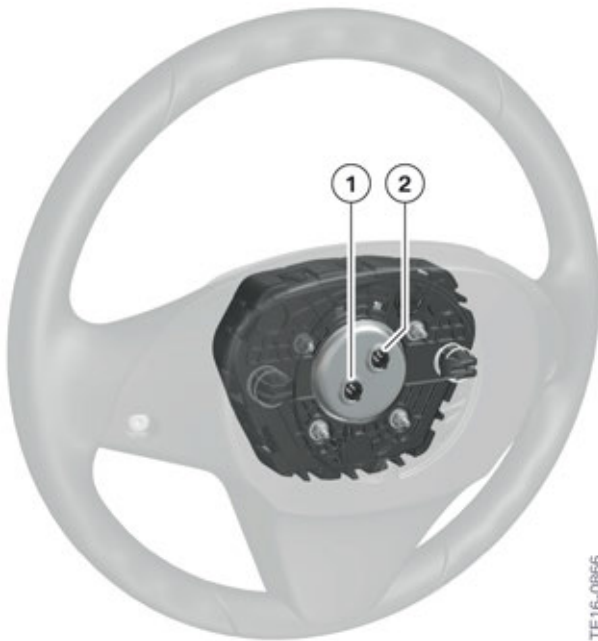
G30 Passive Safety Systems

4. System Components

4.3.2. Driver's airbag

A two-stage airbag is installed, which can be used to activate the stages at short or long time differences, depending on the severity of the crash detected and taking into consideration the seat position.

In addition, the driver's airbag features an active vent valve.



G30 Driver's airbag

Index	Explanation
1	Ignition module, level 1
2	Ignition module, level 2

G30 Passive Safety Systems

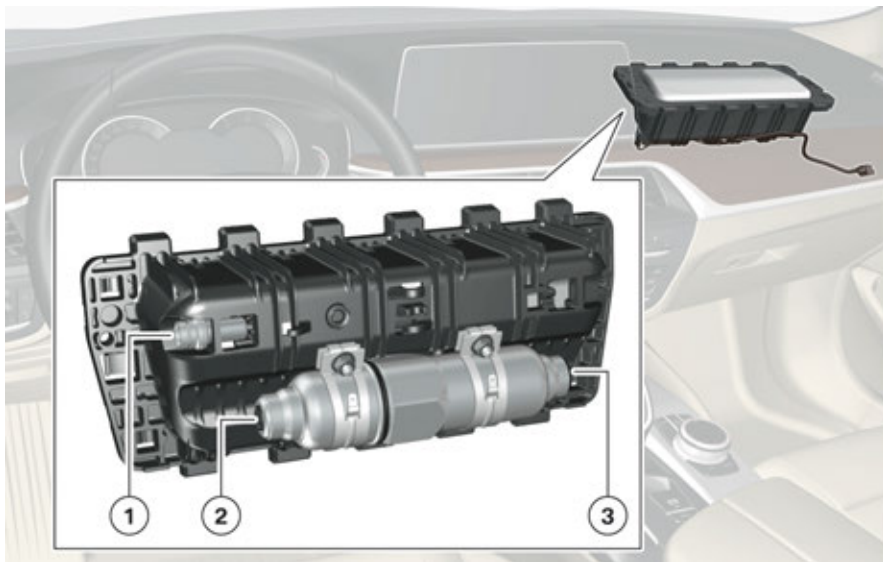
4. System Components

4.3.3. Front passenger airbag

The purpose of the front passenger airbag is to reduce the risk of accident to the front passenger in the event of a front-end crash. The front passenger airbag is located in the dashboard. When the front passenger airbag expands, the dashboard tears open at defined points.

A two-stage gas generator is installed, which can be used to activate the stages at short or long time differences, depending on the severity of the crash detected and taking into consideration the seat position.

Furthermore, the front passenger airbag features an active vent valve.



G30 Front passenger airbag in US version of vehicles

Index	Explanation
1	Ignition module for active vent valve
2	Ignition module, level 1
3	Ignition module, level 2

G30 Passive Safety Systems

4. System Components

4.3.4. Knee airbag

Front driver & passenger

Knee airbags are installed on the driver's side and passenger's side to control the forwards displacement of the occupant(s) in the event of a head-on crash.



G30 knee airbag

G30 Passive Safety Systems

4. System Components

4.3.5. Head airbag

Head airbags are installed in the G30 to protect the occupants' heads in the event of side collisions.

The head airbag extends from the A-pillar to the C-pillar and covers the entire area of the side windows. It expands between the occupants and side structure.

System features:

- Extended covered area across all front and rear side windows
- Protection of occupants from glass splinters
- Covered area for different-sized occupants optimized



G30 Head airbag

G30 Passive Safety Systems

4. System Components

4.3.6. Side airbag

As with all current BMW models, the side airbag at the front ignites out of the front seat backrest.

The side airbags and gas generators are accommodated in a plastic housing, the airbag module. This is installed in the front seat backrest and is concealed by the seat cover.

If activated, the side airbag emerges outwards from the backrest frame and spreads between the side structure and occupant.



It is important to ensure that no additional seat covers are fitted as they would greatly impair the function of the side airbag, or even immobilize it altogether.



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G30 side airbag

Index	Explanation
1	Side airbag

G30 Passive Safety Systems

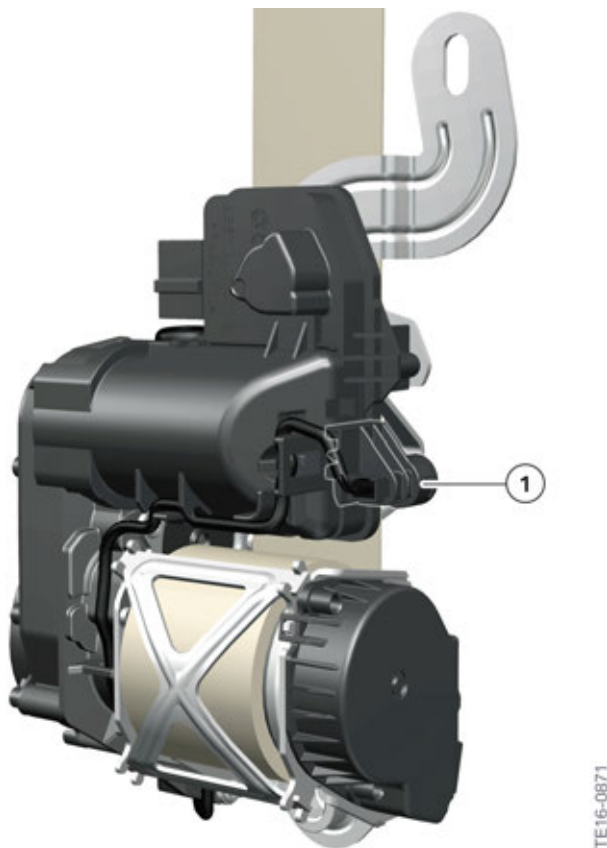
4. System Components

4.3.7. Automatic tensioner with linear mechanical force limiter

In the event of a front-end or rear-end crash or rollover, the automatic reel blocks the extension of the seat belt in order to restrain the occupants. The belt force limiter limits the load exerted by the belt on the occupants during the accident and the airbags provide the remaining restraining effect.

With the linear system, the belt force is limited after the locking pins have been sheared off by the twisting motion of a torsion bar spring in the seat belt inertia reel.

Reel pretensioners with linear mechanical force limiters are installed in the G30 in the front and in the rear passenger compartment on the left and right.



G30 Belt tensioner with linear mechanical force limiter

Index	Explanation
1	Connection of ignition module, belt tensioner

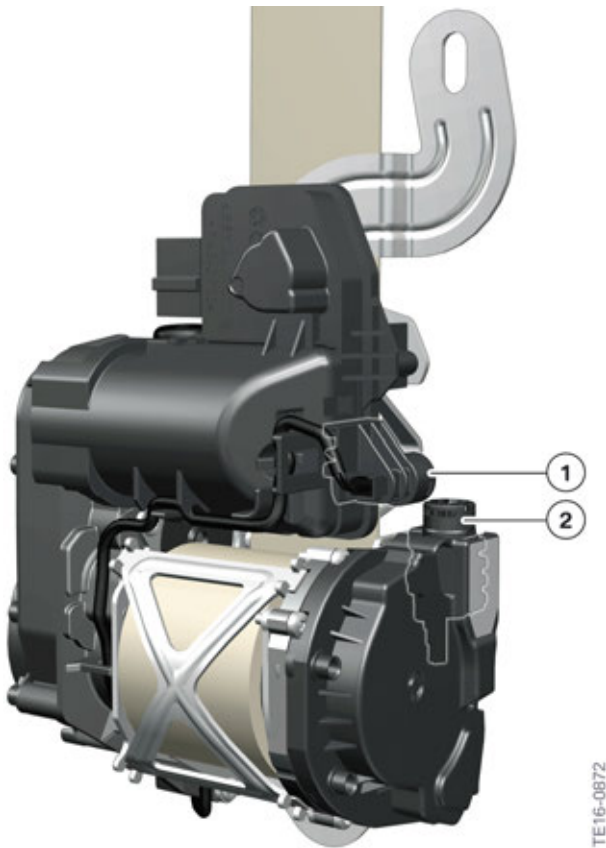
G30 Passive Safety Systems

4. System Components

4.3.8. Automatic tensioner with adaptive force limiter

For the driver and front passenger, an automatic reel with adaptive force limitation is installed. With the aid of a gas generator, there is a changeover from a high to a low power level during the crash, in order to reduce the seat belt restraining forces.

When optimally harmonised with the airbag, it ensures the kinetic energy acting on the occupants is more evenly dissipated for the duration of the crash. Thus lower occupant stress values are achieved.



G30 Belt tensioner with adaptive force limiter

Index	Explanation
1	Connection of ignition module, belt tensioner
2	Connection of ignition module, adaptive force limiter

4.3.9. Active head restraints, front

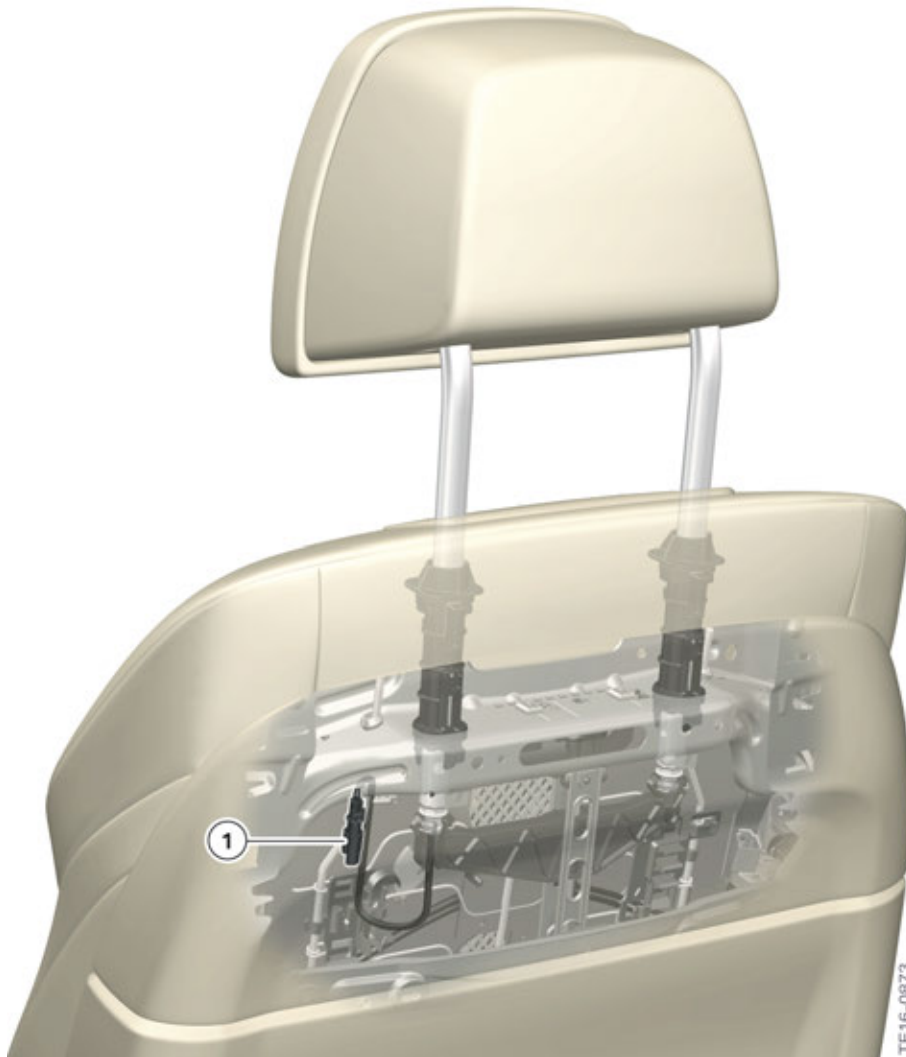
The active head restraint is used in the G30 in conjunction with the multifunction seat (OE 456). This is a head restraint with a pyrotechnic actuator that optimizes the distance and height of the headrest in relation to the head if a rear-end collision of sufficient force occurs. This reduces the load on the cervical vertebrae in the event of a rear-end collision. The head restraint is activated early, even prior to backwards displacement of the occupant's head.

G30 Passive Safety Systems

4. System Components

The active head restraint reduces the load in the cervical vertebrae in the event of a rear-end collision. For the vehicle occupants therefore, correct adjustment of the head restraint and the distance of the head from the head restraint is of crucial importance.

In the event of a rear-end collision, the active head restraint reduces the distance between the head and the head restraint before the occupants are displaced backwards. This reduces the danger of injury to the cervical vertebrae, even if a minor accident occurs.



G30 connection active head restraint, front

Index	Explanation
1	Connection active head restraint



Seat or head restraint covers and/or accessories that could impair the protective effect must not be mounted on the head restraints.

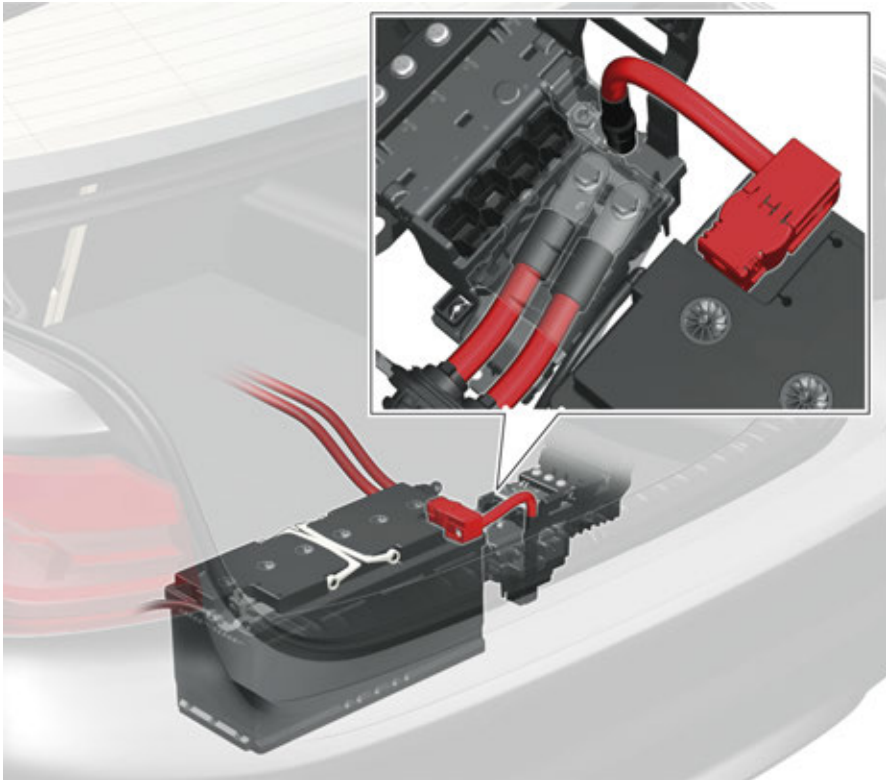
G30 Passive Safety Systems

4. System Components

4.3.10. Safety battery terminal

If the ACSM detects a crash of sufficient force, the safety battery terminal is activated.

Even though the safety battery terminal has been disconnected, a voltage supply to all safety-relevant consumers such as hazard warning lights, interior light, airbag and telephone (including emergency call) is still ensured.



G30 Safety battery terminal (SBK)

4.3.11. Airbag indicator light

The airbag indicator light is located on the instrument panel. The airbag indicator light lights up and then goes out during the pre-drive check to signal readiness of the Advanced Crash Safety Module (ACSM) and passive safety systems.

G30 Passive Safety Systems

4. System Components



G30 Airbag indicator light

4.3.12. Seat belt warning light

A visual and audible warning is issued if the seat belt is not fastened or is unbuckled during driving.



G30 Seat belt warning light

The seat belt warning light of the seat belts in the rear passenger compartment is briefly visible when the engine is started or for a change in the instrument cluster.

G30 Passive Safety Systems

4. System Components

4.3.13. Indicator lamp for front passenger airbag deactivation

In the G30, the indicator lamp for front passenger airbag deactivation is located in the roof function center. The indicator lamp for front passenger airbag deactivation is automatically activated if the CIS mat detects a small child in a child seat or if the front passenger seat is unoccupied.



G30 Indicator lamp for front passenger airbag deactivation

Index	Explanation
1	Indicator lamp for front passenger airbag deactivation



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