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E93 Electronic Systems

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Subject Page

Electronic Systems

Model: E93

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Identify changes to bus system on the E93
- Understand changes and additions to Information and Communication Systems
- Understand changes to the Climate Control System
- Understand changes to the Passive Safety System

E93 Electronic Systems

The vehicle electrical system and the scope of electrical/electronic systems are largely identical to those of the E92 Coupe.

Adaptations and modifications have been implemented in individual systems in view of the different body structures of the closed Coupe and the open Convertible.

This publication describes changes and modifications that result in an expansion or modification to the corresponding function.

The system descriptions are subdivided into following areas:

- Vehicle systems network
- Energy management
  – Terminal control
- General vehicle electrical system
  – Exterior lighting
  – Interior lighting
  – Central locking system
  – Anti-theft alarm system
  – Seats with rear compartment easy entry
  – Changes in control units
  – Power windows
- Air conditioning system
  – Convertible mode
- Information and communication technology
  – CCC function keys
  – Interface box SBX
  – Antenna systems
  – Locations of IKT control units
- Passive safety
  – Crash-reinforced bodyshell
  – Advanced crash and safety management
  – Rollover protection systems
  – Seat-integrated side airbag
  – Knee airbag US

Bus Network

The vehicle systems network US differs in that it features other systems provided specifically for the USA and Canada.

Since no diesel vehicles are currently offered in the USA, the corresponding control units have been omitted on the PT-CAN and BSD.

Changes in K-CAN

A new feature is the Convertible top module (CTM) which is connected to the K-CAN for the purpose of controlling the retractable hardtop.

The ACSM 2 is used as the passive safety system which contains the sensors for the rollover protection system.

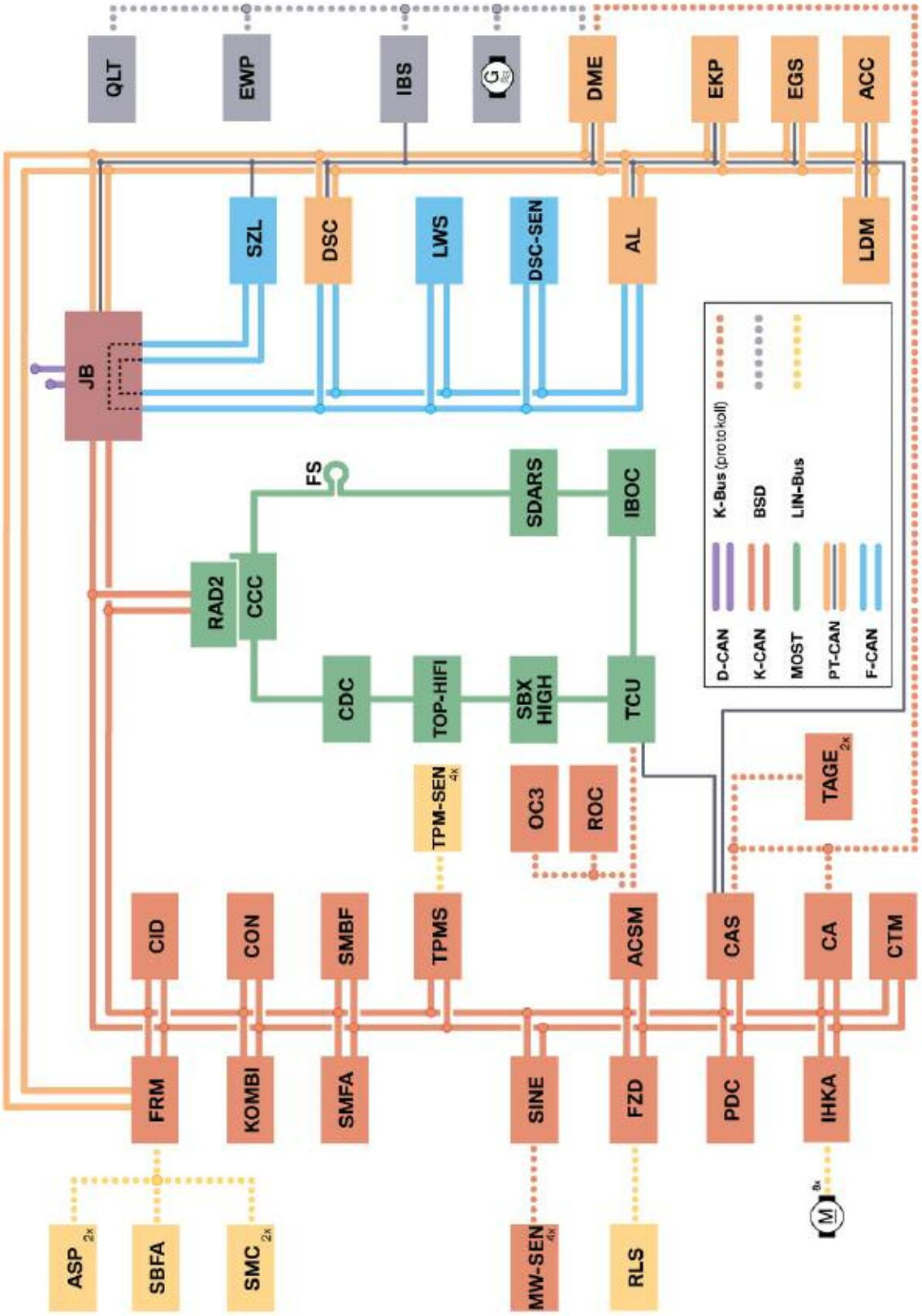
The SINE of the anti-theft alarm system DWA is no longer looped through the roof functions module FZD but rather connected directly to the K-CAN.

The RDC (TPMS) is a tire pressure monitoring system that replaces the tire failure indicator RPA in US vehicles to conform to legal requirements.

Changes in LIN-bus

Two control units for the seat belt extender on the driver's and passenger's side have been dropped from the LIN-bus as the seat belt in the Convertible is located directly in the seat.

E93 Bus Overview



Energy Management

As in the current models, an energy management system is also used on the BMW 3 Series Convertible to ensure a balanced energy supply in the vehicle.

The energy management functions are integrated in the power management system that is implemented in the form of software in the engine control module (DME).

The power management, the components and the various functions of the system differ depending on the equipment configuration of the vehicle.

Two energy management control systems are installed:

- Basic Power Management BPM
- Advanced Power Management APM

On vehicles equipped with advanced power management modifications have been made in the terminal shut-down system through relay 30g and 30g f.

Advanced Power Management

Advanced power management (APM) is used on vehicles featuring following options:

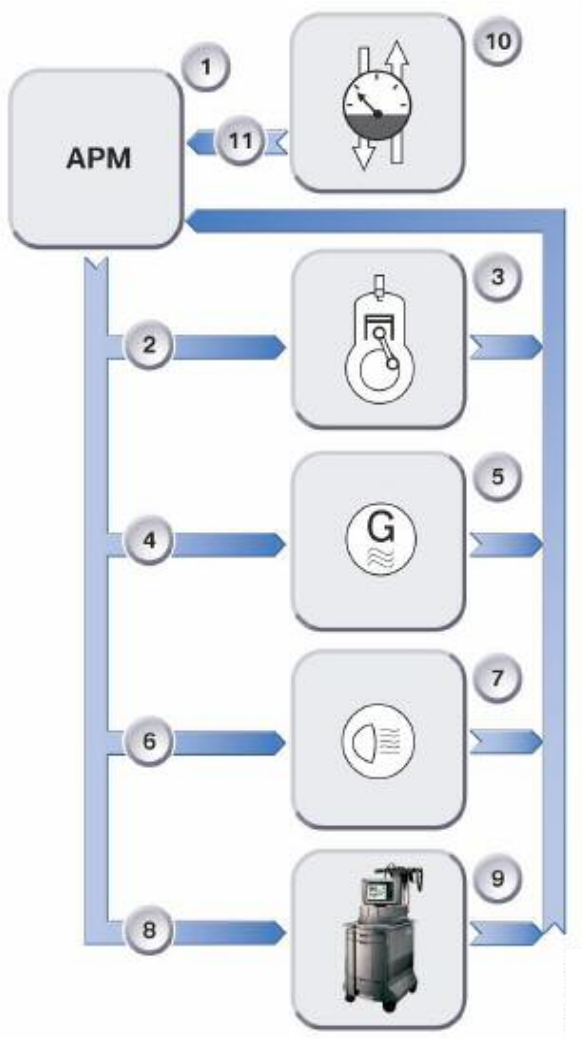
- Comfort access
- Multi-audio system controller
- Car communication computer
- Telephone US/telephone preparation US

The advanced power management has been expanded by the intelligent battery sensor IBS. In addition to the change in the idle speed and the specified charging voltage target value, the system includes the following functions that differ from the BPM.

Expanded APM Functions

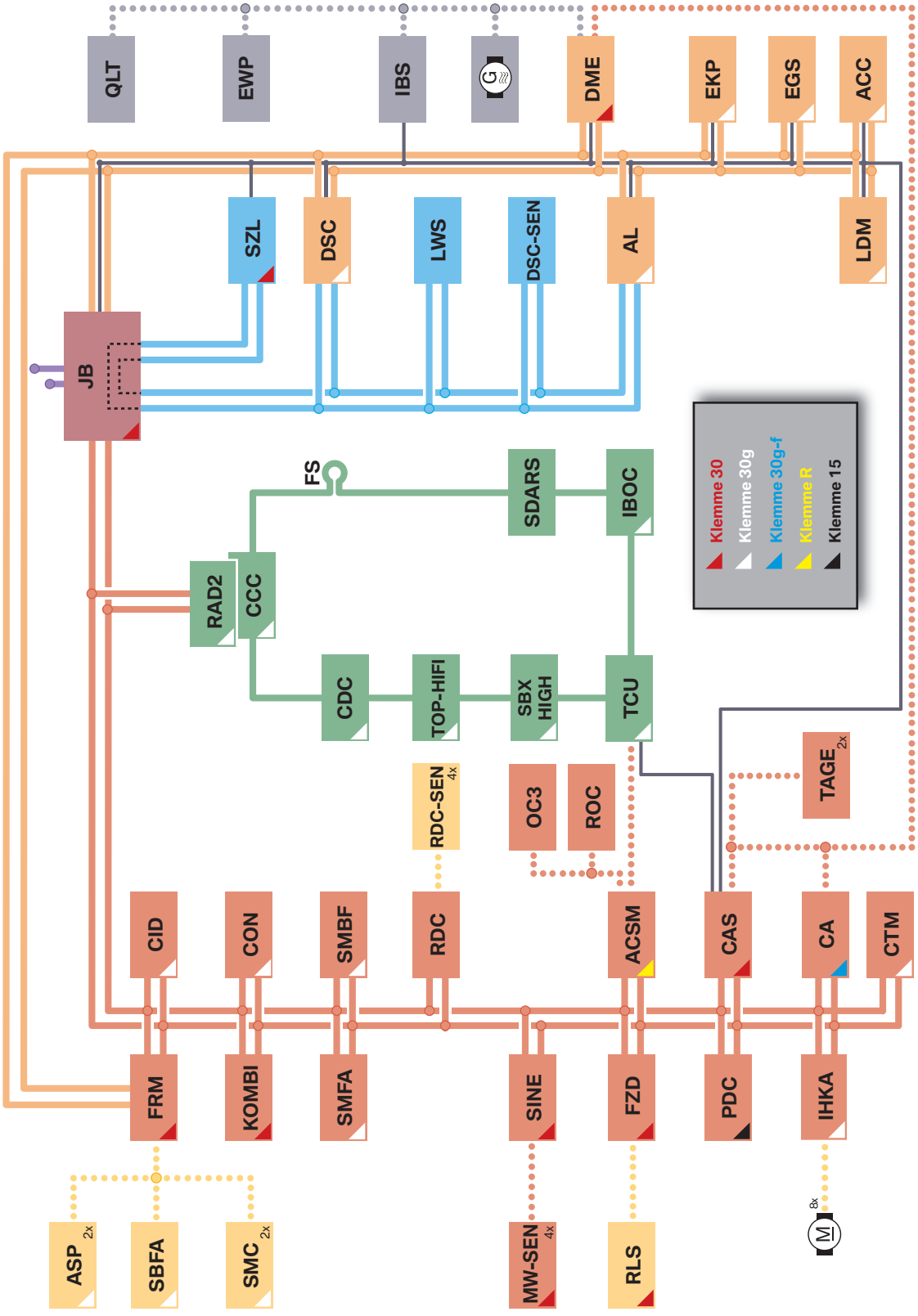
- Electric load reduction
- Electric load shut-down
- Systems network diagnosis
- Battery diagnosis

APM Control Circuit



Index	Explanation	Index	Explanation
1	Advanced power management	7	Electric loads
2	Idle speed boost	8	Electrical system and battery diagnosis
3	Engine	9	BMW diagnosis system
4	Charging voltage target value	10	Intelligent battery sensor
5	Alternator	11	Battery data
6	Electric load reduction		

E93 Bus Overview (with Terminal Status)



Terminal Shut-down Identification

To provide clear identification of the terminal shut-down function, the control units are identified with colored triangles. The identification and assignment to the individual terminals is shown in the legend on the opposing page.

Electric Load Shut-down Terminal 30g Relay

Time-dependent shut-down - The E93 is equipped with a terminal 30g relay for switching off the power supply to most control units. Most convenience electric loads such as the radio are switched off after 30 minutes by terminal 30g in order to maintain the starting capability of the battery.

The after-running time is extended to 60 minutes if a telephone is installed in the vehicle. The terminal 30g relay is activated by the car access system.

Electric Load Shut-down Terminal 30g_f Relay

Fault-dependent shut-down - The terminal 30g_f relay is additionally installed in the junction box of the E93 only when one of the following equipment options is ordered:

- Comfort access
- M-Audio system controller
- Car communication computer
- Telephone US/telephone preparation US

The terminal 30g_f relay is a bistable relay and is always in the ON state under normal conditions. It switches off the connected control units only in the case of fault. The switching status is retained even when no power is applied.

The terminal 30g_f relay is activated by the junction box control unit and switches off the connected electric loads if a fault occurs. The calculations required for activating the terminal 30g_f relay take place in the DME and in the junction box. The following activities are monitored in the junction box:

- Unauthorized wake-ups within the bus system
- Sleep mode preventers (control units that constantly keep the bus systems active)

The battery values are constantly read out and evaluated in the engine control unit. The relay is also switched off when the starting capability limit of the vehicle battery is reached.

Control Units (connected to terminal 30)

Due to their functionality, some control units cannot be switched off and must remain connected to KL30. The following chart shows the control modules connected to KL30 and the reasons why this is needed.

Index	Explanation
JB	Because of master functionality
FRM	Because of legally required hazard warning function
FZD	Because of the connection of the DWA components
SINE	Because of DWA functionality
CAS	Because of the “unlock vehicle” function
SZL	Because of the steering angle sensor data (volatile)
DME	Because of power management
EPS	Because of high current consumption
Kombi	Because of the data saving function (mileage reading)

Control Units (connected to terminal R and 15)

Control units that have only one functionality connected to terminal R or 15 can be switched off directly.

The ACSM2 control unit is connected to terminal R. The high beam assistant and park distance control are connected to terminal 15.

General Vehicle Electrical System

The general vehicle electrical system includes the following:

- Exterior lighting
- Interior lighting
- Central locking system
- Anti-theft alarm system
- Roof functions module
- Seat with rear easy-entry
- Changes in control units
- Power windows

Exterior Lighting

No changes have been made to the exterior lighting of the E93 Convertible compared to the E92 Coupe. The E93 Convertible is equipped as standard with bi-xenon lights.

Adaptive headlights are optionally available in connection with the turn signal or direction indicator light.

The E93 Convertible is equipped as standard with the daytime driving light function that is realized by the corona rings. The E93 Convertible also features the welcome light function.

Note: Important note on tail lights - In the event of a defective bulb in the tail lights, after removal, the bulb carrier must be fitted in the tail light housing otherwise the function of the new bulb cannot be checked due to the lack of ground connection.

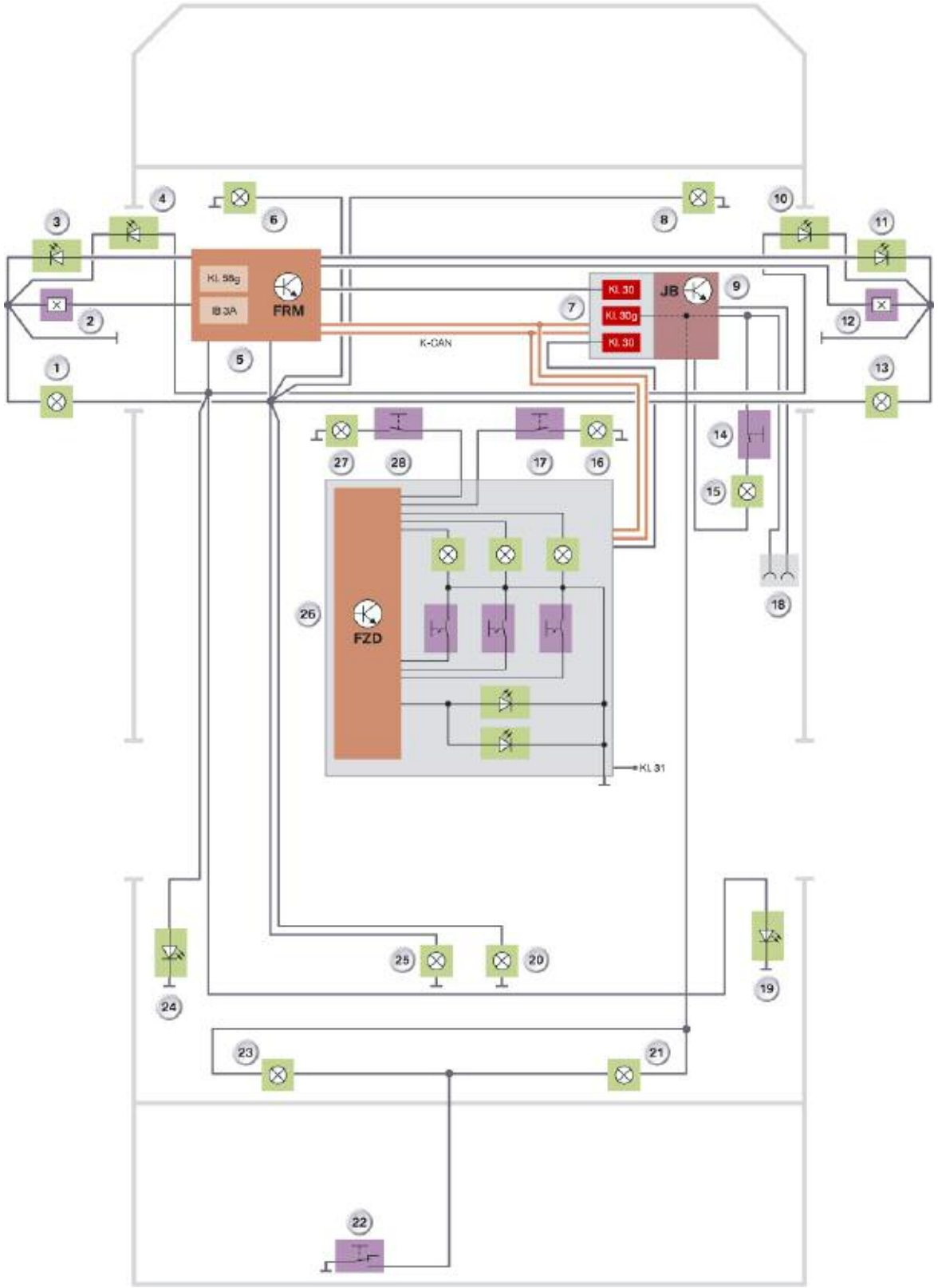
Interior Lighting

The interior lighting system of the E93 Convertible was adopted from the E92 with ambient interior lighting in the door and side trim panels.

For this reason, the general functions and the components of the interior lighting system will not be described in detail again here. The following minor changes have been made to the optional interior lights package:

- No rear interior light in the roof
- The central luggage compartment light has been replaced by two lights at the rear left and right

E93 Interior Light Schematic



Legend for E93 Interior Light Schematic

Index	Explanation	Index	Explanation
1	Exit light, left	15	Glove compartment lighting
2	Door contact, left	16	Vanity mirror light right
3	Courtesy lighting, left	17	Switch for vanity mirror light, right
4	Fiber optic cable for left door linear lighting	18	Charging socket
5	Footwell module	19	Side panel linear lighting, right
6	Footwell light, front left	20	Rear compartment footwell light, right
7	Power distribution box, junction box	21	Luggage compartment light, rear right
8	Footwell light, front right	22	Interior button for boot lid
9	Junction box electronics	23	Luggage compartment light, rear left
10	Fiber optic cable for right door linear lighting	24	Side panel linear lighting, left
11	Courtesy lighting, right	25	Rear compartment footwell light, left
12	Door contact, right	26	Roof functions module with front interior light
13	Exit light, right	27	Vanity mirror light, left
14	Glove compartment switch	28	Switch for vanity mirror light

Central Locking System

The central locking system has been adapted to the specific requirements of the Convertible. In addition to the basic functions of locking the doors, lids and flaps, two further functions have been added:

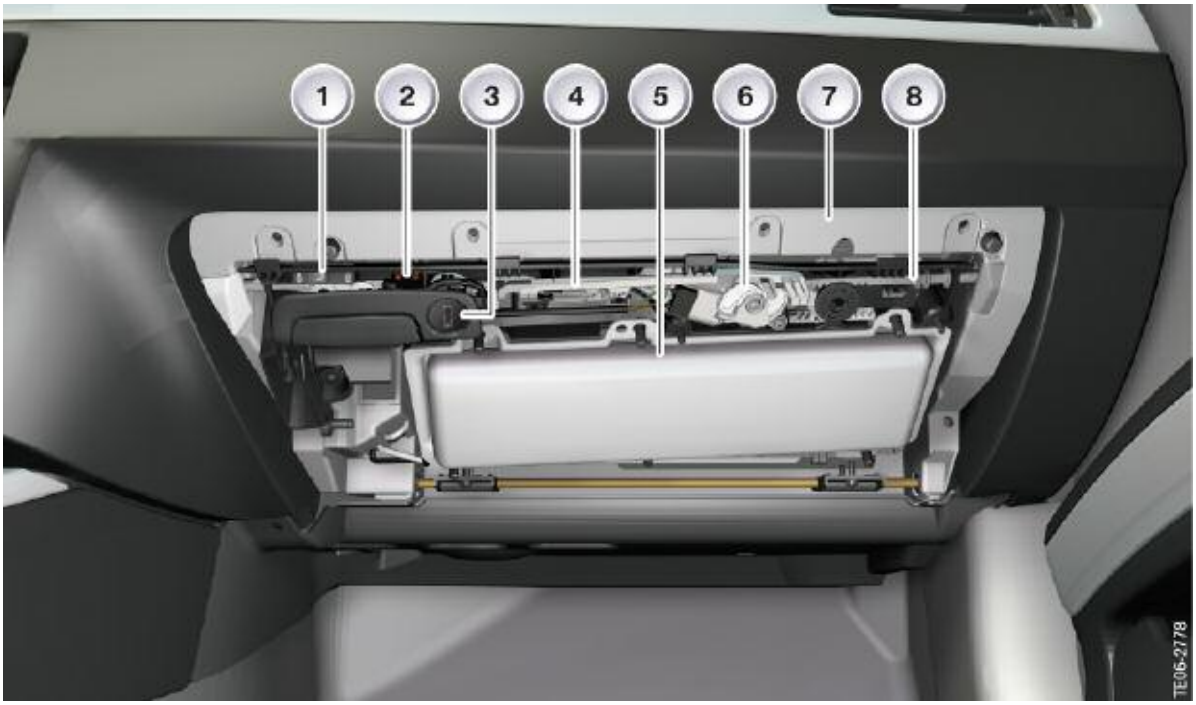
- automatic locking and opening of the glove compartment
- and the locking of the storage compartment in the center console.

These functions are necessary for the purpose of providing a safe place to store objects with the hardtop open.

Glove Compartment Locking

The glove compartment is unlocked by electrical means. The reason for this is that a knee airbag is installed in US vehicles. The knee airbag is located in the lid to the glove compartment.

The opener is located on the left on the glove compartment lid. The lid must be locked on both sides to ensure the resulting forces can be transmitted in the event of the knee airbag triggering.



Index	Explanation	Index	Explanation
1	Hotel switch	5	Knee airbag, front passenger
2	Microswitch, open	6	Unlocking motor with actuating cam
3	Lock with emergency release	7	Glove compartment housing
4	Locking rod, left	8	Locking rod, right

Opening Glove Compartment

The opener is raised slightly to open the glove compartment. A microswitch sends a signal to the junction box which, in turn, activates an actuator motor in the glove compartment. The actuator motor with the gear mechanism pulls back the two locking rods so that the glove compartment lid can be opened.

The power supply to the actuator motor is cut after a short time and the locking rods extend again.

Closing Glove Compartment

The ends of the locking rods are beveled. When closing the lid, the rods are pressed against a spring. When the lid is closed, the spring force pushes the locking rods back into the lock openings thus locking the glove compartment lid.

Locking Glove Compartment

The hotel switch is located in the glove compartment. The hotel switch can prevent unauthorized opening of the boot lid. For this purpose, the glove compartment is locked with the mechanical key at the lock barrel.

Emergency Release of Glove Compartment

In the event of the battery discharging or being defective, the glove compartment can be opened with the mechanical key.

Locking Function of Storage Compartment in Center Console

The storage compartment, in which the mobile phone is kept (depending on equipment variant) contains an actuator motor which locks the storage compartment. This actuator motor is driven directly by the junction box when central arrest is activated.

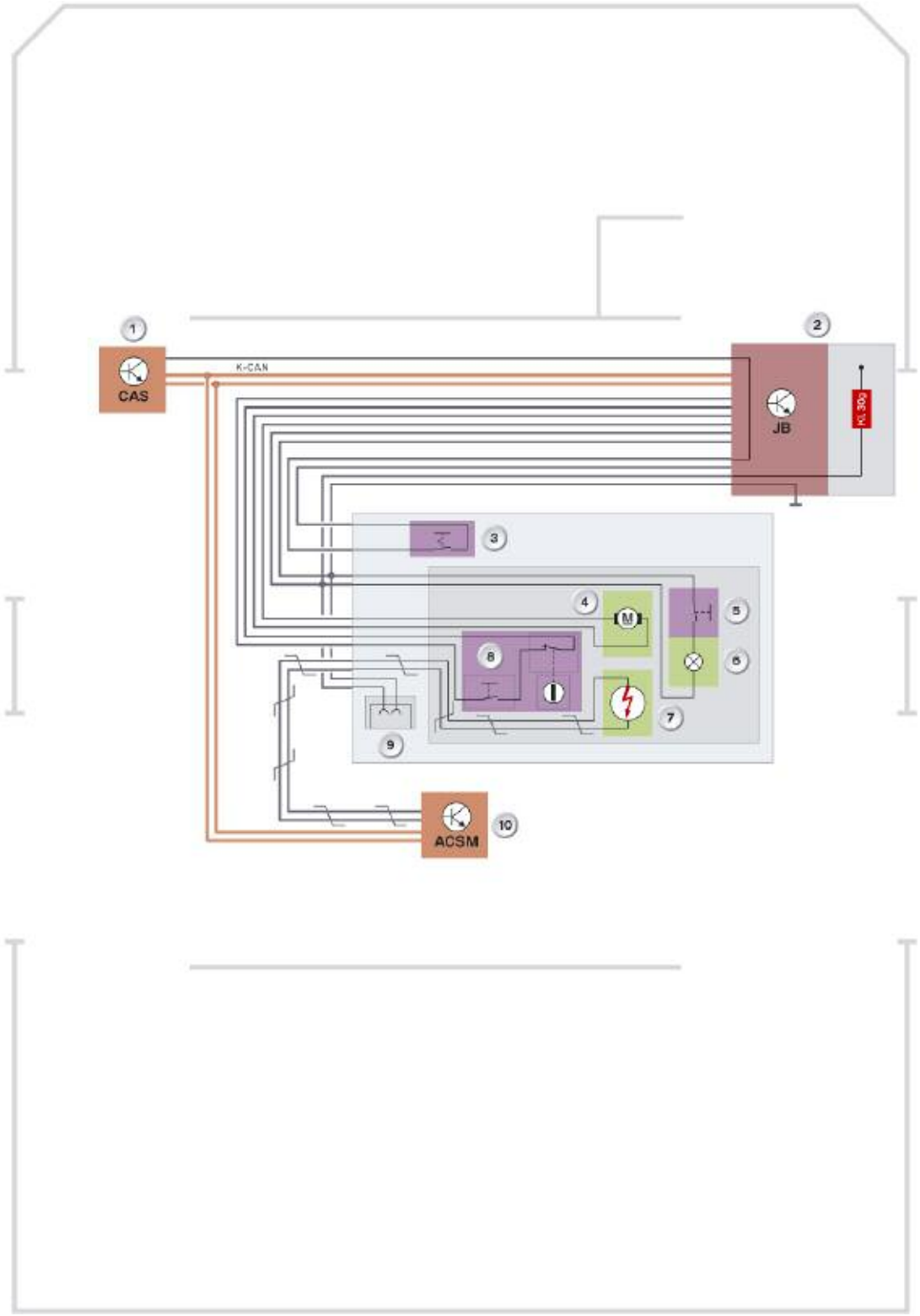
Emergency Release

The storage compartment in the center console can be released by means of a pull cable (1) in the event of the battery discharging or being defective.

For this purpose, the cover must be removed from the rear compartment air outlet, followed by removal of the air outlet.

The storage compartment can then be released by pulling the loop of the pull cable.

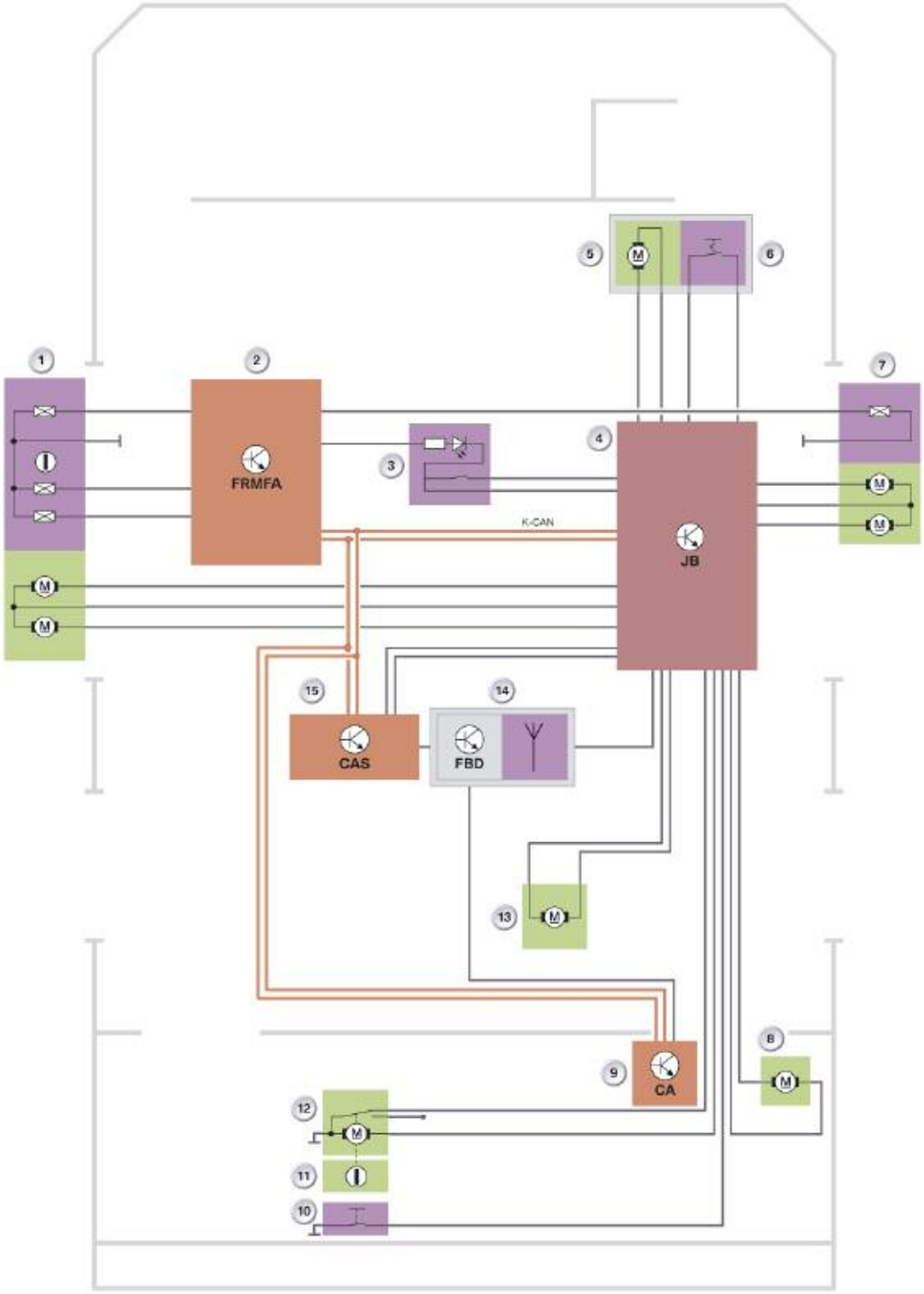
Glove Compartment Schematic



Legend for Glove Compartment Schematic

Index	Explanation
1	CAS
2	Junction Box
3	Hotel Switch
4	Unlocking motor
5	Switch for glove compartment lighting
6	Glove compartment lighting
7	Passenger’s side knee airbag ad glove compartment lid
8	Glove compartment lock with release button
9	Charging socket for flashlight
10	ACSM control unit

Central Locking Schematic



Legend for Central Locking Schematic

Index	Explanation
1	Driver’s door with actuator, door contact and door lock with Hall sensors
2	Footwell module
3	Central lock button
4	Junction box
5	Glove compartment actuator motor
6	Hotel switch
7	Passenger’s door with actuator and door contact
8	Actuator for fuel filler flap
9	Comfort access control unit
10	Trunk lid button
11	Trunk lid lock
12	Trunk lid actuator
13	Center console actuator
14	Interior rear view mirror with remote control receiver
15	Car Access System (CAS)

NOTES PAGE

Anti-theft Alarm System

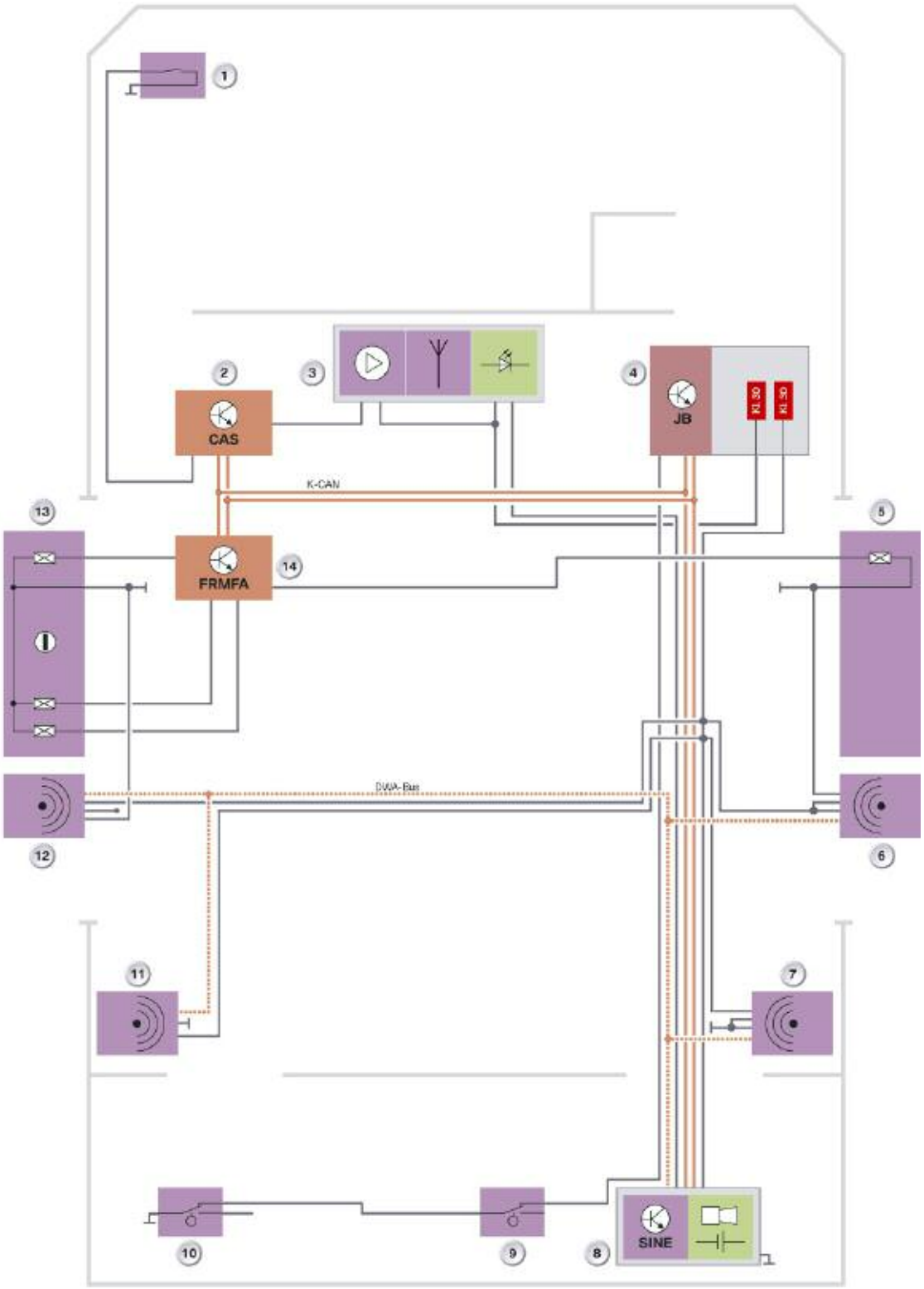
The anti-theft alarm system in the E93 Convertible is identical to that in the 3 Series Sedan in terms of its basic functions and operating mode. There are differences in the interior monitoring function and connection to the system network.

Microwave sensors, as in the E64 Convertible, are used for the interior monitoring system instead of ultrasonic sensors. The microwave sensors facilitate monitoring of the vehicle interior also when the convertible top is down.

The microwave sensors have a semicircular radiation characteristic. By strategic placement in the vehicle, the entire interior can be monitored without the microwave sensors radiating outside the vehicle.

Four microwave sensors are used on the E93 Convertible for the purpose of monitoring the interior. The microwave sensors are connected via the DWA bus to the SINE (siren with tilt alarm sensor). The DWA bus is a sub bus based on the K-bus. SINE is the master control unit and is connected directly to the KCAN. The entire control of the anti-theft alarm system is located in the SINE.

Anti-Theft System Schematic



Legend for Anti-Theft System Schematic

Index	Explanation
1	Hood contact
2	Car Access System
3	Interior rear-view mirror with remote control receiver and DWA LED
4	Junction box
5	Passenger’s door contact
6	Microwave sensor, front right
7	Microwave sensor, rear right
8	Siren with tilt alarm sensor
9	Boot lid contact, right
10	Boot lid contact, left
11	Microwave sensor, rear left
12	Microwave sensor, front left
13	Driver’s door contact
14	Footwell module (FRM)

Power Seats with Easy Entry Function

Special seats with a seat-integrated seat belt system as in the E46/E64 are installed in the E93 Convertible. The electrically adjustable seats (comfort and sport) are equipped with a rear compartment easy-entry function to facilitate entry in the rear compartment.

For this purpose, an adjustment switch is provided on the upper end of the backrest in order to move the seat forward and backward at double the speed via the seat forward/backward adjustment function.

When entering the rear compartment, the customer can move the seat forward with the adjustment switch. By mechanically releasing the seat backrest, it can be additionally tilted forward to create sufficient space for convenient entry.

Index	Explanation
1	Switch for rear compartment easy entry
2	Backrest release lever

At the same time, the headrest is retracted so that the backrest can be completely folded down and does not come in contact with the sun visor. Retraction of the headrest depends on the position of the seat. The headrest is not retracted if the seat position is set in the area approximately 8-10 cm from the rear end stop as there is sufficient space to fully fold down the backrest in this position.

Following entry, the backrest is folded back, the headrest automatically returns to its previous position and the seat can be moved back using the adjustment switch. The position of the headrest is detected by a Hall sensor on the headrest adjustment motor.

The seat moves back and assumes the previous position. The previous position is also determined by means of a Hall sensor on the seat forward/backward adjustment motor. The signals from the Hall sensors are read into the driver or passenger seat module and correspondingly evaluated. The front passenger seat module has no memory function.

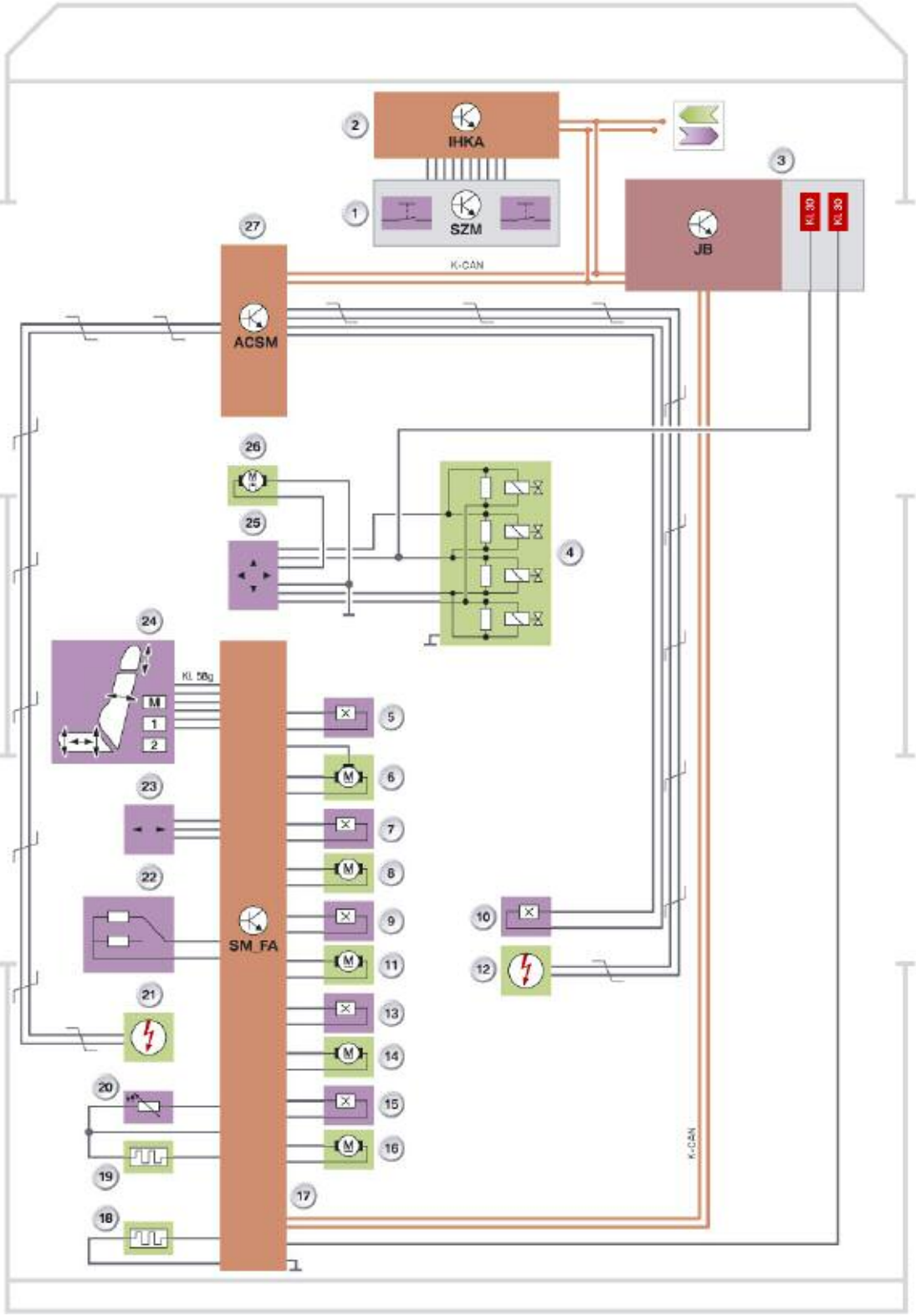
A new feature of the seat in the Convertible is the integration of the side airbag in the backrest. The use of the SGS seat with integrated seat belt system makes it necessary to monitor the backrest lock. If the backrest were not locked correctly, there would be the danger of the occupant moving forward with the backrest without any restraint effect. This would be equivalent to the occupant not wearing a seat belt.

For this reason, the backrests on the driver and front passenger seats are monitored to ensure they are locked correctly. The driver/passenger seat modules monitor the position with Hall sensors in the backrest. The information is sent to the crash safety module via the K-CAN link. The information is used in the calculation of the triggering algorithm.

A backrest that is not locked correctly would have the same effect on the triggering characteristics as an occupant not wearing a seat belt.

If the backrests are not locked correctly, the driver/passenger seat module generates check control messages which are sent via the K-CAN to the instrument cluster and the central information display.

Driver's Seat Schematic



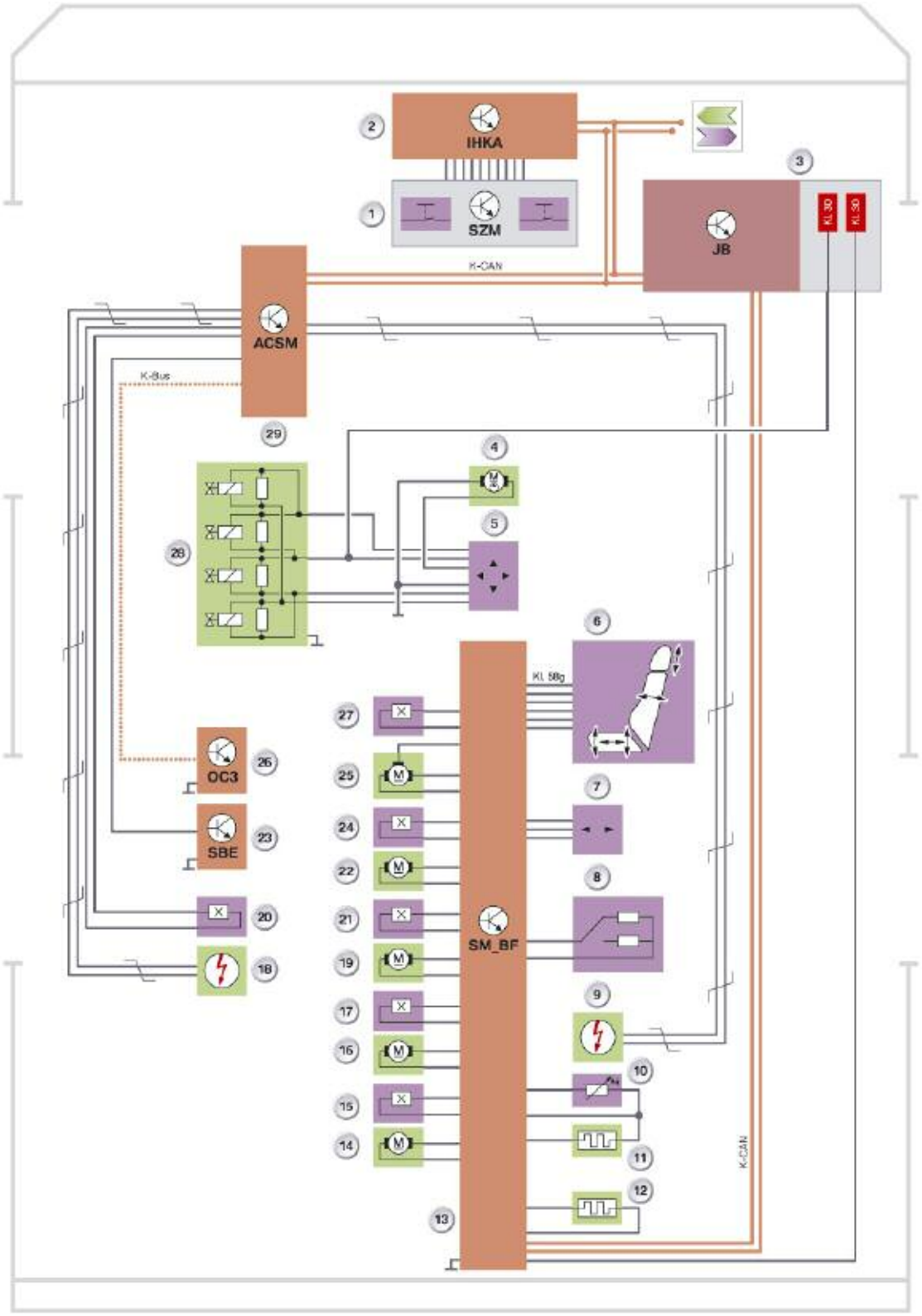
Legend for Driver's Seat Schematic

Index	Explanation	Index	Explanation
1	Center console switch cluster with seat heating buttons	15	Position, headrest height adjustment
2	IHKA	16	Motor, headrest height adjustment
3	Junction box	17	Driver's seat module
4	Pressure control valves for lumbar support adjustment	18	Backrest heating
5	Position, seat forward/backward adjustment	19	Seat cushion heating
6	2-stage motor for seat forward/backward adjustment	20	Seat heating temperature sensor
7	Position, seat height adjustment	21	Side airbag, driver
8	Motor, seat height adjustment	22	Backrest locking contact
9	Seat tilt position	23	Rear compartment easy entry switch
10	Seat belt buckle position	24	Seat adjustment switch with memory buttons
11	Motor for seat angle adjustment	25	Lumbar support button
12	Seat belt pre-tensioner	26	Motor for lumbar support adjustment
13	Backrest tilt position	27	ACSM control unit
14	Motor for seat backrest angle adjustment		

Signals

Input	Information	Source/to	Function
In	Terminal control (KL15)	CAS3> Driver's seat module	Status, KL15
In	Terminal status (KL50)	CAS3> Driver's seat module	Electric load shutdown
Out	Electric load output	Energy management (DME)	Power reduction depending on charge balance
Out	Backrest lock	Driver/passenger's seat module >ACSM	Triggering algorithm
Out	Backrest lock	Driver's/passenger's seat module > KOMBI > CID	Check control message

Passenger's Seat Schematic



Legend for Passenger's Seat Schematic

Index	Explanation	Index	Explanation
1	IHKA	16	Motor for seat backrest angle adjustment
2	Center console switch cluster	17	Backrest tilt position
3	Junction box	18	Seat belt pre-tensioner, front passenger
4	Motor for lumbar support adjustment	19	Motor for seat angle adjustment
5	Lumbar support button	20	Seat belt buckle position switch
6	Switch for seat settings	21	Seat tilt position
7	Rear compartment easy entry switch	22	Motor, seat height adjustment
8	Backrest locking contact	23	Not for US Market
9	Side airbag, front passenger	24	Position, seat height adjustment
10	Seat heating temperature sensor	25	2-stage motor for seat forward/backward adjustment
11	Seat cushion heating	26	Seat Occupancy Detector (OC-3)
12	Backrest heating	27	Position, seat forward/backward adjustment
13	Passenger's seat module	28	Pressure control valves for lumbar support adjustment
14	Motor, headrest height adjustment	29	ACSM control unit
15	Position, headrest height adjustment		

Signals

Input	Information	Source/to	Function
In	Terminal control (KL15)	CAS3> Driver's seat module	Status, KL15
In	Terminal status (KL50)	CAS3> Driver's seat module	Electric load shutdown
Out	Electric load output	Energy management (DME)	Power reduction depending on charge balance
Out	Backrest lock	Driver/passenger's seat module >ACSM	Triggering algorithm
Out	Backrest lock	Driver's/passenger's seat module > KOMBI > CID	Check control message

Changes to Control Units

Due to the various mechanical and electrical changes on the E93, some control modules have been modified or moved from their familiar locations. Brief explanations of these changes are in the following pages.

Roof Functions Module (FZD)

The roof functions module has been adapted in terms of its functionality and geometric form to the specific requirements of the E93 Convertible.

The following functions have been adopted:

- Interior lights, reading light and top light
- Connection of the electrochromic interior rear/view mirror and transmission of values on the K-CAN
- Connection of rain/lights sensor via LIN
- Gateway function LIN > K-CAN
- Connection of the condensation sensor and transmission on the K-CAN
- Emergency call button (option)
- Passenger airbag OFF light (option)

The following functions have been dropped:

- Connection of interior lights at rear
- Ultrasonic interior movement detector
- Operation and actuation of slide/tilt sunroof
- Microphones for hands-free and voice input

On the E93 Convertible, the microphones for hands-free and voice input are located on the steering column trim panel.

FZD Location on E93

Location of microphones for phone and voice input

Junction Box

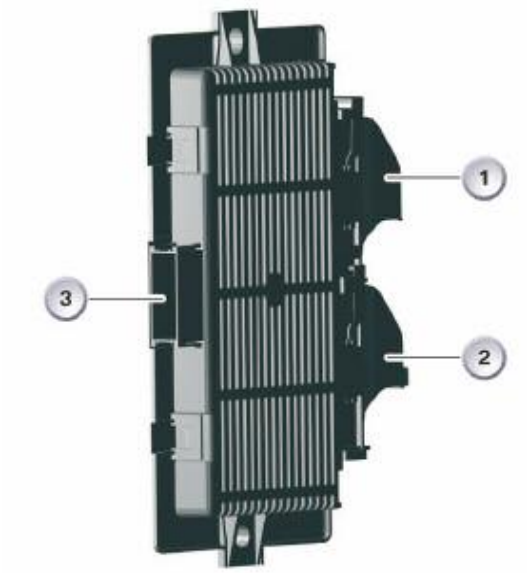
The functions of the junction box have been included to drive the actuators for the glove compartment and storage compartment in the center console.

The gateway function has been adapted to accommodate the D-CAN. At present, all other models are still equipped with the previous diagnosis interface (K-LINE 115 kbit/s).

Footwell Module

As the master control unit for the power windows, the footwell module is responsible for evaluation of the central power window switch. The central power window switch in the Convertible makes it possible to open and close all four side windows simultaneously.

A further function is the extended travel range of the power windows as on the E46/E64 Convertible. The extended travel range function of the power windows is activated when the retractable hardtop is lowered. All side windows are lowered almost fully during this operation to ensure smooth opening.



Index	Explanation
1	51-pin harness connector, main harness
2	51-pin harness connector, main harness
3	26-pin connector, dashboard

Car Access System (CAS3)

The comfort functions of the retractable hardtop have been added to the car access system.

Index	Explanation
1	42-pin connector, main harness
2	14-pin connector, ribbon cable

Power Windows

The E93 Convertible is equipped as standard with power windows at the front and rear. In addition to the individual power window buttons, the switch cluster on the driver's side contains a central button (1), with which all windows can be lowered simultaneously.

As a standard feature on BMW Convertibles, the side windows are frame-less. The windows must enter the door seal by several millimeters in order to avoid leaks and wind noise.

The door windows must be lowered by approximately 15 mm to ensure the doors can be opened and closed without applying any effort.

Automatic Climate Control

The E93 Convertible is available with the following heating/air conditioning systems:

- Integrated automatic climate control (IHKA)

The E93 Convertible with its retractable hardtop combines two vehicles in one. It is a Coupe when closed and a Convertible when open, a fact taken into account by the automatic climate control to create pleasant and comfortable heating/ventilation conditions.

This characteristic makes it possible for an individual climate control program for both states. The software automatically initiates the automatic climate control program when it detects that the hardtop is down.

Trials and customer surveys have shown that the previous air conditioning systems set up for Sedans or Coupes were not ideal for a Convertible with the top down.
The temperature and blower output stage had to be constantly readjusted for the purpose of ensuring pleasant interior conditions.

All control parameters are adapted to the requirements of driving with the top down when the hardtop is lowered.

Convertible mode requires no additional sensors. The IHKA control unit was programmed with corresponding software that takes these specific parameters into account.

Convertible Mode Setting

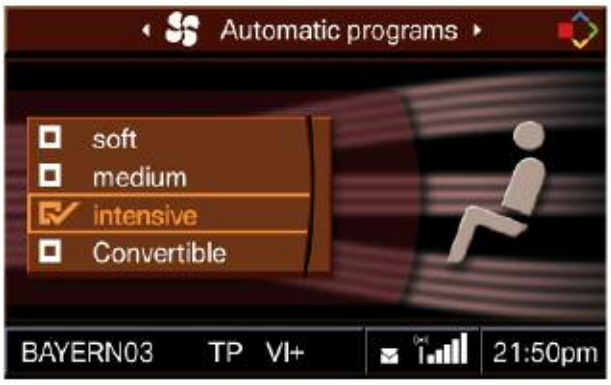
Convertible mode is available only in vehicles equipped with the optional fully automatic climate control (IHKA).

Convertible mode is activated by opening the retractable hardtop. The IHKA receives the corresponding information on the status of the hardtop from the Convertible top module (CTM).

Convertible mode is always active on vehicles with no central information display (CID). On vehicles with central information display, the Convertible Mode box in the "Automatic Program" menu must first be activated. This activation is possibly only with the hardtop open and is set to active as part of initial programming.

Note: If Convertible mode is not activated, the selected automatic program (soft, medium, intensive) is activated when the hardtop is opened.

Settings with Hard Top Down



Settings with Hard Top Up

All other program settings are deactivated (grey) if Convertible mode is activated with the hardtop lowered. The other program settings can be selected if Convertible mode is not activated with the hardtop lowered.

Convertible mode cannot be selected when the hardtop is closed. Convertible mode that has already been selected is correspondingly indicated, however, it is not active when the hardtop is closed (grey) and can also not be changed.

Convertible Mode Control

The aim of Convertible mode is to create an automatic climate control program that makes it unnecessary to continually make manual adjustments while driving.

When driving with the top down, the occupants consciously expose themselves to the solar radiation and outside temperature at changing driving speeds. These parameters have a decisive influence on the climate in the vehicle interior and must therefore be taken into consideration in the control concept.

The spatial separation of the interior is cancelled when the hardtop is opened thus drastically reducing the influence of the interior temperature sensor. The temperature control for the vent outlet temperature is strongly orientated on the outside temperature.

The sun's intensity has a great influence on the climate in the vehicle interior when driving with the top down. Therefore, changes in conditions such as cloudless, cloudy or daytime/night-time are included via the solar sensor to a greater extent in the temperature control than when the hardtop is up.

Unlike when the vehicle is closed, the ventilation outlets become the dominant air distribution level when the hardtop is down and are therefore always fully opened while, to achieve a comfort balance, the footwell outlets must always be restricted as soon as the operating temperature of the engine necessary for heating is reached.

Measures for keeping the windscreen/windows clear are not necessary when driving with the top down, therefore the defrost outlets always remain closed.

The driver sets the required temperature at the temperature control. Depending on the outside temperature, sun's intensity and vehicle speed, the required interior climate is maintained by the supply of correspondingly temperature-controlled air. The most comfortable conditions are achieved with the side windows closed and a wind deflector additionally installed.

The ram pressure compensation that serves the purpose of keeping the air throughput constant when the vehicle is closed is cancelled in Convertible mode. The blower output Is additionally increased based on the vehicle speed in order to maintain a constant air flow about the occupants.

The increasing air volume essentially shields the occupants from increasing turbulence at higher vehicle speeds. The occupants subjectively notice no difference in temperature conditions.

The AUC function is also active in Convertible mode up to a speed of 45 MPH. It is deactivated at higher speeds. This is intended to ensure that no pollutants are blown into the interior of the vehicle via the air conditioning outlets when driving at low speeds, e.g. in urban or stop-and-go traffic. The best effect is achieved with the side windows closed.

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Information and Communication Technology

Several changes have been made to the iDrive in connection with the launch of the E93 Convertible as from 03/07. In addition to the visual changes to the user interface in the form of different fonts and colors the operating philosophy of the Setup menu has been correspondingly adapted. Eight favorites buttons have been included for convenience in operation.

Corresponding software adaptations have also been implemented. Some of the new features are dependent on the optional equipment configuration, e.g. menu for light settings.

Changes in the Setup Menu

The individual user settings can be selected in the Setup menu. As on the other models with CCC as from 09/2006, an additional menu bar has been included in the Setup menu.

The following menu items can be selected in the menu bar:

- Screen OFF
- Information sources
- Settings

Further settings are linked to each menu item. The available menu items depend on the equipment configuration. A new pairing assistant for linking the Bluetooth telephone to the vehicle is provided under the Bluetooth menu item.

Favorites Button for CCC / MASK

Eight additional favorites button have been added to the two options navigation system Business with MASK and navigation system Professional CCC.

The following functions can be stored under the favorites buttons for quick access:

- Radio stations
- Navigation destinations
- Stored telephone numbers/names
- CD/DVD player
- CD changer
- MP3

Note: The freely selectable favorites buttons in the multifunction steering wheel are assigned as before.

The eight favorite buttons are accommodated in the front panel under the upper CD/DVD player. The buttons can be assigned with functions from the entertainment, telephone and navigation menus.

Six buttons are freely programmable for CCC and two buttons are assigned to FM/AM and MODE.

In addition to the pressure sensor element, the buttons contain a capacitive sensor that shows the assignment status of the button when touched in the info bar of the central information display.

A button is simply pressed for longer than 2 seconds to assign a function to it.

Navigation with CCC

Index	Explanation	Index	Explanation
1	Slot in DVD player	5	Eject button, CD player
2	Favorites buttons	6	Rocker switch for station selection, CD
3	Rotary push button	7	Eject button, DVD player
4	Slot in CD player		

Interface Box (High)

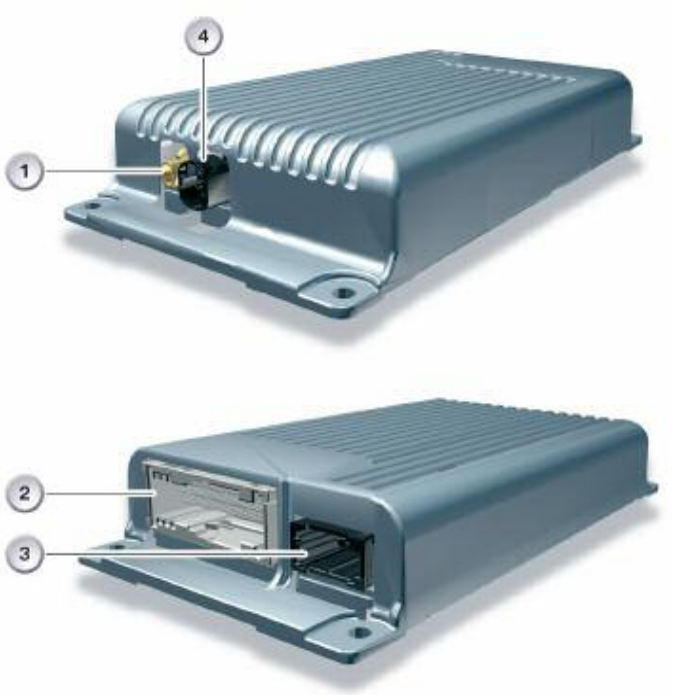
The US vehicle will receive a high variant of the interface box, the SBX High contains following functions:

- Pairing of customer mobile phone to the vehicle via Bluetooth interface
- Voice-activated control of the telephone or expanded voice-activated control in connection with the Assist/Bluetooth option
- Connection of USB/audio interface for USB storage media.

The USB/audio interface can be ordered through the option SA 6FL. The USB interface is located in the immediate vicinity of the 3.5 mm audio jack (AUX-IN). Audio files stored on USB mass storage media can be played in the vehicle via the USB/audio interface.

USB mass storage media that support one of the following standards be connected:

- USB Mass Storage Class
- Apple iPod as from 4th generation.



Index	Explanation
1	Bluetooth signal
2	54-pin connection
3	MOST connection
4	USB connection

Antenna Systems

Since the standard locations for antennas on the roof or in the fixed rear window are not available on the E93 Convertible, the various antenna systems are distributed and integrated in the vehicle. Antennas are required for the following systems:

- Radio
- Digital receivers
- Navigation
- Telephone and telematics
- Remote control

With the exception of the SDARS antenna, the E93 Convertible has no visible antennas. The Convertible does not even have the standard rod antenna, a feature contributing to the harmonious appearance of the exterior.

AM/FM Antennas

Four FM antennas (FM1-FM4) and one AM antenna that are switched via an FM antenna diversity function are used for radio reception in the E93 Convertible.

Index	Explanation
1	FM1 Antenna
2	AM Antenna
3	FM3 Antenna
4	FM2 Antenna
5	FM4 Antenna

Different antennas are used when the hardtop is closed or lowered. When closed, the AM, FM1 and FM3 antennas in the rear window are used as in a Coupe. The antenna amplifier and the rejector circuit for the rear window defogger are located on the left C-pillar. There is only a rejector circuit on the right-hand C-pillar.

The E93 Convertible has many information and communication antennas all of which, except for one, are concealed. Only the SDARS antenna on US vehicles is located on the rear lid as this requires a direct reception path to the satellites. The antenna systems are divided into radio, digital receiver, telephone, navigation and remote control.

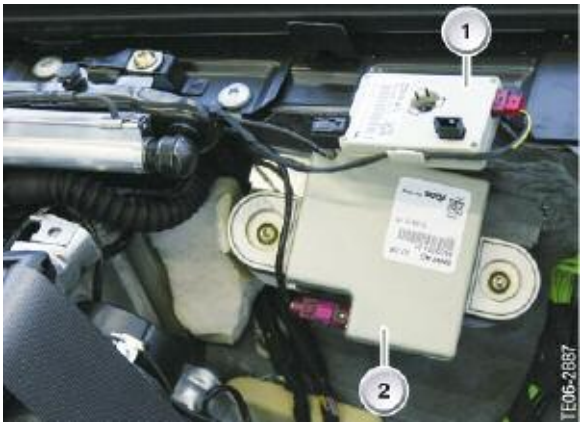
The FM2 and FM4 antennas are located behind the rear bumper panel. The antenna amplifiers for the FM2 and FM4 antennas are located in the antenna diversity module on the rear left in the luggage compartment.

Index	Explanation
1	FM4 Antenna
2	FM2 Antenna

AM and FM1 Antenna, Left

When the hardtop is lowered, the rear window is folded in the luggage compartment so that reception via the antennas is no longer possible. For this reason, a further AM and FM1 antenna is located in the left side trim panel at the rear.

AM and FM1 antenna in LH trim panel

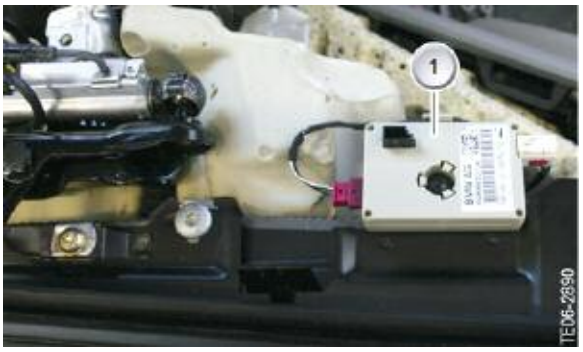


Index	Explanation
1	Antenna amplifier, left
2	Emergency antenna

FM3 Antenna, Right

The FM3 antenna is located in the right side trim panel at the rear. Each antenna has its own antenna amplifier. A total of four antenna amplifiers are installed. The received and amplified signal (RF signal) is then sent to the FM antenna diversity module on the rear left in the luggage compartment.

FM3 antenna in RH trim panel



Index	Explanation
1	Antenna amplifier, right

FM Antenna Diversity

The E93 Convertible features a four FM antenna diversity system that is made up of the following antennas:

- FM1 and FM3 antenna in the rear window
- FM1 and FM3 antenna in the side trim panel
- FM2 and FM4 antenna in the rear bumper
- Antenna amplifier on the C-pillar
- Antenna amplifier on the left and right shoulder (trim)
- Antenna amplifier in diversity module.

Antenna diversity module

Index	Explanation	Index	Explanation
1	FM2 and FM4 antenna input	5	RF signals, rear window
2	Power supply for external antenna amplifiers and input, KL30g	6	RF signal of FM3
3	Signal from CTM and Radio ON	7	RF signal of AM/FM1
4	RF signal for radio navigation	8	Changeover voltage/diagnosis

The switchover between the antennas in the rear window and side trim panels takes place by means of a signal from the Convertible top module CTM.

The sequence of FM antenna diversity is not defined as on previous models. On the E93, the reception quality and field strength of all antennas are checked and stored in a memory.

The next best FM antenna in the list is selected if the signal quality of the radio station received at the active antenna is insufficient in terms of quality and field strength.
The antennas are evaluated and the list updated at the same time as the switchover between the individual antennas.

Changeover takes place in such a way that no interruption is heard. The high frequency signal (RF) of the active FM antenna is routed from the antenna diversity module via a coaxial cable to the tuner for the radio or navigation system. The signal is de-modulate in the tuner and output via the speakers as an audio signal.

The radio or navigation system detects whether a diversity module is installed and generates the changeover voltage (Us) necessary for diversity operation and the intermediate frequency signal (IF).

The IF is evaluated by the electronic circuitry in the diversity module and is a copy of the radio station currently heard on the fixed frequency of 10.7 MHz.

The changeover between AM/FM1 reception and diagnosis mode takes place with the aid of the changeover voltage. This voltage is generated by the radio and used in the diversity module for evaluation purposes.

Diversity mode is active at 2.5 volts (Us = 2.5 V). AM mode is active or the FM1 antenna selected at 0 Volts (Us = 0 V). Diagnosis mode is active at 5 Volts (Us = 5 V).

Up to three signals can be transmitted simultaneously on the coaxial cable:

- RF signal (e.g. 87.5 - 108 MHz) from diversity module to radio
- Control voltage (Us) from radio to diversity module
- Intermediate frequency (IF = 10.7 MHz) from radio to diversity module as basis for assessing the quality of the RF signal.

Mutual influencing is not possible due to the different frequencies. The frequency of the antenna diversity module is 87.5-108 MHz.

Note: No antenna diversity is provided for SW, MW and LW reception as there is only one AM antenna.

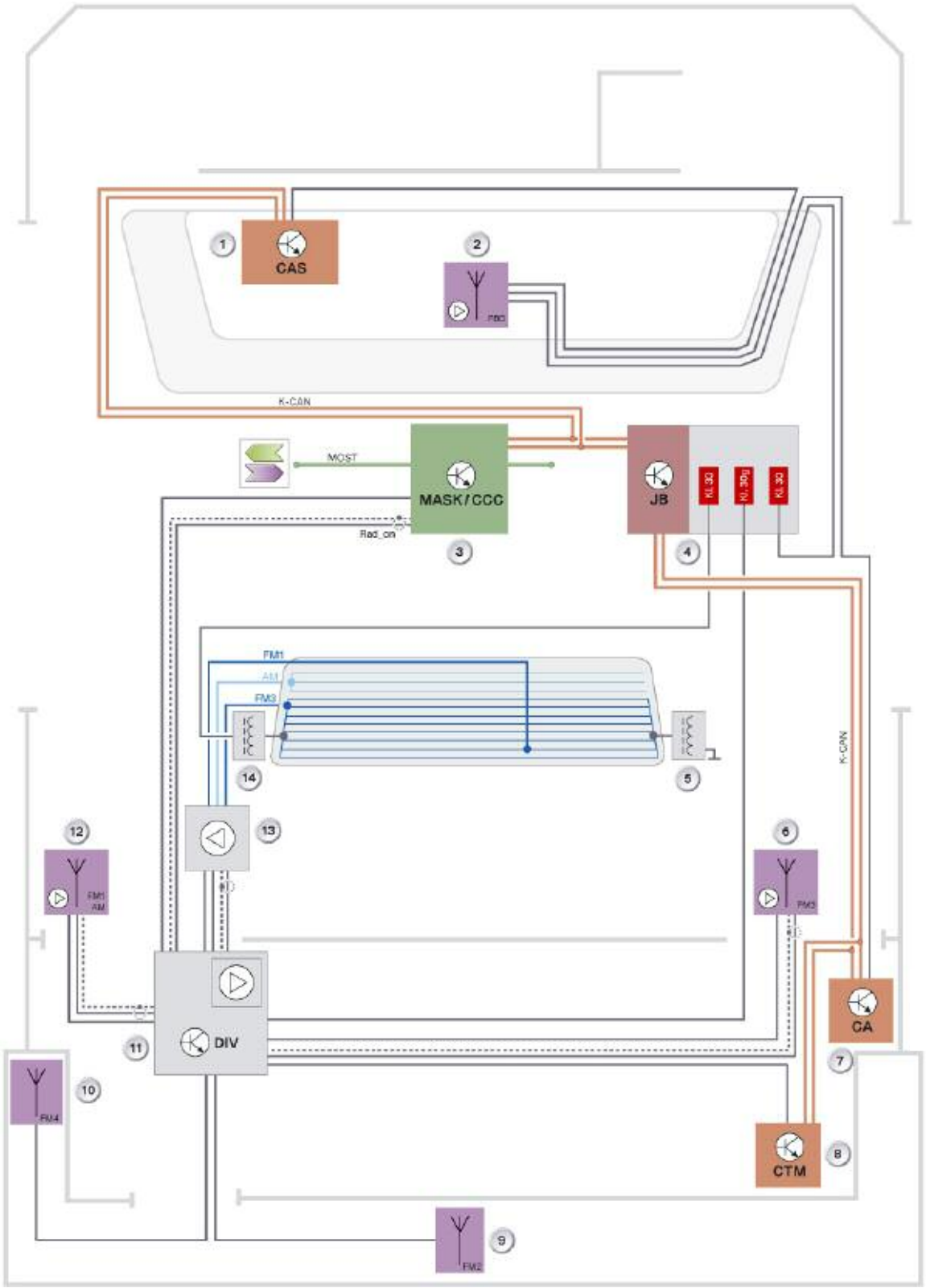
Satellite Antenna

The SDARS uses the “shark fin” antenna on the rear trunk lid area.

IBOC

The terrestrial In Band on Channel (IBOC) uses the FM antennas for digital reception.

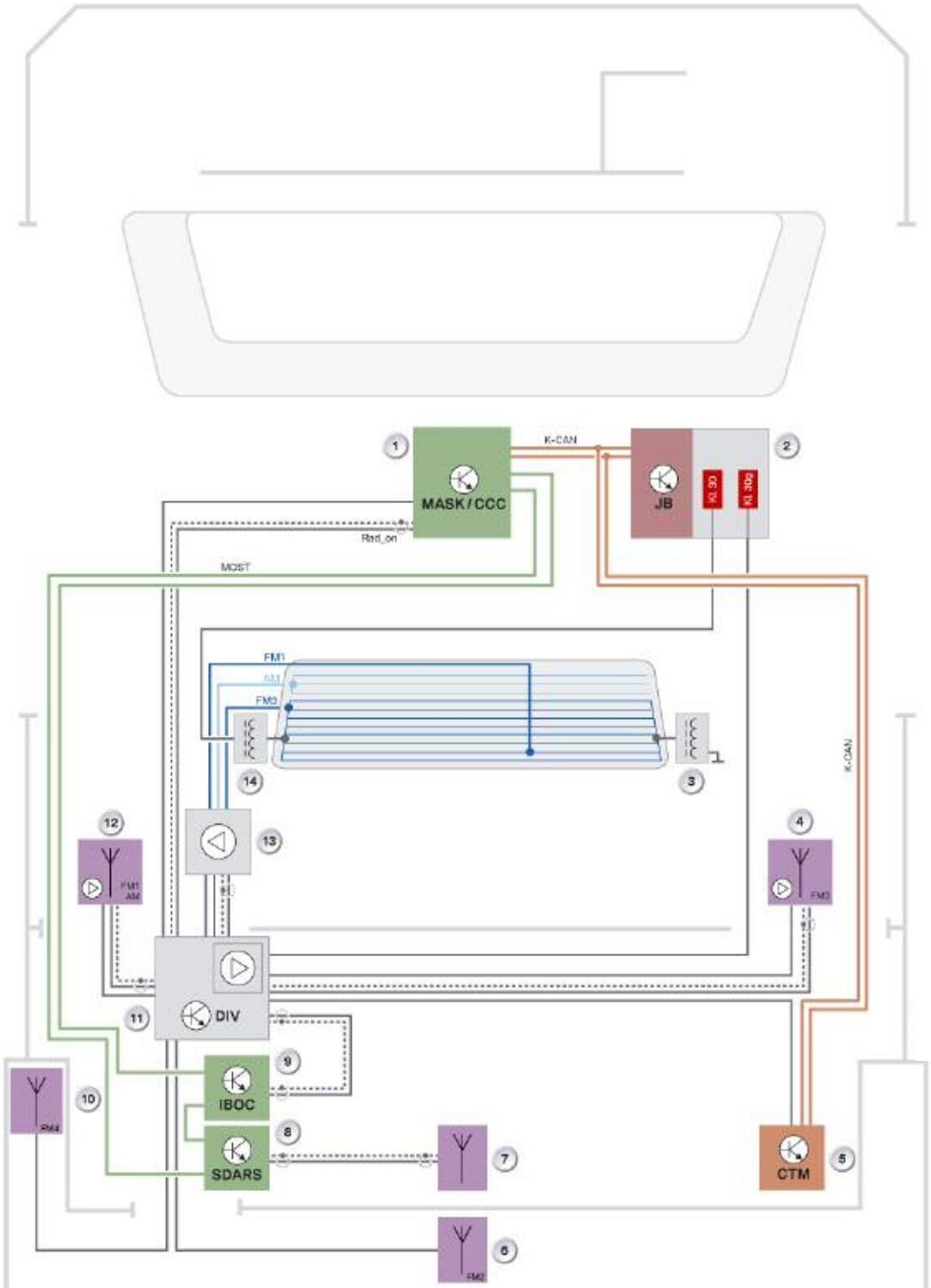
AM/FM Antenna Schematic



Legend for AM/FM Antenna Schematic

Index	Explanation
1	Car Access System
2	Remote control receiver in interior rear view mirror
3	CCC
4	Junction box
5	Rejector circuit, negative
6	FM3 antenna with amplifier in right hand shoulder trim
7	Comfort Access
8	Convertible Top Module
9	FM2 antenna in bumper
10	FM4 antenna in bumper
11	FM antenna diversity module
12	AM/FM1 antenna with amplifier in left hand shoulder trim
13	AM/FM antenna amplifier in rear window
14	Rejector circuit, positive

IBOC and SDARS Schematic



Legend for IBOC and SDARS Schematic

Index	Explanation
1	CCC
2	Junction box
3	Rejector circuit, negative
4	FM3 antenna with amplifier in right hand shoulder trim
5	CTM
6	FM2 antenna in bumper
7	SDARS antenna on rear lid (shark fin)
8	SDARS receiver (satellite tuner)
9	IBOC receiver
10	FM4 antenna in bumper
11	FM antenna diversity module
12	AM/FM1 antenna with amplifier in left hand shoulder trim
13	AM/FM antenna amplifier in rear window
14	Rejector circuit, positive

Antennas for Telephone and Telematics

The following antennas are required for telephone and telematics functions:

- Telephone antenna
- Telematics antenna
- SOS antenna
- GPS antenna
- Bluetooth antenna for internal communication

Telephone Antenna

The telephone antenna is located under the side panel on the front left. This position is possible as the side panels on the E93 Convertible are made of plastic.
The telephone antenna is routed directly to the eject box in the center console.

Telematics Antenna

The telematics antenna (1) is located on the rear bumper under the left tail light.
On vehicles equipped with the Assist, the telematics antenna is connected directly to the telematics control unit TCU and is used solely for data transmission relating to telematics functions.

SOS Antenna

The SOS antenna (2) is activated if the emergency call function is no longer possible via the telematics antenna after an accident. The SOS antenna is installed under the side trim panel on the rear left.

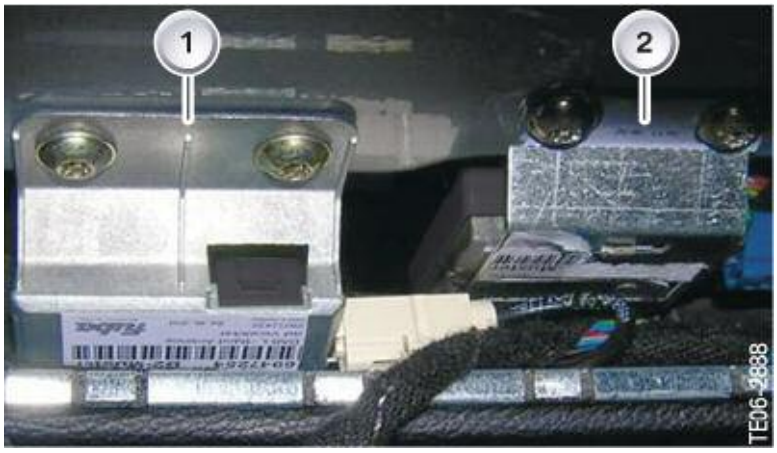
Bluetooth Antenna

The Bluetooth antenna (1) is used for internal transmission of data between the mobile phone and vehicle.
The antenna is located in the left footwell trim panel.

GPS Antenna

A GPS antenna (2) is necessary for the telematics function - Automatic emergency call with location -. On vehicles with CCC navigation system, the GPS antenna is routed directly to the navigation computer. The TCU receives the position data via the MOST.

The GPS antenna is connected directly to the TCU on vehicles with no navigation system but with radio Professional and telematics functions. In this case, the TCU determines the location. The GPS antenna is located behind the roof functions module in the roof frame.



Index	Explanation
1	Not for US Market
2	GPS Antenna

Arrangement of IKT Control Modules

Index	Explanation
1	Telematics control module (TCU)
2	IBOC tuner
3	Hifi or Top Hifi amplifier
4	CD Changer
5	Auxiliary fan for SDARS
6	Satellite tuner

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Passive Safety Systems

In the same way as the Sedan, the E93 Convertible offers vehicle safety at the highest level for all occupants as well as in all crash situations. Numerous reinforcements have been implemented in the body for the purpose of conforming to worldwide stipulations relating to a uniform body.

The loads and stresses that occur in the case of a crash are counteracted by a reinforced floor assembly and a reinforced bulkhead with high-strength A-pillars. The reinforced floor assembly is required particularly in the area of the front seats in order to direct the forces that are exerted in the event of a crash by the seat integrated seat belt systems into the floor assembly.

The sills were reinforced specifically for the Convertible in order to be able to absorb the forces in the event of a side crash and to direct them to the opposite side of the impact.

The roof frame in the area of the windscreen has been reinforced and forms the rollover protection system together with the roll bars integrated in the partition module.

In the event of a crash, in which the vehicle rolls over, the roll bars extend in milliseconds and, together with the roof frame, form an adequate survival space for the occupants.

The E93 Convertible is equipped with a passive safety system with rollover protection. In the event of a crash, in which the vehicle rolls over, the roll bars extend automatically and, together with the windscreen frame form an adequate survival space for the occupants.

The rollover sensor system is integrated in the crash safety module. The actuators are triggered by the ROC control unit. In the event of a side crash, an enlarged side airbag located in the backrest protects the thorax and head of the occupants.

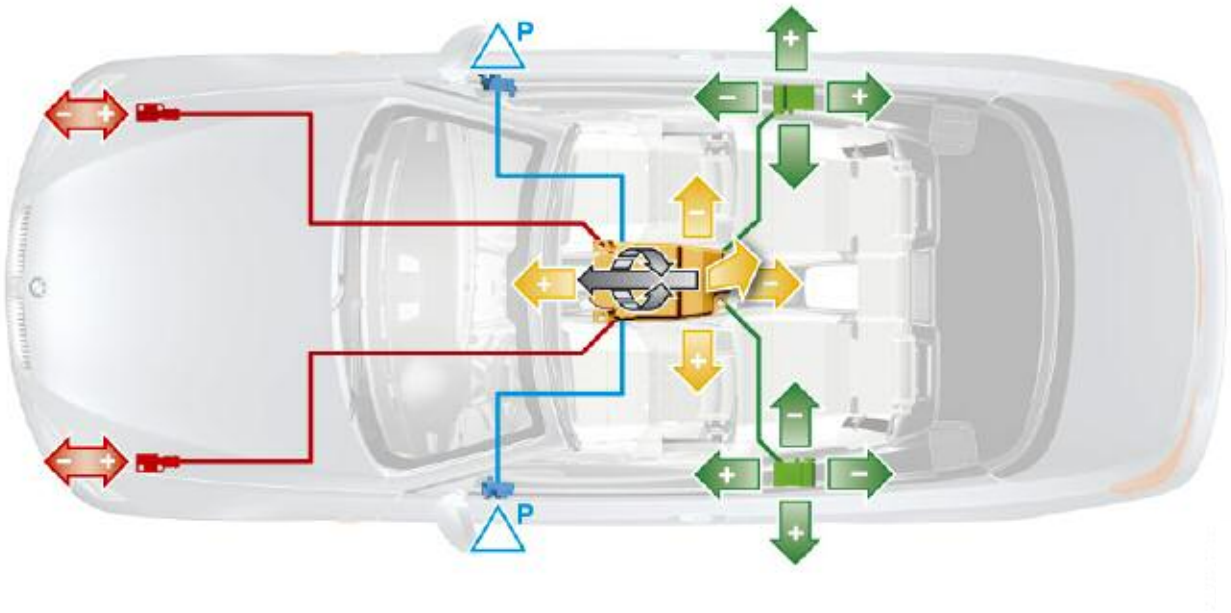
Advanced Crash and Safety Management

The E93 Convertible is equipped with the second generation advanced crash and safety management system (ACSM2). In terms of its scope of functions, the ACSM2 is identical to the ACSM in the E64 Convertible.

The ACSM2 differs from the ACSM in that the supplier is different and it features additional interfaces for future function expansions. The first generation ACSM is supplied by Autoliv while the second generation ACSM is supplied by BOSCH.

The task of Advanced Crash and Safety Management is to evaluate permanently all the sensor signals in order to identify a crash situation. As a result of the sensor signals and their evaluation, the crash safety module identifies the direction of the crash and the severity of the impact.

The crash safety module incorporates a longitudinal acceleration sensor and a transverse acceleration sensor. The sensors serve to detect and verify front-end, side-on and rear-end crashes.



In the E93 Convertible the crash safety module has additional sensors for rollover detection.

Satellites are also integrated in the B-pillars. The satellites each consist of a longitudinal acceleration sensor and a transverse acceleration sensor.

Together with the transverse acceleration sensor in the crash safety module, the transverse acceleration sensors serve to detect side-on crashes. Door pressure sensors are additionally installed in the front doors for the purpose of detecting side crashes.

Together with the longitudinal acceleration sensor in the crash safety module, the longitudinal acceleration sensors serve to detect front and rear-end crashes.

The acceleration sensors measure the positive acceleration (+) and the negative acceleration (- / deceleration) in the X and Y directions. The resultant from the X and Y signals is the definitive factor in determining the direction of the impact.

US vehicles have additional up-front sensors for front-end crash detection.

Also included is information on the occupants and whether they have their seat belts fastened or not. From this information, measures are taken to selectively trigger the necessary restraint systems.

In order to ensure ACSM operational availability at all times, the system monitors itself and indicates that it is ready for operation when the airbag warning lamp (AWL) goes out.

If a fault occurs during operation, this is stored in a fault memory, which can then be read out for diagnostic purposes.

In the event of a crash, this is communicated to the other users in the bus-system network by way of a bus telegram. The relevant control units respond to this telegram by executing their own activities.

These activities include:

- Opening the central-locking system
- Activating the hazard warning flashers
- Switching on the interior lights
- Deactivating the fuel pump
- Switching off the alternator
- Automatic emergency call.

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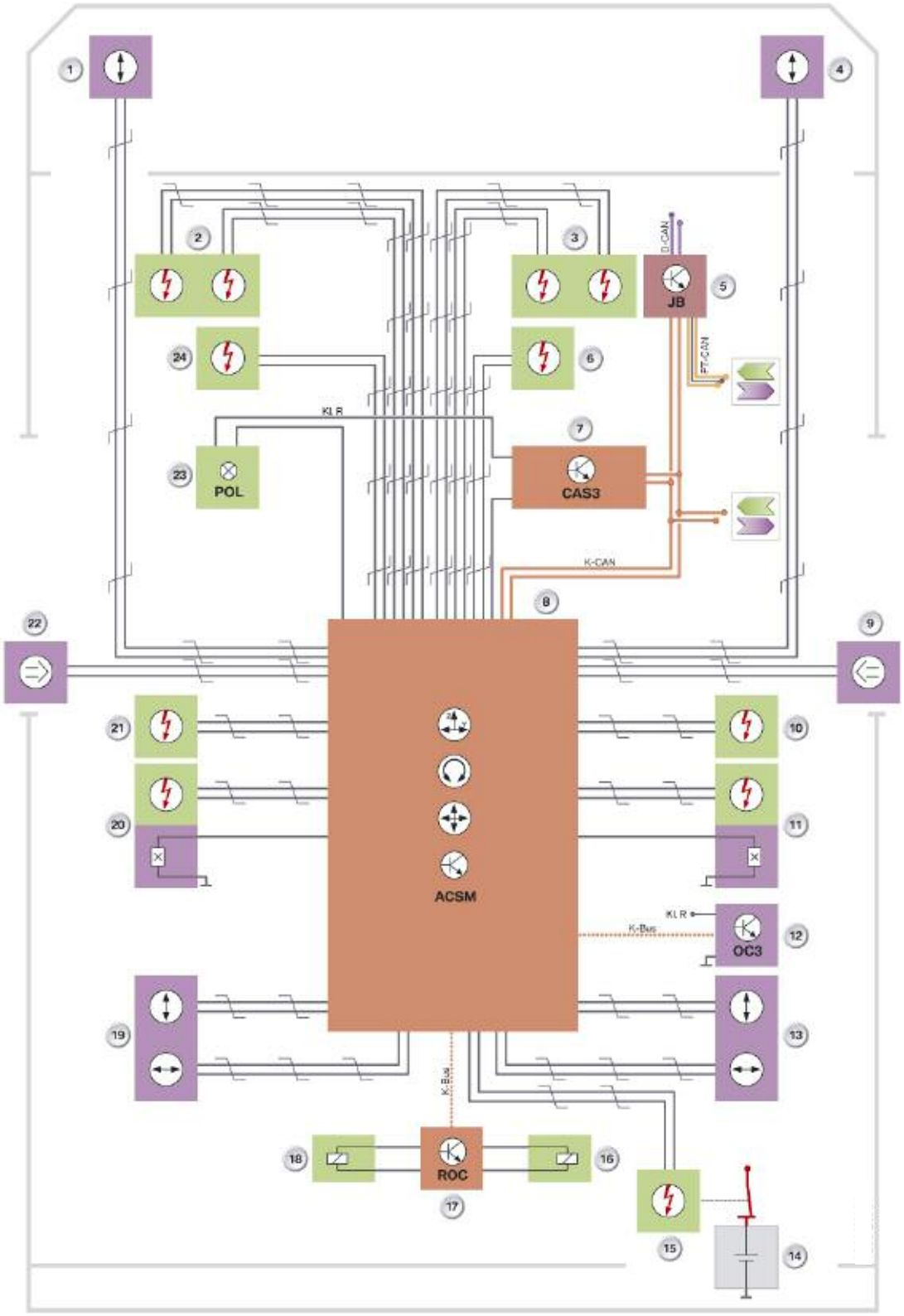
ACSM 2 Schematic



Legend for ACSM 2 Schematic

Index	Explanation	Index	Explanation
1	Up front sensor, left	13	B-pillar satellite, right
2	Driver's airbag	14	Battery
3	Front passenger airbag	15	Safety battery terminal
4	Up front sensor, right	16	Actuator, right roll bar
5	Junction box	17	Rollover controller
6	Knee airbag passenger's side	18	Actuator, left roll bar
7	CAS 3	19	B-pillar satellite
8	Crash Safety Module (ACSM 2)	20	Seat belt pre-tensioner and seat belt buckle switch, driver's side
9	Door pressure sensor, passenger's side	21	Side airbag, driver's side
10	Side airbag, passenger's side	22	Door pressure sensor, driver's side
11	Seat belt pre-tensioner and seat belt buckle switch, passenger's side	23	Passenger Airbag OFF lamp
12	OC-3 mat	24	Knee airbag, driver's side

Signals on the PT-CAN

Input	Information	Source	Function
Out	Crash Telegram	ACSM2>JB>EKP module	Shut down fuel pump
Out	Crash Telegram	ACSM2>JB>DME	Shut down alternator

Signals on the K-CAN

Input	Information	Source	Function
Out	Crash Telegram	ACSM2 > CAS 3	Open central locking
Out	Crash Telegram	ACSM 2 > FRM	Activate hazard warning lights
Out	Crash Telegram	ACSM 2 > FRM	Switch on interior lights

E93 Convertible Rollover Protection System

The rollover protection system is of vital importance to the passive safety of the E93 Convertible. The rollover protection system helps to maintain a sufficient survival space for the occupants in the event of the car overturning or rolling over.

There are different factors which can cause a car to overturn or roll over. The most common causes are:

- The car hits a ramp (e.g. a crash barrier) on one side. The car rotates about its longitudinal axis as a result of the high angular velocity.
- The car skids sideways off the road surface and buries itself with its wheels in the soft soil. The kinetic energy could be sufficient to upend and overturn the car.
- The car skids sideways off the road into the curb and is upended.

The crucial factors which determine whether the car overturns are not just the angle but also the angular velocity at which the car is set into the roll. All these vehicle movements can also occur after a front-end, side-on or rear-end crash.

The rollover protection system consists of two extendable roll bars which are housed in the partition module behind the two rear seats.

Rollover Detection

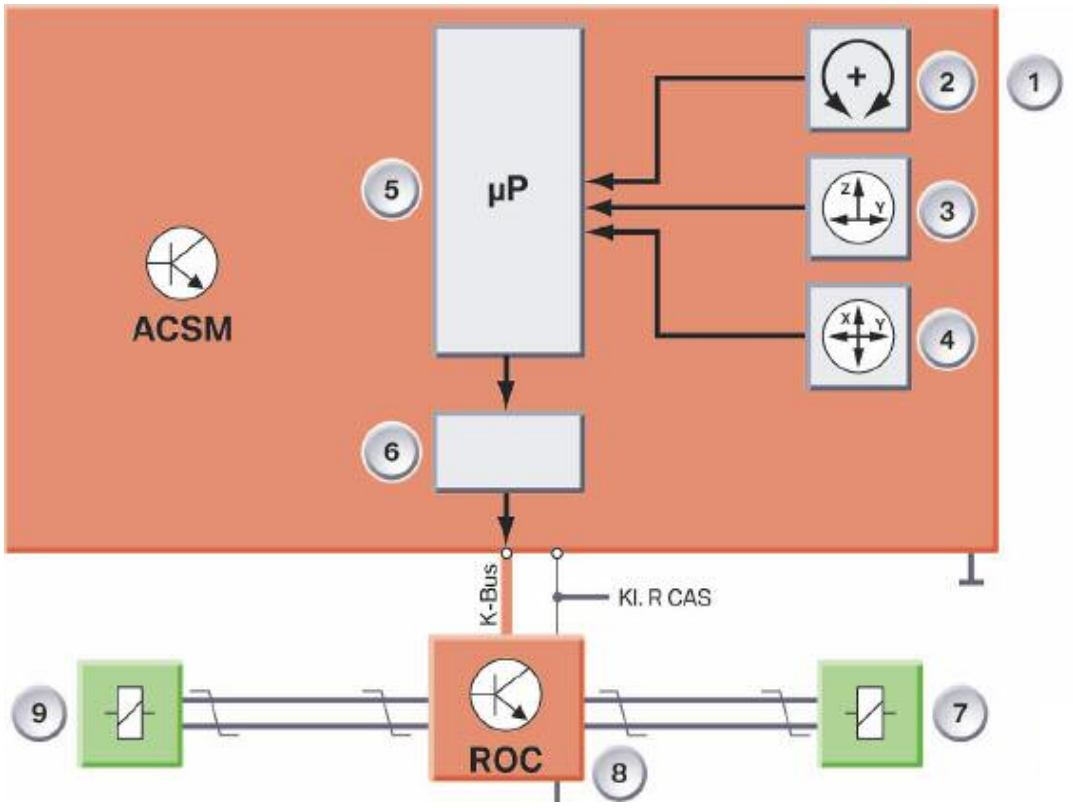
The E93 Convertible has a special sensor system in the crash and safety module ACSM2 for the purpose of detecting rollover situations. In addition of the two sensors (4) for longitudinal (X-axis) and transverse acceleration (Y-axis), there is a rotation rate sensor (2) and a Low-g sensor (3) for the Z-axis and for the Y-axis.

The longitudinal and transverse acceleration sensors (4) register the positive and negative vehicle acceleration in a range from 0-100 g. They serve to detect heavy accelerations and decelerations in a crash.

The two Low-g sensors (3) have a small measuring range of 0-2 g and can therefore detect small accelerations and decelerations with great accuracy. For example, when the vehicle skids sideways off the road surface and buries itself with its wheels in soft ground.

The sensors provide a voltage as measured variable. This voltage is a measure for the acceleration and is converted directly into digital signals in the sensor. The digital values are sent to the processor for evaluation.

The processor evaluates the signals from the longitudinal and transverse acceleration sensors and the two Low-g sensors. The rotation rate sensor is also included in the calculation. The results are compared with the stored algorithm. When the processor detects that a rollover is imminent, it sends two telegrams within a defined timeframe to the ROC control unit with the instruction to trigger the actuators.



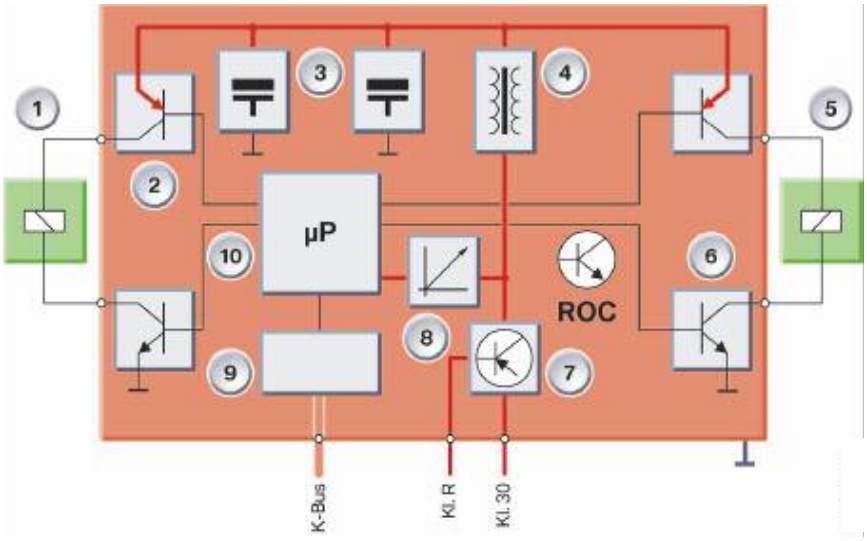
Index	Explanation	Index	Explanation
1	Crash Safety Module (ACSM 2)	6	K-bus interface
2	Rotation rate sensor	7	Actuator, right
3	Low g-sensors (Z/Y axis)	8	ROC control unit
4	Longitudinal and transverse acceleration sensors	9	Actuator, left
5	Microprocessor		

Triggering the Roll Bars

The ROC control unit is supplied with load current via terminal 30. Terminal R ON is applied as the switching signal and enables the power circuit-breaker (7). In this way, the voltage regulator (8), the microprocessor (10) and the switching controller (4) are supplied with voltage. The switching controller transforms the voltage into 35 V and charges up the two firing capacitors (3).

When the processor in the crash safety module detects an imminent rollover, it sends two telegrams within a defined time window via the K-bus.

The first telegram instructs the ROC control unit to make itself ready for firing (arming telegram). The ROC control unit incorporates two firing capacitors (3) connected in parallel for providing the firing energy. Each actuator has one high-side and one low-side power circuit-breaker.



Index	Explanation	Index	Explanation
1	Actuator, left	6	Low-side power circuit breaker
2	High-side power circuit breaker	7	Power circuit breaker
3	Firing capacitors	8	Voltage regulator
4	Switching controller	9	K-bus interface
5	Actuator, right	10	Microprocessor

The second telegram contains the firing command (firing telegram). The low-side power circuit-breakers (6) are connected to ground and the two high-side power circuit breakers (2) are switched through. The ROC control unit now discharges the two firing capacitors and the two actuators are supplied with voltage.

During normal operation, the roll bars are inserted in the cassettes in the partition module. They are pre-tensioned in the direction of their extension by a spring and held in place by a lock on the actuator.

The ROC control unit activates the two actuators via the output stages. Each actuator consists of a single-acting solenoid with a lock for disengaging and engaging its roll bar. The solenoid actuates the lock and releases the spring-loaded roll bar.

The locking pawls on the roll bar press the toothed rack back mechanically as the bar extends. When the protection bar is extended, the locking pawls are supported on the tooth strip. When the car is in the overturned position, the force is transmitted via the locking pawls on the roll bars to the toothed rack.

The rollover protection system may be triggered as follows:

- Automatically when an imminent rollover situation is detected
- By a defined crash severity in a front-end, side-on or rear-end crash
- Via the diagnostic interface
- By a mechanical emergency release mechanism.

In order to return the triggered roll bar back into its initial position, it is necessary to press the toothed strap back so that the bar can be pushed in.

Triggering the Rollover Protection System (via diagnosis equipment)

To check the function of the rollover protection system, it is necessary to trigger the system using the diagnostic equipment. The output stages of the actuators are activated here with the aid of a test module.

It is absolutely essential to observe the following safety precautions:

- Open the hardtop otherwise the rear window will be damaged
- Make sure no-one is situated in the immediate vicinity of the roll bars.

Mechanical Emergency Release

The rollover protection system should be triggered if it has to be removed for repair work. If this cannot be done electrically, e.g. for repair work following an accident, the system must be triggered mechanically in order to avoid the risk of injury.

Follow the procedure set out below:

- Open the hardtop otherwise the rear window will be damaged
- Remove rear seat
- Remove partition panel
- Remove control units under the roll bar cassette
- Remove control unit carrier
- Use a hook (Ø 3 mm) to reach the actuator
- The actuator has an opening in the middle, by means of which the roll bar can be triggered using the hook.

System Components

Advanced crash and safety management in the E93 Convertible essentially comprises the following components:

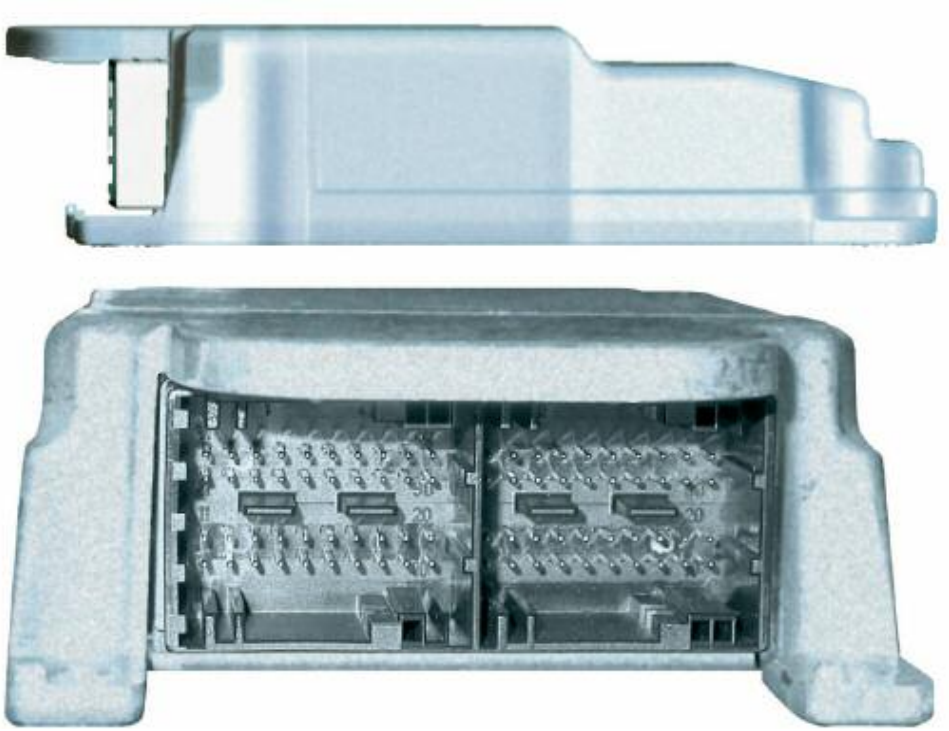
- Crash safety module ACSM2
- ROC control unit
- Sensors and switches
  - Up-front sensors (US only)
  - Door pressure sensors
  - B-pillar satellites
  - Seat occupancy mat US (OC3)
  - Seat belt buckle switch
  - Airbag switch
  - Emergency call button
- Actuators
  - Driver's airbag, two-stage
  - Passenger's airbag, two-stage
  - Knee airbag, driver/passenger (US only)
  - Side airbag, driver/passenger
  - Seat belt pre-tensioner, driver/passenger
  - Safety battery terminal
  - Roll bar, left/right
- Warning lights
  - Airbag warning light AWL
  - Seat belt mannikin
  - Passenger Airbag OFF lamp

Crash Safety Module

The crash safety module is located centrally on the transmission tunnel in the vehicle. The crash safety module consists of a diecast housing with integrated plug cover.

It contains two acceleration sensors offset at an angle of 90°. These acceleration sensors measure the longitudinal acceleration and transverse acceleration of the vehicle.

A rotation rate sensor as well as a Low-g sensor for transverse acceleration (Y direction) and a Low-g sensor for Z-direction are additionally integrated for detecting rollover situations.



Crash Safety Module (ACSM 2)

ROC Control Unit

In the E93 Convertible, advanced crash and safety management is equipped with an additional ROC control unit (rollover controller). The ROC control unit is connected via a K-bus to the crash safety module.

The task of the ROC control unit is to activate the actuators of the rollover protection system in the event of an imminent rollover situation.

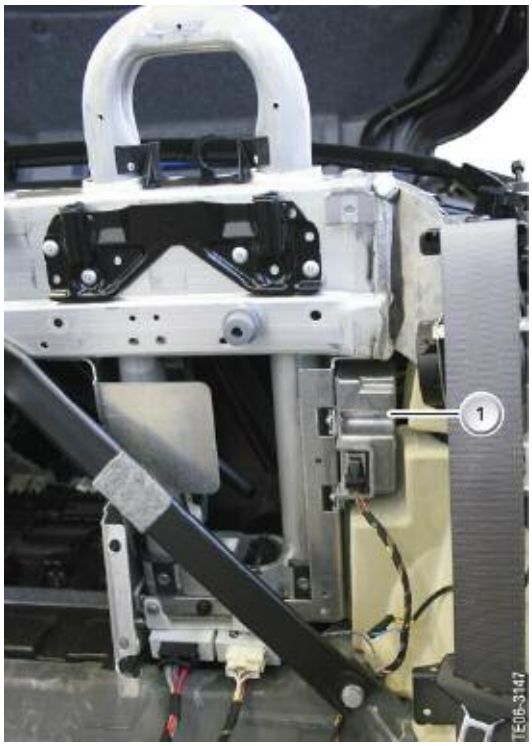
Rollover detection takes place in the crash safety module. Two telegrams are sent to the ROC control unit when the threshold values are reached.

The ROC control unit is mounted on the carrier structure of the rollover protection systems behind the rear right seat.

There are a few particulars to be borne in mind in relation to diagnosis for the ROC control unit.

The ROC (1) control module is not directly diagnosis-compatible. The ROC control unit monitors itself internally. The two circuits for the actuators are also monitored by the ROC.

In the event of a fault, the ROC transmits the fault to the ACSM2 crash safety module, where the fault is stored in the fault memory. ACSM2 activates the airbag warning lamp in the instrument cluster.



Airbag Systems

In addition to the known two-stage driver's and passenger's airbag, newly designed side airbags are used in the E93. The side airbags are integrated in the backrest of the SGS seat.

The side airbags have a larger volume compared to the airbags previously used. The side airbag develops between the seat and door in the event of side impact of sufficient severity. Due to the increased volume, the occupant's thorax and head are additionally protected.

Side airbag on E93

Design features of the E93 Convertible include the pronounced inclination of the windscreen with the windscreen cowl panel extending further towards the rear. Knee airbags are additionally fitted in US vehicles to conform to US legal requirements for protecting occupants not wearing seat belts.

The knee airbags substantially reduce displacement of the pelvis and initiate upper body rotation earlier in the event of an accident, thus preventing occupant contact with the sun visor on the windscreen cowl panel. When the ACSM 2 detects that the front passenger seat is not occupied, the knee airbag on the passenger's side will not be triggered in the event of a crash.