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E93 Complete Vehicle Workbook

Initial Print Date: 04/07 Revision Date:

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Complete Vehicle Workbook

Model: E93

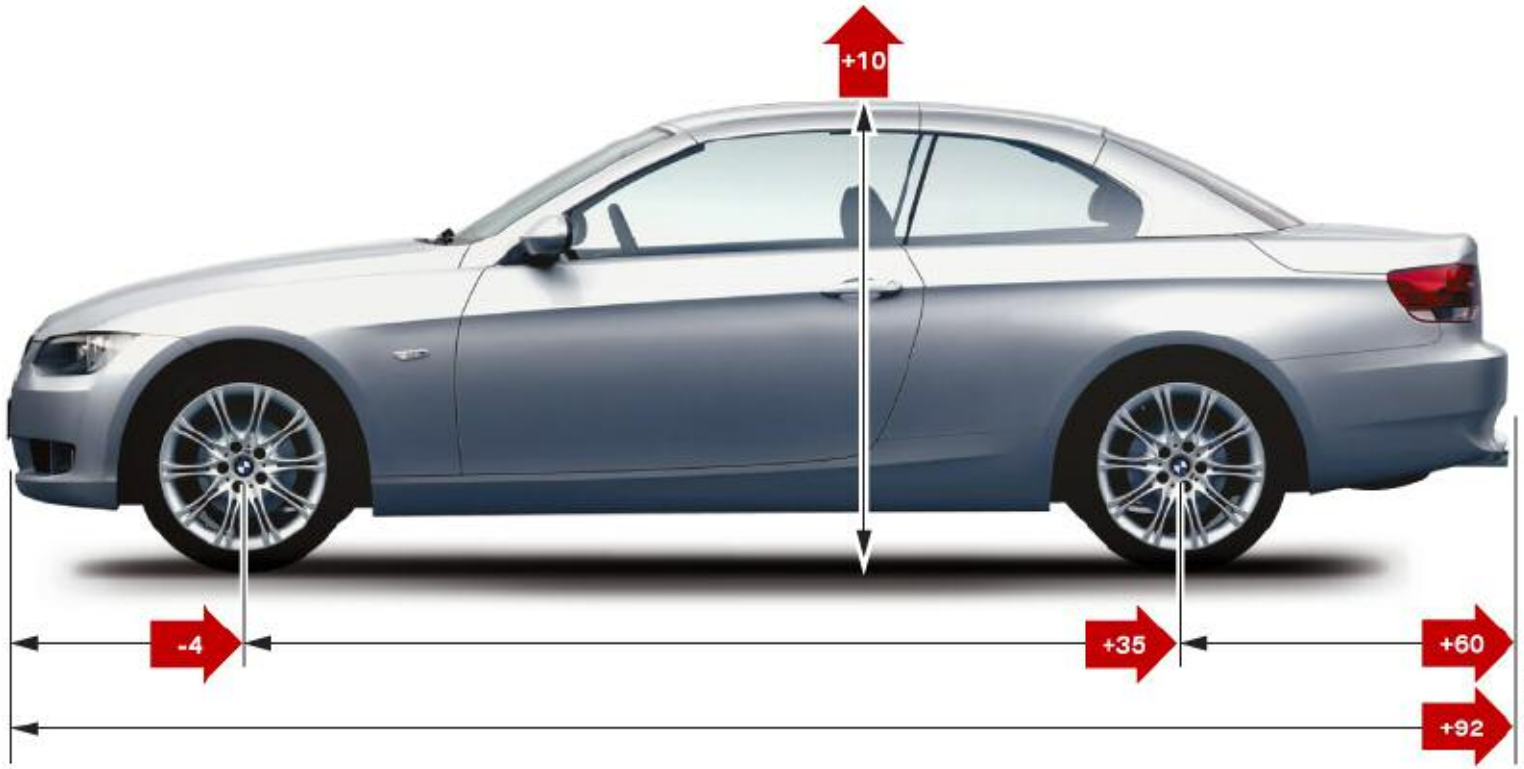
Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Understand the changes to the E93 electrical and entertainment systems
- Diagnose and service systems on the E93
- Understand the operation of the RHT
- Locate and identify components of the RHT
- Diagnose and service the E93 RHT

E93 Introduction



The new E93 is the latest in a long line of 3-series convertibles from BMW starting with the E30. Since then, the 3-series convertible has evolved from a cloth top to the current retractable hard top (RHT).

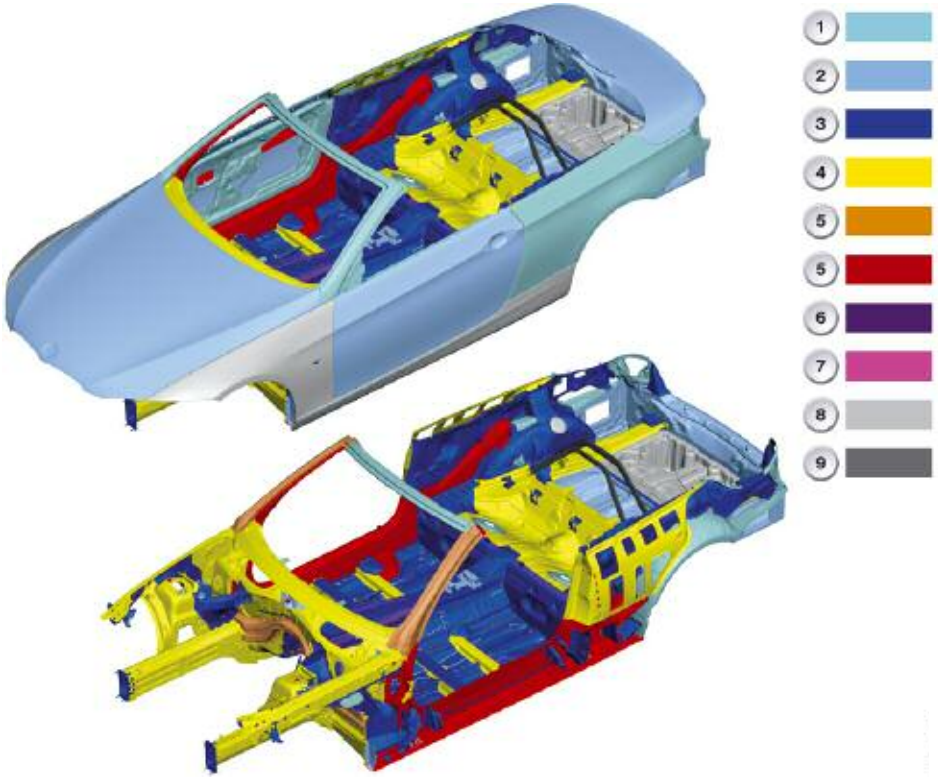
The RHT consists of steel roof panels which fold and stow away into the trunk.

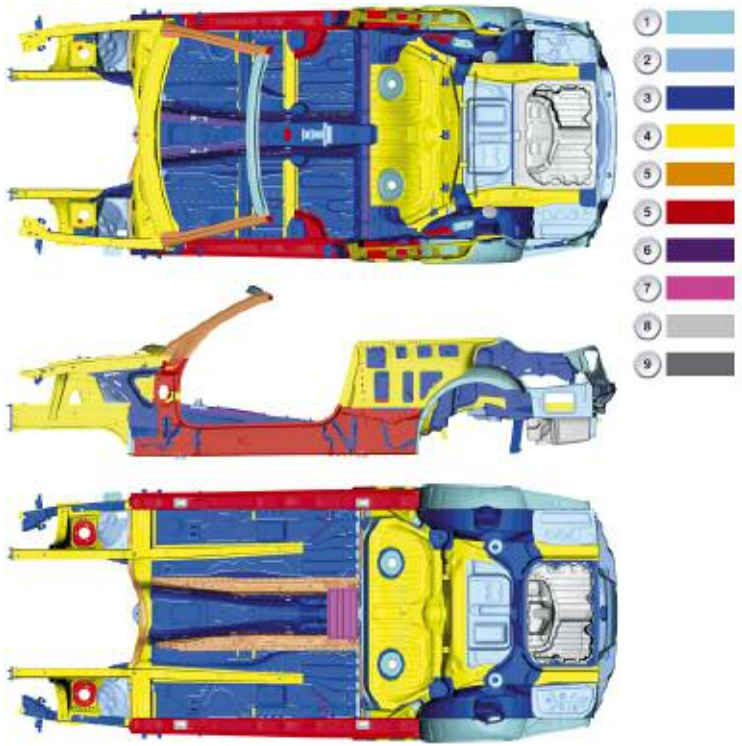
As far as vehicle dimensions are concerned, the E93 is longer, wider, taller and has a longer wheelbase.

The E93 is also heavier than the E46, but maintains the same sporty characteristic as it's predecessor.

Dimensions/Weights	E93	E46	Difference
Length	4,580 mm	4,488 mm	+ 92 mm
Width	1,782 mm	1,757 mm	+ 25 mm
Height	1,384 mm	1,374 mm	+ 10 mm
Wheelbase	2,810 mm	2,775 mm	+ 35 mm
Weight	1,655 kg	1,565 kg	+ 90 kg
Trunk capacity, roof closed (liters)	350 l	300 l	+ 50 liters
Trunk capacity, roof open (liters)	210 l	260 l	- 50 liters

E93 Body Construction





Index	Explanation	Index	Explanation
1	DC 03/04	6	HC 600 C
2	HC 180 BD/HC 220 BD	7	22 Mn B5, Docol 1000 DP
3	HC 260 BD/HC 300 BD	8	Plastics
4	HC 400 TD/HC 380 LAD	9	Other
5	HC 420 LAD		

As with all current BMW models, there is an extensive use of high strength steels.

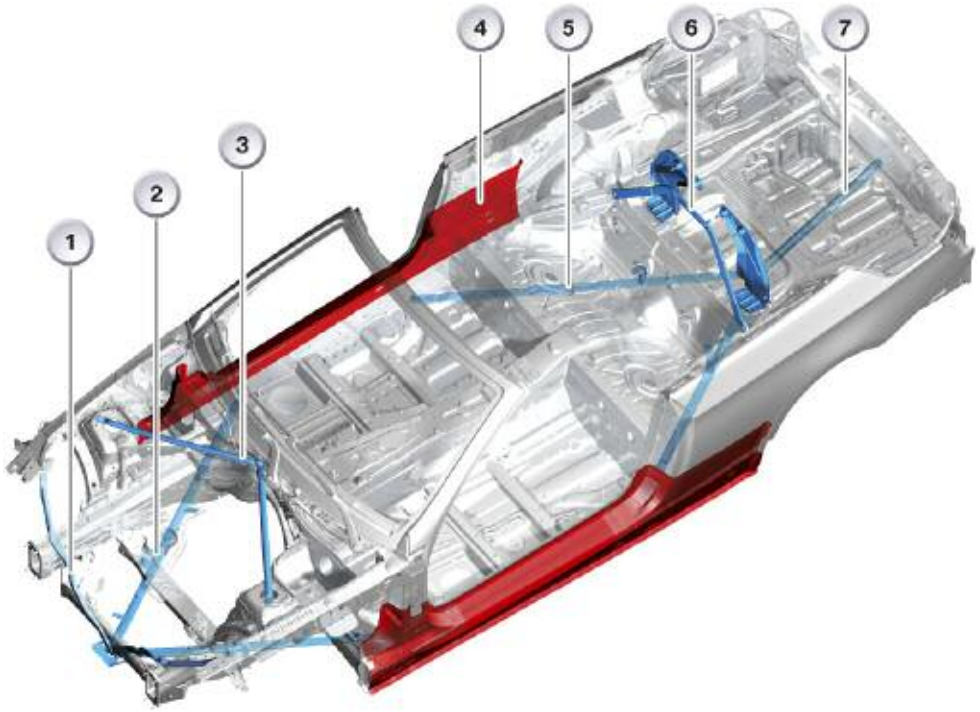
There is an “intelligent mix” of materials to provide the lightest possible weight with the best possible strength.

The color illustrations above, demonstrate the distribution of the materials. For more information, refer to the E93 complete vehicle reference material in TIS and ICP.

The design of the E93 also allows for an increase in torsional rigidity over the E46 iC. The chart at the right illustrates these figures.

Torsional Rigidity	E46iC	E93
Dynamic	17.5 Hz	19 Hz
Static	11,500 Nm/degree	14,500 Nm/degree

Body Reinforcements



As with previous convertibles, additional reinforcement is added to supplement the rigidity of the body structure.

The additional struts consist of:

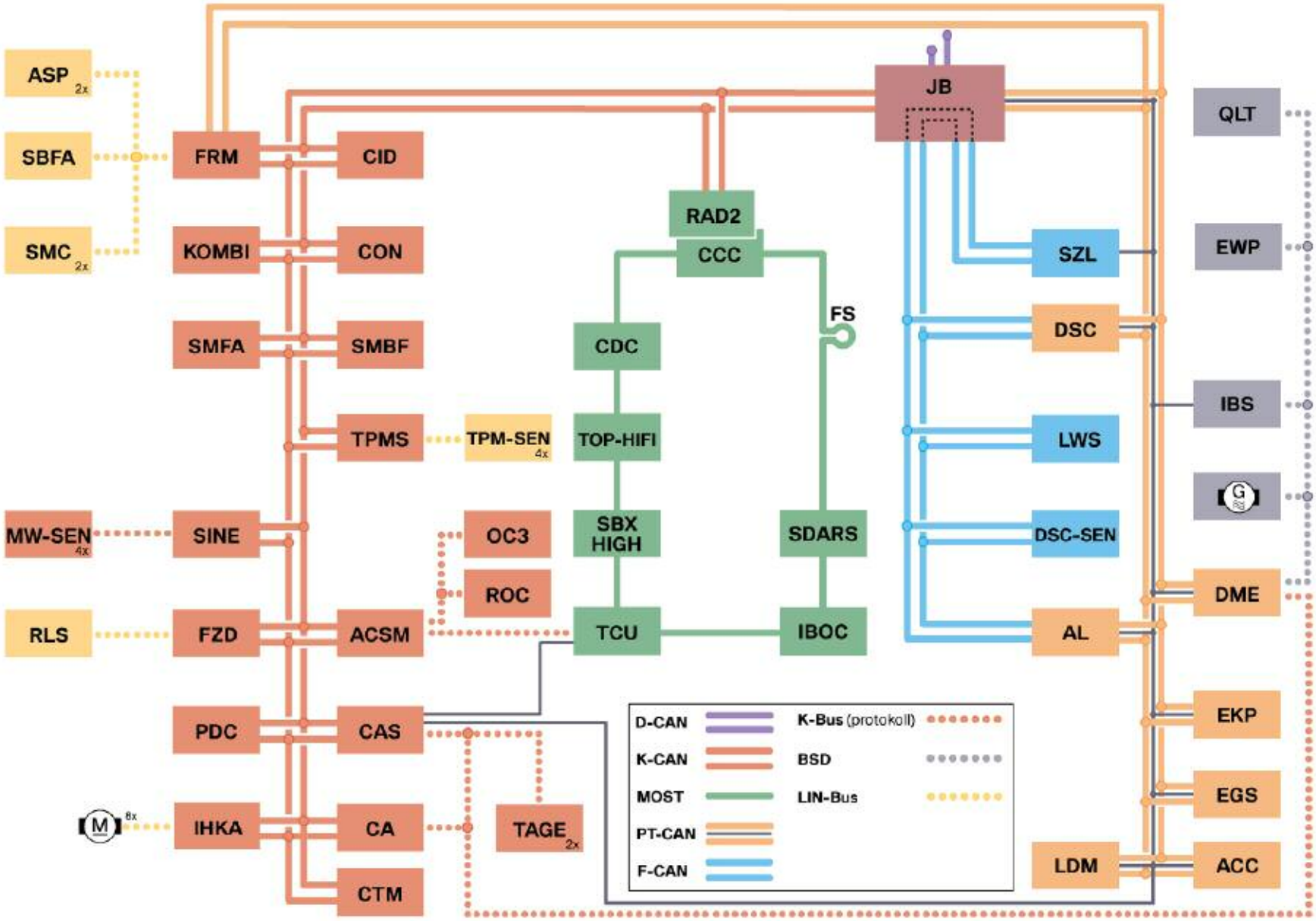
- Front end struts
- Shock tower to bulkhead struts
- Front axle subframe struts
- Tension struts at rear
- Strut in rollover protection system

The cross-section of the sill has been additionally increased as compared to the E92.

Index	Explanation	Index	Explanation
1	Diagonal strut, engine compartment	5	Underbody strut, rear
2	Front axle subframe struts	6	Strut in rollover protection
3	Spring/shock tower strut	7	Tension strut
4	Sill		

Note: Do not attempt to drive an E93 with the reinforcement struts removed. Damage to the body could occur.

E93 Electronic Systems



Workshop Exercise - Bus System Changes

Using the bus chart and classroom posters for comparison, answer the following questions.

What has changed on the LIN-bus? And Why?

Has anything changed in the diagnostic connection?

What three modules are connected to the K-bus?

What new modules are on the MOST bus?

What has changed regarding the wiring of the SINE and FZD?

Which bus connects the microwave sensors to the SINE?

General Vehicle Electrical

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. The headlight assistant is optionally available. Important note on tail lights

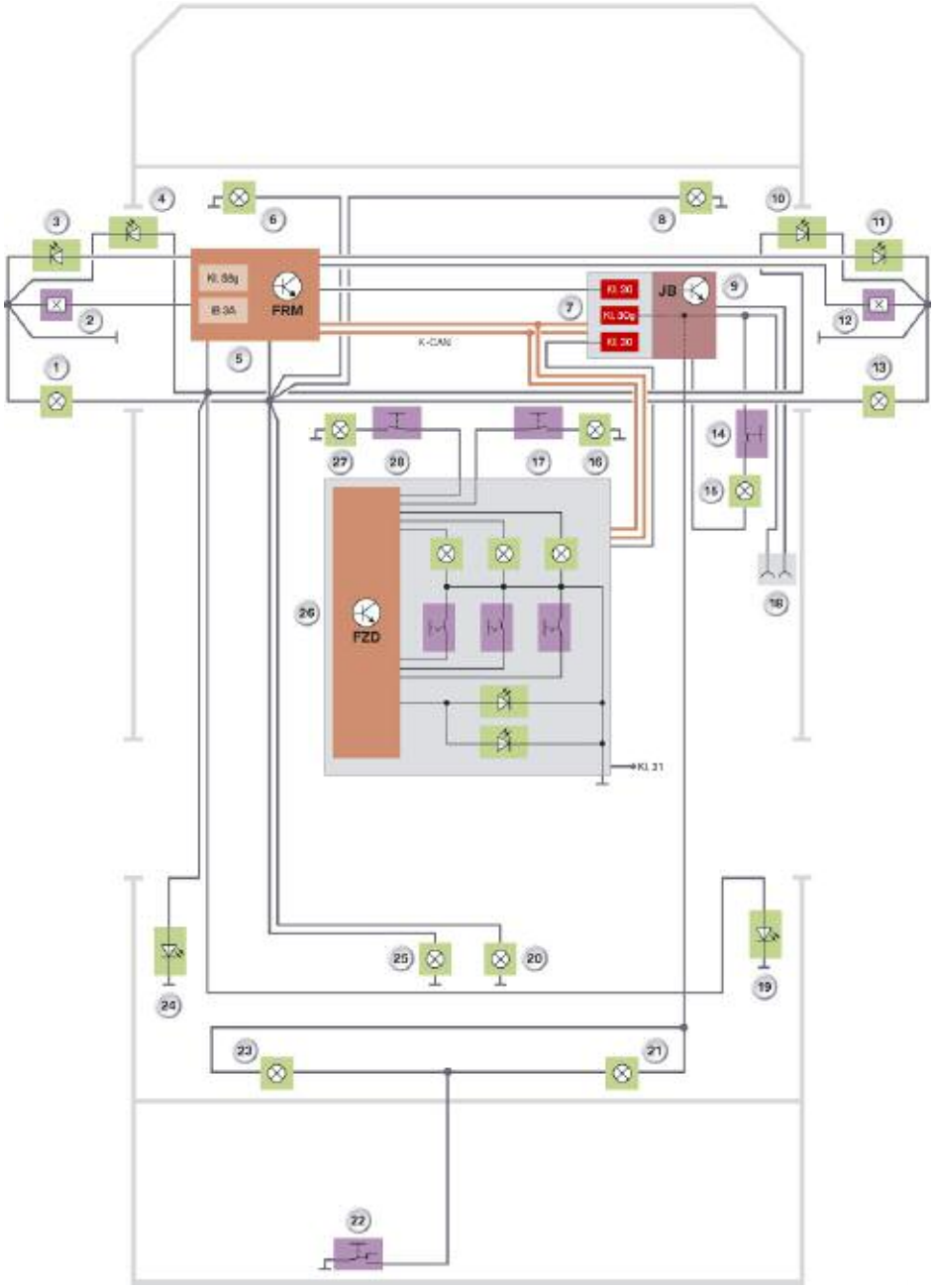
Interior Lighting

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

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 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.

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

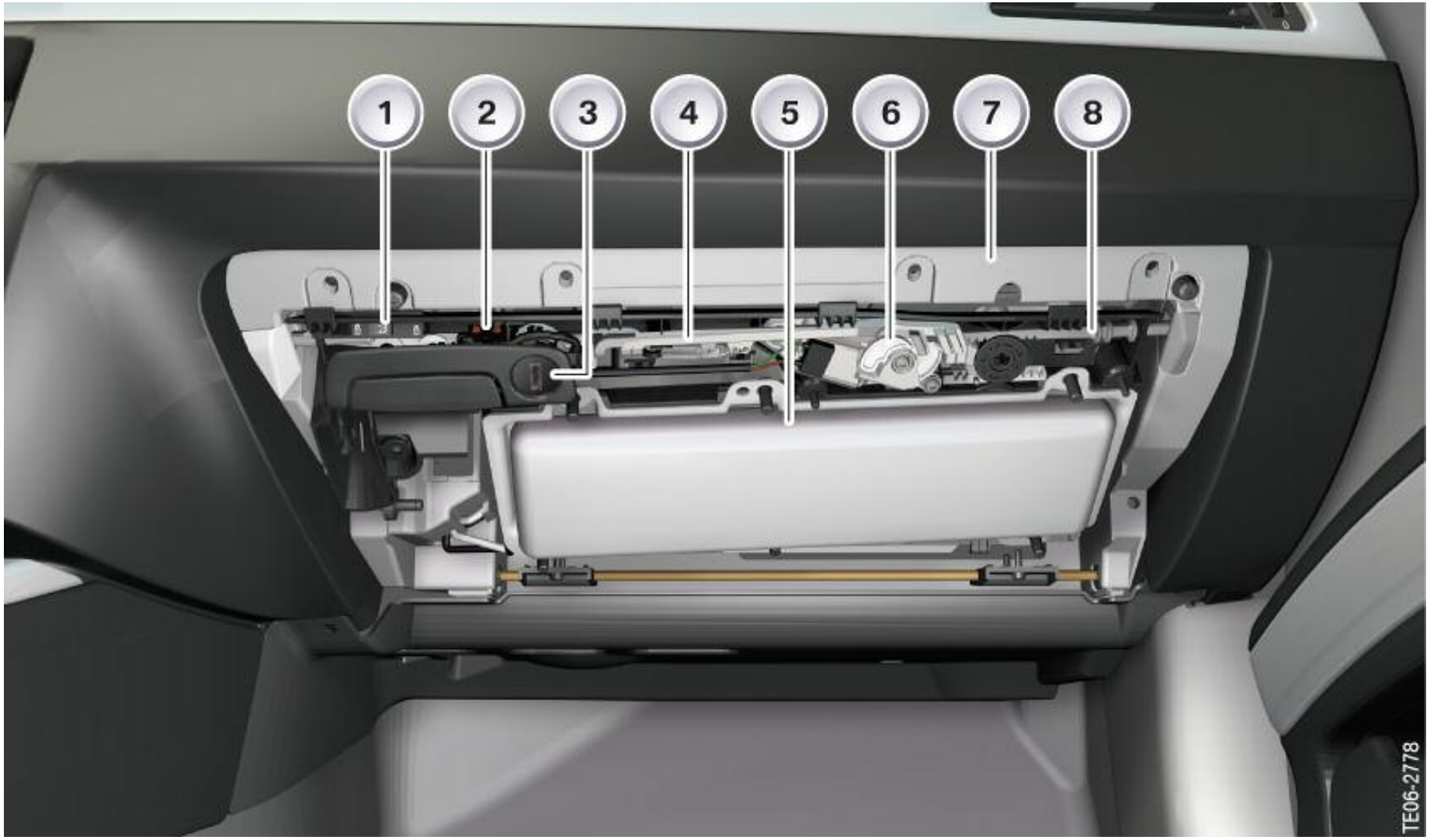
The ends of the locking rods are beveled. When closing the lid, the rods are pressed against a spring. When the lid is closed, the spring force pushes the locking rods back into the lock openings thus locking the glove compartment lid.

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.



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

Locking Function of Center Console

The storage compartment, contains an actuator motor which locks the storage compartment. This actuator motor is driven directly by the junction box when central arrest is activated.

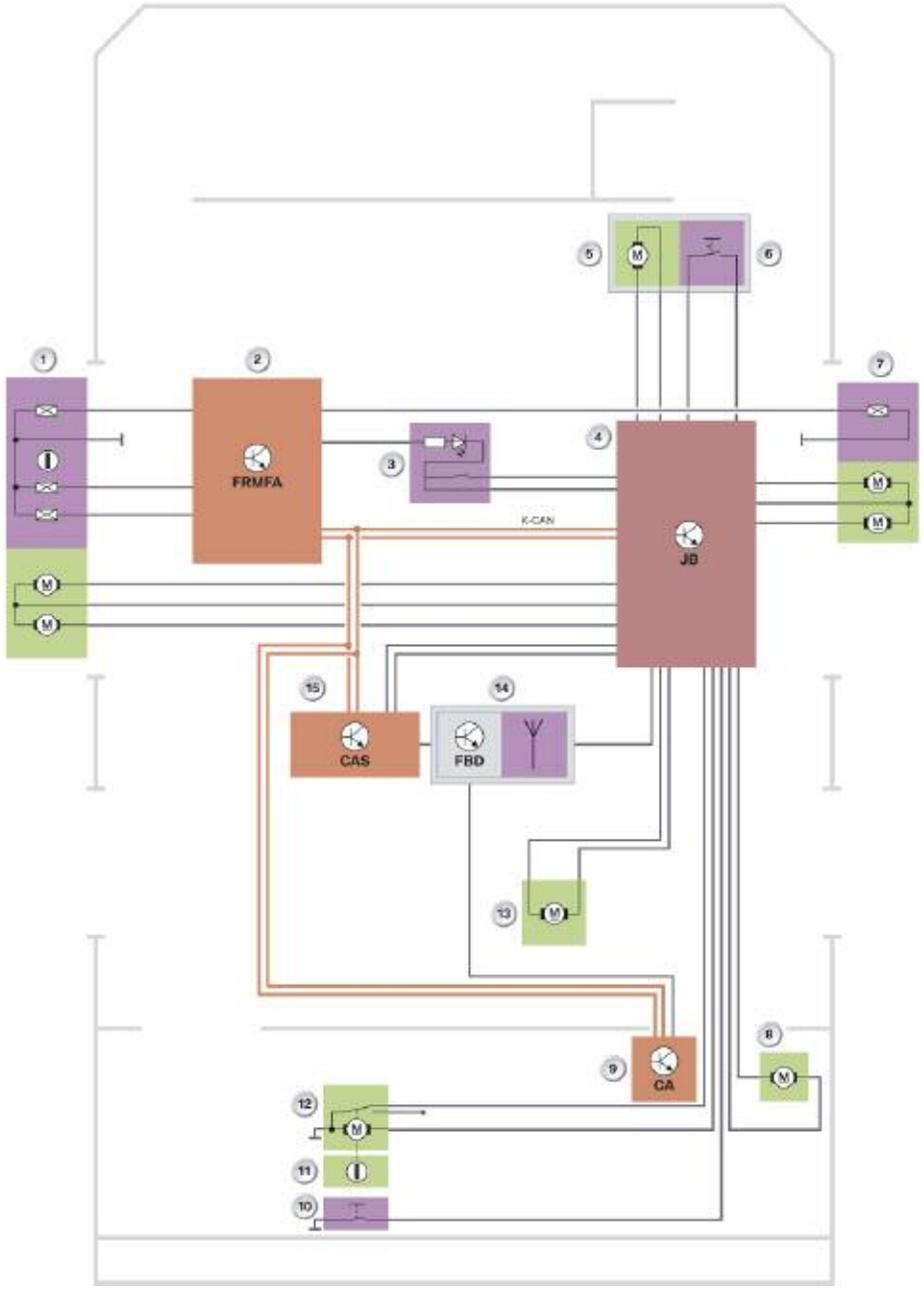
Emergency Release

The storage compartment in the center console can be released by means of a pull cable 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. The central locking system has been adapted to the specific requirements of the Convertible.

The glove compartment and the storage space in the center console have been integrated in the central locking system. The previous central locking functions remain unchanged.

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)

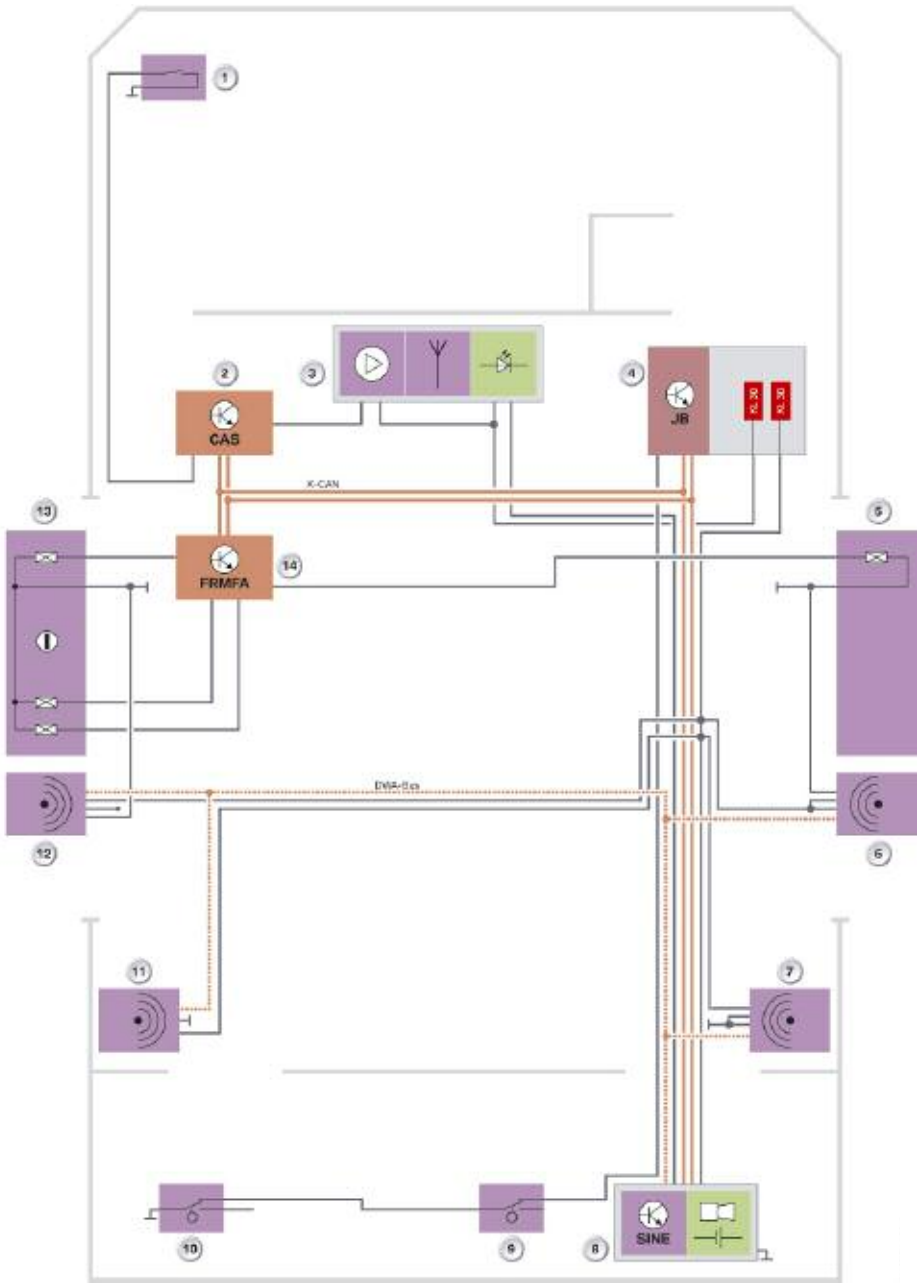
Anti-theft Alarm System

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 K-CAN. The entire control of the anti-theft alarm system is located in the SINE.

Anti-Theft Alarm 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 an 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 fore and aft at double the speed via the seat forward/backward adjustment function.

When entering the rear seat 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.

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.

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

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 is then automatically returned 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 seat with integrated seat belt system (SGS) 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 back rests 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 back rests 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.

NOTES PAGE

Changes to Control Modules

Various changes have been made to the control units in order to incorporate functions specific to the Convertible. Brief descriptions of the changes are provided in the following.

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 electro-chromic 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
- Passenger airbag OFF light

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 k-bits).

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.

Car Access System (CAS3)

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

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.

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.

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)

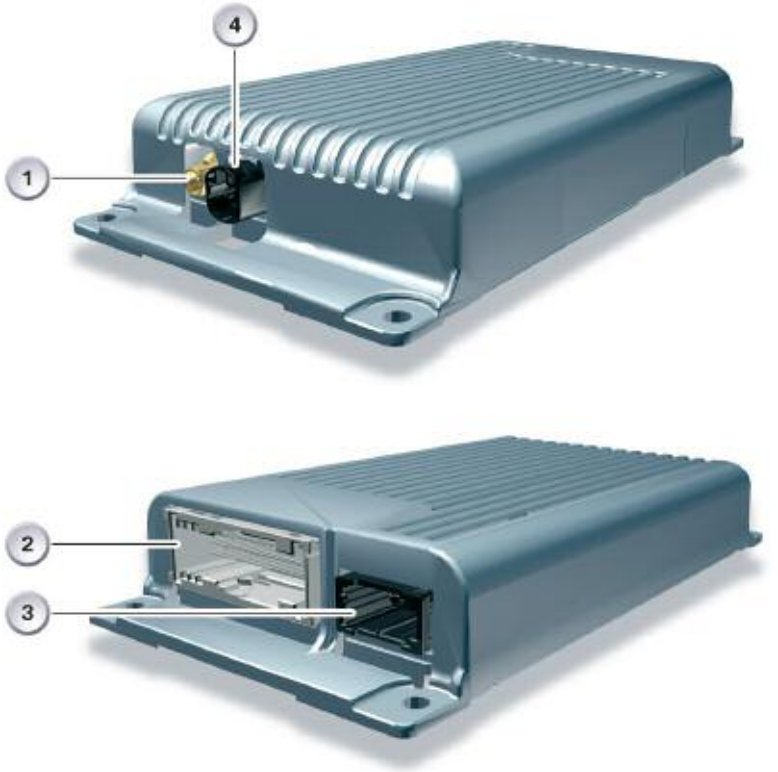
The US vehicle will receive a high variant of the interface box, the SBX High contains the following functions:

- 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 6FL. The USB interface is located in the next to 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

Classroom Exercise - Review Questions

1. As compared to the E46iC, the E93 is:
(circle all that apply)

Longer **Lighter** **Heavier** **Wider**

Taller **Shorter** **Narrower**

Longer Wheelbase **Shorter Wheelbase**

2. The “hotel switch” on the E93 is located:
(circle the correct answer)

In the center console

In the glove compartment

In the driver’s side window switch

In the trunk

3. The emergency release for the center console lock can be found: (circle the correct answer)

At the rear of the console under the AC outlet

Under the front ash tray

Under the shifter boot

There is no emergency release

4. The alarm system on the E93 monitors the interior using:
(circle the correct answer)

Ultrasonic sensors

Flux capacitors

Microwave sensors

Infrared sensors

5. The back rests of the front seats on the E93 are monitored by: (circle the correct answer)

a Hall sensor

a Microswitch

an optical sensor

a magneto-resistive switch

6. On the E93, the microphones for phone and voice input have been relocated to: (circle the correct answer)

Dashboard

Steering column trim

Door panel

Rear view mirror

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.

Different antennas are used when the hardtop is closed or lowered. When closed, the AM, FM1and 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 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.

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

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

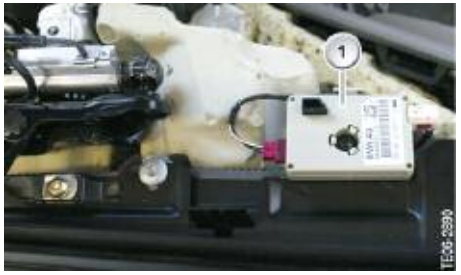
AM and FM 1 Antenna, left

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.

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.



Index	Explanation
1	Antenna amplifier, right

FM Antenna Diversity

The E93 Convertible features a four FM antenna diversity module 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
- Antenna amplifier in diversity module.

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 demodulated 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 “Us”.
This voltage is generated by the radio and used in the diversity module for evaluation purposes.

Diversity mode is active at “Us” = 2.5 Volts. AM mode is active or the FM1 antenna selected at “Us” = 0 Volts. Diagnosis mode is active at “Us” = 5 Volts.

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 is 87.5-108 MHz.

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

Antenna Diagnosis

The antenna diagnosis procedure on the E93 is the same as that on the BMW3 Series (E90, E91, E92). Self-diagnosis of the diversity module is initiated in the diagnosis module of the BMW diagnosis system. This procedure must be carried out with the hardtop up and down in order to check all antennas.

The self-diagnosis includes a check of the antenna inputs based on DC measurement. If this check returns a positive result, each individual FM antenna is switched on one after the other and the field strength assessed (antenna scan).

AM reception can be checked with the AM amplifier switched on and off in the LW, MW and SW ranges. The diagnosis system evaluates the measurements and deduces a diagnostic result if the self-diagnosis of the diversity module is positive.

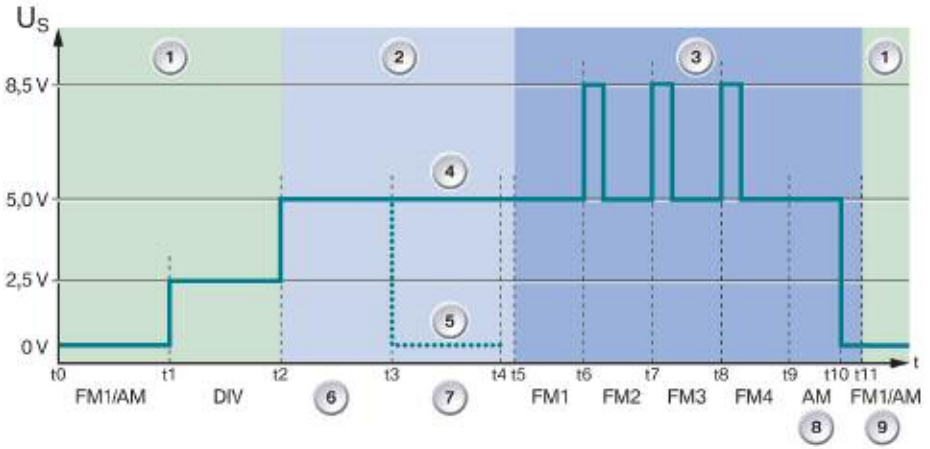
This procedure can also be performed manually through service mode of the CCC and M-ASK. The signal quality and field strength of the station currently tuned in can be indicated in service mode.

Service mode is accessed as follows:

- Select start menu
- Press and hold controller for at least 10 s
- Turn controller 3 notches to the right
- Turn controller 3 notches to the left
- Turn controller 1 notch to the right
- Turn controller 1 notch to the left
- Turn controller 1 notch to the right
- Press controller once

Press the menu button to exit service mode.

Low values relating to the signal quality and field strength may indicate damaged antennas or no terminal Rad_ON. Terminal Rad_ON supplies the antenna amplifier and diversity module with voltage.



Index	Explanation	Index	Explanation
1	Normal reception	6	Self-diagnosis
2	Self-diagnosis/interface	7	Result of self-diagnosis
3	Antenna scan diagnosis	8	Antenna amplifier (to t10)
4	Self-diagnosis-OK	9	Antenna amplifier (from t10)
5	Self-diagnosis error		

Operating Mode	Remark	"Us" min	"Us" typical	"Us" max
FM1/AM	AM reception, diversity off	----	0 V	0.5 V due to ground offset
DIV	Diversity mode	1.5 V	2.5 V	3.5 V
Diagnostic mode	AM/FM diagnosis, AM amplifier off	4.0 V	5.0 V	6.5 V
Switching pulse	Diagnosis, FM antenna switching	7.5 V	8.5 V	14 V
Diagnostic result not OK	Diagnosis output short circuit proof, Us is switched across 200 Ohms to ground	0 V	0.5 V	2 V

Radio Interference

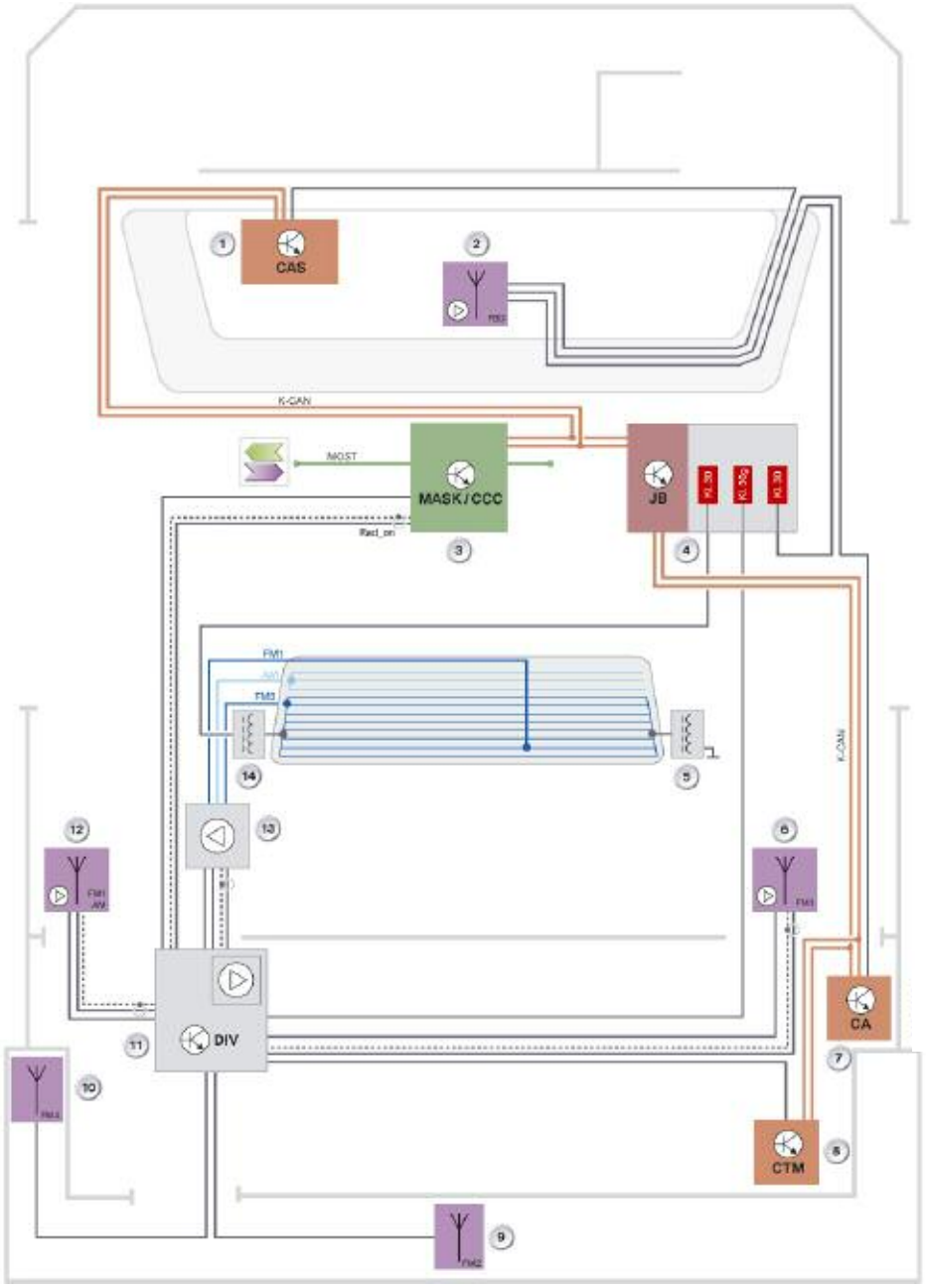
Check the following if radio interference is encountered:

- Station tuning
- Mechanical damage to antenna structure
- Supply voltage terminal Rad_On for antenna amplifiers in diversity module
- Antenna connector at diversity module
- Ground connection of diversity module with mounting screws
- Antenna connector at radio or navigation system

The E93 supports the following concepts for minimizing interference in the reception of AM and FM stations:

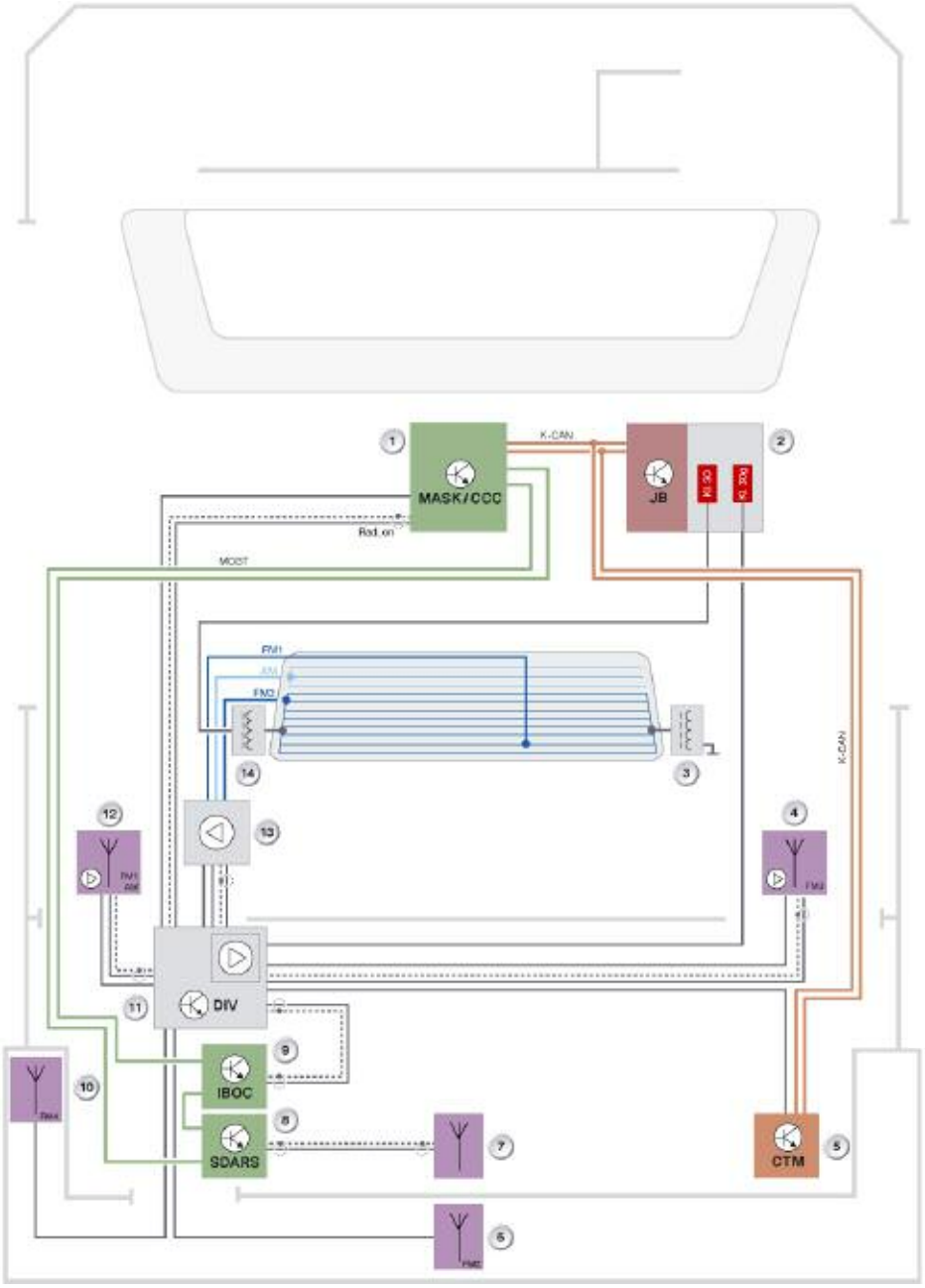
- Ground connection of rear lid via read lid hinge with integrated ground straps
- Ground connection of hinges on left and right of body
- Low-noise AM and FM antenna amplifiers with direct ground screw connection

Schematic for Antenna Systems



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

Schematic for SDARS and IBOC



Index	Explanation
1	CCC
2	Junction box
3	Rejector circuit, negative
4	FM3 antenna with amplifier in right hand shoulder trim
5	Convertible Top Module
6	FM2 antenna in bumper
7	SDARS antenna on rear lid
8	SDARS receiver (satellite tuner)
9	IBOC receiver (digital radio tuner)
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 Digital Receivers

The SDARS system has the only externally visible antenna on the E93. The “shark fin” style antenna is mounted on the trunk lid on those vehicles which have the optional satellite radio.

The IBOC system uses the FM antennas for digital reception.

Antennas for Telephone and Telematic

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 optional Bluetooth®/Assist package, 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.

Index	Explanation
1	Antenna amplifier AM/FM1
2	SOS antenna

Bluetooth® Antenna

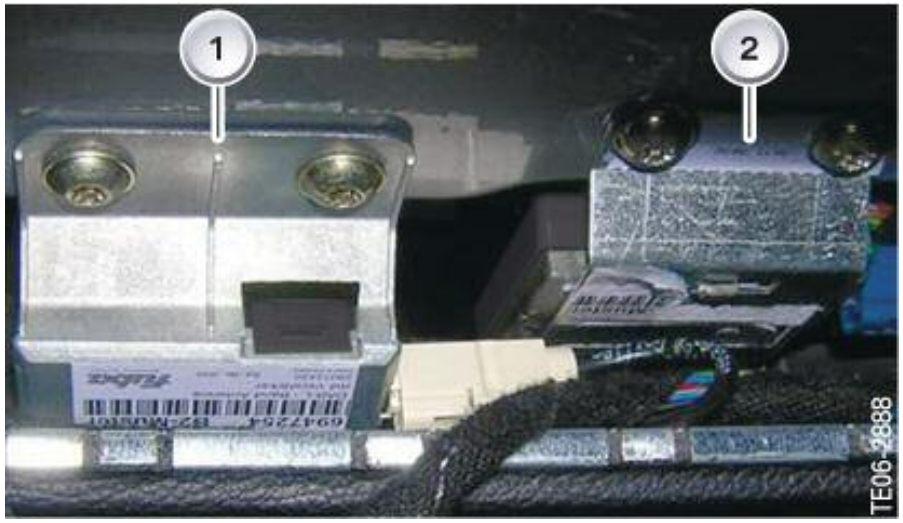
The Bluetooth® antenna (1) is used for internal data transmission between the mobile phone and vehicle.

The Bluetooth® antenna is located in the left footwell trim panel.

GPS Antenna

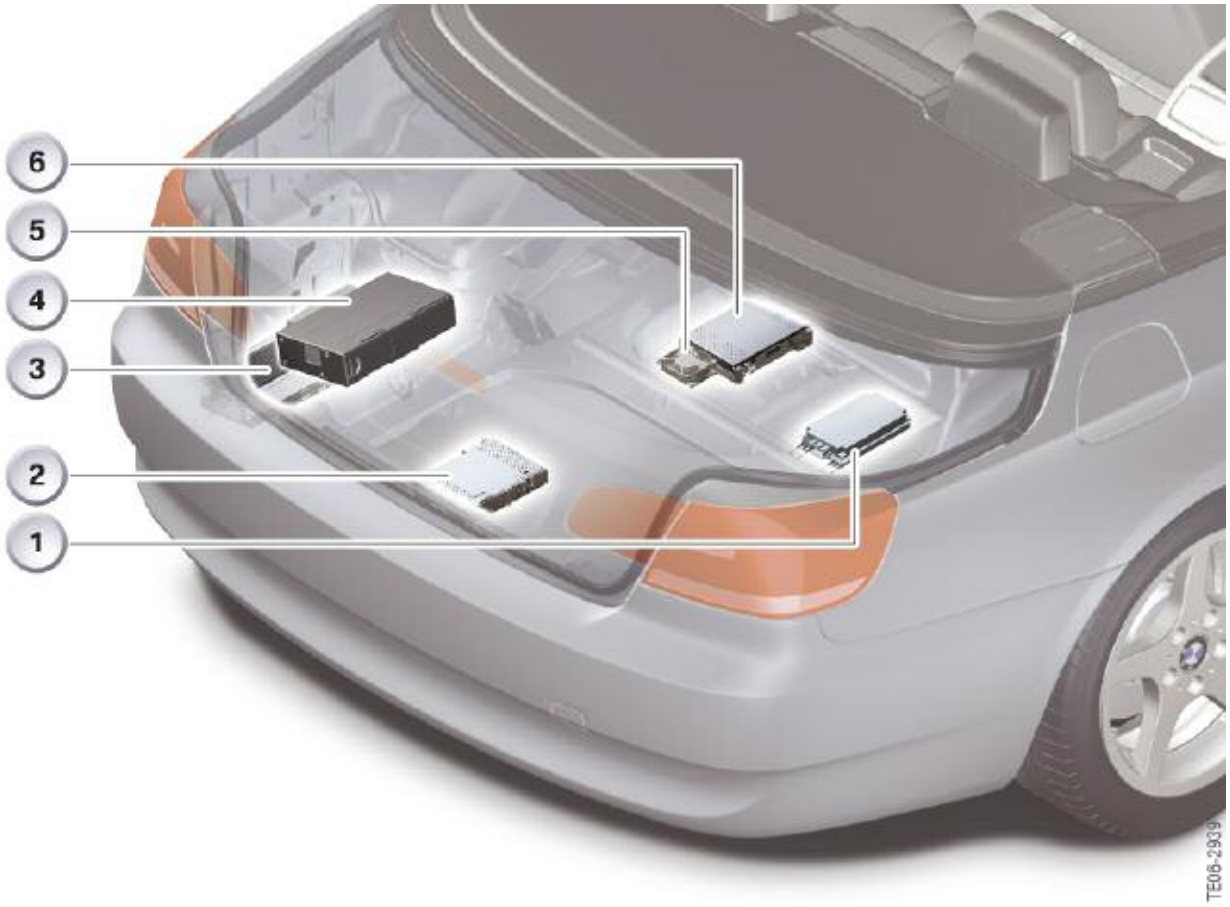
A GPS antenna is necessary for the telematics function for the purpose of automatic emergency call with location. On vehicles with MASK/CCC navigation system, the GPS antenna is routed directly to the navigation computer. The TCU receives the position data via the MOST.

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 in US market
2	GPS antenna

Arrangement and Location of IKT Components



Index	Explanation
1	Telematics control unit (TCU)
2	IBOC tuner (HD radio)
3	HiFi or Top HiFi amplifier
4	CD changer
5	Auxiliary fan for SDARS tuner
6	SDARS 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 windshield 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.

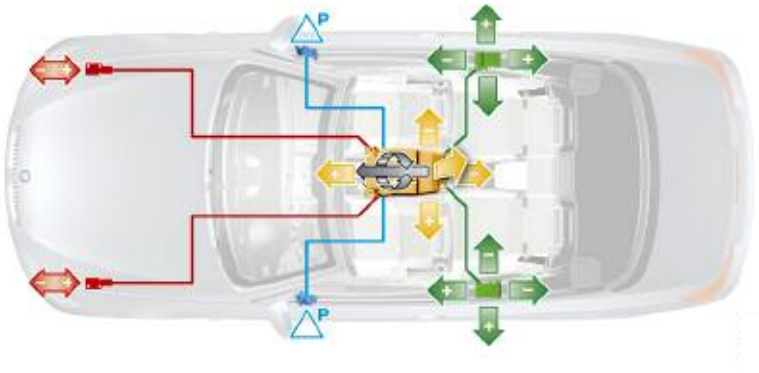
The E93 Convertible is equipped with a passive safety system with rollover protection. In the event of a crash, in which the vehicle rolls over, the roll bars extend automatically and, together with the windshield frame form an adequate survival space for the occupants.

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.

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.

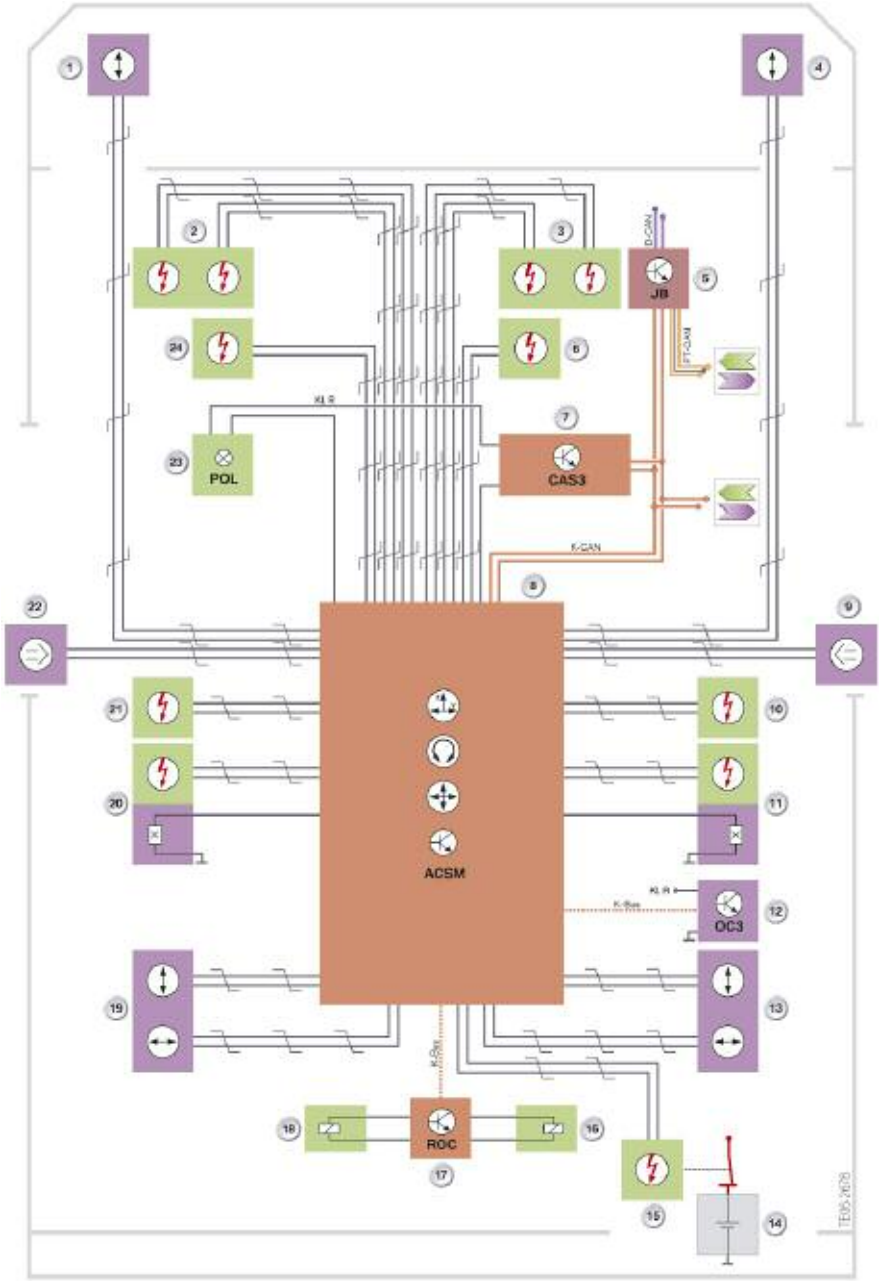
If a fault occurs during operation, this is stored in a fault memory, which can then be read out for diagnostic purposes.

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.

ACSM2 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	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

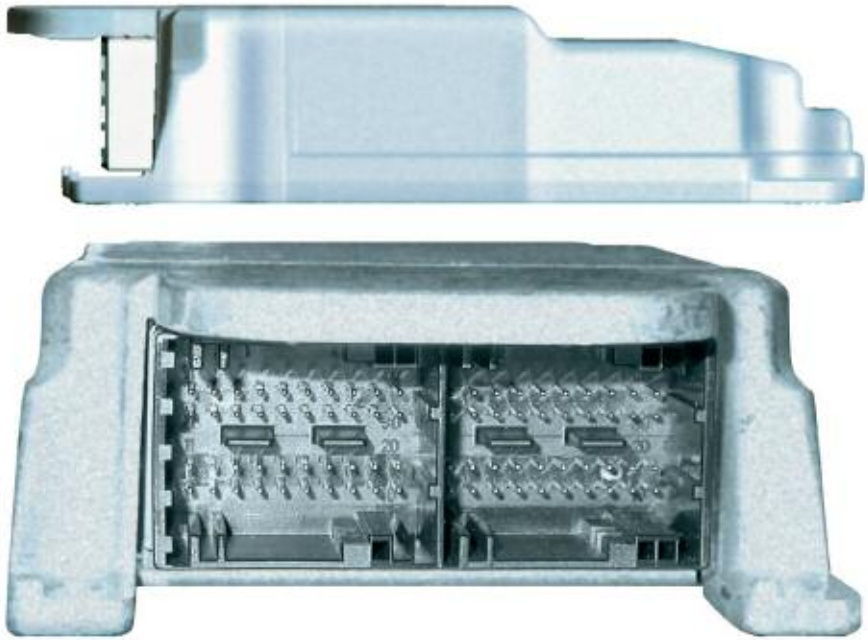
System Components

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
  - – Door pressure sensors
  - – B-pillar satellites
  - – Seat occupancy mat US (OC3)
  - – Seat belt buckle 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 pretensioner, driver/passenger
  - – Safety battery terminal
  - – Rollbar, 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.



The crash safety module 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.

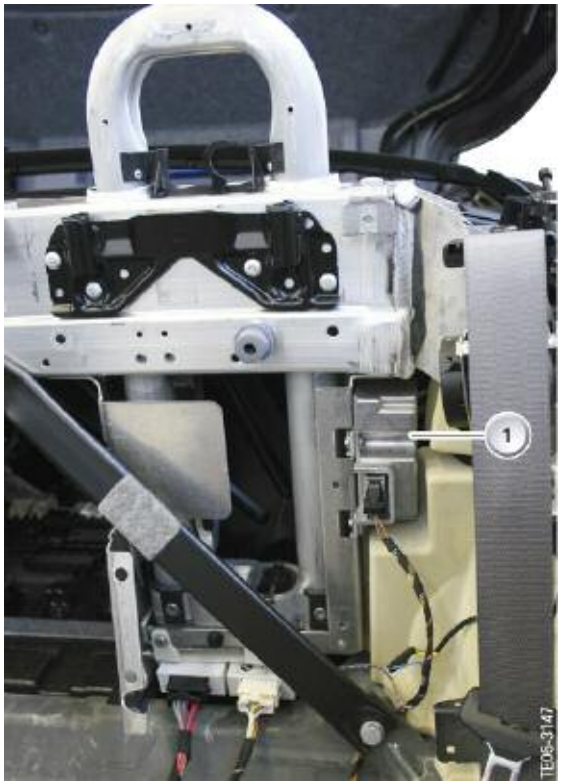
ROC Control Unit

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 (1) is mounted on the carrier structure of the rollover protection systems behind the rear right seat.



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.

Design features of the E93 Convertible include the pronounced inclination of the windshield with the windshield cowl panel extending further towards the rear. Knee airbags are additionally fitted 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 windshield cowl panel. When the ACSM2 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.

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 rollover. 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.

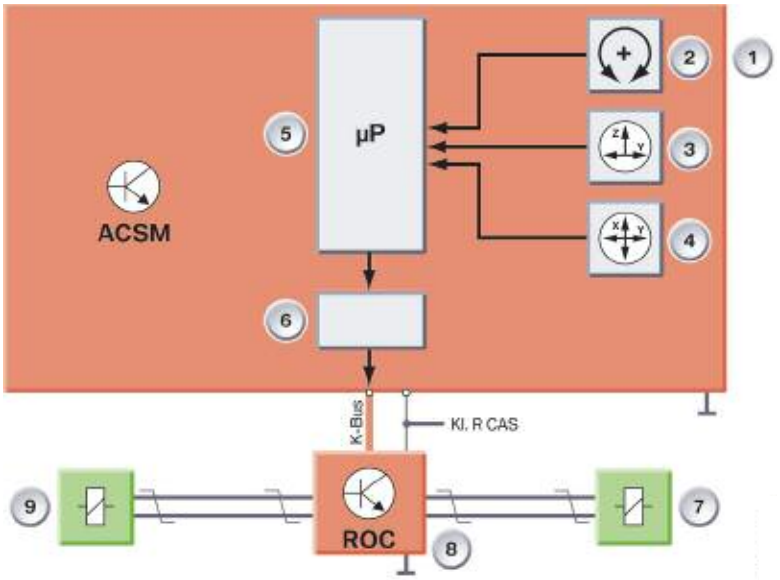
The crucial factors which determine whether the car overturns are not just the angle but also the angular velocity at which the car is set into the roll. All these vehicle movements can also occur after a front-end, side-on or rear-end crash.

The rollover protection system consists of two extendable rollbars 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.



Index	Explanation	Index	Explanation
1	Crash safety module (ACSM)	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	10	

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.

Triggering the Rollbars

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).

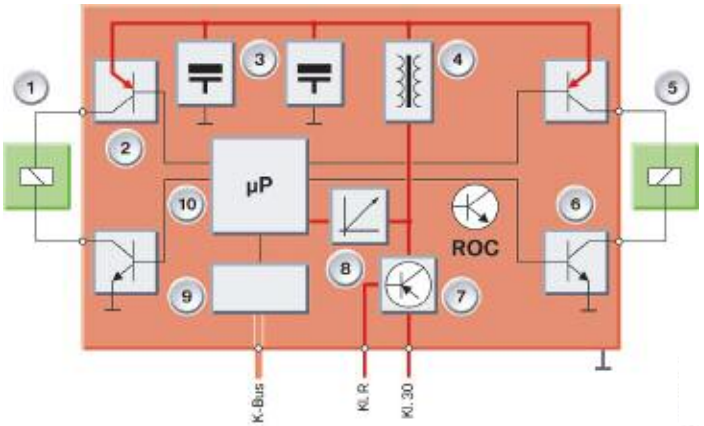
When the processor in the crash safety module detects an imminent rollover, it sends two telegrams within a defined time window via the K-bus.

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.

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 rollbars 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 rollbar. The solenoid actuates the lock and releases the spring-loaded rollbar.



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 locking pawls on the rollbar 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 rollbars 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 rollbar back into its initial position, it is necessary to press the toothed strap back so that the bar can be pushed in.

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

Note: 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 rollbars.**

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 rollbar cassette
- Remove control unit carrier
- Use a hook (3 mm diameter) to reach the actuator
- The actuator has an opening in the middle, by means of which the rollbar can be triggered using the hook.

Automatic Climate Control

The E93 Convertible is available with the IHKA system as standard equipment. This IHKA system functions much the same way as the E92. However, some additional functions have been added to enhance AC operation in the convertible environment.

Due to the RHT, the E93 functions as two vehicles in one - a coupe and an open top convertible. In the past, using the AC with the top down creates a less than optimal situation for the driver.

When the top is down, outside temperature variations and changes in solar radiation can now influence the IHKA system with less than accurate information. Also, the “ram air pressure compensation” feature in BMW IHKA systems is not desirable when the top is down.

This situation forces the driver to continually adjust the temperature and blower controls for maximum comfort. So, a “convertible top mode” has been introduced into the E93.

This mode is activated when the top is down. A signal from the convertible top module to the IHKA provides the activation for the convertible top mode.

This mode requires no additional components or sensors. Only the “top down” signal from the CTM is required.

On vehicles with CCC (CID), the convertible top mode can be selected and disabled. On vehicles without CCC, the convertible top mode is always active when the top is down.

The parameters for controlling the ventilation are based on the sun's intensity, driving speed and outside temperature. This program ensures optimum heating/ventilation comfort for the occupants.

Convertible Mode Control

The aim of Convertible mode is to create an automatic program that renders manual intervention by the driver or passenger unnecessary.

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 windshield/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.

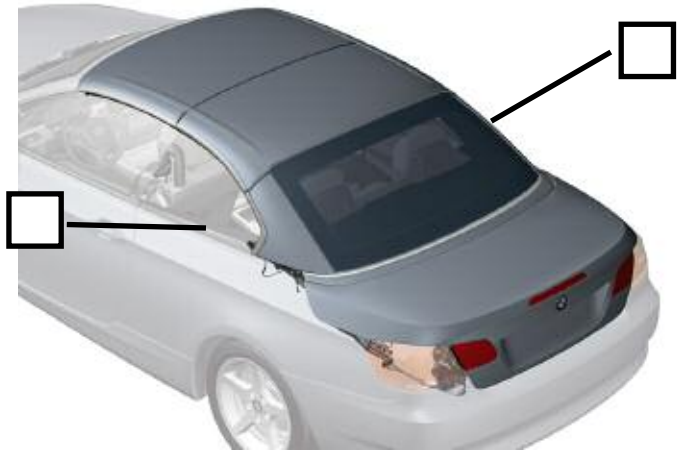
The AUC function is also active in Convertible mode up to a speed of 45 mph (70 km/h). It is deactivated at higher speeds. This is intended to ensure that no pollutants are blown into the interior of the vehicle via the air conditioning outlets when driving at low speeds, e.g. in urban or stop-and-go traffic. The best effect is achieved with the side windows closed.

Note: If Convertible mode is not activated, the selected automatic program (soft, medium, intensive) is activated when the hardtop is opened. All other program settings are deactivated (grey) if the 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.

Classroom Exercise - Review Questions

1. Match the antenna location (illustration) to the antenna description:

A. FM1 B. FM2 C. FM3 D. FM4 E. AM



2. List the location of the antenna amplifiers for the listed antennas:

FM1 (rear window) _____

FM1 (left trim) _____

FM2 (bumper) _____

FM3 _____

FM3 (right trim) _____

FM4 (bumper) _____

AM (rear window) _____

AM (left) _____

3. What is the difference between the side airbags between the E92 and E93?

_____

_____

_____

_____

4. What is the position of the footwell vents when the IHKA system is in “convertible mode”?

_____

_____

_____

_____

_____

_____

NOTES PAGE

Retractable Hard Top (RHT)

For 2007, the new 3-series convertible has a retractable hard top featuring all steel panels. Advantages of the steel panel design include:

- Improved protection against vandalism and theft
- Better sound insulation than the former cloth top
- Optimized year-round suitability
- Eliminates the cost of an additional hard-top
- Improved resale value
- “Coupe-like” appearance when top is up
- Large glass rear window allows more visibility

E93 RHT Features:

- All steel construction including trunk lid
- Hydraulic operation featuring 8 hydraulic rams
- 6 Gas pressurized dampers to provide smooth movement
- High pressure hydraulic pump below luggage compartment floor
- Remote operation (with Comfort Access)
- Complete opening/closing operation in less than 25 seconds
- Soft-close (SCA) trunk operation

Hard Top Operation

The RHT consists of three steel panels which fold up into a roof "package". This roof package can then be stowed into a space designated in the trunk.

The steel roof panels continue to use the interior headliner as used on past convertibles. The liners give the interior a finished appearance and also contribute to noise reduction.

Some of the things to be considered are that the roof panels must also be secured into the trunk to avoid damage and unwanted noise. The details of the hydraulics and mechanical operation will be covered on subsequent pages in this workbook

The mechanical and hydraulic elements in the RHT are designed to achieve to necessary goals of fast, smooth and quiet operation.

The top can be operated via the switch in the center console, the mechanical portion of the key and via remote operation. Remote operation is carried out via the remote control (I.D. transmitter). This feature is only possible with comfort access.

The convertible top switch is in the center console.

It is directly connected to the CTM and provides a ground input for top operation.

The switch has red and green LED's to indicate top status.

The remote control/ID transmitter is capable of providing remote operation only in conjunction with Comfort Access.

The mechanical key can operate the top when inserted into the driver's door lock.

Conditions for Operation

As with previous convertibles there are a set of preconditions which must be met before top operation can be carried out.

The following represents the preconditions for operation:

Workshop Exercise - Preconditions for top operation

Complete the chart below using the ETM and diagnostic equipment.

Precondition	Specification	Signal origin/path	Type of signal	Visual indication (to driver)
Terminal R				
Outside Temperature				
Trunk Lid				
Road Speed				
Power Window (initialization)				
Luggage compartment divider				
Lateral inclination				
Battery voltage				
Successive operations				
Hydraulic fluid temp				

Switch Operation

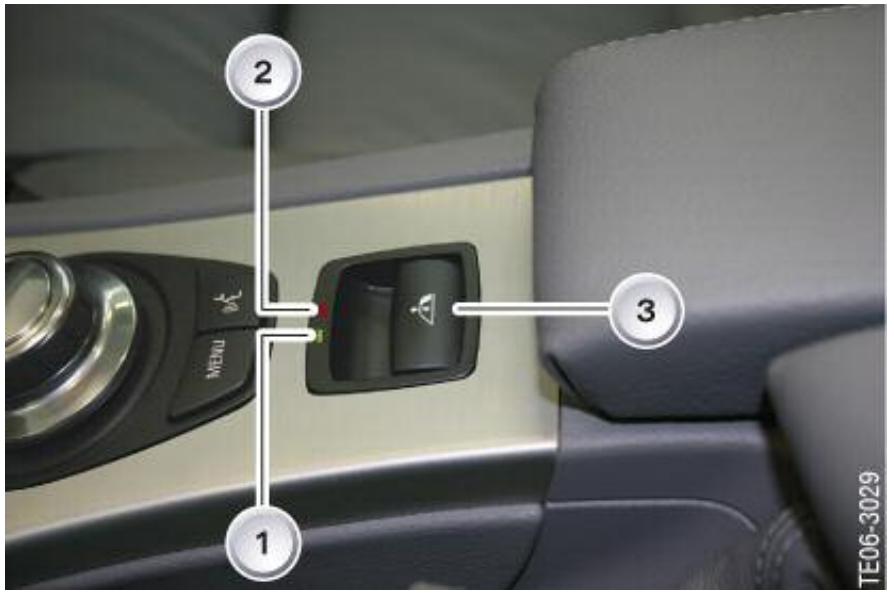
The RHT is operated by a switch in the center console. The switch provides a ground input to the CTM for top operation.
The movement of the hard top is carried out as long as the switch is actuated.

The switch contains two LED's which indicate the status of the top. The green LED is illuminated (solid) when the top is moving and will go out only when the top operation is complete.

The red LED will flash when the switch is released before the top has completed the full opening or closing operation. If the top operation is interrupted, operation can be resumed by pressing the switch until complete (Green LED off).

When the red LED is on continuously (solid), the top is not capable of operating. This could be due to a malfunction or one of the pre-conditions is not met. For example, if the luggage compartment divider not in the fully down position, the red LED will be on continuously as an indication.

When the top is prevented from operation, there will be a check control message (with CCC), an icon and a gong. This will let the driver know that there is a condition which is preventing top operation.



Index	Explanation
1	Green LED
2	Red LED
3	Button

Note: The switch on early production vehicles operates differently than that of later production vehicles.

The early version requires the switch to be pressed in order to close the top. The top is opened by pulling the switch up.

On later production models, the operates in the exact opposite.

Workshop Exercise- Sequence of operation

Using the actual vehicle as a guide, operate the top through the opening and closing operations. Note the sequence and complete the exercise below by numbering the illustrations below in the correct order starting with the top open.






☐ ☐ ☐ ☐ ☐ ☐

Operate the RHT using the center console switch and note the status of the LED's in the switch. Interrupt the RHT during operation to see how the LED's are affected.

Next, attempt to operate the RHT with one or more of the preconditions in the incorrect state (i.e. luggage compartment divider up or trunk open etc.) The note the CC messages and icons which appear.

What type of sensor/switch senses the position of the luggage compartment divider?

If the vehicle does not have CCC, how is the driver warned of improper operation?

Convenience Operation

Other than the switch in the center console, the RHT can be operated via convenience functions. These functions include:

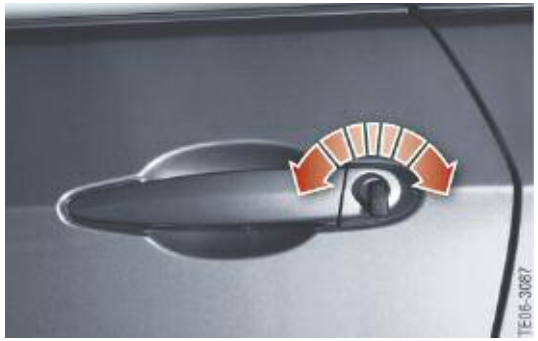
- Via the remote control/ID sensor (with Comfort Access only)
- Via the door lock with the mechanical key (open/close)

By holding the unlock button, the RHT can be fully opened.
The windows will also be lowered by continued pressing of the switch.

(This feature will only work with Comfort Access)

By holding the lock button, the RHT can be fully closed.
The windows will also be raised by continued pressing of the switch.

(This feature will only work with Comfort Access)



The RHT can also be operated by the mechanical key when inserted into the driver's door lock cylinder.

The top can be opened by holding the key in the "unlock" direction and closed by holding in the "lock" direction.

Convenience Loading and Unloading

When the RHT is open and there is a need for access to the luggage compartment, a convenience loading/unloading feature has been added. This allows quick access to the luggage compartment without completely closing the hard top.

As with the other convenience features, this is only available with Comfort Access. Also this feature can only be activated via the remote control/ID sensor.

This feature is activated as follows:

- Briefly press the trunk release button (on the remote)
- Then, press and hold down the trunk release button (no more than one second can pass between the two activations of the trunk release button).

The operation will start by opening the rear module all the way. The roof package will be lifted to the intermediate position. Then, the rear module is closed and locked. Finally, the trunk lid will be released using the SCA and slightly opened.

Now, the luggage compartment divider can re raised and luggage can be loaded (or unloaded) without the need to completely close the hard top.

Once the luggage loading (or unloading) process is complete, the top can be re-opened by pressing the unlock button on the remote. The top will open again completely.

The convenience loading feature is initiated by pressing the trunk release button twice (one quick press followed by holding the button until the process is done).

The convenience loading feature is completed by pressing the unlock button (and holding) to re-open the hard top.

Soft Close Automatic (SCA)

For convenient closing of the boot lid, the Soft Close Automatic is installed as standard. It consists of two Soft Close Automatic drives that lock the boot lid to the rear module carrier on the left and right. This increases the stability of the boot area.

Opening the Boot Lid

When the boot lid is opened using the boot lid button, a microswitch is actuated and its status is read by the junction box JB. The JB sends a message to the CAS via K-CAN. After the check is successfully completed, the CAS sends the release and the JB triggers the drive for unlocking the boot lid. The drive actuates the release catch; the left and right boot lid locks are unlocked via the control cables.

The JB transmits the status of the boot lid (unlocked) on K-CAN, and the CTM receives it. The CTM then triggers the start-up of the SCA drives, which then move to standby position and are available for a closing operation or to support a closing operation.

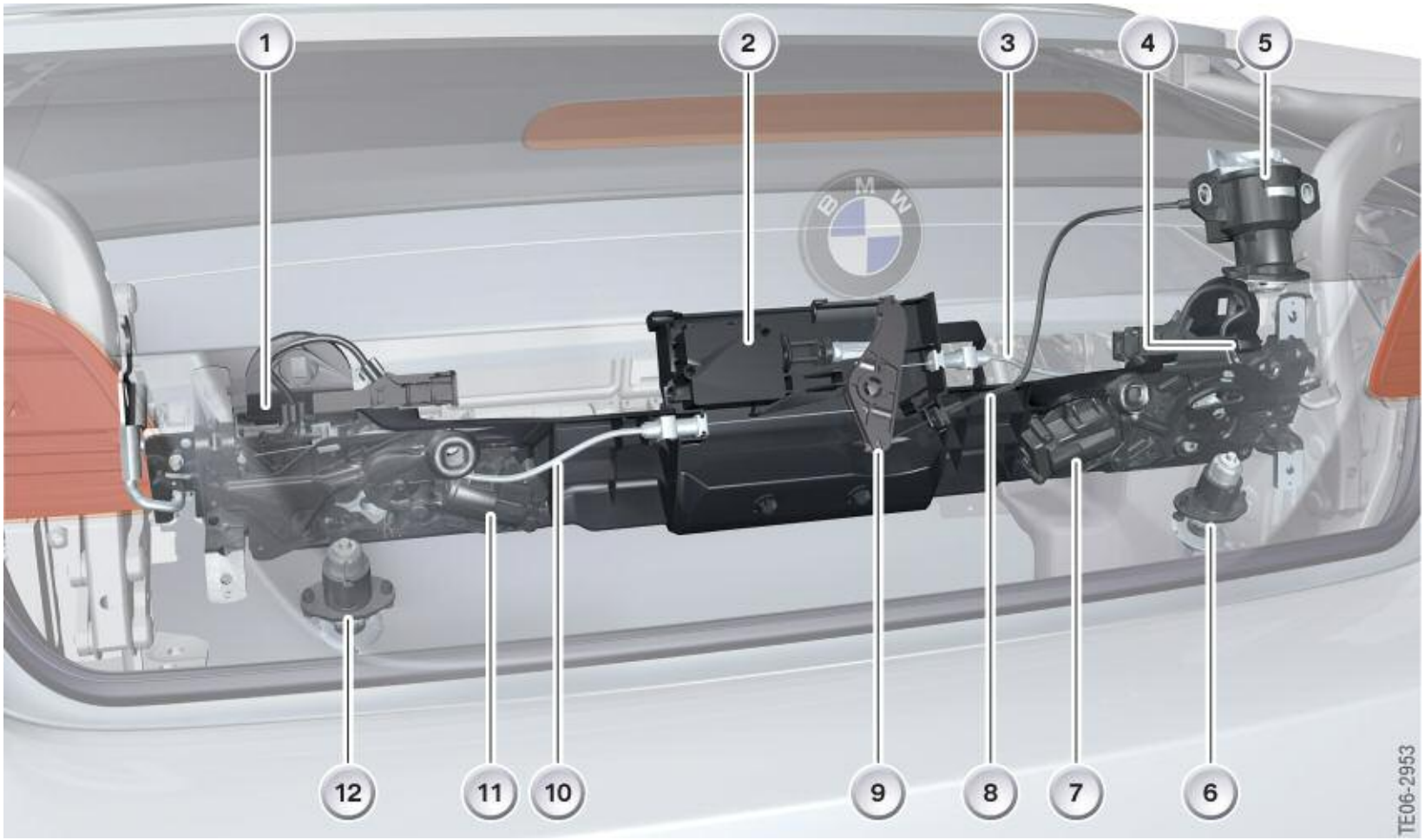
Closing the Boot Lid

When the boot lid is closed, the SCA drives are in standby position. When the left and right boot lid locks have reached the locking clips, two microswitches are actuated and their status is read in by the CTM. The CTM then triggers both SCA drives (one on each SCA drive) until two other microswitches signal the "boot lid locked" status to the CTM.

Manually closing the boot lid would make closing via the Soft Close Automatic drive unnecessary. However, because it must be ensured that the boot lid is really closed, the Soft Close Automatic drive is actuated nonetheless. The end position of the SCA drives in the "Unlocked" status is signalled to the CTM by two additional microswitches.

Non-repeat Lock

Each Soft Close Automatic drive has a “non-repeat” lock to prevent overheating of the Soft Close Automatic drive. It allows up to 20 actuations (counter up to 20 increments) of the Soft Close Automatic drive. Afterwards, the Soft Close Automatic drive is electrically disabled for approximately. 2 minutes.



Index	Explanation	Index	Explanation
1	“Left trunk lid lock” microswitch	7	“Right SCA drive”
2	Drive for central locking of the trunk lid	8	Control cable for mechanical unlocking of the trunk lid
3	Control cable for unlocking the right trunk lid lock	9	Release lever
4	“Right boot lid lock” microswitch	10	Control cable for unlocking the left trunk lid lock
5	Locking cylinder of the trunk lid	11	“Left SCA drive”
6	Right stop buffer	12	Left stop buffer

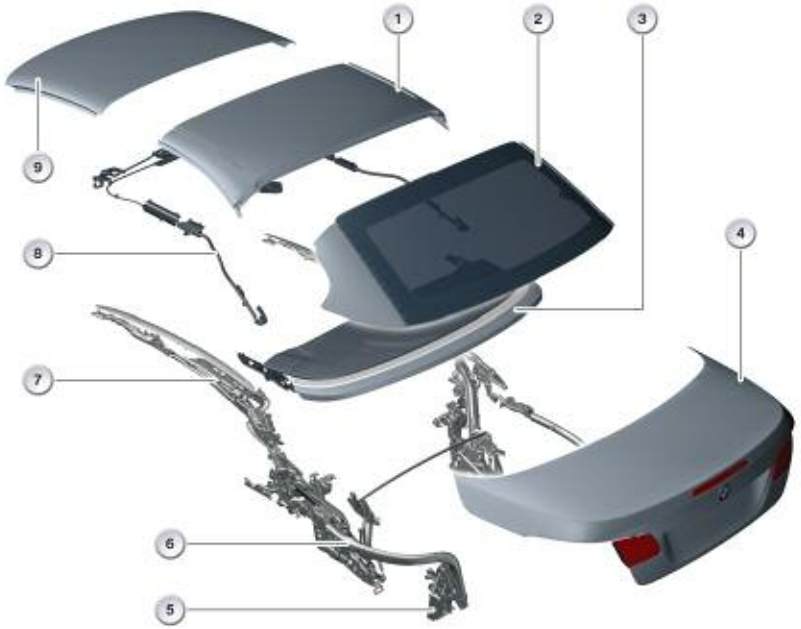
Mechanical Components

The RHT is a roof system which consists of a three piece sheet steel design. The roof system withstands speeds up to 167 mph (270 km/h) and has a sophisticated water management system for draining remaining water when the roof is extended or retracted.

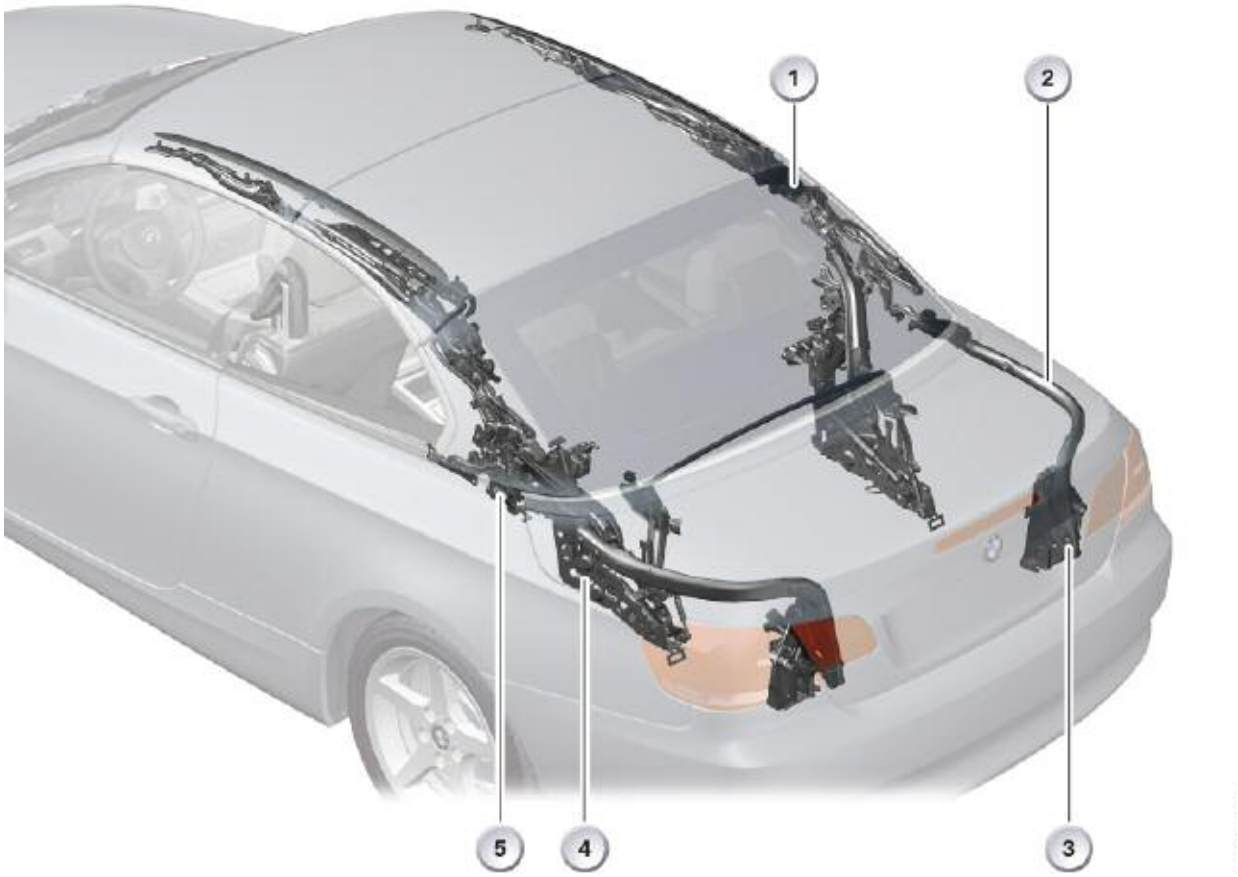
Aerials (AM/FM) are integrated into the bonded rear window. The hardtop roof panels (shells) are made of sheet steel in a classic "sandwich" construction and are engineered for optimum weight and rigidity.

A central hydraulic system in the luggage compartment floor provides the hydraulic pressure for movement of 8 hydraulic cylinders in the overall system.

The retractable hard top (RHT) consists of two main (major) sections; the roof module and the rear module.



Index	Explanation	Index	Explanation
1	Center roof panel	6	Rear module linkage
2	Rear roof panel	7	Roof module linkage
3	Hard top lid	8	Locking mechanism
4	Trunk lid	9	Front roof panel
5	Rear module mount		



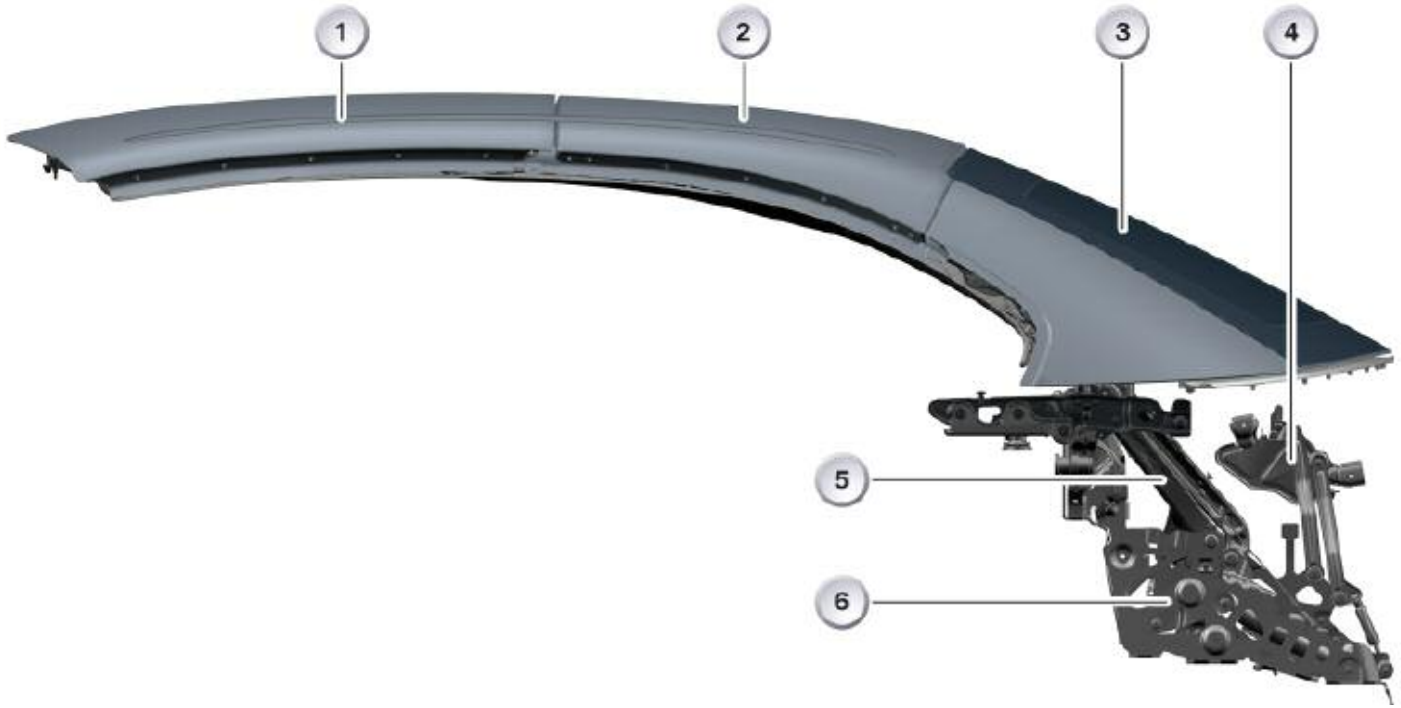
Index	Explanation	Index	Explanation
1	Roof mechanism	4	Roof module main mount
2	Rear mechanism carrier bar	5	Closure
3	Rear module main mount		

Roof Module

The roof module consists of 3 roof panels, linkage, main mount and the hydraulics. The movement sequence of the retractable hardtop is driven by a central hydraulic system with hydraulic 8-cylinder activation, with an additional 2 gas pressure dampers in the main mount.

A total of 8 hydraulic cylinders and 6 gas pressure dampers are used in the retractable hardtop. The hydraulic system is controlled via the Convertible top module (CTM) and is built into a multifunctional tray in the luggage compartment floor.

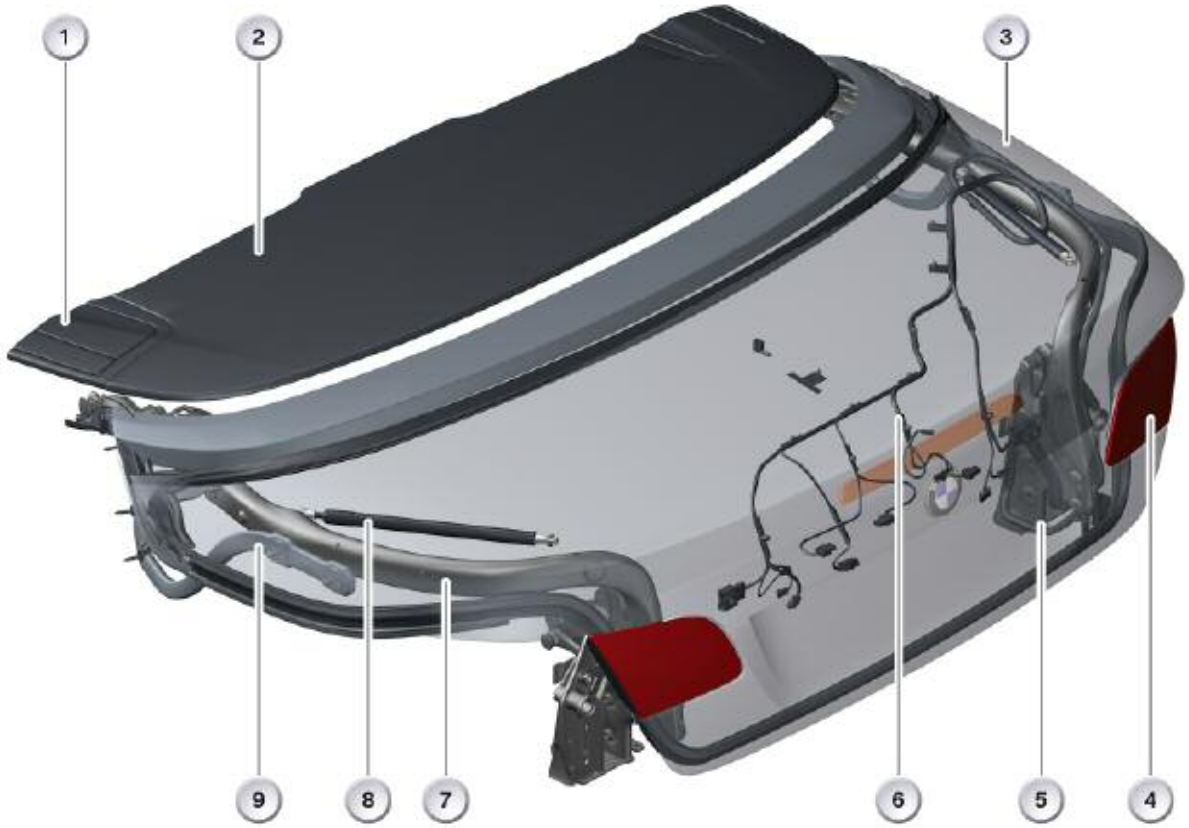
A central electric motor in the front roof panel serves to lock the entire retractable hardtop system. The roof shells are interlocked using drive cable tubes, similar to a sunroof drive. The roof module weighs about 215 lbs (approximately 95 lbs. more than a soft top)



Index	Explanation	Index	Explanation
1	Front roof panel	4	Linkage for luggage compartment divider
2	Center roof panel	5	Linkage
3	Rear roof panel	6	Main mount

Rear module

The trunk lid and hardtop lid are integrated into the rear module. The rear module is fastened to the body using a supporting bar structure with main mount. The rear module weighs about 105 lbs. The trunk lid is equipped with Soft Close Automatic.



Index	Explanation	Index	Explanation
1	Opening hinges for linkage (main pillar)	6	Wiring harness
2	Hardtop lid	7	Rear module linkage
3	Trunk lid	8	Trunk lid damper
4	Tail lights	9	Trunk lid linkage
5	Rear module main mount		

Water Management

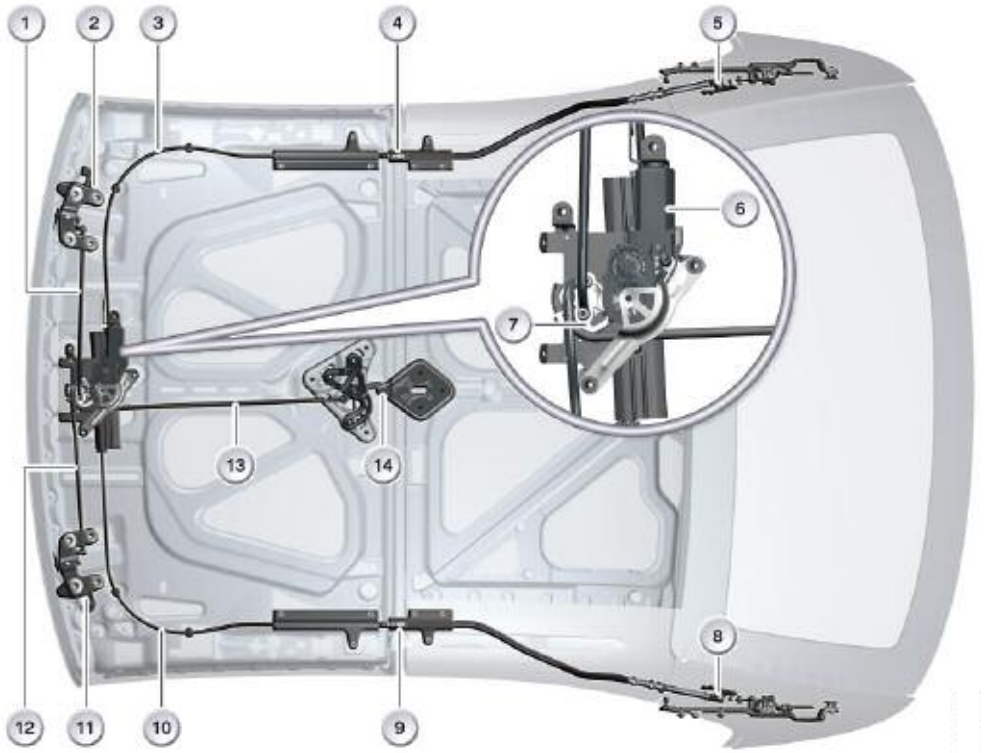
The water flows from the roof channel into a water drain through a duct system with valve on the main guide bar. When the retractable hardtop is stowed while wet, any remaining water droplets are collected in the side storage trays and the channel in the boot sill panel, where they can evaporate. This provides items of luggage with maximum protection from remaining water.

Index	Explanation	Index	Explanation
1	Left storage stray	3	Right storage tray
2	Trunk sill panel channel		

Index	Explanation	Index	Explanation
1	Water hose	3	Water drain
2	Water valve		

Drive for Hardtop Locking

The roof panels of the hardtop are interlocked. In addition, the front roof panel is locked at the cowl panel via two catch hooks.
The electro-motor installed in the center of the front roof panel serves as the drive. The electric motor is activated directly by the CTM.



Index	Explanation	Index	Explanation
1	Connecting rod for right catch hook	8	Locking bolt for center roof panel to rear left roof panel
2	Right catch hook	9	Locking bolt for front center roof panel to center left roof panel
3	Right drive cable	10	Left drive cable
4	Locking bolt for front center roof panel to center right roof panel	11	Left catch hook
5	Locking bolt for center roof panel to rear right roof panel	12	Connecting rod for left catch hook
6	Electric motor	13	Connecting rod for locking hook
7	Control disc	14	Locking hook

Locking Sequence
When the front roof shell has reached the cowl panel, the electric motor is activated.

The left and right drive cables are driven via the gear wheel on the electric motor (in a manner similar to the sliding/tilt sunroof).

Index	Explanation	Index	Explanation
1	Left catch hook	4	Right locking bolt
2	Right catch hook	5	Left locking bolt
3	Electric motor		

The ends of the drive cables have locking bolts that are pushed from the front roof panel into the center roof panel and thus lock these roof panels. The locking bolts press against spring loaded elements in the center roof panel.

By means of these elements and flexible rods, the force is transmitted to the locking bolts of roof panels 2 and 3.

While the drive cables are being driven, the connecting rods are simultaneously activated via the control disk. The force is transmitted from the gear wheel of the electric motor to the connecting rods via the splines on the control disk.

The left and right connecting rods separate, and the front roof panel is locked to the cowl panel via the catch hooks. The locking hook, which locks the front roof panel to the center roof panel, is also driven via the center connecting rod.

The roof shells are unlocked in the opposite direction.

The end positions of the electric motor are detected by two microswitches and forwarded to the CTM.

Locking of the roof shells in the luggage compartment
To prevent damage to the roof shells when stowed, such as when driving over ground contours, potholes, etc., the front roof shell is locked in the luggage compartment. Locking the front roof shell also prevents noises (such as groaning noise or clatter).

Workshop Exercise - Emergency Operation

With the proper repair instructions and instructor guidance, perform the emergency closing procedure. The RHT should be stowed in the trunk area before beginning the process.

If not already removed, remove rear trim as shown.

What special tools are required to open the closure cylinders to unlock the rear module?

Use special tools to unlock rear module.

Open rear module by hand, lift from center of rear module taking care not to damage plastic covers.

Before removing any latches or brackets, make sure to mark bolts to help on reassembly.

Make sure when lifting roof module out of trunk well, have at least 2 people to assist. Keep fingers clear of linkage to avoid injury.

List all tools required to perform this emergency procedure:

Notes:

Classroom Exercise - Review Questions

1. What does a “blinking” red LED indicate on the RHT switch?

2. How will the driver know if the luggage compartment divider is not fully down?

3. The drive motor of the RHT is responsible for locking various elements of the top. Which elements are locked (and unlocked) by the drive motor?

4. Which control module operates the drive motor in the first roof panel?

5. How is the “convenience loading” feature initiated? And, how is is completed?

Electrical Components

Convertible Top Module

The Convertible top module (CTM) is the central electronic control module for all functions of the retractable hardtop. The installation location of the CTM is the right divider compartment module.

The CTM controls the retractable hardtop, the rear module and the Soft Close Automatic feature. Power is supplied to the CTM by the junction box with terminal 30g.

There is an additional power supply to the CTM via terminal 15 of the Car Access System (CAS) so that in certain cases of malfunction, such as an interrupted supply from the junction box, adequate diagnostics and communication with the diagnostic tester are possible.

The CTM controls the electric motor for the interlocking of the roof shells and of the front roof shell to the cowl panel. In addition, it controls the hydraulic pump and the 8 hydraulic cylinders via the 5 valves in the hydraulic unit.

During the hardtop and rear module movements, the respective position is detected by 9 Hall sensors and 5 microswitches in the cowl panel, hardtop and rear module and forwarded to the CTM via the respective wiring harness. Each of them signals whether a certain status has been reached and whether the CTM can initiate the next phase.

The current supply of the microswitches/Hall sensors is provided by the CTM. The CTM also reads in the status of the button.

The CTM is connected to other control units via the K-CAN. For example, information about the outside temperature, driving speed and status of the boot lid is received via K-CAN.

When the hardtop is opened or closed, the CTM sends the request to lower the side windows to the FRM.

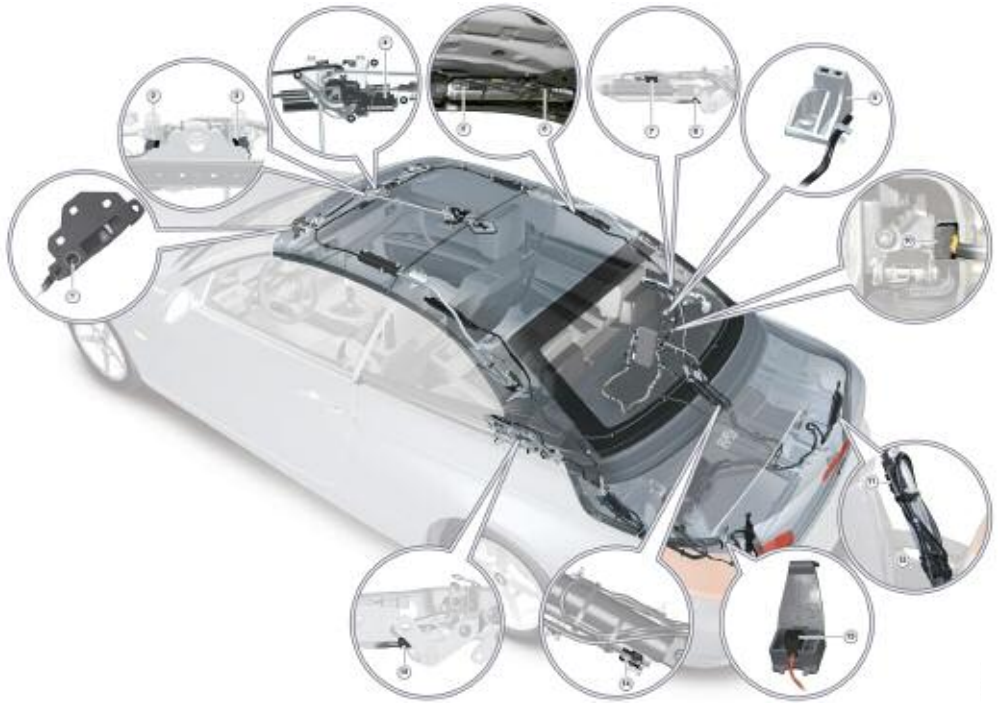
In certain critical situations, the CTM triggers introductions that are easily understandable to the customer in the instrument cluster as check control messages and text messages in the CID.

Depending on whether the roof is closed or open, the CTM will transmit a signal to the diversity aerials to switch from glass mounted aerials to the auxiliary (bumper/trim mounted) aerials.

Index	Explanation
1	26-pin connector for Hall sensors and micro switches
2	2-pin connector for electric motor
3	41-pin connector for power supply, SCA, button, Hall sensors, micro switches and K-CAN
4	18 pin connector for hydraulic control unit

Workshop Exercise - Hall Sensors and Microswitches

Using the available reference material and class vehicle, identify and locate all microswitches and Hall sensors on the vehicle. Complete the exercise by filling in the chart below with the correct sensor/switch terminology.



Index	Explanation	Index	Explanation
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8			

Microswitch and Hall Sensor Locations

“Cowl panel reached” microswitch

This microswitch is built into the left cowl panel on the vehicle.

“Catch hooks locked” microswitch
“Catch hooks unlocked” microswitch

Both of these microswitches are located below the electric motor for hardtop locking

“Roof shells partially open”
“Roof shells partially closed”
Hall Sensor

These two hall sensors are located on the right hand roof shell cylinder

“Right closure open” Hall Sensor
“Right hand closure closed” microswitch

The right hand closure cylinder area contains both a Hall sensor and a microswitch

“Left hand closure closed” microswitch

The microswitch for “left hand closure closed” is on the left hand closure cylinder area

“Rear module closed” Hall Sensor

The hall sensor for “rear module closed” is located on the right hand side of the partition for the RPS system

“Roof package stowed” Hall sensor

This Hall sensor is located on the partition for the RPS, on the right hand side

“Rear module open” Hall sensor
“Rear module almost closed Hall sensor

Both of these Hall sensors are located on the right hand rear module cylinder

“Luggage compartment divider” Hall Sensor

This Hall sensor is located on the right hand rear side of the luggage compartment

“Roof package extended” Hall Sensor

This Hall sensor is located on the right side main roof pillar cylinder

Workshop Exercise - Sensors and Switches

Complete the chart below by filling in the required information on the status of the RHT. The status of the top is shown at the right. Place the top in this position and use the diagnostic equipment to access the required information (i.e. status requests etc).

Micro-switch/Hall Sensor description	Type	ETM/Component #	Status in Diagnosis (No/Yes)	Component location
"Cowl panel reached"	Microswitch			
"Catch hook (cowl panel) locked"	Microswitch			
"Catch hook (cowl panel) unlocked"	Microswitch			
"Roof panels (shells) partially closed"	Hall Sensor			
"Roof panels (shells) partially opened"	Hall Sensor			
"Right closure (coupling) open"	Hall Sensor			
"Right closure (coupling) closed"	Microswitch			
"Rear module closed"	Hall Sensor			
"Roof package stowed"	Hall Sensor			
"Rear module open"	Hall Sensor			
"Rear module almost closed"	Hall Sensor			
"Luggage compartment divider"	Hall Sensor			
"Roof package extended"	Hall Sensor			
"Left closure (coupling) closed"	Microswitch			

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"Right closure (coupling) closed"	Microswitch			
"Rear module closed"	Hall Sensor			
"Roof package stowed"	Hall Sensor			
"Rear module open"	Hall Sensor			
"Rear module almost closed"	Hall Sensor			
"Luggage compartment divider"	Hall Sensor			
"Roof package extended"	Hall Sensor			
"Left closure (coupling) closed"	Microswitch			

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"Rear module open"	Hall Sensor			
"Rear module almost closed"	Hall Sensor			
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"Roof package extended"	Hall Sensor			
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Workshop Exercise - Sensors and Switches

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"Roof package stowed"	Hall Sensor			
"Rear module open"	Hall Sensor			
"Rear module almost closed"	Hall Sensor			
"Luggage compartment divider"	Hall Sensor			
"Roof package extended"	Hall Sensor			
"Left closure (coupling) closed"	Microswitch			

Workshop Exercise - Sensors and Switches

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"Roof package extended"	Hall Sensor			
"Left closure (coupling) closed"	Microswitch			

Workshop Exercise - Sensors and Switches

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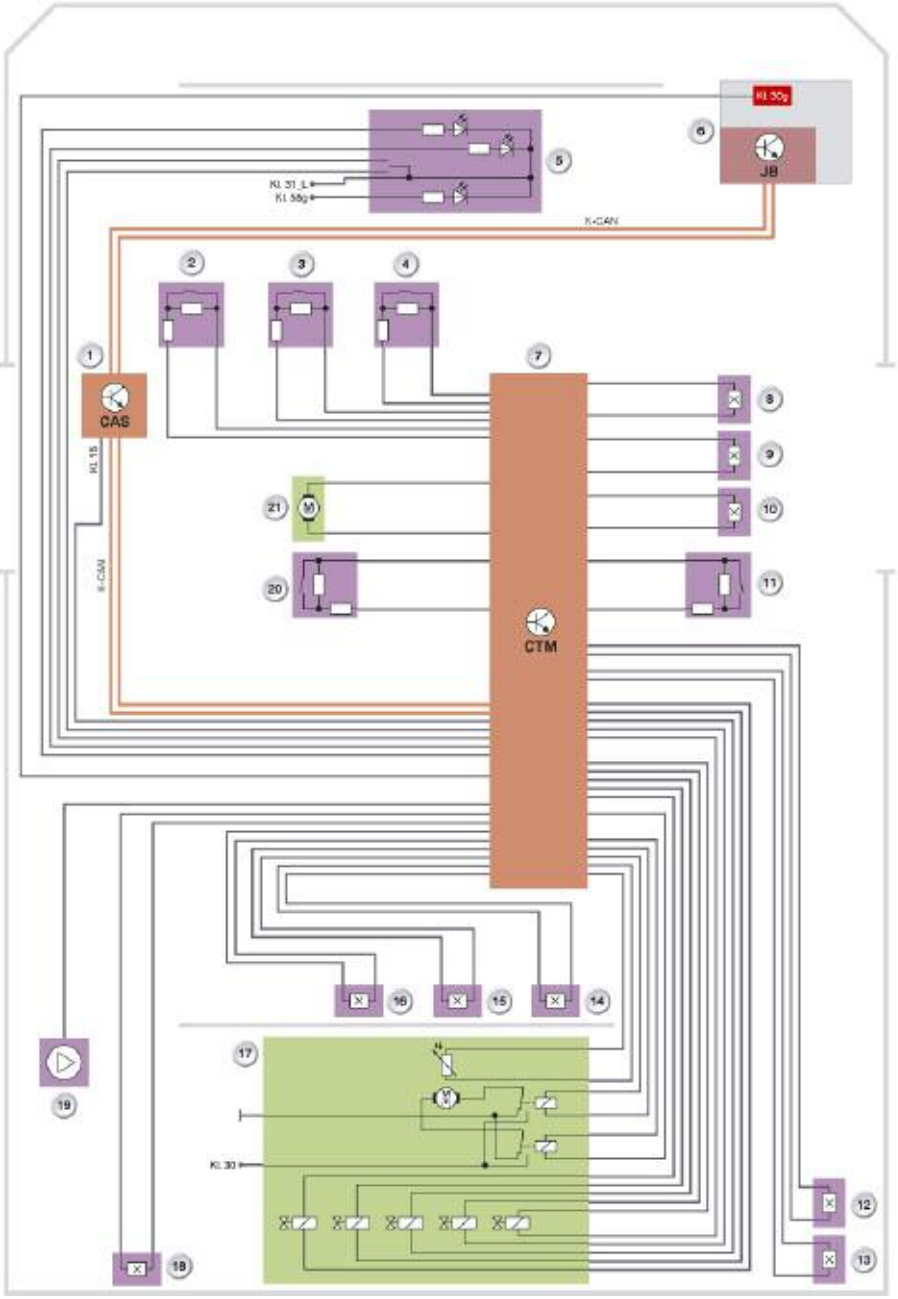
"Rear module almost closed"	Hall Sensor			
"Luggage compartment divider"	Hall Sensor			
"Roof package extended"	Hall Sensor			
"Left closure (coupling) closed"	Microswitch			

Hard Top System Schematic

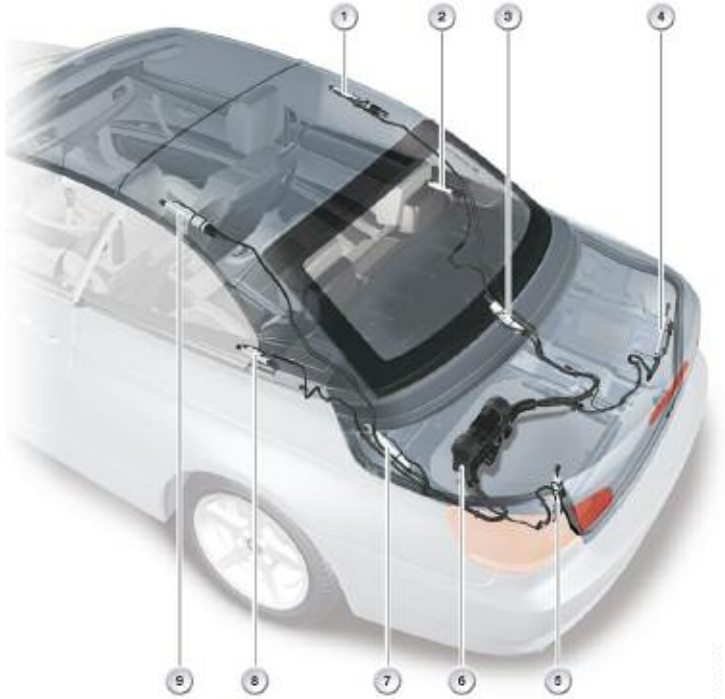


Index	Explanation	Index	Explanation
1	Car Access System (CAS 3)	12	“Rear module open” Hall sensor
2	“Cowl panel reached” micro switch	13	“Rear module almost closed” Hall sensor
3	“Catch hook locked” micro switch	14	“Roof package stowed” Hall sensor
4	“Catch hook unlocked” micro switch	15	“Rear module closed” Hall sensor
5	Operating button for retractable hard top	16	“Roof package extended” Hall sensor
6	Junction Box (electronics)	17	Hydraulic unit (pump,motor,valves)
7	Convertible Top Module (CTM)	18	“Luggage compartment divider” Hall sensor
8	“Open roof shells” Hall sensor	19	Diversity aerial
9	“Close roof shells” Hall sensor	20	“Left closure” microswitch
10	“Closure open” Hall Sensor	21	Electric motor for fastener on cowl panel and interlocking of roof shells
11	“Right closure closed” microswitch		

NOTES PAGE

Hydraulic Components

The retractable hardtop and the rear module are driven hydraulically. The hydraulic system consists of 8 hydraulic cylinders that are supplied with pressure by the hydraulic system via the hydraulic lines. The cylinders are always activated in pairs. The hydraulic assembly is installed in a recess in the luggage compartment floor. Four cylinders are required for the movement of the hardtop: the two roof shell cylinders and two rear pillar cylinders. The rear module is opened and closed by two rear module cylinders. Two closure cylinders are responsible for locking/unlocking the rear roof panels and the rear module.



Index	Explanation	Index	Explanation
1	Right roof panel (shell) cylinder	6	Hydraulic assembly (pump, motor, valves and relays)
2	Right closure cylinder	7	Left main pillar cylinder
3	Right main pillar cylinder	8	Left closure cylinder
4	Right rear module cylinder	9	Left roof panel (shell) cylinder
5	Left rear module cylinder		

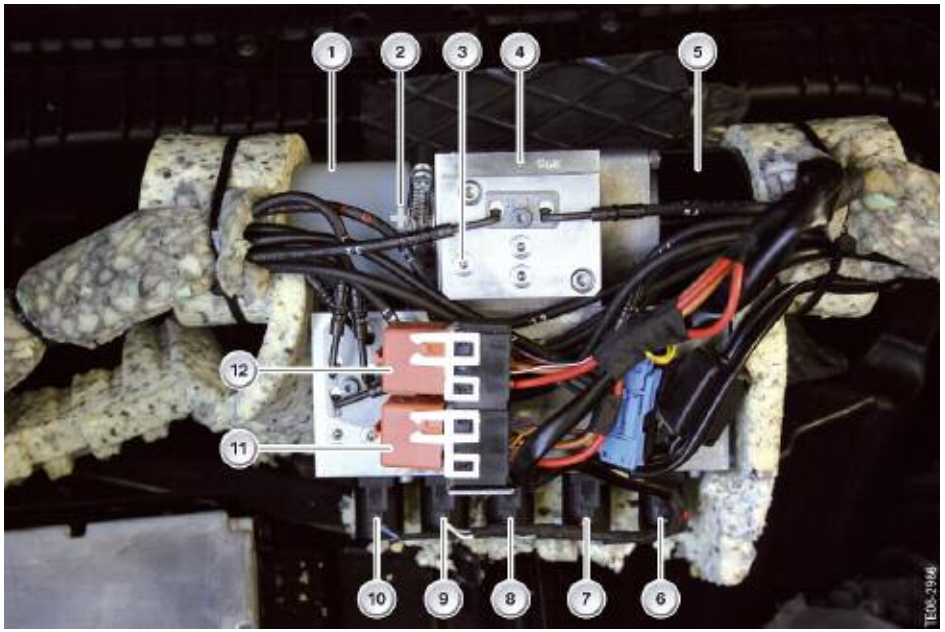
Hydraulic Unit

The movement direction of the hardtop and rear module are determined by corresponding valve positions and by reversing the direction of rotation of the pump. The hydraulic pump in the hydraulic unit is driven by an electric motor that operates in two directions of rotation.

Both rotation directions are implemented with a relay switch. The pump motor and the five hydraulic valves are activated by the CTM. The power consumption of the electric motor is about 40 A (safeguarded by a 50 A fuse). The hydraulic pump generates an operating pressure of 150 to 200 bar.

To prevent the pump motor from overheating if the hardtop is operated frequently, the temperature of the pump motor is measured using an NTC resistor. The NTC resistor is connected to the CTM via two wires with a floating ground. An open circuit causes an entry in the fault code memory, but does not prevent the hardtop from moving.

Two temperature values are particularly important. The lower of these is around 90°C and serves as an "early warning". If this temperature is exceeded, any hardtop movement that has already begun is continued until it as safely come to an end. If the temperature reaches 105°C, the hardtop movement is stopped immediately. It cannot be resumed until the temperature falls back below 90°C.



Index	Explanation
1	Reservoir for hydraulic fluid
2	Fill level mark
3	Bleed screw for emergency actuation
4	Hydraulic pump
5	Pump motor
6	Valve 1
7	Valve 3
8	Valve 5
9	Valve 4
10	Valve 2
11	Relay for counter-clockwise operation
12	Relay for clockwise operation

If the hardtop movement is interrupted, the hardtop remains in the hold position. The pressure in the hydraulic system is maintained at all times and is not shut off. In case of an emergency actuation of the hardtop, the bleed screw on the hydraulic pump must be released. The hydraulic fluid does not need to be changed (lifetime filling).

If the hydraulic fluid needs to be refilled due to leaks ensure that the approved hydraulic fluid is used (see Electronic Parts Catalog). Add hydraulic fluid only up to the mark on the reservoir. If a lot of noise is heard while the hardtop is actuated, the hardtop must be opened and closed a few times in succession to allow the system to bleed.

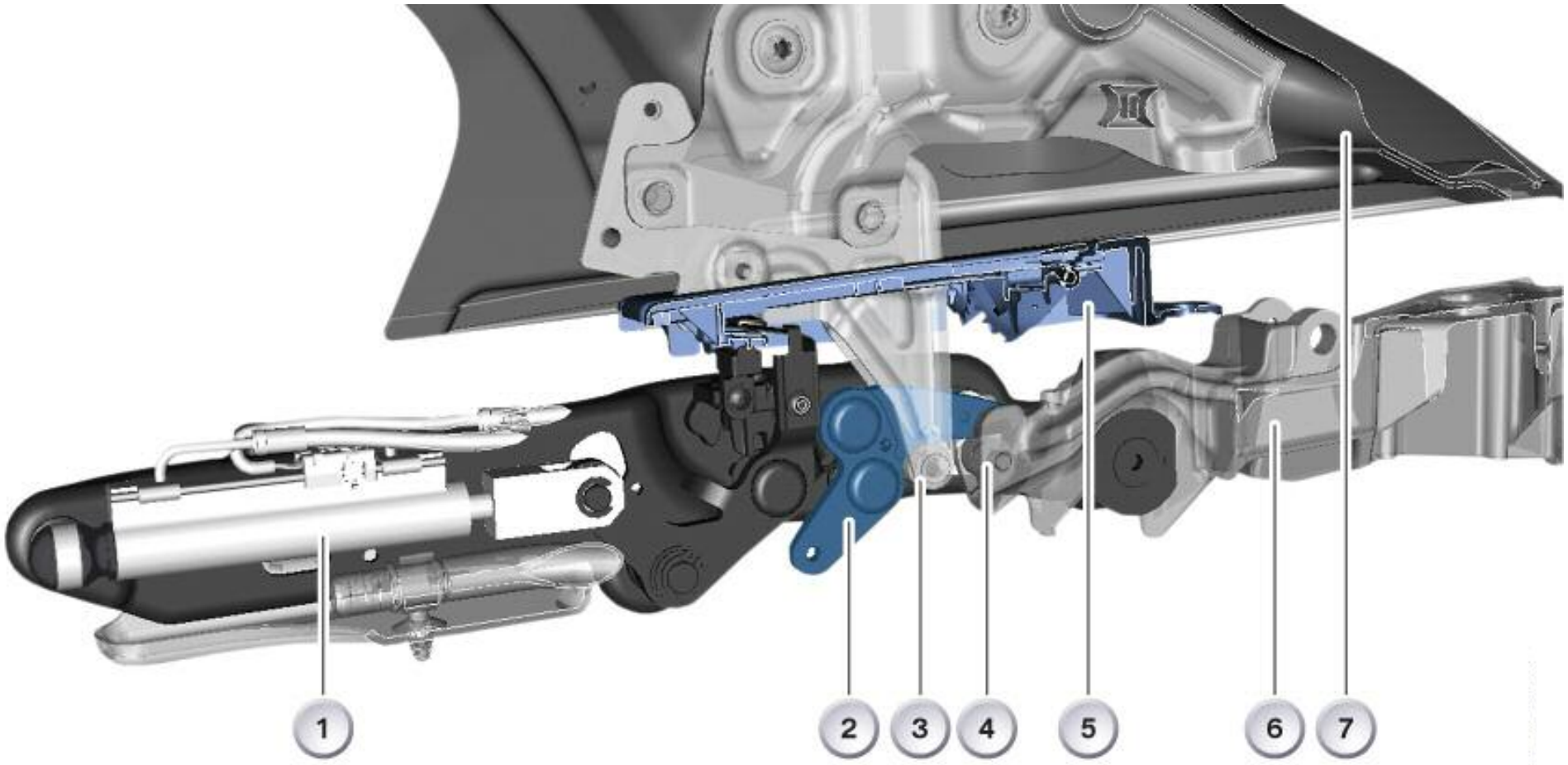
The hydraulic system is automatically bled in the reservoir.

Closure Cylinders

The closure cylinders (1) lock the rear roof panel and rear module to the body. Before the hardtop can be opened, the rear roof shell must be unlocked. It is unlocked by extending the piston. A Hall sensor is installed on the right cylinder that detects the position of the extended piston. Since the cylinders are de-pressurized if the hydraulic pump is not activated, they are engaged while locked or activated via dead center.

The locking is signalled to the CTM by two microswitches (one on each of the two closure cylinders). When the hardtop is closed, after the roof package is extended and the rear module is closed, the closure cylinders are retracted in order to push the rear module all the way into the lower position. Then, the closures open and are not closed until the roof shells are interlocked and locked to the cowl panel. The rear roof panel and the rear module are locked to the body by closing the closures.

Index	Explanation
1	Closure cylinder
2	Lock hook



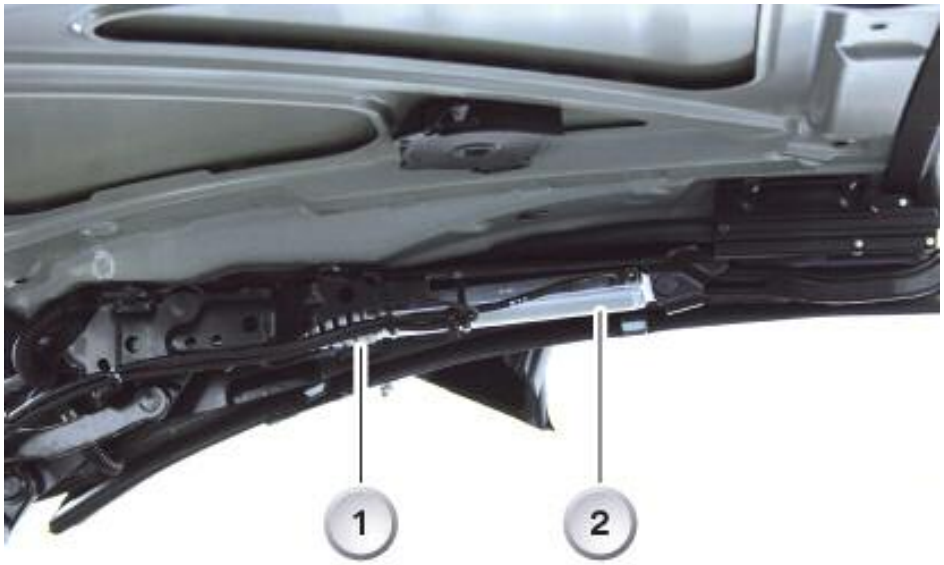
Index	Explanation	Index	Explanation
1	Closure cylinder	5	Outlet flaps for main pillars
2	Lock hook	6	Rear module mechanism
3	Rear roof shell locking roller	7	Rear roof shell
4	Rear module locking roller		

Roof Panel Cylinders

The movement of the roof panels is carried out using two roof panel cylinders. The actuation direction of the roof panel cylinders depends on the rotation direction of the hydraulic pump. When the pistons have retracted into the roof, the hardtop is closed. When the roof panel cylinders are pressurized on the piston side, the pistons are extended and move the roof panels above each other via the roof panel control arms. Two Hall sensors are installed on the right roof panel cylinder and detect the position of the piston.

When the roof panel cylinders are pressurized on the rod side, the pistons are retracted and the roof shells separate. When the Hall sensor detects the position of the retracting piston, the pressure in the cylinder is reduced. In addition, the spring on the roof panel cylinder acts counter to the movement direction.

The reason for this is that the front roof panel moves into the front cowl very slowly, resulting in a harmonious hardtop movement. The slow movement also minimizes the risk of becoming trapped.

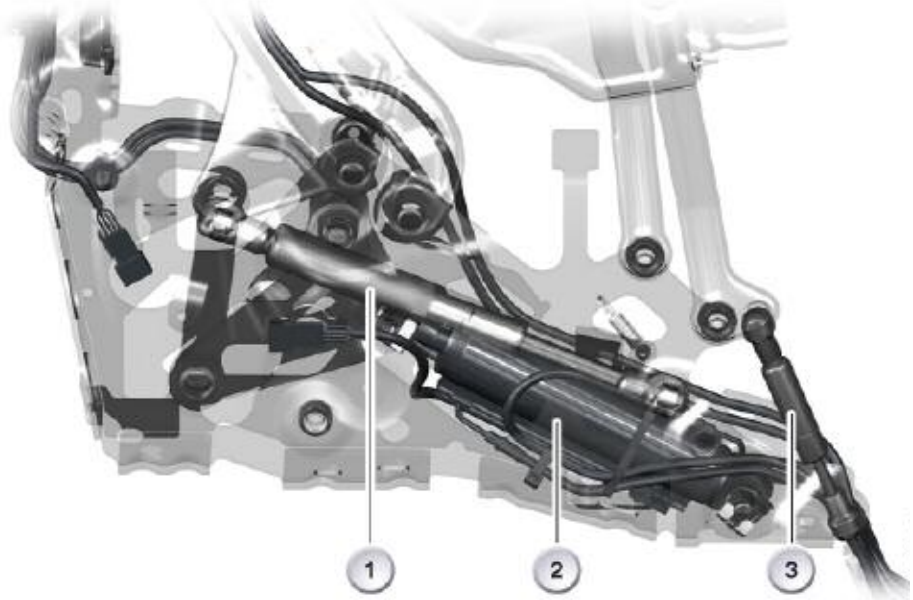


Index	Explanation
1	Spring for mechanically damping the roof panel movement
2	Roof panel cylinder

Main Pillar Cylinders

The main pillar cylinders serve to stow the roof package in the luggage compartment and to lift it out of the luggage compartment. When the rear pillar cylinders are retracted, the roof package is lifted. The roof package is stowed by extending the main pillar cylinders. A Hall sensor is installed on the right main pillar cylinder that signals the "Roof panels extended" position to the CTM.

The uniform movement of the roof package is supported by 2 gas pressure dampers in the main mount.



Index	Explanation
1	Gas pressure damper for main cylinder
2	Main pillar cylinder
3	Gas pressure damper for luggage compartment divider

Rear Module Cylinders

The rear module is opened and closed by the rear module cylinders. When the rear pillar cylinders are retracted, the rear module is closed. The rear module is opened by extending the pistons in the rear module cylinders.

Two Hall sensors are installed on the right rear module cylinder. The upper Hall sensor detects the position of the opened rear module. The lower Hall sensor signals to the CTM that the rear module is almost closed.

Beginning at this position, the pressure in the rear module cylinders is reduced and the rear module is closed more slowly until it reaches the end position.

Index	Explanation
1	Rear module cylinder
2	Rear module

Workshop Exercise - RHT Service

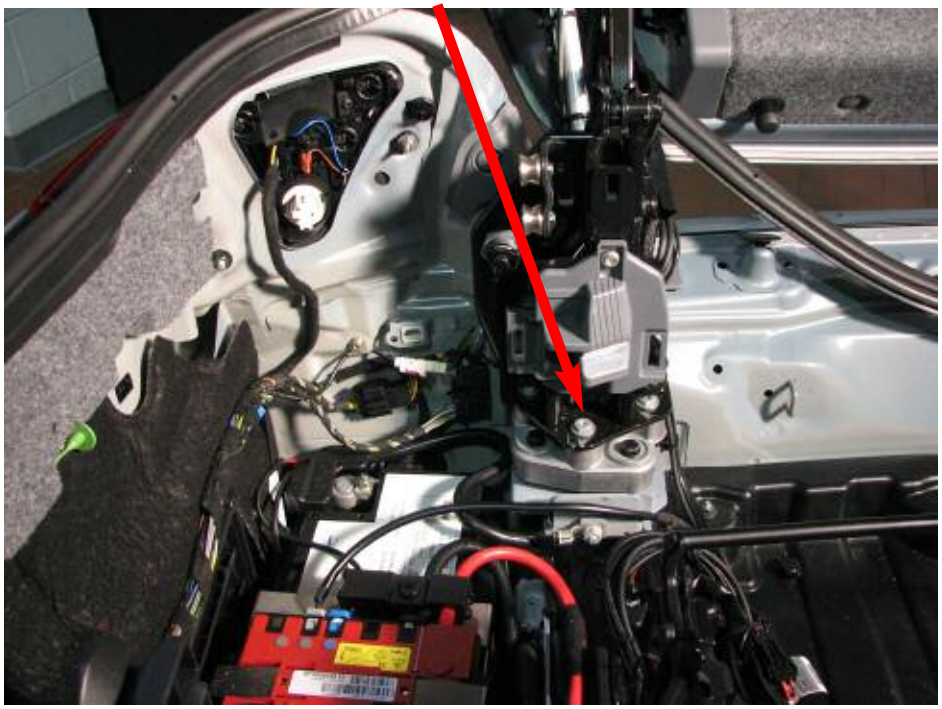
With instructor guidance, prepare to remove complete roof module and rear module assembly. Follow the latest repair instructions in TIS.

First, remove rear module assembly. Be sure to mark mounting locations to ensure proper position during re-assembly.

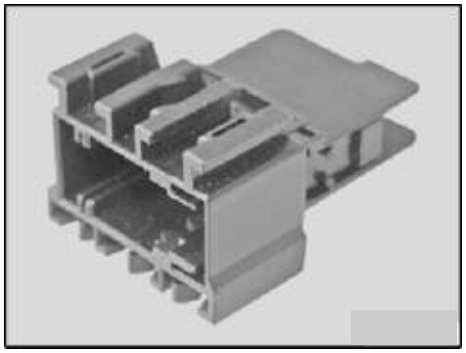
Make sure to protect rear module and trunk from body damage using fender covers or other suitable protection.

Once the rear module is removed, place in safe location away from the vehicle to allow access by special tool (engine crane).

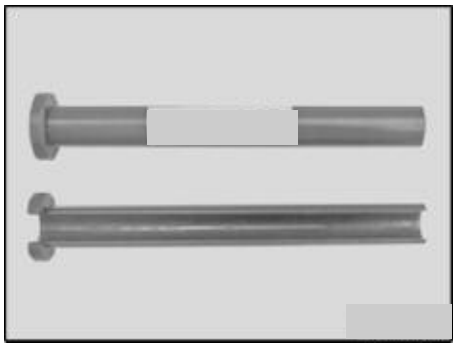
Mark mounting locations on rear module mount.



List the tool number for the special tools shown below:



Tool #: _____



Tool #: _____

Workshop Exercise - RHT Service

After the removal of the rear module, proceed with removal of the roof module.

Be sure plastic cover on hydraulic unit has been removed.

Unclip all cable holders for electrical and hydraulic lines. (Remove CD Changer if equipped)

*Make sure all **necessary** electrical connectors have been unplugged.*

Install special tool to protect rollover protection system.

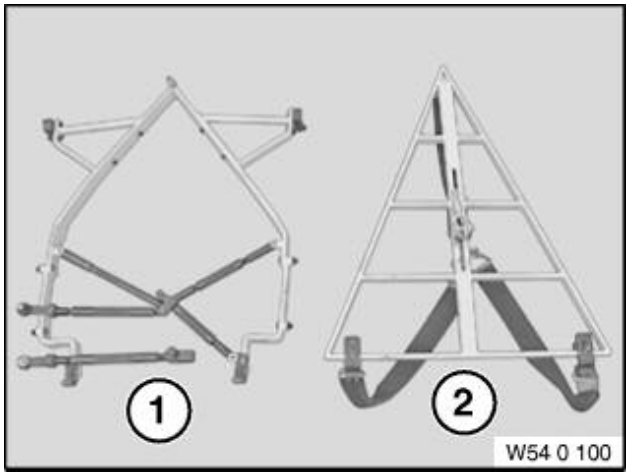
List the special tool # shown in the above illustration:

_____

Release all required fasteners in preparation for removal of the roof module. Replace bushing during re-assembly.

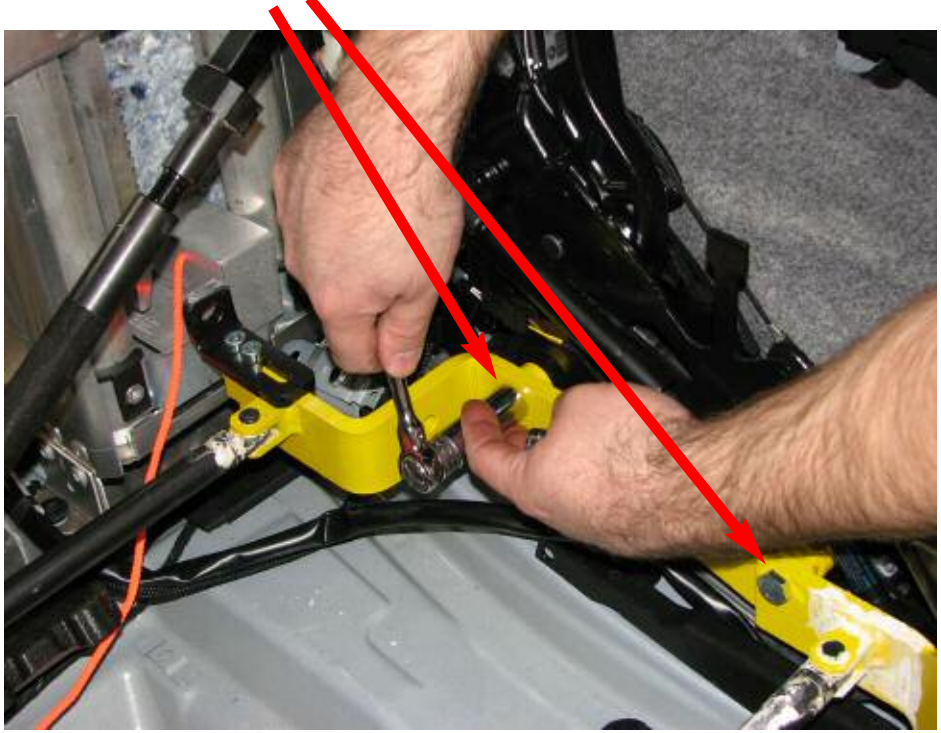
Secure metallic object (washer etc.) on the luggage compartment Hall sensor to simulate closed luggage compartment divider.

Prepare special tool (1) by fully collapsing before installation.



Workshop Exercise - RHT Service

When installing special tool for roof module removal, be aware of the bolt length.



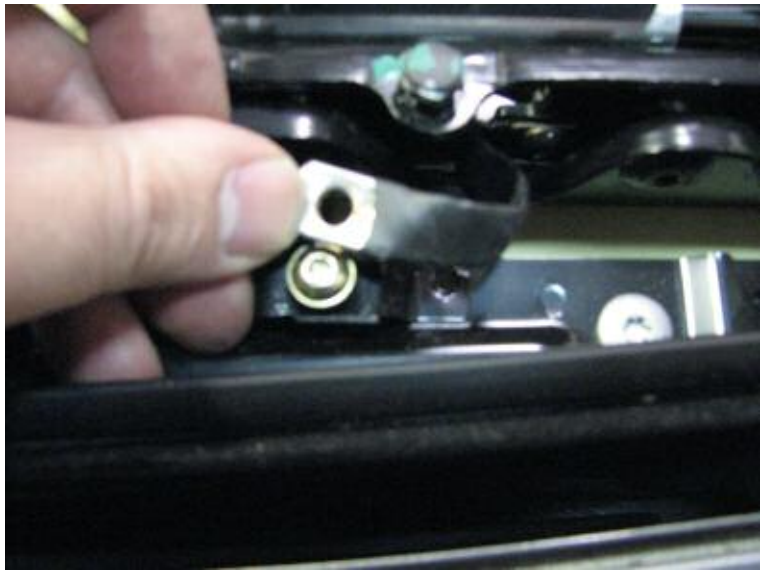
Tighten sleeves on special tool on hand tight. Over-tightening will cause problems during re-assembly.

Using wire ties (or suitable attachment), tie the rear module cylinders and hydraulic unit to special tool.

Remove bolts (front 2x) attaching roof module to body and loosen rear bolts for access later.

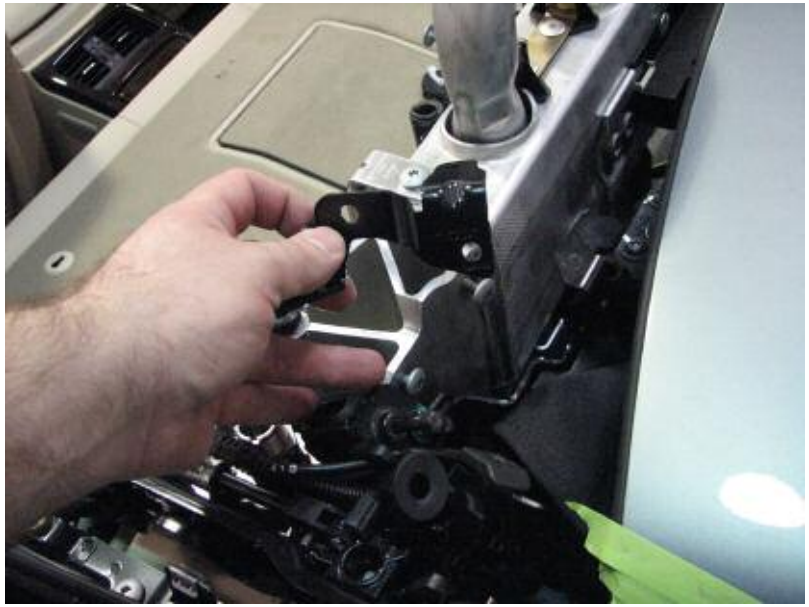
Lower roof module and then disconnect electrical connections from CTM and feed harness through partition.

Now that the roof module is lowered disconnect ground connections and water drains.



Disconnect remaining bolts and check for any remaining wiring harness connections.

Remove brackets as shown.



Attach upper part of sling and remove roof module. Take care to lift roof module straight up and out. Avoid damage by taping up any potentially exposed areas.

Remove roof module and move crane assembly away far enough to room to perform adjustments on vehicle.

Workshop Exercise - RHT Adjustments

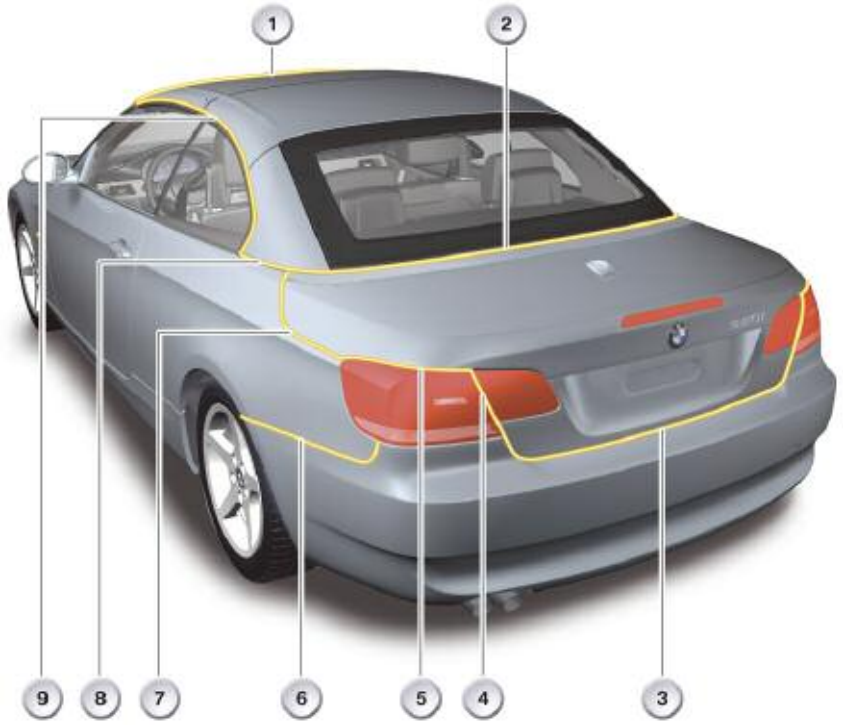
With instructor guidance and repair instructions, perform all of the necessary RHT adjustments using special tools.

List all special tools required to perform RHT adjustments:

Notes:

Workshop Exercise - RHT Reassembly

Check all gap adjustments as shown in repair instructions.



List all gap specifications in the chart below:

Index	Specified Gap	Index	Specified Gap
1		6	
2		7	
3		8	
4		9	
5			

Continue with reassembly and ensure that the RHT is functioning properly. Erase all fault codes and check RHT functions.

Notes:

Classroom Exercise - Review Questions

1. What type of sensor monitors the position of the luggage compartment divider? (circle the correct answer)

   Micro-switch **Optical Sensor**

   Hall Effect Sensor **Microwave sensor**

2. Which hydraulic cylinders is responsible for stowing the roof package? (circle the correct answer)

   Roof shell cylinder **Closure cylinder**

   Rear module cylinder **Main pillar cylinder**

3. Which of the following RHT components are locked to the body by the closure cylinder? (circle the correct answer)

   Roof panel 1 and roof panel 2

   Rear module and roof shell 3

   Roof shell 3 and roof shell 2

   Luggage compartment cover and roof shell 1

4. Which control module is responsible for the actuation of the SCA drives on the E93? (circle the correct answer)

   JB **CTM** **ROC** **FRM**

5. The entire opening/closing operation of the RHT takes place by the use of _____ hydraulic cylinders?
   (circle the correct answer)

   6 **7** **8** **9**

6. The end positions of the electric drive motor are detected by two_____.
   (circle the correct answer)

   Magneto-resistive sensors **Hall Sensors**

   Optical Sensors **Microswitches**

7. The CTM communicates with the diversity module via:
   (circle the correct answer)

   K-CAN **K-Bus** **Hard wire** **LIN-bus**

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