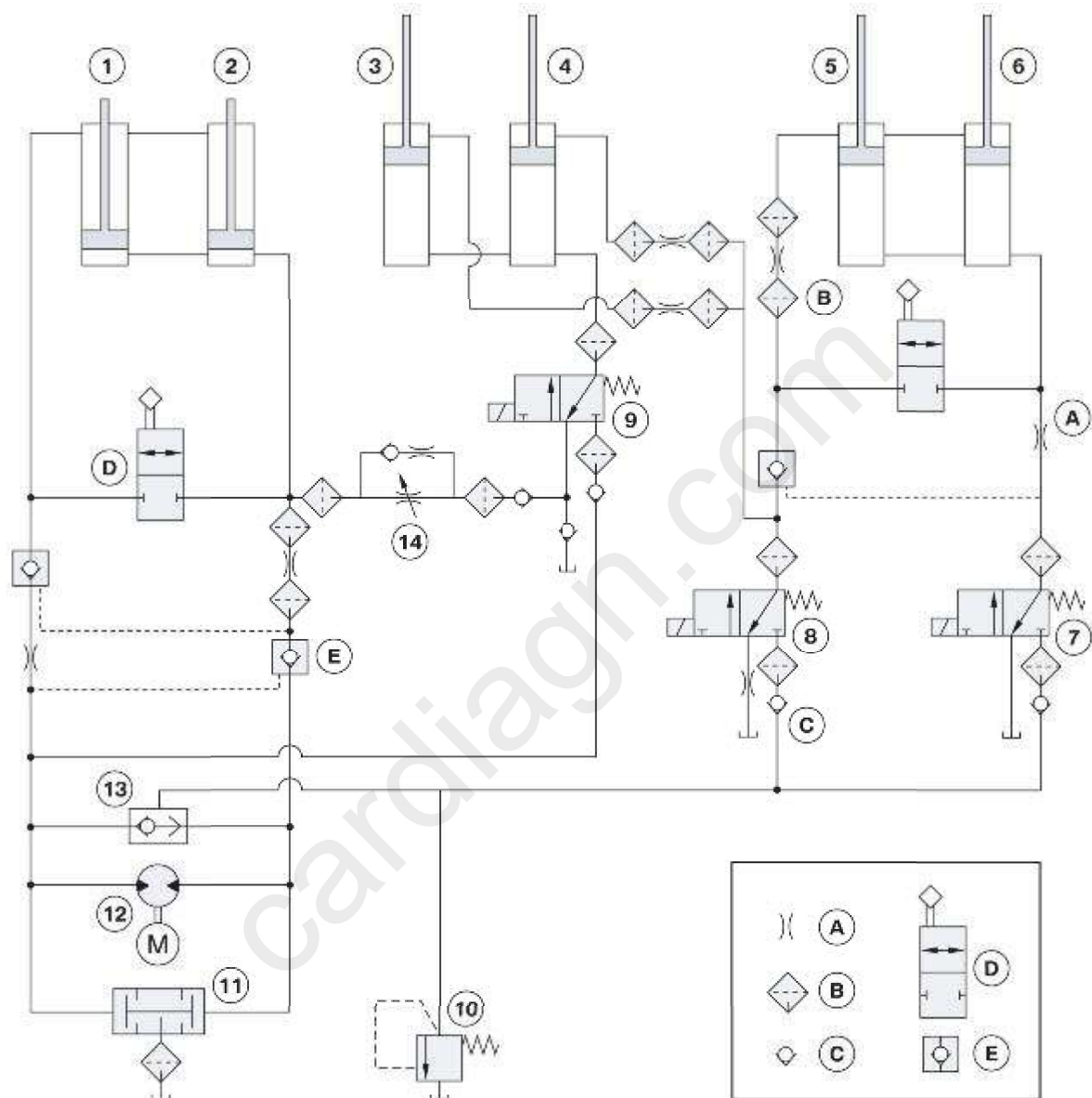


Retractable Hardtop

The retractable hardtop consists of two aluminum roof panels. They are operated by means of an internal linkage. The retractable hardtop and the rear module are driven hydraulically. The hydraulic system consists of 6 hydraulic cylinders that are supplied with pressure by the hydraulic unit via the hydraulic lines. The cylinders are always actuated in pairs. The retractable hardtop is equipped with a headliner without tensioning cables.

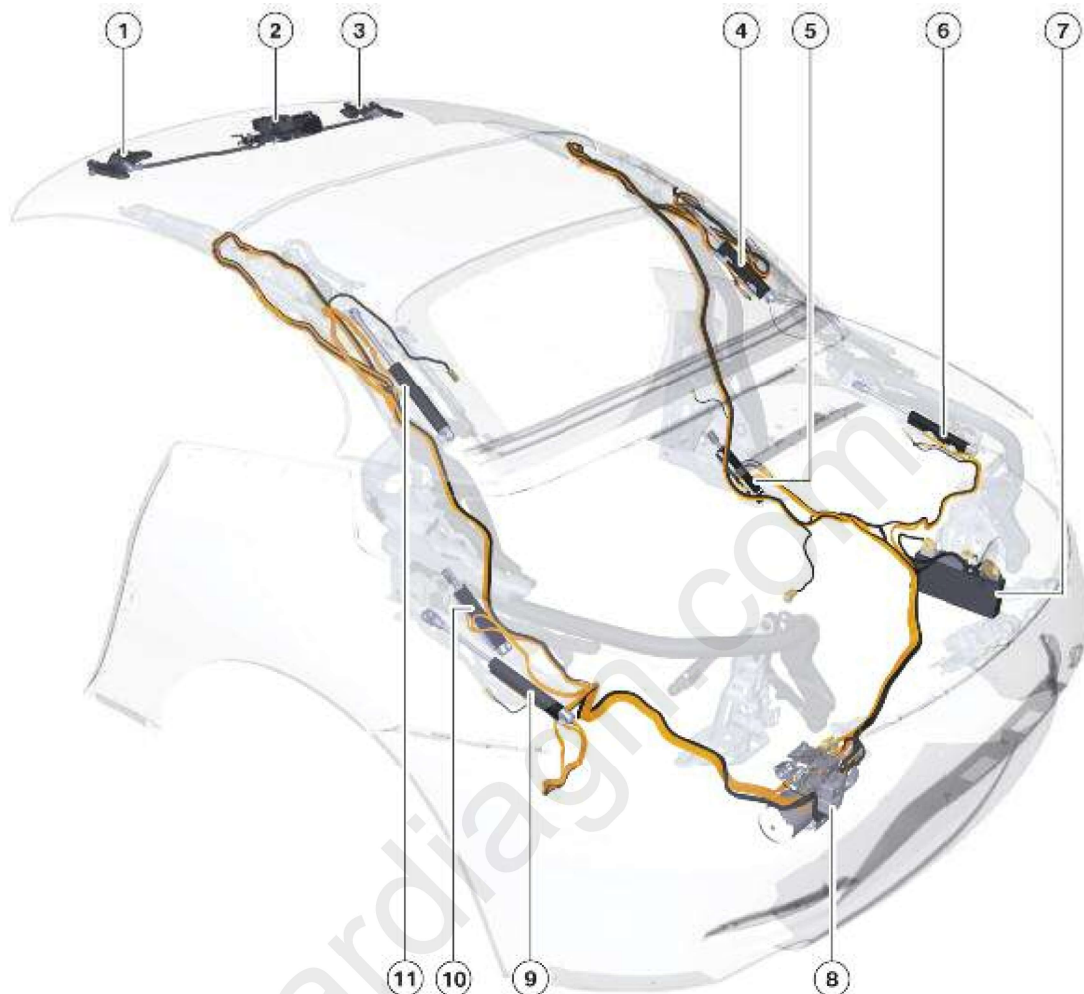


Hydraulic System Circuit Schematic



Index	Explanation
A	Throttle
B	Filter
C	Non-return valve
D	Emergency operating valve
E	Pilot-controlled non-return valve
1	LH hydraulic cylinder, main pillar
2	RH hydraulic cylinder, main pillar
3	LH hydraulic cylinder, roof panel
4	RH hydraulic cylinder, roof panel
5	LH hydraulic cylinder, rear module
6	RH hydraulic cylinder, rear module
7	Valve for rear module
8	Valve for roof panel and rear module
9	Valve for main cylinder and roof panel
10	Pressure relief valve
11	Changeover valve
12	Hydraulic pump
13	Changeover valve
14	Two-way flow control valve

Hydraulics and Locking Mechanism



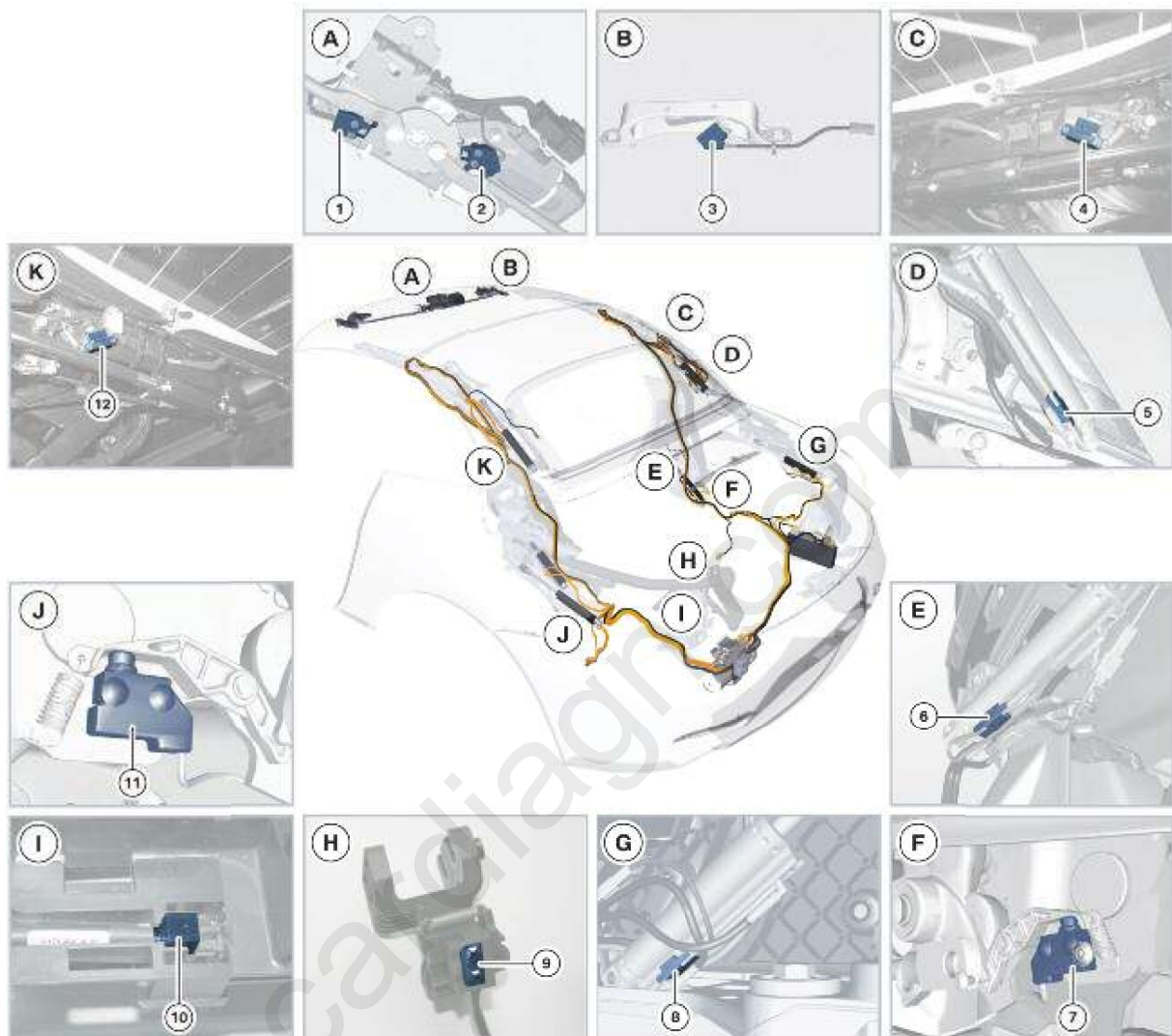
Index	Explanation
1	LH latch, windscreen cowl panel
2	Drive for locking retractable hardtop
3	RH latch, windscreen cowl panel
4	RH hydraulic cylinder, roof panel
5	RH hydraulic cylinder, main pillar
6	RH hydraulic cylinder, rear module
7	Convertible top module
8	Hydraulic unit
9	LH hydraulic cylinder, rear module
10	LH hydraulic cylinder, main pillar
11	LH hydraulic cylinder, roof panel

Mechanical System Overview



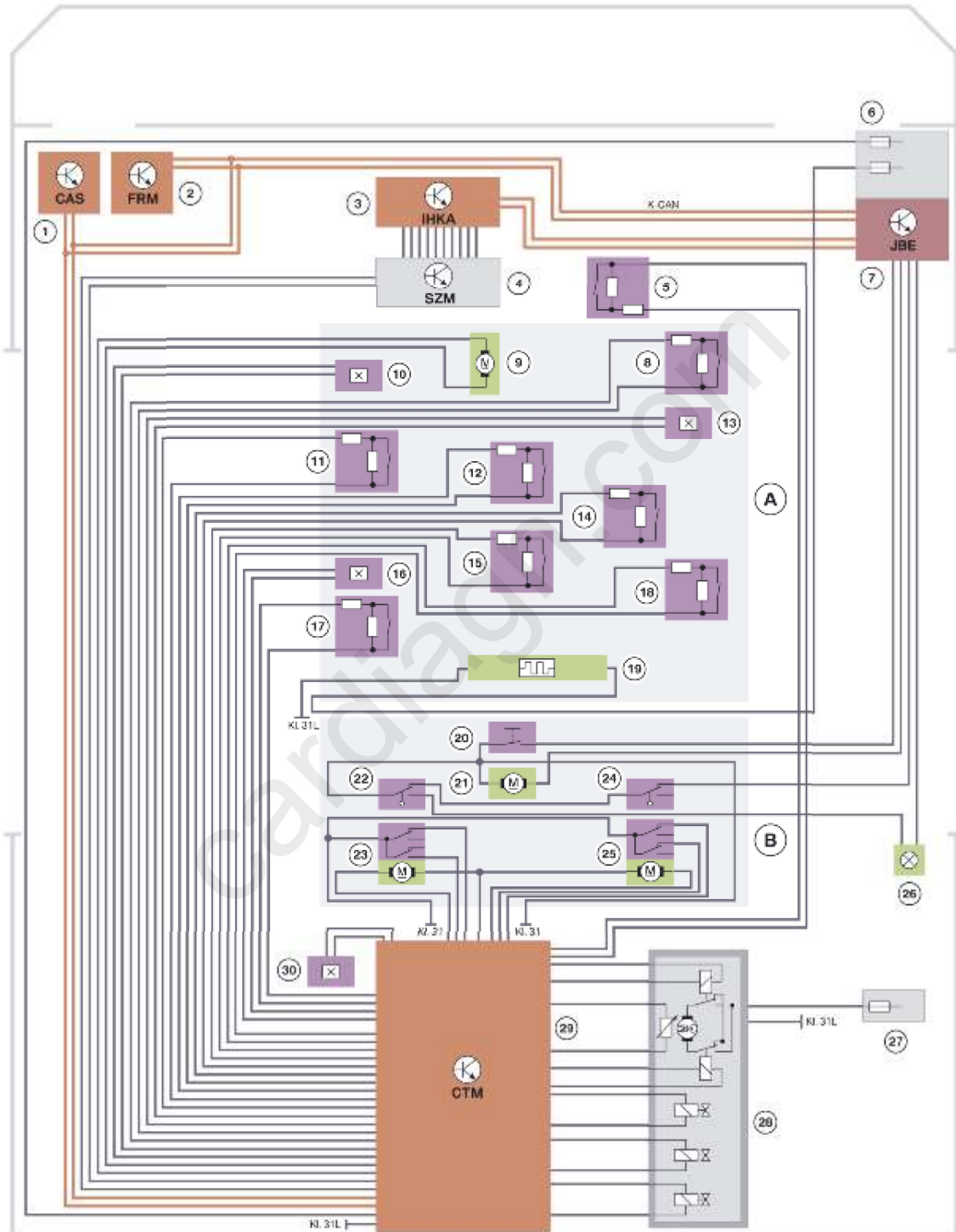
Index	Explanation
1	Roof panel 2
2	Roof panel 1
3	Main pillar mechanism
4	Rear module mechanism
5	Rear module

Sensors



Index	Explanation
A - K	Locations
1	Microswitch, cowl panel unlocked
2	Microswitch, cowl panel locked
3	Microswitch, cowl panel reached
4	RH microswitch, roof panel closed
5	Hall sensor, roof panel packed
6	Hall sensor, roof panel opened
7	RH microswitch, rear module closed
8	Hall sensor, roof package extended
9	Microswitch, roof module compartment locked
10	Hall sensor, luggage compartment partition
11	LH microswitch, rear module closed
12	LH microswitch, roof panel closed

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E89 Complete Vehicle



Index	Explanation	Index	Explanation
A	Roof module	15	Microswitch, roof module compartment locked
B	Rear module	16	Hall sensor, rear module opened
1	Car Access System (CAS)	17	LH microswitch, rear module closed
2	Footwell module (FRM)	18	RH microswitch, rear module closed
3	Integrated automatic climate control (IHKA)	19	Heated rear window
4	Center console control panel (SZM)	20	Rear lid button
5	"Cowl panel reached" microswitch	21	Release drive
6	Front power distribution box	22	Rear lid lock switch
7	Junction box electronics (JBE)	23	LH automatic soft close drive
8	RH microswitch, roof panel closed	24	Rear lid lock switch
9	Drive for locking retractable hardtop	25	RH automatic soft close drive
10	Hall sensor, roof package extended	26	Luggage compartment light
11	LH microswitch, roof panel closed	27	Battery power distribution box
12	Microswitch, cowl panel unlocked	28	Hydraulic unit
13	Hall sensor, roof panel packed	29	Convertible top module (CTM)
14	Microswitch, cowl panel locked	30	Hall sensor, luggage compartment partition

System Components

Microswitches and Hall Sensors

The various positions of the retractable hardtop and of the rear module are detected by 8 microswitches and 4 Hall sensors and signalled to the convertible top module CTM. All microswitches and Hall sensors receive their voltage supply from the convertible top module and have diagnostic capabilities.

After loss of terminal 30 or after emergency operation, the retractable hardtop can still be operated without the need for re-initialization. The microswitches and Hall sensors ensure the convertible top module reliably detects the position of the retractable hardtop.

Buttons for Operating the Hardtop

Two buttons are provided in the center console for the purpose of operating the retractable hardtop. These buttons are wired to the convertible top module. When a button is pressed, the convertible top module receives the information and executes the corresponding command. Movement of the retractable hardtop or side windows stops if the button is released while the hardtop is moving. Operation is indicated by a red LED in one button and a green LED in the other. The convertible top module actuates the LEDs via the K-CAN.



The green LED in the button lights up during the opening/closing operation. The red LED signals an operating error or incorrect conditions (e.g. luggage compartment partition not in lower position). The red LED flashes as soon as the retractable hardtop is in an intermediate position and not operated. The LED flashing does not indicate a fault. The flashing LED draws attention to the fact that the vehicle cannot be driven in this situation.

A fault code that cannot be read out is stored under following conditions:

- Terminal R On while the button is pressed
- When the button is pressed for longer than 20 seconds after roof operation has concluded.

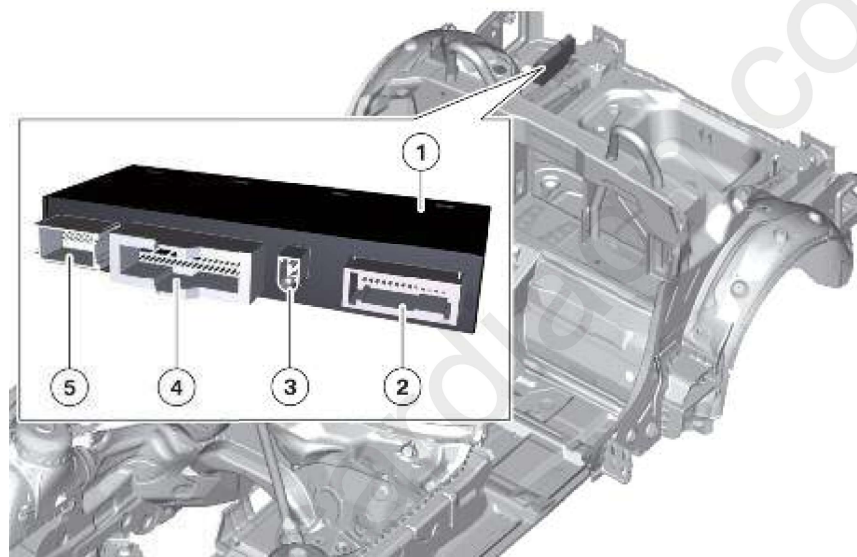
The retractable hardtop is then temporarily inoperative. The retractable hardtop can be operated again after pressing the Open button once.

Convertible Top Module

The Convertible top module (CTM) is the central electronic control unit for all functions of the retractable hardtop. The convertible top module is installed on the right in the luggage compartment. The convertible top module controls the retractable hardtop, the rear module, the automatic soft close system and the drive unit for locking the hardtop.

The CTM also controls the hydraulic pump and the six hydraulic cylinders by way of the three valves in the hydraulic unit. The K-CAN connects the convertible top module to other control units. Information on outside temperature, driving speed and rear lid status etc., is received via the K-CAN. The convertible top module ends a signal to the car access system (CAS) when the retractable hardtop is opened or closed. The car access system is the master for the power windows. In certain situations, the convertible top module outputs information in the form of check control messages in the instrument cluster.

Convertible Top Module - Location and Connections



Index	Explanation
1	Convertible top module
2	26-pin connector for Hall sensors and microswitches
3	2-pin connector to drive unit for locking retractable hardtop
4	41-pin connector for voltage supply, automatic soft close system, and K-CAN
5	18-pin connector for actuating hydraulic unit

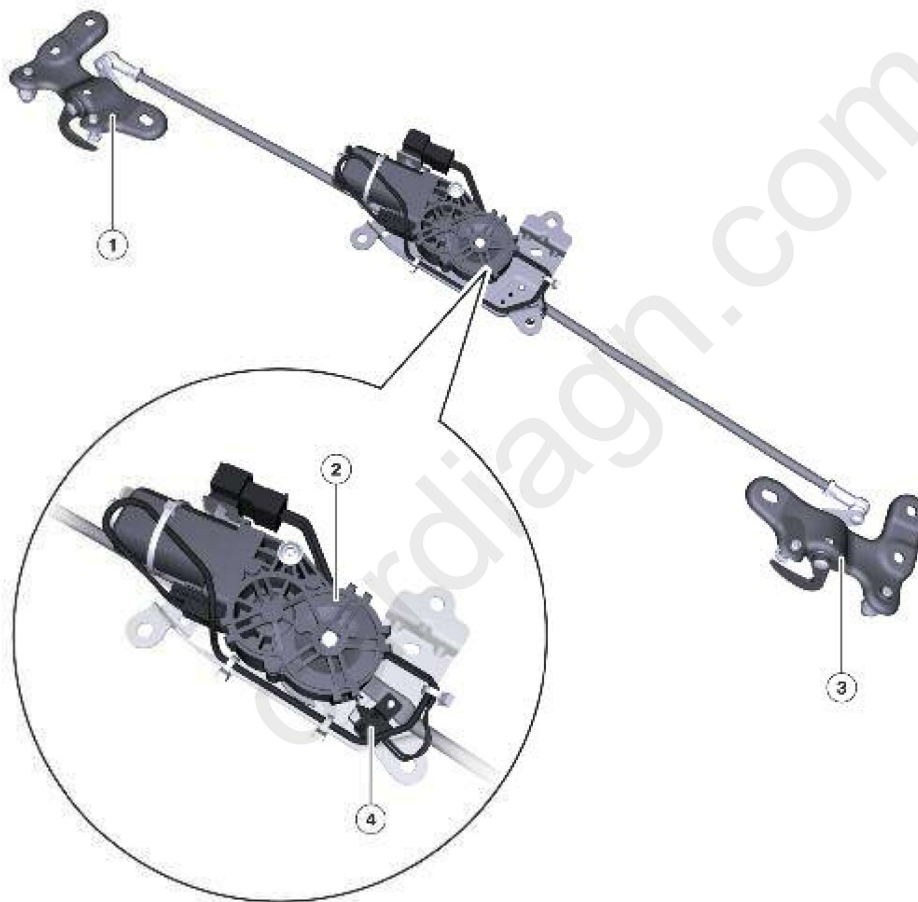
Note: ISTA-P must be used to encoded the new module after replacement.

Drive for Locking the Retractable Hardtop

The drive unit, consisting of an electric motor with gear mechanism, locks and unlocks the retractable hardtop with the cowl panel at the upper windscreen frame. The convertible top module actuates the electric motor. The drive unit is arranged in the middle. The retaining hooks on the right and left are moved by a rotary plate and push rods. The two Hall sensors 'cowl panel locked and unlocked' monitor the locking procedure.

When the retractable hardtop is opened, the drive unit locks the hardtop on the base plate in the rear module. This is a crash-lock function, which prevents the retracted hardtop from folding forward in the event of a crash.

Drive for locking the retractable hardtop



Index	Explanation
1	Retaining hook, left
2	Drive for locking retractable hardtop
3	Retaining hook, right
4	'Cowl panel unlocked' microswitch and 'cowl panel locked' microswitch

Hydraulic Unit

The hydraulic unit is located in a pan in the luggage compartment floor. The movement direction of the retractable hardtop and rear module are determined by corresponding valve positions and the direction of rotation of the hydraulic pump. The direction of rotation of the hydraulic pump is controlled by two relays.

The hydraulic pump generates an operating pressure from 150 to 200 bar.

The temperature in the hydraulic pump is measured to avoid the pump overheating during frequent use of the retractable hardtop. Two cables connect the temperature sensor ground-free to the convertible top module. A line break (open circuit) results in a fault code being entered in the fault code memory. At from a temperature of 90°C, hardtop closing movement already started is continued up to the secure end position. The movement of the retractable hardtop is stopped immediately at a temperature of 105°C.

The movement can be continued after the temperature has dropped below 90°C. The hydraulic unit is protected by a 50 amp slow-blow fuse.

Other than topping the hydraulic system off, the hydraulic fluid does not require any servicing. Add only the approved hydraulic fluid to the mark on the reservoir.



Hydraulic Unit Location

Note: Excessive noise during top operation may be due to aerated hydraulic lines. If excessive operating noise is heard during operation, the retractable hardtop should be opened and closed several times in order to automatically bleed the hydraulic system via the fluid reservoir.

Instrument Cluster - KOMBI

The instrument cluster provides the outside temperature (bus signal). The instrument cluster uses the check control symbol to show check control messages relating to the retractable hardtop.

Footwell Module - FRM

The footwell module FRM actuates the front power window regulators. The side windows must be lowered in order to open the retractable hardtop (bus signal to convertible top module).

Junction Box Electronics - JBE

The junction box electronics JBE actuates the rear power window regulators. The side windows must be lowered in order to open the retractable hardtop (bus signal to convertible top module). The junction box electronics provides the signal indicating whether the rear lid is closed (bus signal).

The power distribution box in the junction box supplies terminal 30g to the convertible top module. The convertible top module additionally receives terminal 15 from the car access system. This still enables adequate communication with the BMW diagnosis system when, for example, the voltage supply from the junction box is interrupted.

Car Access System - CAS

The car access system is the master control unit for the power window regulators. On request of the convertible top module, the car access system lowers or raises the side windows. In addition, the car access system prevents the rear lid from being opened and movement of the power windows when the retractable hardtop is in an intermediate position. The car access system controls the auto-remote opening function for the retractable hardtop. The signals from the remote control are received by the remote control receiver and sent to the car access system.

Antenna Diversity

The convertible top module sends a corresponding signal to the antenna diversity module depending on whether the retractable hardtop is closed or open. The antenna diversity function then correspondingly switches over the antennas.

Principles of Operation

The following options are available for operating the hardtop:

- Using the button (close and open)
- Using the key in the lock cylinder in the driver's door handle (close and open)
- Using the remote control (open only)
- Using the ID transmitter with Comfort Access option (close, as long as the ID transmitter is within range of the comfort access antennas and open as with the remote control).

Operating Pre-Conditions

The retractable hardtop can be opened and closed using the button in the center console only if the following conditions are met:

- Terminal R ON
- Outside temperature above -12°C
- Boot lid closed
- Vehicle stationary (driving speed $< 0.7 \text{ km/h}$)
- Luggage compartment partition in lowest position
- Lateral inclination of vehicle $< 11^{\circ}$
- Power windows initialized
- Battery voltage $> 11.5 \text{ V}$
- Less than five successive opening/closing operations
- Hydraulic fluid temperature for opening $< 90^{\circ}\text{C}$ and for closing $< 105^{\circ}\text{C}$
- Electrical system check successful
- Production, transport and workshop mode (FeTraWe) not set.

It is not possible to open and close the retractable hardtop while driving. Due to the high current consumption of the retractable hardtop of up to 40 amps, the hardtop should only be operated when the battery charger is connected or the engine is running.

**Note: The rear power window regulators do not have an anti-trap system.
There is also no one-touch function for closing the rear windows.**

Opening the Retractable Hardtop

The retractable hardtop is normally operated by pressing the open or close button in the center console. The hardtop moves for as long as the button is pressed. The green LED in the button lights up while the retractable hardtop is moving. Movement of the retractable hardtop, rear module or side windows is stopped immediately if the button is released while the retractable hardtop is moving. The red LED then flashes in the button.

Movement of the hardtop can be resumed by pressing the button again. Movement of the side windows can be resumed within 10 seconds. If one of the conditions is not met, the red LED will light continuously.

The convertible top module checks the conditions for opening the retractable hardtop when the Open button in the center console is pressed. If the check is successful, the hardtop is opened as follows:

- Lower side windows (if closed or in intermediate position)
- Release hardtop at cowl panel
- Switch off heated rear window (takes place via junction box electronics)
- Unlock and open rear module
- Roof panel 2 is released and packed over roof panel 1
- Stow roof panel package in rear module and lock
- Close and lock rear module
- Close side windows.

The hardtop is closed automatically in the reverse order.

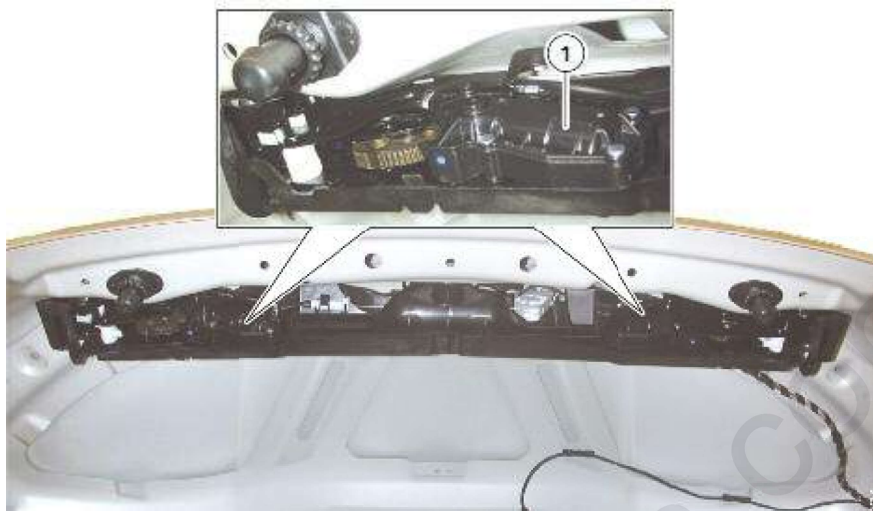
■ Operating Conditions with Comfort Access

The following functions can be performed only when the ID transmitter is less than 4 m away:

- Open
- Close
- Easy Load feature

Automatic Soft Close System

The automatic soft close function is installed as standard to conveniently close the rear [trunk] lid. The automatic soft close system consists of two drive units. The drive units lock the rear lid on the left and right on the rear module carrier. This increases the stability of the rear end.



Automatic soft close drive (1)

Each trunk lid latch assembly has a microswitch. These two microswitches are operated when the rear lid locks on the left and right have reached the lock strikers. The signals are hard wired to the junction box electronics which then makes the signal available to the convertible top module via the K-CAN-bus. The convertible top module then actuates the two drive units of the automatic soft close system until the rear lid is locked.

Manually shutting the rear lid would make closing via the automatic soft close system unnecessary. For safety reasons, steps must be taken to ensure that the rear lid is completely closed. For this reason, the drive units of the automatic soft close system are still actuated.

Both drive units feature a repeat interlock to avoid overheating. The repeat interlock allows the automatic soft close system to be actuated up to 20 times (counter up to 20 increments). The automatic soft close system is then inhibited electrically for approximately 2 minutes.

Check Control Messages

It is not possible to open or close the retractable hardtop in certain situations. In such cases, corresponding messages are shown in the instrument cluster in the form of check control messages.

A short message and additional information are shown on vehicles equipped with a central information display (CID). The check control messages provide explanatory information relating to the red LED in the button that lights up in the case of fault. An active check control message is shown every 5 seconds.

Check Control Symbol	Check Control Message	Additional Information
	Luggage compartment open!	-
	Roof malfunction!	No roof movement possible. If the retractable hardtop does not lock, contact the nearest BMW dealer.
	Roof operation!	Roof movement not completed. Check whether roof movement is blocked. Then press button again.
	Roof control failed!	Roof position and roof locking are not detected. Trip can be continued if roof is locked securely. See Owner's Handbook for information on checking the roof lock.
	Roof not locked!	Roof not locked. First open or close roof completely before continuing trip.
	Luggage compartment partition!	No roof movement possible. Move luggage compartment partition into required position; see Owner's Handbook.
	Roof drive overheated!	Roof drive overheated.
	Roof operation not possible!	Roof operation only possible when vehicle is stationary.
	Vehicle not parked on level ground!	Vehicle not parked on level ground. No roof movement possible.

Sensor Status

	Retractable hardtop open	Intermediate position1	Intermediate position2	Retractable hardtop closed
"Roof package stowed" Hall sensor	● On	○ Off	○ Off	○ Off
LH microswitch, roof panel closed	○ Off	○ Off	○ Off	● On
RH microswitch, roof panel closed	○ Off	○ Off	○ Off	● On
Hall sensor, roof panel packed	● On	● On		○ Off
Microswitch, cowl panel locked	● On	○ Off	● On	● On
Microswitch, cowl panel unlocked	○ Off	● On	○ Off	○ Off
LH microswitch, rear module closed	● On	○ Off	● On	● On
"Rear module open" Hall sensor	○ Off	● On	○ Off	○ Off
RH microswitch, rear module closed	● On	○ Off	● On	● On
Microswitch, roof module compartment locked	● On	○ Off	○ Off	○ Off
"Cowl panel reached" microswitch	○ Off	○ Off	● On	● On
"Luggage compartment divider" Hall sensor	● On	● On	● On	● On

Convenient Loading Function of Rear Lid

The retractable hardtop can be opened and closed using the ID transmitter on vehicles equipped with the Comfort Access option.

The new auto-remote function for loading and unloading provides fast access to the luggage compartment when the retractable hardtop is down. This function makes it easier to load larger items of luggage for instance. The auto-remote function is activated as follows:

- Briefly press the rear lid button on the remote control
- Then, press and hold the rear lid button on the remote control (no more than one second may pass between releasing and pressing the rear lid button).

Initially, the rear module is unlocked and fully opened. The roof package is swivelled out of the luggage compartment. The rear module is then closed and locked. The rear lid is unlocked by the automatic soft close system. The boot lid opens a little. The auto-remote functions via the remote control conform to national market specifications.

Emergency Opening of Rear Lid

As there is no lock cylinder and Bowden cable assembly, the rear lid cannot be released in the event of the rear lid lock being defective. At the same time, movement of the retractable hardtop is inhibited by the unknown status of the rear lid.

The lid can be opened if the Bowden cable (emergency glow in the dark) handle can be reached from the through load compartment.

The rear lid can also be forced to open by using the diagnostic tester. The rear lid activation via the JBE component activation function. This activation request ignores all status that would typically inhibit rear lid operation such as top position.

Emergency Actuation of the Retractable Hardtop

An emergency actuation facility for releasing the retractable hardtop by the customer is not possible. Emergency actuation is, however, possible in the service workshop. The emergency actuation procedure is described in detail in the repair instructions.