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# Convertible Top

**Model: E64**

**Production: Start of Production MY 2004**

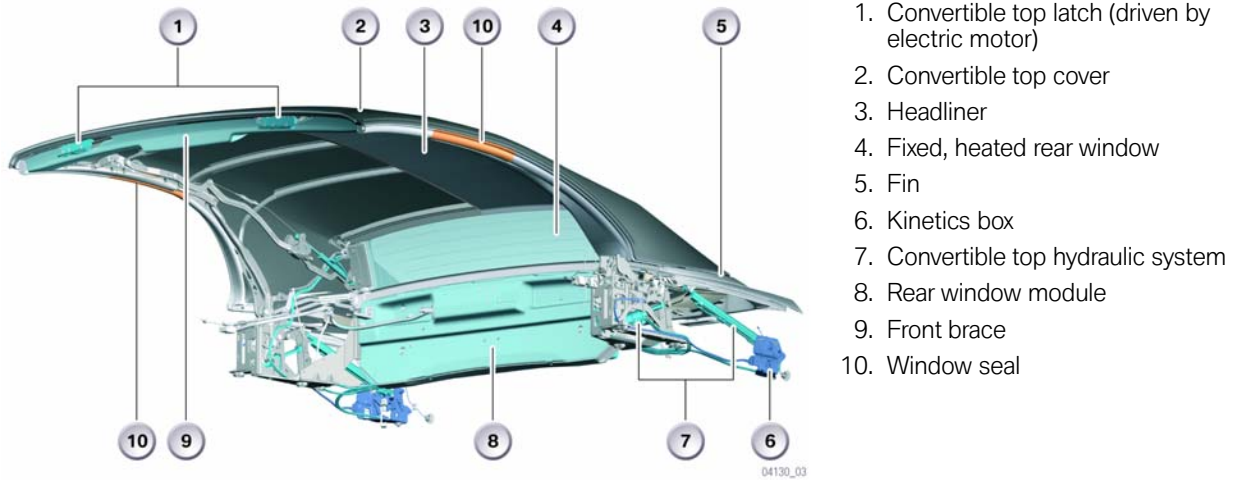
# OBJECTIVES

After completion of this module you will be able to:

- Identify the components of the Electrohydraulic convertible top.
- Remove the rear window module.
- Relate the convertible top opening/closing sequence.
- Perform convertible top emergency operation

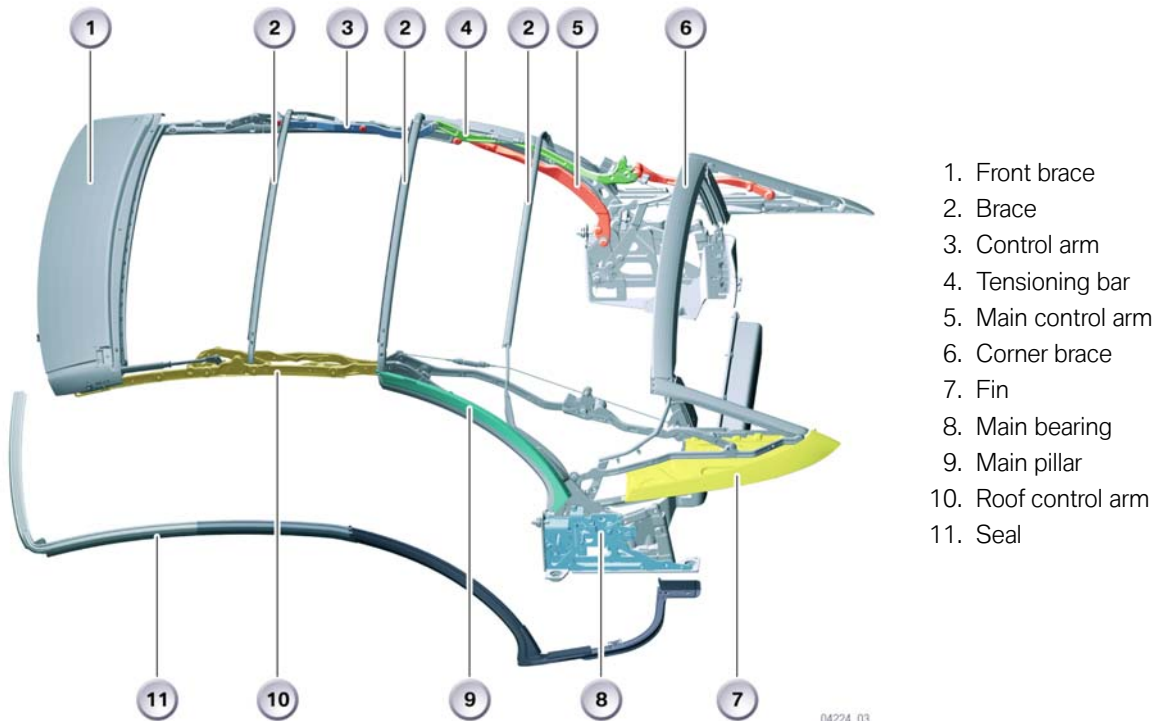
## Convertible Top

A technical highlight of the E64 is the fully automatic, electrohydraulic convertible top.



The electrohydraulic convertible top consists of mechanical, electrical and hydraulic components.

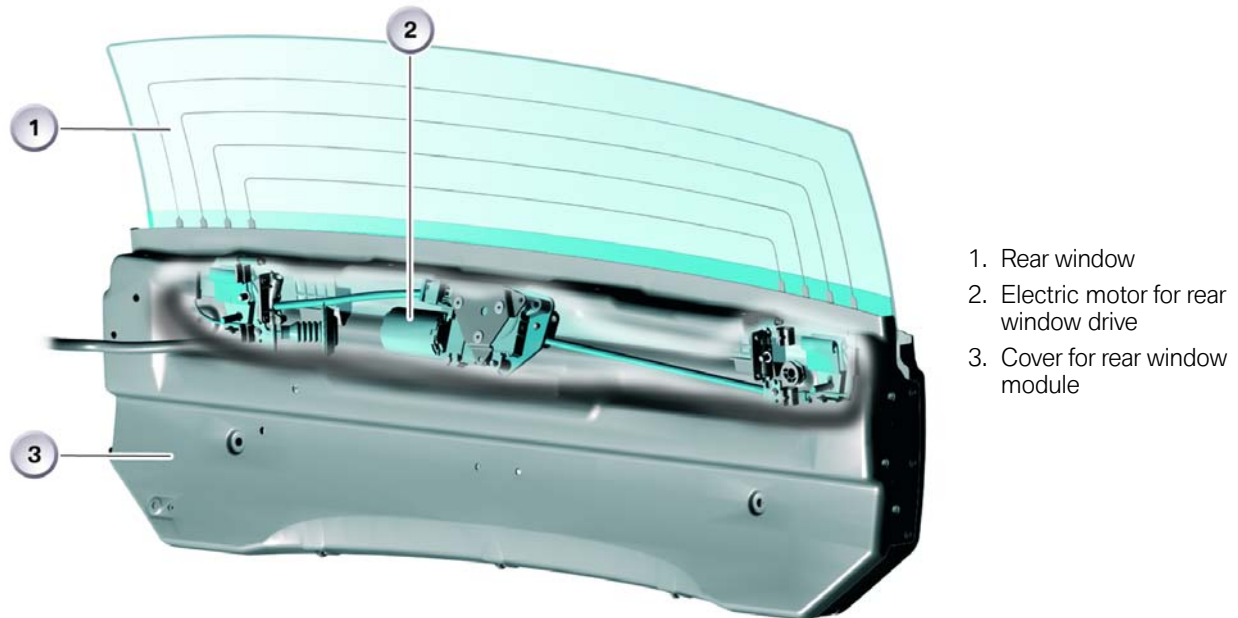
### Mechanical Components



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In addition to the convertible top frame, other important mechanical components of the convertible top include the headliner and the convertible top cover with their mounting elements.

## Rear Window Module



The rear window module, however, represents a completely new mechanical element in the convertible top of the E64.

The rear window module can be removed as a complete unit. This is recommended if major repairs need to be performed.

### Removal Procedure

- Unplug cables (remove rear side trim, rear seat and rear seat backrest)
- Remove cover for rollover protection system
- Unclip cover on rear window module
- Unscrew retaining bracket under cover
- Remove hydraulic unit (four screws)
- Loosen six side screws at rear window module (if necessary, mark position beforehand)
- Unscrew cover for rear window module (nine screws, partly under module)

The complete rear window module can now be removed.

**Note:**

**It is sufficient to detach the cover of the rear window module if only the rear window is to be replaced.**

Continue as follows:

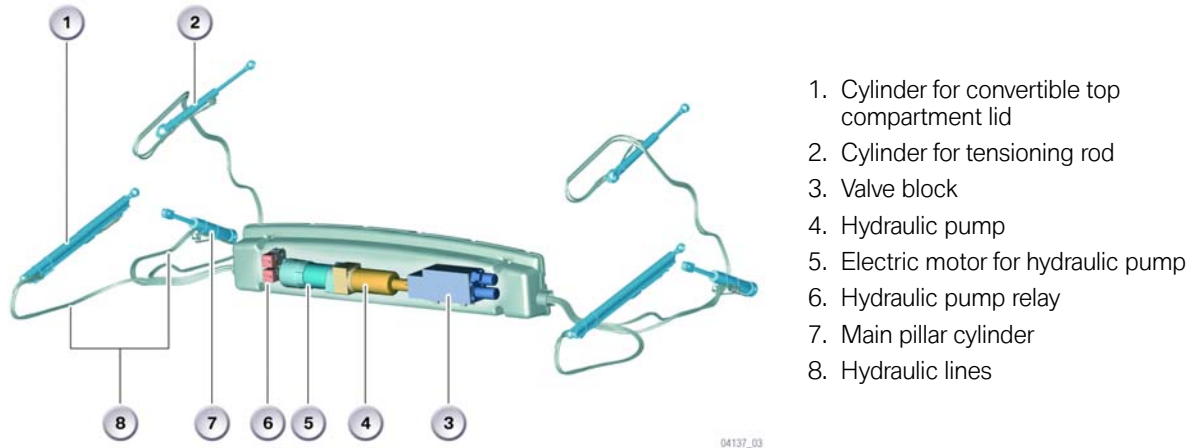
- Screw on clamps
- Disconnect two cables for rear window defogger
- Lift out rear window

When installing, the rear window must first be placed on the bottom slide and centered. The rear window is then firmly clamped.

The rear window must also be removed beforehand if the electric motor for the rear window drive is to be replaced (refer to repair instructions for details).

Any leaks in the area of the rear window can be rectified by releasing the upper mounting screws of the rear window module and tilting the seal or changing the seal pressure. If this measure is not successful, the rear window must be shifted correspondingly in its clamp mounting.

## Hydraulic Components



A pair of cylinders each acts on the main pillars, convertible top compartment lid and tensioning rods. The cylinders are double-acting, i.e. operated both from the piston as well as from the rod end.

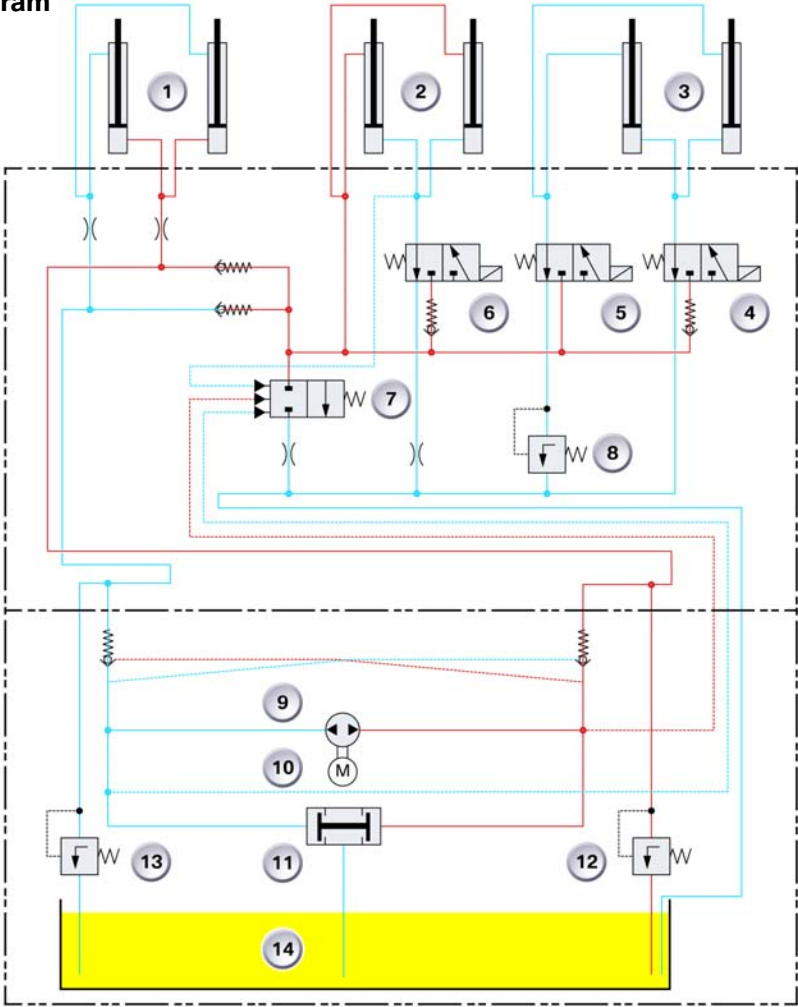
The operating direction of the main pillar cylinders depends on the direction of rotation of the hydraulic pump.

The convertible top compartment lid is extended by corresponding actuation of the changeover valve 6. The cylinders for the convertible top compartment lid are designed such that the pressure on the piston rod end is always prevalent. The tensioning rods are extended and retracted by correspondingly switching the changeover valves 4 and 5.

Changeover valve 7 is responsible for depressurizing the hydraulic system. Changeover valve 7 is activated for as long as the hydraulic pump is operating and/or pressure is applied to the piston end of the cylinders for the convertible top compartment lid so as to maintain pressure in the hydraulic system. Changeover valve 7 is no longer actuated when no pressure is applied to the piston end of the cylinders for the convertible top compartment lid and the hydraulic pump is stationary. The pressure is then reduced via changeover valve 7, thus depressurizing the hydraulic system.

The pressure relief valves open at a system pressure of approx. 190 bar.

**Hydraulic Diagram**



- |   |                                       |
|---|---------------------------------------|
| 1. Main pillar cylinder                           | 8. Pressure relief valve              |
| 2. Convertible top compartment lid cylinder       | 9. Hydraulic pump                     |
| 3. Tensioning Rod cylinder                        | 10. Electric motor for hydraulic pump |
| 4. Changeover valve, extended tensioning rod      | 11. Silencer                          |
| 5. Changeover valve, retract tensioning rod       | 12. Pressure relief valve             |
| 6. Changeover valve, extended top compartment lid | 13. Pressure relief valve             |
| 7. Changeover valve, depressurize system          | 14. Oil reservoir                     |

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The hydraulic oil need not be changed (lifetime filling). If it is necessary to top up the hydraulic oil due to leaks, particular care must be taken to ensure that only approved hydraulic oil is used for this purpose (see electronic parts catalogue). Top up hydraulic oil only up to the mark on the oil reservoir.

If the noise level is excessively high during operation of the convertible top, open and close the convertible top several times in succession in order to bleed the system.

The hydraulic system is bled automatically in the oil reservoir.

A temperature sensor measures the temperature of the electric motor in the hydraulic unit. The convertible top can only be closed once automatically as from a temperature of 90°C and can then no longer be opened.

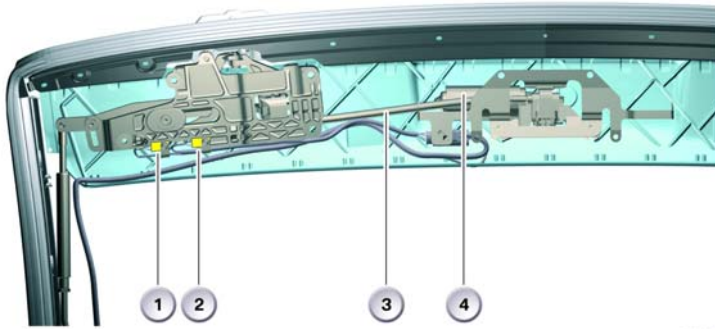
## **Electrical Components**

The following electrical components are mounted on the electrohydraulic convertible top of the E64:

- Electric motor for releasing and locking the catch hooks at the cowl panel
- Two Hall sensors for detecting the release/lock status of the catch hooks
- Two angle rotation sensors for detecting the position of the convertible top frame
- Two Hall sensors in the main bearings for detecting the lock status of the convertible top compartment lid
- One Hall sensor on the top left cylinder for the convertible top compartment lid for detecting the upper position of the lid
- One Hall sensor on the left-hand kinematics box for detecting the bottom position of the convertible top compartment lid. This Hall sensor additionally checks the lock status of the convertible top compartment lid.
- One microswitch for the convertible top compartment for detecting the position of the floor of the convertible top compartment.

Further electrical components include:

- Driver's switch block with Convertible-specific switch for opening/closing all 5 windows and separately opening/closing the rear window
- Switch cluster in the center console for opening/closing the convertible top
- Convertible top module 5 CVM 5 control unit for the electrohydraulic convertible top. This control unit is mounted behind the rear left side panel.



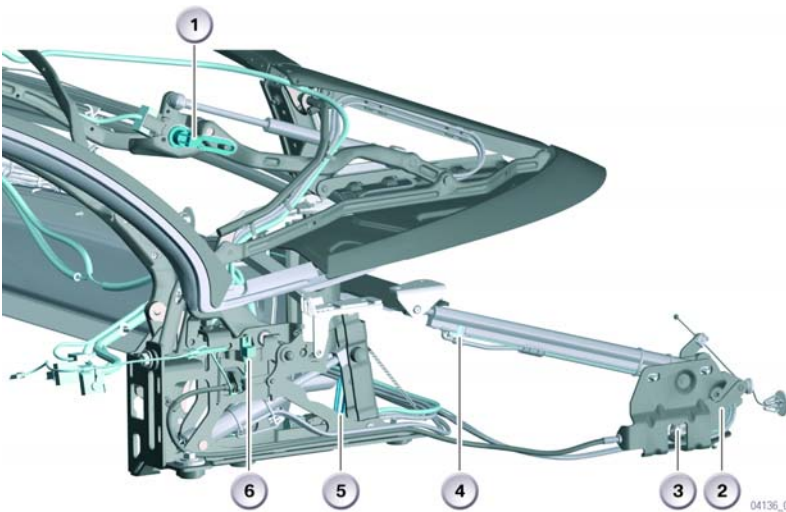
1. Hall sensor, catch hooks closed
2. Hall sensor, catch hooks open
3. Drive shaft
4. Electric motor

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### Convertible Top Lock

The catch hooks for the convertible top lock at the cowl panel are driven by an electric motor.

The Hall sensors are installed on the left-hand side of the front brace. They signal the "Convertible top locked at cowl panel" and "Convertible top released at cowl panel" statuses.



1. Angle of rotation sensor, tensioning rod
2. Kinematics box
3. Hall sensor, convertible top compartment lid down and locked
4. Hall sensor, convertible top compartment lid up
5. Angle of rotation sensor, main pillar
6. Hall sensor, convertible top compartment lid locked, left

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## Sensors

### Tensioning Rod

The angle of rotation sensor is designed as a potentiometer and is installed on the left-hand tensioning rod. The output voltage changes at the wiper contact of the potentiometer during convertible top operation.

The CVM 5 converts the voltage values to angle values. The CVM 5 uses the angle value to recognize the main pillar angle of 1070 for instance. The convertible top lid is not release and opened before this angle is reached.



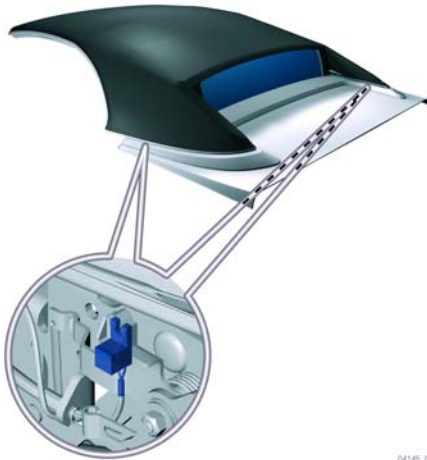




### Main Pillar

The angle of rotation sensor is designed as a potentiometer and is installed on the left-hand main pillar. The output voltage changes at the wiper contact of the potentiometer during convertible top operation.

The CVM 5 converts the voltage values to angle values.

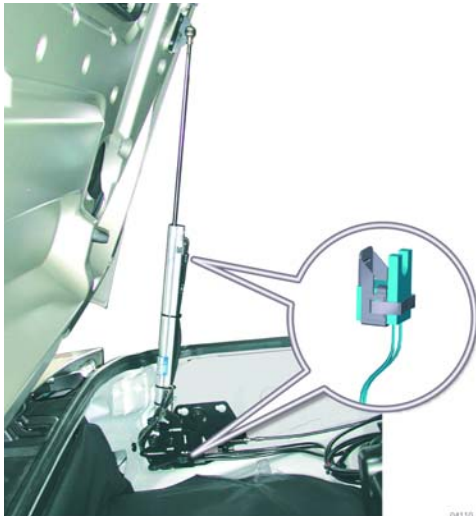


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### Convertible Top - Compartment Locked

One Hall sensor is fitted on the left-hand main bearing and the other on the right-hand main bearing of the electrohydraulic convertible top.

The two Hall sensors signal the "Convertible top compartment lid locked at main bearing" status to the CVM 5.



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### Convertible Top - Compartment Up

The Hall sensor for "Convertible top compartment up" is installed at the top end of the left-hand cylinder for the convertible top compartment lid.

### Kinematics Box

The cylinders press the convertible top compartment lid into the down position such as to operate the cable assemblies that in turn engage the catch hooks. The cable assembly runs from the kinematics box to the main bearing of the convertible top. After the cable assembly has been operated, the Hall sensor signals the "Convertible top compartment lid down and locked" status to the kinematics box.

**Note: The convertible top compartment lid can no longer be locked after opening the electrohydraulic convertible top using the emergency facility. Consequently, the driving wind can rip the convertible top compartment lid out of its hinge.**

### Microswitch - Convertible Top Compartment

The microswitch is installed on the right-hand side on the convertible top compartment. The CVM 5 evaluates the signal from the microswitch. The CVM 5 receives a low signal when the convertible top compartment is in the down position.



### Convertible-Specific SBFA Buttons

In the SBFA, the buttons for the rear power window additionally feature Convertible-specific functions. These functions are:

- Raise or lower all 5 windows simultaneously
- Raise or lower the rear window

The functions are controlled with the buttons for the rear window defogger. Two additional buttons in the SBFA activate the corresponding function. A green LED in the corresponding button indicates when a function is active.



1. Button for all 5 windows
2. Power window button, rear driver's side
3. LED button, all 5 windows activated and at standby
4. LED button, rear window activated and at standby
5. Power window button, rear passenger's side
6. Button, rear window

### Door Module

Convertible-specific power window functions When one of the doors is opened, the TMFA or TMBF recognizes this status via the respective door contact. The side windows are then lowered by approx. 2 cm in order to protect the seal. The side windows are lowered by approx. 10 cm when opening or closing the convertible top. The CVM 5 sends the request to lower the power windows via the K-CAN to the CAS 2.

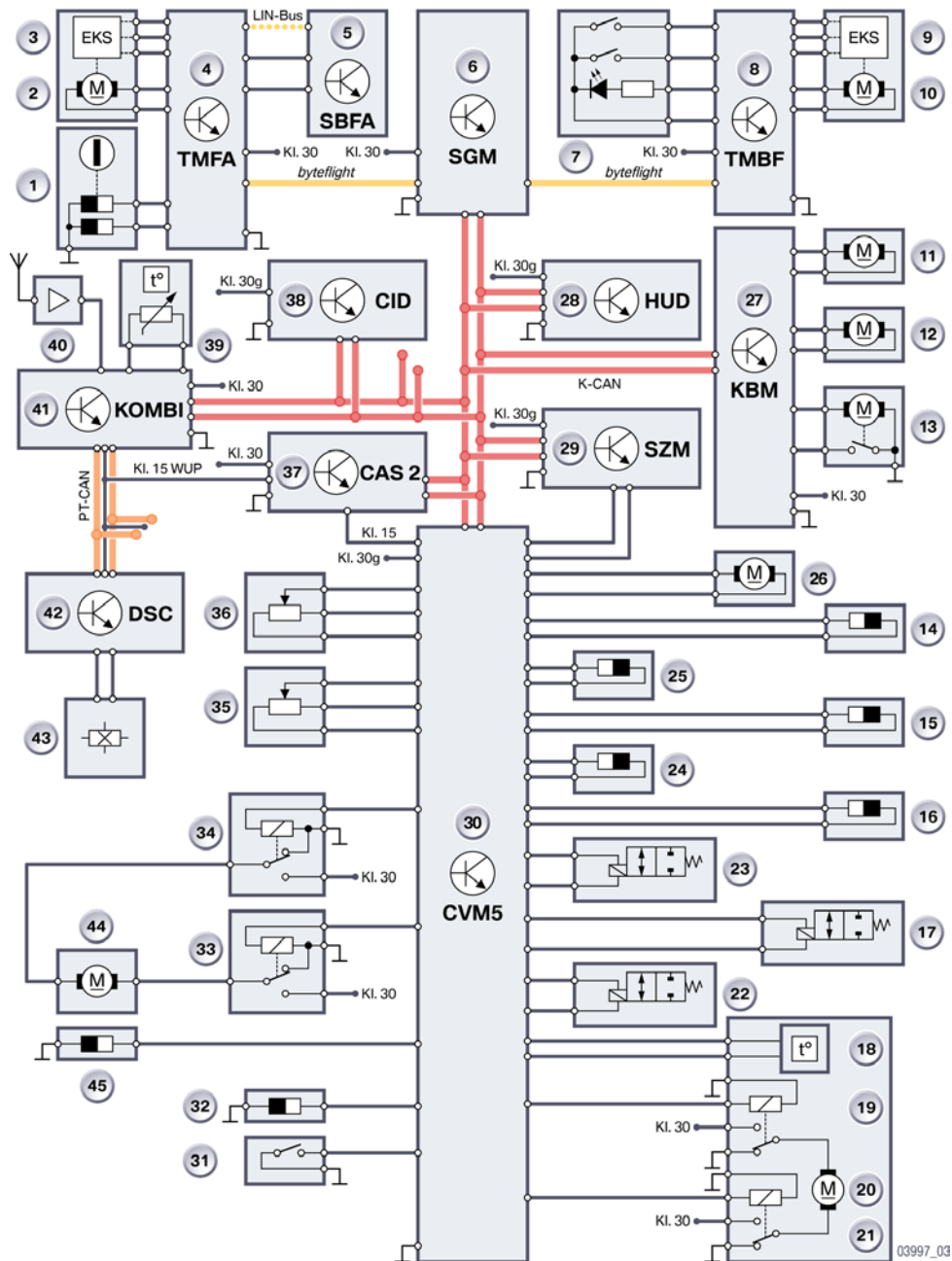
### Basic Body Module KBM

Convertible-specific power window functions Since the rear power windows feature no anti-trapping circuit, the KBM evaluates and forwards the following statuses:

- Power window in Open position
- Power window between Open/Close or Close/Open position
- Power window in Closed position

The power window Open or Closed positions are detected based on the blocking current of the power window motors.

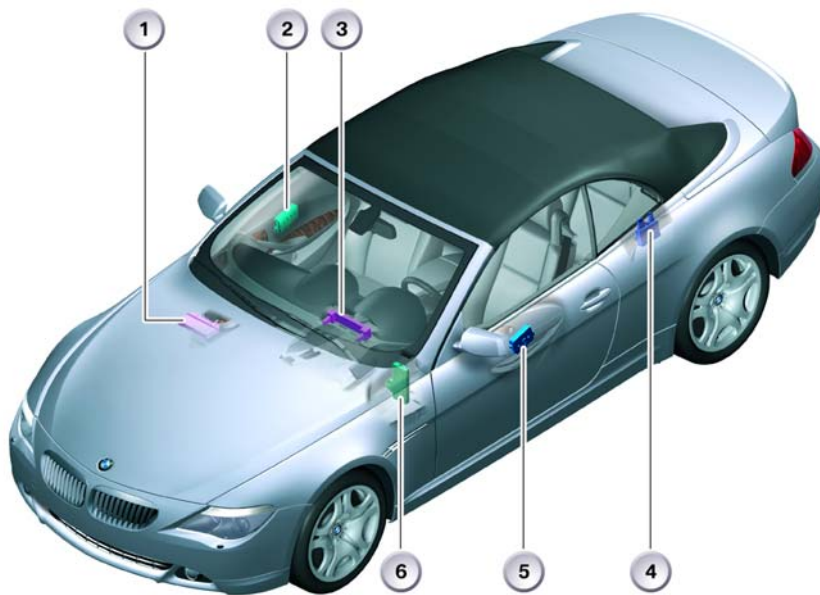
## Convertible Top Schematic



- |                       |                           |                            |                           |
|-----------------------|---------------------------|----------------------------|---------------------------|
| 1. Driver's Door Lock | 13. Trunk Lock            | 25. Sensor lid locked r/s  | 37. CAS2                  |
| 2. Window Motor L/F   | 14. Sensor Top Cowl Open  | 26. Motor top lock         | 38. CID                   |
| 3. Anti-trap L/F      | 15. Sensor Top Cowl Clsd  | 27. KBM                    | 39. Outside temp sensor   |
| 4. Door Module L/F    | 16. Sensor Top Lid L/S    | 28. HUD                    | 40. Remote                |
| 5. Switch Block       | 17. Valve Tension rod     | 29. SZM                    | 41. KOMBI                 |
| 6. SGM                | 18. Hydraulic Temp Sensor | 30. CVM5                   | 42. DSC                   |
| 7. Window Switch R/F  | 19. Pump Relay closed     | 31. Switch top lid down    | 43. Sensor wheel speed    |
| 8. Door Module R/F    | 20. Hydraulic pump motor  | 32. Sensor lid bottom left | 44. Motor rear window     |
| 9. Anti-trap R/F      | 21. Pump Relay open       | 33. Relay r. window down   | 45. Sensor r. window down |
| 10. Window Motor R/F  | 22. Valve Tension rod     | 34. Relay r. window up     |                           |
| 11. Window Motor L/R  | 23. Valve top lid         | 35. Sensor Main Pillar     |                           |
| 12. Window Motor R/R  | 24. Sensor lid open       | 36. Sensor tension rod     |                           |

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## CVM5



1. Basic body module
2. Door module, passenger's side
3. Centre console switch cluster
4. Convertible top module 5
5. Door module, driver's side
6. CAS2

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### Signal Sequence

The center console switch cluster SZM recognizes the switch position "Open convertible top" and this information is sent via the K-CAN to the CVM 5. Following a safety enquiry performed by the CAS2, the CVM 5 activates the power window motors via the front door modules and KBM. The motors lower the 4 side windows a little. The rear window motor completely lowers the rear window (activated by CVM 5).

The CVM 5 then drives the electric motor in the front brace. This motor releases the catch hooks at the cowl panel and slightly raises the front brace.

The CVM 5 now activates the hydraulic module. First, the fins and front brace are raised. The convertible top compartment lid is then released and opened. When the Hall sensor on the cylinder for the convertible top compartment lid signals the "Convertible top compartment lid up" status, the CVM 5 switches over the pump in the hydraulic module (hydraulic pump turns in other direction) and the convertible top is folded by means of the main pillar cylinders into the convertible top compartment.

When the angle of rotation sensors on the convertible top frame signal to the CVM 5 that the convertible top is positioned in the convertible top compartment, the changeover valve for driving the cylinders of the convertible top compartment lid is switched off and the convertible top compartment lid is closed by means of the cylinders. The convertible top compartment lid is locked by means of a cable assembly from the kinematics box to the main bearing. The Hall sensor on the left-hand kinematics box signals to the CVM 5 that the convertible top compartment lid is closed and locked. The CVM 5 and KBM send a signal indicating that all 5 windows are now closed.

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## Top Operation

### Normal Operation

In addition to the correct position of the base of the convertible top compartment, further conditions must be met before the convertible top can be operated:

- Boot lid must be closed
- Vehicle speed must be less than 30 km/h
- Outside temperature must not be below -10°C
- Key in ignition lock turned to at least position R

Once these conditions have been met, the following operating procedure is initiated by pressing and holding the button to open the convertible top:

- Side windows are lowered slightly
- Rear window is lowered completely
- Front brace of convertible top is released at cowl panel
- Fins are raised
- Convertible top lid is released and raised
- Convertible top is folded into convertible top compartment
- Convertible top compartment lid is closed and locked
- Side windows and rear window are raised

The convertible top can also be opened with the key. The key must be held in open direction in the driver's door during the entire convertible top opening procedure.

Auto-remote opening with remote control is also possible. An auto-remote closing feature is not provided for safety reasons.

### Emergency Operation

The convertible top can also be operated manually in the event of electrohydraulic system failing.

Emergency closing of convertible top:

1. Slightly lower side windows and completely lower rear window.
2. Release emergency top compartment lid from the luggage compartment using the emergency release facility (left and right) and open.
3. With the aid of a second person, lift the convertible top out of the convertible top compartment and raise the fins.









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4. Close convertible top compartment lid.
  5. Lower the fins onto the convertible top compartment lid.
  6. Remove cover at middle of front brace.
  7. Using the cranked socket head wrench from the vehicle tool box, lock the convertible top at the front brace. The cranked hexagon socket head wrench engages in the gear unit of the electric motor and locks the catch hooks at the cowl panel.

## **Rear Window Emergency Operation**

### **Emergency Closing**

- Remove cover between the rear headrests
- Fit the cranked hexagon socket head wrench from the vehicle tool box on the screw and turn in counter clockwise direction until the rear window is closed.

## Check-Control Messages

CC-Message	CC-Indicator	Message in CID
Rear window Emerg. operation		Rear window Malfunction: Operation of soft top only possible after emergency operation of rear window. For emergency operation of rear window, see Owner's Handbook. Have the problem checked as soon as possible by BMW Service.
Lower soft-top compartment base		Soft-top comp. base Base not lowered, soft top cannot be operated. Lower soft-top compartment base and open soft top.
Soft top not engaged		Soft top Automatic locking faulty. Lock soft top manually, see Owner's Handbook. Have the problem checked by BMW Service.
Soft top max. 30 km/h		Soft top Automatic soft top may only be opened or closed at speeds of up to 30 km/h. Reduce speed and resume operation of soft top.
Soft top Emergency operation		Soft top Control electronics failed. For emergency operation of soft top, see Owner's Handbook.
End of convertible top movement		End of convertible top movement.
Roll-over protection fault		Roll-over protection Malfunction: Have the problem checked by the nearest BMW Service.
Boot open		Please close boot lid.



## Workshop Exercise - Convertible Top Assembly

### Rear Window Module Removal

*With the Instructor's assistance:*

- 1. Remove the RR interior trim panel (armrest and speaker panel).*
- 2. Remove rear seat (upper and lower), rear headrests, upper seat and URSS trim panels.*
- 3. Remove rear window base seal.*
- 4. Unscrew hydraulic unit (4 screws) and slide rearward.*
- 5. Remove retaining bracket screws (2). Loosen the side screws (3 per side) on the rear window module.*
- 6. Unplug the rear window motor wiring harness (at the body).*
- 7. Manually lower the rear window (if up), slide the rear window module out of the retaining bracket and remove for bench top service.*
- 8. With the module on the bench, remove the remaining cover screws to expose the electric motor and window drive.*
- 9. Reassemble and install in vehicle.*

### Convertible Top Emergency Operation

- 1. With top open, open trunk, access and pull the release cables (Left and Right).*
- 2. Switch ignition off, wait a few seconds for the hydraulics to bleed down.*
- 3. With 2 people, lift the top storage cover and fold the top up and out. Close the storage cover lid and unfold the top into the closed position.*
- 4. The crank handle (in tool kit) is required to lock the top at the front brace (windshield frame). Using the same tool, remove the access panel between the rear headrests and crank the rear window up.*