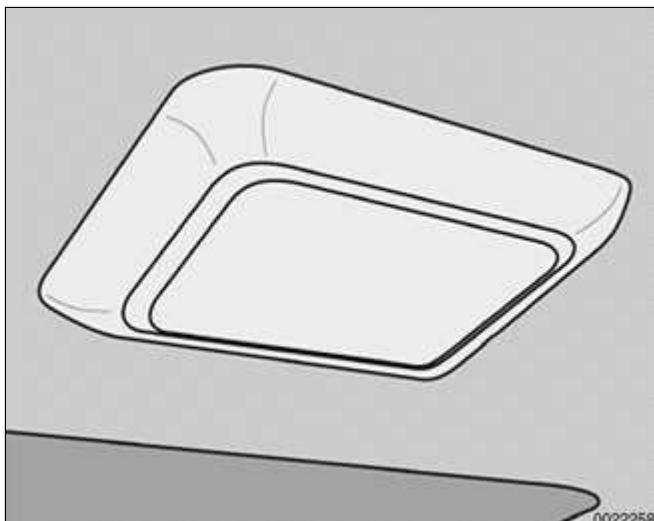
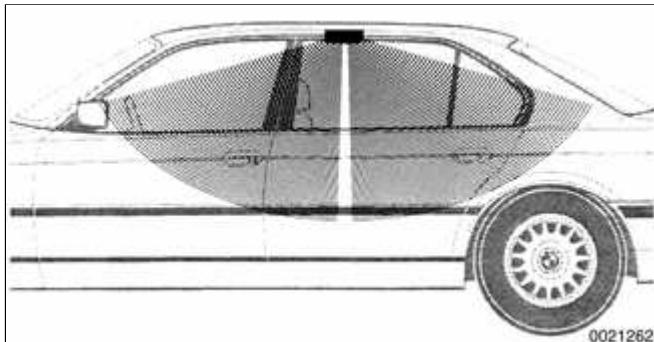


and is currently monitoring the vehicle angle. b. If the tilt sensor detects a change in the vehicle angle when DWA is armed, the NG signal is switched to inform the GM V to activate the siren.

When the tilt sensor receives the STDWA signal from the GM V, the angle of the vehicle is memorized and monitored by the solid state electronics. Once armed, if the angle changes, the tilt sensor provides a switched ground signal to the GM V to activate DWA.

Interior protection (UIS)



↖ The combined ultrasonic transmitter and receiver in UIS monitors the vehicle interior for motion.

↖ The UIS is mounted in the center of the headliner panel even with the door (B) pillar. Due to the design of the vehicles interior, the sensor is unidirectional and must be installed in the proper direction to ensure proper operation of the system (trim cover ensures directional installation).

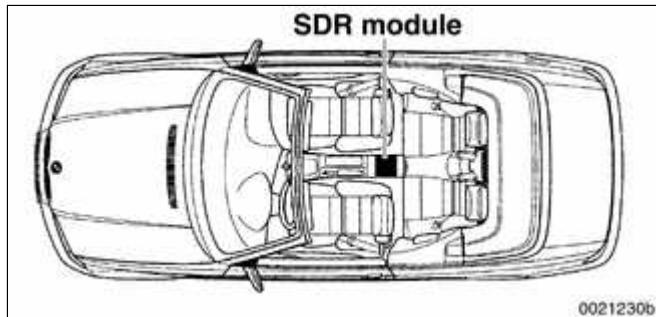
Every time the DWA system is armed (STDWA signal), the sensor adapts to whatever objects are stationary in the interior. The sensor emits ultrasonic waves in a programmed timed cycle. It receives echoes of the emitted signals. The UIS amplifies the received sound wave signals and compares them with the transmitted waves. The UIS also checks the incoming echoes for background hiss (wind noise through a

partially open window) and adapts for this.

If the echoes are consistently similar, no movement is detected. If the echoes are altered or inconsistent, the UIS changes to a constant cycle and the echo is compared again. If the inconsistency is still present the UIS sends the activate siren signal (INRS) to the GM V.

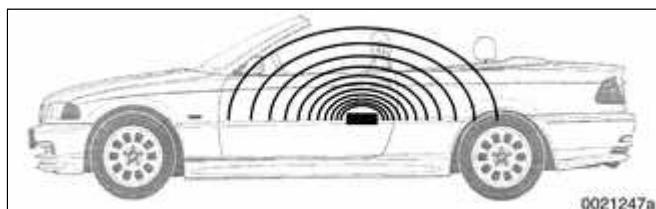
As with the tilt sensor, the UIS is also switched OFF when the vehicle is locked two times within ten seconds. This allows the sensor to be switched OFF for transportation purposes.

Convertible interior protection (SDR)



- ◀ In Convertible models, the interior motion detector for the alarm system is a short distance radar (SDR) detector located on the center tunnel, under the center console next to the parking brake handle. The central position allows the most effective monitoring of the vehicle interior.

The SDR detector consists of two printed circuit boards, one being the transmitter/receiver and the other the processing electronics. The module housing is highly conductive material for high frequency transmission.



- ◀ The SDR sensor transmits an electromagnetic field in a hemispherical pattern within the vehicle interior. The monitoring radius is preset in the module. The receiving antenna monitors reflected signals from the interior. The module evaluates these signals as a base line for vehicle security. Any objects that come into this monitoring radius will be detected and evaluated by the SDR module.

The module operates in pulse mode. The radar unit transmits a signal, then pauses for the reflected signals to be received by the module.

The detection range of the radar is adjusted by rapid switching when the system is armed. This allows the sensor to adjust its range to either the windshield with the top lowered or to the soft top when it is raised.

The module will signal the GM V to trigger the alarm if a new object is detected within its sensing hemisphere. However, false alarms may be triggered by objects falling into the interior when the system is armed with the top lowered. Also, large metal objects, such as the seat backrests, will shield the microwave pulse and create a sensor "shadow" effect in the interior.

As with the tilt sensor and the UIS, the SDR sensor can be switched OFF by activating the central locking system twice within 10 seconds.

Alarm siren

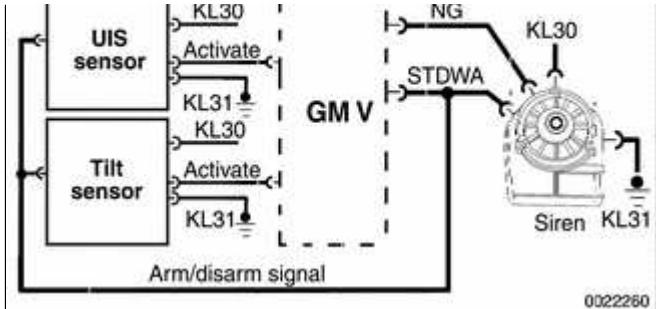
The DWA siren is installed in the right rear engine compartment. This location provides a secure position with loud acoustic output.

The siren contains electronic circuitry for producing the warning tone when the alarm is triggered. The siren also contains a rechargeable battery that is used to power the siren when the alarm is triggered. The rechargeable battery will allow the siren to sound if it or the vehicle battery is disconnected. The siren battery is recharged from the vehicle battery when DWA is not in the armed state.

Alarm arm/disarm circuit



The siren has four wires connecting it to



the alarm system:

- ◆ KL 30 (power)
- ◆ KL 31 (ground)
- ◆ STDWA signal (arm/disarm signal from GM V)
- ◆ NG signal (activate siren output signal to the GM V)

The arm/disarm output signal from the GM V (STDWA) is provided to the tilt sensor, UIS sensor and the siren simultaneously. The arm/disarm signal is a switched ground that signals the components of DWA armed/disarmed status.

To activate the siren, the NG signal is high whether DWA is armed or disarmed. If a monitored input activates the alarm, the high signal to the siren is switched to a 50% duty cycle at the GM V. The control circuitry in the siren activates the siren. If the DWA is armed and the battery is disconnected, the siren circuitry recognizes the normally high NG signal as suddenly going low. In this case the siren is also activated.

Panic mode operation

When the trunk button on an FZV key is pressed and held, the GM V activates the siren for the panic mode. The panic mode is functional with either an armed or disarmed DWA system.

Emergency disarming

Emergency disarming occurs automatically if a key is used to turn the ignition switch ON and EWS accepts it.

The EWS signals the GM V to unlock the doors and to deactivate the DWA.

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General

This repair group covers removal and installation of the front and rear seats.

Seat design and upholstery



The front seats installed in E46 cars come in either manual or powered versions. They offer firm support and comfort. Their internal construction is engineered to work together with the vehicle suspension to absorb vibration. The internal ventilation system of the seats adds to the built-in comfort of these seats.

Convertible front seats are unique to those models in that they incorporate the seat belts. This is called the Seat Integrated Seatbelt (SGS) system.

Vinyl is the most common upholstery, and leather is an available option. The leather appears not only on the seats but on the door panels and other areas as well.

Front seatback nets are standard.



Seat adjustments

Regardless of level of trim, E46 seats offer the following minimum adjustments, with manual (**photo**) or power controls (**below**):

- ◆ Fore-aft position
- ◆ Backrest angle

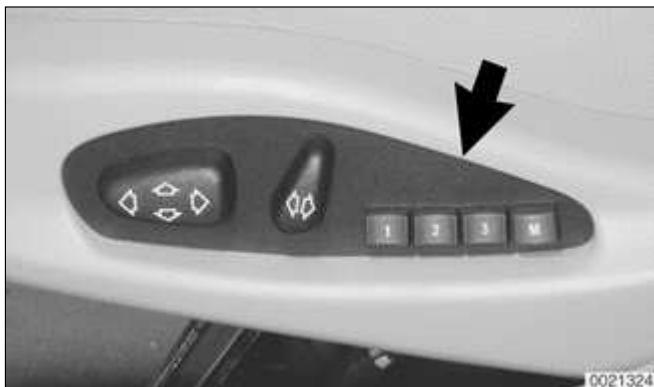


0021324a

- ◆ Cushion height

- ◆ Head restraints.

Seat memory system



0021324



In cars with seat memory, the driver's front seat incorporates two control modules: One in the seat adjusting switch (**arrow**) and the second under the seat cushion. The two modules process the following:

- ◆ Seat adjustments
- ◆ Comfort entry aid switch (2-door models)
- ◆ Seat backrest lock microswitch (2-door models)
- ◆ Seat belt fastened
- ◆ K-bus communication with the General Module (GM V) and instrument cluster

The driver seat module stores three seat positions for recall. The information is stored in non-volatile memory, preventing loss of memory in case of electrical power failure or battery disconnection.

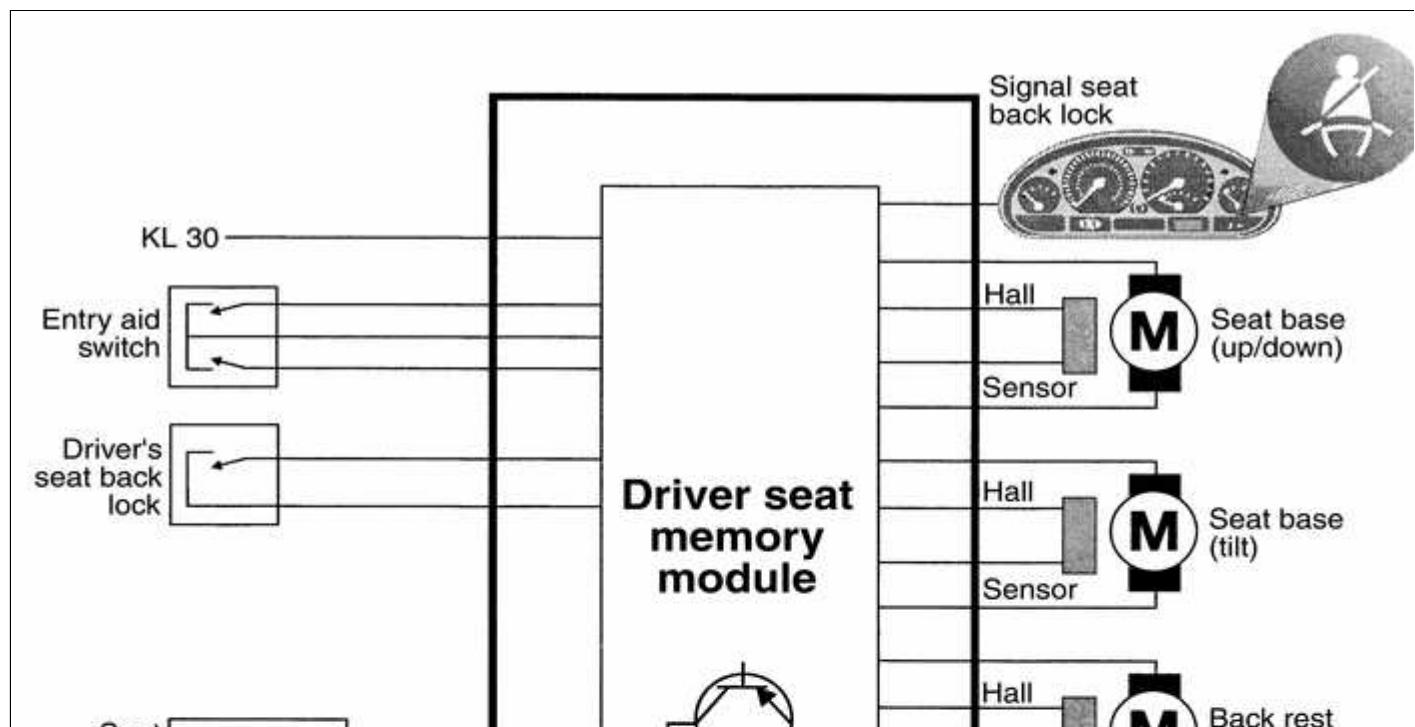
The seat adjusting switch block in the driver's seat communicates with the seat cushion control module over dedicated lines. The output stages for seat motor movement are in the seat cushion control module. Seat positions are recognized through the use of Hall sensors in the motors. All components

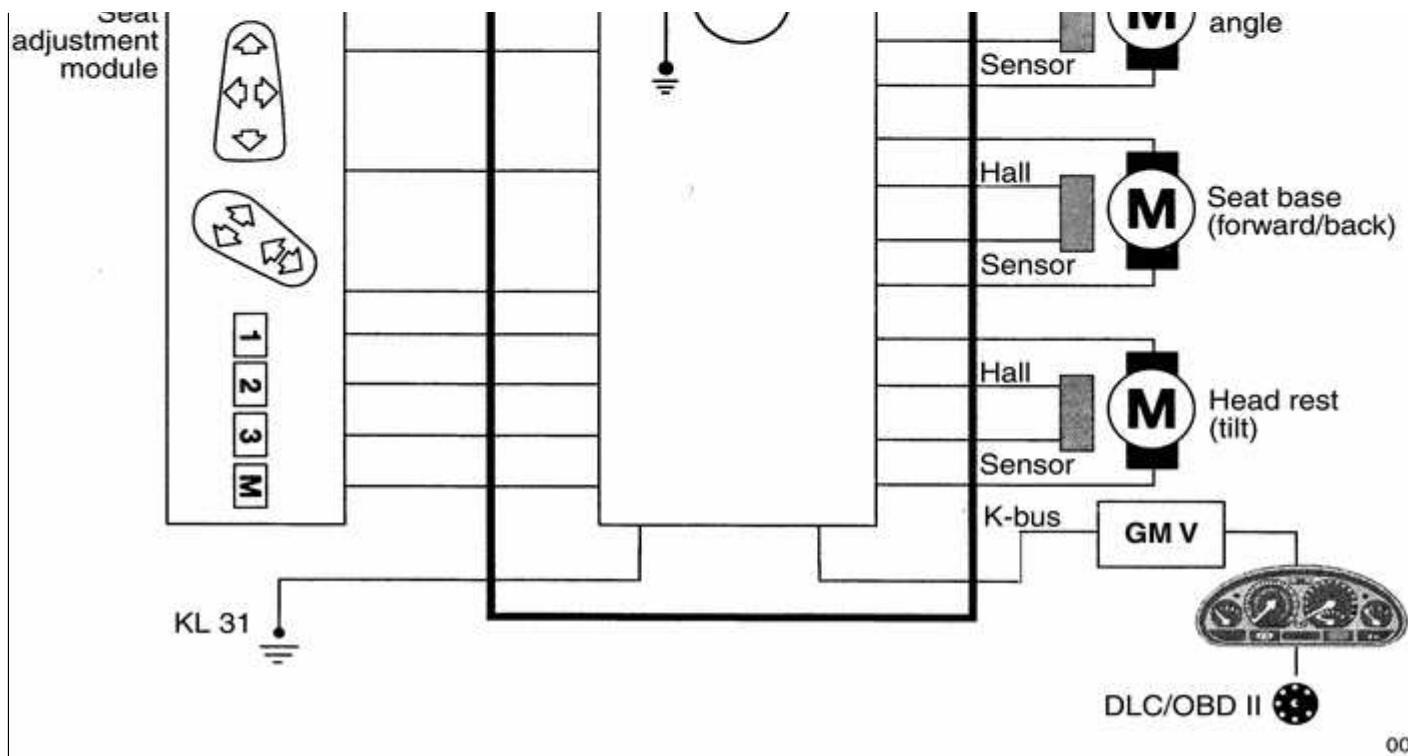
of the seat memory system are monitored for faults. Access the fault codes using BMW scan tool DIS or MoDiC.

In Coupe and Convertible models, the easy entry feature facilitates access to the rear seats. When a front backrest is folded over, the entire seat moves forward 90 mm (3.54 in.) to facilitate rear entry. In models with seat memory, the seat control module memorizes the position of the seat and headrest when the entry aid feature is activated. The seat will return to its previous set position when the entry aid button is pressed rearward or the seat backrest is locked.

The passenger's seat on four door models uses a simplified control system within the switch block and does not include a memory module. No on board diagnostics are incorporated into the passenger seat on these models.

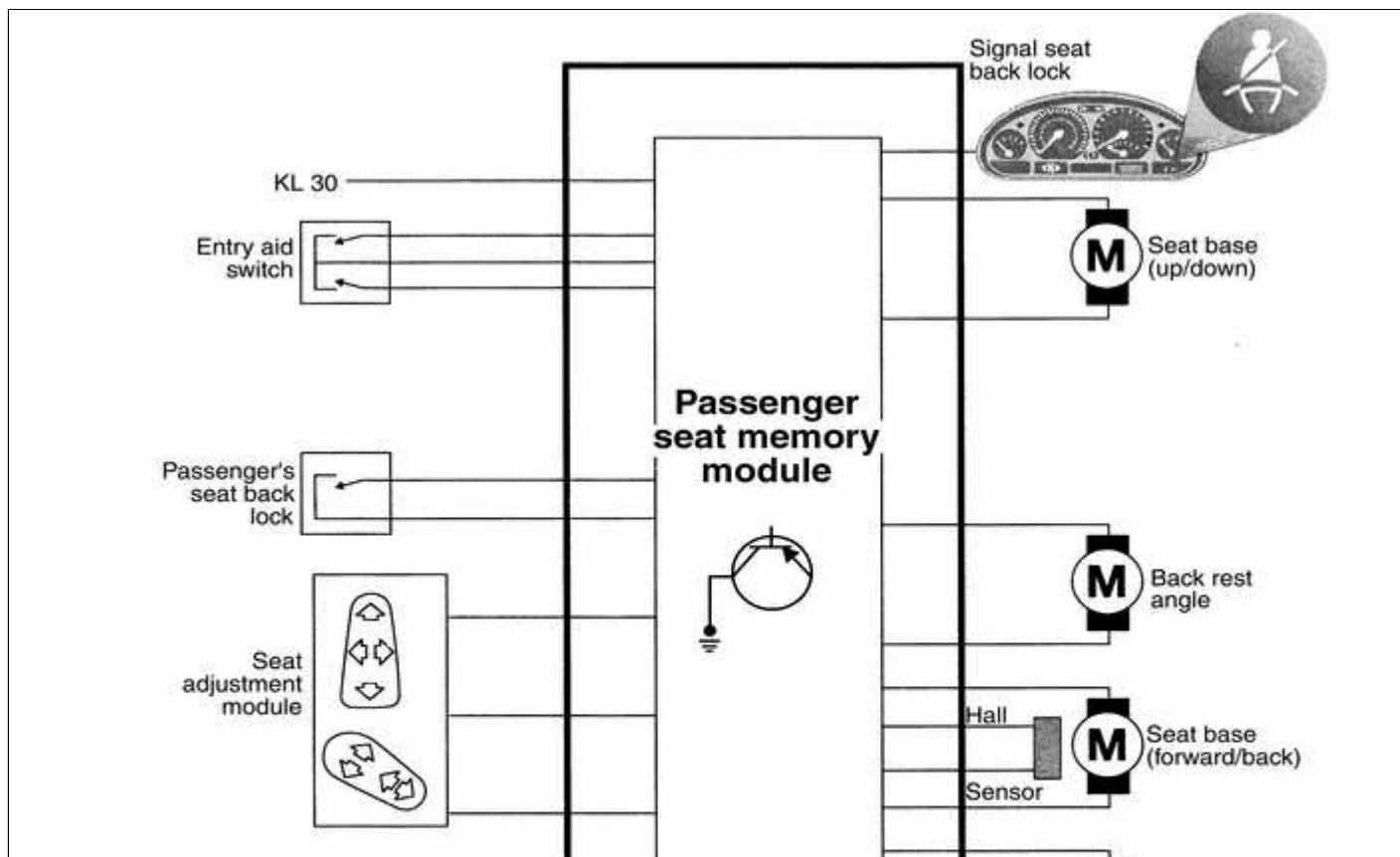
Driver seat memory module

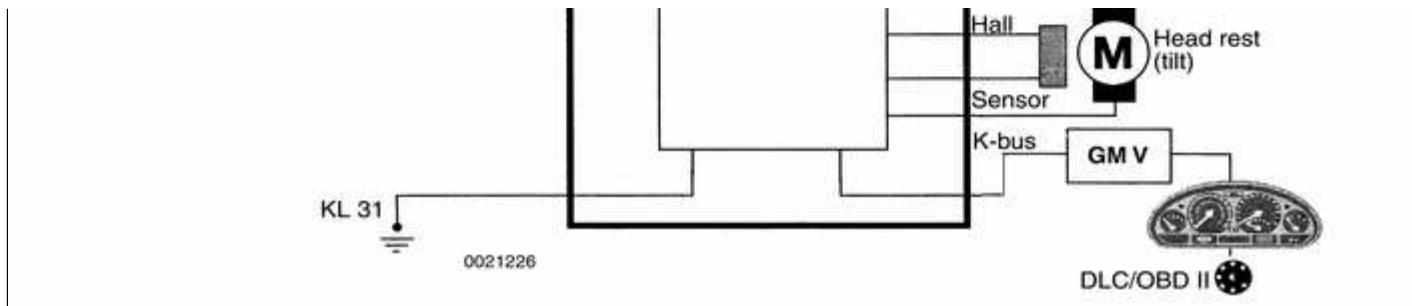




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Passenger seat memory module





Rear seat configuration



- ◀ Split rear folding seats are optional in the Sedan and standard in the Sport Wagon and Coupe. They are split 1/3 right to 2/3 left with a folding center armrest in the left portion. The armrest, when folded down, is equipped with a storage compartment and cupholders.

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Front Seats

Seat removal and installation is similar for all versions. Seat disassembly differs in detail among the many models of seats.

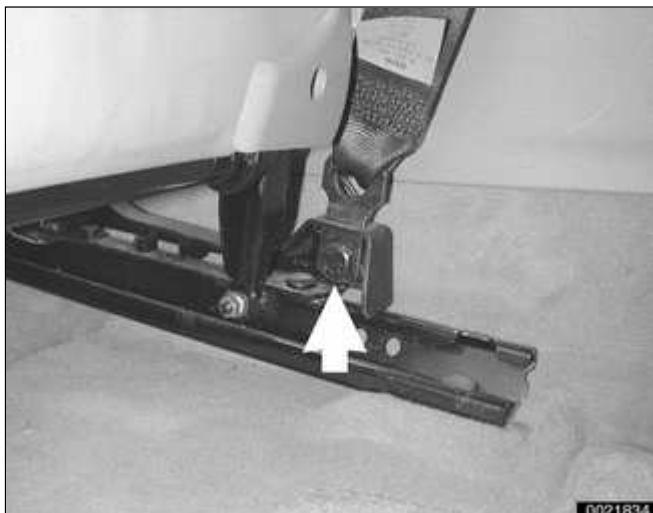
Seat repair and component replacement is possible once the seat has been removed from the vehicle.

Front seat, removing and installing

WARNING!

- ♦ *The front seats are equipped with pyrotechnic seat belt tensioners. These tensioners are powerful devices and should be handled with extreme care. Incorrect handling can trigger off the tensioner and cause injury.*
- ♦ *BMW recommends that all repair or replacement work on pyrotechnic devices must be carried out by a qualified BMW technician.*
- ♦ *Be sure to disconnect the battery and wait 5 seconds before attempting to work on pyrotechnic devices.*
- ♦ *Pyrotechnic devices cannot be repaired. Always replace them.*
- ♦ *Never treat pyrotechnic components with cleaning agents or grease.*

- ◆ ***Do not expose pyrotechnic components to temperatures above 75°C (167°F).***
- ◆ ***Pyrotechnic components can only be tested electrically when installed, using BMW service tester DIS, MoDiC or equivalent scan tool.***
- ◆ ***Do not fire a pyrotechnic gas generator prior to disposal. It must be fired by a special disposal company or shipped back to BMW in the packaging of the new components.***
- ◆ ***During body straightening and welding with an electric arc welder, always disconnect the battery and the connection to the pyrotechnic gas generators.***



↖ 4-door models: raise seat and move to its forward position. Working at base of seat near doors, remove seat belt mounting bolt (**arrow**).

- Remove headrests (not convertible).



↖ Remove two mounting bolts (**arrows**) at rear of seat rails.

- Move seat to its rear most position, keeping it raised.



◀ Remove plastic caps over front seat mounting nuts, then remove mounting nuts (**arrows**).

- Disconnect negative (-) cable from battery.

CAUTION!

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.



◀ Tilt seat back to access electrical harness connectors. Slide lock to release and disconnect. Cut or untwist wire ties as necessary.

- Remove seat from car. The headrests may be removed to provide additional clearance.

Note:

Use a blanket to protect door sill from scuffing by seat rail during seat removal.

- Installation is reverse of removal. Use wire ties or equivalent means to keep seat harness wiring from fraying.

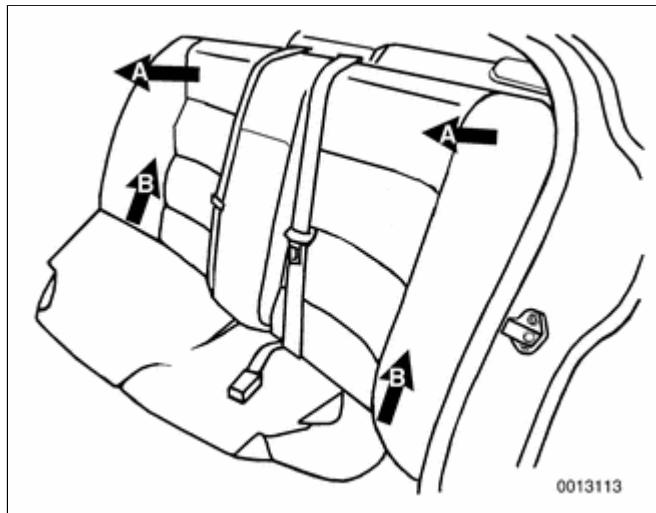
| Tightening torque | |
|--------------------------|------------------|
| Front seat to floor | 45 Nm (33 ft-lb) |
| Seat belt end to seat | 48 Nm (35 ft-lb) |

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Rear Seats

Rear seat cushion and backrest, removing and installing (fixed seat back models)

- Pull front of rear seat cushion up to release clips. While holding front of cushion up, pull cushion forward to remove.



Remove rear seat backrest:

- ◆ Pull top outer corners of backrest forward (**A**) to detach from top retainers.
- ◆ Pull entire backrest up (**B**) to detach from bottom hooks.
- ◆ Slide backrest to side to clear seat belts.

Note:

If the car is equipped with heated rear seats, detach electrical harness connector(s) as you remove the seat components.

- When reinstalling, be sure to pull seat belts and buckles up through appropriate slots in seat cushion.

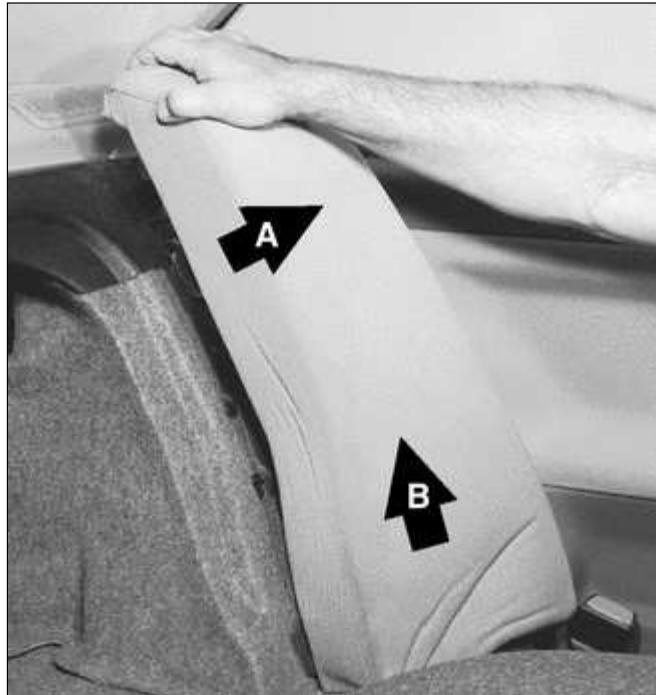
Rear seat cushion and backrest, removing and installing (fold-down seat back models)

- Pull front of rear seat cushion up and out of clips. While holding front of cushion up, pull cushion forward to remove.

- Tilt backrests forward.

Note:

Remove rear headrests, if equipped, by pulling straight up.



- ◀ Remove backrest side section by pulling out (**A**) and up (**B**).

- Working between two sections of backrest, remove backrest center mount screws.

- Remove outer backrest mounting screws.

- Raise backrests in middle slightly and separate left and right backrest guide. Lift backrest(s) out through back door(s).

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General

This repair group covers the slide-tilt sunroof assembly.

Component locations, initialization, sunroof panel replacement, and sunroof height adjustment are covered. Replacement of the cable assembly or frame require that the headliner be removed. Removal and repair of the sunroof assembly and other components inside the roof cavity is beyond the scope of this manual.

Sunroof electronic controls, initializing

Initialize the sunroof in the following situations:

- ◆ Malfunctions such as lack of one-touch function, lack of comfort opening/closing or lack of safety (anti-trapping) features
- ◆ If sunroof motor has been removed and reinstalled
- ◆ If power supply to the sunroof has been interrupted
- ◆ If repairs have been performed on the slide/tilt mechanism

Normalization

During normalization the mechanical end positions of the sunroof are detected and stored by the General Module (GM V).



◀ Press and hold sunroof switch in "lift" direction.

- ◆ After reaching end position, keep switch pressed for approximately 20 seconds longer.
- ◆ The sunroof motor will briefly jerk upwards, signalling normalization is complete.

Characteristic curve

The characteristic resistance curve of the E46 sunroof is learned using coding software. This resets the safety (anti-trapping) feature. See your BMW dealer service department.

Sunroof panel, emergency closing



◀ Remove access panel from below sunroof motor by gently prying at the rearmost edge with a plastic tool.



◀ Disconnect the electrical connections and lay switch panel aside.



- ◀ Insert hex key into drive in sunroof motor, and turn hex key to manually close sunroof.

Note:

The hex key for manually (emergency) closing the sunroof can be found in the tool kit located in the trunk lid (sedan, coupe and convertible) or under the cargo area floor panel (Sport Wagon).



Sunroof panel, adjusting

Note:

Be sure to check drains in front corners of sunroof carrier if water is entering car through headliner.

The sunroof is controlled by a set of cables that move the sunroof panel along guide rails when the motor is operated. The sunroof can be adjusted without removing it from the car.

The sunroof panel should be adjusted under the following circumstances:

- ◆ Sunroof misaligned with roof
- ◆ Sunroof does not close squarely
- ◆ Wind noise at high speeds (sunroof closed)

- ◆ Sunroof has been removed

Whenever the top of the closed sunroof becomes misaligned with the roof of the car, if it does not close squarely, if there are wind noises at speed, if there are water leaks, or if the sunroof has been removed.



- ◀ Correct sunroof alignment:

- ◆ Sunroof must be fully closed.
- ◆ Gap must be even all around edge of sunroof.

Note:

Use a credit card to measure the gap. The card should insert through the gap with equal resistance all around the perimeter.

- ◆ Front of sunroof must be flush to 1 mm (0.04 in.) below surface of roof.
- ◆ Rear of sunroof must be flush to 1 mm (0.04) above surface of roof.
- To adjust sunroof height, shut sunroof fully.

- ◀ Slide sunroof liner back into roof cavity until approx. 90 mm (3.5 in.) is exposed.





◀ The sunroof panel is retained by three Torx screws (**arrows**) on each side. To adjust sunroof height:

- ◆ Loosen Torx screws until sunroof can just be moved.
- ◆ Push sunroof panel forward.
- ◆ Push sunroof panel up or down until correct height is achieved.
- ◆ Tighten screws. Recheck height.
- ◆ Check sunroof function.nothing

| Sunroof height adjustment specifications | |
|---|---------------------------------|
| Rear | flush/1 mm higher than roof top |
| Front | flush/1 mm lower than roof top |

| | |
|-------|---------------------------------|
| Rear | flush/1 mm higher than roof top |
| Front | flush/1 mm lower than roof top |

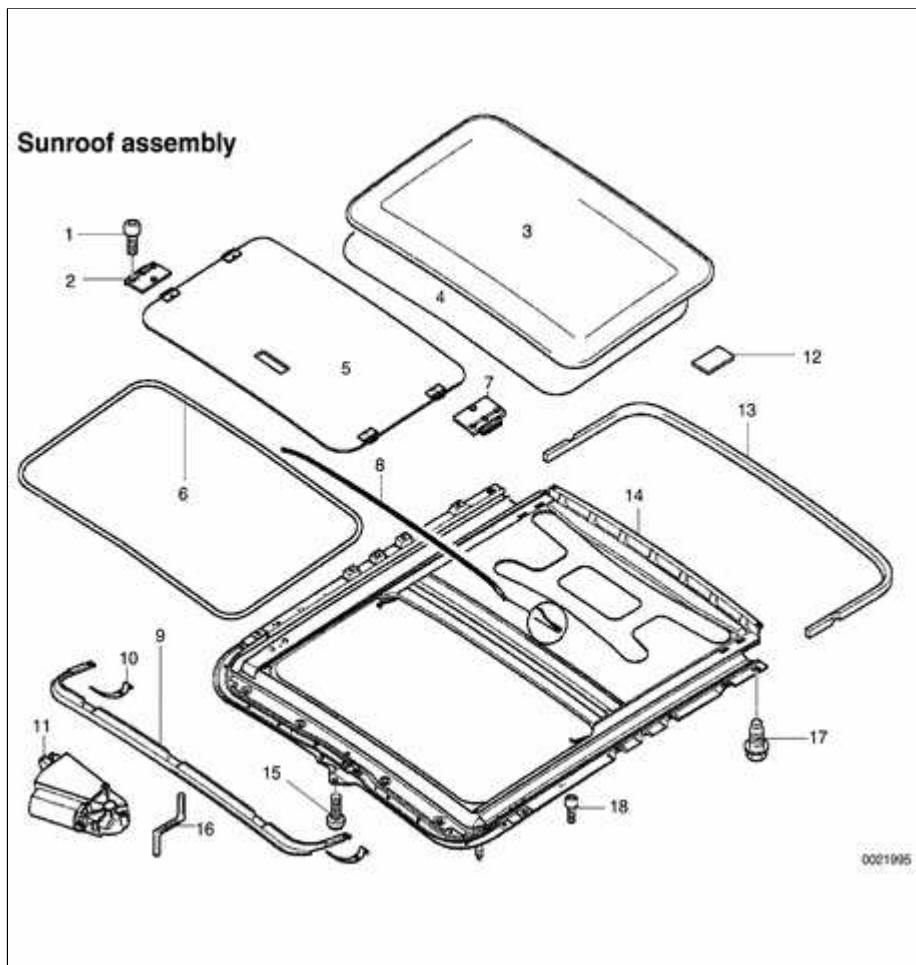
| Tightening torque | |
|------------------------------|-------------------|
| Sunroof panel to roof (Torx) | 4.5 Nm (40 in-lb) |

| | |
|------------------------------|-------------------|
| Sunroof panel to roof (Torx) | 4.5 Nm (40 in-lb) |
|------------------------------|-------------------|

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Sunroof Components

Sunroof assembly removal and installation involves headliner removal, and is not covered in this manual. After sunroof repairs be sure to follow initialization and adjustment procedures given earlier.



Sunroof assembly

- 1 - Torx bolt M5
 - 2 - Slider
 - 3 - Glass sunroof panel
 - 4 - Sunroof panel gasket
 - 5 - Velour ceiling panel
 - 6 - Synthetic strip
 - 7 - Slider
 - 8 - Gasket
 - 9 - Wind deflector
 - 10 - Deflector spring
 - 11 - Sunroof motor
 - 12 - Felt
 - 13 - Frame gasket
 - 14 - Sunroof frame
 - 15 - Torx bolt M5
- ◆ tighten to 3.5 Nm

(31 in-lb)

16 - Emergency operation crank handle

17 - Hex bolt with washer

18 - Torx bolt M4

Sunroof panel, removing and installing



- ↖ To remove sunroof panel, open sunroof and remove wind blocker by removing Torx screw (**arrow**) on each side.



- ↖ Close sunroof and slide sunroof liner back into roof cavity until approximately 90 mm (3.5 in.) is exposed.



- ↖ Remove three Torx screws (**arrows**) on each side, and lift panel out.
 - Installation is reverse of removal.



Adjust sunroof height and gap as described earlier.

Tightening torque

| | |
|------------------------------|-------------------|
| Wind blocker to roof (Torx) | 1 Nm (9 in-lb) |
| Sunroof panel to roof (Torx) | 4.5 Nm (40 in-lb) |

Sunroof panel gasket, replacing

- Remove sunroof panel as shown above.
- ◆ Pull old seal from panel.
- ◆ Coat new seal and channel in sunroof panel with soapy water.
- ◆ Starting at back center of panel, install new seal, taking care to not pull seal too tightly around four corners of panel.
- Installation is reverse of removal. Adjust sunroof height and gap as shown earlier in this repair group.

Tightening torque

| | |
|------------------------------|-------------------|
| Wind blocker to roof (Torx) | 1 Nm (9 in-lb) |
| Sunroof panel to roof (Torx) | 4.5 Nm (40 in-lb) |

Sunroof motor, replacing



- ◀ Remove access panel from below sunroof motor by gently prying at the



rearmost edge with a plastic tool.



- ▲ Remove sunroof motor mounting screws (**arrows**).
- Installation is the reverse of removal. Perform initialization procedure as described earlier.

Tightening torque

Sunroof motor to sunroof carrier

2.8 Nm (25 in-lb)

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General

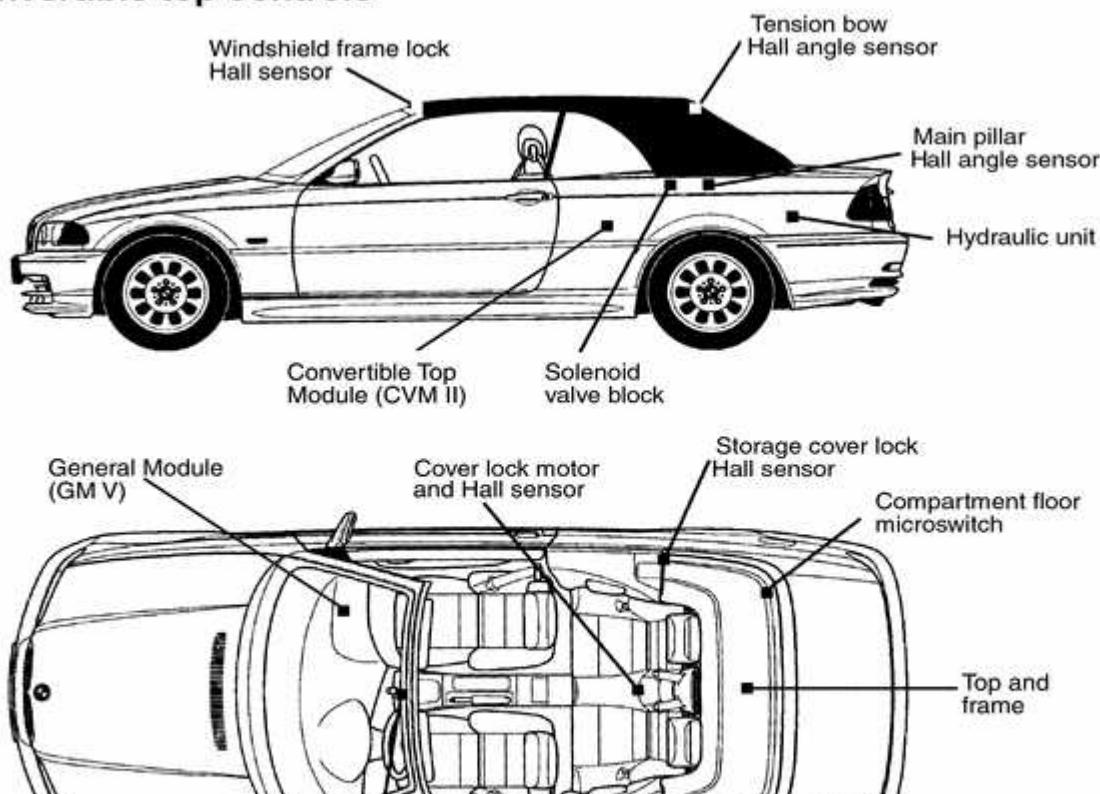
This repair group covers the automatic electro-hydraulic convertible top. Information on the Rollover Protection System is also included here.

Note:

- ◆ *The convertible top control module (CVM II) is located behind the left rear side trim panel. For the location of other convertible top electric components see ⇒ [610 Electrical Component Locations](#).*
- ◆ *The glass rear window in the Convertible is not replaceable separately.*

Convertible top controls

Convertible top controls





Convertible battery

BMW has designed a special battery tray for the Convertible which serves to dampen Convertible body flexing and vibration.

CAUTION!

The E46 Convertible requires a special battery which is designed for constant vibration. A battery not designed for this will fail much earlier.

Convertible top operation

The automatic E46 Convertible top system completely opens and closes the top using hydraulic cylinders and electric motors.

The convertible top system features:

- ◆ Convertible Top Module (CVM II) with fault memory storage.
- ◆ Electro-hydraulic operation
- ◆ Convenience opening using FZV (remote) key or door lock cylinder
- ◆ Convenience closing using door lock cylinder
- ◆ Glass rear window

- ◆ Top monitoring during operation using Hall sensors and angle Hall sensors

Emergency operation

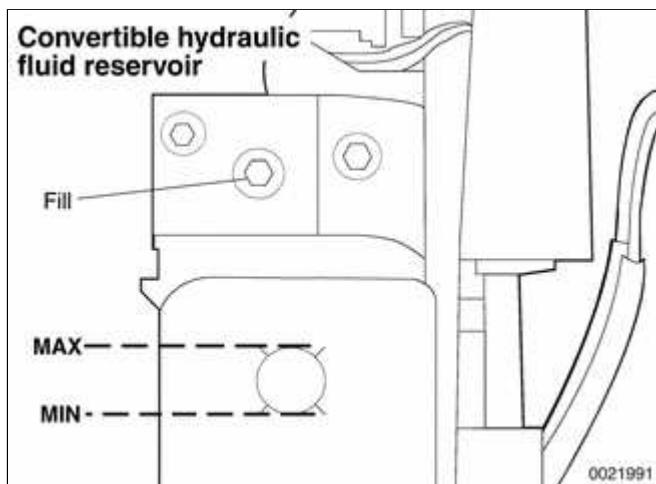
- Manually unlock top storage cover:
- ◆ Remove center arm rest.
- ◆ Lift seat upholstery below ski bag.
- ◆ Press button on motor assembly to release motor from gear linkage.
- ◆ Use hand crank (stored on assembly cover) to turn linkage assembly through access hole in motor assembly cover.
- ◆ Unlock top cover and open.
- Switch off ignition. Hydraulic pressure will be released in steps after approximately 10 seconds until all pressure is drained from cylinders.
- Manually raise or lower top. Use handcrank to lock or unlock top at windshield top frame.

Hydraulic fluid level, checking or filling

Note:

Make sure top is lowered into storage compartment and storage cover is closed.

- Working in trunk, remove trunk trim liner and soundproofing. If necessary, partially remove hydraulic unit to gain view of fill plug and fluid reference mark (circle). DO NOT detach hydraulic lines.



◀ To check:

- ◆ Level must be between **MAX** and **MIN** marks.
- ◆ Reference mark is circle in translucent reservoir.

- To fill:

- ◆ Detach hydraulic unit and pull out without disconnecting fluid lines.
- ◆ Lay unit on its side and fill through fill plug.
- ◆ Turn unit upright and recheck level.
- ◆ Install new fill plug seal.

- To drain:

- ◆ Detach hydraulic unit and pull out without disconnecting fluid lines.
- ◆ Lay unit on its side and allow to drain through fill plug.
- ◆ Turn unit upright and recheck level.
- ◆ Install new fill plug seal.

Convertible top fluid

| | |
|-----------------|--------------|
| Hydraulic fluid | Aral Vitamol |
|-----------------|--------------|

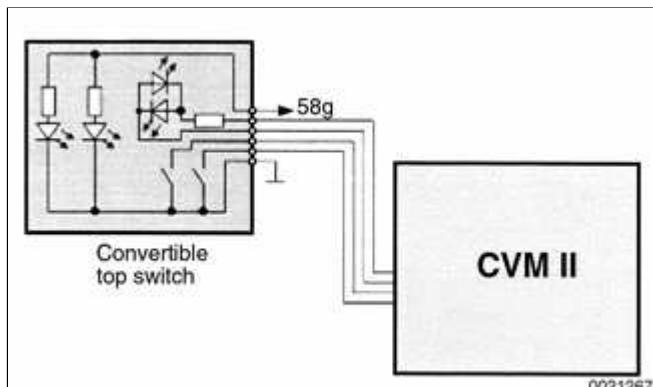
Tightening torques

| | |
|-------------------------------|-----------------------------|
| Filler plug to hydraulic unit | 10 + 1 Nm (89 + 9 in-lb) |
| Hydraulic unit to body | 10 Nm (89 in-lb) |

Note:

The convertible top hydraulic fluid is supplied in the spare parts kit. To restock fluid, check with an authorized BMW dealer parts department.

Convertible top switch



◀ The convertible top switch assembly is in the center console below the IHKA control panel. Two push buttons, one for each direction of travel, provide ground input signals to the Convertible Top Module (CVM II).

Two LEDs are positioned in the center of the switch assembly. The top LED will flash whenever the top is being operated and not locked to the windshield or stored completely in the storage compartment. The lower LED will illuminate if the top switch is pushed (open top signal) and the storage compartment floor is in the folded up position. See ⇒ [Top storage compartment floor](#) later in this group.

The top ceases moving once the switch is released. The hydraulics hold the top in position and remain under pressure for approximately 20 minutes if the ignition key is left in the ON position.

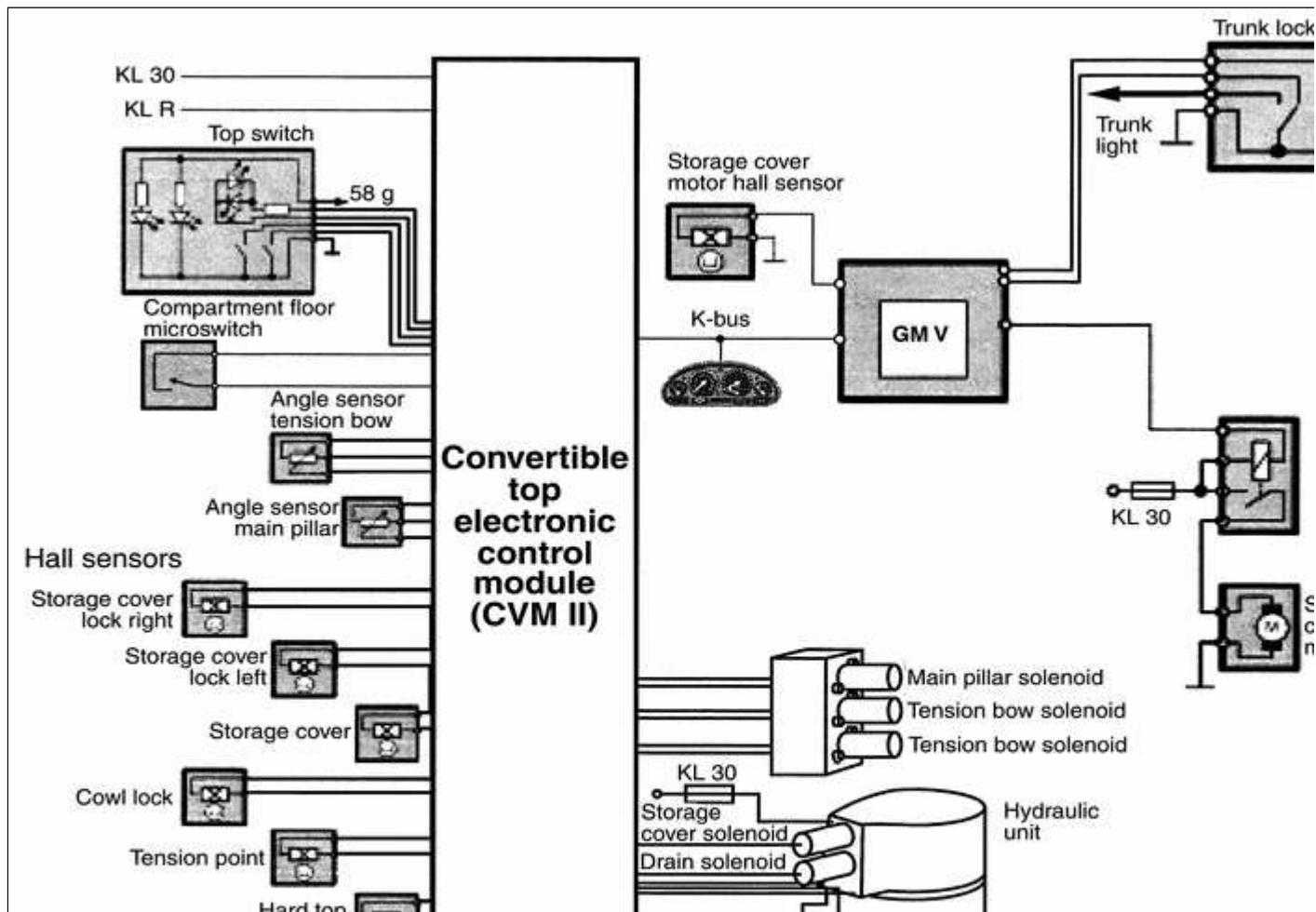
Convertible Top Module (CVM II)

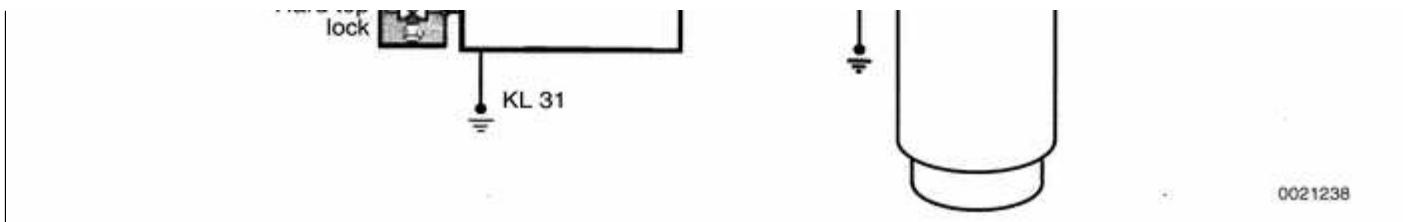
The CVM II is installed in the left rear of the car behind the side trim (next to the seat). It contains the processing, controlling and monitoring electronics for top operation.

The CVM II communicates with the General Module (GM V) over the K-bus for operation of top storage cover and windows.

The CVM II is fully self-diagnostic and is capable of storing monitored faults. Fault code access and diagnosis is carried out over the K-bus with BMW diagnostic scan tools DIS or MoDiC.

Convertible top electronic control module (CVM II)





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Fault memory storage

Convertible Top Module (CVM II) fault memory is stored in NVRAM. Up to 16 fault codes can be stored in order of occurrence. A distinction is made between permanent and sporadic faults.

If a fault occurs during raising or lowering the top, all top movement will cease and a fault code will be stored in memory. Then the emergency closing procedure must be followed.

Depending on the location and type of the fault, it may be possible to raise or lower the top fully by pressing the switch in the opposite direction.

If the top switch is held on more than 20 seconds after the top is completely raised or lowered, a fault code will be set. CVM II assumes a fault to ground in the switch or electrical harness. The ignition switch must then be cycled OFF - ON to clear the fault before the top will function again. The fault will remain in memory until cleared with a scan tool (DIS, MoDiC or equivalent).

All sequenced movements of the convertible top have time-out limits preset in CVM II. If a time-out occurs before the end position is reached, movement will be switched off to prevent damage to any of the top components.

Note:

The temperature sensor in the convertible top system signals CVM II to

cease operation if the hydraulic fluid temperature exceeds 95°C (203°F). However, any functions that have been started will be completed before the system is switched off. If the temperature exceeds 105°C (221°F) the system is immediately switched off. Close the top using the emergency closing procedure. Automatic operation can be resumed when the fluid temperature drops below 95°C.

Comfort operation

Comfort closing of the top is possible by using the key in the driver door lock cylinder. Holding the key in the locking position will raise the top and close the windows.

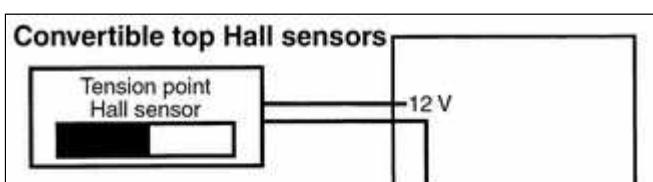
Comfort opening is possible from either the driver door or remotely using the FZV key.

Windshield frame lock

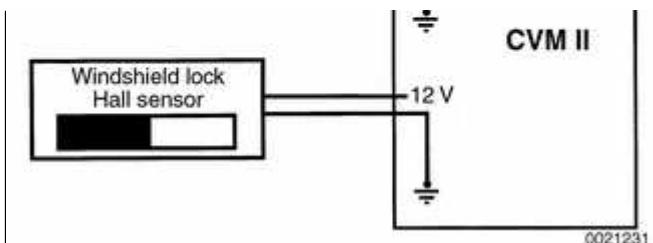
The windshield frame lock assembly consists of the top lock motor positioned in the center of the top frame and two lock drive mechanisms positioned on either side of the top frame.

The lock motor and drive mechanism unlock the top from the windshield and raise the front of the top past the tension point. Flexible drive shafts are used to activate the lock assemblies and drive the tension link rods.

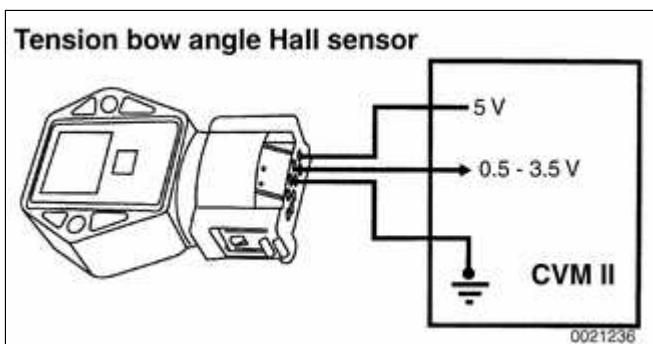
Convertible top sensor operation



- Three Hall sensors detect the position of the top frame are located on the left lock drive assembly. All three sensors receive power and ground from CVM II.

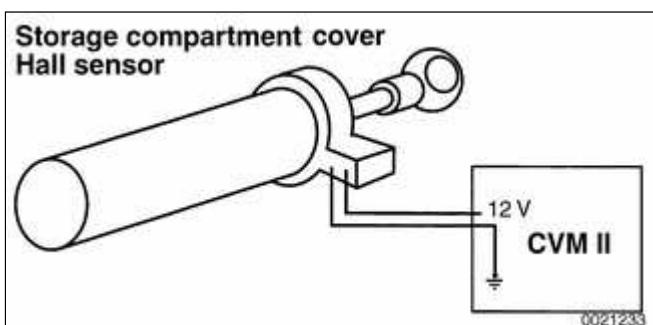


Windshield lock sensor provides low signal when top frame is unlocked from windshield. LED in convertible top switch will flash.



- ◀ Tension point position sensor provides high signal when top frame is raised past tension point. The angle sensor provides a linear voltage signal input to CVM II (approx. 0.5 - 3.5 volts) as tension bow moves from a vertical to a horizontal position.

Main pillar Hall angle sensor is similar in function and output to tension point position sensor. It is mounted on left side top linkage by left main pillar hydraulic cylinder. The CVM uses input signal from main pillar angle sensor for top frame positioning.



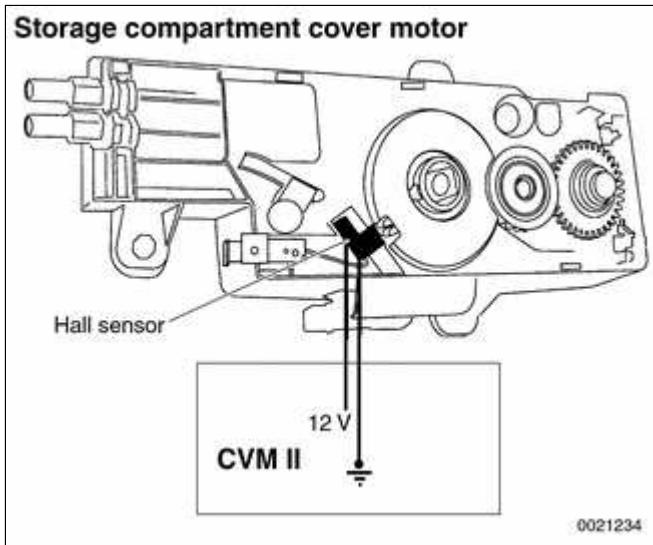
Top storage compartment cover

- ◀ Top storage compartment cover position is detected and signalled to CVM II by a Hall sensor on left side storage cover hydraulic cylinder in trunk. The sensor provides a high signal when storage cover is fully open.

The CVM II uses this input as a switching signal:

- ◆ For activating tension bow solenoid during top lowering
- ◆ For activating main pillar solenoid during top raising.

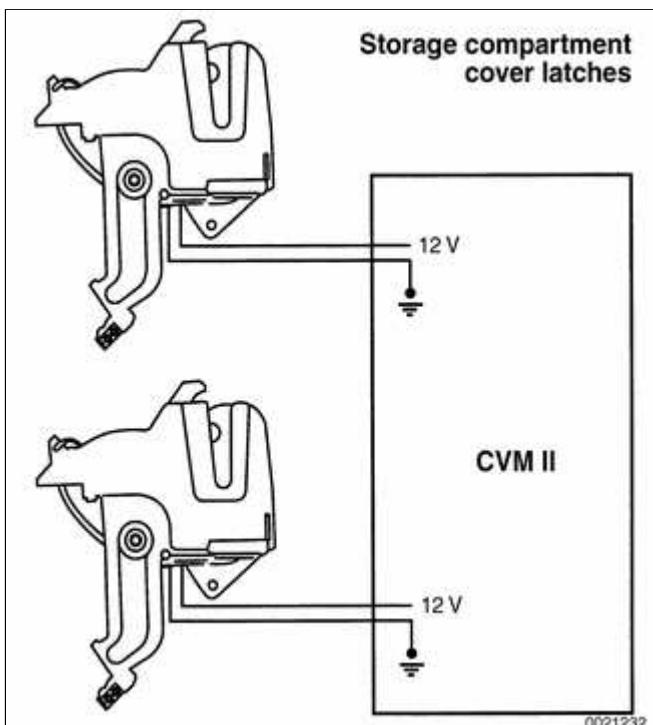
Top storage compartment cover lock motor



The convertible top storage compartment cover lock motor is on driveshaft tunnel under rear seat. It consists of a motor with Hall sensor, gear assembly and two bowden cables connected to cover locks on two sides of cover. The Hall sensor detects locked/unlocked position of cover.

During convertible top operation (raising or lowering) CVM II signals General Module (GM V) over K-bus to unlock storage compartment. The lock motor runs 180° to unlock cover latches. The motor always turns in same direction to lock or unlock.

Once motor has turned 180°, the Hall sensor will signal GM V to switch off motor. At the same time, GM V will signal CVM II to continue top operation.



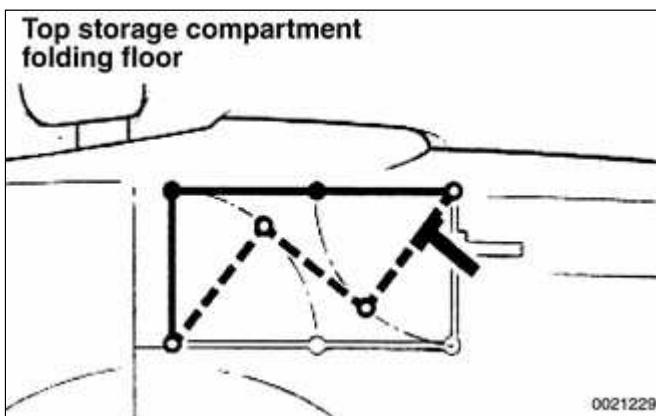
There are two storage compartment cover lock Hall sensors, one mounted on each storage cover latch. The switches receive power and ground from CVM II. Each switch input provides a high signal when cover is unlocked and raised far enough by cover hydraulic cylinders to clear latches.

When cover is completely lowered by hydraulic cylinders, the Hall sensors send a signal to CVM II which signals GM V to relock storage cover.

Top storage compartment floor

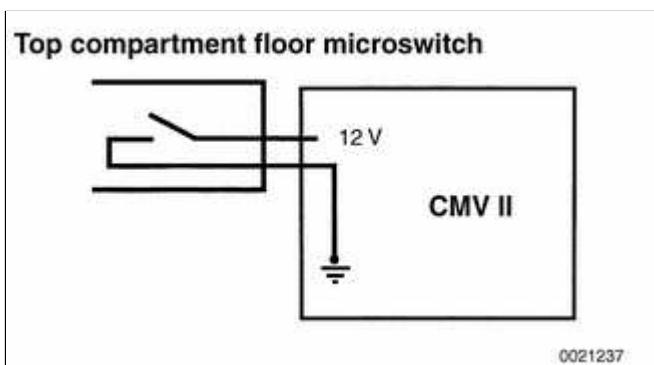
The trunk of the E46 Convertible offers the variable convertible top storage compartment floor. This feature allows the luggage storage area to be enlarged by approximately 40 liters (1.5 cu. ft.)

when soft top is raised or removed for hard top installation.



◀ The plastic variable compartment floor is hinged at four point so that it can articulate and be rotated up into top storage space.

A lever on right side of variable floor actuates and locks floor into position.



◀ A dampening piston on right side maintains position of variable floor. The lower dampening piston hinge switches a microswitch on right side of variable floor when floor is in folded (raised) position. This signal to CVM II locks out operation of top.

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Convertible Top Components

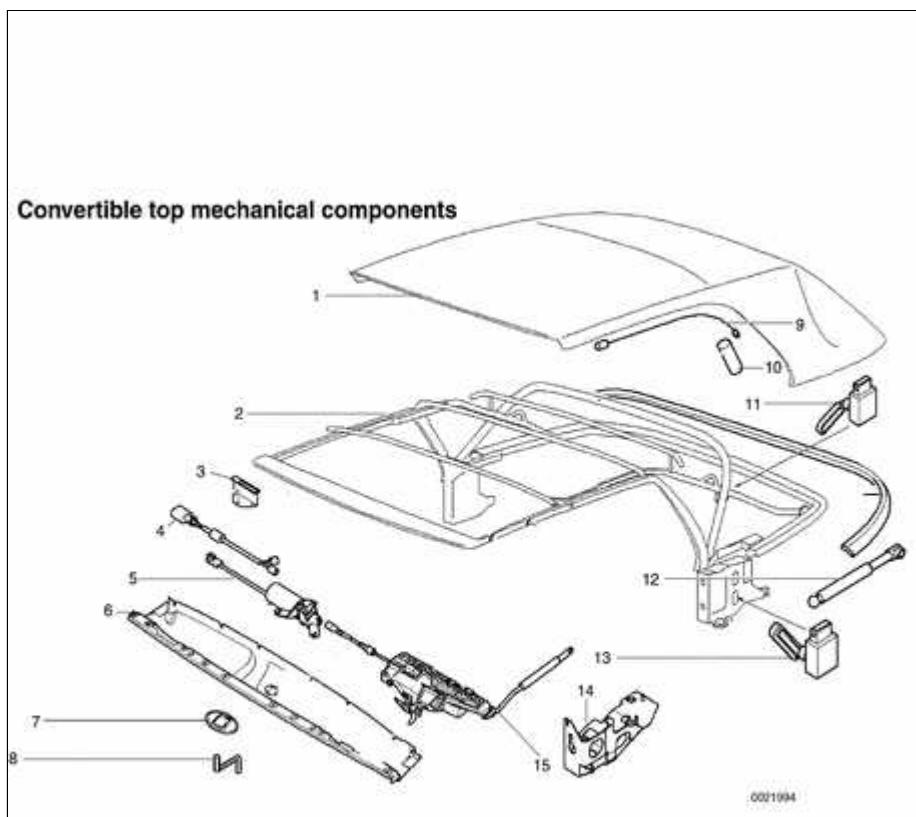
Mechanical top components

The metal folding frame of the top is bolted to the sides of the car behind the door pillars (B-pillars).

The three layer soft top consists of:

- ◆ Fabric outer layer
- ◆ Middle fleece liner
- ◆ Inner liner

Refer to the accompanying illustration for mechanical component locations.



Convertible top mechanical components

- 1 - Folding top
- 2 - Folding top frame
- 3 - Base plate
- 4 - Windshield frame lock microswitch
- 5 - Windshield frame lock drive motor
- 6 - Windshield

- 
- frame cover
 - 7 - Emergency mechanism cover
 - 8 - Emergency operation crank
 - 9 - Tension rope Insulation
 - 10 - Tension bow
 - 11 - Hall sensor
 - 12 - Gas pressurized spring
 - 13 - Main pillar Hall sensor
 - 14 - Console
 - 15 - Windshield latch (left side)

Hydraulic system repairs

CAUTION!

- ♦ *When working on hydraulic system, system must be at zero pressure.*
- ♦ *Disconnect supply and return lines a with convertible top stowed and in untensioned state.*
- ♦ *Once hydraulic system has been opened, a function test must be carried out after work has been completed.*

- ♦ Once hydraulic lines have been disconnected from hydraulic components, top must not be moved. Fluid will leak from separated coupling.
- ♦ Avoid scratching hydraulic piston rods. Even paint mist and welding spots are harmful.
- ♦ When working around hydraulic cylinders, cover with a protective cloth.

Working in the trunk at the convertible top hydraulic unit, disconnect the supply and return lines and connect them to each other (short circuit). The system is thus closed and the couplings are protected against damage. The hydraulic system cannot build up high pressure and convertible top can be moved manually.

Hydraulic system components and electronics are shown in the accompanying illustrations.

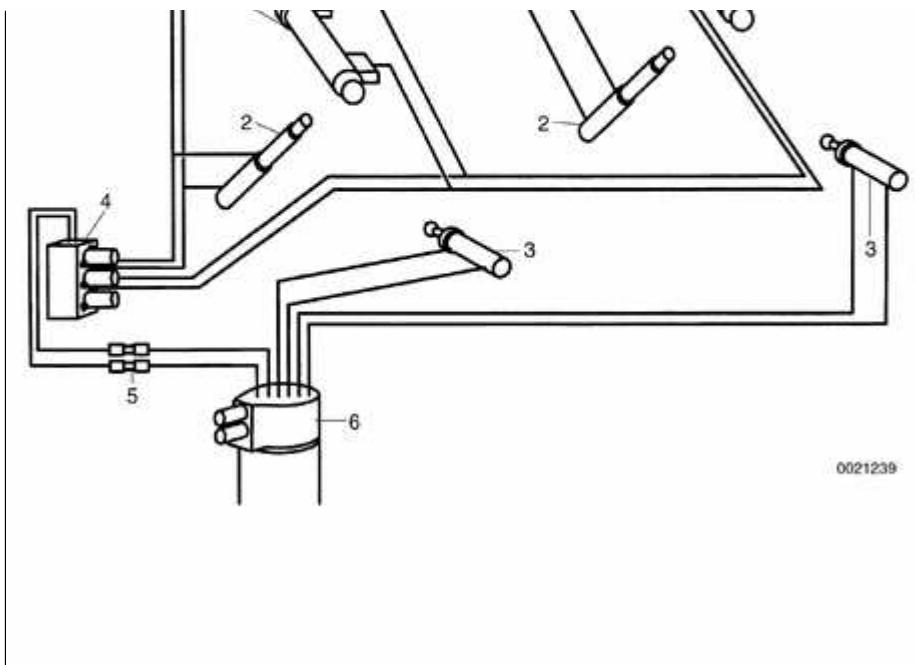
Terms and definitions used in diagnosing and repairing the convertible top hydraulic system are listed in => [Table a. Definition of hydraulic system terms](#). Basic repair procedures for hydraulic system repair are listed in => [Table b. Convertible top hydraulic system repair procedures](#).

Convertible top hydraulic components



Convertible top hydraulic components

- 1 - Tension bow (rear of top) hydraulic

**cylinders:**

- ◆ Operate on top frame linkage to raise and lower bow
- ◆ Located on two sides of tension bow, at sides of rear window
- ◆ Angle Hall sensor on left tension bow linkage detects bow position
- ◆ Hydraulic lines for right tension bow cylinder routed under top fabric along tension bow

2 - Main pillar hydraulic cylinders:

- ◆ Actuate soft top frame
- ◆ Located on two sides of top frame linkage
- ◆ Angle hall sensor detects position of main top linkage
- ◆ Hydraulic lines for right main pillar cylinder routed under top fabric along tension bow

3 - Top storage compartment cover hydraulic cylinders:

- ◆ Open and close storage compartment cover
- ◆ Located in trunk
- ◆ Left cylinder equipped with Hall sensor to detect fully opened position of cover

4 - Solenoid valve block on left side of top frame:

- ◆ Solenoid V1 controls operation of main pillar hydraulic cylinder
- ◆ Solenoid V2 controls tension bow cylinders for raising top
- ◆ Solenoid V3 controls tension bow cylinders for lowering top

5 - Quick disconnect in trunk

6 - Hydraulic pump unit:

- ◆ In left side of trunk behind trim
- ◆ Mounted on rubber bushings and covered by sound insulation
- ◆ Unit consists of:
Hydraulic motor and pump, Storage cover solenoid valve, Drain solenoid valve, Hydraulic fluid reservoir, Hydraulic fluid temperature sensor
- ◆ Operates at pressures of up to 200 bar (2900 lb/in²).

Convertible top hydraulic electronics

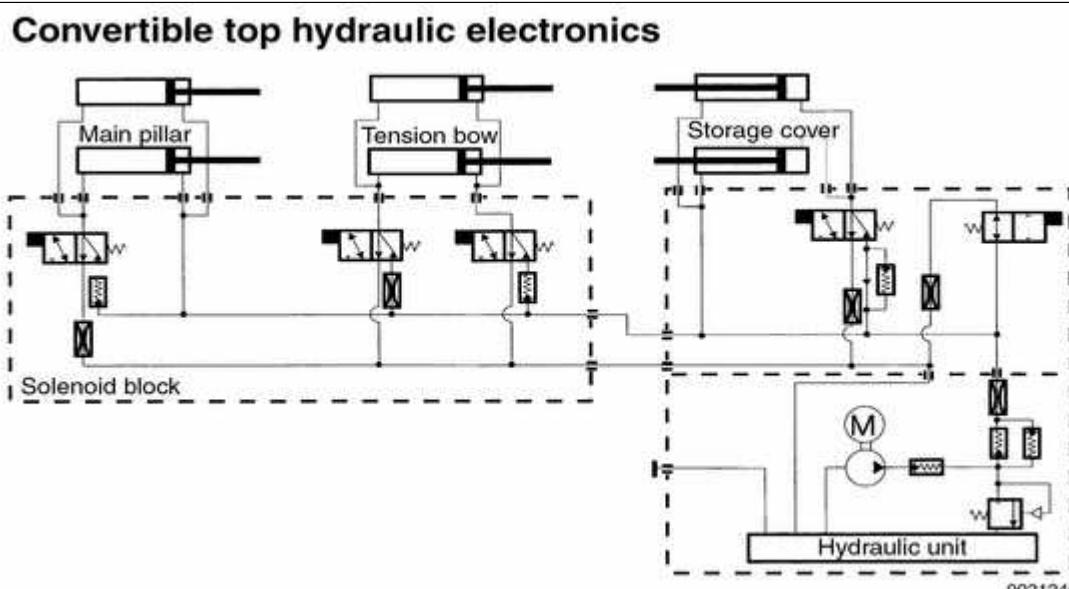


Table a. Definition of hydraulic system terms

| Term | Action | Notes |
|-----------------------------------|---|---|
| Hydraulic system at zero pressure | Turn ignition to 0 position. Wait 15 seconds. | Hydraulic system has no or very low pressure. |
| Untensioned state | | |
| Mechanical (emergency) actuation | Open or close top by hand. | See ⇒ Emergency operation |
| Closed system | All hydraulic lines connected. | Even short-circuiting of lines is possible. |
| Function test | Open and close top several times (min. 3 times). Check hydraulic unit fluid level and top up if necessary. | Refer to Operating Instructions. |
| Short circuit | Unfasten quick release coupling. Connect supply and return lines to each other. | Hydraulic system cannot build up pressure. Convertible top can be moved. |

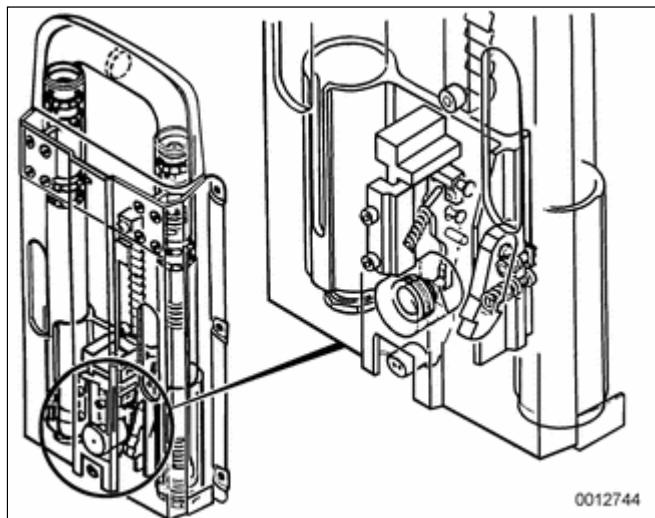
Table b. Convertible top hydraulic system repair procedures

| Operation | Procedures |
|--------------------------------------|--|
| Mechanical (manual) operation of top | <ul style="list-style-type: none"> ◆ Ignition must be turned off ◆ Hydraulic lines must be disconnected. (Reconnect when finished) ◆ After repeated actuation, system fluid is pumped into supply tank of hydraulic unit. If hydraulic components are replaced, there will be too much fluid in system. |
| Fluid level check | <ul style="list-style-type: none"> ◆ Stow convertible top and close storage compartment |

| Operation | Procedures |
|------------------------------|---|
| Fluid topping up or draining | <p>lid.</p> <ul style="list-style-type: none">◆ Follow directions in ⇒ Hydraulic fluid level, checking or filling, earlier in this group. |

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Rollover Protection System



Two spring-loaded rollbar cassettes are mounted behind the rear seat. The cassettes are bolted into the reinforced carrier behind the seat backs. When retracted they are covered by the rear headrest which incorporates a flap at the back, that will open when the rollbars deploy.

A rollover sensor, mounted in the rear behind the left rear seat back on the rollbar cassette, contains the electronics for rollover detection and deployment final stage for triggering the rollover bar solenoids. Two capacitors are installed for rollbar deployment in case of a power failure during a crash.

The rollover sensor performs a self-check every time the ignition is switched on. The sensor is connected to the diagnostic link (DLC) for troubleshooting purposes.

If faults are detected, the warning lamp in the instrument cluster will light up. In case of a crash, the system will attempt to trigger the rollover cassettes to deploy even if a fault code is stored in fault memory.

Note:

Diagnosis of convertible top and Rollover Protection System are beyond scope of this book. Your authorized BMW dealer has proper diagnostic equipment and tools to carry out these tasks.

After deployment, the detent pawl in a rollover protection cassette can be retracted by pulling the reset lever

forward so that rollbar can be pushed down and locked into the solenoids.

WARNING!

Ensure that area above and adjacent to rollover bars remains clear and unobstructed at all times.

CAUTION!

- ♦ ***It is not possible to close convertible top with rollover bars extended.***

- ♦ ***If a hardtop is mounted, be sure to install the protective rollover bar covers provided with hardtop to prevent damaging rear window in case of deployment.***

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General

A brief description of the principal parts of the electrical system is presented here. Also covered here are basic electrical system troubleshooting tips.

See also ⇒ [121 Battery, Alternator, Starter.](#)

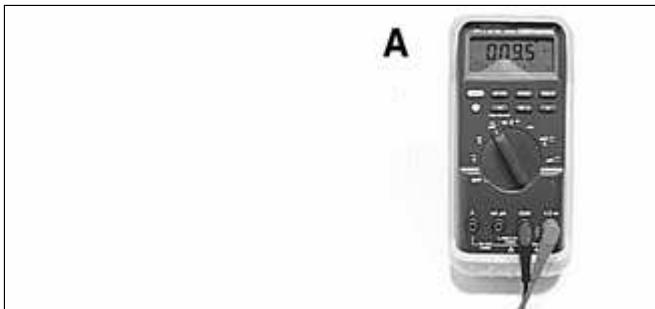
Electrical test equipment

Many electrical tests described in this manual call for measuring voltage, current, or resistance using a digital multimeter. Digital meters are preferred for precise measurements and for electronics work because they are generally more accurate than analog meters. An analog meter (swing-needle) may draw enough current to damage sensitive electronic components.

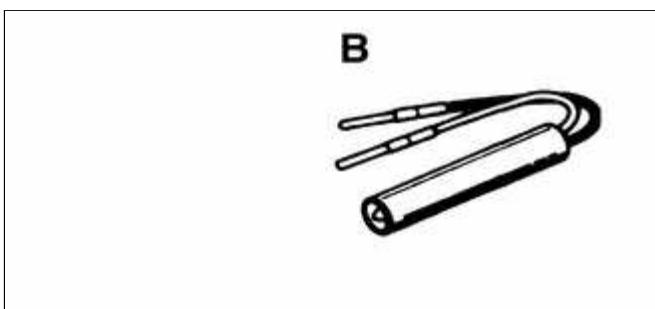
An LED test light is a safe, inexpensive tool that can be used to perform many simple electrical tests that would otherwise require a digital multimeter. The LED indicates when voltage is present between any two test-points in a circuit.

The integrated safety, comfort, security and handling systems on E46 cars are designed with self-diagnostic capabilities. The quickest way to diagnose many problems is to start out with a scan tool read out of Diagnostic Trouble Codes (DTCs). See ⇒ [OBD On Board Diagnostics](#) at rear of manual.

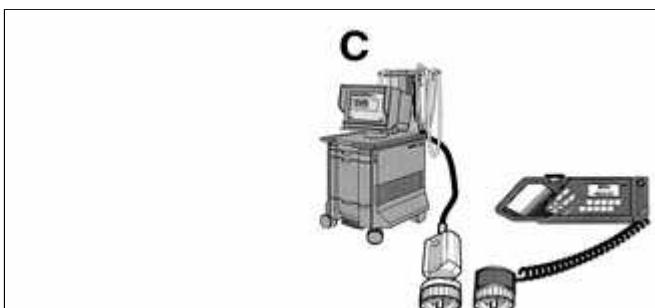
Special Tools

**A**

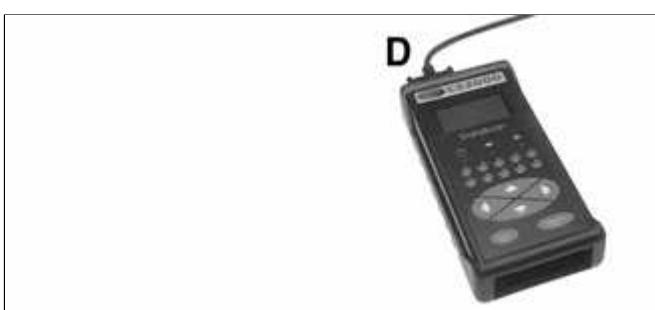
◀ Automotive digital multimeter Fluke 87

**B**

◀ LED tester with thin spade probes
Baum 1115 (Source: Baum Tools Unlimited)

**C**

◀ Scan tools BMW DIS/MoDiC

**D**

◀ Aftermarket scan tool Baum CS2000
(Source: Baum Tools Unlimited)

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E46 Electrical System

E46 cars are electrically complex. Many vehicle systems and subsystems are interconnected or integrated. In addition, the requirements of second generation On-Board Diagnostics (OBD II) are such that there are now many more circuits and wires in the vehicle than ever before. The components must exchange large volumes of data with one another in order to perform their various functions.

The use of dedicated data lines for each link in the system has reached the limits of its capabilities. On the one hand, wiring harnesses now must be so complex that they become unmanageable. In addition, the finite number of pins on conventional connectors becomes a limiting factor in electronic control module development.

The solution has been found in the use of specialized, vehicle compatible serial bus systems. The E46 bus system is summarized in => [Table a.](#)

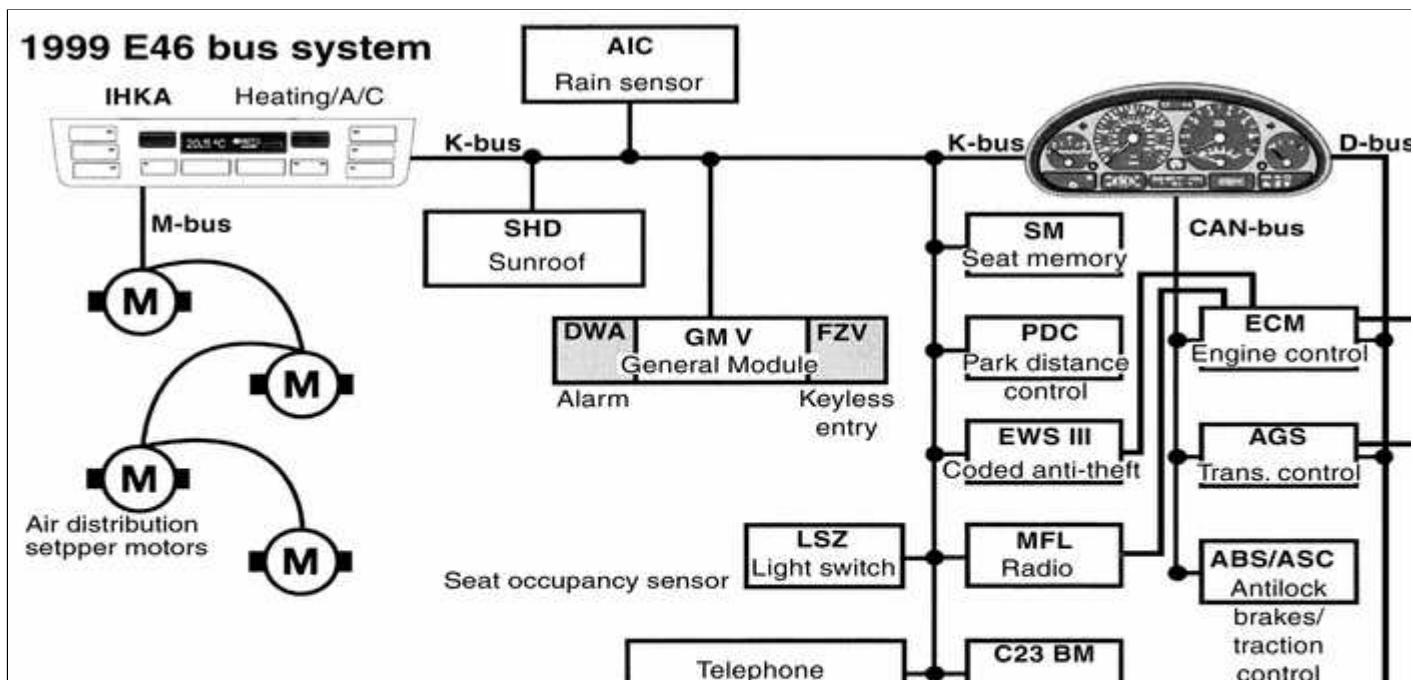
Table a. E46 busses

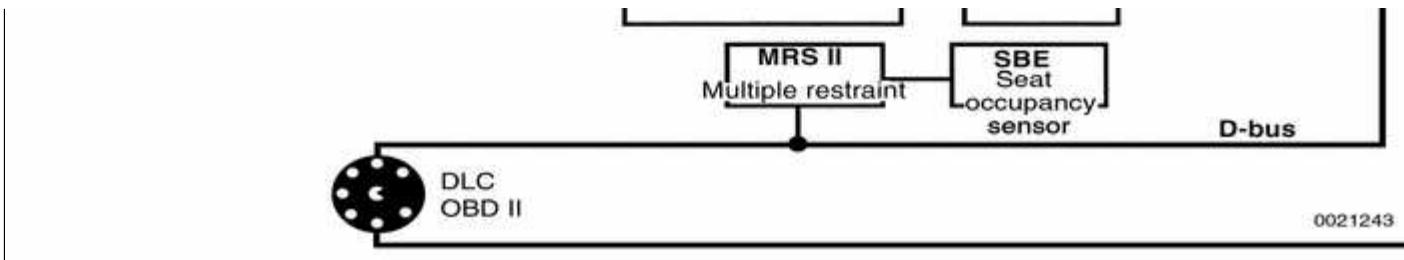
| Bus | Circuits covered |
|-------|--|
| K-bus | Driver information systems (instrument cluster, Check Control, on-board computer) Central Body Electronics (ZKE V) General Module (GM V) Seat memory (SM) Sunroof (SHD) Rain sensor (AIC) Telephone and sound system Headlight module (LSZ) |

Table a. E46 busses

| Bus | Circuits covered |
|---------|--|
| | Coded anti-theft (EWS III) and anti-theft (DWA) Remote entry (FZV) Park distance control (PDC) |
| M-bus | Heating and air conditioning (IHKA) components |
| CAN-bus | Engine management system (DME) Transmission control (AGS) Antilock brakes (ABS) Traction control (ASC) Dynamic stability control (DSC) |
| D-bus | Data link connector (DLC) OBD II connector Multiple restraint system (MRS II) |

1999 E46 bus system, diagram





Voltage and polarity

The vehicle electrical system is a 12-volt direct current (DC) negative-ground system. A voltage regulator controls system voltage at approximately 12-volts. All circuits are grounded by direct or indirect connection to the negative (-) terminal of the battery. A number of ground connections throughout the car connect the wiring harness to chassis ground. These circuits are completed by the battery cable or ground strap between the body and the battery negative (-) terminal.

Wiring, fuses and relays

Electrical components connect using one of the following:

- ◆ Heavy cables with lug-type connectors (battery and starter)
- ◆ Electrical harnesses with keyed, push-on connectors that lock into place
- ◆ Busses with modular connectors



With the exception of the starter and the charging system, most electrical power is routed from the ignition switch or the battery through the main relay panel in back of the glove compartment or the



main fuse box (**arrow**) above the glove compartment. Fuses are color coded to indicate current capacities.

The relays and control modules are mounted in various places throughout the vehicle. See ⇒ [610 Electrical Component Locations](#).

Central Body Electronics (ZKE V)

E46 vehicles are equipped with an integrated complex of electronic modules connected mostly via K-bus. This system, called ZKE V, is primarily controlled by the General Module (GM V).

These functions are controlled directly by the GM V:

- ◆ Windshield wiper/washer system, with optional Rain Sensor Interface. See ⇒ [611 Wipers and Washers](#).
- ◆ Central locking, power trunk release, keyless entry (FZV). See ⇒ [515 Central Locking and Anti-theft](#).
- ◆ Power window control. See ⇒ [512 Door Windows](#).
- ◆ Car Memory/Key Memory. See ⇒ [515 Central Locking and Anti-theft](#).
- ◆ Interior lighting. See ⇒ [612 Switches](#).
- ◆ Alarm system (DWA). See ⇒ [515 Central Locking and Anti-theft](#).
- ◆ Electronic consumer sleep mode, described later in this section

Other functions are not directly controlled by the GM V but interconnected:

- ◆ Rain sensor (AIC). See ⇒ [611 Wipers and Washers](#).
- ◆ Sunroof operation (SHD). See ⇒ [540 Sunroof](#).
- ◆ Seat memory (SM) and electrical operation. See ⇒ [520 Seats](#).
- ◆ Outside rear-view mirror control and heating. See ⇒ [510 Exterior Trim, Bumpers](#).
- ◆ Windshield washer jet heating. See ⇒ [611 Wipers and Washers](#).

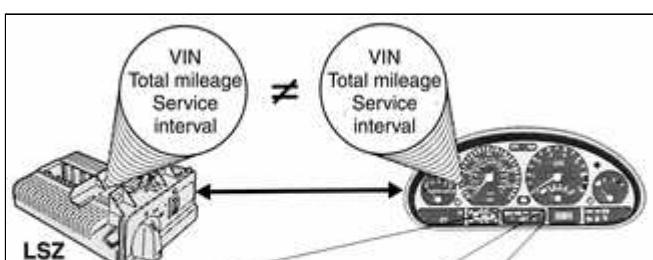
Redundant data storage

The following vehicle information is stored redundantly in the instrument cluster and the light switch module:

- ◆ Vehicle identification number (VIN)
- ◆ Total mileage
- ◆ Service interval data

This redundancy means that the instrument cluster or light module may be replaced without loss of stored data.

- ◀ The data between the two units is compared each time the ignition is switched on (KL 15 on). If the data does not match the tamper warning dot (**arrow**) in the mileage display will be illuminated. Under certain circumstances





a fault code (DTC) will be set.

Resetting and resynchronizing of codes and data requires the use of BMW scan tools DIS or MoDiC.

Car Memory/Key Memory

A number of features and functions can be customized to the driver(s) preference. The identity of the vehicle user is provided by a signal from the keyless entry system (FZV).

Car Memory and Key Memory are actually two separate functions, although they are marketed as a combined feature. See ⇒ [515 Central Locking and Anti-theft](#) for further details.

Electrical consumer sleep mode

Central body electronics (ZKE V) is designed to bring the vehicle electrical consumers into "sleep mode" after 16 minutes of inactivity.

In order to test sleep mode:

- ◆ Switch ignition off.
- ◆ Close all doors, trunk and hood.
- ◆ Lock vehicle using central locking.
- ◆ Wait 16 minutes.

If one of a number of inputs into the General Module (GM V) is activated before the vehicle is in sleep mode, the 16 minute cycle starts again. Once the vehicle is in sleep mode, the GM V will "wake up" if it receives a change of signal from one of the following sensors:

- ◆ K-bus
- ◆ Door jamb sensors
- ◆ Trunk lid lock cylinder microswitch
- ◆ Interior trunk lid release push-button microswitch
- ◆ Central locking button
- ◆ Engine hood latch microswitch
- ◆ Trunk key position switch
- ◆ Interior light switch
- ◆ Internal motion sensor
- ◆ Tilt sensor
- ◆ Driver's door lock sensors

Note:

If an interior light is accidentally left on, the GM V will override the signal from it after 16 minutes and implement sleep mode.

Electrical system safety precautions

Please read the warnings and cautions in this section before doing any work on your electrical system.

WARNING!

- ◆ *An airbag unit houses an explosive powerful charge. Making repairs without the proper knowledge and special test equipment may cause serious personal injury. See ⇒ [721 Airbag System \(SRS\)](#).*
- ◆ *The ignition system of the car operates at lethal voltages. People with pacemakers or weak hearts should not expose themselves to the ignition system electric currents. Extra caution must be taken when working on the ignition system or when servicing the engine while it is running or the key is on. See ⇒ [120 Ignition System for additional ignition system warnings and cautions.](#)*
- ◆ *Keep hands, clothing and other objects clear of the electric radiator cooling fan when working on a warm engine. The fan may start at any time, even when the ignition is switched off.*

CAUTION!

- ◆ *Always turn off the engine and disconnect the negative (-) cable from the battery before removing any electrical components. Disconnecting the battery may erase fault code(s) stored in control module memory. Check for fault codes using special BMW diagnostic equipment.*
- ◆ *Prior to disconnecting the battery, read the battery disconnection cautions given at*

the front of this manual on page viii.

- ◆ *Connect and disconnect ignition system wires, multiple connectors and ignition test equipment leads only while the ignition is off.*
- ◆ *Do not disconnect the battery with the engine running.*
- ◆ *Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.*
- ◆ *Do not use an analog meter. Use only a digital multimeter.*
- ◆ *Many of the solid-state modules are static sensitive. Static discharge will permanently damage them. Always handle the modules using proper static prevention equipment and techniques.*
- ◆ *To avoid damaging harness connectors or relay panel sockets, use jumper wires with flat-blade connectors that are the same size as the connector or relay terminals.*
- ◆ *Always switch a digital multimeter to the appropriate function and range before making test connections.*

- ◆ *Do not try to start the engine of a car which has been heated above 176F/80C, (for example, in a paint drying booth). Allow it to cool to normal temperature.*
- ◆ *Disconnect the battery before doing any electric welding on the car.*
- ◆ *Do not wash the engine while it is running, or anytime the ignition is switched on.*
- ◆ *Choose test equipment carefully. Use a digital multimeter with at least 10 megaohm input impedance, or an LED test light. An analog meter (swing-needle) or a test light with a normal incandescent bulb may draw enough current to damage sensitive electronic components.*
- ◆ *An ohmmeter must not be used to measure resistance on solid state components such as control units or time delay relays.*
- ◆ *Always disconnect the battery before making resistance (ohm) measurements on the circuit.*

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Wiring Diagrams

The wiring diagrams shown in Electrical Wiring Diagrams have been specially designed to enable quick and efficient diagnosis and troubleshooting of electrical malfunctions.

Wiring codes and abbreviations

A lot of information is included in each wiring diagram if you know how to read them. Wire colors in the diagrams are abbreviated. Combined color codes indicate a multi-colored wire. For example the code BLU/RED indicates a blue wire with a red stripe.

Many electrical components, connectors, fuses, and ground locations are identified using a unique number. Each of these numbers corresponds to a particular part in the circuit commonly found in Electrical Wiring Diagrams.

Note:

Sometimes the color of an installed wire may be different than the one on the wiring diagram. Don't be concerned. Just be sure to confirm that the wire connects to the proper terminals.

Table b. Wire color codes

| German code | English code | Color |
|-------------|--------------|-------|
| SW | BLK | Black |
| BL | BLU | Blue |
| BR | BRN | Brown |
| GN | GRN | Green |

Table b. Wire color codes

| German code | English code | Color |
|--------------------|---------------------|--------------|
| GR | GRY | Grey |
| | ORG | Orange |
| RT | RED | Red |
| VI | VIO | Violet |
| WS | WHT | White |
| GE | YEL | Yellow |

Most terminals are identified by numbers on components and harness connectors. Terminal numbers for major electrical connections are shown in the diagrams. Though many terminal numbers appear only once, several other numbers appear in numerous places throughout the electrical system and identify certain types of circuits. Some common circuit numbers are listed below in ⇒ [Table c.](#)

Table c. Terminal and circuit numbers

| Number | Circuit description |
|---------------|---|
| 1 | Low voltage switched terminal of coil |
| 4 | High voltage center terminal of coil |
| +X | Originates at ignition switch. Supplies power when the ignition switch is in the PARK, RUN, or START position |
| 15 | Originates at ignition switch. Supplies power when ignition switch is in RUN or START position |