



## Self-study Programme 379

# The Eos 2006 Electrical system

Design and function



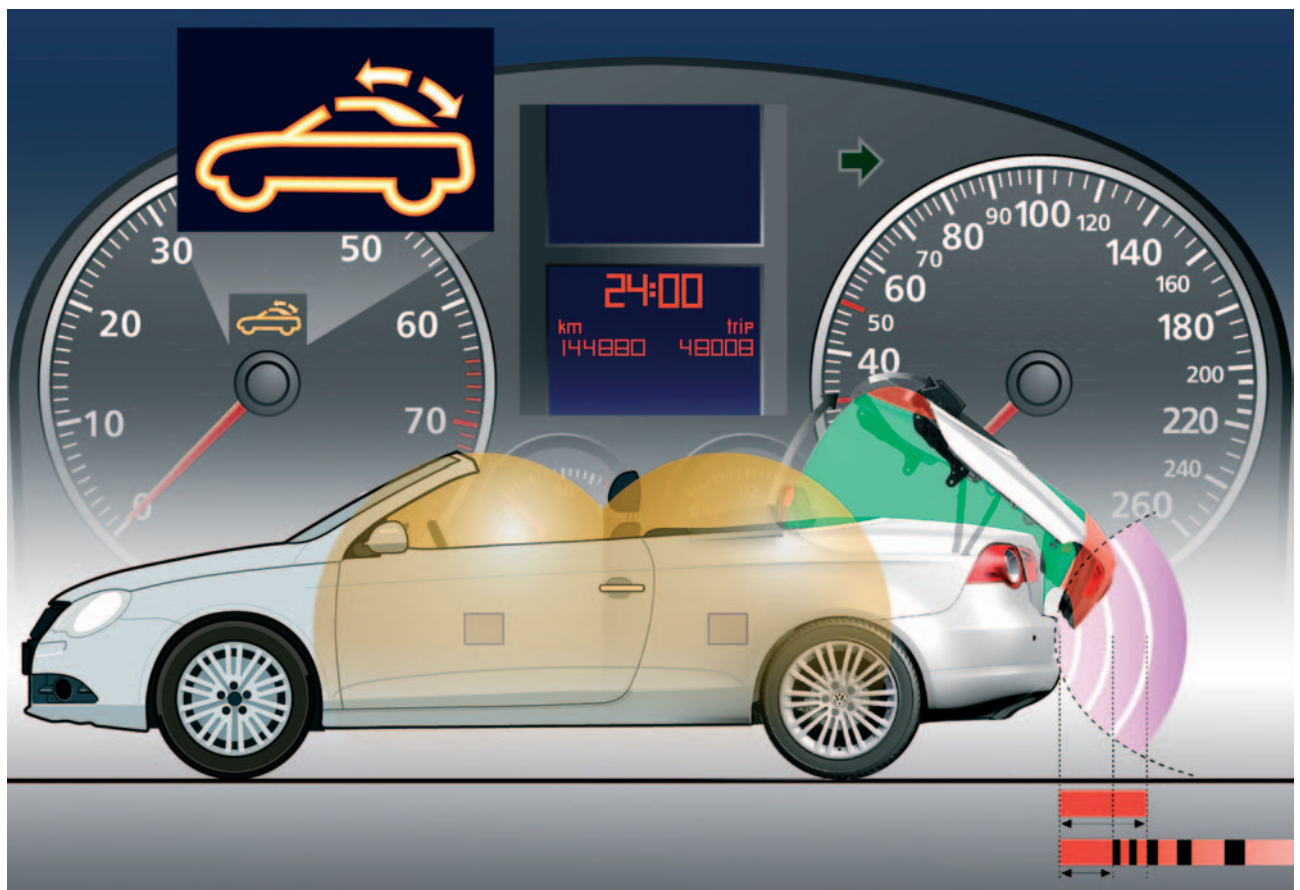
The Volkswagen Eos takes a pioneering approach to convertible roof technology.

Besides the actual convertible roof control system, this also affects some of the vehicle's other electronic systems, such as e.g. the window convenience control system, the interior monitoring system or the parking aid function.

As a supplement to self-study programme 335 "The Eos 2006", we would like to focus on the function of the convertible roof control system and the electrical system in the Eos in this issue.



Please also note self-study programme SSP355 "The Eos 2006" under all circumstances. Only by reading both programmes will you be able to obtain an overview of the complex roof structure and its function.



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**NEW**



**Important Note**



**The self-study programme shows the design and function of new developments.  
The contents will not be updated.**

For current testing, adjustment and repair instructions, refer to the relevant service literature.



<b>Introduction</b> .....	<b>4</b>
<b>The vehicle electrical system</b> .....	<b>6</b>
The structure of the vehicle electrical system .....	6
Voltage supply .....	8
<b>Data bus networking</b> .....	<b>10</b>
The vehicle electrical system in the CAN data bus .....	10
<b>Convenience electronics</b> .....	<b>12</b>
Electrohydraulic convertible roof actuation .....	12
Electric easy entry seats .....	58
Interior monitoring system .....	59
<b>Radio and navigation</b> .....	<b>62</b>
The aerial concept .....	62
<b>Service</b> .....	<b>64</b>
Emergency operation strategies .....	64
<b>Test yourself</b> .....	<b>65</b>





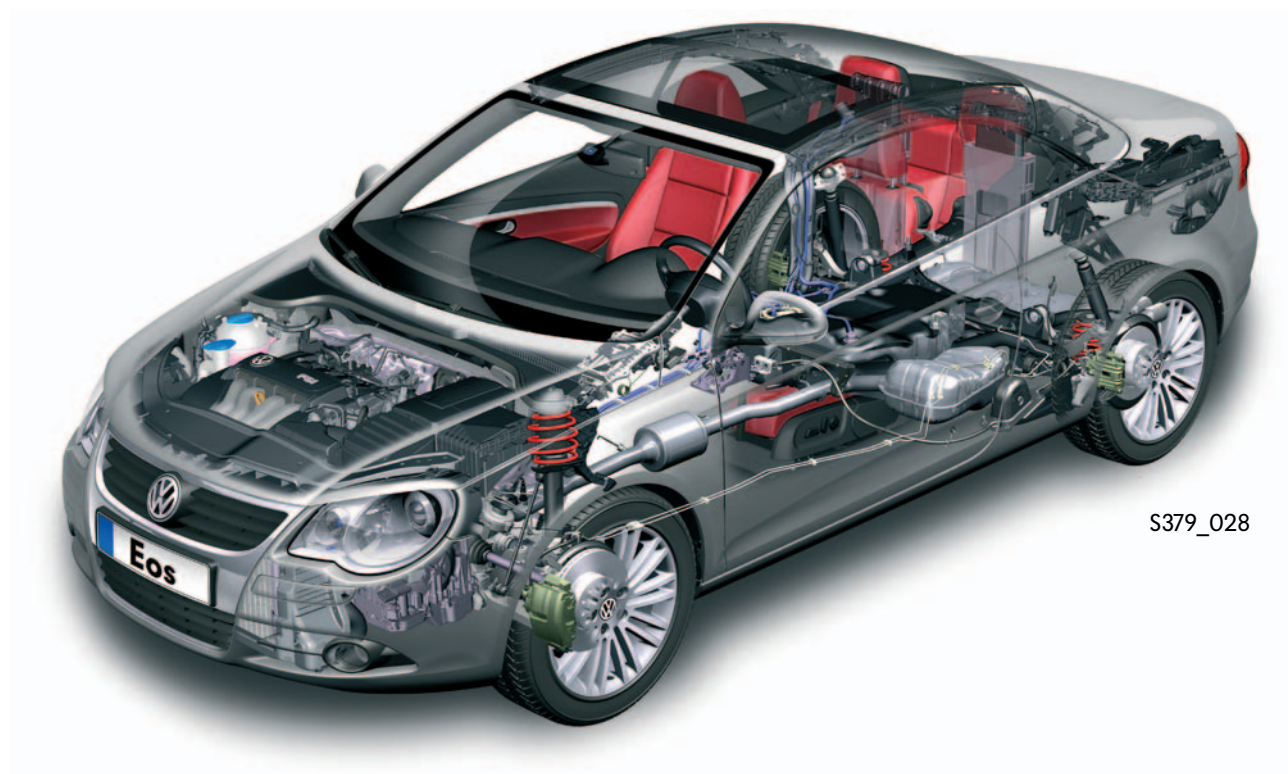
# Introduction



Modern motor vehicles are characterised by a multitude of electrical and electronic systems, which regulate the vehicle's operation, increase vehicle safety and driving comfort and support the driver in driving the vehicle.

Interaction between these systems can only function if they respond to each other. For example, the ABS and ESP control unit must be able to instruct the engine control unit to reduce the engine's output if this is made necessary by a corresponding driving situation. Today, this information is extensively exchanged in digital form via fast data bus systems. As a result of this high technical standard, it is becoming increasingly important to update the vehicle systems' software via on-line workshop links and to ensure that this is kept up-to-date.

In view of this, the Eos, the most recent development in the convertible range, also reveals a multitude of vehicle systems which exchange information, as part of controlling the convertible roof, to ensure safe and flawless convertible roof operation. In the Eos, the new immobilizer IV is one of those systems which requires an on-line workshop link to download data to adapt the system.



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In terms of its electrical system, the Eos offers the following special features, some of which originate from the vehicle's conception as a coupé convertible:



- **Convertible roof control system**

This contains the hydraulic and electric drive, the convertible roof sensor system and communication with other vehicle systems via CAN data bus.

- **Interior monitoring system**

Modern microwave technology guarantees protection against theft even when the convertible roof is open.

- **Immobilizer**

The Eos is equipped with the immobilizer IV with download function. An on-line link is the prerequisite for adapting this.

In contrast to the Passat 2006, in which the system was fitted for the first time, the immobilizer IV is not equipped with an electric steering column lock.

- **Climate control system**

This gives consideration to the influence of ambient conditions when the convertible roof is open.

- **The aerial concept**

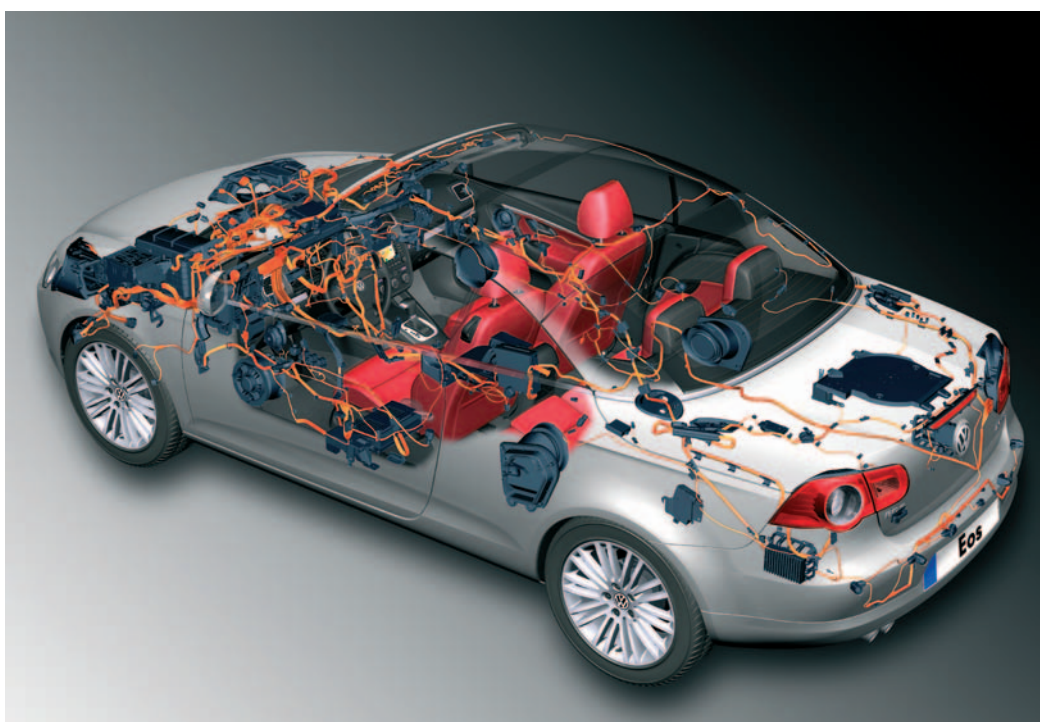
Thanks to a new installation concept in the rear lid, exterior and window aerials are no longer necessary.

- **Rear lid assist**

An extended Park Distance Control function ensures that the space required behind the vehicle for the convertible roof's action is available.

- **Electric easy entry function**

Comfortable entry and exiting to and from the rear seats thanks to an electric seat adjustment system.



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# The vehicle electrical system

## The structure of the vehicle electrical system

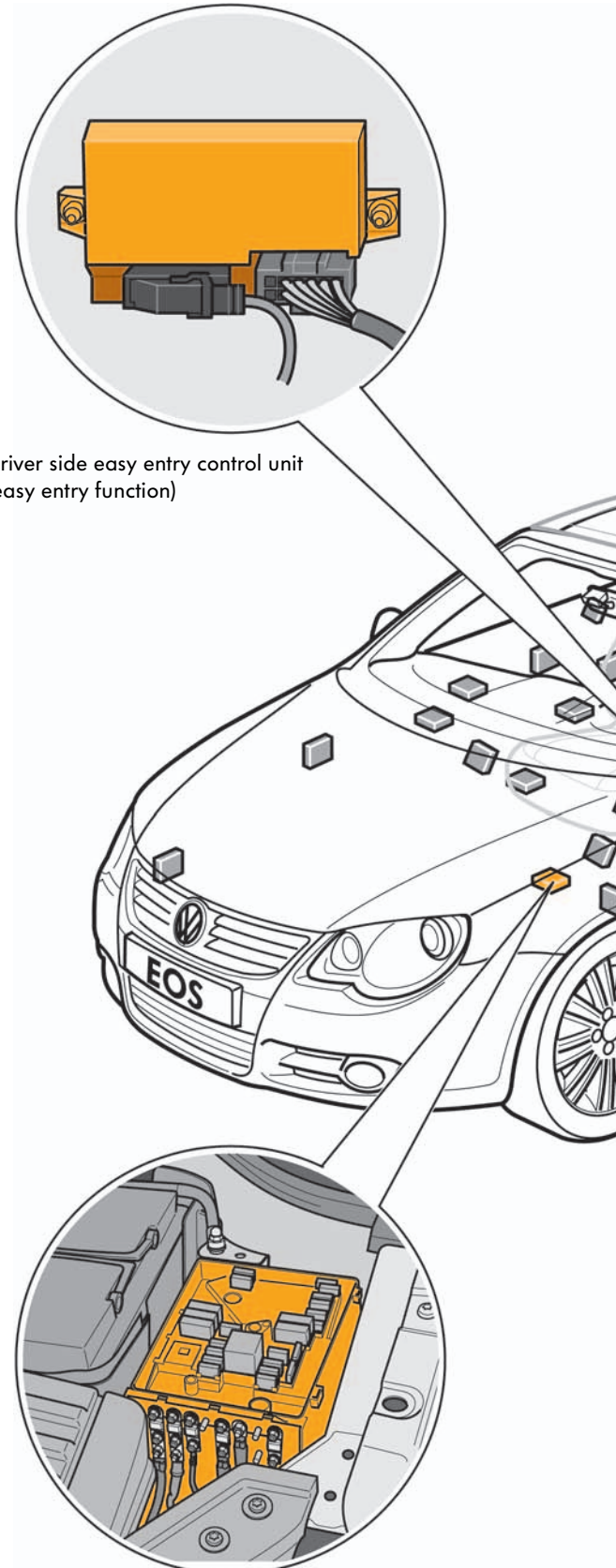
### Installation locations of the electrical components

To implement the electrical functions, it was necessary to completely redesign certain control units and to accordingly adapt other control units originating from the Golf platform.

The vehicle electrical system's central component is the vehicle electrical system control unit. In the Eos, this is located beneath the dash panel on the driver's side. The electronics box in the engine compartment contains the main fuse holder and a relay carrier. Further relays are located on the vehicle electrical system control unit and the relay carrier on the vehicle electrical system control unit bracket. The thermo-fuse for the externally guided sliding roof is also located there.

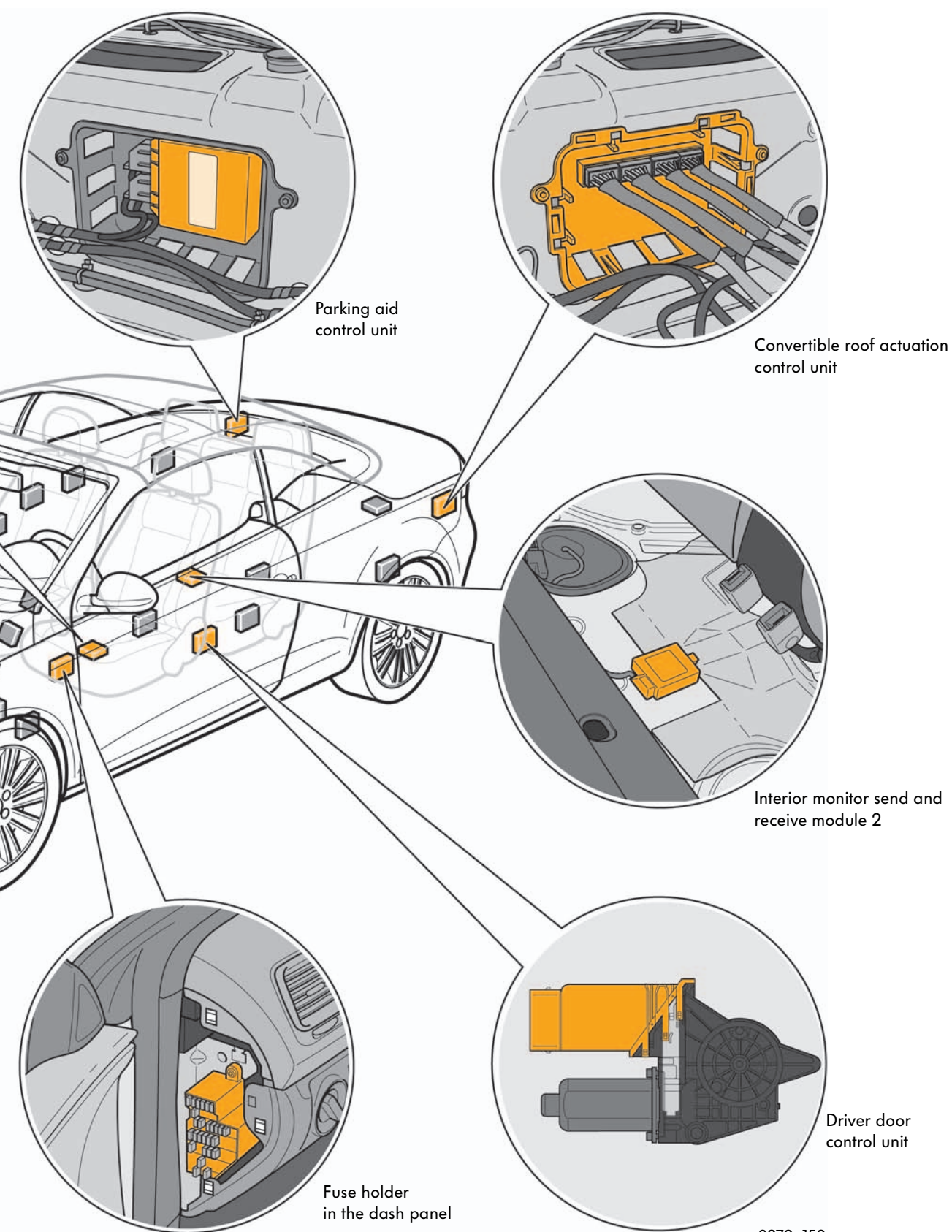
A further fuse holder is located at the left-hand side of the dash panel. The convertible roof actuation system fuses are located together on the main fuse holder in the electronics box.

Due to the vehicle-specific spatial conditions, the Eos is equipped with two 6V batteries instead of one 12V battery if the 6-cylinder engine is installed.



Electronics box with relay carrier and fuse holder





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# The vehicle electrical system

## Voltage supply

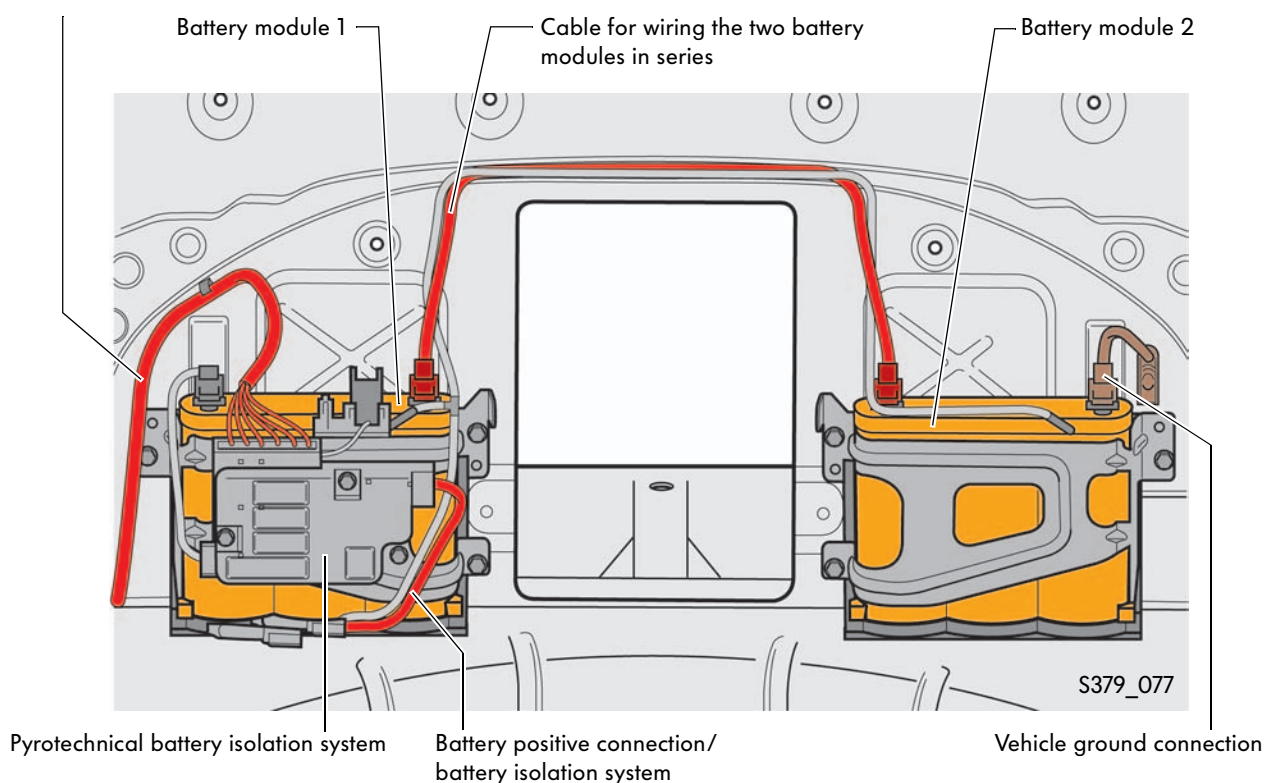
Due to reasons of space depending on which engine is fitted, the Eos is equipped with two 6V absorbent mat batteries instead of the conventional 12V battery in the engine compartment. These are installed behind the rear seat backrest on the left and right-hand sides of the vehicle and wired in series via a connecting cable with degassing pipe. This battery concept is used if engines requiring large amounts of space, e.g. the V6 engine, are fitted in the Eos.



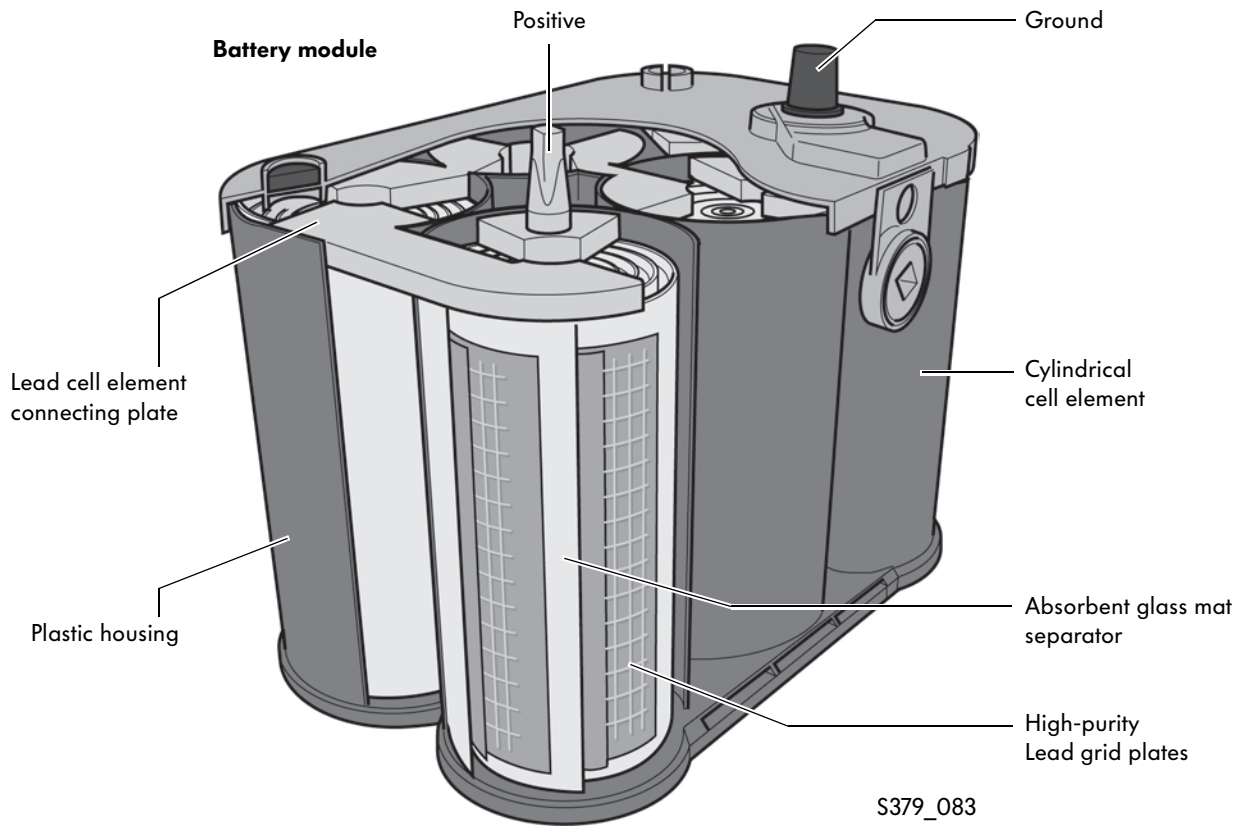
The following points must be observed under all circumstances in the event of repair and servicing:

- When charging, checking or renewing, both 6V batteries must be treated as one 12V unit.
- Only charge the modules to a maximum of 14.4V with voltage limitation.
- Never charge or renew a 6V module individually.
- 6V modules must always be evenly loaded. Never connect a consumer to just one module.
- On disconnection, always loosen the body-side negative terminal first, as there is otherwise a risk of one 6V module's short-circuiting due to ground contact.

Vehicle electrical system positive connection







### Absorbent mat batteries

The structure of absorbent mat batteries differs significantly from that of conventional vehicle batteries.

Significant features of absorbent mat batteries include:

- The rolled, cylindrical structure of the positive and negative lead grid plates together with an absorbent glass mat separator to form a cell element results in a very compact battery module design with a simultaneous increase in output.
- The compact, pressed cell connection results in increased vibration resistance and therefore a longer service life.
- The battery acid is bound in the absorbent glass mat separator. The battery is therefore leak-proof.
- The absorbent mat battery has a higher cold-starting output than conventional vehicle batteries.
- The battery modules are maintenance-free.



When handling the 6V absorbent mat batteries in the Eos, note the information in the corresponding workshop manuals under all circumstances.

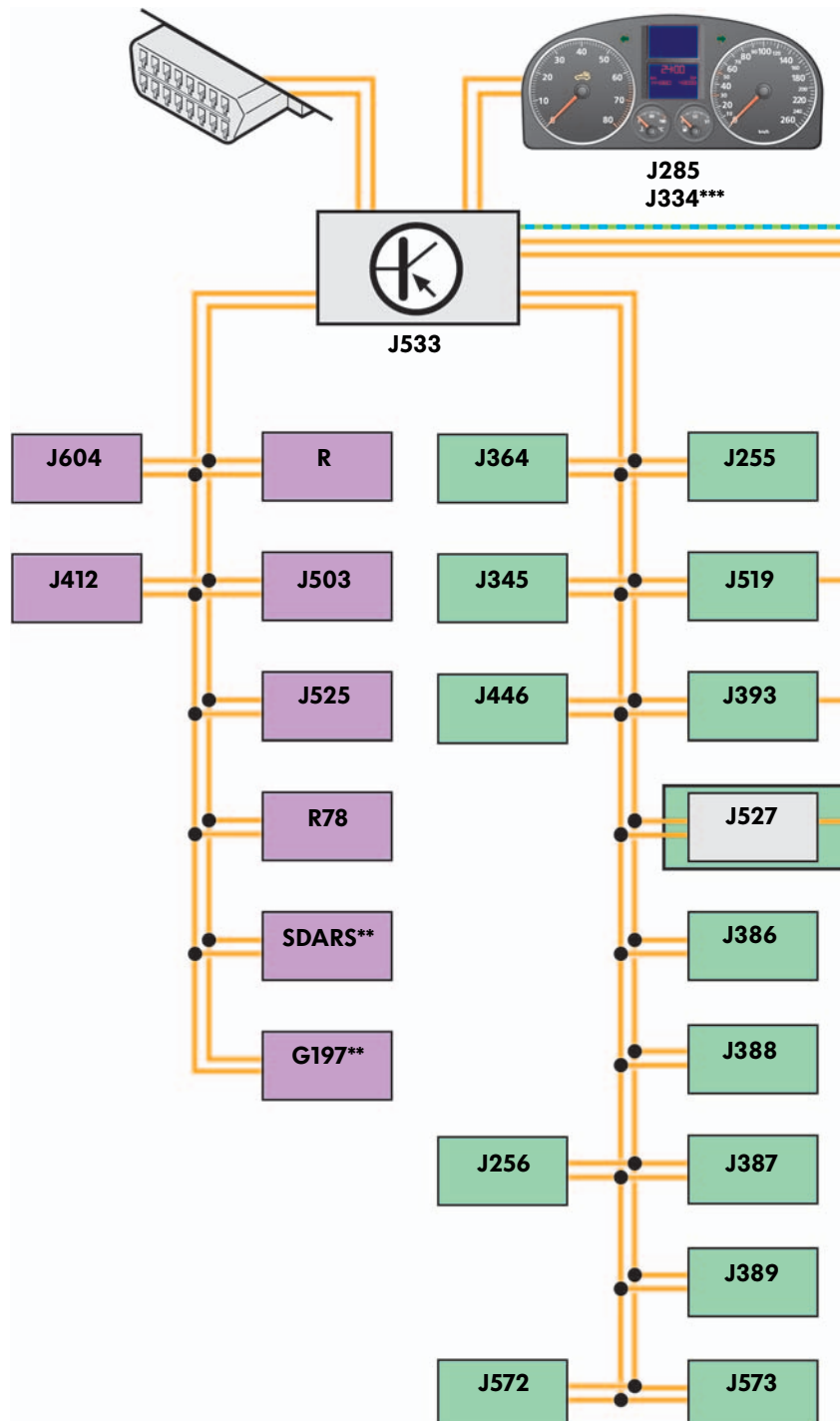
# Data bus networking

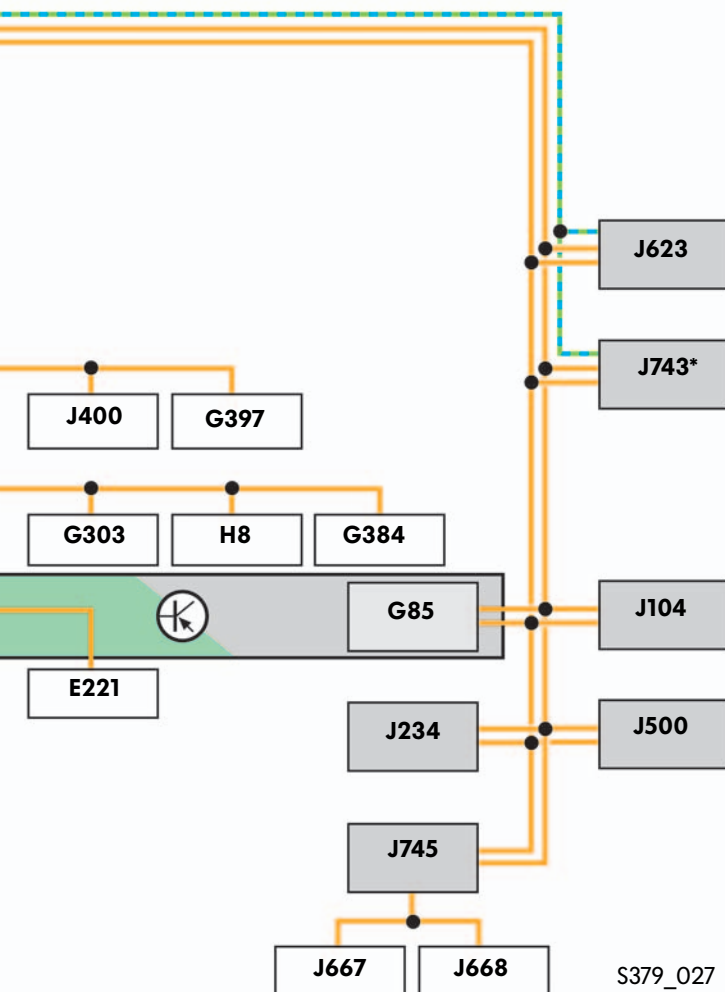
## The vehicle electrical system in the CAN data bus

The block diagram shows you which control units in the vehicle electrical system communicate with each other via the CAN or LIN data bus, in order to implement the different vehicle systems.

The schematic which is shown is merely an example, as the precise number of control units in the CAN data bus systems is dependent on the vehicle's equipment. An example of this is the different sound packages or the vehicle's being equipped with a direct shift gearbox or a manual gearbox.

As will be described in detail at a later point, communication via the CAN data bus is also vital to actuation of the convertible roof. To obtain approval to open and close the roof, diverse pieces of information have to be exchanged between different vehicle systems, in order to guarantee maximum possible safety and functionality.





### Legend

E221	Operating unit in steering wheel
G85	Steering angle sender
G197	Magnetic field sender for compass **
G303	Interior monitor send and receive module 1
G384	Vehicle inclination sender
G397	Rain and light sensor
H8	Anti-theft alarm system horn
J104	ABS control unit
J234	Airbag control unit
J255	Climatronic control unit
J256	Convertible roof actuation control unit
J285	Control unit with display in dash panel insert
J334	Immobilizer control unit ***
J345	Trailer detector control unit
J364	Auxiliary heater control unit
J386	Driver door control unit
J387	Front passenger door control unit
J388	Rear left door control unit
J389	Rear right door control unit
J393	Convenience system central control unit
J400	Wiper motor control unit
J412	Mobile telephone operating electronics control unit
J446	Parking aid control unit
J500	Power steering control unit
J503	Control unit with display for radio and navigation
J519	Onboard supply control unit
J533	Data bus diagnostic interface
J525	Digital sound package control unit
J527	Steering column electronics control unit
J572	Driver side easy entry control unit
J573	Front passenger side easy entry control unit
J604	Auxiliary air heater control unit
J623	Engine control unit
J667	Power output module for left headlight
J668	Power output module for right headlight
J743	Mechatronic unit for direct shift gearbox *
J745	Cornering light and headlight range control unit
R	Radio
R78	TV tuner

SDARS = **S**atellite **D**igital **A**udio **R**adio **S**ervices\*\*  
(digital audio satellite reception system)

\* With direct shift gearbox only

\*\* North America only

\*\*\* Immobilizer IV with download  
(without electric steering column lock in the Eos)





## Electrohydraulic convertible roof actuation

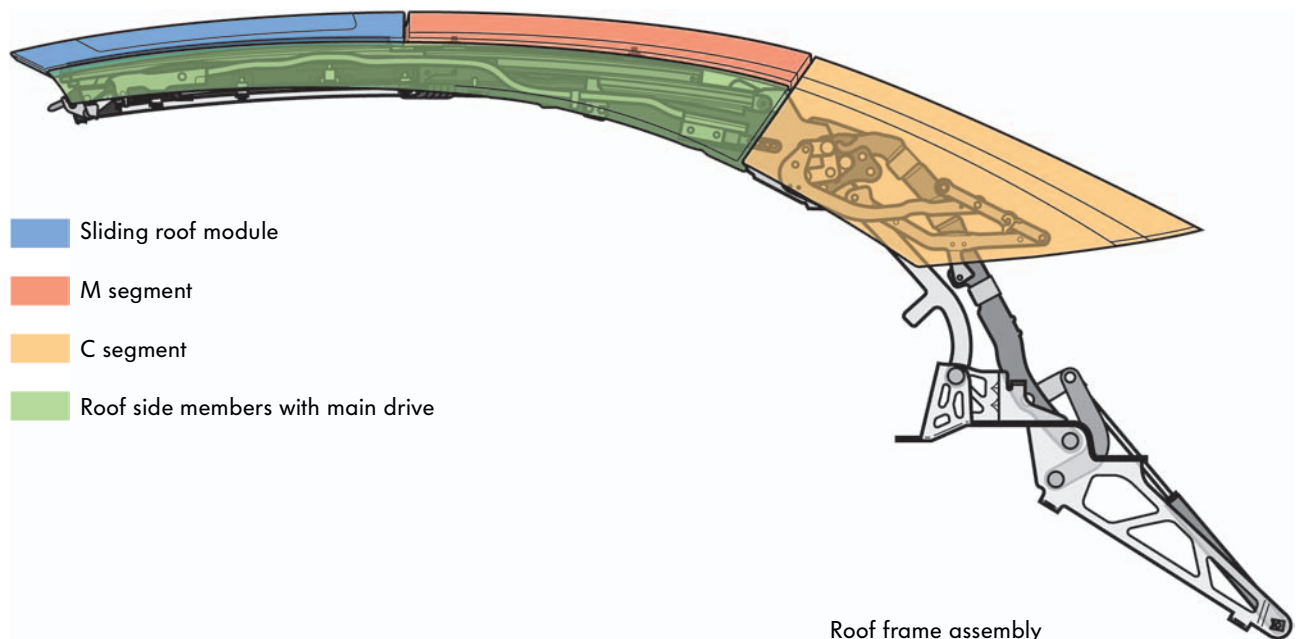
### CSC convertible roof structure

CSC convertible roof means **C**oupé **S**liding and **C**onvertible roof.

It is divided into five assemblies, which are moved independently of each other during convertible roof actuation:

- The sliding roof module
  - The middle segment (M segment) with the sliding roof module's electric drive
  - The C segment with the rear window
  - The roof side members with the main drive.
- On each side of the vehicle, these are comprised of the main hinge, two hydraulic cylinders, the roof side member including its trim panels and the necessary mechanical actuations and locks.

Apart from the sliding roof module, all of the assemblies are moved with the aid of hydraulic cylinders. The operating pressure required for this is supplied by an electric hydraulic pump. The sliding roof module is driven by an electric motor, which is installed in the middle segment.



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## Rear lid structure

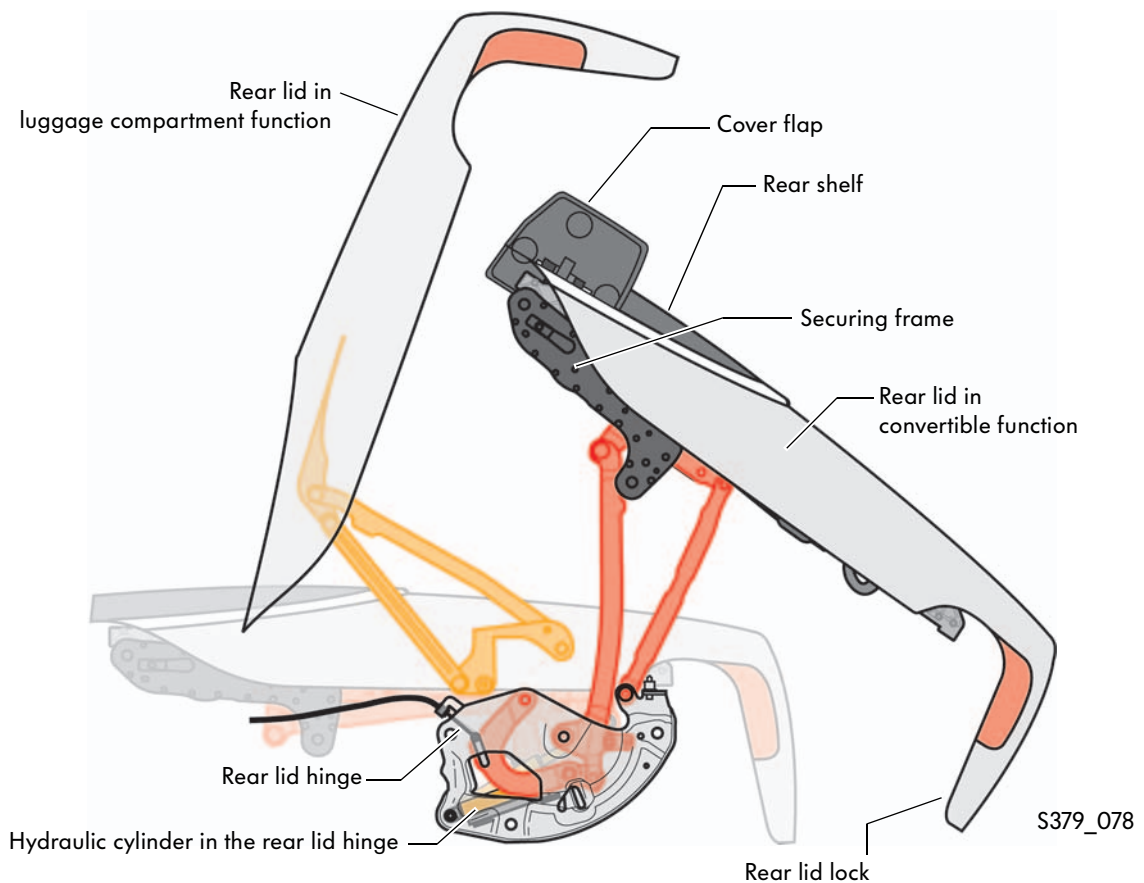
The rear lid is comprised of the two securing frames, the rear lid hinges, the rear shelf with cover flaps, the rear lid lock and the rear lid.

To open the luggage compartment to accommodate the roof package, the rear lid's movement is linked closely to the roof segments' movement sequence.

Two hydraulic cylinders on each side of the vehicle also undertake the necessary functions on actuation of the rear lid. A pair of cylinders in the rear lid securing frames releases the rear lid from the body

and the C segment and locks the securing frames to the rear lid, so that the rear lid can pivot backwards, before the roof package is placed into the luggage compartment. This pair of cylinders also ensures that the cover flaps on the rear shelf are closed.

The second pair of cylinders is installed in each rear lid hinge. This carries out the rear lid and roof side member flap opening and closing movement.



## Convertible roof control system

### The involved electrical components

To guarantee flawless roof operation, not only do the CSC convertible roof's electronic components have to communicate with and react to each other, but extensive information also has to be exchanged with other control units and electronic components.

For example, the convertible roof control unit has to transmit the command "Lower windows" or "Raise windows" to the door control units. In turn, the door control units inform the convertible roof control unit of the position of the side windows. This is necessary, because the side windows have to be lowered before the roof begins to move so that they do not collide with the moving parts of the convertible roof.

The adjacent schematic shows all of the electronic components and control units which communicate with each other as part of the convertible roof control system.



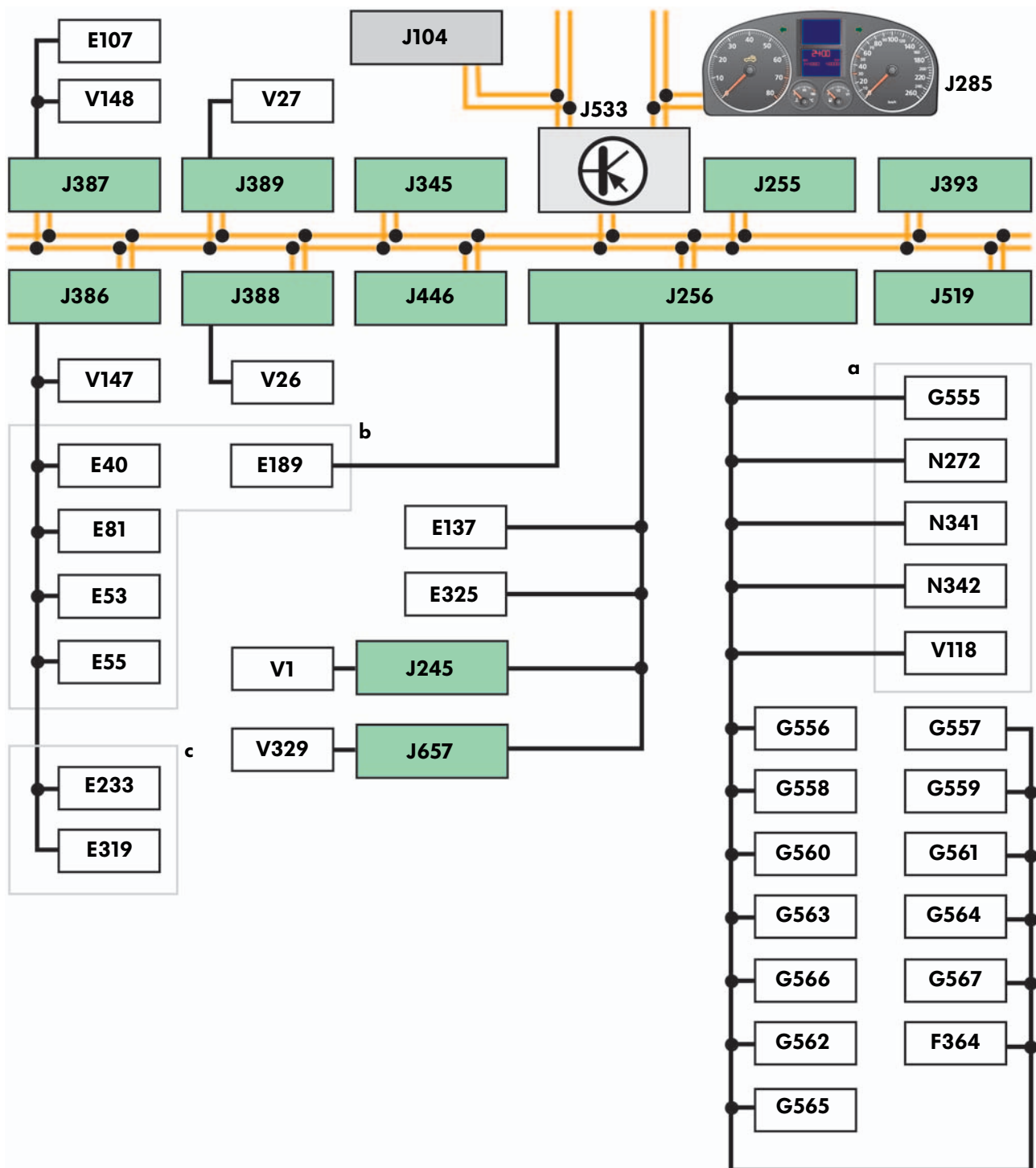
More detailed information on the operating conditions for roof movement can be found in this issue as of page 38.

### Legend

E40 Front left window regulator switch  
E53 Rear left window regulator switch, in driver door  
E55 Rear right window regulator switch, in driver door  
E81 Front right window regulator switch, in driver door  
E107 Window regulator switch in front passenger door  
E137 Convertible roof actuation button  
E189 Central switch for window regulators in driver door  
E233 Rear lid remote release button  
E319 Fuel tank flap release button  
E325 Sunroof button  
F364 Luggage cover contact switch  
G555 Hydraulic pump temperature sender  
G556 Front sender for position of left roof member  
G557 Front sender for position of right roof member  
G558 Sender for left roof member locked  
G559 Sender for right roof member locked  
G560 Left sender for rear window frame locked  
G561 Right sender for rear window frame locked  
G562 Sender for rear window frame open  
G563 Left sender for rear shelf locked  
G564 Right sender for rear shelf locked  
G565 Sender for roof stowed  
G566 Sender for left roof member flap open  
G567 Sender for right roof member flap open  
J104 ABS control unit  
J245 Sliding sunroof adjustment control unit  
J255 Climatronic control unit  
J256 Convertible roof actuation control unit  
J285 Control unit with display in dash panel insert  
J345 Trailer detector control unit  
J386 Driver door control unit  
J387 Front passenger door control unit  
J388 Rear left door control unit  
J389 Rear right door control unit  
J393 Convenience system central control unit  
J446 Parking aid control unit  
J519 Onboard supply control unit  
J533 Data bus diagnostic interface  
J657 Power latching control unit  
N272 Power operated convertible roof valve 1  
N341 Power operated convertible roof valve 2  
N342 Power operated convertible roof valve 3  
V1 Sliding sunroof motor  
V26 Rear left window regulator motor  
V27 Rear right window regulator motor  
V118 Convertible roof actuation hydraulic pump  
V147 Driver side window regulator motor  
V148 Front passenger side window regulator motor  
V329 Power latching motor

a Hydraulic unit  
b+c Driver door control panels





S379\_029



## Controls and displays

### The sliding roof module button

This is integrated into the convertible roof actuation button.

Pressing opens the sliding roof. Pulling closes the sliding roof. Depending on the length of time for which the button is pressed or pulled, movement is carried out either automatically or manually.

If, on opening, the button is held down for less than 0.5 seconds, automatic movement which brings the sliding roof to the ventilation position and ends there is started.

Further actuation of the button for less than 0.5 seconds starts a second automatic movement, which opens the sliding roof fully.

If, when the sliding roof is closed, the button is actuated for longer than 0.5 seconds, manual movement is started. Manual movement continues as long as the button is actuated. After passing the ventilation position, a switch can be made from manual to automatic mode by actuating the button again for less than 0.5 seconds. The sliding roof opens completely.

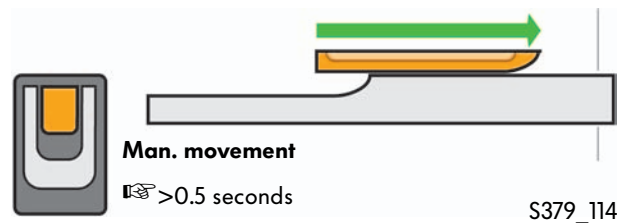
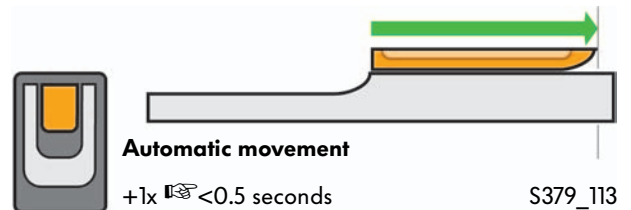
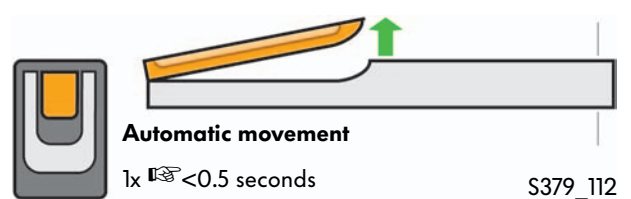
When closing the roof, automatic or manual movement is also possible. In this case, the sliding roof always stops at the ventilation position. Closing it completely is only possible in manual mode.



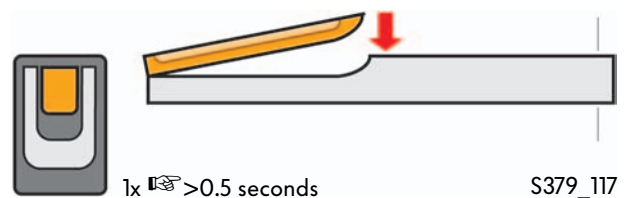
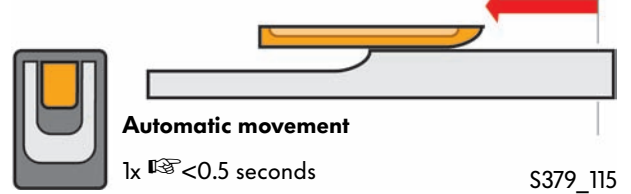
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### Open sliding roof

Ventilation position.



### Close sliding roof



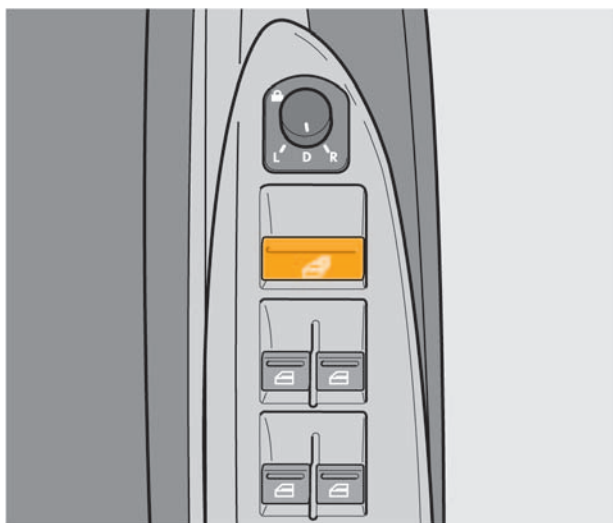


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### Convertible roof actuation button

The convertible roof actuation button can also be actuated in two directions. Pressing and holding opens the convertible roof if the conditions for movement are met. Pulling and holding closes the convertible roof. If the button is released during roof movement, the movement stops.

If the button is not actuated again within max. 8 minutes, only closing is then possible. After max. 9.5 minutes, the convertible roof is lowered automatically in clocked stages, accompanied by a continuous gong, in the direction of the nearest centre of gravity position. This means that, depending on the position which the roof has reached, lowering is carried out in the "opening" or "closing" direction, in accordance with gravity.



S379\_041

### Window regulator actuation

In convertible operation, it will often be the case that all window regulators have to be actuated simultaneously. A central switch for window actuation is therefore necessary. This central switch for window regulators in the driver door E189 is integrated into the window actuation button panel on the driver's side.

Its signal runs directly to the convertible roof actuation control unit, and from there to the individual door control units.

The side windows must be completely lowered so as not to impede or damage the convertible roof modules during their movement sequence.



# Convenience electronics

## Roof status indicator, low-line version



In this variant, communication between the convertible top control system and the driver takes place via an indicator symbol in the dash panel insert and an acoustic signal sender. The symbol lights up during roof movement. The driver is informed that the end position has been reached via a gong and extinguishment of the indicator symbol.

A flashing indicator symbol indicates a system fault in the convertible roof control system, e.g. an incorrectly inserted luggage cover.

During vehicle operation, a flashing symbol with repeated gong indicates that the convertible roof is not fully closed or stowed.



Convertible roof actuation control unit fault messages are only shown on the display when the convertible roof is actuated. The exception to this is a fault in the roof member locked senders. Failure of these is immediately displayed by setting the indicator symbol and with the "System fault – close convertible roof" message, to encourage the driver to check the situation.

## Roof status indicator, mid-line and high-line version



Besides the indicator symbol and the acoustic signal sender, these two equipment variants contain a text field in the dash panel insert, in which the driver is shown information on convertible roof operation. In addition to the illuminated symbol, the message "convertible roof operation" is also shown in the dash panel insert during roof movement. After reaching an end position, the gong is also sounded and the indicator symbol extinguished in this case. Depending on the status of the convertible roof, "convertible roof opened" or "convertible roof closed" is displayed in the text field.

During vehicle operation, a flashing symbol with repeated gong indicates that the convertible roof is not fully closed or stowed.

The following information is shown as notes or fault messages in the display:

### Notes

- Close luggage cover
- Close rear lid
- Obstacle in rear area
- Convertible roof overheating
- Speed too high
- Sliding roof overheating
- Convertible roof open
- Convertible roof closed
- Convertible roof operation
- Continue convertible roof operation

### Fault messages

- Close side windows
  - Close sliding roof
  - Trailer – no convertible roof operation
  - Open rear lock
  - System fault – close convertible roof
  - System fault – open convertible roof
  - System fault - no convertible roof operation
  - Convertible roof defective!
- Operating instructions.


























# Convenience electronics

## Displays on "opening" the roof

To guarantee a high level of safety, roof movement is accompanied, depending on the equipment variant, by optical, acoustic and/or text displays/indications. The acoustic indication is a gong, which is sounded once.



























	Low-line		Mid-line			High-line		
Situation	Indication (Optical/ acoustic)		Indication (Optical/acoustic/text)			Indication (Optical/acoustic/text)		
Open sliding roof and side windows					Convertible roof operation			Convertible roof operation
Open C segment					Convertible roof operation			Convertible roof operation
Open rear lid					Rear lid pivots out!			Rear lid pivots out!
Stow roof package					Convertible roof operation			Convertible roof operation
Close rear lid					Convertible roof operation			Convertible roof operation
End "opening" process					Convertible roof open			Convertible roof open
On interruption of convertible roof movement					Continue convertible roof operation			Continue convertible roof operation

## Displays on "closing" the roof



Note for vehicles in North America.

During convertible roof movement, a gong is sounded several times here. Reaching the relevant end position is indicated via the single gong, as in the other countries.

	Low-line		Mid-line			High-line		
Situation	Indication (Optical/ acoustic)		Indication (Optical/acoustic/text)			Indication (Optical/acoustic/text)		
Open side windows					Convertible roof operation			Convertible roof operation
Open rear lid					Rear lid pivots out!			Rear lid pivots out!
Stow roof package					Convertible roof operation			Convertible roof operation
Close rear lid					Convertible roof operation			Convertible roof operation
Open C segment					Convertible roof operation			Convertible roof operation
Close sliding roof					Convertible roof operation			Convertible roof operation
End "closing" process					Convertible roof closed			Convertible roof closed
On interruption of convertible roof movement					Continue convertible roof operation			Continue convertible roof operation



# Convenience electronics

## Sensors and hydraulic system

The function of the CSC roof involves complex interaction between the roof hydraulics and roof sensors. As described above, the entire roof movement sequence, with the exception of the sliding roof module, is carried out via 8 hydraulic cylinders, which are actuated in pairs by a hydraulic unit. This actuation is carried out via three solenoid valves in the hydraulic unit's valve block.

So that the roof control system can monitor the current positions of all moving assemblies, the roof system is equipped with 12 Hall senders. A microswitch in the luggage compartment registers the correct position of the luggage cover.

A temperature sensor on the hydraulic pump monitors the temperature of the pump drive.

Timeouts, which indicate failure of the roof function due to

- a leak in the hydraulic system,
- mechanical damage,
- blocked movements,
- implausible convertible roof position messages or
- communication faults between the linked control units

are additionally integrated into the roof control electronics.

These timeouts also serve to protect the system, etc., by limiting convertible roof operation following continuous operation or stoppage in an intermediate position for 8 minutes.

### Legend

Hydraulic cylinders:

- 1 In the left main hinge
  - 2 In the left roof side member (C-pillar)
  - 3 In the left rear lid hinge
  - 4 In the left rear lid securing frame
  - 5 In the right main hinge
  - 6 In the right roof side member (C-pillar)
  - 7 In the right rear lid hinge
  - 8 In the right rear lid securing frame
- a Sliding roof module  
b M segment  
c C segment  
d Roof side member  
e Rear lid  
f Side flap

J256 Convertible roof actuation control unit

Hydraulic unit

- G555 Hydraulic pump temperature sender  
N272 Power operated convertible roof valve 1  
N341 Power operated convertible roof valve 2  
N342 Power operated convertible roof valve 3  
V118 Convertible roof actuation hydraulic pump

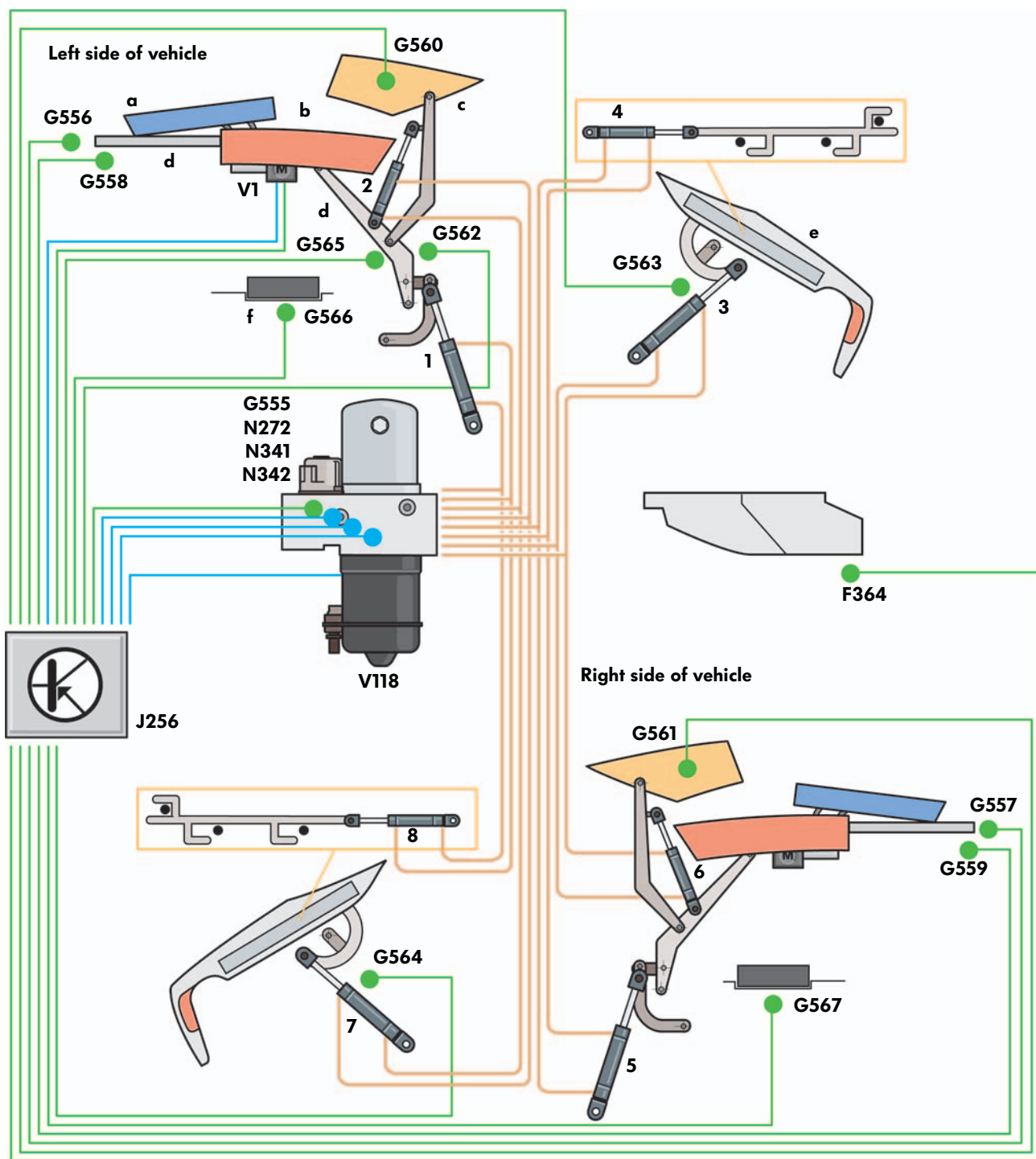
Sensors

- F364 Luggage cover contact switch  
G556 Front sender for position of left roof member  
G557 Front sender for position of right roof member  
G558 Sender for left roof member locked  
G559 Sender for right roof member locked  
G560 Left sender for rear window frame locked  
G561 Right sender for rear window frame locked  
G562 Sender for rear window frame open  
G563 Left sender for rear shelf locked  
G564 Right sender for rear shelf locked  
G565 Sender for roof stowed  
G566 Sender for left roof member flap open  
G567 Sender for right roof member flap open

Sliding roof module

- V1 Sliding sunroof motor





S379\_018



# Convenience electronics

## Convertible roof sensors

The Eos is equipped with an extensive roof sensor system.

The illustration shows the approximate positions of the individual sensors within the overall convertible roof. An initial breakdown of the tasks and installation locations of the sensors is available in the form of an overview in the following tables. More detailed information can be found in the chapter entitled "Electrical components".

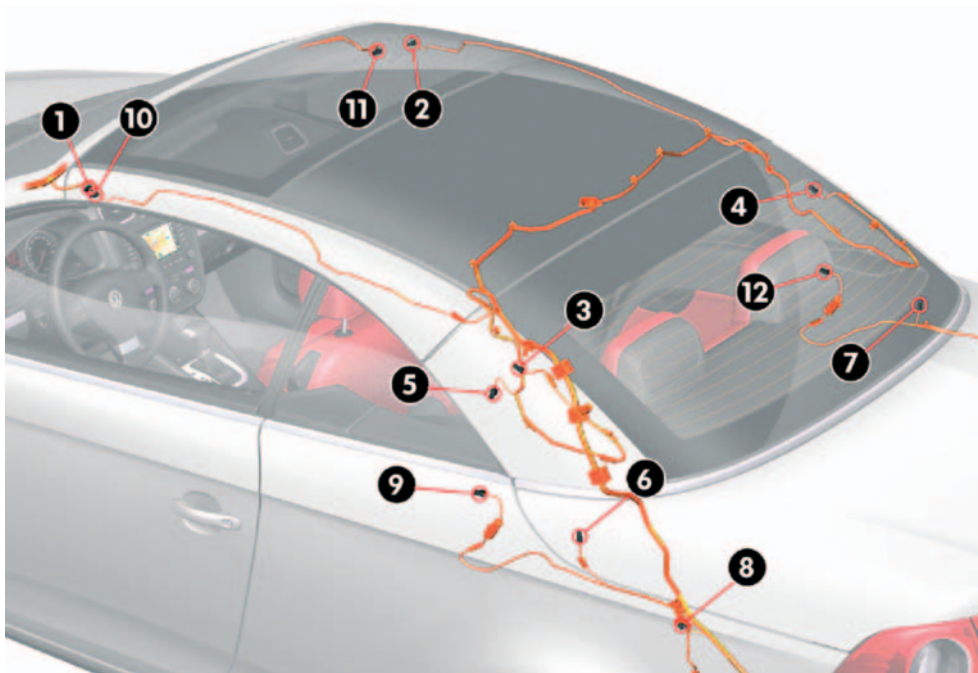
With one exception, the sensors are all Hall senders. Only the sensor which determines whether the luggage cover is in position is a microswitch. This is the luggage cover contact switch F364, located on the left-hand luggage cover mounting.

Three types of Hall sender are fitted:

- Hall elements with integrated reference magnet,
- Hall elements with an external reference magnet and
- Hall elements with two external reference magnets.

These do not register the entire course of a movement, but only one or more end points of the movements of individual components and locks. The convertible roof actuation control unit cannot therefore determine the intermediate position in which a roof segment is located at an arbitrary point in time, only whether it is located in one of the end positions.

To guarantee maximum possible operating safety, the majority of sensors are fitted twice (1 sensor per side of the vehicle). These are also referred to as redundant sensors.



S379\_056



No.	Short designation	Name	Task
1	G556	Front sender for position of left roof member	This indicates that the convertible roof has docked onto the cowl panel on the left-hand side of the vehicle.
2	G557	Front sender for position of right roof member	This indicates that the convertible roof has docked onto the cowl panel on the right-hand side of the vehicle.
3	G560	Left sender for rear window frame locked	This indicates that the C segment is closed on the driver's side and is locked to the M segment.
4	G561	Right sender for rear window frame locked	This indicates that the C segment is closed on the front passenger's side and is locked to the M segment.
5	G562	Sender for rear window frame open	This indicates that the C segment is open.
6	G563	Left sender for rear shelf locked	This indicates that the left-hand rear lid has been released and is locked for the "luggage compartment" function.
7	G564	Right sender for rear shelf locked	This indicates that the right-hand rear lid has been released and is locked for the "luggage compartment" function.
8	G565	Sender for roof stowed	This indicates that the roof package is stowed in its end position in the luggage compartment.
9	G566	Sender for left roof member flap open	This indicates that the roof side member flap on the driver's side is open.
10	G558	Sender for left roof member locked	This indicates that the roof side member on the driver's side is locked to the A-pillar.
11	G559	Sender for right roof member locked	This indicates that the roof side member on the front passenger's side is locked to the A-pillar.
12	G567	Sender for right roof member flap open	This indicates that the roof side member flap on the front passenger's side is open.



# Convenience electronics

## Hall senders in the roof sensor system

As in the case of other vehicle systems, Hall senders are also suitable for position detection. The roof sensor system in the Eos is equipped with three different types of Hall sender:

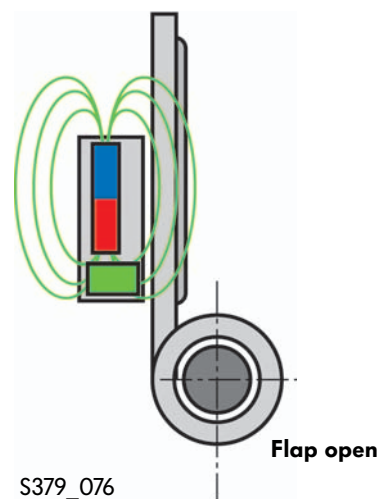
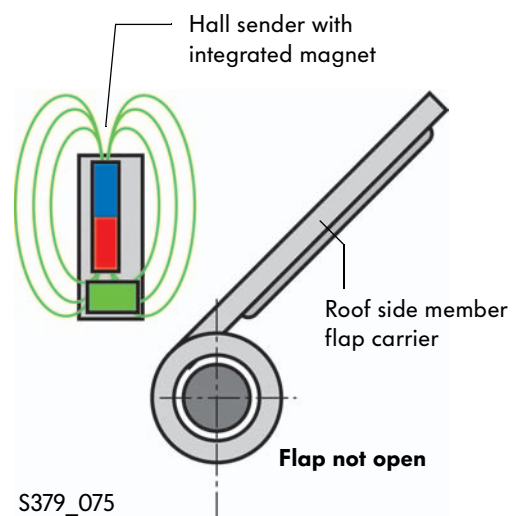
- Hall senders with integrated magnet
- Hall senders with an external magnet
- Hall senders with two external magnets.

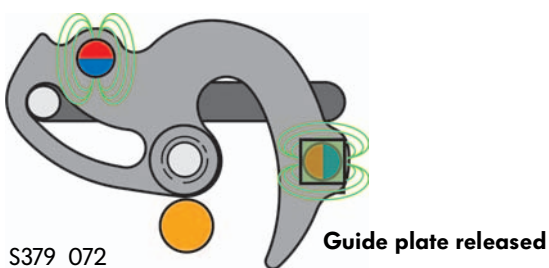
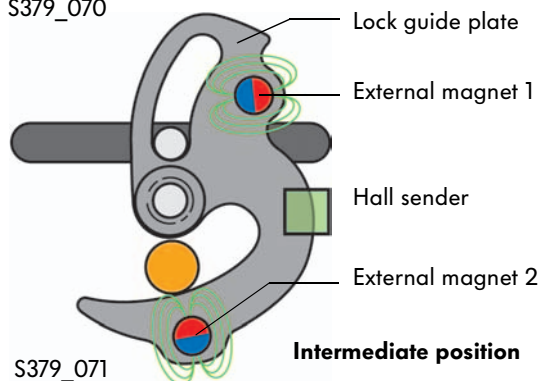
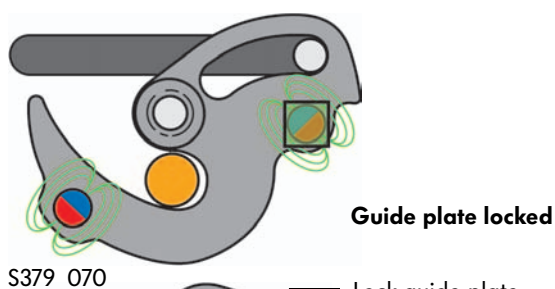
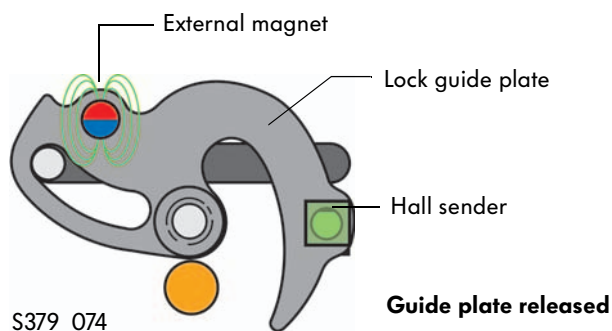


### ● Example: Sender with integrated reference magnet

In this design, as e.g. in the case of the senders for opening the roof side member flaps, the sender's signal voltage changes when the roof side member's carrier moves into the integrated magnet's field. By positioning the sender accordingly, the monitored component's reaching a defined end position can be determined. Due to this structure, however, the sensor electronics are unable to distinguish between whether the monitored component is located in the other end position or between the two end positions.

The disadvantage of this design is that the sender and the sensed component have to be positioned very precisely in relation to each other, so that the sensed component is able to adequately influence the signal voltage when it moves through the integrated magnet's magnetic field. This means that precise adherence to these distances has to be ensured during repair work.





- Example: Sender with external reference magnet

In comparison with Hall senders with integrated magnets, Hall senders with external magnets have the advantage that they permit greater installation dimension tolerances in the spatial layout between the sender and sensed component, in order e.g. to carry out adjustments within certain limits. One example of the design with an external magnet are the senders for locking the rear window frame to the M segment. In these, the lock guide plates carry a magnet. The Hall sender is therefore able to determine the positions "guide plate locked" and "guide plate not locked".



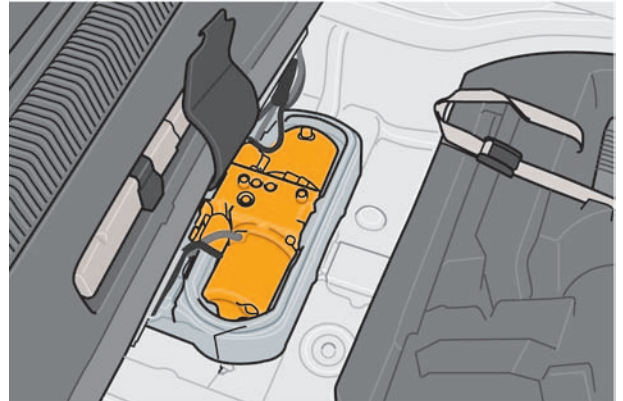
- Example: Sender with two external reference magnets

To determine whether a lock, e.g. that of the rear lid, is located in one of the defined end positions or between the two, the design with two external magnets is appropriate. In this case, both magnets are mounted on the moveable lock guide plate in such a way that one of the two is located above the stationary sender when the monitored component is in one of its two end positions. This enables the convertible roof actuation control unit to distinguish between released and locked. It can additionally determine whether the sensed component is located in an intermediate position.

# Convenience electronics

## Hydraulic unit

The 8 hydraulic cylinders for the convertible roof and the rear lid are supplied with hydraulic fluid by just one hydraulic unit. This is installed beneath the floor cover in the luggage compartment and is encapsulated in a foam jacket.



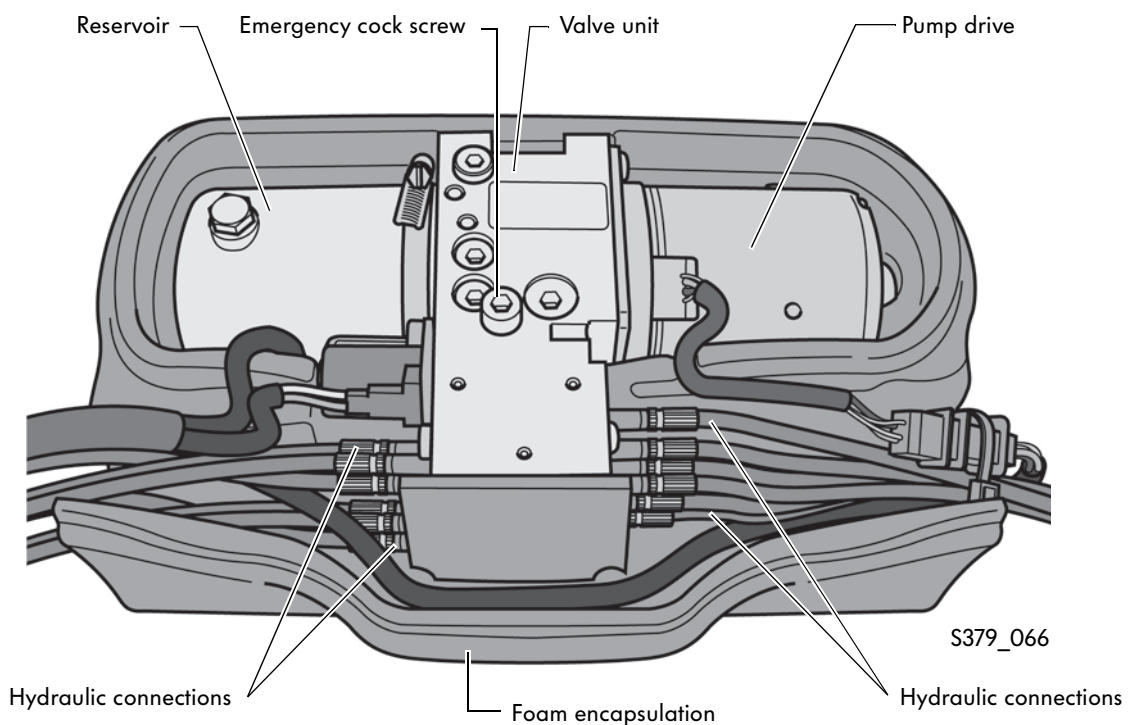
S379\_163

## Structure of the hydraulic unit

The hydraulic unit is comprised, amongst other elements, of the reservoir, the pump drive (convertible roof actuation hydraulic pump V118) and the valve unit with three 3/2-way solenoid valves. The hydraulic pump temperature sender G555 is integrated into the pump drive, and monitors its temperature to prevent overheating.

The convertible roof actuation hydraulic pump V118 is initialised to the left and right by the convertible roof actuation control unit J256.

All hydraulic connections are marked with a numerical code, so that they can be easily distinguished during installation work.



## Structure of the valve unit

The valve unit is comprised of three 3/2-way solenoid valves, two mechanical shuttle valves, a number of non-return valves, a mechanical dual pressure valve and an emergency cock screw. The solenoid valves are called:

Power operated convertible roof valve 1 N272,

Power operated convertible roof valve 2 N341 and

Power operated convertible roof valve 3 N342.

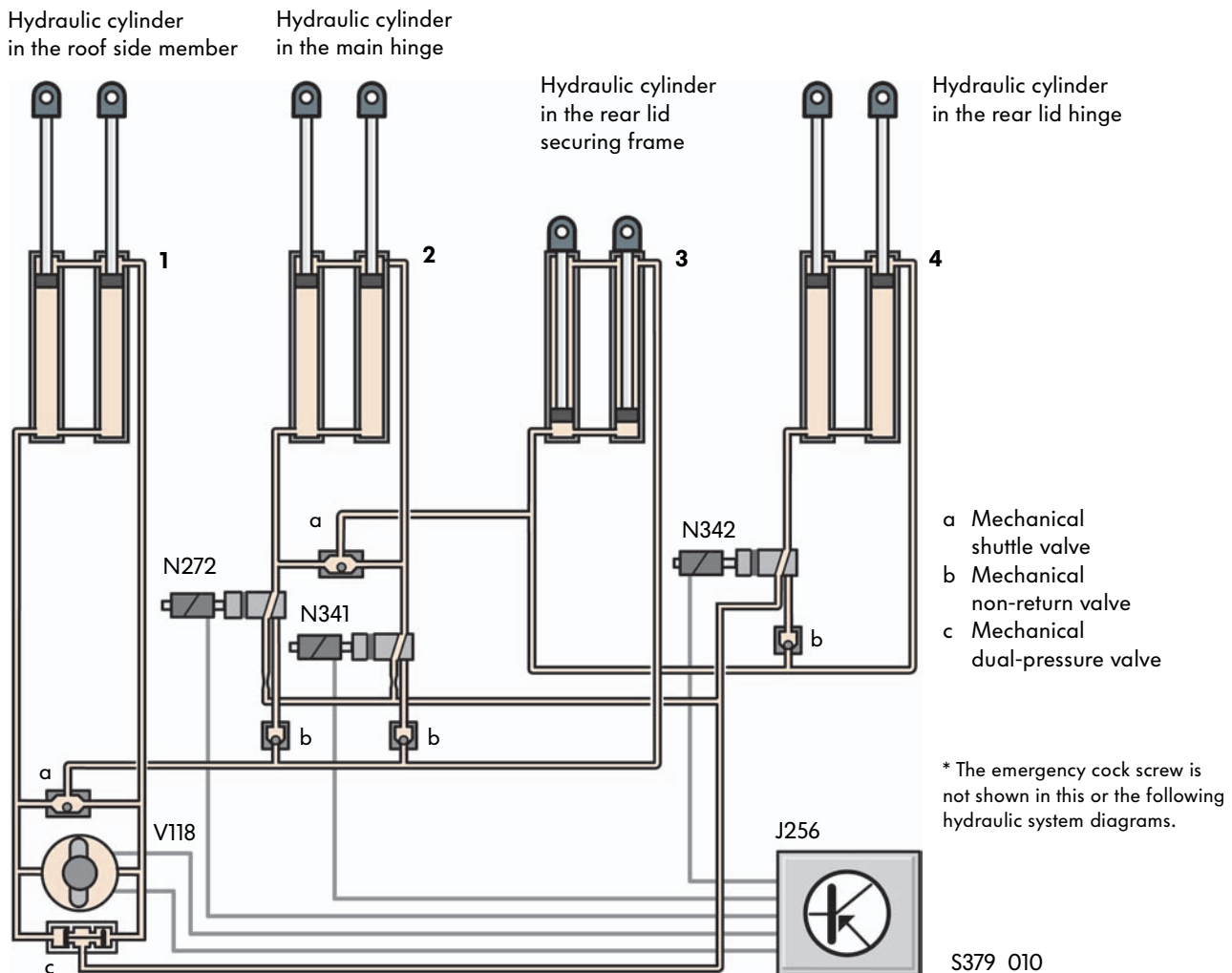
An emergency cock screw \* is used to open a bypass which depressurises the system. In an emergency, the convertible roof can therefore also be moved manually.

If a valve is supplied with current, it allows the delivery pressure through. If it is not supplied with current, hydraulic fluid is able to flow in the opposite direction back to the pump reservoir (return flow position). Due to the special layout of the valves and integration of the pump's operating direction, the four cylinder pairs can be actuated independently of one another.

In the following, the entire roof opening and closing movement will be broken down into individual stages in order to clarify the valve control system's interaction.



## Illustration with roof closed





# Convenience electronics

## Opening the convertible roof

1.

The pump is initialised to the right. The hydraulic fluid passes to solenoid valves N272, N341 and N342 via the shuttle valve (a). These are supplied with current and open. Valve N342 is supplied by the second shuttle valve (b).

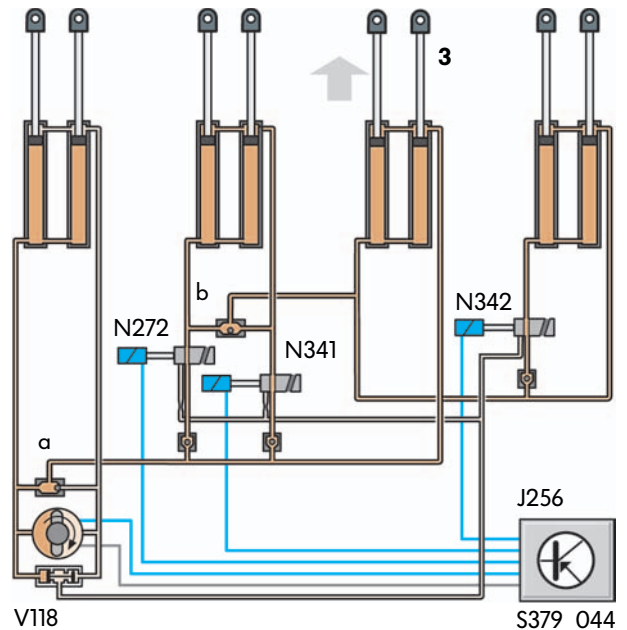
The hydraulic cylinders in the rear lid securing frames (3) extend, because the operating pressure beneath the plungers acts on a larger plunger surface than above the plunger.

Due to the hydraulic cylinders' movement, the rear lid is released from the body and the C segment.

The securing frame is locked to the rear lid so that the rear lid is able to pivot out to the rear during the further process.



S379\_089



2.

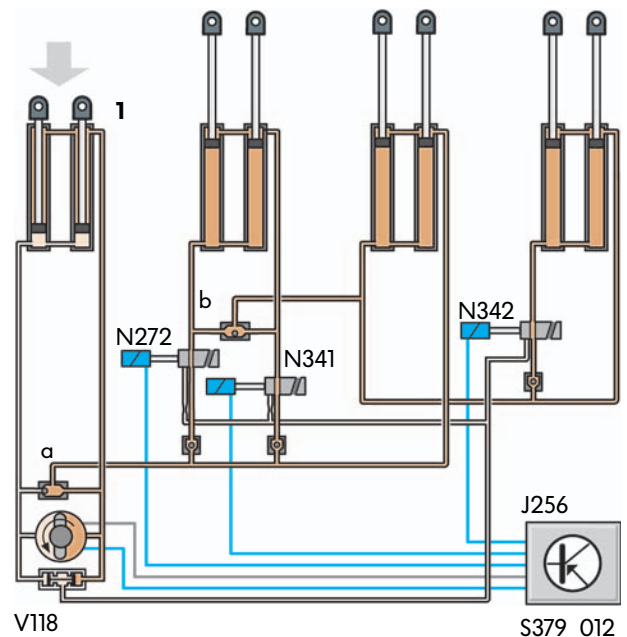
The pump's delivery direction changes; the three valves N272, N341 and N342 continue to be supplied with current.

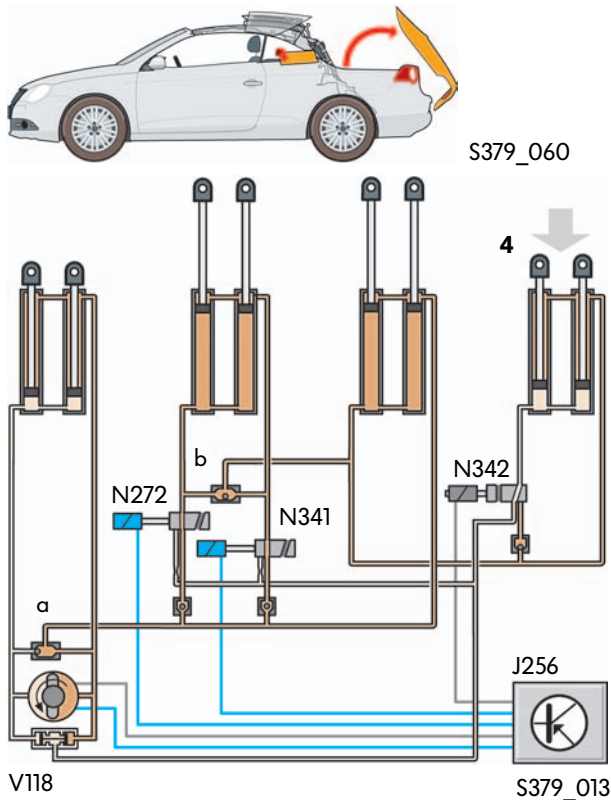
In this position, the pump's delivery current is forced into the hydraulic cylinders in the roof side members (1), so that these are retracted. Due to this movement, the upper C segment is released and is then pivoted over the middle segment. The roof side members are additionally released from the A-pillars.

The shuttle valve (a) over the hydraulic pump closes versus the return flow from the roof side members' hydraulic cylinders, with the result that the remaining cylinders are held in position.



S379\_059





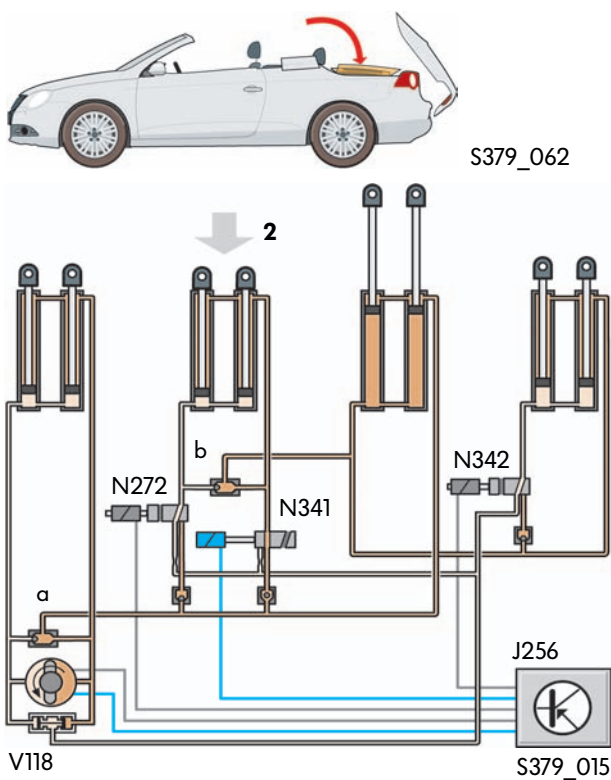
3.

The pump continues to deliver to the left.

Valve N342 switches to the return flow position.

The pump's delivery current now flows to the hydraulic cylinders in the rear lid hinges (4) and moves the plungers into the cylinders. Due to this movement, the rear lid is pivoted open to the rear, and the roof side member flaps open.

The roof package can now be stowed in the luggage compartment. The hydraulic cylinders in the roof side members remain under pressure, so that they hold the C segment in position above the M segment.



4.

Now, valve N272 is also switched to the return flow position. Only valve N341 is now supplied with current, and allows the delivery current to pass.

In this valve position, the hydraulic fluid from the pump compresses the two hydraulic cylinders in the main hinges (2).

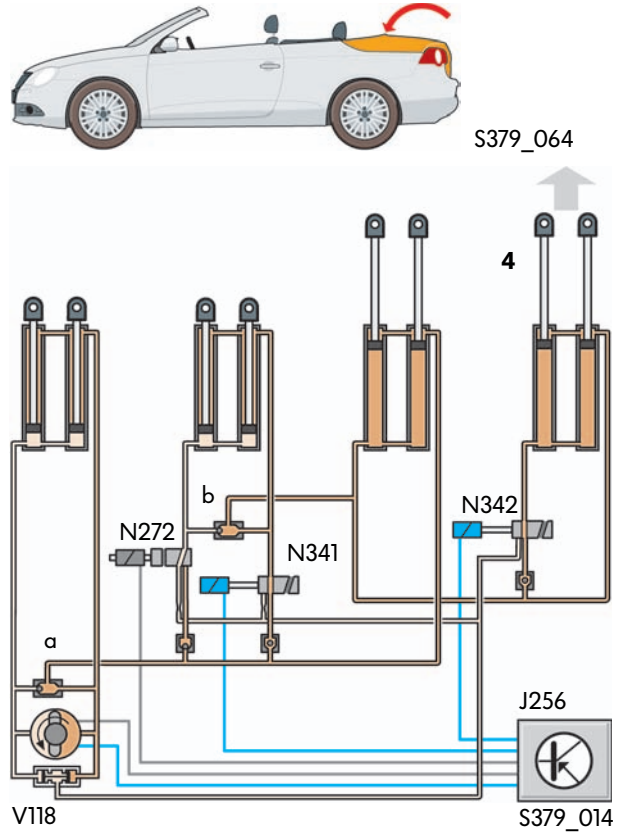
The roof package is stowed in the luggage compartment, whereby the roof side members are compelled to move outwards via a sliding guide rail.

# Convenience electronics

5.

Now, valves N341 and N342 are also supplied with current by the convertible roof actuation control unit J256.

The hydraulic pump continues to deliver to the left. The two hydraulic cylinders in the rear lid hinges (4) extend again, so that the rear lid and the roof side member flaps are closed again.



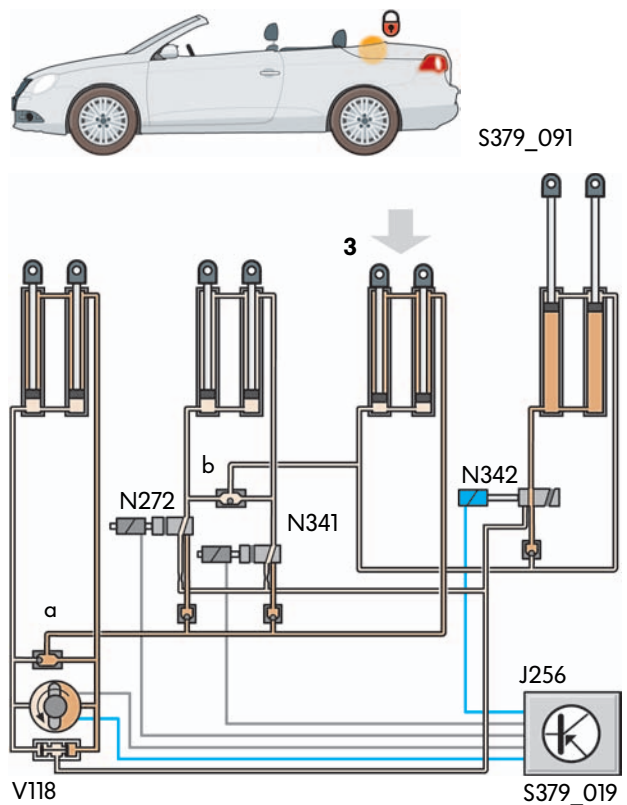
6.

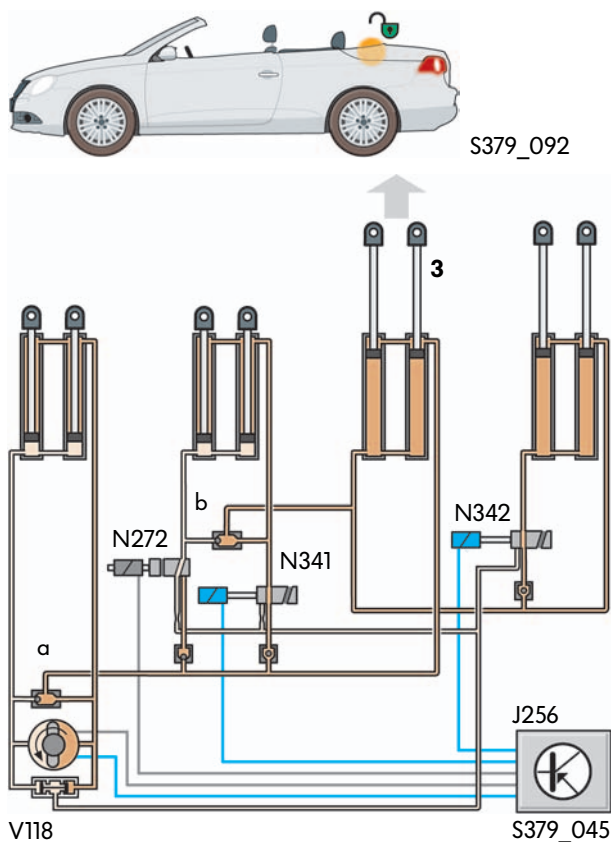
When the pump is operating to the left, valve N342 causes the securing frame to be locked to the body and the securing frame to be released from the rear lid by compressing the hydraulic cylinders in the rear lid securing frame (3) again.

The C segment is locked in position in the luggage compartment with the aid of rubber buffers.

When valve N342 is currentless and the convertible roof actuation control unit's hydraulic pump is switched off, convertible roof movement is completed.

The system is once again pressureless.



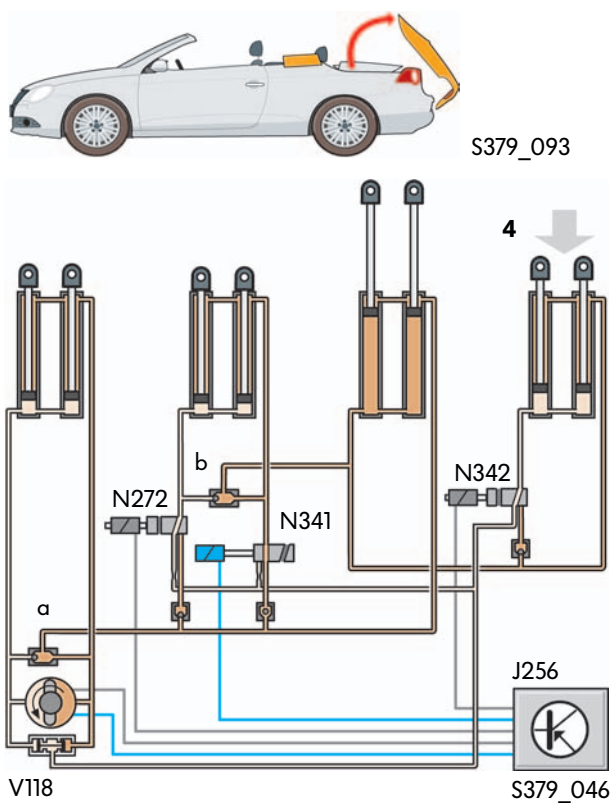


## Closing the roof

1.

The hydraulic pump starts up to the left and valves N341 and N342 are supplied with current. The hydraulic cylinders in the rear lid securing frames (3) extend, because the operating pressure in the chamber below the plungers acts on a greater plunger area than in the chamber above the pistons.

The securing frame locks move into the position for opening the rear lid.



2.

The pump continues running to the left and only valve N341 is supplied with current. In this manner, the delivery current passes via the second shuttle valve (b) to the hydraulic cylinders in the rear lid hinges (4). As valve N342 is located in the return flow position, the two cylinders are compressed again, so that the rear lid and the roof side member flaps open.

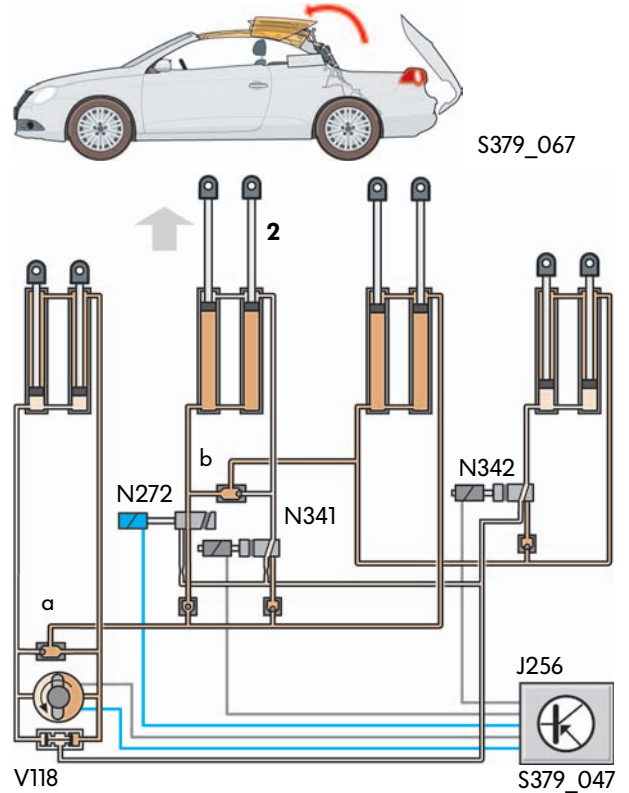
# Convenience electronics

3.

Valve N341 switches to the return flow position.

Valve N272 opens and allows the delivery current to pass. As a result of this, the two hydraulic cylinders in the main hinges (2) are extended.

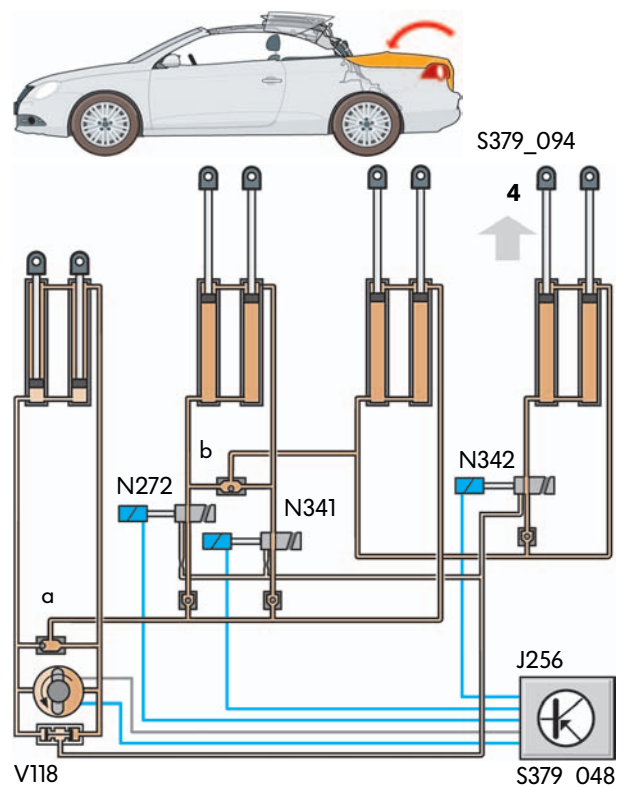
The main drive thereby lifts the convertible roof package out of the luggage compartment. The roof side members are moved inwards again and dock onto the A-pillars.



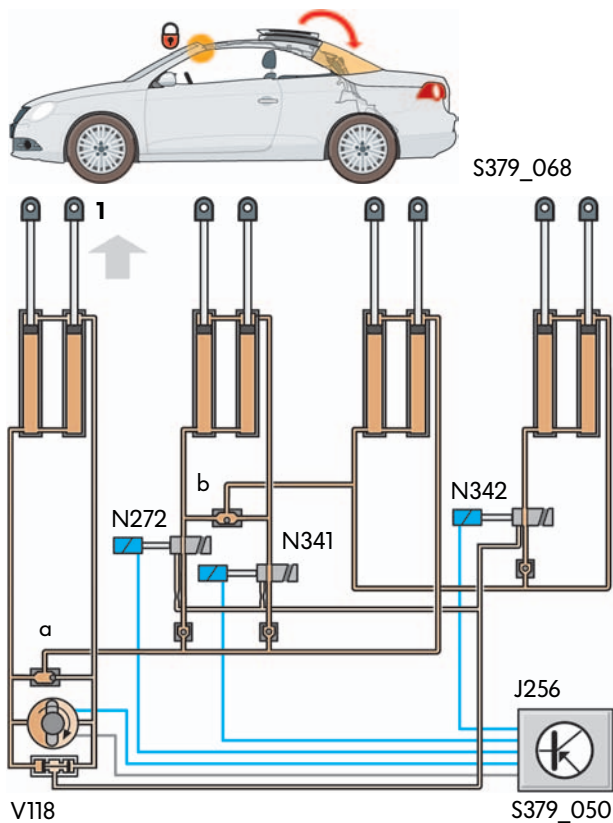
4.

When the pump is operating to the left, all three valves open.

In turn, the delivery current flows to the hydraulic cylinders in the rear lid hinges (4) and moves these apart. The rear lid and the roof side member flaps close.

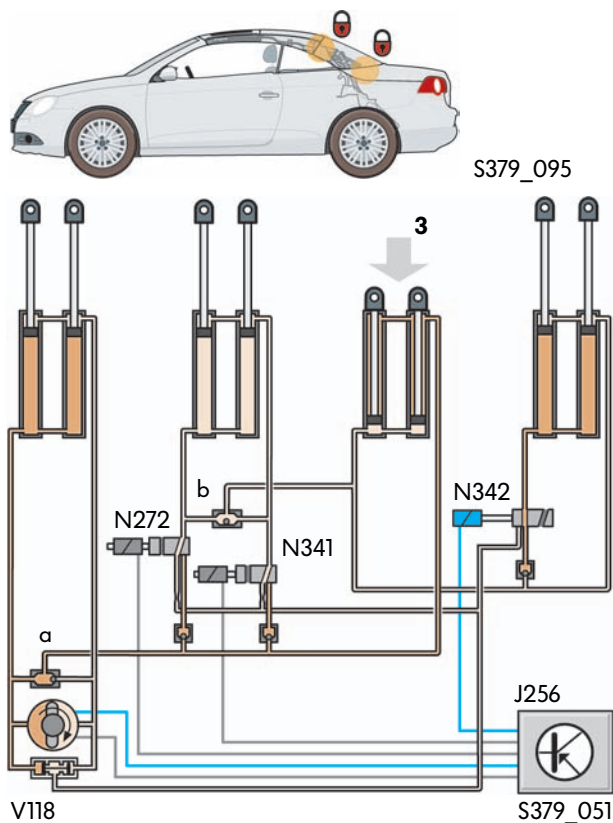






5.

The hydraulic pump motor's rotational direction changes. The three solenoid valves remain open. In this manner, the pump's delivery current is able to extend the hydraulic cylinders in the roof side members (1). The C segment lowers and is locked to the M segment. At the same time, the roof side members are locked to the A-pillars.



6.

When the pump is operating to the right, only valve N342 remains open. The hydraulic cylinders in the rear lid securing frames (3) are compressed. The rear lid and C segment locks close and thereby secure the roof's "closed" end position. The rear lid is released again at the same time. When the hydraulic pump is switched off and valves N272, N341 and N342 are switched to currentless, the roof movement is ended and the system is pressureless again.



# Convenience electronics

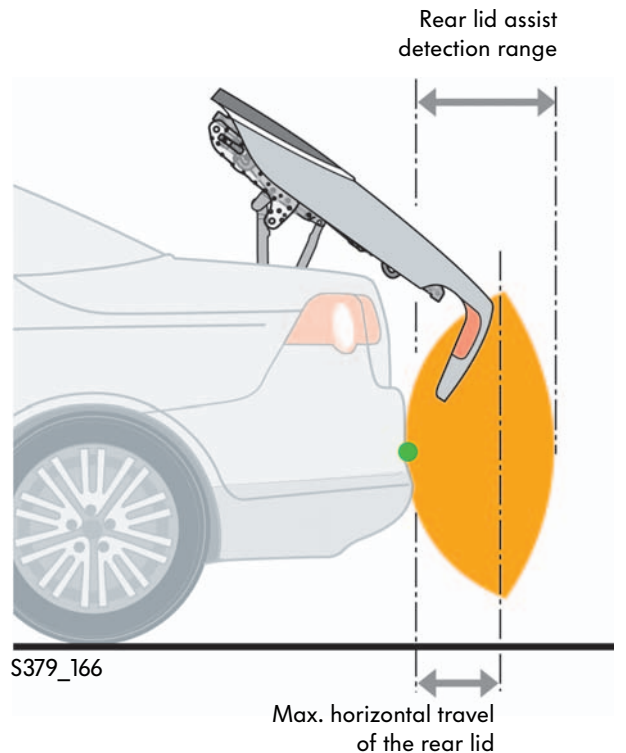
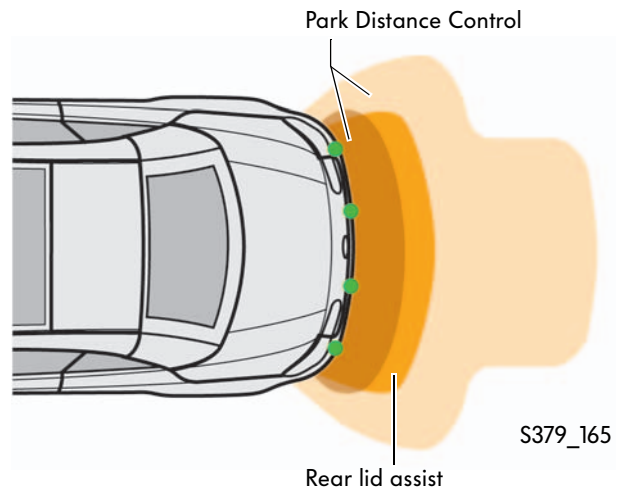
## Rear lid assist

If the Eos is fitted with Park Distance Control (PDC), this additionally contains the rear lid assist function. This is a convenience function and serves to avoid damage to the rear lid on movement of the convertible roof.

In achieving this, the rear lid assist system makes use of the vehicle's Park Distance Control sensors, which are installed in the bumper, the convertible roof control system sensors, the convertible roof actuation button, plus the gong and the display in the dash panel insert.

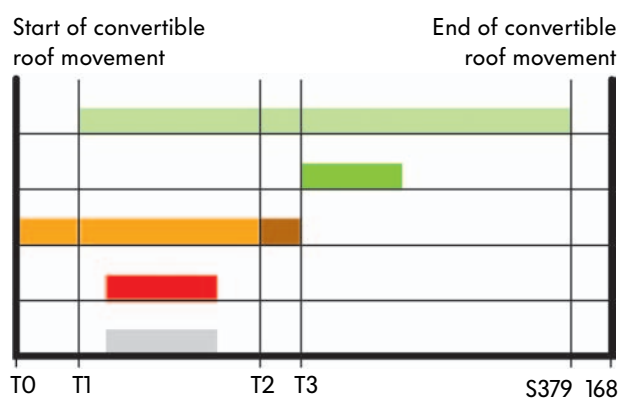
Rear lid assist functions independently of Park Distance Control. Park Distance Control is only active when reverse gear is engaged, whilst rear lid assist is active as soon as the convertible roof actuation button is pressed to move the convertible roof. If reverse gear is engaged at the same time, rear lid assist takes precedence over Park Distance Control.

Whilst Park Distance Control emits a stop warning in the form of a continuous sound if an obstacle is located approx. 30cm behind the vehicle, rear lid assist operates with an alarm distance of approx. 50cm to the rear of the vehicle. This ensures that sufficient space is available to move the rear lid horizontally (approx. 38cm).



If the convertible roof actuation button is pressed, this also simultaneously activates the rear lid assist system. If an obstacle is located within the detection range to the rear of the vehicle at this point in time, the operator is provided with a corresponding warning message via the display, and a corresponding acoustic signal is sounded via the gong. Depending on the convertible roof actuation control unit's coding, convertible roof operation is not started. By pressing the button again for a few seconds, convertible roof movement can be commenced despite the warning message.

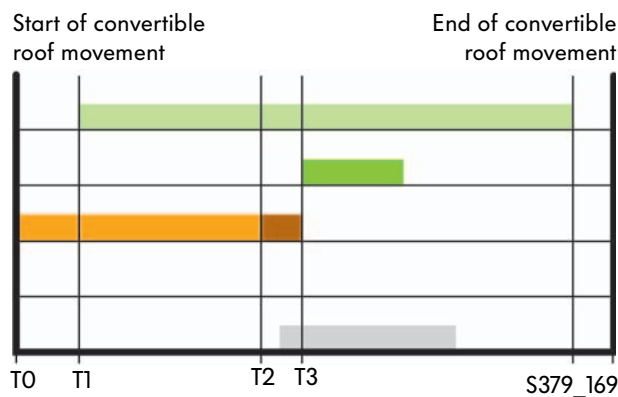
#### Case example: Obstacle arises after T1



If no obstacle has been detected in the rear area on requesting convertible roof movement, i.e. by pressing the convertible roof actuation button (T0), a calculated time interval starts on release of the rear lid (T1). Within this time interval, rear lid assist remains active and a warning message is issued if a new obstacle is detected.

The time interval ends with the calculated point in time T2. This is the point of time as of which the rear lid moves into the rear lid assist detection range.

#### Case example: Obstacle arises after T2



As of point in time T2, rear lid assist is switched to passive mode, i.e. no warning message is issued, as rear lid assist is unable to distinguish between the vehicle's own rear and a new obstacle which emerges. The rear lid assist function for this convertible roof movement cycle ends with the roof side member flap senders' message that the roof side member flaps and therefore the rear lid are open (T3).

- Rear lid released
- Rear lid open
- Rear lid assist active
- Rear lid assist passive
- Warning message
- emerging obstacle



The operator is always responsible for convertible roof operation, as only he is able to oversee the entire convertible roof movement range, including the area above the rear lid, which is not detected by the sensors.





# Convenience electronics

## Operating conditions

Various conditions have to be met to enable roof movement to be carried out. This applies to opening and closing the convertible roof. One vital element of roof movement release is the detection of a plausible roof assembly position. This applies to the position of the roof assembly within its own movement sequence (e.g. identical signal from the sensor pair) and to the position of the roof assembly within the entire roof movement sequence.

The release conditions also include the position of the rear lid (e.g. the C segment must not pivot down before the rear lid is closed).

Accordingly, the information "C segment is locked" and "rear lid is open" would be implausible.



## Conditions for opening the roof

1	Terminal 15 ignition is "on".
2	The convertible roof position is plausible.
3	The CAN data bus reports "communication is possible".
4	The sliding roof reports "communication is possible".
5	The position of the sliding roof has been recorded.
6	Sliding roof not overheated.
7	The microswitch detects the engaged luggage cover.
8	The engine control unit (or ABS ECU/dash panel insert) reports "vehicle speed is less than 1 km/h".
9	The convertible roof actuation control unit detects that roof movement has not yet been completed, i.e. the information "roof open" is not yet available.
10	The sensors report "rear lid is closed".
11	The convertible roof actuation switch supplies a plausible signal.
12	The hydraulic pump temperature sender reports "temperature below 95 °C". *
13	The hydraulic unit reports a valve operating time of less than 8 minutes. **
14	No trailer operation detected.
15	The vehicle electrical system control unit reports a system voltage of over 10.8 V.
16	The door control units report that the necessary window position has been reached.



17	The power latching system reports "closed" after the convenience system control unit has output the signal "convertible roof box main catch closed".
18	The control unit with display in dash panel insert reports "exterior temperature greater than minus 15 °C". ***
19	The heated rear window is switched off. It is automatically deactivated on actuation of the convertible roof switch.
20	As a parking aid function (special equipment), rear lid assist reports "no obstacle in rear area".

- \* If the temperature of the hydraulic fluid exceeds 95°C, only the "close convertible roof" command is possible. If the temperature of the hydraulic fluid exceeds 105°C, actuation of the convertible roof is blocked completely until the temperature falls below the threshold value again.
- \*\* If the hydraulic unit's valves are operated for longer than 8 minutes, e.g. due to repeated opening and closing, the convertible roof control system only permits the roof to be closed. Opening is then no longer possible. This measure also serves to prevent overheating, etc.
- \*\*\* If the temperature falls below minus 15°C, it is assumed that the viscosity of the hydraulic fluid is too high to enable roof movement.



## Conditions for closing the roof

The pre-conditions are essentially identical to those of opening. Exceptions include:

2	At least one sensor must supply a plausible signal (logical 0/1) for each partial convertible roof movement.
7	The microswitch signal that the luggage cover is in position is not vital as regards closing the roof.
9	The convertible roof must not already be fully closed for the "close" command.
12	A hydraulic fluid temperature of over 95 ° but below 105 °C does not influence the close command.
13	The total actuation time of the hydraulic pump valves must be less than 9.5 minutes so that the close function is released.

# Convenience electronics

## Convertible roof movement abort conditions

Different conditions, which lead to the abortion of roof movement, apply to prevent damage to the roof. The convertible roof responds in different ways depending on which abort condition has occurred.

These range from stopping roof movement and the options of only being able to open or close the convertible roof to clocked lowering of the roof package in the event of a timeout. One further possibility is complete failure in the event that operating voltage is absent.

The following conditions lead to the abortion of convertible roof movement:



1	The vehicle electrical system voltage falls below 9.0 V.
2	The ignition (terminal 15) is switched off.
3	Communication via the CAN data bus is interrupted.
4	The convertible roof actuation control unit determines that at least one hydraulic valve is defective.
5	The convertible roof actuation control unit determines a defect in the hydraulic unit.
6	The sensors report that the rear lid is not closed.
7	The sensors report that the power latching system is not closed.
8	A trailer is detected via the trailer socket.
9	The sensors do not supply plausible signals regarding the convertible roof position.
10	The speed is higher than 1km/h.
11	The temperature of the hydraulic pump rises above 105°C .
12	The terminal stage of the convertible roof actuation control unit is overheated (overheating protection).
13	The convertible roof actuation control unit fails due to an internal fault.
14	The door control units supply implausible signals regarding the window position or are reported as having failed.
15	The convenience system control unit supplies implausible or no signals.
16	The gateway supplies implausible or no signals.
17	The gearbox control unit supplies implausible or no signals.

18	The total hydraulic valve operating time exceeds 9.5 minutes.*
19	The convertible roof actuation switch signal is interrupted.**
20	The convertible roof actuation control unit generates a timeout.***
21	During the opening process, the luggage cover microswitch reports that the convertible roof guard is not engaged.
22	During roof movement, the exterior temperature falls below the threshold value of minus 15 °C.
23	The convertible roof actuation control unit determines that the temperature sender in the hydraulic unit has failed.

\* Convertible roof movement is interrupted if a period of 8 min is exceeded.

\*\* The convertible roof actuation switch may be defective, or the operator releases the switch.

\*\*\* Under certain circumstances, the hydraulic pump runs although certain of the preceding steps in the mechanical sequence have not yet been carried out or completed. The convertible roof actuation control unit registers this and switches the hydraulic pump off after a few seconds.



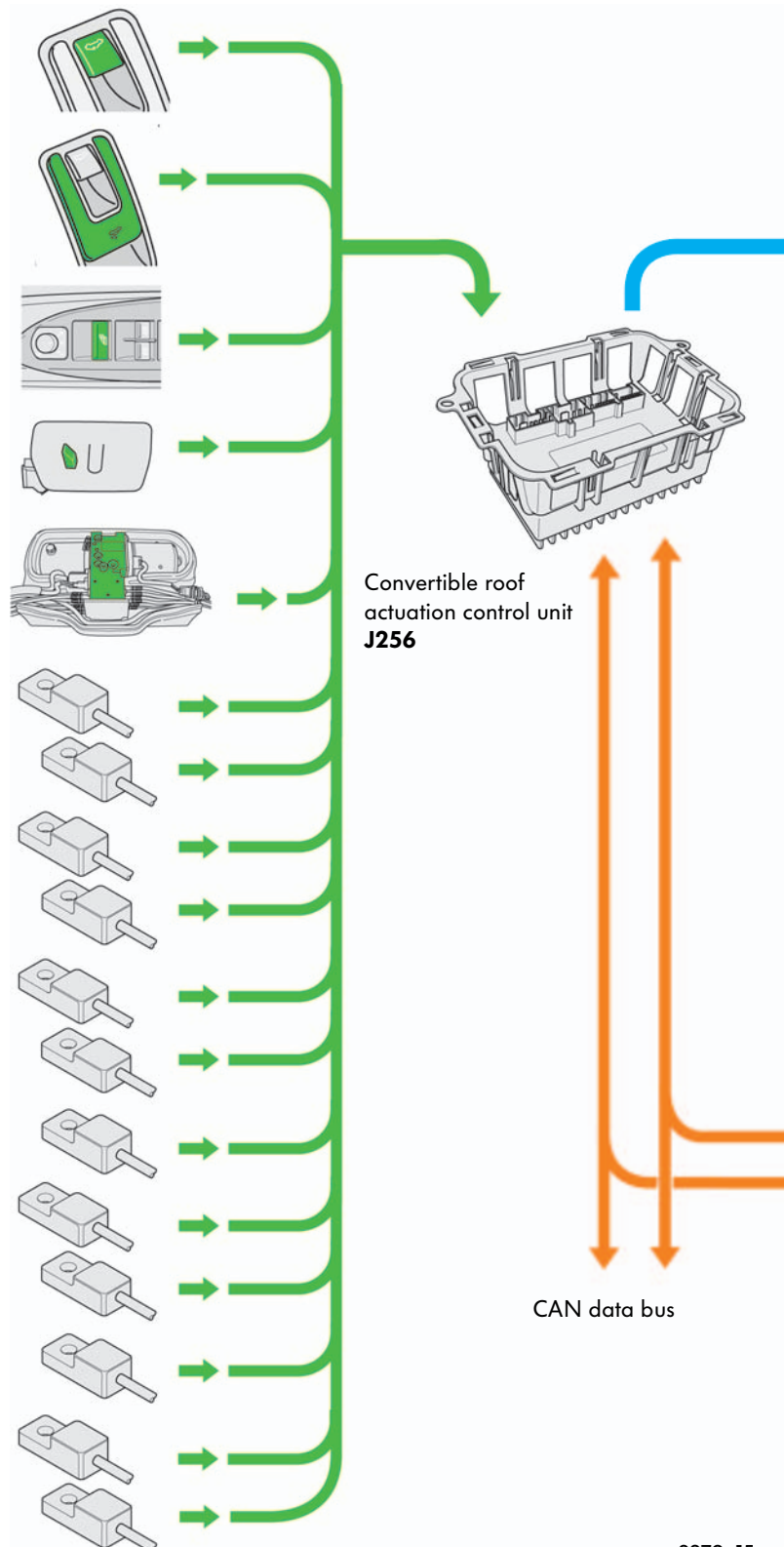
# Convenience electronics

## Roof control system overview

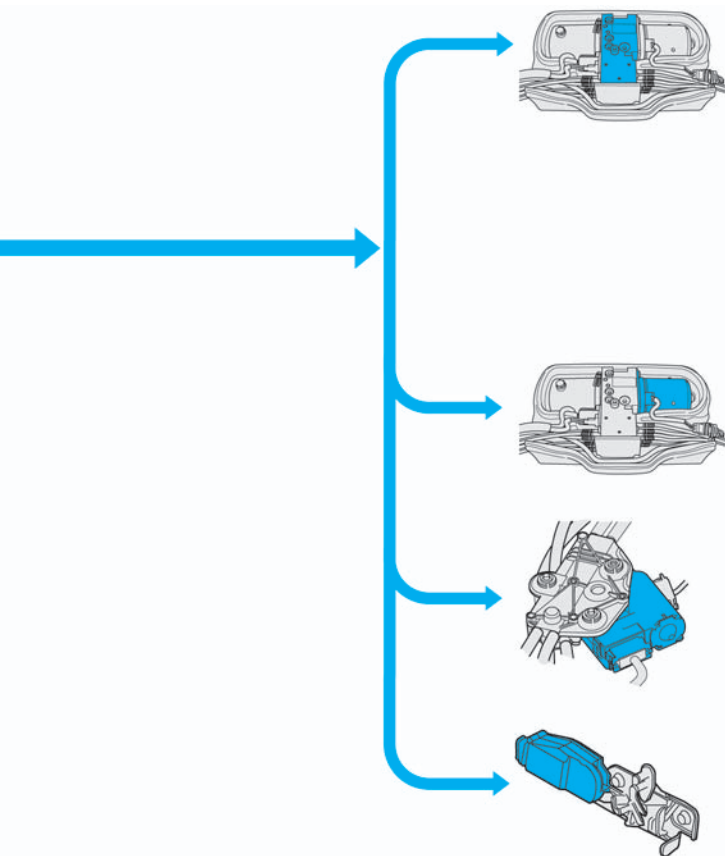
### Sensors



- Convertible roof actuation button **E137**
- Sunroof button **E325**
- Central switch for window regulators in driver door **E189**
- Luggage cover contact switch **F364**
- Hydraulic pump temperature sender **G555**
- Front sender for position of left roof member **G556**
- Front sender for position of right roof member **G557**
- Sender for left roof member locked **G558**
- Sender for right roof member locked **G559**
- Left sender for rear window frame locked **G560**
- Right sender for rear window frame locked **G561**
- Sender for rear window frame open **G562**
- Left sender for rear shelf locked **G563**
- Right sender for rear shelf locked **G564**
- Sender for roof stowed **G565**
- Sender for left roof member flap open **G566**
- Sender for right roof member flap open **G567**



S379\_15



## Control elements

Power operated convertible roof valve **N272**,  
 Power operated convertible roof valve 2 **N341**  
 Power operated convertible roof valve 3 **N342**

Convertible roof actuation hydraulic pump **V118**

Sliding sunroof motor **V1**

Power latching control unit **J657**  
 Power latching motor **V329**



J285 Control unit with display  
 in dash panel insert

S379\_159

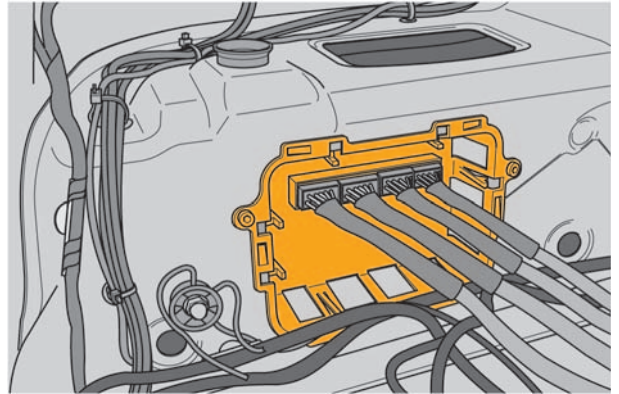


# Convenience electronics

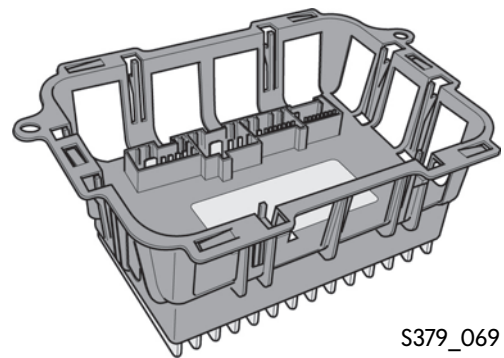
## Electrical components

### Convertible roof actuation control unit J256

The striking feature of the convertible roof actuation control unit is its basket-shaped bracket. This guarantees that the control unit's heat sink is adequately ventilated (forced ventilation). In addition, an integrated temperature sensor monitors the temperature in the control unit.



S379\_154



S379\_069

### Redundant sensors

Redundant means that something is fitted more than once. In technical systems, redundant components serve to maintain operation even if one of these multiply fitted components should fail. The second sensor's signal can also be used to determine the plausibility of the signal.

The control unit thereby monitors the function of the redundant sensors.

The convertible roof sensors' installation in pairs ensures that the locked end positions can be detected in convertible roof movement, thereby enabling safe operation.

The following sensors are fitted in pairs in the CSC convertible roof sensor system:

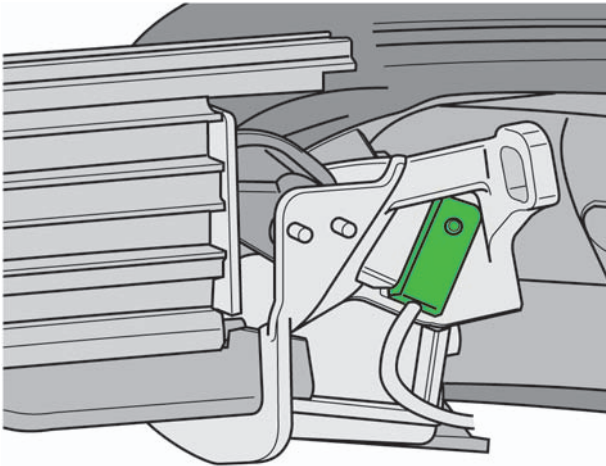
- The front senders for the position of left/right roof member G556 and G557,
- The left/right senders for rear window frame locked G560 and G561,
- The left/right senders for rear shelf locked G563 and G564,
- The senders for left/right roof member locked G558 and G559 and
- The senders for left/right roof member flap open G566 and G567.



## Electrical components - sensors

Front sender for position of left roof member **G556**

Front sender for position of right roof member **G557**



S379\_118

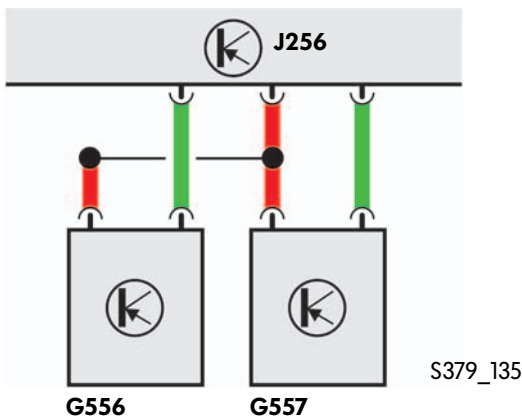
Both sensors are Hall senders with an integrated reference magnet. They are installed on the left and right sides of the cowl panel above the windscreen. They are electrically connected to the vehicle wiring harness via the A-pillars.



### Signal use

The sensors indicate that the CSC convertible roof has docked onto the cowl panel.

### Electrical circuit



S379\_135

### Effect in the event of failure

If one of the two sensors fails (short-circuit or open circuit), the other sensor's value serves to check whether the CSC convertible roof has docked onto the cowl panel and is therefore closed.

If the side members have already docked onto the A-pillars, subsequent sensor failure has no effect unless roof movement is started again.

If a sensor fails when the convertible roof is closed, roof movement cannot be started. If both sensors fail, roof movement is no longer possible.

# Convenience electronics

## Sender for left roof member locked G558 Sender for right roof member locked G559

The sensors are located at the front in the roof side members at the locking mechanisms for locking the roof side members to the A-pillars. These are Hall senders with integrated magnets, whereby the locking hook acts on the sensor.



### Signal use

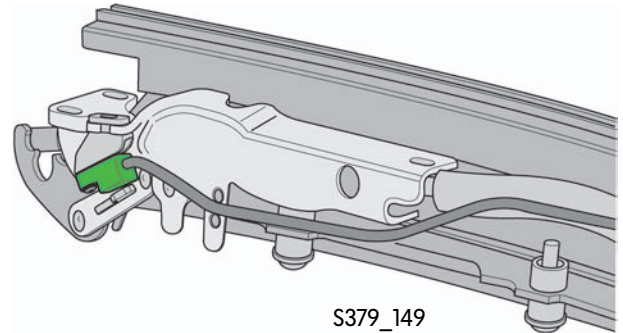
The signal from these sensors indicates that the CSC convertible roof and the A-pillars are locked or released.

If the sensor detects that the lock is open, this means that the roof side members are released and that roof package lowering can be released from this point of view. The signal additionally indicates that roof movement has commenced or that the convertible roof is no longer located in the "closed" position.

### Effect in the event of failure

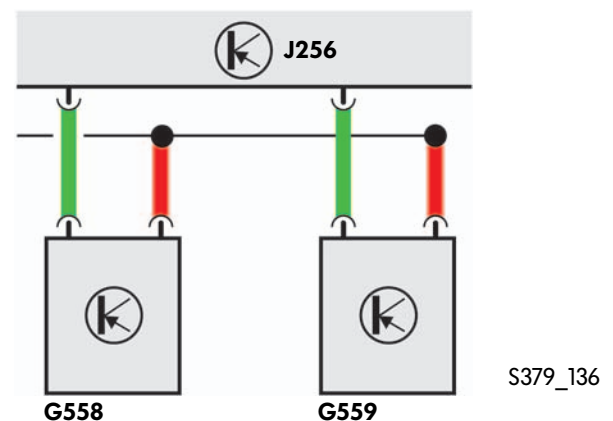
If one of the two sensors fails when the convertible roof is not completely closed, the other sensor's value serves to check whether the CSC convertible roof and the A-pillars are locked or released.

In this case, the convertible roof actuation control unit increases the hydraulic cylinder actuation time slightly, to rule out the fact that a mechanical blockage in the roof mechanism is delaying lock engagement and that this is the reason why the anticipated sensor signal has not been received.



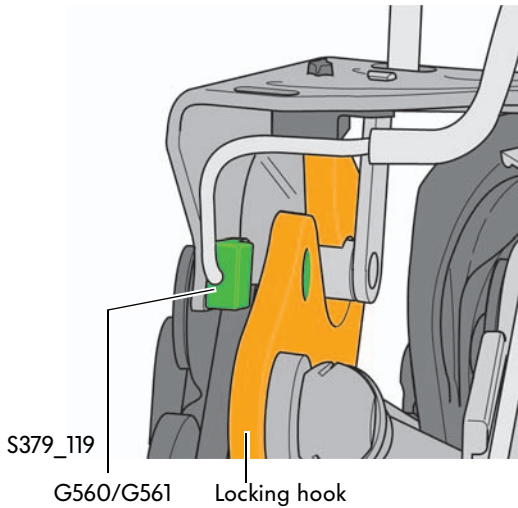
S379\_149

### Electrical circuit

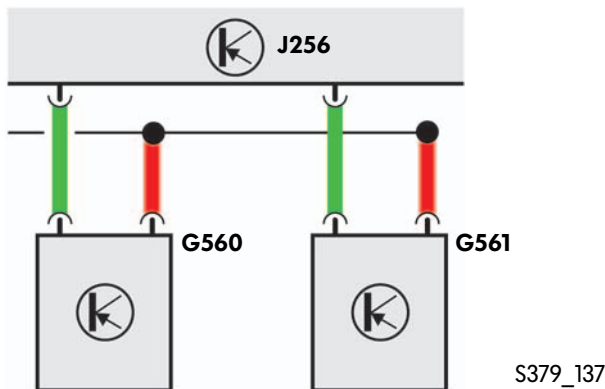


S379\_136

## Left sender for rear window frame locked G560 Right sender for rear window frame locked G561



### Electrical circuit



### Effect in the event of failure

If one of the two sensors fails when the convertible roof is not completely closed, the other sensor's value serves to check whether the C segment is locked to the side member.

In this case, the convertible roof actuation control unit slightly increases the actuation time for the hydraulic cylinders in the roof side members, to rule out the fact that a mechanical blockage in the roof mechanism is delaying lock engagement and that this is the reason why the anticipated sensor signal has not been received.

The sensors are positioned at the height of the C segment locking hooks in the left and right roof side members. With the aid of two external magnets on the locking hooks, these determine the locking status of the C segment to the roof side members and therefore the M segment.



### Signal use

These sensors' signal indicates that the C segment is in the "closed" position and is locked to the roof side members.

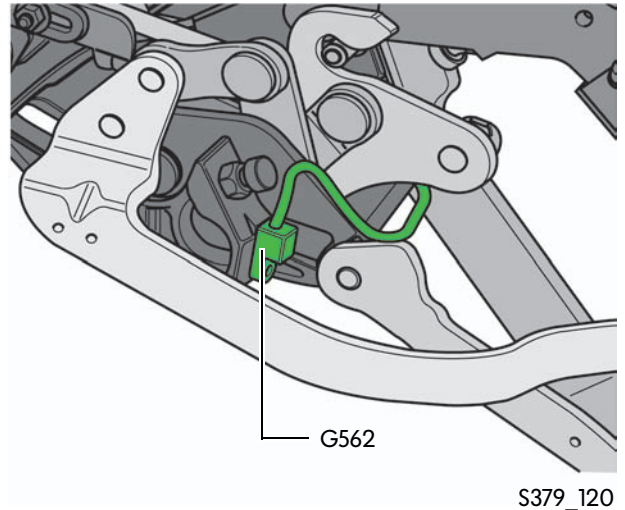
If the sensor detects that the lock is open, this means that the C segment is free to pivot over the M segment.

However, only one sensor's signal cannot be used to determine whether the C segment on both sides of the vehicle is correctly released or locked. If this fault occurs when the convertible roof is already partially open, convertible roof operation can be continued until the "roof closed position" is detected.

# Convenience electronics

## Sender for rear window frame open G562

This Hall sender with integrated magnet is located in the left roof side member in the vicinity of the hydraulic cylinder for actuating the C segment.



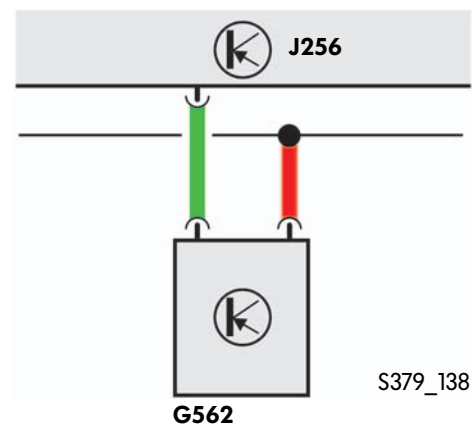
### Signal use

The signal indicates that the C segment is located in the "open" position and C segment movement over the M segment is therefore completed.

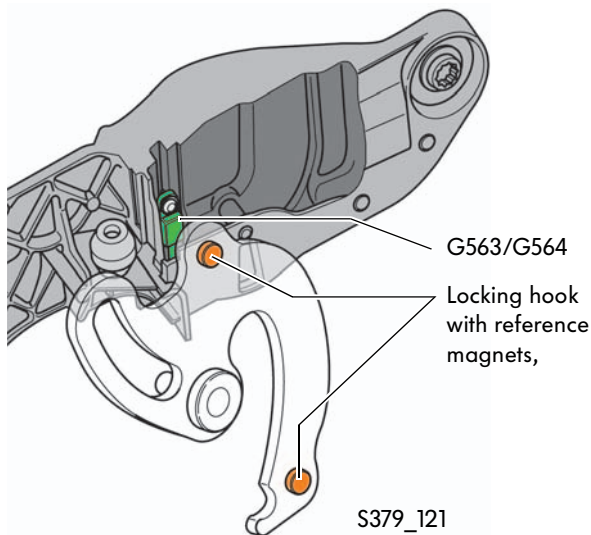
### Effect in the event of failure

Without this sensor's signal, the convertible roof actuation control unit is unable to directly determine whether the hydraulic cylinders have opened the C segment completely. Via the other sensors, it only knows that the C segment is not closed. As it cannot be ensured, without this signal, that the C segment has reached its end position over the M segment, roof movement is interrupted.

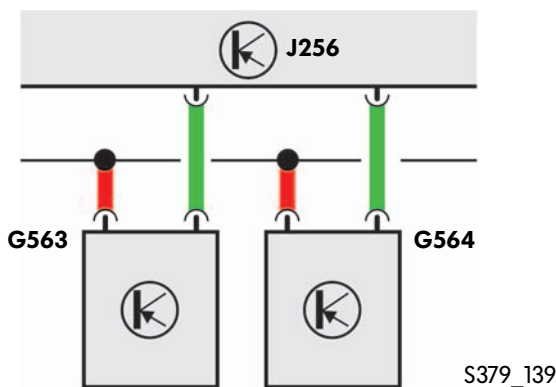
### Electrical circuit



## Left sender for rear shelf locked G563 Right sender for rear shelf locked G564



### Electrical circuit



### Effect in the event of failure

If one of the two sensors fails when the convertible roof is not completely closed, the other sensor's value serves to check whether the rear lid and the C segment are located in the locked/released position.

In this case, the convertible roof actuation control unit slightly extends the initialisation time for the hydraulic cylinders in the rear lid securing frames, in order to rule out the fact that a mechanical blockage in the roof mechanism is delaying lock engagement and that this is the reason why the anticipated sensor signal has not been received.

The sensors are positioned at the height of the hooks which lock the rear lid to the body on the left and right sides of the vehicle. With the aid of two external magnets on each locking hook, they determine the components' locking status.

### Signal use

The signal from these sensors indicates that the rear lid is located in the "locked" position and is therefore linked to the body or is located in the "released" position and can therefore be pivoted open.

If the sensor detects that the lock is open when the roof is closed, this also means that the lower C segment is no longer locked to the rear lid. It can therefore pivot over the M segment.

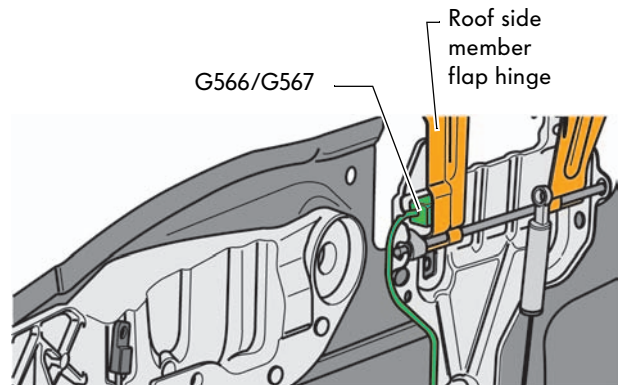
When the roof is closed, this signal additionally indicates that the C segment is locked to the rear lid. This signal is additionally used to check the plausibility of the fact that the rear lid is moving in the "open" direction.



# Convenience electronics

## Sender for left roof member flap open G566 Sender for right roof member flap open G567

G566 and G567 are also Hall senders with integrated reference magnets. They are located at the hinges of the left and right roof side members. If a roof side member flap opens, the flap carrier moves into the detection range of the Hall sender. This leads to a change in signal voltage and indicates to the convertible roof actuation control unit that the roof side member flap is open.

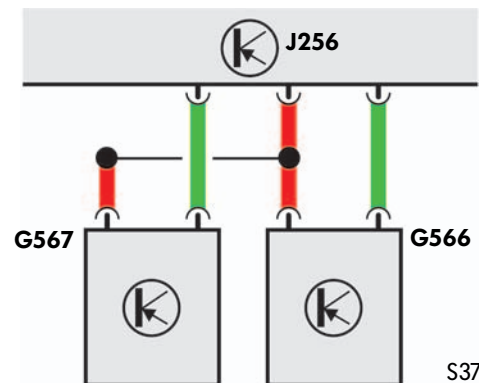


S379\_124

### Signal use

This signal indicates that the rear lid is open and the roof side member flaps are in the "open" position. The path for stowing the roof package in the luggage compartment or for lifting the roof package out of the luggage compartment is free.

### Electrical circuit



S379\_135

### Effect in the event of failure

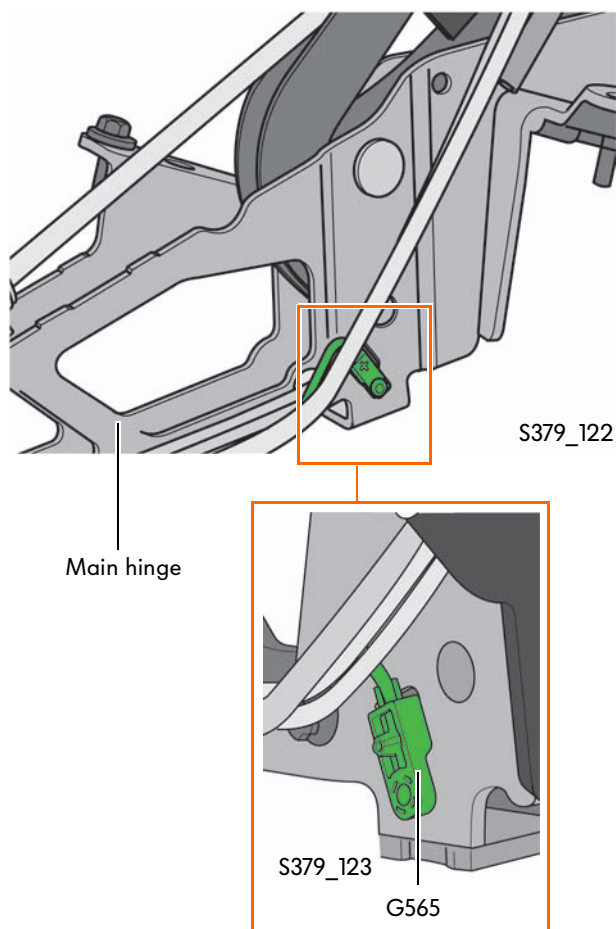
If one of the two sensors fails when the convertible roof is not completely closed, the other sensor's value serves to check whether the roof side member flaps and the rear lid are open or closed.

In this case, the convertible roof actuation control unit slightly increases the actuation time for the hydraulic cylinders in the rear lid securing frames, in order to rule out the fact that a mechanical blockage in the roof mechanism is delaying flap contact and that this is the reason why the anticipated sensor signal has not been received.

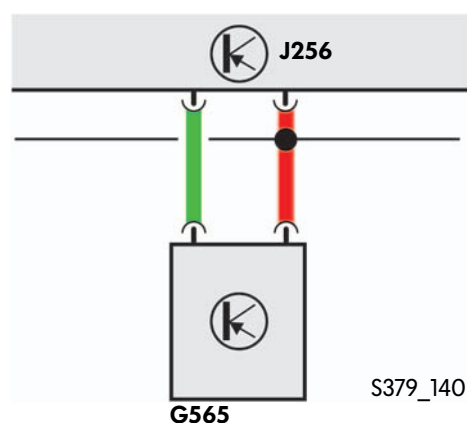
However, only one sensor's signal cannot be used to determine whether both roof side members are open or closed. If this fault occurs when the convertible roof is already partially open, convertible roof operation can be continued "roof closed position" is detected. The signals from sensors G563 and G564 serve the convertible roof actuation control unit as a substitute signal for "rear lid closed".



## Sender for roof stowed G565



### Electrical circuit



This Hall sender also has an integrated magnet. This is located on the left-hand main hinge in the vicinity of the hydraulic cylinder for stowing the roof package.

### Signal use

This signal indicates that the roof package is stowed in its end position in the luggage compartment and that the convertible roof is therefore open. In addition, the rear lid and the roof side member flaps can be closed or opened again.

On closing the convertible roof, the sender's signal indicates that roof movement is taking place and that the roof package has left its position in the luggage compartment.



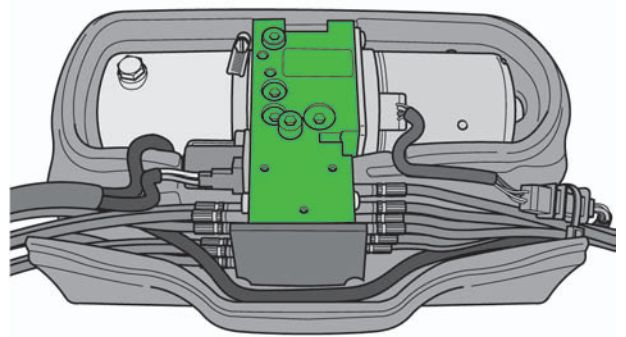
### Effect in the event of failure

On failure of the sensor, roof movement is only prevented if the convertible roof is fully open or closed, as the convertible roof actuation control unit cannot be certain that the roof package has reached its end position in the luggage compartment. If the sensor fails in an intermediate roof package position, the roof package is moved in the intended direction, either to stow or to close it. Convertible roof movement which is commenced after this is not continued. This means, for example, that the rear lid remains open.

# Convenience electronics

## Hydraulic pump temperature sender G555

The temperature sender is integrated into the hydraulic pump and cannot be renewed. It measures the temperature of the hydraulic unit.



S379\_148

### Signal use

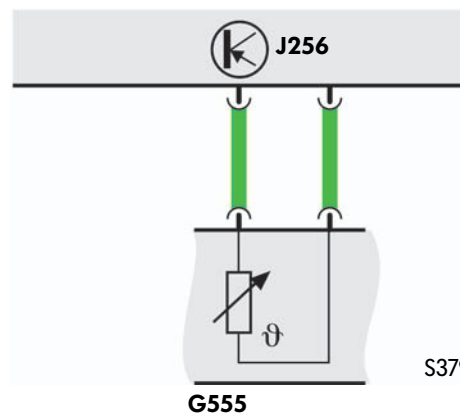
The temperature signal protects the pump drive from overheating.



### Effect in the event of failure

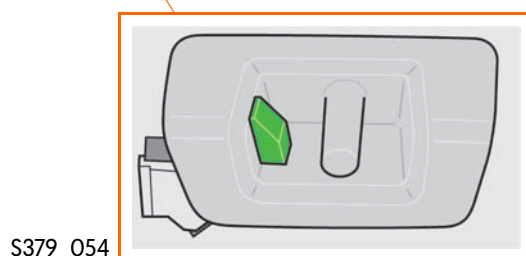
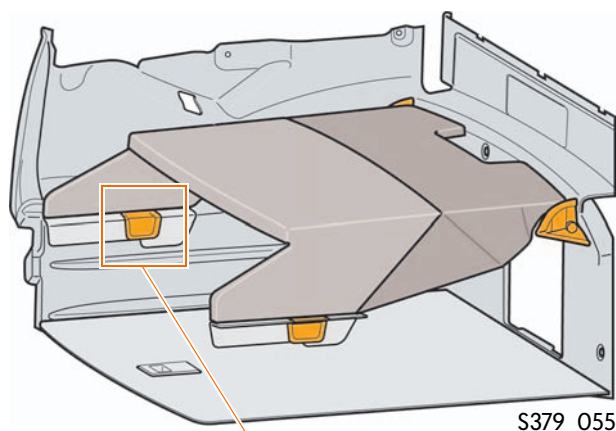
If the defect occurs when the convertible roof is completely closed, no further movement is possible. If the fault occurs when the convertible roof is already partially open, operation can be continued until the convertible roof "closed" position is reached. Of course, timeout checks (max. 8min, and max. 9.5min) by the convertible roof actuation control unit continue to be carried out.

### Electrical circuit



S379\_142

## Luggage cover contact switch F364



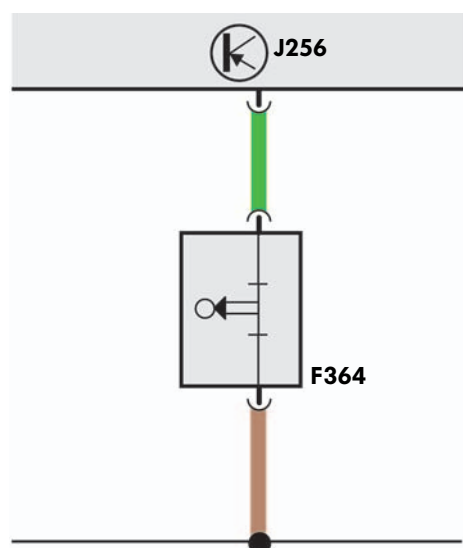
Contact switch F364 is located in the left-hand luggage cover mounting. The switch is designed so that it is open when the luggage cover is correctly engaged and closed if the luggage cover is missing or not correctly engaged.

### Signal use

This signal indicates that the luggage cover is engaged and that roof movement can therefore be released.



### Electrical circuit



S379\_141

### Effect in the event of failure

If a contact switch defect occurs when the convertible roof is closed or during convertible roof movement in the "open" direction, the convertible roof actuation control unit can no longer determine whether the luggage cover has been engaged. Convertible roof movement is not therefore released or aborted by the control unit.

If the convertible roof is completely open, the luggage cover contact switch signal is irrelevant and the convertible roof can be closed.

# Convenience electronics

## Convertible roof actuation hydraulic pump V118

Hydraulic pump V118 is part of the hydraulic unit.

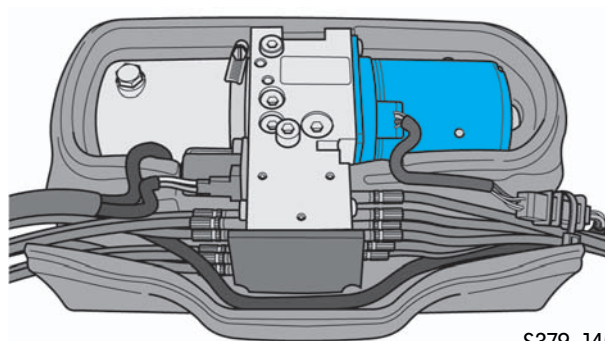
### Task

The convertible roof actuation hydraulic pump is driven by an electric motor. This supplies the convertible roof mechanism's eight hydraulic cylinders with hydraulic fluid and a maximum pressure of 160 bar. As required, the convertible roof actuation control unit actuates the pump to the left or the right.



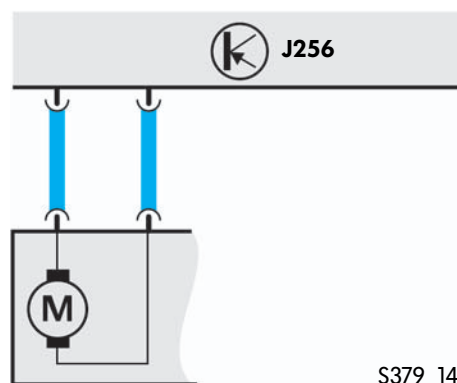
### Effect in the event of failure

Convertible roof operation is not possible if the hydraulic pump is defective. Only the sliding roof can still be opened when the convertible roof is closed, as this is equipped with a separate, electric drive.



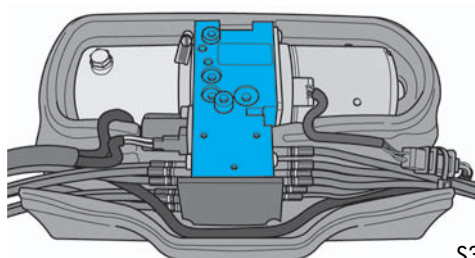
S379\_145

### Electrical circuit



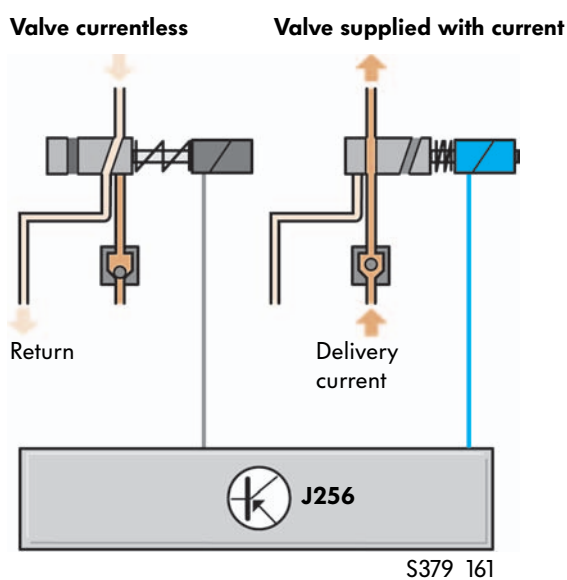
S379\_143

**Power operated convertible roof valve 1 N272**  
**Power operated convertible roof valve 2 N341**  
**Power operated convertible roof valve 3 N342**



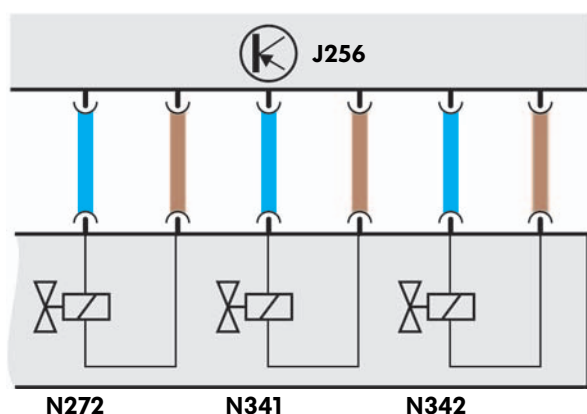
S379\_147

All three valves are seated in the hydraulic unit's valve block.



S379\_161

**Electrical circuit**



S379\_144

**Task**

With the aid of the three power operated convertible roof valves, the convertible roof actuation control unit operates the convertible roof mechanism's eight hydraulic cylinders.

In their currentless state, hydraulic fluid is able to flow back into the reservoir. If a valve is actuated, it allows the delivery current coming from the hydraulic pump to pass.



**Effect in the event of failure**

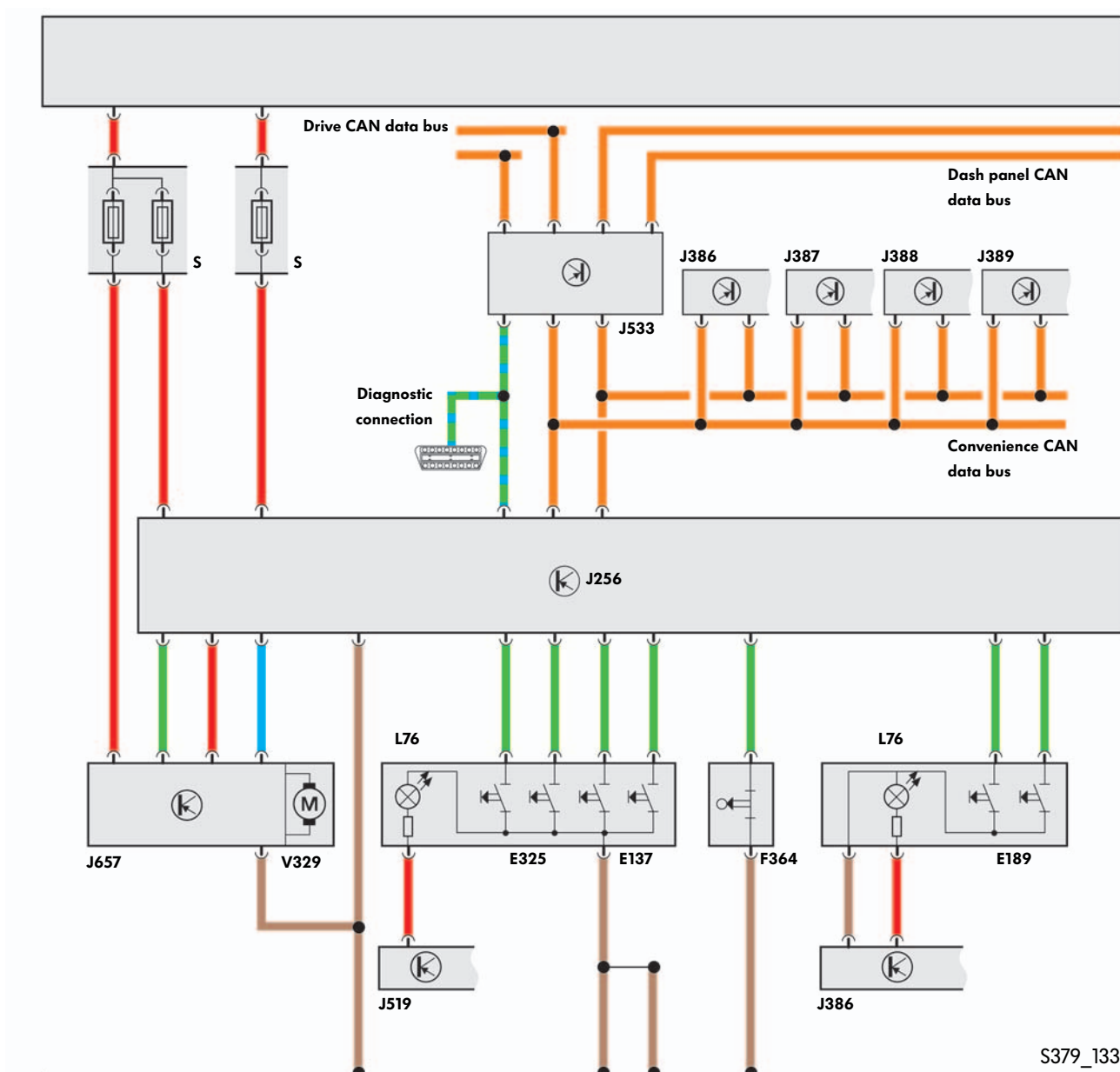
If the convertible roof actuation control unit determines one or more defective valves, convertible roof operation is prohibited and the failure is stored in the convertible roof actuation control unit's fault memory.

Like the pump, the valves are provided with two-fold protection against overheating:

- By the hydraulic pump temperature sender G555 and
- By the run time calculated by the convertible roof actuation control unit.

# Convenience electronics

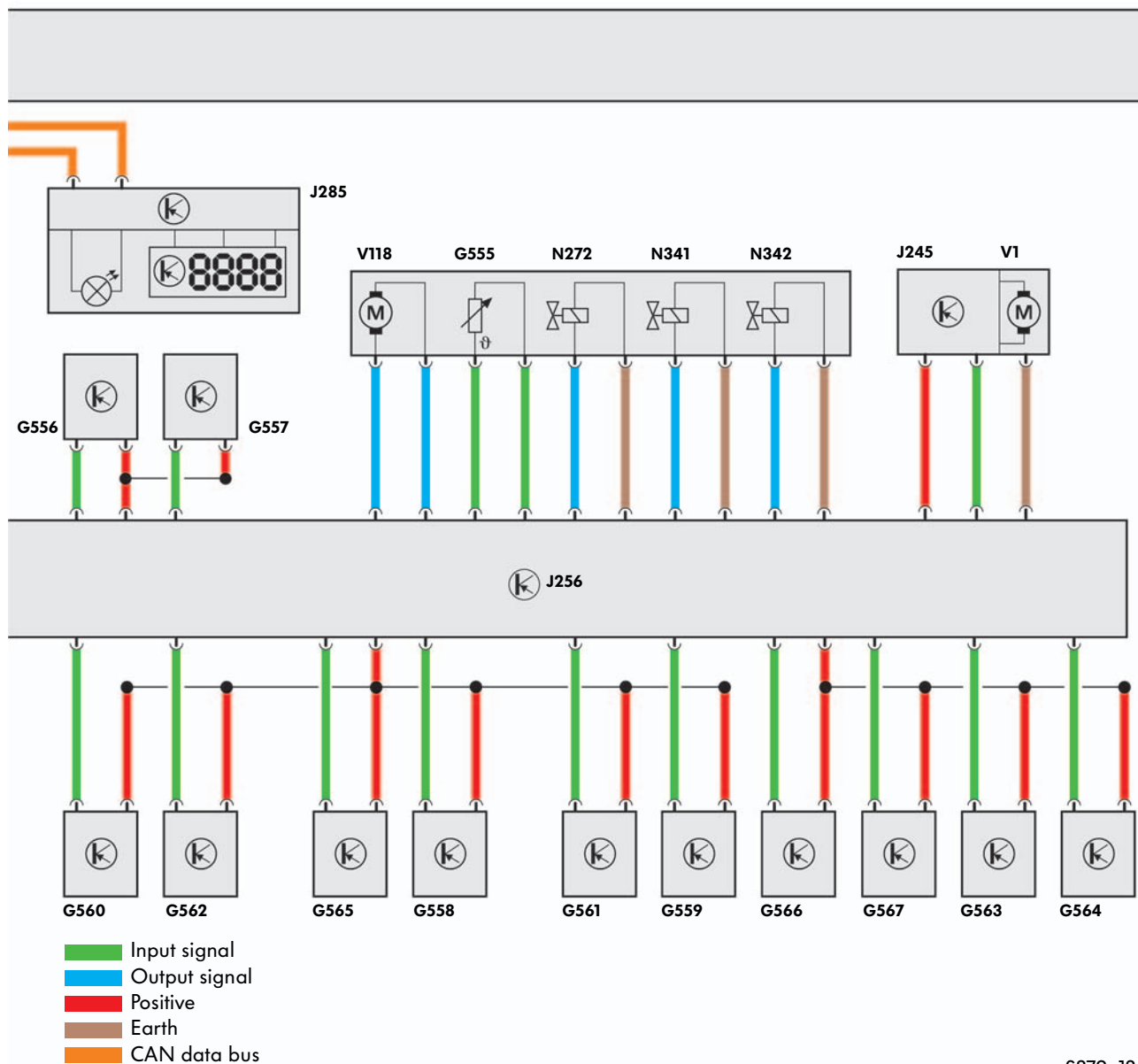
## Functional diagram



- E137** Convertible roof actuation button
- E325** Sunroof button
- E189** Central switch for window regulators in driver door
- F364** Luggage cover contact switch
- J245** Sliding sunroof adjustment control unit
- J256** Convertible roof actuation control unit
- J285** Control unit with display in dash panel insert
- J386** Driver door control unit
- J387** Front passenger door control unit
- J388** Rear left door control unit
- J389** Rear right door control unit
- J519** Onboard supply control unit
- J533** Data bus diagnostic interface
- J657** Power latching control unit

- L76** Button illumination bulb
- S** Fuse
- V1** Sliding sunroof motor
- V118** Convertible roof actuation hydraulic pump
- V329** Power latching motor





S379\_134

- G555** Hydraulic pump temperature sender
- G556** Front sender for position of left roof member
- G557** Front sender for position of right roof member
- G558** Sender for left roof member locked
- G559** Sender for right roof member locked
- G560** Left sender for rear window frame locked
- G561** Right sender for rear window frame locked
- G562** Sender for rear window frame open

- G563** Left sender for rear shelf locked
- G564** Right sender for rear shelf locked
- G565** Sender for roof stowed
- G566** Sender for left roof member flap open
- G567** Sender for right roof member flap open
- N272** Power operated convertible roof valve 1
- N341** Power operated convertible roof valve 2
- N342** Power operated convertible roof valve 3



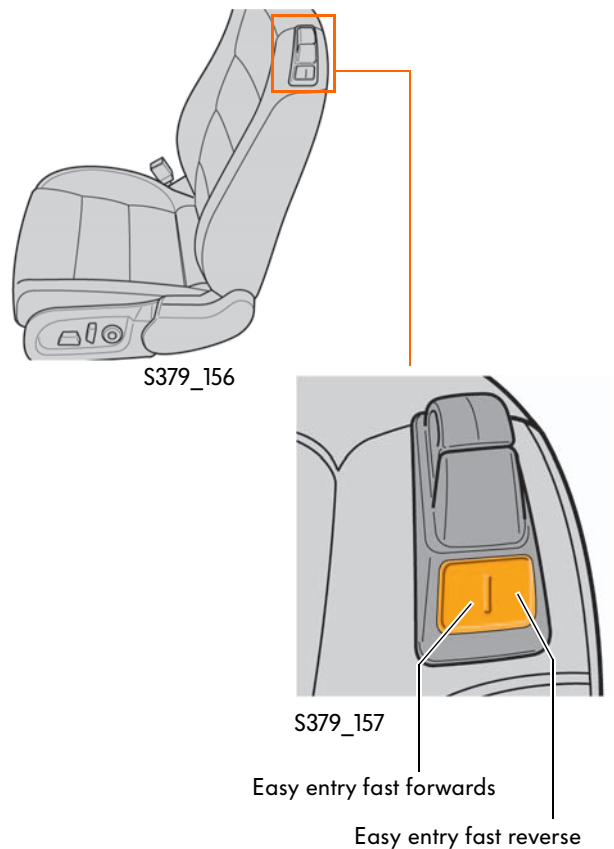
# Convenience electronics

## Electric easy entry function

An electrically activated entry assistant, the easy entry function, is fitted in the Eos for the first time. This is an extension of the seat functions and is available as special equipment.

### Design

Besides the release lever for the backrest, a seat with electric easy entry is fitted with a rocker switch, which can be actuated to move the seat quickly. The front area of the switch serves to move the seat forwards, the rear surface to move the seat backwards. This function enables passengers to reach the rear seats in comfort.

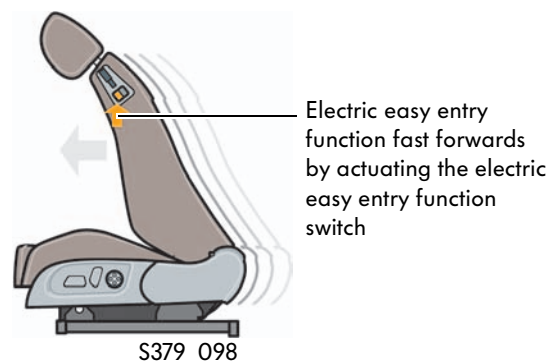
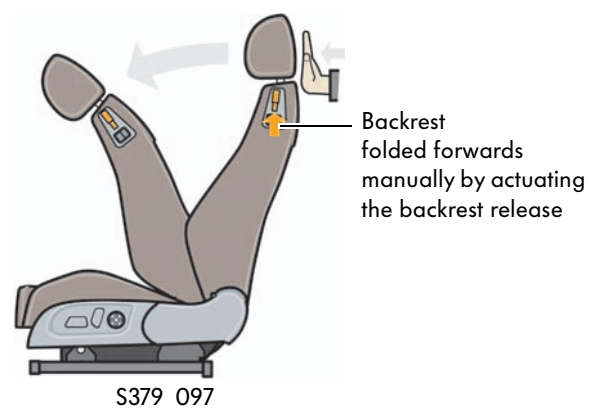


### Function

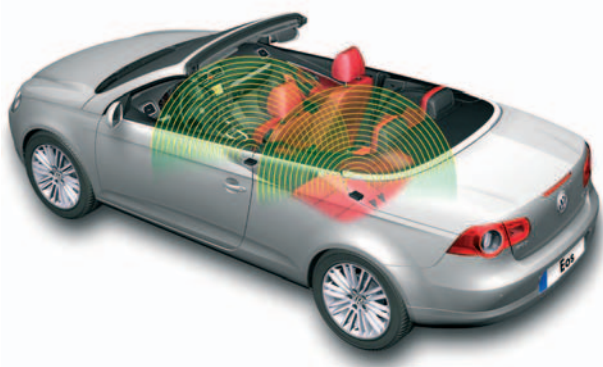
By actuating the front area of the switch, the seat is moved forwards rapidly (2.5 times faster than via standard seat longitudinal adjustment). In this case, the previous seat position is retained in the relevant easy entry control unit. By actuating the rear area of the switch, the seat is rapidly moved backwards to its original position again.

Fast adjustment functions independently of the backrest position. The backrest is folded forwards by hand.

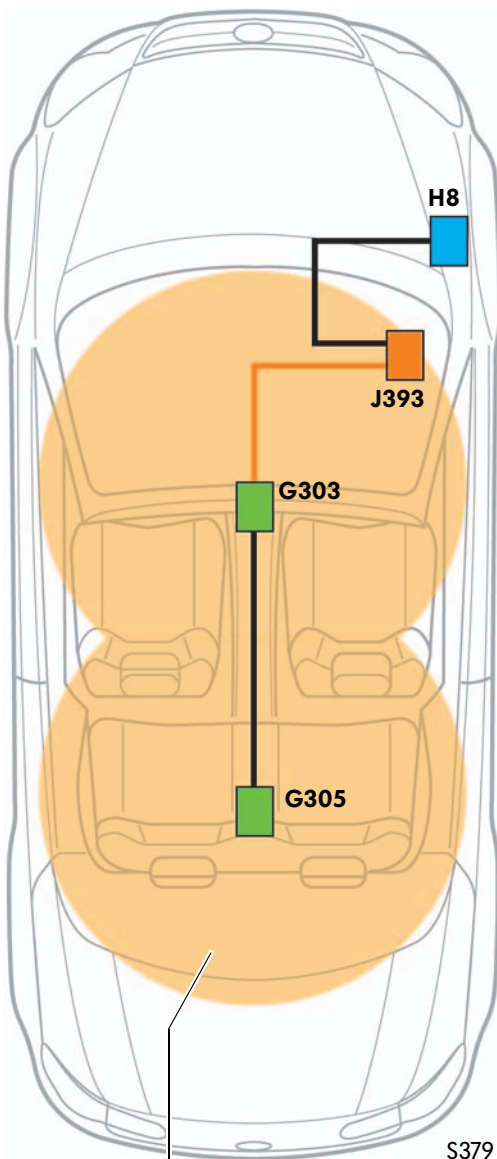
To protect persons sitting in the front, the electric easy entry function can only be operated at a speed of less than 5km/h and with the doors open within 10 minutes after opening the doors.



## Interior monitor



S379\_032



S379\_096

Monitored range

So that efficient interior monitoring is also guaranteed when the Eos is open, the vehicle is equipped with an interior monitor system based on microwave technology. This technology is necessary to negate ambient conditions or electromagnetic interference as far as possible. The interior monitor can be deactivated via a button in the driver door's storage compartment.

### Design

The system is essentially comprised of the two interior monitor send and receive modules 1 and 2 (G303 and G305) and the anti-theft alarm system horn H8. The send and receive modules are installed in the front of the passenger compartment on the centre tunnel and beneath the rear seat bench at the rear of the passenger compartment. The modules are control units, which are linked in master-slave formation. As the master, the front module communicates with the convenience system central control unit J393 via the LIN data bus. The slave module is linked to the master module via a further 1-wire data bus.

Both modules are equipped with a microwave sender and microwave receiver and each monitor their own area, whereby these intersect.

The microwave technology enables precise adjustment of the radius of the monitored range. In the Eos, 75 centimetres are set for the passenger compartment in the factory.



# Convenience electronics

## Microwave technology

The use of microwaves instead of thermal radiation in monitoring the passenger compartment has the advantage that electromagnetic waves in the microwave range are less susceptible to interference and are more precise than ultrasonic monitoring.

In the Eos, microwave technology has the advantage of insensitivity:

- To movements outside of the vehicle, e.g. a passing lorry or wind movements
- To interfering radio signals, mobile telephone networks (GSM)
- To interfering electromagnetic fields which may be caused, e.g. due to the electric charge carried by keys or coins (passive inter-modulation)



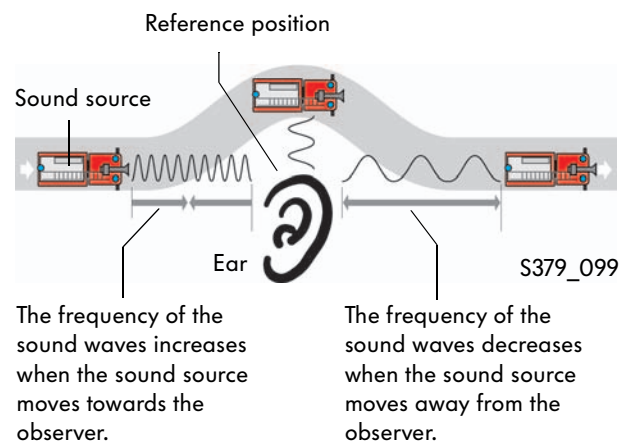
The functional principle of interior monitoring using microwaves is based on the Doppler effect, and corresponds to the manner in which a depth sounder or radar functions.

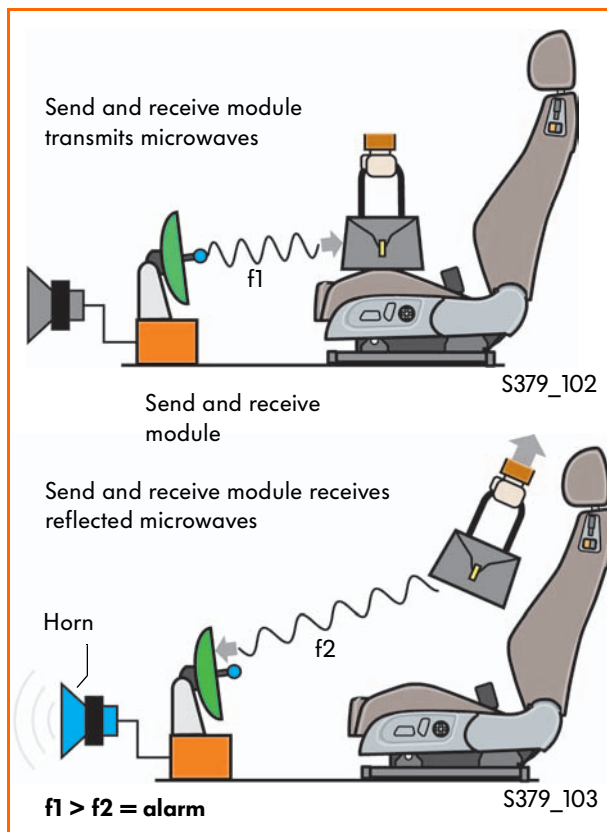
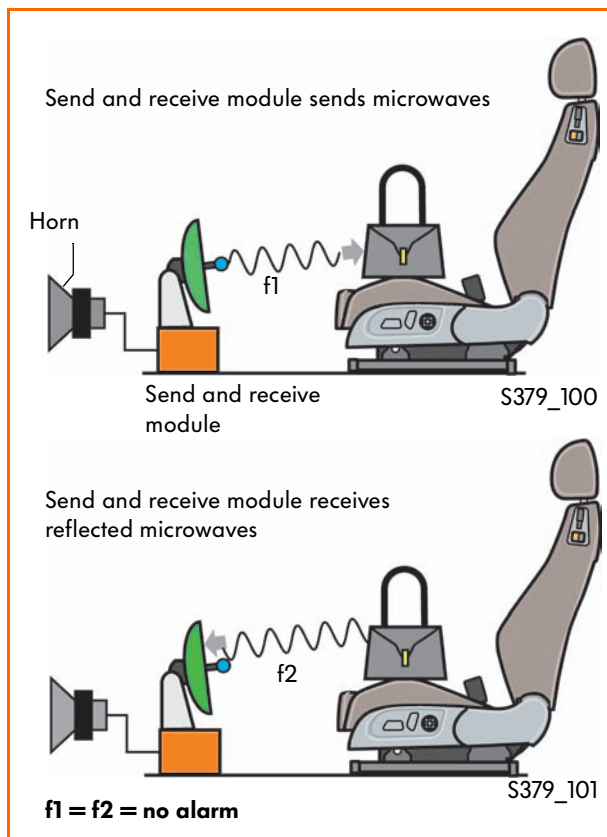
## The Doppler effect

This is named after the Austrian physicist and mathematician, Christian Doppler, who predicted this effect in 1842 for determining the movement of stars. The principle of the Doppler effect is based on the fact that the frequency of waves (sound waves, electromagnetic waves) between an observer and an object changes when this object moves towards or away from the observer.

If the object moves towards the observer, the frequency increases; if it moves away, the frequency decreases. A common example is the change in the pitch of sound waves, e.g. when an emergency vehicle with its siren sounding moves towards a pedestrian. The pitch increases for the pedestrian until the vehicle has passed him. The pitch then decreases as the vehicle moves away.

In the case of electromagnetic waves, the increase in frequency when the object moves towards the observer is referred to as blue shift, and the decrease in frequency when the object moves away from the observer as red shift.





The interior monitor send and receive module shown here in schematic form emits microwaves. If they encounter an object in the monitored range, they are reflected and return to the send and receive module. There, they are acquired and evaluated. This means that the send and receive module compares the frequencies of the microwaves which are sent and received. If the object does not move, the frequencies of the sent ( $f1$ ) and received waves ( $f2$ ) are identical.



If the object is moved away from the send and receive module as shown the Doppler effect occurs. This means that the frequency of the reflected microwaves ( $f2$ ), which the send and receive module acquires, is lower than the frequency of the microwaves which have been sent ( $f1$ ). An alarm is triggered.

As movement parallel to the transmitter does not generate a Doppler effect, because the distance between the object and transmitter does not change, the Eos is fitted with two send and receive modules, which are positioned in relation to each other so that an object in the interior of the vehicle changes its distance from at least one of the transmitters when it moves and therefore causes a Doppler effect.

# Radio and navigation

## The aerial concept

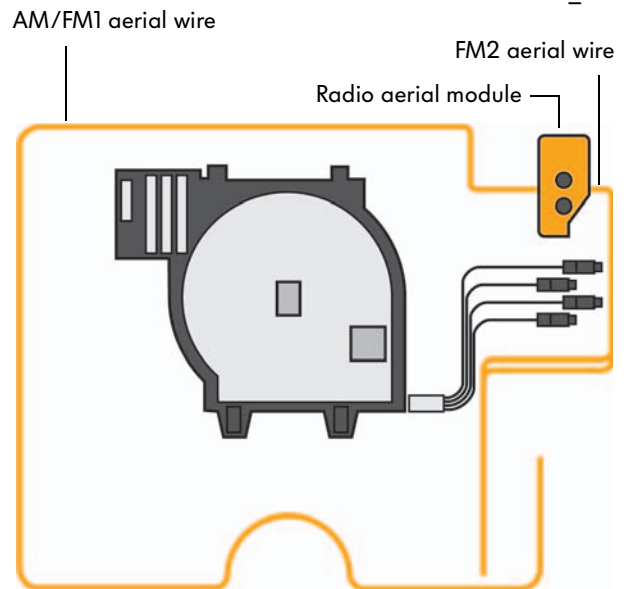
The Eos' aerial system is housed in the rear lid. To guarantee interference-free reception, the rear lid is therefore manufactured from plastic. The system's main components are the aerial module carrier, the radio aerial module and, depending on equipment, further receiver modules plus the FM/AM aerial structure, which is firmly bonded in the rear lid. Depending on the equipment level, 2-6 Fakra connectors round off the system.



S379\_104

### Radio aerial module

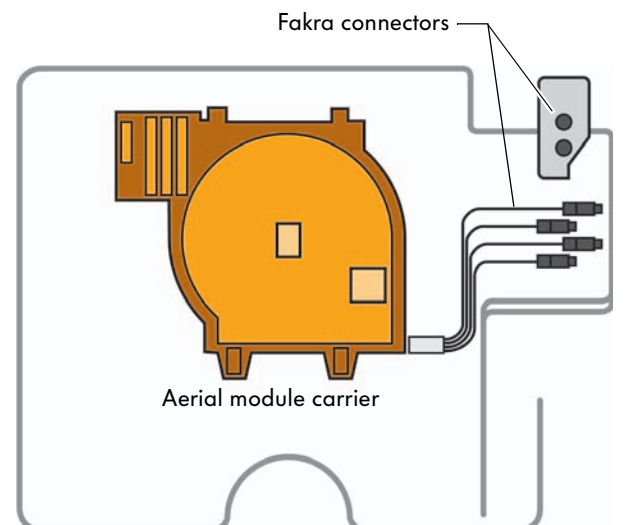
The radio aerial module contains the amplifiers for FM, AM and TV\*\*. If the vehicle is equipped with an auxiliary heater, the aerial structure for telestart is additionally housed on the module's printed circuit board. By bolting the radio aerial module on, the FM/AM aerial structure is simultaneously connected to the module. Two to a maximum of four Fakra connectors are provided on the module as pick-ups for the aerial signals.



S379\_109

### Aerial module carrier

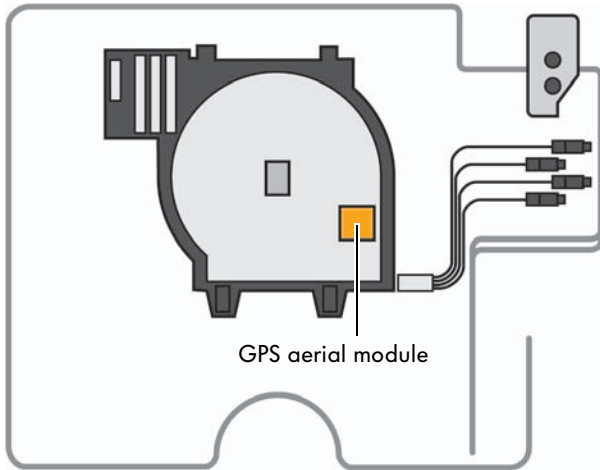
The aerial system's most striking component is the central, plate-shaped aerial module carrier. This carries the aerial modules for GPS/GSM/SDARS\*. The aerial module carrier is located centrally in the rear lid.



\* North America only, \*\* Japan only

S379\_105

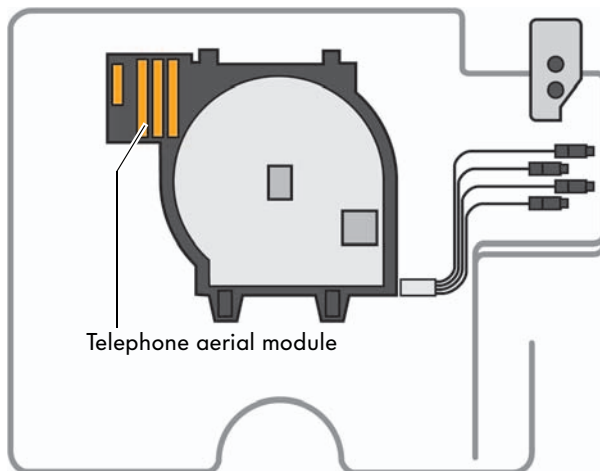




S379\_107

### GPS aerial module

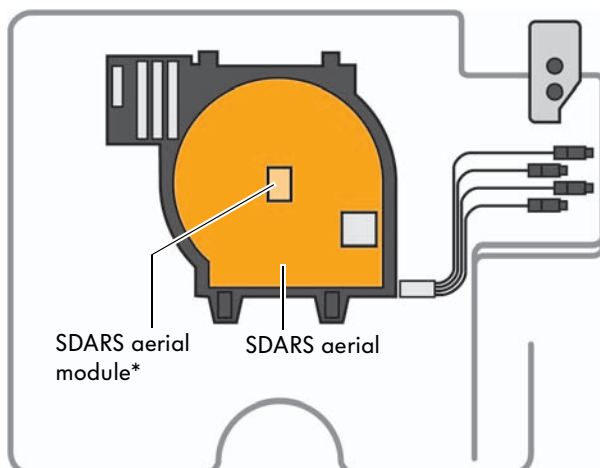
GPS means "**G**lobal **P**ositioning **S**ystem".  
The GPS module, which also contains the aerial, is housed as an autonomous unit, galvanically separated, on the central aerial module carrier. The module is connected via a separate supply cable with a Fakra connector.



S379\_108

### Telephone aerial module (GSM)

GSM means "**G**lobal **S**ystem for **M**obile communications".  
The aerial for the GSM network is also housed on the aerial module carrier and is electrically separated. This module is also connected via a separate supply cable with a Fakra connector.



North America only\*

S379\_106

### SDARS aerial module\*

SDARS means:  
"**S**atellite **D**igital **A**udio **R**adio **S**ervices"  
(digital audio satellite reception system).  
The aerial is formed by the copper film which is extensively applied onto the aerial bracket. Contact with the aerial module is established directly on installation of the module onto the film. Depending on the tuner variant, connection to the SDARS tuner is carried out via 1 or 2 Fakra connectors.

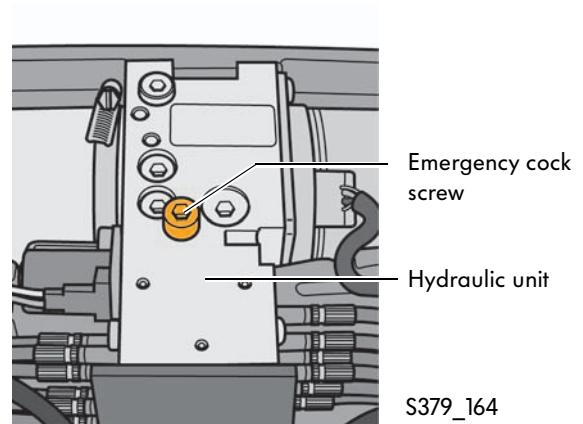
## Emergency operation strategies

### Manual opening/closing

If the electrohydraulic convertible roof actuation system fails during roof movement, the Eos' convertible roof can be moved to one of the two end positions from any position.

To do this, the emergency cock screw on the hydraulic unit must first be loosened.

The convertible roof components can now be moved individually with the assistance of a second person. A second person is required to move the convertible roof components in parallel.



### Closing/opening with VAS 5051

If the convertible roof can no longer be moved from the secure "closed" or "open" positions due to an electrical fault, e.g. defective Hall sender, (hydraulic system is OK), this can be carried out using a corresponding programme in VAS 5051.

### Closing force limitation

The movement sequences on opening and closing the convertible roof are very complex. Depending on the position

of the convertible roof, different lever forces occur at the convertible roof's components. As a result of these different lever forces, the convertible roof control system does not limit the force. This means that there is a risk of injury if persons are located in the path of roof movement due to improper use of the convertible roof control system.

Only the sliding roof has a separate force limitation system as part of the sliding roof function due to its separate, electric drive.



Under all circumstances, observe the current work instructions in ELSA during all repair, installation or adjustment work. Improperly executed work may extensively damage the complex convertible roof mechanical and control systems.

## Which answers are correct?

One or several of the given answers may be correct.

### 1. Which Hall sender designs occur in the roof sensor system in the Eos?

- ☐ a) Hall senders without magnets
- ☐ b) Hall senders with integrated magnet
- ☐ c) Hall senders with an external magnet
- ☐ d) Hall senders with two external magnets.

### 2. On which of the following paths is the signal from the central switch for window regulators in driver door E189 transmitted?

- ☐ a) From the switch to the driver door control unit via the convenience system central control unit to the individual door control units
- ☐ b) From the switch directly to the convertible roof actuation control unit, and from there to the individual door control units
- ☐ c) From the switch directly to the driver door control unit, and from there to the other door control units



### 3. Which statement about the luggage cover contact switch is correct?

- ☐ a) The luggage cover contact switch is actuated by the correctly engaged luggage cover.
- ☐ b) If the contact switch is not actuated, the convertible roof cannot be opened.
- ☐ c) If the contact switch is not actuated, the convertible roof cannot be closed.

# Test yourself

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## 4. How is the position of the convertible roof detected in the Eos?

- ☐ a) Via incremental senders at the relevant rotational axes
- ☐ b) Via Hall senders located in key positions
- ☐ c) Via contact switches at the relevant roof locks

## 5. How are the hydraulic cylinders actuated?

- ☐ a) The power operated convertible roof valves are always actuated simultaneously so that the operating pressure of 150 bar is achieved.
- ☐ b) The hydraulic pump is able to actuate all 4 power operated convertible roof valves simultaneously.
- ☐ c) The convertible roof actuation control unit controls the eight hydraulic cylinders via three power operated convertible roof valves and the convertible roof actuation hydraulic pump's delivery direction.

## 6. Which of the following statements are pre-conditions for closing the convertible roof?

- ☐ a) The temperature of the hydraulic pump is less than 105°C.
- ☐ b) The total hydraulic valve operating time is less than 9.5 minutes.
- ☐ c) All Hall senders report a plausible signal regarding the positions of the convertible roof's sensed components.
- ☐ d) The vehicle speed must be less than 1km/h.
- ☐ e) The side windows must be in the "closed" position.
- ☐ f) The luggage cover contact switch is actuated.



## 7. Rear lid assist stops convertible roof movement ...

- ☐ a) If an obstacle is detected in the rear area at the start of convertible roof movement.
- ☐ b) If an obstacle arises in the rear area during convertible roof movement before the rear lid moves into the rear lid assist detection range.
- ☐ c) If the rear lid is open and an obstacle is detected in the rear area.

## 8. When are the convertible roof's Hall senders referred to as redundant?

- ☐ a) The signal is redundant when the signal voltage is sufficiently high to be reliably detected by the convertible roof actuation control unit.
- ☐ b) The signal is redundant when the convertible roof actuation control unit saves the signal to have it available for the next stage of control.
- ☐ c) The signal is redundant when there are at least two Hall senders which monitor the correct position of a convertible roof assembly.





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