Service Training

Audi A4 Cabriolet convertible top control

Self-Study Programme 314

Introduction

The perfectly shaped Audi Cabriolet continues to enjoy undiminished popularity.
Innovative technology, sportiness, modern design as well as dynamics and exclusivity are the hallmarks of the Audi A4 Cabriolet. The sporty lines and the outstanding material quality and finish of the interior are typical attributes. The convertible top control also defines a new dimension in open-topped driving.
The new Audi A4 debuted as the first production saloon by Audi with a fully automatic, electro-hydraulic convertible top with heated glass rear window.

When open the hood is fully retracted and nothing interferes with the characteristic shoulder line which gives the vehicle body a smooth edge. But even with the hood closed, the dynamism and harmony of the silhouette are retained. The wide arch of the roof's outline, without any visible ridges created by the linkage, accentuates the body's flat proportions and the subtle wedge shape of the unit as a whole.
State-of-the-art convenience electronics makes the convertible top even easier and more convenient for the driver to operate.

Contents

The Self-Study Programme conveys basic principles with regard to the design and function of new models, new automotive components or new technologies.

The Self-Study Programme is not a Repair Manual!
All values given are intended as a guideline only, and refer to the software version valid at the time of publication of the SSP.

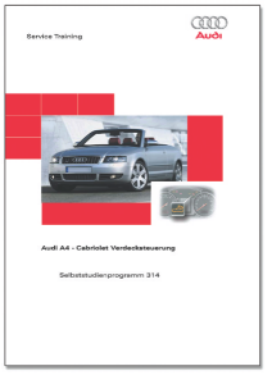
For maintenance and repair work, always refer to the current technical literature.

Reference

Note

Information materials

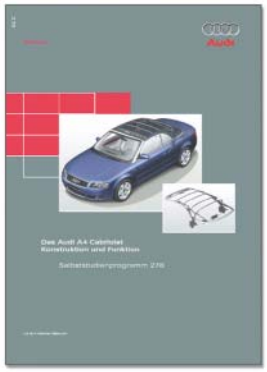
The design and function of the Audi A4 Cabriolet are described in two separate Self-Study Programmes:



314_003

This Self-Study Programme deals with the design and the function of the electrical convertible top control fitted in the Audi A4 Cabriolet.
It will help you to familiarise yourself with the electrical system and electronics in the Audi A4 Cabriolet.
It explains the fitting locations of the components as well as the control unit.
It also describes various functions and modifications in the diagnostics.

Audi A4 Cabriolet convertible top control
Self-Study Programme 314



314_004

The hydraulic functions, the convertible top design, the emergency release and the body design of the Audi A4 Cabriolet are described in Self-Study Programme 278.

The Audi A4 Cabriolet
Design and function
Self-Study Programme 278

314_005

Detailed information about operation, handling and special features can be found in the vehicle Owner's Manual.

Owner's Manual
Audi A4 Cabriolet

The illustrated CD-ROMs
provide further supporting media.

For a better understanding of the electronics, it is recommended that you familiarise yourself with the contents of the Multimedia Training CDs.

CAN Data bus 1 and 2

314_006

Automotive Electrics 1 to 3

314_007

General

The well thought-out design of the convertible top allows easy and quick operation.
The convertible top opens and closes automatically. The opened convertible top is completely folded in its compartment and the convertible top compartment lid is closed.

Operating sequence of the convertible top control

For detailed information about operation of the convertible top, refer to vehicle Owner's Manual as well as Self-Study Programme 278 "The Audi A4 Cabriolet - Design and Function".

For safety reasons, the convertible top can only be opened or closed while the vehicle is stationary.

314_008

Overload protection / runtime monitoring

To protect the hydraulic system, the runtime of the hydraulic pump is limited.
If the convertible top is operated continuously for a lengthy period of time, this will place a great deal of strain on the hydraulic unit.
Damage to the system is prevented by activation of the overload protection function.
This protective function disables the convertible top control for approximately 15 minutes. The convertible top control can be put back into operation after this time expires.
The number of complete operating cycles of the convertible top is limited to four (approx. 200 s continuous load), as otherwise overheating can occur in the hydraulic unit.

314_009

If the runtime monitoring function is activated, no fault message is entered into the fault memory.

314_010

Variable convertible top compartment

The variable compartment must have been fully lowered before the convertible top can be opened.

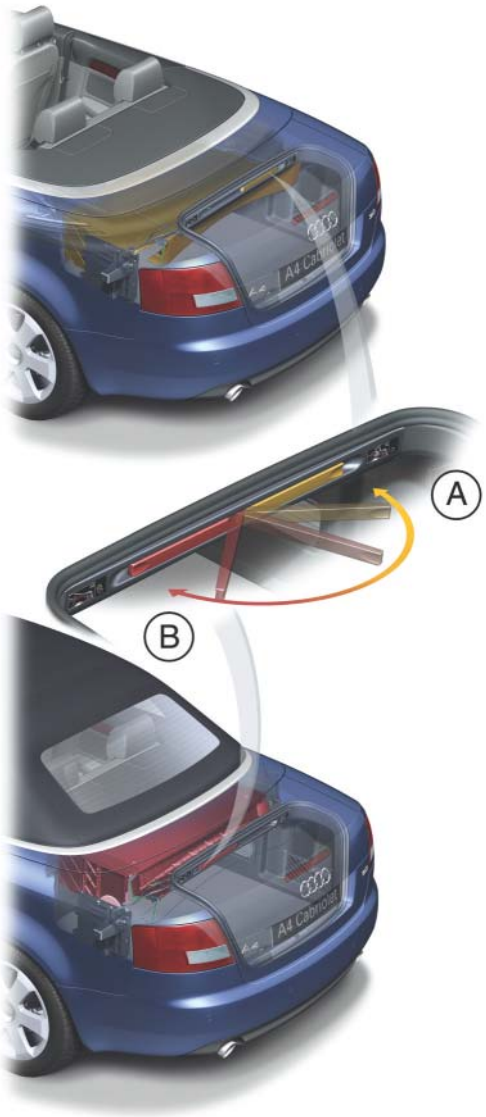
The open convertible top is then folded away completely into the convertible top compartment.

The variable compartment cannot be raised while the convertible top is open.

When the convertible top is closed, the convertible top compartment can be raised to increase the size of the luggage compartment.

Convertible top compartment lowered:
Operating lever in position **A**

Convertible top compartment raised:
Operating lever in position **B**



314_011

Note

Attempting to raise the variable convertible top compartment while the convertible top is open can result in (possibly irreparable) damage to mechanical components.

314_012

A warning message appears on the dash panel insert display if an attempt is made to open the convertible top without having lowered the variable compartment.

314_013

Emergency release

In the event of a malfunction, the automatic convertible top can also be closed manually.
Such manual closing and opening should however only be carried out in emergency situations.

Emergency release key

Emergency closing of the convertible top requires the use of an emergency release key.
This is located behind the fuse box cover in a separate compartment.

314_016

Note

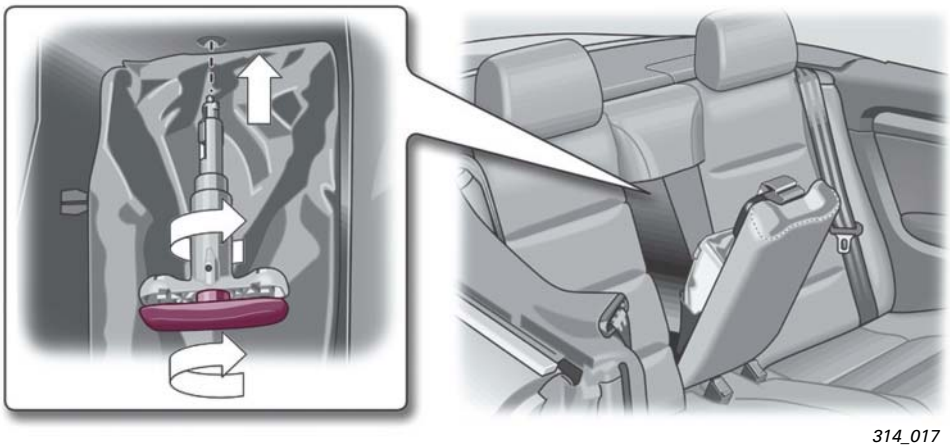
Manual operation of the convertible top is only allowed while the ignition is off.

If the emergency release procedure is initiated manually, this must also be completed manually. The convertible top must therefore be completely closed or opened.

314_018

Reference

For detailed information about the emergency release system, please refer to the vehicle Owner's Manual as well as Self-Study Programme 278 "The Audi A4 Cabriolet - Design and Function".



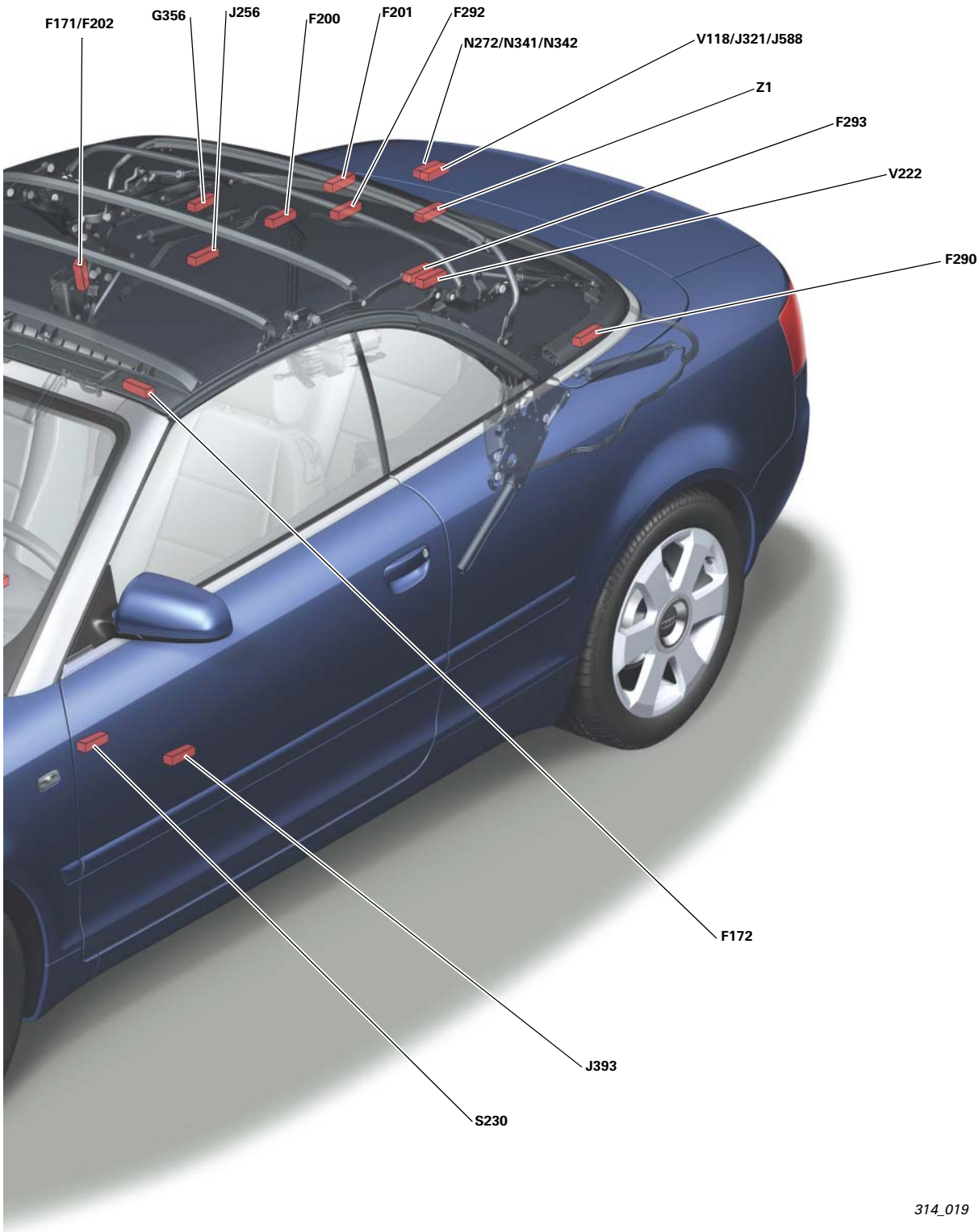
314_017

Fitting locations of system components

To provide you with a quick overview, all fitting locations of the components which belong to the electrical convertible top control are listed on this double page.
On the following pages, you will find illustrations and descriptions of the system components.

Electronic components

E87 Air conditioning system/Climatronic operating and display unit
E137 Convertible top switch
F170 Convertible top right latch switch (for USA only)
F172 Convertible top front latch switch
F171 Convertible top stowed switch
F200 Convertible top box lid latched switch 1, right
F201 Convertible top box lid, top switch
F202 Convertible top front switch
F290 Convertible top box lid switch, left
F292 Convertible top compartment tray position switch
F293 Convertible top compartment lid lock switch, unlocked
F294 Convertible top latch switch, open
F295 Convertible top latch switch, closed
G356 Convertible top frame position sender
J256 Convertible top operation control unit
J285 Control unit with display in dash panel insert



314_019

J321 Hydraulic pump relay, convertible top operation
J393 Convenience system central control unit
J588 Hydraulic pump relay 2, convertible top operation
L72 Convertible top operating switch illumination
N272 Power-operated convertible top valve 1
N341 Power-operated convertible top valve 2
N342 Power-operated convertible top valve 3
S67 Roof actuation fuse
S230 Fuse in fuse holder
V118 Convertible top operation hydraulic pump
V222 Convertible top compartment lid lock motor
V223 Convertible top latch motor
Z1 Heated rear window

Component parts of the convertible top control

On the following pages, you will find descriptions of the individual system components.

The convertible top operation control unit J256 controls and monitors the fully automatic operating sequence of the convertible top and drives the convertible top mechanism by way of a hydraulic system and two power latching mechanisms.

Further operation of the convertible top is only possible if all microswitches or senders indicate to the control unit that they are in their predefined positions.
Loss of a signal from a microswitch or sender will trigger a system shutdown.

Convertible top switch E137

The operator uses a rocker switch to control the convertible top and start the opening and closing sequences.

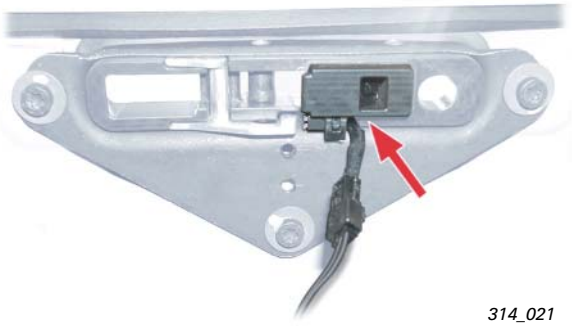
Control switch in centre console
- To open convertible top - pull up
- To close convertible top - press

When the switch is released, all movements of the convertible top stop immediately.
From this position, the convertible top can be moved in any direction by pressing the switch.

314_020

Convertible top front latch switch F172

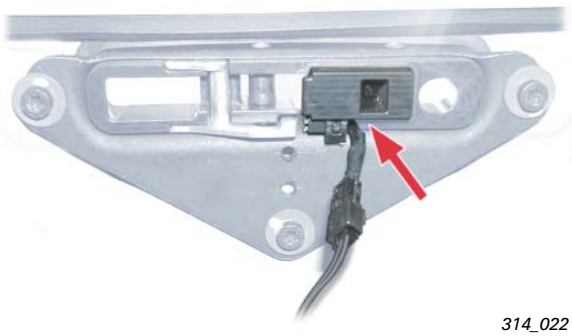
The switch (on the roof frame at the top left) informs the convertible top control unit whether the convertible top latch is "closed" or "open".
The left-hand latching hook on the convertible top actuates the microswitch integrated in the lock.



314_021

Convertible top right latch switch F170 (for USA only)

In addition to switch F172, the switch (on the roof frame at the top right) signals to the convertible top control unit whether the convertible top latch is "closed" or "open".
The right-hand latching hook on the convertible top actuates the microswitch integrated in the lock.



314_022

Convertible top stowed switch F171

The convertible top stowed switch sends a signal to the convertible top operation control unit J256 as soon as the convertible top linkage has reached the stop position "convertible top stowed in convertible top compartment".

Convertible top front switch F202

The convertible top stowed switch sends a signal to the convertible top operation control unit J256 as soon as the convertible top linkage has reached the stop position "convertible top fully closed".

Convertible top stowed switch F171 and convertible top front switch F202 are installed in a housing on the right convertible top main bearing.

314_023

Convertible top box lid switch, left F290

This switch sends a signal to the convertible top operation control unit J256 as soon as the fasteners on the convertible top compartment lid have engaged in the locks.

The switch is integrated in the left hand lock on the convertible top compartment lid.

Convertible top box lid latched switch 1, right F200

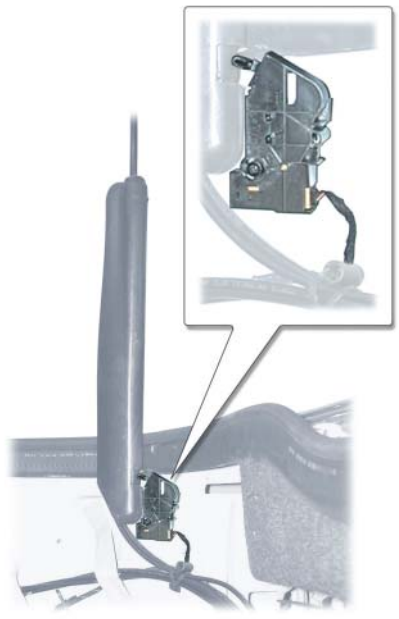
This switch signals the convertible top operation control unit J256 whether the convertible top compartment lid is "locked" or "unlocked".

The switch is integrated in the right hand lock on the convertible top compartment lid.

314_024

Convertible top box lid, top switch F201

This switch sends a signal to the convertible top operation control unit J256 as soon as the piston of the right hand hydraulic cylinder has reached the stop position "convertible top compartment lid open".



314_026

Convertible top compartment tray position switch F292

This switch sends a signal to the convertible top operation control unit J256 as soon as the convertible top compartment tray has been lowered.

This prevents movement of the convertible top (opening) while the convertible top compartment tray is raised.

The switch is mounted on the right-hand side of the lifting / lowering mechanism at the convertible top compartment tray.

314_027

Convertible top compartment lid lock switch, unlocked F293

This switch indicates the motor position "convertible top compartment lid lock unlocked" to the convertible top operation control unit J256.

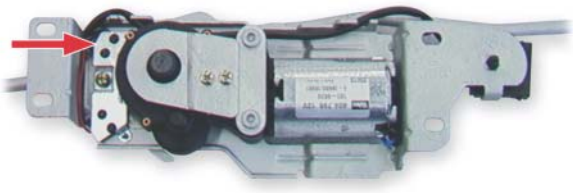
The switch is mounted on the convertible top compartment lid lock motor V222.

314_028

Convertible top latch switch, open F294

The switch indicates the motor position "convertible top latch open" to the convertible top operation control unit J256.

The switch is mounted on the convertible top latch motor V223.

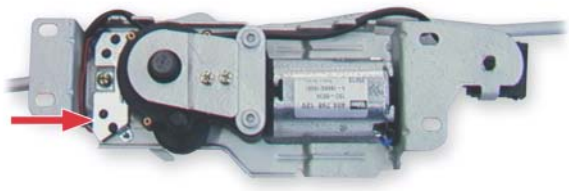


314_029

Convertible top latch switch, closed F295

The switch indicates the motor position "convertible top latch closed" to the convertible top operation control unit J256.

The switch is mounted on the convertible top latch motor V223.



314_030

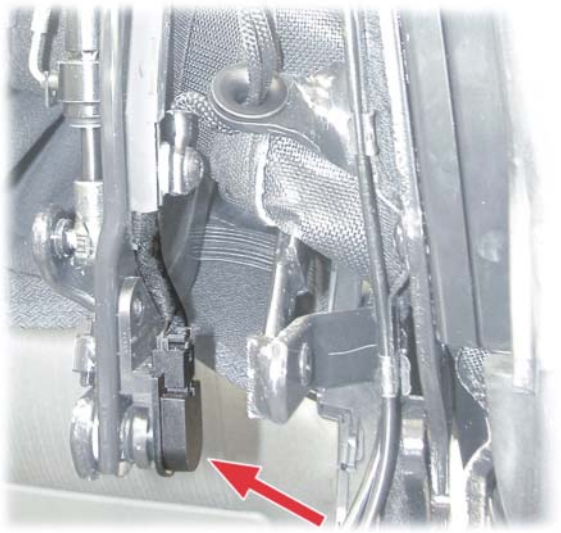
Convertible top frame position sender G356

The signal from this sender is utilised to determine the position of the convertible top frame.
Using the information generated by this potentiometric angle sender, the convertible top operation control unit J256 determines the position of the convertible top frame.
For the convertible top to operate correctly, three different positions of the convertible top frame must be determined:

- frame raised
- frame lowered
- dead centre (lowest position of convertible top frame (mechanical dead centre)/ convertible top frame is completely seated on the convertible top compartment lid

A sender which is not adapted to the convertible top operation control unit can lead to emergency operation of the convertible top, which will then run at a reduced speed.

The sender is mounted on the convertible top linkage for the rear right convertible top frame.



314_031

Convertible top operation control unit J256

The fully automatic convertible top operating sequence is implemented by using the convertible top operation control unit.

The control unit controls and monitors the convertible top operating sequence and drives the convertible top mechanism by means of a hydraulic system and two power latching mechanisms.

The convertible top operation control unit acquires and monitors the positions of the convertible top mechanism by means of various microswitches and a potentiometric angle sender.

If the condition for operation is met and convertible top switch E137 is actuated, the control unit will commence operation of the convertible top.

The control unit is installed in the rear compartment behind the right side trim.

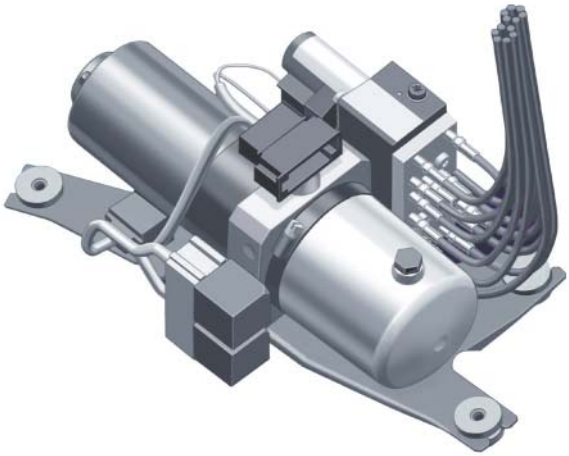
314_032

Convertible top operation hydraulic pump V118

The convertible top control unit drives the mechanism by way of a 3-circuit hydraulic unit (3 valves, bidirectional hydraulic pump).
Depending on the direction of rotation of the electric motor and the circuit state of the solenoid valves, the rotor piston pump feeds the hydraulic fluid into the pressure lines routed to the hydraulic rams.

Reversing the direction of rotation of the electric motor also reverses the direction of pumping.

The hydraulic pump is installed in the stowage compartment on the right-hand side of the luggage compartment.



314_033

Reference

More information about the hydraulic system and its functions can be found in Self-Study Programme 278 "The Audi A4 Cabriolet - Design and Function".

Two power latches are used to lock the convertible top and the convertible top compartment lid.

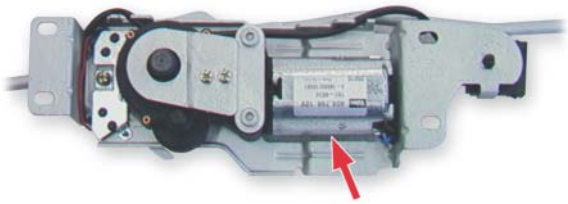
Convertible top compartment lid lock motor V222

The motor actuates the two convertible top compartment lid locks and is mounted on the convertible top compartment at the centre of the rear bulkhead.

314_034

Convertible top latch motor V223

While opening and closing, the convertible top latch motor actuates the latching hook facing the window frame on the roof top end.



314_035

Control unit with display in dash panel insert J285

In the dash panel insert there is a convertible top operation warning lamp which provides the driver with information about the status of the convertible top control.
It lamp comes on if the convertible top has not been completely opened or closed.
It flashes if one of the conditions for automatic opening and closing of the convertible top has not been met.
This warning lamp is driven via the convenience CAN bus.

314_036

In addition, messages are displayed on the central display panel in the dash panel insert.
They provide information about the current operating status of the convertible top and are codetermined by the convertible top operation control unit.
This happens if a safety function of the convertible top has been activated or a malfunction has occurred.

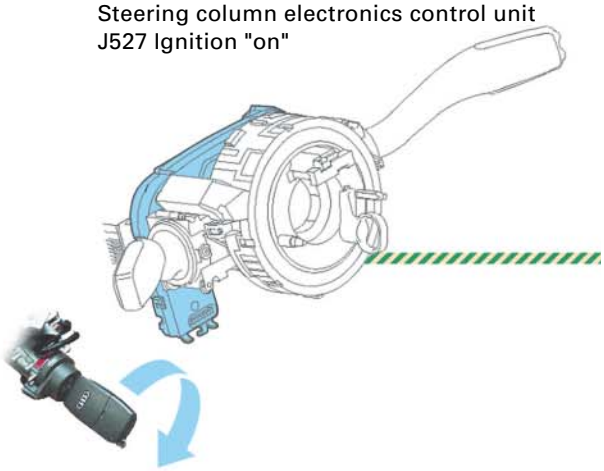
314_037

The convertible top operation warning lamp is activated parallel to and independently of the messages displayed.
The convertible top operation control unit J256 receives vehicle speed signals from the dash panel insert. This is a criterion for enabling operation of the convertible top at vehicle speeds of less than 5 kph.

Overview of the fully automatic convertible top control system

E137 Convertible top switch

Steering column electronics control unit
J527 Ignition "on"

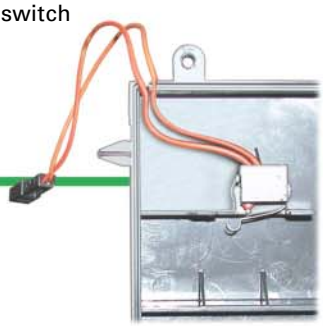


F200 Convertible top box lid latched switch 1, right /
F290 Convertible top box lid switch, left

G356 Convertible top frame position sender

F172 Convertible top front latch switch
F170 Convertible top right latch switch (for USA only)

F292 Convertible top compartment tray position switch



F295 Convertible top latch switch, closed
F294 Convertible top latch switch, open

F201 Convertible top box lid, top switch

F293 Convertible top compartment lid lock switch, unlocked

Twin microswitches F171 Convertible top stowed switch and
F202 Convertible top front switch

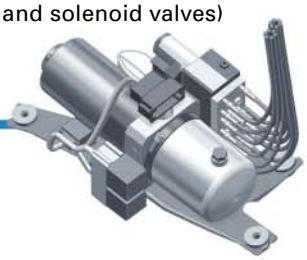
Control unit with display in dash panel insert J285 (road speed signal to dash panel insert)

Convertible top operation warning lamp

Central display of the dash panel insert

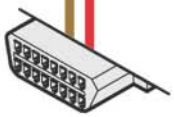
Convertible top operation control unit J256

Fig. V118 Convertible top operation hydraulic pump (with switching relay and solenoid valves)



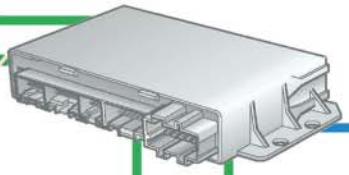
V222 Convertible top compartment lid lock motor

Diagnosis connection (K and L leads)

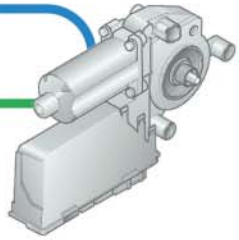


V223 Convertible top latch motor

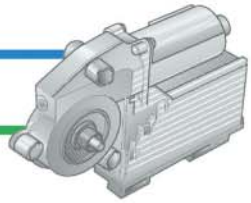
J393 Convenience system central control unit



Electric windows
Front door control unit J386 / J387



Electric windows
Rear door control unit J388 / J389



Rear lid status 'Lock rear lid'
V139 Rear lid release motor

Windscreen heater

E87 Air conditioning system/Climatronic operating and display unit

314_038

Overall vehicle data bus network

The CAN data bus system has attained great importance on account of the ever-increasing use of electronic control units in vehicles and the growing need for data interchange.
The network interconnects the various control units by data bus cables.

In this way, various signals can be transmitted digitally between control units. In total, two data bus cables are used for this purpose, which saves using a separate line for each signal.

G85 Steering angle sender
E87 Air conditioning system/Climatronic operating and display unit
J104 ABS with EDL control unit
J136 Seat and steering column adjustment control unit with memory
Memory function
J217 Automatic gearbox control unit
J220 Motronic control unit
J234 Airbag control unit
J256 Convertible top operation control unit
J285 Control unit with display in dash panel insert
J345 Trailer detection 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
J401 Navigation system with CD drive control unit
J402 Operating electronics control unit, navigation
J412 Mobile telephone operating electronics control unit
J415 Navigation/TV tuner
J446 Parking aid control unit
J453 Multi-function steering wheel control unit
J519 Onboard power supply control unit
J526 Telephone/telematics control unit,
J527 Steering column electronics control unit
J572 Driver side easy entry control unit
J573 Front passenger side easy entry control unit
R Radio
R94 Navigation interface
R99 Chip card reader unit

The data bus system has three subsystems:

convenience CAN bus

driveline CAN bus

infotainment CAN bus

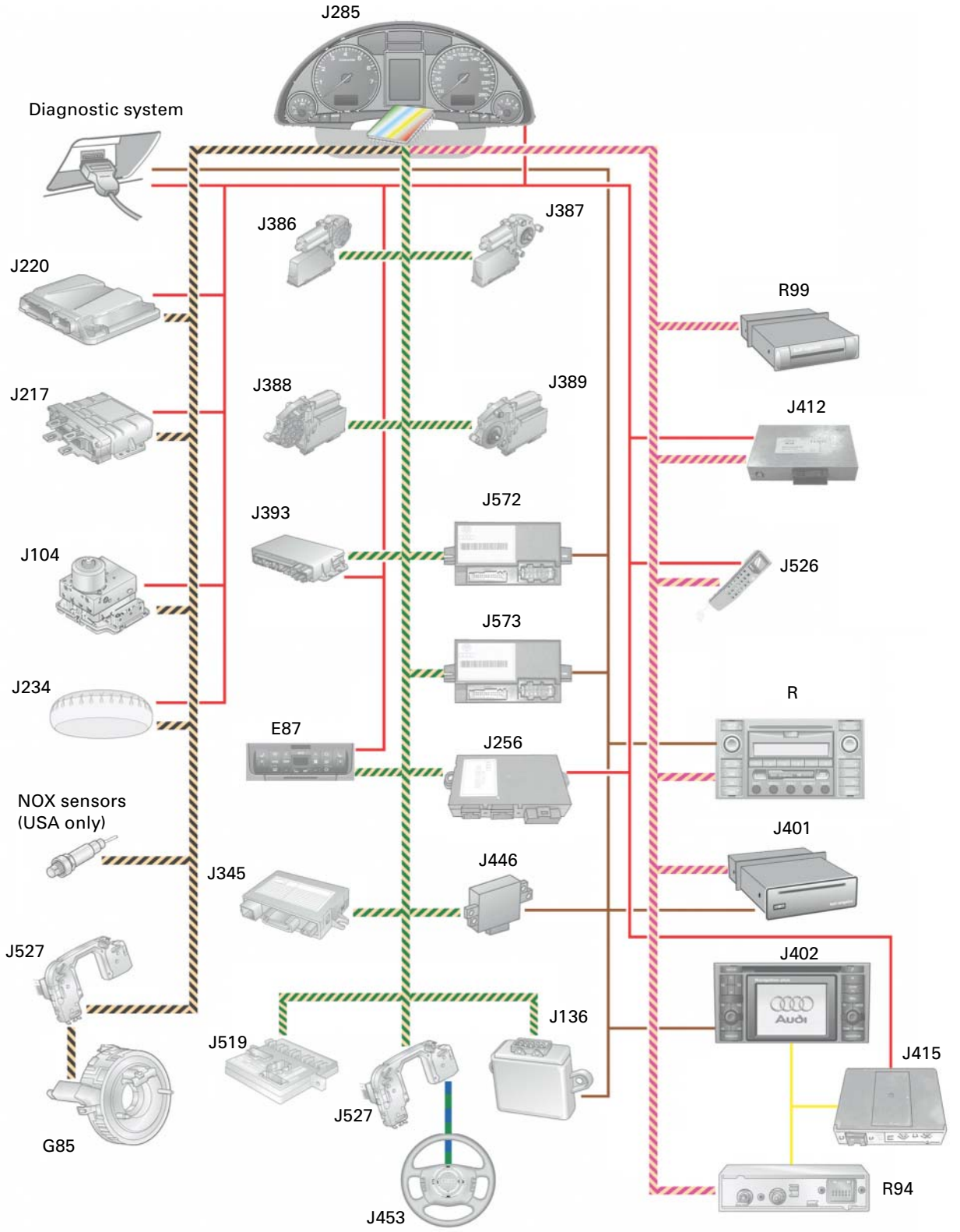
Diagnosis connection

K lead

L lead

Various sub-bus systems

Bidirectional



Note

The steering column electronics acquire the signals generated by the ignition switch as well as the multifunction and "tiptronic" steering wheel control buttons.

CAN information exchange

The convertible top operation control unit J256 is connected to the other control units in the vehicle via the convenience CAN bus.
For function and process control, a continuous exchange information takes place between the control units across the convenience CAN bus.

Convertible top operation control unit J256

314_040

The convertible top operation control unit J256 reads the information from the CAN data bus as described on the following page.

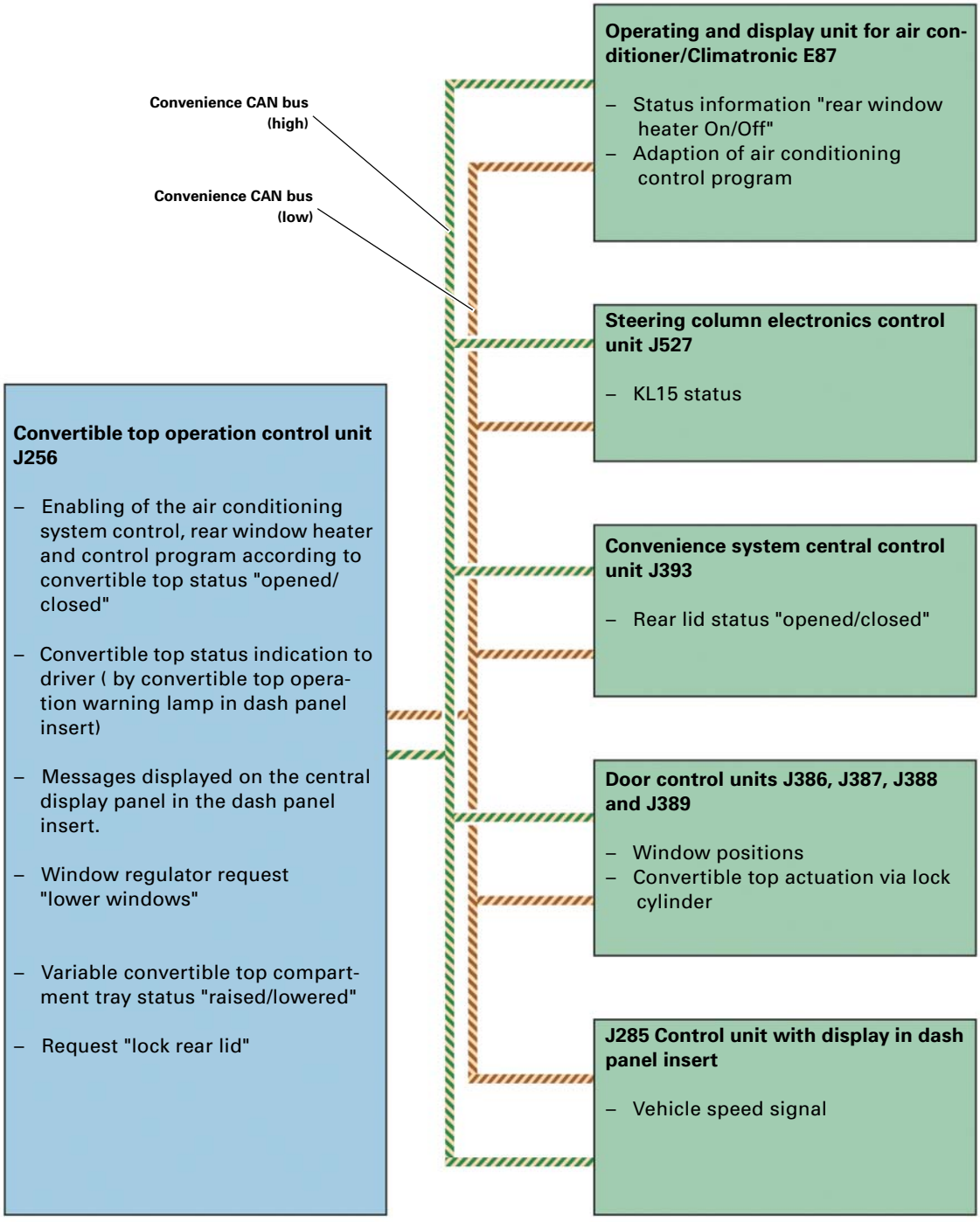
The convertible top operation control unit J256 automatically sends information on the status of the convertible top to the CAN bus, and thus makes it available to the other bus users.

In addition, the convertible top operation control unit is connected discretely (by a separate cable) to the convenience system central control unit J393 via the enabling terminal.
For vehicle diagnosis, the convertible top operation control unit is connected to the K lead.

The convertible top control interface to the CAN-BUS

Information exchange between the convertible top operation control unit J256 and the networked control units mainly takes place across the convenience CAN bus.

The system overview shows, by way of example, what information is made available across the CAN bus and is received and utilised by networked control units.



Information transmitted by the convertible top operation control unit J256 to the convenience CAN bus.

Information received and evaluated by the convertible top operation control unit J256.

314_041

Relationships:
Convertible top status, air conditioning system, rear window heater, window regulators, rear lid

Air conditioning system
Operating and display unit for air conditioner/ Climatronic E87
The air conditioning system switches the control program depending on the convertible top status. The settings selected by the driver for "opened/ closed" are saved.

If the rear window heater is "on", the air conditioning system activates or deactivates the rear window heater depending on whether the convertible top is in the "opened" or "closed" position.
The convertible top operation control unit J256 also controls the enabling of the rear window heater. For this purpose, a current conducting cable is routed from the air conditioning system control unit, looped through the convertible top operation control unit and switched.

If the convertible top operation control unit J256 is not taking part in the communication taking place on the CAN bus, the air conditioning system must disable the rear window heater.

314_042

Window regulator
Door control units J386, J387, J388 and J389 lower the windows to a defined position. When the convertible top is in operation, the window regulator and door control units are likewise controlled based on the information from the convertible top operation control unit J256.


314_043

Rear lid
A collision between the rear lid and the convertible top compartment lid must be avoided.
For this reason, the convertible top cover should only be opened if the rear lid is closed and, conversely, the rear lid should only be opened are if the convertible top cover is closed.
This function must be ensured by the convertible top operation control unit J256 in combination with the convenience system central control unit J393.

If communication between the two control units is interrupted, convertible top operation will be disabled.
The rear lid may only be unlocked and opened manually by the user using the ignition key.
In this case, the responsibility lies with the user.


314_044

Note

The convertible top compartment lid and the luggage compartment lid can become badly damaged as a result.

Introduction

An understanding of how the components and how the distributed functions are interlinked is the basis for successful fault-finding.
The vehicle diagnosis, testing and information system VAS 5051 as well as the vehicle diagnosis and service information system VAS 5052 are available for checking the convertible top control on the Audi A4 Cabriolet.

For example, they can be used for reading the fault memory and starting a guided fault finding routine.

314_045

The following operating modes are available through the vehicle diagnosis, testing and information system VAS 5051:

- Guided Fault Finding
- Vehicle Self-diagnosis
- Test Instruments and
- Guided Functions
- OBD (**O**n-**B**oard **D**iagnosis
  Monitoring of the engine management system, exhaust-related engine functions and components).

The Guided Fault Finding mode checks all installed control units in a vehicle specific fashion for erroneous entries and automatically compiles from the results an individual test plan.

The test plan, in combination with information provided by ELSA, such as current flow diagrams or Workshop Manuals, guides you systematically to the source of the fault.

314_046

Note

To enable dialogue to take place between the vehicle and the diagnostic tester, the ignition must be switched "on".

Diagnosis

There are two diagnosis (K and L) leads for communication between integrated control units and the diagnostic tester.

Adapters VAS 6017 and VAS 6017 A allow communication to be established with all control units.

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Before commencing fault-finding, account should be taken of the fact that the convertible top can only be opened and closed automatically if the following conditions are met.

Conditions for operation:

- vehicle stationary / road speed < 5 kph
- ignition "on"
- rear lid closed
- variable convertible top compartment lowered
- adequate onboard power supply / operating voltage (≥ 11.5 V)

Convertible top operation control unit J256

An internal self-diagnosis function monitors the system functions and stores fault information in a data memory. This information can be exported via the diagnosis interface (K lead) on the VAS diagnostic tester.

Information in the fault memory

If a fault occurs while the convertible top is operating, it is initially stored in the fault memory with the status STATIC fault. The convertible top operating sequence is aborted.

If the convertible top switch E137 or the ignition key is operated again after being released, the control unit will repeat its self-diagnosis. If the current fault does not recur, it becomes a sporadic fault. On completion of multiple complete, uninterrupted convertible top operating cycles (OPEN and CLOSE), the sporadic faults are erased.

Note

To store fault information in the fault memory in the event of a system malfunction, the convertible top switch (E137) must be actuated for at least 30 seconds.
The entry in the fault memory is indicated by flashing of the convertible top operation warning lamp.

Teach in convertible top frame position

If the convertible top operation control unit J256 is installed in a vehicle for the first time or if the convertible top frame position sender G356 is replaced, the control unit must be adapted to the sender.

After the sender has been replaced, there is the possibility that the operating points stored in the control unit might not be reached. As a result, it might not be possible to operate the convertible top.

Procedure

The convertible top operation control unit determines the operating points automatically. It uses for this purpose the Guided Fault Finding mode on the VAS 5051 or VAS 5052.
If the adaption is not performed, the control unit will enter emergency mode, which means that the convertible top will operate at a reduced speed.

During the convertible top operating sequence, the control unit performs a plausibility check based on the positions of the microswitches.
The runtimes of the individual steps in the convertible top operating sequence, the hydraulic unit and the power latching mechanism are monitored.

Convertible top frame position sender G356

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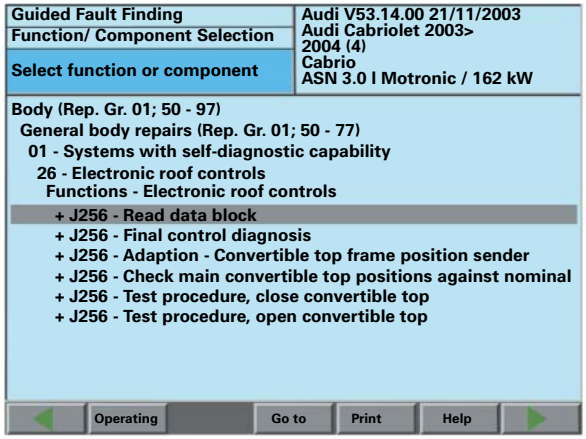
Read data block

The operating states of the microswitches can be exported to the data blocks using the Guided Fault Finding function of the VAS diagnostic tester.
The microswitches which have caused a fault message can be determined by checking the data blocks.



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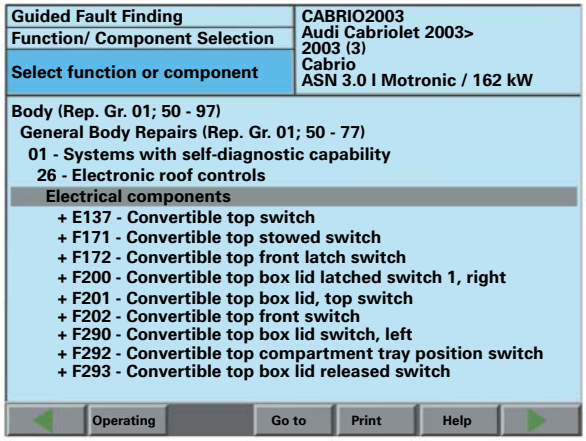
Component selection

Irrespective of the system test plan, you can compile your own test plan.
The tests you have selected can be included into the test plan in Function and Component Selection mode and executed in any order during the subsequent diagnosis procedure.



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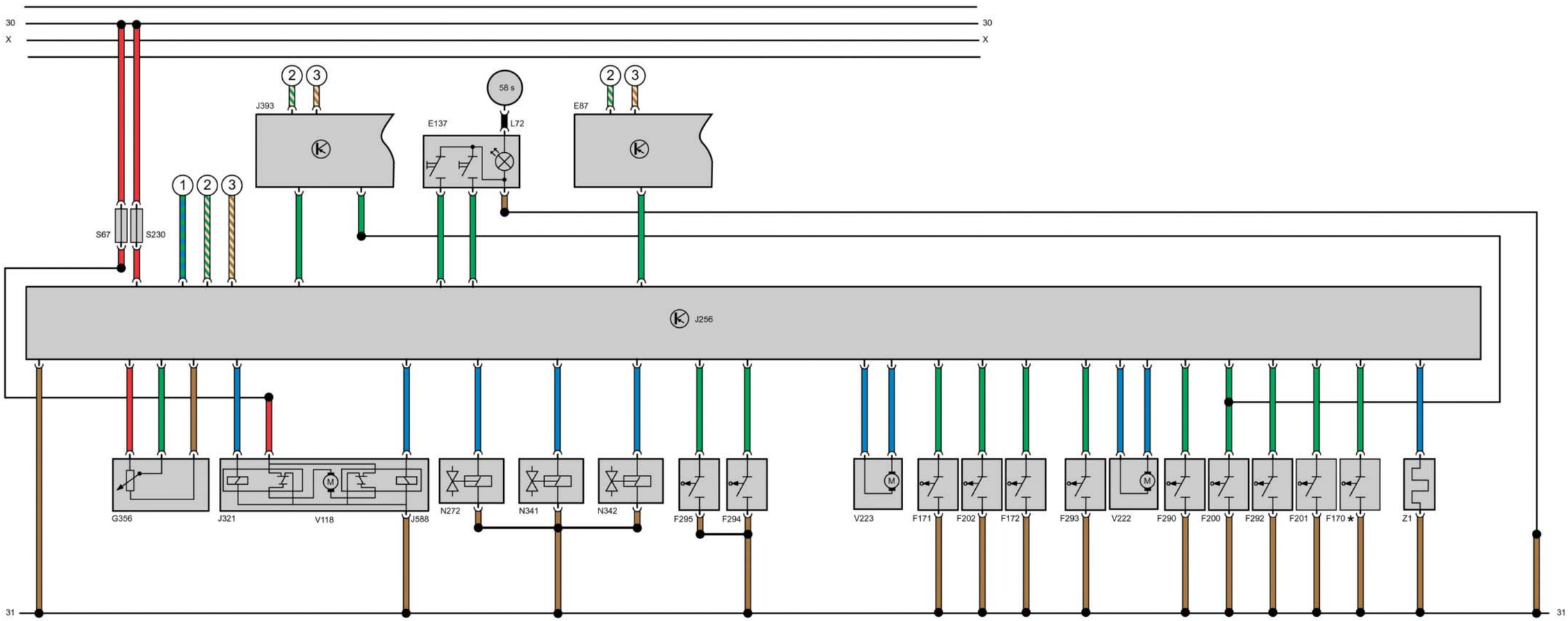
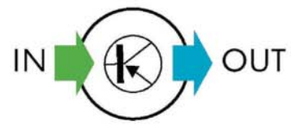
Note

Effects of signal failure
Failure of a microswitch or the convertible top frame position sender will cause the system to shut down.
In the event of signal failure, the convertible top will no longer be able to operate automatically.
For safety reasons, no substitute function is activated after a malfunction or failure occurs.
The electrical system is not always the source of the fault.
Of course, operation of the convertible top can also be disrupted by hydraulic or mechanical malfunctions.

Convertible top control





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Convertible top control

E87 Air conditioning system/Climatronic operating and display unit
E137 Convertible top switch
F170* Convertible top right latch switch (for USA only)
F172 Convertible top front latch switch
F171 Convertible top stowed switch
F290 Convertible top box lid switch, left
F200 Convertible top box lid latched switch 1, right
F201 Convertible top box lid, top switch
F202 Convertible top front switch
F292 Convertible top compartment tray position switch
F293 Convertible top compartment lid lock switch, unlocked
F294 Convertible top latch switch, open
F295 Convertible top latch switch, closed
G356 Convertible top frame position sender
J256 Convertible top operation control unit
J321 Hydraulic pump relay, convertible top operation
J393 Convenience system central control unit
J588 Hydraulic pump relay 2, convertible top operation
L72 Convertible top operating switch illumination
N272 Power-operated convertible top valve 1
N341 Power-operated convertible top valve 2
N342 Power-operated convertible top valve 3
S67 Roof actuation fuse
S230 Fuse in fuse holder
V118 Convertible top operation hydraulic pump
V222 Convertible top compartment lid lock motor
V223 Convertible top latch motor
Z1 Heated rear window

Colour code

= input signal

= Output signal

= positive supply

= ground

= convenience CAN bus (high)

= convenience CAN bus (low)

= bidirectional

Auxiliary signals

1 K diagnosis connection

2 Convenience CAN bus (high) connection

3 Convenience CAN bus (low) connection

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