

Service.



Self-Study Programme 298

The Touareg Electrical System

Design and Function



Vehicles with off-road capability are no longer just utility vehicles for a limited group of people.

At all levels in the population they are now becoming more and more sought after.

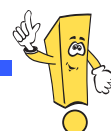
The off-road vehicle features a number of hi-tech convenience systems for improved comfort.

This Self-Study Programme is designed to help you learn about the electrical and electronic systems in the Volkswagen Touareg.



S298_052

NEW



**Important
Note**



**This Self-Study Programme explains the design and function of new developments.
The contents will not be updated.**

Please refer to the relevant Service Literature for current inspection, adjustment and repair instructions.



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Introduction



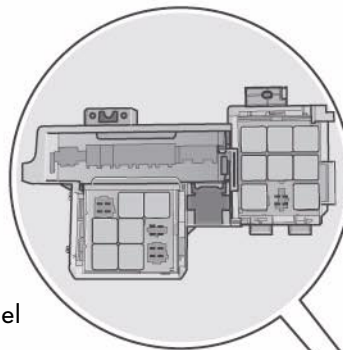
Fuse boxes and relay slots in vehicle's electrical system

Fitting locations

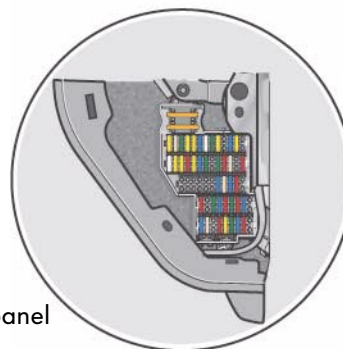
The fuse boxes and relay slots can be found at various locations in the vehicle due to the fact that the onboard power supply does not have a central layout.

The illustrations here provide an overview of their fitting locations.

E-box
on left under dash panel

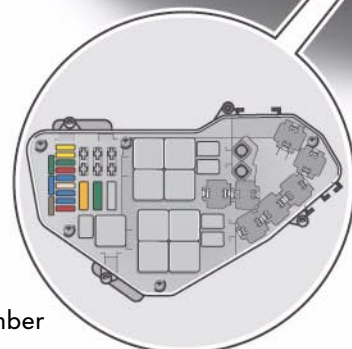


Fuse box
on right under dash panel



More detailed information can be found in the electronic service information system (ELSA).

E-box
on left in plenum chamber





Introduction



The data bus network

Networking

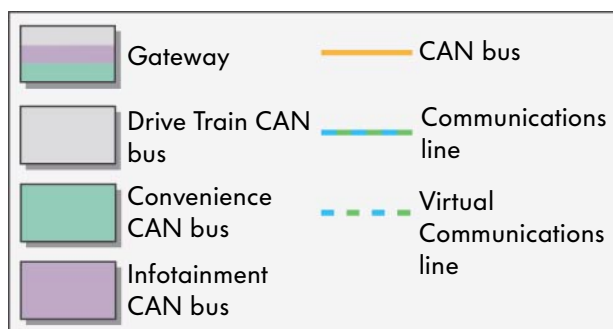
In order that the control units can exchange information between each other, they are connected in a network via the Gateway in the dash panel insert J285.

The data exchange allows the control units to access various kinds of information in the vehicle. The more information a control unit has about the current driving situation, the greater the level of safety and comfort.

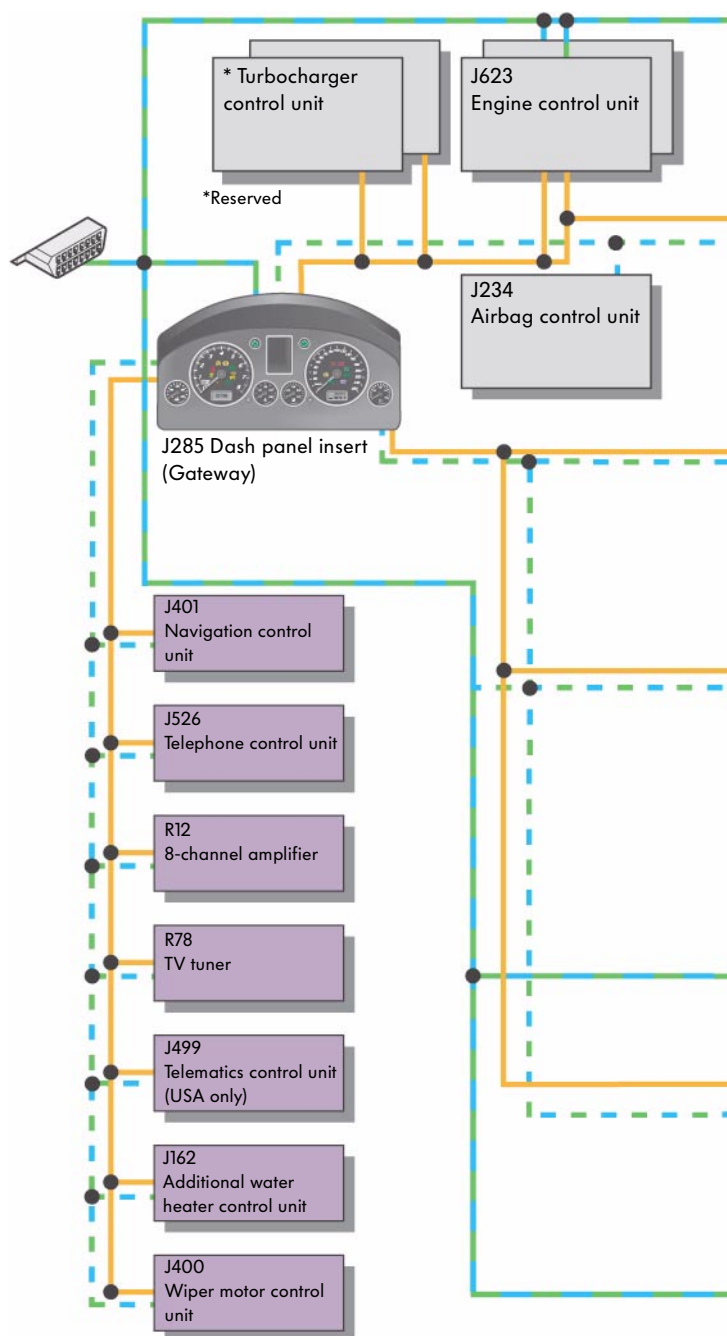
To ensure the exchange of data can take place, the control units are connected together in a network via a CAN bus system. Due to reasons of safety and because the data bus systems work at different rates of transfer, the control units are allocated to different CAN bus systems. If one data bus system should fail, the others can continue to function.

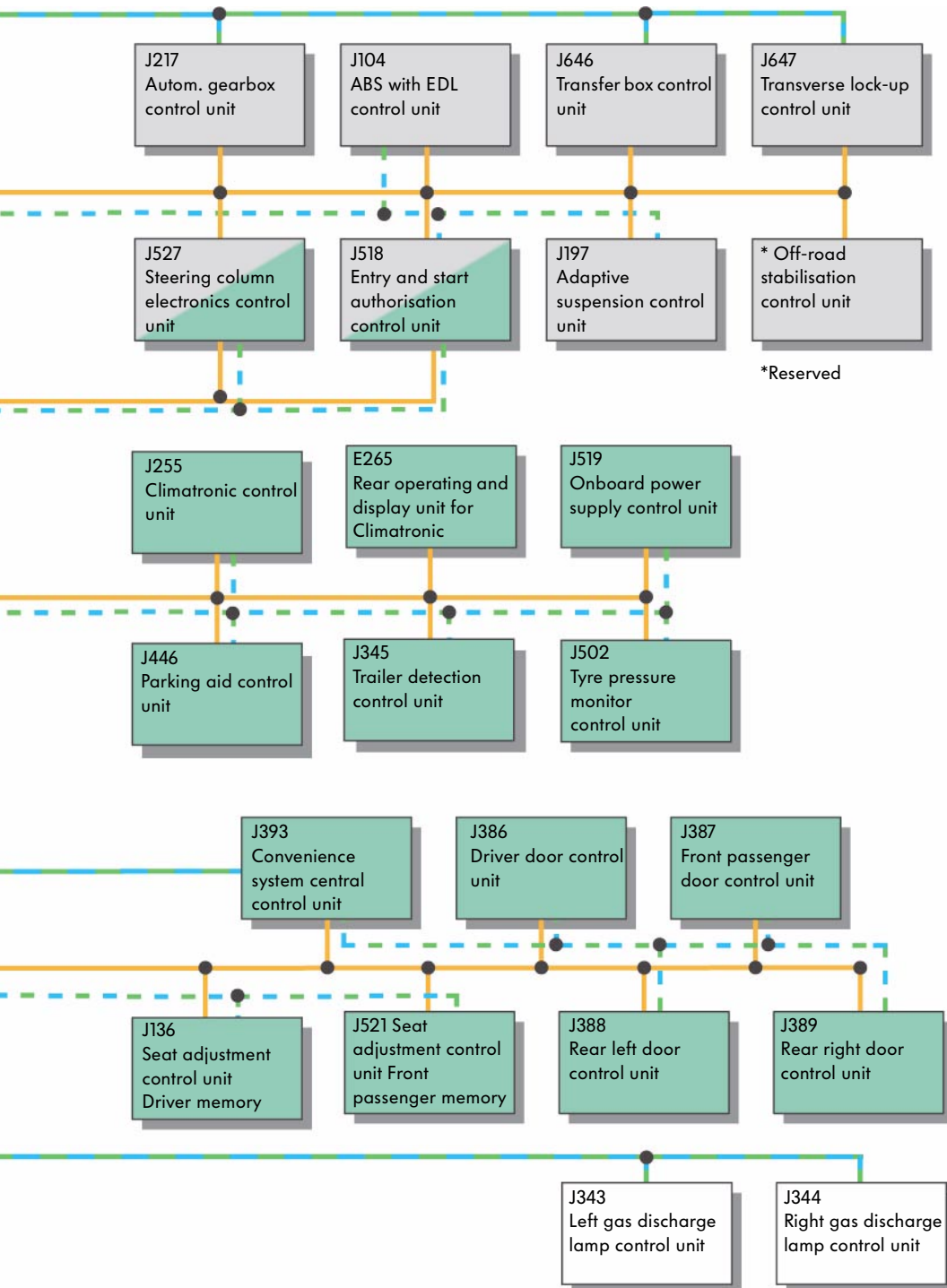
The CAN bus systems are separated as follows

- Drive Train CAN bus,
- Convenience CAN bus,
- Infotainment CAN bus.



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S298_003

Introduction



The control units in the Drive Train CAN bus

Control units

The illustrations here provide an overview of the fitting locations.

The Drive Train CAN bus operates at a data transfer rate of 500 kbit/s. The data is transmitted via the CAN High and CAN Low line. Both wires are entwined together. The cable colour for CAN High is orange/black and for CAN Low it is orange/brown.

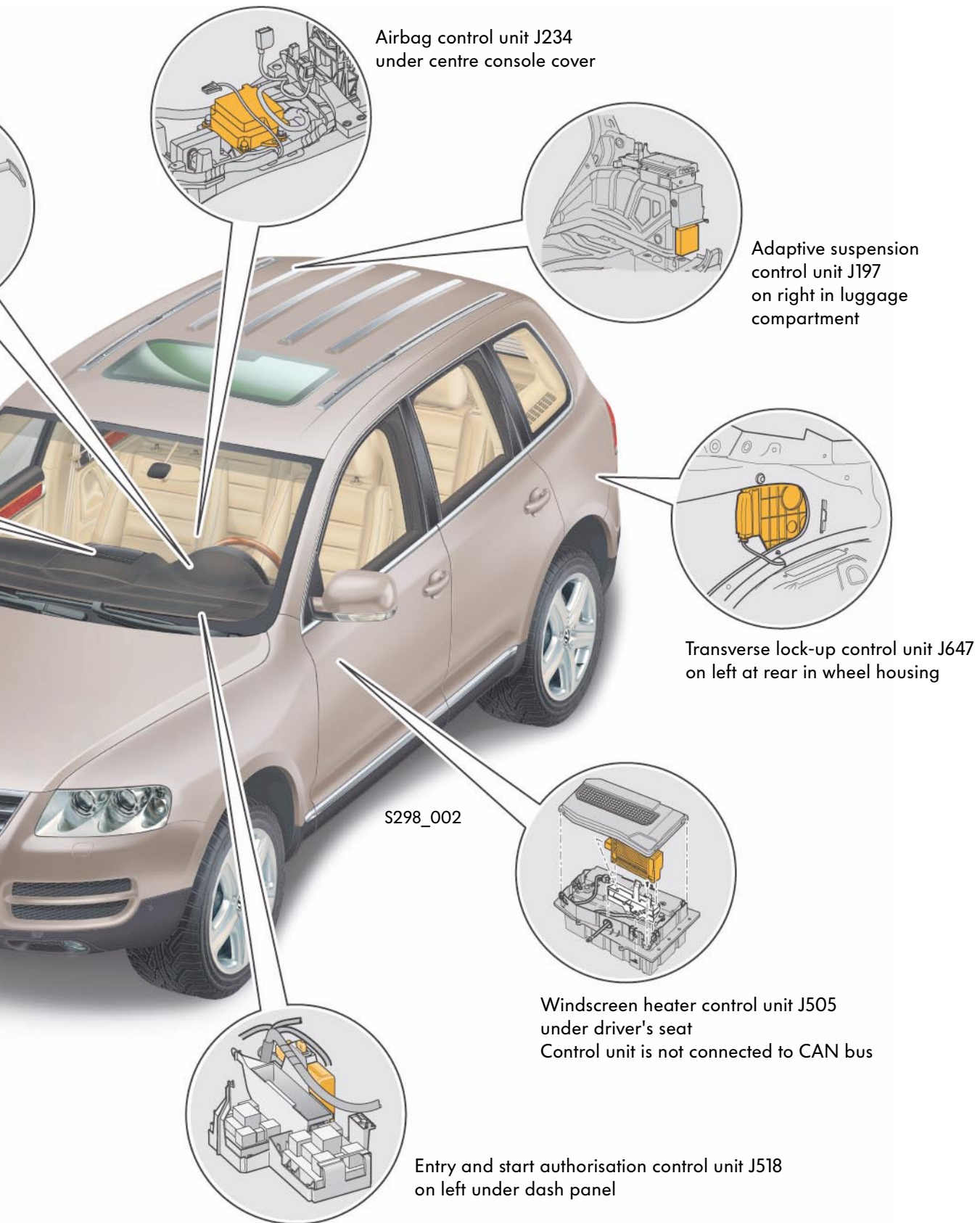
Steering column electronics control unit J527
on steering column

Autom. gearbox control unit J217
Transfer box control unit J646
under front passenger's seat

Engine control unit J623
in right of plenum chamber

ABS with EDL control unit J104
in right of plenum chamber





Introduction



The Drive Train CAN bus control units

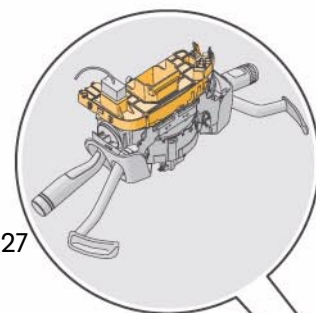
Control units

The illustrations here provide an overview of the fitting locations.

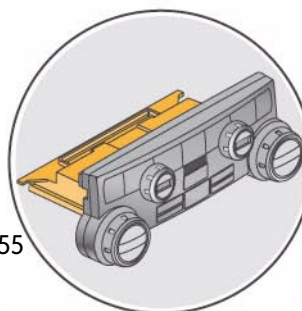
The Convenience CAN bus operates at a data transfer rate of 100 kbit/s.

The data is transmitted via the CAN High and CAN Low line. Both wires are entwined together. The cable colour for CAN High is orange/green and for CAN Low it is orange/brown. The CAN bus is single wire compatible, which means that if one CAN bus wire should fail, the CAN messages can be transmitted via the other wire.

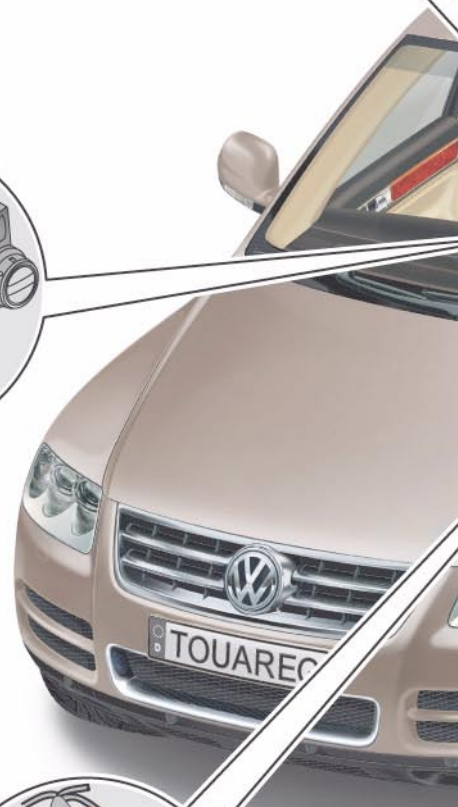
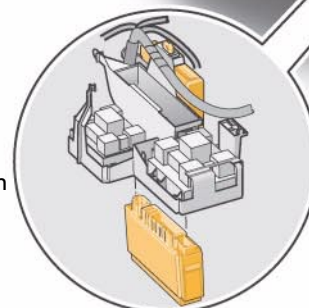
Steering column
electronics control unit J527
on steering column

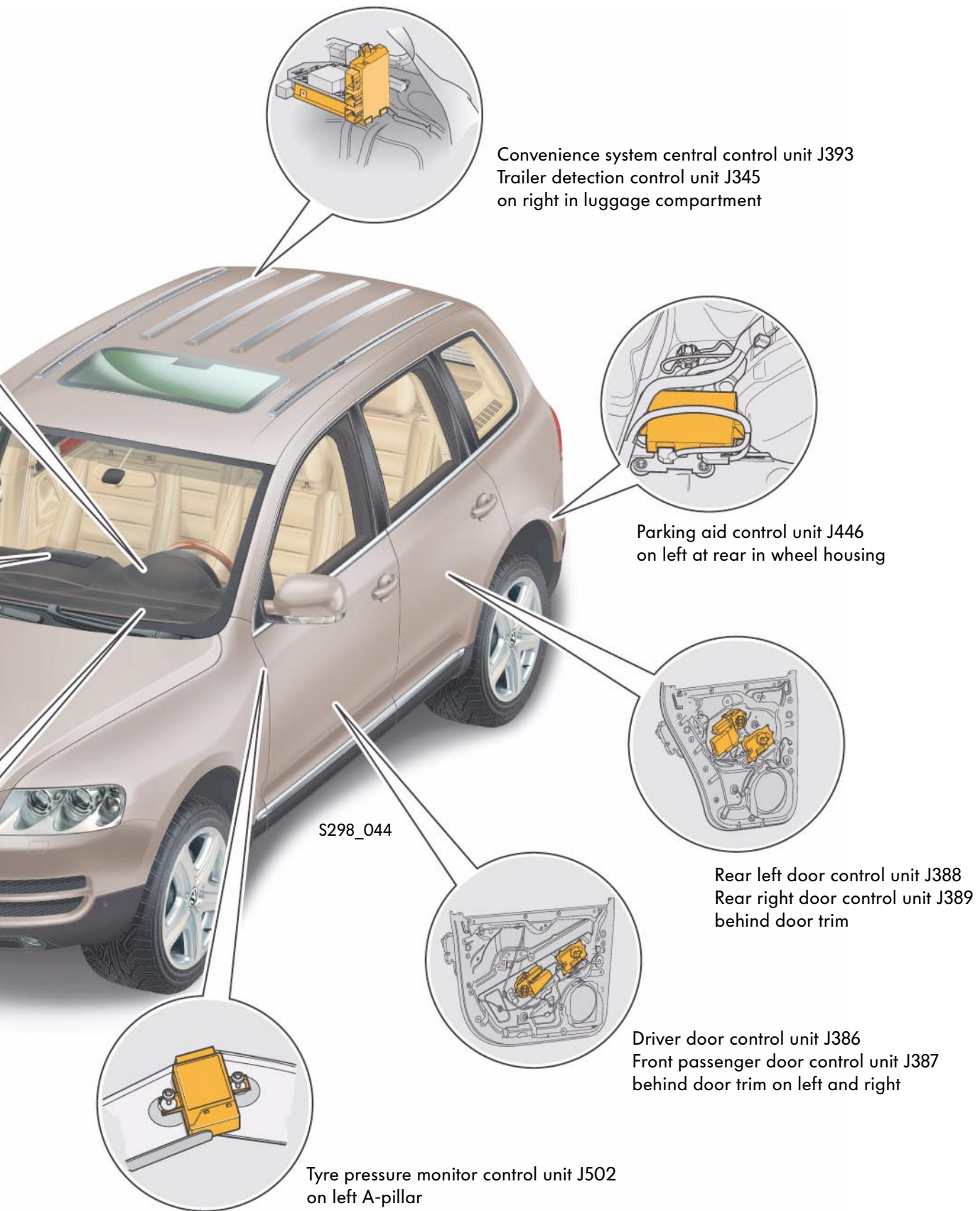


Climatronic control unit J255
in left of dash panel



Entry and start authorisation
control unit J518
Onboard power supply
control unit J519
on left under dash panel





Introduction



The Infotainment CAN bus control units

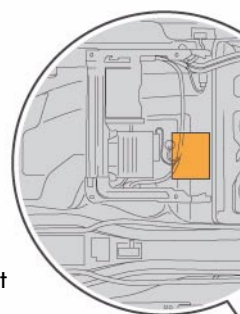
Control units

The illustrations here show the fitting locations of the control units for the Infotainment CAN bus.

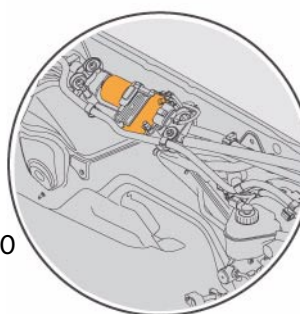
The Infotainment CAN bus operates at a data transfer rate of 100 kbit/s.

The data is transmitted via the CAN High and CAN Low line. Both wires are entwined together. The cable colour for CAN High is orange/violet and for CAN Low it is orange/brown.

The Infotainment CAN bus is single-wire compatible, which means that if one wire fails, data can be sent and received via the other wire.

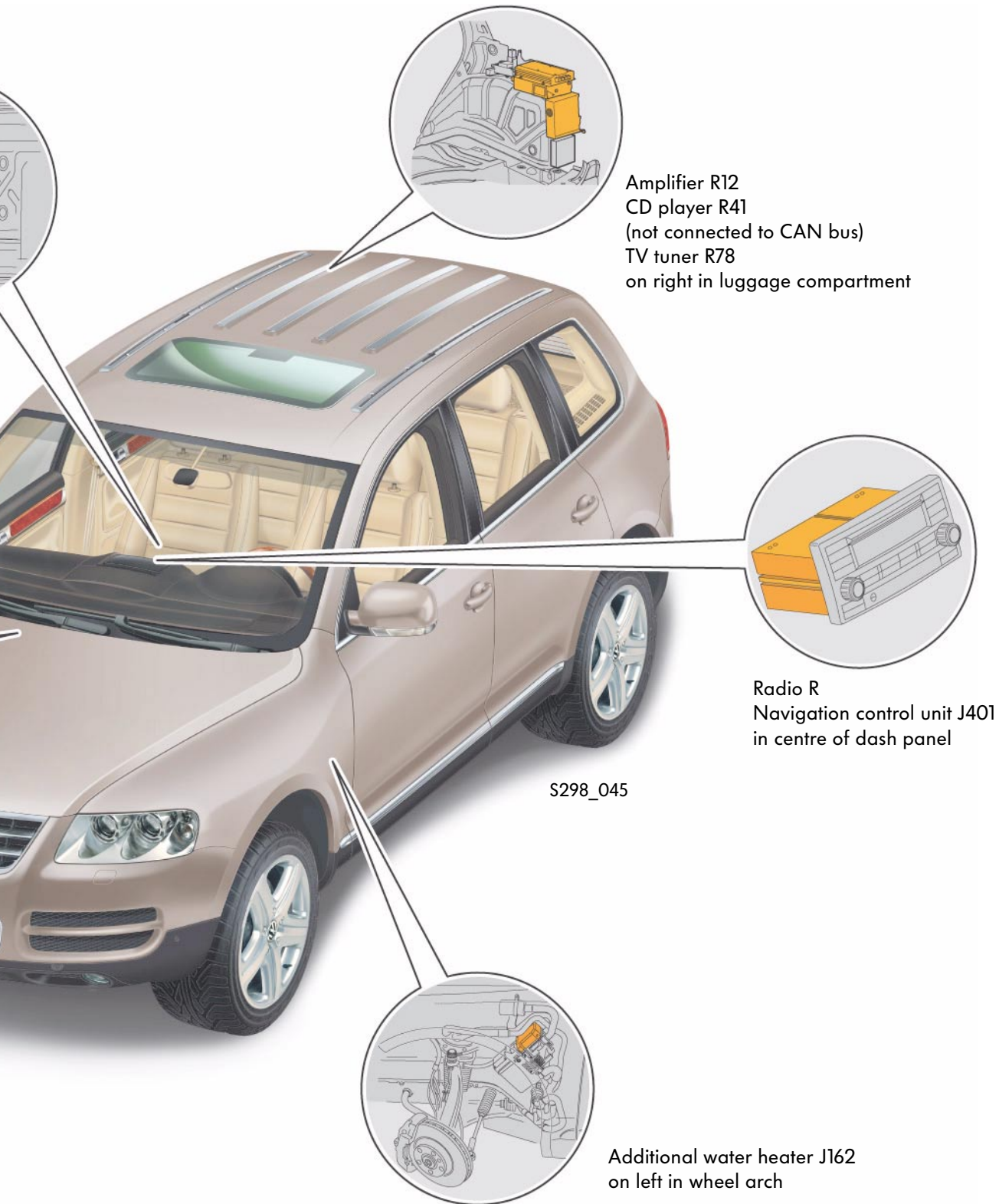


Telephone control unit J526
under front passenger's seat



Wiper motor control unit J400
in plenum chamber





Onboard power supply

The fuse and electrical boxes

The fuse boxes can be found in the dash panel on the left and right-hand side.

The back-up fuse box is under the driver's seat and the E-boxes can be found on the left in the plenum chamber and under the dash panel.

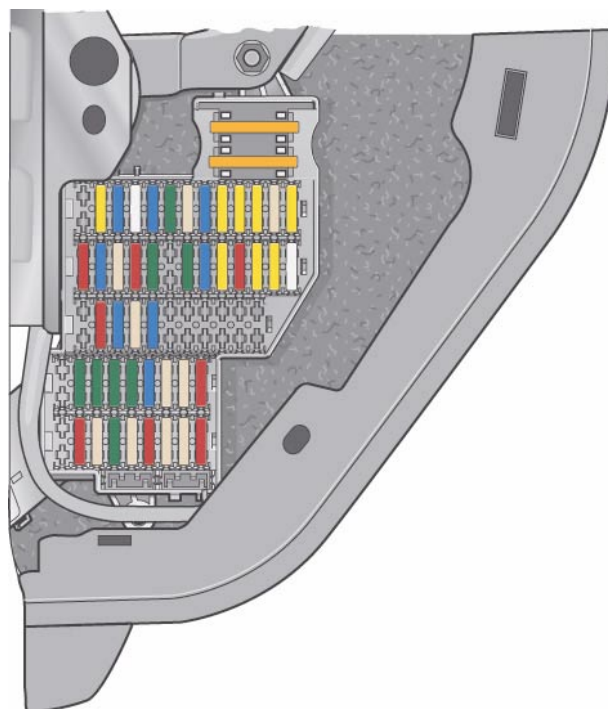


Fuse box on left of dash panel

The fuse box on the left of the dash panel, for example, houses the fuses for the following control units:

- Onboard power supply control unit
- Entry and start authorisation control unit
- Tyre pressure monitor control unit
- Engine control unit
- Airbag control unit
- ABS with EDL control unit
- Steering column electronics control unit
- Convenience system central control unit
- and fuses for other electrical consumers

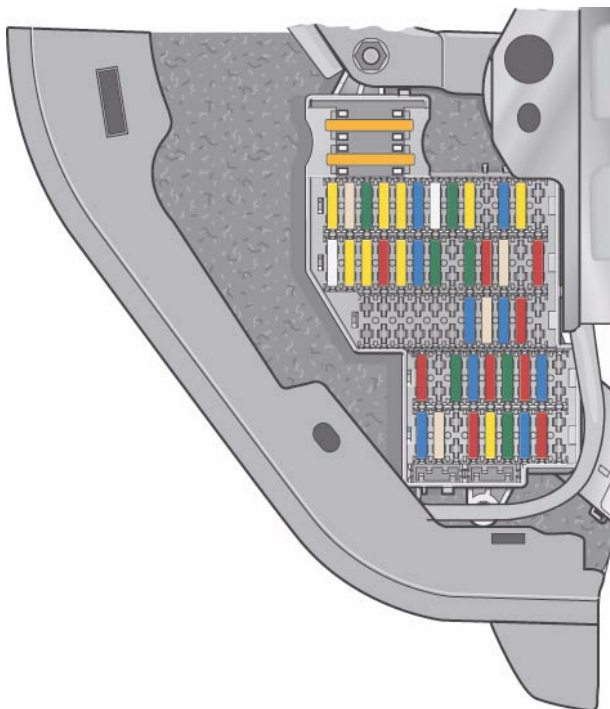
Fuse box on left of dash panel



S298_004



Fuse box on right of dash panel



S298_005

Fuse box on right of dash panel

The fuse box on the right of the dash panel houses the following fuses:

- Trailer detection control unit
- Parking aid control unit
- Telephone control unit
- ABS with EDL control unit
- Navigation control unit
- CD changer
- TV tuner
- Radio
- Radio amplifier
- Convenience system central control unit
- Adaptive suspension control unit
- Automatic gearbox control unit
- Convenience system central control unit
- Telephone
- and fuses for other electrical consumers



The exact fuse allocation can be found in the electronic service information system (ELSA).

Onboard power supply

Back-up fuse box under driver's seat

The following fuses and relays can be found in the back-up fuse box:

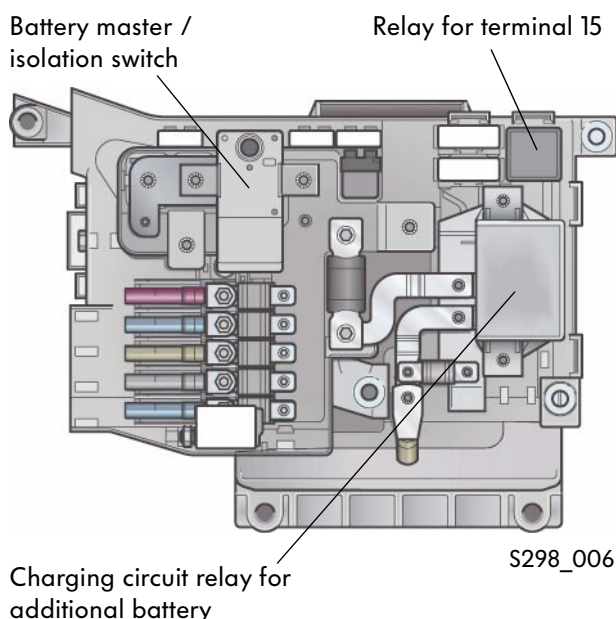
Fuses:

- Fuse sockets
- Fuse for terminal 15 relay
- Battery parallel circuit relay
- E-socket
- Fuse for onboard power supply control unit
- Starter lead diagnosis
- Fuse for adaptive suspension, compressor

Relays:

- Battery master / isolation relay E74
- Relay for terminal 15
- Charging circuit relay for vehicles with dual battery electrical system

Back-up fuse box under driver's seat

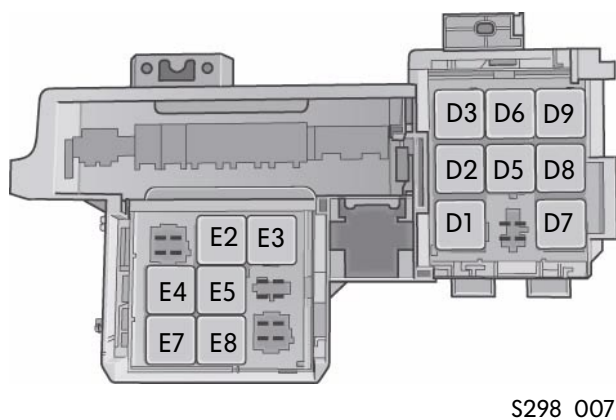


E-box under dash panel

The following relays can be found in the E-box:

- | | |
|--|----|
| - Servotronic relay | D1 |
| - Relay for tailgate closing aid | D2 |
| - Relay for adaptive suspension compressor | D3 |
| - Relay for power supply terminal 15 | D5 |
| - Relay for additional water heater | D6 |
| - Relay for heated rear windscreen | D7 |
| - Relay for seat heating | D8 |
| - Additional relay for brake lights | D9 |
| - Relay for spare wheel | E2 |
| - Relay for manual air-conditioning system | E3 |
| - Relay for circulation pump | E4 |
| - Relay for start-up consumers | E5 |
| - Relay for headlight washer system | E7 |
| - Relay for residual warmth | E8 |

E-box under dash panel



E-box on left of plenum chamber

The allocation of the fuses and relays is dependent on the engine type. This layout is specific to the AZZ engine and is shown here for demonstration purposes only.

Fuses:

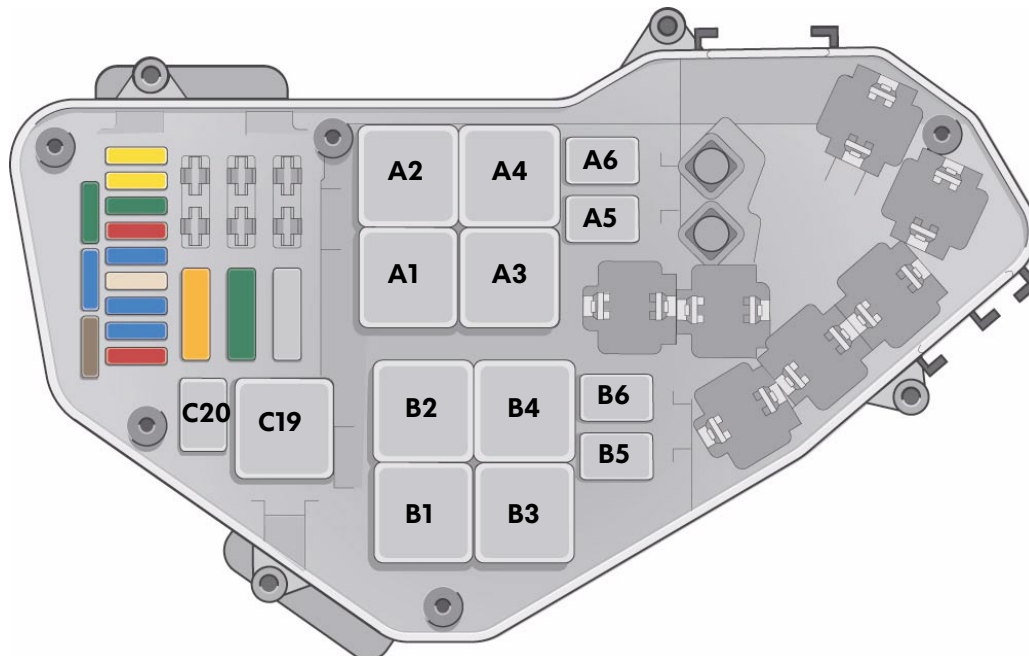
- Fan
- Secondary air pump
- Injectors
- Engine control unit, variable camshaft timing, intake manifold changeover valve, thermal heating
- Leak diagnosis of fuel tank, high pressure sender for air conditioning, radiator fan control unit

Relays:

- | | |
|----------------------------|----------|
| - Terminal 30 power supply | A1 / A3 |
| - Secondary air pump | A4 |
| - Additional coolant pump | A5 |
| - Fuel pumps | A6 / C19 |
| - Terminal 50 power supply | C20 |



E-box in plenum chamber



S298_008



Fuse boxes will vary depending on the vehicle and engine type. For precise details on the fuse boxes, please refer to the electronic service information system (ELSA).

Onboard power supply

Battery master / isolation rely E74

Battery isolation

In a crash, the battery is isolated from the starter lead via the battery master switch. This prevents a short circuit in the starter lead which could lead to a fire.

The isolation signal is received by the battery master switch from the airbag control unit J234 via a separate signal wire.

Recognition of isolation

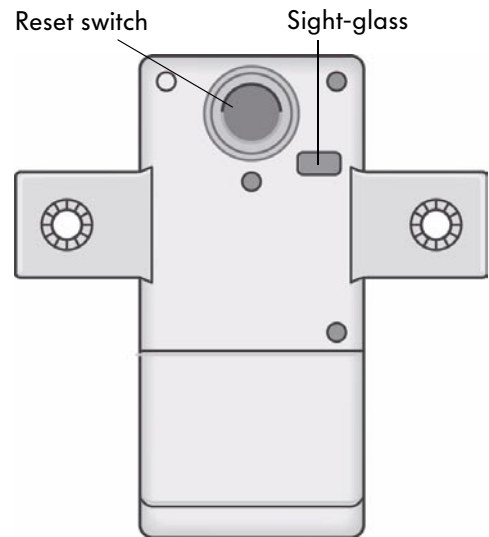
If the battery has been isolated, a white cover will be seen in the sight-glass instead of a copper winding. The relay should then be reset using the reset switch, otherwise starting the engine will not be possible.

If the onboard power supply has a twin battery concept, the onboard power supply control unit checks the position of the battery master switch. If the master switch is on, starting the vehicle using the starter battery will be prevented.

Key

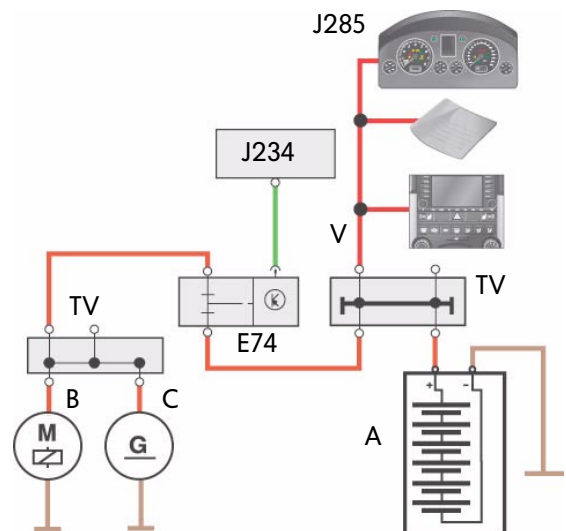
- A Battery
- B Starter motor
- C Alternator
- E74 Battery master / isolation switch
- J234 Airbag control unit
- J285 Dash panel insert
- TV cable distributor
- V Onboard consumers

Battery master / isolation switch



S298_017

Electrical circuit



S298_040



Before resetting, the starter lead must be checked for short circuits. For this reason, resetting should only be carried out by a specialist workshop.

The electrically folding towing device

Trailer recognition control unit

In addition to normal actuation of the lights on the trailer, the control unit also controls activation of the folding tow hitch.

Operation is via the control buttons in the interior.

The tow hitch is unfolded by an electric motor with a Hall sender and the procedure is monitored by the control unit. If the tow hitch encounters an obstacle, the unfolding procedure is stopped. For this purpose, the control unit monitors the power drawn by the motor. If the control button is actuated repeatedly, the unfolding procedure can be continued.

Conditions for switching off

The following conditions could lead to the folding procedure being stopped:

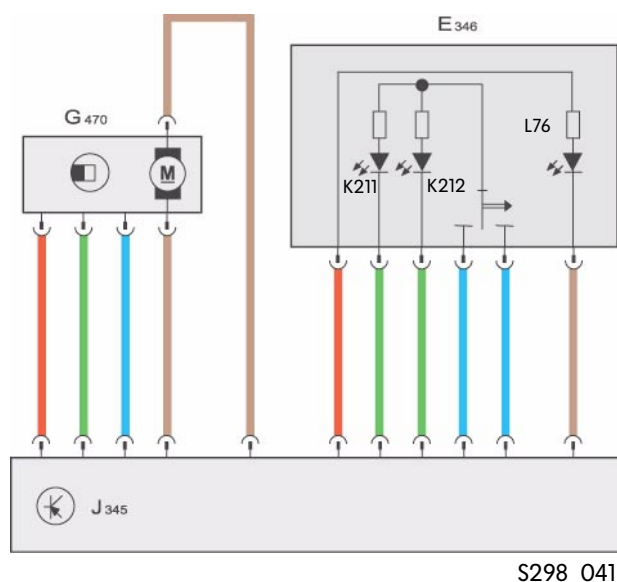
- Overload recognition as protection against entrapment
- The folding procedure will be stopped if there is a change in the power supply, i.e. if the voltage drops below 9 Volt or rises above 15 Volt for more than 300 ms
- Change in the conditions that permit activation

Activation conditions

- Terminal 15 off
- Terminal 15 on and engine off



Electrical circuit



Key

- J345 Trailer detection control unit
- G470 Tow bar coupling motor Hall sender
- E474 Button for electrically folding tow hitch
- K211 Tow hitch folding out warning lamp
- K212 Tow hitch folding in warning lamp
- L76 Switch illumination

Battery concept

The equipment with batteries

Overview

The Volkswagen Touareg can be fitted with different battery systems.

The following derivatives are possible:

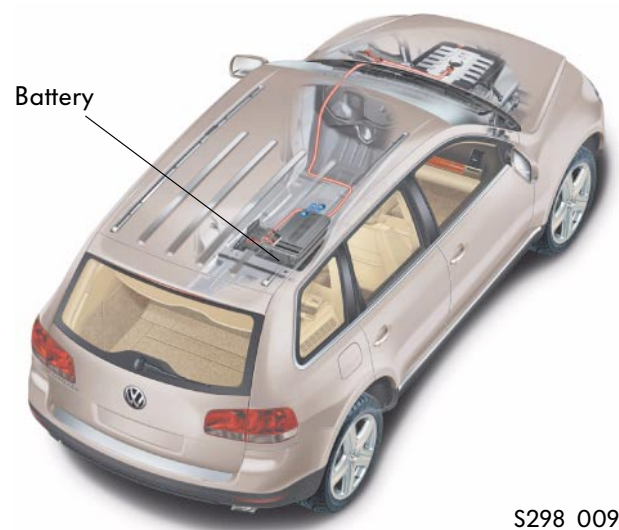
- Single battery electrical system
- Single battery electrical system with second battery to supply additional water heater
- Twin battery electrical system for V10 TDI engine



Single battery electrical system

Vehicles with a single battery electrical system draw the power required for the onboard power supply and the starter from this one battery.

Single battery electrical system



Single battery electrical system with additional battery

The second battery supplies the additional water heater with power and is charged when the engine is running via a charging circuit relay.

S298_009

Dual battery electrical system

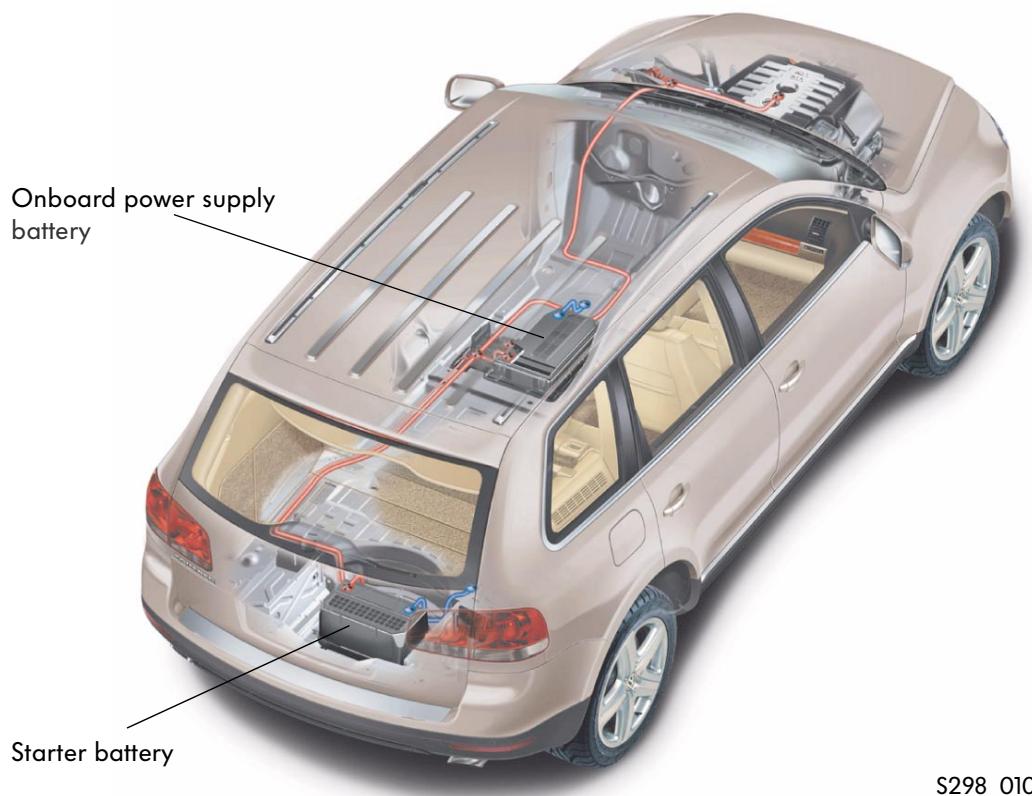
To ensure that the power required for starting is always available on vehicles with V10 TDI engines, a twin battery electrical system is fitted.

In this electrical system, one battery, the starter battery, has the role of supplying the starter with power and, if necessary, also the electrical consumers required for the starting procedure (start-up consumers). The second battery, the onboard power supply battery, provides the rest of the electrical consumers with power.

The batteries are switched in parallel to provide the necessary current to start the V10 TDI engine.



Dual battery electrical system



S298_010

Battery concept

Dual battery electrical system

Onboard power supply structure of twin battery electrical system

To prevent the starter battery from becoming discharged by electrical consumers, the consumers are split into two categories:

- Start-up consumers (e.g. glow plug system, engine control unit)
- Onboard consumers (e.g. radio, heated rear window)

The start-up consumers and the remaining electrical consumers are supplied from the onboard power supply battery.

Via the relay for start-up consumers, these can be supplied from the starter battery. Consumers that require a large amount of energy, such as the glow plugs on diesel engines, are always supplied from the starter battery.

In addition, both batteries can be connected via the additional/starter battery charger relay to charge the starter battery.

The actuation of the relays comes from the onboard power supply control unit. It monitors the voltage of both batteries when the vehicle is in motion and can thus detect when the starter battery needs recharging.

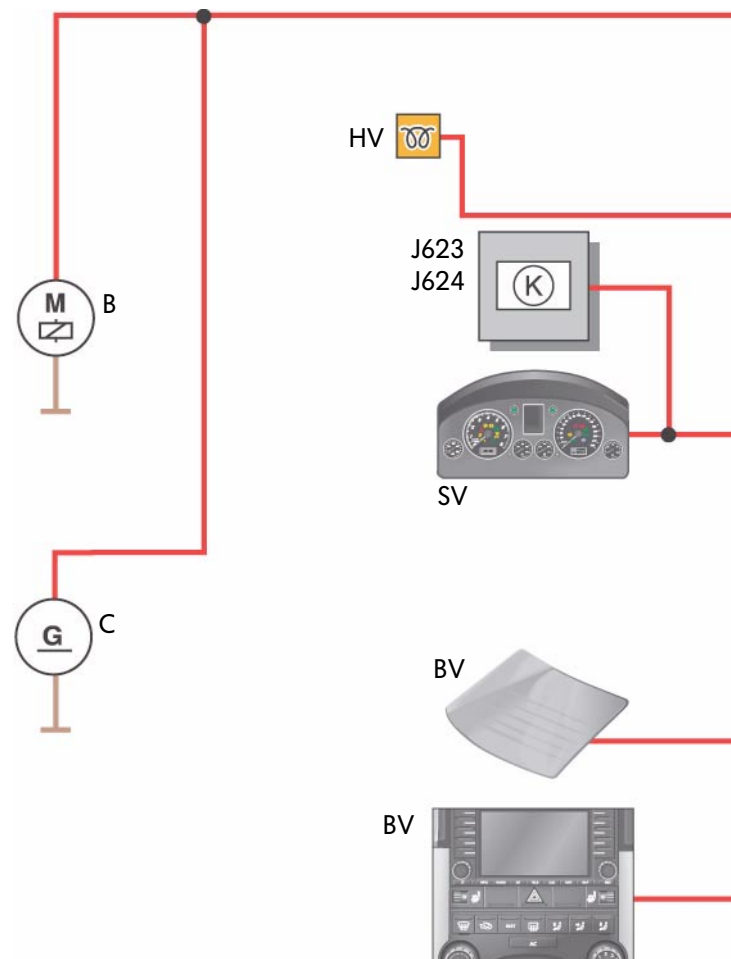
Stand-by

The system is on stand-by when the onboard power supply control unit is in sleep mode (terminal S not active).

If on stand-by, relay 1 for voltage supply J701 and second/starter battery charging circuit relay J713 are open.

Relay 2 for voltage supply J710 is closed.

Stand-by switch position

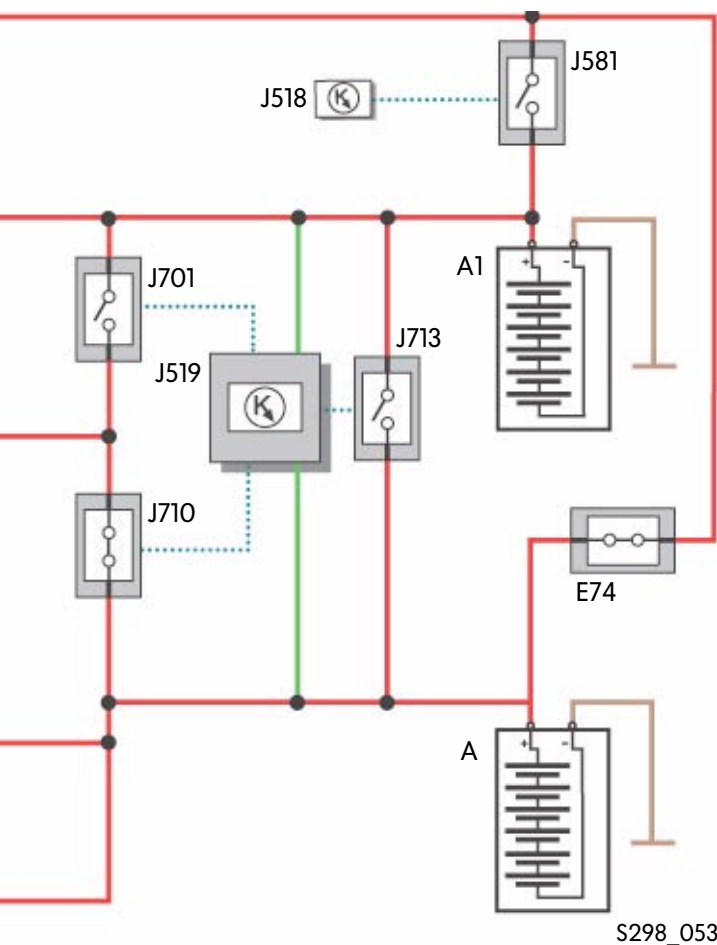


Starting procedures

When the ignition is switched on, the onboard power supply control unit J519 is activated (wake-up mode) and evaluates the charge status of the batteries. If the voltage reading of the onboard power supply battery is below 10.5 Volt, it is deemed to be discharged. The starter battery is deemed to be discharged if the voltage reading is below 11.5 Volt.

There are four different conditions that can be detected before the engine is started depending on the charge status of the batteries:

- Onboard power supply and starter battery charged
- Onboard power supply battery discharged, starter battery charged
- Onboard power supply battery charged, starter battery discharged
- Onboard power supply and starter battery discharged



Key

A	Onboard power supply battery, battery
A1	Additional battery, starter battery
B	Starter
C	Alternator
E74	Battery master / isolation switch
J518	Entry and start authorisation control unit
J519	Onboard power supply control unit
J581	Relay for parallel switching of batteries
J623	Engine control unit
J624	Engine control unit 2
J701	Voltage supply relay 1
J710	Voltage supply relay 2
J713	Charger relay for additional and starter battery
BV	Onboard power supply consumers
SV	Start-up consumers
HV	HT consumers

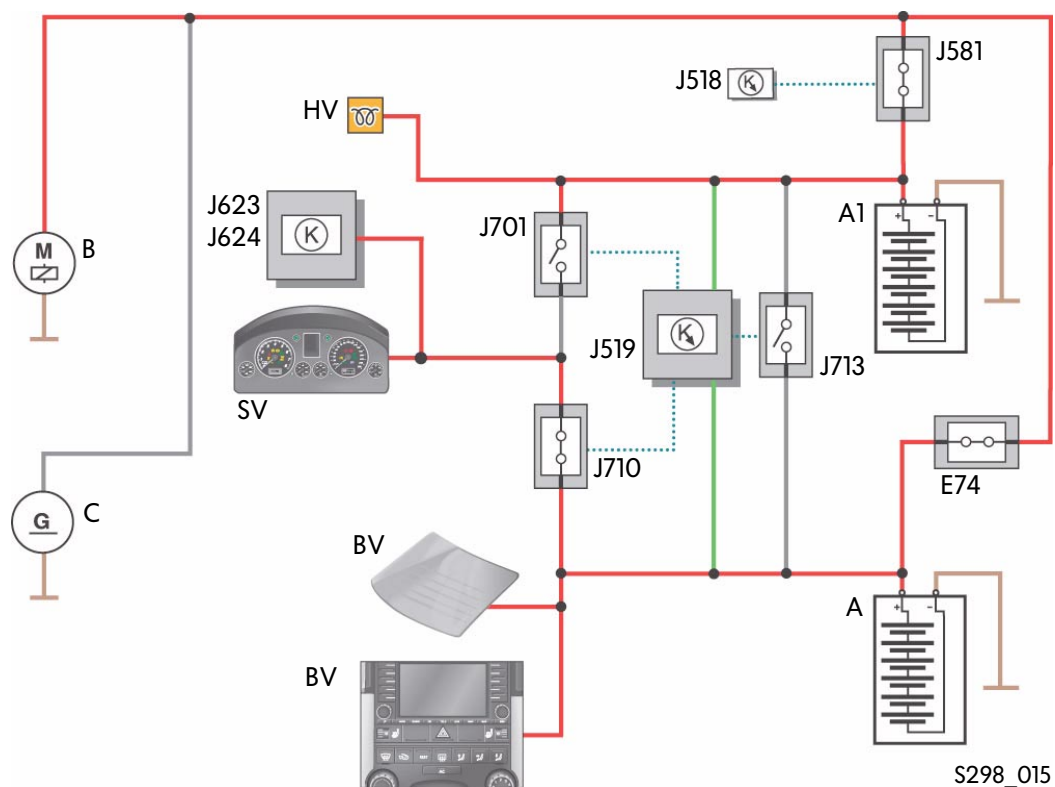
Battery concept

Start procedure with charged onboard power supply battery and starter battery

Start-up is in the normal relay switch position (stand-by). The charging circuit relay for the additional and starter battery J713 and voltage supply relay 1 J701 are open. Voltage supply relay 2 J710 is closed. The battery parallel circuit relay J581 is activated by the entry and start authorisation control unit in the same way as terminal 50.



Switch position with charged onboard power supply battery and starter battery



Key

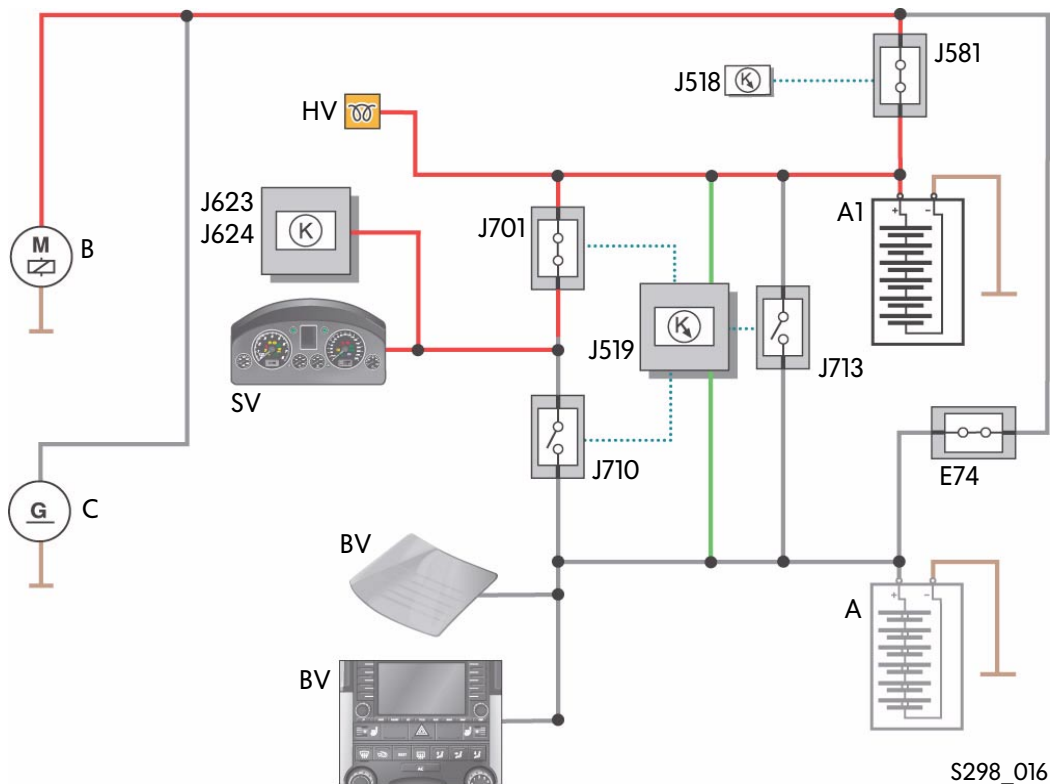
A	Onboard power supply battery, battery	J624	Engine control unit 2
A1	Additional battery, starter battery	J701	Voltage supply relay
B	Starter	J710	Voltage supply relay 2
C	Alternator	J713	Charging circuit relay for additional battery (starter battery)
E74	Battery master / isolation switch	BV	Onboard consumers
J518	Entry and start authorisation control unit	SV	Start-up consumers
J519	Onboard power supply control unit	HV	HT consumers
J581	Battery parallel circuit relay		
J623	Engine control unit		

Start procedure with discharged onboard power supply battery and charged starter battery

The start-up consumers are switched from the onboard power supply battery to the starter battery. To prevent voltage compensations between the two batteries, voltage supply relay 2 J710 is opened first and after about 100 milliseconds, voltage supply relay 1 J701 is closed. The second battery charging circuit relay J713 remains open. In this case, the vehicle cannot be opened using the radio remote control. Because the onboard power supply control unit detects a discharged onboard power supply battery when the ignition is switched on, an emergency start is activated.



Switch position with discharged onboard power supply battery and charged starter battery



The information is sent to the dash panel insert and the control unit for entry and start authorisation via the emergency mode cable connection. In the display of the dash panel insert, the warning message "Please start engine" will then be shown. If the onboard power supply control unit detects that the alternator is charging the batteries when the engine is running, the onboard consumers will be switched to the onboard power supply battery. The emergency start procedure is then complete. Only now, using the automatic gearbox selector lever, is it possible to select a gear and drive the vehicle. If the ESP warning lamp lights up, it will go out after the vehicle is set in motion when the steering angle sensor is rematched. Glow plug operation is inhibited, the glow plug system warning lamp will flash.

Battery concept

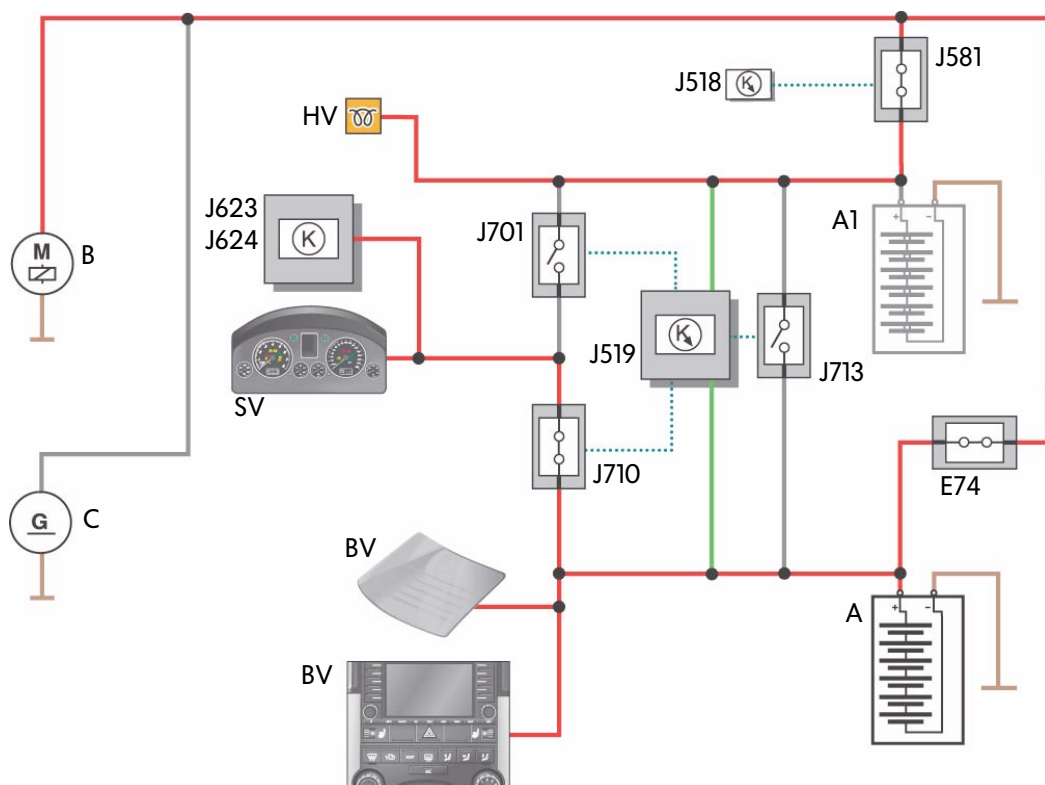
Start procedure with charged onboard power supply battery and discharged starter battery

The relay is in the same switch position as with starting procedures when both batteries are charged.

The charging circuit relay for the additional and starter battery J713 and voltage supply relay 1 J701 are open. Voltage supply relay 2 J710 is closed.



Switch position with charged onboard power supply battery and discharged starter battery



Key

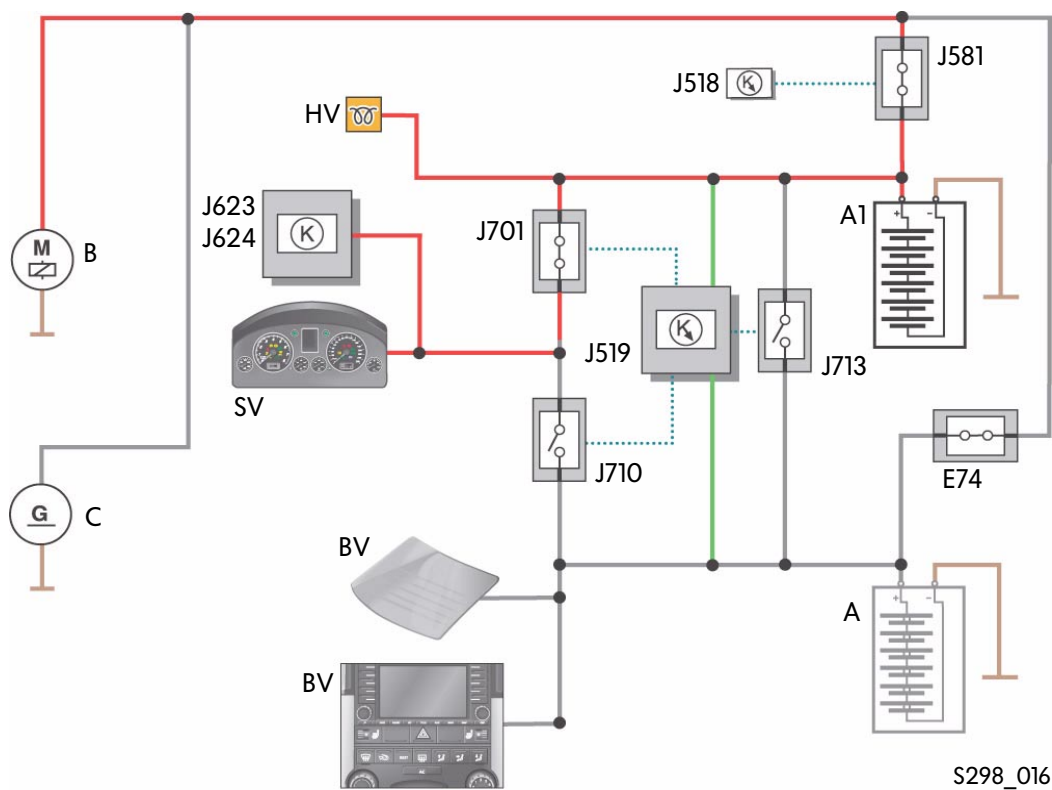
A	Onboard power supply battery, battery	J624	Engine control unit 2
A1	Second battery, starter battery	J701	Voltage supply relay 1
B	Starter	J710	Voltage supply relay 2
C	Alternator	J713	Second battery charging circuit relay (starter battery)
E74	Battery master / isolation switch	BV	Onboard consumers
J518	Entry and start authorisation control unit	SV	Start-up consumers
J519	Onboard power supply control unit	HV	HT consumers
J581	Battery parallel circuit relay		
J623	Engine control unit		

Starting procedure with weak starter battery and onboard power supply battery

If the voltage of the onboard power supply battery is less than 10.5 Volt and the voltage of the starter battery is less than 11.5 Volt, the voltage of both batteries is calculated following activation of the onboard power supply control unit wake-up mode.

If during this calculation, the starter battery voltage is found to be greater than that of the onboard power supply battery, the start procedure for discharged onboard power supply battery is selected. If the onboard power supply battery has the greater voltage reading, the start procedure is actuated without change in the relay switch position.

Switch position at high starter battery voltage



Key

A	Onboard power supply battery, battery	J624	Engine control unit 2
A1	Second battery, starter battery	J701	Voltage supply relay 1
B	Starter	J710	Voltage supply relay 2
C	Alternator	J713	Second battery charging circuit relay (starter battery)
E74	Battery master / isolation switch	BV	Onboard consumers
J518	Entry and start authorisation control unit	SV	Start-up consumers
J519	Onboard power supply control unit	HV	HT consumers
J581	Battery parallel circuit relay		
J623	Engine control unit		

Power supply

Alternator

Drive layout

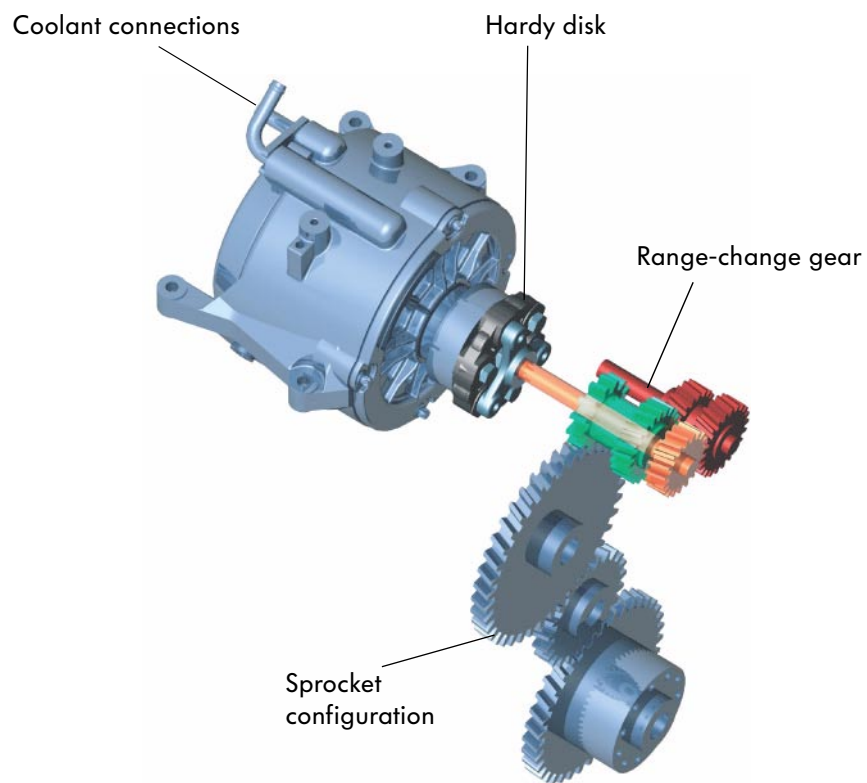
The drive layout of the alternator on the V10 TDI engine consists of a sprocket configuration, a range-change gear with a ratio of 3.6:1 and a Hardy disk.

The range-change gear increases the working speed of the alternator, which thereby improves performance. This is necessary to provide the large amount of voltage required by the electrical system, even at idling speed.

The alternator is cooled via the engine cooling circuit to protect it against overheating, which in turn ensures improved longevity and efficiency.



Alternator



S298_048

Charging

Charging of the starter and onboard power supply battery

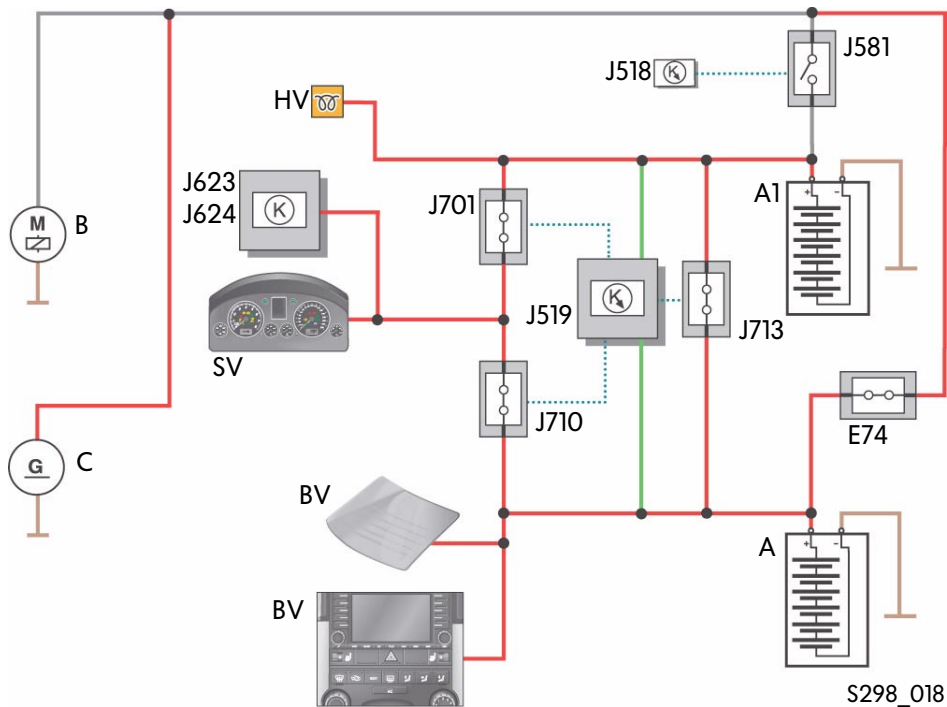
The onboard power supply battery is charged continuously. The starter battery is charged via the second battery/starter battery charging circuit relay J713. This is actuated by the onboard power supply control unit J519. The normal charging time is 20 minutes. After this period the relay will open. If the starter battery voltage drops below 12.8 Volt, a new charging cycle of 20 minutes maximum is started. While the glow plugs are active, the relay stays closed.

If voltage supply relay 1 J701 does not open after the engine has been started because the contacts are sticking for example, the charging circuit relay J713 will close after four minutes until the ignition is switched off.

The onboard power supply derives its power from both batteries which are connected in parallel and protected against overload by relay J701.



Switch position for charging



Key

A	Onboard power supply battery, battery	J624	Engine control unit 2
A1	Second battery, starter battery	J701	Voltage supply relay 1
B	Starter	J710	Voltage supply relay 2
C	Alternator	J713	Second battery charging circuit relay (starter battery)
E74	Battery master / isolation switch	BV	Onboard consumers
J518	Entry and start authorisation control unit	SV	Start-up consumers
J519	Onboard power supply control unit	HV	HT consumers
J581	Battery parallel circuit relay		
J623	Engine control unit		