Service.

Self-study programme 311

The Transporter 2004
Electrical system

Design and function

The Transporter 2004 has an extensive network of electronic control units.

Functions which were controlled in the predecessor model switches and relays are controlled digitally via the drive train CAN data bus and the convenience CAN data bus systems.

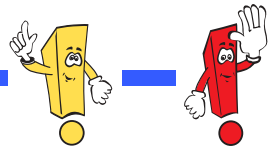
The formerly mechanical opening of the sliding door is now controlled electrically. There are many other functions which also represent modifications to the predecessor model.

This Self-Study Programme will give you a better understanding of the innovations to the electrical system of the Transporter 2004.

This will ensure that, as before, you are able to provide customer satisfaction through technical competence.

S311_121

NEW



Important Note

This Self-Study Programme shows 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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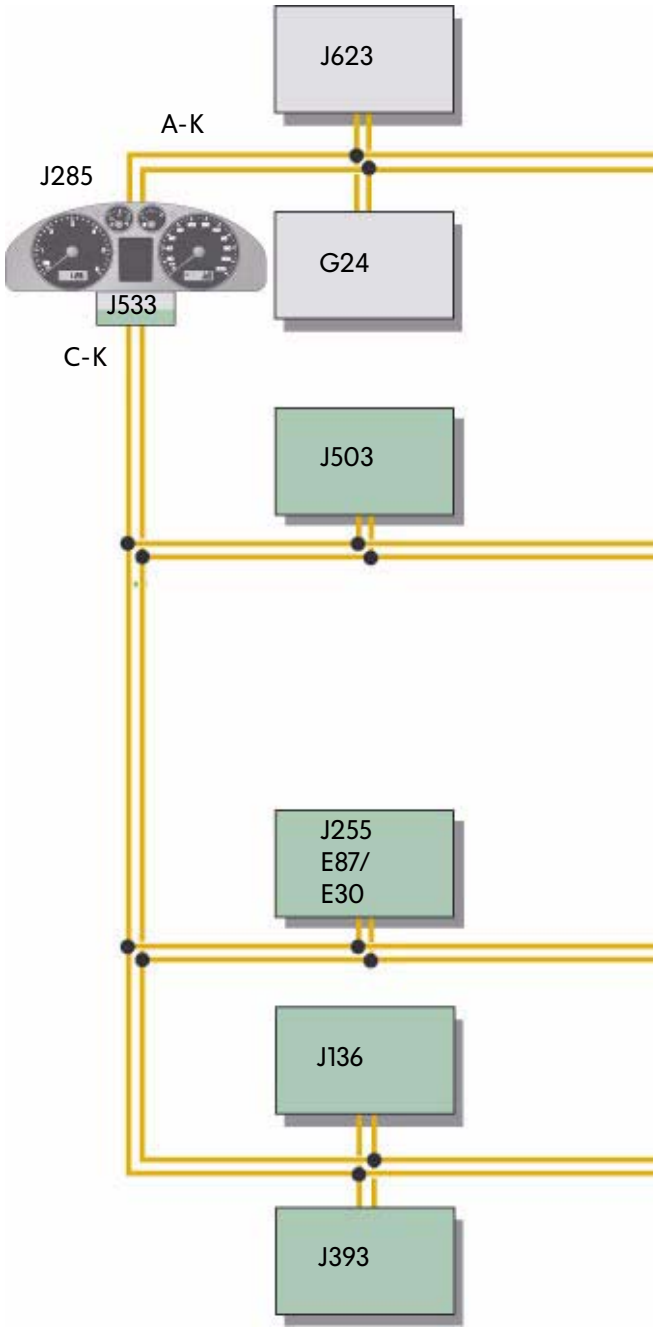
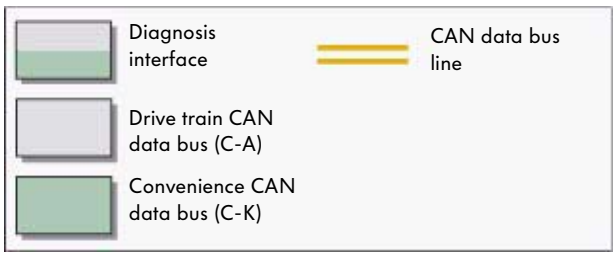
Introduction

The CAN data bus

Data bus network

The control units of the Volkswagen Transporter are connected to each other via the CAN data bus network.
The network makes it possible to exchange data between the control units.
Information is sent via the CAN data bus in digital form instead
of via discrete cable connections.
This makes it possible for other control units to access the information.
The CAN data bus is split into two single systems, the drive train CAN data bus and the convenience CAN data bus.
Both bus systems are connected to each other via the data bus diagnosis interface (Gateway) J533 in the dash panel insert and this allows the exchange of data.





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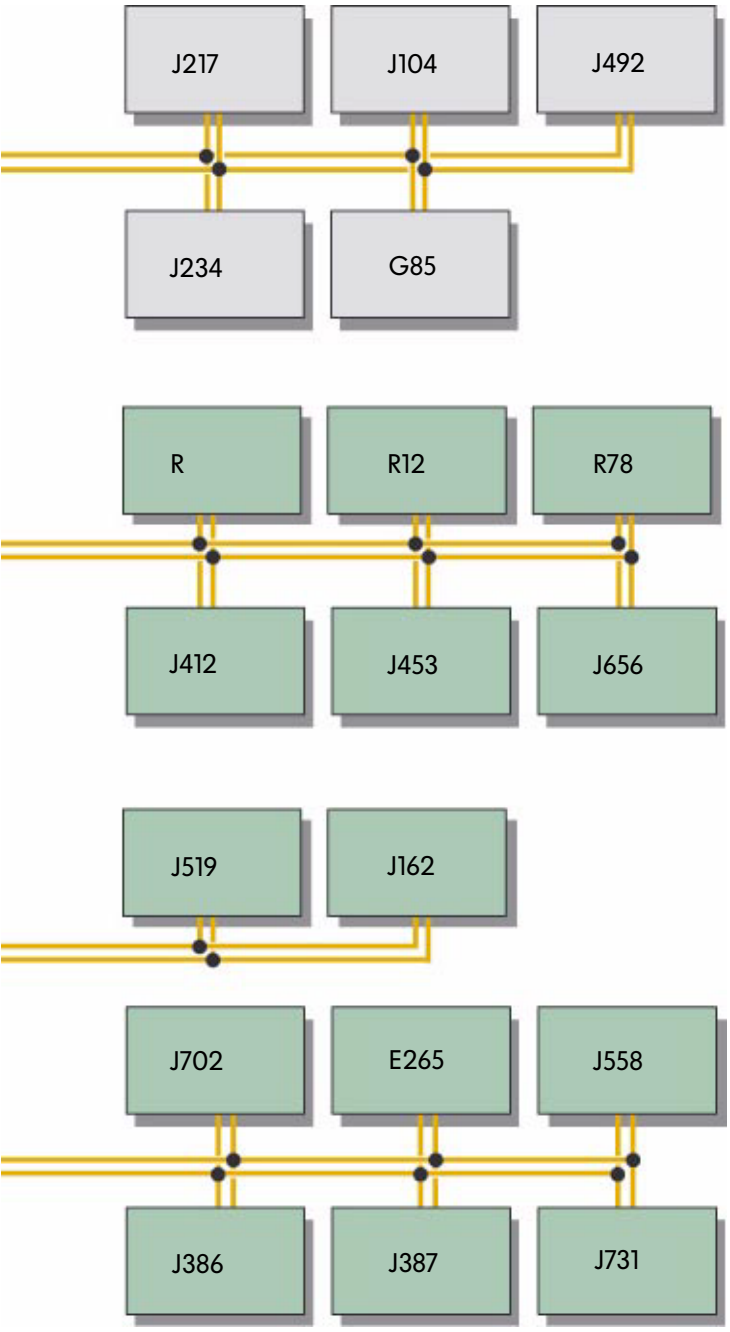


S311_001

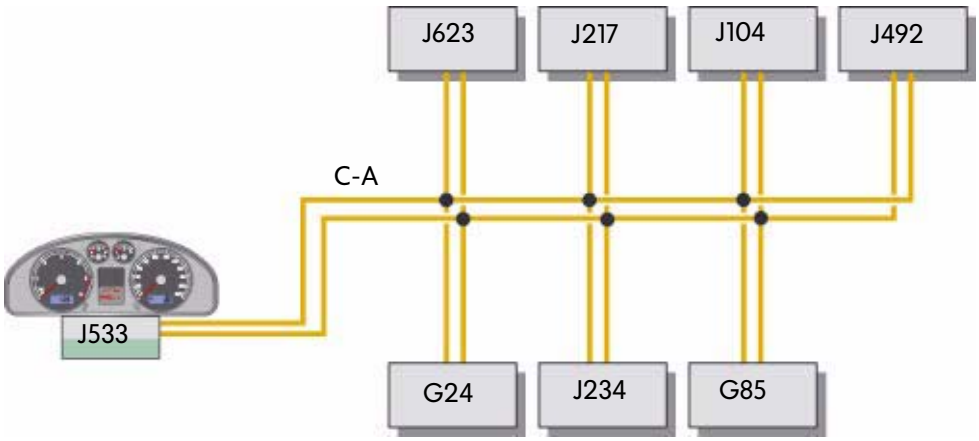
Legend

G24	Tachograph
G85	Steering angle sender
E30	Air conditioner switch
E87	Air conditioning system/Climatronic operating and display unit
E265	Rear Climatronic operating and display unit
J104	ABS with EDL control unit
J136	Seat adjustment control unit with memory function
J162	Heater control unit
J217	Automatic gearbox control unit
J234	Airbag control unit
J255	Climatronic control unit
J285	Control unit with display in dash panel insert
J386	Door control unit, driver side
J387	Door control unit, front passenger side
J393	Central convenience system control unit
J412	Operating electronics control unit, mobile telephone
J453	Multi-function steering wheel control unit
J492	Four-wheel drive control unit
J503	Radio and navigation control unit with display unit
J519	Onboard electrical system control unit
J533	Data bus diagnosis interface
J558	Sliding door control unit
J623	Engine control unit
J656	Voice enhancement control unit
J702	Roof display unit
J731	Right sliding door control unit
R	radio: (Delta radio only, not in commercial vehicles)
R12	Amplifier
R78	TV tuner

Introduction

The drive train CAN data bus (C-A)

All control units assigned to the drive train
are connected to each other via the drive train CAN data bus.
The data transfer rate is 500 kbit/s. Data is transmitted along the CAN high and CAN low lines.
The drive train CAN data bus only has ready status if both data lines are intact.
In case of failure of a data line, an open circuit or a short circuit, no data transfer takes place.
A fault is entered into the fault memories of the participating control units.
The CAN data bus lines are colour-coded orange/black for the CAN high line and orange/brown for the CAN low line. The lines are twisted together.



S311_102

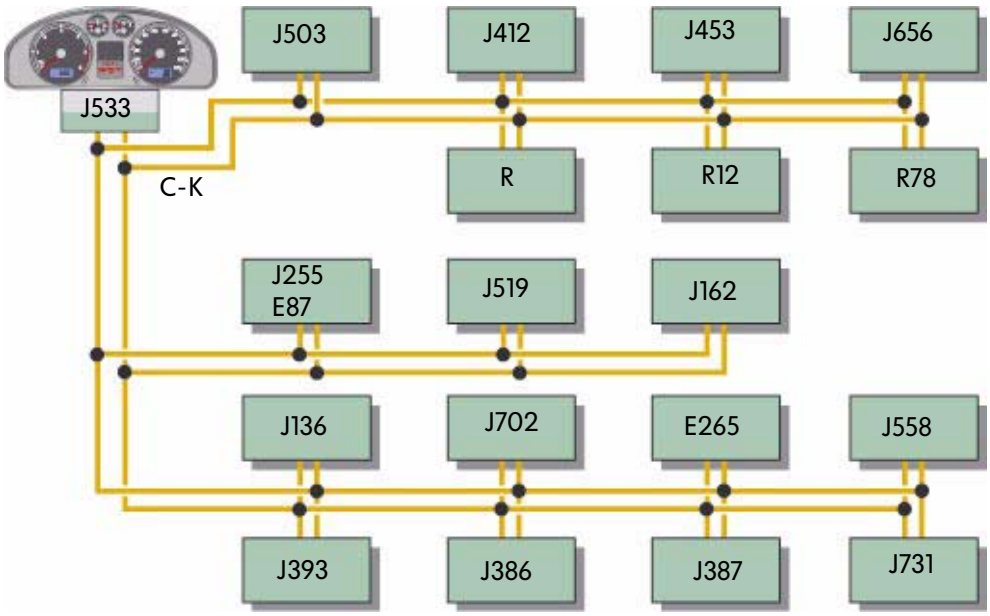
You can find further information on the CAN data bus in SSP 186, entitled "The CAN data bus" and in SSP 238, entitled "Data exchange on the CAN bus".

Legend

G24	Tachograph
G85	Steering angle sender
J104	ABS with EDL control unit
J217	Automatic gearbox control unit
J234	Airbag control unit
J492	Four-wheel drive control unit
J533	Data bus diagnostic interface
J623	Engine control unit

The convenience CAN data bus (C-K)

Control units not assigned to the drive train are connected to each other via the convenience CAN data bus.
The data transfer rate is 100 kbit/s. Data is transmitted along the CAN high and CAN low lines.
The convenience CAN data bus has ready status even if a data line is not intact.
In case of failure of a data line, an open circuit or a short circuit, data is still transferred across the remaining data line (single-wire mode).
If a short circuit occurs, a fault will be entered into the fault memories of the participating control units
The CAN high line is orange/green, the CAN low line is orange/brown.
The lines are twisted together.



S311_103

Legend

E87 Air conditioning system/Climatronic operating and display unit
E265 Rear Climatronic operating and display unit
J162 Additional heater control unit
J136 Seat adjustment control unit memory function (not for market launch)
J255 Climatronic control unit
J386 Door control unit, driver side
J387 Door control unit, front passenger side
J393 Convenience system central control unit
J412 Mobile telephone operating electronics control unit
J453 Multi-function steering wheel control unit
J503 Control unit with display for radio and navigation
J519 Onboard power supply control unit
J533 Data bus diagnosis interface
J558 Sliding door control unit
J656 Voice enhancement control unit
J702 Roof display unit
J731 Right sliding door control unit
R Delta radio
R12 Amplifier
R78 TV tuner

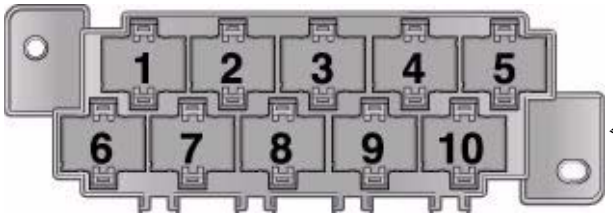
Onboard power supply

Fitting locations of the electrical components

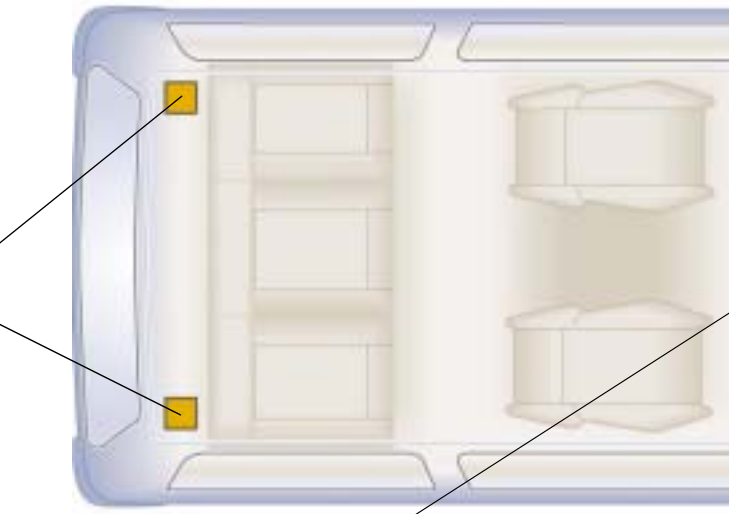
Overview of the fitting locations in the onboard power supply

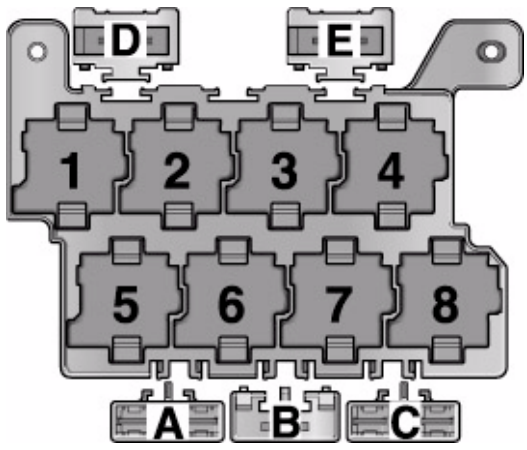
The fuse holder, relay positions and connector stations are fitted at different locations in the vehicle.

10-socket connector stations
The connector station is located:
on D-pillar on the left
on D-pillar on the right



S311_068

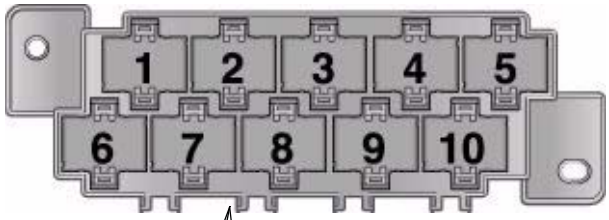




S311_065

8-socket relay holder
The relay holder is located in the seat base on the left.

10-socket connector stations
The connector stations are located:
on A-pillar on the left
in the seat base on left
in the seat base on right



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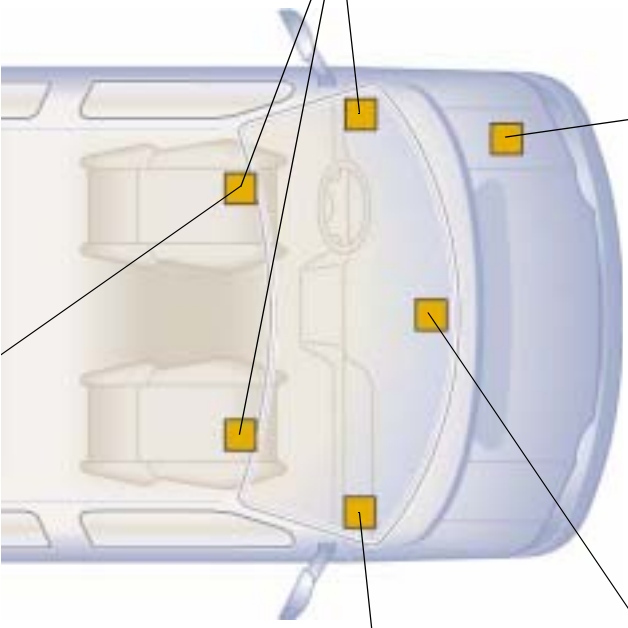
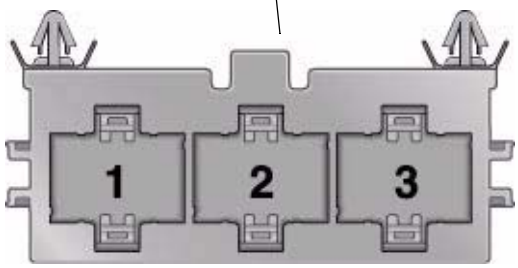


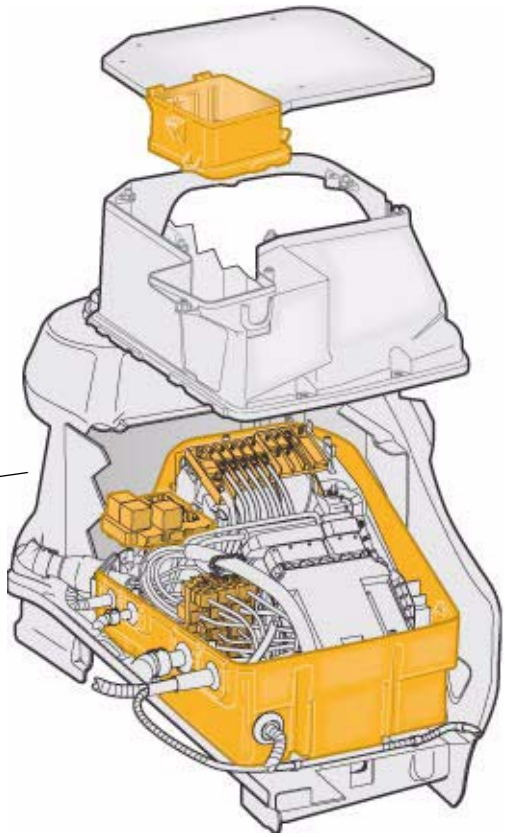
S311_003

3-socket connector station
The connector station is located on the A-pillar at the right.



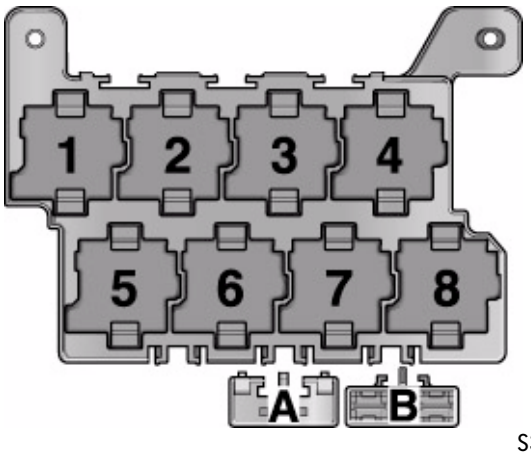
S311_070

Electronics box



S311_005

8-socket relay holders (1 and 2)
The relay holder are located under the dash panel, in the centre

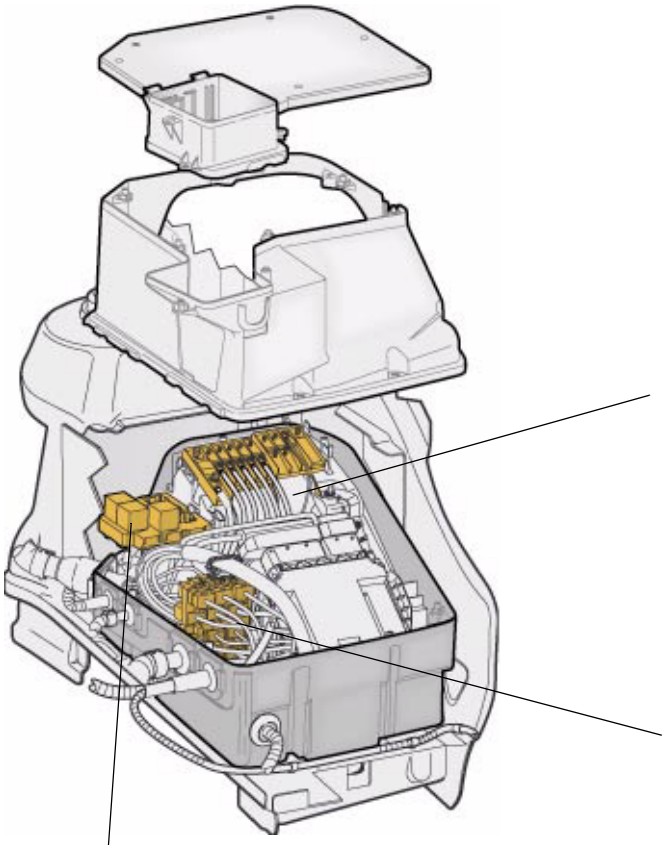


S311_066

Onboard power supply

Electronics box

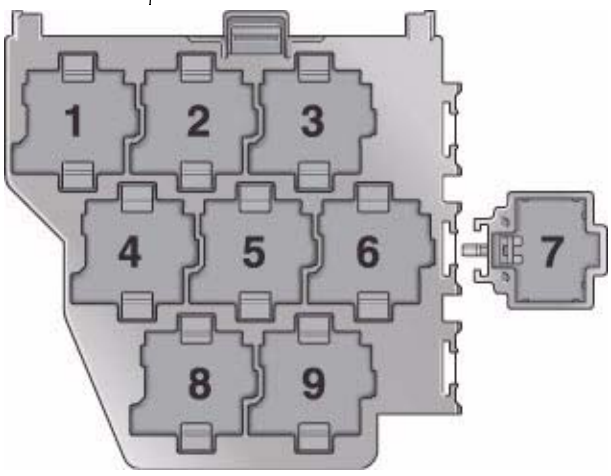
The electronics box is located in the engine compartment, on the left in the direction of travel. It accommodates the fuses for the engine compartment, the engine control unit J623 and the automatic gearbox control unit J217.
It consists of a watertight housing and allows the serviceable installation of the control units.



S311_104

9-socket relay holder

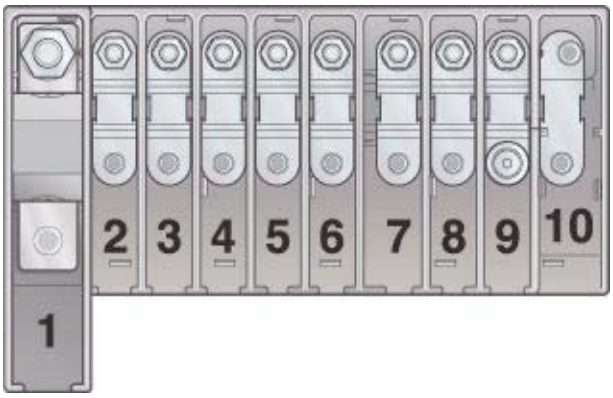
The relay holder is located in the engine compartment in the electronics box.



S311_051

Main fuse holder

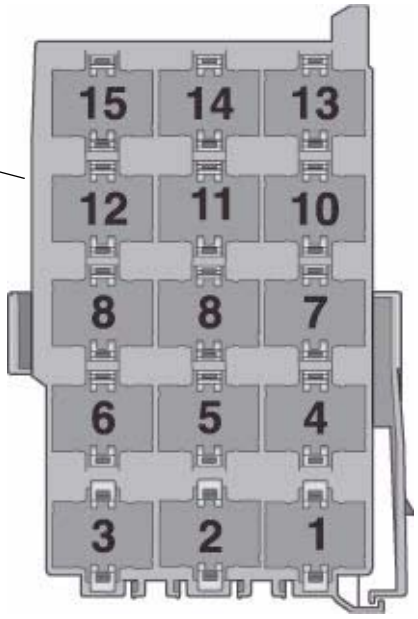
The main fuse holder is located in the engine compartment in the electronics box.



S311_049

15-socket connector station

The connector station is located in the engine compartment in the electronics box.

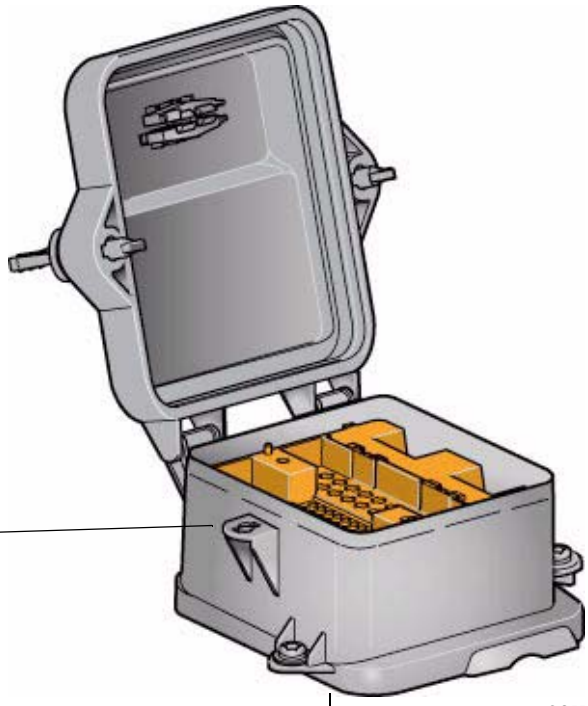


S311_052

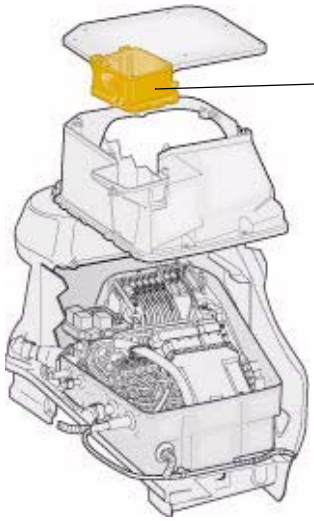
Onboard power supply

Service port

A service port allows fuses to be replaced without having to remove the complete housing.



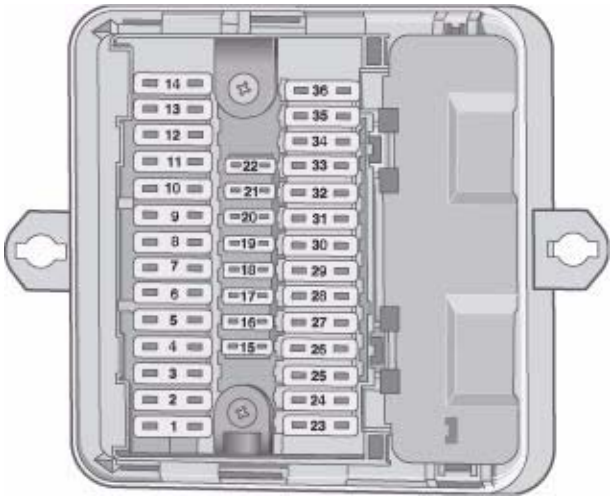
S311_004



S311_105

Fuse holder for SD fuses

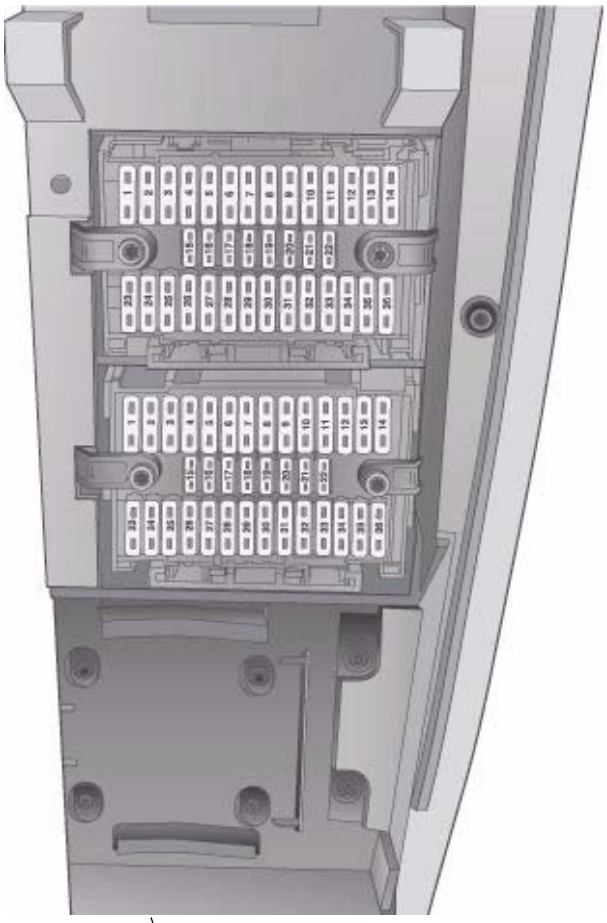
The fuse holder is also located in the engine compartment in the electronics box. It can be accessed through the service port.



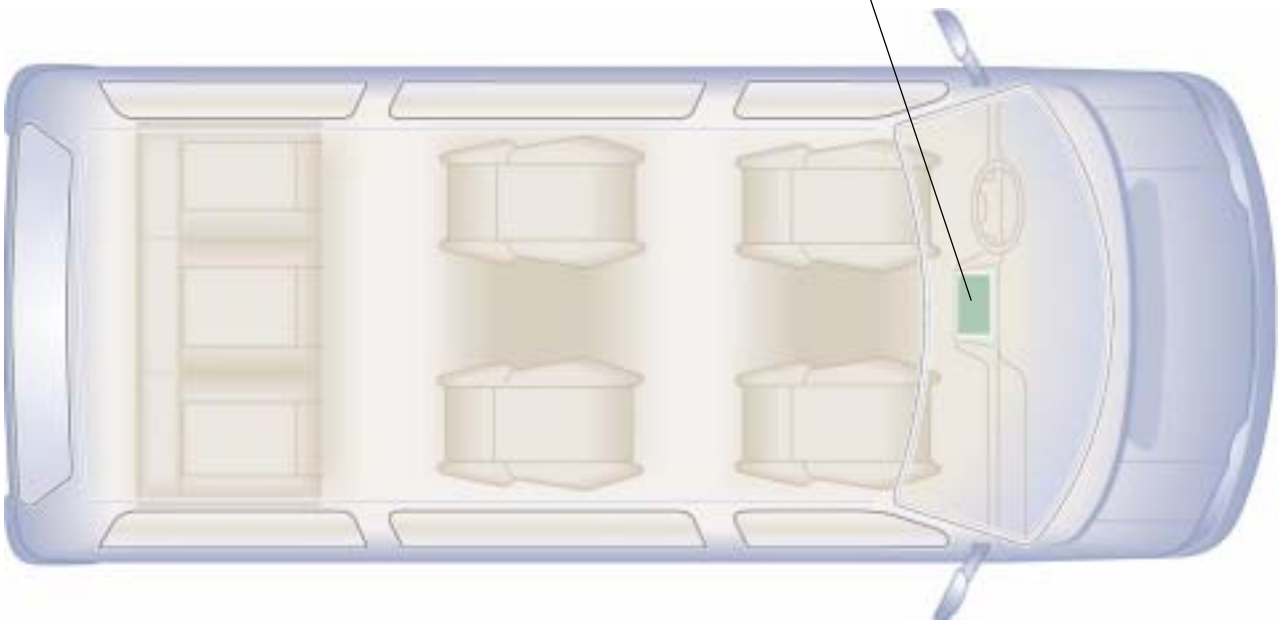
S311_050

Fuse holder for SC fuses

The fuse holder is located in the centre of the vehicle below the dash panel and is covered by a trim panel.



S311_053



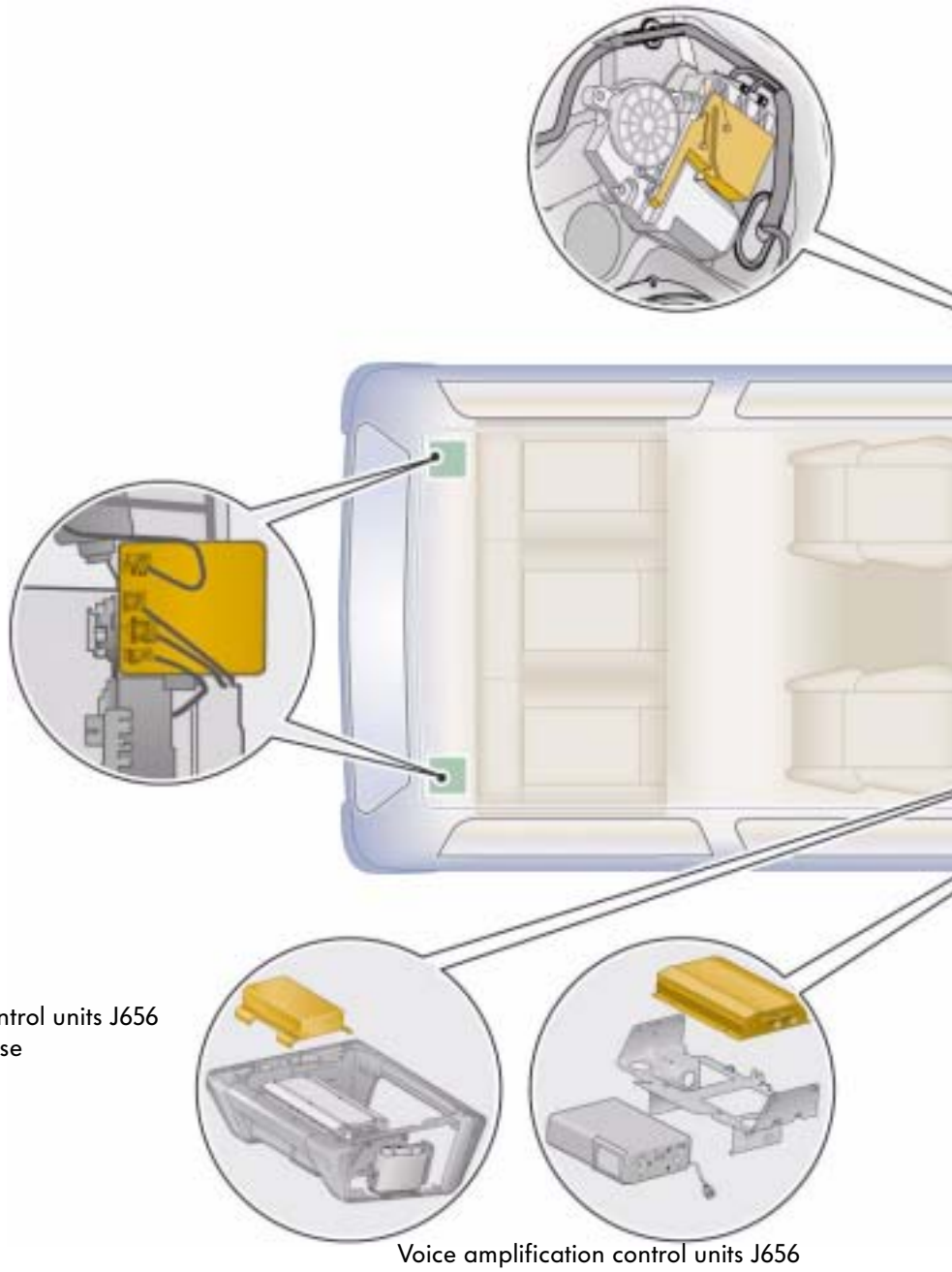
S311_056

Onboard power supply

Fitting locations of the control units

The control units are fitted at different locations in the vehicle.

Door control unit, driver side J386
in the door on the left



Sliding door control unit
J558
on D-pillar on left

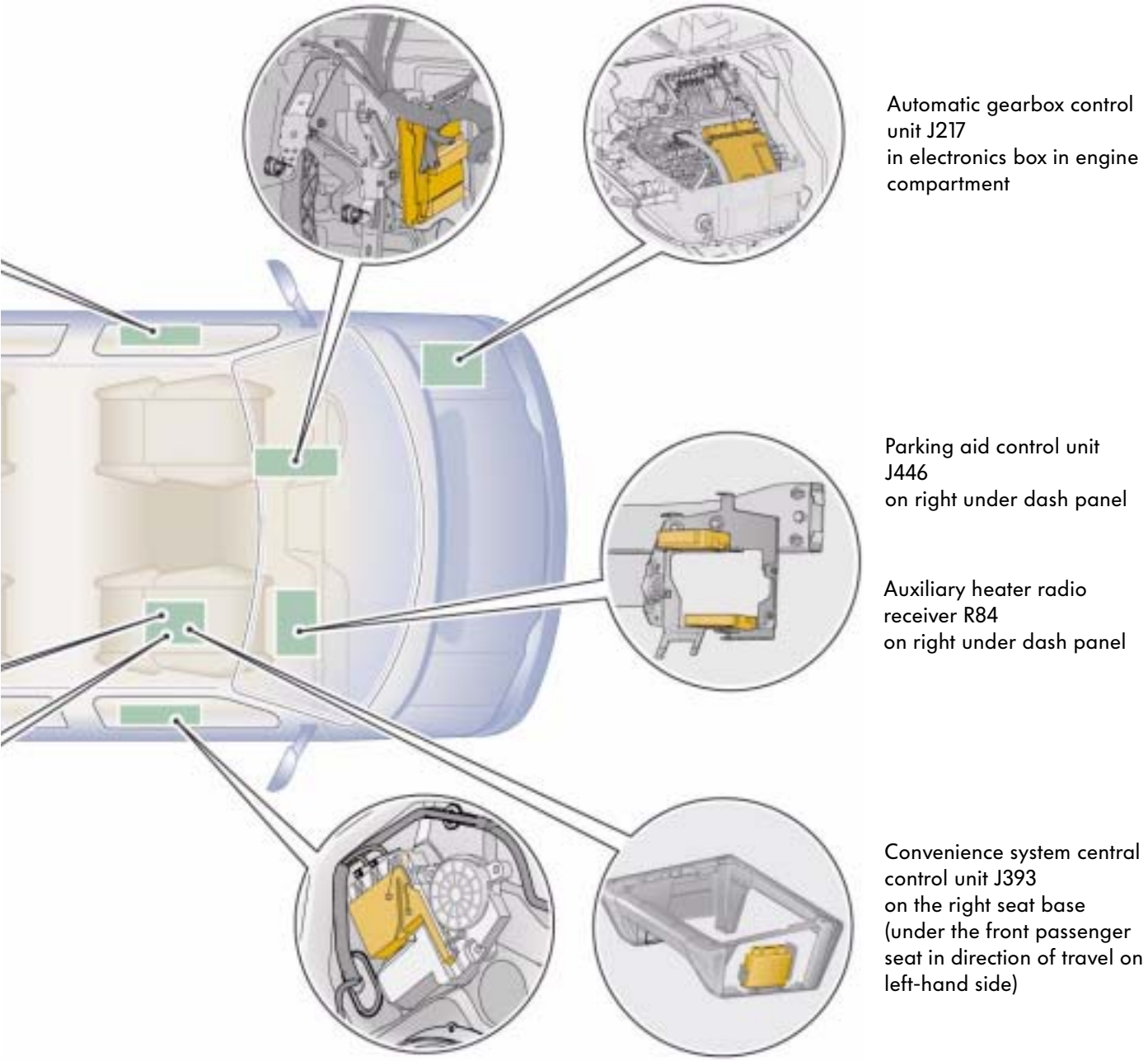
Right sliding door control unit
J731
on D-pillar on right

Voice amplification control units J656
on right under seat base

Voice amplification control units J656
on right under seat base

Onboard electrical supply control unit J519
on left under dash panel

Engine control unit J623
in electronics box in engine compartment



Automatic gearbox control unit J217
in electronics box in engine compartment

Parking aid control unit J446
on right under dash panel

Auxiliary heater radio receiver R84
on right under dash panel

Convenience system central control unit J393
on the right seat base (under the front passenger seat in direction of travel on left-hand side)

Door control unit, front passenger side J387
in door on right

S311_002

Onboard power supply

The onboard power supply control unit J519

Combined in the onboard power supply control unit are functions of relays/control units which were previously executed by various relays/control units located at different positions.

This has the following advantages:

- easier assembly
- less electrical wiring
- fewer connectors
- lower costs
- quick fault-finding through diagnosis

The onboard power supply control unit can exchange data with the other control units in the vehicle via the convenience CAN data bus.

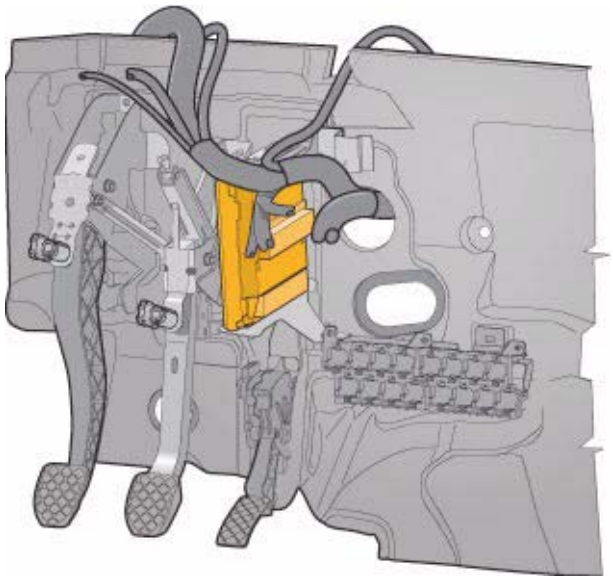
Fitting location

The onboard power supply control unit is located below the dash panel on the left.

Variants

The onboard power supply control unit is available in the following variants:

- Basis Low
- Basis
- Medium/Midline
- High end/Highline



S311_008

The following function charts provide an overview of the input and output signals as well as the signal paths. Under no circumstances do they replace the valid current flow diagram.
For fault-finding and repair, always use the Vehicle Diagnosis, Testing and Information System VAS 5051 and the Electronic Service Information System (ELSA).

Tasks

The onboard power supply control unit controls and switches the following functions:

- Turn signal control
- Windscreen wiper motor actuation
- Activation of the heated rear window
- Control of the alternator pre-excitation via terminal "L"
- Activation of the interior lighting
- Activation of the heated exterior mirror
- Control of the function enable for the sliding sunroof and the window regulator
- Activation of the battery isolation relay
- Control of the starter inhibitor
- Activation of the reversing lights
- Switch and instrument light regulation
- Control of electrical fuel pump feed
- Electrical load management control
- Recognition of switch positions on the cruise control system
- Control of the Shift-Lock function in vehicles with automatic gearbox
  A driving range can only be selected if the foot brake is applied.
- Recognition of the positions of the central lokking switches of all doors and bonnet contact switch F266 and output to the CAN data bus.
- Recognition of the states of terminals S, 15, X and 50 and output to the CAN data bus
- Activation of the heated windscreen
- Control of the dual tone horn
  The signal from horn plate H is read in by the onboard power supply control unit, and the dual tone horn is directly activated from here.

The following legend applies to all function diagrams below.

- Signal output
- Earth
- Signal output
- Positive
- CAN data bus line

Onboard power supply

The turn signal control

Functional description

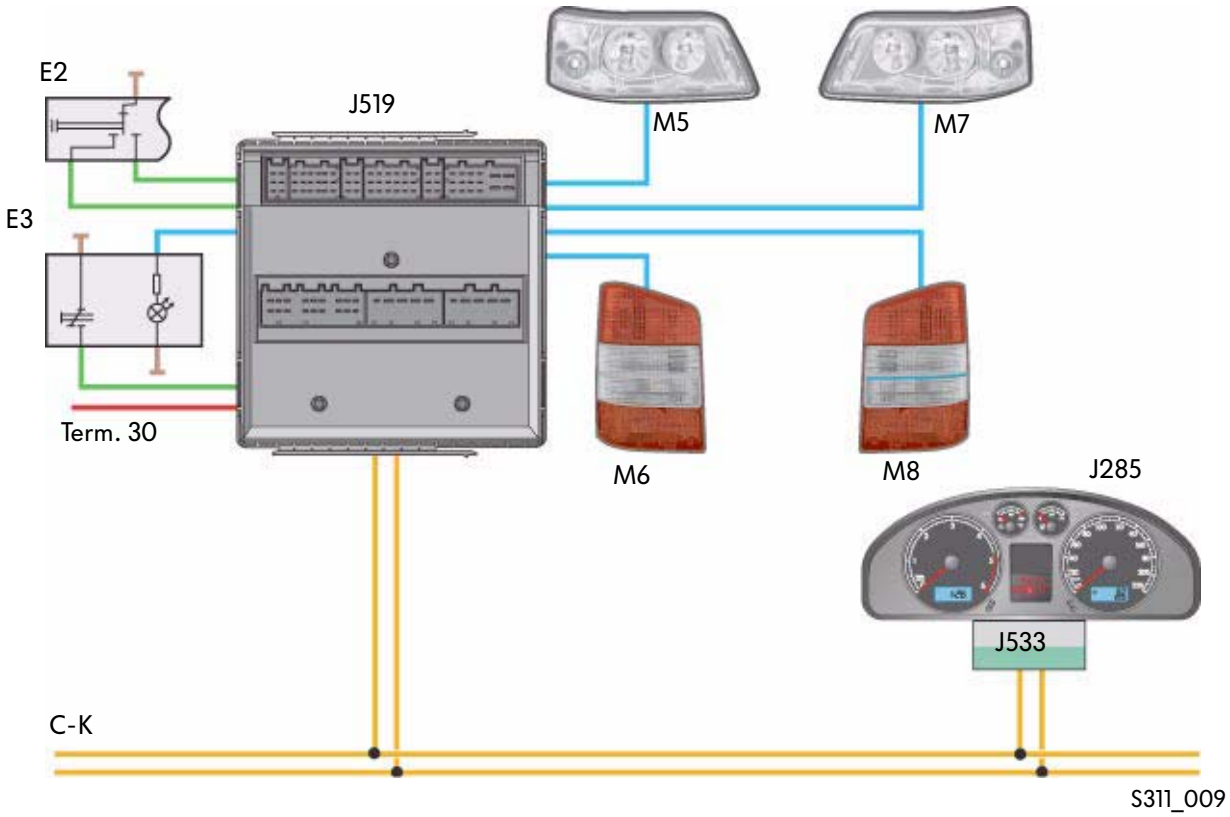
The turn signal function is executed in the onboard power supply control unit. The flashing lights are activated depending on the input signals from the turn signal switch. The turn signal frequency is controlled by the onboard power supply control unit.
The turn signal operation always begins with a bright phase.

Turn signal warning lamps

The left and right turn signal warning lamps K65 and K94 in the control unit with display in the dash panel insert are activated via the convenience CAN data bus.
The warning lamps flash at the same frequency as the flashing lights.

Motorway hazard warning light function

If the turn signal switch is operated only briefly (flicked), the flashing lights will flash three times.



Legend

E2	Turn signal switch
E3	Hazard warning light switch
J285	Control unit with display in dash panel insert
J519	Onboard power supply control unit
J533	Diagnosis interface for data bus
M5	Turn signal bulb, front left
M6	Turn signal bulb, rear left
M7	Turn signal bulb, front right
M8	Turn signal bulb, rear right
C-K	Convenience CAN data bus

Description of the hazard warning function

The hazard warning function is executed in the onboard power supply control unit.
The flashing lights are activated depending on the input signals from the hazard warning light switch E3. The turn signal frequency is controlled by the onboard power supply control unit.
The hazard warning function always begins with a bright phase.

Hazard warning light system warning lamps

The hazard warning light system warning lamp K6, as well as the left and right turn signal warning lamps K65 and K94 are activated.
The system is activated directly by the onboard power supply control unit via a pulse-width modulated signal.

There are two activation modes:

- activation depending on the set dim stage (for switch illumination).

- activation as a warning lamp when the warning light function is active. A flashing light is produced by switching between the min and max brightness levels.

Collision warning light function

The flashing-light collision warning function (activation of warning light in case of collision) is activated by the onboard power supply control unit. This control unit sends a corresponding signal from the airbag control unit via the drive train CAN data bus, the data bus diagnostic interface in the dash panel insert and the convenience CAN data bus.
To deactivate the function, the ignition (terminal 15) must be turned off and the hazard warning light switch operated.

Flasher function for anti-theft alarm system

The function "flash on activation of the anti-theft alarm system" is activated by the convenience system central control unit J393 via the convenience CAN data bus.

The function is not activated if the hazard warning light system or the turn signals are switched on.

Turn signal failure detection

If a turn signal fails, the flashing rate of the warning lamp will be doubled and the flashing lights will continue to flash at normal frequency. A bulb failure is not indicated when the hazard warning function is active.

To ensure proper operation of the turn signal warning lamps, trailer operation must be encoded in the onboard power supply control unit.
For encoding, use the Vehicle Diagnosis, Testing and Information System VAS 5051 and the Electronic Service Information System (ELSA).

Onboard power supply

Windscreen wiper motor actuation

Functional description

The wiper switch signals are evaluated directly by the onboard power supply control unit. The selected function for windscreen wiper motor activation is executed via the onboard power supply control unit.

Flick wipe

When the "Flick wipe" function is activated, terminal 53 (stage 1) of the windscreen wiper motor is energised. After the function is deactivated, wiping continues until the wiper reaches its rest position.

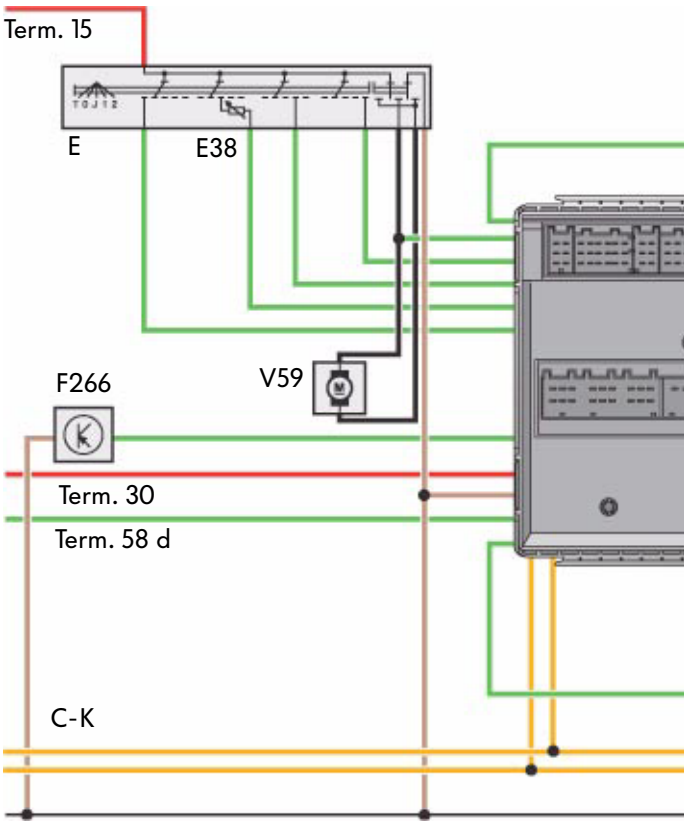
Wipe stage 1

When the "Wipe stage 1" function is activated, terminal 53 (stage 1) of the windscreen wiper motor is energised. Wipe stage 1 is maintained if the vehicle comes to a standstill. After the function has been deactivated, wiping continues until the wiper reaches its rest position.

Wipe stage 2

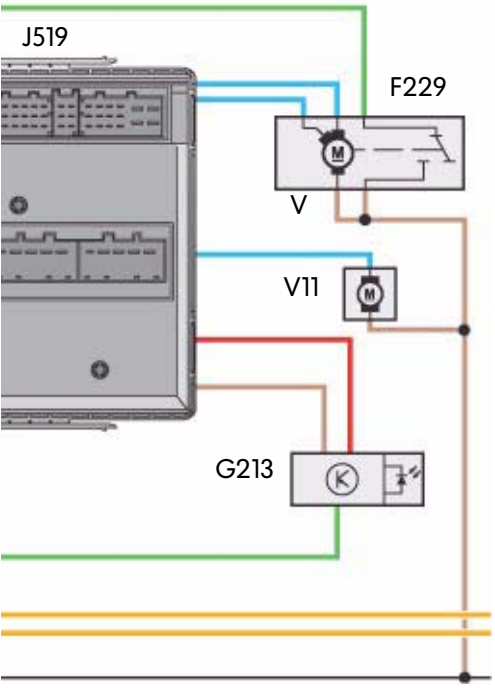
When the "Wipe stage 2" function is activated, terminal 53b (stage 2) of the windscreen wiper motor is energised. Wipe stage 2 is maintained if the vehicle comes to a standstill. After the function has been deactivated, wiping continues until the wiper reaches its rest position.

Function diagram of windscreen wiper motor actuation



Legend

E	Windscreen wiper switch
E38	Intermittent wiper control
F229	Windscreen wiper limit switch
F266	Bonnet contact switch
G213	Rain sensor



S311_010

J519 Onboard power supply control unit
V Windscreen washer motor
V11 Headlight washer system pump
V59 Windscreen and rear window washer pump
C-K Convenience CAN data bus

"Wash/wipe" function

When the "Wash/wipe" function is activated, the windscreen and rear window washer pump V59 is activated directly by the wiper switch; it feeds washer fluid to the windscreen immediately.
The wipers come on after approx. 200 ms.
The windscreen wiper motor is activated at terminal 53 by the onboard power supply control unit.

A predetermined number of wipe cycles is executed depending on the operating time of the wiper switch and the interval between two wash/wipe cycles.

Switch operating time (t)	wipe cycles
$t < 0.5$ s	2
$t > 0.5$ s	3

Interval (t_p)	wipe cycles
$t < 200$ ms	3

Blocked motor detection

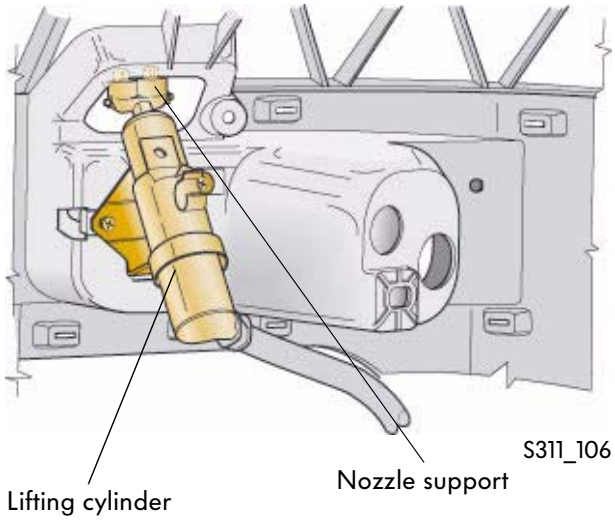
If no signal switchover is detected at the limit switch (terminal 31b) for 40 s during operation of the windscreen wiper motor, the onboard power supply control unit switches over to direct activation by the wiper switch.
The windscreen wiper motor can be switched off in any position.

Onboard power supply

Headlight washer system

When the light is on, the headlight washer system pump V11 is activated in the "Wash/wipe" function in addition to the windscreen and rear window washer pump.

The headlight washer system pump is activated approx. 1500 ms after the windscreen and rear window washer pump is activated. The duration of the wash cycle is approx. 700 ms.

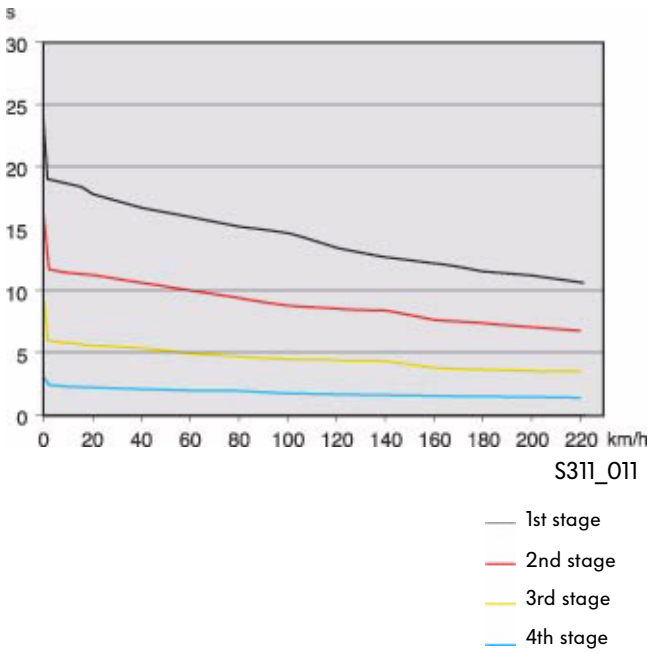


S311_106

Speed dependent intermittent delay

If no rain sensor is installed in the vehicle, the intervals in intermittent mode are controlled depending on the road speed and the adjustment of the intermittent wiper control E38.

When an elevated, higher sensitivity is set, a wipe operation is triggered immediately. When a lower sensitivity is set, no wipe operation is triggered.



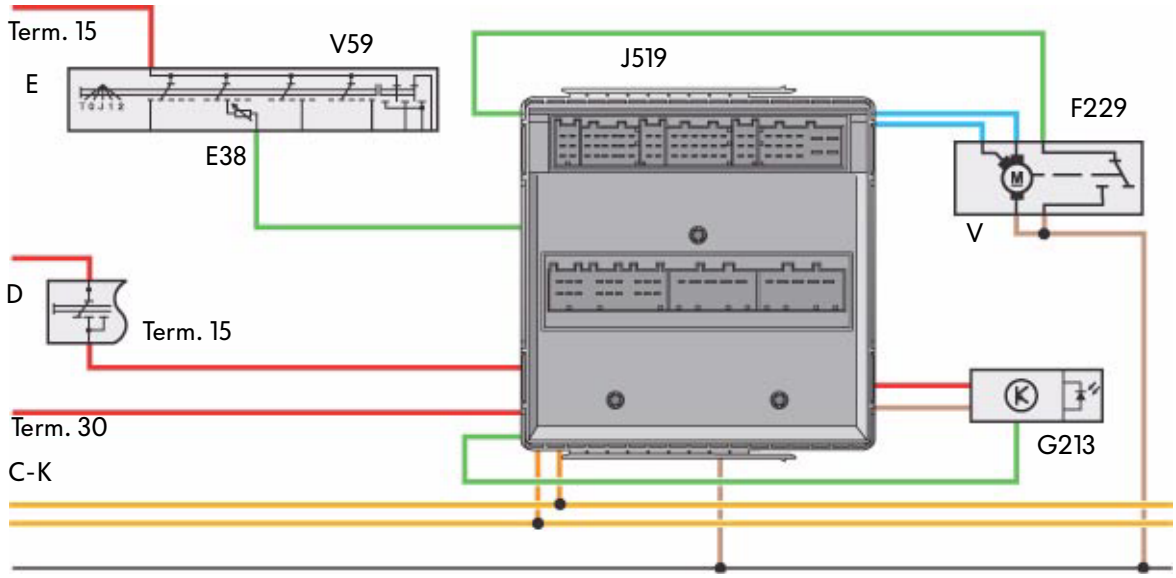
S311_011

Rain sensor dependent intermittent wiper control

The Volkswagen Transporter can be optionally equipped with a rain sensor.
The rain sensor is mounted on the windscreen. Its signals are evaluated by the onboard power supply control unit.
The rain sensor is activated at terminal 15 (ignition "on") and with the windscreen wiper switch in the "Intermittent" position. If the "Intermittent" stage is already active when the ignition is turned on, then the ignition must be switched off and on again in order to activate the rain sensor.

The rain sensor emits a light signal via an LED. Depending on the state of the windscreen (dry or wet), this light signal is reflected to a greater or lesser extent.
A photo diode receives this reflected signal. The electronics of the rain sensor convert the signal to a voltage signal and transmit it to the onboard power supply control unit. The onboard power supply control unit evaluates the signal and controls the intermittent delay accordingly.

If the rain sensor fails, the intermittent delay is controlled as a function of road speed.



S311_012

Legend

D	Ignition switch
E	Windscreen wiper switch
E38	Intermittent wiper control
E229	Windscreen wiper limit switch
G213	Rain sensor
J519	Onboard power supply control unit
V	Windscreen washer motor
C-K	Convenience CAN data bus

Onboard power supply

Activation of the heated rear window

Functional description

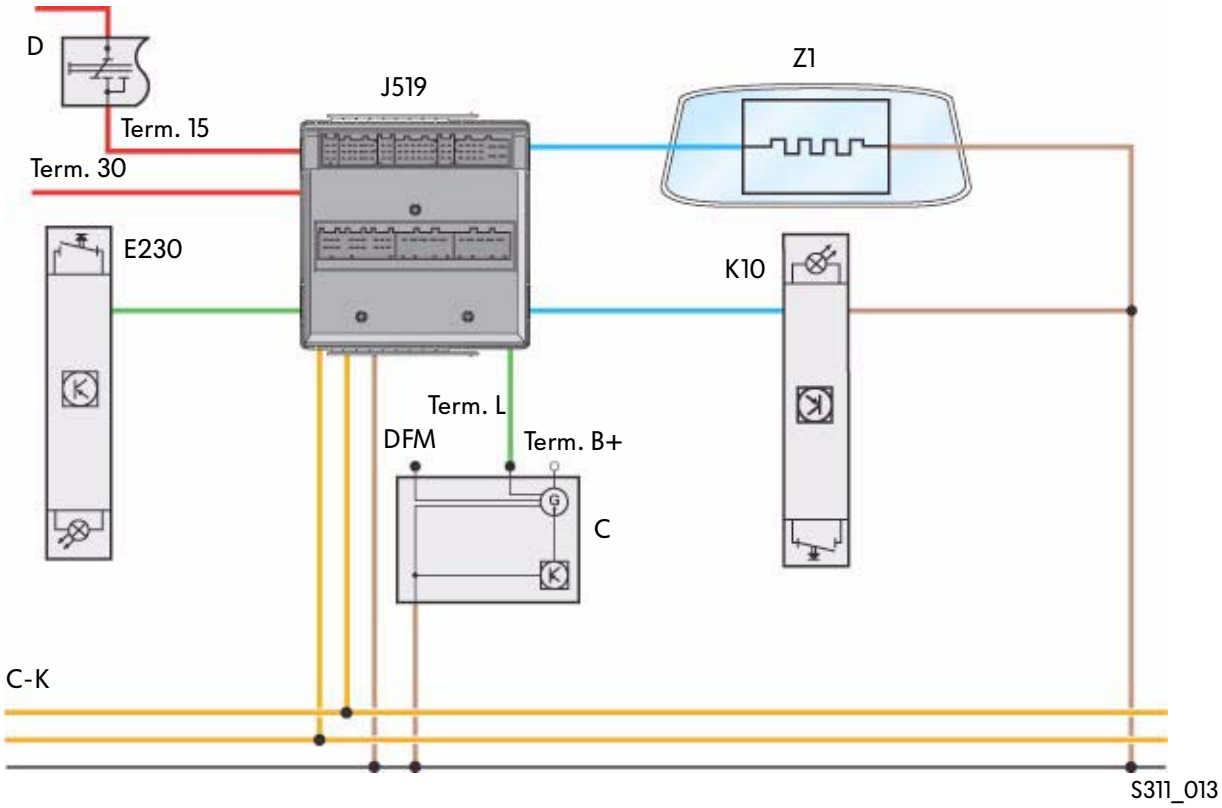
The onboard power supply control unit reads in the signal from the heated rear window button E230 and activates the heated rear window directly.

Activation conditions

- Alternator is charging and
- heated rear window button pressed

Deactivation conditions

- alternator is not charging or
- heated rear window button pressed again or
- automatic switch-off after maximum operating time of four minutes
- switch-off by the electrical load management system.



Legend

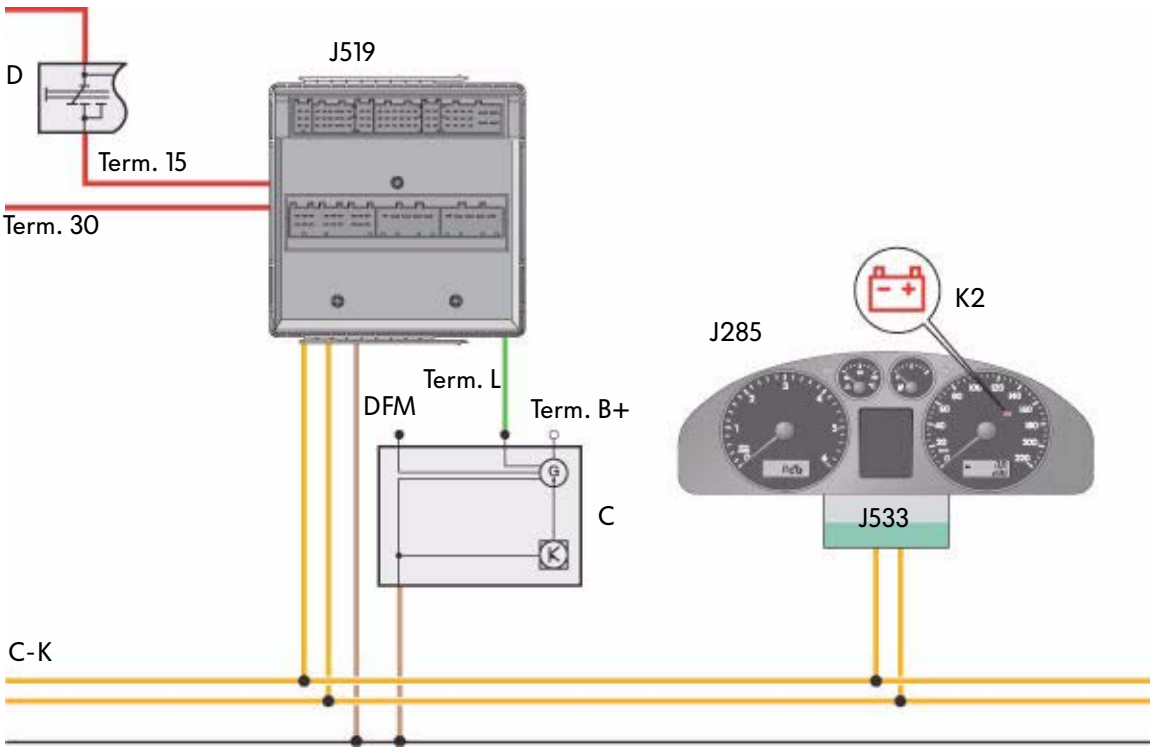
C	3-phase AC alternator
D	Ignition switch
E230	Heated rear window button
J519	Onboard power supply control unit
K10	Heated rear window warning lamp
Z1	Heated rear window
C-K	Convenience CAN data bus

Control of alternator pre-excitation via terminal "L"

Functional description

To ensure that an alternator can generate the required power as soon as it starts up, the alternator must be pre-excited after terminal 15 is energised.

Pre-excitation is controlled by the onboard power supply control unit. Current flows via terminal L to the exciter winding in the alternator, thus building a magnetic field.
This magnetic field is required for power generation directly after the engine starts in order to ensure sufficient alternator output.



S311_014

Legend

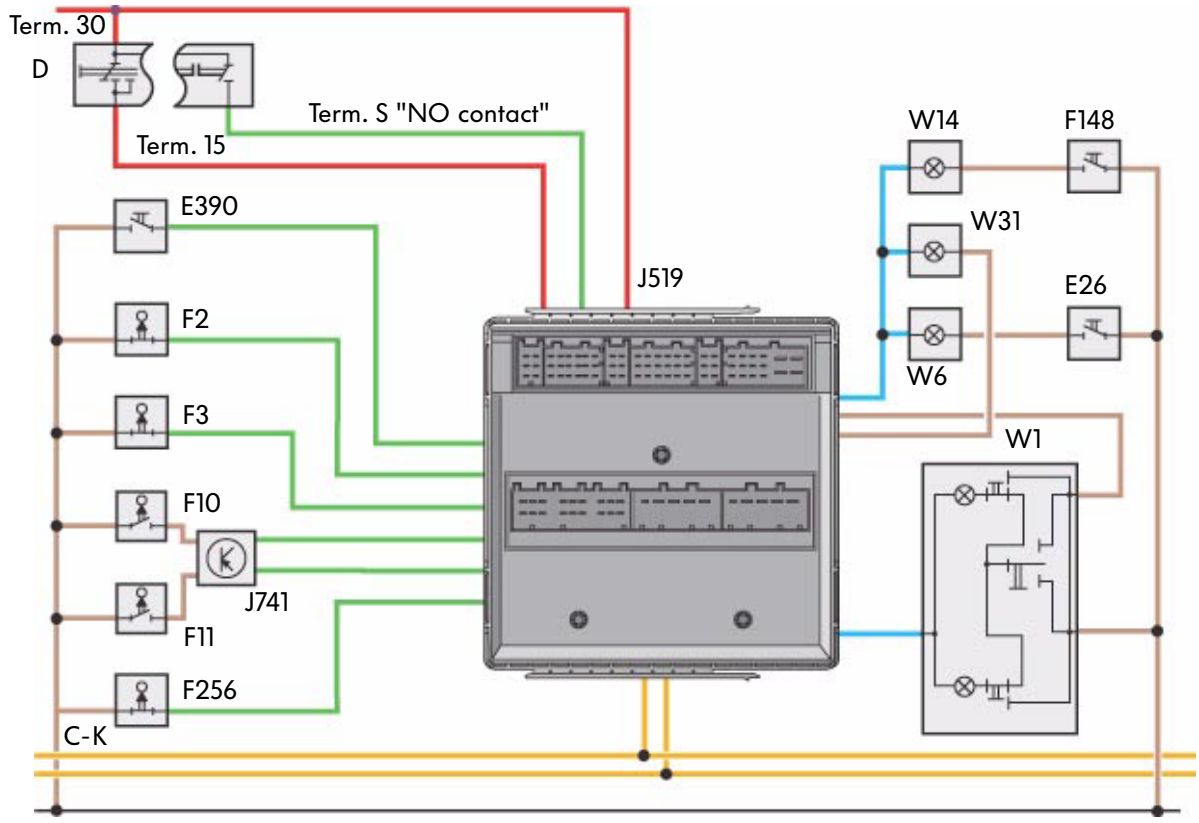
C	3-phase AC alternator
D	Ignition switch
J285	Control unit with display in dash panel insert
519	Onboard power supply control unit
JJ533	Data bus diagnostic interface in the dash panel insert
K2	Alternator warning lamp
C-K	Convenience CAN data bus

Onboard power supply

Activation of the interior lighting, terminal 30G

Functional description

Terminal 30G is engaged via the onboard power supply control unit and supplies the interior lights with voltage. It is disabled with delayed effect after approx. 30 minutes (terminal 30G delayed) in order to avoid discharge of the onboard power supply battery since the interior lights are permanently switched on.



S311_015

Legend

D	Ignition switch
E26	Glove box light switch
E390	Interior light central switch button
F2	Door contact switch, driver side
F3	Door contact switch, front passenger side
F10	Rear left door contact switch
F11	Rear right door contact switch
F148	Vanity mirror contact switch, front passenger side
F256	Tailgate locking unit
J519	Onboard power supply control unit
J741	Dual inverter relay
W1	Front interior light
W6	Glove box light
W14	Illuminated vanity mirror, front passenger side
W31	Front left entry light
C-K	Convenience CAN data bus

Activation conditions

- Operation of an interior light switch
- Activation of terminal 15 (ignition "on")
- Operation of a door contact switch
- Operation of the bonnet contact switch

Immediate switch-off

The interior lights are switched off immediately

- if terminal 15 (ignition) is energised after opening and closing a door.
- if the vehicle is locked and no door is open.
- if the last door is closed and terminal 15 is energised.

Switch-off delay

The operating time of the interior lights is limited to
10 minutes if one or more doors are open and the ignition is off. If, in the case of several open doors, a door is closed, the interior lights will be switched on again for 10 minutes. If only one door was open, and is closed, the switch-off delay is 30 seconds.

The interior lights are switched on or off with a switch-off delay of
approx. 30 seconds

- if the vehicle was unlocked with the ignition key or the remote control.
- if a door is opened and then closed again.
- if the ignition key is removed from the ignition/ starter switch.

Collision behaviour

In the event of a collision, the airbag control unit J234 sends a collision signal to the drive train CAN data bus. This signal is sent to the convenience CAN data bus via the data bus diagnostic interface J533 in the dash panel insert, and can be read by the onboard power supply control unit J519.

If a collision signal is detected, the onboard power supply control unit switches the interior lights on. They stay switched on until terminal 15 has been switched on and off again.

The "Interior lighting control" function is not active until terminal 15 has been energised.

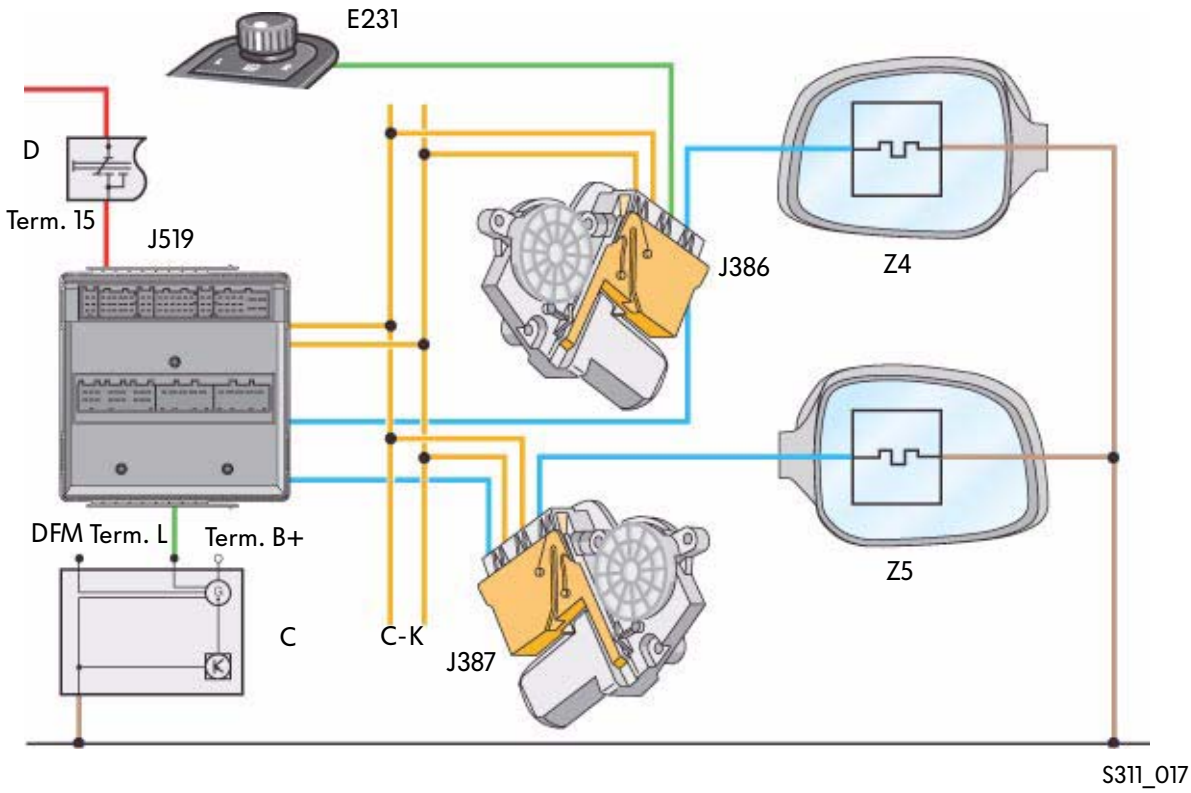
Onboard power supply

The heated exterior mirror

Exterior mirror heating via door control unit, driver side J386

The mirrors on the driver and front passenger sides are heated when terminal L is active if the exterior mirror heating button E231 in the driver door is in the "Heat" setting.
The door control unit, driver side J386 reads in the heating request and sends it via the convenience CAN data bus to the onboard power supply control unit J519.

The onboard power supply control unit then switches the exterior mirror heating on.
The signals are looped through the door control units.

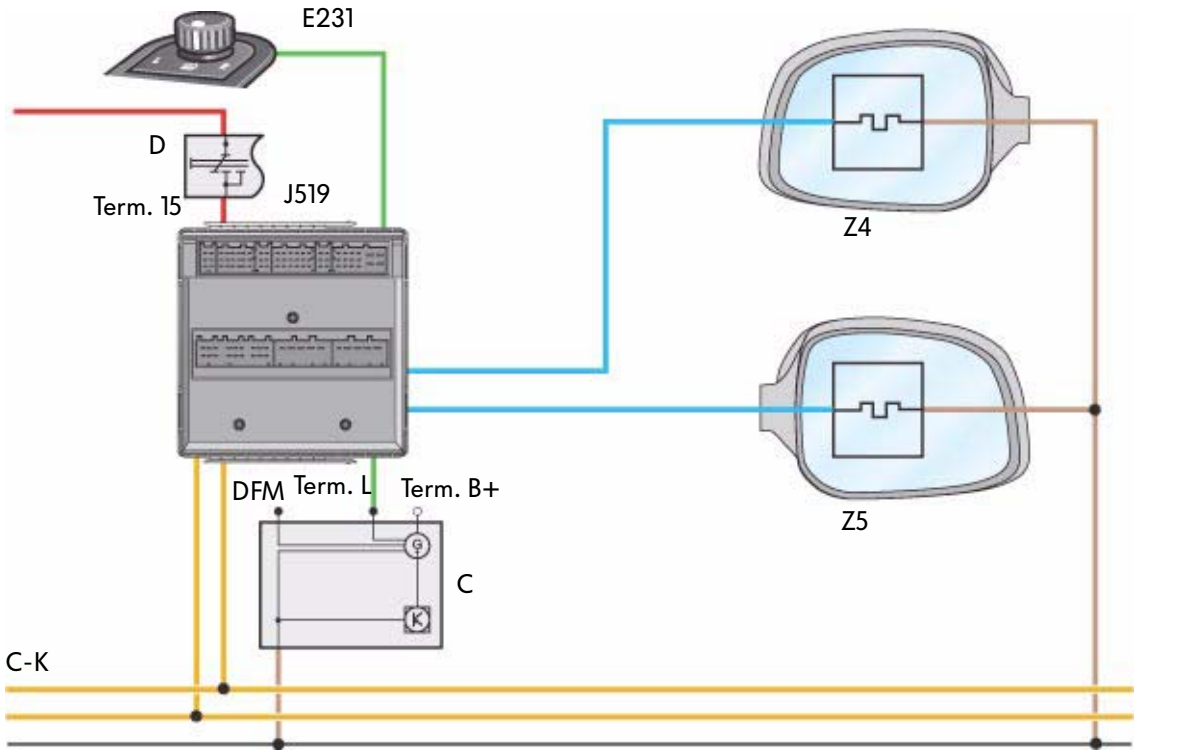


Exterior mirror heater is only available in combination with electrically adjustable mirrors.
It is not possible to adjust the mirror while it is being heated.

Exterior mirror heating without door control units

The mirrors on the driver and front passenger sides are heated when terminal L is active if the exterior mirror heating button E231 is pressed.

The onboard power supply control unit J519 receives the heating request directly from the switch and switches the exterior mirror heating on.



S311_018

Legend

C	3-phase AC alternator
D	Ignition switch
E231	Exterior mirror heating button
J386	Door control unit, driver side
J387	Front passenger door control unit
J519	Onboard power supply control unit
Z4	Heated exterior mirror, driver side
Z5	Heated exterior mirror, front passenger side
C-K	Convenience CAN data bus

Onboard power supply

Function enable for sliding sunroof and window regulator

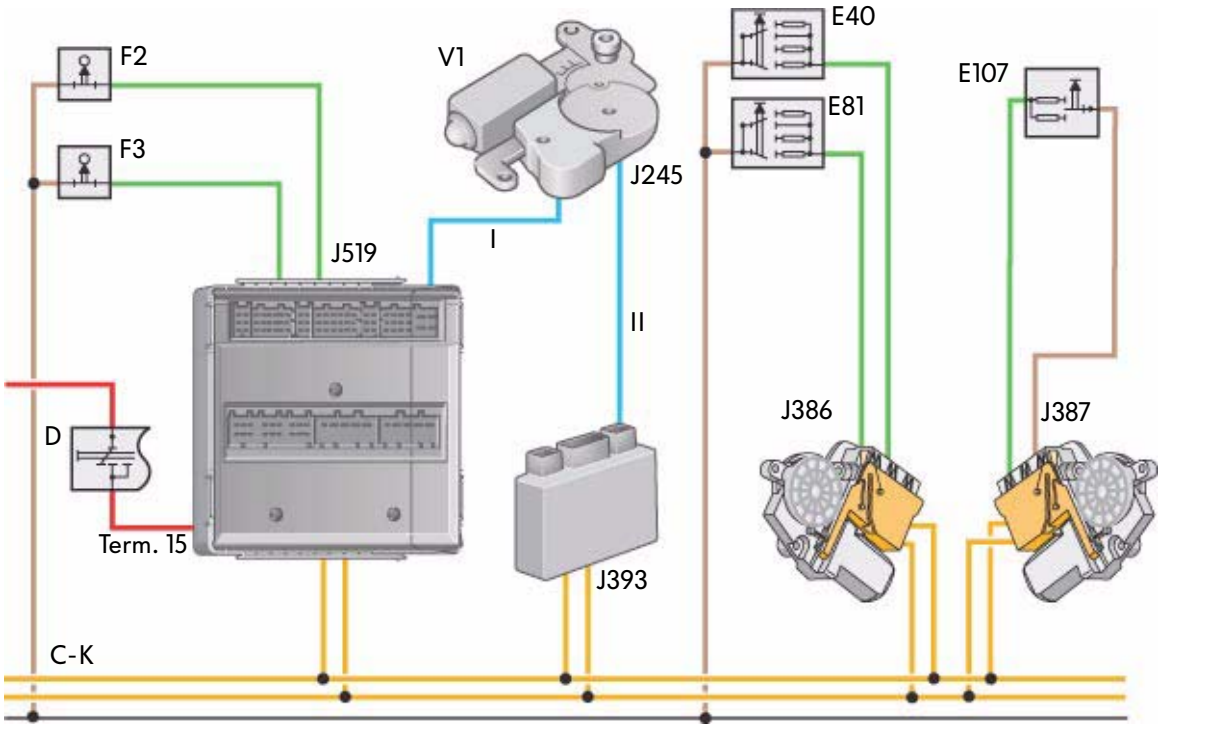
Functional description

The function enable for the sliding sunroof and the window regulator is issued by the onboard power supply control unit J519. The release is issued after turning on the ignition, and remains active after turning off the ignition until one of the front doors is opened, but for no longer than 10 minutes after terminal 15 active is switched off.

The function enable for the window regulator is issued via the convenience CAN data bus to the door control unit, driver side J386 and the door control unit, front passenger side J387.

The remote enable for the sliding sunroof is issued via a signal wire.

The door control units and the sliding sunroof adjustment control unit monitor the force which the electric motors have to apply in order to close window and the sliding sunroof.
If a preset value is exceeded, the closing cycle is reversed.



S311_019

Legend

D	Ignition switch
E40	Front left window regulator switch
E81	Front right window regulator switch, driver
E107	Window regulator switch, in front passenger door
F2	Door contact switch, driver side
F3	Door contact switch, front passenger side
J245	Sliding sunroof adjustment control unit
J386	Door control unit, driver side
J387	Front passenger door control unit
J393	Convenience system central control unit
J519	Onboard power supply control unit
V1	Sliding sunroof motor
I	Signal for function enable
II	Signal for convenience operation
C-K	Convenience CAN data bus

Activation of the battery isolation relay J7

Functional description

To supply the auxiliary heater with voltage, the Volkswagen Transporter is equipped with a second battery A1. The battery is charged by the vehicle's 3-phase AC alternator C.

The onboard power supply control unit activates the battery isolation relay. As a result, the second battery is, for charging purposes, connected to the onboard power supply or disconnected from the onboard power supply when the engine is switched off. Disconnecting the battery from the onboard power supply when the engine is switched off prevents, for instance, an operating additional water heater from discharging the vehicle battery A.

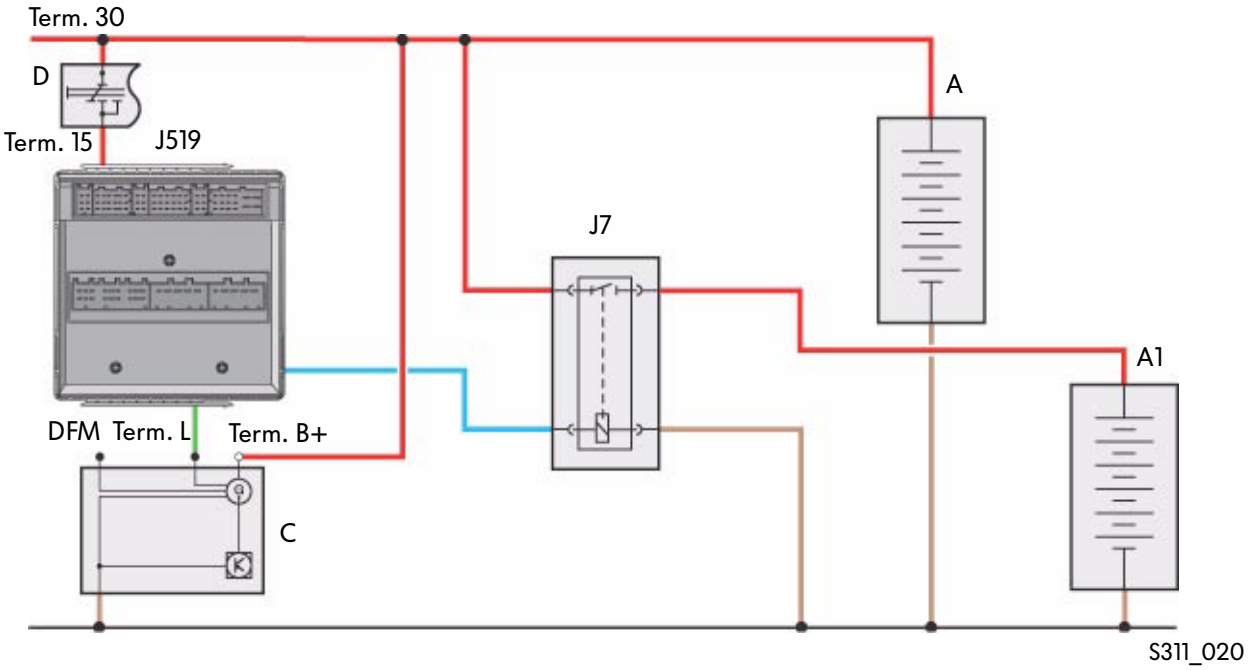
Activation conditions (relay closed)

- Terminal X on (ignition a)
  and
- alternator is charging

Deactivation conditions (relay open)

- Terminal X off (ignition "on")
  or
- alternator is not charging

The signal indicating whether the alternator is charging or not is detected by terminal L on the alternator via a separate cable.



Legend

A	Battery
A1	Second battery
C	Alternator
D	Ignition switch
J7	Battery isolation relay
J519	Onboard power supply control unit

Onboard power supply

Control of the starter inhibitor

Functional description

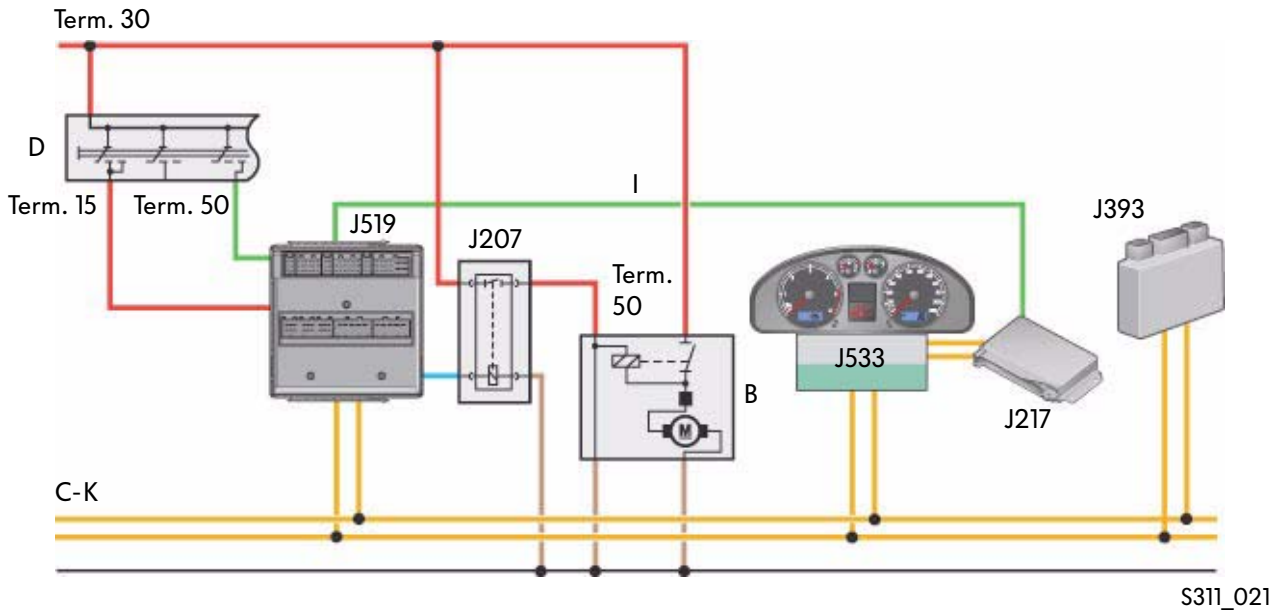
The onboard power supply control unit J529 activates the starter inhibitor relay J207.

The following input signals are required:

- Terminal 15 on (ignition a)
- Terminal 50 on (ignition switch start)
- Enable signal from anti-theft alarm system
- Enable signal from automatic gearbox control unit J217

The enable signal from the anti-theft alarm system is sent by the convenience system central control unit J393 via the convenience CAN data bus.

If unauthorised entry is gained to the vehicle and the anti-theft alarm system is triggered, a corresponding signal is sent to the convenience CAN data bus and read by the onboard power supply control unit.
In this case, starter inhibitor relay J207 will not be activated and the engine cannot be started.



S311_021

Legend

B	Starter
D	Ignition switch
J207	Starter inhibitor relay
J217	Automatic gearbox control unit
J393	Convenience system central control unit
J519	Onboard power supply control unit
J533	Data bus diagnosis interface
C-K	convenience CAN data bus
I	Enable signal via conventional cable connection

Activation of the reversing lights

Variants

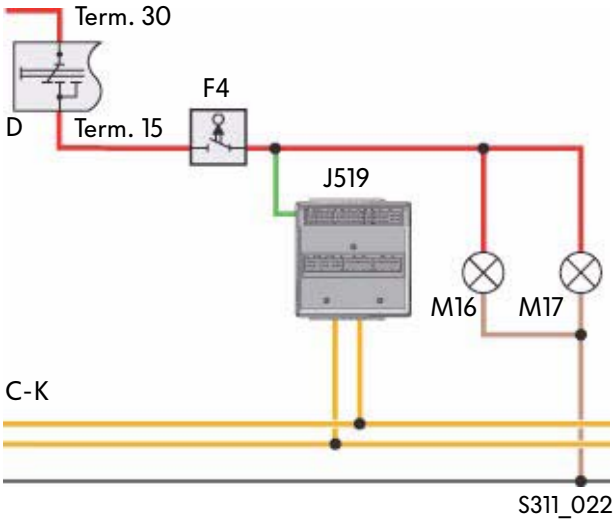
There are two function variants:

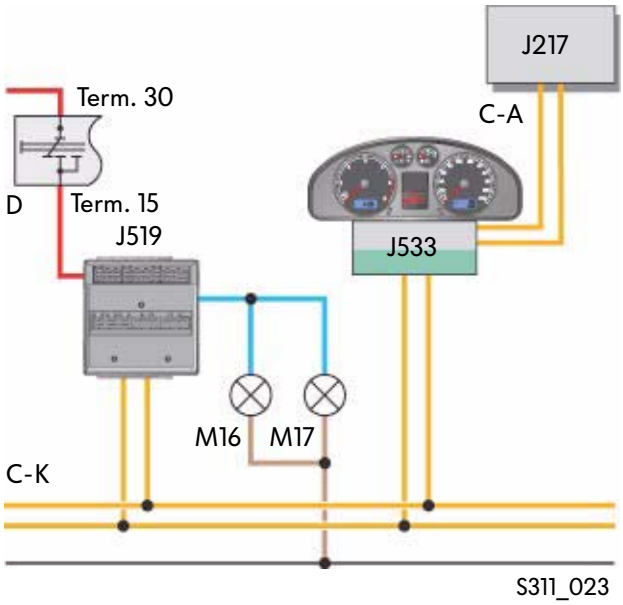
Vehicles with manual gearbox

On vehicles with a manual gearbox, the reversing lights are activated directly by the reversing light switch F4.
The onboard power supply control unit reads this signal and sends it to the convenience CAN data bus. The drive train CAN data bus receives the signal via the data bus diagnostic interface J533.

Vehicles with automatic gearbox

On vehicles with an automatic gearbox, the reverse gear is detected via the selector lever, read by the automatic gearbox control unit J217 and sent to the drive train CAN data bus.
The signal is sent to the convenience CAN data bus via the data bus diagnostic interface in the dash panel insert and read by the onboard power supply control unit which in turn energises the reversing lights.





Legend

D	Ignition switch
F4	Reversing light switch
J217	Automatic gearbox control unit
J519	Onboard power supply control unit
J533	Data bus diagnosis interface
M16	Reversing light bulb, left
M17	Reversing light bulb, right
C-K	Convenience CAN data bus
C-A	Drive train CAN data bus

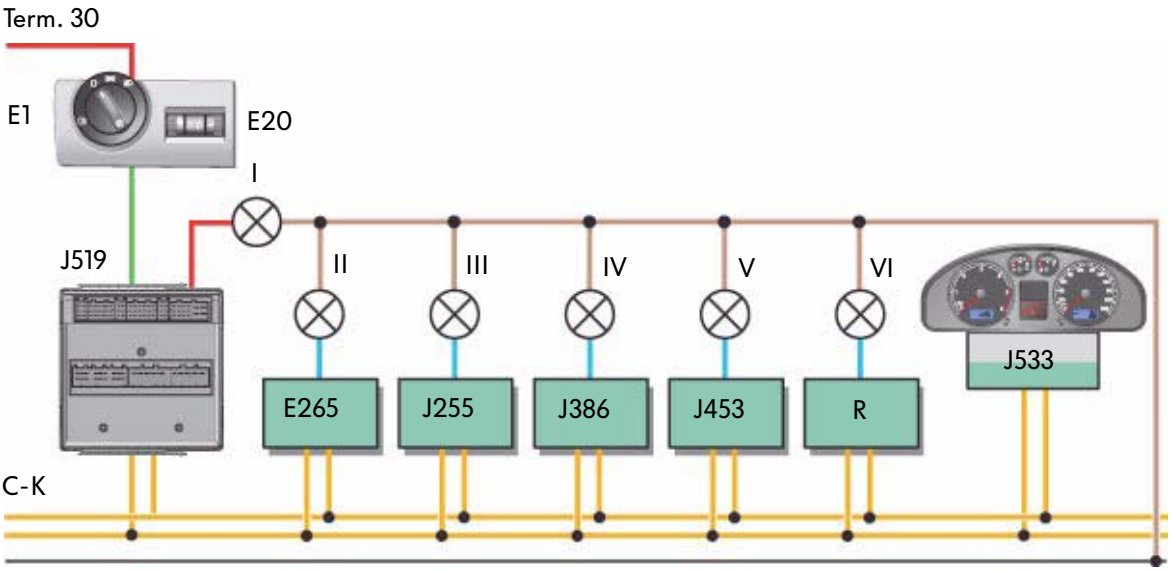
Onboard power supply

Switches and instruments light regulation

Functional description

The switch and instrument light regulator E20 generates a pulse-width modulated signal which is sent via the onboard power supply control unit to the convenience CAN data bus as a digital message. The control units connected to the convenience CAN data bus receive this message and control the illumination of the switches and display instruments as signalled.

The hazard warning light switch light is activated directly by the onboard power supply control unit.



The control units shown in the diagram are only intended as examples. S311_016

Legend

E1	Light switch
E20	Switch and instrument light regulator
E265	Rear Climatronic operating and display unit
J255	Climatronic control unit
J386	Door control unit, driver side
J453	Multi-function steering wheel control unit
J519	Onboard power supply control unit
J533	Data bus diagnosis interface
R	Radio
I	Hazard warning light switch lamp
II	Rear Climatronic operating and display unit lamp
III	Climatronic operating and display unit lamp
IV	Driver door operating unit lamp
V	Multi-function steering wheel control button lamp
VI	Radio lamp
C-K	Convenience CAN data bus

Control of electrical fuel pump feed

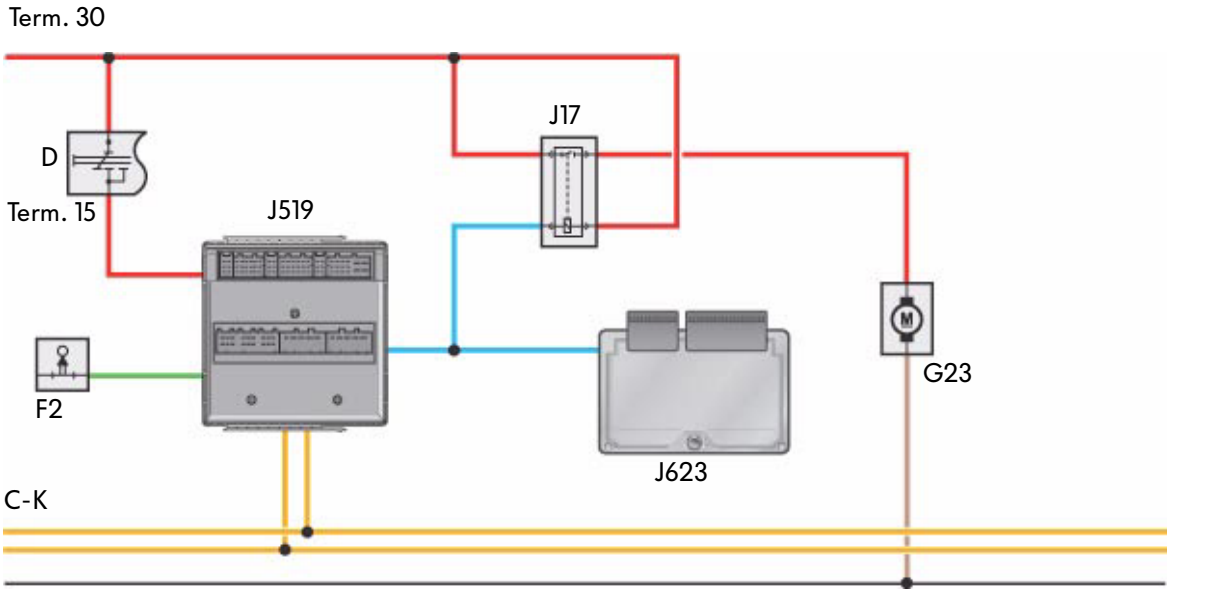
Functional description

If the driver's door is opened and terminal 15 is switched off, the onboard power supply control unit activates the electrical fuel pump for approx. 0.1 second.
If the door stays open, the fuel pump is reactivated after approx. 1 minute for approx. 0.1 seconds. The fuel pump is activated for a final time after a further minute. If the ignition is switched on during the feed cycle, the feed cycle will stop immediately.

If the ignition is switched off and the engine has not been started, the onboard power supply control unit inhibits feed for 1 minute.

After the engine is started, the fuel pump is activated by the engine control unit.

If a collision is detected, electrical fuel pump feed will be deactivated.
To reactivate the feed function, the ignition must be switched off and on again three times.



S311_024

Legend

D	Ignition switch
F2	Door contact switch, driver side
G23	Fuel pump
J17	Fuel pump relay
J519	Onboard power supply control unit
J623	Engine control unit
C-K	Convenience CAN data bus

Onboard power supply

Electrical load management

General description

The electrical load management ensures that there is always enough energy in the battery to turn the engine over.

For this purpose, the electrical consumers of the convenience system are deactivated. The standard of technical safety is retained.

To switch off the consumers, the onboard power supply control unit evaluates the engine speed, the battery voltage and the alternator load via the DF signal (dynamo field).

From this information and from information about which consumers are switched on with short activation periods, the onboard power supply control unit carries out an evaluation of the onboard power supply load state.

Based on this evaluation, the onboard power supply control unit can increase engine speed via the engine control unit. The deactivation of convenience consumers is still possible in the same way.

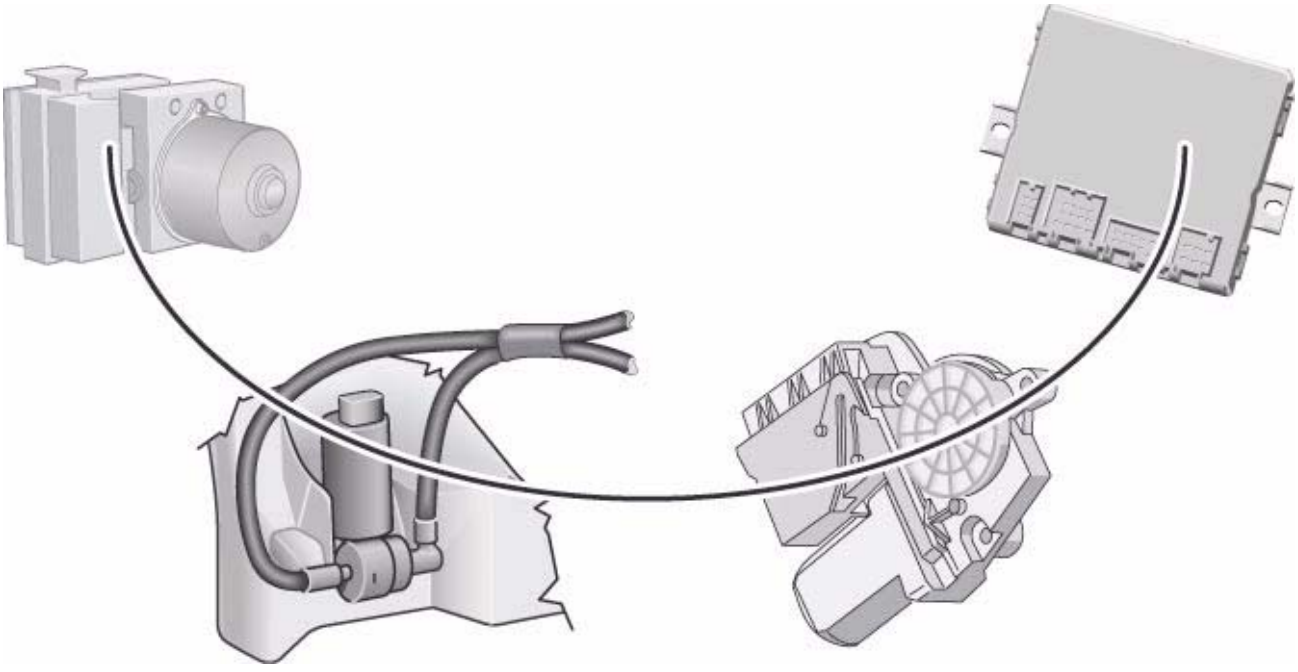
Measures

In the following cases the load management system initiates measures to maintain the onboard power supply.

- Extremely short trips
- Starting the engine
- Critical onboard power supply status
- Avoidance of voltage drops caused by high current consumers related to vehicle safety
- Collision

High current consumers include:

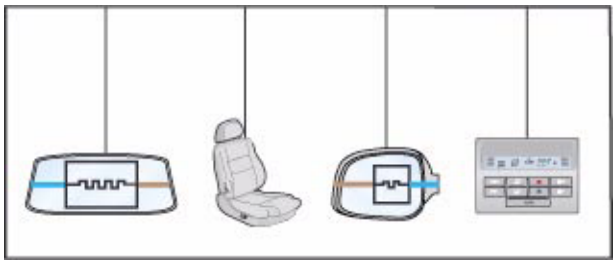
- Hydraulic pump for ABS/ESP
- Solenoid valves for ABS/ESP
- Twin washer pump
- Window regulator motor
- Sliding door motor



S311_129

Measures in response to extremely short trips

Due to the frequency of critical onboard power supply states, the onboard power supply control unit is able to identify extremely short trips. In this case, consumers are allowed to be disabled during the start phase in order to retain the battery charge.

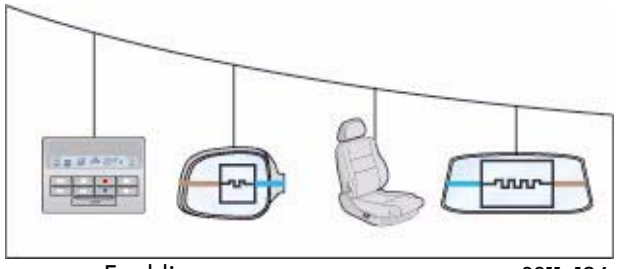


Switchable consumers S311_130

Measures in response to engine starting

To distribute peak surge currents over time for the following current consuming convenience systems, they are enabled at intervals of 2 seconds after starting the engine.

- Climatronic
- Heated exterior mirrors
- Seat heating
- Heated rear window



Enabling sequence S311_124

Onboard power supply

Measures in response to critical onboard power supply status

Measure I

The onboard power supply status is determined via the battery voltage.

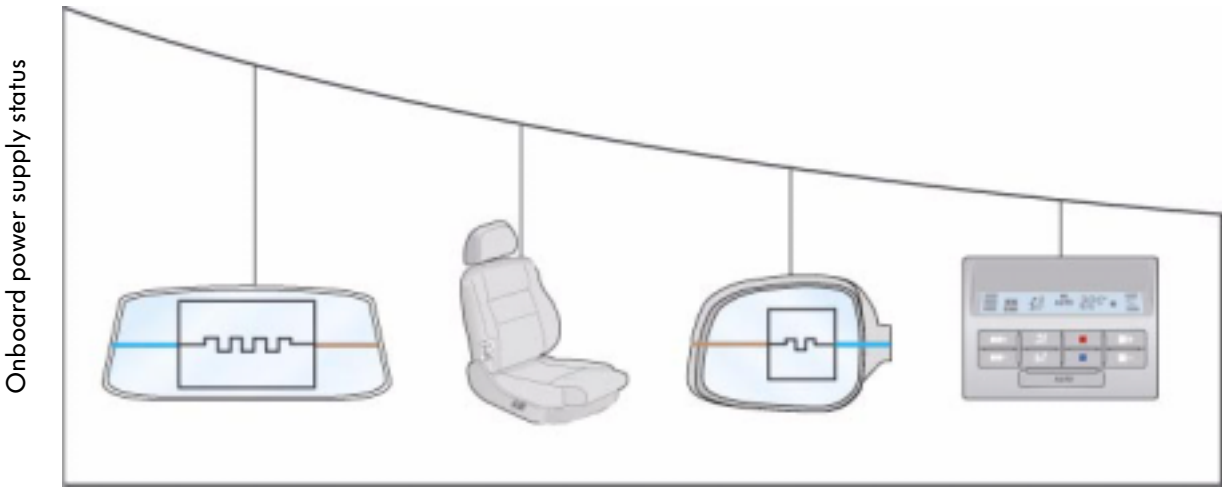
If the battery voltage is less than 12.7 V, the onboard power supply control unit requests the engine control unit to increase the engine idle speed.
This request can be issued directly after starting the engine.

Measure II

If the battery voltage is less than 11.0 V during the start phase (up to approx. 4 minutes after Term. 50 on) and the alternator is active, or less than 12.2 V during operation, the following current consuming convenience systems are not enabled or switched off in a defined order.
Due to the time period of four minutes, all selected function are, where possible, made available to the driver.

- Heated rear window
- Seat heating
- Heated exterior mirrors
- Climatronic
- Air conditioning system
- PTC heater is currently not fitted
  An inactive current consuming convenience system is skipped.

Switch-off sequence

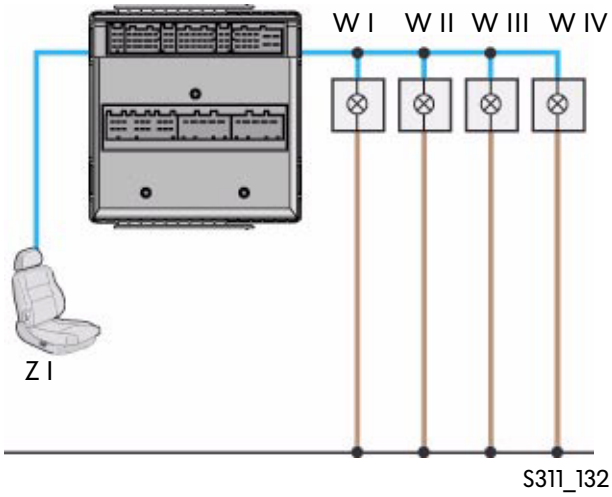


S311_125

Measure III

If the battery voltage is less than 11.5 V and the alternator is inactive, the following consumers will be switched off.

• Interior lights	W I	Stage 1
• Reading lights	W II	Stage 1
• Glove box light	W III	Stage 1
• Luggage compartment light	W IV	Stage 1
• Seat heating	Z I	Stage 1



Measures to avoid significant voltage drops

To prevent significant voltage drops on activation of a high current consumer relevant to vehicle safety (e.g. hydraulic pump for ABS/ESP), the current consuming convenience systems with the lowest priority is disabled.

• Heated rear window	Priority level 1
• Seat heating	Priority level 2

If the high current consumer is no longer in operation, the current consuming convenience systems is re-enabled.

Measures in response to a collision

In the event of an accident with a defined minimum force, the following consumers are disabled.

- Heated rear window
- Seat heating
- Heated exterior mirrors
- Climatronic
- Air conditioning system

Cancellation of disables

Disables are cancelled if the deactivation condition no longer exists.

Onboard power supply

Control unit with display unit in dash panel J285

Variants

The following type variants are used.

- Lowline variant
- Midline variant
- Highline variant

All variants are equipped with:

Analog displays with pointer instruments

- Rev counter G5
- Speedometer G21
- Coolant temperature gauge G3
- Fuel gauge G1

Digital displays

- Digital clock Y2
- Two-line odometer display Y4

Central display

- The Lowline variant has a selector lever position indicator for the automatic gearbox
- The Midline variant has a Mini-DOT matrix display.
- The Highline variant has a DOT matrix display plus, in the Multivan, an oil temperature display Y12 and a vehicle voltage display Y11.

Warning lamps

- Left turn signal warning lamp K65
- Right turn signal warning lamp K94
- Warning lamps in the central display
- Warning lamps in the rev counter
- Warning lamps in the speedometer

Lowline variant

S311_038

Midline variant

S311_039

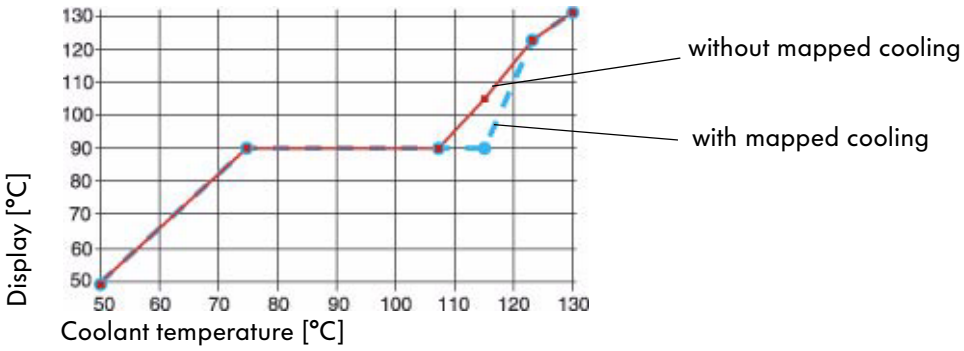
Highline variant

S311_114

Display features

The additional instruments have a damping function in order to prevent frequent variation of the display. The pointers maintain a constant position in the normal operating ranges. If the operating conditions change and it is necessary to inform the driver, the pointer position will change.

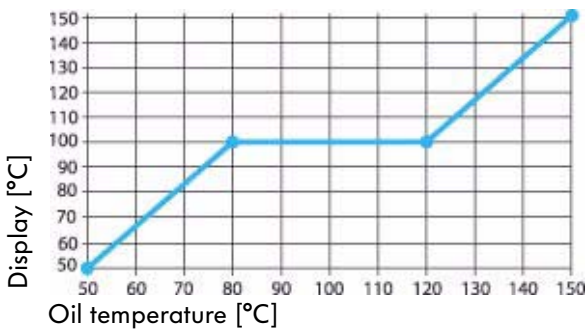
Coolant temperature gauge



S311_109

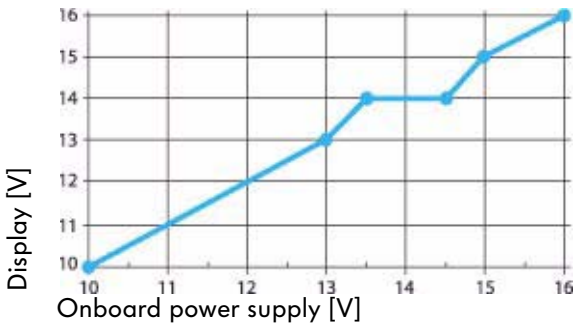
S311_040

Oil temperature display



S311_110

Onboard power supply voltage display



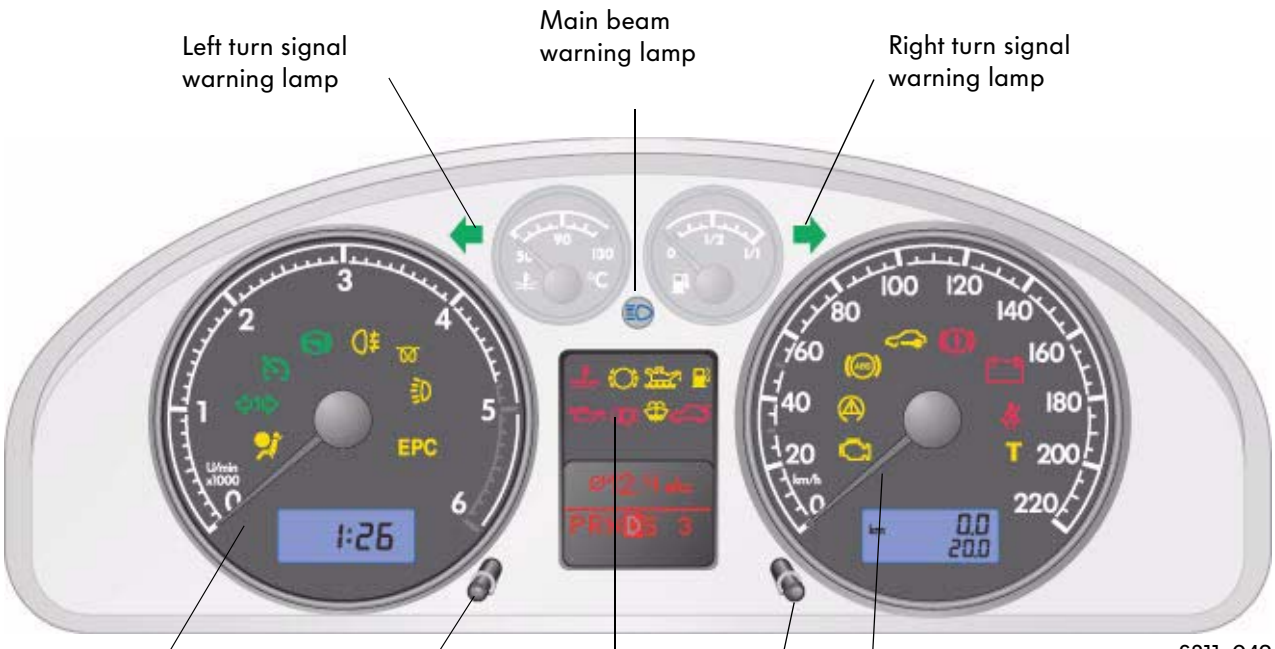
S311_111

Onboard power supply

Warning lamp function test

The warning lamps, which come on for approx. 3 seconds after turning on the ignition (Term. 15 on) and then go off again, are checked by the control unit which has a display in the dash panel insert. This includes the alternator warning lamp K2.

The other warning lamps (e.g. the airbag warning lamp K75) are activated by their associated control unit. They stay on until the internal test of the control unit has been completed and no malfunction is detected.



Warning lamps in the rev counter

Warning lamps in the central display

Warning lamps in the speedometer

Digital/radio controlled clock adjusting knob
turn anticlockwise hours
turn clockwise minutes

Trip recorder reset button

Electrical tachograph

Tachograph G24

The tachograph G24 is a control unit in DIN radio format. The display shows the date, time, mileage, the adjusted workgroups and the symbols for the selected speed-time charts.

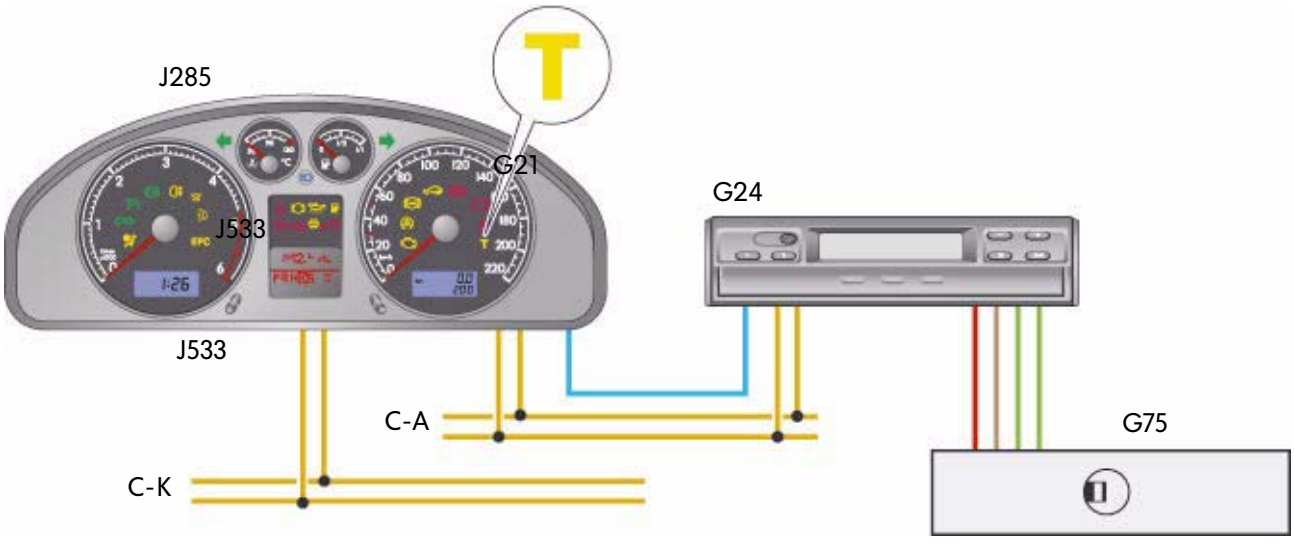
If a fault in the system occurs, it will be indicated via the warning lamp "T".

Time display

The time is displayed digitally in hours and minutes. The time source is dependent on the vehicle specification. If there are several sources in the vehicle, the time information is prioritised as follows:

Highest priority	tachograph
Second highest priority	radio controlled clock
Third highest priority	quartz clock

System overview



S311_084

Legend

G24 Tachograph
G75 Tachograph sender
J285 Control unit with display in dash panel insert
J533 Data bus diagnostic interface in dash panel insert
C-K Convenience CAN data bus
C-A Drive train CAN data bus

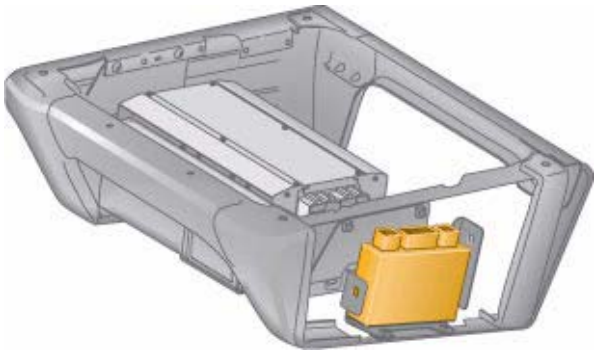
Work on the tachograph system may only be performed by trained personnel.
Persons who make unauthorised modifications to tachographs, signal wires and display units in order to influence the recording process will be liable to prosecution under criminal law.

Convenience and safety electronics

The convenience system central control unit J393

Fitting location

The convenience system central control unit is located on the subframe of the front passenger seat on the left. It controls and monitors the functions of the central locking and the anti-theft alarm systems.



S311_043

Functional description

All central locking motors are activated directly by the convenience system central control unit. Depending on equipment specification, up to five motors are possible.

Operating points

The central locking system can be operated at the following points:

- The contact switch in lock cylinder, driver side F241
- The contact switch in lock cylinder, front passenger side F242
  (not available with radio wave remote control)
- radio wave remote control
- Interior locking switch,
  driver side E150
- Interior locking switch, front passenger side E198
  (North American region only)

S311_119

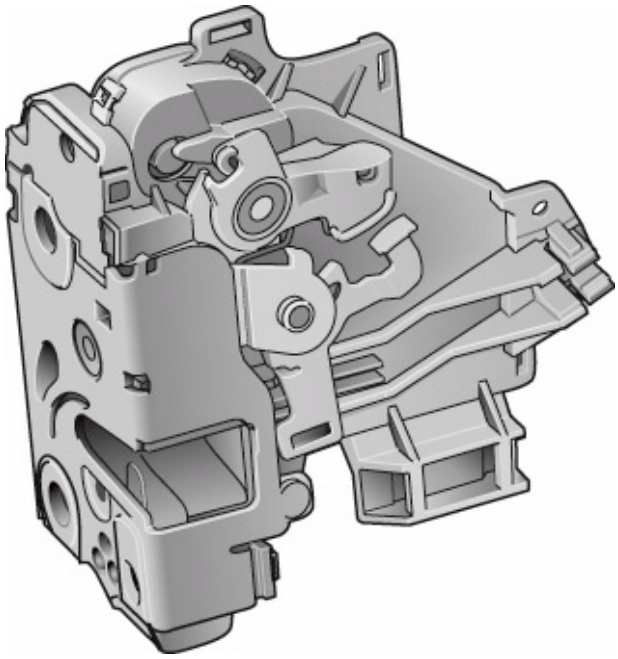
Operating points

Door locks

The door locks can assume three states:

- Unlocked — Door can be opened from the exterior and interior.
- Locked — Door can only be opened from the interior.
- Safe — Door cannot be opened from the exterior or interior.

The "Safe" function is not implemented on door locks in vehicles in the North American region. "CLS without Safe" is encoded in the convenience system central control unit.



S311_057

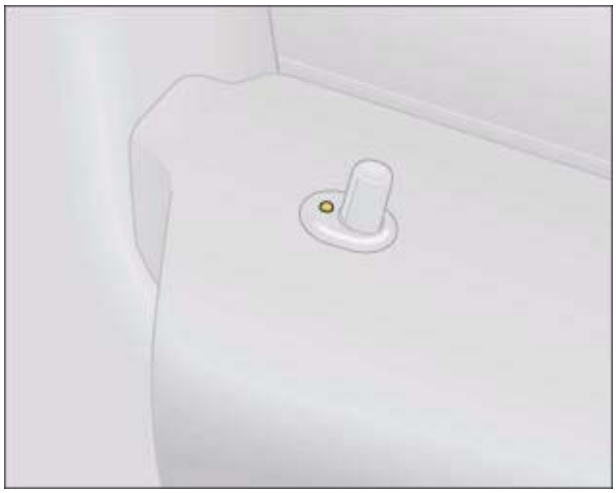
Vehicle state

The central locking warning lamp K133 in the driver door indicates the locked state of the vehicle.

In the case of convenience system central control units anti-theft alarm system, the warning lamp flashes when the alarm system is activated and primed.

In the case of convenience system central control units with or without deactivated anti-theft alarm system, warning lamp flashes when all door locks are safe.

If the central locking is encoded "without safe", the warning lamp flashes immediately after lokking.



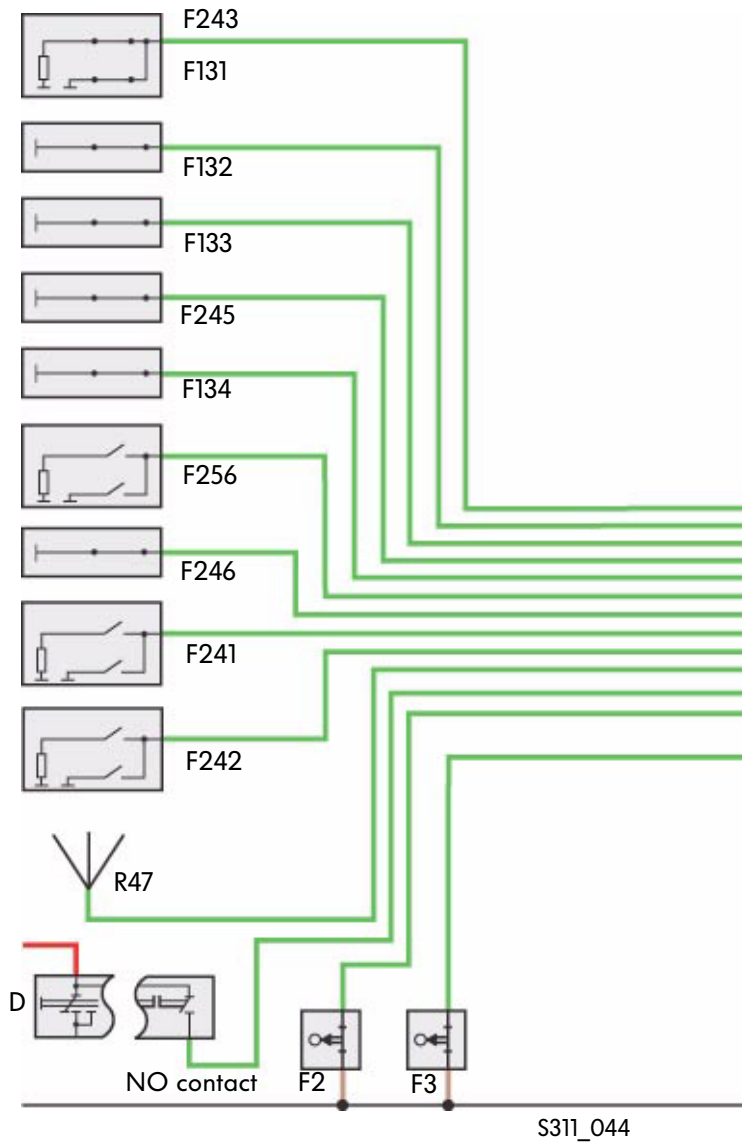
S311_120

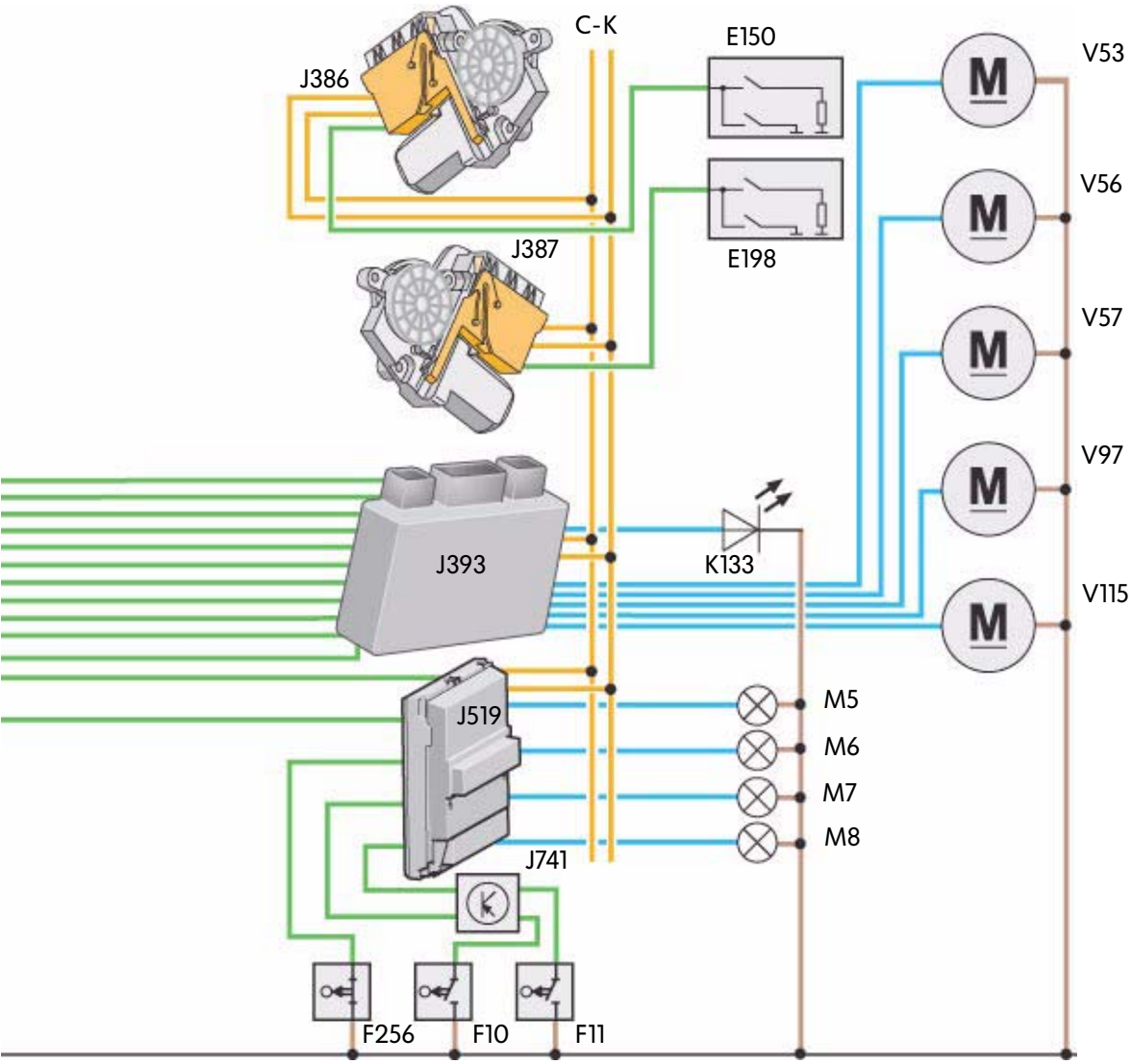
Convenience and safety electronics

Function chart

Legend

D	Ignition switch
E150	Interior locking switch, driver side
E198	Interior locking switch, front passenger side
F2	Door contact switch, driver side
F3	Door contact switch, front passenger side
F10	Rear left door contact switch
F11	Rear right door contact switch
F256	Tailgate locking unit
F131	Central locking actuator, front left
F132	Central locking actuator, rear left
F133	Central locking actuator, front right
F134	Central locking actuator, rear right
F241	Contact switch in lock cylinder, driver side
F242	Contact switch in lock cylinder, front passenger side
F243	Central locking actuator (Safe), driver door
F245	Central locking actuator (Safe), rear left door
F246	Central locking actuator (Safe), rear right door
F256	Tailgate locking unit
J386	Door control unit, driver side
J387	Front passenger door control unit
J393	Convenience system central control unit
J519	Onboard power supply control unit
J741	Dual inverter relay
K133	Central locking warning lamp -Safe-
M5	Turn signal bulb, front left
M6	Turn signal bulb, rear left
M7	Turn signal bulb, front right
M8	Turn signal bulb, rear right
R47	Central locking and anti-theft alarm system aerial
V53	Central locking motor, tailgate
V56	Central locking motor, driver door
V57	Central locking motor, front passenger door
V97	Central locking motor, rear right door
V115	Central locking motor, rear left door
C-K	Convenience CAN data bus





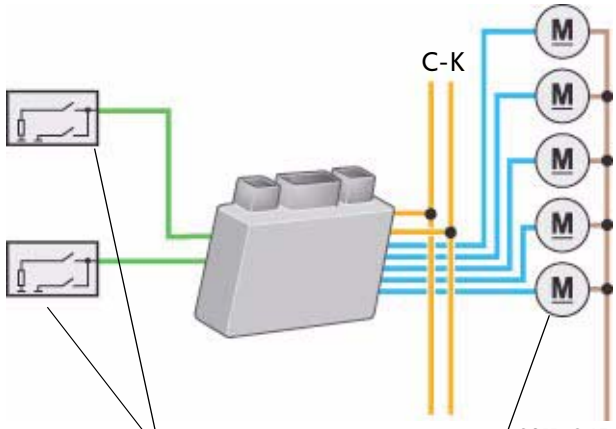
Sliding door post-locking

If a sliding door is open, it will not be locked. After the door has been closed, a comparison is made to determine whether the required status of the sliding door matches the actual status of the other vehicle doors. If there is no match, the sliding door will be post-locked.

Convenience and safety electronics

Operation of the central locking system via the contact switches in the lock cylinder

The contact switches transmit the open or close signal to the convenience system central control unit, which controls the central locking motors. The central locking system can be encoded for individual door opening or all-door opening in the convenience system central control unit. If individual door opening is configured, this setting is acknowledged via the flashing lights only when the doors are opened for the first time.



S311_045

Contact switch in the lock cylinder

Central locking motors

Relocking after open with the radio wave remote control

After the vehicle has been opened with the radio wave remote control, the vehicle is automatically relocked after approx. 30 seconds.

Relocking can be prevented by the following conditions:

- Opening a door
- Open driver door
- Turning on the ignition
- Change of door status

S311_046

Unlocking after removal of key from ignition lock

If the key is removed from the ignition/starter switch (NO contact opened), the onboard power supply control unit sends this information to the convenience CAN data bus.
The convenience system central control unit then issues an unlock command to the central locking motors.

S311_058

Overload protection

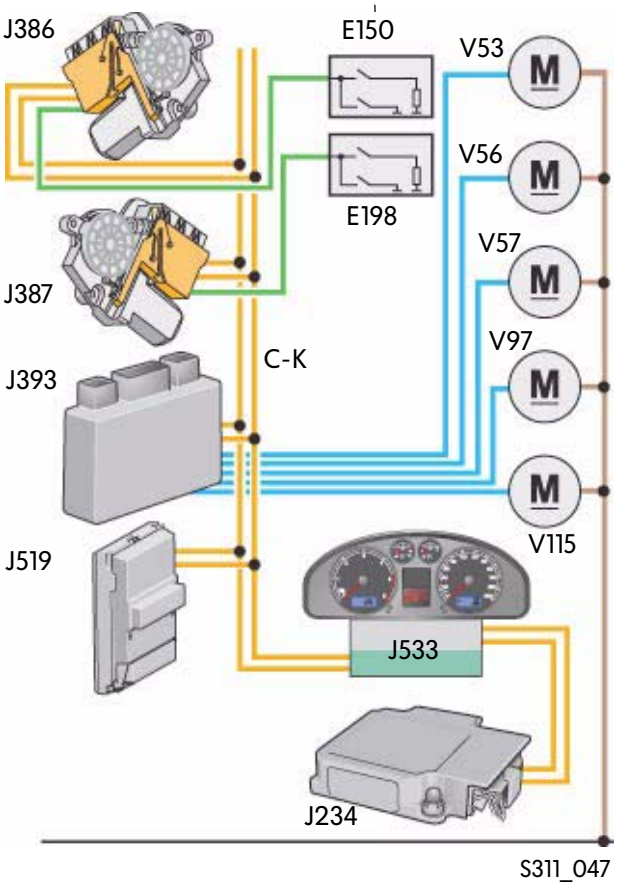
To protect the central locking motors against thermal overload, continued operation of the motors is inhibited for approx. 30 seconds after approx. 50 operations (lock and/or safe).

Unlocking cycles are performed provided that the states of the door locks are not identical, e.g. locked and unlocked.

S311_046

Collision response

In the event of a collision, the airbag control unit sends a collision message to the CAN data bus. The convenience system central control unit receives this message via the data bus diagnostic interface and unlocks all locked doors if the ignition is on. The doors cannot be locked again via the interior locking switch until the ignition has been switched off and on again. Locking via the contact switches in the door locks is disabled. To cancel the disable, the ignition first has to be switched on. After that, a door must be opened if the key is not in the ignition lock (NO contact off) or after switching the ignition on again.



S311_047

Legend

E150 Interior locking switch, driver side
E198 Interior locking switch, front passenger side
J234 Airbag control unit
J386 Door control unit, driver side
J387 Front passenger door control unit
J393 Convenience system central control unit
J519 Onboard power supply control unit
J533 Data bus diagnosis interface
V53 Central locking motor, tailgate
V56 Central locking motor, driver door
V57 Central locking motor, front passenger door
V97 Central locking motor, rear right door
V115 Central locking motor, rear left door
C-K Convenience CAN data bus

Convenience and safety electronics

Anti-theft alarm system

Monitored areas

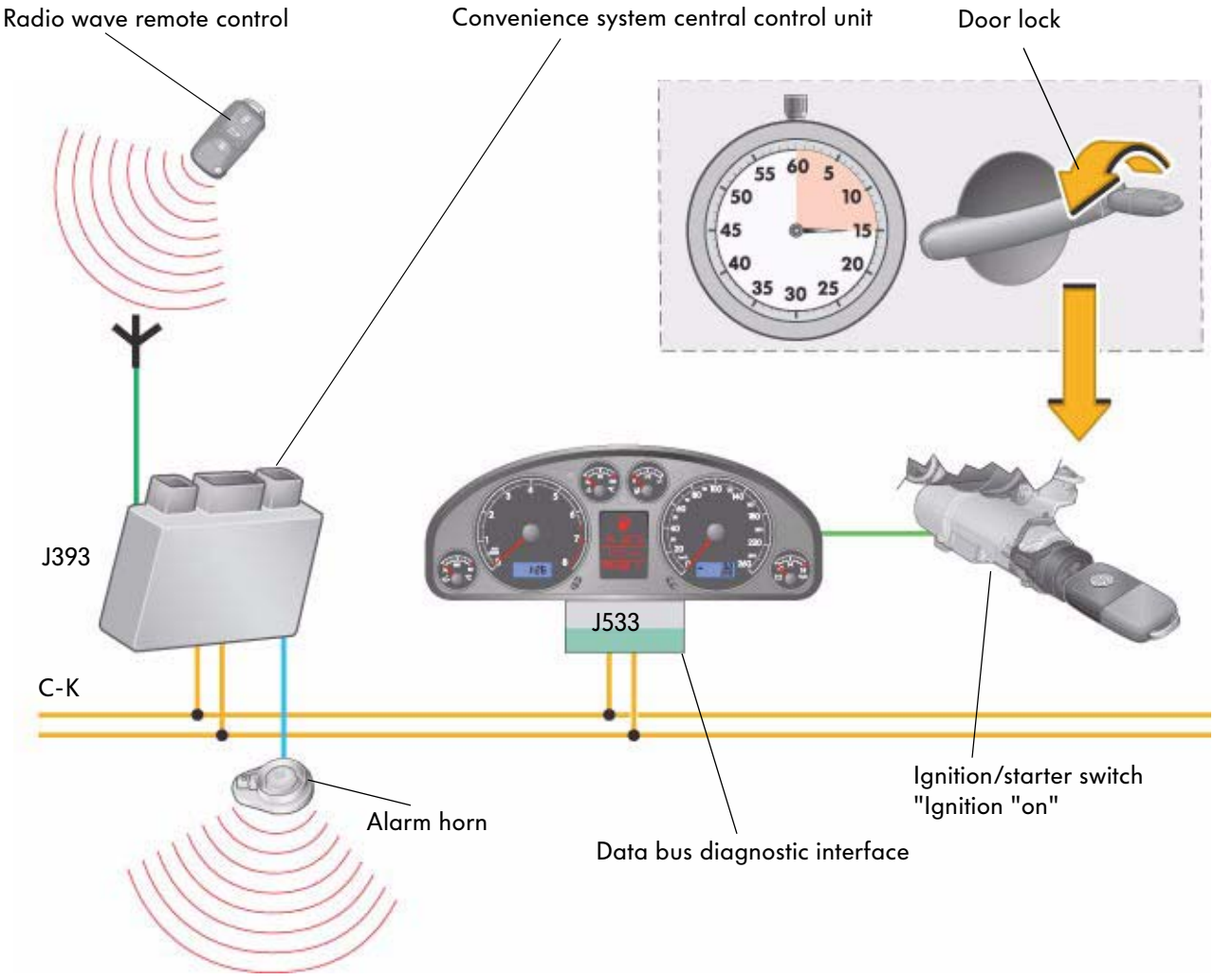
The anti-theft alarm system monitors all four doors, the tailgate, the bonnet and the terminal 15 signal.

Activation

The anti-theft alarm system is primed when the vehicle is locked. The anti-theft alarm is not primed if the ignition is on or if the driver door is open. The primed anti-theft alarm system is indicated by the central locking warning lamp K133. The display is limited to a max. period of 14 days, provided that the CAN data bus goes into the idle state.

Deactivation

The anti-theft alarm system is deactivated via the radio wave remote control. When the vehicle is opened via a door lock, the ignition must, at the latest, be switched on after 15 seconds. Otherwise the alarm will be triggered.



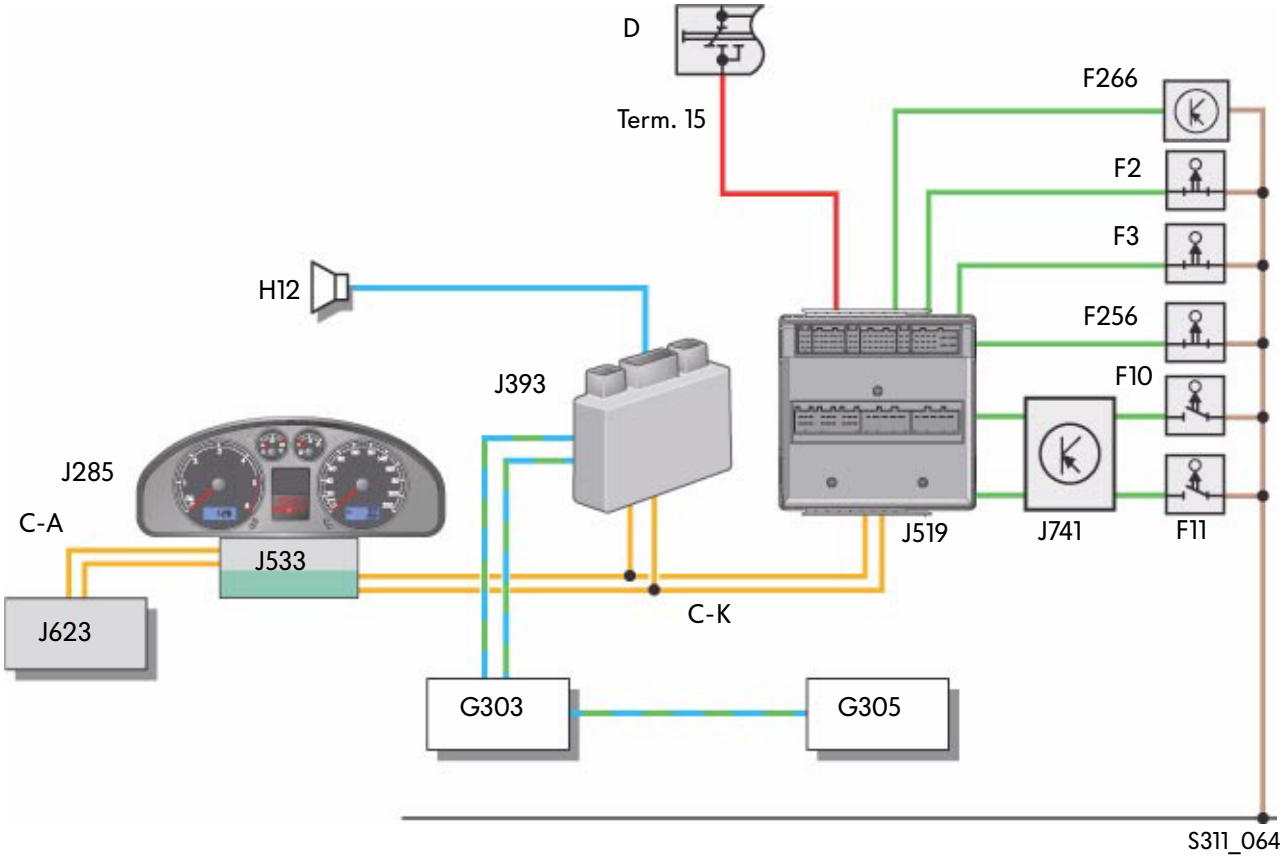
S311_048

Triggering the anti-theft alarm system

If an anti-theft alarm system is primed, a change in the monitored areas will cause the alarm to trigger.

If the alarm is triggered again while the alarm horn is sounding, the alarm time will not be affected. If the alarm is triggered again at the end of the first alarm, the alarm horn will sound again.

If an alarm is triggered by "terminal 15 on", with the vehicle in the SAFE state, the vehicle will be locked and the central locking warning lamp will no longer be activated.



Legend

D	Ignition switch
F2	Door contact switch, driver side
F3	Door contact switch, front passenger side
F10	Rear left door contact switch
F11	Rear right door contact switch
F256	Tailgate locking unit
F266	Bonnet contact switch
G303	Interior monitor sender/receiver module 1
G305	Interior monitor sender/receiver module 2
H12	Alarm horn
J285	Control unit with display in dash panel insert (immobiliser)
J393	Convenience system central control unit
J519	Onboard power supply control unit
J533	Data bus diagnosis interface
J623	Engine control unit
J741	Dual inverter relay
C-K	Convenience CAN data bus
C-A	Drive train CAN data bus

Convenience and safety electronics

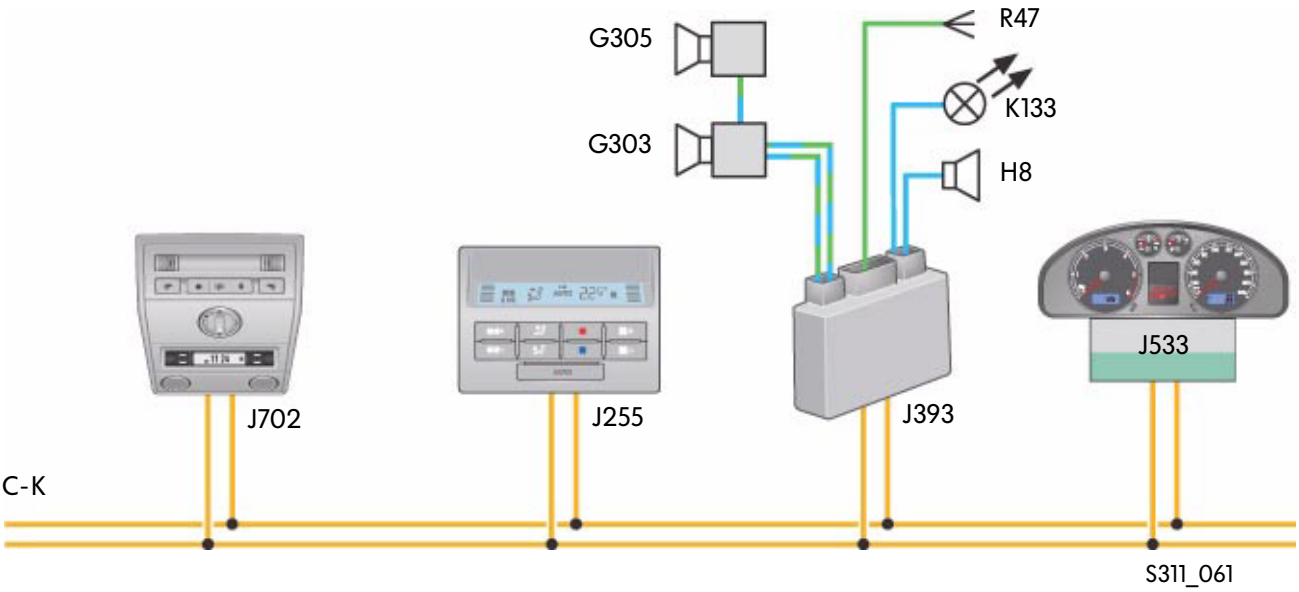
Interior monitor

The interior monitor comprises interior monitor sender/receiver module 1 (master) and interior monitor sender/receiver module 2 (slave). Both modules operate according to the ultrasonic principle.

The master monitors and regulates communication between the interior monitor sender/receiver modules and also communicates via a bidirectional interface with the convenience system central control unit which releases the alarm.

When the anti-theft alarm system is primed, the interior monitor sender/receiver modules register an alarm case if a movement is sensed in the vehicle interior.

If the additional heater is switched on or if the Climatronic residual heat function is active, the response sensitivity of the interior monitor is reduced so that the air flow does not trigger false alarms.

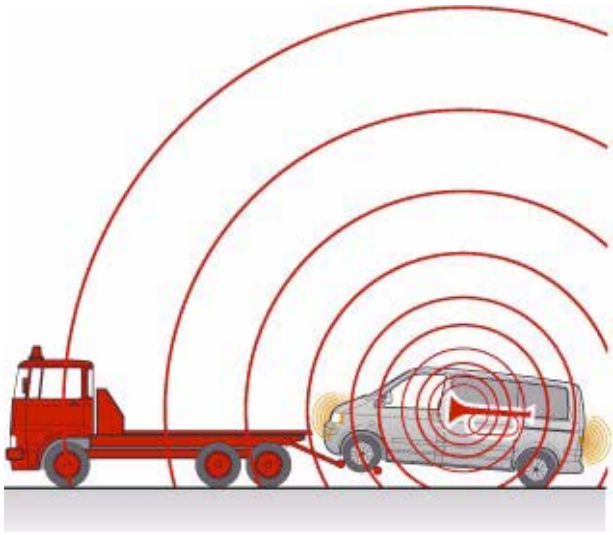


Legend

G303 Interior monitor sender/receiver module 1 (master)
G303 Interior monitor sender/receiver module 2 (slave)
H8 Alarm horn
J255 Climatronic control unit
J393 Convenience system central control unit
J533 Data bus diagnosis interface
J702 Roof display unit
K133 Central locking warning lamp
R47 Central locking and anti-theft alarm system aerial
C-K Convenience CAN data bus

Tow-away protection

The vehicle inclination sender G384 is located in the interior monitor sender/receiver module 1 (master).
It registers the angle of inclination of the vehicle between - 25° and + 25° in the longitudinal and transverse directions. When the anti-theft alarm system is primed, the current angle of inclination is stored. Through continuous cyclical comparison between the stored angle of inclination and the current angle of inclination, the vehicle inclination sender triggers an alarm if a change is detected.



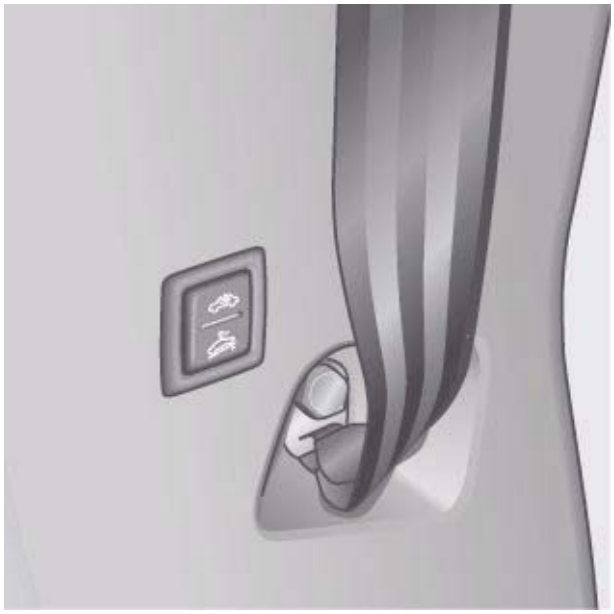
S311_031

You will find a functional description in SSP 273 "The Phaeton Convenience and Safety Electronics"

Deactivation

The interior monitor and the tow-away protection can be deactivated via the interior monitor switch E183.
For this purpose, switch E183 must be operated after switching off the ignition and before priming the anti-theft alarm system.

Deactivation is cancelled if the ignition is switched on after operating switch E183 or if the anti-theft alarm system has been deactivated.



S311_100

Self-test

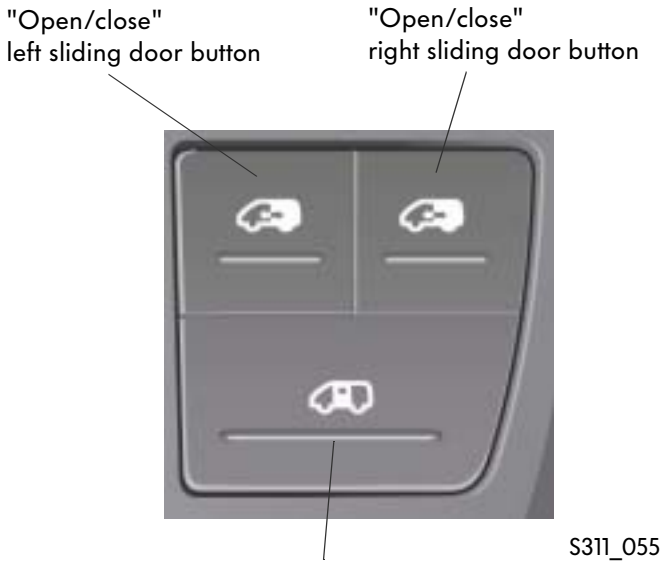
Interior sensor errors are indicated by the interior monitoring deactivation warning lamp.
If an error occurs, the warning lamp flashes for a maximum period of 60 seconds after the ignition is switched on and if the anti-theft alarm system is deactivated.

Convenience and safety electronics

Electrically operated sliding door

Operation

The electrically operated sliding door can be opened or closed by operating the interior or exterior door handles, the sliding door button E442 or the right sliding door button E482 in the instrument panel, or by pressing the corresponding button on the radio wave remote control.

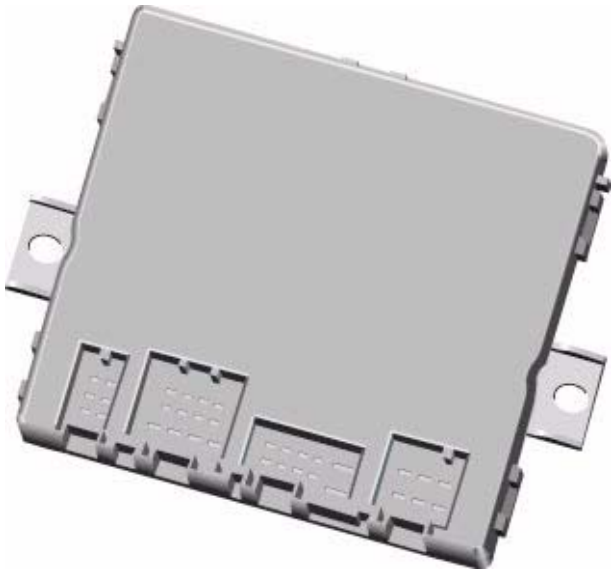


S311_055

Sliding door control unit

An electrically operated sliding door can be installed optionally on the left and/or right hand sides of the vehicle.

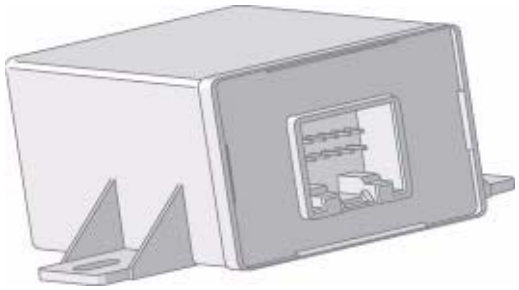
The sliding door is controlled by the sliding door control unit J558 and/or the right sliding door control unit J731.



S311_027

Sliding door sender unit G477

The sliding door sender unit transmits the door handle signals, the lock states "locked and Safe", as well as the latched states of the door locks wirelessly to the sliding door control unit.

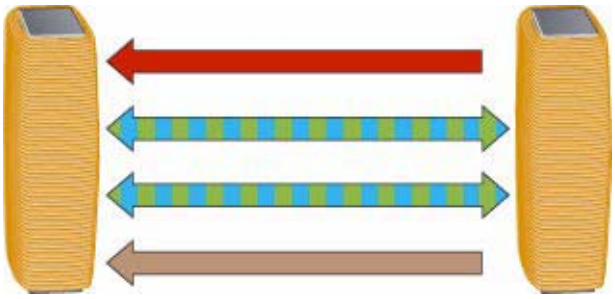


S311_029

Data transfer

Data is transmitted without wire between the sliding door control unit J558/J731 and the left/ right sliding door sender unit G477.

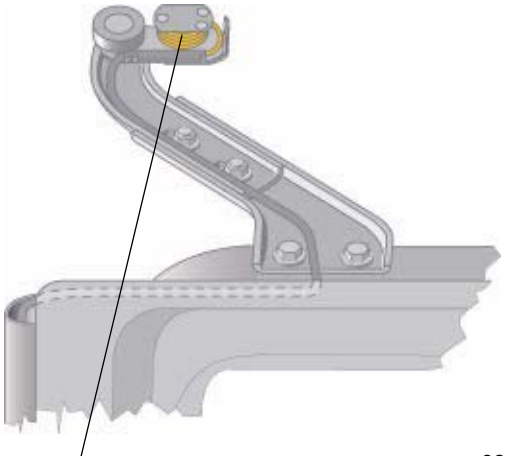
This inductive data transfer system supplied the sender unit with energy from the sliding door control unit via a 125 kHz signal.
Information is exchanged between both control units by modulating this signal.



S311_118

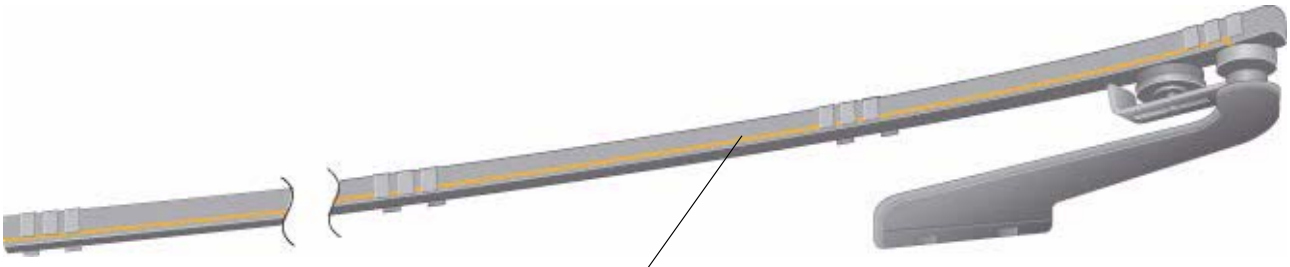
Data is transferred via sliding door magnetic coil D5 on the upper roller guide and sliding door reader coil D4 on the upper guide rail.

Upper roller guide


S311_026

Sliding door magnetic coil D5

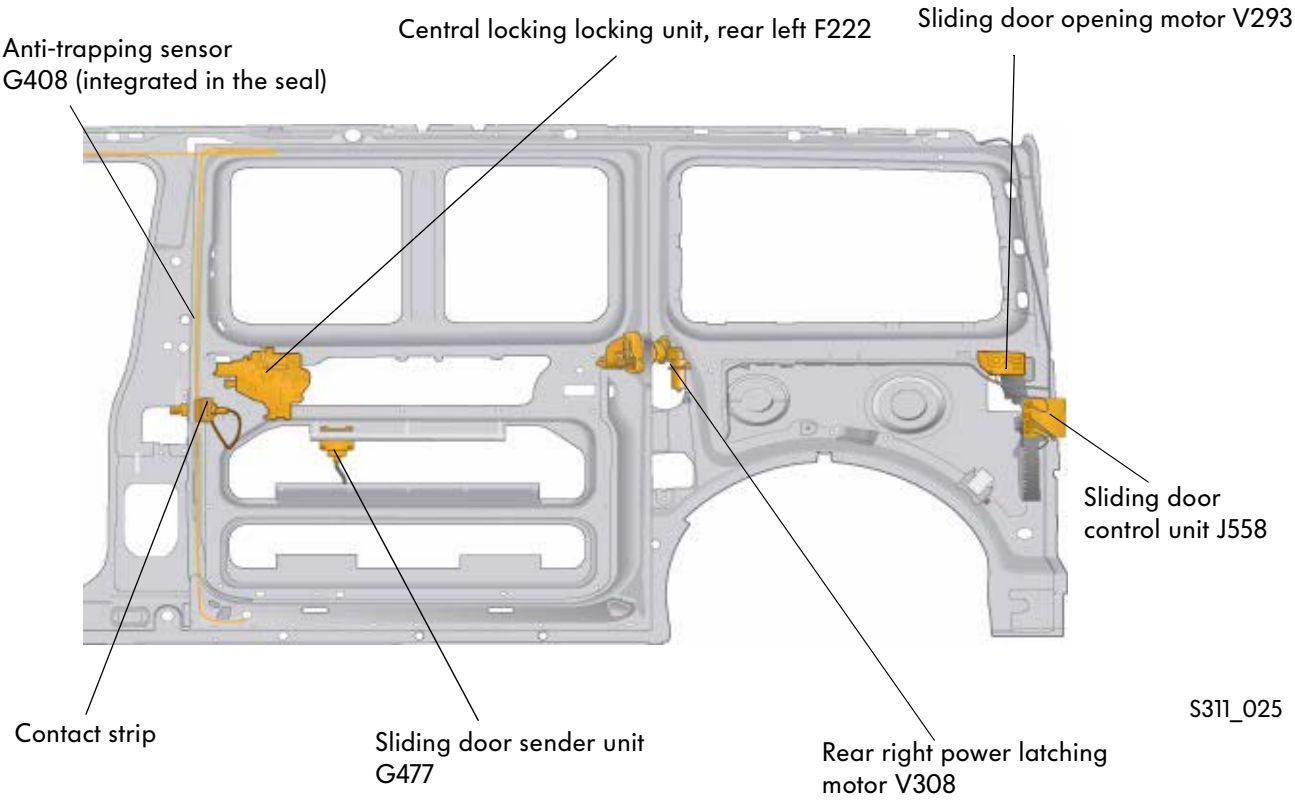
Upper guide rail


S311_028

Sliding door reader coil D4

Convenience and safety electronics

Overview of components



Anti-trapping protection

Passive anti-trapping protection

If the engine speed of the sliding door opening motor decreases sharply during the opening or closing movements of the sliding door, and this decrease has not been requested by the sliding door control unit , an obstruction may have occurred.

If this occurs while the sliding door is closing, the sliding door will move back to the fully-open position. If this occurs while the sliding door is opening, the sliding door will stop moving.

In addition, opening or closing the sliding door is inhibited at speeds of over 3 kph.

Active anti-trapping protection

Integrated in the sliding door seal is a protective moulding whose ohmic resistance changes under pressure. While the sliding door is closing, the sliding door control unit monitors the resistance continuously. If the default value changes, an obstruction has occurred and the sliding door will be fully reopened.

Deactivating the anti-trapping protection function

If the sliding door button is held down while the sliding door is opening or closing, the active and passive anti-trapping protection functions will be deactivated.

Sliding door opening motor V293

The sliding door opening motor is activated by the sliding door control unit. It drives the sliding door operating cable via an integrated gear.

S311_054

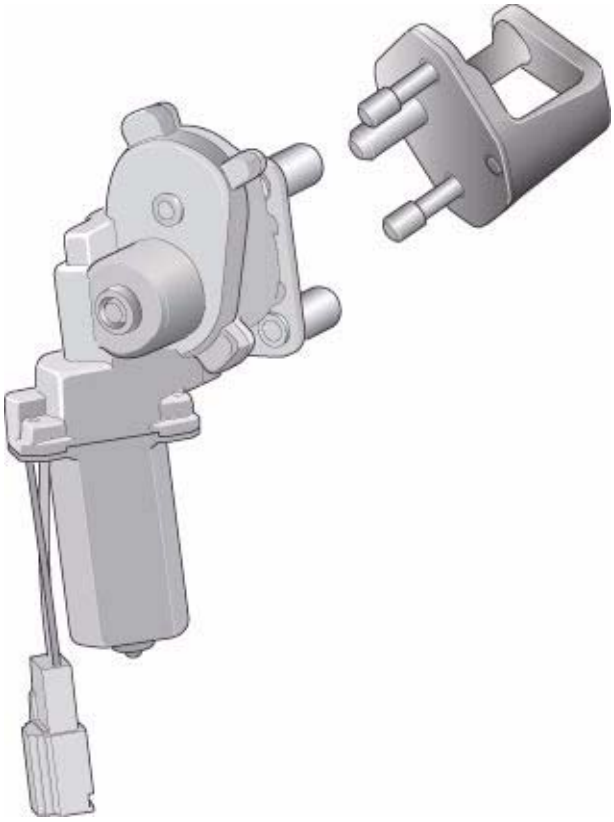
Rear right power latching motor V308

To assist opening and closing, the electrical sliding door has a power latching system.

Power latching is controlled by the sliding door control unit. Opening and closing of the door lock is registered via the door contact switch, and the power latching motor is activated until the power latching system contact switch signals the completion of the latching operation.

For safety reasons, the latching operation is limited in time.

If no electrical sliding door is installed, the power latching (system) function is controlled by a separate control unit.



S311_031

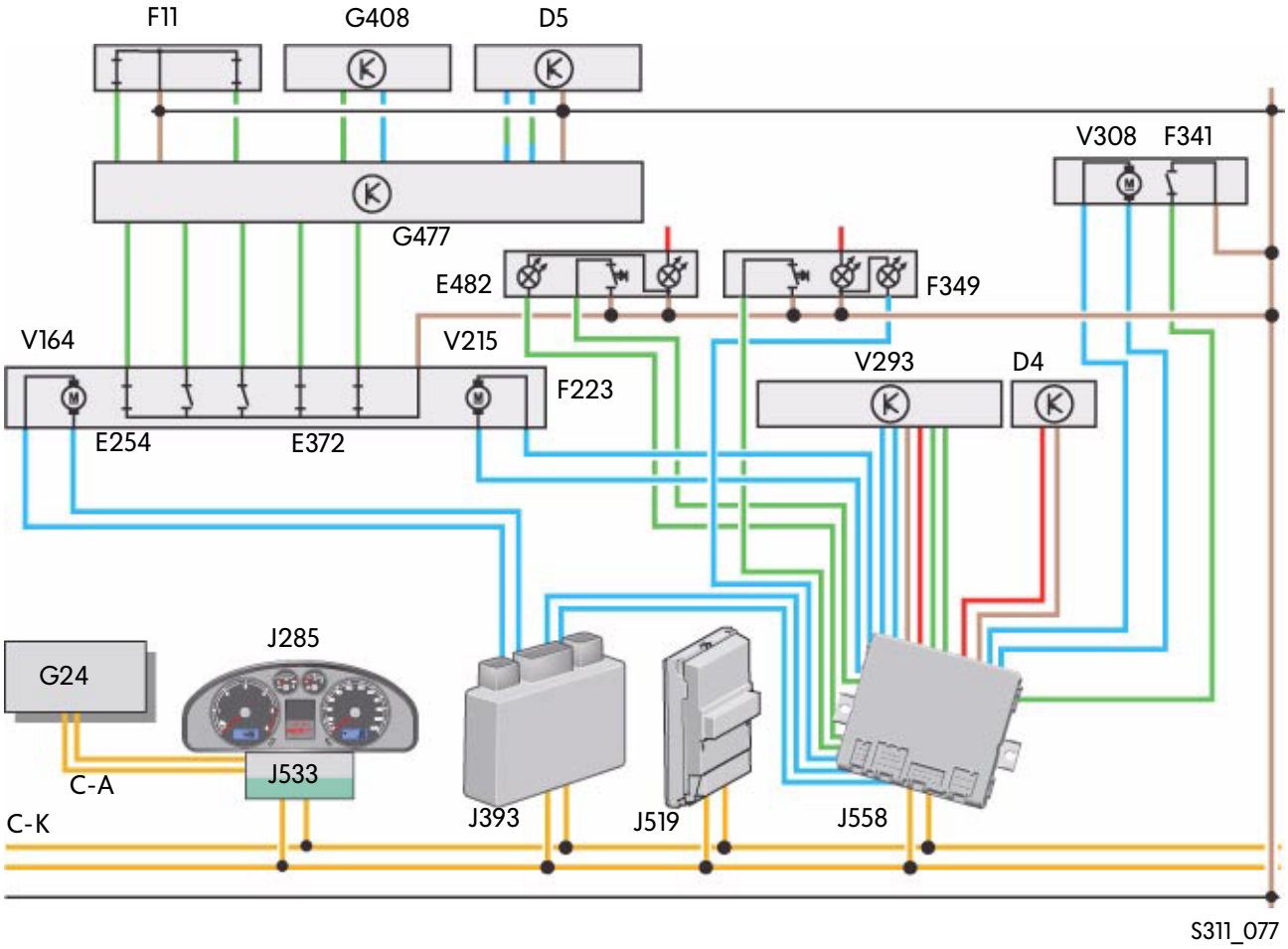
You will find a functional description of the mechanism in SSP 310 "The Transporter 2004 ".

Convenience and safety electronics

Function chart

Function	Operator controls	Activation conditions	Deactivation conditions
• Opening the electrical sliding door	• Interior door handle • Exterior door handle • Electrical sliding door open/ close button • Radio wave remote control	• D oor is unlocked and • the electrical sliding door has not been deactivated by the deactivation switch and • the interior door handle for opening door has been operated or • the exterior door handle for opening door has been operated or • the open/close electrical sliding door button for opening door has been operated or • the radio wave remote control opening door has been operated	• the door has reached fully-open position or • the anti-trapping protection does not operate or • the road speed is higher than 3 kph
• Closing the electrical sliding door	• Interior door handle • Exterior door handle • Open/close electrical sliding door button • radio wave remote control	• the electrical sliding door has not been deactivated by the deactivation switch and • the interior door handle for closing door has been operated or • the exterior door handle for closing door has been operated or • the open/close electrical sliding door button for closing door has been operated or • the radio wave remote control closing door has been operated	• the sliding door is closed or • the anti-trappinganti-trapping protection does not operate door opened to fully-open position or • the road speed is higher than 3 kph

Functional diagram



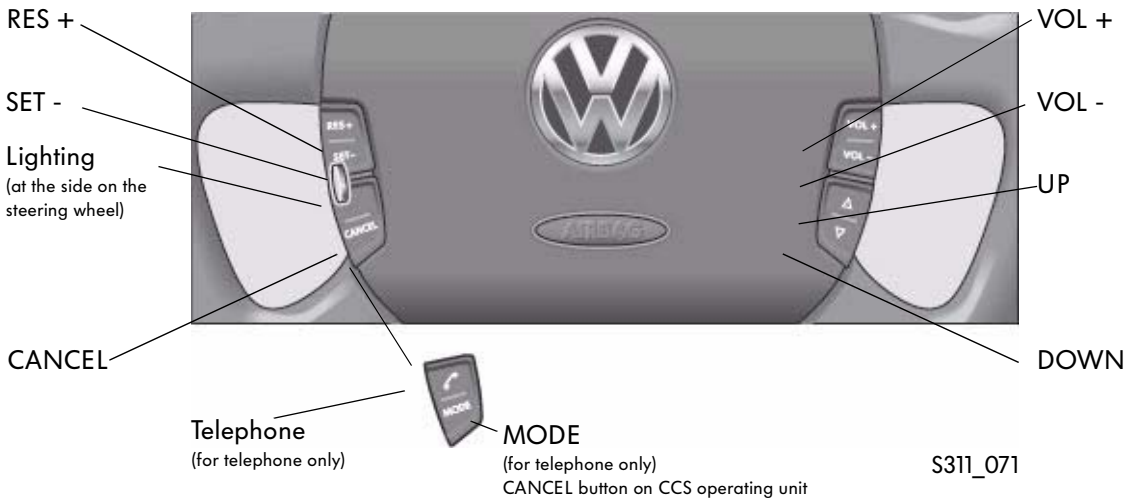
Legend

D4 Sliding door reader coil
D5 Sliding door magnetic coil
E254 Child safety lock switch
E372 Exterior door handle central locking button, rear right door
E482 Right sliding door button
F11 Rear right door contact switch
F341 Rear right door power latching system contact switch
F349 Deactivation button for sliding door
F223 Central locking locking unit, rear right
G408 Anti-trapping sensor
G477 Sliding door sender unit
G24 Tachograph
J285 Control unit with display in dash panel insert
J393 Convenience system central control unit
J519 Onboard power supply control unit
J533 Data bus diagnosis interface
J558 Sliding door control unit
V164 Central locking motor (Safe), rear right door
V215 Central locking motor (Lock), rear right door
V293 Sliding door opening motor
V308 Rear right power latching motor
C-K Convenience CAN data bus
C-A Drive train CAN data bus

Multi-function steering wheel

Operator controls

The cruise control system (CCS), the audio system and, depending on the variant, the telephone, can be operated by the buttons on the multi-function steering wheel.



Operating the audio system, the cruise control system and the telephone

The nominal speed can be changed and reset with the RES+ button.
The nominal speed can be stored and reduced with the SET button.
The cruise control system can be temporarily deactivated with the CANCEL button.

Visual feedback is via the multi-function display in the control unit with display in the dash panel insert is required for the "UP", "Down" and "Mode" buttons. If no visual feedback is possible due to a display with an elevated, higher priority, no feedback is provided. However, the function is executed.

The "VOL +" and "VOL - buttons can be used to adjust the volume setting at any time without visual feedback when the audio system is active or during a telephone call.

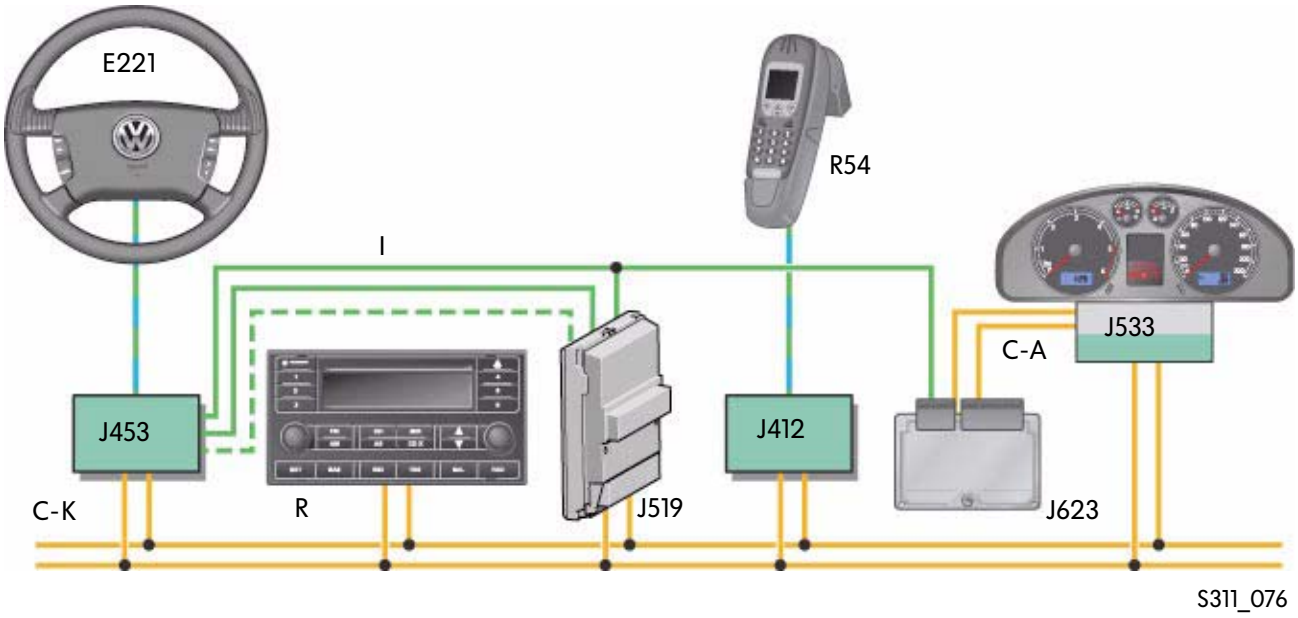
When the "Mode" button is pressed for the first time, the current function assignments of the "UP" and "DOWN" button appear in the multi-function display. To change to a different function, press the button again within 5 seconds. The new function is displayed for approx. 5 seconds.

A telephone call can be accepted, set up or ended by pressing the "Telephone" button.

Signal sequence

The signals from the control buttons are transmitted from the steering wheel button module to the multi-function steering wheel control unit J453. The multi-function steering wheel control unit converts the signal to CAN data bus messages and sends them to the convenience CAN data bus. The control unit with display in dash panel insert, the radio and the telephone/telematics control unit can read these messages and execute the operator's command.

The signals for operating the cruise control system are transmitted via conventional (discrete) cable connections.



S311_076

Legend

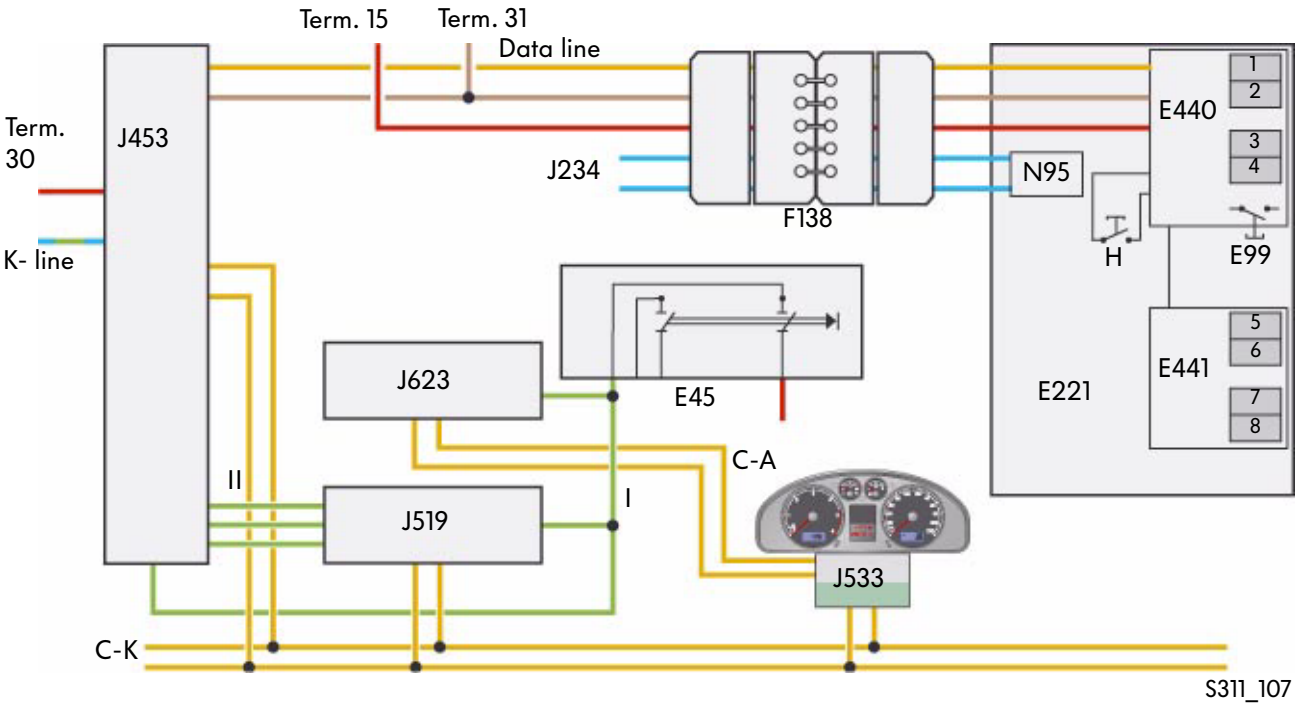
E221	Operating unit in steering wheel
J412	Mobile telephone operating electronics control unit
J453	Multi-function steering wheel control unit
J519	Onboard power supply control unit
J533	Data bus diagnosis interface
J623	Engine control unit
R	Radio
R54	Mobile telephone
C-K	Convenience CAN data bus
C-A	Drive train CAN data bus
I	Discrete messages (broken line: not available with telephone)

Convenience and safety electronics

Multi-function steering wheel for audio and CCS operation

The signals from the control buttons are registered by the operating unit in the steering wheel and sent via a single-wire bus connection to the multi-function steering wheel control unit. The multi-function steering wheel control unit sends this signal to the convenience CAN data bus. The cruise control system signals are relayed via three separate lines to the onboard power supply control unit.

The On/Off signals from the cruise control system switch are transmitted along a conventional cable connector to the onboard power supply control unit, the multi-function steering wheel control unit and the engine control unit.



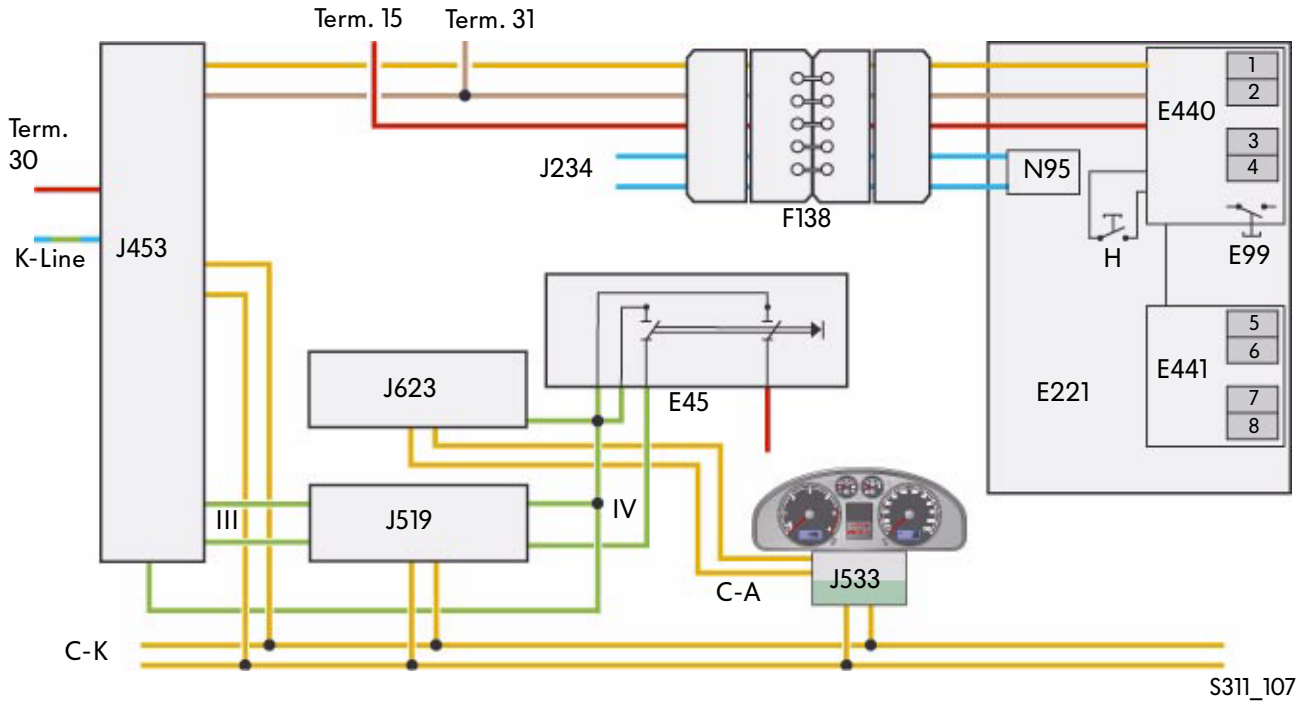
Legend

E45 Cruise control system switch
E99 Operating unit illumination regulator
E221 Operating unit in steering wheel
E440 Multi-function buttons on left of steering wheel
E441 Multi-function buttons on right of steering wheel
F138 Airbag coil connector
H Horn plate
J234 Airbag control unit

Multi-function steering wheel for audio, CCS and telephone operation

The signals from the control buttons are transferred in the same way as the signals from the multi-function steering wheel for the audio and cruise control systems.
The cruise control system signals are, however, relayed via two separate lines to the onboard power supply control unit.

The On/Off and "CANCEL" signals from the cruise control system switch are transmitted along a conventional cable connector to the onboard power supply control unit, the multi-function steering wheel control unit and to the engine control unit. In this the variant, the "CANCEL" button is located on the cruise control system switch.



J453 Multi-function steering wheel control unit for audio
J519 Onboard power supply control unit
J533 Data bus diagnosis interface
J623 Engine control unit

N95 Airbag igniter, driver side
C-K Convenience CAN data bus
C-A Drive train CAN data bus

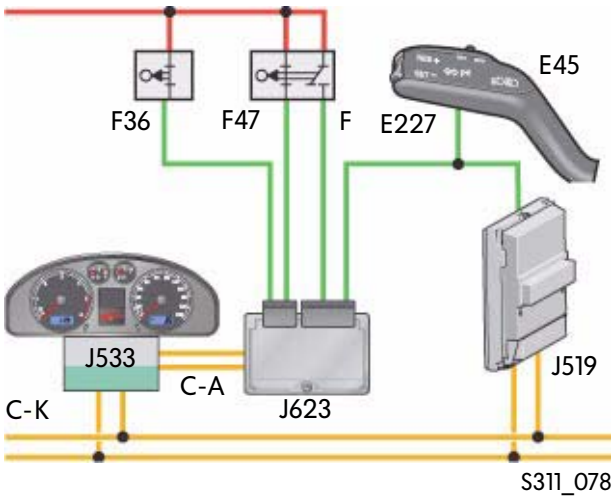
Discrete button signals

I	II	III	IV
On/Off	Cancel SET- RES+	On/Off Cancel	SET- RES+

Cruise control system (CCS)

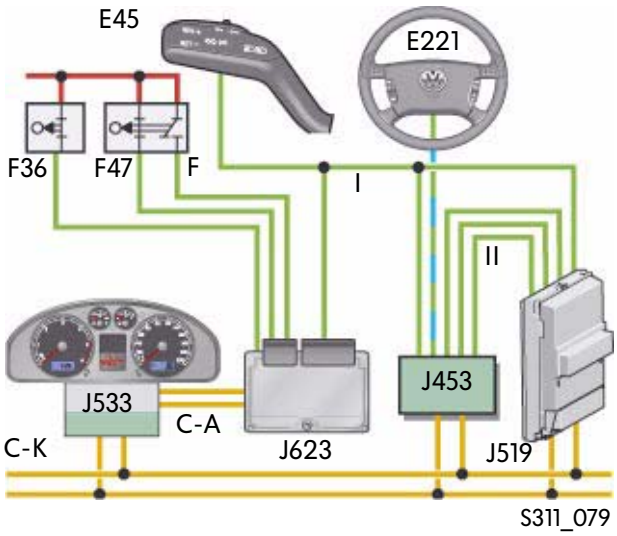
Cruise control system without multi-function steering wheel

In vehicles without a multi-function steering wheel, the cruise control system can only be operated via the cruise control system switch E45 and the cruise control system (CCS) button E227. The switches are connected to the onboard power supply control unit and the engine control unit.



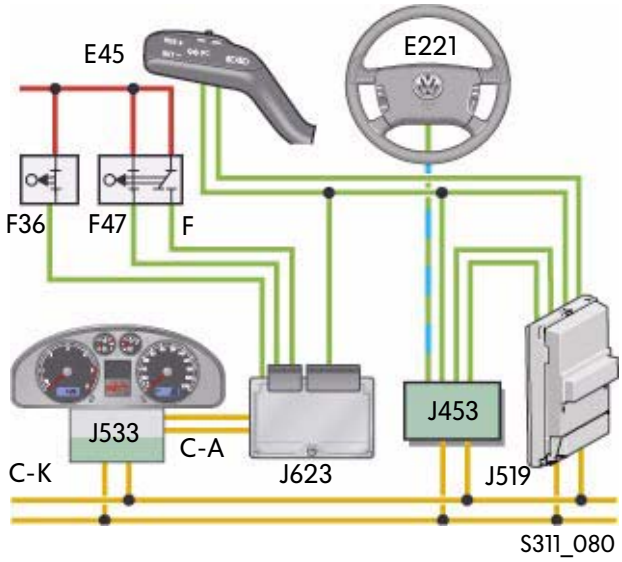
Cruise control system with multi-function steering wheel (CCS/audio)

Vehicles equipped with a multi-function steering wheel for operating the cruise control system and the audio system have only a cruise control system switch on the turn signal switch, it is connected directly to the onboard power supply control unit, the multi-function steering wheel control unit for audio and the engine control unit. The SET-, RES+ and CANCEL signals from the operating unit in steering wheel are transmitted via the conventional cable connection to the onboard power supply control unit and relayed from here via the convenience CAN data bus and the data bus diagnostic interface to the engine control unit.



Legend

E45	Cruise control system switch
E221	Operating unit in steering wheel
E227	Cruise control system (CCS) button
F	Brake light switch
F36	Clutch pedal switch
F47	Cruise control system brake pedal switch



Cruise control system with multi-function steering wheel (CCS/audio/telephone)

If a multi-function steering wheel for operating the cruise control system, the audio system and the telephone is fitted, the cruise control system switch and the Cancel button are located on the turn signal switch.

The On and Off switch is connected to the onboard power supply control unit, the multi-function steering wheel control unit for audio and the engine control unit. The Cancel button is only connected to the onboard power supply control unit.

The SET- and RES+ signals from the operating unit in the steering wheel are transferred along conventional cable connections to the onboard power supply control unit, and relayed from here via the convenience CAN data bus and the data bus diagnostic interface to the engine control unit.

J453 Multi-function steering wheel control unit for audio
J519 Onboard power supply control unit
J533 Data bus diagnosis interface
J623 Engine control unit
C-K Convenience CAN data bus
C-A Drive train CAN data bus

The multi-function steering wheel is only available in combination with radio systems which can communicate via the CAN data bus
or the navigation system and in the Multivan.

Radio/telephone/navigation

Radio systems

Alpha radio

The Alpha radio comprises, as an audio source, a tuner, an internal amplifier and a compact cassette player, and is fitted in commercial vehicles only.

A bass loudspeaker and a mid-range/treble loudspeaker are connected to the two output channels.

The audio signal is conditioned by the internal amplifier. It is not possible to connect an external amplifier.

The Alpha radio offers the possibility to connect the mobile telephone operating electronics control unit J412 or a telephone.

Legend

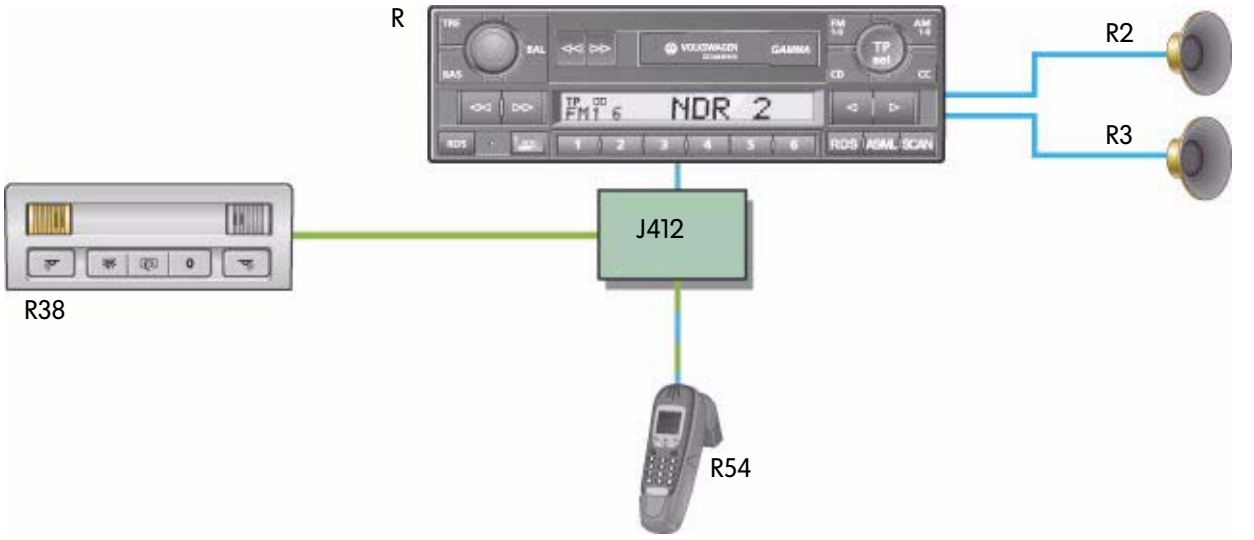
R	Radio
R2	Loudspeaker, front left
R3	Loudspeaker, front right

Beta radio

The Beta radio comprises, as an audio source, a tuner, an internal amplifier and a compact cassette player. Like the Alpha radio, it is only available in commercial vehicles.

A bass loudspeaker and a mid-range/treble loudspeaker are connected to the two output channels.

The audio signal is conditioned by the internal amplifier. It is not possible to connect an external amplifier.
The Beta radio offers the possibility to connect a telephone or the mobile telephone operating electronics control unit, as well as an external CD changer.



S311_087

Legend

J412	Mobile telephone operating electronics control unit
R	Radio
R2	Loudspeaker, front left
R3	Loudspeaker, front right
R54	Mobile telephone
R38	Telephone microphone

Radio/telephone/navigation

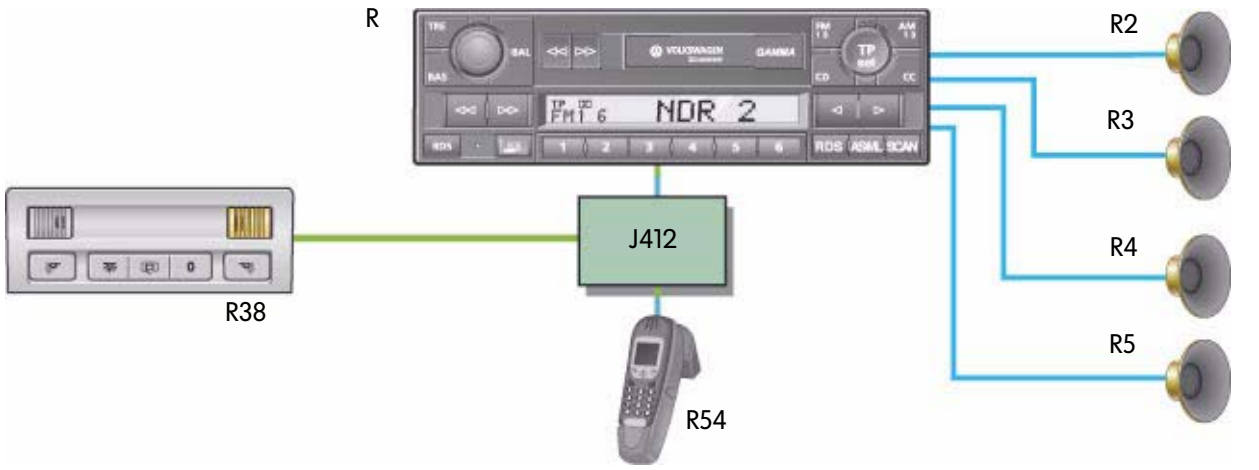
Gamma radio

The Gamma radio has, as an audio source, a tuner, an internal amplifier and a compact cassette player. It is possible to connect an external CD player or a CD changer. This radio is only fitted only in right-hand drive vehicles in Europe.

The audio signal is conditioned by the internal amplifier. It is not possible to connect an external amplifier.

The Gamma radio offers the possibility to connect the mobile telephone operating electronics control unit or a telephone.

A bass loudspeaker and a mid-range/treble loudspeaker is connected via a frequency switch to each of the front output channels as well as to each of the rear output channels.



S311_089

Legend

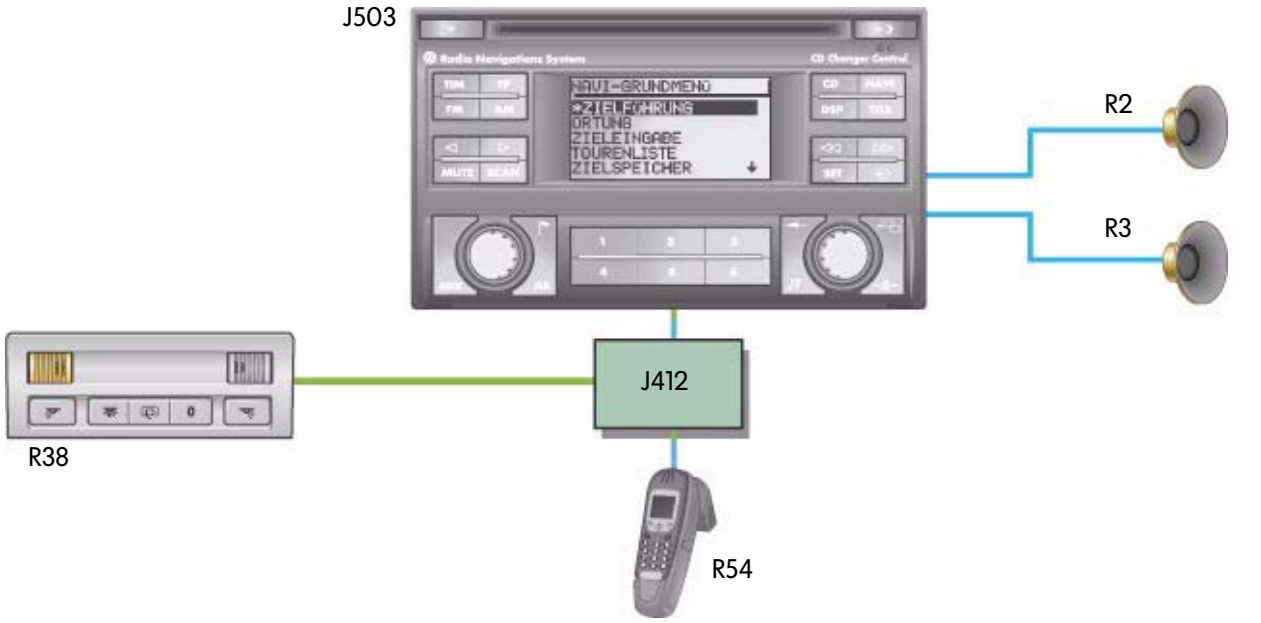
J412	Mobile telephone operating electronics control unit
R	Radio
R2	Loudspeaker, front left
R3	Loudspeaker, front right
R4	Loudspeaker, rear left
R5	Loudspeaker, rear right
R38	Telephone microphone
R54	Mobile telephone

MCD radio navigation system (Mono Chrome Display)

The MCD radio/navigation system comprises, as an audio source, a tuner, an internal amplifier and a Compact Disc Player. It is only fitted in commercial vehicles.

A bass loudspeaker and a mid-range/treble loudspeaker is connected to both output channels. It is not possible to connect an external amplifier.

The radio/navigation system MCD also offers the possibility to connect external CD changer, a telephone or the mobile telephone operating electronics control unit.



S311_116

Legend

J412	Mobile telephone operating electronics control unit
J503	Control unit with display for radio and navigation
R2	Loudspeaker, front left
R3	Loudspeaker, front right
R38	Telephone microphone
R54	Mobile telephone

Radio telephone, navigation

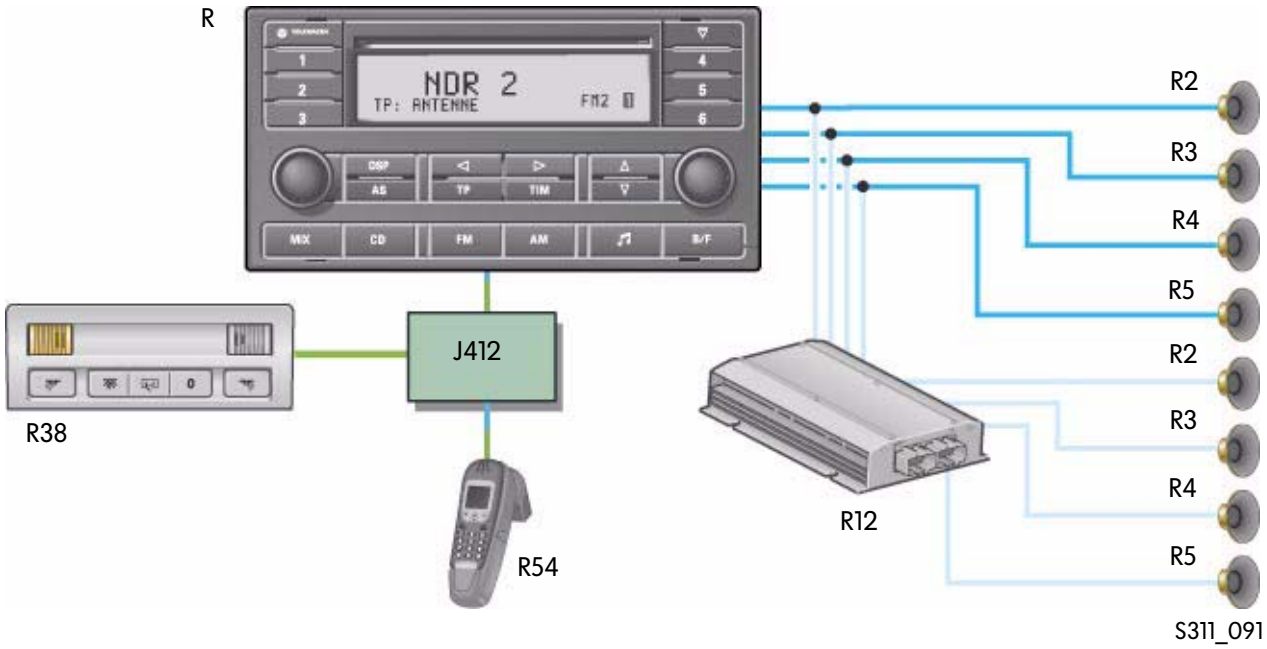
Delta radio

The Delta radio comprises, as an audio source, a tuner, an internal amplifier and a compact disc player. It is possible to connect an external CD changer.

The audio signal is conditioned by the internal amplifier. Depending on how the radio is encoded, the loudspeakers can be connected directly or via an analogue 8-channel amplifier.

If the loudspeakers are connected directly, a bass loudspeaker and a mid-range/treble loudspeaker are supplied at each of the front output channels and at each of the rear output channels.

The Delta radio is not fitted in commercial vehicles.



Legend

J412 Mobile telephone operating electronics control unit
R Radio
R2 Loudspeaker, front left
R3 Loudspeaker, front right
R4 Loudspeaker, rear left
R5 Loudspeaker, rear right
R12 Amplifier
R38 Telephone microphone
R54 Mobile telephone
Light-blue or dark-blue connection to loudspeakers depending on specification

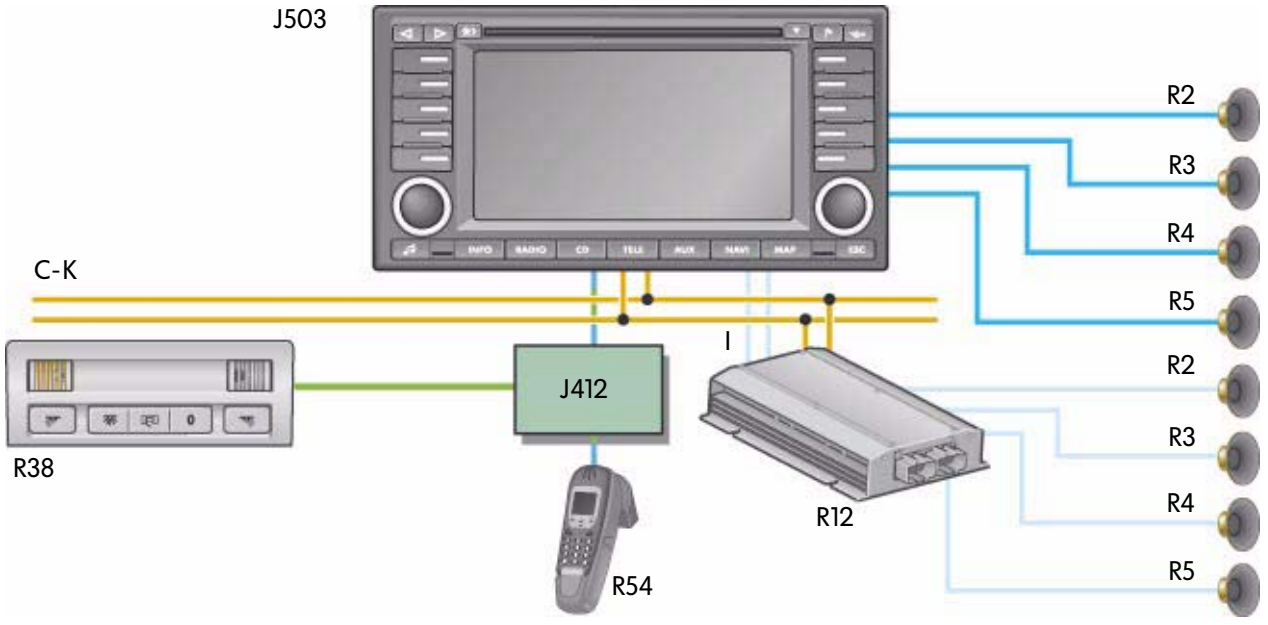
Radio/navigation system 2

Radio/navigation system 2 comprises, as an audio source, a tuner, an internal amplifier and a compact disc player. It is possible to connect an external CD changer. This system is not fitted is in commercial vehicles.

The audio signal is conditioned by the internal amplifier. Depending on how the radio is encoded, the loudspeakers can be connected directly or via a digital 12-channel amplifier.

If the loudspeakers are connected directly, a bass loudspeaker and a mid-range/treble loudspeaker are supplied at each of the front output channels and at each of the rear output channels.

The operator settings for volume, sound, balance and fading are transferred from the control panel via the convenience CAN data bus to the amplifier.



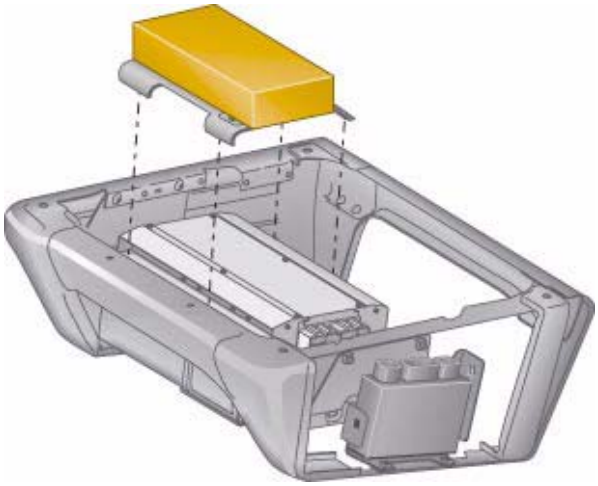
Legend

J412 Mobile telephone operating electronics control unit
J503 Control unit with display for radio and navigation
R2 Loudspeaker, front left
R3 Loudspeaker, front right
R4 Loudspeaker, rear left
R5 Loudspeaker, rear right
R12 Amplifier
R38 Telephone microphone
R54 Mobile telephone
C-K Convenience CAN data bus
I Line- Out
Pale-coloured connections are dependent on specification

Digital Voice Enhancement (DVE)

Fitting location

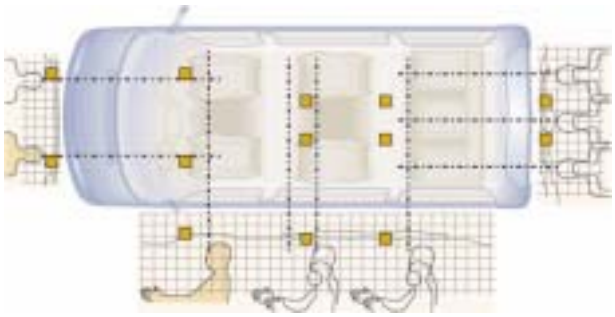
The voice enhancement control unit J656 is located under the front passenger seat.



S311_095

Microphone R140 - R145

For occupant voice recording by the voice enhancement control unit, six microphones are fitted in the vehicle headlining.



S311_096

Balance control R6

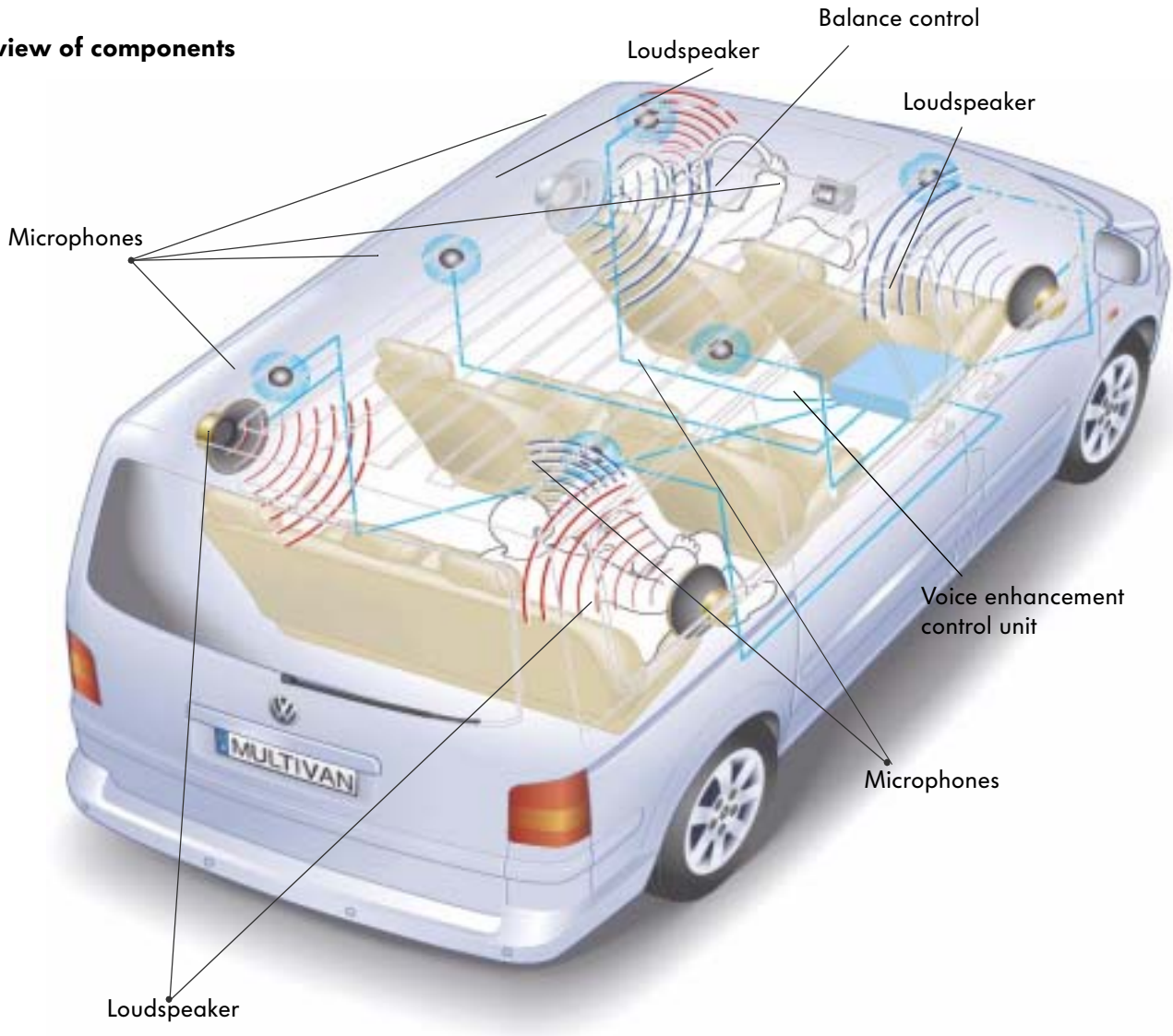
The balance control is located in the instrument panel. It adjusts the balance between left and right loudspeakers and controls the voice component of the loudspeaker output signal.

S311_097

Loudspeakers

Voice output is through the loudspeakers of the audio system.
To avoid feedback, the speech of the front occupants is transmitted only to the rear and the speech of the rear occupants is transmitted only to the front. The speech of mid-vehicle occupants is transmitted both to the front and to the rear.

Overview of components



Radio/telephone/navigation

Digital Voice Enhancement active

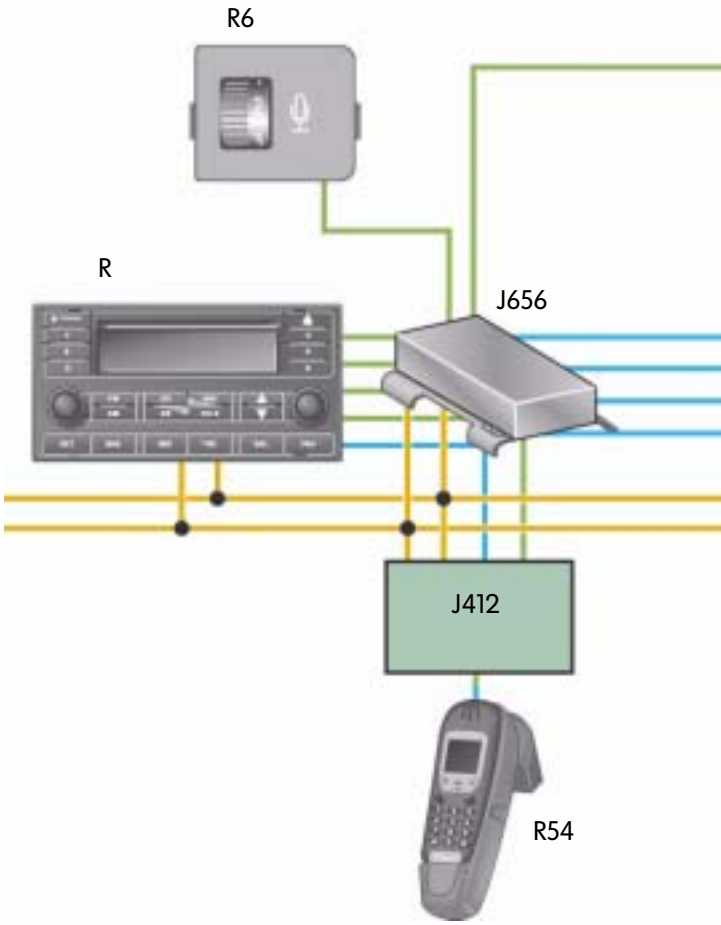
Digital Voice Enhancement provides clear communications among the vehicle occupants and, if a telephone is fitted, as a hands-free talking facility for all vehicle occupants.

For this purpose, there are six microphones installed in the vehicle for picking up voice signals.
The voice of the loudest speaker is transmitted. Voice is reproduced together with the radio signal or the navigation system voice output via the loudspeakers of the sound system.

The background driving noises picked up by the microphones are filtered out by the voice enhancement control unit.

The voice enhancement control unit is located in the signal path between the radio and the amplifier.
The mobile telephone operating electronics control unit is connected to the voice enhancement control unit.

During a telephone call, the signal from the currently active microphone is transmitted to the mobile telephone operating electronics control unit. Voice transmission within the vehicle remains active.



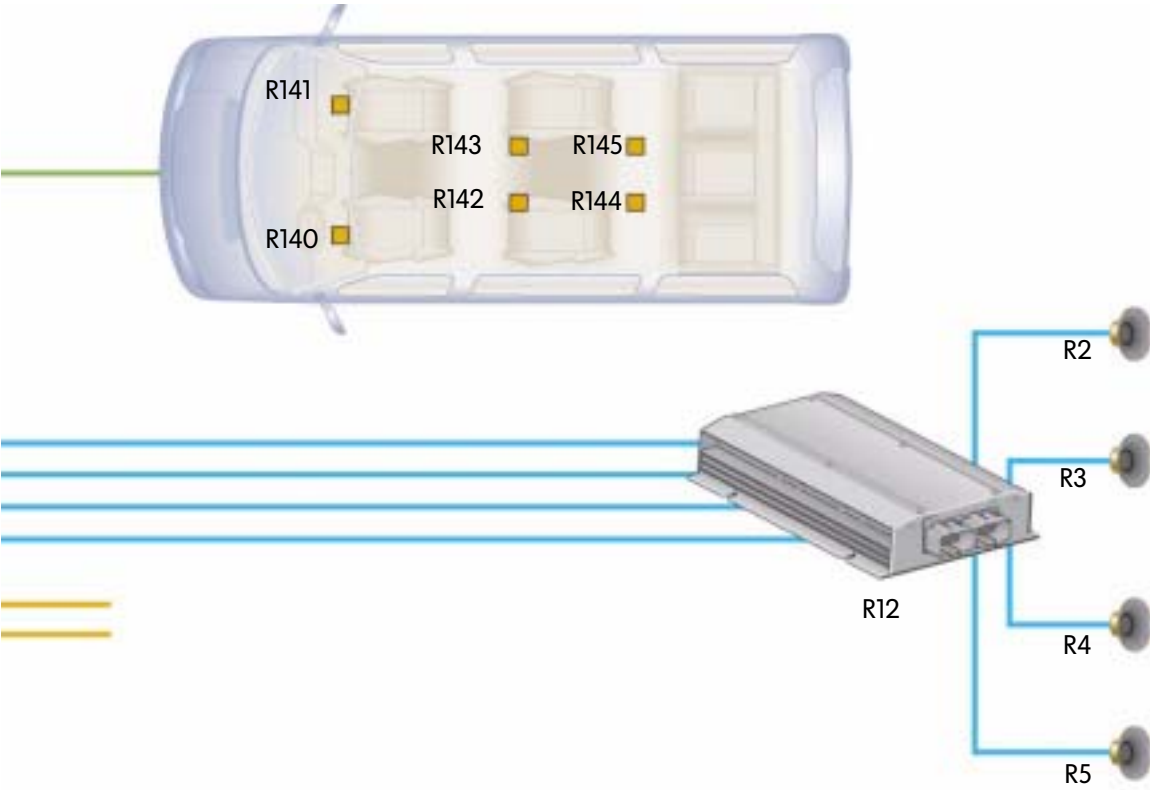
Legend

J412	Mobile telephone operating electronics control unit
J656	Voice enhancement control unit
R	Radio
R2	Loudspeaker, front left
R3	Loudspeaker, front right
R4	Loudspeaker, rear left

Digital Voice Enhancement deactivated

When the Digital Voice Enhancement feature is deactivated, the radio signals are relayed in an unprocessed form to the 8-channel amplifier and played back through the loudspeakers. Voice signals are not transmitted.

During a telephone call, only the front left microphone (driver) is active. The telephone signals are also relayed in an unprocessed form.



S311_094

R5 Loudspeaker, rear right
R6 Balance control
R12 Amplifier
R54 Mobile telephone
R140 Front left microphone
R141 Front right microphone
R142 Centre left microphone
R143 Centre right microphone
R144 Rear left microphone
R145 Rear right microphone

Amplifiers

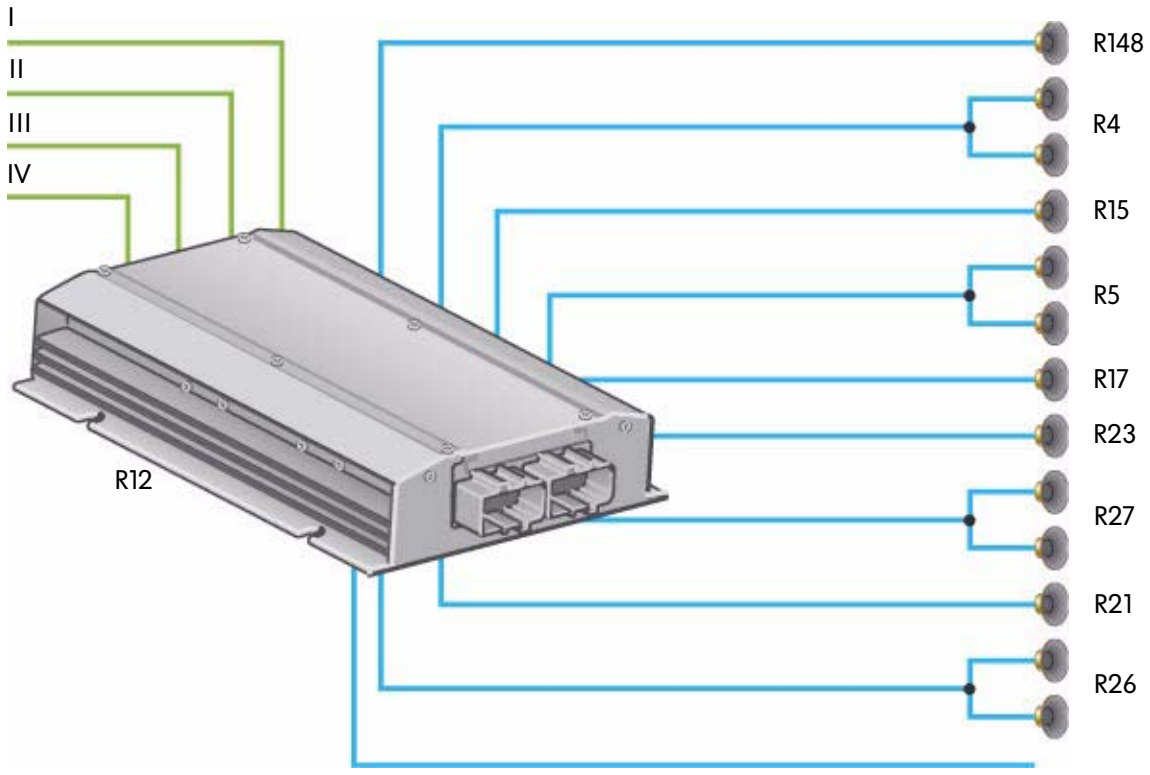
External amplifier

It is possible to connect a loudspeaker system adapted to the vehicle interior by using external amplifiers. The loudspeaker system comprises tweeters, mid-range loudspeakers, bass reflex loudspeakers and a subwoofer.
The external amplifier generates signals with the corresponding frequency response for the individual loudspeakers.

Analogue 8-channel amplifier

The analogue 8-channel amplifier has a total of 10 outputs to which the five individual loudspeakers and four mid-range/treble loudspeakers are connected. One output remains unused.

For diagnostic purposes, the amplifier is connected to the convenience CAN data bus.



S311_098

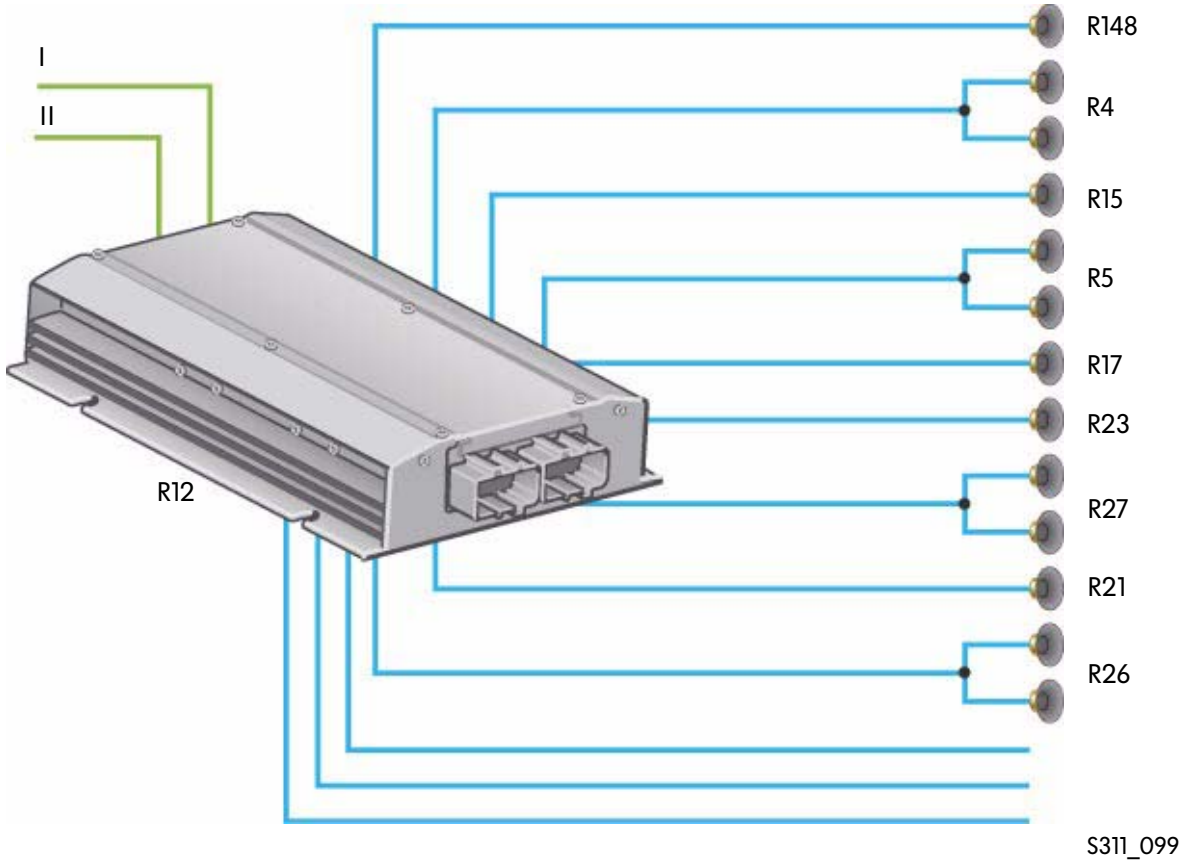
Legend

R12	Amplifier
R4	Loudspeaker, rear left
R5	Loudspeaker, rear right
R15	Bass loudspeaker, rear left
R17	Bass loudspeaker, rear right
R21	Bass loudspeaker, front left
R23	Bass loudspeaker, front right
R26	Mid-range/treble loudspeaker, front left
R27	Mid-range/treble loudspeaker, front right
R148	Subwoofer
I - IV	Radio input channels

Digital 12-channel amplifier

The digital 12-channel amplifier has a total of 12 outputs, to which are connected the five individual loudspeakers and four mid-range/treble loudspeakers. Three outputs remain unused.

To transfer the settings from the control panel and to the diagnostic system, the amplifier is connected to the convenience CAN data bus.



Legend

R12	Amplifier
R4	Loudspeaker, rear left
R5	Loudspeaker, rear right
R15	Bass loudspeaker, rear left
R17	Bass loudspeaker, rear right
R21	Bass loudspeaker, front left
R23	Bass loudspeaker, front right
R26	Mid-range/treble loudspeaker, front left
R27	Mid-range/treble loudspeaker, front right
R148	Subwoofer
I - II	Line-Out from radio

Aerial systems

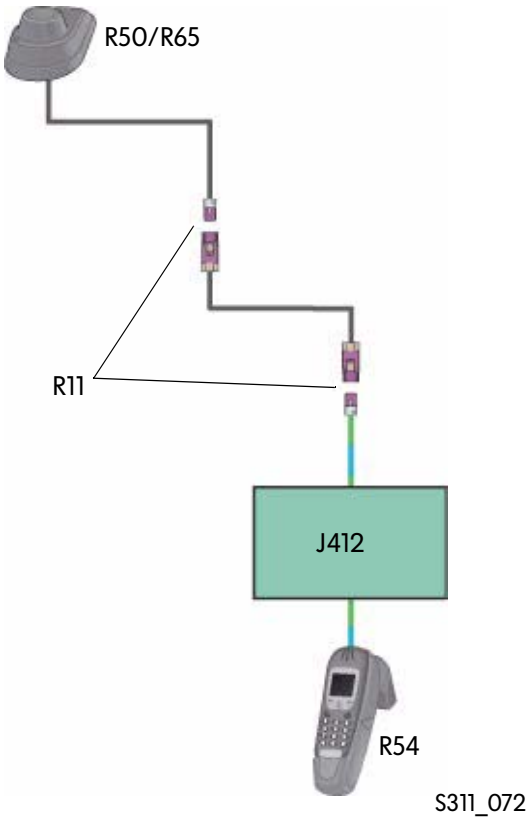
Roof mounted aerial for GSM Dualband or GPS

This variant is fitted in

- Commercial vehicle
- Camper
- Multivan

in combination with GSM and/or GPS aerials

The dual-band GSM aerial is suitable for the digital radiotelephone network (D network) and the E network

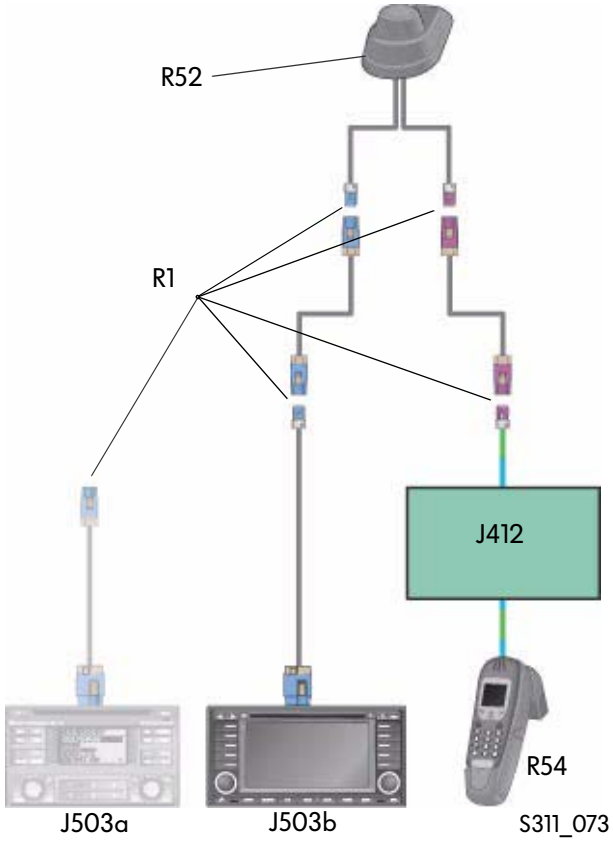


Roof mounted aerial for GPS and GSM Dualband

This variant is fitted in

- Commercial vehicle
- Camper
- Multivan

in combination with GSM and/or GPS aerials



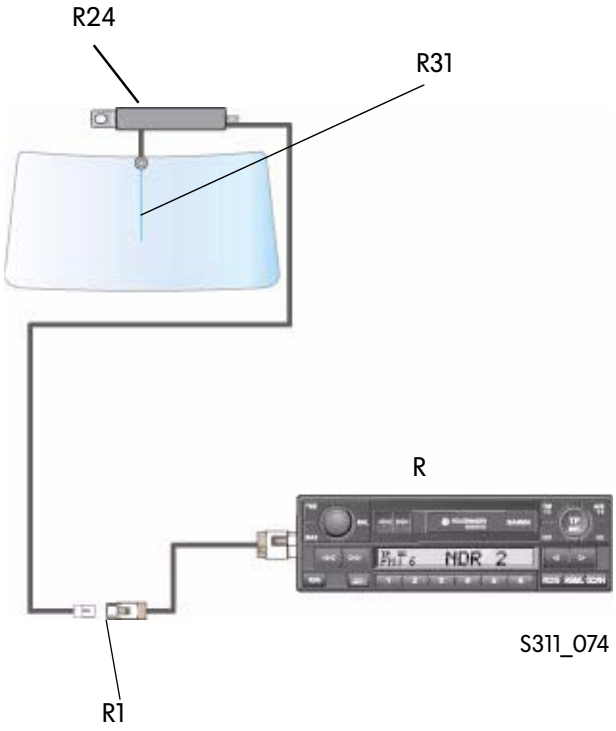
Legend

J412	Mobile telephone operating electronics control unit
J503a	Control unit with display for radio and navigation (Mono Chrome Display)
J503b	Control unit with display for radio and navigation (Multi Function Display)
R1	Aerial connection (FAKRA connector)
R50	Navigation aerial (GPS)
R52	Radio/telephone/navigation aerial (GPS)
R65	Telephone aerial

Windscreen aerial

This variant is fitted in

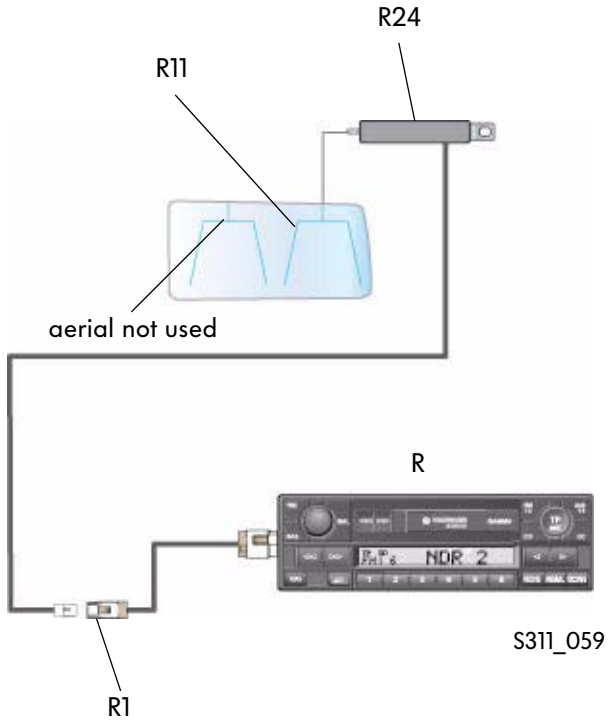
- Commercial vehicle
- Camper



Side window aerial

This variant is fitted in

- Multivan right-hand drive vehicle
- European export left and right-hand drive vehicles equipped with a factory-fitted wiring harness for radio installation



Legend

R	Radio
R1	Aerial connection (FAKRA connector)
R11	Aerial
R24	Aerial amplifier
R31	Window aerial

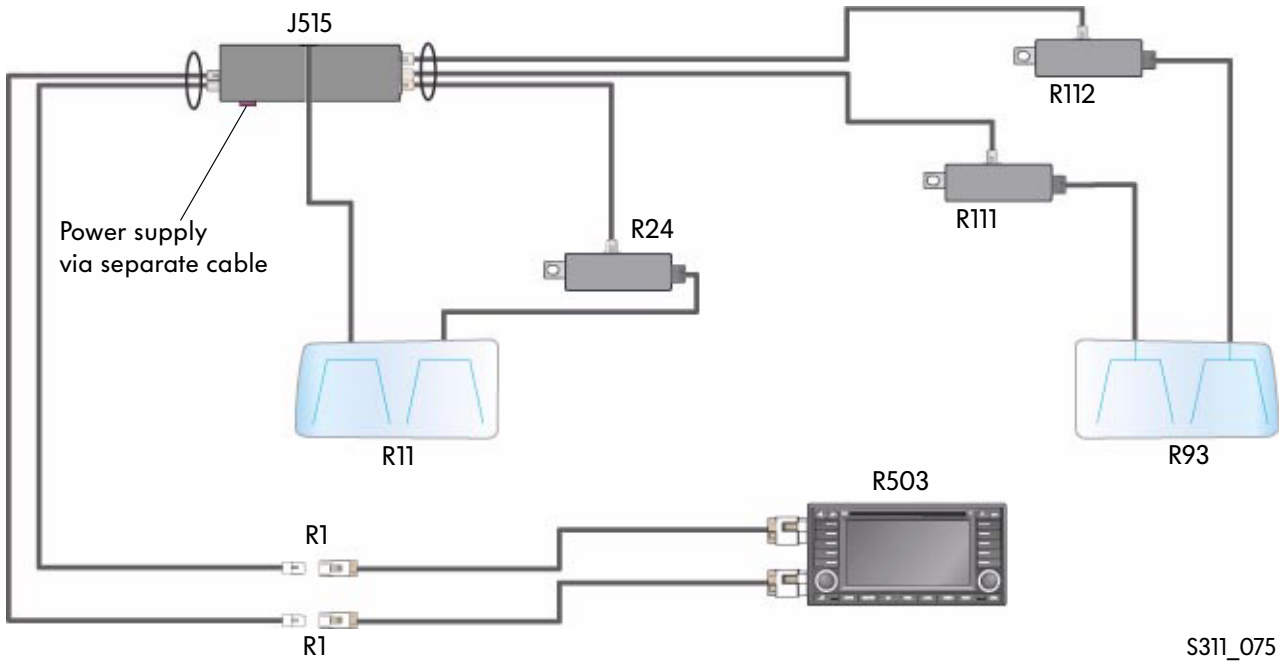
Radio/telephone/navigation

Diversity aerial

This variant is fitted in

- Multivan

Two aerials in the rear side windows.
The strongest of the four aerial signals is evaluated and utilised.
The voltage for the aerial selection control unit J515 is supplied via a separate cable.

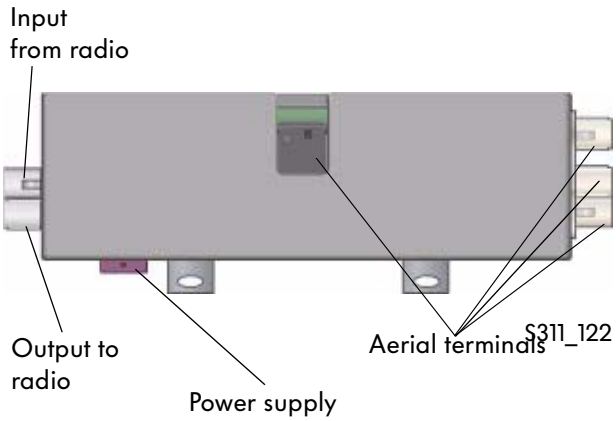


Legend

J503	Control unit with display for radio and navigation
J515	Aerial selection control unit
R1	Aerial connection (FAKRA connector)
R11	Aerial
R24	Aerial amplifier
R93	Radio aerial 2
R111	Aerial amplifier 2
R112	Aerial amplifier 3

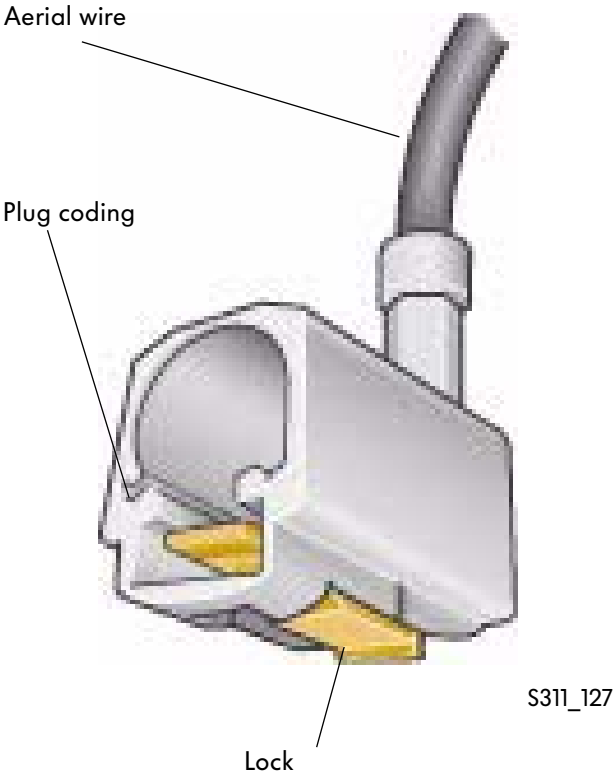
Aerial selection control unit J515

The reception signal of one of the four aerials is transmitted to the radio via the aerial selection control unit. The radio checks the quality of the signal and returns the result via the aerial wire. If the signal is too weak, the aerial selection control unit switches to the next aerial, whose signal is also checked in the radio. This process is continuously repeated, thus ensuring that the aerial with the best signal is always selected. The switchover operations are not noticeable to the user.



FAKRA connector

To prevent interchanging of the aerial terminals, the connectors are encoded. They also have different colours. Each connector plugs only into the associated mating socket.



Air conditioning system

Air conditioning systems

The manual air conditioning system is available in two variants.

Manual air conditioning system for vehicles without R5 TDI engine

Manual air conditioning system with internally controlled compressor. The functions of the air conditioning system are monitored via the air conditioning system control unit J301, which is not provided with diagnostic capability and has no CAN data bus interface. The compressor is output-controlled. Compressor output is controlled via the regulating valve in the compressor and is dependent on the pressure differential of the refrigerant in the low and high pressure circuits

Manual air conditioning system for vehicles with R5 TDI engine

Manual air conditioning system with externally controlled compressor and air conditioning system compressor regulating valve N280. The functions are monitored and controlled via the air conditioner switch E30. The air conditioner switch is provided with diagnostic capability and has an interface to the convenience CAN data bus. The refrigerant temperature sender G454, the ambient temperature sensor G17 and the high pressure sender G65 enable cooling capacity to be set to a pre-determined setpoint.

The operator controls are identical in terms of their appearance and functions:

- AC function
- Air recirculation
- Temperature adjustment
- Air distribution
- Fresh air blower adjustment
- and - dependent on specification - activation of the second heat exchanger by the master switch (Multivan only)

S311_063

Climatronic

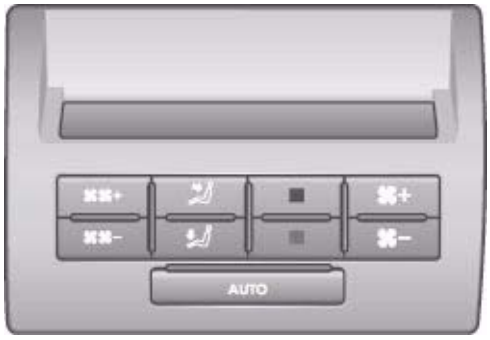
The Climatronic is operated via the air conditioning system/Climatronic operating and display unit E87 and the rear Climatronic operating and display unit E265.
The air conditioning system/Climatronic operating and display unit E87 and the Climatronic control unit J255 are combined as a modular unit.

The Climatronic control unit J255 controls all actuators.
The fresh air blower motor is activated by a pulse-width modulated signal via the fresh air blower control unit.

S311_062

Rear Climatronic operating and display unit

The rear Climatronic operating and display unit sends the signals to the rear actuators.
Both operating and display units (front and rear) exchange information via the convenience CAN data bus.



S311_101

The air conditioning system/Climatronic can be set to a lower power output or switched off, depending on engine load or of the electrical onboard power supply.

Diagnosis

The control units can be diagnosed with the Vehicle Diagnosis, Testing and Information System VAS 5051 or the Vehicle Diagnosis and Information System VAS 5052.

The connections to the individual control units are established in different ways.

Control unit with CAN data bus connection and virtual communication line to the data bus diagnostic interface

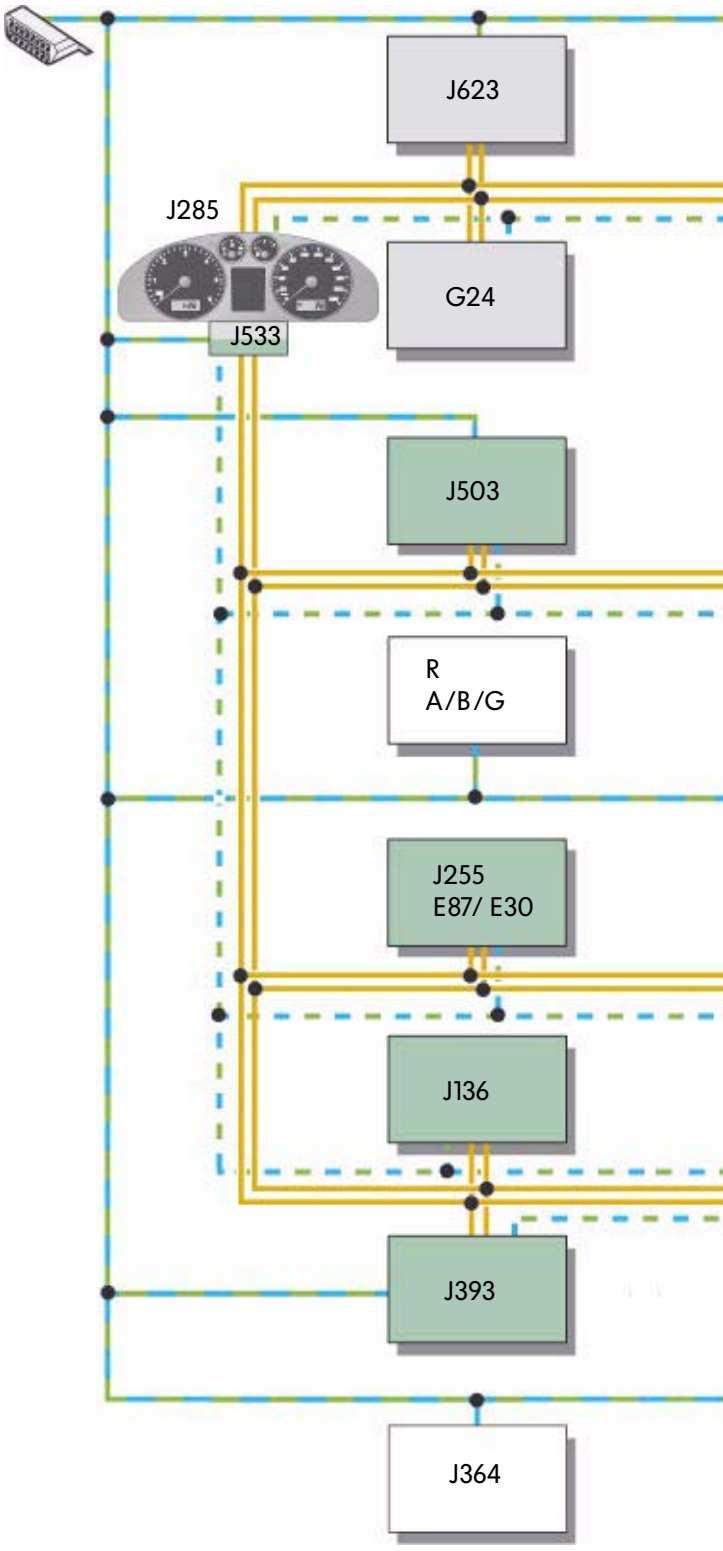
The connection is established via the communication line, the data bus diagnostic interface and the CAN data bus.

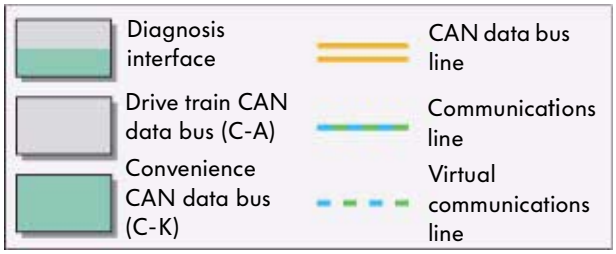
Control unit with communications cable connection

The connection is established via the communication line routed directly to the control unit.

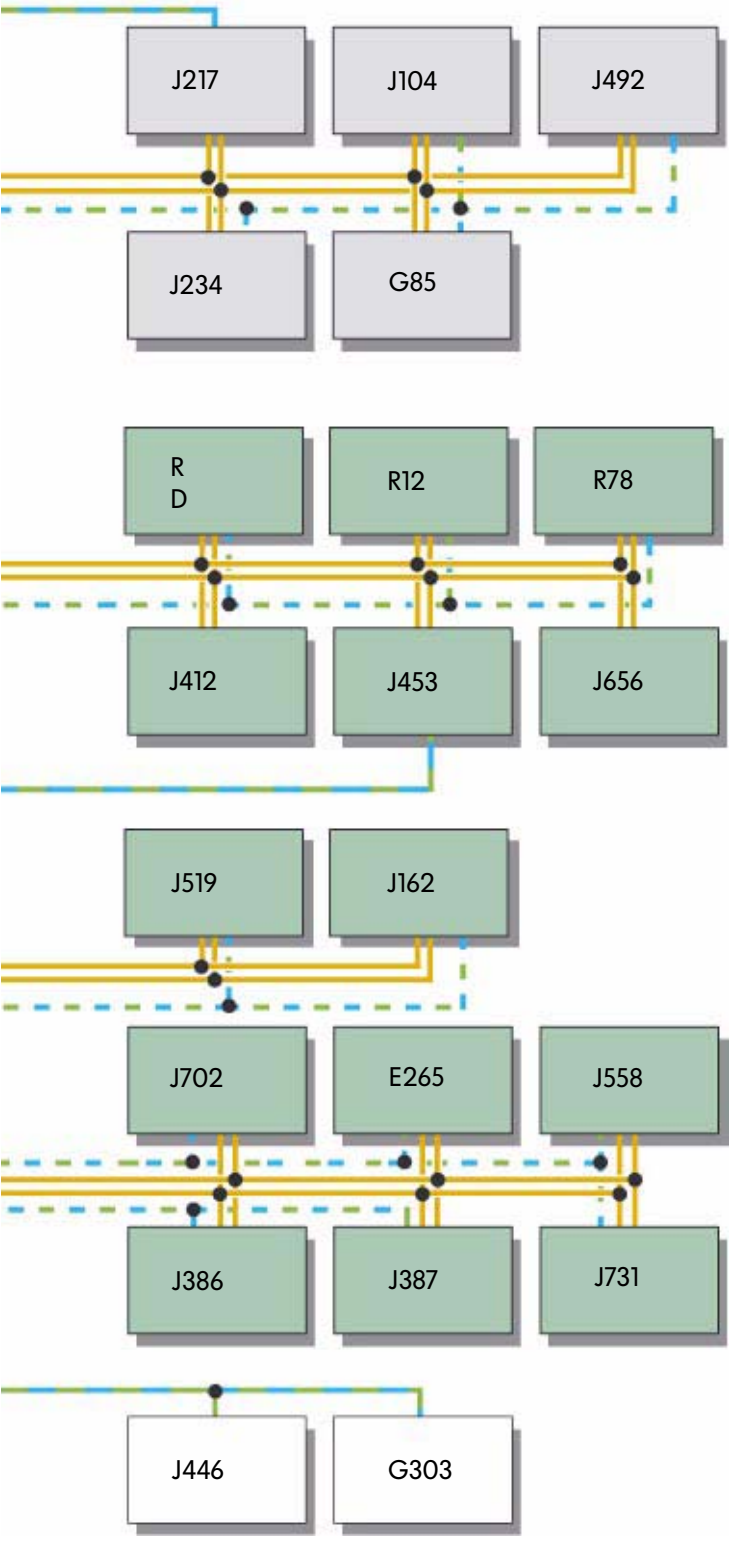
Control unit with CAN data bus connection, without virtual communication line to the data bus diagnostic interface

The connection is established via a control unit with virtual communications line and the CAN data bus.





S311_037



S311_112

Legend

G24	Tachograph
E30	Air conditioner switch
G85	Steering angle sender
G303	Interior monitor sender/receiver module 1, master
E87	Air conditioning system/Climatronic operating and display unit
E265	Rear Climatronic operating and display unit
J104	ABS with EDL control unit
J136	Seat adjustment control unit with memory function
J162	Heater control unit
J217	Automatic gearbox control unit
J234	Airbag control unit
J255	Climatronic control unit
J285	Control unit with display unit in dash panel insert
J364	Additional heater control unit
J386	Door control unit, driver side
J387	Door control unit, front passenger side
J393	Convenience system central control unit
J412	Operating electronics control unit, mobile telephone
J446	Parking aid control unit
J453	Multi-function steering wheel control unit
J492	Four-wheel drive control unit
J503	Radio and navigation control unit with display unit
J519	Onboard electrical system control unit
J533	Data bus diagnosis interface
J558	Sliding door control unit
J623	Engine control unit
J656	Voice enhancement control unit
J702	Roof display unit
J731	Right sliding door control unit
R	Radio:
	A ALPHA
	B BETA
	G GAMMA
	D DELTA
R12	Amplifier
R78	TV tuner

Test yourself

1. Into what data bus systems is the network of the Volkswagen Transporter subdivided?

Ã a) The air conditioning system CAN data bus, the drive train CAN data bus and the convenience CAN data bus.

Ã b) The drive train CAN data bus and the convenience CAN data bus.

Ã c) The Infotainment CAN data bus and the diagnosis CAN data bus.

2. What is the task of the data bus diagnostic interface?

Ã a) It connects the drive train and convenience CAN data bus systems in such a way that both data bus systems can exchange data with each other.

Ã b) It transfers the data of the vehicle diagnosis, testing and information system VAS 5051 from the communications line to the CAN data bus for the diagnosis of control units which only have one virtual communications line.

Ã c) It performs the tasks of the immobilizer control unit J362 and transfers data from the Infotainment CAN data bus to the drive train CAN data bus.

3. What are the tasks of the onboard power supply control unit J519?

Ã a) It controls turn signal operation, and activates the interior lights, the reversing lights and the central lokking.

Ã b) It controls turn signal operation, and activates the interior lights, the reversing lights and the power windows.

Ã c) It controls the turn signal operation, and activates the interior lights, the reversing lights and the electrical load management system.

4. The electrical load management system is allowed to take measures to maintain the onboard power supply

Ã a) when extreme short-distance operation is detected.

Ã b) when the engine is started.

Ã c) to avoid significant voltage drops due to high current consumers relevant to vehicle safety.

5. How is data transmitted to the electrical sliding door?

Ã a) Via a flexible cable connection and the T10 connector.

Ã b) Wirelessly via the sliding door reader coil and the sliding door magnetic coil.

Ã c) Via the sliding door CAN data bus.

6. Which is the following statements is true?

Ã a) Digital Voice Enhancement provides clear communications between the vehicle occupants and persons outside the vehicle.

Ã b) Digital Voice Enhancement provides clear communications between the vehicle occupants and other telephone callers.

Ã c) Digital Voice Enhancement is only active when the telephone is switched off.

Answers:
1. b ; 2. a, b ; 3. c ; 4. a, b, c ; 5. b ; 6. b

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