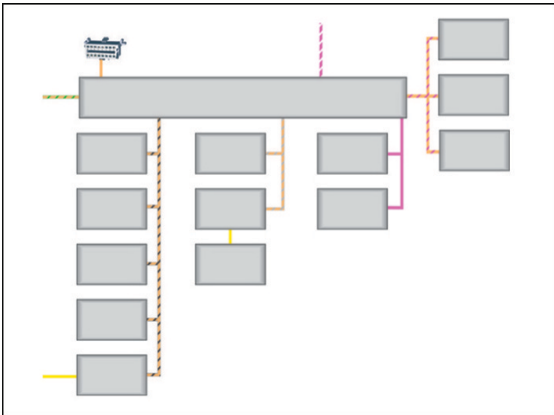


Audi A5 - Networking

Self-Study Programme 395

Innovations in the electrical system and electronics on the Audi A5

The number of control units in motor vehicles continues to increase, and the Audi A5 is no exception. Many functions would not be possible without this multiplicity of control units. Ongoing advance professional training is needed in order to abreast with the rapid rate of development within this sector. This self-study programme gives you the opportunity to familiarise yourself with the networking topology of the control units on the Audi A5. In addition, you will learn about the installation locations of the various control units.



395_029

Familiar components such as the data bus diagnostic interface, the alternator, the onboard power supply control unit and the light switches have now been updated. This self-study programme contains information about the new aspects of these components, as well as service-related information about the outside lights on the new Audi A5.



395_030

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The self-study programme teaches the design and function of new vehicle models, new automotive parts or new technologies.

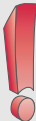
The self-study programme is not a repair manual!
All values given are intended as a guideline only and refer to the software version valid at the time of preparation of the SSP.

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

Reference

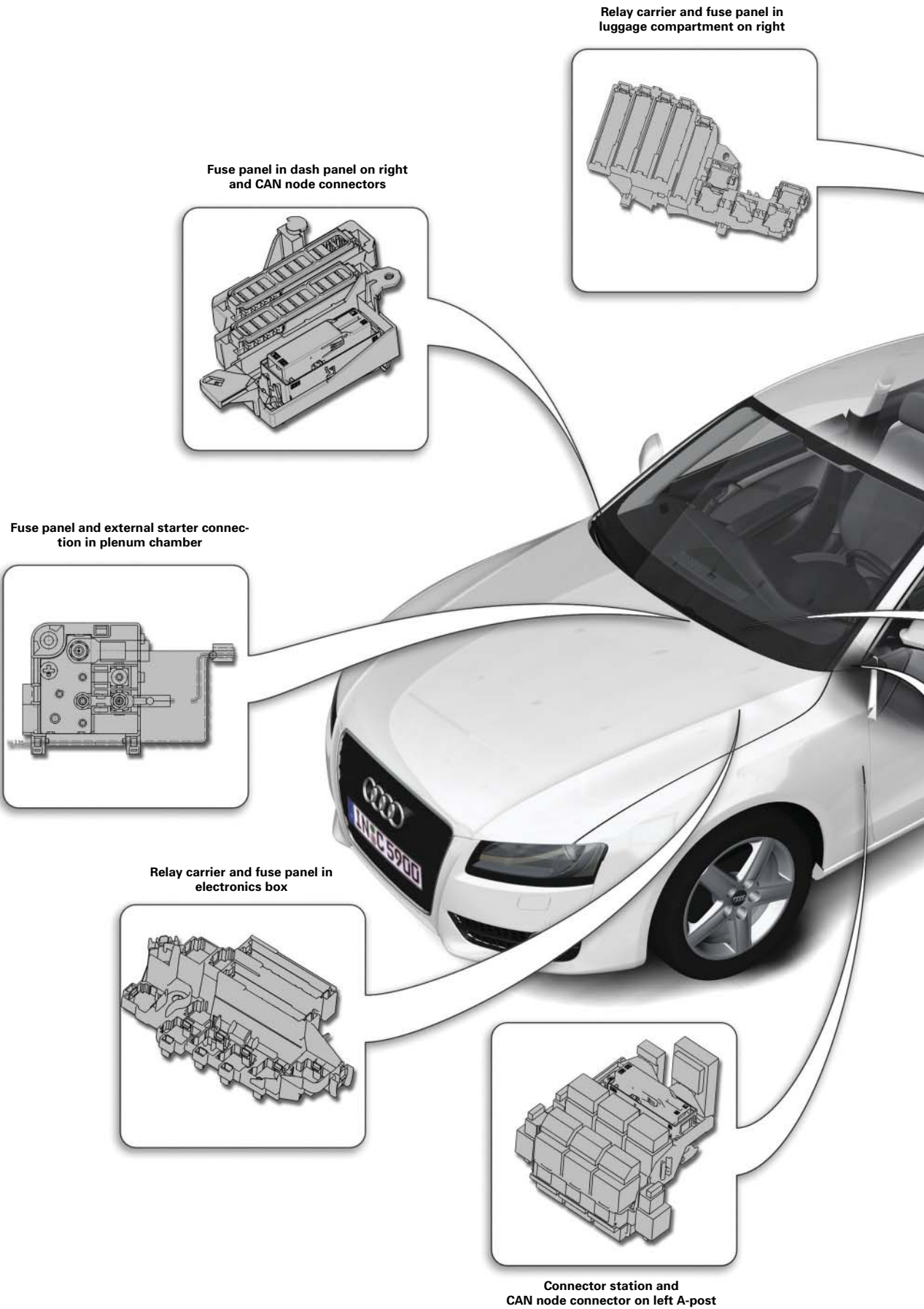


Note

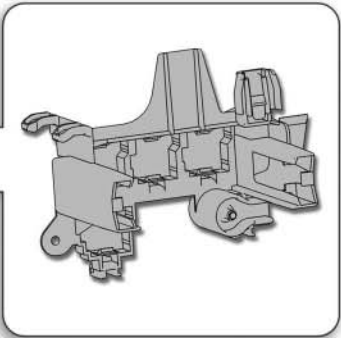
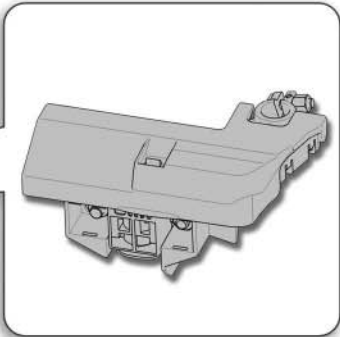


Overview

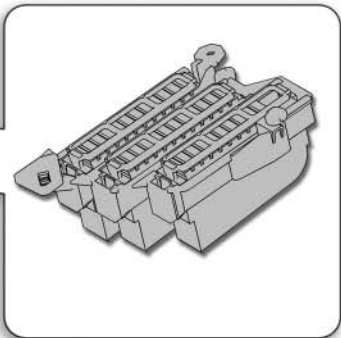
Fuses and relays



**Fuse panel and battery disconnecting
element at battery positive pole**

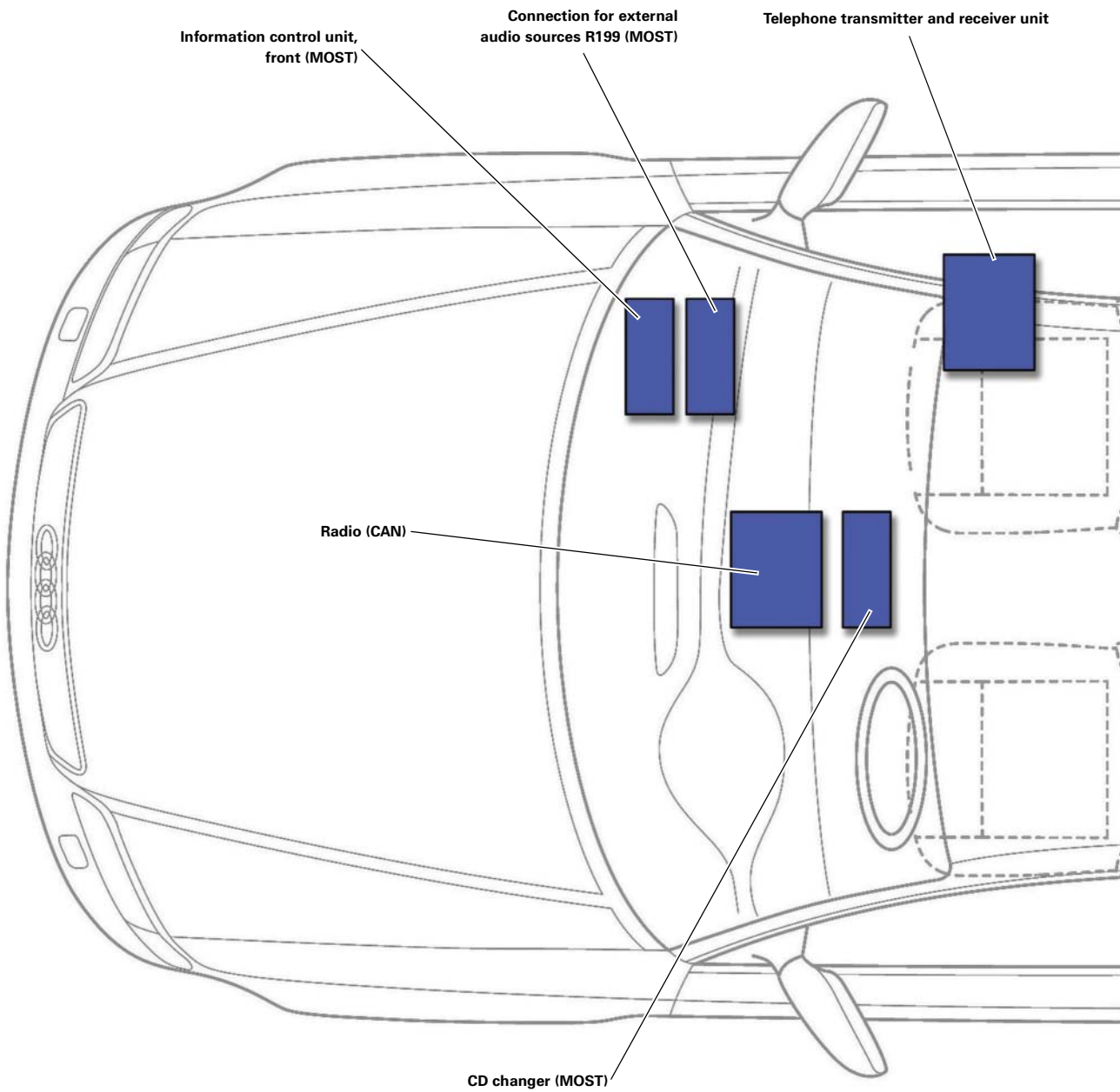


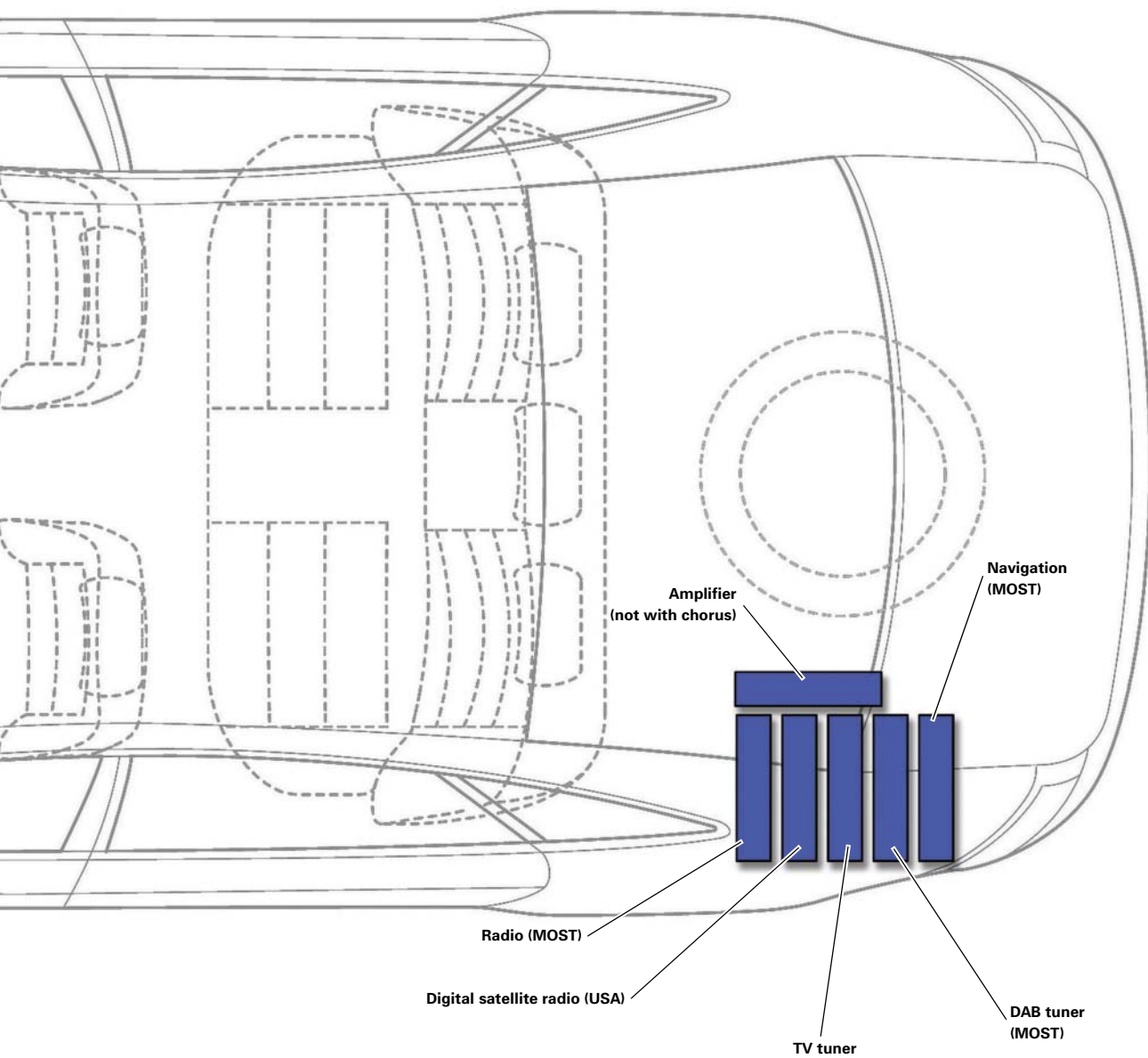
**Relay carrier and mounting bracket for onboard
power supply control unit in driver-side footwell**



Fuse panel in dash panel on left

Installation locations of Infotainment components

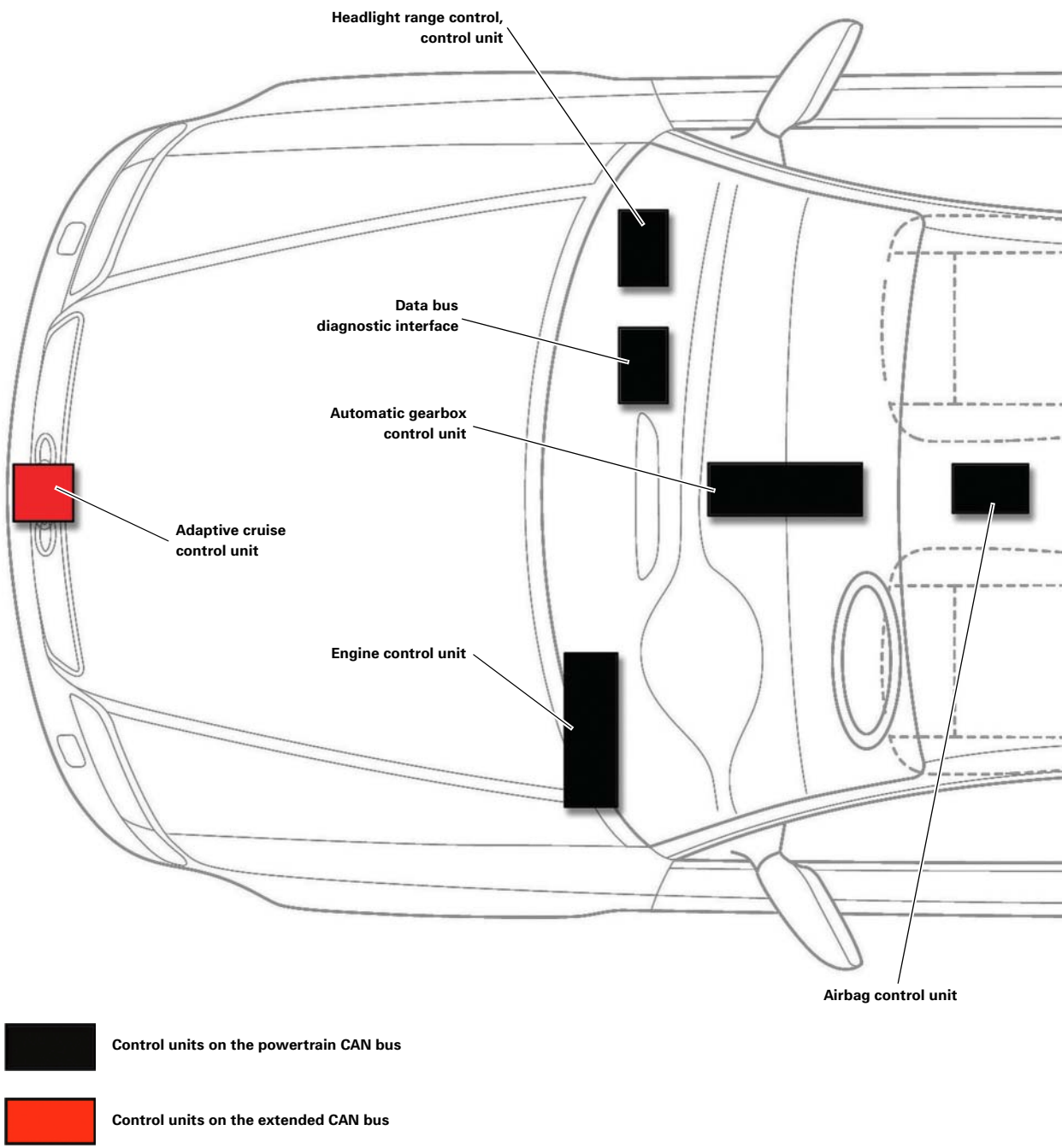


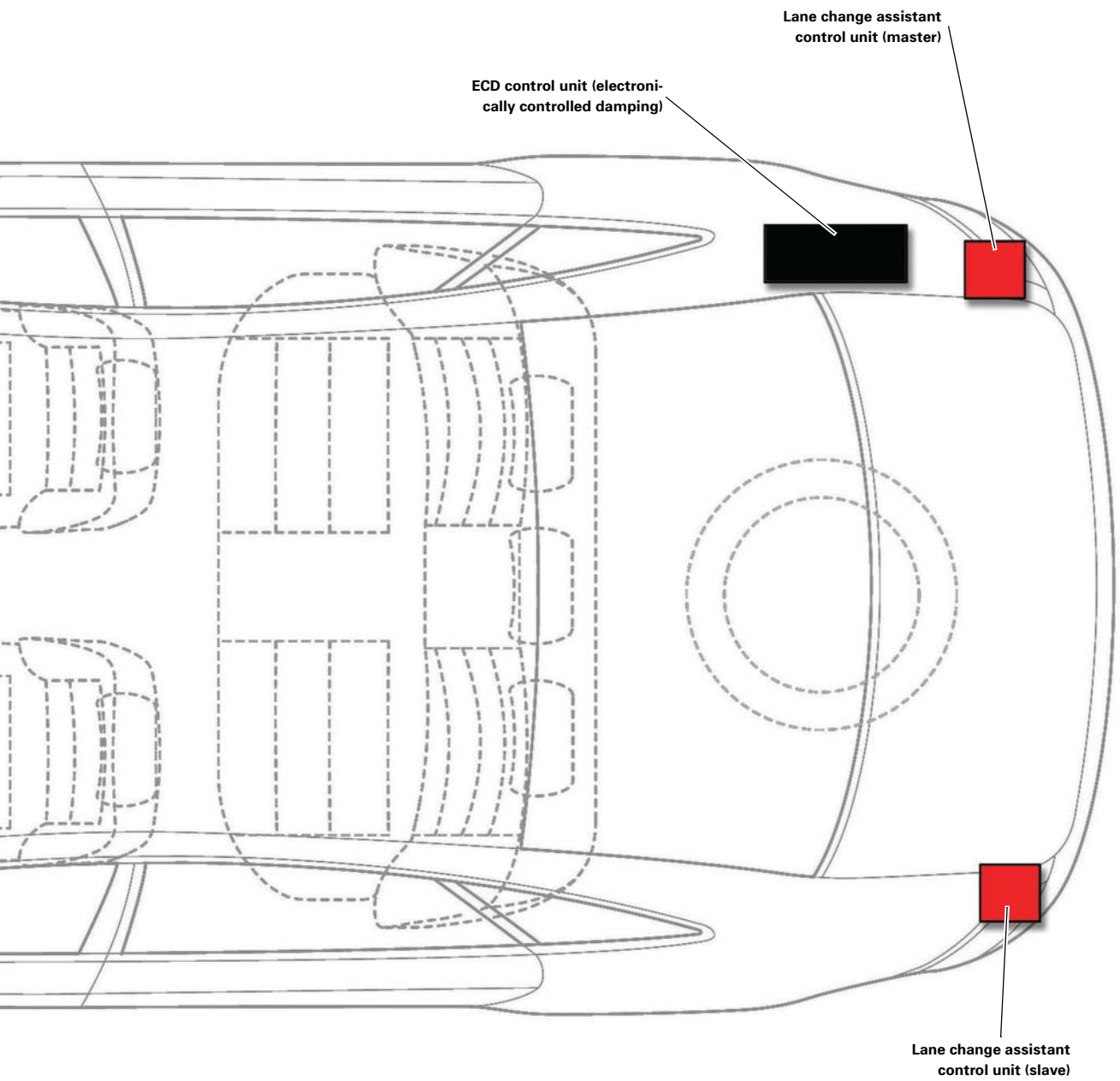


395_001

Overview

Installation locations of control units on the powertrain CAN bus and extended CAN bus

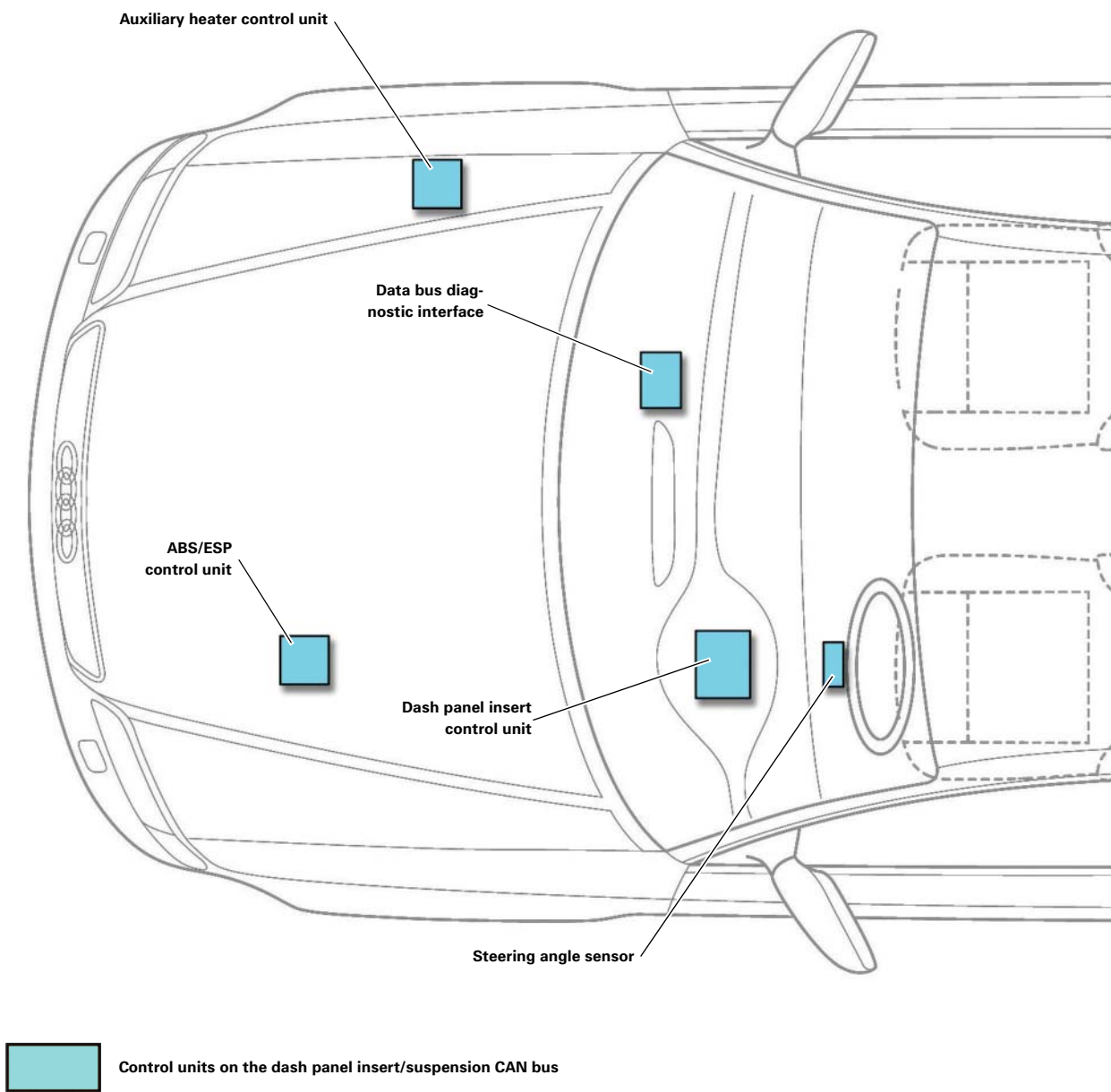


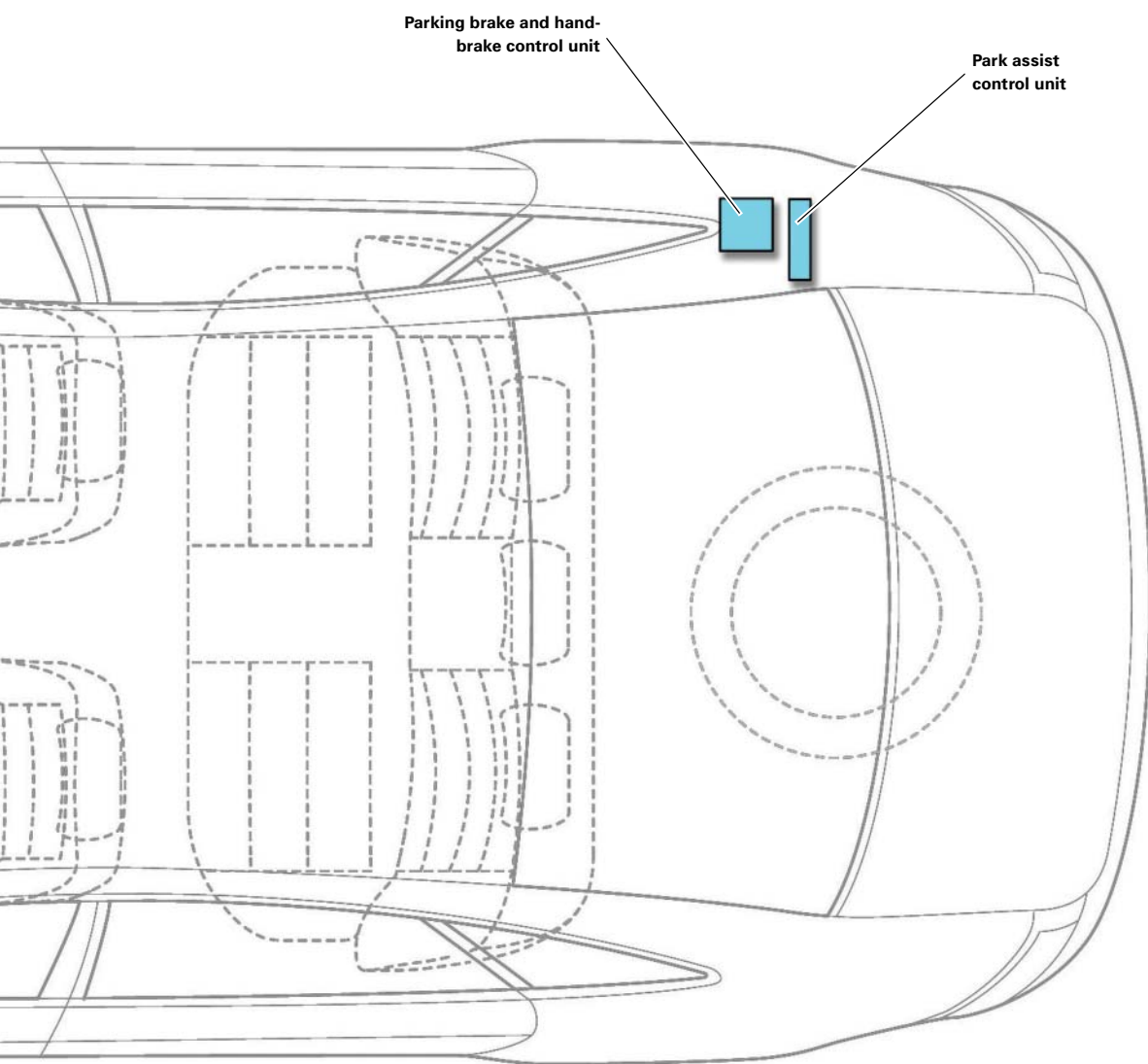


395_002

Overview

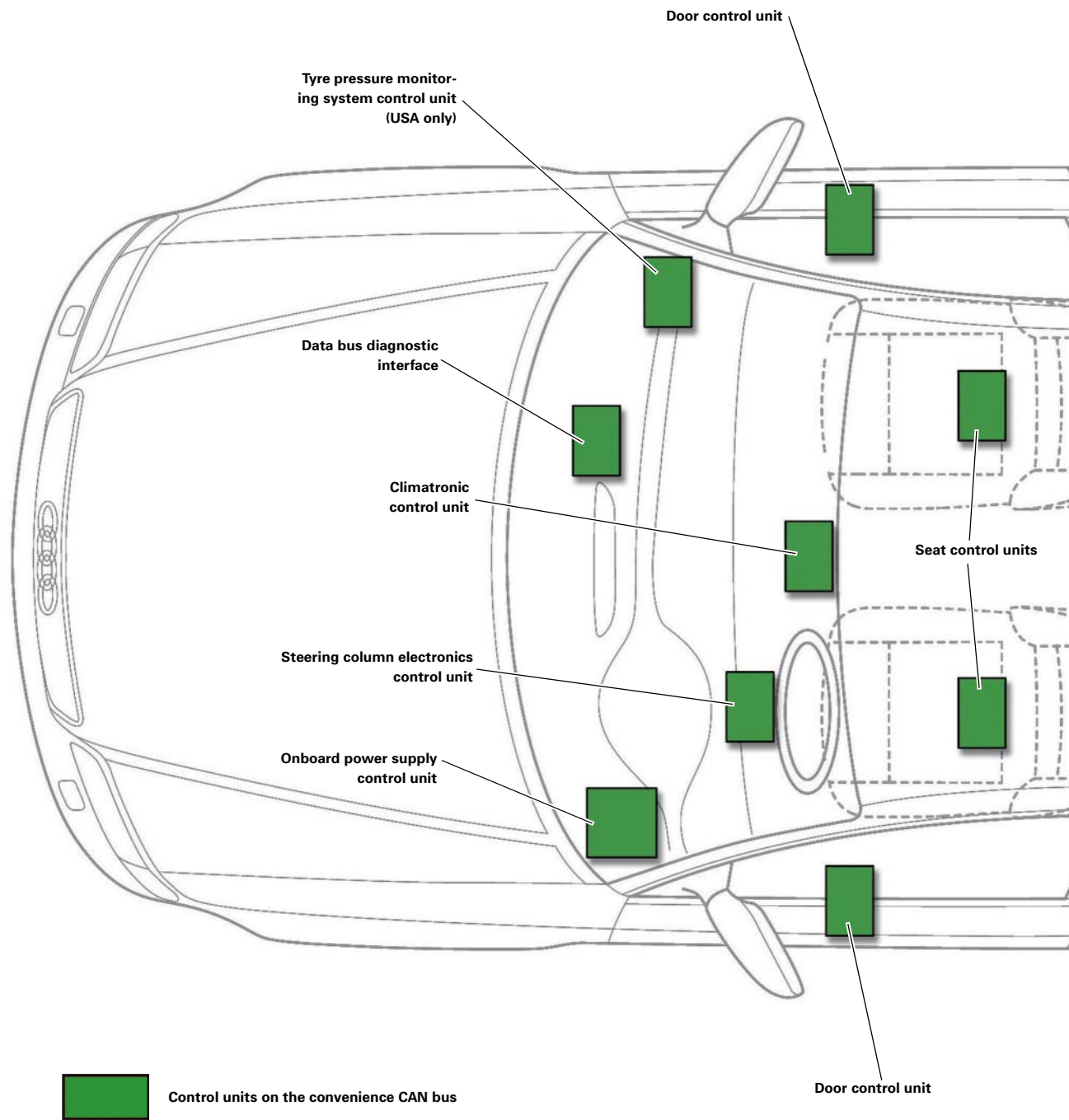
Installation locations of control units on the dash panel insert / suspension CAN bus

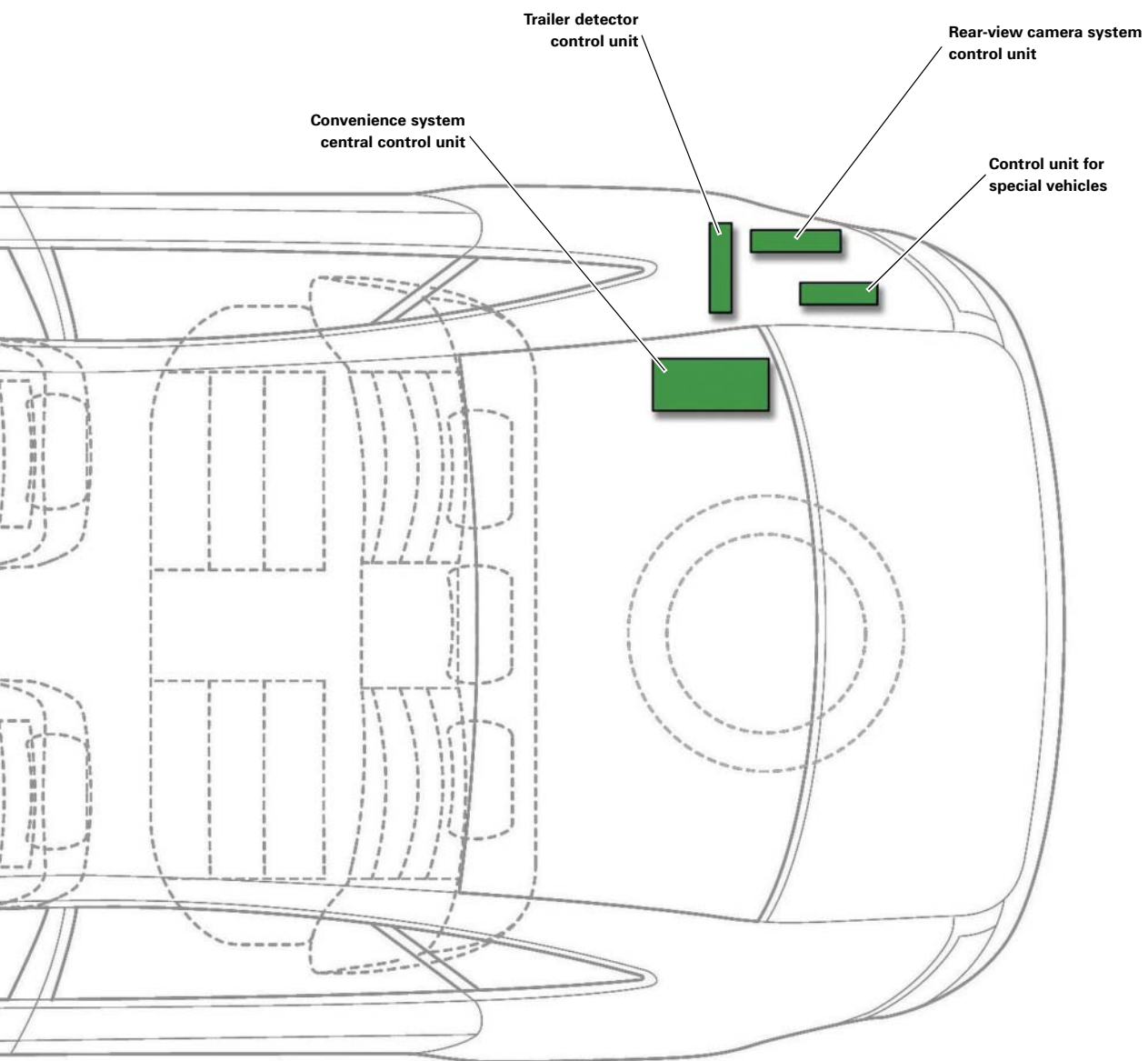




395_003

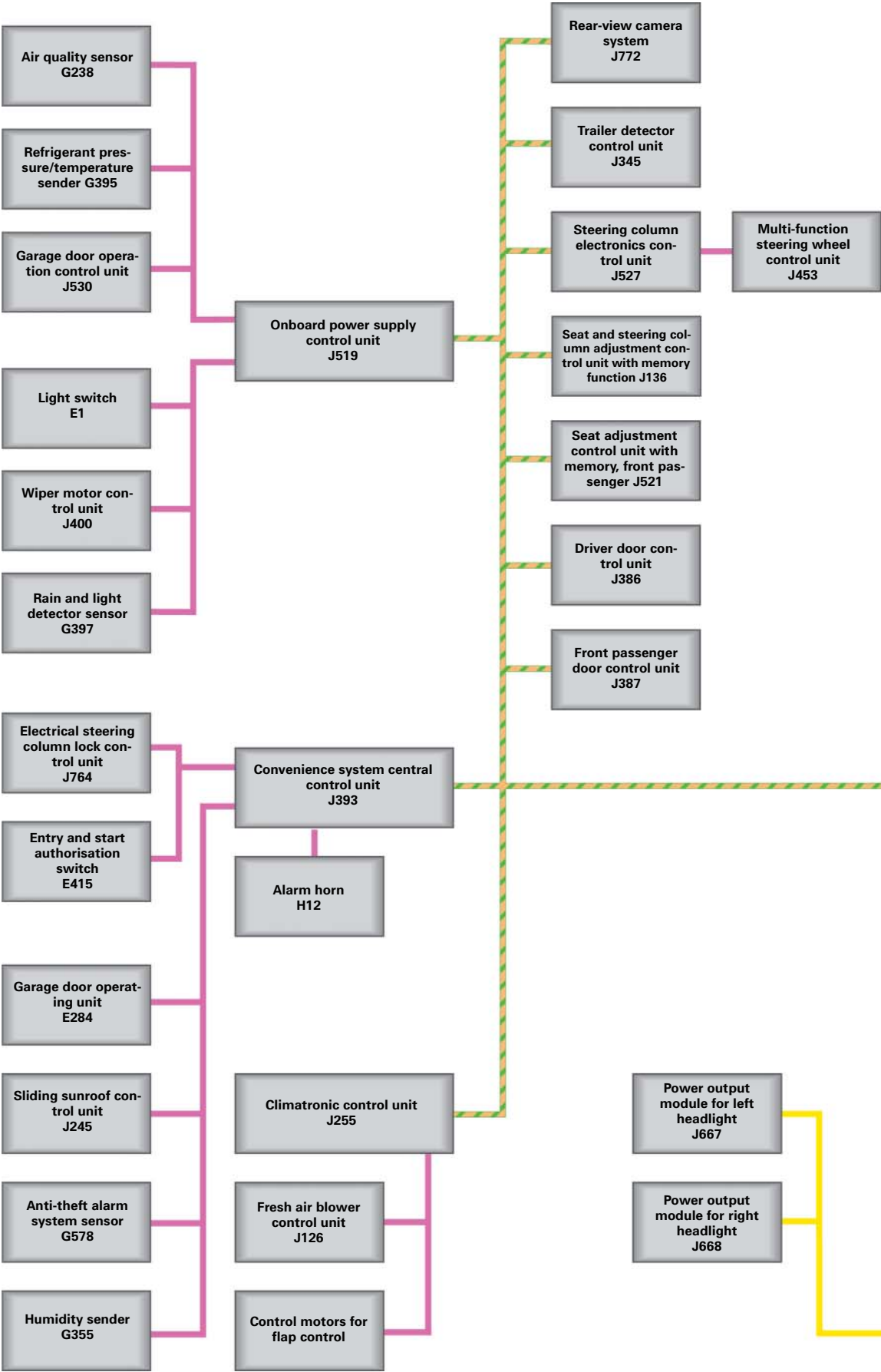
Installation locations of control units on the convenience CAN bus

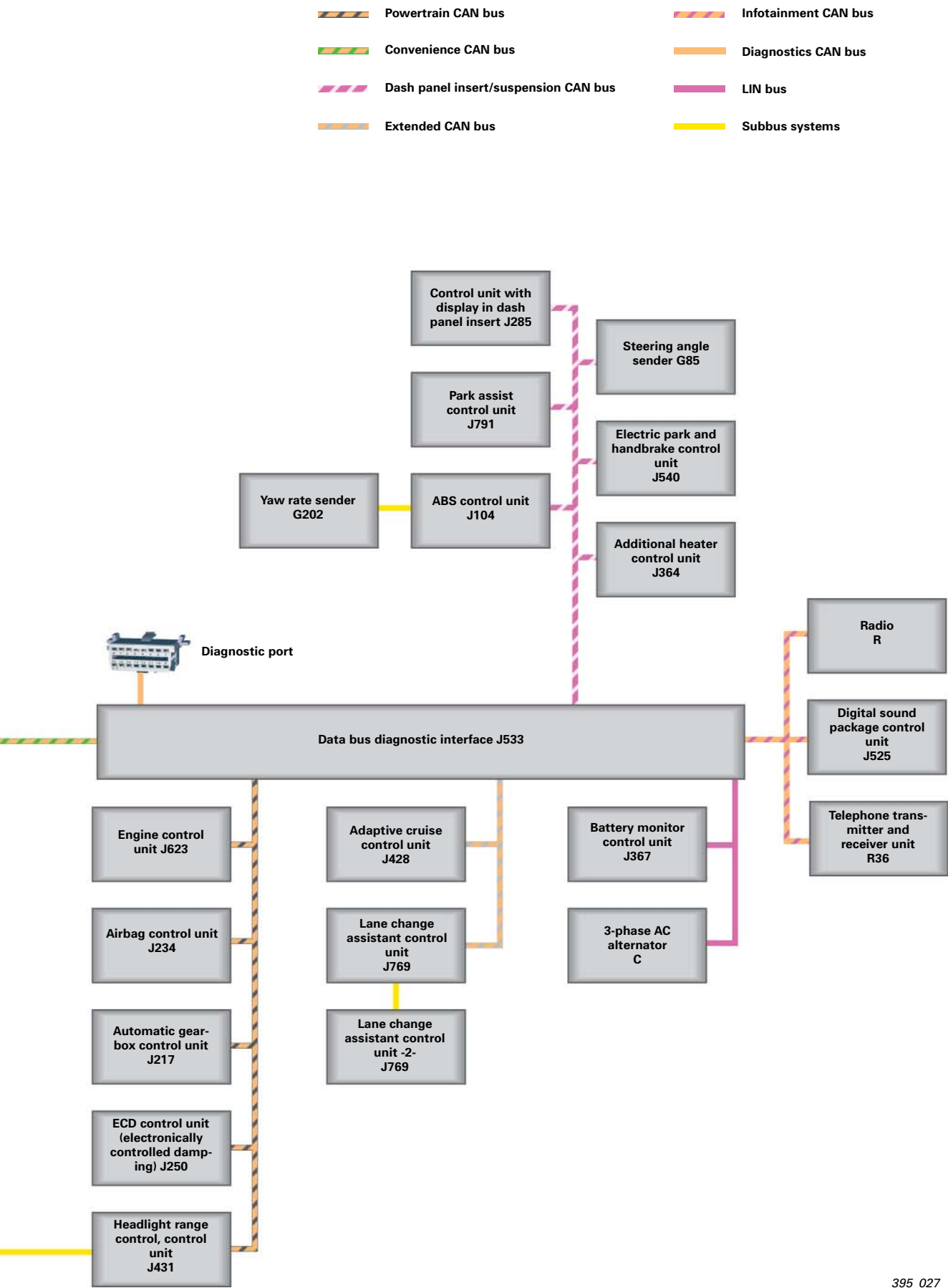




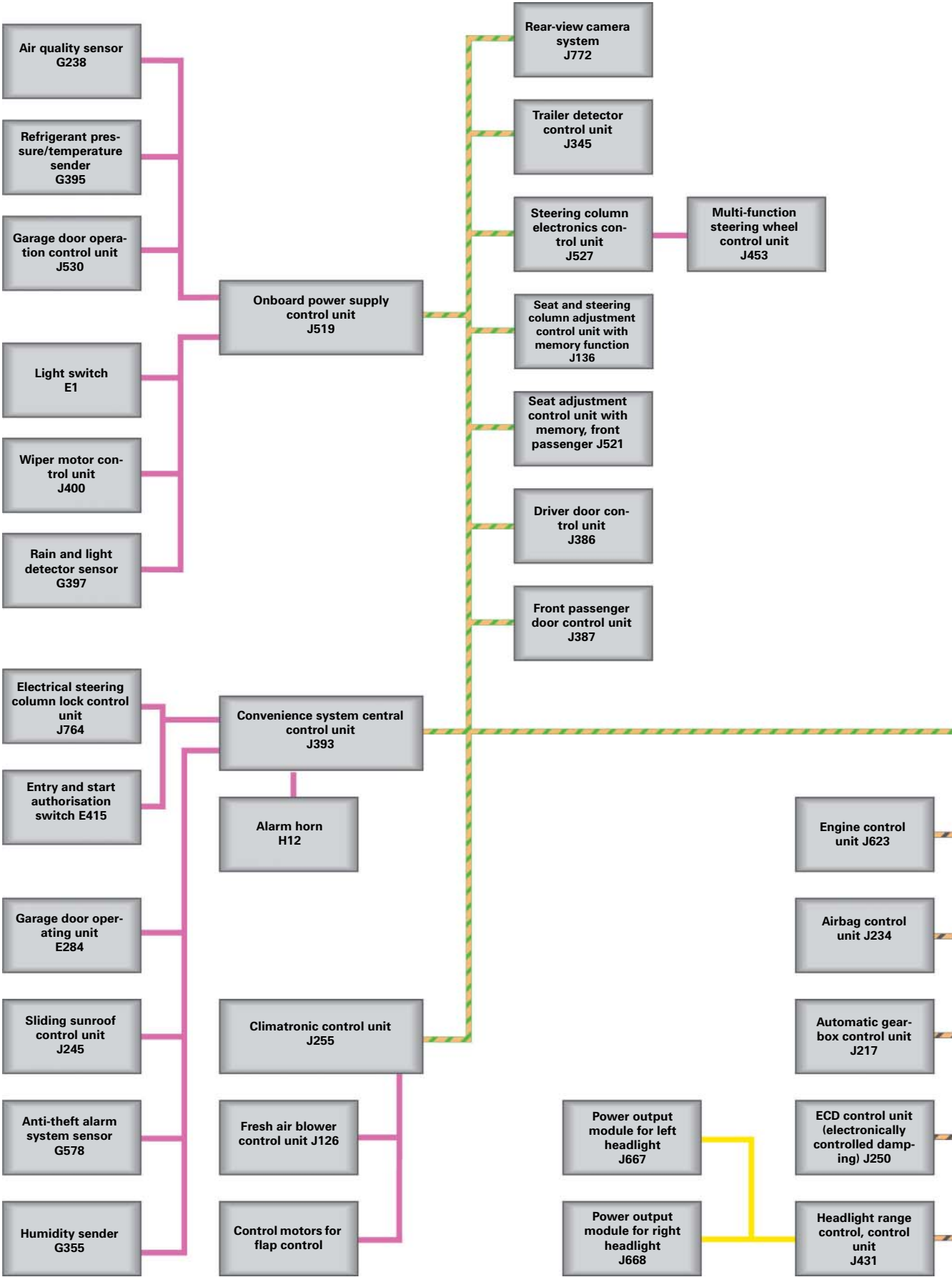
395_004

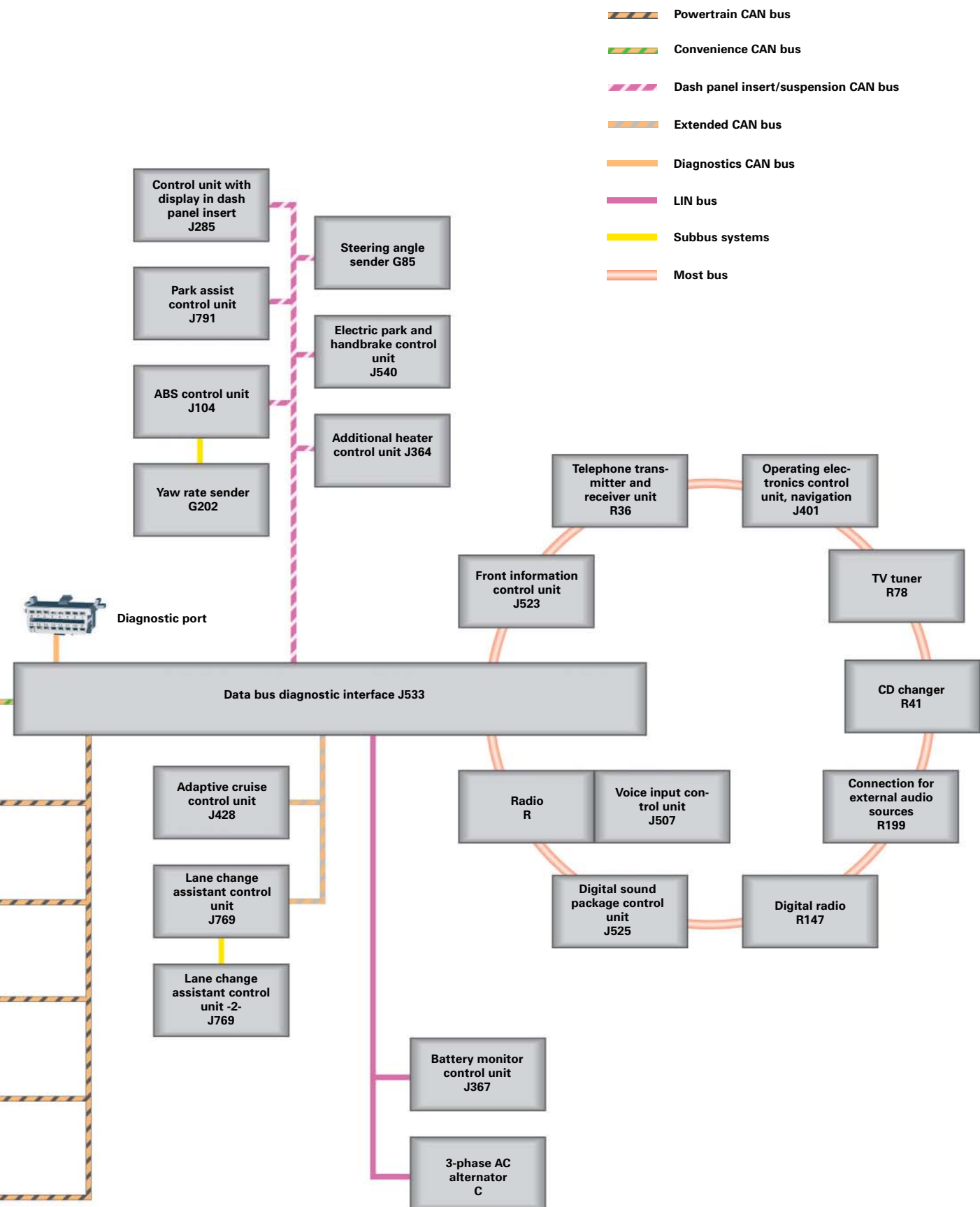
Networking / vehicles with infotainment CAN bus





Networking / vehicles with MOST bus



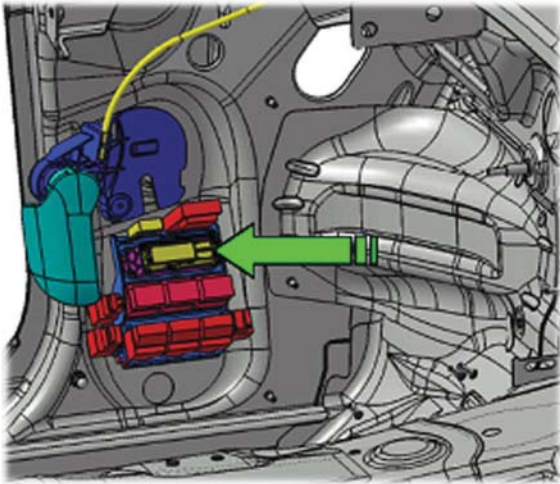


CAN node connectors

Installation location

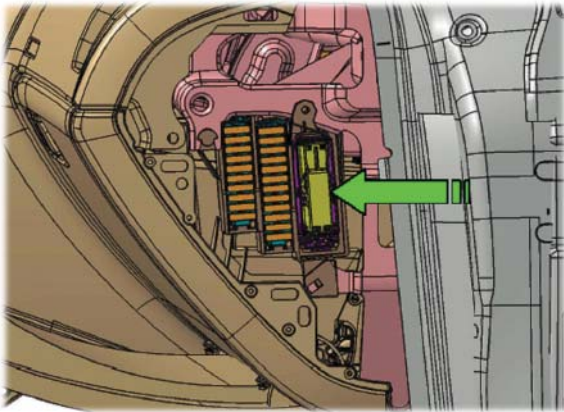
The CAN node connectors are located on the relay carrier on the left and on the fuse holder in the dash panel on the right.

Relay carrier, left



395_007

Fuse holder in dash panel on right

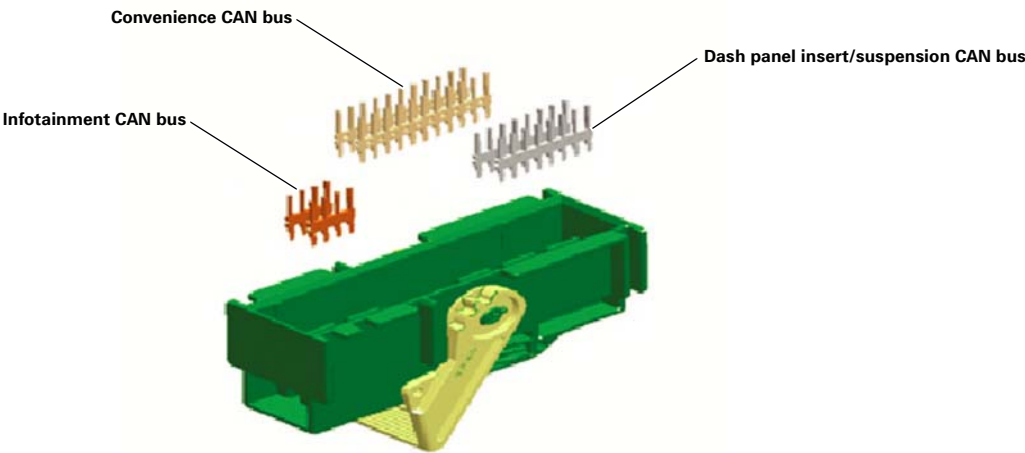


395_008

Assignments

The infotainment CAN bus, the convenience CAN bus and the dash panel insert / suspension CAN bus control units are connected to both CAN node connectors. The familiar CAN isolating adaptor V.A.G 1598/38 can be used for fault-finding. In this way, it is possible to access the data lines of the control units without removing trim parts or opening the wiring harness.

This reduces fault-finding time. The powertrain CAN and extended CAN bus systems are not connected to the node connectors. They are connected to the wiring harness by crimp connectors.



395_006

Diagnostics

To perform diagnostics on the Audi A5, the VAS testers require the basic CD 11.XX and the relevant branded CD by Audi.

This is because the data protocol (language) which several control units and the VAS tester use to interchange data has changed.

The tester must therefore be capable of processing both the "old" data protocol, Key Word 2000, and the "new" data protocol, UDS with ASAM/ODX.

The change of data protocol does not affect service personnel.

The Guided Fault Finding and Guided Functions programs can be used as before.

Again, data is exchanged between the vehicle and the tester via the diagnostics CAN bus.

The voltage level and the transmission speed on this CAN data bus have not changed.

For the first time, it is only possible to encode the control units on the Audi A5 with a tester connected online.

Encoding can no longer be performed without an active online connection.



395_022



395_026

UDS

Unified **D**iagnostic **S**ervices Protocol

ODX

Open Diagnostic **D**ata Exchange

ASAM

Association for **S**tandardization of **A**utomation and **M**easurement Systems

ASAM has been a registered German association since 1998.

J533 Data bus diagnostic interface (gateway)

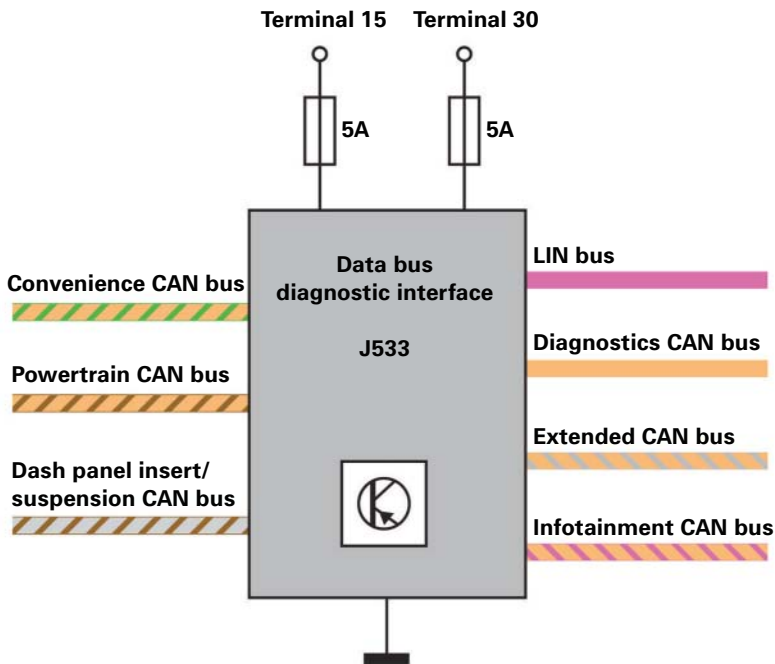


395_031

Introduction

The new Audi A5 has an independent data bus diagnostic interface J533. The diagnostic interface represents the link between the various CAN bus systems. Depending on specification, the vehicle has between 4 and 6 different onboard CAN bus systems:

- ▶ Diagnostics CAN bus
 - all Audi A5 models have one
- ▶ Powertrain CAN bus
 - all Audi A5 models have one
- ▶ Dash panel insert/suspension CAN
 - all Audi A5 models have one
- ▶ Convenience CAN bus
 - all Audi A5 models have one
- ▶ Infotainment CAN bus
 - an Audi A5 has either an infotainment CAN bus or the MOST optical bus system (depending on specification)
- ▶ Extended CAN bus
 - if the vehicle has one of the following optional extras:
 - ACC
 - lane change assist



395_016

New features

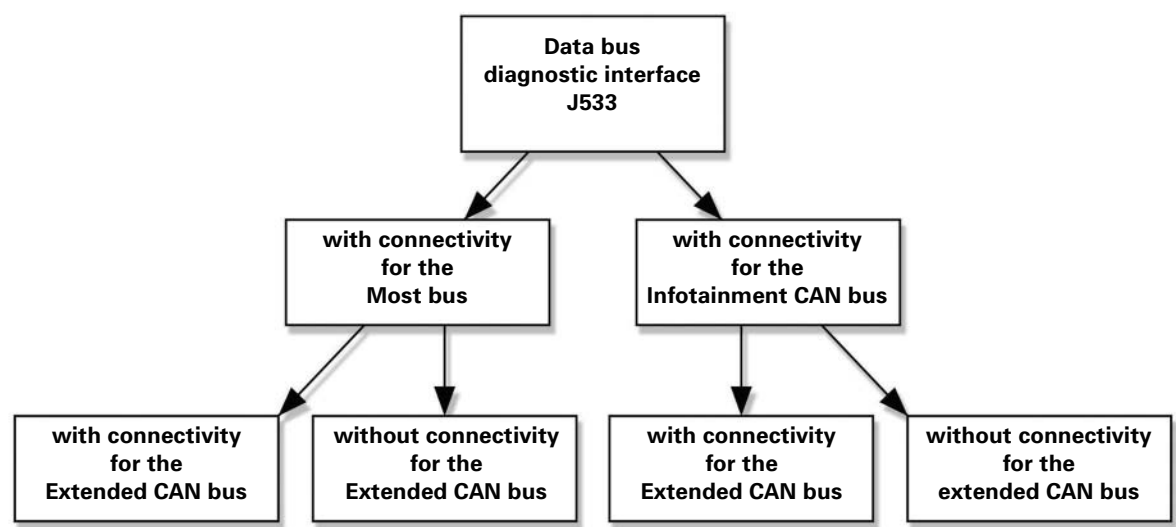
The data bus diagnostic interface now also includes a battery power management function. For this purpose, a LIN line is connected to a so-called "battery data module" located directly adjacent to the negative pole on the vehicle battery.

As a result, it has been possible to dispense with the wake-up line between the diagnostic interface and the control unit with display in dash panel insert, which are familiar from the gateways of other vehicles.

The control unit with display in dash panel insert J285 is now connected to the diagnostic interface together with various suspension control units via the dash panel insert/suspension CAN bus. This high-speed CAN bus has wake-up capability, which is why the line is no longer required.

Versions

In total, there are four different versions of the data bus diagnostic interface:



395_017

Address word

As on other Audi vehicles, the data bus diagnostic interface J 533 can be accessed via address word 19 using the VAS diagnostic testers.

Installation location

The data bus diagnostic interface on the Audi A5 is located behind the dash panel and can be accessed by removing the trim panels in the right footwell.

Control units

Extended adaption

The data bus diagnostic interface J533 has what is known as "extended adaption" capability. The adaption program can be used to start diagnostic routines and perform settings.

As in all other control units, manual encoding is no longer needed.

The following actions and settings can be performed using the "extended adaption" function:

- 1 Transport mode can be activated and deactivated.
- 2 Static current power-down stages can be set manually. This can be used to check for correct response of individual control units to preset power-down stages.
- 3 A quick static current measurement can be made. The measured actual static current is output through a data block and displayed on the diagnostic tester.
- 4 New battery parameters can be entered into the data bus diagnostic interface. This must be done after changing the battery and after replacing the diagnostic interface .
- 5 The battery data module is flashable. The battery data module is connected to the diagnostic interface via the LIN bus.
- 6 The light power of MOST bus users can reduced. This gives an indication of the ageing of the optical fibres.

Component protection function

The data bus diagnostic interface is the master for the component protection function. The task of the component protection function is to prevent the use of stolen control units in a different vehicle. All new control units with a component protection function must be adapted online using the diagnostic tester.

As with the immobiliser, the so-called Fazit database is used for this purpose. If a control unit is not adapted, it will only have limited operating capability.

Battery monitor control unit J367 (battery data module)

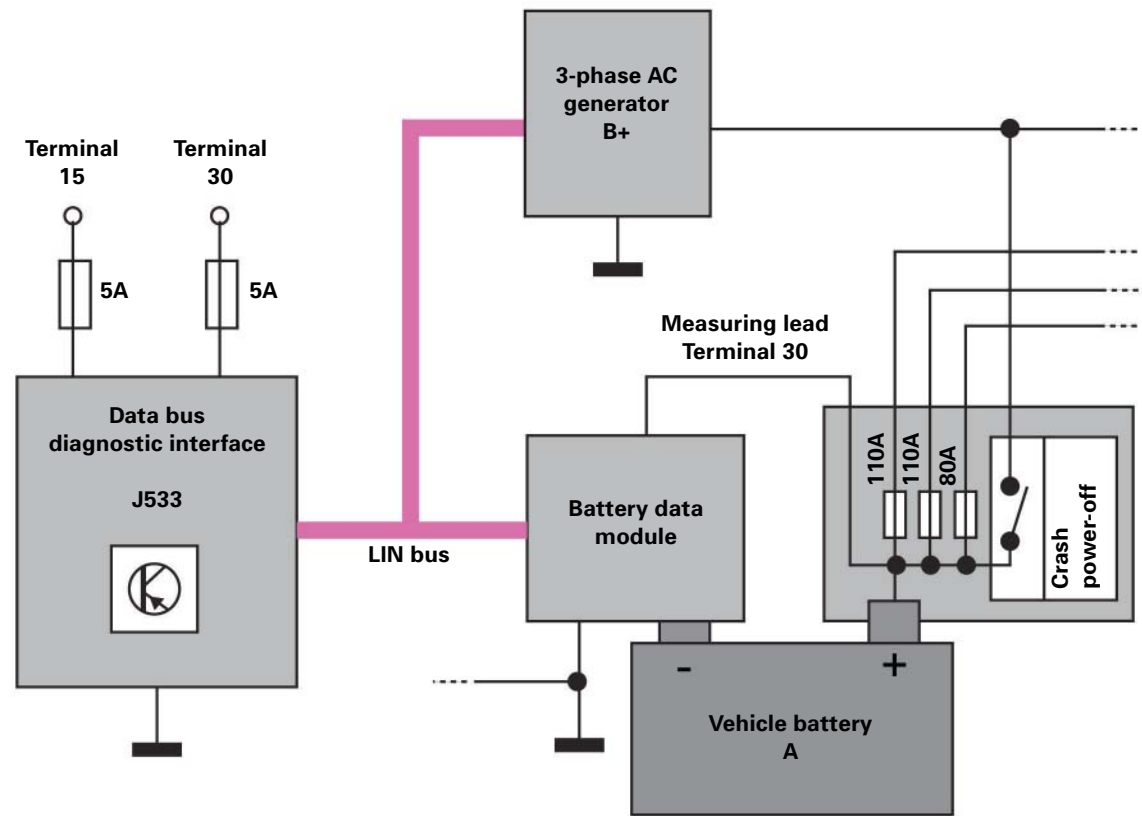
The battery data module measures the following parameters:

- Charging and discharge currents of the vehicle battery
- Battery voltage
- Battery temperature

These three parameters and other information which the module receives from the diagnostic interface via the LIN bus is required by the "Electronic Battery Sensor". This software computes the actual battery state and sends information to the LIN master, i.e. the data bus diagnostic interface.

"Quick static current measurement" capability has been implemented on the battery data module. This function is started using the diagnostic tester in the "extended adaption" mode of the data bus diagnostic interface J533. The measured static current is then indicated on the diagnostic tester. This function allows a quick static current measurement to be performed without the need for labour-intensive preparation of the vehicle.

The battery data module is flashable. The flash cycle is also started in the "extended adaption" mode of the data bus diagnostic interface. The new software is then transmitted to the battery data module via the diagnostic tester, the diagnostics CAN bus, the data bus diagnostic interface and the LIN bus.



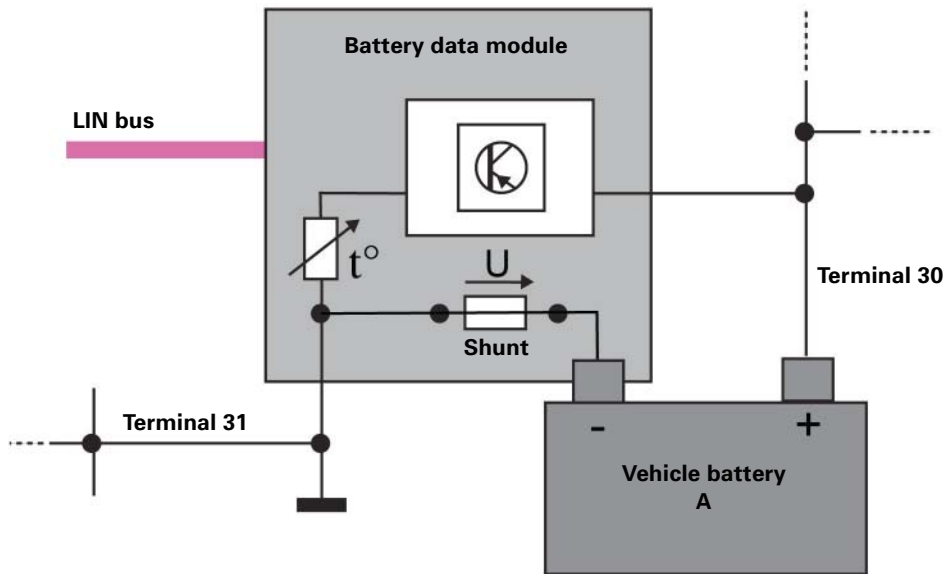
Functions of the Electronic Battery Sensor

The Electronic Battery Sensor in the battery data module computes the following parameters, which are transmitted to the data bus diagnostic interface J533 via the LIN bus:

- 1 "Battery down" recognition: if the battery data module fails to detect a battery for longer than 30s, a corresponding bit is set
- 2 The voltage currently required for optimal battery charging
- 3 The "engine start capability" bit (indicates whether the battery is presently capable of starting the engine or not)
- 4 How much charge can currently be withdrawn from the battery until the limit of engine start capability is reached
- 5 Actual battery state of charge
- 6 Battery ageing (ageing of the battery can be determined from parameters such as energy storage capacity and actual battery power)
- 7 Battery static voltage
- 8 Battery internal resistance

Design of the battery data module

The core of the battery data module is a CPU which determines the three measurands and communicates with the diagnostic interface.



395_019

Battery current measurement

The battery current is measured at the battery negative pole, to which the battery data module is also attached. The total current at the battery negative pole flows through the battery data module, or, to be precise, through a shunt resistor. The shunt resistor has a resistance in the milliohm range. This value must be so small as to minimise power loss, and therefore heat build-up.

The falling voltage at the shunt resistor is proportional to the electrical current. The CPU measures the voltage drop and can therefore compute the electrical current flowing back into the battery.

Battery voltage measurement

Battery voltage is monitored directly at the battery positive pole by voltage measurement.

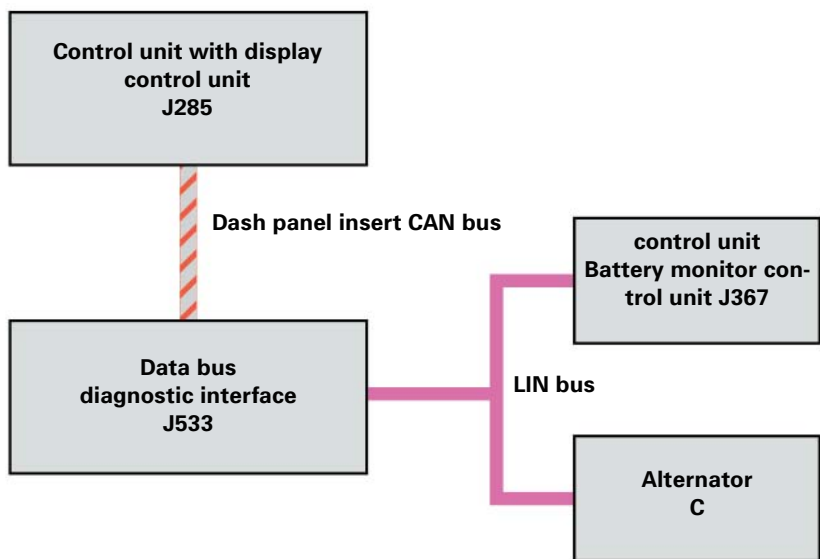
For this purpose, a measuring lead is routed from the positive pole to the battery data module.

Battery temperature measurement

The battery temperature is measured by an NTC temperature sensor in the battery module.

As the battery data module is attached directly to the battery, the battery temperature can be determined reliably via the NTC temperature sensor within the battery module and the data can be subsequently processed by the software.

Alternator



395_005

Data transfer

In addition to the battery data module, the alternator is the second LIN bus user on the data bus diagnostic interface J533. All data relevant to the status of the alternator is read in at J533 via the LIN connection.

The information which is required to activate the alternator warning lamp is provided by the data bus diagnostic interface J533 and read in by the dash panel insert CAN via the dash panel insert control unit J285.

Diagnostics

In case of problems with the alternator, the following components and terminals should be checked:

- Battery poles
- Ribbed vee belt voltage
- Alternator mounting
- Terminal 30 screw connection on alternator
- Offset between body earth and engine earth (= alternator earth)

Diagnostics

As the data bus diagnostic interface J533 is the master control unit for the alternator as a LIN bus user, the address word "19" must be selected for alternator diagnostics using the VAS tester. The data blocks contain information on the status of the alternator.
Among other things, the following information is displayed:

- Alternator communication status
- Alternator type, manufacturer and size
- Alternator status, electrical / mechanical / thermal

In the event of sporadic alternator faults, data is available in the following format in set 13 of the history data on the data bus diagnostic interface J533:

YYYY-MM-DD-hh:mm*I-J-K-L*RRR.R*AAAAA**
YYYY-MM-DD-hh:mm*I-J-K-L*RRR.R*AAAAA**
YYYY-MM-DD-hh:mm*I-J-K-L*RRR.R*AAAAA**
YYYY-MM-DD-hh:mm*I-J-K-L*RRR.R*AAAAA**
YYYY-MM-DD-hh:mm*I-J-K-L*RRR.R*AAAAA**
YYYY-MM-DD-hh:mm*I-J-K-L*RRR.R*AAAAA**

This means:

YYYY-MM-DD	= date
hh:mm	= time
I	= 1 means there was an electrical fault in the alternator = 0 means there was no electrical fault in the alternator
K	= 1 means there was a mechanical fault in the alternator = 0 means there was no mechanical fault in the alternator
L	= 1 means there was a thermal fault in the alternator = 0 means there was no thermal fault in the alternator
M	= continuously negative energy balances This means: the battery becomes discharged, as more electrical current is consumed than is supplied by the alternator
RRRR.R	= duration of last trip in hours
AAAAA	= number of data entries on sporadic faults

Battery / external starter connection

Installation location: in the spare-wheel recess in the luggage compartment

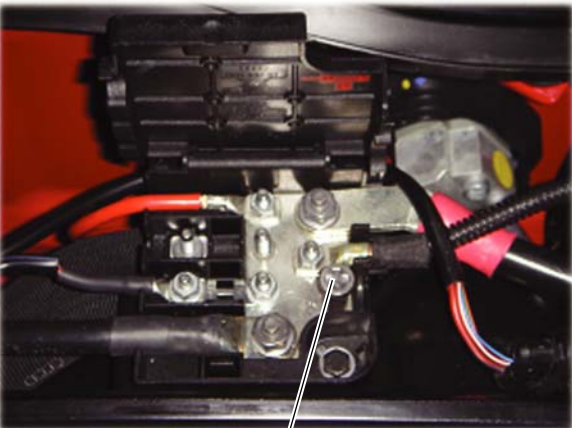


395_010

Depending on engine size and specification, batteries rated from 61Ah / 330A to 110Ah / 520A are used on the Audi A5.

For exact assignments to the associated spare part numbers, please refer to the electronic parts catalogue (ETKA) .

An external starter connection is installed in the plenum chamber. It is easily accessible and can be used for battery backup in the showroom.



Slave start connector in the plenum chamber



Earthing bolt in the plenum chamber

395_011

395_012

Onboard power supply control unit J519



395_009

Functions

The onboard power supply control unit J519 has the following functions on the Audi A5:

Lighting functions:

- ▶ Outside light master and activation of the front lights
- ▶ Emergency light operation logic in case of failure of the main central processor
- ▶ Plausibilised terminal 15: terminal 15 via CAN or terminal 15 via discrete line
- ▶ Reading in the rotary light switch via LIN bus connection
- ▶ Reading in the rain/ light sensor via LIN bus connection
- ▶ MMI gateway for tourist light
(implemented in the headlight range control, control unit J431)
- ▶ Activation of the front turn signals
(the turn signal master is the convenience electronics control unit J393)
- ▶ Activation of the side turn signals via the door control units
- ▶ Reading in the hazard warning button
- ▶ Emergency turn signal master (direction indicator function, hazard warning lights, flashing light collision warning) in case of failure of J393
- ▶ Interior lighting master (interior light, front and rear footwell lights)
- ▶ Function and locating lights (terminals 58s, 58st and 58d)

Control units

Driver information:

- ▶ Reading in the ambient temperature
- ▶ Reading in the oil pressure switch
- ▶ Reading in the brake pad wear warning
- ▶ Reading in the brake fluid warning
- ▶ Reading in the coolant warning
- ▶ Reading in the low washer fluid warning
- ▶ Reading in the light warning

Air conditioning functions:

- ▶ Activation of front seat heater
- ▶ LIN gateway for air quality sensor and refrigerant pressure sensor
- ▶ Activation of the air conditioner compressor

Windscreen wipe/wash functions:

- ▶ Activation of the wiper motor control unit J400 via LIN bus connection
- ▶ Reading in the rain/light sensor via LIN bus connection
- ▶ Activation of the windscreen washer pump
- ▶ Activation of the headlight washer pump

Interfaces to the convenience electronics control unit J393:

- ▶ Enabling of the electrical steering column lock (discretely and via CAN)
- ▶ Feedback from discrete terminal 15 (to J393 via CAN)
- ▶ Reading in the rear-window roller sun blind switch

Other functions:

- ▶ Activation of the signal horn relay
- ▶ Activation of the Servotronic valve
- ▶ Reading in the reversing light switch (discrete signal or CAN information for models with automatic gearbox)
- ▶ Reading in the forward gear selector
- ▶ Reading in the handbrake switch (CAN information from the electromechanical parking brake)
- ▶ Enabling the power supply to the electrical seat adjustment system (via external relay)
- ▶ Reading in the bonnet contact
- ▶ LIN gateway for garage door operation control unit J530
- ▶ Reading in settings via MMI (outside light, interior light, wiper)

Special functions:

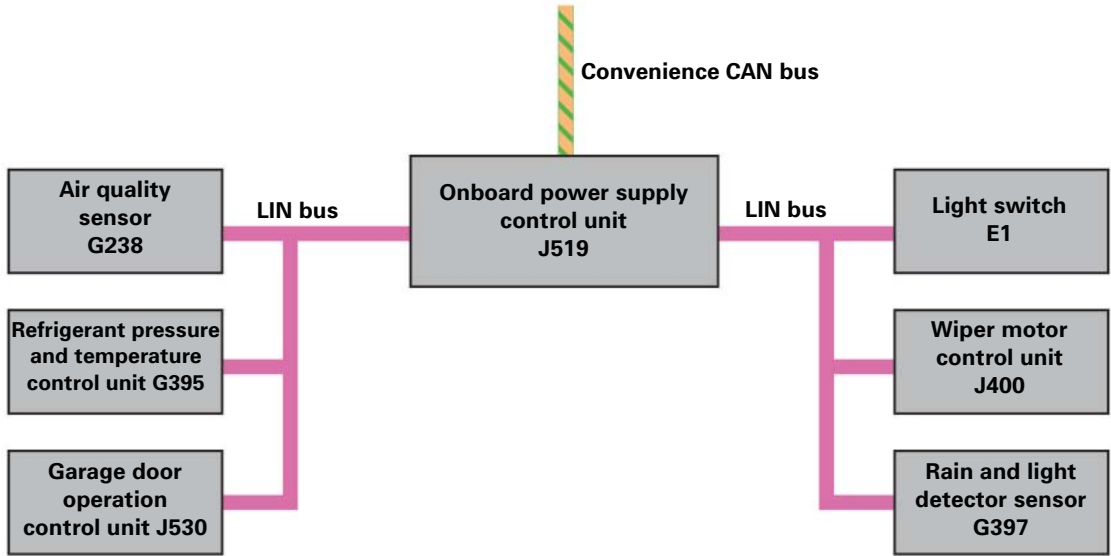
- ▶ Encoding option daytime driving light deactivated
- ▶ Energy management power-down stages
(interior light, footwell lights, Coming/Leaving Home, daytime driving light, main beam deactivated)
- ▶ Transport mode
(interior light, footwell lights, Coming/Leaving Home, daytime driving light, fog light)
- ▶ Component protection function

Control units

System overview

The onboard power supply control unit J519 is a convenience CAN bus user. It is the master control unit for the LIN bus users wiper motor control unit J400, the rain/light sensor G397, as well as light switch E1 for the first time.

The onboard power supply control unit performs a gateway function for the following LIN bus users: air quality sensor G238, refrigerant pressure/temperature sender G395 and the garage door operation control unit J530.



395_025

Address word

As on all other Audi vehicles, the onboard power supply control unit can be accessed via the address word 09 using the VAS diagnostic testers.

Installation location

The data bus diagnostic interface on the Audi A5 is located behind the dash panel and can be accessed by removing the trim panels in the left footwell.

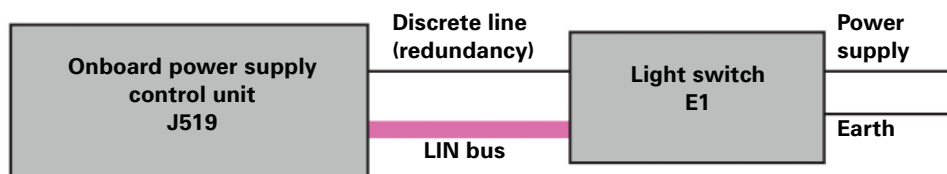
Light switch

Function

For the first time, light switch E1 is a LIN slave of the onboard power supply control unit.

The light switch has four electrical connections. In addition to the power supply and earth connections, there is a LIN bus connection and a discrete line leading to the onboard power supply control unit. The light switch indicates its switch position via the LIN bus.

The discrete line serves as a redundancy line for plausibilising the switch position. If the same switch position is not indicated to the onboard power supply control unit via both lines, the onboard power supply control unit activates the emergency light function. The following entry appears in the fault memory: "Light switch implausible switch position".



395_024

Wiper motor control unit

The wiper motor control unit J400 is already known from other Audi models. The following functions have been implemented on the Audi A5:

- ▶ Alternating wiper blade parking position
- ▶ Engine speed reduction at reversing points
- ▶ Intermittent control via rain sensor
- ▶ "Teardrop" (afterwipe) function
- ▶ Snow load protection
- ▶ One-level wiping speed reduction when vehicle stops
- ▶ Flick wipe is speed setting 2
- ▶ Service position for wiper blade replacement

Control units

Outside lights, front

Headlights

A distinction is generally made between three variants on the Audi A5:

- ▶ Halogen headlights
- ▶ Bi-xenon headlights
- ▶ Bi-xenon headlights with adaptive light

Arrangement of the front lamps on the halogen headlight variant



395_013

The following bulbs are used on the halogen headlight variant:

12 V bulb	Type	Rated power
Side light	W5WH	5 watts
Low-beam headlight	H 7	55 watts
Main-beam headlight	H 7	55 watts
Turn signal	PY24W	24 watts
Sidemarker (SAE **)	W5WH	5 watts

* ECE variant for the European market

** SAE variant for the North American market

Arrangement of the front lights on the bi-xenon headlight and bi-xenon headlight with adaptive light variants



395_014

The following bulbs are used on the bi-xenon headlight variant:

12 V bulb	Type	Rated power
Side light	W5WH	5 watts
Low-beam headlight	D3S	35 watts
Main-beam headlight	D3S	35 watts
Turn signal	H21W	21 watts
Sidemarker (SAE**)	W5WH	5 watts
Daytime driving lights	8 LEDs	

* ECE variant for the European market
** SAE variant for the North American market

Light bulb replacement

To replace the bulbs, it is necessary to remove the headlight. This can be done using a screwdriver with Torx blade included in the car tool kit. In the case of the halogen headlight, no provision has been made for replacement of the turn signal bulb by the customer.

In the case of the bi-xenon headlight, the turn signal bulb and the side light bulbs can be replaced by the customer. Please observe the safety instructions in the current service literature for handling gas discharge lamps.

Control units

Fog lights

The fog lights on the Audi A5 are integrated in the bumper. After removing the grille and undoing the 2 Torx screws, the fog lights can be removed and the bulb replaced. A 55 watt H11 bulb is used.



395_021

Sidelight

The side turn signal uses LED technology and is housed in the door mirror housing. The side turn signal is activated by the respective door control unit. The side turn signal and the electrically adjustable outer mirror glass drive motor can be replaced individually in the service workshop.

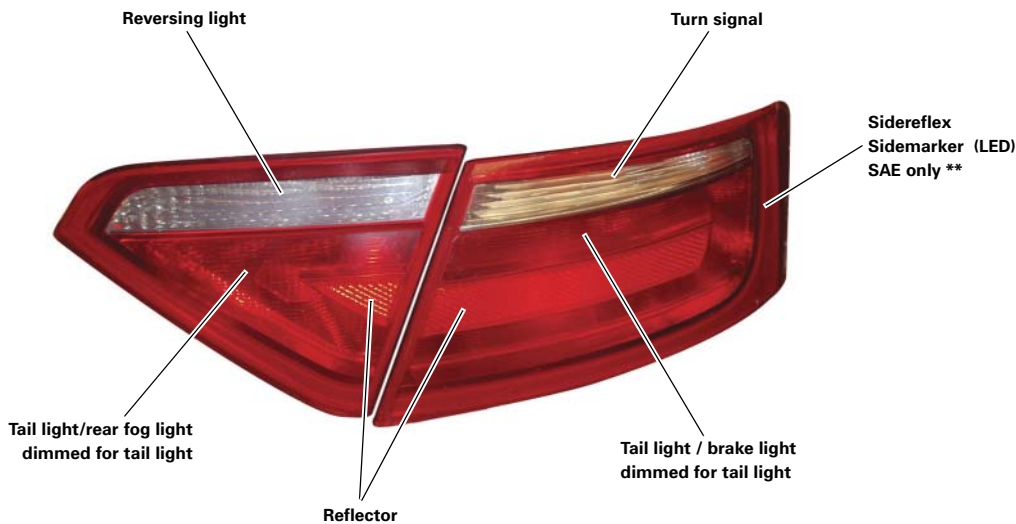


395_020

Outside lights, rear

Tail lights

The tail lights on the Audi A5 are of four-piece design, with two light assemblies in the boot lid and two light assemblies in the body side panels.



395_023

The following bulbs are used on the tail lights:

12V bulb	Type	Rated power
Reversing light	W16W	16 watts
Turn signal	W16W	16 watts
Tail light	P21W	21 watts (dimmed)
Rear fog light	P21W	21 watts
Brake light	P21W	21 watts
Sidemarker (SAE only **)	LED	

** SAE variant for the North American market

Light bulb replacement

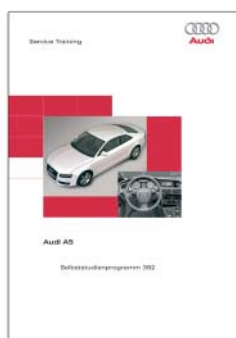
For replacement of the bulbs, there is a maintenance flap on the boot lid trim through which access can be gained to the tail light bulbs in the boot lid.

The tail lights in the body side panels must be removed to replace the light bulbs. This can be done by removing the mounting bolt in the side panel and taking the lamps out of the body side panel.

Self-study programmes relating to the Audi A5

The following self-study programmes have been prepared for the Audi A5:

- SSP 392 Audi A5
- SSP 393 Audi A5 - Convenience Electronics and Driver Assist Systems
- SSP 394 Audi A5 - Suspension
- SSP 395 Audi A5 - Networking



SSP 392 Audi A5

- Body
- Occupant protection
- engine
- Gearboxes
- Suspension system
- Electrical systems
- Infotainment
- Air conditioning
- Service
- Diagnosis

Order number: A07.5S00.34.20



SSP 393 Audi A5 - Convenience Electronics and Driver Assist Systems

- Dash panel insert
- Door control unit
- Convenience system control unit
- Electronic ignition lock
- Audi Service Key

Order number: A07.5S00.35.20



SSP 394 Audi A5 - Suspension

- Front axle
- Rear suspension
- Brake system
- Steering system

Order number: A07.5S00.36.20



SSP 395 Audi A5 - Networking

- Networking / topology
- Battery monitoring
- Onboard power supply control unit
- Outside lights

Order number: A07.5S00.37.20

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