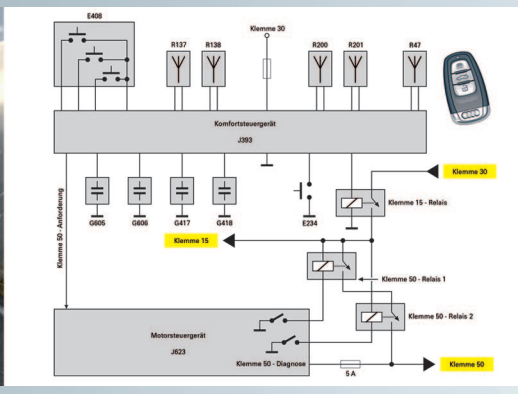
Self-study programme 483



Audi A7 Sportback

Convenience electronics and Audi active lane assist

Audi
Service Training

Introduction

On his first outing with an Audi A7 Sportback, the driver might well have to face the challenge of finding the ignition lock in the vehicle. However, no matter how closely he looks, he won't find one!

In the Audi A7 Sportback, for the first time a model from Audi will no longer require an ignition lock from the outset. A keyless starting system, frequently also referred to as Keyless Go, has become standard equipment.

Pressing the start-stop button in the centre console starts the engine. This feature is familiar from the Advanced Key optional extra in other models. A Keyless Entry system is offered as an option, the ideal supplement to the keyless starting system.

Another highlight in the Audi A7 Sportback is the introduction of the new Audi active lane assist. This new generation of the lane departure warning intervenes in steering to prevent the driver from leaving his driving lane inadvertently. Depending on the set mode, continuous steering interventions are initiated with the aim of keeping the vehicle in the centre of the lane - or only when the vehicle approaches lane boundary lines - and drawing the driver's attention to what might be an inadvertent departure from the lane.

If enabled in the MMI, a warning for the driver by means of a vibrating steering wheel is also available to the customer in the new generation of the lane departure warning.

It has been possible to implement Audi active lane assist by deploying an electromechanical steering system in the Audi A7 Sportback.

483_002

Contents

Topology of the Audi A7 Sportback

Convenience electronics

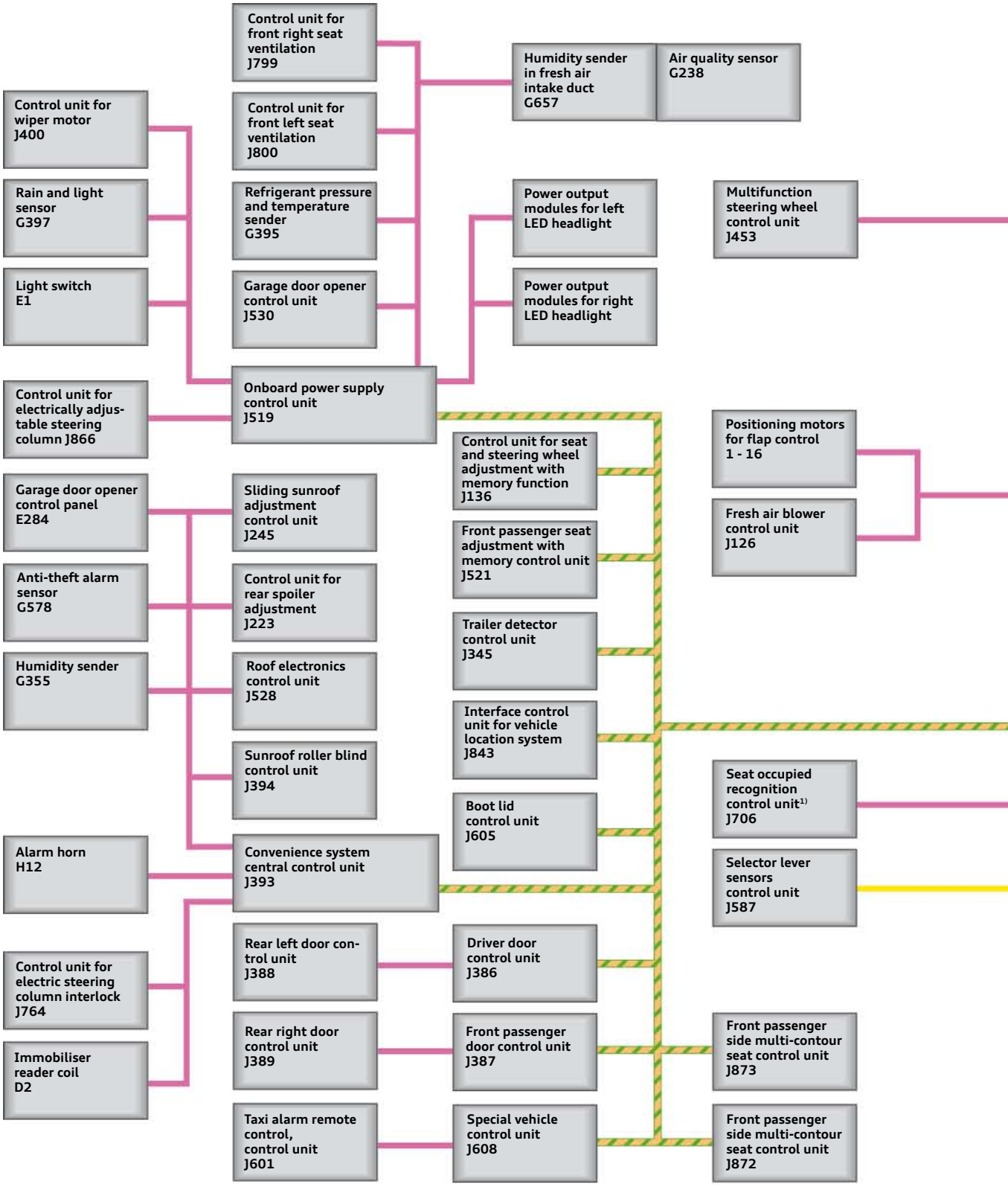
Audi active lane assist

▸ The self-study programme describes the fundamentals of the design and function of new vehicle models, new automotive components or new technologies.
The self-study programme is not a Repair Manual! Any figures quoted merely serve the purpose of facilitating understanding and relate to the version of data valid at the time the SSP was produced.
It is essential that you refer to the latest technical literature when carrying out maintenance and repair jobs. You will find an explanation of terms that are printed in italics and marked with an asterisk in the glossary at the end of this self-study programme.

Note

Reference

Topology of the Audi A7 Sportback



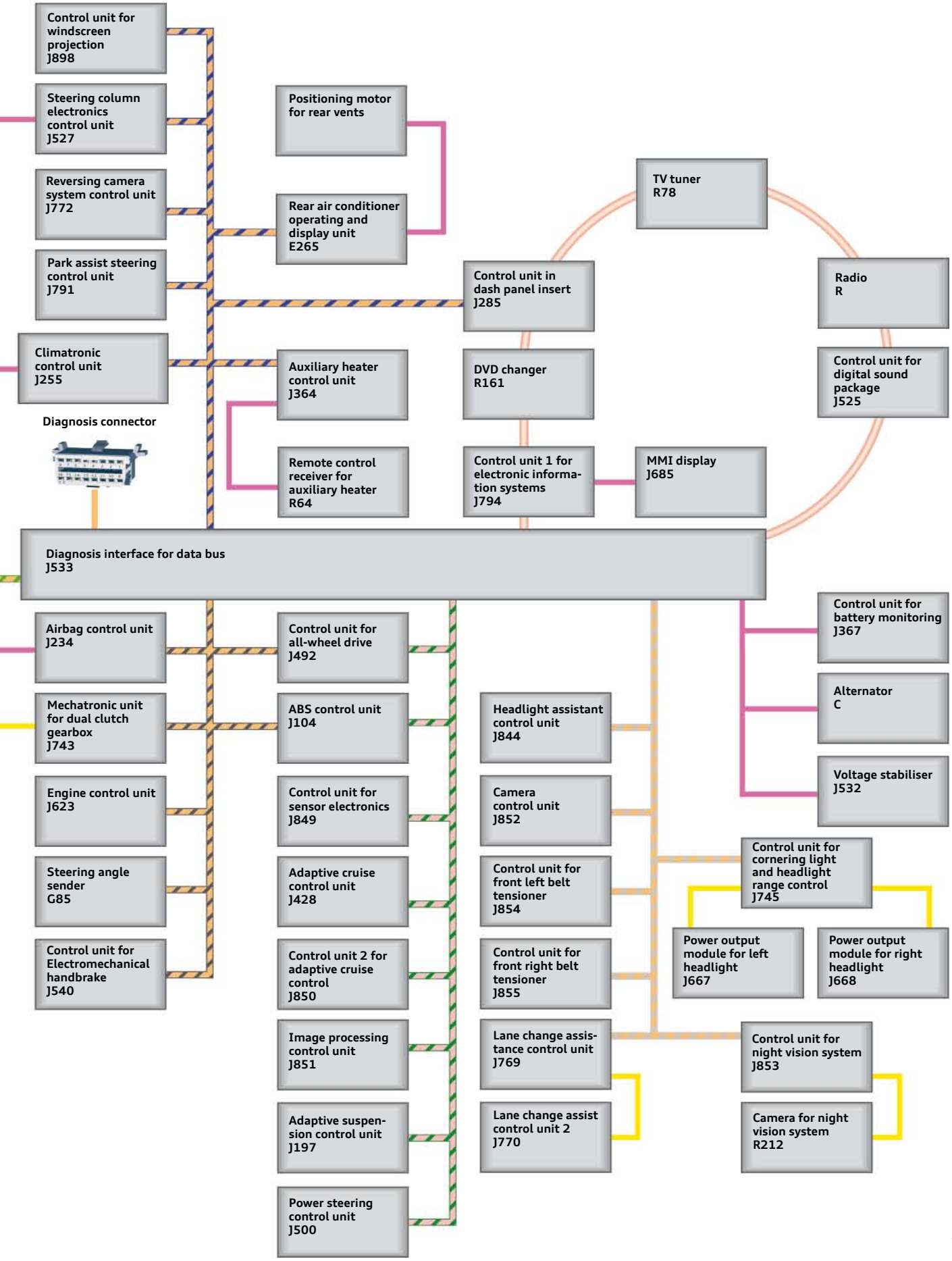
Key:

- Drivetrain CAN
- Comfort/convenience CAN
- Extended CAN
- Display and control CAN
- Diagnosis CAN
- FlexRay
- MOST bus
- LIN bus
- Sub-bus systems

The diagram shows the network topology for a vehicle with an extensive level of optional equipment.

Some of the control units listed are equipment that is optional or specific to particular national markets.

1) only specific markets


Control unit for windscreen projection J898
Steering column electronics control unit J527
Reversing camera system control unit J772
Park assist steering control unit J791
Climatronic control unit J255
Diagnosis connector
Positioning motor for rear vents
Rear air conditioner operating and display unit E265
Auxiliary heater control unit J364
Remote control receiver for auxiliary heater R64
TV tuner R78
Control unit in dash panel insert J285
DVD changer R161
Control unit 1 for electronic information systems J794
MMI display J685
Radio R
Control unit for digital sound package J525
Diagnosis interface for data bus J533
Airbag control unit J234
Mechatronic unit for dual clutch gearbox J743
Engine control unit J623
Steering angle sender G85
Control unit for Electromechanical handbrake J540
Control unit for all-wheel drive J492
ABS control unit J104
Control unit for sensor electronics J849
Adaptive cruise control unit J428
Control unit 2 for adaptive cruise control J850
Image processing control unit J851
Adaptive suspension control unit J197
Power steering control unit J500
Headlight assistant control unit J844
Camera control unit J852
Control unit for front left belt tensioner J854
Control unit for front right belt tensioner J855
Lane change assistance control unit J769
Lane change assist control unit 2 J770
Control unit for battery monitoring J367
Alternator C
Voltage stabiliser J532
Control unit for cornering light and headlight range control J745
Power output module for left headlight J667
Power output module for right headlight J668
Control unit for night vision system J853
Camera for night vision system R212

481_001

Convenience electronics

Control unit in dashboard module J285

The instrument cluster in the Audi A7 Sportback is available in two different equipment variants:

- a base version with a monochrome 5-inch display for the driver information system

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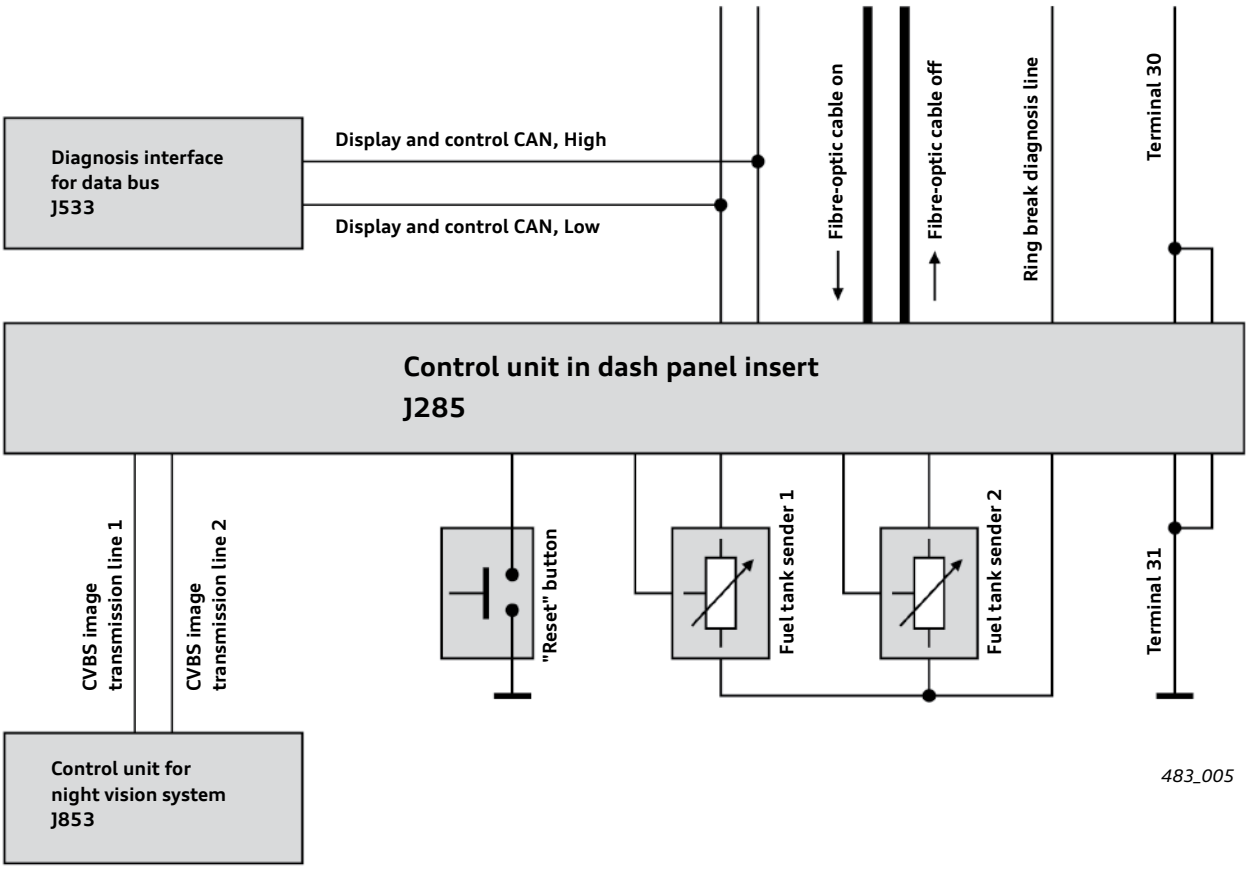
- and a higher-level variant with a 7-inch colour display for the driver information system

483_004

Components and lines connected to the instrument cluster



In the last few years, the number of components connected to the instrument cluster (control unit in dash panel insert J285) has fallen from one model to the next. The aim has been to make the instrument cluster what it originally used to be: purely a display instrument and not an evaluation unit for sensors. Many sensors that used to be evaluated by the control unit in dash panel insert J285 are now connected to other control units such as the control unit for onboard cable network J519 and the engine control unit J623.

The only two sensors that are still connected to the instrument cluster are the two fuel tank senders. The software for calculating the tank level is integrated in the control unit in the dash panel insert J285. Otherwise, only the reset button for resetting the trip recorder requires a mention; this is also read in by the instrument cluster.

All other lines to the instrument cluster are either bus or voltage supply lines.

To display high-quality navigation graphics, the instrument cluster is connected to the MOST bus, as was the case in the Audi A8 '10. For diagnostic reasons, a ring break diagnosis line also leads to the instrument cluster in order to be able to quickly pinpoint the cause in the event of failure of the MOST bus. Two other bus lines come from the control unit for night vision assistant J853; the image of the night vision assistant is transmitted across these lines.

To conclude, there are two more CAN bus lines that enable data interchange with other control units. The control unit in dash panel insert J285 is connected to the display and control CAN.

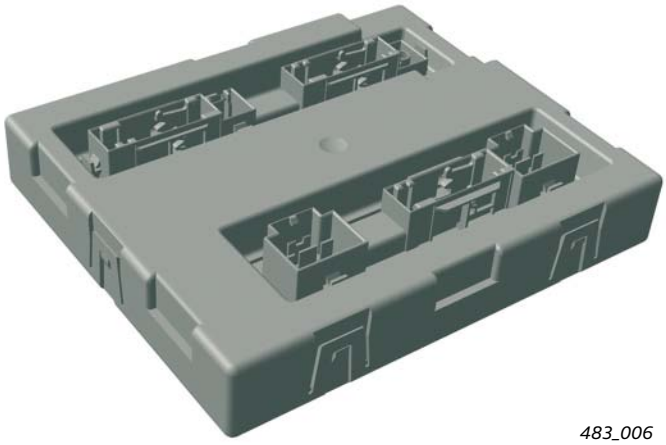
Comfort/convenience system control unit J393

Connections at the comfort/convenience system control unit J393

Power supply	▸ Three separately protected "terminal 30" inputs ▸ Two "terminal 31" lines
Bus lines	▸ Two comfort/convenience CAN lines ▸ LIN bus line to alarm horn H12 ▸ LIN bus line to electronic steering column lock control unit J764 and to the coil for the immobiliser D2 ▸ LIN bus line to the electric rear spoiler, sender for atmospheric humidity, anti-theft alarm sensor, interior light module and garage door opener control panel
Inputs	
Switches and buttons	▸ Brake light switch ▸ Grasp switch (softtouch) in the boot lid ▸ Boot lid contact prelock and boot lid contact full lock ▸ Start / stop button (for switching ignition and engine on and off) ▸ Clutch pedal switch (only in the case of vehicles with manual gearboxes) ▸ Gear selector positions "P" and "N" (only in the case of vehicles with automatic gearboxes) ▸ Microswitch for power latching, position "boot lid retracted" ▸ Microswitch for power latching, position "boot lid extended"
Signals, sensors and aerials	▸ Enable signal from electronic steering column lock control unit J764 to switch on terminal 15 ▸ Sensor for rear window break ▸ Sensors for outside door handle contact in each vehicle door ▸ Aerial for central locking
Outputs	
Relays	▸ Terminal 15 relay ▸ Electric socket relay ▸ Relay for rear window heater
Lights and LEDs	▸ Tail lights in the boot lid, left and right ▸ Brake lights in the boot lid, left and right ▸ Turn indicators in the boot lid, left and right ▸ Rear fog lights in the boot lid, left and right ▸ Tail lights in the side wall, left and right ▸ Brake lights in the side wall, left and right ▸ Turn indicators in the side wall, left and right ▸ Reversing lights in the side wall, left and right ▸ Raised brake light ▸ Number plate light ▸ Luggage compartment lights, left and right
Actuators	▸ Central locking motor in the boot lid ▸ Rear roller blind motor ▸ Power latching motor for boot lid ▸ Positioning element for fuel filler flap ▸ Motor for electrical steering column interlock
Signals, terminals and supply voltages	▸ "Terminal 50" request to engine control unit

Control unit hardware

The comfort/convenience system control unit familiar from the Audi A8 '10 is fitted in the Audi A7 Sportback. The control unit also has the same part number (4H0.907.064) as the comfort/convenience system control unit J393 of the Audi A8. The vehicle model in which the control unit is fitted is defined in the encoding.



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Place of installation of the comfort/convenience system control unit J393

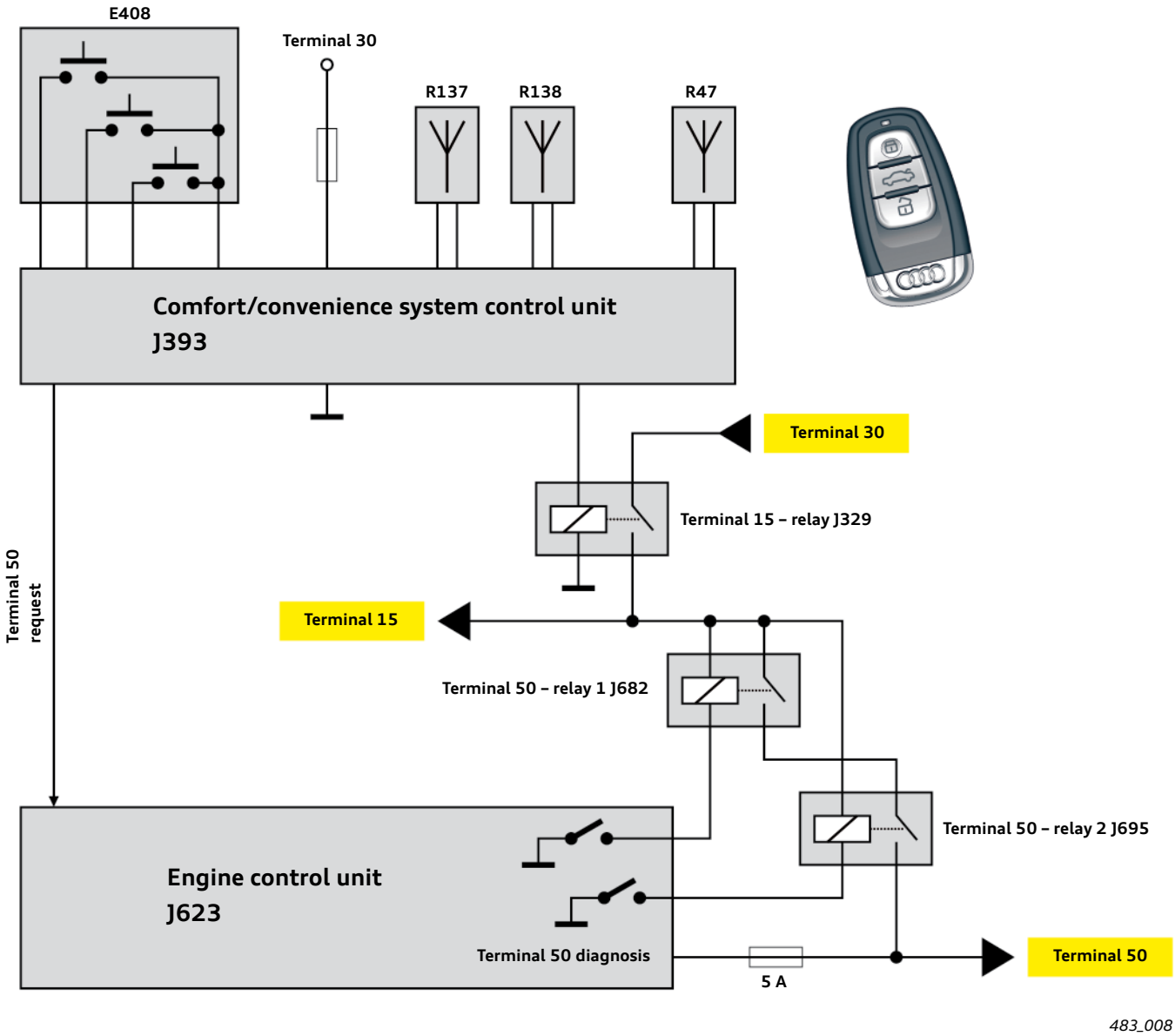
In the Audi A7 Sportback, the comfort/convenience system control unit J393 is located in the luggage compartment on the rear right behind the side trim.

483_007

Keyless starting system

The Audi A7 Sportback is the first model from Audi that has a series standard keyless starting system from the outset. This fact means that the vehicle can only be started using the start-stop button; an ignition lock is no longer fitted.
At an extra charge, the Keyless Entry system can be purchased as a good supplement to the keyless starting system. In other models, these two systems are only available together under the designation "Advanced Key".

For safety reasons, the start-stop button (entry and start authorisation switch E408) is designed with three microswitches. On pressing the button, all three microswitches are actuated and read in individually by the comfort/convenience system control unit. A defective microswitch would therefore not lead to failure of the entire system. If at least two microswitches are detected as actuated, this is interpreted as a start request from the driver and the engine start is initiated and/or the ignition is turned on.



483_008

Key:

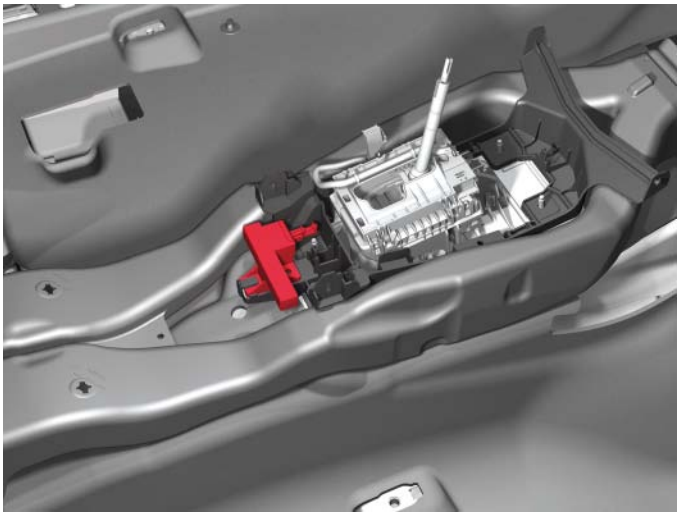
E408 ... entry and start authorisation switch

R47 ... aerial for central locking
R137 ... luggage compartment aerial for entry and start authorisation
R138 ... interior aerial 1 for entry and start authorisation

The keyless starting system in the Audi A7 Sportback requires the following two interior aerials:

Interior aerial 1 for entry and start authorisation R138

Place of installation:
In the centre console below the MMI control panel



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Luggage compartment aerial for entry and start authorisation R137

Place of installation:
In the luggage compartment at the rear trim plate

483_010

Sequence of a starting cycle:

1. The driver actuates the start-stop button E408.
2. The comfort/convenience system control unit J393 registers the button actuation by reading in the three microswitches.
3. The comfort/convenience system control unit activates the two interior aerials R137 and R138 with a temporal offset.
4. The key in the vehicle interior receives the messages from the two aerials and measures their reception intensity.
5. The key transmits a message with the two reception intensities, the key identification and information on the secret immobiliser code of the key.
6. The comfort/convenience system control unit receives the key message via the aerial for central locking R47.
7. The comfort/convenience system control unit checks the key message as to whether the transmitting vehicle key has the correct secret immobiliser code.
8. The comfort/convenience system control unit checks on the basis of the transferred reception intensities whether the transmitting vehicle key is located within the vehicle (including luggage compartment).
9. If the switch-on conditions for terminal 15 are met, the terminal 15 relay is activated.
10. The engine control unit receives a terminal 50 request via the CAN bus and via a discrete line.
11. If the conditions for starting the engine have been met, the engine control unit activates the two terminal 50 relays.
12. The starter motor is energised, engages and sets the vehicle engine in motion.
13. If the engine speed exceeds a threshold value, fuel injection begins; the engine control unit assumes engine management and terminates activation of the two terminal 50 relays; the internal combustion engine runs.

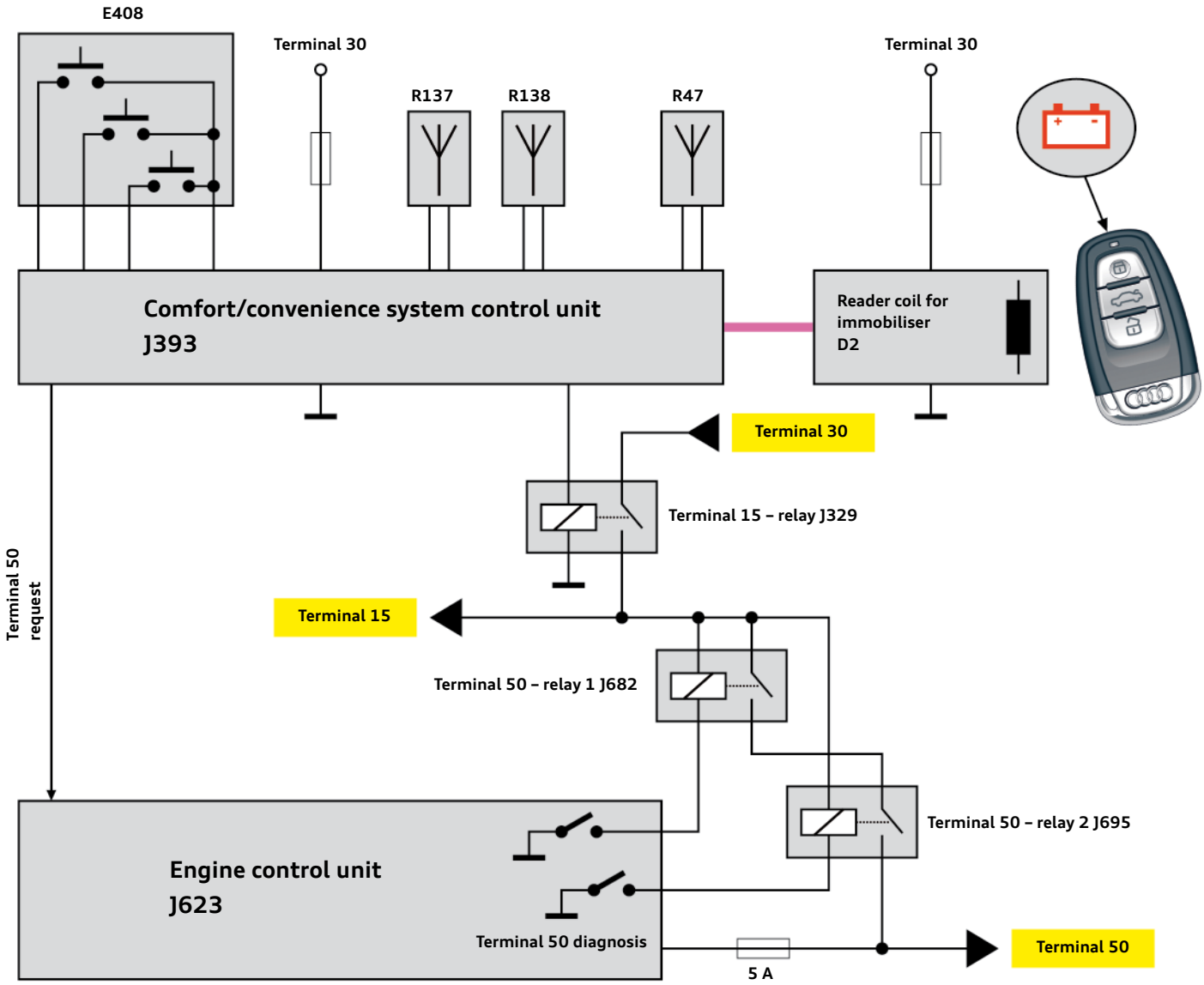
Vehicle start via emergency transponder coil

The elimination of the ignition lock in the Audi A7 Sportback made it necessary to develop an emergency start facility that enables a vehicle start in the event of certain technical problems.

To achieve this, a LIN participant was developed. It is connected to the comfort/convenience system control unit and contains a transponder coil. As it is only used in exceptional cases, it is referred to as an emergency transponder coil. In Audi Service, it is designated the "immobiliser reader coil D2".

The immobiliser reader coil D2 is required to start the vehicle in the event of the following failures:

- The battery in the vehicle key is flat
- One of the two interior aerials is no longer available
- The aerial for central locking R47 is defective
- Local disruption on the HF radio signals (e.g. by a jamming transmitter of the same frequency)



483_011

Key:

E408 ... entry and start authorisation switch

R47 ... aerial for central locking
R137 ... luggage compartment aerial for entry and start authorisation
R138 ... interior aerial 1 for entry and start authorisation

Vehicle start via the immobiliser reader coil D2

As an example, the vehicle start in the case of a flat key battery is explained:

1. The driver actuates the start-stop button E408.

2. The comfort/convenience system control unit J393 registers the button actuation by reading in the three microswitches.

3. The control unit J393 activates the two interior aerials R137 and R138 with a temporal offset.

4. If the comfort/convenience system control unit has not received a response from a vehicle key within a prescribed time window, the following steps are initiated:

   - The instrument cluster issues the following message:

483_012

   - At the same time, the immobiliser reader coil D2 is activated via LIN bus

5. If the vehicle key is now held at the marking of the emergency transponder coil, it transfers its secret immobiliser code. The vehicle key must be held in the position at the marking as shown in the diagram. Deviations from this can mean that the key information cannot be read out.

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6. The secret immobiliser code is sent via LIN bus to the comfort/convenience system control unit and evaluated there.
7. If the switch-on conditions for terminal 15 are met, the terminal 15 relay is activated and the ignition is switched on.
8. The engine control unit receives a terminal 50 request via the CAN bus and via a discrete line.
9. If the conditions for starting the engine have been met, the engine control unit activates the two terminal 50 relays.
10. The starter motor is energised, engages and sets the vehicle engine in motion.
11. If the engine speed exceeds a threshold value, fuel injection begins; the engine control unit assumes engine management and terminates activation of the two terminal 50 relays; the internal combustion engine runs.

Advanced Key

The Advanced Key function is offered in the Audi A7 Sportback as an optional extra. The keyless entry system is a good supplement to the series standard keyless starting system.

Four aerials for entry and start authorisation are required for the keyless entry and starting system.

In comparison with standard equipment, the following two additional aerials are fitted with the Advanced Key:

Left aerial for entry and start authorisation R200

Place of installation:
in the left-hand rear door

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Right aerial for entry and start authorisation R201

Place of installation:
in the right-hand rear door

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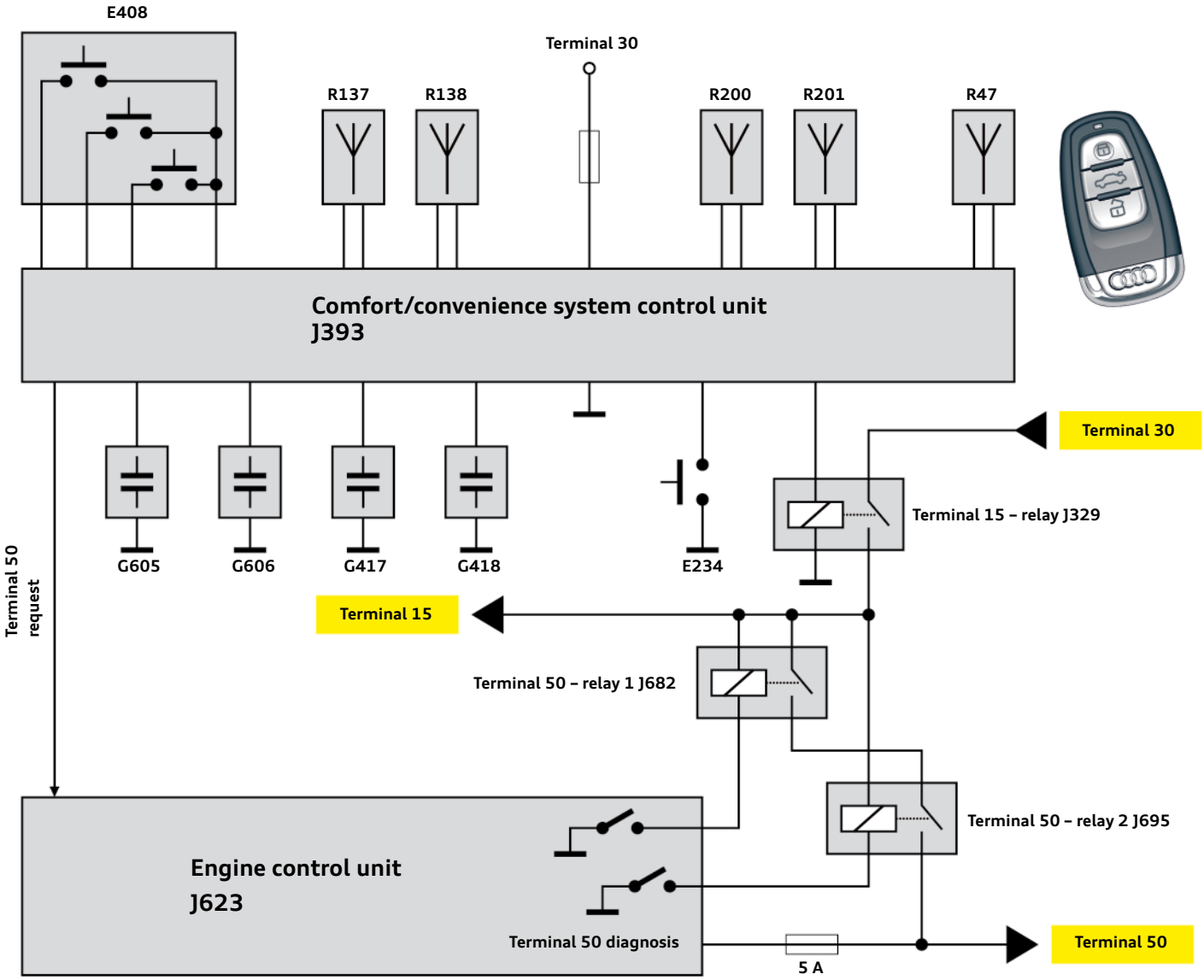
Unlocking the vehicle with Advanced Key

As an example, unlocking the vehicle via the door handle in the driver's door is explained here:

1. The driver grips the door handle of the driver's door.
2. The comfort/convenience system control unit recognises the action of the driver via the contact sensor for front left exterior door handle G605.
3. With a temporal offset, the control unit J393 activates the four aerials for entry and start authorisation R137, R138, R200 and R201.
4. A key that has been adapted to the vehicle that is in the vehicle or in the immediate vicinity of the vehicle receives the messages of the four aerials and measures their reception intensities.
5. The key transmits a message with the four reception intensities, the key identification and information on the secret immobiliser code of the key.
6. The comfort/convenience system control unit receives the key message via the aerial for central locking R47.
7. The comfort/convenience system control unit checks whether the transmitting vehicle key has the correct secret immobiliser code.
8. The comfort/convenience system control unit checks on the basis of the received reception intensities whether the sending vehicle key is in the immediate vicinity of the driver's door outside of the vehicle.
9. If the conditions for unlocking the vehicle are met, the corresponding messages are placed on the comfort/convenience CAN and the vehicle is unlocked.



483_016

Key:

E234 ... button for unlocking in the boot lid handle
E408 ... entry and start authorisation switch

G417 ... contact sensor for rear left door exterior handle
G418 ... contact sensor for rear right exterior door handle
G605 ... contact sensor for front left exterior door handle
G606 ... contact sensor for front right exterior door handle

R137 ... luggage compartment aerial for entry and start authorisation
R138 ... interior aerial 1 for entry and start authorisation
R200 ... left aerial for entry and start authorisation
R201 ... right aerial for entry and start authorisation

Electric rear spoiler adjustment

As series standard, the Audi A7 Sportback has an electrically adjustable rear spoiler. The control of the rear spoiler is assumed by the control unit for rear spoiler adjustment J223 which is connected via a LIN bus to the comfort/convenience system control unit J393.

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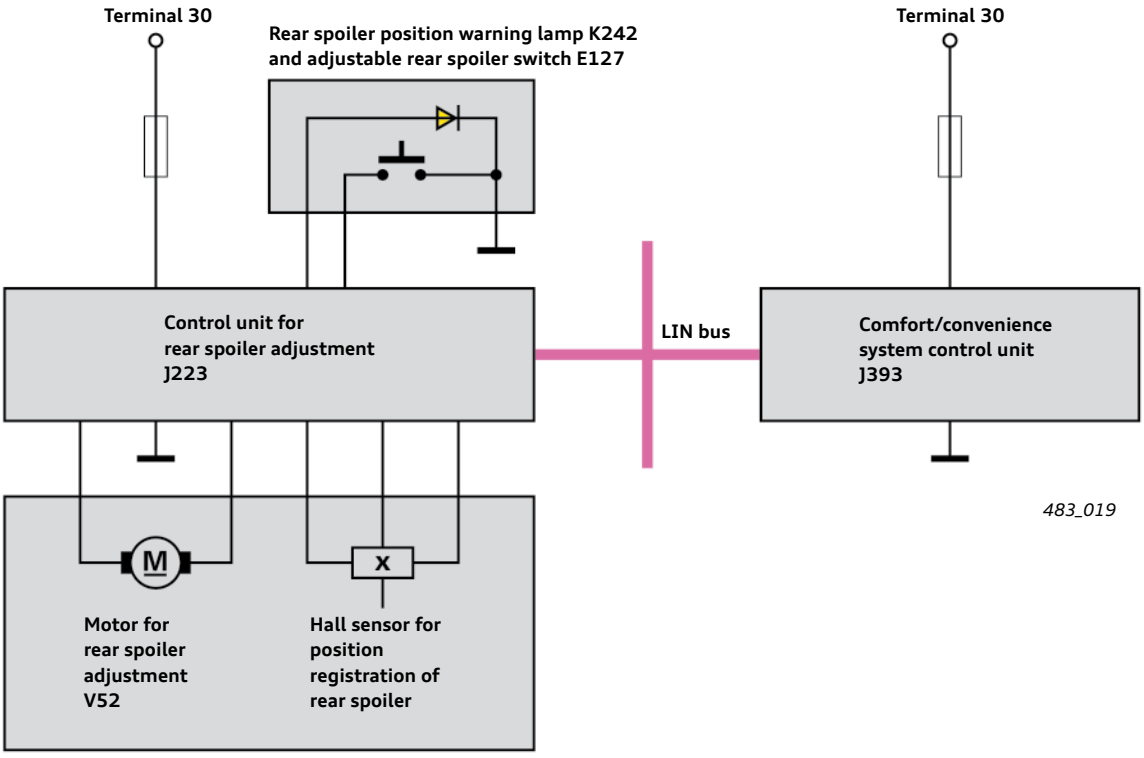
483_018

Tasks of the control unit for rear spoiler adjustment J223

The new control unit for rear spoiler adjustment has the following tasks:

- Activation of the motor for rear spoiler adjustment V52
- Reading in the Hall sensor signals for registration of the spoiler position
- Reading in the switch for rear spoiler adjustment E127
- Activation of the rear spoiler position warning lamp K242
- Diagnosis of the control unit and connected components
- Communication with other control units via the LIN bus



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Functions of the control unit for rear spoiler adjustment J223

Automatic mode

The rear spoiler extends and retracts automatically depending on the road speed. To do so, it is informed of the current vehicle road speed by the ABS control unit J104 via the CAN and LIN buses. The extend and retract thresholds are stored in the control unit for rear spoiler adjustment and have the following values:

Automatic extension of the rear spoiler at v > 130 km/h

Automatic retraction of the rear spoiler at v < 80 km/h

For extension, the automatic mode always has priority over the manual mode.

Manual mode

Pressing the button for rear spoiler adjustment retracts and extends the spoiler manually. In the manual mode, only these two final positions can be approached; moving to intermediate positions is not possible. Every time the button is actuated, the direction of movement of the rear spoiler changes in the manual mode.

When the spoiler is extended in the manual mode, the function LED in the button is activated.

483_020

Reaction to actuation of the button for rear spoiler adjustment is road speed-dependent and can be described as follows:

Behaviour at vehicle road speed less than 20 km/h:

Extending the rear spoiler

Touching the button for rear spoiler actuation extends the spoiler to the final position "extended". The function LED in the button is activated in response.

Retracting the rear spoiler

The button for rear spoiler adjustment must be actuated until the final position "retracted" is reached. Releasing the button before reaching the retracted state leads to cancellation of the activation and the rear spoiler returns to the final position "extended".

Behaviour at vehicle road speed greater than 20 km/h and less than 130 km/h:

Extending the rear spoiler

Touching the button for rear spoiler actuation extends the spoiler to the final position "extended". The function LED in the button is activated in response.

Retracting the rear spoiler

Touching the button for rear spoiler actuation retracts the spoiler to the final position "retracted". On reaching the final position "retracted", an active function LED in the button is deactivated.

Behaviour at vehicle road speed greater than 130 km/h:

The system switches to the automatic mode. An active function LED would be deactivated in response.

In this speed range, actuating the button has no effect.

483_021

Childproofing

The protect the spoiler motor, an actuation counter has been deployed as childproofing. The counter is incremented by one with each adjustment of the spoiler in the manual mode. If no manual adjustment has taken place for 10 seconds, the counter is decremented by one provided the count is greater than 0. On reaching a counter value of 15, manual retraction is suppressed; extension is still possible. The childproofing has no influence on the automatic mode.

Emergency operation functions

If the system recognises conditions for activation of the emergency operation function, the rear spoiler is activated in the direction "extended". This also occurs if the final position "extended" is detected.
A corresponding fault memory entry is made via LIN bus in the comfort/convenience system control unit J393. The emergency operation function remains active for the entire terminal 15 cycle. Only when no active fault memory entry is set in the case of a renewed terminal 15 cycle is the emergency operation function terminated.

The following conditions lead to emergency operation:

- Failure of the LIN bus
- No current road speed signal is received
- The final positions of the rear spoiler are implausible
- The position of the rear spoiler changes without activation of the rear spoiler motor
- The supply voltage is too low for a certain time

System behaviour if the final position "extended" is not reached

If the upper final position is not reached within a prescribed time when the rear spoiler is extended, the operation is aborted. After a short period, the rear spoiler is then retracted a little and subsequently extended once again.

If the "extended" final position is not reached after a second attempt, a corresponding fault memory entry is made in the comfort/convenience system control unit J393 via LIN bus.
This behaviour is to be observed for every extension movement until the fault is repaired.

System behaviour if the final position "retracted" is not reached

If the final position "retracted" is not reached within a prescribed time when the rear spoiler is being retracted, activation of the motor for rear spoiler adjustment is terminated. After a short period, the rear spoiler is then extended a little and a corresponding fault memory entry is made in the comfort/convenience system control unit J393 via LIN bus.

Note
If the transport mode is active, extending the rear spoiler manually is not possible. The automatic mode is not influenced by the transport modus.

Electrically actuated boot lid

As series standard, the Audi A7 Sportback has an electrically actuated boot lid. The drives of the boot lid already familiar from the Audi A6 Avant have been adapted to the Audi A7 Sportback.

The control system electronics of the two electric drives have been transferred to a separate control unit:
the boot lid control unit J605.

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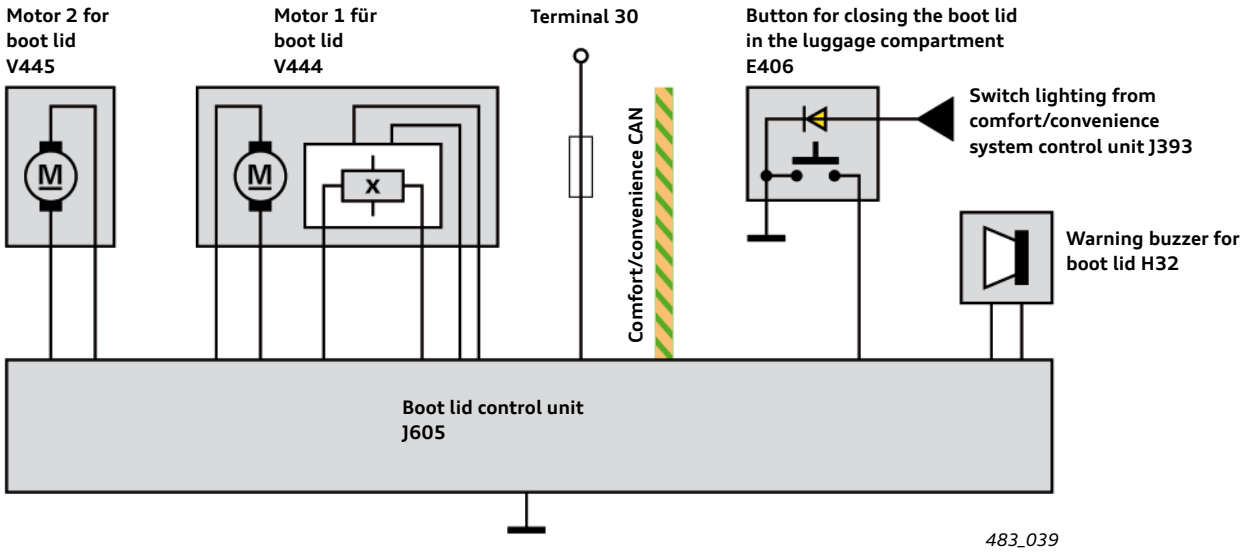
483_038

The boot lid control unit J605 activates the two drives of the boot lid V444 and V445. The drive 1 V444 has two Hall sensors. Two items of information are obtained from the Hall sensor signals: the number of motor revolutions per time unit and the direction of movement of the boot lid.

Both items of information are transferred across separate discrete lines to the control unit J605 which evaluates the signals. The control unit can use the two signals to determine the current position of the boot lid during an opening or closing operation.

The boot lid control unit is connected to the comfort/convenience CAN. Via the comfort/convenience CAN, it receives - among other things - the command to activate the drives to open or close the boot lid.



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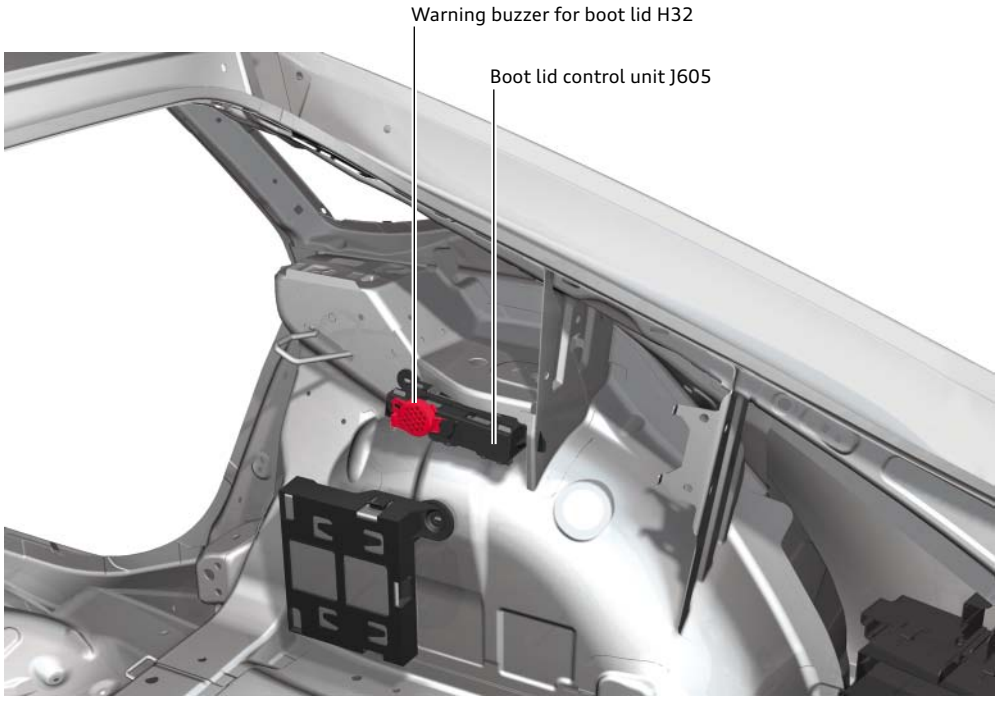
The control unit J605 also reads in the "close" button in the boot lid E406. The button lighting, however, is supplied with power by the comfort/convenience system control unit J393.

A new system component is a warning buzzer that draws attention to possible dangers when automatically closing the boot lid. The warning buzzer for boot lid H32 is identical to the warning buzzer familiar from the parking aid.

The warning buzzer H32 issues acoustic signals in the following situations:

- During the closing operation of the boot lid after actuation of the button for remote unlocking of the boot lid E233 in the driver's door
- During the closing operation of the boot lid after actuation of the boot lid button on the radio remote control key

If the boot lid is closed after actuation of the "close" button in the boot lid or actuation of the handle in the boot lid (soft touch), no acoustic signals are issued. Due to the installation positions of the two actuation points, it can be assumed that the corresponding person is in the area of the boot lid and is paying attention to possible dangers.



483_040

Saving the desired upper end position of the boot lid

The desired upper end position of the boot lid can be set by the customer. To do so, the boot lid must first be placed in the desired position. Subsequently, the "close" button in the boot lid must be actuated for approx. 4 seconds. Successful saving is confirmed by brief flashing and an acoustic signal of the warning buzzer H32.

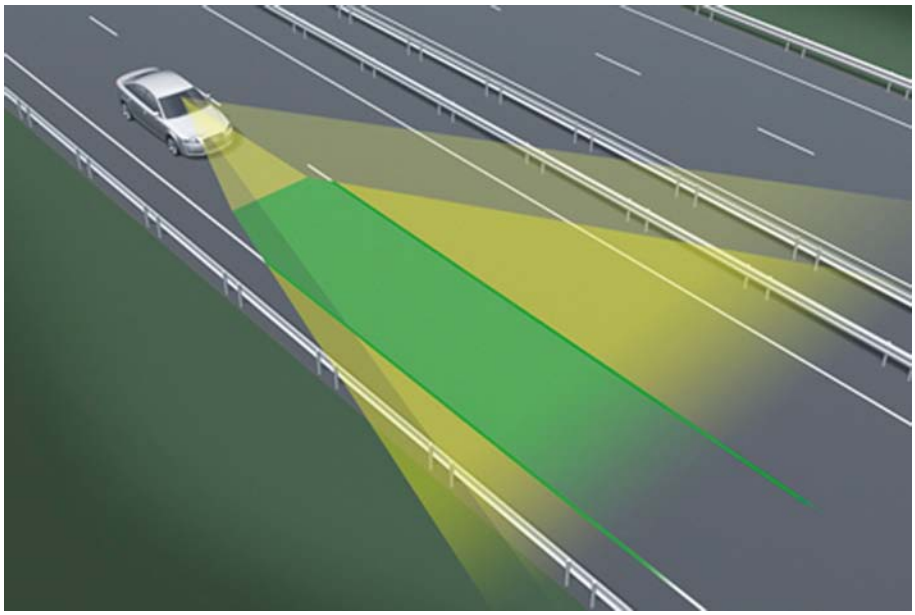
Power latching

Every vehicle with an automatically actuated boot lid also has a servo closing system for the boot lid (power latching). However, the power latching is not controlled by the boot lid control unit J605, rather by the comfort/convenience system control unit J393.

Audi active lane assist

Audi lane assist

In the year 2007, Audi introduced the driver assistance system Audi lane assist (lane departure warning). The lane departure warning supports the driver in keeping in lane. Lane boundary lines are detected using a camera. If the vehicle approaches a detected boundary line and is likely to exit from the lane, the driver is warned by the steering wheel vibrating. If a turn indicator is set before crossing the boundary line, the warning is suppressed, as the system assumes the lane change is deliberate.



483_022

The system is designed for driving on motorways and larger dual carriageways and operates as of a speed of 65 km/h. With the first generation of Audi lane assist, two lane boundary lines had to be detected for the system to become active or ready to issue warnings.

The function is available both during the day and at night and is switched on or off using a button in the turn signal lever.

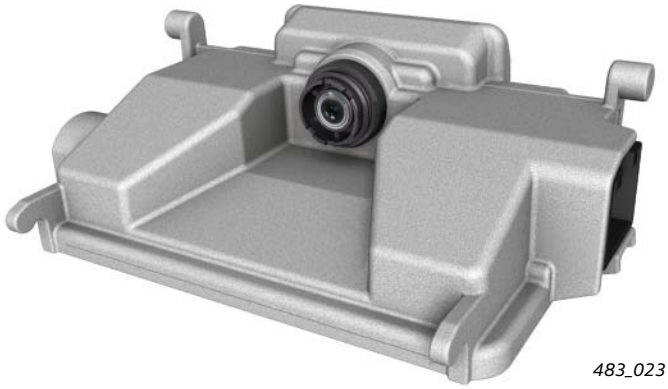
Poor ambient conditions, for example a dirty or snow-covered road, a lane that is too narrow or even ambiguous lane markings as might be expected in the area of road works on the motorway mean that the system is temporarily not ready to issue warnings. The current system state is indicated to the driver in the instrument cluster.

The following information is important with regard to Audi lane assist and Audi active lane assist: both systems are **driver assistance systems**. They support the driver in preventing inadvertent lane departures. However, the driver himself is responsible at all times for remaining in lane.

Reference
More detailed information on the lane departure warning can be found in self-study programme 398 "Lane departure warning - Audi lane assist".

Further development of Audi lane assist

Since introduction of the Audi A8 '10, a new generation of the lane departure warning has been offered. The function has been enhanced so that it is ready to issue warnings even if only one lane boundary line is detected. Furthermore, cutting a corner slightly no longer leads to a warning, even if the lane boundary line was touched or briefly crossed.



483_023

Furthermore, a higher quality of camera is used in the Audi A8 '10, and this has now been adopted for Audi active lane assist. It has a higher resolution and can distinguish between yellow and white lane boundary lines.

New features of Audi active lane assist

The next generation of the lane departure warning is being introduced in the Audi A7 Sportback: Audi active lane assist.
The introduction of this new generation is enabled by the electromechanical steering in the Audi A7 Sportback.

Audi active lane assist has the following new features:

- Steering intervention of the system by the motor for electromechanical steering
- Steering wheel vibrations as driver warning can be disabled in the MMI
- A system mode that uses continuous steering intervention to support the driver in keeping the vehicle in the middle of the lane
- A system mode that supports the driver in preventing inadvertent lane departures when approaching the lane boundary line
- Steering wheel vibrations are generated by the motor for electromechanical steering and no longer by an imbalance motor in the steering wheel
- The master control unit of the function is the image processing control unit J851 and no longer the camera control unit J852 or the lane departure warning control unit J759

Reference
More information on the new features of the lane departure warning in the Audi A8 '10 can be found in the -study programme 461 entitled "Audi A8 '10 – driver assistance systems".

Active steering intervention of Audi active lane assist

The customer has the possibility to choose between two system modes:

- The mode **steering point "early"** – supports the driver in keeping the vehicle in the middle of the lane
- The mode **steering point "late"** – supports the driver in avoiding inadvertent lane departures

System mode: steering point "early"

The mode steering intervention "early" supports the driver in keeping the vehicle in the centre of the lane. In this mode, Audi active lane assist continuously intervenes in the form of steering moments in the direction of the centre of the lane.

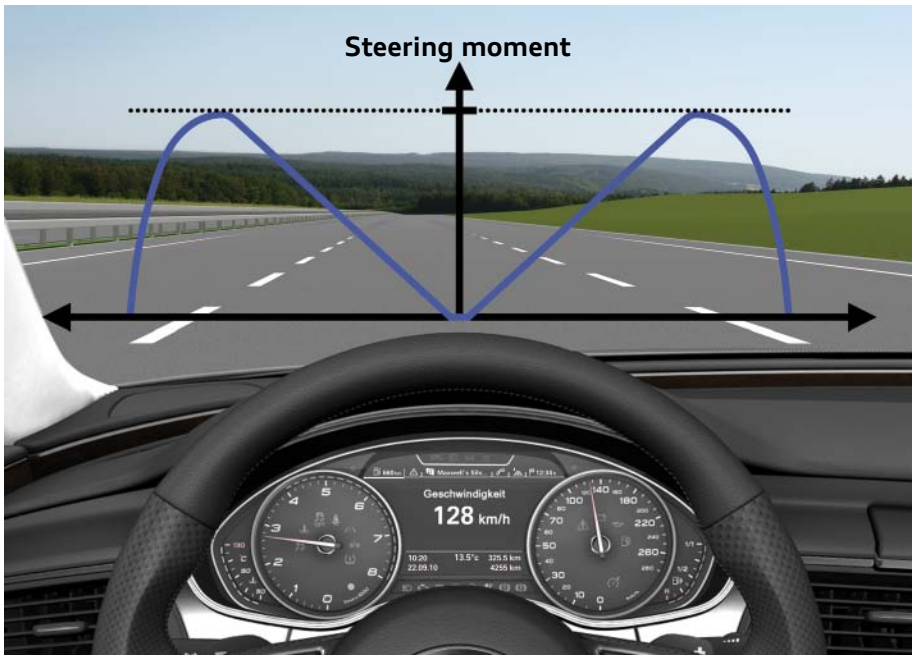
The steering moment required by Audi active lane assist is referred to in the following as system steering moment and is applied by the motor for power steering V187 to the steering. The motor V187 is in turn activated by the power steering control unit J500. The required steering moment is requested by the image processing control unit J851, which is the master control unit of Audi active lane assist.

In the"early" mode, the steering intervention takes place as soon as the vehicle is no longer moving in the centre of the lane. The requirements for steering intervention are that the function is ready to issue warnings and that the turn indicator was not actuated.

The system steering moment becomes greater the further the vehicle moves from the lane centre. The driver perceives this steering intervention as a steering recommendation. Whether or not he follows that recommendation is his decision. To steer the vehicle onto the neighbouring lane, the driver steering moment must be greater than the counteracting steering moment of the system.

If Audi active lane assist determines that the driver is not accepting the steering recommendation and executes a lane change, the system steering moment is withdrawn and the steering intervention terminated.

The maximum value of the system steering moment is designed in such way that the steering intervention of the system can be overcome by the driver applying a little force.



483_024

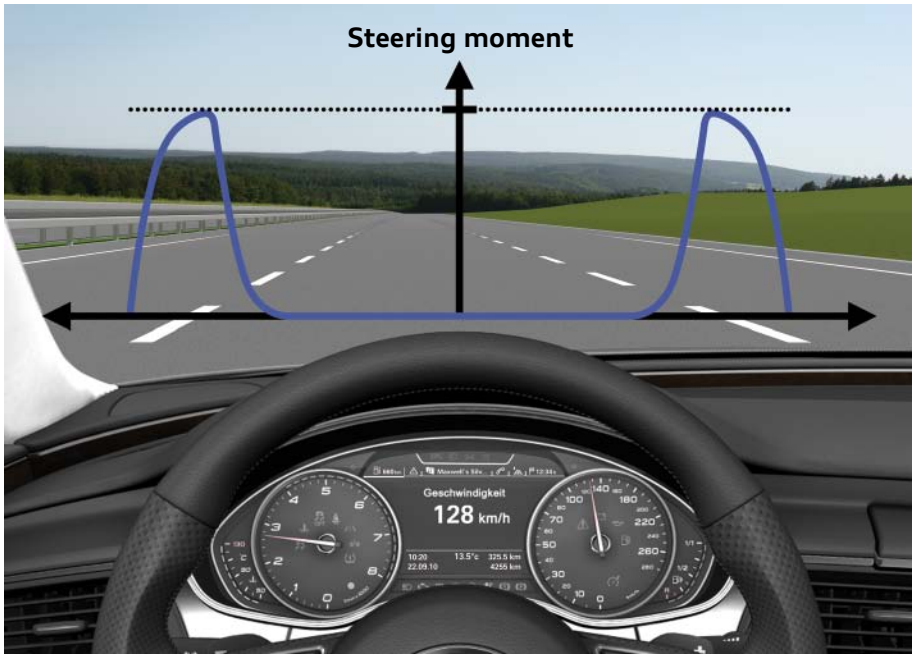
Note
Steering intervention in the system mode steering point "early" only occurs if two lane boundary lines are detected.

System mode: steering point "late"

The mode steering intervention "late" supports the driver in avoiding inadvertent lane departures. The steering intervention of Audi active lane assist only occurs in this mode when the vehicle is already near the lane boundary line.

If the driver steering moment is greater than the counteracting system steering moment, the vehicle moves further towards the neighbouring lane. Subsequently, the system steering moment is reduced until it ulimately reaches the value of zero. In this situation, the system assumes that the lane change was deliberate.

The maximum value of the system steering moment for steering point "early" is the same as that for steering point "late".



483_025

Note
For the implementation of Audi active lane, the corresponding vehicle model series requires electromechanical steering. The Audi A7 Sportback and Audi A6 '11 have such steering systems. The electromechanical steering of the Audi A7 Sportback is described in detail in self-study programme 480 entitled "Audi A7 Sportback – running gear / suspension".

Displays and operation

Displays of Audi active lane assist

The current system state is indicated by a function lamp in the instrument cluster. If the vehicle has a head-up display, the system state can also be shown there.

Distinctions are made between three different system states:

- Switched on and ready to issue warnings
- Switched on and not ready to issue warnings
- Switched off

System state: Switched on and ready to issue warnings

The indicator lamp lights up green when the system is ready to issue warnings.

483_026

Explanation of diagram:

In the case of a system that is ready to issue warnings that has detected two lane boundary lines and is currently not issuing a warning, the two lane boundary lines are shown in white. In the diagram, the right-hand lane boundary line is shown in red, as the vehicle is likely to leave this lane to the right.

Parallel to this, a warning is issued by vibration of the steering wheel if the "Vibration Warning" of Audi active lane assist is set to "on" in the MMI.

In addition, the system applies steering moment towards the centre of the lane to support the driver in keeping in lane.

System state: Switched on and not ready to issue warnings

The indicator lamp lights up yellow when the system is switched on but not ready to issue warnings. In this state, there are neither steering interventions nor are warnings issued with steering wheel vibration.

This system state can have the following causes:

- The vehicle speed is below 65 km/h
  (NB: this speed threshold can vary in some countries)
- The driving lane is narrower than approx. 2.5 m or wider than approx. 4.5 m
- There is no lane boundary line
- The corner / bend is too tight
- The driver's hands are not on the steering wheel
- The relevant lane boundary lines are not detected

  Possible causes of non-detection of lane boundary lines:

  - Road works markings
  - Snow or dirt on the road surface
  - Light reflections due to wet road surface
  - Dazzling due to low sun or oncoming traffic

483_027

Explanation of diagram:

If the system is currently not ready to issue warnings, the two lane boundary lines are shown in grey.

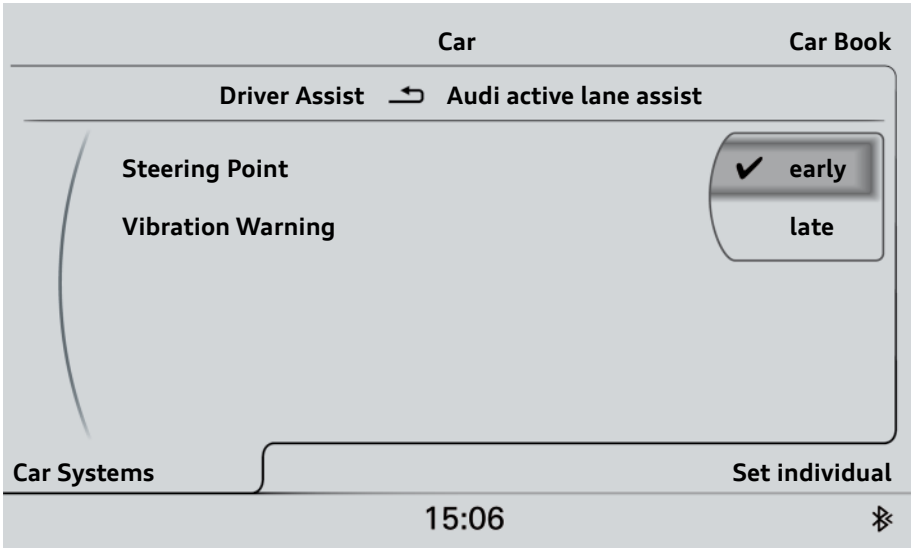
Operation of Audi active lane assist

Switching on and off

483_028

The Audi active lane assist function is switched on and off via the button on the turn signal lever.

MMI setting: Steering Point

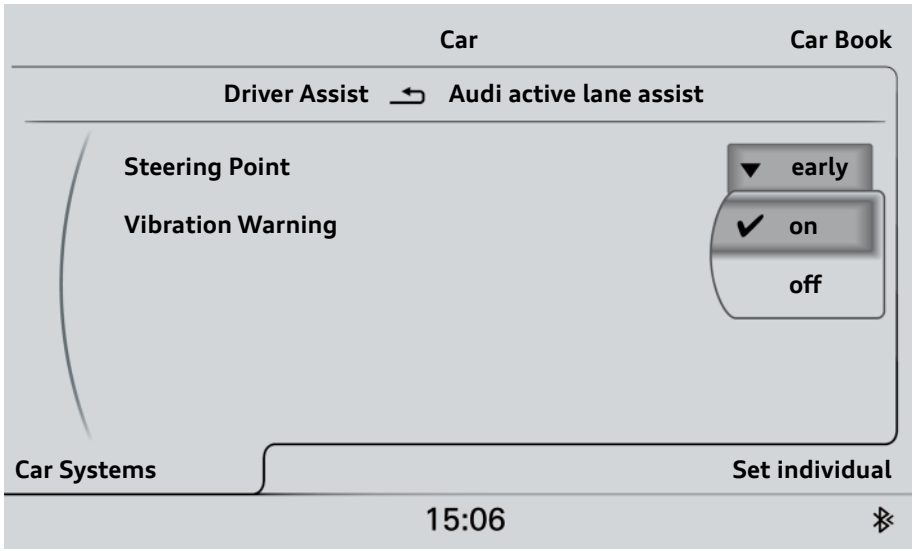


483_029

early Steering interventions support the driver continuously in keeping the vehicle in the centre of the lane. The system steering moment increases the closer the vehicle gets to the lane boundary line

late Steering intervention only takes place when the vehicle has approached a lane boundary line

MMI setting: Vibration Warning



483_030

on In addition to steering intervention, the steering wheel vibrates before the lane boundary line is crossed

off The vibration alarm is switched off; Audi active lane assist operates only with steering intervention

Additional functions

Deactivation of the function for hands-free driving

483_031

The Audi active lane assist function supports the driver in keeping in lane. The system set requires that the driver keep his hands on the steering wheel at all times. Recognition of hands-free driving is based on the measured steering moments of the sender for steering moment G269.

If hands-free driving is determined, the function is deactivated temporarily. The function lamp of Audi active lane assist changes its colour from green to yellow.
If the driver subsequently grips the steering wheel again, the function is reactivated.

Deliberate lane change without set turn indicator

483_032

If the driver changes lane with the turn indicator set, the system does not intervene, as it assumes the lane change is deliberate. However, Audi active lane assist also interprets some lane changes without a set turn indicator as deliberate if certain requirements are met.

These requirements include:

- Detection of a road user in front of the vehicle
- A distance to the vehicle ahead that is typical for overtaking
- The difference in speed in relation to the vehicle ahead is sufficiently large

On detection of such a scenario, there is no warning and/or no steering intervention of the system.

System characteristics with obstacles detected on the neighbouring lane

483_033

Inadvertently leaving your own lane can have particularly severe consequences if the vehicle is likely to be damaged immediately after leaving the lane. This is the case, for example, if there are guarding rails near the lane boundary line or if there are vehicles in the neighbouring lane.

In addition to the evaluation of the camera images, the measured variables of the two driver assistance systems rear / front parking aid and ACC are used to recognise such situations. For Audi active lane assist to be able to implement this auxiliary function, the vehicle must at least be fitted with the front / rear parking aid. If the vehicle does not have these optional extras, Audi active lane assist works without the auxiliary function. If the vehicle also has ACC, obstacles can be detected even more reliably.

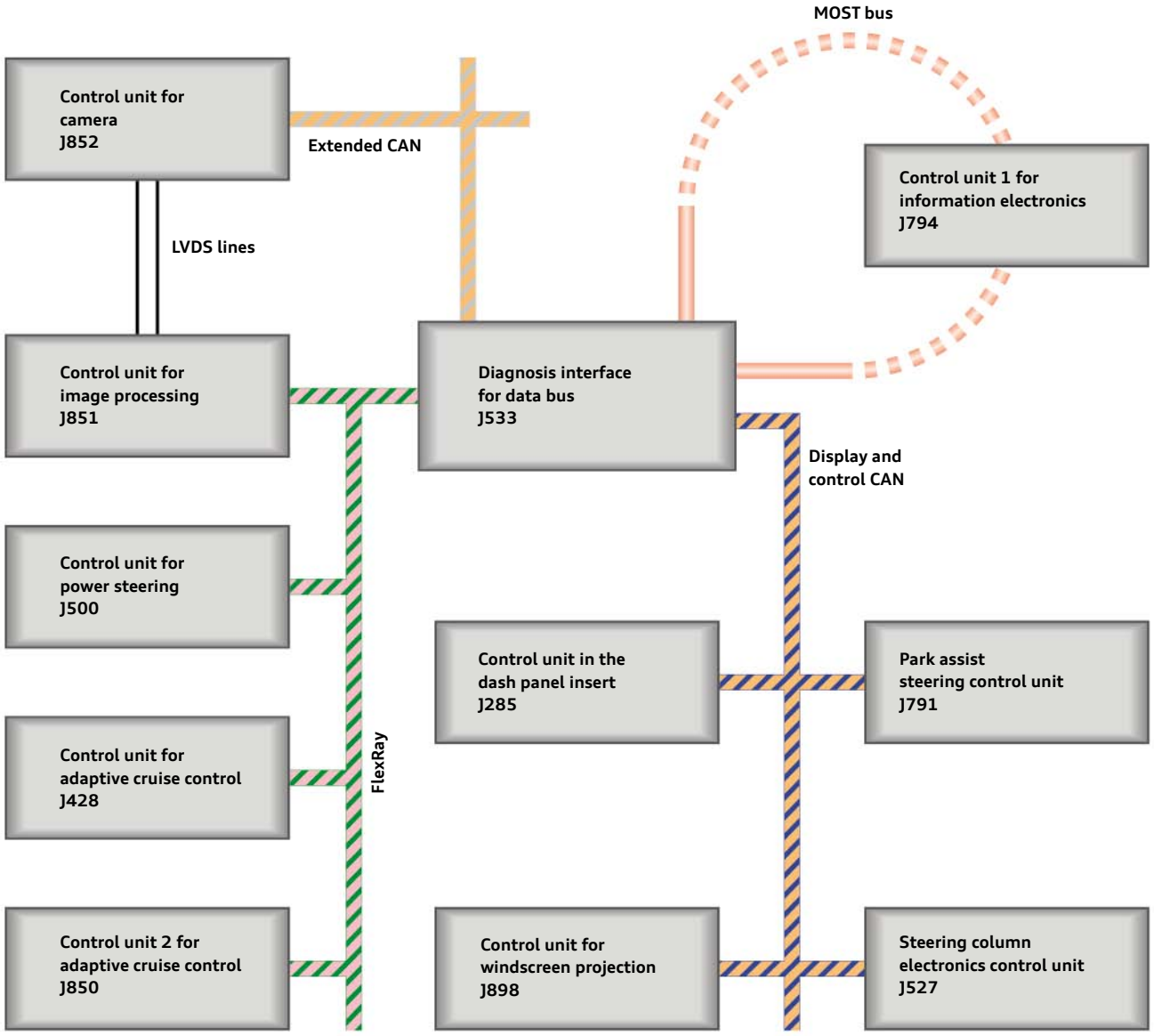
If such a situation is detected, Audi active lane assist reacts by issuing the vibration warning earlier and the driver has to apply more force to overcome the system steering intervention [1)].

[1)] Only applies to the setting steering point "late"

Communication structure

In order to be able to implement the functionality of Audi active lane assist, the image processing control unit J851 requires a large amount of information from different control units.

The following section describes the control units with which Audi active lane assist exchanges information and what that information essentially involves.



The control units necessary for the Audi active lane assist function:

Camera control unit J852:

- Registers the area in front of the vehicle and transfers the images to the image processing control unit J851
- Searches for lane boundary lines in the images, determines their exact position and geometry, and transfers this information to the control unit J851

Image processing control unit J851:

- The function software of Audi active lane assist is integrated in this unit
- Transmits the required system steering moment to the control unit for power steering J500 and, if required, requests a vibration alarm
- Asks the control unit in dash panel insert J285 to display the current system state and, if required, to display messages and warnings
- Transfers the current system state to the control unit for windscreen projection J898 and asks it, if required, to display warnings
- Saves the settings for Audi active lane assist made via the MMI. The stored values are assigned to the vehicle key in use.

Power steering control unit J500:

- Activates the motor for electromechanical steering according to the specifications of the control unit J851 (generation of the required system steering moment and output of a vibration warning)
- Reads in the sensor for steering moment G269 and forwards the steering moment to the control unit J851

Data bus diagnostic interface J533:

- The interface of the various data bus systems

Steering column electronics control unit J527:

- Reads in the button for switching the Audi active lane assist on and off and places the information on the CAN bus

Control unit in dash panel insert J285:

- Displays the current system state of Audi active lane assist
- Issues messages of Audi active lane assist

Control unit 1 for information electronics J794:

- Settings for Audi active lane assist can be made via the control unit J794

Optional control units that can be used if fitted:

Adaptive cruise control unit J428 and control unit 2 for adaptive cruise control J850:

- If the vehicle has the optional extra ACC, its measured variables are used for the two functions "Deliberate lane change without set turn indicator" and "System characteristics with obstacles detected on the neighbouring lane"

Park assist steering control unit J791:

- If the vehicle has the optional extra front / rear parking aid, its measured variables are used for the function "System characteristics with obstacles detected on the neighbouring lane"

Control unit for windscreen projection J898:

- If the vehicle has a head-up display, the current system state and warnings from Audi active lane assist can be displayed there

Test your knowledge

In all cases, one answer or a number of answers can be correct.

Question 1: Which of the following statements regarding the keyless starting system are correct?

- ☐ a) For its implementation, 4 aerials for entry and start authorisation are required
- ☐ b) The system is fitted as series standard in the A7 Sportback
- ☐ c) No vehicle keys are required for this system. Instead, the driver must carry a chip card.
- ☐ d) At an extra charge, the system can be upgraded to a keyless entry and starting system (Advanced Key)

Question 2: Which statements regarding a vehicle start via the emergency transponder coil are correct?

- ☐ a) In Audi Service, the emergency transponder coil is designated the "immobiliser reader coil D2"
- ☐ b) The emergency transponder coil is required to start the vehicle if the vehicle key battery is flat
- ☐ c) The button for emergency start E907 must be actuated for an emergency start via the emergency transponder coil
- ☐ d) After an emergency start of the vehicle via the emergency transponder coil, various convenience functions are not available to the driver

Question 3: Which relays are activated by the comfort/convenience system control unit J393?

- ☐ a) The terminal 75 relay J680
- ☐ b) The relay for the rear window heater J9
- ☐ c) The terminal 15 relay J329
- ☐ d) Both terminal 50 relays J682 and J695

Question 4: Which of the following statements regarding electric rear spoiler adjustment are correct?

- ☐ a) Control of the electric rear spoiler adjustment is handled by the comfort/convenience system control unit J393
- ☐ b) The rear spoiler can also be extended manually via the button for rear spoiler adjustment
- ☐ c) The electric rear spoiler adjustment is series production content in the Audi A7 Sportback
- ☐ d) The rear spoiler extends automatically as of a speed greater than 130 km/h if it has not already extended

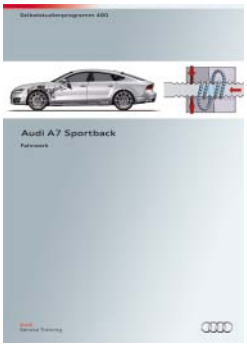
Question 5: Which statements regarding Audi active lane assist are correct?

- ☐ a) The lane departure warning control unit J759 is the master control unit of the function
- ☐ b) A vehicle with Audi active lane assist no longer has an imbalance motor in the steering wheel spoke
- ☐ c) The system offers a vibration alarm that can be disabled in the MMI
- ☐ d) Audi active lane assist intervenes in the steering of the vehicle
- ☐ e) The system monitors whether or not the driver has his hands on the steering wheel and reacts to this
- ☐ f) Audi active lane assist requires hydraulic steering in the vehicle
- ☐ g) The system requires installation of the camera control unit J852 in the vehicle
- ☐ h) Audi active lane assist uses information from the control units for active cruise control J428 and J850 and the control unit for park assist steering J791 if these are present in the vehicle

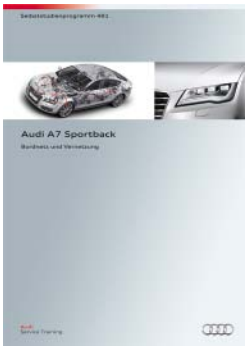
Solutions: 1) bd; 2) ab; 3) bc; 4) bcd; 5) bcdegh

Self-study programmes

More information on the technology in the Audi A7 Sportback can be found in the following self-study programmes.



SSP 478 Audi A7 Sportback, Order number: A10.5S00.71.20
SSP 479 Audi 3.0-ltr. V6 TDI engine (2nd Generation), Order number: A10.5S00.72.20
SSP 480 Audi A7 Sportback running gear / suspension, order number: A10.5S00.73.20



SSP 481 Audi A7 Sportback vehicle electrical system and networking, Order number: A10.5S00.74.20
SSP 482 Audi A7 Sportback head-up display and speed limit indicator, Order number: A10.5S00.75.20
SSP 484 Audi A7 Sportback occupant protection, infotainment, cabin climate, Order number: A10.5S00.77.20

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