

Audi lane assist

Self-Study Programme 398

Preface

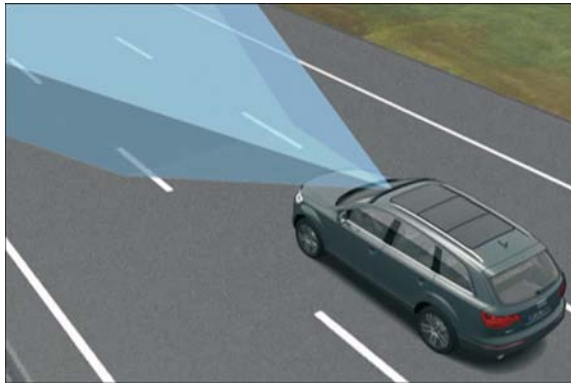
To mark the launch of the new Q7 premium SUV, Audi extended its range of driver assist systems to include two new systems: the radar-assisted "Audi side assist" system and the rear-view camera. Both systems met with a very encouraging response from customers and experts alike. They once again emphasise the fact that Audi takes its slogan "Vorsprung durch Technik" very seriously.

A logical consequence of this is that Audi is now extending this range to include a new system: Audi lane assist. This system helps the driver to stay in lane.

In the event that the driver is inattentive or distracted, the vibrating steering wheel can warn when the vehicle is about to leave its lane. The aim is to help avoid accidents.

Despite the availability of this technology, however, it is still imperative that motorists only get behind the steering wheel when they feel fit to drive. Audi lane assist is a driver assist system designed to help the driver. However, the responsibility for staying in lane ultimately rests with the driver.

Under current plans, Audi lane assist will be available on models A4, A5, A6, Q7 and A8.



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098_036

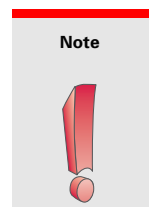
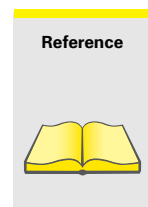
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The self-study programme teaches the design and function of new vehicle models, new automotive parts or new technologies.

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 publication of the SSP.

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



Function

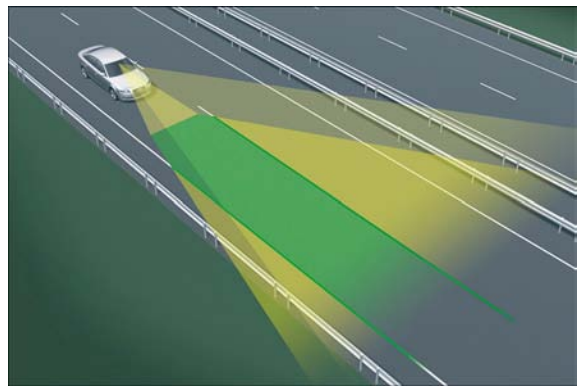
Function

Audi lane assist helps the driver to stay in lane. A camera is used for detecting lane markers. Audi lane assist is "on alert" when lane markers are detected on either side of the lane in which the vehicle is driving. When the vehicle approaches a detected lane marker and is about to leave the lane in which it is driving, Audi lane assist alerts the driver by making the steering wheel vibrate. If Audi lane assist is "on alert" and the driver indicates before crossing a lane marker, no warning is given because the system assumes that the lane change is deliberate.

The steering wheel vibrates once only in order to alert the driver when the vehicle is approaching or crossing a detected lane marker. A second warning is only given if the vehicle has moved a sufficient distance away from the lane marker after the first warning and subsequently approaches the lane marker again. This avoids warnings being given continuously when the vehicle is travelling in parallel with a lane marker.

The system is designed for use on motorways and trunk roads. For this reason, it does not become active until the vehicle is travelling at a speed of approx. 65 kph or higher.

Adverse ambient conditions, e.g. dirty or snow-covered road surface, a lane being too narrow or ambiguous lane markers such as occur in road works on motorways, may result in the system being temporarily unavailable. Current system status is indicated to the driver on the dash panel insert.



398_034



398_037

Note






Audi lane assist is a driver assistance system. The system helps the driver to avoid leaving a lane inadvertently by issuing an alert warning before the vehicle crosses detected lane markers. However, the responsibility for staying in lane ultimately rests with the driver!

Warning lamp on dash panel insert



398_002

Possible states of the warning lamp

	<p>If the warning lamp on the dash panel insert is lit green, the system is active and "on alert".</p>
	<p>If the warning lamp on the dash panel insert is lit yellow, this means that the system is active but not "on alert" due to the prevailing conditions.</p> <p>In this condition, Audi lane assist does not assist the driver and gives no alert warnings. Possible reasons for deactivation are given below.</p>
	<p>If Audi lane assist warning lamp is not lit, then the system is inactive.</p> <p>To activate the system, push the Audi lane assist button on the indicator stalk.</p>

If the yellow warning lamp is lit on the dash panel insert, this can be due to the following reasons:

- There is only one or no lane marker.
- The system is not detecting lane markers (e.g. due to snow, dirt, wet, backlight).
- There are more than two lane markers in the lane in which the vehicle is travelling (e.g. white and yellow markers at road works).
- The vehicle is travelling at less than the minimum activation speed of approx. 65 kph.
- The lane is narrower than approx. 2.5 m or wider than approx. 5 m.
- The curve is too tight (curve radius less than approx. 250 m).

Additional function display in the Audi A4 and A5 Coupé

An Audi A4 and A5 Coupé with Highline dash panel insert offers an additional function display which indicates the current status of the adaptive cruise control (ACC) and Audi lane assist systems.

The following examples show the combined colour display:



398_024

The graphic display indicates the following:

- **adaptive cruise control:**
active, the system has detected a vehicle
- **Audi lane assist:**
not installed or switched off



398_025

The graphic display indicates the following:

- **adaptive cruise control:**
off or in Standby mode
- **Audi lane assist:**
not installed or switched off



398_026

The graphic display indicates the following:

- **adaptive cruise control:**
active, the system has detected a vehicle
- **Audi lane assist:**
switched on, but inactive (not "on alert")



398_027

The graphic display indicates the following:

- **adaptive cruise control:**
active, driver is requested to take control
- **Audi lane assist:**
switched on and active ("on alert")



398_028

The graphic display indicates the following:

- **adaptive cruise control:**
active, the system is not detecting a vehicle
- **Audi lane assist:**
switched on, active ("on alert") and alert warning on left-hand side



398_029

The graphic display indicates the following:

- **adaptive cruise control:**
no ACC installed!
- **Audi lane assist:**
switched on, active ("on alert") and alert warning on right-hand side



Note

If an Audi A4 and A5 Coupé with Highline dash panel insert only has either of the two optional extras, only the graphic relevant to the function is shown on the colour display.

Displays

adaptive cruise control is not available as optional equipment for the Audi A4 and A5 Coupé with Lowline dash panel insert. The Highline dash panel insert is a mandatory in combination with ACC. If the vehicle is equipped with Audi lane assist, however, the additional function displays are as follows:



398_030

The graphic display indicates the following:

- **adaptive cruise control:**
no ACC installed!
- **Audi lane assist:**
switched off



398_031

The graphic display indicates the following:

- **adaptive cruise control:**
no ACC installed!
- **Audi lane assist:**
switched on, but inactive (not "on alert")



398_032

The graphic display indicates the following:

- **adaptive cruise control:**
no ACC installed!
- **Audi lane assist:**
switched on and active ("on alert")
(Neither of the two lane markers is flashing!
No warning is given.)



398_033

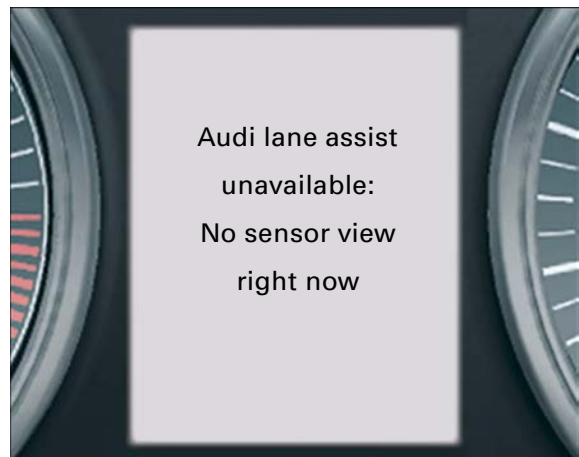
The graphic display indicates the following:

- **adaptive cruise control:**
no ACC installed!
- **Audi lane assist:**
switched on and active ("on alert").
The right lane marker is flashing. This means that Audi lane assist is alerting the driver to the fact that the vehicle has crossed the right lane marker!

Text messages on the dash panel insert centre display

The message "Audi lane assist unavailable: sensor currently has no visibility" may be displayed for the following reasons:

- 1 The exterior of the camera viewing window is dirty or iced-up. In this event, the driver should de-ice or clean the viewing window as required.
- 2 The camera viewing window is misted on the inside. In this case, it is recommended to wait until the system has been de-misted.
- 3 No lane markings are detectable due to the prevailing road conditions (e.g. snow-covered or dirty).

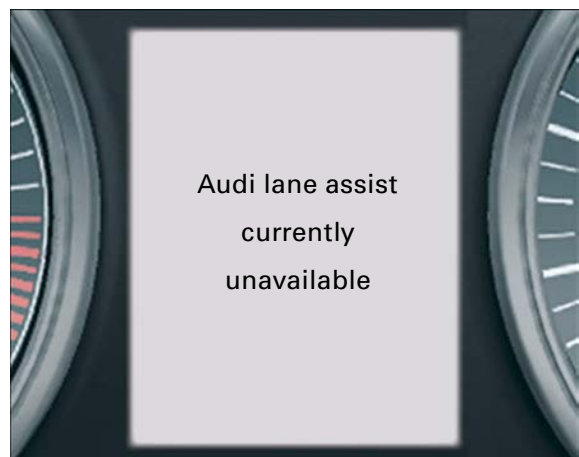


398_004

The message "Audi lane assist currently unavailable" is displayed when a temporary fault occurs.

An attempt should be made to activate the system a short time later.

The can, for example, be due to excess temperature inside the control unit.



398_004

The message "Audi lane assist unavailable: system fault" is displayed in the event of a fault of such severity that it is necessary to take the vehicle to an Audi Service Partner.

Audi lane assist should be checked by an authorised service station at the next opportunity.

Possible reasons for this are a faulty control unit, a faulty vibration motor or a faulty Audi lane assist button.

The same display appears when status "System not calibrated" is indicated on the control unit.



398_004

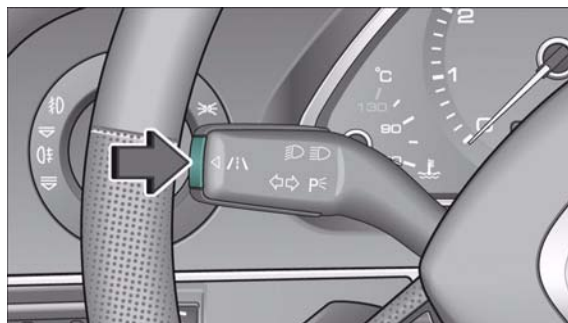
Switching the system on and off

The Audi lane assist button E517 is integrated in the indicator stalk. Pushing the button switches the system on or off.

Current system status is indicated by the warning lamp on the dash panel insert. The system is "on" when the warning lamp is lit and "off" when the lamp is not lit.

Actual activation status is stored and assigned to the corresponding ignition key.

This means: if Audi lane assist was active the last time the ignition was turned on, the system is reactivated the next time the ignition is turned on. A prerequisite is use of the same ignition key as during the previous trip.

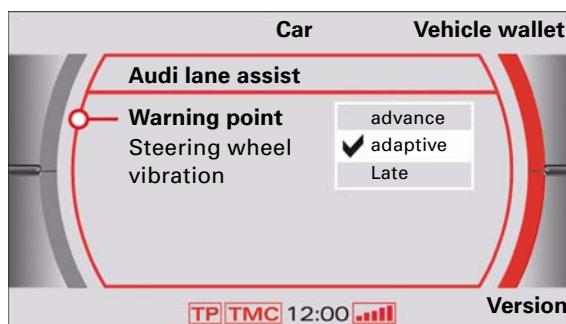


398_022

Setting the warning point

The driver can decide whether an alert warning is to be given before the vehicle inadvertently leaves the lane, or not until a wheel makes contact with the lane marker. There are three possible warning point settings on the MMI. The relevant submenu can be accessed as follows:

- press the function key "Car" on the MMI control panel
- select the subitem "Systems"
- select the "Audi lane assist" system
- open the options menu of subitem "Warning point"
- set the warning point to "advance", "adaptive" or "late"



398_005

Notes on warning point setting options

advance

In this setting, the driver is warned before a wheel makes contact with the detected lane marker. The warning point is dependent on angle of approach to the lane marker. If the vehicle approaches the lane marker at an obtuse angle, the warning is given at a greater distance from the lane marker. If the vehicle approaches the lane marker at an acute angle, the warning is given when the wheel makes contact with the line.

adaptive

In this setting, the warning point is adapted to the course of the road and the speed at which the vehicle is travelling. Alert warnings are given later in curves and earlier on straights. Alert warnings are given later on narrow roads than on wide roads.

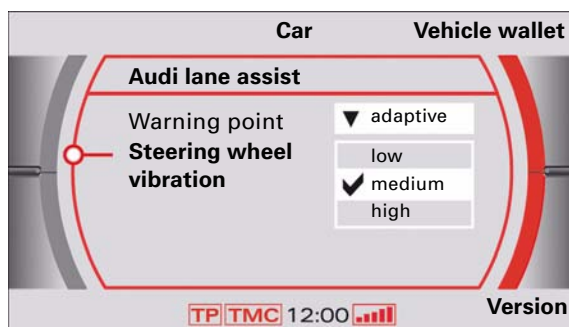
late

In this setting, a warning is given before a wheel makes contact with the detected lane marker.

Setting the steering wheel vibration

The driver can choose between three different settings for steering wheel vibration level on the MMI. The corresponding submenu is accessed as follows:

- press the function key "Car" on the MMI control panel
- select the subitem "Systems"
- select the "Audi lane assist" system
- open the options menu of subitem "Steering wheel vibration"
- set the steering wheel vibration level to "low", "medium" or "high" as required



398_006

After setting the steering wheel vibration level, the steering wheel vibrates once at the level set. This allows the driver to check the set vibration level immediately.

Note

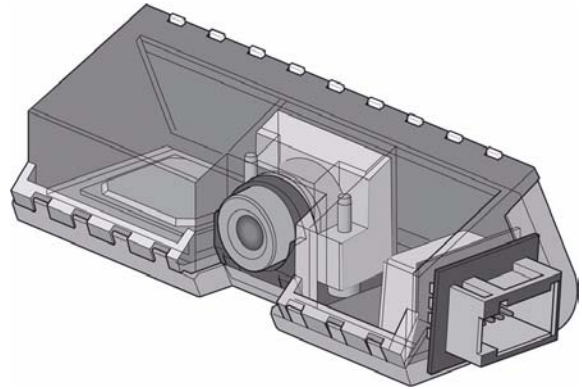


The Audi lane assist settings on the MMI are stored when the ignition is turned off and assigned to the corresponding ignition key.

The settings of the ignition key currently in use are re-activated after the ignition is turned on.

Audi lane assist control unit J759 with camera

The Audi lane assist control unit and the camera are an integral unit and can only be replaced as a whole.



398_007

The image acquisition sensor scans the road ahead of the vehicle in the form of a black and white image. It has a resolution of 640 x 480 pixels. The image acquisition sensor has a lens with a focal length of 6 mm.

The camera has an optical range of up to 60 metres. Environmental influences may reduce the camera's optical range. If the optical range falls below the minimum level, the system switches over to "not on alert" status.

Electronic image processing

The black and white image made by the image acquisition sensor is analysed by image processing software. Firstly, the system scans the image for lane markers. If the system detects lane markers on both sides of the vehicle, it calculates the width and curvature of the lane.

In addition to this, the software calculates the position of the vehicle in the lane, i.e. the distance from the vehicle to the left or right lane marker and the angle of approach to the lane marker. The image processing software also assesses the quality of road recognition.

The warning point is determined from the calculated values and the known measurements of the vehicle. Different methods of calculation are used depending on what warning point is set on the MMI. They are also required to establish whether or not to deactivate the function temporarily due to the road geometry.



398_008



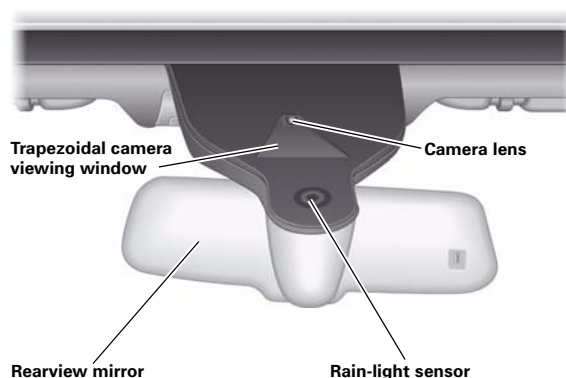
Note

Image 398_008 has been acquired using special software designed by Audi's technical development centre. It cannot be shown on the MMI display.

Installation location

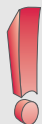
The Audi lane assist control unit J759 is clipped into a holder. The holder is glued onto the windscreen and supplied together with the windscreen as an assembly part. Audi is currently working on a service solution which will allow the holder to be replaced separately.

The holder is not visible from the exterior, as it is located behind the black print on the windscreen. Only the trapezoidal camera viewing window of the Audi lane assist system is visible. The camera viewing window is positioned within the wiping field of the windscreen wiper in order to minimise visibility impairment due to rainfall and snowfall.



398_009

Note



For logistical reasons, vehicles with Audi lane assist are always equipped with a rain-light sensor.

Audi lane assist windscreen heater Z67

Audi lane assist has a heated camera viewing window which de-mists and de-ices the camera viewing window in combination with the windscreen wiper.

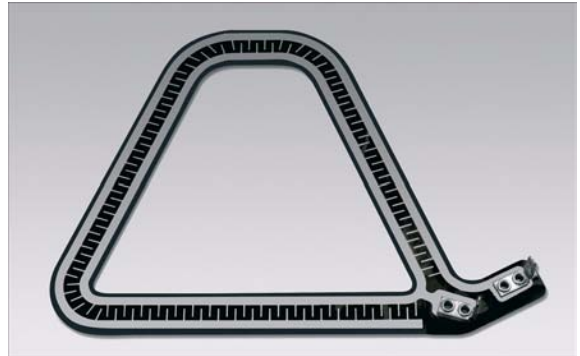
The Audi lane assist windscreen heater Z67 is designed as an etched foil resistance heating element. It is glued directly onto the windscreen. It has two terminals: one of the terminals is supplied with battery voltage via the Audi lane assist control unit J759 while the windscreen heater is active; the other terminal connects the heater to vehicle ground.

A multiplicity of parallel resistors on the etched foil resistance heating element generate heat by allowing electrical current to flow through them. The heated resistors heat the windscreen. This eliminates misting and thaws ice to the extent that it can be removed by the windscreen wiper. The etched foil resistance heating element surrounds the windscreen section through which the Audi lane assist camera scans the road ahead of the vehicle.

The windscreen heater Z67 is activated if the image generated by image sensor does not have enough contrast. If the image does not have enough contrast, the lane markers cannot be identified sufficiently and the function switches over to "not on alert" status.

When the image again has enough contrast for purposes of lane detection, the windscreen heater is reactivated.

If visibility impairment cannot be eliminated by the heater (e.g. due to dirt), the driver is notified of this fact by a text message (see Chapter 3) on the centre display of the dash panel insert.



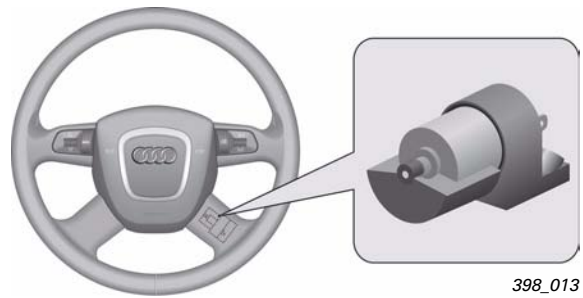
398_011

Vibration steering wheel for Audi lane assist

The steering wheel has a vibration motor which produces vibration of the steering wheel. The vibration motor is integrated in the bottom right steering wheel spoke.

Steering wheel vibrations are produced by the rotation of an imbalance attached to the motor. The motor cannot be replaced separately. If the vibration motor is faulty, the whole steering wheel must be replaced.

The duration of steering wheel vibration is dependent on the driver's reaction and is usually about one second.



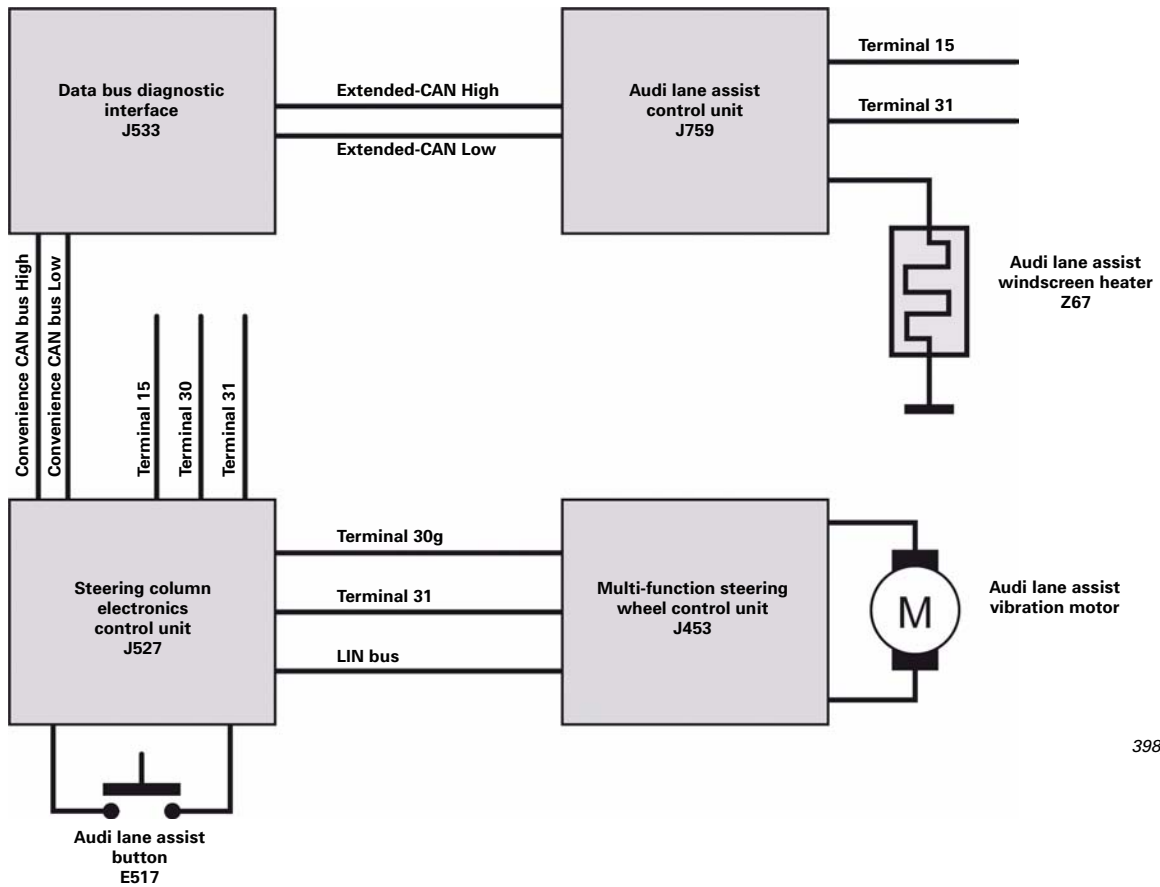
398_013

Note



Vehicles with Audi lane assist require a multifunction steering wheel. The reason for this is that the vibration motor is activated by the multifunction steering wheel electronics. The vibration motor is always integrated in a 4-spoke steering wheel.

System overview



398_014

Audi lane assist windscreen heater Z67

The Audi lane assist windscreen heater Z67 is activated directly by the Audi lane assist control unit. Only one terminal is required for this purpose. The windscreen heater is assigned to a ground terminal on the vehicle.

Audi lane assist button E517

The Audi lane assist button E517 is read in by the steering column electronics control unit J527. It is integrated in the indicator stalk.

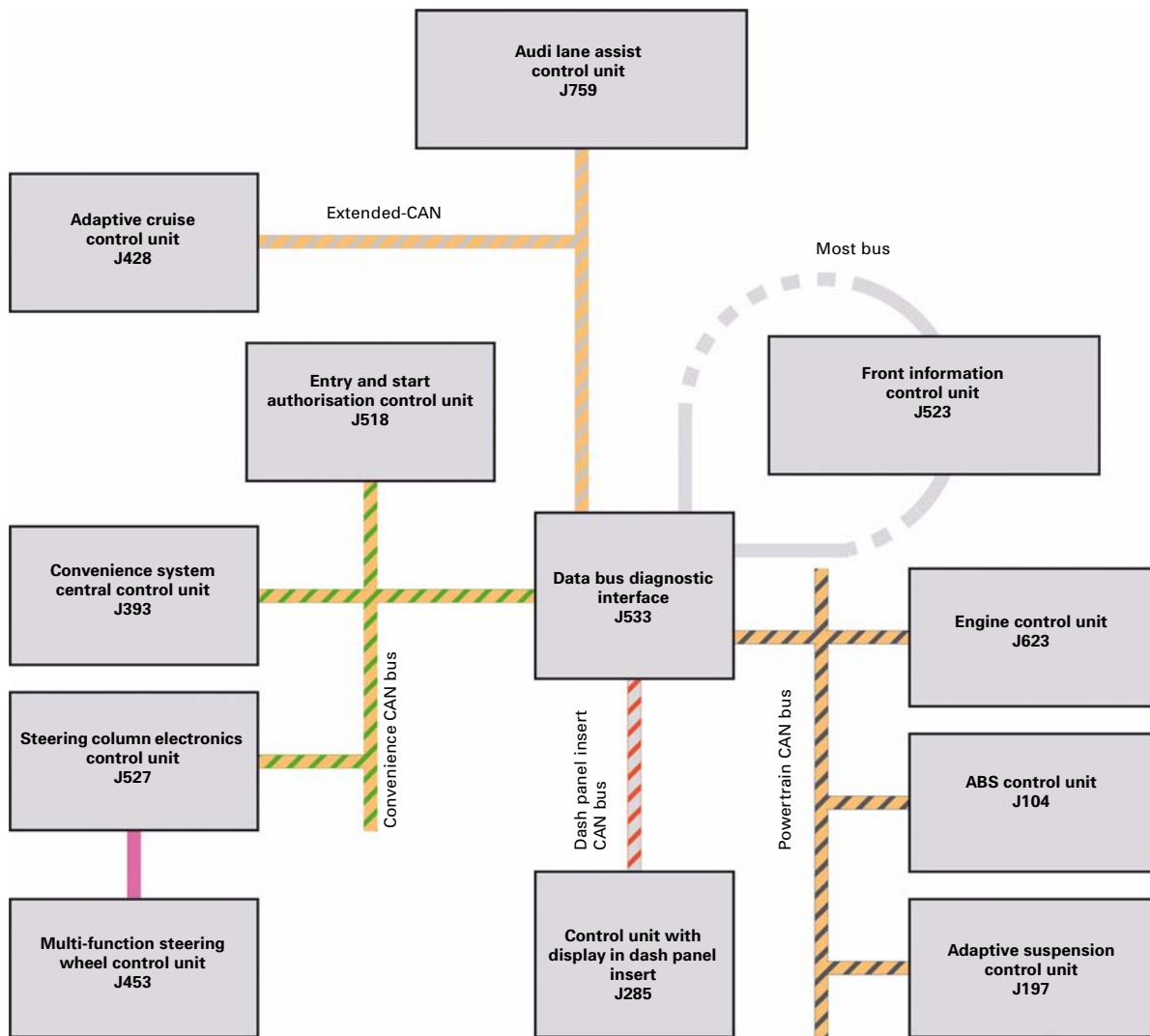
Audi lane assist vibration motor

The Audi lane assist vibration motor is activated by the multifunction steering wheel J453. It is integrated in a steering wheel spoke.

Communication structure

Communication structure

The following diagram summarises all the control units which contribute to the Audi lane assist function. They transmit information to and receive information from the Audi lane assist control unit J759.



398_015

A description is given below of the control units which exchange information with the Audi lane assist control unit and the information exchanged. The description is structured according to the bus systems to which the control unit is connected.

Extended-CAN users

1 Adaptive cruise control unit J428

To avoid warnings being given simultaneously by Audi lane assist and Stopping Distance Reduction system 2, Audi lane assist suppresses its steering-wheel vibration warning if the Stopping Distance Reduction system simultaneously activates the brake.

Convenience CAN bus users

2 Entry and start authorisation control unit J518

transmits information on which ignition key is currently recognised by the vehicle. The Audi lane assist control unit utilises this information to assign stored driver settings to the corresponding ignition key.

3 Convenience system central control unit J393

transmits information on whether the left or right indicator is currently active.

4 Steering column electronics control unit J527

transmits information on whether the Audi lane assist button on the steering column stalk is being actuated or not.

receives from Audi lane assist the information on whether or not to activate the driver-alert vibration motor. This information is then sent via a LIN bus message to the multifunction steering wheel, which activates the vibration motor.

MOST-bus users

5Front information control unit J523

transmits changes in driver settings relevant to the "Audi lane assist" function to the Audi lane assist control unit. The new settings are then saved and assigned to the ignition key currently in use.

Communication structure

Powertrain CAN bus users

6 Engine control unit J623

transmits the current engine speed. Audi lane assist requires this data, because the activation times of the windscreen heater are dependent on whether the engine is presently running or not. (no heating phases are allowed at "engine off".)

7 Adaptive suspension control unit J197

keeps Audi lane assist informed at all times about the actual height of the dampers on the vehicle. This data is required for electronic correction of the current camera height, as well as the pitch and roll angle of the camera.

8 ABS control unit J104

supplies the vehicle speed signal required for activating or deactivating Audi lane assist, as well as the yaw velocity.

Convenience CAN bus users

9 Control unit with display in dash panel insert J285

receives information on the current status of Audi lane assist for activating the warning lamp on the dash panel insert (yellow, green or off).

receives information on whether or not to display a text message and, if so, what text message.

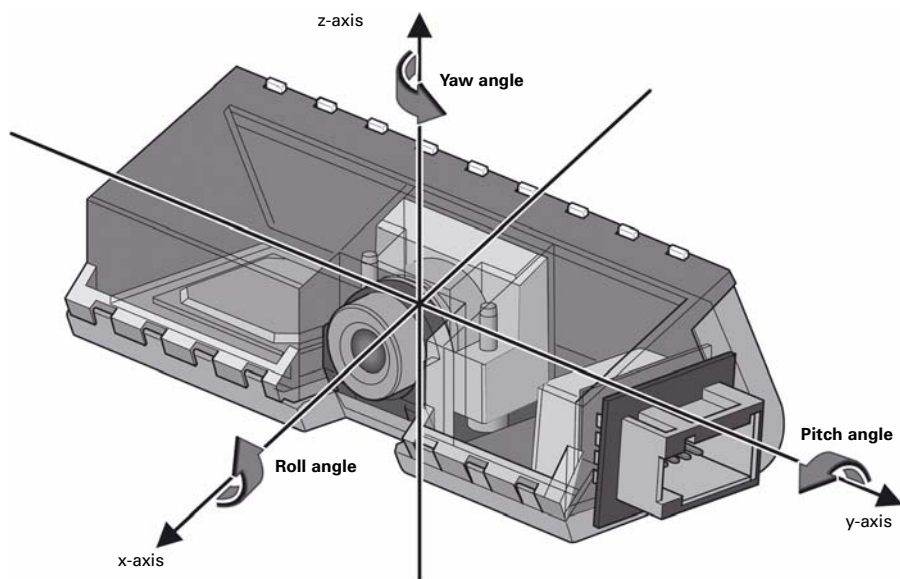
Task of calibration

The calibration procedure involves determining the actual orientation angle of the camera on the vehicle. To make an exact determination, the installed position of the camera on the vehicle must be known. Deviations from the nominal installed position can occur due to component tolerances of the holder or windscreen or because of manufacturing tolerances.

The system must be calibrated in order to compensate for these effects. The calibration procedure involves determining the three orientation angles of the camera in relation to the vehicle's direction of travel, as well as the height at which the camera is installed in relation to the tyre contact area. The calibration is made electronically. There are no mechanical adjustments on the camera.

The three orientation angles are as follows:

- Roll angle (rotation about the x-axis)
- Pitch angle (rotation about the y-axis)
- Yaw angle (rotation about the z-axis)



398_016

Calibration principle

The orientation angles of the Audi lane assist camera cannot be determined directly. They are calculated using a calibration board. The calibration board consists of geometric elements which contrast distinctly with the rest of the board.

The board is aligned in a reference position in front of the vehicle. The camera then records images of the calibration board. The position of the geometric elements on the image is determined. A software routine uses the image co-ordinates and the known reference position of the board to determine the camera's actual orientation angle, and stores this information in the control unit. The actual height of the camera on the vehicle is also determined.

System calibration

New special calibration tools

New special tools are required for calibrating Audi lane assist. They belong to tool family VAS 6430. This device can be used for calibrating both Audi lane assist and Active Cruise Control ACC.

Special tool VAS 6430 is a complete set and includes the following separately available components:

- VAS 6430/1 calibration device basic set
- VAS 6430/2 ACC laser unit (VW)
- VAS 6430/3 ACC reflector mirror (Audi)
- VAS 6430/4 Audi lane assist calibration board

The VAS 6430 complete set is intended for service partners who are still not equipped with an ACC calibration device.

Customers who already have an ACC calibration device VAS 6190 needs only order the components VAS 6430/1 and VAS 6430/4 in order to have a complete calibration device suitable for both systems. The existing ACC laser unit by VW and the ACC reflector mirror by Audi can be attached to the new calibration device VAS 6430/1.



398_017

VAS 6430/1 calibration device (basic set)



398_018

VAS 6430/4 Audi lane assist calibration board

Note



The calibration board for Audi lane assist VAS 6430/4 does not attach to the ACC calibration device VAS 6190.

Tools requires for the calibration

The following tools are required to calibrate the Audi lane assist system:

- Diagnostic tester (VAS 5051B or VAS 5052)
- Approved wheel alignment computer including wheel alignment lift
- Calibration tools VAS 6430/1 and VAS 6430/4



398_020

When is it necessary to calibrate the system?

The Audi lane assist system has to be calibrated for the following reasons:

- The fault memory contains the entry "no or incorrect basic settings/adaption".
- The Audi lane assist control unit has been replaced.
- The windscreen has been replaced or removed.
- Rear axle toe has been adjusted.
- Modifications affecting body height have been made to the vehicle's suspension system.
- The level senders on vehicles with damping control or air suspension have been readapted.

Calibration procedure

For details of the exact calibration procedure, refer to in the Workshop Manual.
The main calibration steps are described below:

- The "Calibration Audi lane assist" program is started on the wheel alignment computer.
- Quick release clamps are mounted on all 4 wheels.
- Transducers are mounted on the rear two wheels.
- Wheel runout compensation is performed on the rear wheels.
- Two transducers are attached to the VAS 6430.
- The calibration device VAS 6430 is aligned with the direction of travel in several steps using the wheel alignment computer as a guide.
- The calibration program on the diagnostic tester is started under "Guided Fault Finding".
- Body height is measured at the front left and right wheel arch edges as well as at the rear left and right wheel arch edges and entered into the program.
- The calibration routine then runs to completion automatically.

Online calibration

The system also has an "Online calibration" function. In Online calibration mode, the Audi lane assist system checks while the vehicle is being driven whether the yaw and pitch angle have changed during the calibration. Any changes are incorporated into the values

- yaw angle offset and
- pitch angle offset

and taken into account by the system. The values are represented in a data block.
The two values are reset to zero during the next calibration.

Diagnostics

The Audi lane assist control unit has full self-diagnostic capability. Data blocks, adaption channels, actuator diagnoses, control unit codings, basic settings and fault memory entries are available. The Audi lane assist control unit is addressed by the diagnostic tester with address word 5C.

Data blocks on the function

The following values can be read out under the menu item "Data blocks":

- Control unit supply voltage
- Measured temperature in control unit
- Windscreen heater status
- Reason for activation or deactivation of the windscreen heater
- Geometric lane data determined by the image processor, e.g.
 - Lane width
 - Current curve radius
- Audi lane assist system status (off/on & active/on & inactive)
- Audi lane assist warning status (warning inactive/active; if active due to left/right hand side warning)
- Audi lane assist button status (pressed/not pressed)
- Left direction indicator function (active/inactive)/right direction indicator function (active/inactive)
- Actual height values generated by the 4 vehicle level senders (if air suspension is installed on the vehicle)
- Set warning point and warning vibration level
- Saved personalised settings assigned to the individual remote control keys (system status, warning point and vibration level)
- Vibration motor: fault detected (yes/no); Audi lane assist button: fault detected (yes/no); the information is supplied by the steering column electronics control unit J527
- Status of communication CAN with control units which transmit the information which Audi lane assist requires for proper operation

Calibration data blocks

- Roll, pitch and yaw angles of the camera
- Camera height
- Reason for failed calibration
- Yaw and pitch angle offset
- Information on the online calibration

Diagnosis

Adaption channels

It is possible to reset the complete system to its as-delivered condition via the adaption channels.

The following values can be found on the adaption channels:

- body height to be measured at the edges of the wheel arch during the calibration:
 - front left
 - front right
 - rear left
 - rear right

Since the body height at the wheel arch edges is input into the diagnostic tester calibration program, these adaption channels are not required in practice.

Actuator diagnoses

The following components can be activated via an actuator diagnosis:

- Windscreen heater Z67 can be activated by actuator diagnosis on the Audi lane assist control unit J759. It remains active for approx. 20 seconds.
- The vibration motor integrated in the steering wheel can be activated by initiating the appropriate actuator diagnosis on the steering column electronics control unit J527.
- The Audi lane assist warning lamp on the dash panel insert can be activated via an actuator diagnosis on the control unit with display in dash panel insert J285 together with the other warning lamps.

Control unit coding

The control unit coding provides the following vehicle information to the Audi lane assist control unit J759:

- the Audi model in which the system is installed
- the market for which the vehicle is intended: USA, Japan, United Kingdom or Rest of World
- whether the vehicle has air suspension or damping control
- whether the vehicle has the "stopping distance reduction" function

Basic settings

The system calibration is implemented via "Basic settings". However, since the diagnostic tester operator is guided step by step through the program during the calibration routine, the individual basic settings do not have to be started individually. The basic settings are initiated automatically by the tester at the correct point in the program and therefore are executed entirely in the background.

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