

Workshop Manual

Audi A4 2008 ➤

Audi A5 Coupé 2008 ➤

System description - lane departure warning (Audi lane assist)

Edition 10.2011



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List of Workshop Manual Repair Groups

Repair Group

01 - Self-diagnosis, electrical checks



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents

01 - Self-diagnosis, electrical checks	1
1 General notes on lane departure warning	1
1.1 Technical data	1
1.2 Components used	1
1.3 Exchange of data between system components	2
2 Description	4
2.1 Electronic image processing	4
2.2 Switching the system on and off	4
2.3 Possible states of warning lamp in instrument cluster	4
3 Notes for service	6
3.1 Calibration	6
3.2 Diagnosis	8



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01 – Self-diagnosis, electrical checks

1 General notes on lane departure warning

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The lane departure warning (Audi lane assist) helps the driver to stay in lane. A camera is used for detecting lane markers. The lane departure warning 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, the steering wheel vibrates to warn the driver. If the lane departure warning is "on alert" and the driver operates the turn signals 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 km/h or higher.

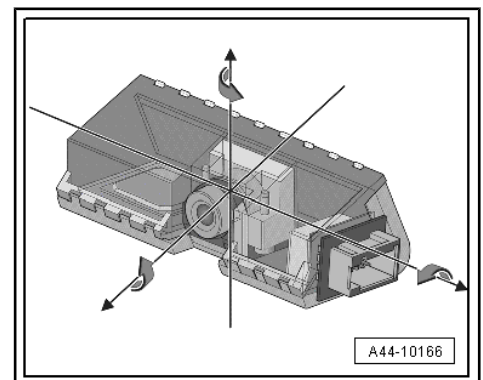
Adverse road conditions, such as a dirty or snow-covered road surface, a lane which is too narrow for the vehicle, or ambiguous lane markers (as commonly found in road works on motorways for instance) may result in the system being temporarily unavailable. The current system status is indicated to the driver on the dash panel insert.



1.1 Technical data

The lane departure warning control unit and the camera are combined in a single unit and can only be replaced together. 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.



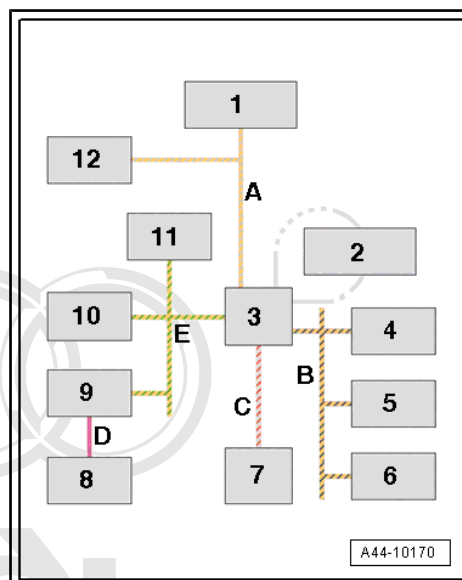
1.2 Components used

The following list summarises all the control units which contribute to the lane departure warning function. They transmit information to and receive information from the lane departure warning control unit J759.

- ◆ 1: Lane departure warning control unit -J759-

- ◆ 2: Control unit for front display and information control panel - J523-
- ◆ 3: Data bus diagnostic interface -J533-
- ◆ 4: Engine control unit -J623-
- ◆ 5: ABS control unit -J104-
- ◆ 6: Adaptive suspension control unit -J197-
- ◆ 7: Control unit in dash panel insert -J285-
- ◆ 8: Multi-function steering wheel control unit -J453-
- ◆ 9: Steering column electronics control unit -J527-
- ◆ 10: Convenience system central control unit -J393-
- ◆ 11: Entry and start authorisation control unit -J518-
- ◆ 12: Adaptive cruise control unit -J428-

Bus networking: The diagram shows which bus systems are used to network which components.



A	CAN extended MOST bus
B	CAN drive train
C	CAN instrument cluster/running gear
D	LIN
E	CAN convenience

1.3 Exchange of data between system components

Adaptive cruise control unit - J428-	To avoid warnings being given simultaneously by the lane departure warning system and the braking guard, the lane departure warning system suppresses its steering wheel vibration warning if the braking guard simultaneously activates the brake.
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Entry and start authorisation control unit -J518-	Transmits information on which ignition key is currently recognised by the vehicle. The lane departure warning control unit utilises this information to assign stored driver settings to the corresponding ignition key.
Convenience system central control unit -J393-	Transmits information on whether the left or right turn signal is currently active.
Steering column electronics control unit -J527-	Transmits information indicating whether or not the lane departure warning button on the steering column lever is currently activated. Receives information from lane departure warning system 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.
Control unit for front display and information control panel - J523-	Transmits changes in driver settings relevant to the "lane departure warning" function to the lane departure warning control unit. The new settings are then saved and assigned to the ignition key currently in use.
Engine control unit -J623-	Transmits the current engine speed. The lane departure warning system 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 when the engine is off.)
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.
ABS control unit -J104-	Supplies the vehicle speed signal required for activating or deactivating the lane departure warning, as well as the yaw rate.
Control unit in dash panel insert -J285-	Receives information on the current status of the lane departure warning 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.

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2 Description

2.1 Electronic image processing

The black and white image captured 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 marking 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. The calculated values are also required to establish whether or not to deactivate the function temporarily due to the road geometry.

2.2 Switching the system on and off

The lane departure warning button E517 is integrated in the turn signal lever. Pushing the button switches the system on or off. The 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.

The current activation status is stored and assigned to the corresponding ignition key. This means: if the lane departure warning was active the last time the ignition was turned on, the system is reactivated the next time the ignition is turned on. The above applies only if the same ignition key is used on the two trips.

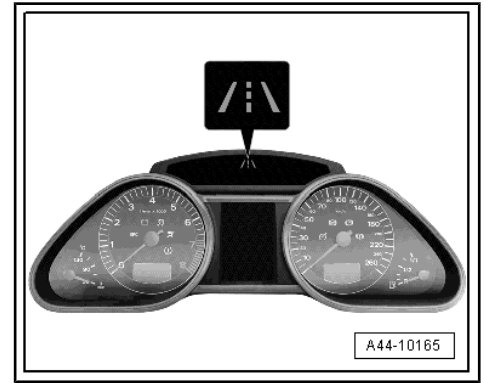
2.3 Possible states of warning lamp in instrument cluster

- ◆ Green warning lamp: system is switched on and "on alert"
- ◆ Yellow warning lamp: system is switched on but not "on alert" due to the prevailing conditions

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 km/h.
- ◆ 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).

- ◆ Warning lamp off: system is switched off To activate the system, push the lane departure warning button on the turn signal lever.



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3 Notes for service

3.1 Calibration

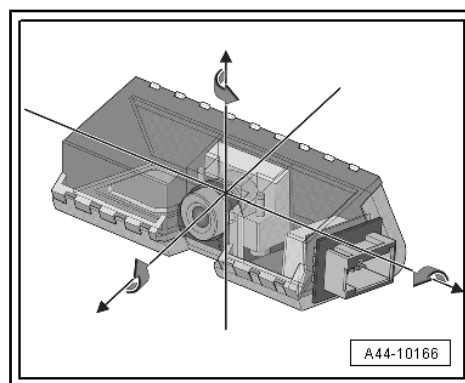
The calibration procedure involves determining the actual orientation angle of the camera on the vehicle. To ensure that the system's warning response is correct, the exact installation position of the camera on the vehicle must be known. Deviations from the specified installation position can occur due to component tolerances of the holder or windscreen or because of manufacturing tolerances.

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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 performed 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)



3.1.1 Calibration principle

The orientation angles of the lane departure warning 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 by analysing the picture. A software routine uses the image co-ordinates and the known reference position of the board to determine the camera's actual orientation angles, and stores this information in the control unit. The actual height of the camera on the vehicle is also determined.

3.1.2 New special calibration tool

New special tools are required for calibrating the lane departure warning system. They belong to tool family VAS 6430. This device can be used for calibrating both the lane departure warning system (Audi lane assist) and the adaptive cruise control (ACC).

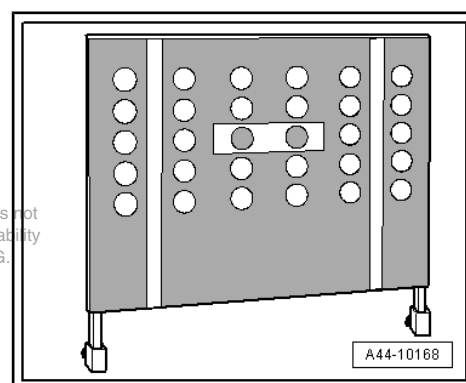
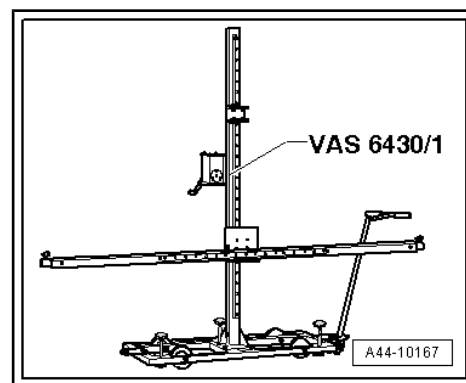
Special tool VAS 6430 is a complete set and includes the following separately available components:

- ◆ VAS 6430/1 setting device, basic set
- ◆ VAS 6430/2 ACC laser unit, VW
- ◆ VAS 6430/3 ACC reflective mirror, Audi
- ◆ VAS 6430/4 calibration board for lane guard system

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

Dealers who already have the VAS 6190 ACC setting device need 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 from VW and the ACC reflective mirror from Audi can be attached to the new VAS 6430/1 setting device.

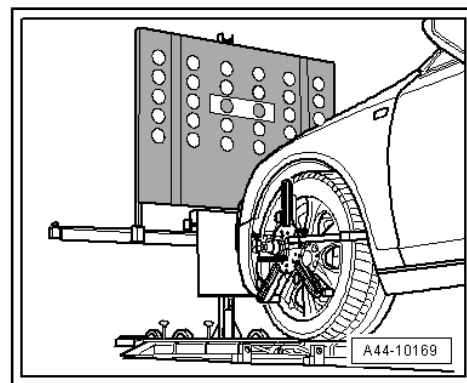
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3.1.3 Further tools required for calibration

The following tools are required to calibrate the lane departure warning system:

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



3.1.4 When is it necessary to calibrate the system?

The lane departure warning system has to be calibrated for the following reasons:

- ◆ The fault memory contains the entry "no or incorrect basic settings/adaption".
- ◆ The lane departure warning control unit has been renewed.
- ◆ The windscreen has been removed or renewed.
- ◆ Rear axle toe setting 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.

3.1.5 Calibration procedure

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

- ◆ The "lane departure warning calibration" program is started on the wheel alignment computer.
- ◆ Quick release clamps are mounted on all 4 wheels.
- ◆ Wheel alignment sensors are mounted on the two rear wheels.
- ◆ Wheel runout compensation is performed on the rear wheels.
- ◆ Two wheel alignment sensors are attached to the VAS 6430.
- ◆ The setting 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 Functions".
- ◆ The body height is measured at the edges of all four wheel arches and entered into the program.
- ◆ The calibration routine then runs to completion automatically.

3.1.6 Online calibration

The system also has an "online calibration" function. In online calibration mode, the lane departure warning system checks while the vehicle is being driven whether the yaw and pitch angles determined during the calibration have changed. Any changes are incorporated into the values

- ◆ yaw angle offset and
- ◆ pitch angle offset

and are taken into account by the system. The values are shown in a "measured value block". The two values are reset to zero during the next calibration.

3.2 Diagnosis

The lane departure warning control unit has full self-diagnostic capability. Measured value blocks, adaption channels, final control diagnoses, control unit codings, basic settings and fault memory entries are available. The lane departure warning control unit is addressed by the diagnostic tester with address word 5C.

3.2.1 Measured value blocks

The following variables can be read out using the "Measured value blocks" function:

- ◆ 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 or current corner radius
- ◆ Lane departure warning status (off/on & active/on & inactive)
- ◆ Lane departure warning status (warning inactive/active, if active due to left/right hand side warning)
- ◆ Lane departure warning button status (pressed/not pressed)



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- ◆ Actual height values generated by the 4 vehicle level senders (if air suspension is installed on the vehicle)
- ◆ Warning point setting and warning vibration level
- ◆ Stored personalised settings assigned to the individual remote control keys (system status, warning point and vibration level)
- ◆ Vibration motor: fault detected (yes/no); lane departure warning button: fault detected (yes/no); the information is supplied by the steering column electronics control unit J527
- ◆ Status of CAN communication with control units which transmit the information for the lane departure warning function
- ◆ Roll, pitch and yaw angles of the camera
- ◆ Camera height
- ◆ Reason for failed calibration
- ◆ Yaw and pitch angle offset
- ◆ Information on the online calibration

3.2.2 Final control diagnoses

The following components can be activated via a final control diagnosis:

- ◆ Windscreen heater Z67 can be activated by final control diagnosis on the lane departure warning 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 final control diagnosis on the steering column electronics control unit J527.
- ◆ The lane departure warning lamp on the dash panel insert can be activated together with the other warning lamps via final control diagnosis on the control unit in dash panel insert J285.

3.2.3 Control unit coding

For the Audi A5 (or Audi A4 2008➤), coding of the control unit is only possible online via target/actual comparison in Guided Functions. The control unit coding provides the following vehicle information to the lane departure warning 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 "area monitoring system" function

3.2.4 Basic setting

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.