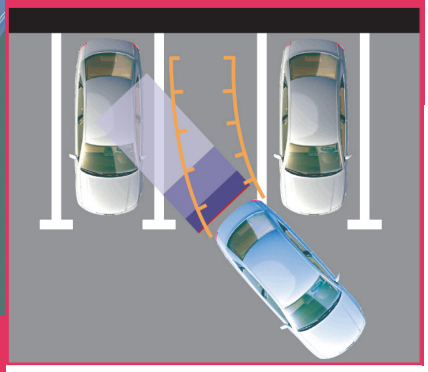
Service Training





Audi Q7 - Driver's Assistance Systems

- Lane Change Assistance
- Optical Parking System (OPS)
- Rear View Camera

Self-Study Program 996603

Audi of America, Inc.
Service Training
Printed in U.S.A.
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Table of Contents

Lane Change Assistance (LCA) 1

Optical Parking System (OPS) 17

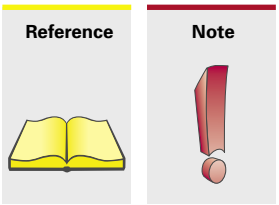
Rear View Camera 25

Self-Study Programs for the Audi Q7 37

The self-study program provides introductory information regarding the design and function of new models, automotive components or technologies.

The self-study program 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.



Driver Assistance Systems

One of the important goals when developing new vehicles is the continuous improvement of vehicle safety. The new driver assistance systems which are entering production for the first time with the Audi Q7 make a significant contribution to this goal. Several innovative driver assistance systems are available as options, including the radar-assisted Lane Change Assistance System, the Optical Parking System (OPS) with acoustic and visual feedback, and the Rear View Camera System.

A frequent cause of accidents is the failure to see vehicles during lane changes. By permanently monitoring the adjacent lanes, especially in the area behind the vehicle, the Lane Change Assistance System helps the driver during overtaking and lane changes, thus contributing to an active safety. The driver is informed if one of the adjacent lanes is occupied by one or more other vehicles. Despite the extensive capacity of the system, the driver must always be aware that the system provides support but cannot relieve the driver of responsibility. In spite of Lane Change Assistance System, it is still necessary to turn one's head, look in the exterior rear-view mirror and watch for other traffic.

Two new functions are available to the driver. The familiar acoustic parking aid has been expanded by a graphic screen display in the MMI. Using bar diagrams, it shows in detail to the vehicle owner where a collision is imminent. The bar diagrams allow for a precise estimation of the distance up to the obstacle. The familiar acoustic feedback is still available to the driver.

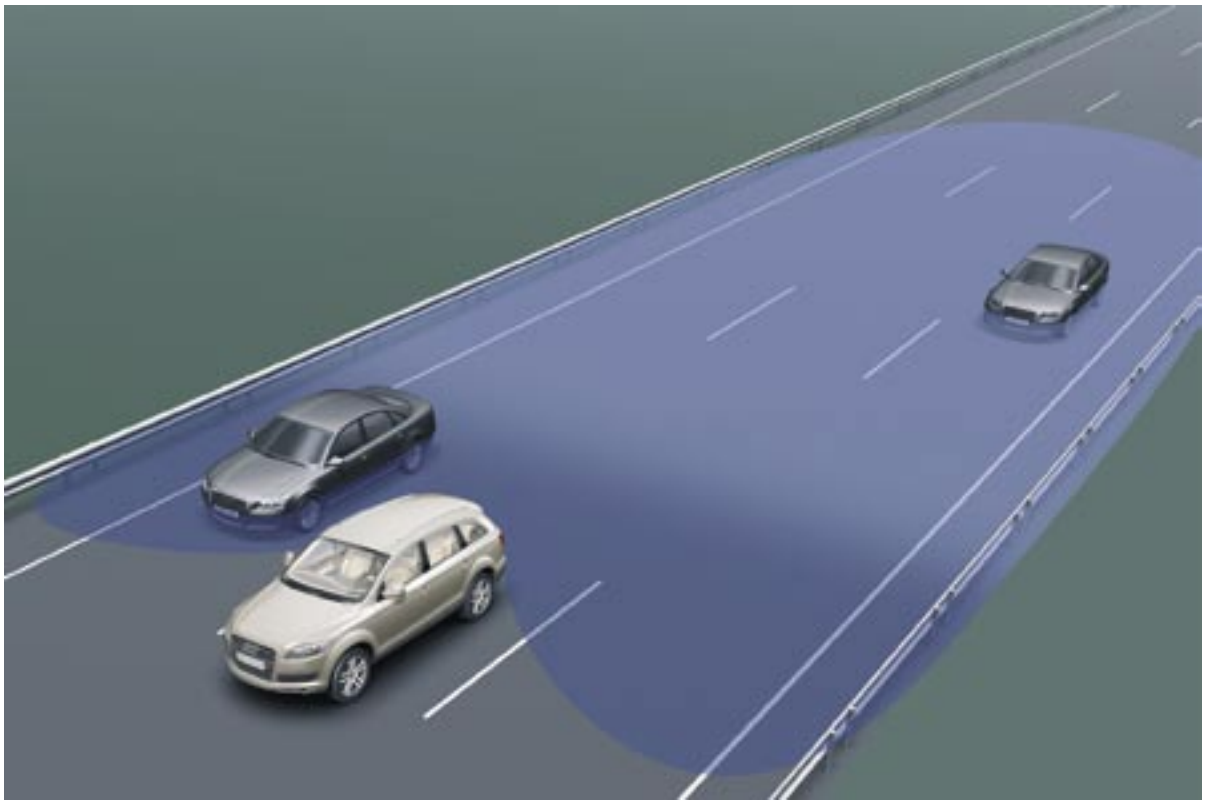
Anyone who prefers to form their own picture of the situation behind the vehicle can display on the MMI screen an image from a rear view camera system. The camera is integrated into the tailgate lift handle and provides an optimal overview of what is happening behind the vehicle. The camera image appears automatically when the reverse gear is engaged.

Lane Change Assistance (LCA) in the Audi Q7

Introduction

The task of the Lane Change Assistance System is to monitor the areas to the rear and to the sides of the vehicle with the aid of radar sensors and to help the driver during a lane change. The monitored area covers also what is known as the “blind spot.” The driver side and the passenger side are both monitored. A separate radar sensor is provided for each side.

If the Lane Change Assistance System (LCA) detects a critical situation which could result in an accident during a lane change, the system informs and warns the driver. The driver is informed by the activation of the warning lights in the appropriate exterior rear-view mirror, and is warned by the warning lights flashing brightly.



375_040

Radar Sensors and Control Modules

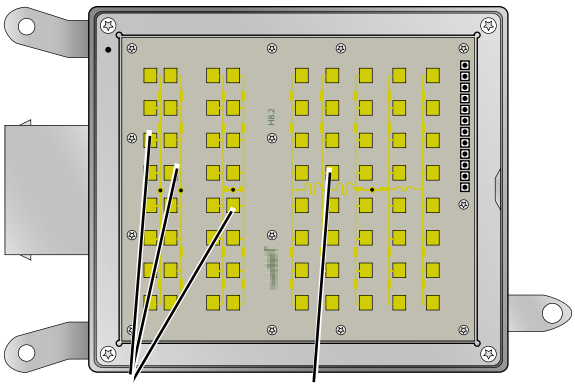
The Lane Change Assistance System has two control modules, the Lane Change Assistance Control Module J769 (master control module) and the Lane Change Assistance Control Module 2 J770 (slave control module). The master control module forms one unit with the right-side radar sensor, and the slave control module forms one unit with the left-side radar sensor.

The master and slave control modules share an identical design. They are based on a printed circuit board with a digital signal processor as the central computing unit. One of its functions is to detect and track objects recognized by the radar sensors. The system manufacturer is the Hella Company.



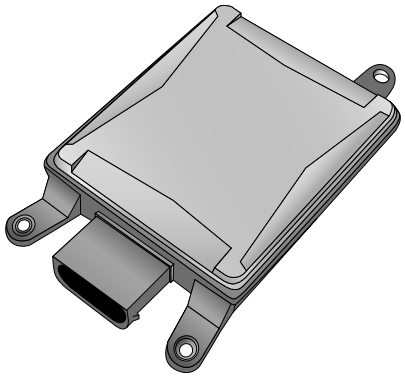
375_001

The antenna board with the transmitting and receiving antennas is connected to the electronics board by means of a strip connector.
The transmitting antenna consists of 40 copper facets, and the 3 receiving antenna consist of 8 or 16 copper facets. A copper facet is called a “patch” in technical language.
The reflected radiation recorded by the receiving antenna is then analyzed by the digital signal processor to identify its physical properties. This information is used to calculate the size, position and speed of the reflecting object.



375_002

The control module upper cover is a plastic “radome”. This is a special plastic allowing optimal penetration of the radar beams without any degradation.



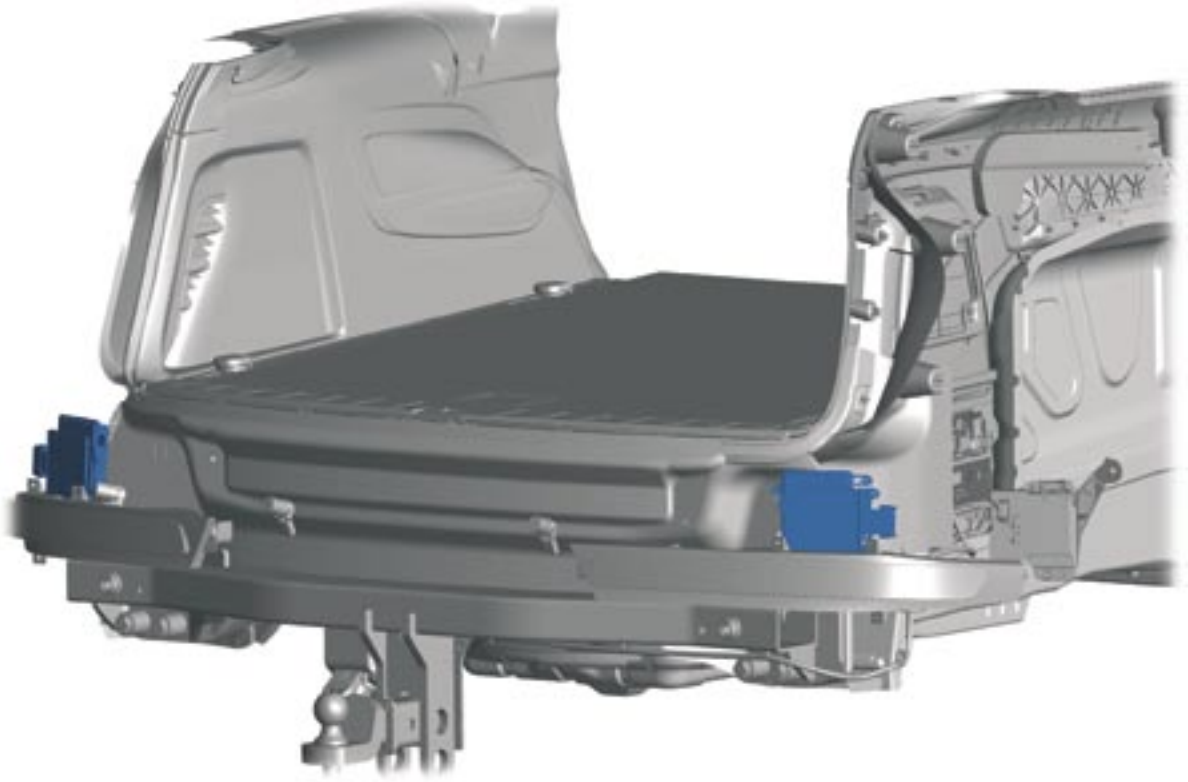
375_003

Component locations

In the Audi Q7, both control modules are located behind the rear bumper cover and are attached to the bumper support. The rear bumper support is attached by clips to the bumper cover and fastened to the body with screws. As a result, the bumper cover conceals the units which, contrary to the parking aid sensors, are not visible from the outside. Since the bumper cover is made of plastic, it does not present an obstacle to the radar beams.

The control modules are installed at an angle of 22 degrees to the vehicle's transverse axis, which allows a better monitoring of the side areas. They are inclined upward at about 3 degrees. An exact calibration is performed with the help of the diagnostic tester and special calibration tools after installation of the units on the vehicle.

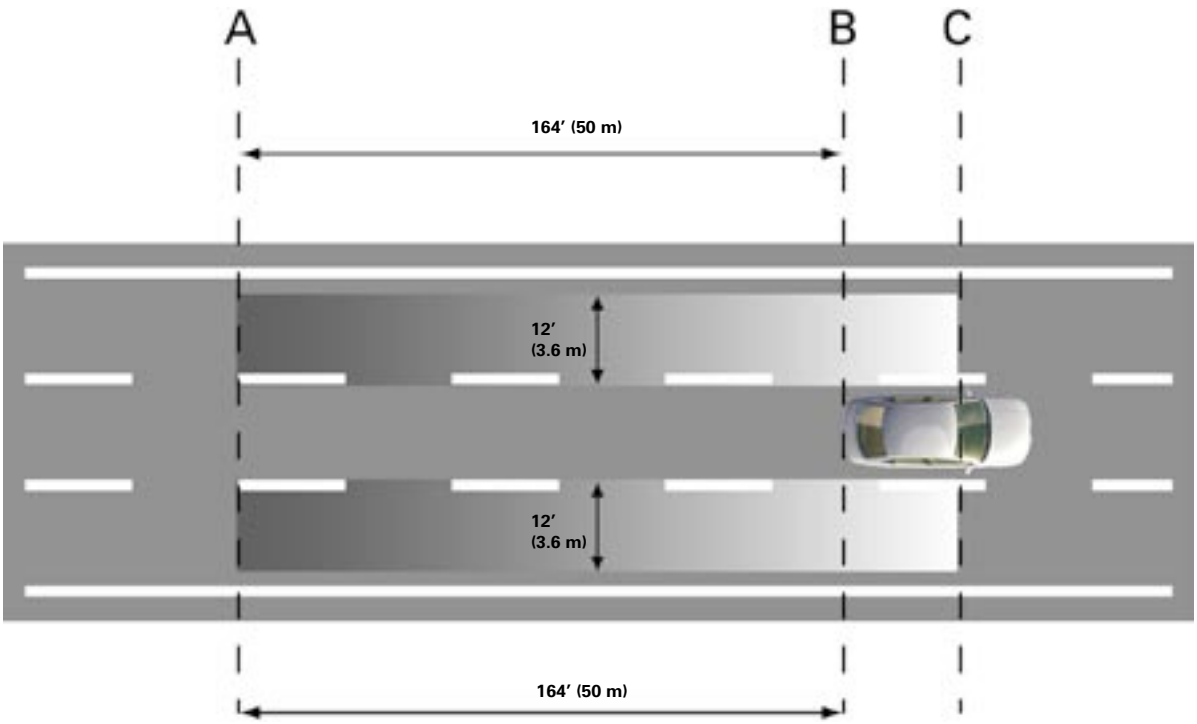
The calibration and the tools required for it are described in more details in a later section.



375_004

Area Monitored by the Radar Sensor

The area monitored on each side of the vehicle includes a side and a rear area. The rear monitoring area extends back for about 164 feet (50 meters) from the rear of the vehicle. This is the grey colored area between lines A and B. The side area extends from the rear corner of the vehicle to about the level of the B-pillar, which is the grey area between lines B and C. The width of the grey areas is about 12 feet (3.6 meters).



Sensor monitoring area

375_005

The illustration of the sensor monitoring area shows a straight road. On winding roads, the Lane Change Assistance System operates up to a minimum curve radius of about 558 feet (170 meters). If the curve radius is below the 558 feet limit, the Lane Change Assistance System switches to a deactivated state since the radar beams being transmitted can no longer scan the full 167 feet of the rear monitoring area. This deactivation threshold has a lag of 98 feet (30 meters). This means that a Lane Change Assistance System, deactivated because of a short curve radius, is reactivated only once a radius of more than 655 feet (200 meters) is reached.

The Lane Change Assistance Control Module calculates the path of the road from the yaw rate and the individual wheel speeds from the ABS Control Module J104. When driving on winding roads, the curved monitoring area is converted by the software to the image of a straight road. This way, the basis for the warning algorithm's decision to warn the driver or not remains the same on a straight road or when driving around bends.

Warning Lamps in the Exterior Mirrors

The Lane Change Assistance System warns or informs the driver of potential dangers during a lane change with warning lamps integrated in both exterior mirrors.

Lane Change Assistance Warning Lamp K233 is located in the left outside rearview mirror housing while Lane Change Assistance Warning Lamp K234 is located in the right outside rearview mirror housing.

The two warning lamps K233 and K234 can be replaced separately without having to remove the mirror housing. The procedure is described in the Repair Manual.

The warning lamps are activated directly by the Lane Change Assistance Control Module 2 J770 (slave control module). They consist of four yellow LEDs.



375_006

If the Lane Change Assistance System detects a critical situation on one side of the vehicle without any indication of an imminent lane change, the driver is informed by the warning lamp in the corresponding mirror lighting up. If the turn signal operation indicates an intentional lane change when the adjacent lane is occupied, the driver is warned by the warning lamp flashing four times.

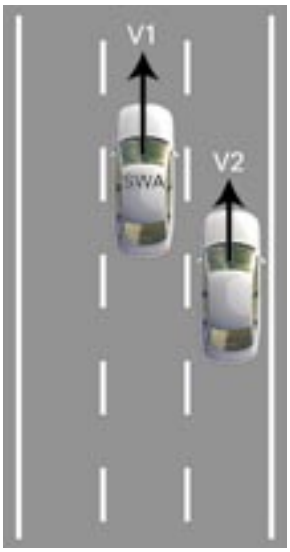
The brightness of the warning lamps can be adjusted by the driver to 5 different levels in the MMI. The ambient light currently being measured by the Rain/Light Recognition Sensor G397 is also used to determine the brightness of the warning lamps.

Two typical Traffic Situations

As an example, two typical traffic situations are described below, which can result in a warning from the Lane Change Assistance System.

Scenario 1

The vehicle with lane change assistance (LCA) is traveling in the center lane of a three-lane freeway and is just passing the vehicle on the right. The speed differential between the car with LCA and the vehicle being passed is less than 9.3 mph (15 km/h). As a result of the small speed differential, the passing maneuver takes some time, and the vehicle being passed disappears at some point in the "blind spot". In this situation, the warning lamp in the right exterior mirror must inform the driver that the right lane is occupied. If the driver of the LCA-vehicle now uses his right turn signal, the driver is warned by the lamp in the right exterior mirror flashing four times.

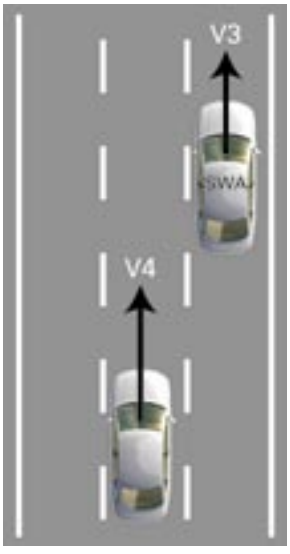


375_007

Scenario 2

The vehicle with lane change assistance (LCA) is traveling at medium speed in the right lane of a three-lane freeway. A vehicle approaches from the rear in the center lane at a clearly higher speed. The approaching vehicle is detected by the Lane Change Assistance System, which activates the warning lamp in the left exterior mirror. If the left turn signal is now used, a flashing warning lamp warns the driver against making a lane change because of the danger of a collision.

The distance between the vehicles at which the warning lamps are activated depends on the speed differential. The greater the speed differential, the higher the distance between the two vehicles at which the driver is informed of the danger of a potential collision. However, the earliest warning can only come at a 164 feet (50 meters) distance, since 50 meters is the upper limit of the radar sensors detection range.



375_008

Lane Change Assistance

System Operation

The Lane Change Assistance Button E530 is located in the driver's door next to the central locking switch. The function of the button is to switch the lane change assistance on or off. A red LED in the button indicates the current status. If the LED is lit, it means that the lane change assistance is switched on. An indicator lamp that is off indicates that the system is switched off or defective. After each restart, the previously applicable system status is reapplied.

When the system is switched on, the lane change assistance can be either active or inactive. Two conditions must be met in order to activate the system: the vehicle must be traveling faster than the minimum speed of 37 mph (60 km/h) and the curve radius must be higher than 557 feet (170 meters). If one of the two conditions is not met, the assistance switches to the inactive mode.

It should be noted that there is no indication to the driver whether the system is currently in active or inactive mode. The driver will only know if the system is active by the indication of the warning lamps in the respective outside mirrors.

Lane Change Assistance Button E530

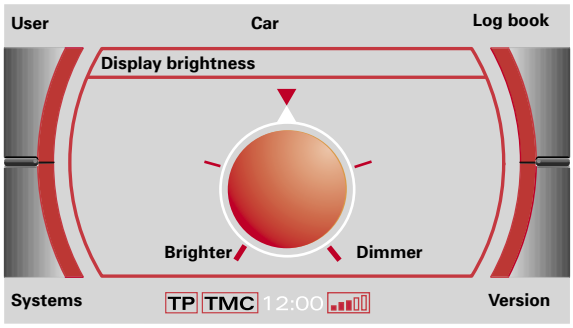


375_009

Adjusting the Brightness of the Warning Lamps

The driver has the option of adjusting individually the brightness of the exterior mirror warning lamps through the MMI. To do this, the menu item “Audi side assist” is selected in the MMI Car menu and activated by pressing the rotary control knob.

The brightness of the warning lamp can be adjusted to 5 different levels. The third level is the factory setting. After the selection has been made, the warning lamps are activated for 2 seconds at the selected brightness.



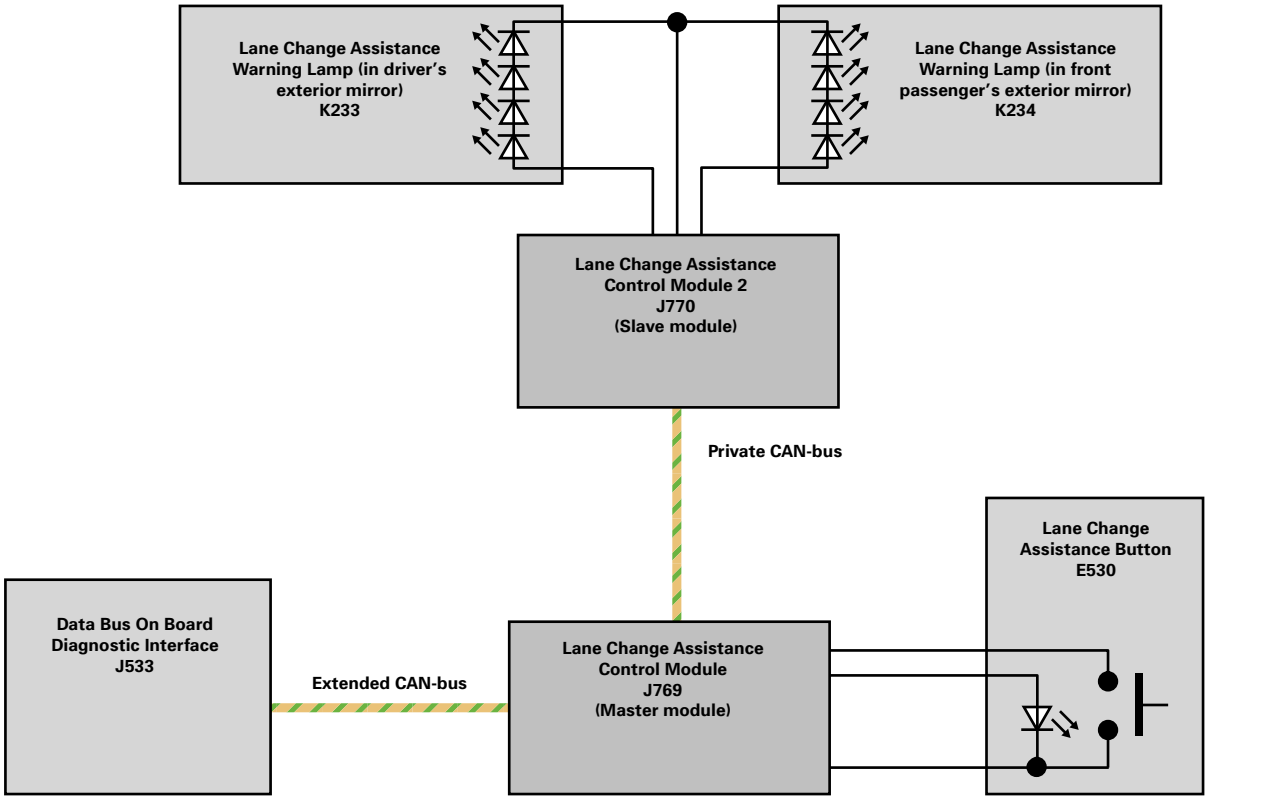
375_010

Personal settings

At the end of the trip, the Lane Change Assistance Control Module J769 (master control module) saves the brightness setting selected by the driver, for the most recently used vehicle key. The recorded settings will be reactivated the next time the same key is used.

System Wiring Diagram

The master and slave control modules exchange data over a private high-speed CAN bus. The master control module participates to the extended CAN bus to exchange data with other bus participants over the Data Bus On Board Diagnostic Interface J533. The master control module is also responsible for reading the input from the Lane Change Assistance Button E530. The slave control module on the other hand controls the two Lane Change Assistance Warning Lamps K233 and K234 in the exterior mirrors.



375_011

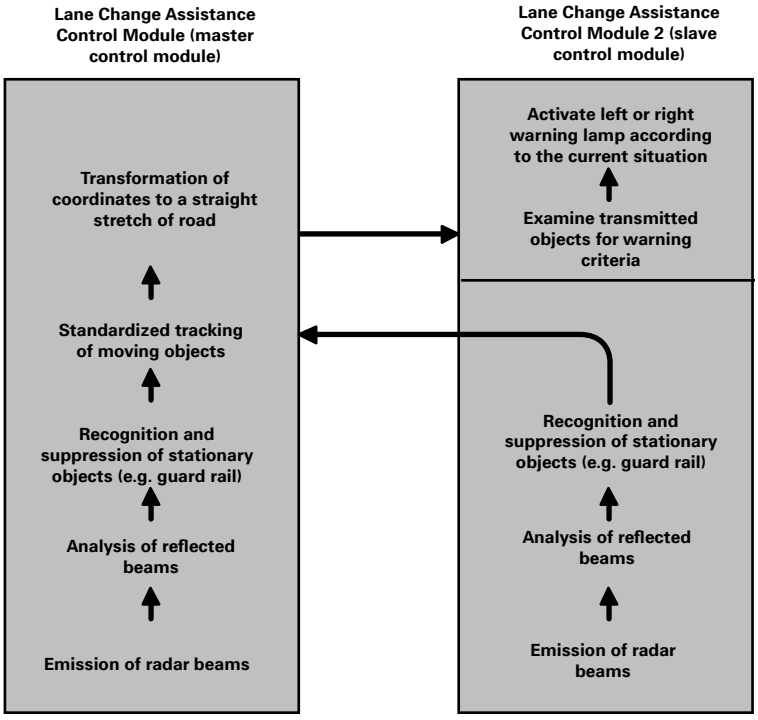
Division of Tasks Between Master and Slave Control Modules

Both control modules transmit radar beams through their transmitting antennas. The emitted radar beams are reflected by objects. Depending on the object composition, a large part of the radar signal, or little or no radar signal at all is reflected.

The reflected radar signal is measured by three receiving antennae for each control module. Based on the physical properties of the reflected radar signal, the control modules are able to detect various information about the reflecting objects. Among the physical properties are, for example, the time delay between transmission and reception of the radar signal, the frequency shift between transmitted and received signal, as well as the phase shift at the receiving antenna. From this information, the current position, speed and the direction of movement of various objects can be calculated.

Each control module by itself is capable of detecting stationary reflecting objects, such as the guard rail, structures at the edge of the road or stationary vehicles. Since these objects cannot cause a warning, they are not tracked further by the control modules.

Objects that are recognized as moving vehicles are tracked further by the master control module. Stretches of road that are not straight are also transformed in this control module into a straight stretch of road. This simplifies the assessment of the current situation by the warning algorithm.

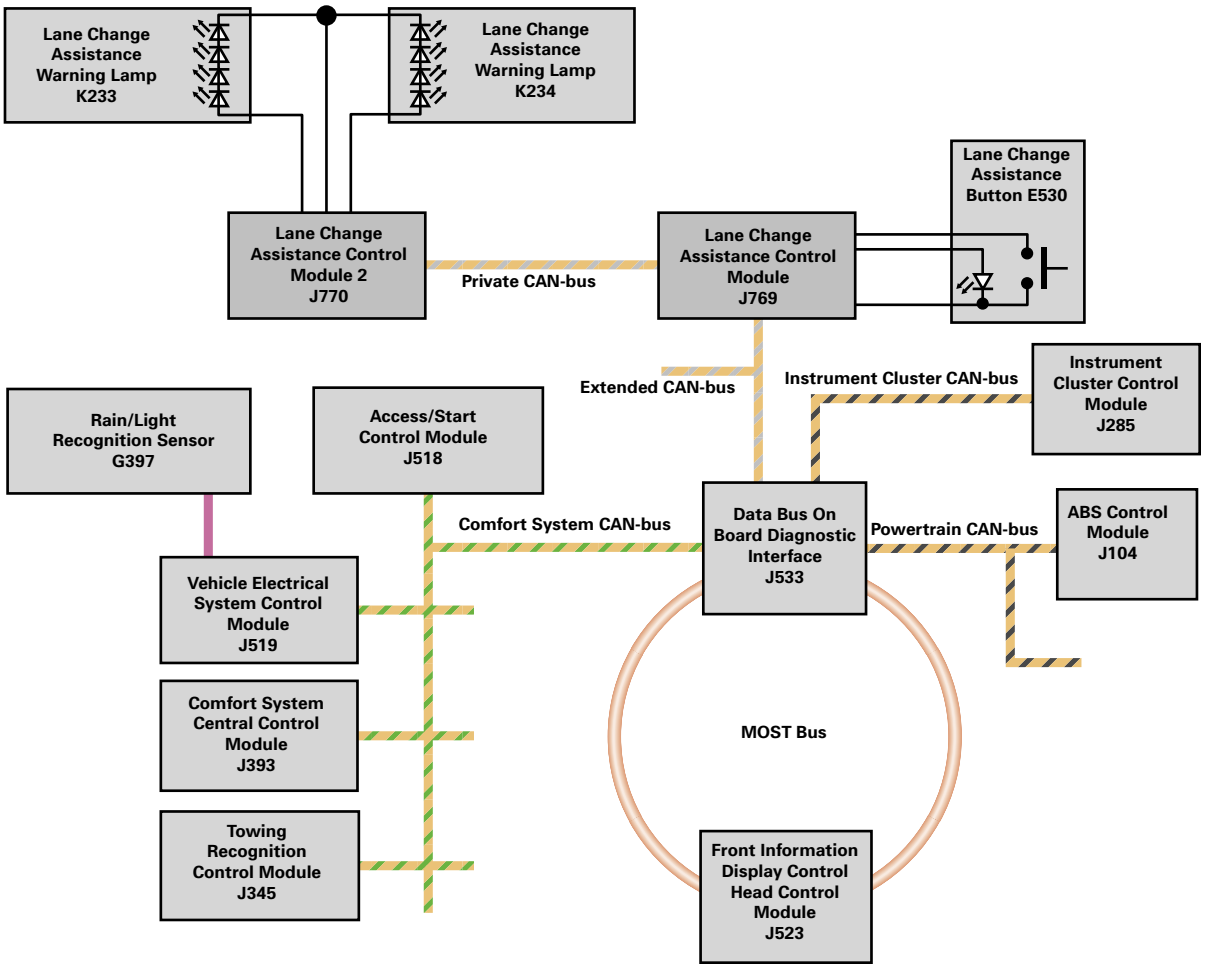


375_012

The data processed up to this point are transferred over the private CAN to the slave control module J770 where the warning algorithm is started. If the slave control module detects the danger of a collision during a lane change, based on the preset warning criteria, it activates the warning lamp on the appropriate side. If the driver additionally uses the turn signal on the critical side, the low-intensity continuous light changes into a high-intensity flashing lamp.

Lane Change Assistance Communications Structure

The Lane Change Assistance System requires a large number of informational items from the various control modules, connected to the various bus systems. The following describes the control modules exchanging data with the Lane Change Assistance System over the bus systems, and what information or variables are involved.



375_013

Rain / Light Recognition Sensor G397

Provides the Lane Change Assistance System with the measurement of current ambient brightness through its own LIN Master, the Vehicle Electrical System Control Module J519. This allows to adjust the brightness of the warning light to the ambient conditions.

Instrument Cluster Control Module J285

Informs the driver of problems occurring in the Lane Change Assistance System, with error messages and additional acoustic signal.

ABS Control Module J104

Provides the current yaw rate and wheel speeds to the Lane Change Assistance System. Using these variables, the current vehicle speed and the radius of the curve negotiated by the vehicle are computed.

Towing Recognition Control Module J345

Informs the Lane Change Assistance System if a trailer is presently hooked up to the vehicle or not. If there is a trailer, the function is deactivated since the sensor's field of vision could be affected by the trailer. A message to this effect is displayed for the driver in the instrument cluster. This function may be different for vehicles sold in the North American market.

Comfort System Central Control Module J393

Transmits information whether the right or left turn signal is being used. The Lane Change Assistance System uses this information to infer that a lane change is planned. The Comfort System Central Control Module also informs the Lane Change Assistance System whether the back-up lights are currently on or not. Lane change assistance is inactive while backing up.

Access/Start Control Module J518

Transmits the key number of the vehicle key currently in use. Once the "Ignition On" signal has been received, the personal brightness setting for the warning lamps is restored.

Front Information Display Control Head Control Module J523

The driver uses this module to adjust the desired brightness of the warning lamps. The value is saved in the Lane Change Assistance Control Module for the appropriate key.

Diagnosis

The Lane Change Assistance Control Module J769 (master) is assigned the Address Word 3C in the Scan Tool. The Lane Change Assistance Module J770 (slave) cannot be addressed separately by the Scan Tool and therefore does not have its own Address Word. The fault memory, the Measuring Value Blocks, the coding and the channels for the Lane Change Assistance System are all stored in the Lane Change Assistance Control Module J769 (master).

The following variables can be read in the Measuring Value Blocks:

- Supply voltage and internal temperature of master and slave modules
- Status of communication on the private CAN-bus between master and slave
- Current system status (on/off)
- Input variables for the functions that are transmitted by other control modules over the CAN-bus
- Currently computed curve radius
- Status of the Lane Change Assistance Button and its indicator lamp
- Status of both warning lamps in the exterior mirrors
- X and Y coordinates of the nearest object in the left, center and right lane
- Relative speed of the nearest object in the left, center and right lane
- Current status of auto-calibration; calibration information
- Status of communication with the control modules of the general functions

The following properties are encoded in the module:

- Model of the vehicle containing the Lane Change Assistance System
- Country in which the vehicle is being operated
- Left-hand or right-hand drive
- Whether a trailer control module is installed in the vehicle or not

The following variables can be configured in the configuration channels:

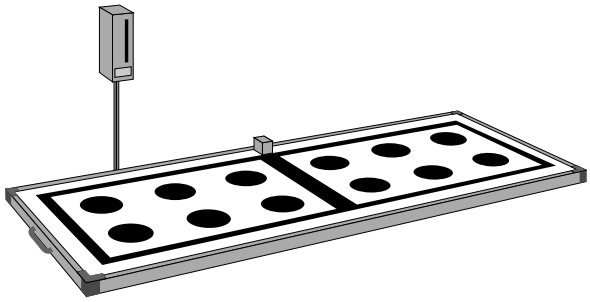
- The brightness of the warning lamps

The following components can be activated in the Diagnostic Test Mode:

- Indicator LED in the Lane Change Assistance Button
- Lane Change Assistance Warning Lamp in the driver's exterior mirror
- Lane Change Assistance Warning Lamp in the passenger's exterior mirror

Special Tool for System Calibration

Special tools have been developed for calibrating the radar sensors. They are a Calibration Board with a Doppler Generator VAS 6350, Wheel Center Recorders VAS 6350/1 and Distance Measuring Equipment VAS 6350/2 with laser measurement technology. The calibration board is used to calibrate both the radar sensors for the Lane Change Assistance System and the Rear View Camera System.



375_014

The first step is the correct positioning of the calibration board, which is described precisely in the Calibration Guide. First, the calibration board is aligned at a specified distance of the two rear wheels. To do this, the wheel center recorders, also referred to as “paddles”, are pushed onto the wheel nuts with a special installer. Gravity aligns the paddles perpendicular to the ground. The calibration board is now adjusted on both sides to the specified distance using an electronic distance gauge.



375_015

Using a line laser mounted centrally on the calibration board, the calibration board is aligned centrally to the vehicle longitudinal axis without changing the distance that has already been set. The laser creates a vertical line on the rear of the vehicle which, when it is correctly aligned, divides the rear Audi emblem, for example, into two equal halves.

After correct alignment, the calibration process can be started using the Scan Tool. The rest of the procedure is completely automatic. The black circles on the calibration board are needed only to calibrate the Rear View Camera System. The “Doppler generator” is used to calibrate the radar sensors. It simulates a moving object by means of a rotating fan wheel whose specified position is known to the control module. From the difference between the actual position and the specified position, the control module can learn the corrective values to use to correct the measured positions from this point on.

Note

Please always consult the electronic repair information for specific calibration instructions.

Applied Radar Technology

Radar Sensor System

The word RADAR is an acronym that stands for RAdio Detection And Ranging.

The technology is used with stationary objects to determine their position as a distance and an angle. With moving objects, the movement is detected in the form of current position, speed and direction of movement.

This is done by transmitting high-frequency electromagnetic radiations, or “microwaves,” and analyzing the radiation reflected by objects. The reflective characteristics of the objects are of paramount importance. Metallic objects reflect the radiation extremely well. Plastic, however, lets radiations pass almost completely through the material.

Therefore motor vehicles are very well suited for detection by radar sensors.

Benefits of Radar Sensors Compared to Other Sensor Systems

During the selection of the sensor system, the choice was made for radar technology rather than competing technologies such as video, ultrasonic or infrared technology.

Ultrasonic sensors have the disadvantage of a very limited range and are quite sensitive to environmental factors. Ultrasonic sensors must always be in direct contact with the propagating medium, air, and therefore need to be placed in a visible location.

Infrared sensors are primarily suitable for detecting lateral movement and can only very poorly detect movements toward or away from the sensor. It is precisely this last directional movement that is significant for lane change assistance. In addition, infrared sensors exhibit high sensitivity to environmental factors such as rain.

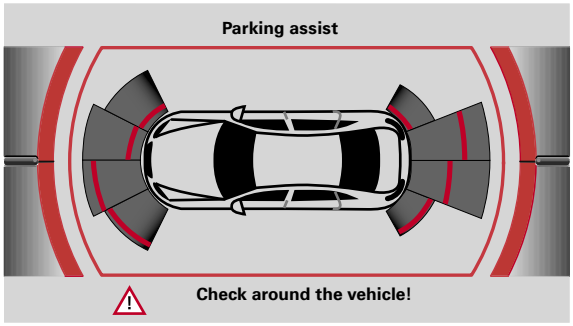
The sensitivity to environmental factors is also the reason why a video sensor system was not selected for this application. The range and lack of precision are other reasons against a video sensor system. The lack of precision comes from the need to interpret a video image before a distance could be measured. It is an indirect measurement process compared with the direct measurement method of a radar sensor system.

A radar sensor system is best suited for this task because it is insensitive to environmental factors and penetrates non-metallic materials, and as a result the sensors can be concealed by the bumper cover. Radar applications have also become much more cost-effective in recent years, which has made possible their use on a broad scale.

Optical Parking System (OPS) in the Audi Q7

Introduction

The Optical Parking System (OPS) is an innovative evolution of the previous parking aid systems from Audi. The 4-channel system (parking aid rear only) and the 8-channel system (parking aid front and rear) are already familiar. With these systems, the driver receives feedback through an acoustic signal identifying the distance between his or her vehicle and an obstacle.



375_016

The new Optical Parking System (OPS) is used with the 8-channel system. In addition to the existing acoustic sensor analysis, it provides the customer with an image in the MMI display which shows schematically the current distance of each individual parking aid sensor to an obstacle. Additional hardware is not needed for this expanded function. The Optical Parking System can be ordered with or without the rear view camera.

A major benefit for drivers compared with the purely acoustic system is that they can now determine visually at what point their vehicle is approaching an obstacle. With the purely acoustic solution, the only distinction that can be made from the signal frequency is whether an obstacle was detected by the front 4 parking aid sensors or by the rear 4 sensors.

Parking Aid Control Module J446

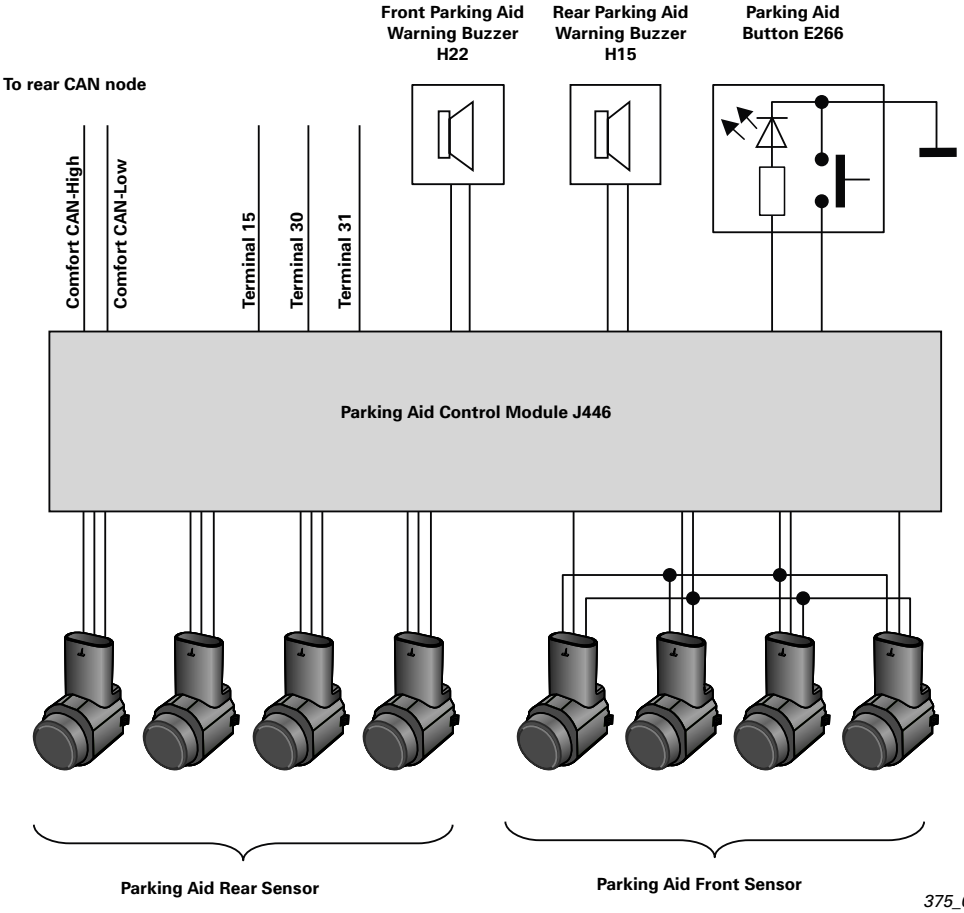
The Parking Aid Control Module has the following tasks:

- Make the supply voltage available to the parking aid sensors
- Analyze and process the signals from the parking aid sensors
- Activate the two Parking Aid Warning Buzzers H15 and H22
- Transmit the necessary information to the Front Information Display Control Head Control Module J523 to show the OPS image on the MMI screen
- Save the settings related to the vehicle key when the vehicle is locked (volume front/rear, frequency front/rear)
- System diagnosis; fault memory management
- Reading of the Parking Aid Button E266
- Actuation of the indicator lamp in the Parking Aid Button E266
- Communication with other control modules for transmitting and receiving message content



375_017

Functional diagram of the Parking Aid Control Module J446



375_018

Location

The Parking Aid Control Module J446 is installed at the right rear, below the load floor.

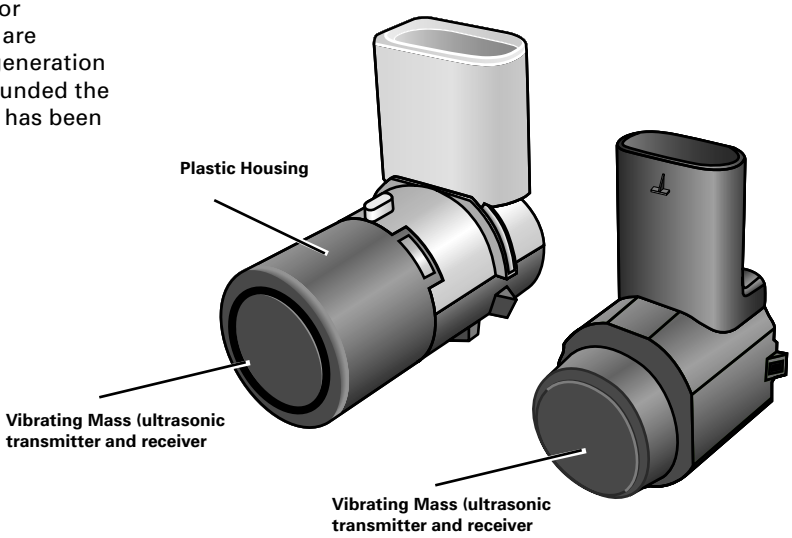
It can be addressed with the Scan Tool under the Address Word 76.



375_019

Parking Aid Sensors

Fifth generation parking aid sensors are used for the first time in the Audi Q7. Their dimensions are considerably smaller than those of the fourth generation sensors. The solid plastic housing which surrounded the vibrating mass of the fourth generation sensor has been eliminated in the new sensor generation.



375_020

Operation of the Optical Parking System (OPS)

Monitoring Range of the Parking Aid System

The Optical Parking System (OPS), like the previous 8-channel systems, monitors the area around the vehicle with 4 parking aid sensors integrated into the front bumper and 4 in the rear bumper. The acoustic message is given by one warning buzzer in the front area and one in the rear area of the vehicle. The visual display is in the MMI screen.

Depending on their location, the parking aid sensors detect obvious obstacles as follows:

- Side rear parking aid sensors: starting at about 24" (60 cm)
- Side front parking aid sensors: starting at about 35" (90 cm)
- Center rear parking aid sensors: starting at about 47" (120 cm)
- Center front parking aid sensors: starting at about 63" (160 cm)

The signal changes to a continuous tone at the following distances:

- Front: at about 10" (25 cm)
- Rear: without trailer hitch: at about 12" (30 cm)
  with trailer hitch: at about 14" (35 cm)

Optical Parking System

Operation of the Parking Aid System

There is acoustic and visual feedback to the driver only when the Parking Aid System is active. The system is automatically activated when the reverse gear is engaged.

When parking forwards or driving forwards towards an obstacle, the Parking Aid System must be activated manually by pressing the Parking Aid Button.

The system activation is always reported back to the driver by an acknowledgement signal. An activated Parking Aid System can also be recognized by the indicator lamp lighting in the Parking Aid Button.

As a result of the system activation, the MMI also switches automatically to the Optical Parking System display. If the rear view camera is installed as well in the vehicle, the setting of the display that should appear on the screen can be selected in the Car menu of the MMI under the “Audi parking system” item. The possible MMI customer settings are explained in more details in the rear view camera section.



375_021

An activated Parking Aid System is deactivated:

- when the speed exceeds about 9.3 mph (15 km/h) (forwards),
- by switching the ignition off,
- by pressing the Parking Aid Button.

Once the system has been deactivated, the indicator lamp in the button goes off and the MMI switches back to the image displayed before the system was activated.

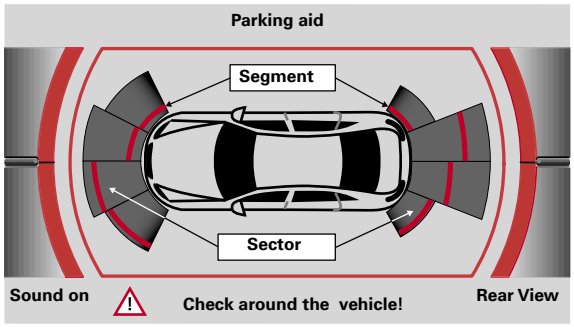
Feedback to the Driver

If an obstacle is detected within the warning zone when the Parking Aid System is activated, the distance warning begins. As the distance to the obstacle reduces, the time interval between the tone pulses also becomes shorter until it changes into a continuous tone after a critical distance is passed.

With the Optical Parking System (OPS), in addition to the acoustic warning, the current distance readings from the parking aid sensors are displayed in the MMI display. One sector is assigned to each sensor, so there are 4 sectors at the front and 4 sectors at the rear with the 8-channel system.

Within a sector, a red segment represents the current distance of an obstacle to the vehicle, or to the sensor making the measurement. If an obstacle is moving towards the vehicle, the red segment in the graphic also moves towards the vehicle.

OPS display in MMI High

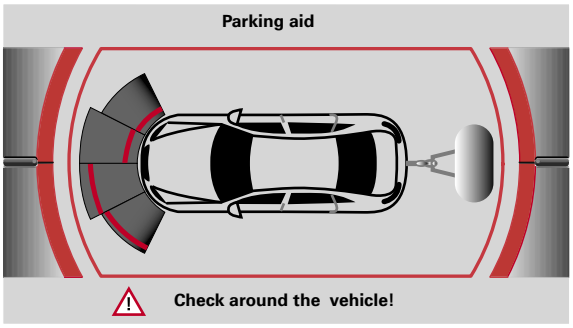


375_022

375_023

Trailer Operation

If the Parking Aid Control Module recognizes from the coding that a trailer hitch has been installed, the continuous tone area is extended by 2" (5 cm) to 14" (35 cm). This is necessary because the trailer hitch makes the vehicle longer at the rear.



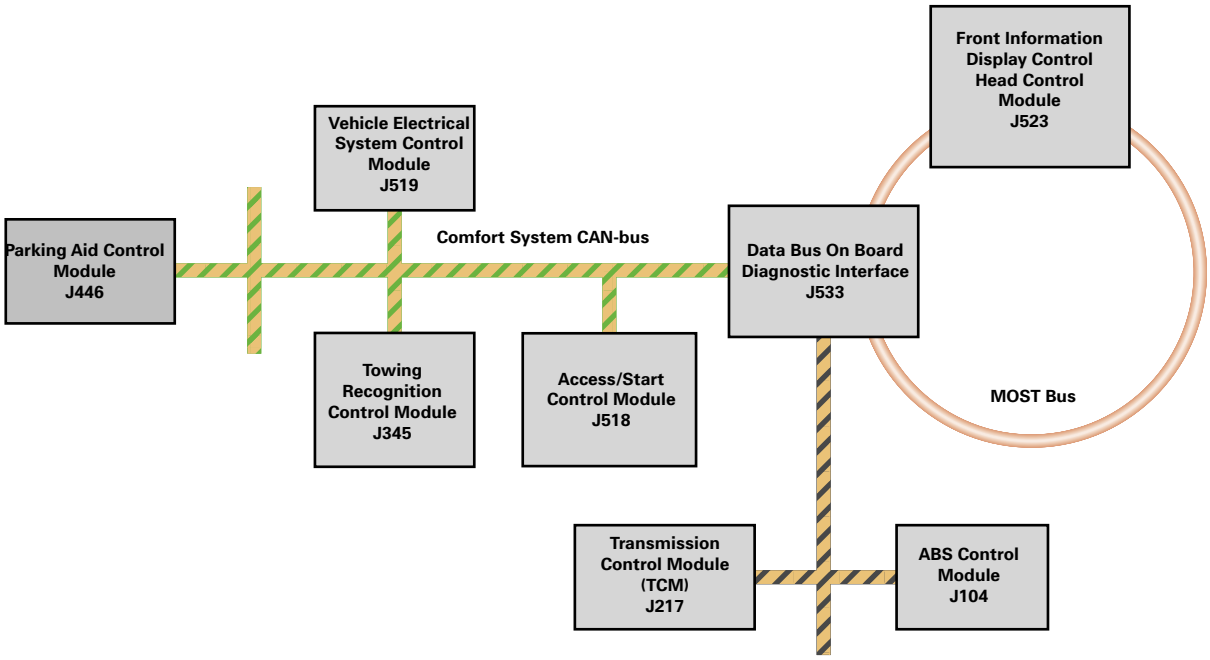
375_024

Note

Trailer operation of the Optical Parking System for the North American market has not been configured at the time of this printing. Please consult the appropriate repair manual for the latest information.

Communications Structure of the Optical Parking System

The Parking Aid Control Module requires information from other control modules in order to operate correctly. The Parking Aid Control Module obtains this information over the Comfort System CAN-bus. Information required from participants to other bus systems are transferred to the Comfort System CAN-bus by the Data Bus On Board Diagnostic Interface and are therefore accessible to the Parking Aid Control Module.



375_025

The Parking Aid Control Module J446 receives the following information from each control module:

Vehicle Electrical System Control Module J519

The backup light is on. This implies that the reverse gear has been engaged and the parking aid has to be activated.

(CAN message is analyzed only on vehicles with manual transmission.)

Towing Recognition Control Module J345

Trailer currently detected or not. If a trailer is currently detected, the rear parking aid is deactivated.

Access/Start Control Module J518

The current terminal status and the number of the key currently in use are transmitted. The key number is used to activate individual settings, such as for example, the volume and frequency of the acoustic warning.

ABS Control Module J104

Transmits the current vehicle speed. This information is needed since with the parking aid system activated, the front parking aid is available only up to a speed of v=9.2 mph (15 km/h). If this threshold is exceeded, the system is deactivated. Since vehicle speed is needed only for parking forwards, the message from the ABS Control Module J104 is analyzed only in an 8-channel system.

Front Information Display Head Front Control Module J523

Transmits the individual settings to the Parking Aid Control Module which saves the settings for the current vehicle key. J523 is also used to display to the driver the distances determined by the parking aid sensors, as graphical segments.

Transmission Control Module (TCM) J217

Transmits that the selector lever is in the “R” position or not. If it is, the Parking Aid System is activated.



Note

Trailer operation of the Optical Parking System for the North American market has not been configured at the time of this printing. Please consult the appropriate repair manual for the latest information.

Diagnosis

The Address Word 76 is assigned to the Parking Aid Control Module in the Scan Tool.

The following variables can be read in the Measuring Value Blocks:

- Distance of the individual rear sensors to an obstacle
- Distance of the individual front sensors to an obstacle
- Minimum distance of the 4 rear sensors
- Minimum distance of the 4 front sensors
- Vehicle speed
- Supply voltage for the parking aid sensors
- Reverse gear engaged Yes/No
- Trailer attached Yes/No
- Function button actuation
- Rear acoustic warning volume and frequency setting
- Front acoustic warning volume and frequency setting
- Decay time for the individual rear sensors
- Decay time for the individual front sensors
- Currently valid vehicle key number
- Settings saved for the current vehicle key

The following properties are encoded in the module:

- Vehicle version (Sedan, Avant, Coupe...)
- USA or Rest of the World
- Type of transmission installed (manual/automatic)
- Rear view camera installation in vehicle
- Trailer hitch installation in vehicle
- Optical Parking System (OPS) or pure 8-channel acoustic parking aid

The following variables can be configured in the adaptation channels:

- Acknowledgement tone when the Parking Aid System is activated on/off
- Reset of volume and frequency to factory settings

The following components can be activated in the Diagnostic Test Mode:

- Rear Parking Aid Warning Buzzer H15
- Front Parking Aid Warning Buzzer H22
- Parking Aid Indicator Lamp K136



Note

Please always consult the electronic repair information for diagnostic information on the system.

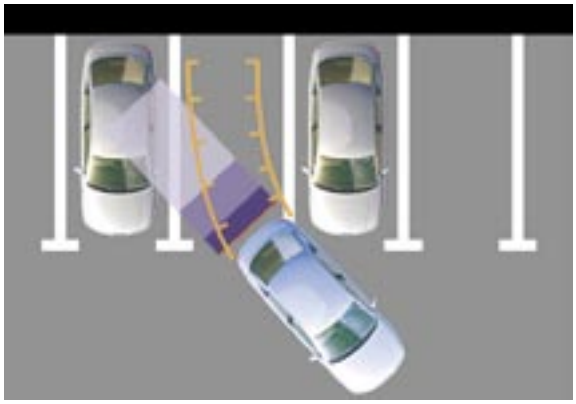
The Rear View Camera in the Audi Q7

Introduction

The Audi Rear View Camera provides the driver with an improved vision toward the rear by scanning the area to the rear of the vehicle and displaying it on the MMI screen. This greatly simplifies for the driver the tasks of backing-up on a street or while parking.

It is possible to drive up much closer to obstacles with the rear view camera. The driver can keep looking forward most of the time and does not have to keep his head turned constantly. Static and dynamic assistance lines are added to the video image to make it even simpler to backup into a parking space.

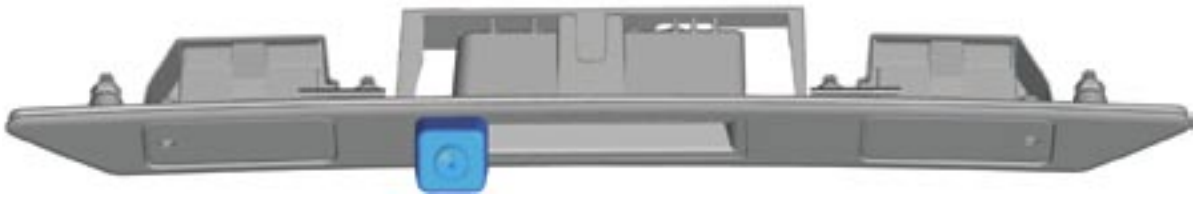
The Rear View Camera can be ordered as an individual parking aid system, along with the acoustic rear parking aid, or with the Optical Parking System (OPS). The ordering options vary considerably according to the particular market.



375_032

Rear View Camera

The Audi Rear View Camera is supplied by PANASONIC. It weights 1.4 oz (40 grams) and its dimensions are 1.06" x 0.96" x 1.38" (27 mm x 24.5 mm x 35 mm). Thanks to its compact size, the camera could be integrated into the rear hatch lift handle.



375_026

It is a wide-angle camera, with an horizontal angle of coverage of 130° and a vertical angle of coverage of 95°. The camera image is severely distorted because of the wide-angle lens being used and it has to be compensated before the image is shown on the MMI display. The image compensation takes place in the Rear View Camera System Control Module J772.



375_027

The chip used to record the images has a horizontal resolution of 510 pixels and a vertical resolution of 492 pixels, for a total resolution of 250K pixels.

Note

It is recommended that the lens be moistened with a commercial alcohol-based glass cleaner and cleaned with a dry cloth.

The camera lens has a dirt-repellent coating. Any dirt present on the camera lens is not identified by the Rear View Camera System Control Module but by the driver, from the image quality on the MMI screen. It is the driver's job to clean the dirty lens.



375_028

Rear View Camera System Control Module J772

Control Module Tasks

The Rear View Camera System Control Module J772 is part of the Comfort System CAN-bus.

The Rear View Camera System Control Module has the following tasks:

- Provide the supply voltage to the Rear View Camera
- Compensate the wide-angle camera image
- Insert the static and dynamic assistance lines into the camera image
- Provide a video input for the camera signal
- Provide a video input for the TV tuner
- Switch over to the desired video signal with an integral video switch
- Provide a video output of the completed video signal
- Perform the control module self-diagnosis
- Perform the diagnosis of incoming camera signals
- Perform the system calibration with a VAS Scan Tool and calibration board

In some markets (however, not in North America) a TV tuner is offered as optional equipment. If no TV tuner is installed in the vehicle, the second video input on the Rear View Camera Control Module remains unused.



375_029

Installation Location

The Rear View Camera System Control Module is at the right rear of the vehicle, close to the wheel housing. The image is transmitted from the Rear View Camera to the control module over a shielded line. The complete video signal is transmitted over this line with color, brightness, blackout and synchronization information.



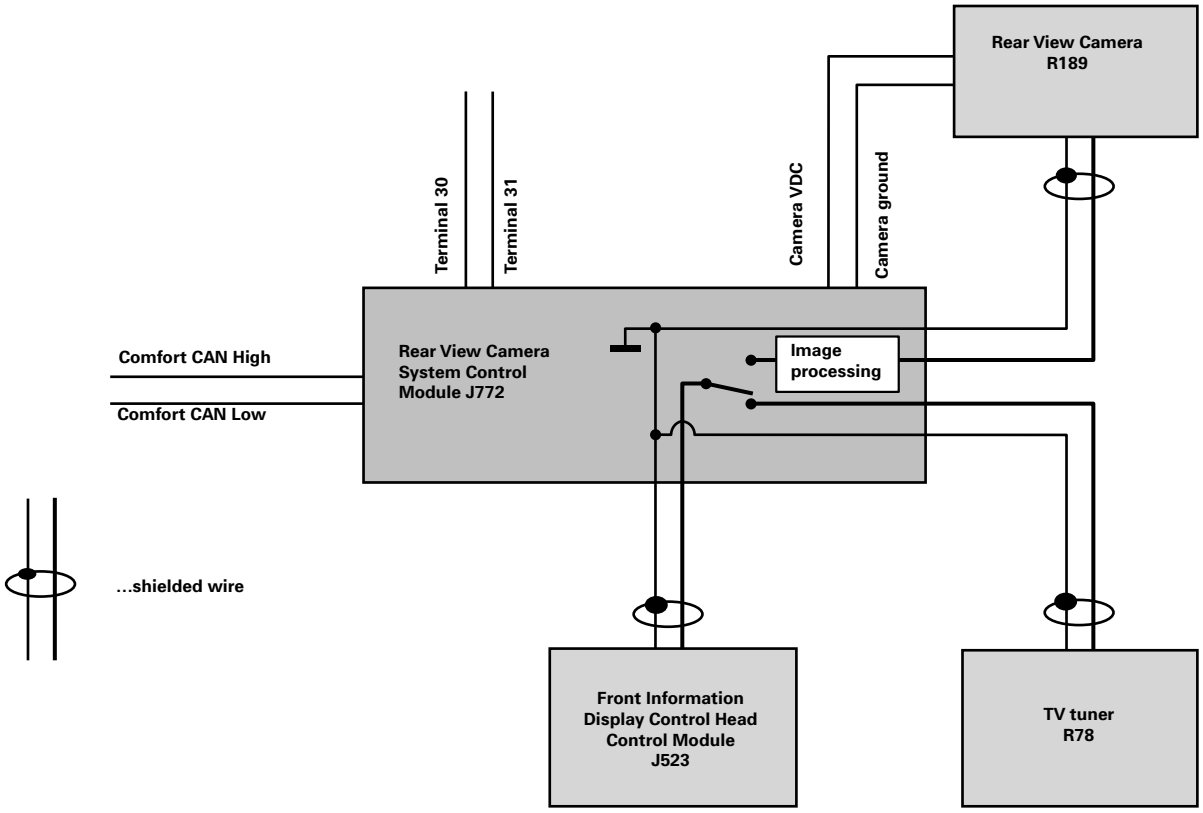
375_030

System Wiring Diagram

The rear view camera and its control module are connected to each other by 4 wires. There is a wire for the camera power supply, the matching ground wire, a shielded wire for the video signal, and the video signal shield, connected to the ground.

The camera is switched on and off through the supply voltage. The supply voltage for the camera is 6.5 Volts and is generated in the Rear View Camera System Control Module by means of a switched mode power supply. In operation, it requires about 500 mW of power.

The supply voltage for the camera is switched off above a speed of about 15 mph (25 km/h) since the function is not active at higher speeds.



375_031

The Front Information Display Control Head Control Module J523 has only one video input although there may be two video signal sources in the vehicle: the TV Tuner R78 (not available in North America) and the Rear View Camera R189.

For this reason, the Rear View Camera System Control Module J772 has 2 video inputs and a video switch which feeds the image from the TV Tuner or the image from the Rear View Camera on its video output. The video output of the Rear View Camera System Control Module J772 is connected to the video input of the Front Information Display Control Head Control Module J523.

The normal position for the video switch in J772 is shown in the illustration above: the video signal from the TV Tuner is applied to the video output. The video splitter only switches to the Rear View Camera when the rear view image is needed in the MMI. The image from the rear view camera must first be processed in the Rear View Camera System Control Module before it reaches the Front Information Display Control Head Control Module J523 over the video switch and the video output.

Parking Modes

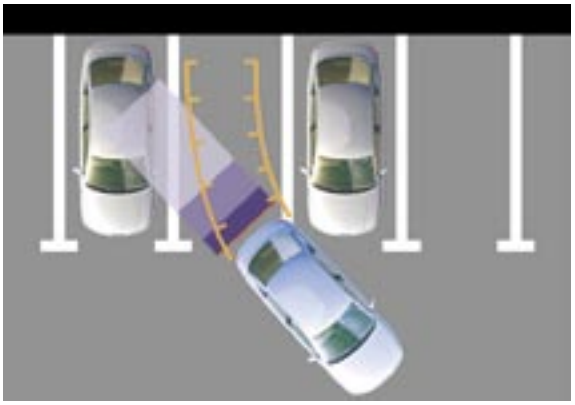
There are two different parking modes with the Audi Rear View Camera, the “perpendicular parking” mode and the “parallel parking” mode. Depending on the parking situation, the customer can choose one of the two modes.

The “perpendicular parking” mode is set as the default mode. To change the mode that is currently active, the “Mode” softkey must be pressed in the MMI operating area.

If the vehicle has the Optical Parking System (OPS) as well, it is possible to switch to the OPS graphic through the “Graphic” softkey.

Parking Mode 1: Perpendicular Parking

The Parking Mode 1 “Perpendicular Parking”, as shown in the illustration on the right, is especially suitable for backing into a parking space. It is also well suited for backing up on narrow lanes such as long garage driveways.



375_032

The blue area represents a vehicle contour extended by 16’ 5” (5 meters). The vehicle would drive over the blue field shown if it backed up another 16’ 5” in a straight direction.

The blue color gradient makes it easier for the driver to estimate the distance to obstacles. The first transition from deep blue to blue takes place at about 3’ 3” (1 m) from the rear bumper, the next transition is at about 6’ 7” (2 m) distance. The following light blue area extends to a distance of about 16’ 5” (5 m).

The red line at the beginning of the deep blue field is at about 1’ 4” (40 cm) from the rear of the vehicle. If it bumps into an obstacle, backing up should stop.

Since the alignment of the assistance field is independent of the steering angle and depends only on current vehicle position, it is also called a static assistance field.

In contrast, the orange assistance lines indicate the path which the vehicle would cover in the next 16’ 5” (5 m) if the steering wheel angle were to remain the same. Since the line radius depends on how far the steering wheel is turned, they are called “dynamic assistance lines.” The markings to the sides of the dynamic assistance lines are at intervals of about 3’ 3” (1 m).

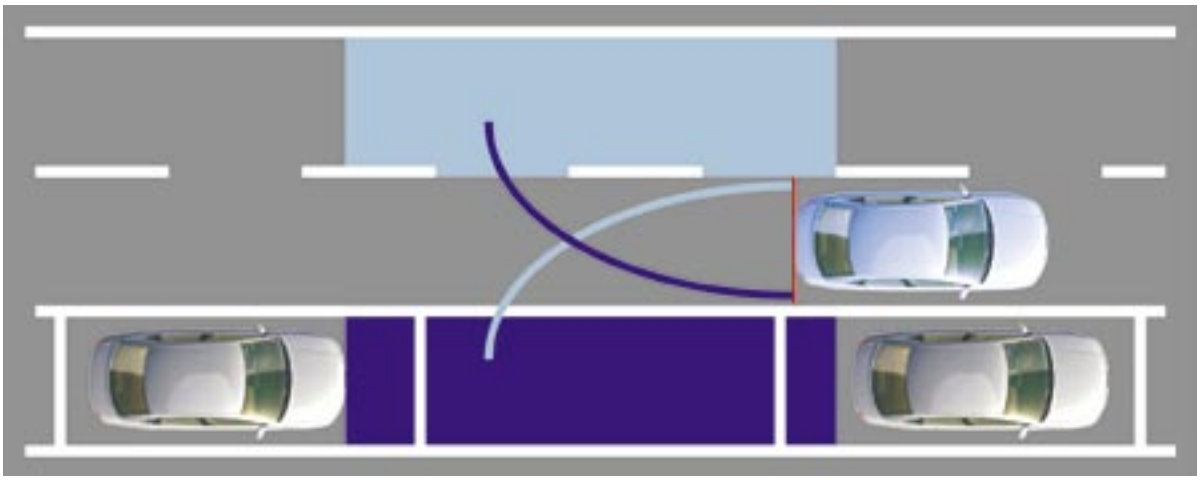


Check around the vehicle! **Graphic**

375_033

Parking Mode 2: Parallel Parking

Parking Mode 2 “Parallel parking” makes it easier for the driver to backup into a parking space along the curb. Two blue fields are shown, one light blue for backing up on the right side, and one dark blue for backing up on the left side. The illustrated static blue lines indicate to the driver the optimal point at which to turn the steering wheel.



375_034

Procedure for Backing up into a Parking Space

If the dark blue area fits between the two vehicles between which the parking is to take place, the parking space is sufficiently large.

Backup straight until the end of the dark blue area bumps into the rear vehicle (see upper right illustration). Now backup with the steering wheel turned fully to the right.

The driver must be careful to avoid contact with the vehicle behind which he or she is parking. When the dark blue line touches the curb (see lower illustration), the steering wheel must be turned fully to the left and the vehicle should continue to backup until it is standing parallel to the curb.

The driver should then drive straight forward just a little bit and the vehicle is optimally parked.



Check around the vehicle! **Graphic**

375_035



Check around the vehicle! **Graphic**

375_036

System Operation

Rear View Camera Activation

The display of the Rear View Camera image on the MMI screen is activated automatically as soon as the Terminal 15 is activated and the reverse gear is engaged.

On vehicles equipped with Optical Parking System (OPS), the display for the Rear View Camera can also be activated by the parking aid button on the center console. This is possible at forward speeds lower than 6.2 mph (10 km/h).



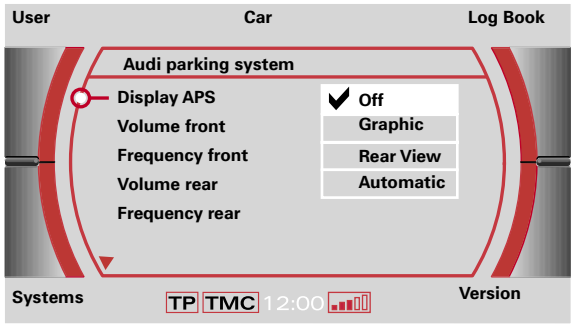
375_021

Deactivating the Rear View Camera

The display from the rear view camera in the MMI switches off when terminal 15 is deactivated, when another MMI hardkey is pressed or when the vehicle is moving at a forward speed higher than 6.2 mph (10 km/h). On vehicles equipped with OPS, pressing the parking aid button also switches off the screen display of the Rear View Camera image.

Possible Settings in the MMI

As is familiar from other Audi models equipped with parking aid, the driver has the option of individually setting the frequency and the volume of the front and rear warning tones. To do this, select the menu item “Audi parking system” in the Car menu of the MMI.



375_038

Since two possible parking aids are available on vehicles equipped with Optical Parking System (OPS) and Rear View Camera, the settings for the MMI display listed in the adjacent table can be chosen for the start of a parking cycle, under the MMI item “Display APS.”

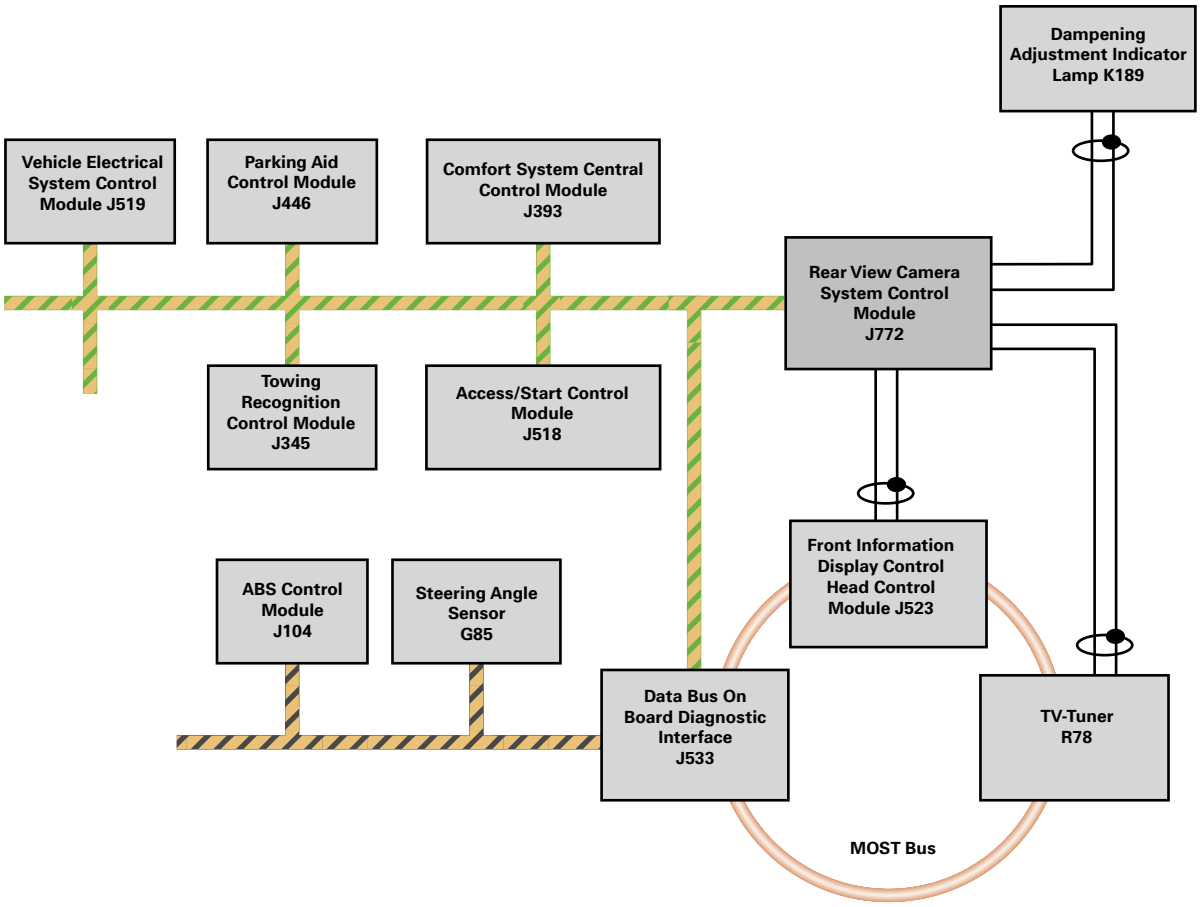
The settings will become active at the next parking cycle.

MMI display settings

1	Off	There is no display for the parking aid function in the MMI screen	
2	Graphic	The graphic for the Optical Parking System (OPS) is shown in the MMI display	
3	Rear View	The image from the Rear View Camera appears in the MMI display	
4	Automatic	When backing up, the image from the rear view camera is displayed in the MMI display, when driving forward the OPS graphic is displayed	

Communications Structure for the Rear View Camera

The Rear View Camera System Control Module exchanges information with various control modules. This information is needed for correct operation of the entire function and is described here:



375_039

Steering Angle Sensor G85

Provides the current steering angle which is needed to calculate the dynamic assist lines in the camera image.

Parking Aid Control Module J446

Informs whether the parking aid is currently active based on the button activation or based on engaged reverse gear, and whether the Parking Aid Control Module is defective.

Towing Recognition Control Module J345

Communicates to the Rear View Camera System whether a trailer is currently attached to the vehicle or not. If there is a trailer on the vehicle, the assist lines and the assist field are deactivated.

Comfort System Central Control Module J393

Transmits the information whether the rear hatch is closed or open. If the rear hatch is open, the assist lines and the assist field are deactivated.

Access / Start Control Module J518

Transmits current status of terminal 15 to the Rear View Camera.

Front Information Display Control Head Control Module J523

It shows the camera image on its display. In addition, it allows to define system settings for the Rear View Camera.

Vehicle Electrical System Control Module J519

Informs whether the backup light is being activated. On vehicles without Parking Aid Control Module, this implies that the reverse gear is currently engaged and, accordingly, the camera image must be displayed on the MMI screen.

ABS Control Module J104

The information “Present vehicle speed” from J104 is needed to determine the conditions for switching the Rear View Camera on and off.

Data Bus On Board Diagnostic Interface J533

Places required CAN messages from other bus systems on the Comfort System CAN-bus. Transmits freeze frame information in the event of a fault memory entry in the Rear View Camera System Control Module.

Note

Trailer operation of the Optical Parking System for the North American market has not been configured at the time of this printing. Please consult the appropriate repair manual for the latest information.

Note

The following control modules are optional and not available for all markets. Therefore, they are not installed in every Audi Q7:

- Parking Aid Control Module J446
- Towing Recognition Control Module J345
- TV tuner R 78

Diagnosis

The Rear View Camera System Control Module is assigned the Address Word 6C in the Scan Tool.

The following variables can be read in the Measuring Value Blocks:

- S contact status and terminal 15 status
- Reverse gear engaged Yes/No
- Control module supply voltage
- Camera supply voltage
- Rear hatch open/closed
- Present vehicle speed
- Calibration active/not active
- Status of most recent calibration
- Cause of failed calibration

The following properties are encoded in the module:

- Vehicle manufacturer VW/Audi
- Country version
- OPS (Optical Parking System) installation Yes/No
- Trailer hitch installation Yes/No
- Steering installed
- Camera height above ground (depends on chassis and tires)
- Vehicle model

The following variables can be configured in the adaptation channels:

- Start calibration
- Coordinate information for calibration of the camera
- Brightness, contrast and color settings of the video picture



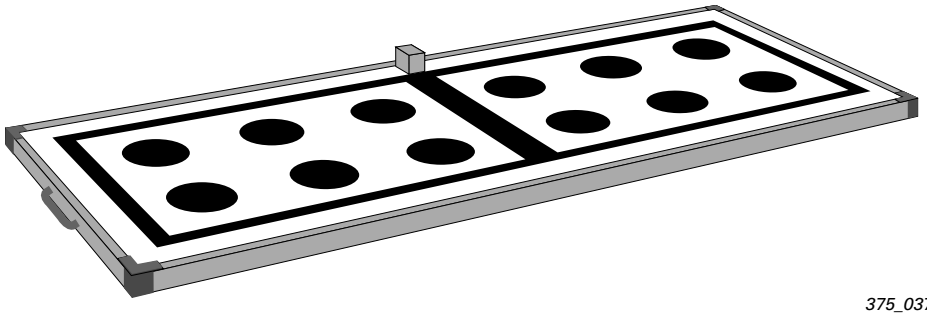
Note

Please always consult the electronic repair information for diagnostic information on the system.

Special Tool for System Calibration

The same calibration board is used to calibrate the Rear View Camera and the Lane Change Assistance System. However, the Doppler generator is not required. An exact description of how the calibration board must be aligned to the vehicle is included in the pertinent Repair Manual, and is also briefly described in the Lane Change Assistance calibration section. Additional care should also be taken to ensure that an exactly planar alignment is achieved using the three adjustable feet on the bottom of the calibration board. A bubble level is built into the calibration board and shows whether the board is in the required position.

The distance of the calibration board surface to the ground must be determined using a tape-measure and entered into the tester before the calibration process. There is a hole next to the bubble level for measuring this distance.



375_037

The calibration must be carried out in accordance with the instructions available in Guided Fault Finding. If the calibration device is correctly aligned, the calibration program can be started in Guided Fault Finding.

The purpose of calibrating the Rear View Camera is to correct the compensation of the camera image. First, the two black bordered rectangles on the calibration board are located. Once they have been found, the six black circles inside them are located and their centers are identified. The actual positions of the circle centers is compared with the specified positions stored in the control module. From this information, the correction parameters are calculated and are used to continuously correct the camera image.

Notes

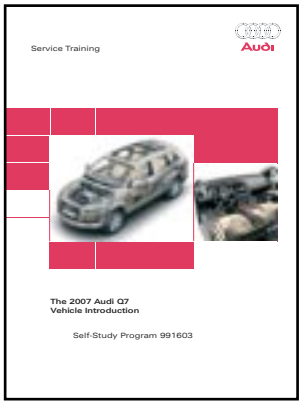
The following Self Study Programs are applicable to the Audi Q7:

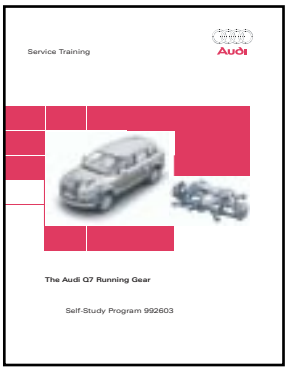
– SSP 991603 The Audi Q7 Vehicle Introduction
– SSP 992603 The Audi Q7 Running Gear
– SSP 993603 The Audi Q7 Power Transmission
– SSP 994603 The Audi Q7 Electrical System
– SSP 996603 Driver Assistance Systems

SSP 991603 The Audi Q7 Vehicle Introduction

– Body
– Passenger protection
– Engine
– Running Gear
– Electrical
– Air conditioning
– Infotainment

Order number: A04.5S00.14.00

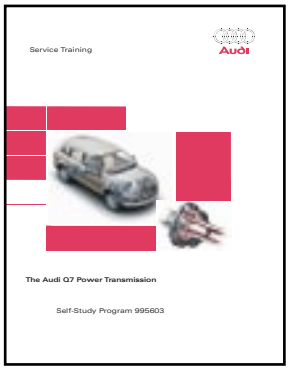




SSP 992603 The Audi Q7 Running Gear

– Front axle
– Rear axle
– ESP braking system
– Steering systems

Order number: A05.5S00.15.00



SSP 993603 The Audi Q7 Power Transmission

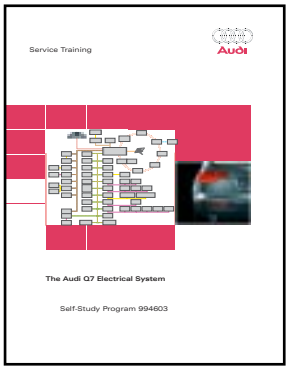
– Automatic transmission
– Manual transmission
– Torsen differential
– Rear wheel drive

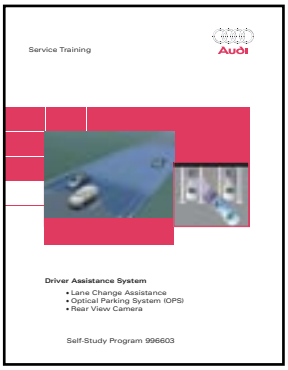
Order number: A05.5S00.16.00

SSP 994603 The Audi Q7 Electrical System

– Networking
– Bus topologies
– Comfort electrical system
– Infotainment

Order number: A04.5S00.09.00





SSP 996603 Driver Assistance Systems

– Lane change assistance (SWA)
– Optical Parking System (OPS)
– Rear View Camera

Order number: A05.5S00.21.00

Notes

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this SSP.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

www.accessaudi.com

From the accessaudi.com homepage:

- Click on the “ACADEMY” Tab
- Click on the “Academy Site” Link
- Click on the ”CRC Certification” Link

For assistance, please call:

Audi Academy

Learning Management Center Headquarters

1-877-AUDI-LMC (283-4562)

(8:00 a.m. to 8:00 p.m. EST)

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