

The 2019 Audi A8 Driver Assistance Systems

eSelf-Study Program 990393



Audi Academy

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Always check Technical Bulletins and the latest electronic service repair literature for information that may supersede any information included in this booklet.

Introduction The new Audi A8 driver assist systems New driver assistance systems for longitud and lateral control	1 inal
Active lane departure warning Switching on and off Displays Master control module	4 5
Adaptive cruise assist Introduction Displays and operation	6
Longitudinal control Overview Predictive efficiency assist	10
Lateral control New features of the vehicle's lateral control function Functional configuration and sensors requir	l 16 red
New features of the vehicle's lateral control function	l 16 red 18 se
New features of the vehicle's lateral control function Functional configuration and sensors requin Control modules partnered to adaptive crui	l

Parking systems	
Parking system plus	27
Rear view camera	
3rd generation surround view cameras	

Profile master for driver assistance

systems	
Structure	
Operating concept	
System configuration	

2nd generation matrix LED high

beam assist	.38
Operating the system and setting options	
Additional functions	40
System networking	41

3rd generation camera-based traffic sign recognition system

_____43

Rear radar based driver assistance

systems	44
New features of side assist	45
Turn assist function of side assist	46
Use of turn assist in other traffic scenarios	47
New features of the exit warning system	48
New features of cross-traffic assist	49

Intersection assist50Functional description50Intersection assist sensors51Warnings of intersection assist52Driver information53System networking54

Driver Assistance Systems Control

Module J1121	56
Versions	
Installation location of J1121	57
J1121 and its inputs	58
J1121 – Version A0	60
J1121 – Version A	61
J1121 – Version B	62
J1121 – Version C	64

Laser Distance Regulation Control

Module J1122	66
Design and function	
Service	69

Control Module for Adaptive Cruise

Control J428	
Design and function	
Operation and driver information	69
Service operations	69
eSelf-Study Programs	70
Knowledge assessment	71

The eSelf-Study Program (eSSP) teaches a basic understanding of the design and mode of operation of new models, new automotive components or new technologies.

Note

It is not a repair manual! Figures are given for explanatory purposes only and refer to the data valid at the time of preparation of the SSP.

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

Reference

Introduction

The new Audi A8 driver assist systems

When it comes to the Audi A8, each model change marks the premiere of innovative solutions and new automotive systems. Each new Audi A8 model broadens the spectrum of driver assistance systems and extends the range of situations in which drivers are assisted by cutting-edge technology.

The 5th generation of the Audi A8 includes new features such as intersection assist - a system that assists drivers in impaired visibility situations such as at intersections and obscured exits. The system helps the driver to avoid collisions with cross-traffic ahead of the vehicle by issuing several different types of warning.

Adaptive cruise assist is also featured for the first time in the Audi A8. It assists the driver by providing longitudinal and lateral control assistance over a continuous speed range from 0 to 155.3 mph (0 to 250 km/h). This system combines several driver assistance systems featured previously in other Audi models.

A new laser scanner is being used for the first time. It is located at the front end of the vehicle and enhances the performance of existing systems by precisely surveying the area in front of the vehicle. New driver assistance systems would not be possible without it.

The 2019 Audi A8 utilizes, for the first time at Audi, a central driver assistance systems control module which acts as the master control for multiple assistance systems. Its service designation is Driver Assistance Systems Control Module J1121. It replaces several control modules whose functions are now integrated in J1121.

Several sensors are connected directly to J1121 but no longer utilize an in-car bus system. The sensor data is processed in J1121. This applies to the front camera for driver assistance systems and the four surround view cameras. In turn, J1121 receives data from the other sensors via the FlexRay bus.

The fact that all sensor data is now available in a single control module means it is possible to supply functions with high-quality data on the area around the vehicle. This, in turn, is the basis for further improvements in the performance of the various driver assistance systems.



New driver assistance systems for longitudinal and lateral control

New structure

At the launch of the 2019 A8, two new driver assistance systems were created from the three well-known assistance systems.

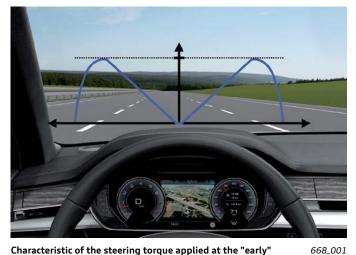
These are the three established driver assistance systems:

1. Audi active lane assist (AALA)

Audi active lane assist aids the driver with lateral control of the vehicle by providing corrective steering inputs. The driver can accept the system's corrective steering inputs or override them at any time.

With AALA, the driver can select from "early" and "late" corrective steering points in the MMI. The "early" corrective steering point corresponds to a lane assist system in that it tries to keep the vehicle in the center of its lane by continuously applying corrective steering inputs.

The alternative to the "early" corrective steering point is the "late" corrective steering point.



Characteristic of the steering torque applied at the "early" corrective steering point as a function of vehicle position relative to the center of the lane

2. Adaptive cruise control (ACC)

Adaptive cruise control is an enhancement of the existing cruise control system. In addition to adapting the speed of the vehicle, the system also adapts to a variable distance to a vehicle ahead. When the vehicle approaches a vehicle driving ahead, ACC maintains the set distance to this vehicle. If no traffic is detected ahead, the system acts as a regular cruise control system.

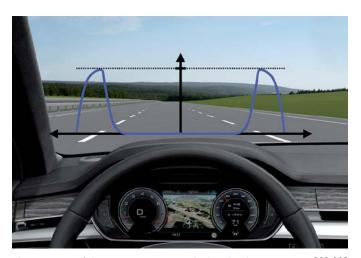
3. Traffic jam assist

Traffic jam assist helps the driver in traffic jam situations. It takes over longitudinal and lateral control of the vehicle up to a maximum speed of 37.2 mph (60 km/h).

When traffic jam assist is active, the driver can let the system operate the accelerator and brake pedals.

In terms of the functionality of the individual systems there have been no fundamental changes, but the grouping of the systems is new. In addition, the newly created driver assistance systems have been given new designations.

In this configuration, the system works to prevent the vehicle from unintentionally leaving its lane. When the vehicle approaches a lane boundary line, corrective steering torque is applied towards the center of the lane. A requirement for corrective steering inputs is that a turn signal has not been activated beforehand; this would indicate that the driver intends to change lanes. In addition to the corrective steering torque applied when crossing over a lane boundary line, the steering wheel vibrates. This function can also be deactivated in the MMI. An activated turn signal would, however, prevent the vibration warning as the system assumes again in this case that the driver intends to change lanes.



Characteristic of the steering torque applied at the "late" corrective steering point as a function of vehicle position relative to the center of the lane

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In the case of the ACC system, the driver is still required to operate the accelerator and brake pedals in certain situations. The process of vehicle speed adaptation is also referred to as longitudinal control. An active Adaptive cruise control system provides for longitudinal control of the vehicle whenever the momentary road and traffic conditions permit. The responsibility for longitudinal control of the vehicle, however, still remains with the driver.

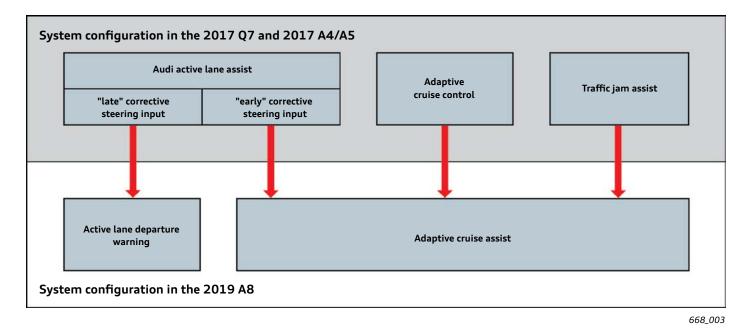
However, the driver must be able to take control of the vehicle again. Full responsibility for operating the vehicle still remains with the driver. The driver's hands must stay on the steering wheel when lateral control is active. The driver can accept or override the steering torque applied by the system.

1. Active lane departure warning

The working principle of the Active lane departure warning corresponds to that of the Audi active lane assist with "late" corrective steering point. It is offered in the Audi A8 for the first time as a separate function.

2. Adaptive cruise assist

Adaptive cruise assist combines three formerly independent systems - adaptive cruise control, Audi active lane assist with "early" corrective steering point and traffic jam assist - in a single system. The new driver assistance system offers continuous longitudinal and lateral control over a speed range from 0 to 155.3 mph (250 km/h). Because adaptive cruise assist is also a driver assistance system, the driver retains full responsibility for operating the vehicle even while the system is in use. It is offered in the 2019 A8 for the first time as an independent function.



Active lane departure warning

The lane departure warning system warns the driver when the vehicle is in danger of leaving its lane. A requirement for a lane departure warning is, however, that the driver has not indicated an intent to change lane by activating the corresponding turn signal. The system uses the turn signal to determine whether the imminent lane departure is intended or not. A warning is issued only if the system assumes that the lane departure is unintentional.

A warning that the vehicle is about to cross over a lane boundary line can be issued in three different ways:

- 1. By a corrective steering input towards the center of the lane by the system.
- 3. By highlighting the affected lane boundary line in red on the instrument cluster display.

2. Through steering wheel vibration.

Notes on the warning mechanisms:

- > When adaptive cruise assist with lane assist is active, no further further corrective steering inputs are provided shortly before the vehicle crosses over a lane boundary line. Active lane assist is already a protective mechanism, which prevents the vehicle from unintentionally leaving its lane by providing corrective steering inputs.
- The steering wheel vibration warning can be switched on and off in the MMI. The current setting is saved as a custom setting when the ignition is switched off.

Switching on and off

The lane departure warning can be switched on and off with a virtual button on the lower touch display. When the lane departure warning is off, a red bar is displayed over the function symbol. The lane departure warning is always switched off for only one Terminal 15 cycle. The lane departure warning is reactivated next time the ignition is switched on, regardless of whether the ignition was off or on when the lane departure warning was switched off. The steering assist button on the end of the turn signal stalk is of no relevance to the lane departure warning. It is used only to activate and deactivate the Audi active lane assist function of adaptive cruise assist.



Positioning of the virtual button for activating and deactivating the lane departure warning

Lane departure 668_005 warning is ON



Lane departure warning is OFF

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Displays

lane to the left.

The current activation status of the lane departure warning is indicated by the function symbol in the instrument cluster or on the head-up display.

The lane departure warning is OFF.

The lane departure warning is ON but inactive. Possible reasons for this include driving at too low a speed or the absence of lane boundary lines.

The lane departure warning is ON and active. The system is currently only able to detect the left lane boundary line. For this reason, a warning can only be issued when the vehicle leaves its

The lane departure warning is ON and active. The system is currently able to detect lane boundary lines on the left and right.

The lane departure warning is ON and active. The system is currently able to detect lane boundary lines on the left and right. As the vehicle is in danger of leaving its lane to the right, a warning is given.

Master control module

The master control module for the lane departure warning system is the Driver Assistance Systems Control Module J1121. Version A0 of J1121 is used for this function.



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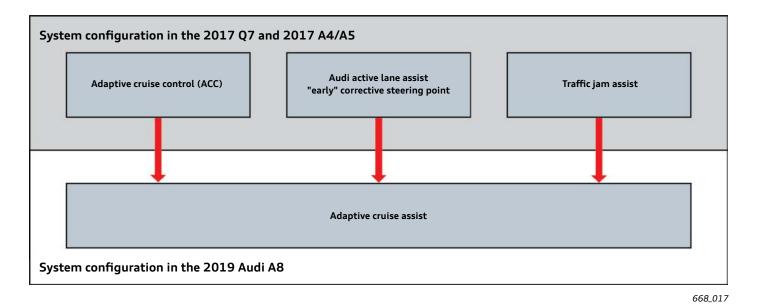
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Adaptive cruise assist

Introduction

Adaptive cruise assist is a new driver assistance system, which is offered for the first time in the 2019 Audi A8 as optional equipment.

It combines three formerly independent systems - adaptive cruise control, Audi active lane assist with "early" corrective steering point and traffic jam assist - into a single driver assistance system.



With adaptive cruise assist, a combined longitudinal and lateral control assistance function is available for the first time at speeds between 0 and 155.3 mph (0 and 250 km/h). The term "longitudinal control" is generally understood to mean accelerating and braking the vehicle, while the term "lateral control" is generally understood to mean steering the vehicle. However, the driver's hands must stay on the steering wheel while the lateral control function is active.

With adaptive cruise assist, both longitudinal and lateral control functions are available to the driver. However, the driver can also deactivate the lateral control function so that only the longitudinal control function stays active. This means that vehicle behaves in much the same way as previously when driving with ACC. The longitudinal control function in the Audi A8 is very similar to the 4th generation ACC system used on the 2017 Audi Q7, 2017 A4 and 2017 A5. With adaptive cruise assist, it is not possible to deactivate the longitudinal control function while the lateral control function is active.

Traffic jam assist provides lateral control at speeds of up to 37.2 mph (60 km/h) when a traffic jam situation is detected. Audi active lane assist provides lateral control at speeds of 40.3 mph (65 km/h) and higher. This means that lateral control is interrupted when, for instance, a traffic jam situation clears up. This interruption in lateral guidance does not apply to the adaptive driver assistance system in the Audi A8 since lateral guidance is the task of only one assistance system and this system operates at speeds between 0 and 155.3 mph (0 and 250 km/h).

Adaptive cruise assist is a driver assistance system, but the driver is still fully responsible for operating the vehicle. The driver's hands must stay on the steering wheel. The system assists the driver, but it does not release the driver from his responsibility. Adaptive cruise assist reduces the strain on the driver and makes for more comfortable driving.

Displays and operation

Activating and deactivating adaptive cruise assist

The Audi A8 comes equipped with both the customary ACC control stalk and a button for activating steering assist on the end of the turn signal stalk.

To use adaptive cruise assist, the ACC control stalk must be moved into the ON detent position.

Adaptive cruise assist is activated and deactivated in the same way as the ACC function. The procedure for setting the desired speed and the desired distance to the vehicle ahead is also unchanged. The procedure for the resumption of adaptive cruise assist is also familiar: a short pull on the operating stalk.



ACC control stalk

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Button for activating steering assist

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Switching lane assist on and off

When adaptive cruise assist is active, the driver can decide whether or not to use the lane center holding function ("early" corrective steering point) of Audi active lane assist. Lane assist can be switched on and off by pressing the button on the end of the turn signal stalk. The corresponding function symbol in the instrument cluster indicates the ON status of lane assist to the driver.

Display of lane assist system status

The lane assist function of adaptive cruise assist can have three different states:

- 1. Switched on and active.
- 2. Switched on and inactive.
- 3. Switched off.

If active, lane assist is deactivated when at least one of the following conditions is not or is no longer met:

- > The road on which the vehicle is travelling does not have lane boundary lines or the system is unable to detect such lines. Furthermore, there are no objects or structures which lane assist can use as alternatives to the lane boundary lines.
- > The lane is either too narrow or too wide.
- > A curve has a radius which is less than the required minimum radius.

Display of lane assist system status

 The system detects no hands on the steering wheel over a defined period of time.

> The front camera is unable to supply lane assist with images of sufficient quality. This can occur, for example, due to glare on the camera lens or dirt build-up on the windshield.

The color of the two triangles on the left and right indicates the current status of lane assist. The two triangles denote lane assist. The status of the system is indicated in the following displays:

- In the driver assist display in the instrument cluster. The driver assist display is one of the display options.
- 2. In the adaptive cruise assist function symbol in the instrument cluster below the speedometer.
- 3. In the adaptive cruise assist function symbol in the optional head-up display.

System status	Color of the two triangles	Function symbol	Driver assistance display
"switched on and active"	green	80 mph	
"switched on and inactive"	white	► 🚺 ► ► ► ► ► ► ► ► ► ► ► ► ► ► ► ► ► ►	
"switched off"	Neither of the two triangles is displayed	80 mph	

The status of lane assist is always displayed together with information on the status of the longitudinal control function. To illustrate better how the various states of lane assist are displayed, the status of the longitudinal control function stays unchanged in the table above. The states of the longitudinal control function are:

Adaptive cruise assist is switched on and active. The vehicle is currently driving in convoy, with adaptive cruise assist maintaining a preset distance to the vehicle ahead. The driver has set a maximum speed of 80.7 mph (130 km/h) for free flow of traffic.

Adaptive cruise assist adjustment options

The following settings can be made in the MMI under the system settings of the profile master for driver assistance systems:

1. Saving the last setting for time interval to vehicle ahead

Using the ACC control stalk, the customer can set a time interval to a vehicle ahead for adaptive cruise assist. Five time interval options are available. These are: 1 second, 1.3 seconds, 1.8 seconds, 2.4 seconds and 3.6 seconds.

If saving the last value is not activated, a following distance of 1.8 seconds is set by default whenever the ignition is turned on. The last value is saved to the current user account.

2. Predictive control

The following settings for adjustment to the route ahead can be made under "Predictive control":

- > Deactivate adaptation to route ahead.
- > Slow, medium or fast adaptation to route ahead.
- > Use speed limit
 - > on
 - with tolerance
 - > off

Predictive control Adaptation to route ahead off off slow medium fast

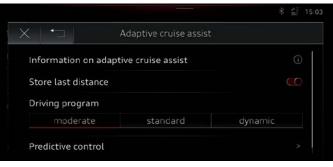
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3. Setting the driving program

A driving program can be set for adaptive cruise assist. This driving program is not dependent on the current Audi drive select setting. The acceleration and braking behavior of the longitudinal control function of adaptive cruise assist varies depending on what driving program is set.

The following driving mode options are available:

- > moderate
- standard
- > dynamic

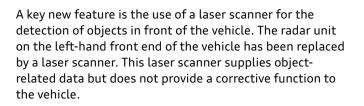


Longitudinal control

Overview

In the context of adaptive driver assist, the term "longitudinal control" refers to all controlled (driver-independent) longitudinally dynamic driving maneuvers such as acceleration, constant-speed driving and deceleration, while "lateral control" is provided by means of driver-independent steering inputs. The driver's hands must be on the steering wheel at all times, as monitored by a hands-off detection system.

In the Audi A8, longitudinal control is provided by Control Module for Adaptive Cruise Control J428.



A functional distinction must be made between the basic and additional ACC functions and the predictive functions in combination with the efficiency assist functions.





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Basic and additional functions

- > Maintaining a set distance to a vehicle ahead.
- > Cruise control in free flow of traffic.
- > ACC stop & go including start-off monitoring.
- > Distance indicator / distance warning.
- > Side assist.
- > Traffic jam assist.
- > Audi pre sense front*.
- > Collision avoidance assist*.
- Turn assist*.

Predictive functions in combination with efficiency assist

- > Adjustment to speed limits.
- > Adaptation to route ahead (cornering speed).

New features for the basic and additional ACC functions

Driving program

A new feature is the option for activating various driving programs in the MMI. The choice of mode - "moderate", "standard" or "dynamic" - defines the dynamic behavior of the vehicle when ACC mode is active. The choice of mode affects acceleration, behavior when following a vehicle ahead (driving in convoy) and cornering dynamics. When "moderate" is selected, the vehicle accelerates moderately. In comparison with the "dynamic" driving program, greater variation in distance to the vehicle ahead is allowed when driving in convoy. This makes for more harmonious, comfortable and relaxed driving.

If the driver selects the "dynamic" driving program, the full acceleration potential of the engine is used. The vehicle maintains a relatively constant distance to the vehicle ahead when driving in convoy.

Distance indicator / distance warning

When ACC is switched off, the driver is informed about the momentary distance to a vehicle ahead and receives a warning if the distance set by the driver is undershot.

Traffic jam assist

This function reduces the driver's workload by providing for longitudinal and lateral control of the vehicle.

In the Audi A8 the traffic jam assist function is integrated in the adaptive cruise assist system and is no longer implemented separately. There is no longer any provision for functional deactivation at a certain maximum speed. Only one vehicle driving ahead had to be detected to activate the function in the Audi A8. The activation and abort conditions have also been minimized. Refer to the Owner's Manual for further details.

 Adaptive cruise assist

 Information on adaptive cruise assist

 Store last distance

 Driving program

 moderate
 standard

 dynamic

 Predictive control

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The "standard" driving program offers a suitable response for most driving situations as a "compromise" between "moderate" and "dynamic".

The following three warning thresholds (time gaps) can be set: 1 second, 2seconds and 3 seconds.



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For detailed information about ACC functions, refer to eSelf-Study Program <u>960163,The 2017 Audi Q7 Running Gear and Suspension System</u> and eSelf-Study Program <u>979443, Audi ACC Systems</u>.

Predictive efficiency assist

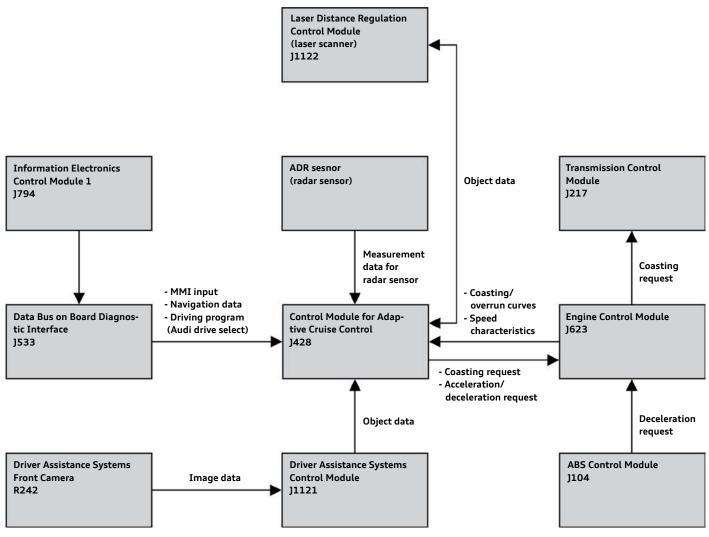
Overview

Models equipped with Navigation Plus also have efficiency assist. This function assists the driver by prompts aimed at promoting an efficient driving style.

If the vehicle is also equipped with adaptive cruise assist, longitudinal control will implemented predictively. The "master" for this function is Control Module for Adaptive Cruise Control J428.

This assistance system uses the predictive route data of the vehicle navigation system to control the vehicle's longitudinal dynamics, with the aim of promoting an efficient driving style and reducing the driver's workload. Depending on the MMI setup, speed limits, route profiles (corners, intersections etc.) and terrain topology (uphill and downhill gradients) are incorporated in the ACC control processes. The functional system components are, apart from the modifications listed below, identical to those in the 2017 Audi Q7.

- Image processing is handled by Driver Assistance Systems Control Module J1121. The front camera supplies the image data which is transmitted to J1121 via LVDS bus.
- In the Audi A8, the radar unit on the left-hand front end of the vehicle has been replaced by a laser scanner. This laser scanner supplies object-related data and does not have a corrective function. All longitudinally dynamic control processes are carried out by J428.



The adaptation function controls acceleration processes, constant-speed driving including coasting and engine shut-off as well as deceleration through engine torque reduction or ESC braking.

The driver can select the parameters to be used for predictive control in the MMI.

- Use speed limit and/or
- > Adaptation to route ahead

The predictive control function is activated by using either of the above functions. If both functions are activated, the system's full predictive longitudinal control capability will be available.

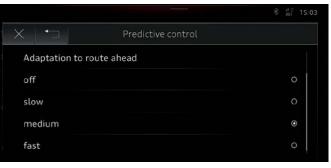
Use speed limit

The function uses two different sources to determine the current speed limit:

- > The predictive route data for vehicle navigation.
- > The camera-based traffic sign recognition system.

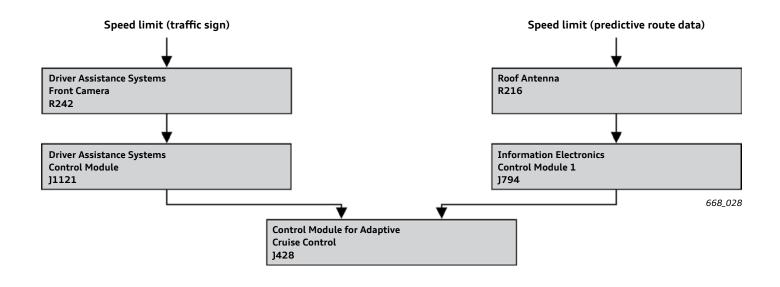
In an adaptation situation, both sources supply the same information. Due to temporary changes in speed limits (for example, due to road construction), the speed limits indicated by traffic signs may deviate from the data in the navigation system. In these cases, the speed limits indicated by the traffic signs have higher priority and are implemented.

The 3rd generation camera-based traffic sign recognition system is used in the Audi A8. This advancement is based on the 2nd generation system used in the 2017 Audi Q7.



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In the 2nd generation system the information for display to the driver was supplied directly before reaching the applicable range or the relevant traffic sign, the information is now sent earlier. In favorable conditions, the ACC control module receives the information approximately 109.3 yd (100 m) before reaching the traffic sign and, on average, about 54.6 yd (50 m) in advance. This enables the system to react predictively to upcoming changes in the speed limit by controlling the above-mentioned functions (acceleration, constant-speed driving/coasting, deceleration/ braking).





Reference

For detailed information about the 2nd generation camera-based traffic sign recognition system, refer to eSelf-Study Program 970263, The 2017 Audi Q7 Driver Assistance Systems.

Adaptation to route ahead

As an add-on to the "adaptation to route ahead" function a desired cornering speed (slow, medium or fast) can also be preset in the Audi A8. This, in combination with the selected drive program (moderate, standard, dynamic), provides a range of individual settings. For example, the "moderate" driving program, in combination with the "slow" setting for "adaptation to route ahead", is the most comfortable setting for negotiating corners.

If the "dynamic" driving program is selected in combination with the "fast" setting for "adaptation to route ahead", the cornering dynamics are maximized.

All other setting combinations provide dynamic response within the bounds of these threshold settings. An exception to this is the "efficiency" setting in Audi Drive Select, which additionally activates an efficiency-enhancing program of adaptive cruise assist independent of driver inputs.

A key control parameter is the measured value for lateral acceleration, which is acquired by the sensors in the airbag control module. Working on the basis of the curve radius contained in the predictive route data of the vehicle navigation system, the ACC control module determines the lateral acceleration and cornering speeds which correspond to the MMI settings. These parameters are controlled primarily by adapting the engine torque. Active braking operations are also initiated by ESC as required.

The "adaptation to the route ahead" function has been expanded to include another key function. When the control system is activated, the Audi A8 now also reacts to stop signs, the position of which is obtained from the predictive route data. The vehicle is not brought to a complete stop the until it reaches the sign, but is slowed down to a minimum driving speed of 9.3 mph (15 km/h). In this way, the driver is alerted to the right of way and is able to bring the vehicle comfortably and safely to a standstill at the stop line. Any braking maneuvers performed by the driver will deactivate the control function. The control function can again be activated by moving the button on the ACC operating stalk into the "Resume" position.

The vehicle's speed is not reduced at intersections on roads with equal rights of way and at traffic lights.

When driving on main roads which turn off to the left or right the cornering speed of the vehicle is also controlled at the intersection.

If the vehicle leaves the main road while the route guidance function is active, the control function is adapted accordingly.



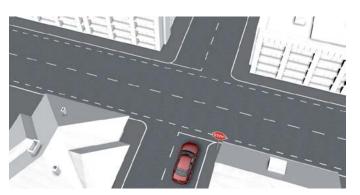
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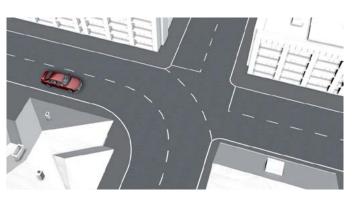






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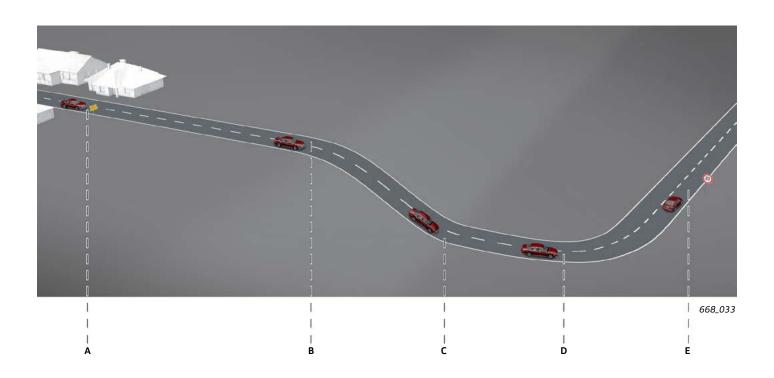
The following example uses a possible driving profile to show the process typical of the predictive control system. The driver has activated the "use speed limit" function, as well as the "intelligent coasting" function and the "adaptation to route ahead" function in the MMI.

- A: The vehicle is leaving an urban area. Before the new speed limit of 62.1 mph (100 km/h) is indicated to the driver, the ACC control module is notified by Driver Assistance Systems Control Module J1121 that the vehicle is about to leave the urban area. The ACC control module computes the amount of acceleration required and sends this information to the engine control module, which implements the required acceleration by increasing engine torque when the vehicle exits the urban area.
- **B:** The vehicle was accelerated to 61.2 mph (100 km/h) and is travelling at a constant speed on a near horizontal road surface.
- **C:** The vehicle is approaching a long downhill gradient. The ACC control module receives this information as predictive route data and computes the reduction in engine torque required to maintain the set speed. The ACC sends this torque request to the ECM so that it can be implemented. The road gradient and road resistance coefficients are factored into the calculation so that a constant driving speed is maintained even when coasting. The ACC then sends a coasting enable signal to the ECM, which, in turn, assigns this task to the TCM. The ECM also decides whether the engine is to be shut down during the coast phase. Coast phases are generated most frequently in the "efficiency" mode of Drive Select.

The control processes are primarily aimed at providing the driving style desired by the driver - be it moderate, efficiency-oriented or dynamic - to ensure that the vehicle operates efficiently.

- D: The predictive route data of the vehicle navigation system indicates that the vehicle is approaching a corner. Taking the curve radius and the MMI settings for the driving program and route ahead as a basis, ACC computes how much lateral acceleration is required to negotiate the corner. As the driver has selected the "slow" option in the "Adaptation to route ahead" menu, the computed cornering speed allows the driver to comfortably negotiate the corner. As the "moderate" driving program has been selected, the braking and subsequent acceleration phases are correspondingly comfortable. Accordingly, the vehicle is braked by the resultant engine drag torque. If this braking effect is not sufficent to achieve the required corner entry speed, the ESC is also "tasked" with braking the vehicle.
- E: After exiting the corner, the vehicle again accelerates up to the speed limit. A new limited speed zone of 49.7 mph (80 km/h) indicated by a traffic sign begins within a distance of about 56.4 yd (50 m). This sign is identified by the camera-based traffic sign recognition system. Although the predictive route data would allow a higher speed, the vehicle's speed is reduced to 49.7 mph (80 km/h) because traffic signs have a higher priority.

The vehicle has been configured in such a way that the transitions and interactions between control operations are as harmonious as you would expect of an actual, experienced driver.



Lateral control

New features of the vehicle's lateral control function

The lateral control function of adaptive cruise assist provides the driver with steering assistance and reduces the strain while driving.

This is a further development of the lane center guide function in Audi active lane assist. The focus of the development was on the availability of the lateral control function The lateral control function of adaptive cruise assist is now also available in situations where it is deactivated in Audi active lane assist on other Audi models.

In the case of Audi active lane assist, which will be available in nearly all other Audi models starting from launch of the Audi A8, lateral control is based solely on the lane boundary lines. A consequence of this is that the lateral control function is not available full-time if road boundary lines are not continuous or absent. This also applies to lane boundary lines which are hard to detect due to road or weather conditions.

The lateral control function of adaptive cruise assist in the Audi A8 has now been expanded so that it can under certain circumstances stay active even after the loss of lane boundary lines.

Measures to increase the availability of the lateral control function

Adaptation to static structures and objects

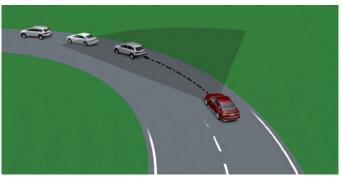
If the lane boundary lines end but structures and objects are detected in the path of the route, the lateral control function is able to adapt to these features. The software in the Driver Assistance Systems Control Module J1121 decides in each specific situation whether detected structures or objects are suitable.

In principle, the system is able to adapt to the following structures and objects:

- Crash barriers
- Grassy areas
- > Curbs

Adaptation to traffic ahead

If the road boundary lines end and one or more vehicles is an appropriate distance ahead, it may be possible to continue using the lateral control function on the basis of these vehicles. The software in the Driver Assistance Systems Control Module J1121 decides whether the current traffic situation is suitable.





Lane center guide function on roads without centerline markings

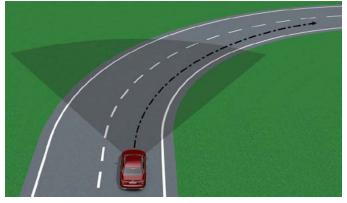
This scenario shows a road with two lane boundary lines at the roadside. One lane is available for each driving direction, but there is no center-line marking. Adaptive cruise assist recognizes this scenario and divides the road into two lanes for its calculations. It implements the lane center guide function for the right lane, although this lane is not separated from the left oncoming lane by center-line markings. In this way, the lane center guide function can be offered without both lanes actually being divided by an physical line. Because of this, it is possible to provide lateral control in more situations than was the case prior to the launch of adaptive cruise assist.

In this case, however, a lane departure warning can only be given on the right-hand side of the vehicle due to the absence of a center-line marking.

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Increased comfort when negotiating corners

When a vehicle negotiates a corner with lane assist active, the vehicle has until now negotiated the corner in the center of the lane. When the line assist function of adaptive cruise assist in the Audi A8 is active, the planned line is shifted slightly towards the inside of the curve as this best reflects the steering behavior of most drivers.



668_037



Note

In the case of the lateral control function in the Audi A8, the driver must keep both hands on the steering wheel. The driver is still fully responsible for lateral control of the vehicle. The system's corrective steering inputs are similar in character to a steering recommendation and can be overridden by the driver at any time.

Functional configuration and sensors required

In the case of adaptive cruise assist, there are two control modules of central importance to the system.

These are:

- Control Module for Adaptive Cruise Control J428 (master control unit).
- > Driver Assistance Systems Control Module J1121.

J428 has the following tasks:

- > Is the master control module of adaptive cruise assist.
- > Is the master control module for the longitudinal control function of adaptive cruise assist.
- > Reading the data generated by the front radar sensor for monitoring the area in front of the vehicle.
- Collecting the data measured by all vehicle sensors monitoring the area in front of the vehicle. All measurement data is saved to an internal memory card.

J1121 has the following tasks:

- > Is the master control module for the lateral control function of adaptive cruise assist.
- Reading the images captured by Driver Assistance Systems Front Camera R242.
- > Lane recognition on the basis of the images captured by the front camera.
- > Object recognition on the basis of the images captured by the front camera.

- > Implementing the longitudinal control function of adaptive cruise assist.
- > Controlling the system displays in the instrument cluster and in the head-up display.
- > Saving the system settings selected by the driver.
- Processing the signals of various system controls. When buttons are pressed and the ACC control stalk is actuated, the corresponding signals are sent to the vehicle data bus by Steering Column Electronics Control Module J527.
- > Implementing the lateral control function.
- Reading data from the front four ultrasound sensors (depending on the vehicle configuration, the data from the four front ultrasound sensors can also be read by Vehicle Electrical System Control Module J519 if version B of Driver Assistance Systems Control Module J1121 is installed.

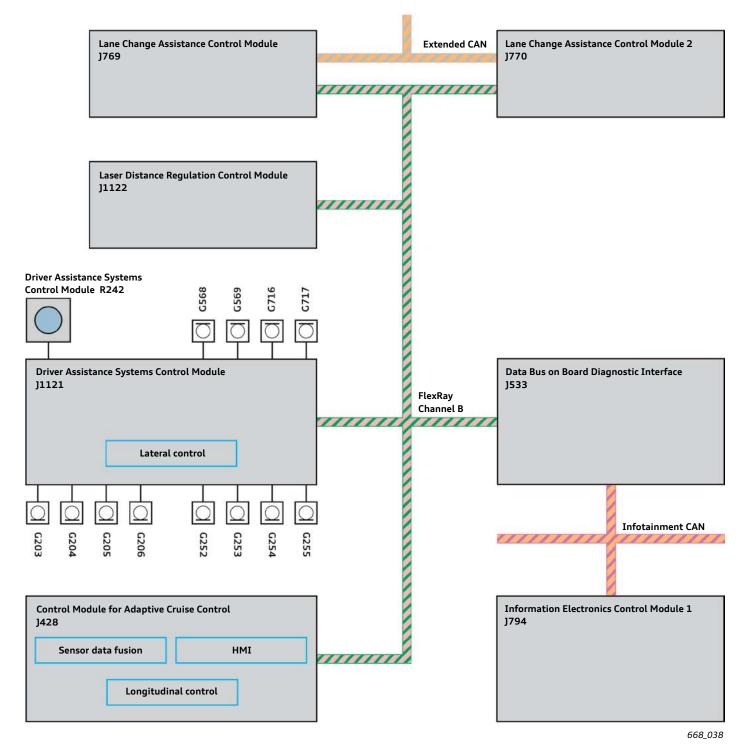
Sensors

The following components are required by adaptive cruise assist:

- > Driver Assistance Systems Front Camera R242.
- > Control Module for Adaptive Cruise Control J428.
- > Right and Left Front Parking Aid Sensors (G252 to G255).
- > Driver Assistance Systems Control Module J1122.

The following sensors are not required by adaptive cruise assist, but are used if installed:

- Right and Left Lane Change Assistance Control Modules J769 and J770.
- > Parallel Parking Assistance Sensor (G568, G569, G716 and G717).



Key:

HMI Is the abbreviation for Human Machine Interface - the interface between the driver and the vehicle system. This interface includes both the system displays (system -> driver) and the options for system operation (driver -> system).

G203 – G206	Rear Parking Aid Sensors
G252 – G255	Front Parking Aid Sensors
G568 - G569	Front Parallel Parking Assistance Sensors
G716 - G717	Rear Parallel Parking Assistance Sensors
R242	Driver Assistance Systems Control Module

Control modules partnered to adaptive cruise assist

Power Steering Control Module J500

 Applies the steering torque requested by adaptive cruise assist to the steering.

Engine Control Module J623

- > The driveline coordinator in the ECM receives the acceleration torque requested by adaptive cruise assist. The driveline coordinator is a central software module which receives the requested acceleration values from various systems and prioritises the requests accordingly.
- Provides engine braking assistance when braking torque is requested.

ABS Control Module J104

- > Provides the current vehicle speed to the FlexRay bus.
- > Is responsible for the vehicle's braking and stop management system. The function of the stop management system is to keep the stationary vehicle at a standstill.
 After the ESC has kept the vehicle at a standstill for three minutes, the electrical parking brake is actuated in order to protect the brake system components against overheating.

Transmission Control Module J217

> Is required for the longitudinal control function of adaptive cruise assist. J217 implements the required gearshift operations at the request of the ECM.

Steering Column Electronics Control Module J527

> Reads the information from the ACC control stalk and from the Audi side assist button in the turn signal stalk and sends this information to the vehicle bus system.

Airbag Control Module J234

> Sends the crash signal to the vehicle bus system which is read by adaptive cruise assist. In the event of a collision, adaptive cruise assist deactivates.

Information Electronics Control Module 1 J794 and Front Information Display Control Head J685

- > The customer can configure the settings for adaptive cruise assist via these two control modules. These settings are transmitted via the vehicle bus system to Driver Assistance Systems Control Module J1121 and Control Module for Adaptive Cruise Control J428, which in turn put this information into action.
- Sends the current user data to the vehicle bus system.
 When the ignition is switched off, adaptive cruise assist saves the current system settings to the last user.

Instrument Cluster Control Module J285

Displays the adaptive cruise assist function symbol in the instrument cluster display and displays text messages on request. In addition, the customer can activate the driver assist display in the instrument cluster. Is a component part of the onboard computer displays.

Vehicle Electrical System Control Module J519

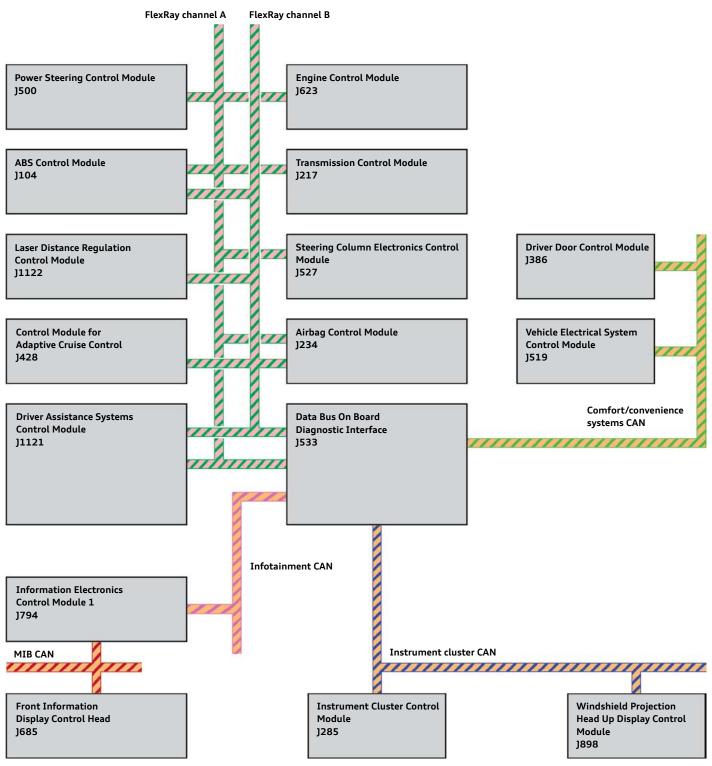
Sends the states of the turn signals to the vehicle bus system. When the turn signals are activated, lane assist is temporarily inactive since an intended lane change is assumed.

Driver Door Control Module J386

Sends the status of the driver door contact switch to the bus system. If the driver's door is opened when adaptive cruise assist is active, adaptive cruise assist deactivates for safety reasons.

Windshield Projection Head Up Display Control Module J898

> Displays the adaptive cruise assist function symbol.



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Emergency assist

Function

Emergency assist has been designed for situations in which the driver has incurred an medical emergency and, for this reason, is no longer able to operate the vehicle.

The task of emergency assist in this situation is to take over longitudinal and lateral control of the vehicle and bring it to a controlled stop in its own lane.

During the braking operation the following measures are taken:

- > The hazard warning flashers are activated to warn other road users.
- > The seat belt is fully tensioned during the final standstill braking operation.
- The windows and the panoramic sunroof close automatically

If emergency assist fails to detect the driver's hands on the steering wheel for a defined period of time, it assumes than an acute emergency has occurred. A special software algorithm, the "hands-off detector", has been developed in order to detect this. This is a known feature of Audi active lane assist.

Inducing the driver to take control of the vehicle

A second, key function of emergency assist is to alert an inactive driver to take control of the vehicle by taking various measures.

For this purpose, the system takes the following action before and during the braking maneuver:

- > Display of text messages in the instrument cluster.
- > Acoustic signal output.
- > Initiation of brake warnings.
- > Initiation of a strong emergency brake warning.
- > Brief tightening of the driver's seat belt.
- > Muting of infotainment system.

Emergency assist master control module

The master control module for emergency assist is Driver Assistance Systems Control Module J1121. The basic version A0 is sufficient for emergency assist.

Connectivity to other driver assistance systems is not a mandatory requirement for emergency assist in the Audi A8.

If adaptive cruise assist is not installed on the vehicle, longitudinal control of the vehicle is implemented using Driver Assistance Systems Front Camera R242. If the vehicle is travelling at too high a speed as it approaches traffic ahead, braking power is increased to slow the vehicle down. In this way, the system attempts to avoid an impending rear-end collision or to reduce the severity of such a collision.

When emergency assist is active, a series of in-car measures are taken in order to protect the driver and minimize the risk of a collision.

After the vehicle has come to a standstill, the following measures are taken:

- > Selector position "P" is engaged.
- > The vehicle doors are unlocked.
- > The interior light is switched on.
- > An emergency call is sent.

To facilitate hand-off detection, the signal from the steering torque sensor is analyzed in an ongoing basis. This characteristic tells the software whether or not the driver's hands are on the steering wheel. Use of the accelerator and brake pedal is a further criterion for driver inactivity.

After all, it is also possible that the driver is distracted and, for this reason, is not concentrating on driving although able to drive.

If the driver is ready to again take control of driving the vehicle, the driver can indicate this through any of the following measures:

- The driver again actively takes over steering the vehicle.
 -or-
- The driver applies the footbrake.
 -or-
- > The driver presses down on the accelerator.

The longitudinal control function is required by emergency assist in order to increase braking power. The idea is, when possible, to avoid a collision with slower vehicles when traveling at a high rate of speed. In this case, R242 normally replaces the front radar sensor required for longitudinal control (J428 Control Module for Adaptive Cruise Control)and Laser Distance Regulation Control Module J1122.

Time sequence of active emergency assist processes

The time sequence of the various emergency assist escalation phases are explained on the basis of two specific driving situations.

Example 1:

An Audi A8 is travelling at a speed of 62.1 mph (100 km/h) with emergency assist active. The driver operates the vehicle manually. Driver assistance systems which influence longitudinal and lateral control of the vehicle are currently not active.

Phase 0:

The driver operates the vehicle actively by means of steering inputs and by operating the accelerator and brake.

Phase 1:

The driver releases the steering wheel and does not press the accelerator pedal or the brake.

Phase 2:

Emergency assist detects an inactive driver and activates. The first measure taken is to activate the lateral control system, with the aim of preventing the vehicle from leaving its lane. For this purpose, the lateral control system activates the "late" corrective steering point. At the start of phase 2, the distance to the traffic ahead is also monitored.

Phase 3 begins when any of the following events occurs:

- The lateral control system performs a first corrective steering input ("late" corrective steering point).
 -or-
- The system detects an inactive driver over a period of at least 30 seconds.
 -or-
- Corrective braking is initiated in response to a vehicle ahead.

Phase 3:

The following text message is displayed in the instrument cluster: "Emergency assist" . lack of driver activity detected". The lateral control mode changes from "late" to "early" (active lane assist). The vehicle starts to brake at a rate of deceleration of 0.3 m/s². If a danger of collision with traffic ahead is detected, heavier braking is applied. Phase 3 takes between 7 seconds and 10 seconds depending on the speed of the vehicle.

Phase 4:

The rate of deceleration of the vehicle is now increased to 1.0 m/s² and audio output is muted. The system starts to alert the driver to take control of the vehicle by displaying the text message: "Emergency assist: please take control of vehicle". It also issues an audible warning as well as brief brake and seatbelt warnings. Phase 4 takes between 5 seconds and 8 seconds depending on the speed of the vehicle.

Phase 5:

If driver inactivity continues, standstill braking begins at a rate of 2.5 m/s^2 . If a collision hazard is detected, the rate of deceleration can be increased to 3.5 m/s^2 .

The system further intensifies its efforts to alert the driver to take control of the vehicle by issuing warning tones and a noticeable emergency brake warning. Further brake warnings accompany the standstill braking operation, and full tensioning of the driver seatbelt is initiated. The hazard warning flashers are also activated to alert nearby traffic to the critical situation. For safety reasons, the windows and sunroof are also closed. The following text message is displayed in the instrument cluster: "Emergency assist". automatic emergency stop performed"

Phase 6:

After the vehicle has been braked to a standstill, selector position "P" is engaged and the electronic parking brake is applied. After 5 seconds of braking, the central locking system is unlocked and the interior light is switched on. An emergency call is sent 15 seconds after the vehicle comes to a standstill.

Emergency assist activation conditions

- During manual vehicle operation, emergency assist can only be activated at speeds of 34.1 mph (55 km/h) or higher. After a speed threshold of 55 kph is exceeded, emergency assist can be activated at the earliest after 20 seconds.
- > Lane boundary lines must be detected.
- > After actuating a turn signal, emergency assist can be activated at the earliest after 15 seconds.
- If the driver changes over from assisted driving to manual operation, emergency assist can be activated at the earliest after 20 seconds.
- When the status of emergency assist changes from "active" to "inactive", emergency assist can be reactivated at the earliest after 20 seconds.

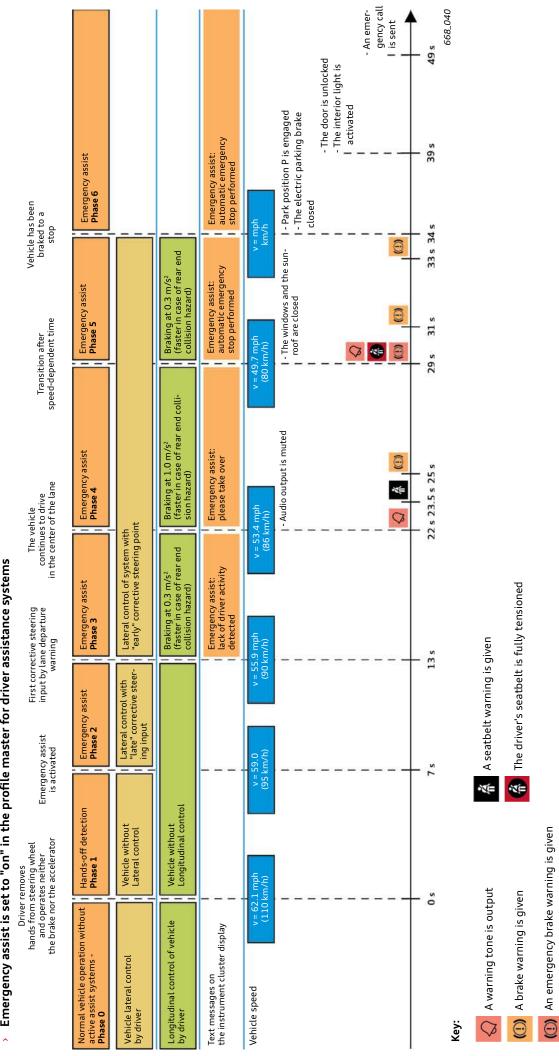


The time and speed values specified in the diagram are situation-specific and are intended only as a guide. They may in reality deviate from the values specified.

Time sequences of emergency assist processes during vehicle operation without assist systems activated

Adaptive cruise assist is either not installed or is off ~

Emergency assist is set to "on" in the profile master for driver assistance systems



Example 2:

An Audi A8 with active emergency assist is travelling at a speed of 62.1 mph (100 km/h). The driver has activated adaptive cruise assist, which has taken over longitudinal and lateral control of the vehicle.

Phase 0:

Adaptive cruise assist is active and the driver has both hands on steering wheel.

Phase 1:

The driver takes hands off the steering wheel and then behaves passively.

Phase 2:

Adaptive cruise assist detects that the driver no longer has hands on the steering wheel and displays the text message "Adaptive cruise assist: lack of driver activity detected".A warning tone is given 15 seconds after the text message is displayed. A short time later, another five warning tones are given.

Phase 3:

Emergency assist activates and the vehicle is immediately braked at a rate of deceleration of 1.0 m/s². Adaptive cruise assist is deactivated at the same time. The following text message is displayed in the instrument cluster: "Emergency assist: please take control of vehicle". The system starts to alert the driver to take control of the vehicle by issuing an acoustic warning as well as brief brake and seatbelt warnings. Audio output is also muted. Despite the fact that lateral control is active, the driver's hands must be on the steering wheel, which was also the case until time t = 0 seconds.

Phase 4:

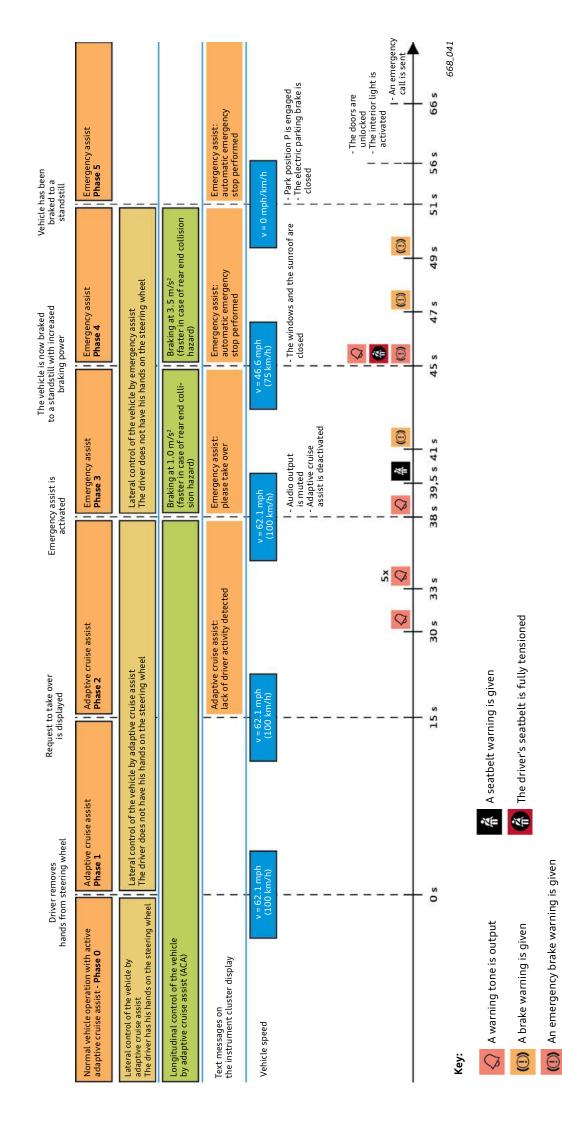
If driver inactivity continues, standstill braking commences at a rate of 3.5 m/s². The system further intensifies its efforts to alert the driver to take control of the vehicle by issuing warning beeps and a noticeable emergency brake warning. Further brake warnings accompany the standstill braking operation, and full tensioning of the driver seatbelt is initiated. The hazard warning flashers are also activated in order to alert nearby traffic to the critical situation. For safety reasons, the windows and the tilt/slide sunroof are also closed. The following text message is displayed in the instrument cluster: "Emergency assist: automatic emergency stop performed".

Phase 5:

After the vehicle has been braked to a standstill, selector position "P" is engaged and the electronic parking brake is closed. After 5 seconds of deceleration, the vehicle's central locking system is unlocked and the interior light is switched on. Finally, an emergency call is sent 15 seconds after the vehicle comes to a standstill.



Emergency assist is set to "on" in the profile master for driver assistance systems



Time sequence of emergency assist processes when driving with adaptive cruise assist

26

Parking systems

Parking system plus

Every Audi A8 worldwide is equipped with an audible and visual parking aid with at least eight ultra-sound sensors.

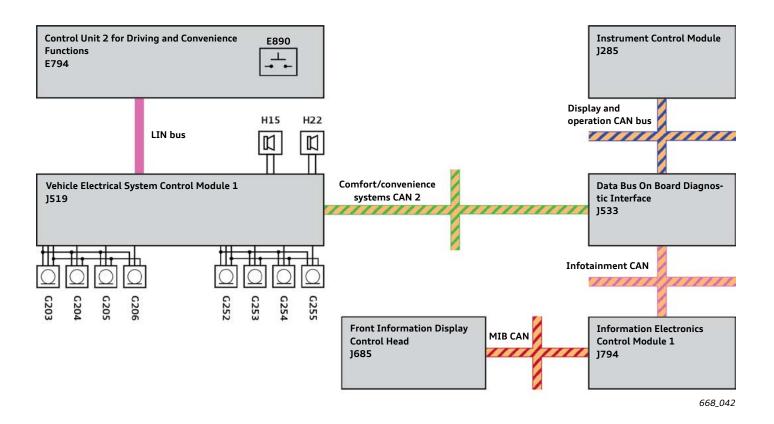
Electrical configuration of parking system plus

In terms of electrical configuration, there are two different versions of parking system plus in the Audi A8 :

- The first version uses Vehicle Electrical System Control Module J519 as the master control. The eight front and rear parking aid sensors and Front and Rear Parking Aid Warning Buzzers H14 and H 15 are connected to J519. The ultrasound sensors are 5th generation sensors, as used previously in other Audi models.
- 2. The second version uses Driver Assistance Systems Control Module J1121 as the master control. The eight front and rear parking aid sensors as welll Front and Rear Parking Aid Buzzers H15 and H22 are connected to J1121. Four additional lateral sensors are always installed in the version.

Electrical configuration of version 1:

Version 1 is implemented if the vehicle has version AO, A or B of the Driver Assistance Systems Control Module J1121.



Key:

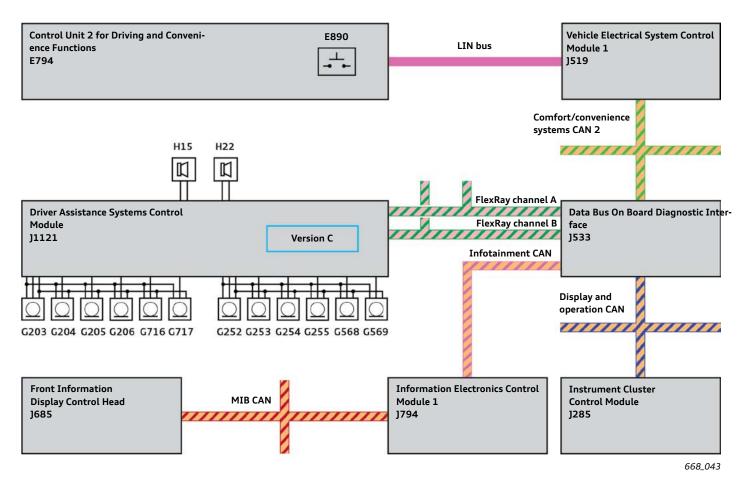
- E890 Parking Assistance System Button
- G203 Left Rear Parking Aid Sensor
- G204 Left Rear Center Parking Aid Sensor
- G205 Right Rear Center Parking Aid Sensor
- G206 Right Rear Parking Aid Sensor
- G252 Right Front Parking Aid Sensor

- G253 Right Front Center Parking Aid Sensor
- G254 Left Front Center Parking Aid Sensor
- G255 Left Front Parking Aid Sensor
- H15 Rear Parking Aid Warning Buzzer
- H22 Front Parking Aid Warning Buzzer

Electrical configuration of version 2:

Version 2 is implemented if the vehicle has version C of Driver Assistance Systems Control Module J1121 installed.

The version of J1121 installed depends on the driver assistance systems ordered with the vehicle.



Key:

- E890 Parking Assistance System Button
- G203 Left Rear Parking Aid Sensor
- G204 Left Rear Center Parking Aid Sensor
- G205 Right Rear Center Parking Aid Sensor
- G206 Right Rear Parking Aid Sensor
- G253 Right Front Center Parking Aid Sensor
- G254 Left Front Center Parking Aid Sensor
- G255 Left Front Parking Aid Sensor

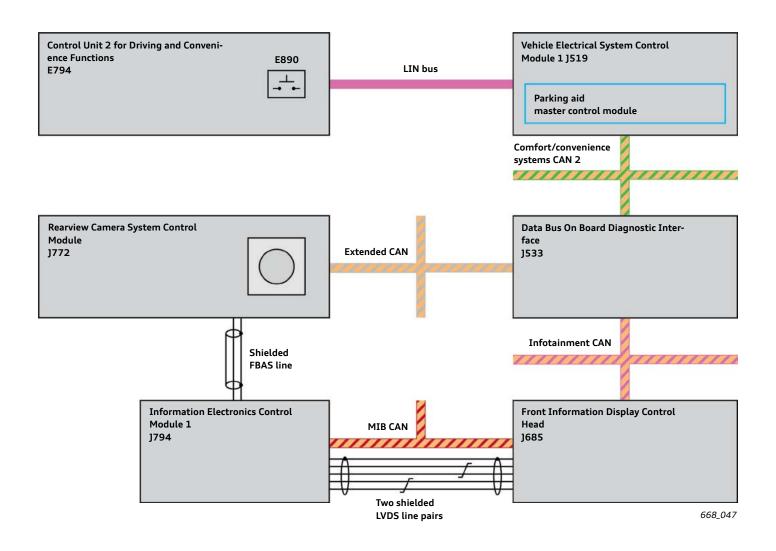
G568 Left Front Parallel Parking Assistance Sensor

- G569 Right Front Parallel Parking Assistance Sensor
- G716 Left Rear Parallel Parking Assistance Sensor
- G717 Right Rear Parallel Parking Assistance Sensor
- H15 Rear Parking Aid Warning Buzzer
- H22 Front Parking Aid Warning Buzzer

Rear view camera

Electrical implementation of the rear view camera system

The rear view camera is one of the new driver assistance systems in the Audi A8 which does not require Driver Assistance Systems Control Module J1121. The processes of correcting the camera's wide angle image, calibration and projecting reference lines onto the camera image are performed by Rearview Camera System Control Module J772. The image captured by the rear view camera is sent directly to Information Electronics Control Module 1 J794 over a shielded FBAS line. The image is then transmitted over shielded LVDS lines to Front Information Display Control Head J685.



Key:

E890 Front Information Display Control Head

System activation

The rear view camera can be activated by selecting reverse gear, pressing Parking Assistance System Button E890 or through automatic system activation.



Parking Assistance System Button E890

Washer jet

The rear view camera is prone to being obstructed by dirt build-up under certain ambient conditions. For this reason, the Audi A8 has a washer jet for cleaning the camera lens.

Cleaning the camera lens

The process of cleaning the camera lens through brief activation of the jet can be initiated in two ways.

1. Cleaning cycle initiated by driver:

The driver has the option of initiating a camera lens cleaning cycle in the parking aid settings menu. To do this, the driver selects the "Clean rear view camera" option.

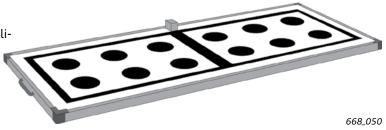
2. Cleaning cycle initiated by the camera:

If J772 detects that the camera lens is dirty when evaluating the camera images, it initiates a cleaning cycle.

Calibration

The camera is calibrated using Special Tool VAS 6350 (calibration plate).





3rd generation surround view cameras

Surround view cameras are optional in the Audi A8. They assist the driver during parking and maneuvering by offering various views of the area around the vehicle.

The surround view cameras also offer a bird's-eye view of the vehicle. The bird's-eye view image is generated from the individual images captured by the four surround view cameras.

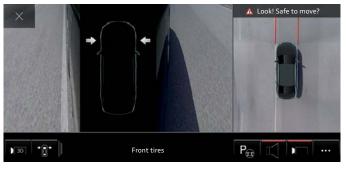
New features of the 3rd generation

- The surround view cameras are controlled by Driver Assistance Systems Control Module J1121. All surround cameras send the images they capture directly to J1121 via shielded LVDS lines. Version C of J1121 is required for the surround view cameras. Version C of J1121 is required for the surround view cameras.
- 2. J1121 has image processing software which searches for objects in the images captured by the surround view cameras. Where technically possible, the height, length and width of these objects are determined. In the case of static objects, however, this is only possible when the vehicle is moving. The objects are viewed from different locations, allowing images to be captured in a threedimensional form.
- 3. To extend the range of the surround view cameras, the installation positions of the cameras in the door mirrors have been modified. They are located further towards the outside of the door mirrors of the Audi A8 and no longer face down vertically, but rather are inclined outwards. This extends the lateral range of the cameras, which, in turn, provides a better view of the area around the vehicle.
- The 3rd generation surround view cameras provide the customer with two additional two-dimensional views of the vehicle:
 - > Simultaneous view of the front left and right wheels.
 - > Simultaneous view of the rear left and right wheels.
- 5. The cameras provide the customer with a three-dimensional view of the vehicle for the first time. The vehicle viewing angle is not set as a default by the system, but rather it can be selected by the customer via the touchscreen.

It is also possible to choose between three different, default viewing angles using the virtual button on the touchscreen.



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Calibration

The 3rd generation surround view cameras are calibrated using the VAS 721 001. It has two calibration mats, each approximately 8.7 ft (8 m) long, which are aligned in parallel with the vehicle. This special tool was also used for calibrating the 2nd generation surround view cameras.

When the calibration mats have been aligned as directed in the workshop manual, the calibration routine can be started on the VAS Scan Tool. It takes only a few seconds to successfully complete the calibration.

Due to the length and alignment of the calibration mats, each mat can be viewed simultaneously by three surround view cameras. Depending on vehicle side, these are the left or right side camera and the two front and rear cameras. Due to this fact, all four cameras can be calibrated simultaneously after aligning both calibration mats.



Profile master for driver assistance systems

The Audi A8 features a new operating concept for configuring the various driver assistance systems. One of the goals of concept development was not to increase but reduce the number of different controls for driver assistance systems. An effort was made to simplify operation in order to keep this customer-friendly despite the growing number of assistance systems. Some of the driver assistance systems available in the Audi A8 can be switched on and off in the profile master for driver assistance systems.

As in the case of other driver assistance systems whose ON status and system settings have to be adaptable while driving, the controls have been simplified.

Structure

The profile master for driver assistance systems offers customers the following profiles:

Maximum

By selecting this profile, the customer decides that all driver assistance systems participating in the profile master are to be switched on.

Individual

The "Individual" profile gives the customer the option of choosing which driver assistance systems to switch on and switch off. These adjustments are made on the basis of a list of all in-car driver assistance systems participating in the profile master. This list can be accessed via the symbol showing a written sheet of paper and a pen and is located to the right of the "Individual" profile.

Basic

By selecting this profile, the customer decides that only pre-defined driver assistance systems are to be switched on. Depending on optional equipment, this can be systems such as emergency assist or Audi pre sense. If neither of these systems is installed on the vehicle, "All off" is displayed in place of "Basic".

			*	[⇒] 36: 15:02
НОМЕ		ar • Driver	assist	\Diamond
(()) RADIO	Maximum			
MEDIA	Individual		a b	
V TEL	Basic			

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Selecting a profile

The required profile can be selected by touching the corresponding profile name. Another way of making a selection is to push the driver assistance systems button one or more times. Each push of the button selects the next profile.

Complete overview of driver assistance systems participating in the profile master for driver assistance systems

- > Side assist.
- > Exit warning system.
- > Intersection assist.
- > Emergency assist.

> Night vision assist.

- Distance warning.
- > Audi pre sense.

Complete overview of driver assistance systems <u>not</u> participating in the profile master for driver assistance systems

Basic version of high beam assist or matrix LED high beam assist

 Can be switched on and off in the corresponding MMI menu under the menu option "Exterior lighting"

Adaptive cruise assist

> Can be switched on and off using the control stalk of adaptive cruise assist (ACC control stalk)

Lane assist

> Can be switched on and off with the button on the end of the turn signal stalk

Parking system plus

 Can be switched on and off with the Parking Assistance System Button E890 or the parking aid symbol at the bottom of the touch display

Rear view camera

The ON status of the rear view camera is identical to that of parking system plus. The customer can choose which image or graphics are to be displayed when parking aid is active.

Surround view cameras

 Can be switched on and off with parking system plus; the customer can choose which image or graphics are to be displayed when parking aid is active.

Master control module of the profile master for driver assistance systems

The master profile is stored and controlled by Driver Assistance Systems Control Module J1121.

Camera-based traffic sign recognition

The camera-based traffic sign recognition system is only active when the ignition is "on". The customer can choose how the traffic sign recognition display is to look.

Active lane departure warning

> Can be switched on and off with a separate button at the bottom of the touch display

Rear cross traffic assist

> Can be switched on and off in the parking aid set-up menu

Cruise control and speed limiter

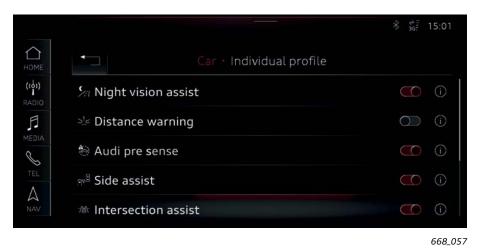
> Can be switched on and off with the control stalk of the cruise control system

Operating concept

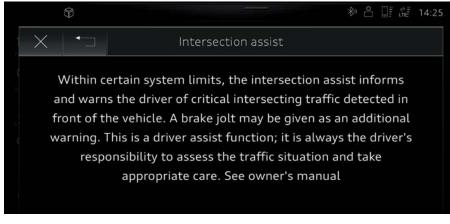
MMI display of driver assistance systems in the "Individual" profile and their ON status

The illustration shows a list of driver assistance systems which are installed in an actual vehicle and participate in the profile master. The scroll bar at the right edge of the screen indicates that only some of the available assistance systems can currently be viewed on the display.

- > The ON status can be set with a slide switch adjacent to the driver assistance system on the right.
 - > When the slide switch is in the right-hand end position, the system is "on". The slide switch is highlighted red to indicate this.
 - > When the slide switch is in the left-hand end position, the system is "off". The slide switch is highlighted grey to indicate this.



A new feature of the Audi A8 is the option to display short texts explaining the individual driver assistance systems. The explanations can be viewed using the (i) symbol, which denotes "information". The description of intersection assist is shown here as an example of the explanatory texts.



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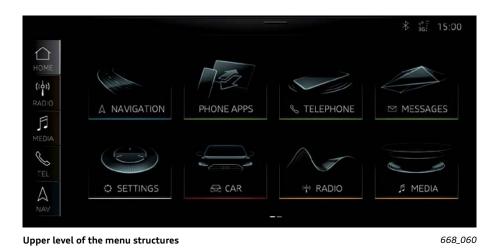
Viewing the profile master for driver assistance systems

The customer can view the profile master for driver assistance systems in two ways:

1. By pressing Driver Assistance System Button E617.



2. The first level of the infotainment system menu structures can be accessed by touching the Home button at the top left edge of the screen. The basic functions of the system are shown on the display. The basic function "Car" must now be selected, resulting in the following display.



This display shows the menu options for the basic function "Car". The home screen of the profile master for driver assistance systems can also be accessed by selecting "Driver assistance".



Display showing the menu options of the basic function "Car"

System configuration

In addition to ON status, almost every driver assistance system offers other options for configuration. The current configuration is saved as a custom setting when the ignition is switched off. The system settings are stored in the master control module of each system.

When the ignition is switched off, the profile master always saves the last profile used - be this the "Basic", "Maximum" or "Individual" profile containing actual ON status information. The system settings can be accessed by touching the gear symbol at the top right of the screen. A list of all configurable in-car driver assistance systems is then displayed. This applies to all driver assistance systems, regardless of whether they are profile master users or not.

				∦ ^{at} ≣ 15:02	
HOME		ar • Driver	assist	<u> </u>	Gear symbol for activating the system settings
(10) RADIO	Maximum				
5 MEDIA	Individual		d A		
S TEL	Basic				
				668 050	5

The speed warning is used here as an example:

After selecting the menu item "Speed warning" from the list of driver assistance systems, the following display appears:

			3GE 15:
X •]	Speed warning		
Speed limit			
	130		
off	0	240 km/h	
Traffic-sign base	ed speed limit		
	10		
off		20 km/h	

In this display the customer can set a warning threshold for the speed warning. In addition to this, the customer can set the offset to be used for the speed warning of the camera-based traffic sign recognition system.

2nd generation matrix LED high beam assist

Three headlight versions are available for the A8. All three versions used LEDs as their main light source.

These are:

- 1. LED headlights
- 2. Matrix LED headlights¹
- 3. Matrix LED headlights with laser high beam²

All three headlights of the Audi A8 have high beam assist. The LED headlight has the basic version of high beam assist which is standard world-wide. The basic version differentiates between two states only: "high beam ON" and "high beam OFF".

The matrix LED headlight with and without laser high beam has a technically more sophisticated version of high beam assist.

The light beam of the high beam is subdivided into multiple segments. Illumination of these segments can be controlled individually. When the system detects oncoming traffic or traffic ahead, only the high beam segments which would blind the other road users are dimmed. Other road users are detected using the images captured by Driver Assistance Systems Front Camera R242 and Driver Assistance Systems Control Module J1121.

Differences between the 1st and 2nd generation matrix LED high beam assist systems

The 2nd generation of matrix LED high beam assist is also used in the 2019 A8 .

It is an improved version of the 1st generation introduced in 2013 as an upgrade for the Audi A8.

The most noticeable differences between the 1st and 2nd generation systems are:

- The geometric composition of the high beam light cone, with its individually selectable and dimmable high beam segments.
- > The matrix LED high beam assist is controlled by Driver Assistance Systems Control Module J1121.
- > The fact that high beam assist is available with additional laser lights.

The differences between the 1st and 2nd generations are as follows:

	1st generation	2nd generation	
Master control module	Headlamp Range Control Module J431	Driver Assistance Systems Control Module J1121	
Breakdown of the high beam core region	2 x 25 light segments	2 x 2 x 16 light segments	
Additional segments	No additional segments	There are three additional segments at the periphery of the high beam light cone.	
Central light beam	None	There is a central light cone with an extended forward range.	
Laser lights	Not available	The central light cone is available in combination with laser lights or LED lights.	

¹Matrix LED headlights are not available at launch. It will be introduced at a later date. The hardware is in the vehicle but it is disabled. In the future, when it is approved, a software update will enable the Matrix beam operation.

²Laser main beam is offered on the S8 only at a later date.

Segmentation of the high beam light cone

The complete high beam light cone can be subdivided into five separate regions in the 2nd generation system.

> Core region of the left headlight

The core region of the left headlight is again subdivided into a lower region comprised of 16 segments and an upper region also comprised of 16 segments. Because the lower and upper regions overlap one another directly, they cannot be seen as two distinct regions in the two-dimensional illustration, but rather are seen as a single region.

A single LED is needed in order to illuminate each individual segment. A total of 32 LEDs required for the core region of the left headlight.

> Core region of the right headlight

The core region of the right headlight is again subdivided into a lower region comprised of 16 segments and an upper region also comprised of 16 segments. Because the lower and upper regions overlap one another directly, they cannot be seen as two distinct regions in the two-dimensional illustration, but rather are seen as a single region.

A single LED is needed in order to illuminate each individual segment. A total of 32 LEDs required for the core region of the right headlight.

> The left edge region of the high beam

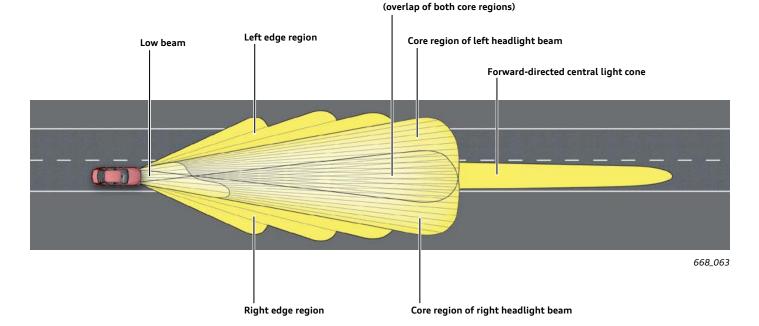
This region consists of three segments. A single LED is needed in the left headlight in order to illuminate each individual segment.

> The right edge region of the high beam

This region consists of three segments. A single LED is needed in the right headlight in order to illuminate each individual segment.

> The forward-directed central light cone

This light cone can be implemented either as laser lights or as an LED segment, depending on which of the two matrix LED headlight versions is on the vehicle. In the version with laser lights the light distribution is as shown in the diagram. In the version with LED lights the central light cone is wider and not as sharply focussed as that of the laser lights. The headlights have considerably less range, approximately that of the lower core region. The task of the light beam in this version is to illuminate the central core region.



Use of laser lights

The central light cone of the high beam created by the laser lights is not activated until a vehicle speed of 43.4 mph (70 km/h) is exceeded. This is done for reasons of safety and is a statutory requirement. Use of laser lights is only permitted in combination with high beam assist.

High beam assist detects oncoming traffic or traffic ahead and makes sure that the other road users are not blinded. When high beam is activated manually, the laser lights are permanently off.

The laser lights have a range of up to 656 yd (600 m) in ideal conditions.

Note

Matrix LED lights and Matrix LED lights with laser high beams will only be available on S8 models at a later date.

Operating the system and setting options

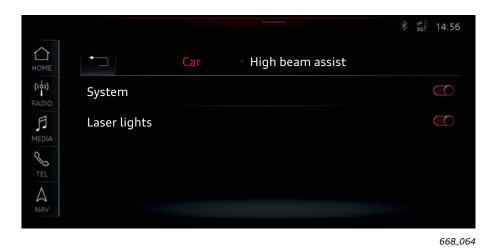
Operation

Matrix LED high beam assist is activated and deactivated using the high beam stalk.

The customer has the option of deactivating the laser lights. In this case, the central light cone created by the laser lights is excluded from the high beam activated by the assist system.

Settings

Matrix LED high beam assist can be switched on and off by the driver in the MMI menu for exterior lighting.



Additional functions

Adaptive dimming in fog

If the high beam of the matrix LED headlights is switched on in foggy conditions, some of the light from the high beam will be reflected by the fog, blinding the driver. The light reflected from the high beam is also visible in the images captured by the front camera. The level of back glare is continuously monitored and compared with a defined threshold value based on the images captured by the front camera.

If the defined threshold for back glare is exceeded, the luminance of the high beam is reduced until the back glare drops below this threshold again.

The luminosity of the high beam is now adjusted so that the backglare is always within the threshold range and thereby adapted to the current fog density.

Dimming on detection of highly reflective road signs

The latest generation of traffic signs is highly light-reflective. Vehicle occupants experience this particularly when driving in dark conditions with the high beam on. The reflected high beam of the front headlights has a strong blinding effect on the driver, who becomes more prone to driver error due to impaired visibility. When a certain fog density level is exceeded, the mechanism described here leads to the deactivation of matrix LED high beam assist. If matrix LED high beam assist is deactivated for this reason, it is registered as a DTC in Driver Assistance Systems Control Module J1121.

Backglare is not only a problem in foggy conditions - it also occurs in conditions of heavy snowfall. In this case too, the luminosity of the high beam is continuously adapted.

Strong reflection can be detected by evaluating the images captured by the front camera. To reduce the blinding effect on the vehicle's occupants, the luminosity of the high beam LEDs is reduced accordingly. However, this only applies to the high beam LEDs whose light currently impinges on the reflective traffic sign. The luminosity of the affected LEDs is reduced to 70%.

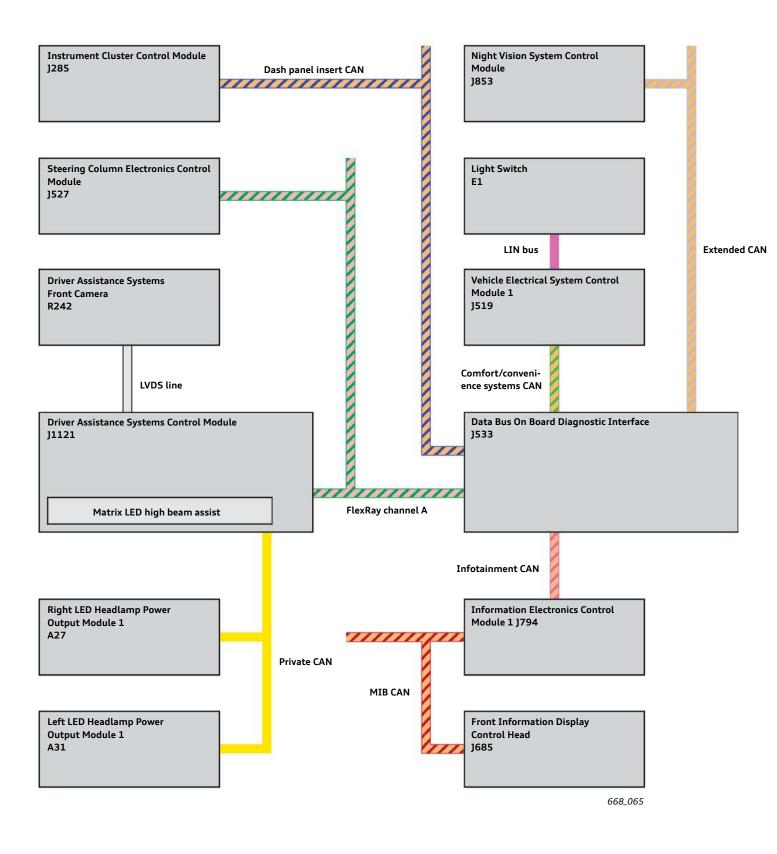
Note

Matrix LED lights and Matrix LED lights with laser high beams will only be available on S8 models at a later date.

System networking

The networking matrix provides an overview of the main control modules integral to LED high beam assist.

It also shows the bus systems which the control modules use to exchange data with one another.



Note

Matrix LED lights and Matrix LED lights with laser high beams will only be available on S8 models at a later date.

Tasks of the control modules

Driver Assistance Systems Control Module J1121 (master control module)

- Reads and processes the images captured by the front camera.
- > Scans the images captured by the front camera for light points.
- > Assigns light points to traffic ahead or oncoming traffic, depending on their characteristics.
- > Determines the maximum luminosity of each of the high beam LEDs on the basis of the assumed positions of other road users. This serves first to illuminate the area in front of the vehicle as best as possible and, second, to ensure that no other road users are blinded by the headlights.
- Activates the marking light at the request of the optional night vision assist system. By flashing several times, the marking light alerts a pedestrian to the acute danger of a collision with the vehicle.
- Transfers the luminosity levels for the high beam LEDs of both headlights to both LED headlight power modules.

Vehicle Electrical System Control Module J519

- > Reads the high beam stalk actuations.
- > Reads the current "position" of the light switch.
- > Reads the MMI customer setting for the ON status of high beam assist.
- > Determines the current ON and activation status of high beam assist and sends this information to J1121.

Driver Assistance Systems Front Camera R242

- R242 scans the area in front the vehicle and sends the images to Driver Assistance Systems Control Module J1121.
- > The front camera also monitors the ambient brightness. This dictates whether an activated headlight assist may actually use the high beam, since use of the high beam is only permitted when driving in the dark.

Steering Column Electronics Control Module J527

> Sends information on high beam stalk actuations to the FlexRay bus.

Light Switch E1

 Sends the current position of the light switch to the LIN bus.

Instrument Cluster Control Module J285

 Indicates the current activation status of matrix LED high beam assist and the ON status of the high beam to the customer.

Information Electronics Control Module 1 - J794

Indicates whether the "High beam assist" menu option in the MMI Car Menu is at "on" or "off". In addition, the predictive route data of the navigation system is still available.

Night Vision System Control Module J853

 Indicates a detected pedestrian and the pedestrian's position via the vehicle bus system in the event of a collision hazard.

LED Headlamp Power Output Modules, right A27 / left A31

 Activates the high beam LEDs in both matrix LED headlights at the request of J1121.

Front Information Display Control Head J685

High beam assist can be switched on and off via the MMI display.

3rd generation camera-based traffic sign

recognition system

The functional range of the camera-based traffic sign recognition system was extended with the launch of the 2019 Audi A8 .

The assistance system in the Audi A8 is capable of recognizing other traffic signs and displaying them in the instrument cluster.

These are:

USA	Canada	
WORK 35		Speed limit within the confines of road construction.
RAMP 40 MPH	EXIT 40 KM/H	Recommended speed limit on freeway entry and exit ramps.
ON RED	ON RED	It is generally permissible to turn right at a red traffic light. If it is not permitted it is indicated to driver by a corresponding sign.

Rear radar based driver assistance systems

The 2019 Audi A8 offers a series of driver assistance systems whose software is integrated in both rear radar sensors. These driver assistance systems use the rear radar sensors as a master control module because they essentially require the measurement data from both rear radar sensors for their function. They use the rear radar sensors, both as sensors and as a control module.

Because the control electronics are integrated in both rear radar sensors, they have the service designation:

- > Lane Change Assistance Control Module J769.
- > Lane Change Assistance Control Module 2 J770.

The following driver assistance systems use the two side assist control modules as a master control module:

- > Side assist (new designation for Audi side assist).
- > Rear cross traffic assist.
- > Exit warning system.

Side assist was extended to include two new subfunctions in the 2019 Audi A8.

These are:

- > Turn-off assist of side assist.
- > The merge assist function.

The measurement data generated by the rear radar sensors is still used by other driver assistance systems. They are not absolutely essential for function, but are used if the rear radar sensors are available in the vehicle.

These include:

- > Adaptive cruise assist.
- Intersection assist.

Two additional radar sensors are integrated in the right and left areas of the front bumper on the 2019 A8 if the vehicle is equipped with intersection assist. They are very similar to the rear radar sensors in terms of visual appearance, design and function. Intersection assist monitors the area in front of the vehicle with regard to cross traffic. This new driver assistance system is described in the following pages.



For more information about assistance systems side assist, rear cross traffic assist and the exit warning system, refer to eSelf-Study Program <u>970263, The 2017 Audi Q7 Driver Assistance Systems.</u>

New features of side assist

The task of side assist is to warn the driver before an intentional lane change of the danger of a collision with a vehicle travelling in the same direction in an adjacent lane.

The system assumes that the driver intends to change lanes when:

1. The corresponding turn signal is activated

-or-

2. The vehicle continuously moves nearer to the lane boundary line over a defined period of time.

The second condition can, however, only be checked if at least version B of Driver Assistance Systems Control Module is installed in the vehicle.

A situation is classified as critical if the vehicle is approaching from behind at high speed or travelling at a similar speed in the driver's blind spot. The system alerts the driver to critical road users in both the left and right adjacent lanes. Side assist offers valuable assistance particularly when changing lanes on multi-lane roads. Warnings are provided by warning lights integrated in both door mirrors. To alert the driver to a hazard, the light in the corresponding door mirror flashes very brightly four times. Driver information is given if critical traffic is detected in the adjacent lane, but there are no indications that the driver intends to change lanes. The driver information is provided as low luminosity light.

The side assist system used in the Audi A8 has the following new features:

- > Side assist is switched on and off using the profile master for driver assistance systems. It can be switched on or off in the "Individual" profile. It is always switched on in the "Maximum" profile and always switched off in the "Basic" profile.
- Side assist is activated when the vehicle speed exceeds
 6.2 mph (10 km/h) and is deactivated when the vehicle speed drops below 3.1 mph (5 km/h).

Thanks to improved rear radar sensors, other road users are detected at a distance of 87.4 yd (80 m) or less behind the vehicle.

There are two subfunctions of side assist:

- > Turn-off assist.
- > The merge assist function.



668_074

Turn assist function of side assist

Turn assist is primarily designed to avoid collisions with cyclists and motorcyclists when turning. A warning is issued if a cyclist or motorcyclist is classified as "critical" when turning. The turn assist warning is identical to the side assist warning: the warning light flashes brightly four times. A key new feature of turn assist is that the driver can be warned twice about the same road user without the turn signal having to be deactivated in the meantime. This was not previously possibly.

Side assist warning

Side assist issues a first warning when the following conditions are met:

- 1. The turn signal is activated.
- 2. The system has computed a TTC* of 6 seconds or less.
- 3. Side assist is active.
- 4. The other road user is moving forwards.

Turn assist warning

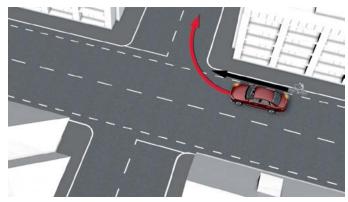
Turn assist issues a warning if:

- 1. The turn signal is still activated.
- 2. The system has computed a TTC* of 2 seconds or less.
- The vehicle turning is moving forwards at a speed not exceeding 18.6 mph (30 km/h).
- 4. the other road user is also moving forwards.

The working principle of the system can be explained using scenario 1 shown below. The red Audi A8 is approaching an intersection, at which the driver intends to turn to the right. The driver activates the right turn signal well ahead of the intersection. When the turn signal is activated, side assist classifies the cyclist to the right of the Audi A8 as "critical". For this reason a warning is issued in the right door mirror.

The driver continues driving with the turn signal activated. When the vehicle reaches the intersection the driver initiates the turn maneuver by turning the steering wheel, with the result that the trajectories of both road users now intersect. Given that the computed TTC* is now less than 2 seconds, a second warning is issued in the right door mirror.

Turn assist helps the driver not only when turning to the right but also when turning to the left, as shown in scenario 2.



Scenario 1

668_075 Scenario 2

668_076

Driver information from turn assist

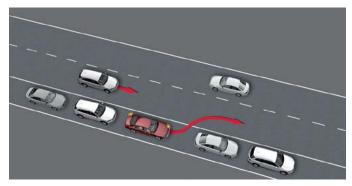
Turn assist also provides driver information in the same way as side assist. Side assist provides driver information when the following conditions are met:

- 1. The turn signal is activated.
- 2. The system has computed a TTC* of 4 seconds or less.
- 3. The vehicle is stationary or is travelling forwards at a speed not exceeding 6.2 mph (10 km/h).
- 4. The other road user is also moving forwards.

Use of turn assist in other traffic scenarios

Parking maneuvers

Turn assist also aids the driver when leaving parking spaces. Even before the start of the maneuver, the system can indicate to the driver whether other traffic could present a hazard. The driver information is still available after the start of the maneuver up to a speed of 6.2 mph (10 km/h). Turn assist will continue to issue a driver warning until a vehicle speed of 18.6 mph (30 km/h) is exceeded if the conditions for this have been met.



668_077

Merging maneuvers

Turn assist can also help the driver in situations where two lanes merge into one. As soon as a turn signal is activated, the driver receives driver information or a warning if the further conditions for this have been met.

Switching the turn-off assist function of side assist on and off

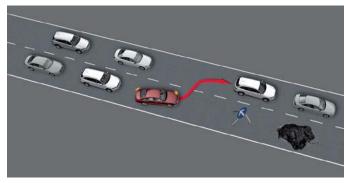
Turn assist cannot be deactivated separately by the driver (its ON status always corresponds to that of side assist).

It, too, can be set in the profile master for driver assistance systems.

Functional separation of turn assist and Audi pre sense front

Turn assist is a subfunction of Audi pre-sense front. It helps the driver in turning situations which involve crossing the opposing lane.

If the ACC front radar sensors detect the risk of collision with oncoming traffic in such a situation, Audi pre sense front warns the driver. Standstill braking is also initiated if the conditions for this have been met.



668_078

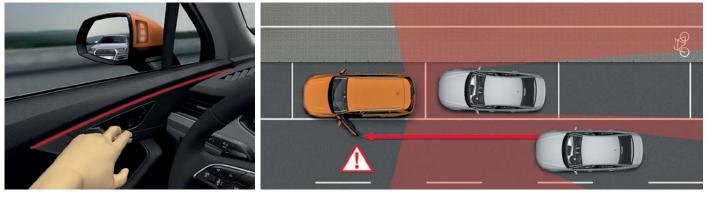


Reference

For further information about the turn-off assist function of Audi pre sense front, refer to eSelf-Study Program <u>970363, The 2017 Audi Q7 Occupant Protection and Infotainment System.</u>

New features of the exit warning system

The exit warning system of the 2019 A8 is similar to that of the 2017 Q7 but has been enhanced to include a special warning function. This function delays the opening of a vehicle door when the system detects the risk of a collision with traffic approaching from the rear. The delay which is implemented serves as an additional warning and is in region of slightly less than one second. This new feature was made possible by the introduction of the electronic door lock. In normal circumstances, the vehicle doors on the Audi A8 are no longer opened mechanically by means of a cable pull, but rather electronically. When the door opening lever is operated, the corresponding door control unit interprets this as a signal to open the door, and it is released electronically. A cable pull is provided for emergencies only, for example, loss of electrical power.



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668_080

The exit warning system is switched on and off using the profile master for driver assistance systems. It can be switched on or off in the "Individual" profile.

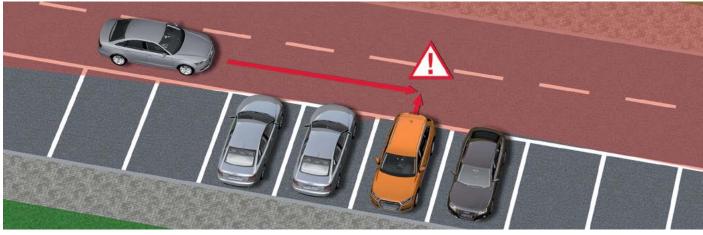
It is always switched on in the "Maximum" profile, but not in the "Basic" profile.

New features of cross-traffic assist

Rear cross-traffic assist is available in the Audi A8 and is based on the function used in the 2017 Audi Q7.

The task of rear cross traffic assist is to warn the driver about traffic crossing behind the vehicle when backing up. This system provides valuable assistance in situations where visibility is impaired. Impaired visibility situations include maneuvering out of a perpendicular parking space or through a narrow driveway exit.

The driver is initially warned visually by red arrows on the displays of the parking aid, the rear view camera or the surround view cameras. If the risk of collision increases, a warning beep sounds; if the risk of collision becomes even more acute, the system initiates corrective braking.



668_081

The function in the Audi A8 features the following modifications:

- > Rear cross traffic assist can be switched on and off separately. For this purpose, there is a separate menu option in the parking aid settings menu.
- > The driver is only warned visually by red arrows when the vehicle is stationary or when backing up. This function is not available when driving forwards at low speed.
- The red arrows flash while corrective braking is in progress.
- > The system brakes the vehicle to a standstill. The vehicle is then held at a standstill for a short period of time before the brakes are released again.

Intersection assist

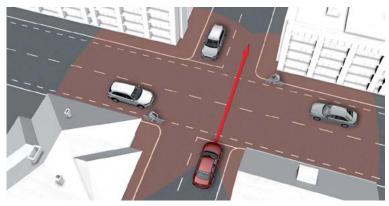
Functional description

Intersection assist is a new driver assistance system. It helps the driver to avoid collisions with cross traffic ahead of the vehicle. Intersection assist helps the driver in situations in which cross traffic ahead of the vehicle can only be seen late due to impaired visibility. Impaired visibility situations such as this can occur at street intersections or when passing narrow entrances and exits. In addition, intersection assist helps the driver in complex traffic situations in which, for example, a vehicle crossing ahead of the vehicle is overlooked because the driver is concentrating on other traffic.

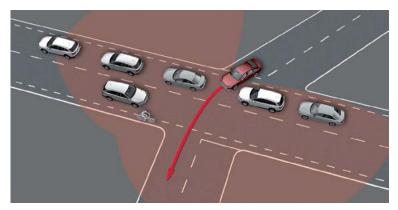
Cross traffic may be a normal vehicle, a bus or a truck, but also a cyclist or motorcyclist.

If the cyclist or motorcyclist is recognized by the system, the system responds in exactly the same way as to a vehicle.

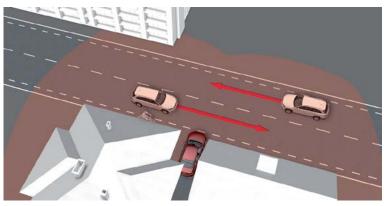
Intersection assist operates in the speed range from approximately 0 to 18.6 mph (0 to 30 km/h).



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Intersection assist sensors

To implement intersection assist, the vehicle requires two additional radar sensors. These are located behind the front bumper. The front radar sensors are similar to the rear radar sensors and are installed in this position for the first time.

They have the following service designations:

- Control Module for Left Front Object Detection Radar Sensor J1088.
- Control Module for Right Front Object Detection Radar Sensor J1089.

Switching intersection assist on and off

Intersection assist must be active in order to alert the driver to critical situations.

Intersection assist is generally switched on and off in the profile master for driver assistance systems.

Calibration of J1088 and J1089

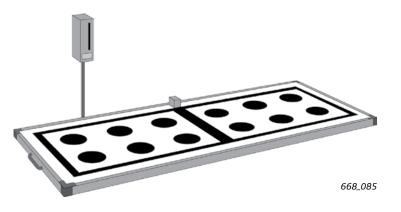
The procedure for J1088 and J1089 is based on the procedure for calibrating the rear radar sensors. The calibration plate VAS 6350 and the doppler generator are also used for this calibration proce

The calibration device is, however, aligned with the vehicle at the front side. Unlike the rear radar sensors, it is also possible to calibrate only one of the front radar sensors. This is because J1088 and J1089 are not in a master-slave configuration. Both control modules work completely independently of each other.

If special tool VAS 6350 is aligned with front side of the vehicle as directed in the workshop manual, the calibration routine can be started using the VAS Scan Tool. The calibration Test Plans are located in Guided Functions.

Both radar sensors monitor the area to the front left and right of the vehicle. Due to the positioning of the two radar sensors at the extreme front left and front right of the vehicle, the system can, in certain situations, detect cross traffic even before the driver sees it. Intersection assist uses this lead time to alert the driver as early as possible to critical cross traffic.

Intersection assist is very similar to rear cross traffic assist.



Warnings of intersection assist

Intersection assist informs / warns the driver about cross traffic ahead of the vehicle if this traffic is classified as "critical" by the system. The intersection assist warnings are staggered in time and engage different senses of the driver.

The key variable for initiating the output of different warnings is the time until a potential collision computed by intersection assist. This time is referred to as "Time-To-Collision" or TTC. When the TTC is computed the system assumes that both vehicles will continue travelling as determined by the system.

Intersection assist has the following warning mechanisms:

- 1. Display of detected cross traffic by arrow symbols on the MMI display and in the instrument cluster.
- 2. Audible warning tone.

- 3. Visual warning output in the instrument cluster and in the optional head-up display.
- 4. Initiation of corrective braking via the ABS Control Module J104.

Time sequence of the interactions

Type of interaction	Driver information	Audible and visual warnings	Corrective braking
Requirements	When the vehicle is stationary with the selector engaged in D or S only and when the vehicle is travelling forwards at a speed not exceeding 18.6 mph (30 km/h)	Only when vehicle travelling for- wards at a speed not exceeding 18.6 mph (30 km/h)	Only when vehicle travelling forwards at a speed not exceeding 6.2 mph (10 km/h)
Head-up display			
Instrument cluster			
MMI display	13:38 Fahrweg kontrolllerent	13:38 Fahrweg kontrollierent	
Corrective braking			
			Con
5	,0 <u>3</u>	3,0	1,5 1,0 0

* Time-To-Collision

The computed time until a possible collision

Driver information

The driver information alerts the driver to the fact that lateral cross traffic has been detected ahead of the vehicle. This is indicated by red arrows in various images and graphical displays. The arrows are always shown at the side of the display from which the cross traffic is approaching. The arrow symbols always indicate the direction in which the cross traffic is travelling.

The red arrows may appear on the following displays:

- 1. In the driver assist display of the on-board computer in the instrument cluster.
- 2. In the visual display of the parking aid on the MMI screen (OPS).
- 3. In the rear view and surround view camera images displayed on the MMI. The following settings can be made for the displays of the surround view cameras:
 - > Bird's eye view (TopView).
 - > Front view.
 - > Corner view, front.

Audible warning

The audible warning is issued when the computed time of about three seconds until a possible collision is imminent. In the event that critical cross traffic is not detected until shortly after this point in time, the audible warning is issued later.

The warning tone is generated by the instrument cluster.

Audible and visual warnings can only be given when the vehicle is moving forwards at a speed not exceeding 18.6 mph (30 km/h).

Visual warning

The visual warning is issued at the same time as the audible warning, that is, at the earliest three seconds before a computed time to collision. The visual warning is issued in the form of a pop-up message in the instrument cluster and, if installed, in the head-up display.

In addition, the red arrows indicating driver information start to flash in order to signal clearly on the MMI display that the driver needs to take action.

It is necessary that one of the three displays described on the left already be active at the time the driver information is given. One of the displays is not activated automatically.

If none of the displays is active in a situation with impaired visibility, the driver can activate the parking aid manually. This is done by pushing the parking assist systems button. This allows the driver to recognize immediately whether intersection assist has detected critical cross traffic and, if so, to determine the direction from which the cross traffic is approaching.

Driver information is issued in a speed range from approx. 0 to 18.6 mph (0 to 30 km/h). However, a requirement is that the gear selector be in position D or S while the vehicle is stationary.

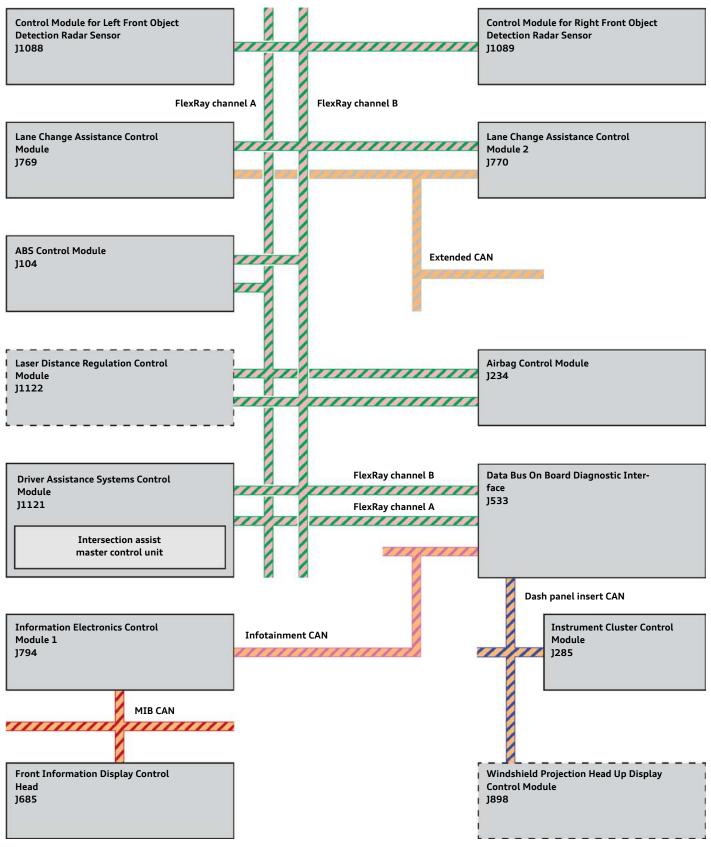
Corrective braking

If the driver fails to respond to either the driver information or the audible and visual warnings and if the vehicle is still in a critical situation, corrective braking is initiated about one second before a possible collision. A requirement for corrective braking is that the vehicle is travelling forwards at a speed not exceeding 6.2 mph (10 km/h).

System networking

The following diagram shows the key control modules participating in intersection assist. It also shows the bus systems which the individual control modules use to communicate with one another. Control modules with a dashed border are optional modules which are not mandatory. However, they will be used by intersection assist if they are installed.

All control modules with a continuous border are mandatory for intersection assist or are standard equipment in the Audi A8.



Control modules required for intersection assist

Driver Assistance Systems Control Module J1121

- Determines the potential risk of collision with oncoming traffic from the radar signals generated by radar sensors J1088 and J1089.
- > Issues a driver warning corresponding to the hazard potential.
- > Instructs the ABS control module to issue a brake warning if there is a high risk of collision.
- > Determines the current activation status of the parking aid and intersection assist.
- > Checks continuously whether the conditions for the activation of intersection assist have been met.

Control Modules for Left/Right Front Object Detection Radar Sensors J1088 and J1089

- > Detect objects on the front left and right right sides of the vehicle.
- Performs self-diagnosis of the radar sensor. Any faults which are detected are registered in the fault memory and indicated to intersection assist.

ABS Control Module J104

- > Initiates corrective braking at the request of intersection assist.
- > Provides information on the vehicle's speed.

Airbag Control Module J234

- > Executes the Audi pre sense side function based on the information provided by intersection assist.
- > Deploys one or more airbags in the event of an accident.

Information Electronics Control Module 1 J794

> Is the interface to the customer. The customer can switch intersection assist on and off in the driver assistance menu of the MMI.

Instrument Cluster Control Module J285

- > Display arrow symbols for cross traffic detected in front of the vehicle in the driver assistance view.
- > Alerts the customer to the risk of collision with cross traffic via both display and an audible signal.

Front Information Display Control Head J685

Shows the parking aid graphics and the images of the surround view cameras. The arrow symbols of intersection assist alerting the driver to cross traffic ahead of the vehicle are also shown.

The following control modules are not required for intersection assist but are, if installed, used by intersection assist:

Laser Distance Regulation Control Module J1122

 If J1122 is installed, the measurement data acquired by are used to assess the hazard potential. This additional information enhances object recognition.

Lane Change Assistance Control Modules J769 and J770

> The measurement data acquired by both modules is used to assess the hazard situation. This additional information enhances object recognition. Due to the large opening angle of the rear radar sensors, these sensors can also provide information on the cross traffic ahead of the vehicle.

Windshield Projection Head Up Display Control Module J898

 Warnings of intersection assist are displayed on the head-up display.

Driver Assistance Systems Control Module J1121

Versions

This control module will be available in four different versions at the launch of the 2019 Audi A8 . The versions have the following designations:

- Version A0 (basic version).
- Version A.

The version required in each A8 depends on which driver assistance systems are ordered. If only the standard driver assistance systems are installed on the vehicle, version AO is sufficient.

If, for example, the optional surround view cameras are ordered, it requires the installation of version C. The optional surround view cameras are currently the only option which necessitates the installation of version C.

- > Version B.
- > Version C (version with widest range of functions).

A detailed description of each individual version will be given in the course of this section. The individual versions are based on each other. The higher the version number, the more hardware and software are integrated in the control module.

However, an external analysis of the control module shows that it is only possible to differentiate visually between two different versions.



Versions A0 and A



Versions B and C

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J1121 is the master control module for the following driver assistance systems:

- Basic version of high beam assist. >
- Matrix LED high beam assist.
- Intersection assist.
- Surround view cameras.

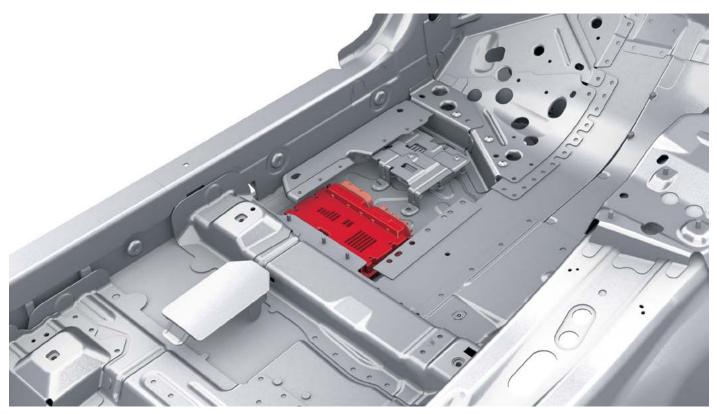
- > Parking system plus (in version C only, otherwise Vehicle Electrical System Control Module J519).
- Active lane departure warning.
- > Emergency assist.
- > Camera-based traffic sign recognition.

Address Word for J1121

J1121 is accessed via Address Word 00A5 using the VAS Scan Tool. Because Driver Assistance Systems Front Camera R242 is no longer an independent control module, its diagnostic functions have been integrated with J1121.

Installation location of J1121

J1121 is installed in the driver footwell in the Audi A8.



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J1121 and its inputs

The illustration shows version C of Driver Assistance Control Module J1121 and all sensors whose measurement data are either received via the FlexRay bus or read directly.

The inputs can be subdivided into two categories:

Category 1:

Sensors and cameras provide input to J1121.

Category 1 sensors in the Audi A8 include:

- > The surround view cameras.
- > The front and rear ultrasound sensors.
- > The front camera for driver assistance systems.

Notes on the surround view cameras:

Peripheral Camera Control Module J928 of other Audi models is not used on the 2019 Audi A8. Its functions are performed by Driver Assistance Systems Control Module J1121.

Notes on the ultrasound sensors:

The ultrasound sensors are read either by Vehicle Electrical System Control Module J519 or Driver Assistance Systems Control Module J1121. It depends on what version of J1121 is installed in the vehicle.

Notes on Driver Assistance Systems Front Camera R242:

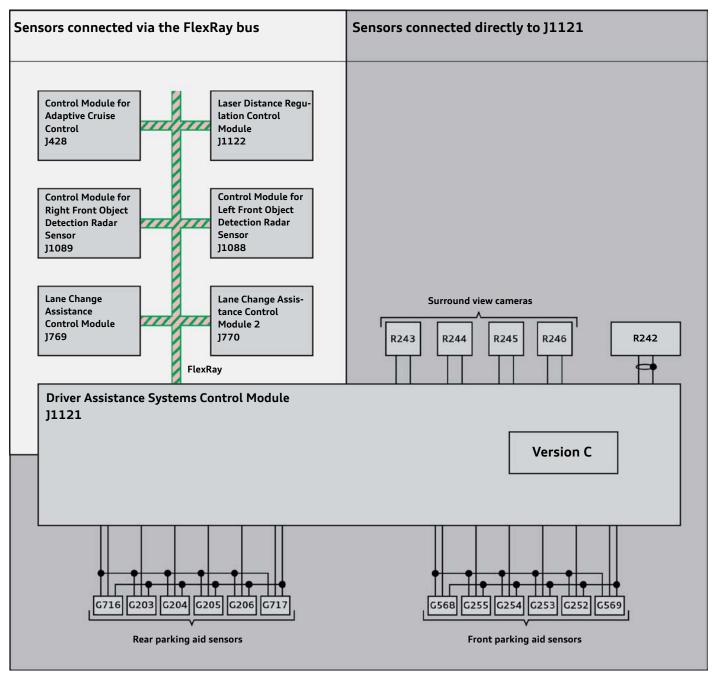
R242 does not process images any longer but rather sends the data to Driver Assistance Systems Control Module J1121 for processing.

Category 2:

These inputs have their own control modules and supply their measurement data to J1121 via the FlexRay bus.

Category 2 inputs in the Audi A8 include:

- > Control Module for Adaptive Cruise Control J428.
- > Laser Distance Regulation Control Module J1122.
- > The Control Modules for Left/Right Front Object Detection Radar Sensor J1088 and J1089 respectively.
- Right/Left Lane Change Assistance Control Modules J769 and J770.



668_090

Key:

G203-G206	Rear Parking Aid Sensors
G252-G255	Front Parking Aid Sensors
G568-G569	Front Parallel Parking Assistance Sensors
G716-G717	Rear Parallel Parking Assistance Sensors

- R242 Driver Assistance Systems Front Camera
- R243 Front Peripheral Camera
- R244 LLeft Peripheral Camera
- R245 Right Peripheral Camera
- R246 Rear Peripheral Camera

J1121 – Version A0

Part number for J1121 - Version A0: 4N0.907.107.M



Version A0 of J1121 is the master control module of the following driver assistance systems:

- > Basic version of high beam assist (standard equipment).
- > Matrix LED high beam assist (optional equipment).

If version A0 of J1121 is installed, the following additional driver assistance systems may be installed in the Audi A8 :

- Parking system plus (standard equipment, master control module: Vehicle Electrical System Control Module J519).
- Rear view camera (optional, master control module: Rearview Camera System Control Module J772).
- Side assist (optional, master control modules: Lane Change Assistance Control Modules 769 and 770).
- Exit warning (optional, master control modules: Lane Change Assistance Control Module 769 and 770).
- Rear cross traffic assist (optional, master control modules: Lane Change
 Assistance Control Module 769 and 770).
- Night vision assist (optional, master control module: Night Vision System

- Lane departure warning (standard equipment in NCAP countries).
- > Emergency assist (optional equipment).

If version A0 of J1121 is installed, the following additional driver assistance systems <u>cannot</u> be installed in the Audi A8 :

- > Camera based traffic sign recognition.
- > Surround view cameras.
- Intersection assist.
- Adaptive cruise assist.

Components and sensors connected directly to J1121:

> Driver Assistance Systems Front Camera R242.

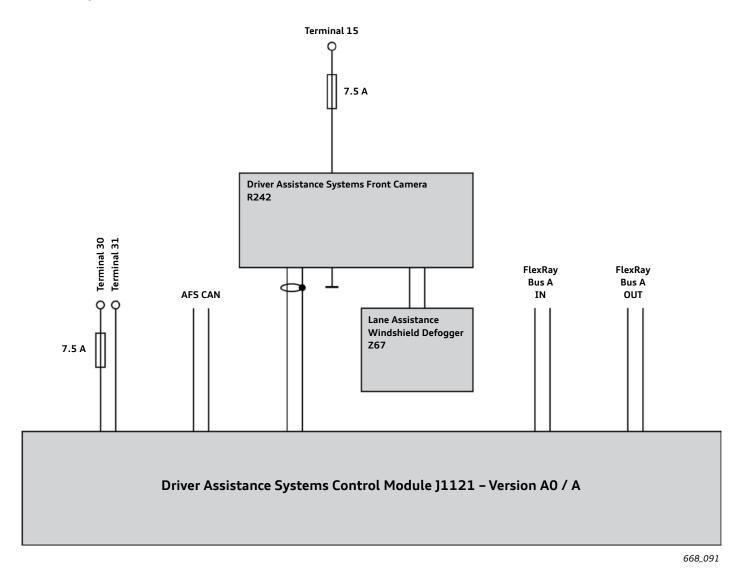


Note

Control Module J853).

If a vehicle is equipped with matrix LED headlights (with or without laser lights), the vehicle automatically has a higher-level version of high beam assist: matrix LED high beam assist. In this case, matrix LED high beam assist is the basic version of high beam assist.

Circuit diagram for J1121 - version A0 and version A



J1121 – Version A

Parts number for J1121 - Version A: 4N0.907.107.N

There is one difference between version A0 and version A: Version A also incorporates the software functions of the camera-based traffic sign recognition system. There are no visual differences between the version A0 and version A of the control modules. The only difference is the part number.

J1121 – Version B

Parts number for J1121 - Version B: 4N0.907.107.Q



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Version B of J1121 is the master control module of the following driver assistance systems:

- > Basic version of high beam assist (standard equipment).
- > Matrix LED high beam assist (optional equipment).
- > Lane departure warning (standard equipment in NCAP countries).

If version B of J1121 is installed, the following additional driver assistance systems may be installed in the Audi A8:

- Parking system plus (standard equipment, master control module: Vehicle Electrical System Control Module J519).
- Rear view camera (optional, master control module: Rearview Camera System Control Module J772).
- Side assist (optional, master control modules: Lane Change Assistance Control Modules J769/J770).
- Exit warning (optional, master control modules: Lane Change Assistance Control Modules J769/J770).
- Rear cross traffic assist (optional, master control modules: Lane Change Assistance Control Modules J769/J770).
- Night vision assist (optional, master control module: Night Vision System Control Module J853).

- > Emergency assist (optional).
- > Intersection assist (optional).
- Lane center holding function (optional functional component of adaptive cruise assist).

If version B of J1121 is installed, the following additional driver assistance systems <u>cannot</u> be installed in the Audi A8:

> Surround view cameras.

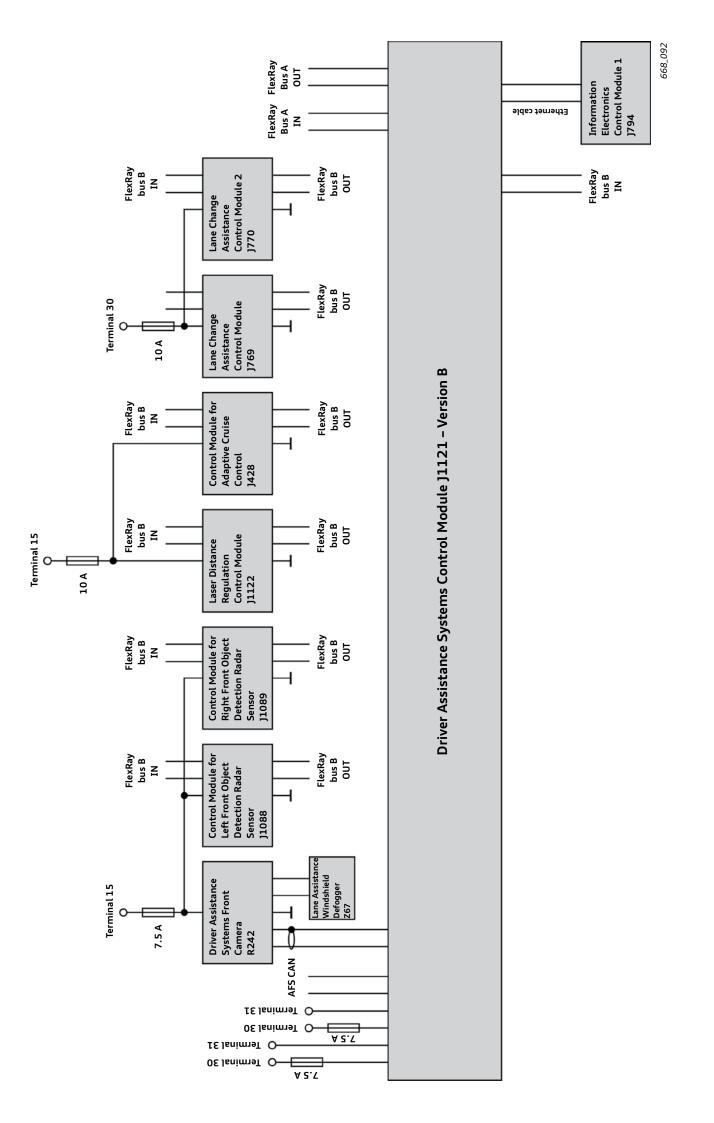
Components and sensors connected directly to J1121:

> Driver Assistance Systems Front Camera R242.



Note

The lane center holding function is a functional component of adaptive cruise assist. The master control module of adaptive cruise assist is Control Module for Adaptive Cruise Control J428. If adaptive cruise assist is installed in the vehicle, the vehicle must have at least version B of Driver Assistance Systems Control Module J1121.



J1121 – Version C

Parts number for J1121 - Version C: 4N0.907.107.S



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Version C of J1121 is the master control module of the following driver assistance systems:

- > Basic version of high beam assist (standard equipment).
- > Matrix LED high beam assist (optional equipment).
- Lane departure warning (standard equipment in NCAP countries).
- > Emergency assist (optional).

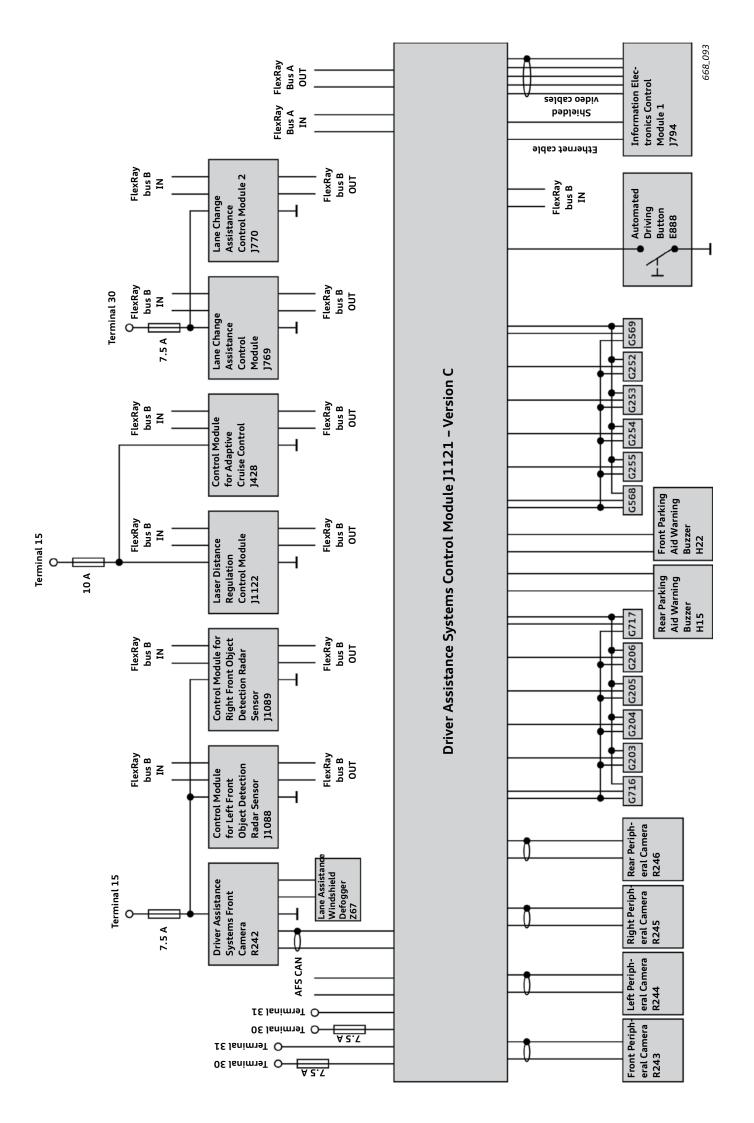
If version C of J1121 is installed, the following additional driver assistance systems may be installed in the Audi A8:

- Side assist (optional, master control modules: Lane Change Assistance Control Modules J769/J770).
- Exit warning (optional, master control modules: Lane Change Assistance Control Modules J769/J770).
- Rear cross traffic assist (optional, master control modules: Lane Change Assistance Control Modules J769/J770).
- Night vision assist (optional, master control module: Night Vision System Control Module J853).

- > Intersection assist (optional).
- Lane center holding function (optional functional component of adaptive cruise assist).
- > Surround view cameras (optional).
- > Parking system plus (standard equipment).

Components and sensors connected directly to J1121:

- > Driver Assistance Systems Front Camera R242.
- > Parking Aid Warning Buzzer, rear H15, front H22.
- > Parking Aid Sensors, rear left G203, rear right G206.
- > Parking Aid Sensors, rear left , G204, rear right G205.
- > Parking Aid Sensors, front right G252, front left G255.
- > Parking Aid Sensors, rear left G253, rear right G254.
- > Left Front Parallel Parking Assistance Sensor G568.
- > Right Front Parallel Parking Assistance Sensor G569.
- Parallel Parking Assistance Sensors G716, rear right G717.
- Front Peripheral Camera R243 and Rear Peripheral Camera R246.
- > Left Peripheral Camera R244 and Right Peripheral Camera R245.



Laser Distance Regulation Control Module J1122

A laser scanner is used in the Audi A8 to implement complex driver assistance functions. It is installed in the center of the bumper under the license plate carrier. Like the long-range radar sensor, the laser scanner scans for objects ahead of the vehicle.

Design and function

The general working principle is similar to that of a radar sensor: instead of radar waves, the laser scanner emits laser beams which are reflected when they hit the surfaces of other objects.

It is possible to measure the distance to an object by determining the elapsed time from emittance to reception of the reflected radiation components. A fundamental difference between laser scanners and radar sensors is the propagation characteristic of the radiation. The cone-shaped radar wave emitted by the radar sensor covers a large area, the bundling of the laser light components produces a single beam concentrated on a small area. To scan a larger area, multiple "individual beams" are emitted in a planar fashion and in multiple planes. The laser pulses which are used (pulse duration: approximately 4 ns) have a wavelength of approximately 905 nm. The electromagnetic radiation is neither visible to the human eye (infrared) nor harmful due to its low energy content (laser class 1).

The laser scanner used in the Audi A8 has a rotating mirror which scatters the light beams in a fan-like fashion. The light emitted by the transmitter unit hits on the surface of the mirror and is radiated. The mirror is driven by an electric motor. For example, if the radiation is reflected by an object at a distance of 100 m, it returns to the receiver diodes in the scanner less than 0.7 μ s after it is emitted. The reflections hit on the lower part of the mirror und and then on the photodiodes, which convert the visual information to electrical signals.





Transmission range



668_096

Frequency band

The horizontal detection zone covers an angular range of about 145°. The range is approximately 87.4 yd (80 m) on average. Objects can be successfully recognized from a distance of about 3.9 in (10 cm).

The horizontal resolution is 0.25° and offers much greater precision than radar technology.

The laser beams are emitted vertically in four planes in a fan-like fashion, each at an angle of 0.8°. This gives an overall vertical angle of approx. 3.2°.

The laser scanner is the ideal complement to the longrange radar. Although the radar system has a much longer range (273.4 yd [250 m]), the coverage angle of approximately 35° is much less than that of the laser scanner.

Much like the radar beams, the laser technology has the advantage of being largely unaffected by ambient light conditions. Another advantage of the laser technology is its accuracy of measurement irrespective of distance. The reflection received by the scanner is made up of a multiplicity of dots known as dot clouds. The high resolution of the laser technology enables the contours of objects to be measured with much greater precision and therefore allows various types of object to be classified. These include passenger cars, trucks, motorcycles, etc. The laser technology also detects persons and geometric structures, such as crash barriers and other objects defining lane boundaries.

The received laser beams reflected by the object are evaluated in such a way that the overall horizontal detection zone of about 145° is subdivided into ten equally sized sectors. Internal software algorithms are able to detect dirt build-up or damage to the reflector lens as well as the range and misalignment of the lens.

Apart from this range information, the FlexRay message contains information about detected objects and their coordinates including applicable standard deviations, as well as the speeds of the objects and the probability that the relevant objects can be detected and classified.

The laser scanner is also equipped with a lens cleaning system. Telescopic washer jets are positioned on both sides of the unit. The accompanying electrical pump is attached directly to the wash water tank. It supplies the washer jets of the laser scanner and the rear camera. Depending on the direction of rotation of the pump motor, either the laser scanner or the rear camera is cleaned. If the laser scanner control module detects dirt build-up on the lens, a message is sent to Vehicle Electrical System Control Module J519, which in turn instructs Windshield Washer Pump Control Module J1100 to clean the lens.



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Service

The system can be accessed via Address Word OOCD using the VAS Scan Tool. Channel B of the FlexRay bus is used for communications.

The installation position of the laser scanner is adjustable. It can be adjusted vertically.

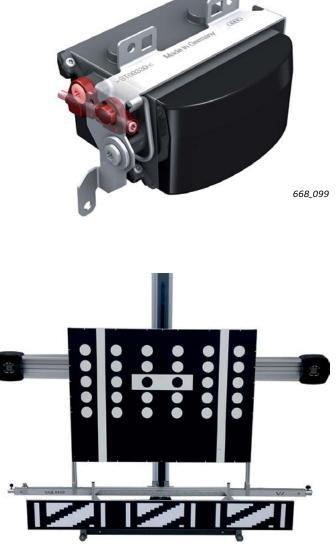
The basic adjustment procedure is identical to the existing procedure for adjusting ACC systems. Special Tool VAS 6430 is also identical and likewise the procedure for alignment of the gauge relative to the geometric drive axis of the vehicle.

A new optical target (calibration device) is used for adjustment of the laser scanner. The laser beam hits on, and is reflected by, the target. The correct alignment of the laser scanner relative to the geometric axis of the vehicle can be determined by evaluating the reflections received. The VAS Scan Tool instructs the Technician to make any necessary adjustments, specifying the direction of rotation and the angle of rotation of the adjusting screw.

The laser scanner unit can only be replaced as a complete unit. It cannot be repaired by service personnel. Although the radiation emitted by the sensor unit is not harmful, there are areas inside the unit where higher-energy radiation is present.

It is necessary to adjust the laser scanner:

- > After removing, installing and replacing the laser scanner.
- > After modifying the suspension set-up (specifically the rear axle tracking).
- > After removing/installing the front bumper.
- > After basic adjustment (programming the suspension height) of the adaptive air suspension.



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Note

In models equipped with "dynamic all-wheel-drive steering", the rear wheels must be moved into the neutral position (zero steer angle) before starting wheel alignment and/or determining the geometric drive axis. Be sure to follow the instructions given in the Workshop Manual.

Control Module for Adaptive Cruise Control J428

Only one Control Module for Adaptive Cruise Control (J428) is used on the 2019 A8. The duties of a second ACC module are performed by Laser Distance Regulation Control Module J1122.

Design and function

The 4th generation system used in the Audi A8 is identical in design and basic functions to the ACC of the 2017 Audi Q7.

The ACC unit is integrated in the front bumper on the righthand side of the vehicle.

J428 uses channel B of the FlexRay bus for communications.



Operation and driver information

The ACC is primarily operated using the control stalk. The same applies to the driver information displays.

Service operations

J428 is accessed via Address Word 0013 via the VAS Scan Tool.

It consists of a radar transmitter and receiver as well as the control module itself and, if faulty, can only be replaced as a complete unit.

The ACC unit is adjusted by the usual procedure using Special Tool VAS 6430/1 in conjunction with ACC reflector mirror VAS 6430/3. The only difference to the adjustment procedure for the 2017 Audi Q7 is that only one ACC unit is installed and needs to be adjusted.

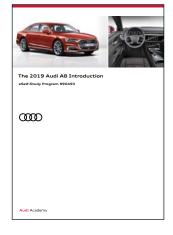


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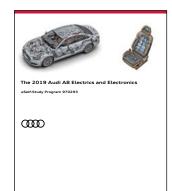


eSelf-Study Programs

For further information please refer to the following eSelf-Study Programs:



SSP 990493 The 2019 Audi A8 Introduction



Audi Academy

SSP 970293 The 2019 Audi A8 Electrics and Electronics



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SSP 990293 The 2019 Audi A8 Infotainment and Audi Connect Systems

Knowledge assessment

An On-Line Knowledge Assessment (exam) is Available for this eSelf-Study Program.

The Knowledge Assessment is required for Certification credit.

You can find this Knowledge Assessment at: www.accessaudi.com

From the <u>accessaudi.com</u> Homepage:

- > Click on the "App Links"
- > Click on the "Academy site CRC"

Click on the Course Catalog Search and select "990393 - The 2019 Audi A8 Driver Assistance Systems"

Please submit any questions or inquiries via the Academy CRC Online Support Form which is located under the "Support" tab or the "Contact Us" tab of the Academy CRC.

Thank you for reading this eSelf-Study Program and taking the assessment.

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