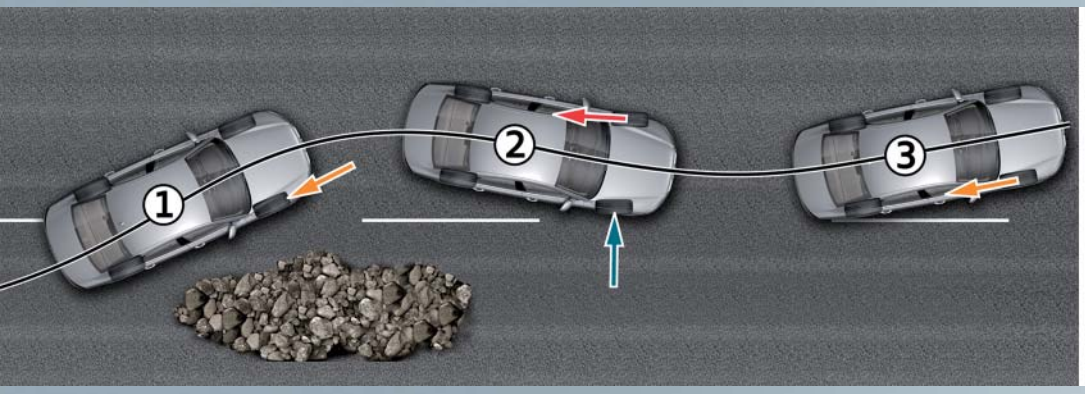
Self-study programme 458



Audi A8 ’10
Running gear and suspension

Audi
Service Training

Introduction

The main objective in the development of the running gear and suspension systems for the new Audi A8 ’10 was to further improve the already exceptionally high standards of the predecessor in terms of driving dynamics and comfort. For this purpose, tried and tested systems such as five-link front axle, trapezoidal link rear axle as well as adaptive air suspension have been consistently further developed and fitted in the new luxury class model. The system networking level has been substantially increased. With the powerful FlexRay bus system it is possible to use a central sensor unit that makes available vehicle movement information to the relevant systems such as ESP, adaptive air suspension, dynamic steering and the sport differential. With this unit it has been possible to significantly reduce the number of sensors in the vehicle.

In the same way as in the predecessor model, the new Audi A8 ’10 is available exclusively with adaptive air suspension.

The following running gear and suspension variants are available for the Audi A8 ’10: The standard running gear and suspension (adaptive air suspension) with the production control number 1BK is the standard production version. The sport running gear and suspension 2MA (adaptive air suspension sport) is the option for customers with sporting ambitions. Compared to the standard running gear and suspension 1BK, the trim position of vehicles equipped with a sport running gear and suspension is reduced by 10 mm. The poor road running gear and suspension 1BY is offered instead of the standard version for use in corresponding markets. In this case, the trim position is 8 mm higher than the standard running gear and suspension 1BK. Vehicles with poor road running gear and suspension are additionally equipped with a reinforced powerplant guard on the front axle.

458_001

Contents

The self-study programme describes the fundamentals of the design and function of new vehicle models, new vehicle components or new technologies.

The self-study programme is not a Repair Manual! Specified values are only provided to facilitate understanding and refer to the software version valid at the time the SSP was compiled.

It is essential that you refer to the latest technical literature when carrying out maintenance and repair jobs.

Note

Reference

Axle and wheel alignment

Overall concept

In the same way as on the current Audi A4, the Audi A8 ’10 is equipped with gearboxes with the axle drive arranged ahead of the clutch. In conjunction with the positioning of the steering gear ahead of the axle, thanks to this measure it has been possible to position the front axle 145 mm further forward compared to the predecessor model. The wheelbase has been increased by 46 mm. The immediate benefit is an improvement in axle load distribution while also improving the vibration comfort and the space available in the vehicle interior.

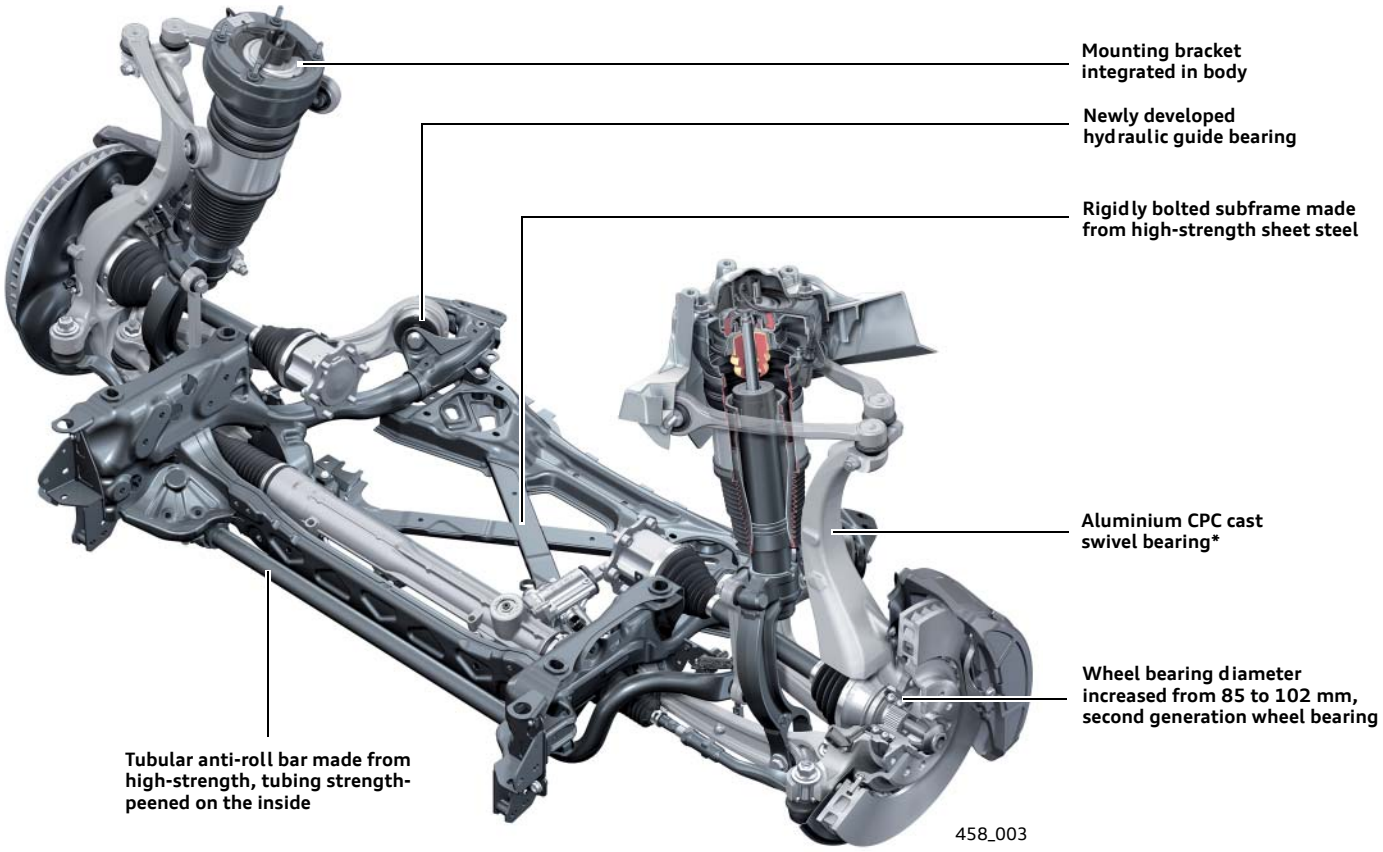
Increasing the track widths by 18 mm on the front axle and 22 mm on the rear axle has a significant beneficial effect on transverse dynamics. Due to these changes, the kinematics of the axles has been completely re-engineered, involving the redesign of all axle components. Despite the substantial increase in the wheelbase, a smaller turning circle has been realised by increasing the maximum wheel steering angle.

458_002

Front axle - overview

The development of the front axle was based on the five-link front axle already used in the current Audi A4. The main advantage of this concept is the arrangement of the steering gear on the assembly mount ahead of the axle. Installation of the steering gear is very exact within extremely close tolerance ranges. As already realised on the Audi A4 this means that it is not necessary to adjust the toe-in curve as a tolerance compensation measure. Thanks to the direct connection of the steering rack to the swivel bearing, the track rod can also assume wheel control tasks, thus serving as the fifth link. For weight and rigidity optimisation purposes, the mounting bracket for the upper wishbone has been integrated in the vehicle body. This arrangement has additionally made it possible to reduce the installation tolerances for the upper wishbone.

All wishbones are forged aluminium components. To achieve the required axle kinematics, the outer joints of the support and guide links are arranged as close as possible to each other. For this reason, the support link joint is fitted in the swivel bearing as a separate component. All rubber mounts have been re-engineered. A newly developed hydraulic mount that connects the guide link to the assembly mount ensures the demanding and in part opposing requirements in terms of comfort, driving dynamics and acoustics are met. To ensure effective self-centring of the steering when driving straight ahead the kingpin inclination angle and the castor angle have been slightly increased compared to the predecessor.



* See "System components" for detailed information

Front axle - system components

Subframe

The subframe is made from high-strength sheet steel. To ensure the highest possible accuracy of the front axle kinematics, during the production process, holes are made in the kinematic link connection points at the end of the welding line to eliminate weld distortion. The subframe is rigidly bolted to the body. Apart from toe adjustment, no other adjustments are therefore necessary in production.

458_004

Swivel bearing, wheel bearing

The aluminium swivel bearing is made in a CPC casting process. This is a special casting process that achieves an extremely dense grain structure. In this process the molten mass is filled at elevated pressure into a casting die that is subjected to pressure. The casting die is then vented, thus further compacting the grain structure.
The wheel bearing diameter has been increased from 85 mm to 102 mm. A second generation wheel bearing is used. The increase in diameter makes it possible to position the outer pivot point of the drive shaft very close to the steering axis. Despite the larger wheel steering angle, the maximum permissible flex angles are not exceeded.

458_005

Support link joint integrated in swivel bearing

Support link

The support link is bolted to the joint integrated in the swivel bearing.

458_006

Guide link, guide bearing

A particular focal point of the design layout is the bearing point joining the guide link to the axle carrier. A component specifically developed to meet the demanding acoustics, driving dynamics and vibration comfort requirements is used for this joint. The convex, inner stop in the bearing ensures all forces are optimally absorbed in all link positions to which the bearing is subjected by the kinematics.

458_007

Anti-roll bar

Tubular anti-roll bars made from high-strength steel tubing are used. To reduce weight, the inner wall of the tube is strength-peened. In this process, the surface is compacted by being blasted with small steel spheres, thus increasing the strength of the component. In this way, it was possible to reduce the cross section of the tube while maintaining the same anti-roll (stabilisation) effect. The anti-roll bar is mounted on the subframe and is attached directly to the shock absorbers by link rods in rubber-metal mounts.

458_008

Suspension strut/air spring

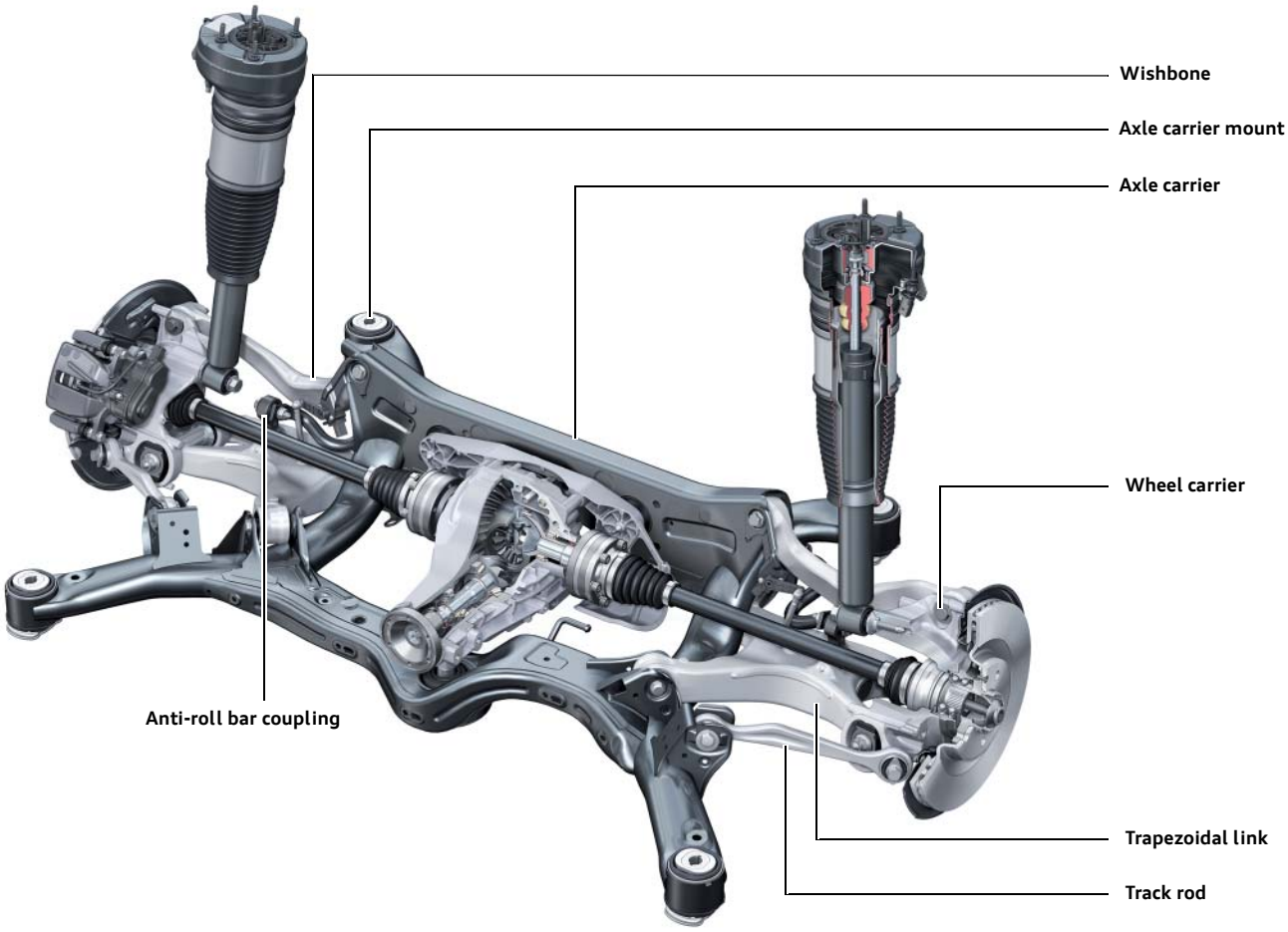
As on the predecessor model, adaptive air suspension is fitted as standard in the Audi A8 ’10.
(See "Adaptive air suspension" for detailed information)

458_009

Rear axle - overview

The concept of the track-guided trapezoidal link axle was also used as the basis for developing the rear axle on the Audi A8 ’10. Compared to the predecessor, this concept has been modified to suit specific requirements. The suspension strut is now supported directly on the wheel carrier. The more direct ratio of 0.9 (0.74 on the predecessor) achieves a more precise response of the damper. With four high-volume hydraulic mounts, the axle carrier decouples axle components and the body, thus rendering ball joints unnecessary without compromising on precision and dynamics.

This applies particularly to the connecting joint between the wheel carrier and trapezoidal link as well as to the track rod and anti-roll bar coupling. All wheel controlling components are a lightweight aluminium construction. The kinematic layout of the axle ensures vertical drive and braking movements are scarcely felt. In the A8 ’10, this concept enables a rear end with a low-set, completely flat load area and allows for the largest fuel tank in the premium segment while retaining the spare wheel well to accommodate a full size spare wheel.



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Rear axle - system components

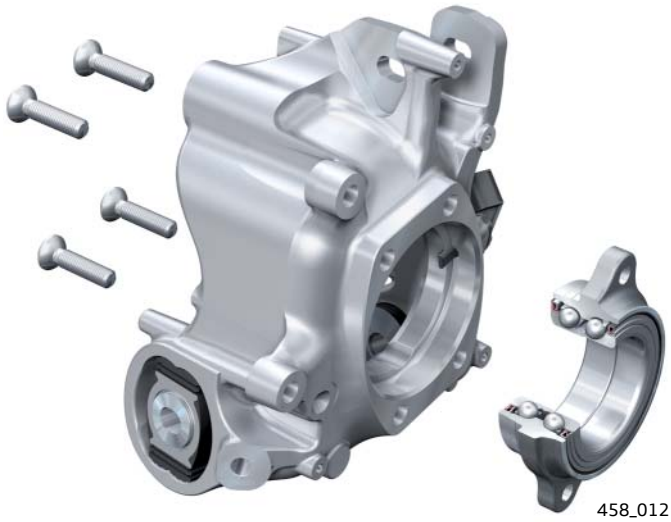
Subframe

The subframe is made from high-strength sheet steel. To reduce weight, the thickness of the sheet steel is partially adapted to the applied load. Thin-walled sheet steel cross struts and tubes with varying wall thickness that are made in an internal high pressure forming process are used. In this process, the blank (tube) is pressed into an external mould by pressure from the inside (internal high pressure forming).
The hydraulic mounts are press-fitted and can be replaced. The mounts are designed such that they are extremely rigid in transverse direction and very soft in vertical direction, thus ensuring precision wheel control (forces in transverse direction) and excellent acoustic decoupling (forces in vertical direction).
The hydraulic damping is particularly effective in dealing with forces in longitudinal direction.

458_011

Wheel carrier, wheel bearing

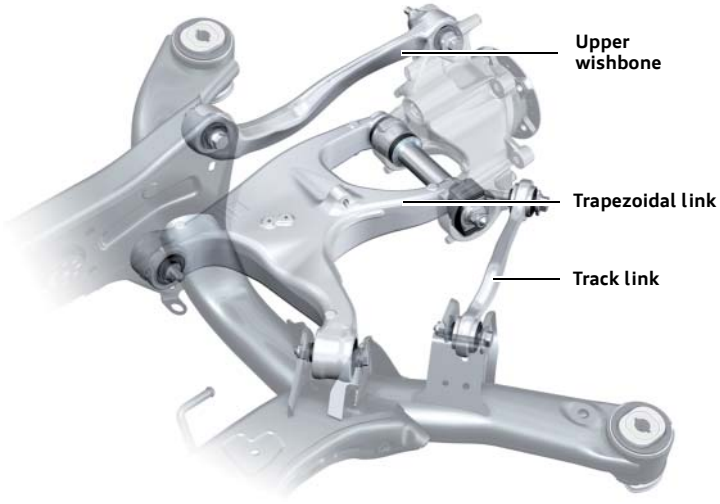
The aluminium wheel carrier is manufactured in a gravity die casting process and is designed to meet the highest rigidity requirements. In connection with the increased wheel bearing diameter it has been possible to increase the tilt resistance of the wheel, thus improving the transverse dynamics of the vehicle through the more precise wheel control.
The main innovation is the attachment of the suspension strut to the wheel carrier.



458_012

Trapezoidal link, upper wishbone, track link

The trapezoidal link is designed as a hollow section and is made from heat-treated aluminium in a sand casting process. The wishbone and track link are forged aluminium components.

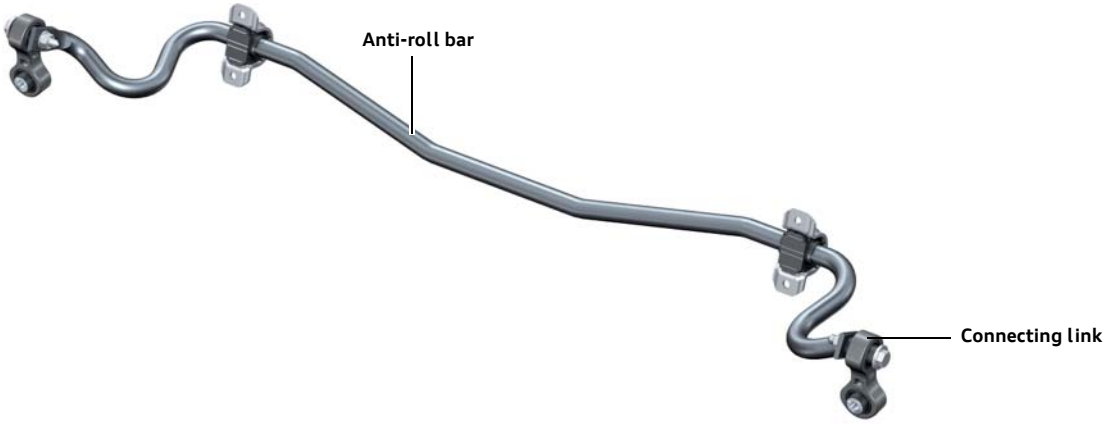


458_013a

Anti-roll bar

The anti-roll bar is made from heat-treated steel tubing. For the first time, the rear axle anti-roll bar is also strength-peened on the inside.

The connecting link is made of glass fibre-reinforced plastic; consistent with the lightweight construction concept.

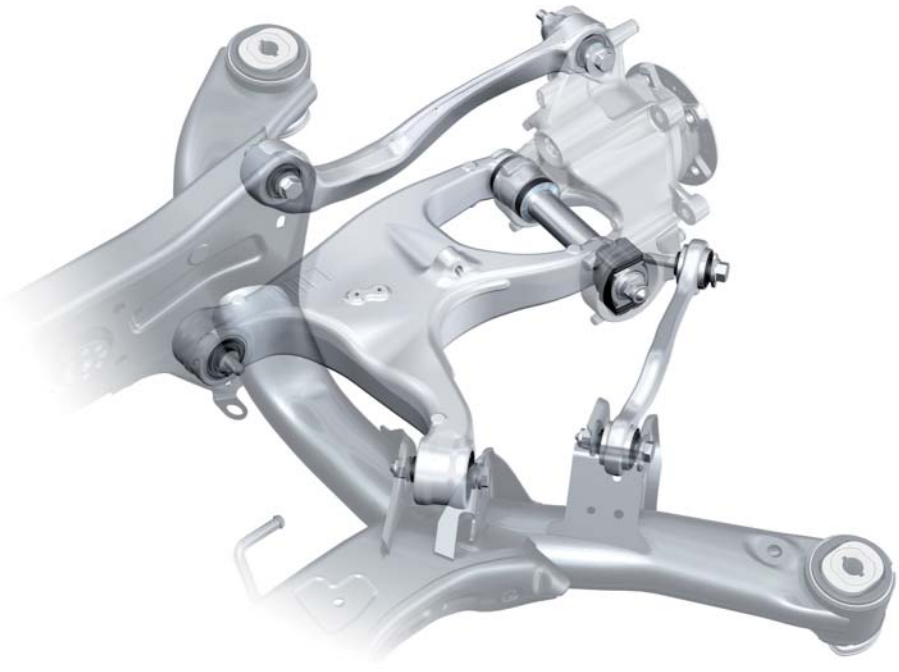


458_014

Rubber mount

The conflict of objectives in the design of the wheel-controlling bearing points is to offer the least possible resistance to rotary motion yet to make them sufficiently rigid to absorb longitudinal and transverse forces. The greater the force applied for rotary motion (also known as secondary spring rate), the poorer the response characteristics of suspension and damping.

Particularly low amplitude road excitation is then more noticeable to the detriment of comfort. To reduce the secondary spring rate, all wheel-controlling rubber mounts have therefore been designed with integrated intermediate sleeves and rubber blends with high damping properties, resulting in perfect damping characteristics. A completely new and patented elastomer joint has been developed as the connecting joint between the wheel carrier and trapezoidal link.

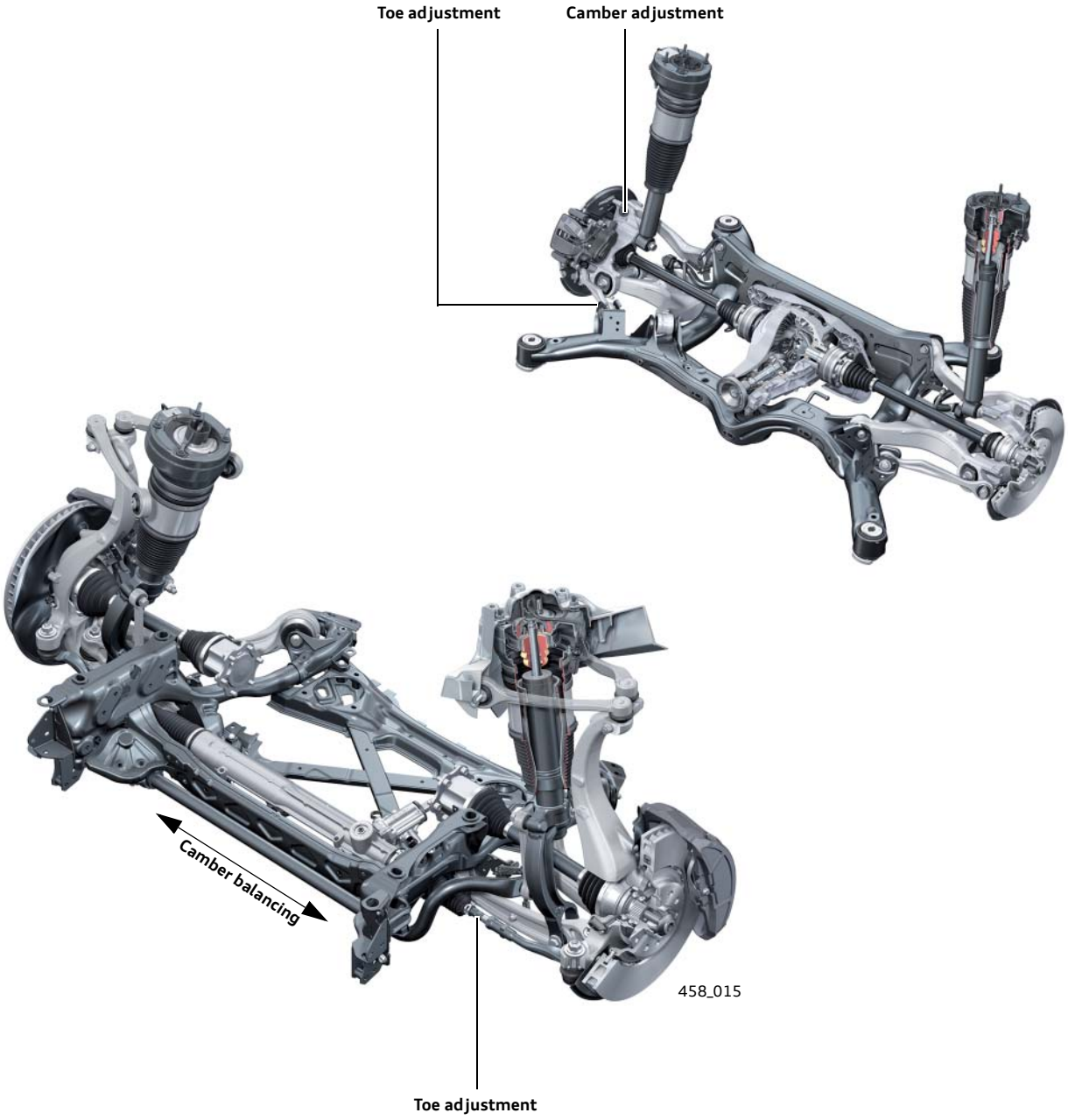


458_013

Wheel alignment

It is possible to set the individual toe on the front axle. Because of the position of the steering gear on the subframe, it is no longer necessary to adjust the toe-in curve.

As on the predecessor, the camber values can be balanced by transverse displacement of the subframe.
Toe and camber can be set separately on either side of the rear axle.

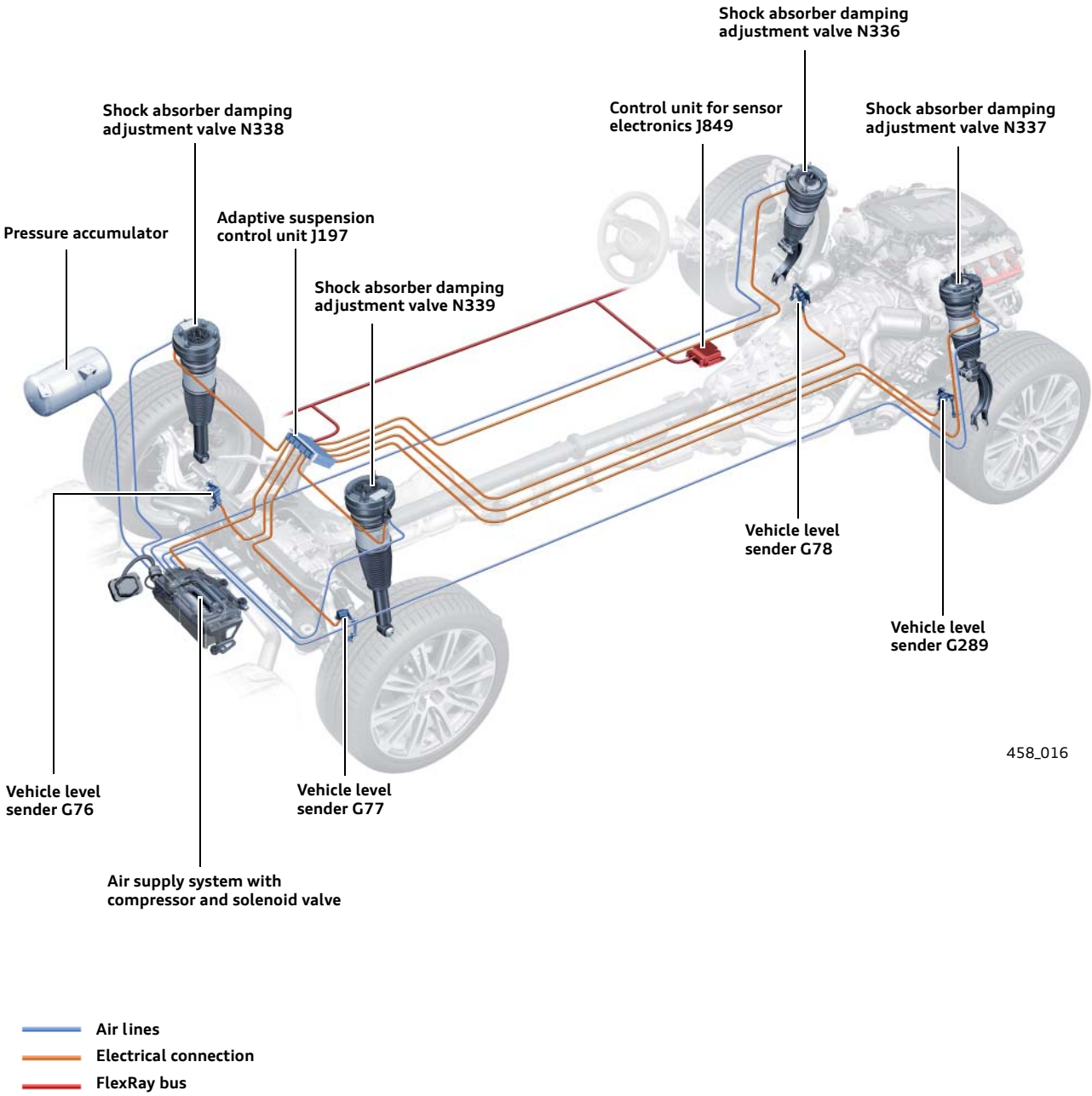


adaptive air suspension

Overview

The main objective when developing the air suspension system in the Audi A8 ’10 was to achieve "best in class" in terms of driving comfort and driving dynamics. To achieve this objective all major system components were newly developed. The control logic differs for the different running gear and suspension variants.

The main feature is the integration of the body acceleration sender in the control unit for sensor electronics. The adaptive suspension control unit communicates via the FlexRay data bus. On the Audi A8 ’10, display and operation tasks have been integrated in the Audi drive select.



System components

Adaptive suspension control unit J197

The main innovation is the connection of the control unit to the FlexRay data bus. This enables improved performance in all aspects of the control system. The adaptive suspension control unit receives the relevant vehicle acceleration values from the control unit for sensor electronics J849 via this bus system.

Changes compared to the predecessor mainly concern the control procedures themselves as well as the display and operating concept. The control unit is installed behind the rear panel in the luggage compartment.
The parameters for the various running gear and suspension variants are adapted by writing corresponding data sets as part of the online coding procedure.

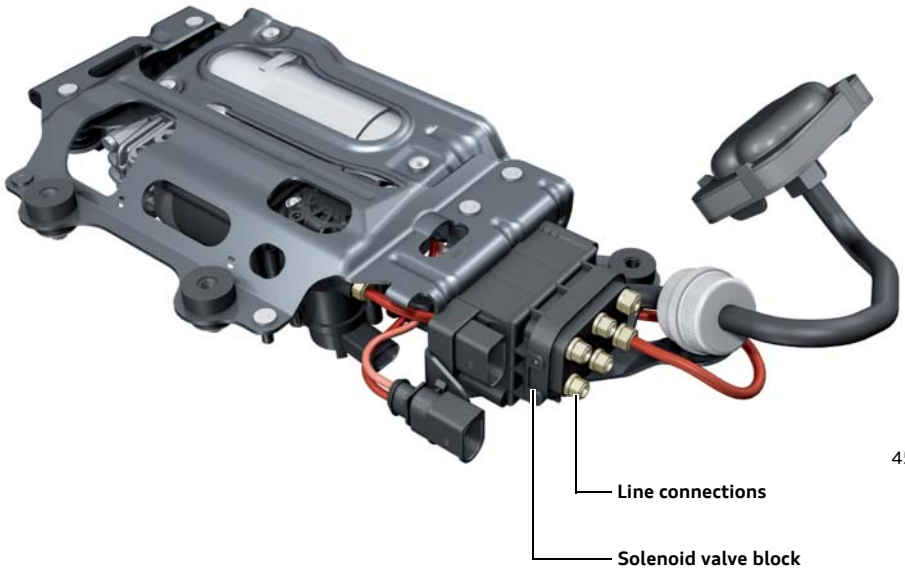
The control unit actuates the solenoid valves and the compressor for vehicle level adjustment as well as the damper valves. However, the damper valves are only operated while the vehicle is driving when a vehicle speed signal is sent from the ESP control unit.

The actuating currents are in the range from 0 A to 1.8 A. The maximum damping force is achieved at 0 A while an electrical current of 1.8 A is required for the minimum damping force.
To achieve maximum driving comfort, the basic electrical current applied at the damper valves is 1.8 A in all modes.

458_017

In terms of its design and pneumatic functional principle, the solenoid valve block corresponds to the components already known from the predecessor and used for the adaptive air suspension on the Audi A6.

Compared to the predecessor and the Audi A6, the positions of the line connections have been changed, however, the colour identification markings are identical.
(Refer to SSP 292 for detailed information on the design and functional principle)

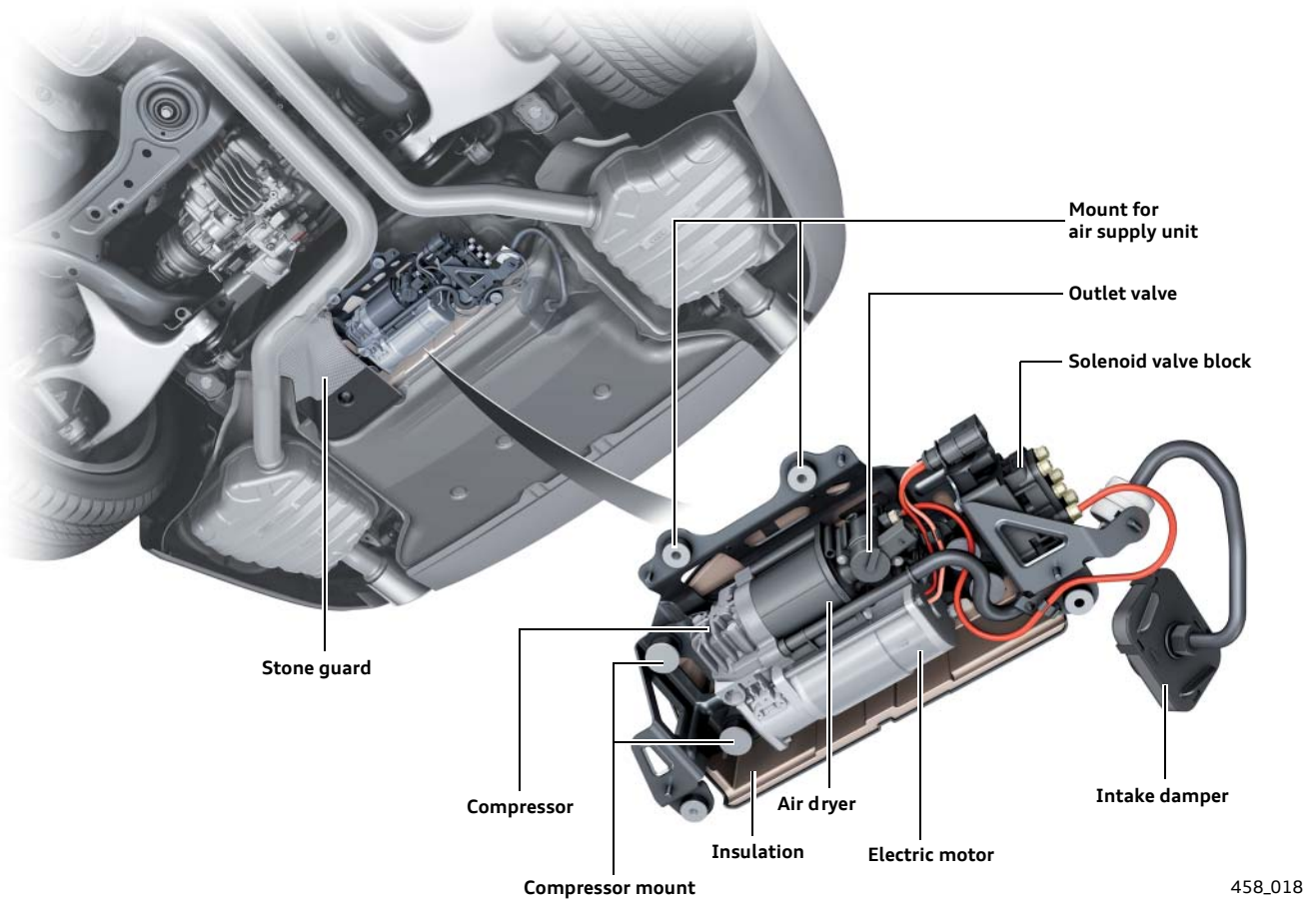


458_020

Air supply system

The air supply system consists of the dry-running, electric motor driven compressor, air dryer, intake, solenoid valve block and the corresponding pneumatic lines.
The fully acoustically encapsulated system is installed under the spare wheel well in the rear end. The complete unit is decoupled from the vehicle body by means of four harder rubber-metal mounts. The compressor is fitted on a separate bracket, which is also mounted by four softer rubber-metal mounts on the first bracket of the air supply system.
The components are shielded from the road.

The single-stage compressor generates a system pressure of 18 bar. A pressure limiting valve arranged in the compressor protects the system from overloading. The air intake takes place via the intake damper and air dryer from the spare wheel well. As on the predecessor, the air dryer is self-regenerating and requires no maintenance. The control rate for raising the vehicle level with the compressor is approx. 2-3 mm/s at the front and rear axle.
The level is reduced by blowing off air at a rate of approx. 10 mm/s.
The compressor temperature is now determined based on a model calculation that renders a temperature sensor unnecessary. The temperature is determined by evaluating the change in resistance of the magnetic coil in the outlet valve.



Pressure accumulator

The task of the pressure accumulator is to maintain system availability. It also improves the acoustic characteristics, especially during control procedures when the vehicle is stationary and at low vehicle speeds. In these situations, control procedures are predominantly carried out only with the pressure accumulator, i.e. without the compressor running. In addition, the vehicle level is raised at a faster rate with the pressure accumulator than with the compressor running. The control rate is approx. 4 mm/s for the front axle and approx. 8 mm/s for the rear axle.
The accumulator has a volume of 5.8 l and a pressure of 18 bar. To reduce weight, an aluminium structure is used. The pressure accumulator is also installed in the rear end.
To rapidly charge the accumulator, 6 mm outside diameter (instead of 4 mm) air lines are used between the solenoid valve block for the pressure accumulator and the solenoid valve block for the compressor.


458_021

Vehicle level sender

The four vehicle level senders are adopted from the Audi A4. The mounting brackets for the senders on the front axle are adapted to the vehicle geometry while the mounting brackets on the rear axle are adopted from the Audi Q5. The senders operate at a sampling rate of 800 Hz.

458_022

Control unit for sensor electronics

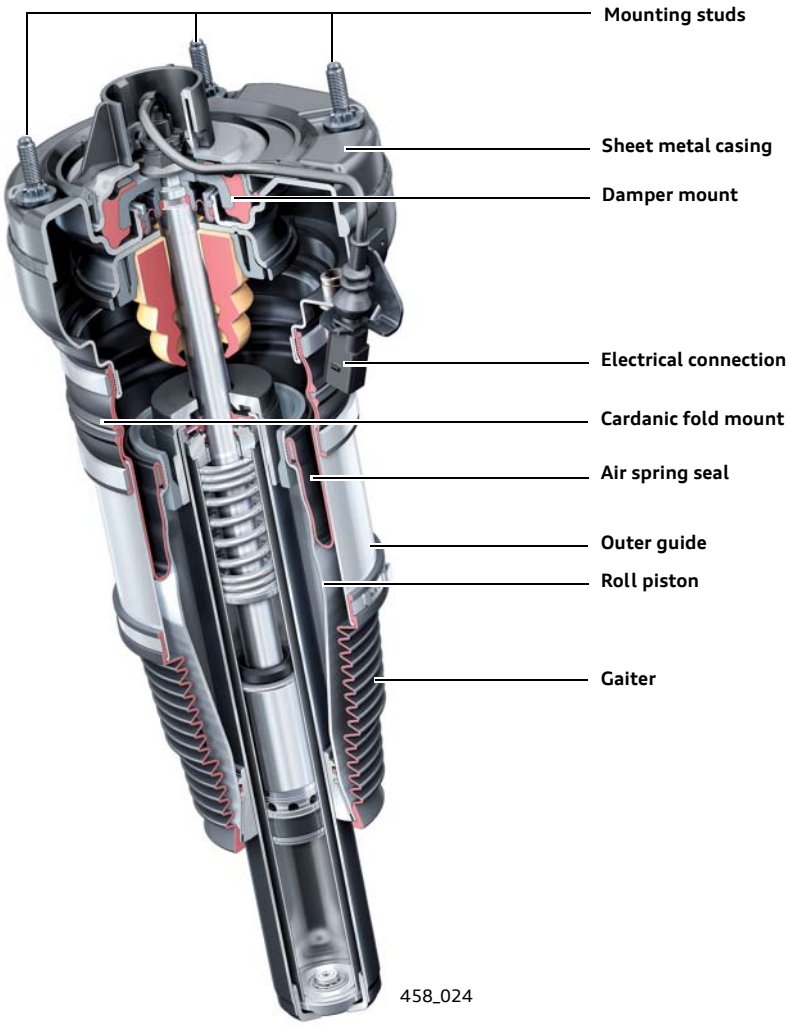
The control unit for sensor electronics sends the vehicle acceleration values in x-, y- and z-direction as well as the corresponding yaw rates to the adaptive suspension control unit. The adaptive suspension control unit calculates the vehicle movement from this information. The body acceleration senders are therefore no longer required. Communication between the control units takes place on the FlexRay data bus.
(For detailed information, see Control unit for sensor electronics, Page 33)

458_023

Air spring strut

The air spring struts are a new development. Infinitely variable twin-tube dampers are used. The controlled valve is located in the camper piston. The electrical line for actuating the magnetic coil in the valve is routed through the hollow piston rod. As on the predecessor, a CDC control system with internal valve is used. The volume of air is located in the area above the damper and essentially formed by the sheet metal casing, air spring seal and roll piston. The sheet metal casing accommodates the damper mount and serves the purpose of securing the spring strut to the vehicle body. The cardanic fold mount joins the sheet metal casing and the outer guide. This mount decouples the torsional and cardanic movements acting on the air spring seal and therefore relieves the mechanical load on the air spring seal.

To optimise damping and rolling comfort, an axial fibre gaiter is used as the air spring seal. The air spring seal is clamped to the sheet metal casing and the aluminium roll piston. The damper has been optimised in that the response characteristics have been substantially improved by minimising the friction between the piston rod and seal. A gaiter prevents dirt entering the air spring seal. Residual pressure retention valves are connected to the air lines of the spring struts. As on the predecessor, they have the task on maintaining a minimum air pressure of approx. 3 bar in the air spring even when an air line is defective or the air spring strut is removed. In this way, the air spring seal is protected from extreme deformation that could otherwise reduce its service life.

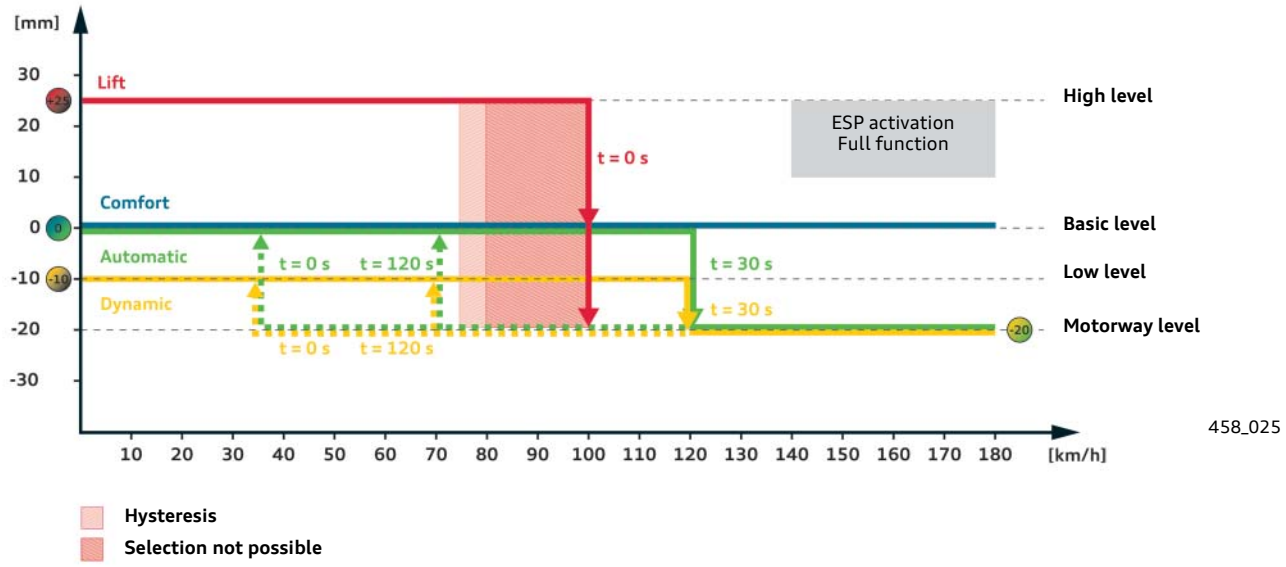


Control strategy

The control algorithms generally differ corresponding to the running gear and suspension variant. There are additional differences in operation with and without a trailer.

When towing a trailer the vehicle suspension can generally not be lowered to motorway level in order to avoid fluctuations in draw bar load when towing trailers.

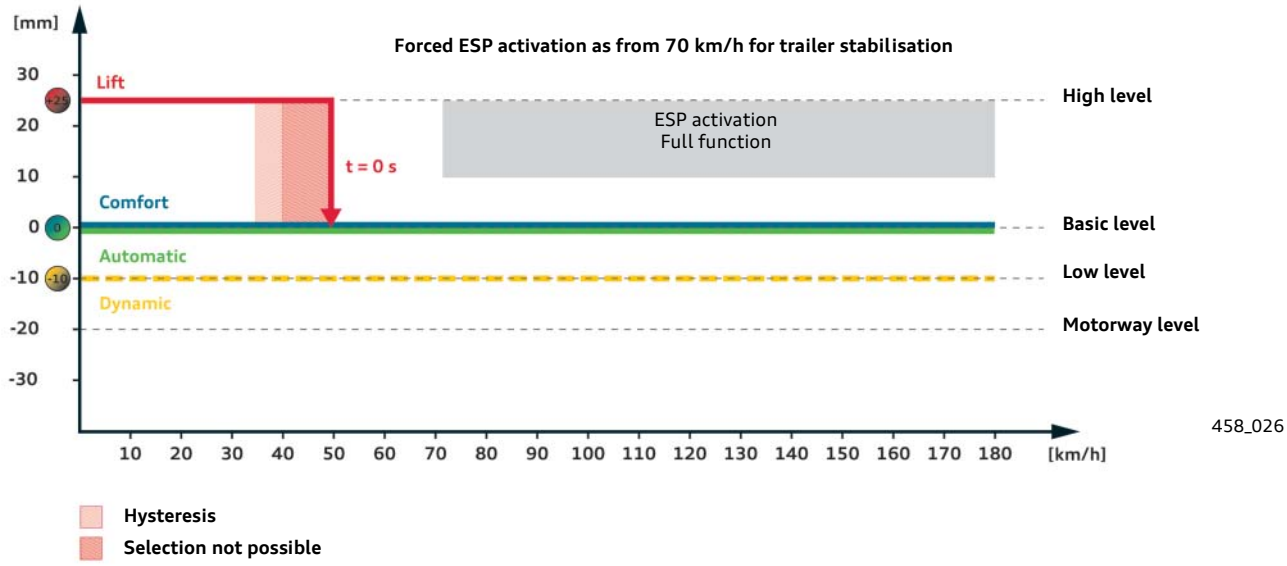
Control strategy - standard running gear and suspension 1BK without trailer operation



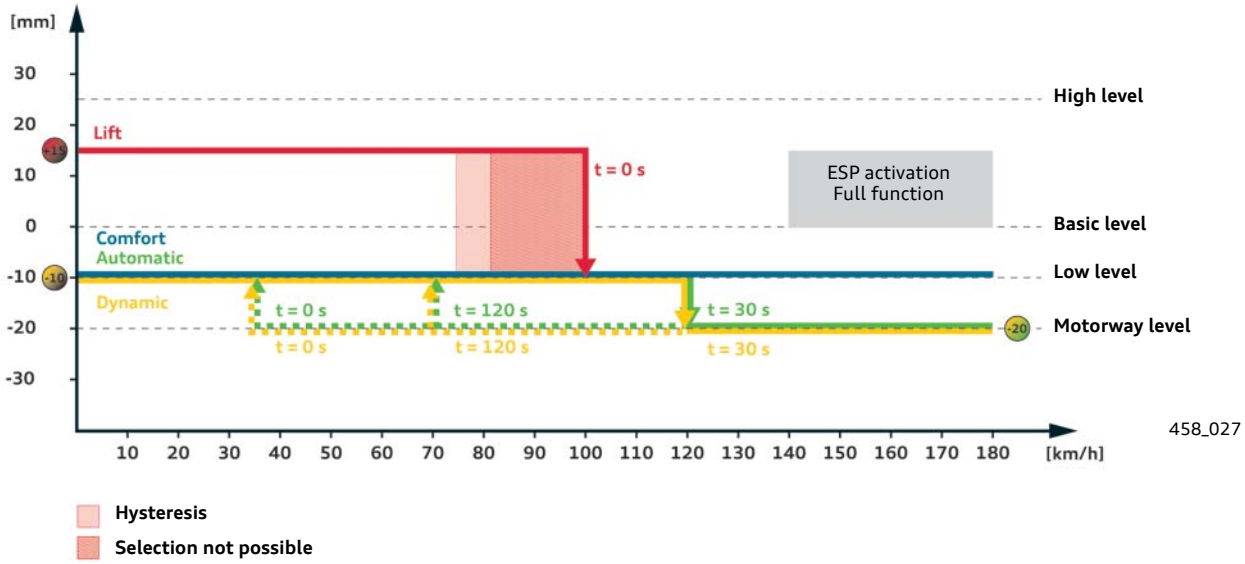
By way of example, the above control strategy of the standard running gear and suspension without trailer operation is described in the following.
Essentially, the control system facilitates four different vehicle height modes (= levels). Starting from the basic level, lift mode can be set by raising the vehicle by 25 mm. Lift mode is immediately deactivated automatically on reaching or exceeding a vehicle speed of 100 km/h. This mode can be selected up to a speed of 80 km/h.
The level is lowered by 10 mm by activating dynamic mode. In automatic and dynamic mode, the level is further reduced to "motorway level", 20 mm below the basic level, when the vehicle is driven at a speed of 120 km/h for 30 seconds.

The vehicle is not lowered to motorway level in comfort mode. Motorway level is deactivated automatically when the vehicle speed drops below 70 km/h for a duration of 120 seconds or immediately when the speed drops below 35 km/h.
On activating comfort mode, the basic level is set together with a comfort-orientated damper control. The ESP full function is deactivated and activated automatically as from a speed of 140 km/h when ESP sport mode is switched on by pressing the ESP button.

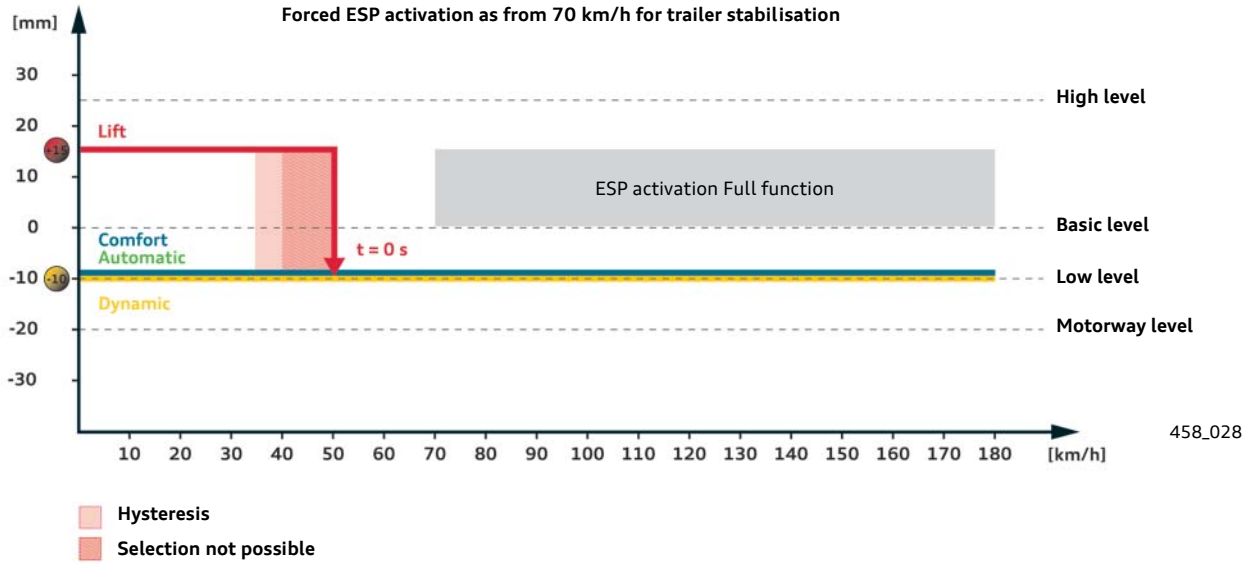
Control strategy - standard running gear and suspension 1BK with trailer operation



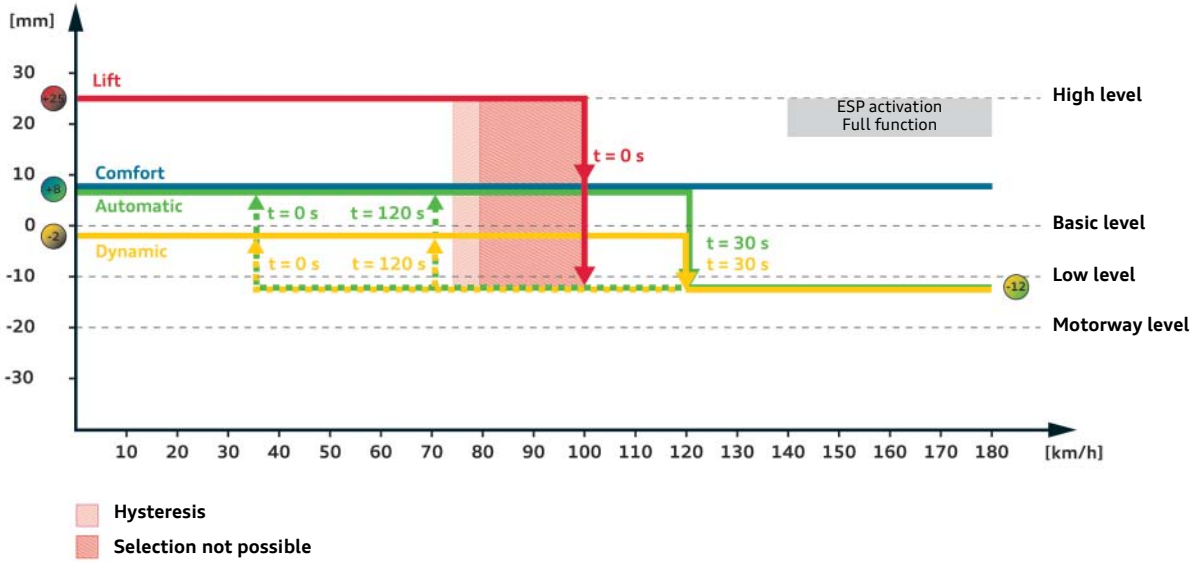
Control strategy - sport running gear and suspension 2MA without trailer operation



Control strategy - sport running gear and suspension 2MA with trailer operation



Control strategy - poor road running gear and suspension 1BY without trailer operation



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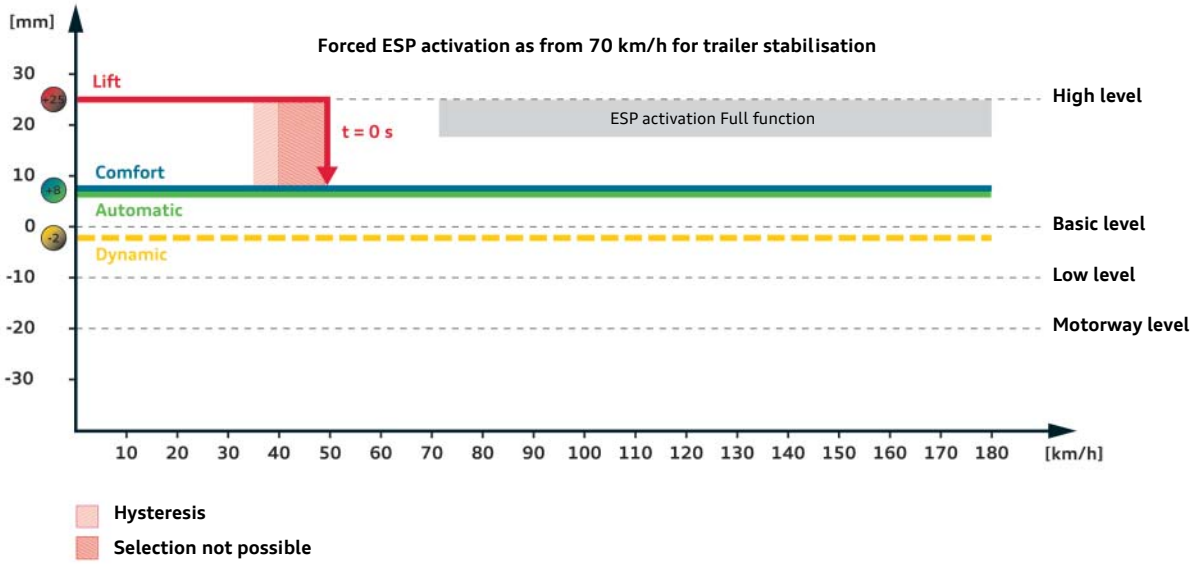
Control strategy - poor road running gear and suspension 1BY with trailer operation



458_030

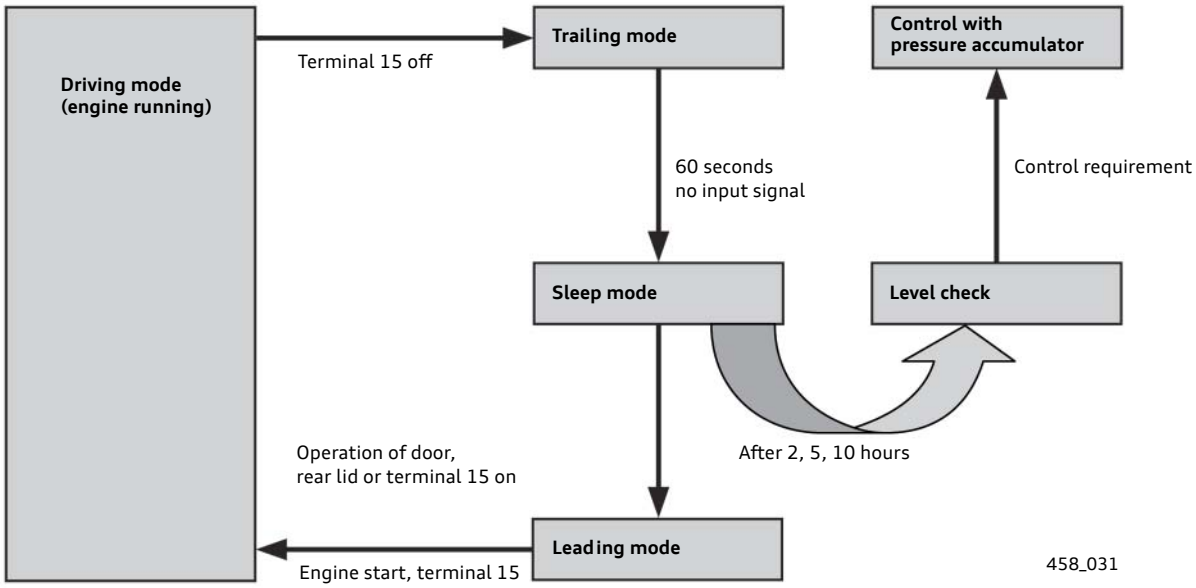
Characteristics of the control strategy

- Control procedures (changing the level) during vehicle operation are effective in the centre of the axle on the front axle and at the wheels on the rear axle.

- Control procedures (changing the level) when learning the control position are effective at the wheels on the front and rear axle to ensure the control position is set with the greatest accuracy.

- After the ignition has been turned off, the control unit remains active for a further 60 seconds and waits for further input signals. If no signals are received, energy-saving sleep mode is activated. In sleep mode, the vehicle level is checked after 2,5 and 10 hours in sleep mode. For this purpose, the adaptive suspension control unit J197 supplies operating voltage to the vehicle level senders and their measured values are read.

If the adaptive suspension control unit J197 recognises that control intervention is required, the system checks whether there is sufficient accumulator pressure for this purpose (min. 3 bar higher than the pressure in the air spring to be regulated). If this is the case, the vehicle level is then corrected. No further control procedures take place if the accumulator pressure is too low. When the antitheft alarm system is activated, the level is raised in such a way as to ensure the difference in level is does not exceed 0.3°.



- The door/rear lid signals are no longer sent via discrete lines to the adaptive suspension control unit as on the predecessor but rather via the bus systems.

- The vehicle level can drop distinctly over prolonged vehicle downtimes. To ensure the vehicle is already set to a defined minimum level at the start of operation, in these exceptional cases, compressor operation is already started after the ignition is turned on even though the engine is not yet running. The precondition for this is that there is a sufficient charge level in the vehicle battery.

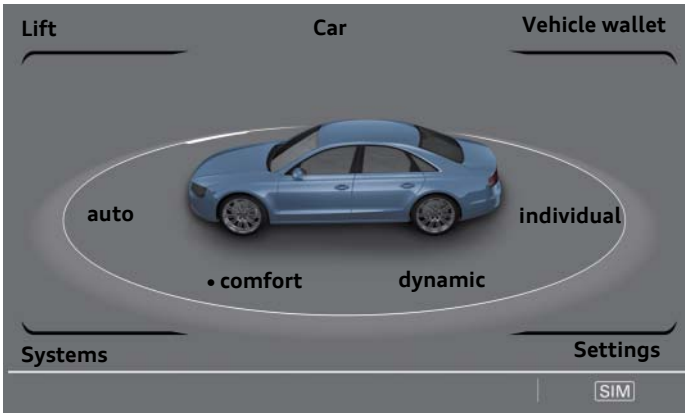
Operation and driver information

In the Audi A8 ’10, the adaptive air suspension system is no longer set up in a separate menu as in the predecessor. The settings are combined with those of other systems in the Audi drive select user interface. These settings can be made by selecting the car menu with the corresponding function key.

458_032

By selecting "comfort", "auto" or "dynamic", the various modes are activated in connection with the corresponding settings of other systems (engine, transmission, etc.). Different system settings (e.g. "dynamic" setting of adaptive air suspension with "comfort" engine and transmission setting) can be combined by selecting "individual" mode.

Lift mode is activated by selecting "lift". The lifting and lowering procedure is indicated in the display by flashing arrows on the front and rear axle. The arrow indication becomes static when the lift level is reached.



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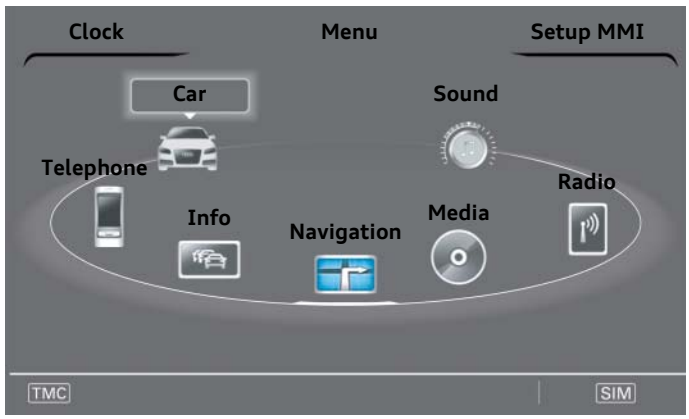
The menu for choosing the various modes can also be accessed by selecting "Car" in the general menu.



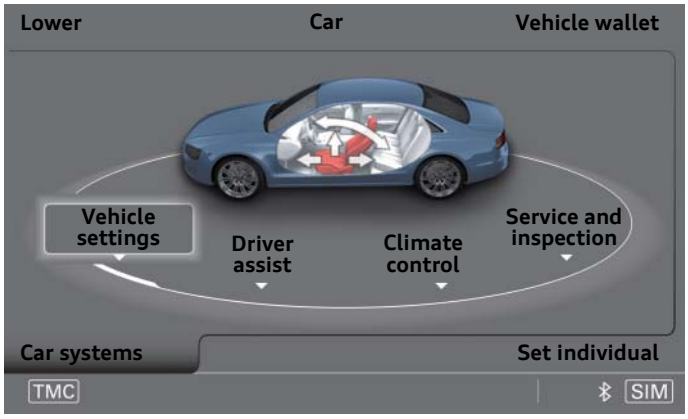
458_033

Reference
Please refer to SSP 456, Audi A8 ’10 for detailed information on Audi drive select.

The following functions can be called up by selecting "Systems" in the "Car" menu and then choosing "Vehicle Settings"/"Service and Inspection":

"Air spring: Trailer"

"Air spring: Wheel change" (see "Service jobs")



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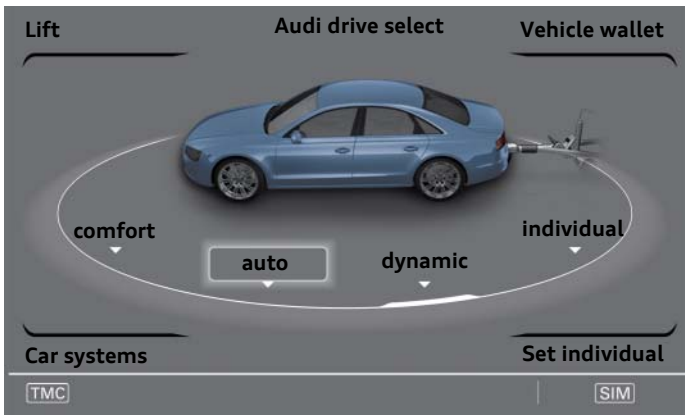
A correctly hitched trailer is detected automatically. In this case, the vehicle is shown in the MMI after pressing the "Car" function key in the "Audi drive select" with towing hitch.



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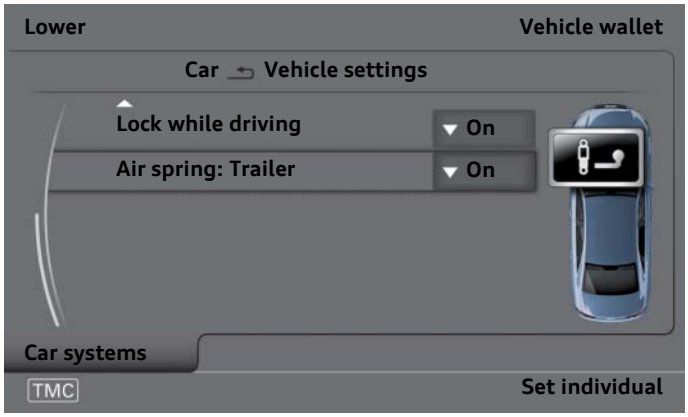
If the trailer is not recognised automatically, trailer operation can be activated by pressing the function keys "Car" – "Car Systems" – "Vehicle Settings" – "Air spring: Trailer" – "On".
In addition, the detected trailer can be deselected if bicycle rack systems are used.



458_037

Messages / Warnings

Text messages relating to the adaptive air suspension in the Audi A8 ’10 are shown in the central display to inform the driver.

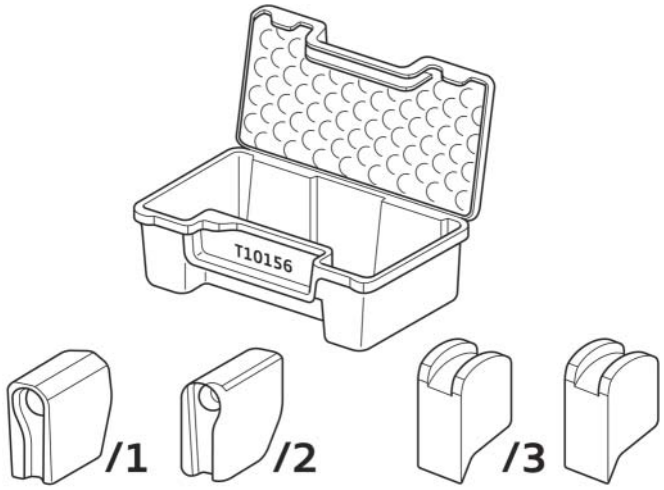
Driver information/warning messages are always shown prioritised according to urgency.

There are three priority levels: Driver information in white, warnings in yellow and highest priority warnings in red.

Service jobs

1. Vehicle transport

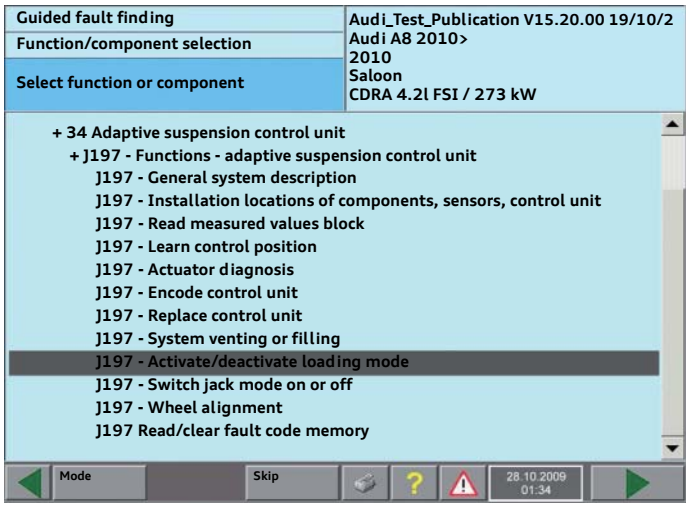
The vehicle is to be raised with the spring blocker set -T10156 for transport purposes. The vehicle must no longer be operated with the engine! Steering movements are to be restricted as far as possible (maximum half a turn of the steering wheel).



458_039

Loading mode

Loading mode is used to ensure sufficient ground clearance and the largest possible ramp angle for loading operations. When this mode is activated, the vehicle is set to and then maintained at a level of 50 mm above the standard level. Other levels cannot be set as long as this mode is active. Loading mode is activated/deactivated with the vehicle diagnostic tester. For safety reasons, the mode is deactivated automatically on exceeding a vehicle speed of 100 km/h or after covering a distance of 50 km.



458_040

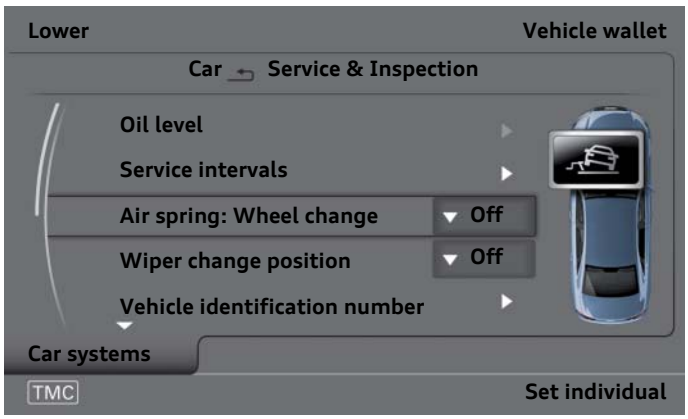
Transport mode

The data bus diagnostic interface J533 sets shut-down level 4 when transport mode is activated. The adaptive suspension control unit responds by preventing/deactivating leading and trailing mode (see graphic on Page 20) and switches off the power supply to the damper valves. The control unit remains in sleep mode even when input signals are received (operation of door/rear lid, change in terminal 15 status). Transport mode is automatically deactivated when the engine is started.
If both transport and loading mode are to be activated, loading mode must always be activated before transport mode.

Note
Service jobs essentially correspond to those of the predecessor. The most important service jobs are outlined in the overview.
This description only serves as an overview and is not a substitute for the repair manual!

2. Removing and installing/replacing system components and additional jobs

The system recognises when the vehicle is raised on a hoist or at the wheel and consequently prevents all control procedures. Air is released for a short time prior to automatic detection. For safety reasons, it is recommended to always additionally switch off the control system manually before starting any service jobs. The system is switched off by selecting "air spring: Wheel change" in the MMI. This setting corresponds to the "Jack mode" setting in the predecessor.
The deactivated function is automatically activated again at a driving speed in excess of 10 km/h.



458_041

Adaptive suspension control unit J197

After installation, a new control unit must be encoded. Encoding takes place online. The software parameters required for operation of the control unit in this specific vehicle are defined and activated by writing data sets as part of the encoding procedure. The coding defines whether the vehicle is equipped with adaptive cruise control (ACC), towing hitch and dynamic steering. Since the adaptation values of the level sender signals have not yet been stored in this new control unit, it is additionally necessary to carry out the "Learn control position" function.

458_017

Air spring strut, solenoid valve block, compressor, pressure accumulator

The air system must be opened in order to remove these components. The system must be vented beforehand. Particular care must be taken when connecting the air lines, especially at the solenoid valve block, to ensure the connections are not interchanged. The air pressure must be corrected (refilled) before installing new air spring struts. The "Learn control position" function must be carried out before reinstalling the air springs.

Vehicle level sender

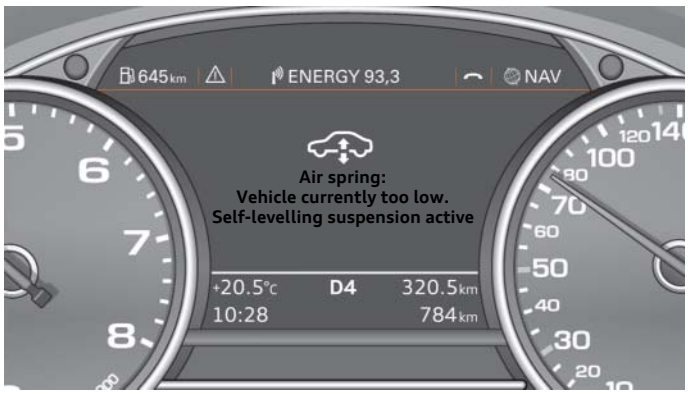
The "Learn control position" function must be carried out after replacing a sender. Since, for tolerance reasons, the new sender returns different measured values for the same vehicle level, the measured value - vehicle ride height allocation must be sent to and store to the control unit. The control unit "recognises" the characteristic curve of the senders and their mechanical ratio when installed (vehicle level change to measured value change). Consequently, when the assignment of the vehicle level to measured value is known for all level positions through the "Learn control position" function, the control unit can determine the assigned level for all other measured value.

458_022

3. Special system statuses

Low level

After prolonged vehicle down periods or when carrying heavy loads, it is possible that the vehicle level may drop below a level suitable for driving. This behaviour is consistent with the system and does not constitute a fault. This situation is caused by the connections of the air lines and the air spring seals themselves that are naturally subject to slight air loss. After the ignition is turned on, a warning appears in the central display, drawing the driver's attention to this situation. The compressor is already activated although the engine has not yet been started. The aim is to raise the vehicle level as fast as possible to an operational level.

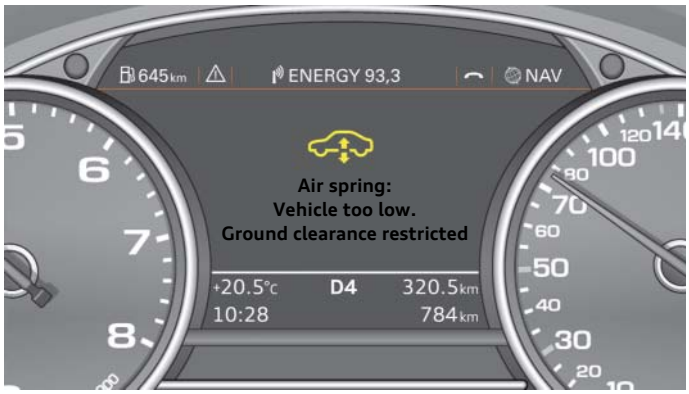


458_044

If the low level is caused by a major leak in the system, i.e. a defect, it will not be possible to raise the vehicle to the required level within a defined period of time. The control unit recognises that there is a fault in the system and issues a corresponding medium priority warning (yellow) on the central display.

Extreme high level

In rare cases it is also possible that the vehicle assumes extreme high level. This can briefly occur when very heavy loads are removed rapidly from the vehicle. If this situation persists, a system fault can be assumed and a high priority warning (red) is shown in the central display.



458_045

Brake system

Overview

The brake system on the Audi A8 ’10 is a consistent further development of the brake system fitted on the predecessor model. 17 inch and 18 inch systems will be fitted on series launch.

The use of lightweight construction methods has made it possible to substantially reduce weight while at the same time achieving outstanding braking values in all driving situations.

	Front axle		**Rear axle**	
Motorisation	V8 4.2 FSI	V8 4.2 TDI	V8 4.2 FSI	V8 4.2 TDI
Brake type	17" 2FNR 42 AL Aluminium floating frame-type caliper	18" 2FNR 42 AL Aluminium floating frame-type caliper	17" CII 43 EPB Aluminium floating caliper	18" CII 43 EPB Aluminium floating caliper
Number of pistons	2	2	1	1
Piston diameter	2 x 42 mm	2 x 42 mm	43 mm	43 mm
Brake disc diameter	356 mm	380 mm	330 mm	356 mm

System components

Brake caliper, front axle

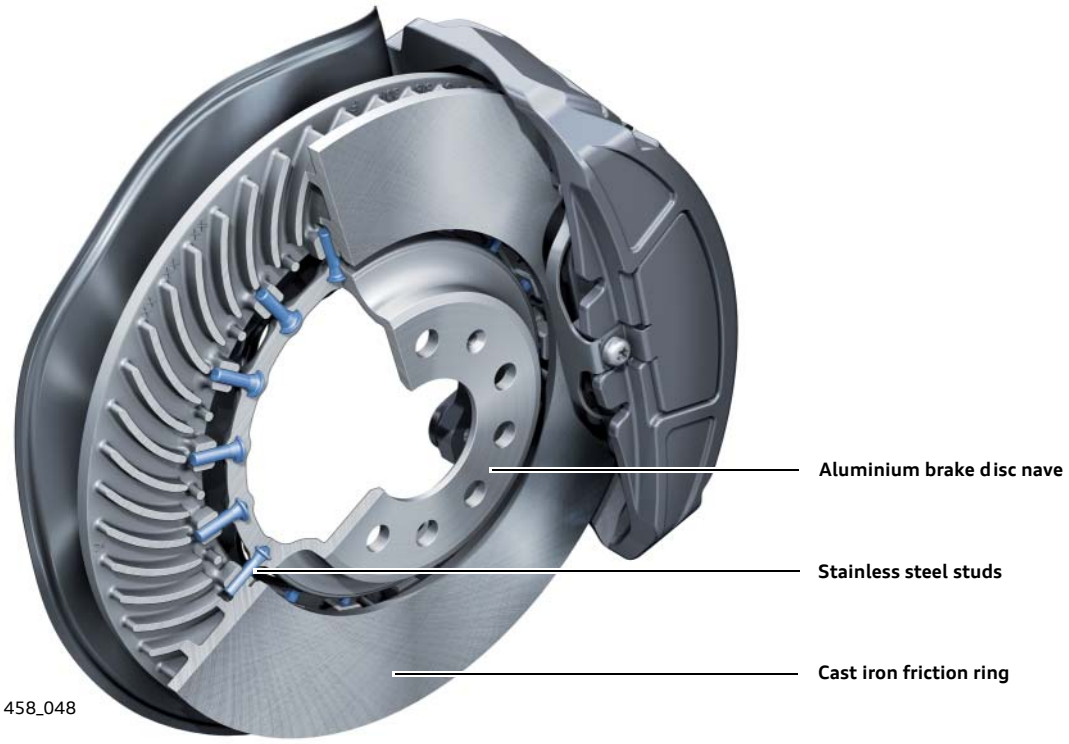
The design of the aluminium brake caliper on the front axle adopted from the predecessor model has been specifically further developed in terms of rigidity and weight. Despite the substantial increase in performance and rigidity, the weight of the brake caliper remains the same.

458_047

Brake discs, front axle

For the first time at Audi, stud-type brake discs with an aluminium nave are used in the luxury class. Due to its enormous weight advantages, this concept is predominantly used in the sports car sector. This enables weight reductions of approx. 2.8 kg for the 17" brake disc and approx. 3.8 kg for the 18" brake disk.

The brake disc ring in made of a cast iron material specially developed for this purpose. The friction ring is connected to the aluminium nave by means of stainless steel studs.



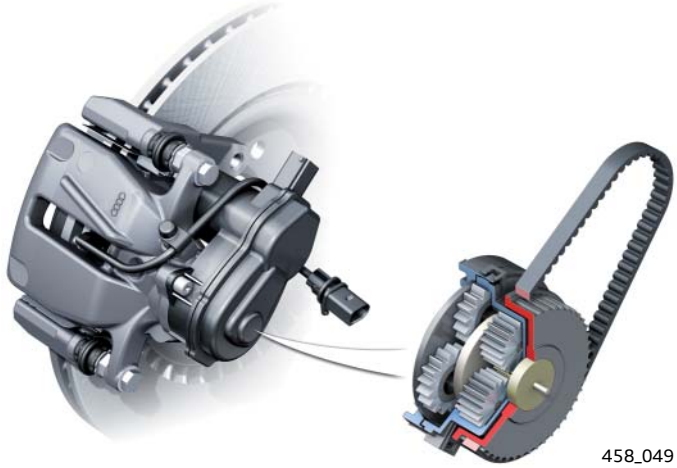
458_048

Brake assembly, rear axle

The tried and tested "Colette II" brake caliper has been adopted from the predecessor model, however, the brake disc diameter has been substantially increased.

Electromechanical parking brake (EPB)

The concept of the parking brake motors with a planetary gear as already implemented in the current A4, A5 and Q5 models is also used on the Audi A8 ’10. The functions realised in the A8 ’10 correspond to those in the specified models. The difference compared to the predecessor model is that the wear of the rear brake pads is no longer determined. It is now measured directly at all four wheel brakes.



458_049

Master brake cylinder, brake booster, brake fluid reservoir and pedal assembly

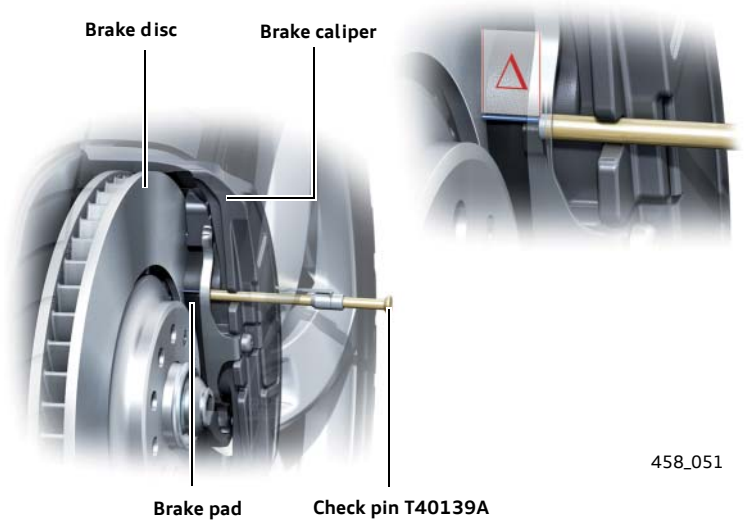
A 8/9 inch tandem brake booster is fitted on the Audi A8 ’10. In line with the lightweight construction concept, for the first time, the brake booster was developed on the basis of an aluminium construction. In connection with the V8 FSI engine, the vacuum supply is realised by the use of the familiar electric vacuum pump UP28. A mechanical vacuum pump is installed in the V8 TDI engine.
The master brake cylinder and brake fluid reservoir are adopted from the Audi A4.
The pedal assembly for left-hand drive vehicles is also adopted from the Audi A4. The accelerator pedal, mounting bracket and brake pedal are geometrically adapted for use in right-hand drive vehicles.

458_050

Service jobs

Brake pad wear measurement

The brake pad thickness can be measured with the check pin T40139A on all wheels available for the A8 ’10.



458_051

ESP

Overview

A new Bosch ESP generation, the ESP Premium is used on the Audi A8 '10. The performance of the hydraulic system has been substantially increased by the use of a further developed pump for active pressure build-up. The increase in electronic efficiency is primarily attributed to data communication on the FlexRay data bus and the extensive networking of many control systems.

458_052

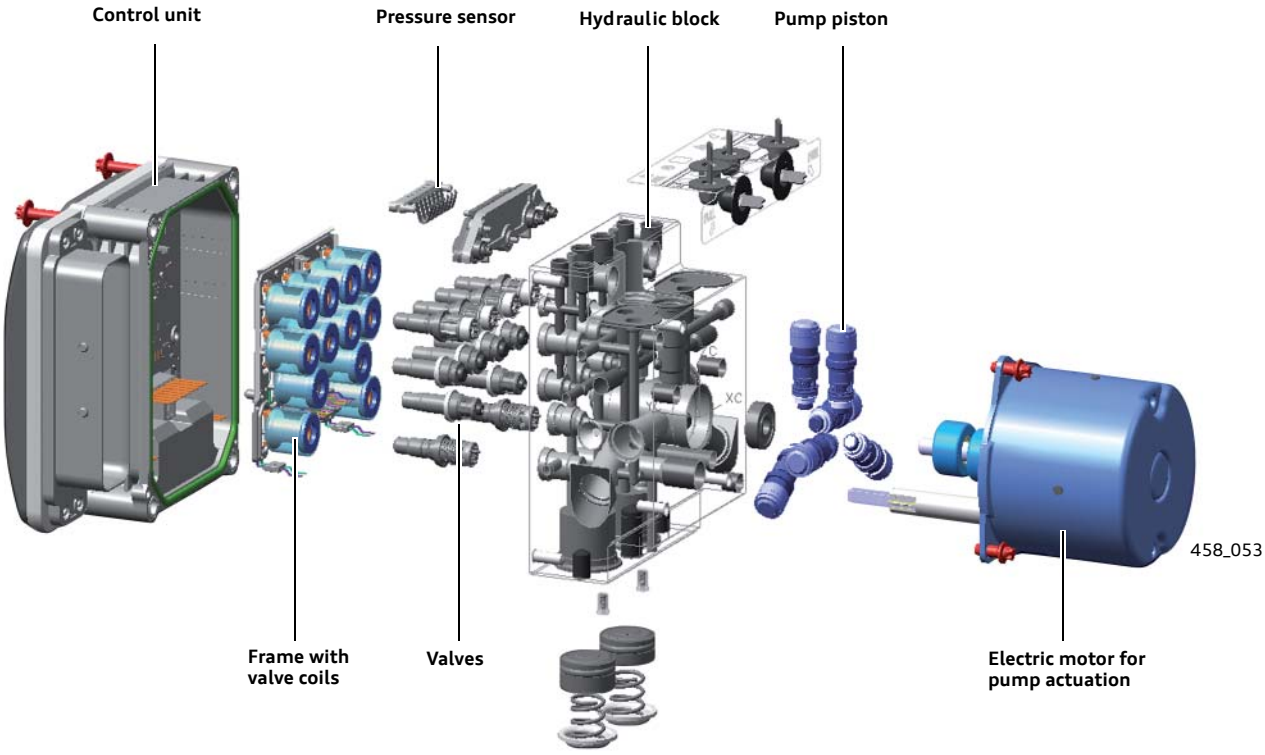
System components

Control unit J104

The main new feature is data communication on the FlexRay data bus. The measured values from the transverse acceleration and yaw rate senders sent by the control unit for sensor electronics J849 are also received via the FlexRay data bus. It therefore enables extremely rapid and secure data exchange, thus substantially improving control quality and comfort. The power electronics in the control unit generates a high frequency current for the purpose of actuating the electric motor for the pump drive. The advantage of this high frequency clock cycle is considerably more precise actuation. This consequently enables extremely dynamic pressure build-up while the smooth start-up of the electric motor relieves the load on the vehicle electrical system.

Hydraulic unit

The most important innovation is the use of a 6-piston pump for active pressure build-up. This new feature achieves more effective pressure build-up dynamics and improved acoustics. The ESP units differ corresponding to their use in vehicles with and without adaptive cruise control (ACC). Three pressure sensors are integrated in the hydraulic unit for ESP with ACC. The brake pressures at the front right and front left wheel brakes are additionally determined in the primary circuit.



458_053

Source: Robert Bosch GmbH

Speed sensors G44-G47

In terms of their design and functional principle, the active speed sensors are adopted from the current Audi A4.

458_054

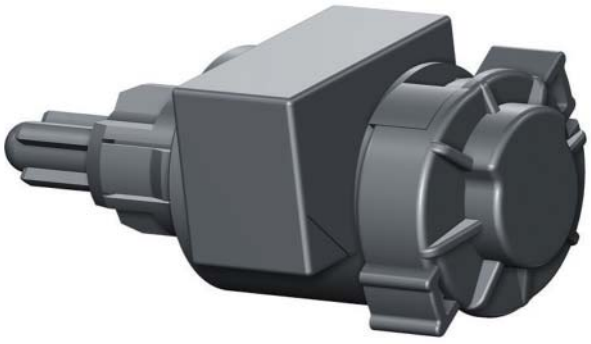
Steering angle sender G85

In terms of its design and functional principle, the steering angle sender is adopted from the current Audi A4.

458_055

Brake light switch F

In terms of its design and functional principle, the brake light switch is adopted from the current Audi A4.



458_056

Reference
You will find information on the design and functional principle of the ESP and its components in the Audi A4 in SSP 394.

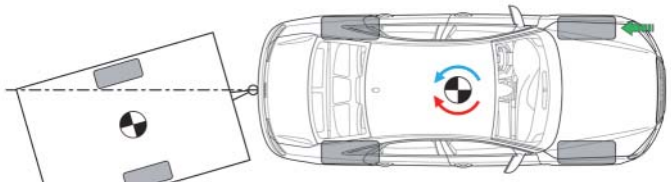
System functions / subsystems

The main system functions/subsystems implemented in the A8 ’10 are listed in the following table. The second column contains a brief outline of the functions or information on the media that contains detail information on the respective function.

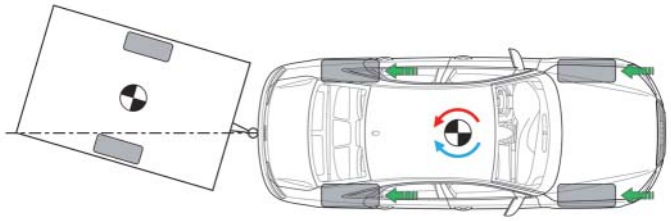
Function / subsystem	Remarks
ABS (anti-lock braking system) **EBD (electronic brake pressure distributor)** **EDL (electronic differential lock)** **TCS (traction control system)** **EBC (engine braking moment control)** **ESP (electronic stability programme)**	Standard functions that are adapted to the respective Audi model by the application of control parameters.
ESP sport mode	Sport mode is selected by pressing the ESP button. Greater wheel slip values are permitted without control intervention, thus enabling a more sport-orientated driving style (see next page)
Low tyre pressure indicator	The low tyre pressure indicator is used in connection with evaluation of the wheel speeds (wheel circumference) and wheel vibration (see Page 55).
FBS (fading brake support)	Compensates for brake fading by controlled brake pressure build-up. (SSP 362)
Drive assist	Holds the vehicle while stationary by means of active pressure build-up, first used in the Audi A5 (SSP 394)
ECD (electronically controlled deceleration)	Software interface that allows external control units to "request" from the ESP vehicle deceleration by active pressure build-up.
Brake disc wiper	Water film is removed by briefly applying the brake pads against the brake discs in order to improve braking response (SSP 362)
Trailer stabilisation system	Incipient snaking of the trailer is prevented by active brake pressure build-up in the towing vehicle (SSP 342, SSP 394, see following pages)
HBA (hydraulic brake assist)	Assists the driver when performing emergency braking by active brake pressure build-up with the aim of achieving maximum possible vehicle deceleration (SSP 254)
Emergency braking function for electro-mechanical parking brake (EPB)	Brakes the vehicle when the EPB switch is operated (SSP 285)
Adaptive brake light	Actuates the brake light and the hazard warning system, first used in the Audi A6 '05 with ESP Bosch 8.0.
Brake system pre-filling for adaptive cruise control (ACC) function "braking guard"	By slightly building up the brake pressure by approx. 2 bar, this system enables a "state of readiness" for imminent braking with the aim of reducing the response time (see "ACC")

Trailer stabilisation system

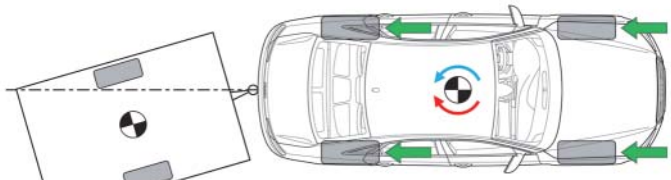
The functions of the trailer stabilisation system already known from other Audi models have been expanded for the Audi A8 ’10. For the first time, a three-stage control concept is used.
The first control stage begins with targeted braking of individual wheels, comparable to ESP control. The application of braking forces initiates torque about the vertical axis of the towing vehicle that counteracts the incipient snaking motion of the trailer.
If this is not sufficient, proportioned braking of the towing vehicle takes place in the second control stage. The aim is to reduce the speed in order to move out of the speed range that gives rise to trailer snaking.
If the desired effect is not achieved or not to a sufficient extent, the brake forces are substantially increased in the third control stage. The greater deceleration ensures the vehicle speed is reduced to a non-critical level faster. The second control stage is new in the stabilisation system. The aim of this control concept is to achieve trailer stabilisation and to reduce the vehicle speed only to by the amount required for this purpose.



1st control stage



2nd control stage



3rd control stage

458_057

ESP sport mode

ESP sport mode is activated by switching over to corresponding control software when the ESP button is pressed. The aim of this mode is to enable a sport-orientated driving style. Not only are considerably greater wheel slip values permitted but the respective movement of the vehicle (vehicle dynamics) is also specifically influenced by the control procedures. Yaw (oversteer/understeer) is controlled as a function of the driving situation in such a way that a driving feel with distinct sport characteristics is achieved. For instance, the engine torque is no longer reduced by interventions in the engine management when the accelerator pedal is depressed. Brake interventions then take place considerably later than is the case with sport mode deactivated. Distinct oversteer then occurs when cornering. The driver receives more stabilising support when he takes his foot off the accelerator. If the vehicle understeers when cornering, the control shifts towards oversteer. The direct effect is sporty and agile vehicle handling.

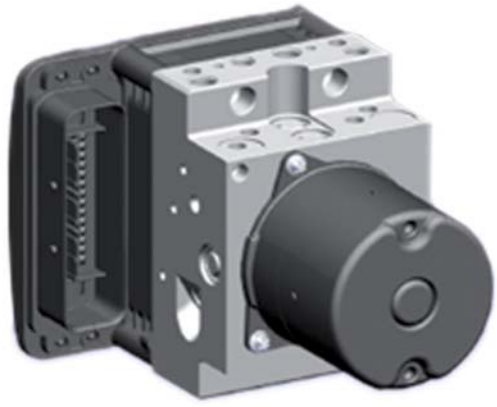
458_058

Service jobs

Online coding is necessary after replacing the control unit. The pressure sensor(s) is(are) automatically calibrated as part of encoding. Actuator diagnosis is required after replacing the hydraulic unit. This ensures that the hydraulic lines are connected correctly to the hydraulic unit.

Note: Whether or not the control unit can be replaced separately was not determined at the time of going to print. If necessary, please refer to the latest repair manual for this information.

The scope of functions specified in Guided Fault Finding corresponds to that of the ESP Plus in the current Audi A4, A5 and Q5 models.



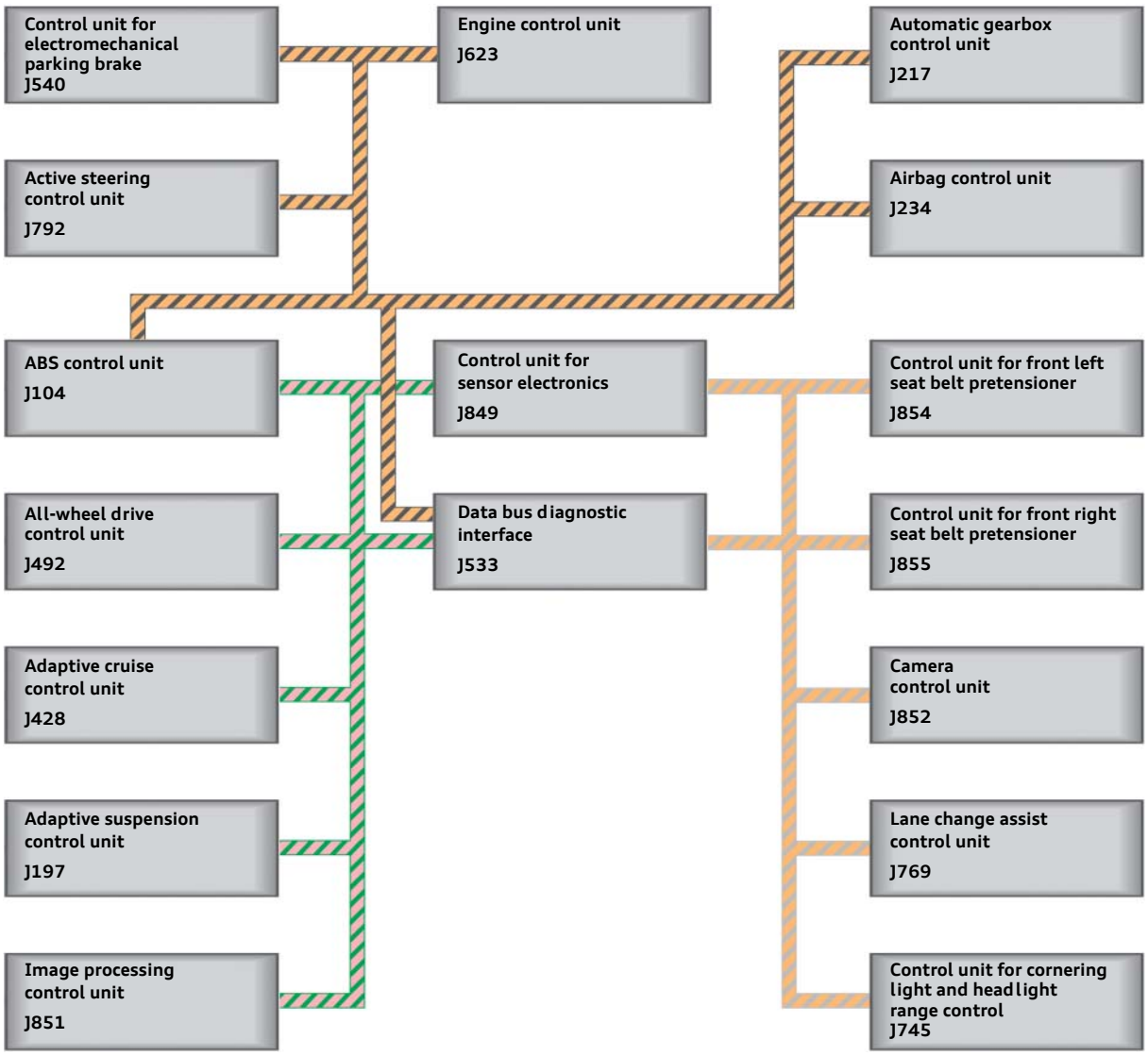
458_059

Control unit for sensor electronics J849

Overview

The control unit for sensor electronics J849 is used for the first time with the launch of the Audi A8 ’10. This control unit contains sensors for registering all vehicle movements. By linking the control unit to the FlexRay data bus, other control units can directly use the measured values. Costs and complexity have been reduced by realising central acquisition of the vehicle movements. Data communication via the FlexRay bus ensures a high level of networking between the corresponding control units and extremely fast data transfer.

458_023



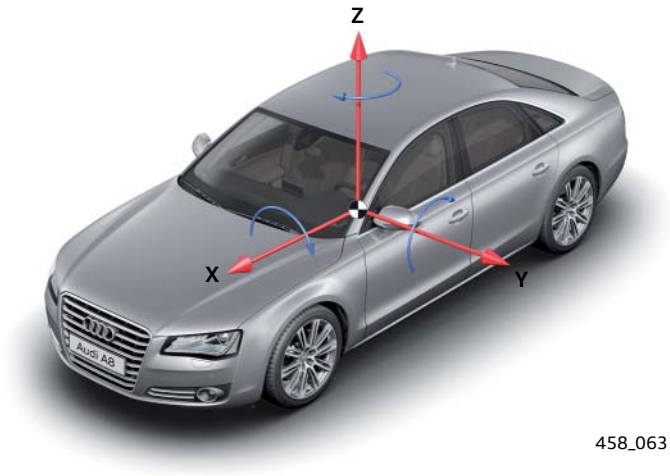
458_062

Control units that use the measured values from the control unit for sensor electronics J849.

Design and functions

Design

The control unit contains sensors for registering the vehicle acceleration in x-, y- and z-direction as well as the vehicle rotation about the x-, y- and z-axis. Functionally, it therefore replaces the ESP sensor unit G419 as well as the body acceleration sensors for the adaptive air suspension.



458_063

Two versions of the control unit are available for the Audi A8 '10. The basic version consists of six sensors: one sensor each for registering the movements in x-, y- and z-direction as well as the rotary movements about the three axes.

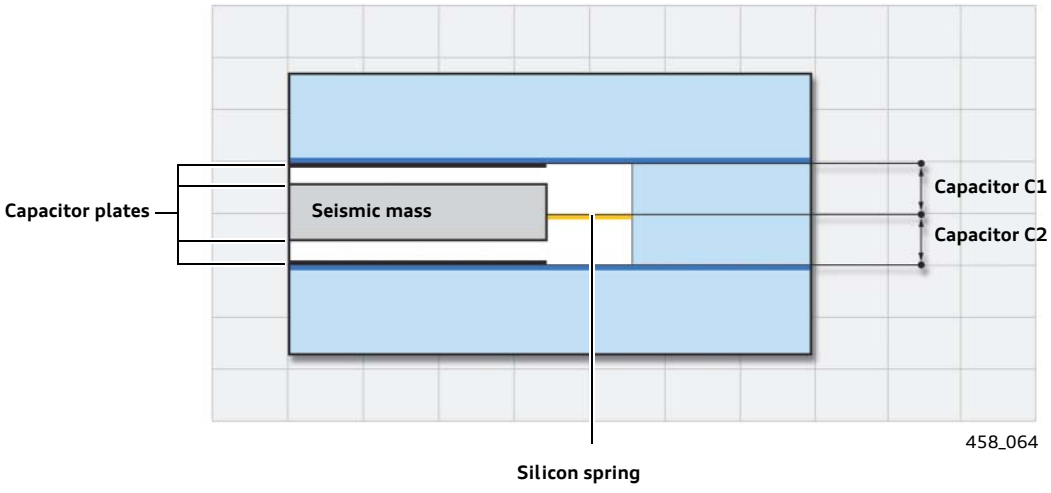
A control unit with an extended sensor system is used for vehicles with dynamic steering and sport differential. In this case each item of data is acquired by two sensors.

Functional principle of sensors for registering movements in x-, y- and z-direction

The sensors for registering the movements in x- y- and z-direction operate in accordance with the "seismic mass" principle. The sensors comprise a spring-mounted mass (= seismic mass) between two electrodes acting as capacitor plates. Likewise, the mass plate also has two electrodes that form two capacitors together with the electrode of the "housing". Under the effect of acceleration, the position of the seismic mass changes relative to the housing. The resulting change in the capacitance of the capacitors is evaluated by electronic logic circuitry.

Rest state:

The seismic mass is located precisely in the centre between two outer capacitor plates. The capacitance of both capacitors C1 and C2 is identical.

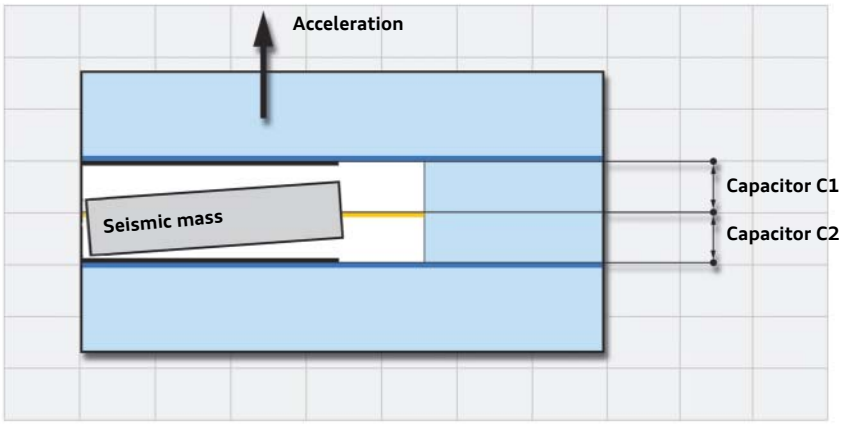


458_064

Accelerated state:

Under the effect of acceleration, inertia deflects the seismic mass from its mid-position. The distance between the electrode changes. The capacitance increases as distance decreases.

In this example, the capacitance of capacitor C2 increases compared to the rest state and that of capacitor C1 decreases.

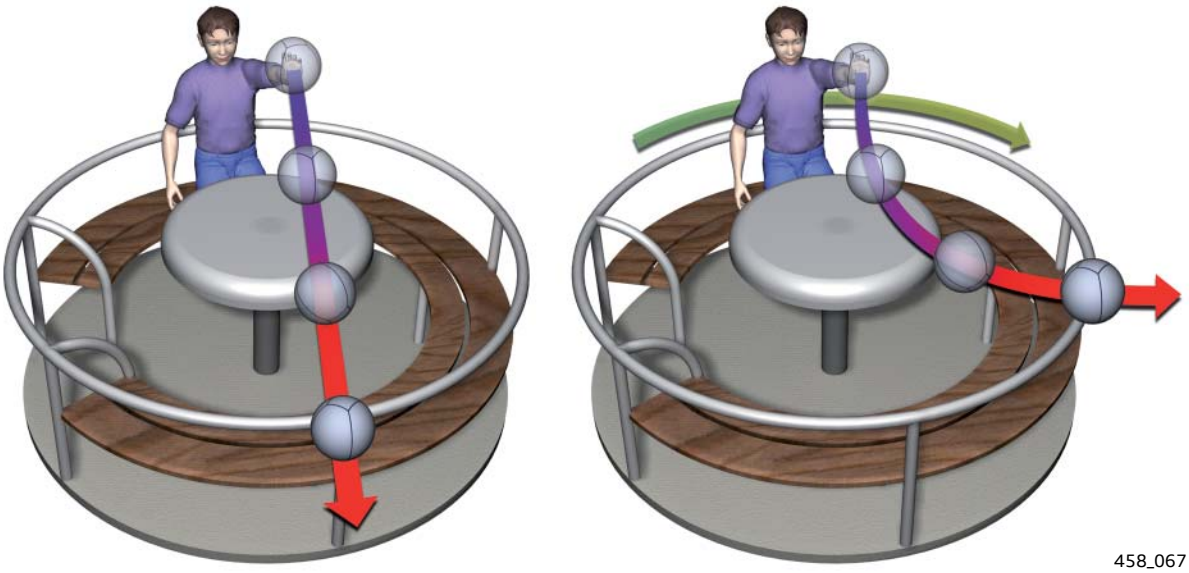


458_065

Functional principle of sensors for registering rotary motion about the x-, y- and z-axis

The sensors for registering the rotary motions of the vehicle make use of the physical effect of the Coriolis force. The Coriolis force acts on all bodies that execute a movement in a rotating reference system. The effect of the force is demonstrated in the following example: A child is sitting on a roundabout and rolls a ball into the centre of the roundabout platform.

When the roundabout is at rest, the ball rolls on a straight path to the centre point. When the roundabout is turning, however, the ball is deflected in its direction of movement. The degree of deflection depends on the rotational speed of the roundabout.



458_067

Simplified, the sensor consists of a micromechanical body which is permanently subjected to oscillation excitation. When the vehicle turns, the direction of movement of the oscillating body changes.

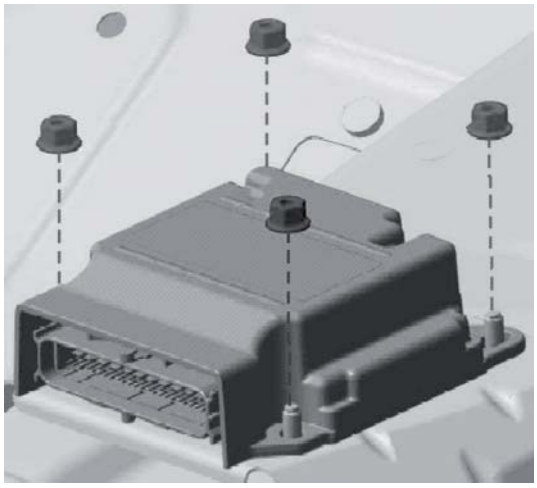
This change in movement is evaluated by electronic logic circuitry. To register rotary motion about the three spatial axes, three identical sensors, each offset by 90° with respect to each other, are arranged in the control unit.

Service jobs

Removing and installing/replacing system components and additional jobs

The installation location of the control unit is subject to close tolerances. For this reason, calibration of the installation position is necessary after installing the control unit. The vehicle must be parked on flat and even ground and must not be moved. The zero calibration corrects the measured values of the sensors with offset values.

The control unit does not require encoding.



458_066

Diagnosis

The control unit is fully integrated in the diagnostic procedure. The system functions are permanently monitored and fault code memory entries are generated in the control unit as required.
For fault finding purposes it is important to bear in mind that the measured data of the control unit are used by various other systems (see Overview on Page 33).

458_023

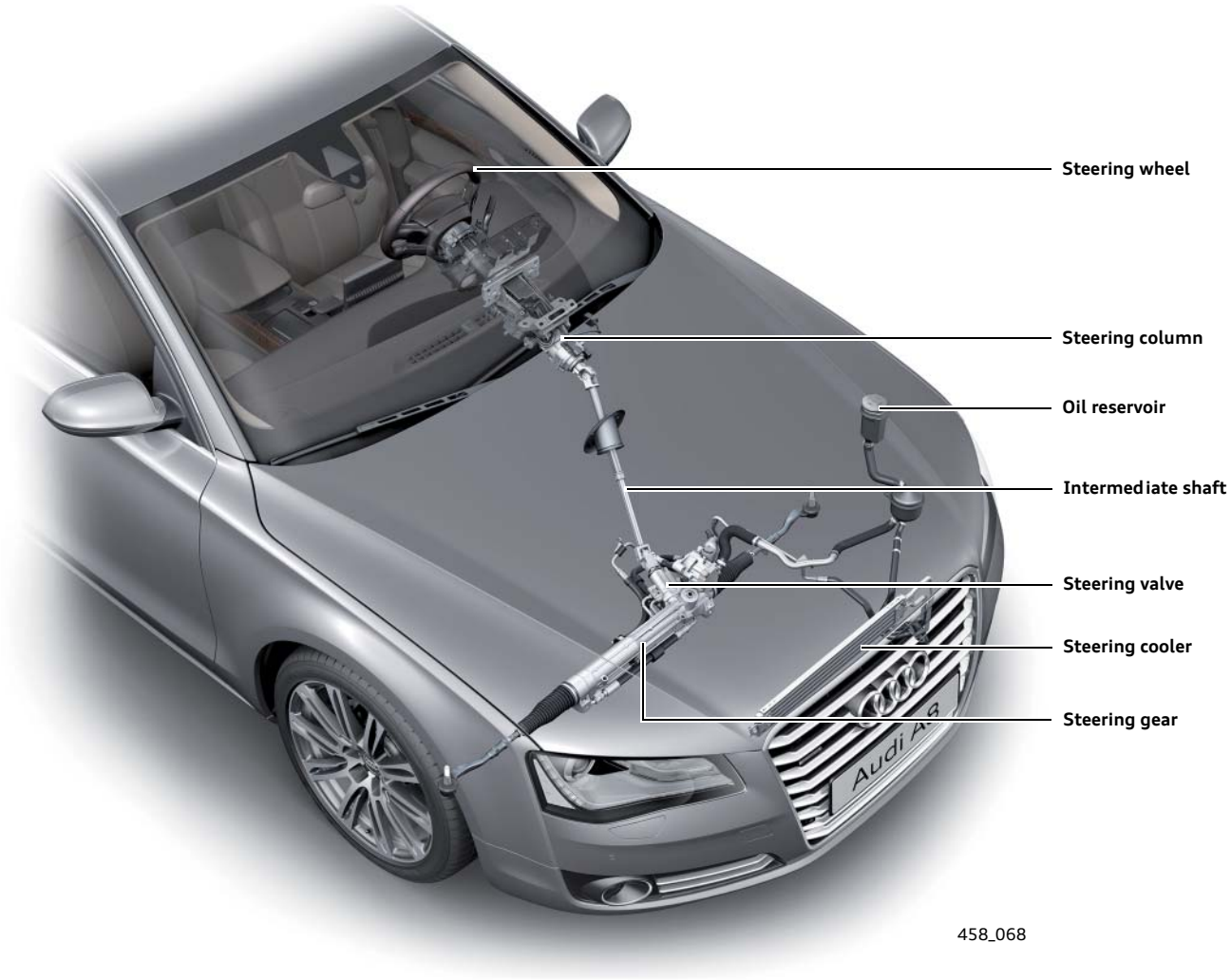
Steering system

Overview

Design

The well proven concept of hydraulic rack and pinion steering in connection with an electrically adjustable steering column is also implemented on the Audi A8 ’10. Audi dynamic steering is optionally available.
The Servotronic speed-dependent power steering system is fitted as standard.

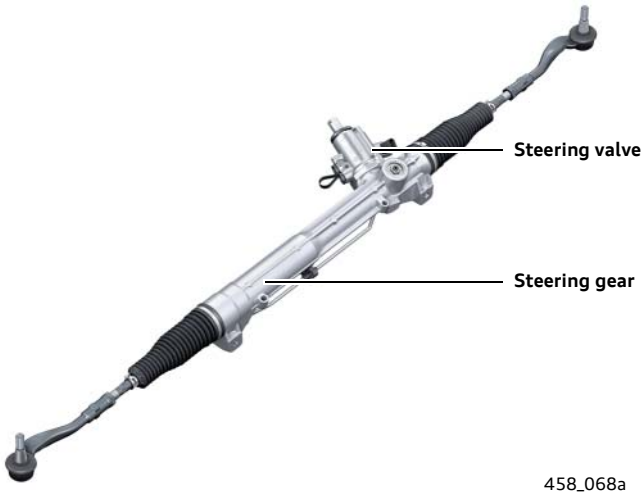
The steering gear, steering column and steering wheel are new developments. The main innovation compared to the predecessor is the arrangement of the steering gear on the subframe ahead of the front axle for distinctly more direct steering response.



System components

Steering gear

A rack and pinion steering gear with constant gear ratio is fitted on the Audi A8 '10. The design and function of the steering gear correspond to that in the current Audi A4. In view of the higher axle load, the rack and piston diameters have been increased. As on the predecessor model, the steering gear features internal damping valves and internal flexible limit stops.



458_068a

Steering valve

The steering valve is designed as a 10-slot valve together with the Servotronic II as already used on the predecessor.

Oil reservoir

The design and function of the oil reservoir for future 6-cylinder engines correspond to those of the current Audi A4. A modified reservoir with horizontal division into two chambers is used for V8 engine vehicles.

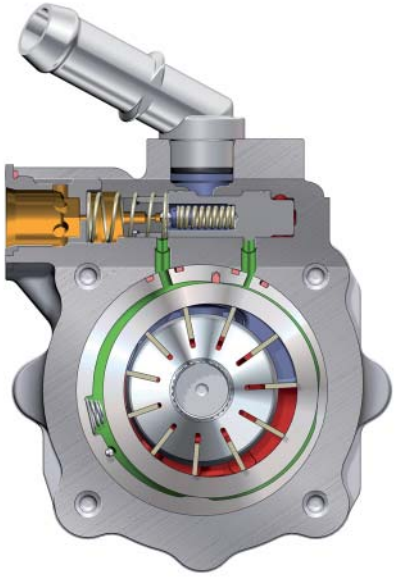
Steering cooler

Tubular coolers are generally used in the steering system of the Audi A8 '10. Vehicles with dynamic steering are fitted with block heat exchangers.

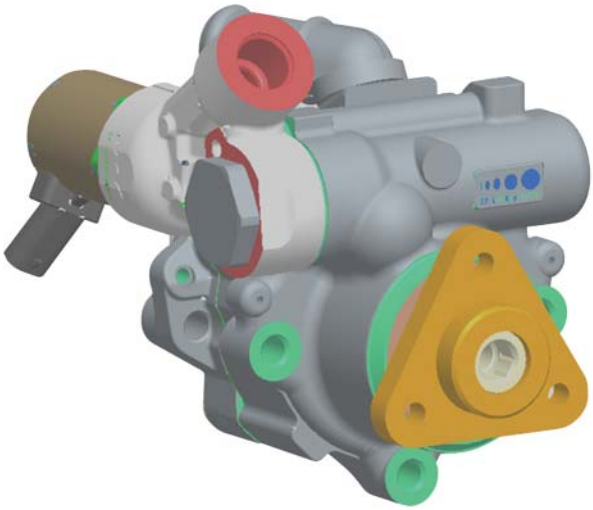
Steering pumps

As in other Audi models, the volumetric flow-controlled Varioserve vane pump supplied by ZF is installed in V8 engine vehicles. The adjustable cam ring controls the volumetric flow (max. 13 cm^3/revolution). The pump therefore always only delivers the volume of oil actually required, thus substantially reducing the hydraulic power requirement. The oil temperature in the steering system is also reduced. The maximum system pressure is 135 bar.

All vehicles with dynamic steering are fitted with ECO pumps as used in the current Audi A4, A5 and Q5 models.



Varioserv vane pump 458_068e

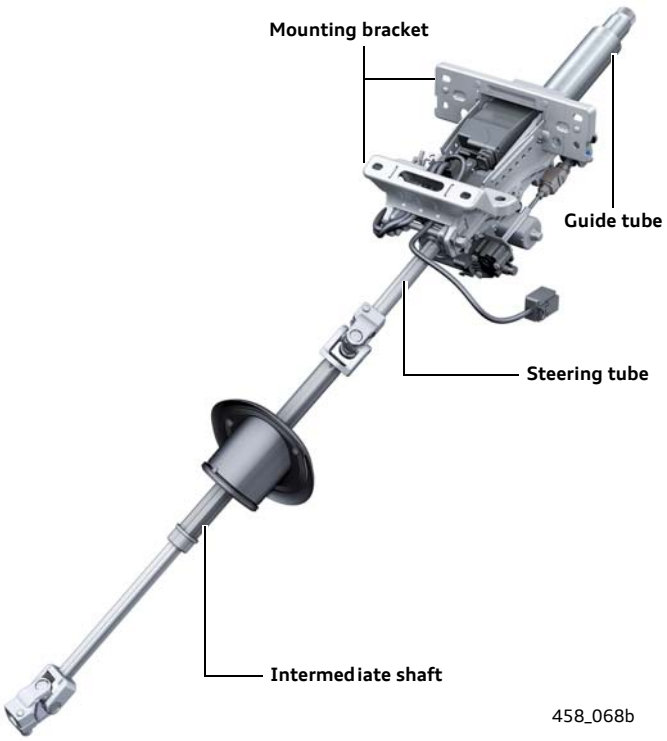


ECO pump 458_068f

Reference
Refer to SSP 402 for detailed information on the ECO pump.

Steering column

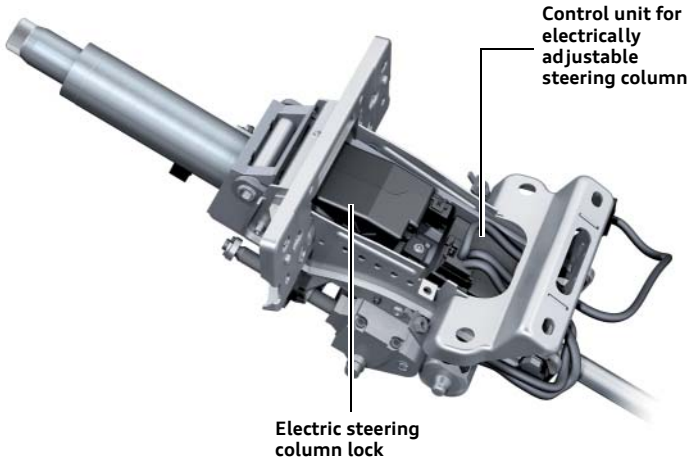
The steering column is designed as a tube-in-tube system. The steering tube is mounted in the guide tube such that it can be shifted longitudinally. The longitudinal adjustment (maximum adjustment range 60 mm) is realised by an electric motor with spindle drive. The guide tube is fitted on a mounting bracket which is rigidly bolted to the body. To enable angle adjustment the front bearing mount of the guide tube is used as a longitudinally compensated pivot point. The rear driver's side mounting is connected to the bracket by means of two pivot levers. A second electric motor spindle drive adjusts the steering column angle by turning the pivot levers. The total vertical adjustment of the steering wheel is 50 mm.
The control unit for electrically adjustable steering column J866 is newly arranged directly on the guide tube of the steering column. Also in the Audi A8 '10, the steering column is electrically locked automatically when the ignition key is removed. The design, functional principle and installation location of the lock essentially correspond to those of the current Audi A4.
In the event of collision involving footwell intrusion (displacement of the steering gear in the direction of the driver) the shaft connected to the steering gear slides into the tube for the intermediate shaft. In the event of the driver impacting the steering wheel the steering tube slides into the guide tube. The impact energy is absorbed by a crash element integrated between the steering tube and guide tube.



458_068b

Electric steering column adjustment

The control unit for electrically adjustable steering column communicates with the onboard power supply control unit J519 via the LIN bus. The adjustment motors are now actuated by pulse width-modulated (PWM) signals. As a result, uniform motor operation is achieved thus increasing adjustment comfort. For the first time, the actuating electronics features an intelligent position and speed controller to enable higher positioning accuracy, smoother motor start-up and softer stops.
By setting the highest steering wheel position, the easy entry function known from the predecessor enables convenient entry and exit. This function is installed as standard in the A8 '10 and can be adjusted via the MMI.
With the memory function, driver-specific steering column/steering wheel settings can be stored in two ignition keys. When equipped with a key memory, up to four different steering wheel positions can be stored.



458_068c

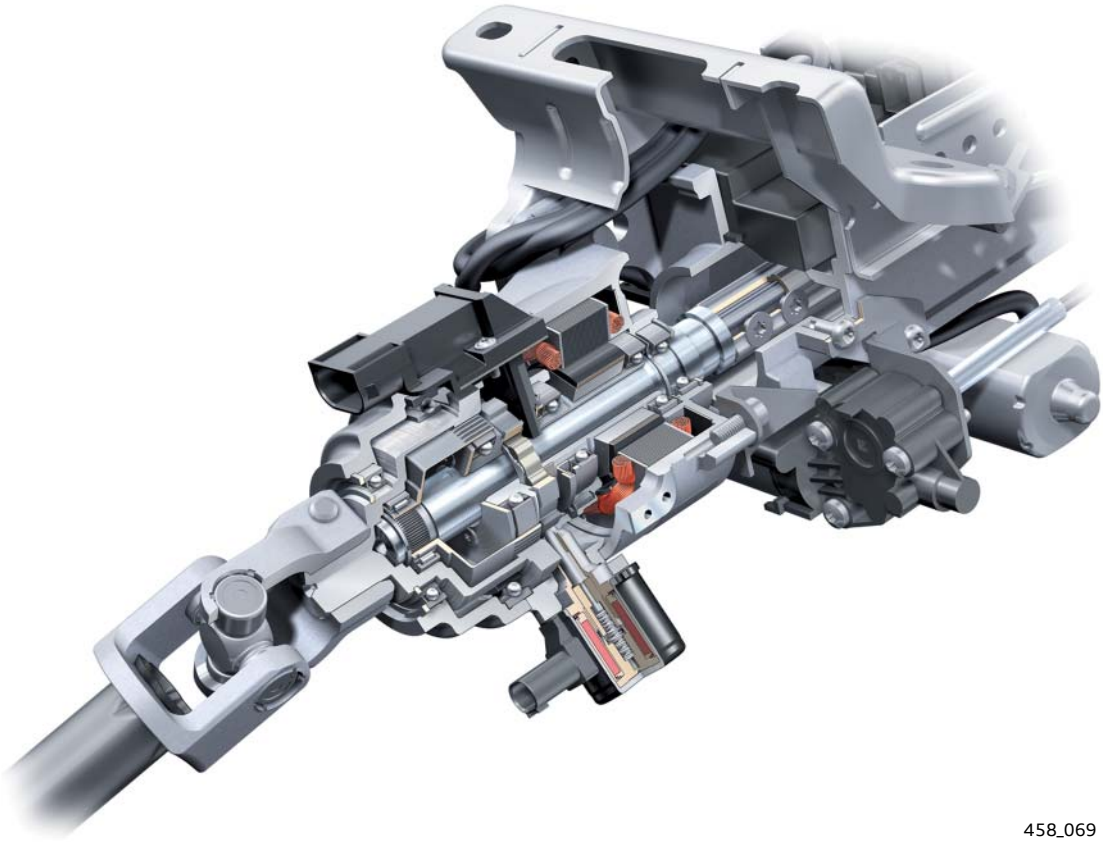
Steering wheels

The leather four-spoke multifunctional steering wheel with tiptronic and a steering wheel rim diameter of 375 mm is used as standard in the Audi A8 '10. This wheel can be optionally ordered as a heated version and in different colours. The leather-clad airbag cap option is new.
Different versions of the sporty leather three-spoke multifunctional steering wheel with a rim diameter of 365 mm are optionally available.
Compared to the predecessor, the mounting arrangement for the airbag module has been changed. This also has implications for the airbag module removal and installation procedures.


458_068d

Dynamic steering

Dynamic steering is also optionally available for the Audi A8 ’10. The design and functional principle of this system correspond to that in the current Audi A4. The service jobs are also identical.



458_069

Adaptive cruise control (ACC)

Overview

A new generation of Bosch ACC is used with the launch of the Audi A8 ’10. For the first time, two ACC sensors are fitted on the right and left at the front of the vehicle. With corresponding vehicle equipment, including the video camera for Audi lane assist, rear radar sensors for Audi side assist and the ultrasonic sensors for parking aid, it is now possible to view the vehicles ahead and behind.

On vehicles with a navigation system, up-to-date road information is included in the control. This is the basis for the quantum leap in terms of the system functionality. Numerous control units work together to realise these functions. As on the predecessor, the ACC system is an optional extra and is available for all engine/transmission configurations.

458_070

System components

Right/left adaptive cruise control sender G259/G258 and adaptive cruise control unit (2) J428 (J850)

Design

The fundamental design of the sender and control unit corresponds to that of the components in the current Audi A4. The main innovation is the connection of the control unit to the FlexRay data bus. A more powerful processor is used to process the considerably higher sensor data rate (data from video camera, rear radar, parking aid sensors, navigation data). Sensor heating makes the system suitable for winter driving conditions.
The senders and control unit are installed in a common enclosure. The senders are adjustable in x- and y-direction.

458_071

Functional principle

The fundamental functional principle of the radar sensor corresponds to the principle described in SSP 289. A completely new quality is achieved by including video data, navigation data etc. in the complex control procedures. A new feature is the way the two control units communicate with each other, realised by a master-slave architecture. The adaptive cruise control unit J428 (installed on the right) acts as the master while the adaptive cruise control unit 2 J850 (installed on the left) acts as the slave.

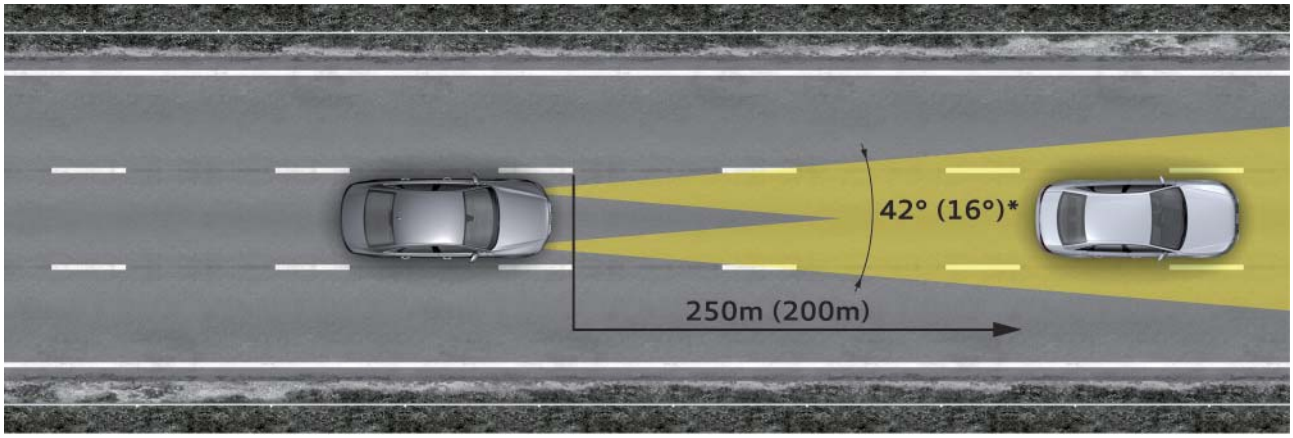
458_072

Right adaptive cruise control sender G259 and adaptive cruise control unit J428

Left adaptive cruise control sender G258 and adaptive cruise control unit 2 J850

The radar range has been substantially increased compared to the previous ACC systems. The measuring range begins approx. 0.5 m in front of the vehicle and extends by approx. 250 m.

With the double radar concept, the detection range of approx. 16 m (30 m in front of the vehicle) is wider than a 3-lane motorway.



*** Values in parentheses refer to the predecessor model**

458_073

Functions

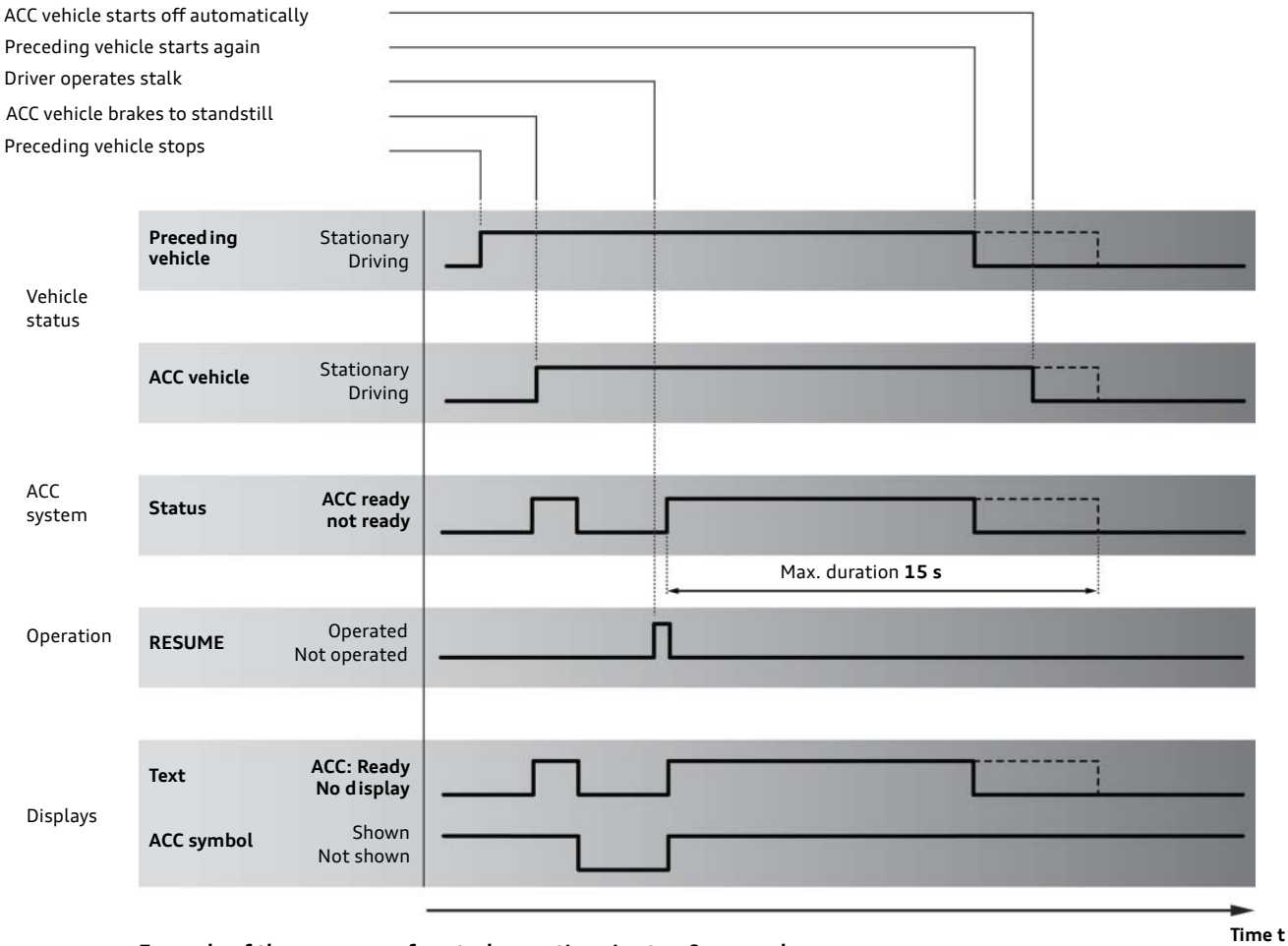
Compared to the ACC systems already in use in other Audi models, the scope of functions has been considerably extended. The speed range, in which ACC can be activated, has been extended to 0 km/h - 250 km/h. The basic function of maintaining a distance from the vehicle in front and maintaining a vehicle speed defined by the driver corresponds to that of the predecessor systems.

The ACC "observes" the traffic situation even when the ACC is switched off at the operating stalk. Refer to SSP 289 for detailed information. The new features and changes are described in the following.

Stop & Go function

As already realised with the ACC in the Audi Q7, also on the Audi A8 '10 the vehicle is braked automatically to standstill. The precondition for this is that the vehicle ahead was moving before it came to a standstill. Targets that are stationary at the moment of detection are not included in the control function (e.g. end of traffic queue). The ESP initiates active braking operations by way of active pressure build-up. The resulting deceleration is dependent on the vehicle speed. At vehicle speeds lower than 50 km/h, the maximum deceleration is approx. 4 m/s², the last 2-3 m before the vehicle comes to a standstill are covered by "crawling" at a speed of approx. 2 km/h. The stopping distance to the vehicle ahead is approx. 3.5-4 m. If the vehicle ahead starts driving again immediately after standstill, the ACC vehicle will also accelerate and follow. The driver can extend this restart period by 15 seconds by operating the stalk (RESUME setting). The 15 second restart period is restarted every time the stalk is operated.

458_074



Example of the sequence of control operations in stop & go mode.

458_075

ACC READY is shown for the driver in the central display.
The precondition for the starting off is that the driver has fasten his/her seat belt.
Automatic start-off can be deactivated with the vehicle diagnostic tester.
In certain markets (e.g. USA), the automatic start-off function is realised without the described option of extending the READY period by pressing the stalk (RESUME).
With the brake pedal depressed, it is possible to activate the ACC system while the vehicle is stationary.

458_076

Under the following conditions the ACC is automatically deactivated and the electromechanical parking brake (EPB) activated while the vehicle is stationary:

- Opening a door: The driver's door is monitored redundantly by the door contact and microswitch in the door lock, all other doors are monitored by the door contact switch.
  The ACC receives the information from the corresponding door control units and redundantly from the ESP control unit.
- Opening the bonnet
- Longer parking period: The ESP enables the pressure holding function by actuating the valves. Since the valve coils heat up due to the actuating current, the maximum vehicle holding time that can be realised by the ESP is limited. Once this period of time has been exceeded, the function is transferred to the parking brake (EPB).
- ESP fault
- Fault in another control unit relevant for the ACC function (except fault in EPB control unit)
- Engine turned off

ACC is deactivated if EPB is operated while ACC is active.

If a fault occurs in the EPB system, the ACC is deactivated and at the same time park position "P" is activated automatically. ACC: TAKE OVER! is shown in the central display.

ACC is also deactivated on an uphill gradient greater than 18 %. ACC deactivation is accompanied by acoustic and visual signals.

458_077

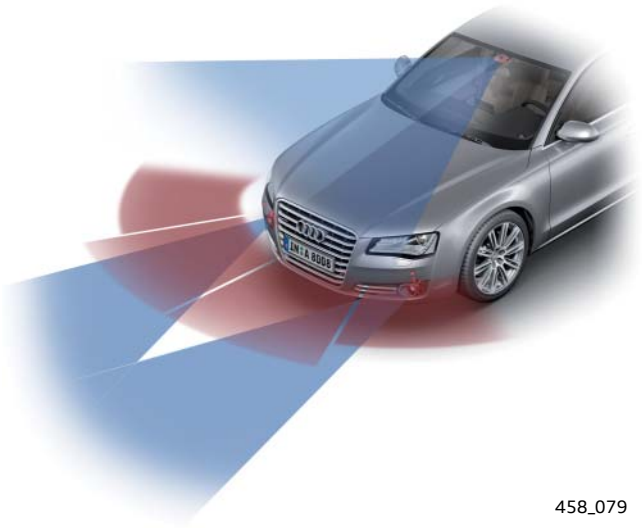
Combination of stop & go function with drive assist

The drive assist function can be switched on and off at any time independent of the ACC.
If the drive assist active and the ACC stop & go function is active while the vehicle is stationary, the drive assist function will switch passively into the background (comparable to "standby" mode).
If ACC is switched off while the vehicle is stationary and the drive assist function is on, the drive assist is activated again and further decelerate the vehicle.


458_078

Start-off monitoring

The ACC scans the area directly in front of the vehicle before the vehicle starts off automatically. Detection takes place in three ways: by radar sensors, video camera and by the four ultrasonic sensors of the parking aid. Through a different configuration, the ACC ultrasonic sensors are operated in a different mode so that objects are still detected at a distance of approx. 4 m. A visual warning is shown in the central display and an acoustic warning (gong) sounds if an obstacle is detected. The vehicle starts off but very slowly so that the driver has sufficient time to respond (braking, evading).
If the signal from the video camera or the ultrasonic sensors is not available, the vehicle will always start off automatically at reduced acceleration. Automatic start-off will not take place if both signals are not available. The system is then deactivated and the driver is requested to take over.

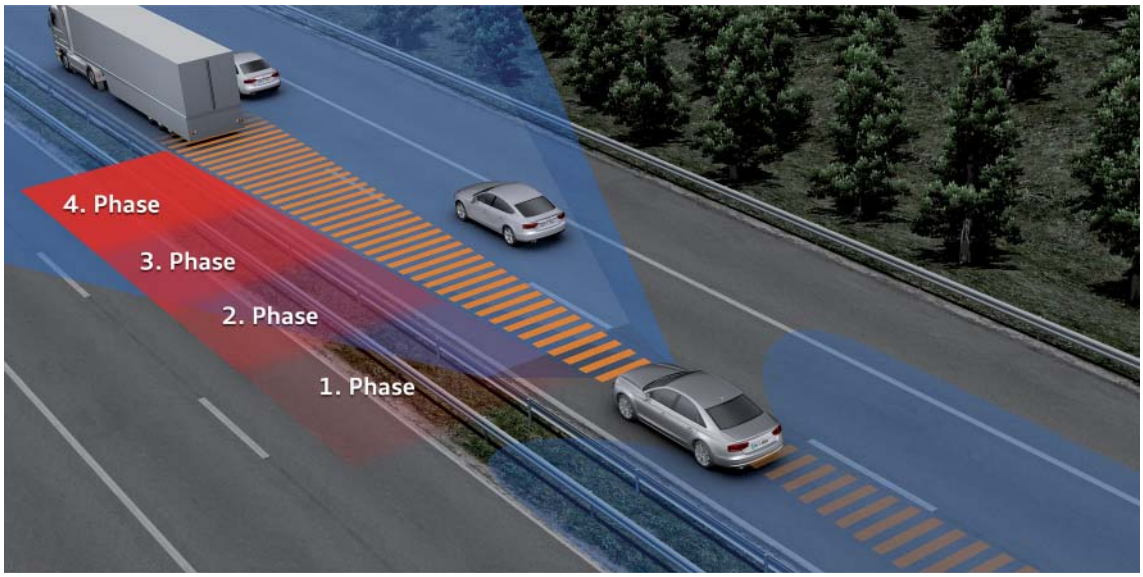


458_079

Audi braking guard

The function already implemented in the Audi Q5, Q7, A4 and A5 models has been significantly expanded for the Audi A8 ’10. The most important new feature is that the vehicle is braked with full deceleration in the last phase of the function. This "new" generation of Audi braking guard is characterised by the following fundamental objective:

- Audi braking guard is always activated when there is an increased risk of collision due to excessively high relative speed in relation to a preceding vehicle. The function is also activated when ACC is switched off at the operating stalk (switching OFF position).
- The four-phase functional principle described below allows the driver to actively intervene by taking evasive action and/or braking.
- Even if the driver reacts too late or not at all, the Audi braking guard reduces the driving speed by way of gradual partial braking and automatic full deceleration by up to 40 km/h. Parallel to this, preventative protective measures are initiated. Even when a collision with a preceding vehicle can no longer be avoided, these measures drastically reduce the collision severity.
- In the Audi A8 ’10, Audi braking guard is a subfunction of "Audi pre-sense". Refer to SSP 456 for detailed information.



458_080

Phase 1

The braking guard logic in the control unit has detected an elevated collision risk and triggers a visual warning and an audible warning (gong signal). This warning is triggered approx. 1.5 s - 2.5 s before the last chance to brake to avoid collision. When exactly the warning is triggered depends on the driver's driving style. Investigations have shown that the driving style also characterises the degree of driver alertness. A dynamic driving style, characterised by frequent acceleration/deceleration and lane changes for instance generally infers an alert driver. The warning is then triggered later than for a less alert driver. If the driver accelerates or steers when Audi braking guard detects an increased risk, it is assumed that the driver has a higher alertness level. The warning is then triggered later than for a "less alert" driver. At this moment, the brake system is precharged at 2 bar braking pressure by active pressure build-up initiated by the ESP.

458_077a

The aim of this measure is to reduce the dead times in the braking system and the cleaning/drying of the brake discs by applying the brake pads against the brake discs. This subfunction is comparable to the already "brake disc wiper function".
At the same time, the triggering criteria for the hydraulic brake assist (HBA) are changed. The HBA is now triggered at lower pedal travel speeds. The traffic situation about the vehicle is included in determining the HBA triggering criteria. To be prepared as best as possible for any imminent particularly dynamic actions (evasion, braking with high vehicle deceleration) the adaptive air suspension sets the dampers to maximum damping force.

458_082

- Visual and audible warning
- Brake system pre-filling
- Damper adjustment

Phase 2

If the driver does not respond to the pre-warning the adaptive cruise control unit initiates short-term brake pressure build-up through the ESP control unit approx. 0.9 s to 1.5 s before the last braking opportunity to avoid collision. This warning jolt that can be clearly perceived by the driver does not serve to decelerate the vehicle but rather to again warn the driver that an immediate reaction is required on his/her part in order to avoid imminent collision.
If the driver initiates a braking operation he/she may be assisted by the hydraulic brake assist (HBA) function of the ESP. Unlike conventional brake assist systems that always initiate full braking, the braking pressure is now build up in such a way that the A8 either stops a little way behind the vehicle ahead or the speed is reduced to such an extent that it can safely follow the preceding vehicle. Depending on the road conditions (coefficient of friction), maximum deceleration values are realised if necessary.

If the driver does not initiate braking after the warning jolt, the ESP actively builds up the braking pressure which, in this phase, begins with medium deceleration (approx. 30 % of the maximum deceleration for approx. 1.5 s). The seat belt slack is reduced at the start of the braking operation in order to effectively restrain the driver. (Refer to SSP 456 for information on vehicle safety)

458_083

- Warning jolt
- Seat belt slack reduction
- Partial braking (approx. 30 %)

The functional principle of phase 3 and 4 described in the following are realised only in vehicles equipped with Audi side assist (function of Audi pre-sense plus). The driver can cancel the corresponding function any time by distinctly depressing the accelerator pedal.

Phase 3

In phase 3, ESP increases the brake pressure to approx. 50 % of the maximum deceleration for a period of approx. 1 s. The hazard warning lights warn the traffic coming from behind of the hazard situation. Since the probability of a collision is now high, open windows/sunroof are closed as far as possible in order to increase the stability of the passenger cell and to protect the occupants from object intrusion. (The function for closing the windows/sunroof is not linked to the Audi side assist and is also realised in Audi pre-sense front.)

458_084

- Partial braking (approx. 50 %)
- Closing windows/sunroof
- Hazard warning flasher

Phase 4

The braking pressure is again increased to maximum vehicle deceleration approx. 500 milliseconds before impact. The seat belt pretensioners are activated (also with Audi pre-sense front). The collision can now no longer be prevent by the driver, however, the full braking power further reduces the vehicle speed by a maximum of 12 km/h. Although the driver takes no steps to avoid collision, Audi braking guard reduces the impact speed by a total of approx. 40 km/h. In addition, best possible steps are taken to prevent an accident. Consequently, the severity of the accident is substantially reduced.

458_085

- Seat belt pretensioner activation
- Emergency braking

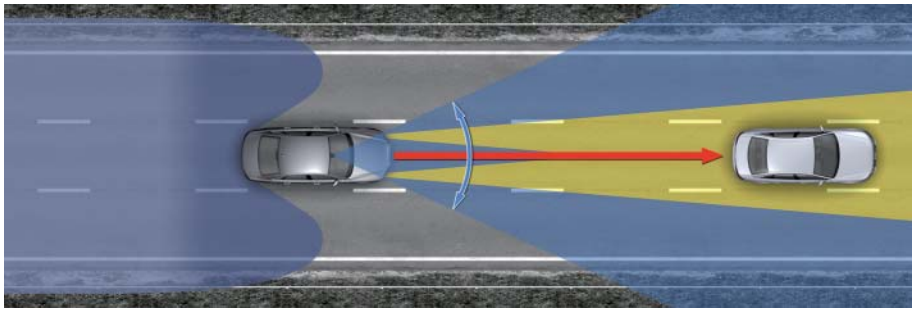
In contrast to the classic ACC function, Audi braking guard also responds to stationary objects. In such cases the driver's visual and audible warning, and, if necessary, the warning jolt are triggered. Active braking, however, does not take place.

ACC function expansion

Function expansion for vehicles with side assist

If the vehicle is equipped with side assist, the data of the rear radar sensors are included in the calculation of the ACC control procedures. If the system detects that the left (right) adjacent driving line is available for a lane change (is clear), if necessary, automatic brake intervention takes place a little later.

In such a situation, the ACC "waits" to establish whether the driver initiates a lane change. The aim of this control strategy is not to curb the driver prematurely and not to regiment the driver more than is necessary.



458_087

Function expansion in vehicles with navigation (only in European markets)

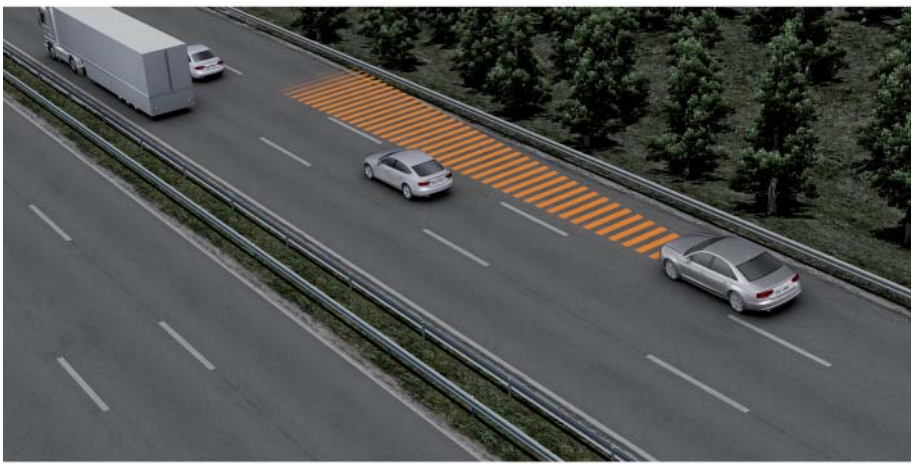
If the vehicle is equipped with a navigation system the predictive route data are used for the ACC control procedures. Determining the driving line of the vehicle is more precise. In connection with the video camera of the lane departure warning system, the turn signal indicator lamps of the vehicle ahead can be additionally registered. This provides the following advantages for the driver:

- Unwanted control actions in response to vehicles (mostly trucks) in adjacent driving lanes while cornering are minimised.
- Vehicles that intend to use an exit are blanked out earlier (no longer included in the control). Acceleration is initiated earlier. The automatic driving procedure is then similar to that a driver of a conventional vehicle would execute.

Function expansion preventing overtaking on the right (left) driving lane

In active ACC mode, overtaking/passing in the right (left) driving lane is only possible without restrictions up to a vehicle speed of approx. 80 km/h. At speeds in the range from approx. 80 km/h to 90 km/h, it is only possible to pass a vehicle with limited relative speed.

The function is active at speeds in excess of 90 km/h. The function can be cancelled by manual acceleration with the operating stalk (RESUME), by pressing the accelerator pedal or increasing the set speed.



458_088

Operation and driver information

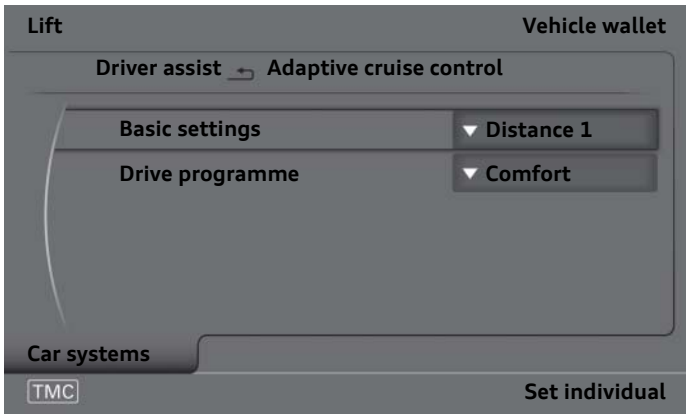
The operation and display concept already well proven in other Audi models with ACC has been adopted as the basis and further developed for the Audi A8 ’10.
The familiar operating functions, i.e. switching on and off (ON, OFF), setting the speed (SET), interrupting control (CANCEL), resuming control (RESUME), setting the distance as well as increasing and decreasing the control speed are realised in the standard way with the ACC operating stalk.
A new feature is that the ACC function can be activated in a speed range from 0 km/h - 250 km/h. If the system is activated at speeds below 30 km/h, the vehicle is accelerated to 30 km/h if all clear and subsequently controlled at this speed.

458_074

Another new feature is that the vehicle can be accelerated manually by pulling the operating stalk (RESUME) while ACC is active. Control is suspended for as long as the stalk is held in this position. The vehicle is controlled to the set speed again after releasing the stalk.

The distance is reset to the "Distance 3" setting every time the ignition is switched. On customer request it is possible to activate a different presetting with the diagnostic tester. In this case, the menu item "Basic settings" is enabled for the customer.

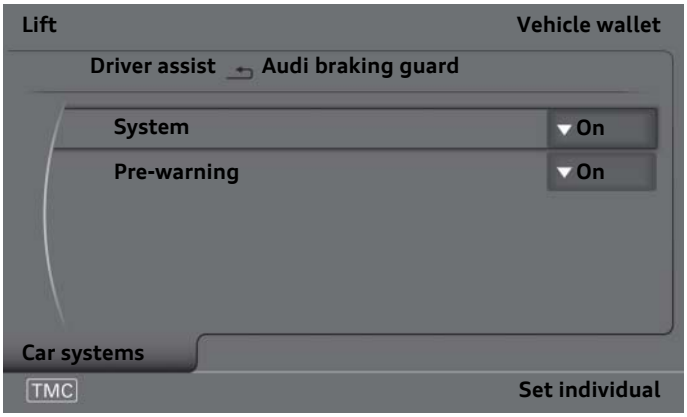
The indicators in the display and speedometer generally correspond to the familiar displays/indicators of the ACC systems in other vehicle models.



458_090

Also in the Audi A8 ’10, with the driving programme in the MMI, the driver has the option of selecting how dynamically the ACC will respond.

On request, the visual/audible distance/collision warning functions as well as Audi braking guard can be deactivated in the MMI. Audi braking guard is also deactivated when ESP is switched to sport mode by pressing the ESP OFF button.

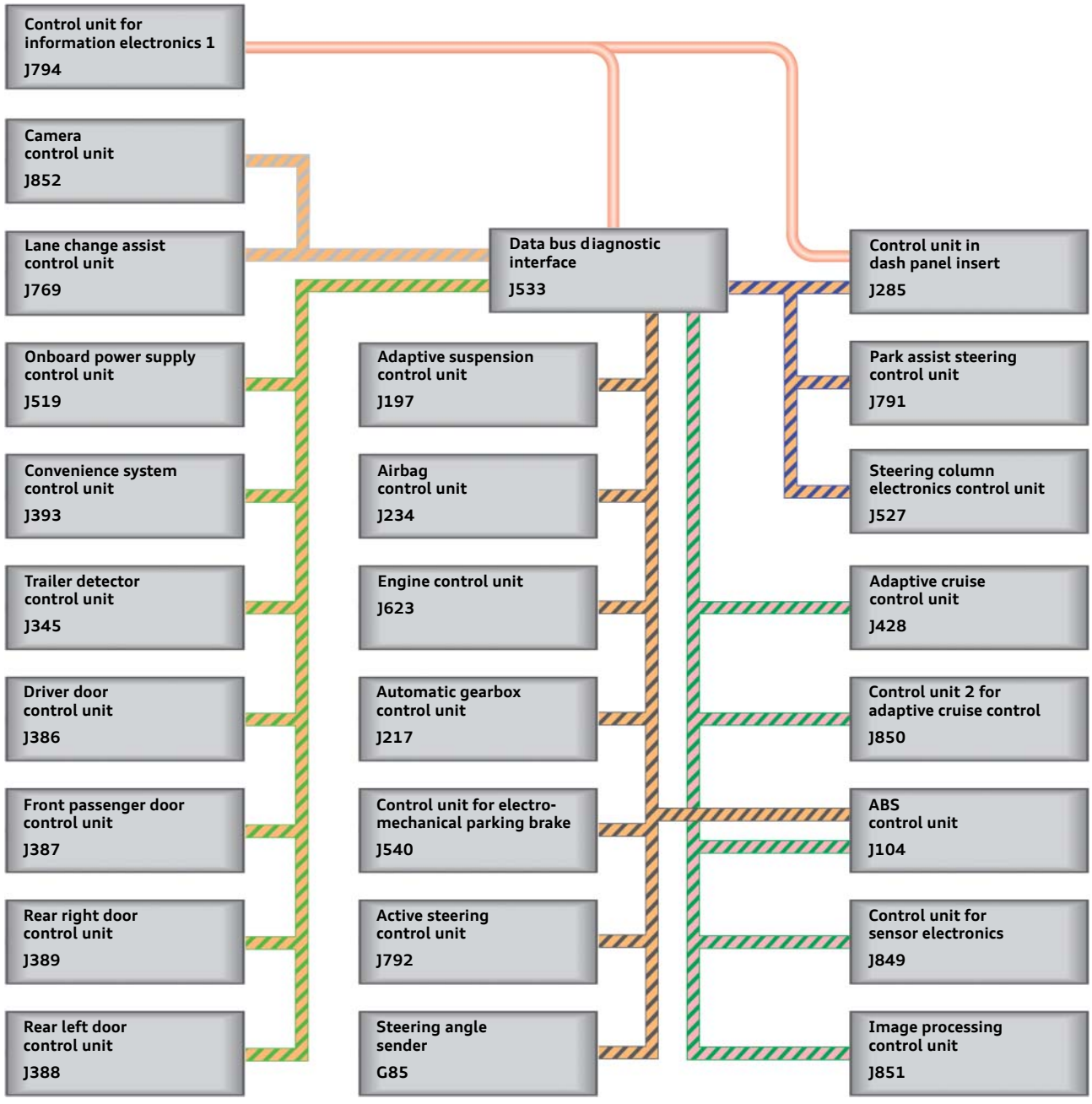


458_091

Networking / CAN data exchange

The ACC control units read approx. 1700 signals from other control units and sensors.

The following overview shows the control units involved in the data exchange.



MOST bus

Extended CAN

Convenience CAN

Powertrain CAN

Display and operation CAN

FlexRay

Service jobs

1. Removing and installing/replacing system components and additional jobs

The right adaptive cruise control sender G259 and adaptive cruise control unit J428 as well as the left adaptive cruise control sender G258 and the control unit 2 for adaptive cruise control J850 are each one component and must not be separate. The control units are encoded online and are part of the component protection system. After replacement, the senders must be reset.

458_093

2. Special settings

The senders require adjustment when:

- The rear axle tracking is adjusted.
- The adaptive cruise control unit J428 and/or control unit 2 for adaptive cruise control J850 was removed and installed.
- The front bumper was removed and installed.
- The front bumper was loosened or displaced.
- There is damage to the front bumper.
- The misalignment angle is greater than -0.8° to +0.8°.

The right adaptive cruise control sender G259 and left adaptive cruise control sender G258 are adjusted one after the other. To ensure they function correctly, both senders must always be adjusted. The adjustment is always started with the right adaptive cruise control sender G259 (master).
Compared to the setting of the ACC senders already in use, the setting procedure has been simplified.
The setting is performed with the special tool VAS 6430.

Note: Since the senders are secured directly to the bumper panel, particular care must be taken the bumper panel is mounted correctly especially at the wheel arches and the underride guard.

Wheels / tyres

Overview

On production launch, the Audi A8 ’10 with V8 4.2 FSI engine will be equipped as standard with 17 inch lightweight forged aluminium wheels while the version with V8 4.2 TDI will be equipped with 18 inch cast aluminium wheels.

19 inch and 20 inch wheels are optionally available.
The Tyre Mobility System (TMS) is installed as standard, 19 and 20 inch space saver wheels are optionally available.

Motorisation	Basic wheels	Winter wheels	Optional wheels
	 1  2	 5  4  3	 8  9  7  6
4.2 FSI	8J x 17 ET 30 (1) Forged aluminium wheel	7.5J x 17 ET 35 (3) Cast aluminium wheel (only for FSI)	9J x 19 ET 33 (6) Cast aluminium wheel
4.2 TDI	8J x 18 ET 28 (2) Cast aluminium wheel	7.5J x 18 ET 26 (4) Cast aluminium wheel 7.5J x 19 ET 29 (5) Cast aluminium wheel	9J x 19 ET 33 (7) Cast aluminium wheel 9J x 20 ET 37 (8) Forged aluminium wheel 9J x 20 ET 37 (9) Cast aluminium wheel

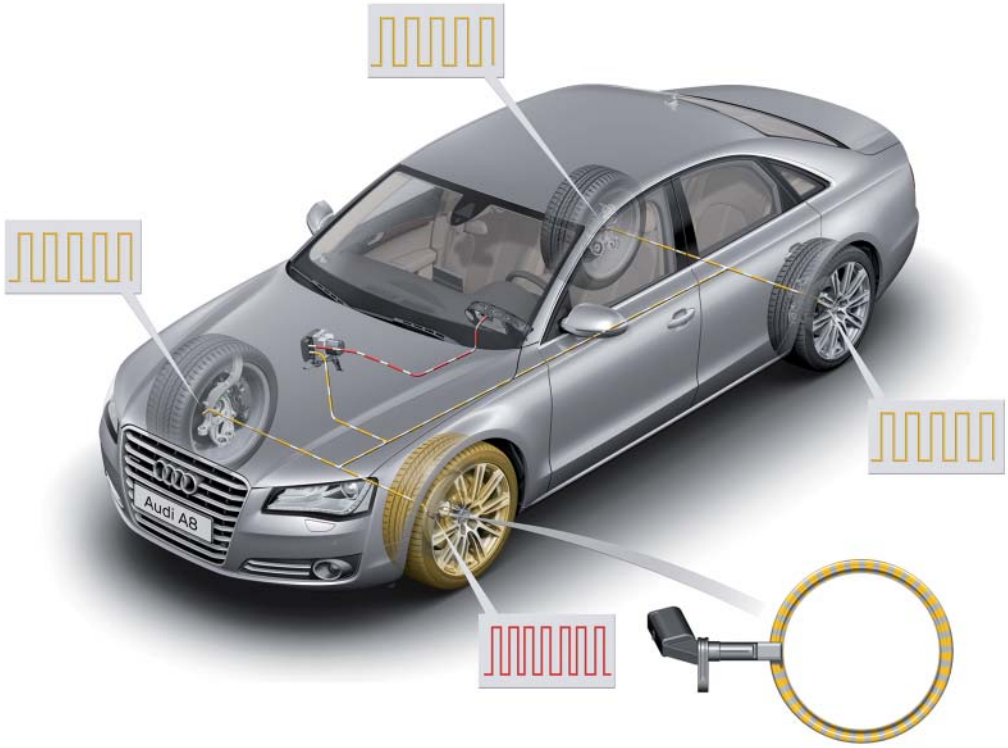
Note: Snow chains can be fitted on all winter wheels.

458_095

Low tyre pressure indicator

The Audi A8 ’10 is also equipped with the familiar second generation low tyre pressure indicator.

In terms of design and function, operation and driver information as well as service jobs, the system fitted in the Audi A8 ’10 corresponds to the systems already known from other Audi vehicles.



458_096

458_097

By evaluating the vibration characteristics of the respective wheel/tyre, second generation systems are capable of determining and indicating the position of the wheel with pressure loss.

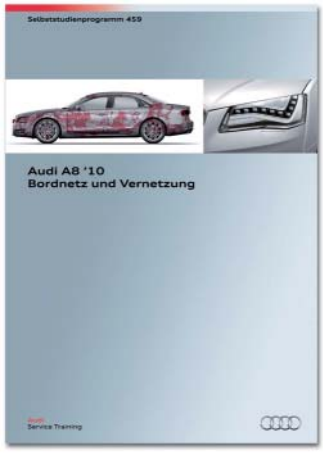
The systems can also detect slow (gradual) pressure loss as well as simultaneous pressure loss at several wheels.

Other self-study programmes on the Audi A8

SSP 456 - The Audi A8 '10

- Body
- Passive safety
- Active safety
- Engine mechanicals
- Engine management
- Gearbox
- Suspension system
- Electrical system
- Service

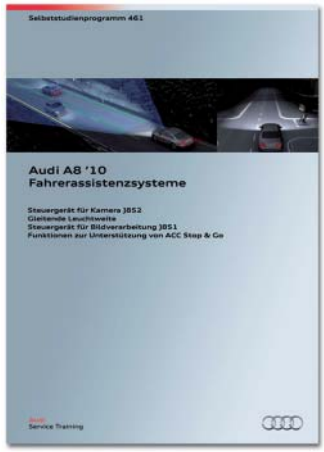
Order number: A05.5S00.21.20



SSP 459 Audi A8 '10 - Electrical and network systems

- Power supply
- Network system
- FlexRay
- Control units
- Exterior lights
- Service

Order number: A08.5S00.44.20



SSP 461 Audi A8 '10 - Driver assistance systems

- Camera control unit J852
- Intelligent light system
- Image processing control unit J851
- Functions supporting ACC stop & Go

Order number: A10.5S00.65.20

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