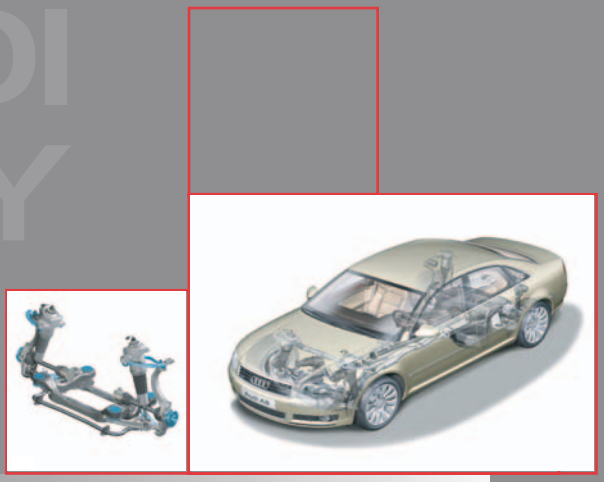
Chassis Systems SSP

AUDI ACADEMY



Audi Academy

Self-Study Program
Course Number 997303

Audi of America, Inc.
Service Training
Printed in U.S.A.
Printed 03/2003
Course Number 998303

©2003 Audi of America, Inc.

All rights reserved. All information contained in this manual is based on the latest information available at the time of printing and is subject to the copyright and other intellectual property rights of Audi of America, Inc., its affiliated companies and its licensors. All rights are reserved to make changes at any time without notice. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, nor may these materials be modified or reposted to other sites without the prior expressed written permission of the publisher.

All requests for permission to copy and redistribute information should be referred to Audi of America, Inc.

Always check Technical Bulletins and the Audi Worldwide Repair Information System for information that may supersede any information included in this booklet.

Trademarks: All brand names and product names used in this manual are trade names, service marks, trademarks, or registered trademarks; and are the property of their respective owners.

Table of Contents

Introduction 1
Bus Arrangement

Front Axle 2
Introduction, System Components

Rear Axle 8
Introduction, System Components

Wheel Alignment 12
General Procedure, Front Axle Settings, Rear Axle Settings

Steering System 14
Introduction, System Components, Servotronic II System, Steering Column, Electric Steering Column Lock (ESCL)

Base Brake System 28
System Components

Electromechanical Parking Brake 30
Introduction, Operation and Display, System Components, Functions, EPB CAN Data Exchange

Electronic Stability Program (ESP) 42
Introduction, System Components

Tire Pressure Monitoring 50
Introduction, Tire Pressure Monitoring System CAN Data Exchange

Table of Contents

This Self- Study Program (SSP) is not a Repair Manual!

Its purpose is to describe new design features and functions of the VAS 5051. All values given in this program are intended to facilitate your understanding of the program, and are based on the software version that was valid at the time the SSP was developed.

For service and repair work, use the current technical literature.

New!



Caution!
Note!



Introduction

The requirements for the new A8L chassis systems were unusually diverse and led to many conflicting technical problems. To solve these complex problems, Audi has made innovative improvements to existing equipment, created new components and thoroughly coordinated all sub-systems.

The new chassis systems have resulted in more road safety features and set new standards in driving luxury.

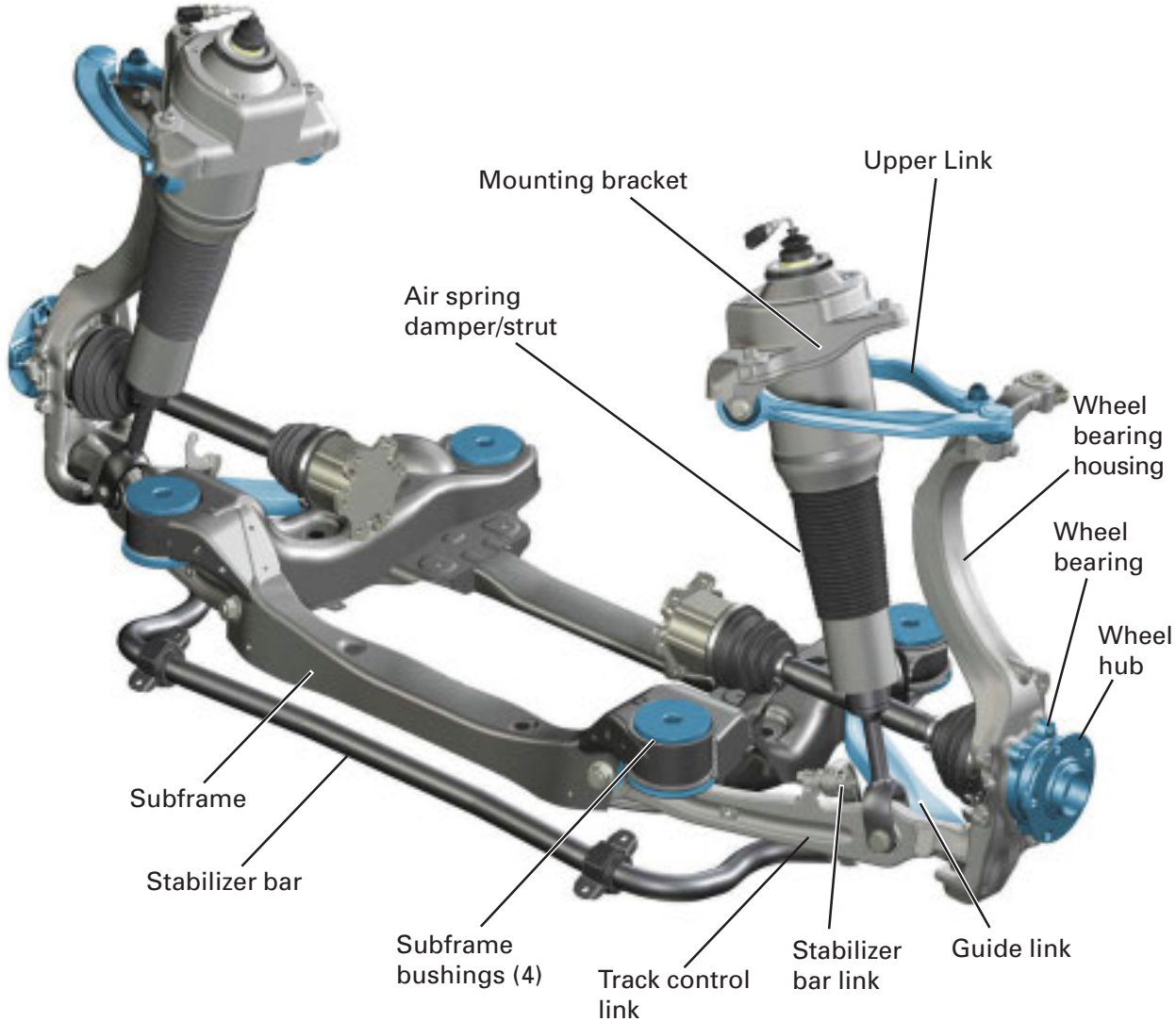


Front Axle

Introduction

The 2004 Audi A8L is equipped with the familiar four-link front axle. A significant new feature is the air suspension combined with electronically controlled dampers (refer to SSP 994303, Air Suspension System).

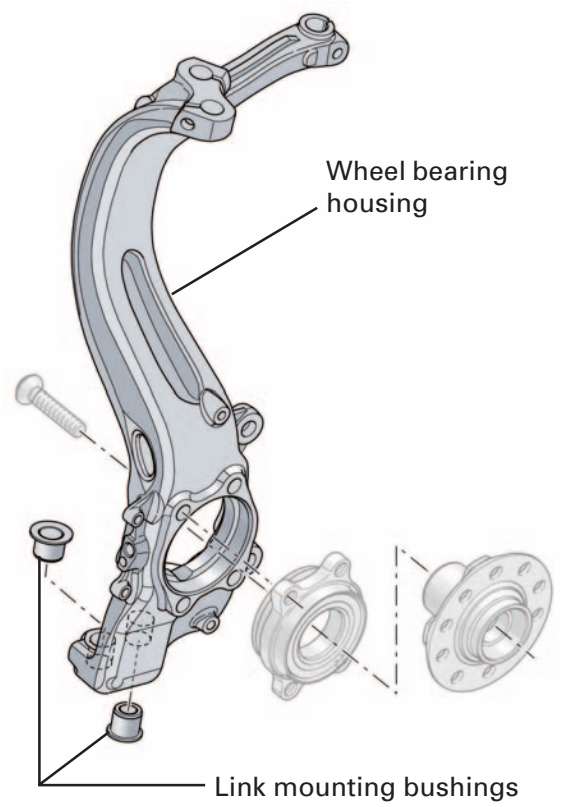
The design of the new air suspension and axle components is based on geometric and kinematic modifications. A substantial weight reduction has also been achieved.
Wherever technically feasible, components used for the VW Phaeton and Audi A8L are identical.



System Components

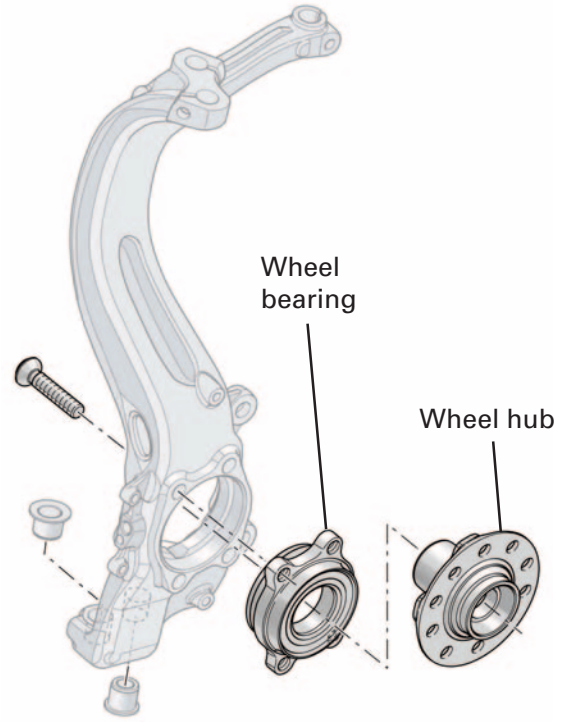
Wheel Bearing Housing

The front wheel bearing housing is made of forged aluminum. The guide and track control link mounts have press-fit, zinc-iron coated bushings.



Wheel Bearing

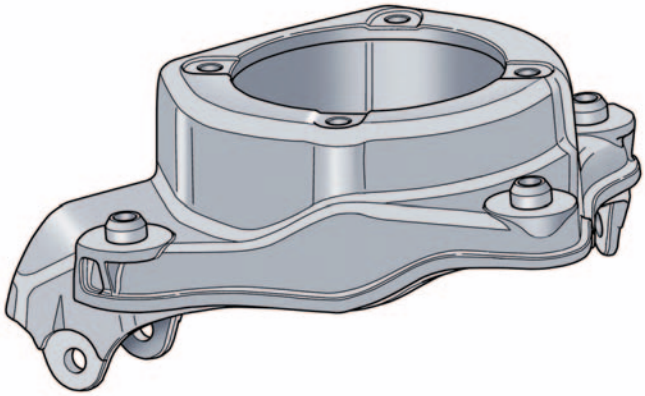
The 2004 Audi A8L is equipped with 3.62- inch (92mm) diameter flanged wheel bearings. The wheel speed sensor ring is part of the wheel bearing. Refer to Anti-Lock Brake Systems.



Front Axle

Mounting Bracket

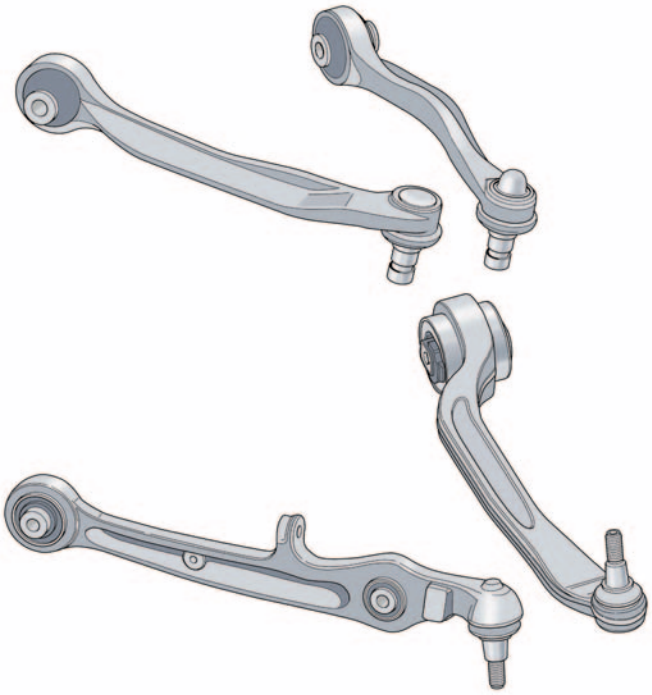
The mounting bracket is made of Poral cast aluminum. It is bolted to the body and supports the upper transverse links and the spring/damper unit.



Pay attention to body bolted joint tightening sequence! Refer to the current Workshop Manual.

Links

The upper and lower links are made of forged aluminum. To minimize road noise and tire vibration, the guide link is connected to the subframe by a large hydraulically-cushioned bushing.



Make sure the bushing is installed correctly! Refer to the current Workshop Manual.

Spring/Damper Unit

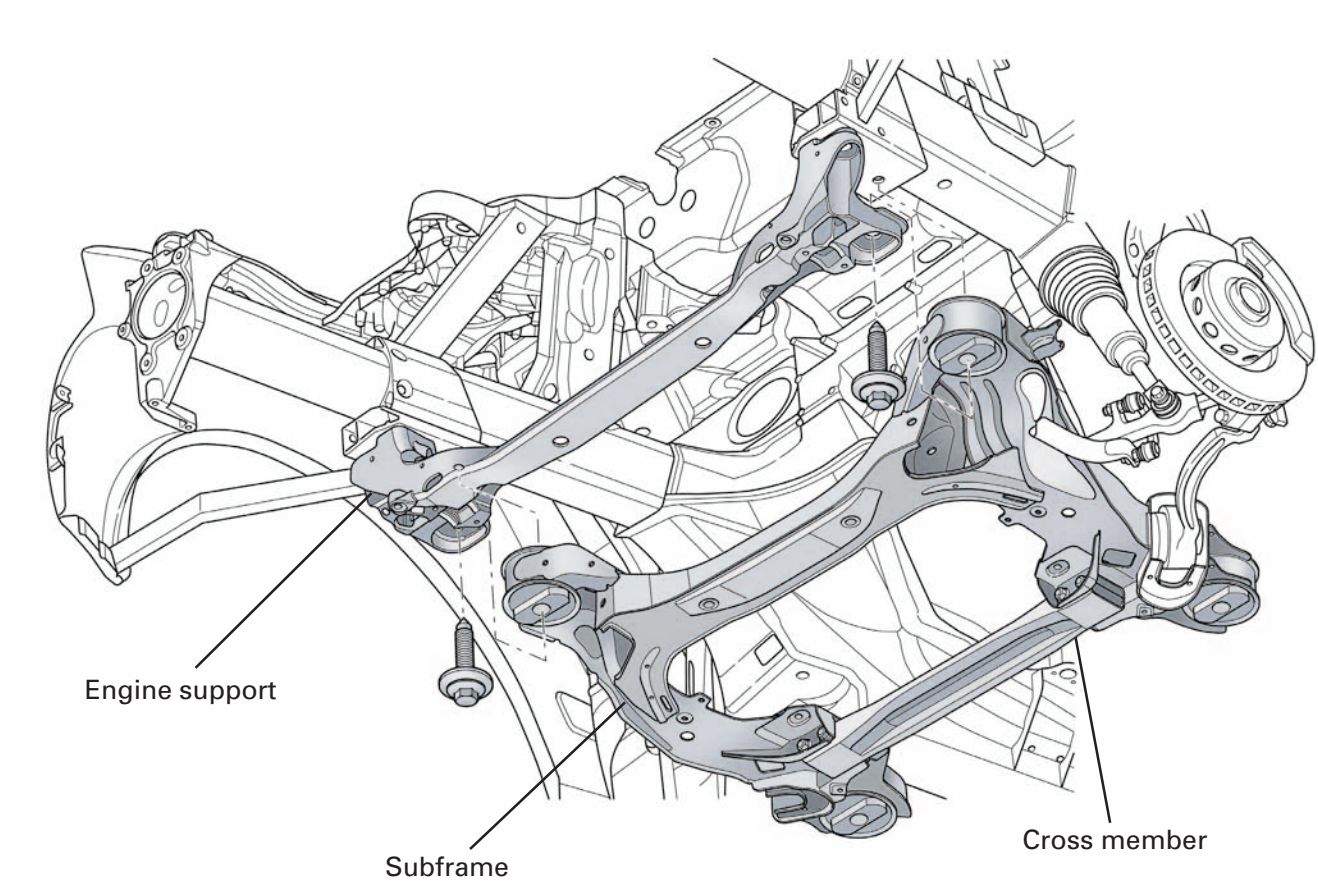
The design and operation of the Air Suspension System Components is described in SSP 994303, Air Suspension System.



Front Axle

Subframe

The subframe is a welded stainless steel shell. To increase rigidity, a bolted cross member is used at the rear.

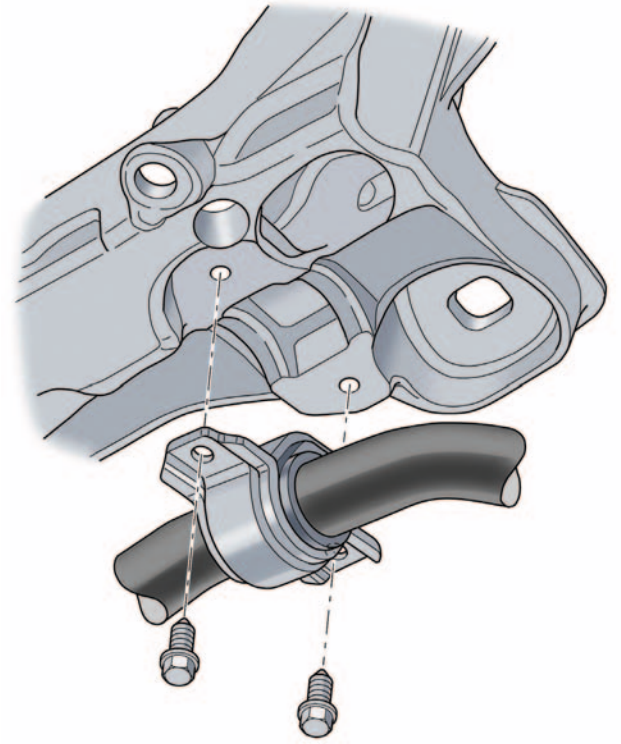


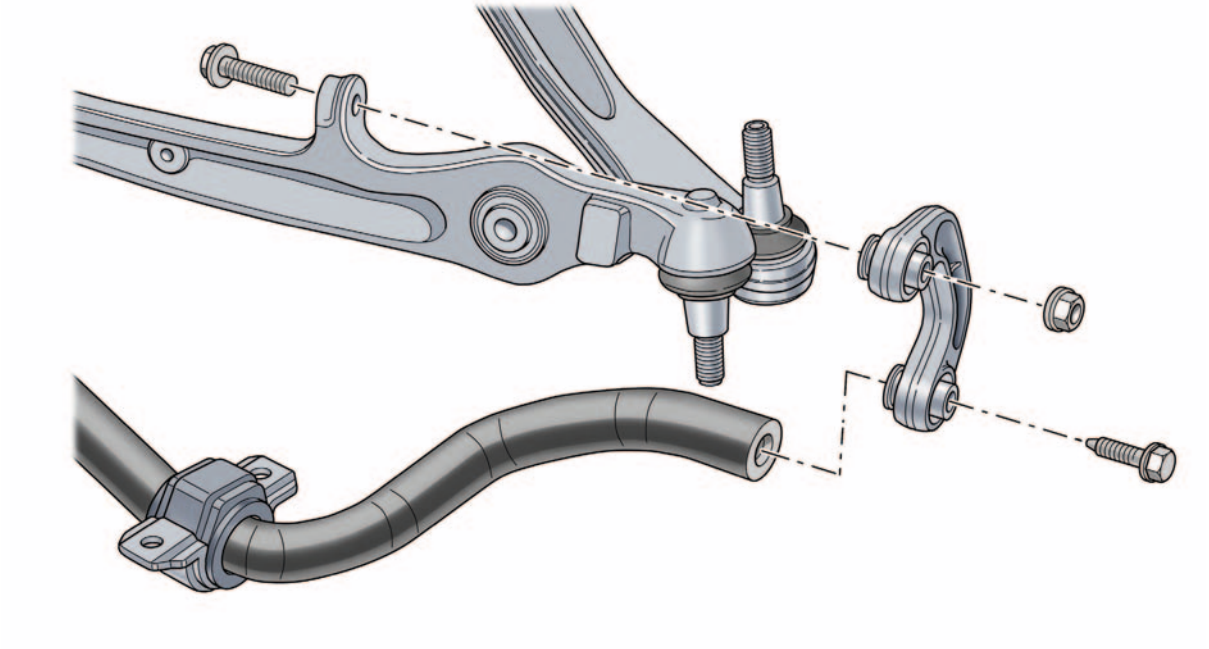
Engine Support

A new engine support is bolted to the front attachment points of the subframe.

Anti-Roll Bar

To save weight, the A8L is equipped with a tubular anti-roll bar. The anti-roll bar joins the two-track control links with connecting links. The method of mounting the anti-roll bar at the engine support is also new. The bushings are vulcanized onto the tubular bar and cannot be replaced separately.





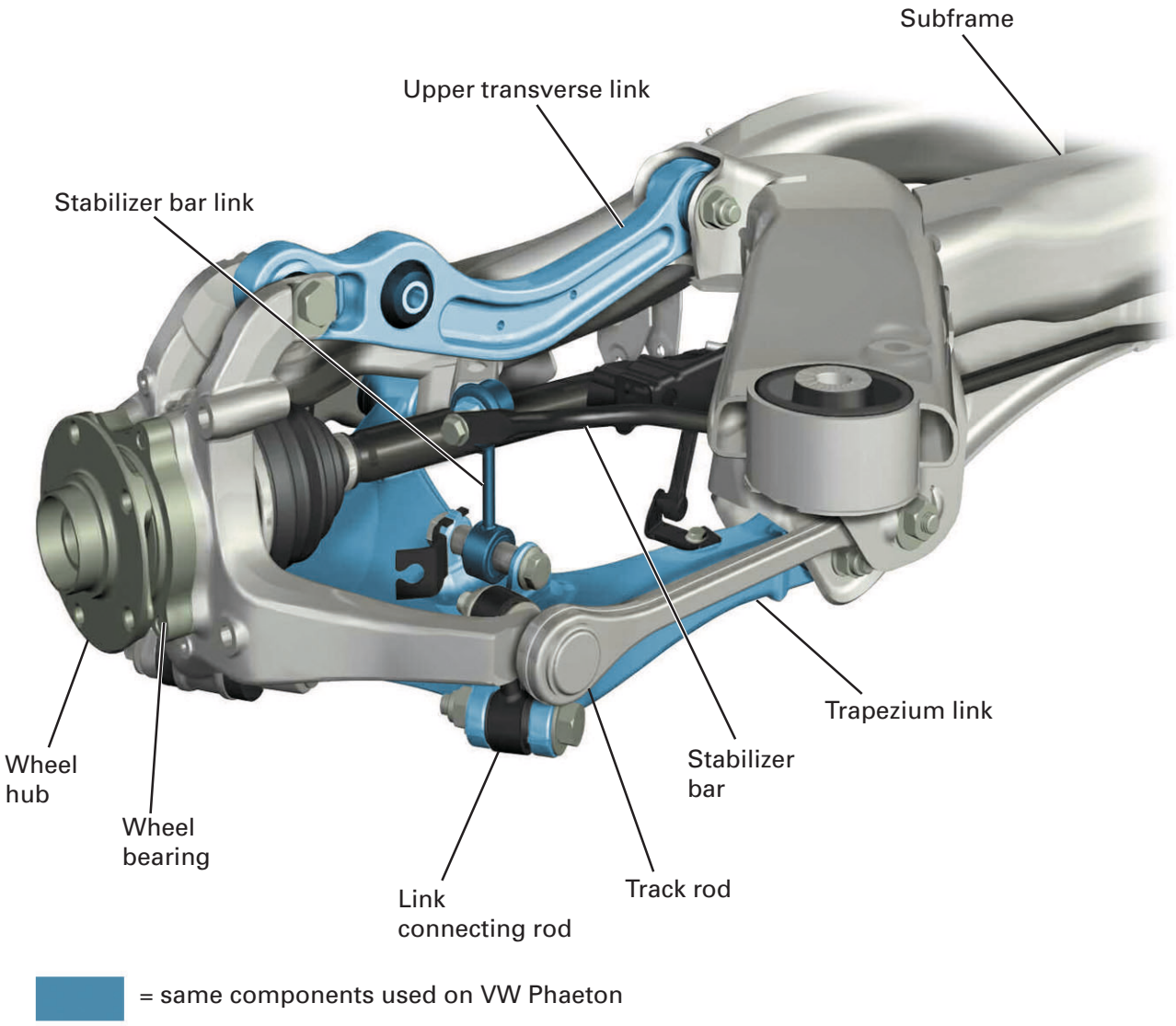
All mounting elements are to be attached in basic level setting (“Automatic” Mode). For more information, refer to SSP 994303 Air Suspension System).

Rear Axle

Introduction

The rear axle is an improved version of the 2003 A8 trapezium-link axle. Compared to earlier models, all axle components are new due to the geometric and kinematics modifications. In addition, the air suspension is new and the weight has been reduced.

Wherever technically feasible, identical components are used for the VWPhaeton and 2004 Audi A8L.



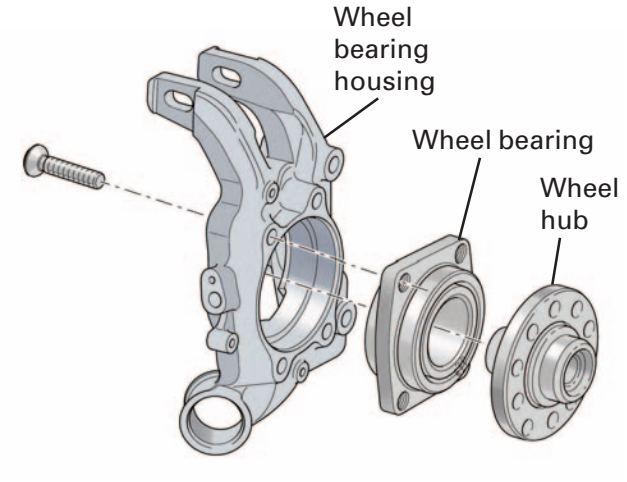
New Features

- Air suspension with electronically controlled damping
- Aluminum subframe to reduce weight
- Spring and damper joint arrangement at the upper transverse link
- Stabilizer bar connected to the trapezium link
- Modified track rod to reduce change in toe during compression and extension of the suspension
- Ball studs to connect wheel bearing housing and track rod, thereby reducing secondary spring rate
- Slotted bonded rubber bushings in upper transverse link and connection between trapezium link and subframe

System Components

Wheel Bearing Housing

The wheel bearing housing is made of gravity die cast aluminum.

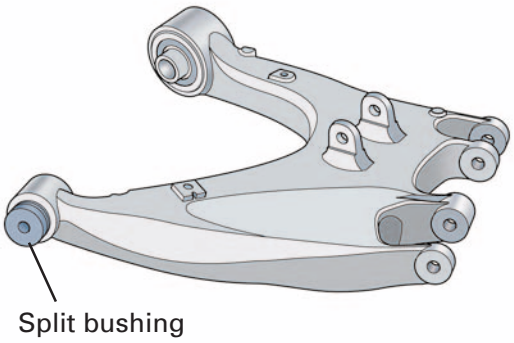


Wheel Bearing and Wheel Hub

The 2004 Audi A8L is equipped with 3.34-inch (85mm) diameter, second generation, flanged wheel bearings. The wheel speed sensor ring is part of the wheel bearing. Refer to the Anti-Lock Brake System.

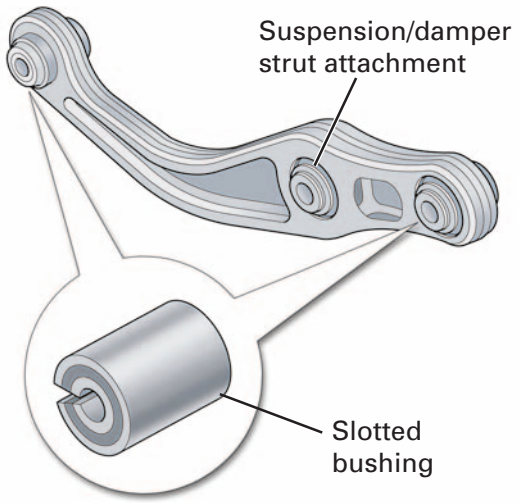
Trapezium Link

The trapezium link is made of sand cast aluminum. It acts as lower connector between wheel bearing housing and subframe. The anti-roll bar connecting link is now attached to the trapezium link. The subframe mount is an asymmetrically split bushing which helps to enhance self-steering action during braking and cornering.



Upper Transverse Link

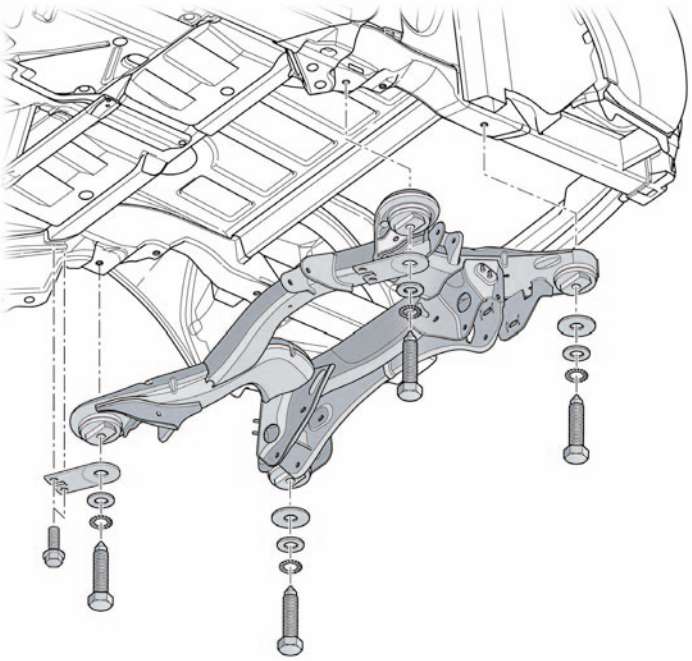
The transverse link is a forged aluminum component. It forms the upper connection between wheel bearing housing and subframe. The suspension strut provides support for the body at the transverse link. These are new mounting elements. The bonded rubber bushings are slotted to let them absorb large axial forces with minimum deformation. They keep their torsional flexibility so that the link can turn without any great resistance.



Refer to the Workshop Manual for current disassembly/assembly information.

Subframe

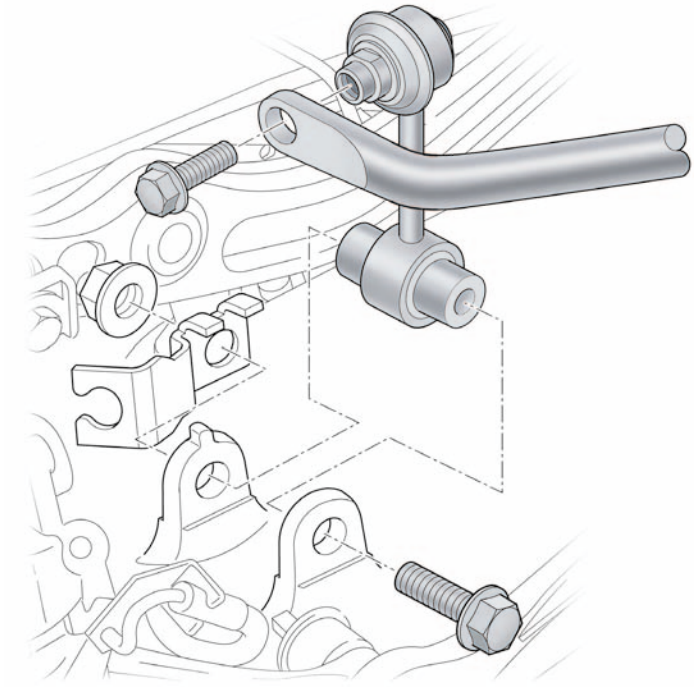
A new aluminum subframe is used which, compared to steel, reduces the weight by approximately 20 lbs. (9kg). The subframe is mounted to the body with four hydro-bushings. The bushing have a specified installation position in the subframe.

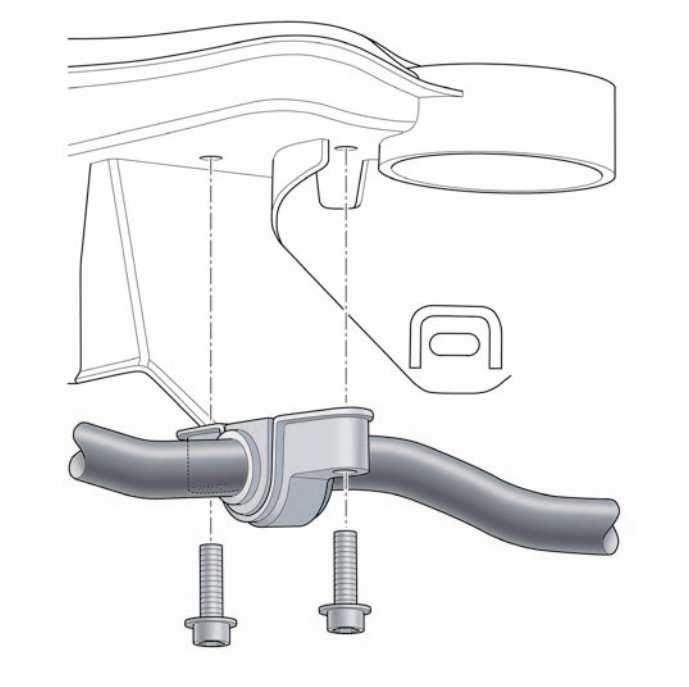


Refer to the current Workshop Manual.

Anti-Roll Bar

The anti-roll bar is mounted at the subframe and attached to the trapezium links with connecting rods.





Wheel Alignment

General Procedure

Compared to the 2003 A8, 2004 A8L basic principles of wheel alignment and adjustment are the same, except for:

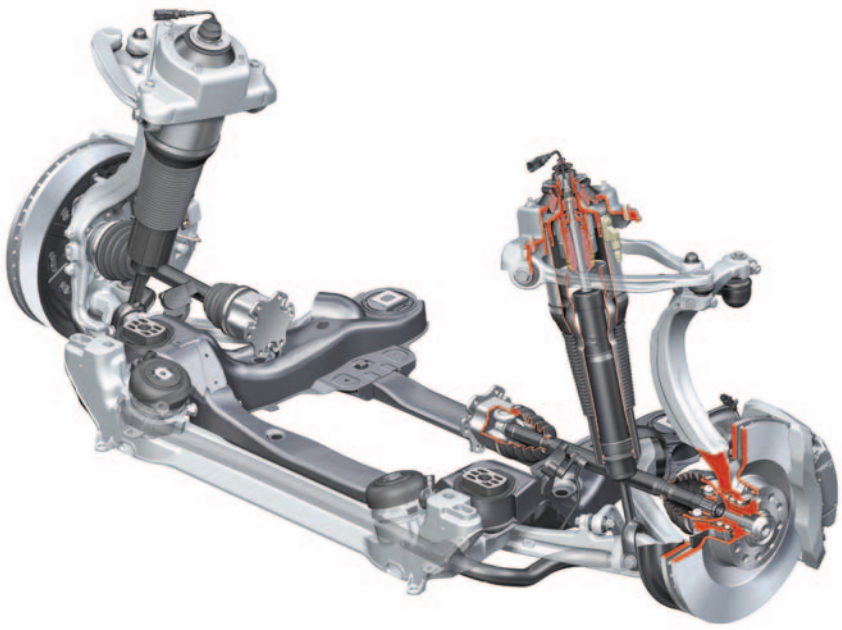
- The toe constant is now set in the vehicle basic position (B=1).
- Balancing out of front axle toe values involves adjusting subframe with the engine support.
- On vehicles equipped with Adaptive Cruise Control, the distance sensor must be checked/ adjusted after changing the rear axle toe values.
- The air suspension system must be set to “Automatic” Mode (in the MMI) before wheel alignment.
- The vehicle must be at a settled, level position at the before wheel alignment procedures begin

For more information, refer to wheel alignment equipment manufacturers’ instructions.

Front Axle Settings

As in the past, individual toe values and the toe change profile on suspension compression/extension (“toe-in curve”), can be set for the four-link front axle. The camber values can be balanced between the right and left side of the axle.

This is achieved by moving the subframe together with the engine support, sideways. For more information, refer to the current Workshop Manual.

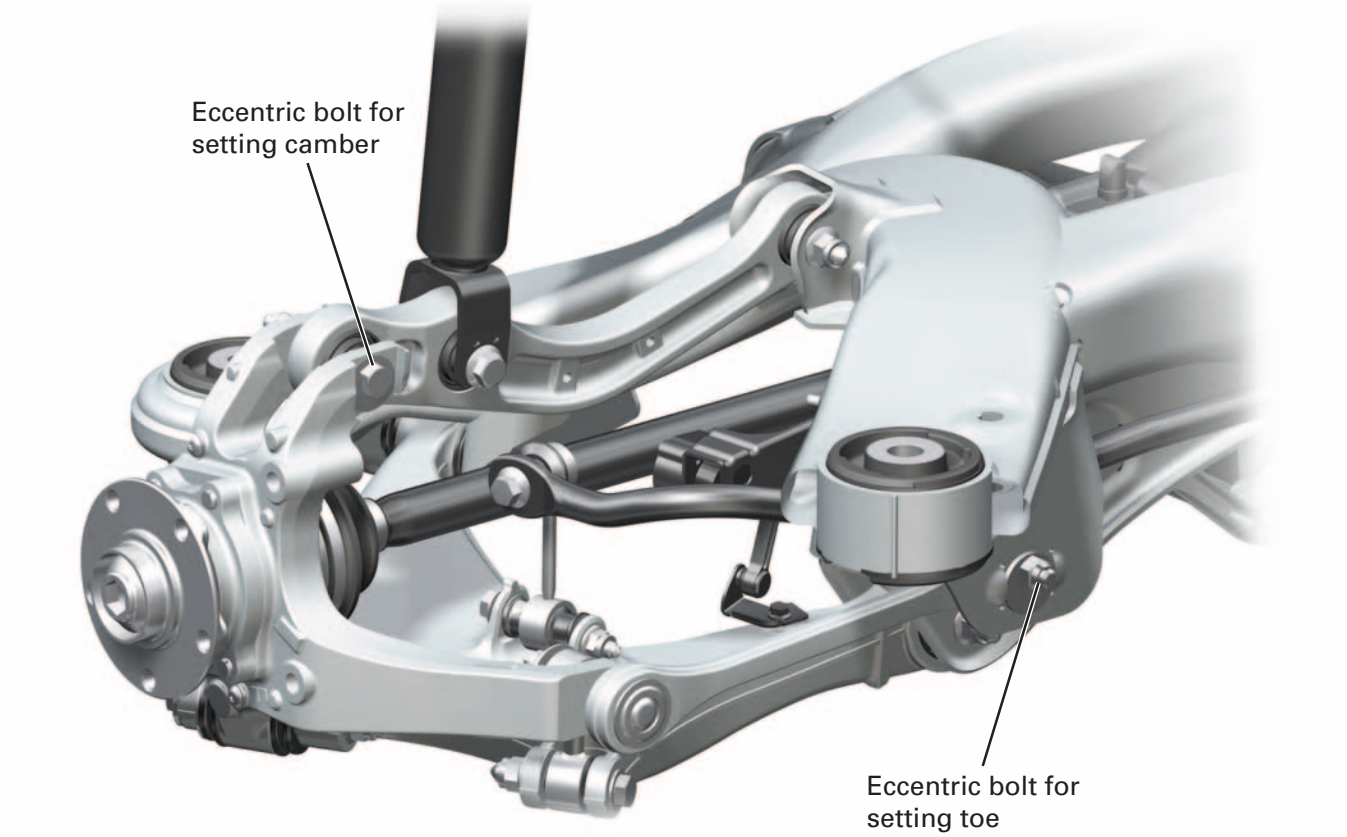


Rear Axle Settings

Camber is set with an eccentric at the transverse link/wheel bearing housing bolted joint.

Toe is set at the track rod/subframe bolted joint.

For more information, refer to the current Workshop Manual.



Steering System

Introduction

The 2004 Audi A8L is available with mechanical or electrical steering column adjustment, and standard power steering or Servotronic II.

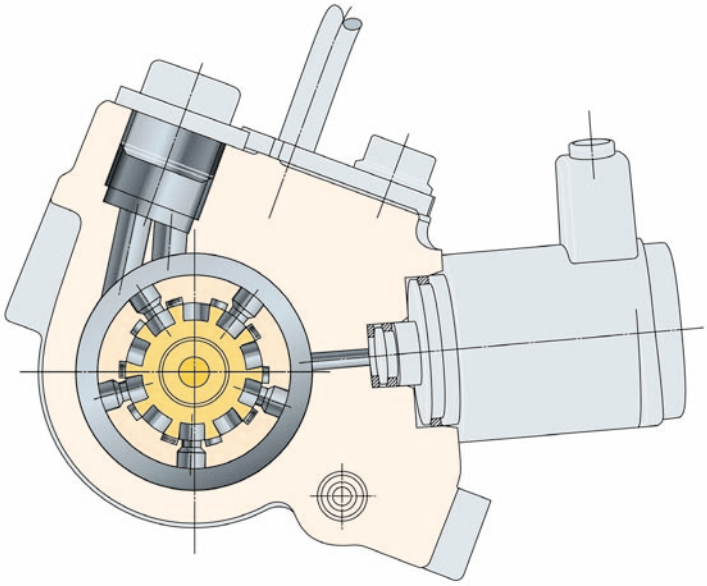
New Features

- Electrical Steering Lock
- Spindle-Driven Electrical Steering Column Tilt Adjustment
- Rigid Track Rods
- Variable Steering Ratio
- Servotronic II
- Larger Steering Mechanism Piston Diameter
- More Detent Positions at Steering Column Splines

System Components

Steering Pump

The 2004 Audi A8L is equipped with an FP6 vane pump with a delivery volume of 0.51oz (15cm^3) per revolution. The maximum system pressure is limited to 1,813 psi (12,500 kPa).



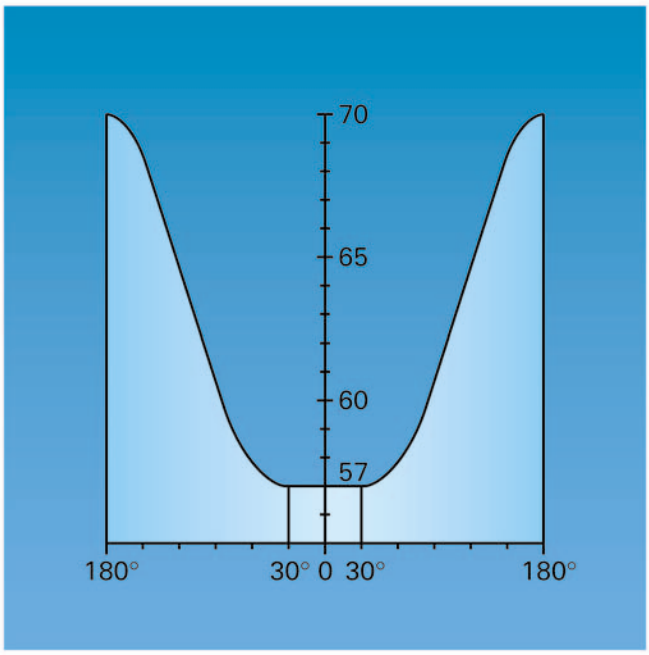
Steering Mechanism

The steering mechanism consists of a rack and pinion with mounting brackets,



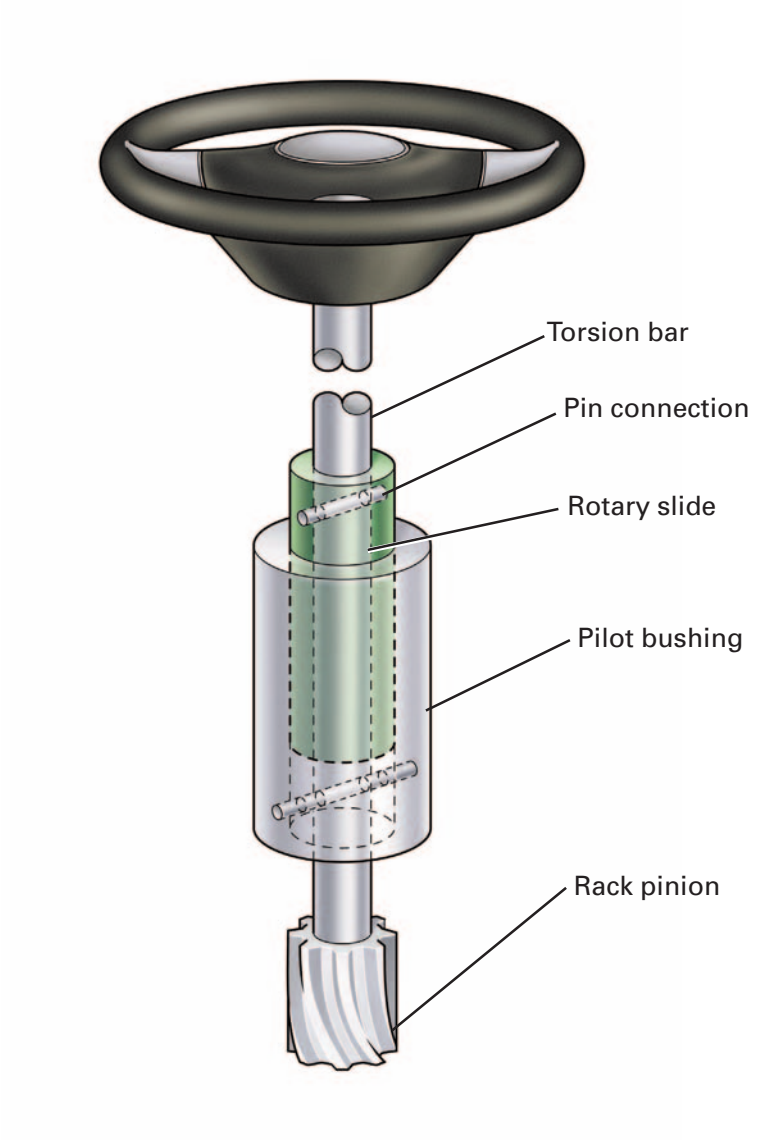
2003 A8 vs. 2004 A8L Steering System Comparison

- Manufacturing the rack splines with different modules and meshing angles allows variable translation of steering wheel movements into rack travel. This variable ratio achieves a more direct response with larger steering angles.
- The piston diameter was increased from 1.7 in to 1.8 in (43mm to 45mm) because of the higher axle load on vehicles equipped with the full range of equipment.
- The rack now has ten grooves instead of six, which increases the number of gear teeth at the rack. This produces a larger area for the flow of fluid and reduces pump noise.



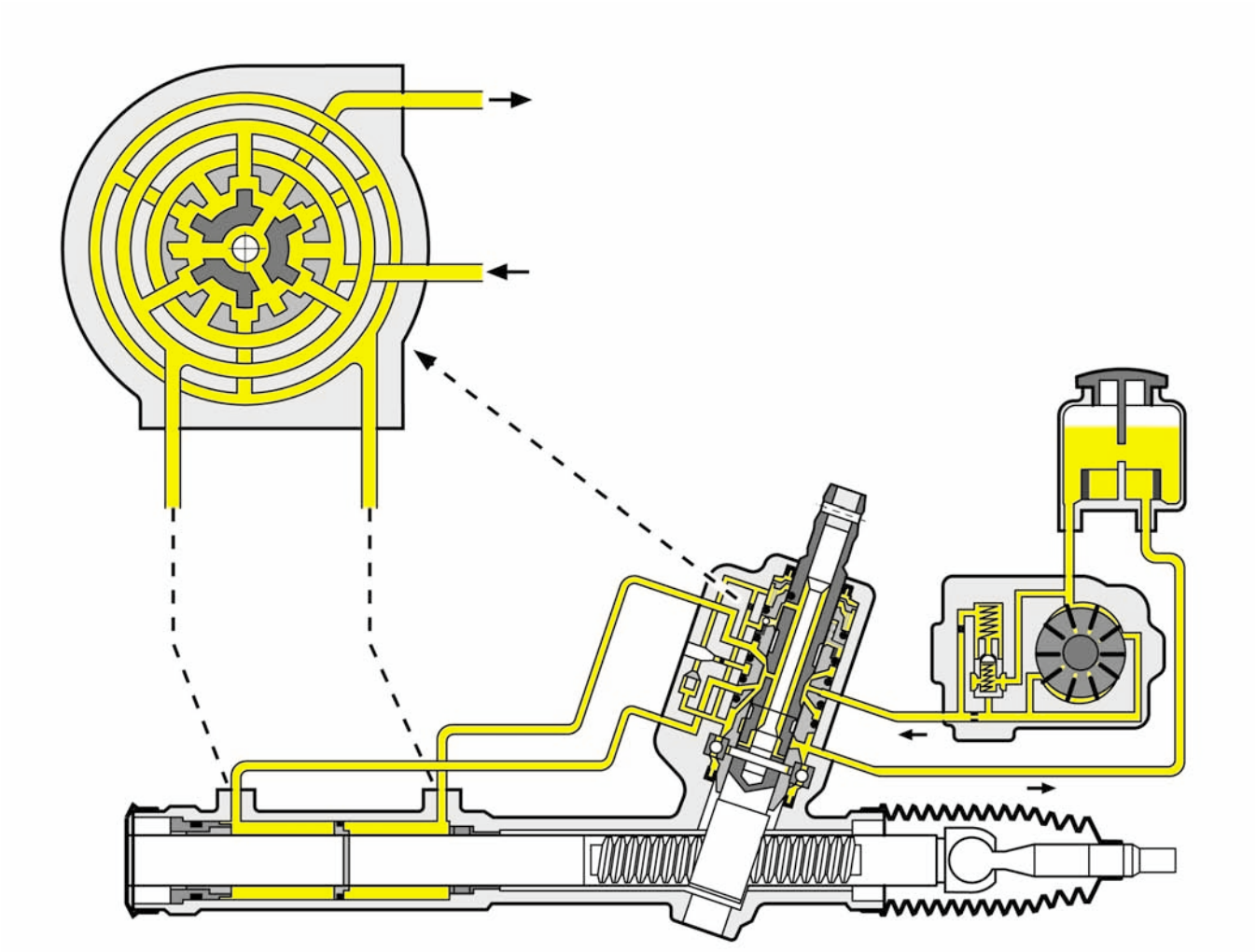
A torsion bar in the rack valve is connected to the steering column shaft with a universal joint. The upper end of the torsion bar is linked to the rack with a pin connection. The lower end is pinned to the pilot bushing.

Turning the steering wheel causes a force to act on the torsion bar. The torsion bar is turned (twisted) relative to the pilot bushing. This results in a change in the relative positions of the grooves and bores in the rack and pilot bushing. Specific fluid ducts can be opened and others closed, depending on the angular offset between rack and pilot bushing.



Neutral Position

If force is not being applied to the steering wheel, the operating cylinder and pressure hose are connected to the fluid reservoir and no pressure is built up in the system.



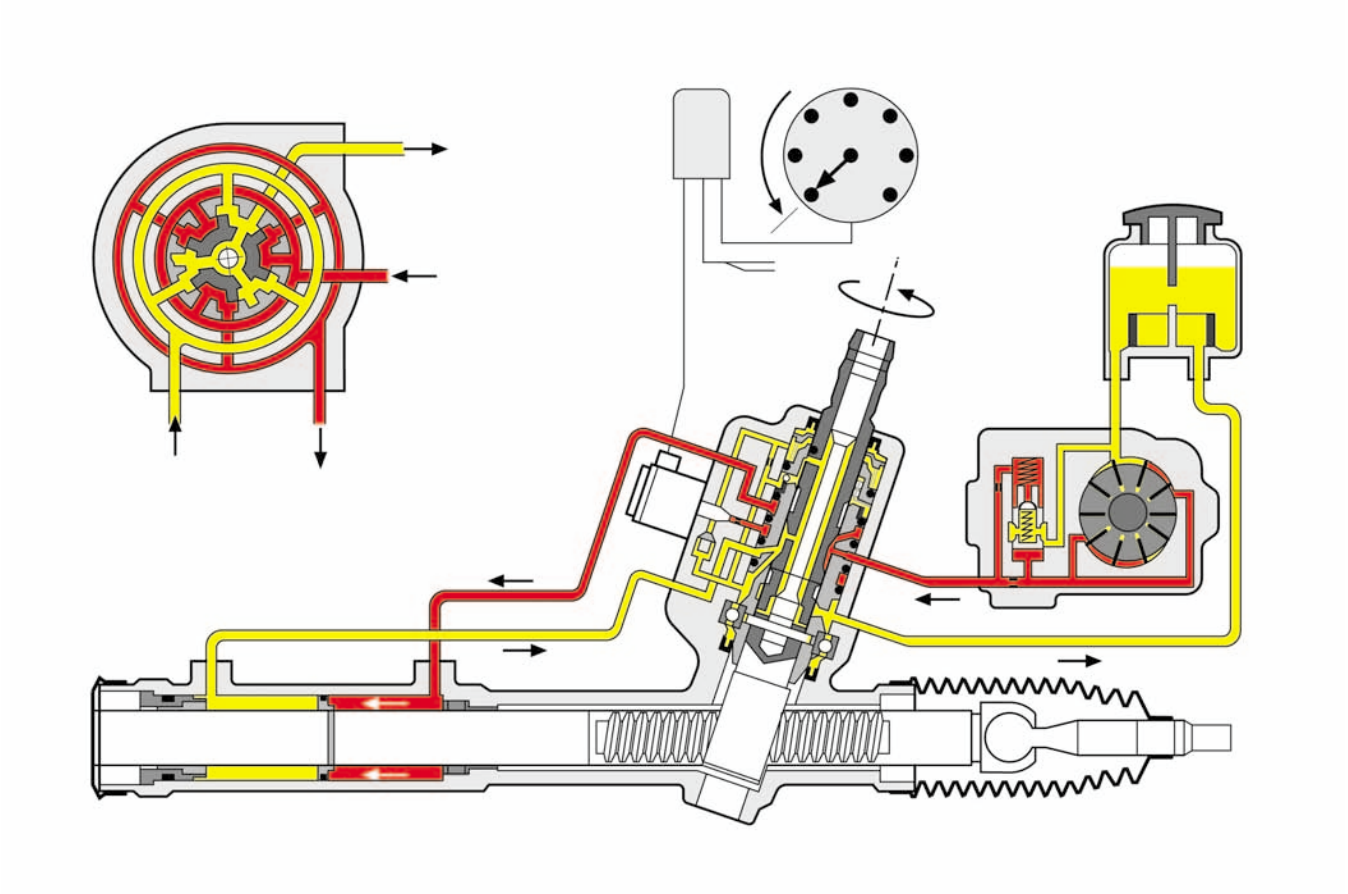
The rack is shown with six instead of ten grooves.

Left Wheel Lock

Turning the steering wheel to the left causes the torsion bar and rack to turn because of the resistance of the tires and road surface to turning.

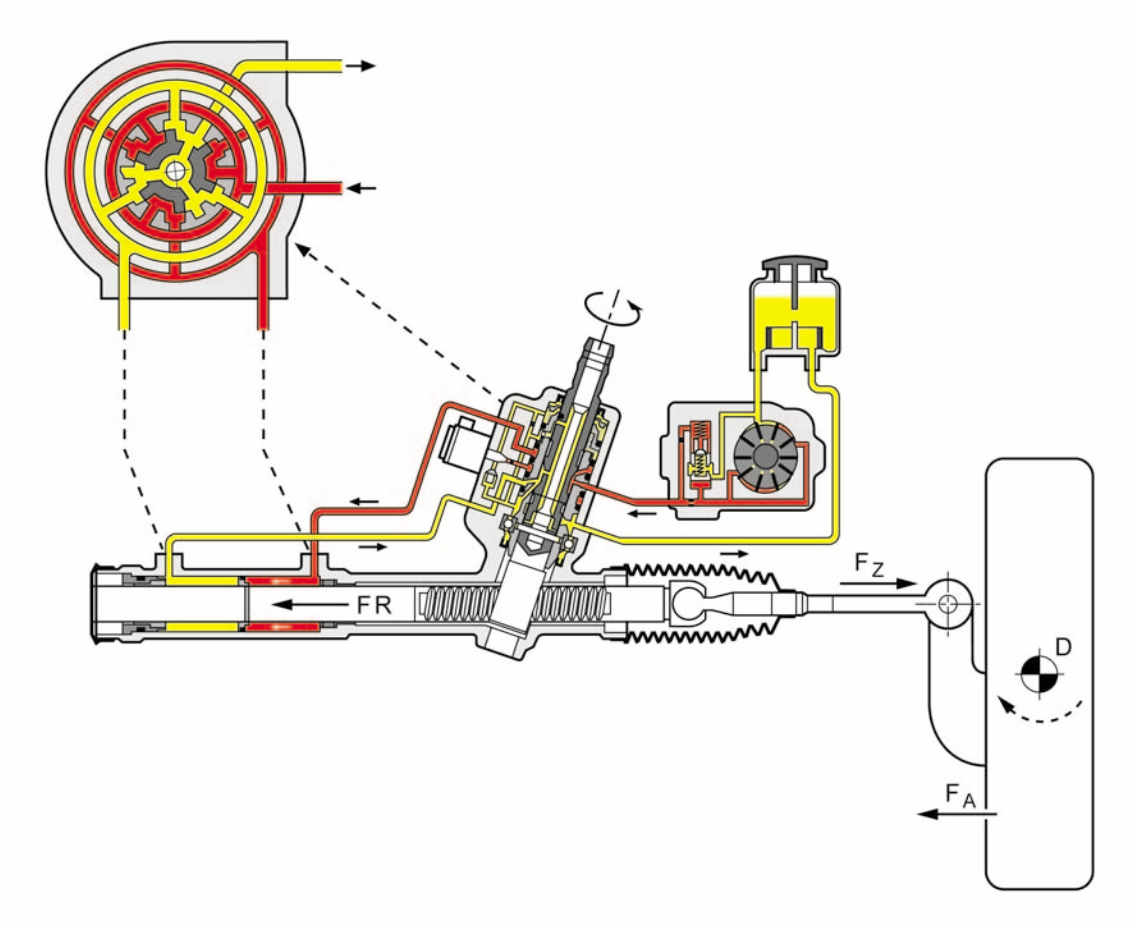
This action opens a fluid duct from the pressure hose to the right operating cylinder. The left operating cylinder is connected to the fluid reservoir by the return hose. The piston is subjected to a force acting in the direction of left wheel lock. The rack continues to move until the total piston and steering force is enough to move the wheels to left lock.

The related movement of the rack pinion also causes the lower part of the torsion bar to turn with the pilot bushing. This movement is maintained until the torsion bar does not turn any more. Therefore, there is no angular offset between the rack and the pilot bushing (neutral position). The return hose is re-connected to the operating cylinders and pressure hose and the system is depressurized again. Every time force is applied to the steering wheel, the torsion bar is turned and the sequence is repeated.



If the forces act in the opposite direction, for example because of an uneven road surface, the power steering has a cushioning effect. This results in the torsion bar turning because of the force of the rack acting on the pinion and torsion bar.

The rack and pilot bushing are turned towards each other out of the neutral position. Fluid under pressure is then sent to the cylinder chamber, where it counteracts the rack movement



Example:

A bump in the road exerts force F_A on the front wheels, causing the wheel to turn around point D (to the right).

The resulting force at the rack (F_Z) causes the pinion and torsion bar to turn.
The fluid supply to the right cylinder side is opened and the left side is connected to the return.

The reaction force F_R at the piston and rack equalizes the action of force F_Z and prevents the wheel from turning.

Servotronic II System

The 2004 Audi A8L is equipped with the newly developed Servotronic II. This new system operates on an active hydraulic reaction principle.

The reaction piston is located above the pilot bushing. The piston is connected to the rack and thus to the torsion bar, and is supported with balls on the centering element which is linked to the pilot bushing. When the steering wheel and torsion bar are not being turned, the balls are positioned in a guide collar. Fluid is applied to the chamber above the reaction piston. The force applied by the reaction piston on the balls (and therefore on the pilot bushing), varies with fluid pressure.

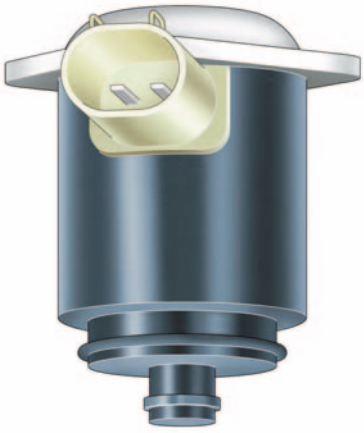
The higher the fluid pressure, the greater the force applied and the higher the torque applied on the steering wheel. The pressure control element is the Servotronic II Solenoid Valve.

The valve is actuated by the Vehicle Electrical Systems Control Module 2 (J520). The input signal for the control unit is the vehicle speed signal from the Electronic Stability Program (ESP) Control Module (J104). The larger the opening of the valve, the smaller the drop in pressure at the valve, and the higher the pressure in the chamber above the reaction piston.

Depending on the speed of the vehicle, different characteristic curves for steering wheel torque and system pressure are achieved.

Servotronic II Solenoid Valve (N119)

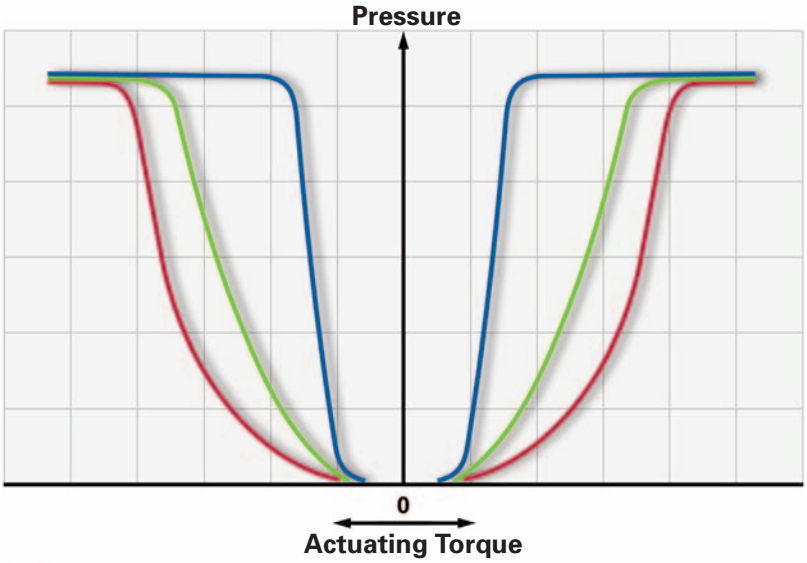
The solenoid valve is an electro-hydraulic converter for performing the Servotronic II function. It is a proportional, normally-open valve (open when de-energized). The higher the current, the smaller the opening.



Servotronic II Operation

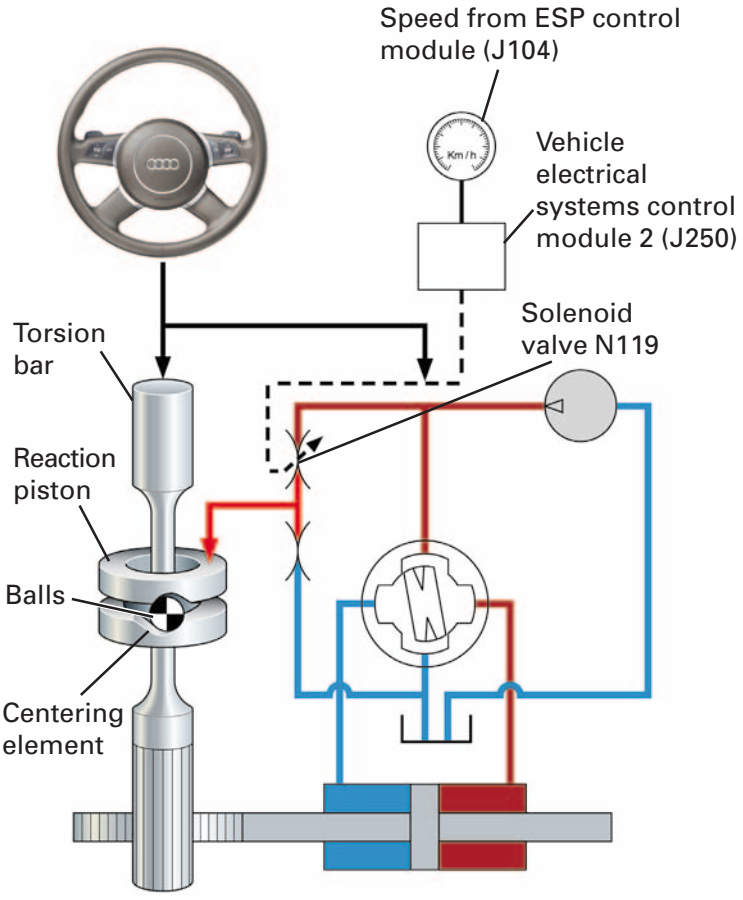
The higher the vehicle speed, the lighter the force the driver has to exert on the steering wheel. This applies to all steering systems, with or without servo action. Consequently, certain concessions must be made when designing the steering. It is important to avoid an impression of over-light steering at high vehicle speeds.

The Servotronic II regulates the actuating torque at the steering wheel as a function of vehicle speed. The maximum servo action is provided when the vehicle is stationary or moving very slowly (e.g., when parking).



In addition to its actual function, the method of operation of the Servotronic II has two more advantages:

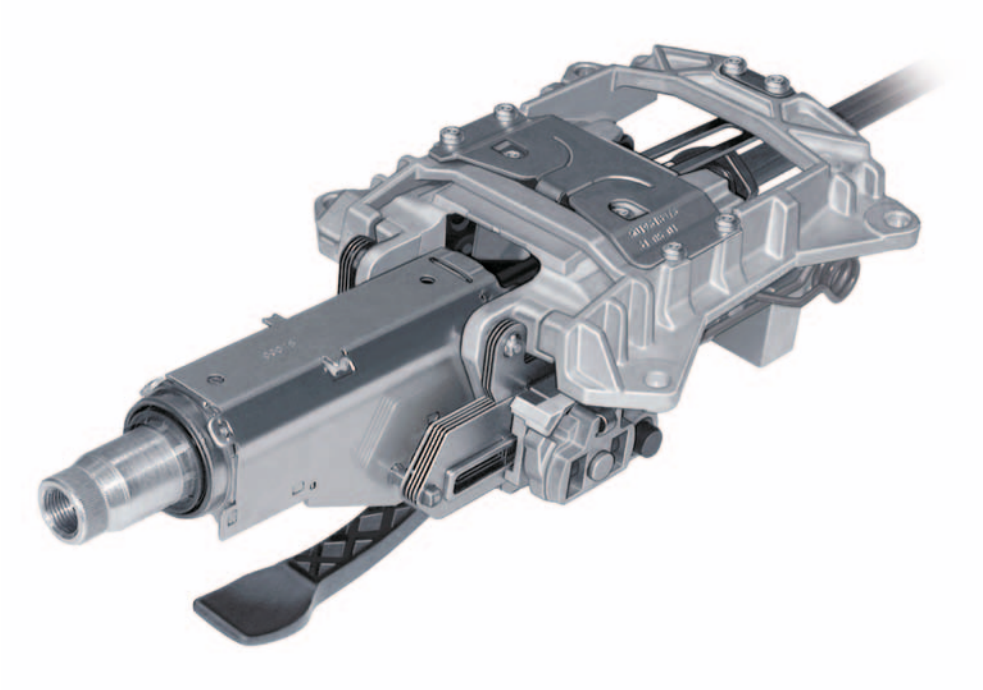
- The guide collar for the balls provides additional steering centering. Straight-ahead stability is enhanced, particularly at high speeds.
- Fluid pressure and flow rate is not reduced. This means that there is always a safety margin for dealing with emergencies (e.g. in case of abrupt, unforeseeable steering correction).



Steering Column

The main components of steering columns with mechanical and electrical adjustment are the same. Both have an electrical steering lock.

The steering wheel mounting splines now have 72 detent positions instead of six.

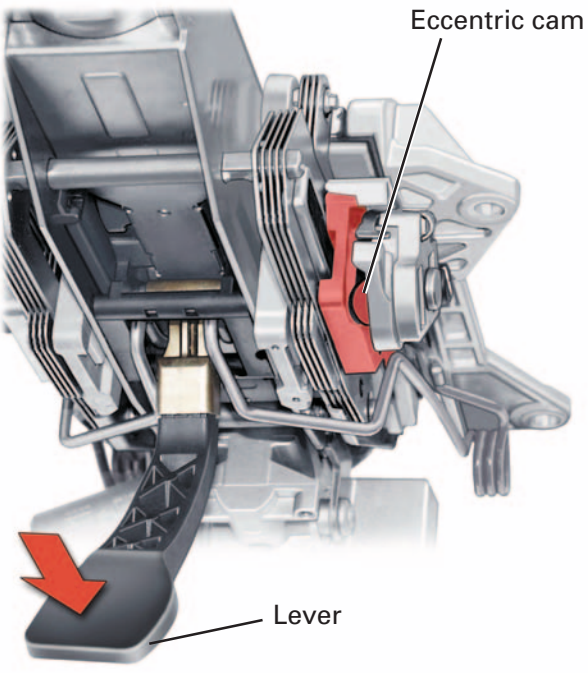


Steering Column with Mechanical Adjustment

The steering column is fixed in position with two sets of plates. Each set has eight steel plates. Four plates each permit axial adjustment. The adjustment recesses in the plates are arranged axially.

The other four plates on each side are arranged vertically and allow vertical adjustment. Clamping is achieved by two rollers that run up a ramp on a cam plate during the locking process.

An over-center spring keeps the lever in position

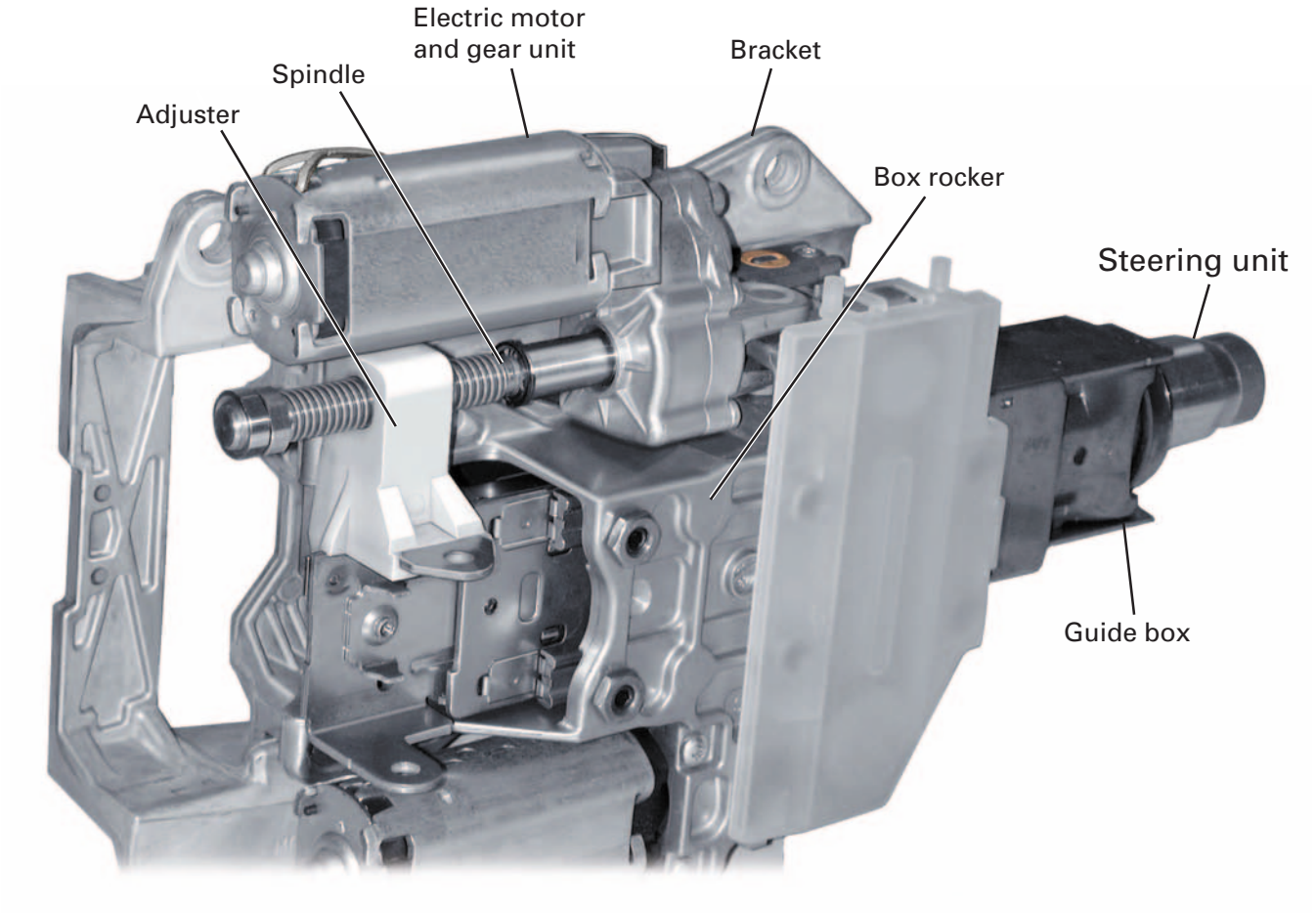


Steering Column with Electrical Adjustment

Axial Adjustment

The electric motor with gear unit and spindle is permanently connected to the box rocker. The guide box with steering unit is permanently connected to the adjuster. The spindle is screwed into the internal thread of the adjuster.

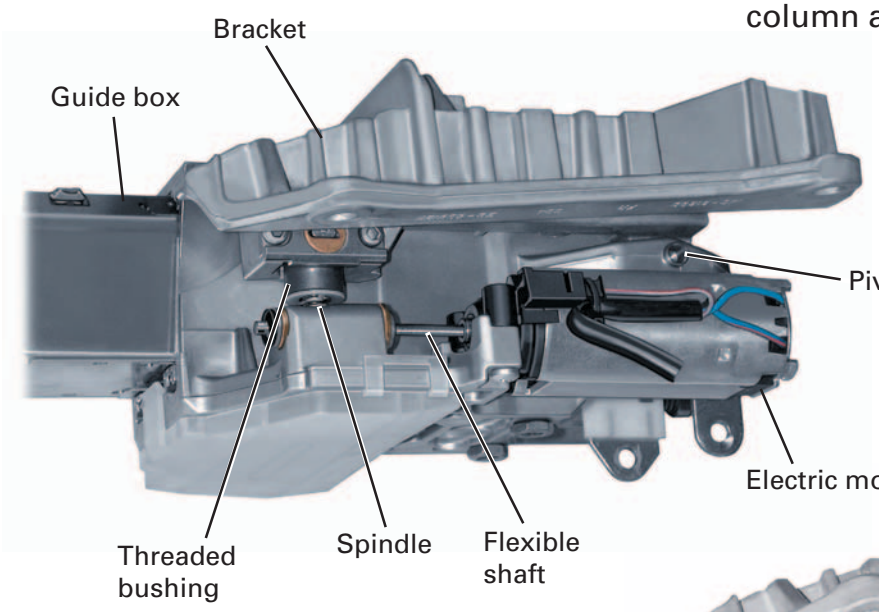
The rotation of the spindle is converted into axial movement of the adjuster with guide box and steering unit. The electric motor has a Hall Sensor which measures the number of revolutions. The control unit uses this information to determine the current position in the steering column adjustment range.

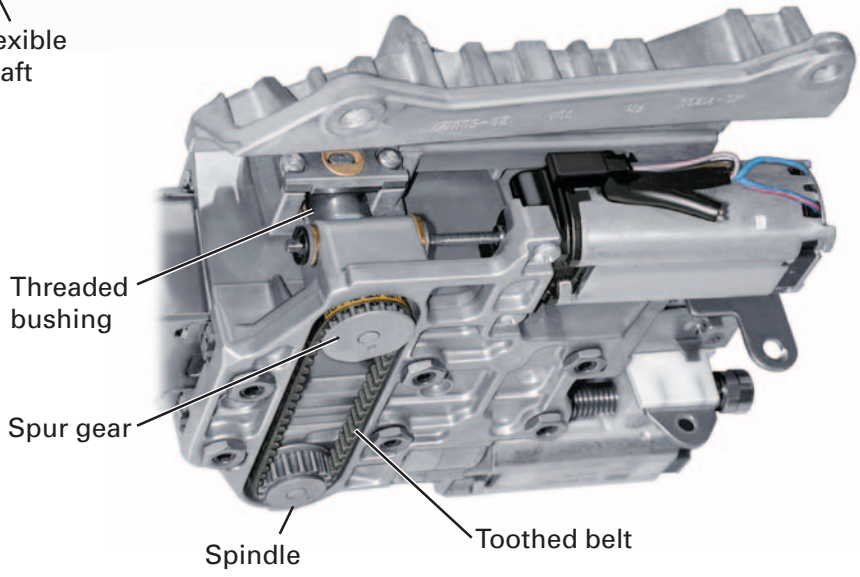


Vertical Adjustment

The box rocker with guide box and steering unit is swivel-mounted in the bracket. The electric motor with a flexible shaft, spindle and gear unit is permanently connected to the box rocker.
The spindle engages a threaded bushing which is mounted in the bracket.
Rotation of the spindle produces vertical movement of the threaded bushing. The rocker with guide box and steering unit turns around the joint pivot point.

The other end of the spindle is permanently connected to a spur gear. A toothed belt transfers the rotation to a spindle on the other side of the steering column, where the adjustment is made. The two-sided mounting system provides a much more rigid attachment of the steering column.
As with the axial adjustment, a Hall Sensor in the electric motor measures the number of revolutions. The control unit uses this information to determine the current position in the steering column adjustment range.

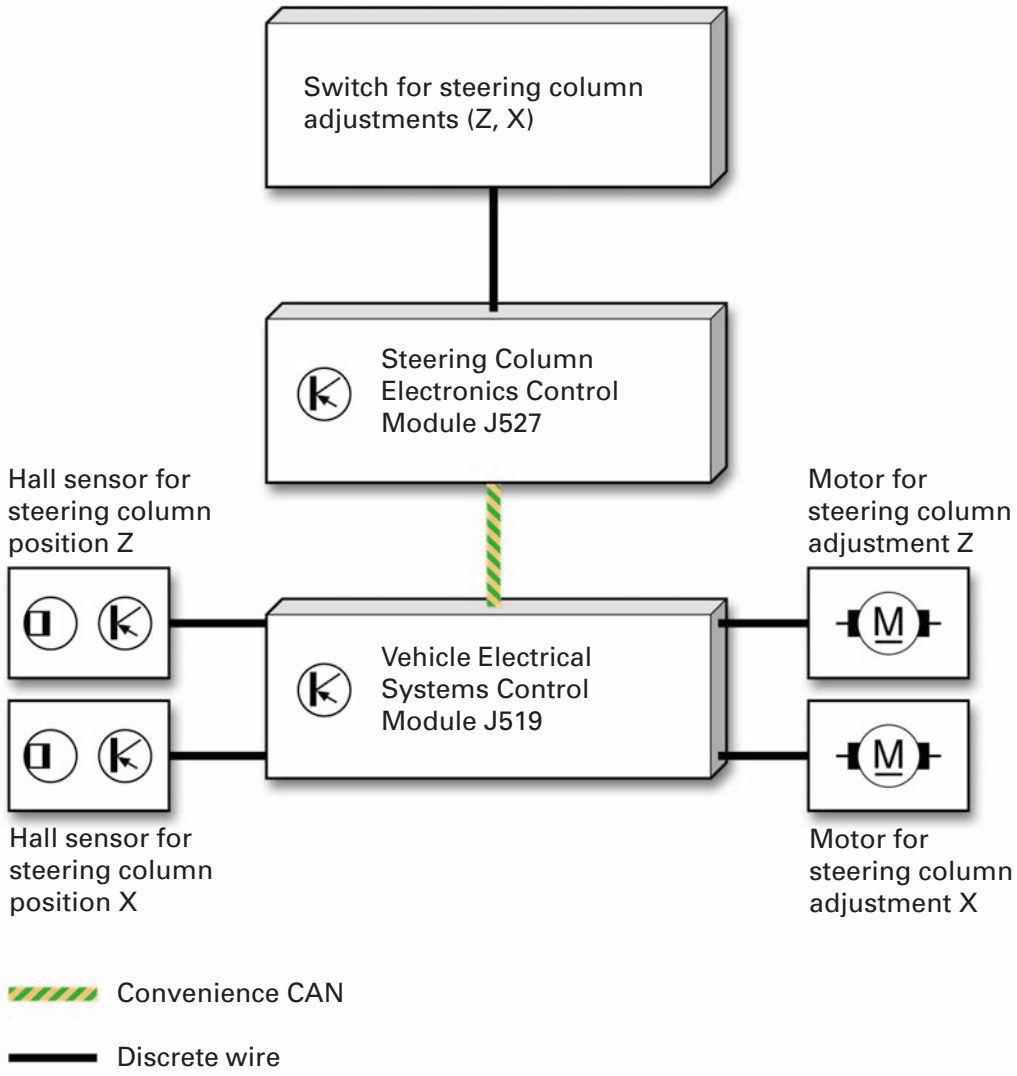




Steering Column Adjustment Block Diagram

During assembly, the fully up and fully retracted positions of the steering column are stored the Vehicle Electrical Systems Control Module (J519) as the default positions.

Every time the driver adjusts the column, the Hall senders record the number of revolutions of the corresponding adjustment motor. The control module J519 uses these values and compares them to the stored positions to determine the current position of the steering column in the adjustment range.



Electric Steering Column Lock (ESCL)

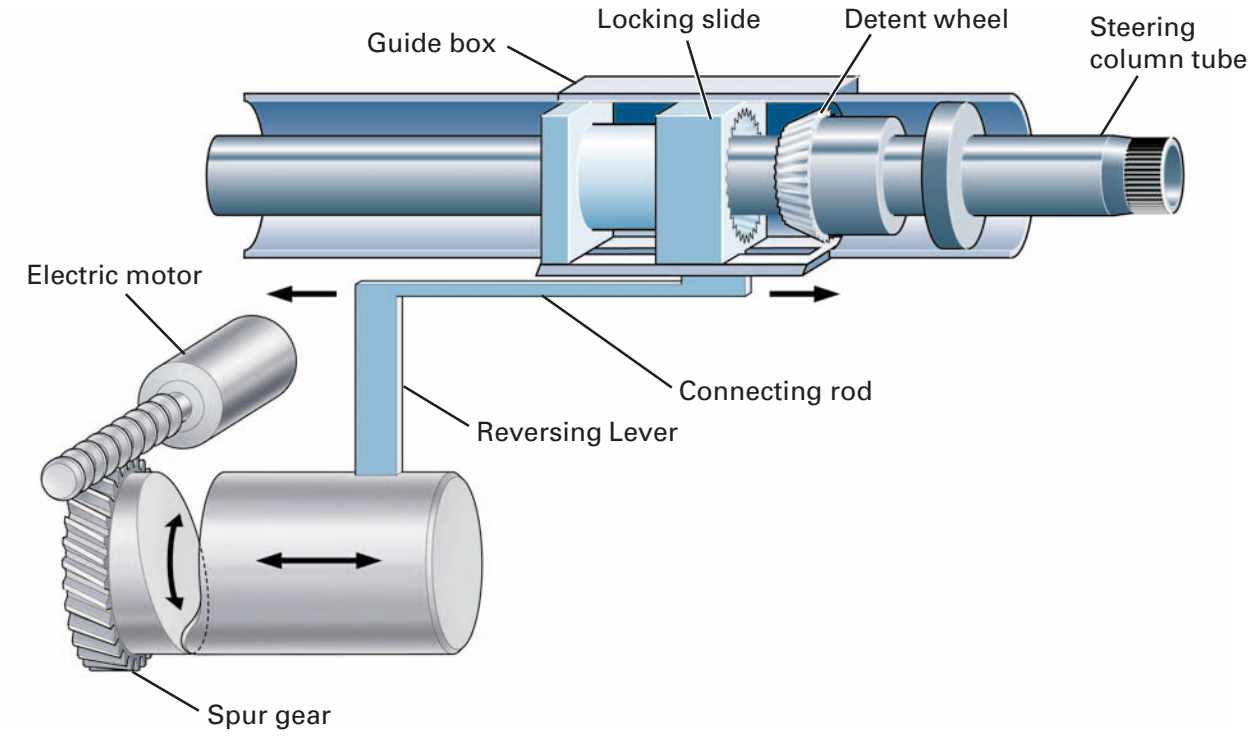
There are several advantages to installing the ESCL unit and the locking mechanism in different locations:

- Passive Vehicle Safety: Space for additional knee guards.
- Anti-Theft Protection: Components less accessible.
- Costs: Arrangement of control unit, motor and gear unit in one assembly.

Design

The detent wheel has beveled outer splines. It is connected with a friction clutch to the steering column tube. An axially adjustable, locking slide with beveled inner splines, is mounted in the guide box.

The electric motor drives the spur gear. The axially adjustable reversing lever is mounted in the ESCL unit and linked with the connecting rod to the locking slide.



Operation

Actuation of the motor turns the spur gear. The side face of the spur gear takes the form of a ramp. The reversing lever runs on this ramp and is axially adjusted in line with the position of the spur gear and ramp position.

The movement of the reversing lever is transmitted directly to the locking slide. Meshing of the locking slide and detent wheel mechanically locks the steering column.

The ESCL unit is connected to the steering column with shear bolts and can only be replaced together with the steering column.
For information on operation and electrical function, refer to 999303, Electrical System Components.

Service:

The ESCL function can be tested with the VAS5051 Control Element Test. Matching is performed with the adaptation function.

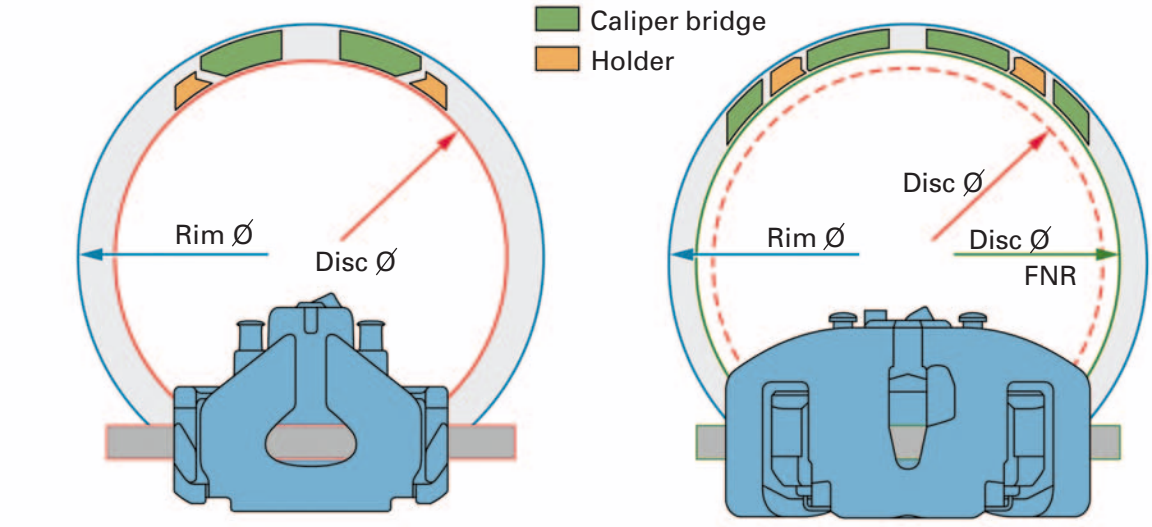
For details, refer to current Workshop Manual and Assisted Fault-Finding.

System Components

Front Axle Brake Caliper

The 2004 Audi A8L is equipped with a new floating frame type (FNR) caliper. The caliper is a frame, which allows for a reduction in material thickness at the caliper bridge. Therefore, it is possible to use a 14-inch (360mm) diameter brake disc in 17-inch wheels. In the past, 18-inch wheels were required for this brake disc dimension.





Comparison of technologies: FN and FNR disc brake in the same wheel

Rear Axle Brake Caliper

The 2004 Audi A8L has aluminum, floating rear brake calipers. Brake disc diameter and pad area has been enlarged to adapt them to the front brake dimension. This results in greater braking power and a longer pad service life.

Corrosion resistance has been improved with stainless steel pad springs and greater pad clearance in the pad guides. Other details were modified to reduce the noise level, optimize braking comfort and ensure environmental compatibility. The rear axle brake caliper was designed for use with the Electromechanical Parking Brake (EPB).

Brake Servo

A tandem, vacuum-type brake servo (8 and 9 inch, same basic design as A4 and A6) is used. Compared to the to the A4 and A6, the transmission ratio has been increased to 7:1. The inlet valve flow characteristics have been optimized and the valve closing distance shortened. As a result, the servo response is much quicker and more precise, and the operating feel is improved.

Vacuum is supplied by a suction jet pump driven by the intake manifold vacuum.

Brake Master Cylinder

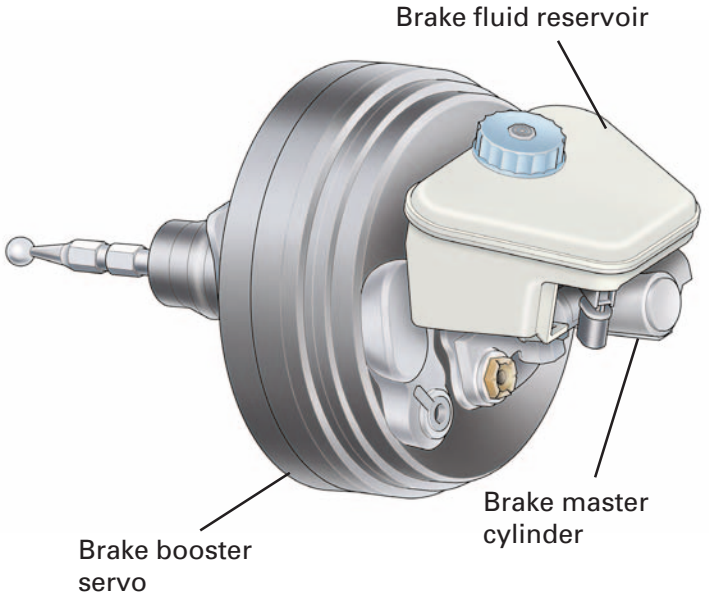
The 2004 Audi A8L has a tandem brake master cylinder. Compared to the A4 and A6, the piston diameter is increased to 1.063-inch (26.99mm) with a total stroke of 1.41-inch (36 mm, 18/18). The central valves of both brake circuits (diagonal configuration) are designed for optimum flow. This permits the use of a self-priming ESP unit without a separate charging pump.

These changes and the modifications to the brake servo result in a significant reduction in pedal travel before brake response and less pedal force. Safety is enhanced by shortening the stopping distance.

Brake Fluid Reservoir

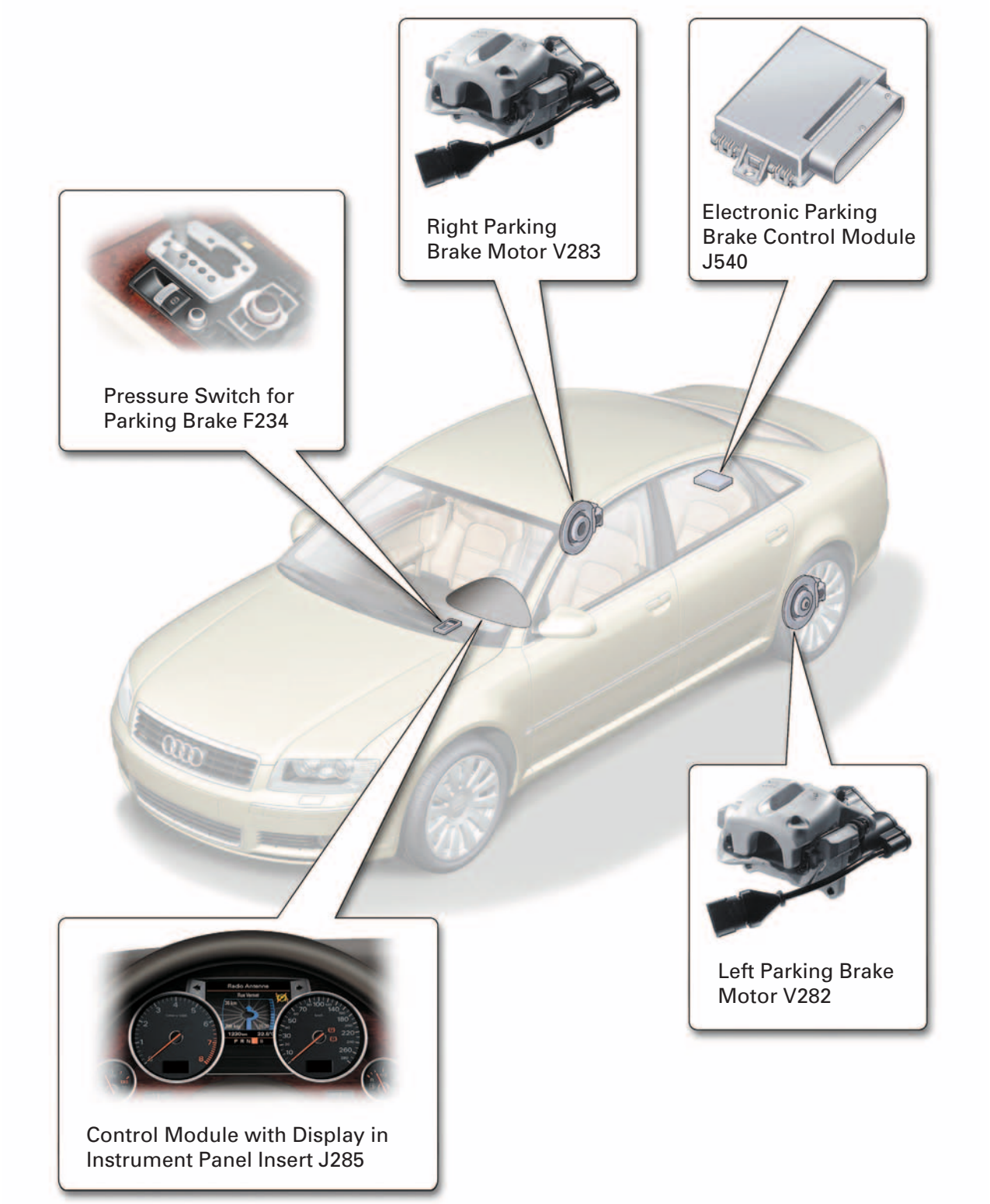
The brake fluid reservoir is a separate component installed in the brake master cylinder.

The brake fluid reservoir should never be completely drained because of the position of the connections. Air will enter the brake system. Refer to the current Workshop Manual for procedure for changing brake fluid.



Electromechanical Parking Brake

Introduction



Operation and Display

The parking brake is actuated by the pressure switch (F234) in the center console. The brake is applied by pulling the switch. It is released by pressing the switch and at the same time, pressing the brake or accelerator pedal.



The EPB can be applied by pulling the switch even when the ignition is off, however the ignition must be on for the brake to be released.

When the parking brake is applied, the parking brake display in the Instrument Panel Insert and a lamp in the switch are illuminated.



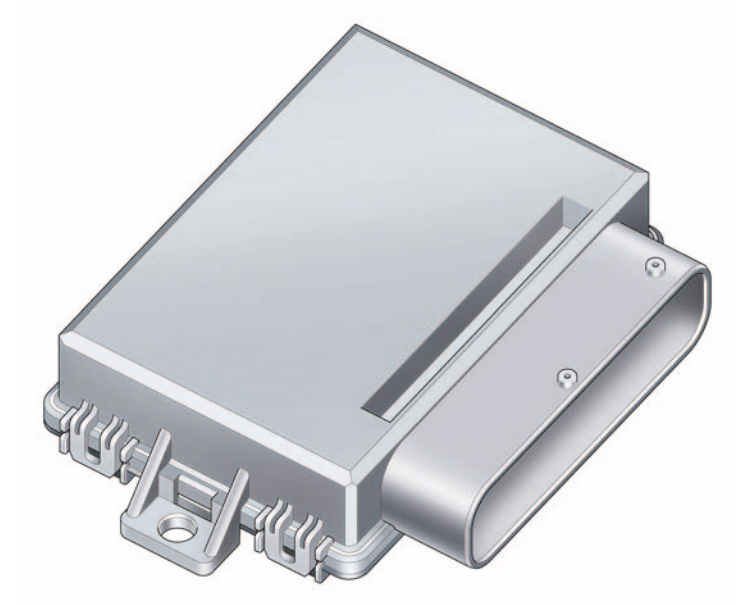
Parking brake display

Electromechanical Parking Brake

System Components

Electronic Parking Brake Control Module (J540)

The Electronic Parking Brake Control Module is mounted under the battery on the right side of the trunk. From the battery, the left and right parking brake motors (V282/283) are actuated separately.



There are two processors in the Parking Brake Control Module. Both processors make release decisions. Data are transferred over the Drive System CAN (refer to "Data Transfer"). The Parking Brake Control Unit has an integrated micro-mechanical tilt angle sensor.

Parking Brake Motors (V282/283)

Design:

The brake pads are mechanically tensioned with a spindle mechanism. The thread on the shaft is self-locking. The spindle is driven by a swash plate mechanism.

The mechanism is driven by a DC motor. The mechanism and motor are flanged to the brake caliper.

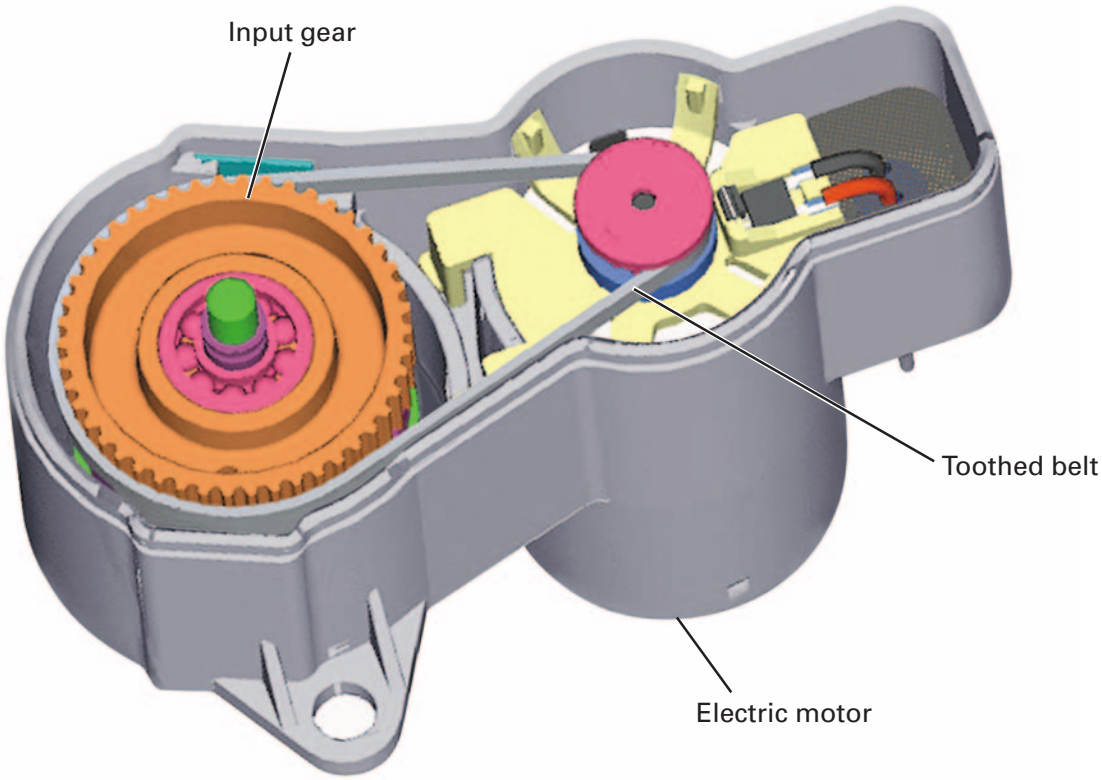


Electromechanical Parking Brake

Operation:

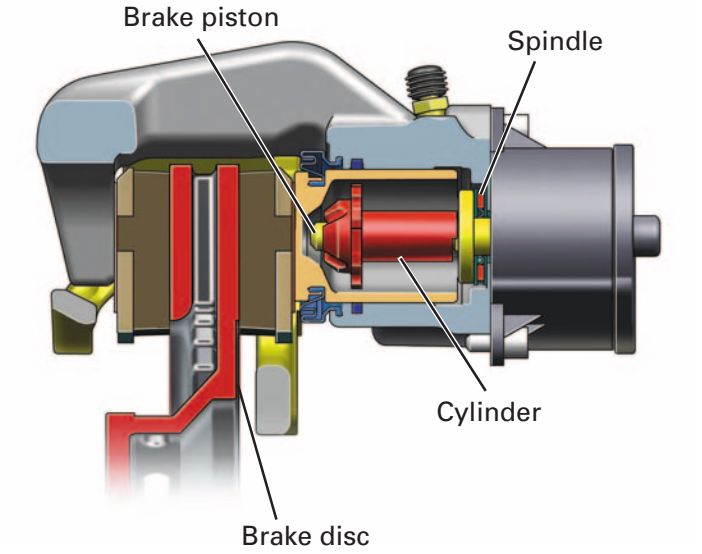
Implementation of the parking brake function involves translating the rotation of the drive motor into a very short brake piston stroke. This is achieved with a swash plate mechanism and the spindle drive.

There are three stages. The first reduction stage (1:3) is achieved by the motor/gear mechanism input toothed belt drive.
The swash plate mechanism controls the second stage.
A speed reduced by a factor of 147 with respect to the electric motor drive speed, is available at the gear mechanism output.



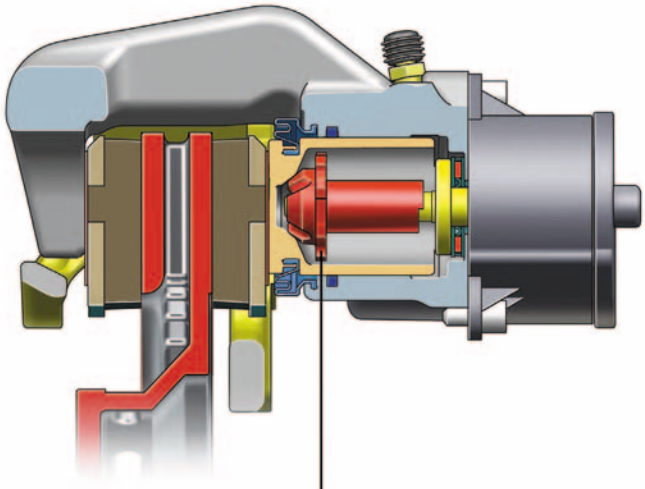
Electromechanical Parking Brake

A spindle, which drives the brake piston, is responsible for converting the rotation into a stroke. The spindle is driven directly by the swash plate mechanism. A cylinder is mounted so that it can slide axially in the brake piston. Two plane surfaces stop the cylinder turning. The flared section at the end of the cylinder is provided with a nut. Rotation of the spindle moves the nut on the spindle thread. The number of motor revolutions is measured by a Hall Sensor which allows the Parking Brake Control Unit to calculate the piston stroke.



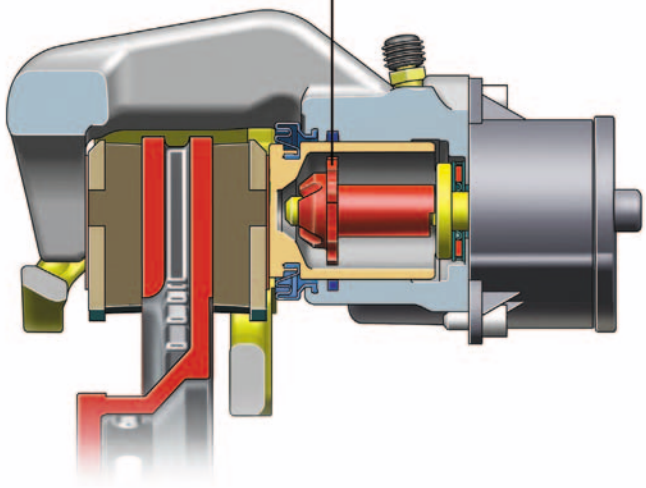
Parking Brake Application

The nut moves forwards on the spindle. The cylinder makes contact with the piston. Cylinder and piston are pressed against the brake disc.



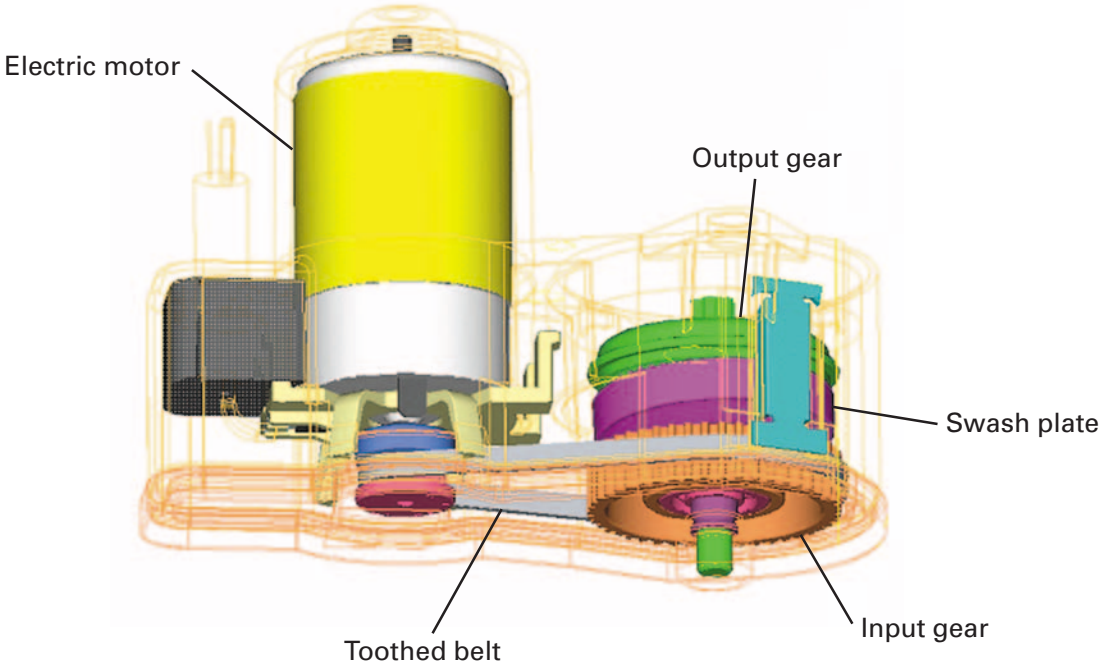
Parking Brake Release

The nut is screwed back on the spindle, which relieves the load on the cylinder. The recovery of the sealing ring moves the piston back and releases the brake disc.

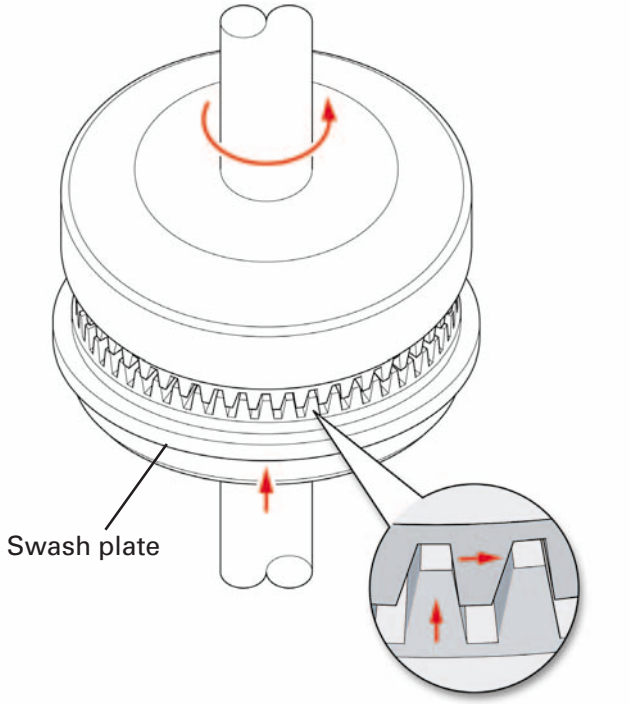


Swash Plate Mechanism Operation

A wheel (swash plate) with beveled splines is mounted on the input gear. It is mounted at an angle with respect to the input gear shaft. This causes the plate to wobble as the input gear rotates. The plate is fixed in position by keyways in the gear housing. It cannot turn freely.

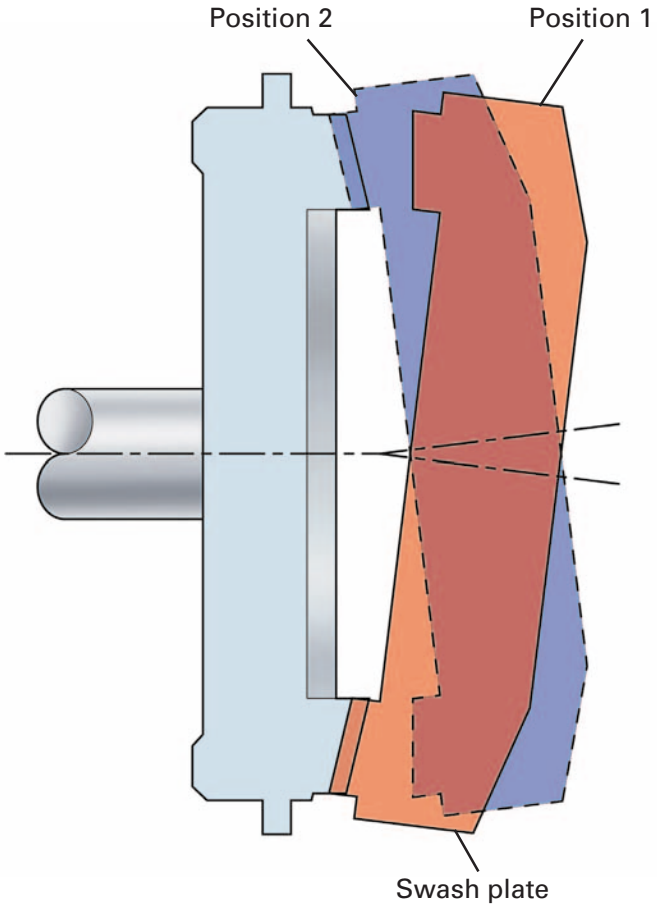


The swash plate has 51 teeth, the output gear 50 teeth. Because of this "pitch error," the swash plate teeth always make contact with the flanks of the output gear and never collide with the tooth spaces. Consequently, the output gear is moved on by a small angle of rotation.



Electromechanical Parking Brake

Two output gear teeth are meshed with two swash plate teeth in one revolution of the input gear. The wobble causes the second pair of teeth (Position 2) to be meshed after half a revolution of the swash plate. In Position 1, the output gear is moved so that the tooth of the swash plate again makes contact with an output gear flank in Position 2. Because of this sequence, each half revolution moves on the output gear and the spindle connected to it by half a tooth face width.



Functions

The following functions are provided by the EPB:

- Parking Brake Function
- Dynamic Emergency Braking Function
- Adaptive Starting-Off Assistant
- Brake Pad Wear Recognition and Play Correction

Parking Brake Function

The tensioning force set by the system is enough for all driving situations. A text message in the Dash Panel Insert Center Display warns the driver in case of gradients exceeding 30%.
Activated status is indicated by lamps in the switch and Dash Panel Insert.

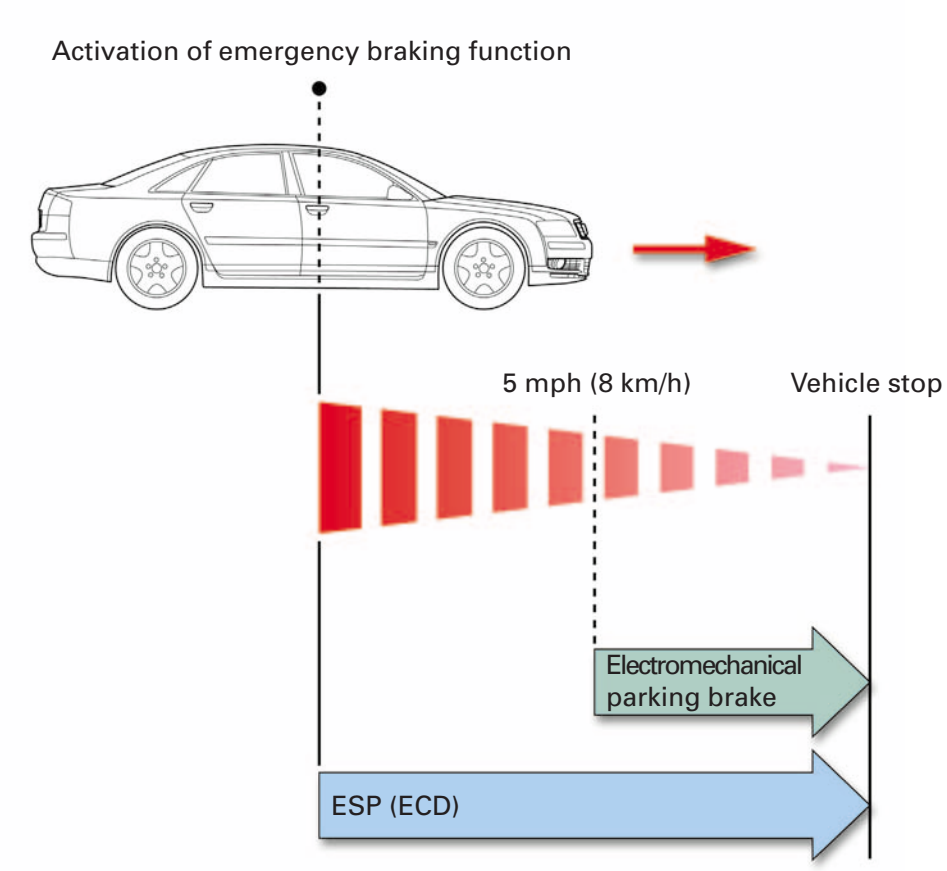
The brake is automatically re-tensioned if the disc cools after parking the vehicle. For this purpose, the current disc temperature is constantly established with a simulation model in the control unit.

Dynamic Emergency Braking Function

Pulling the Parking Brake Pressure Switch (F234) slows the vehicle at a maximum deceleration rate of 8m/s^2. Operation corresponds to that of the handbrake lever. The vehicle is braked as long as the switch is pulled. Braking action is terminated when the switch is released.

If the vehicle is travelling at a speed of more than 5 mph (8 km/h), braking is performed by the ESP Control Module. With the accelerator pedal still pressed, engine torque is reduced to idling level and the ESP Control Module assembly builds up brake pressure at all four wheel brakes. If the Cruise Control System is operating, it is deactivated.

Actuation of the switch at vehicle speeds below 5 mph (8 km/h) causes the parking brake to be applied.
To prevent accidental operation (triggered for example by the front passenger), the emergency braking function is deactivated as soon as the accelerator is pressed again.



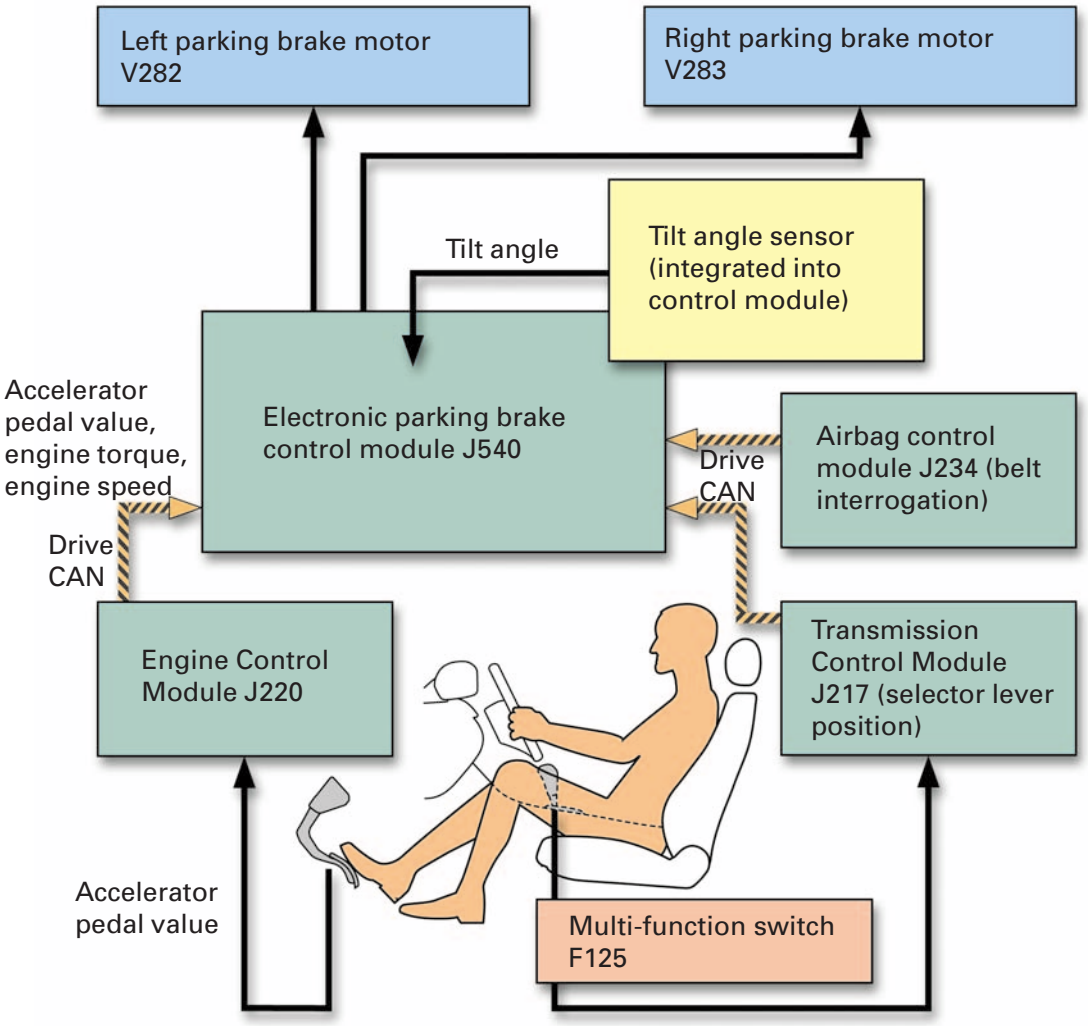
Electromechanical Parking Brake

Adaptive Starting-Off Assistant

The Adaptive Starting-Off Assistant prevents the vehicle from rolling backward when it is started on a hill. The function is only activated if the seat belt is fastened.

The angle of the vehicle is measured by a sensor in the control unit. In addition, the control action allows for engine torque, accelerator pedal position and selected gear. These parameters control the point at which the parking brake is released when driving off.

The tilt angle sensor and starting-off parameters are constantly calibrated. Whenever the vehicle is started on the flat, its acceleration behavior is evaluated and adjusted for control purposes to the parameter stored in the control unit. The function cannot be deactivated by the customer.



Brake Pad Wear Recognition and Play Correction

The thickness of the brake pad is automatically determined (approximately every 310 miles or 500 km) when the vehicle is stationary, the ignition locked and the parking brake released. The brake pad is moved out of its neutral position (end position) towards the brake disc. The value is measured by a Hall Sensor and is used by the control module to calculate the brake pad travel and therefore, the pad thickness.

If drivers regularly use the parking brake, the wear measurement may be less precise than if the parking brake is seldom applied.

Special System Functions

Pad Change Mode

Pad change is performed using the VAS5051 Diagnosis Tester with the parking brake released.

In Basic Setting Function 5, the cylinder is fully retracted by the spindle drive. The pad can be replaced after resetting the brake piston with the special tool VAST10145.

In Basic Setting Function 6, the cylinder is moved back toward the piston.

The pad thickness is entered in Adaptation Function 6. For more information, refer to the current Workshop Manual.

Roadworthiness Test Mode

A dynamometer must be used to monitor braking when checking the operation of the parking brake.

Roadworthiness Test Mode is recognized after three seconds when the rear wheels are turning at a constant speed of between 2 and 6 mph (3 and 9 km/h) on the dynamometer roller.

The ignition must be on.

The parking brake application is modified by the control module:

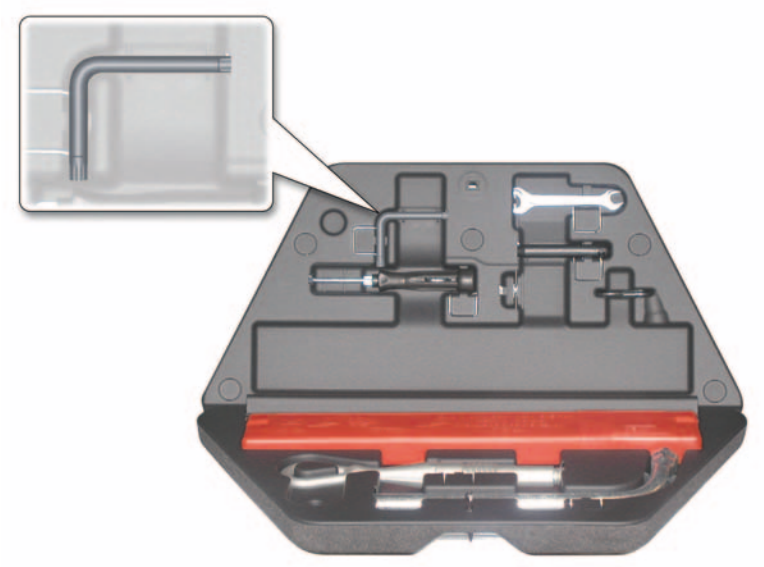
Each time the switch is actuated, the piston is moved by a small predetermined amount and the brake is applied a little more.

Electromechanical Parking Brake

Emergency Release

The parking brake can be released mechanically if electrical actuation is not possible or if the parking brake components are not operating properly. An emergency key in the vehicle tool kit is provided for this purpose
The vehicle must be raised and the appropriate wheel removed.

The Torx head at one end of the emergency key is used to remove the actuator from the brake caliper. The spindle is then turned with the other end of the emergency key until the brake is released.

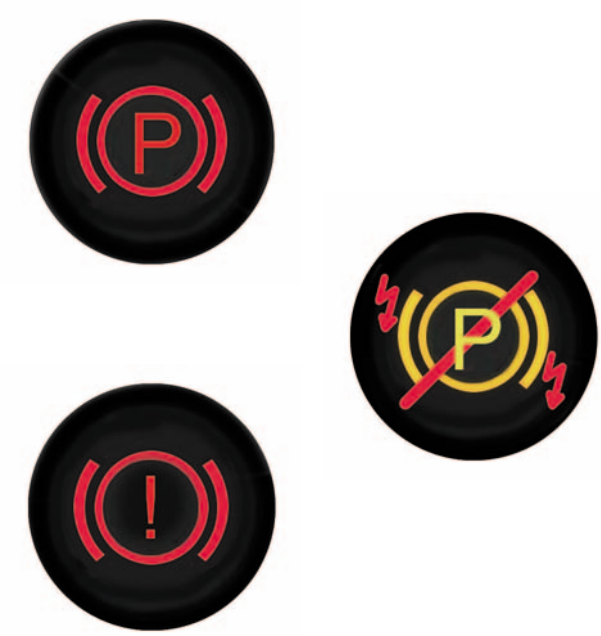


Fault Displays

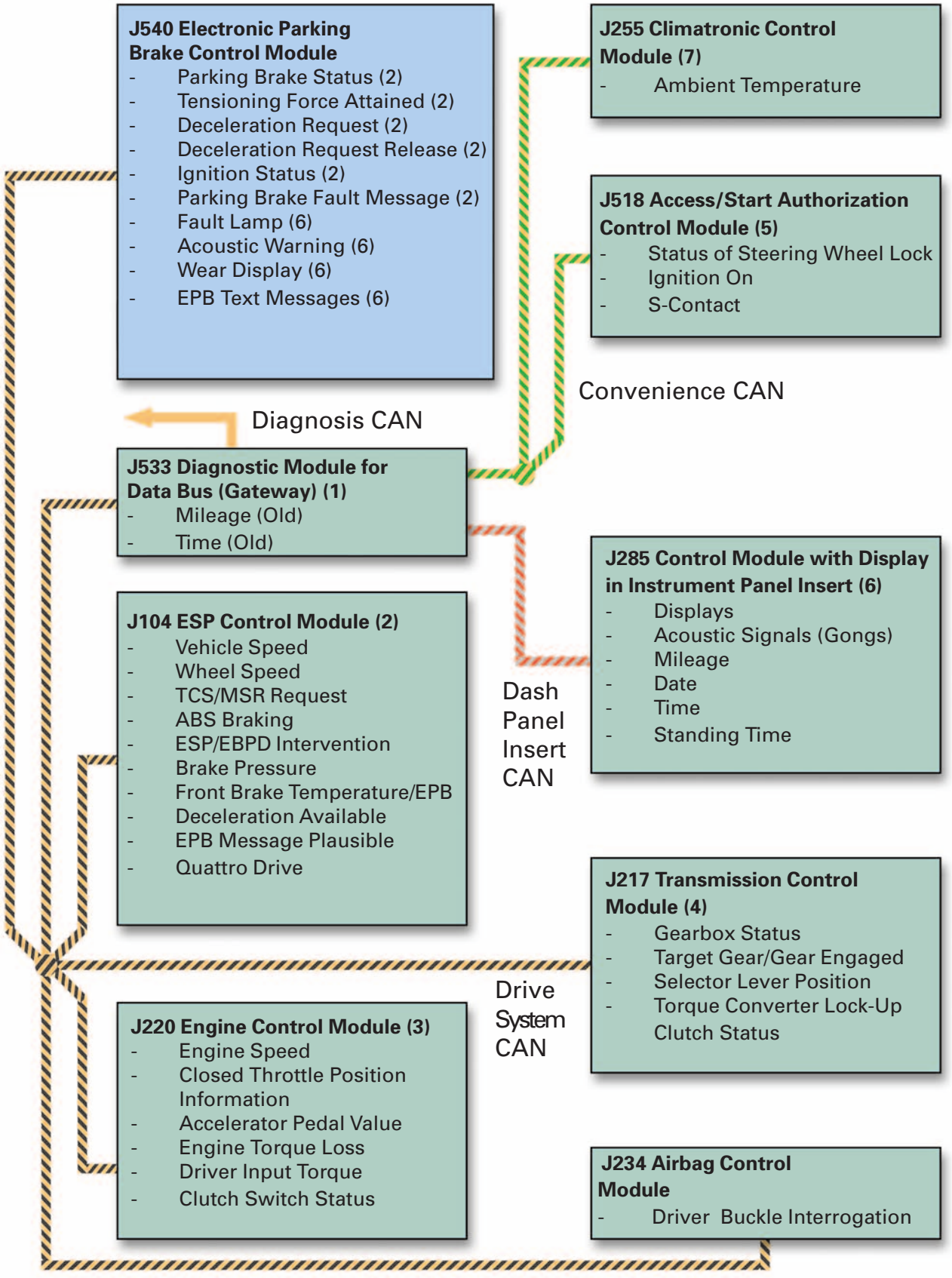
If the parking brake has not been properly applied, the display flashes constantly. If the display flashes when the parking brake pressure switch is activated, it means there is a wiring fault.

Fault detected by control unit restricting operation.

System fault; vehicle should no longer be driven for safety reasons.



EPB CAN Data Exchange



Electronic Stability Program (ESP)

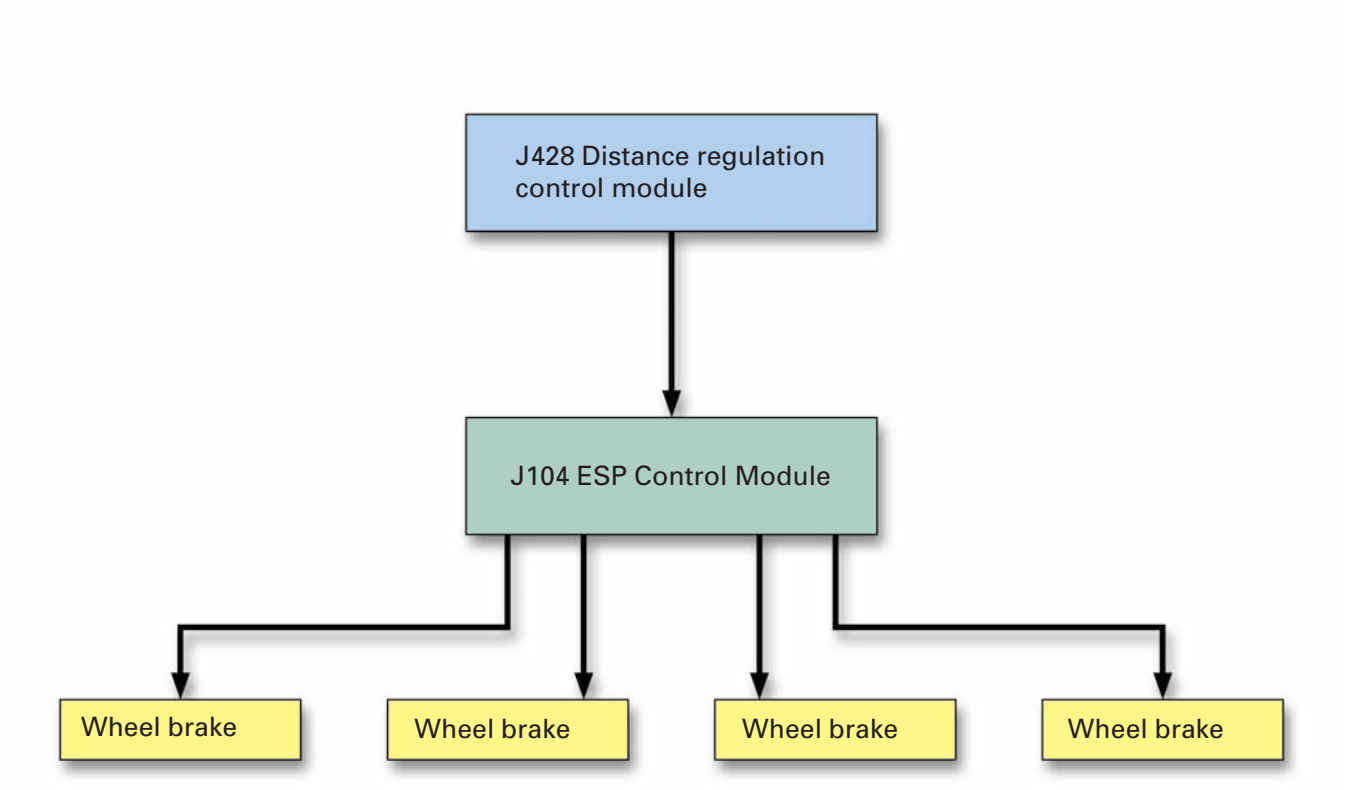
Introduction

The 2004 Audi A8L is equipped with the ESP 5.7 which is used in the Audi A4. In addition to the necessary software adaptation to the new vehicle, there are several new features.

Communication Interface ABS (Anti-Lock Brake System)

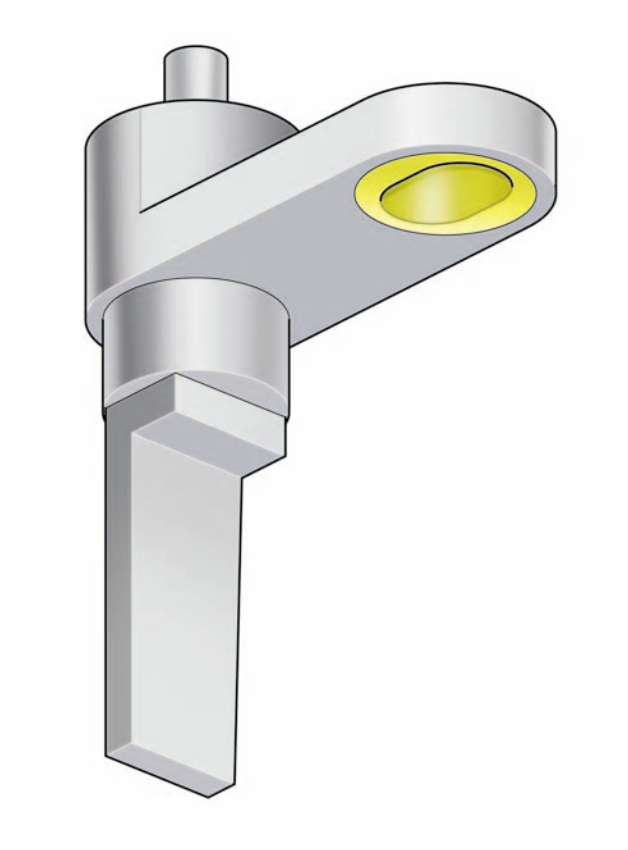
The Communication Interface enables other vehicle systems to actuate the ESP. The ESP Control Unit can be informed directly of deceleration requests. The ABS request involves deceleration of the vehicle at a maximum rate of 8 m/s^2.

Brake pressure is built up evenly at all four wheels.
The interface in the A8L is used by the EPB and Adaptive Cruise Control functions.



Active Speed Sensors

The new sensors detect the corresponding wheel speed directly at the wheel bearing with magnetic multi-poles. Direction of rotation and size of air gap are also determined.



New Software Modules

The Traction Control System (TCS) function has been upgraded to include improved traction on non-compacted surfaces such as deep snow.
Greater wheel slip values are accepted for acceleration when travelling straight ahead or with small steering angle.
Directional stability has priority when cornering. The permissible slip values are reduced.

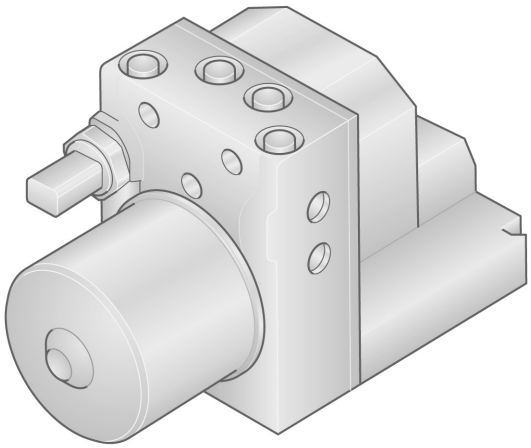
ESP control action is reduced if a sporty driving style is required. Directional stability is maintained but larger float angles are permitted, leading to higher wheel slip values in transverse vehicle direction.
A sporty driving style is recognized from evaluation of accelerator pedal actuation.

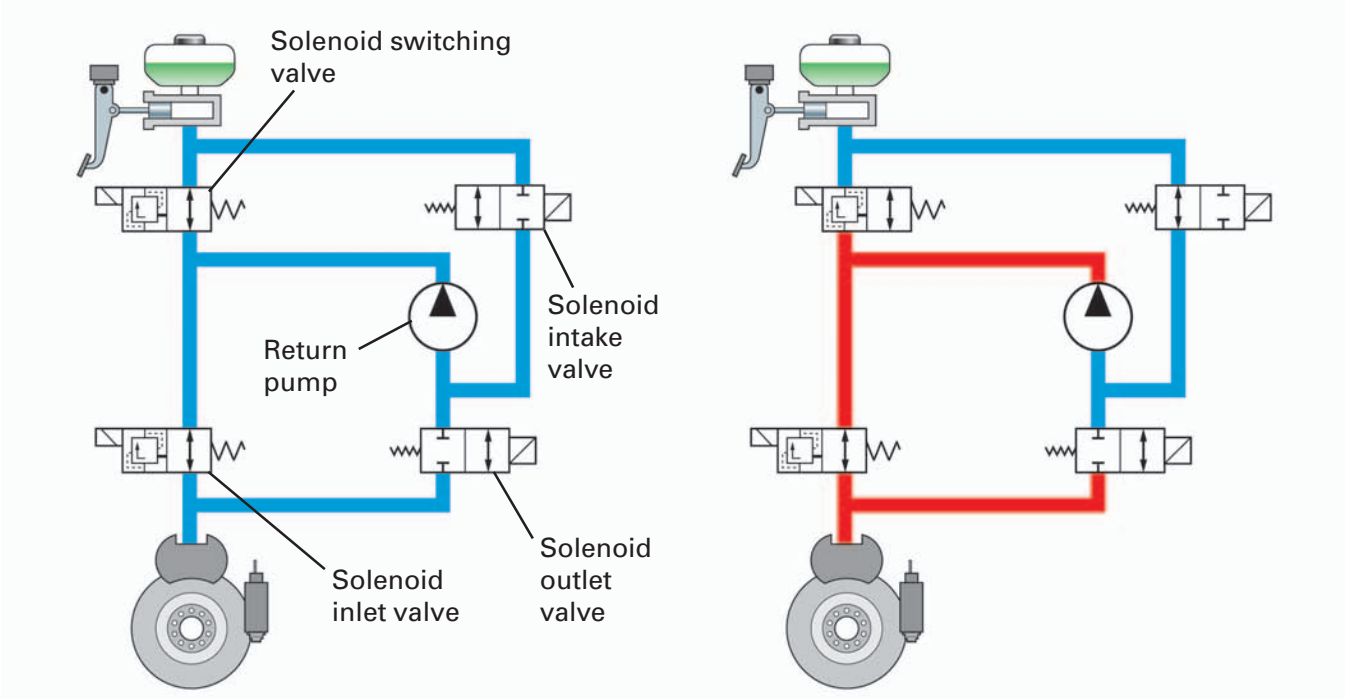
Electronic Stability Program (ESP)

System Components

Hydraulic Modulator

The basic version of the hydraulic modulator is the same as the Audi A4. This customized hydraulic modulator is only used in vehicles equipped with Adaptive Cruise Control. Integrated suction dampers are used to comply with noise level requirements during Adaptive Cruise Control operation. The dampers are small rubber chambers that lessen brake fluid pulsation. The linear solenoid inlet and switching valves developed for the ESP 5.7 are used to attain a high level of braking comfort.





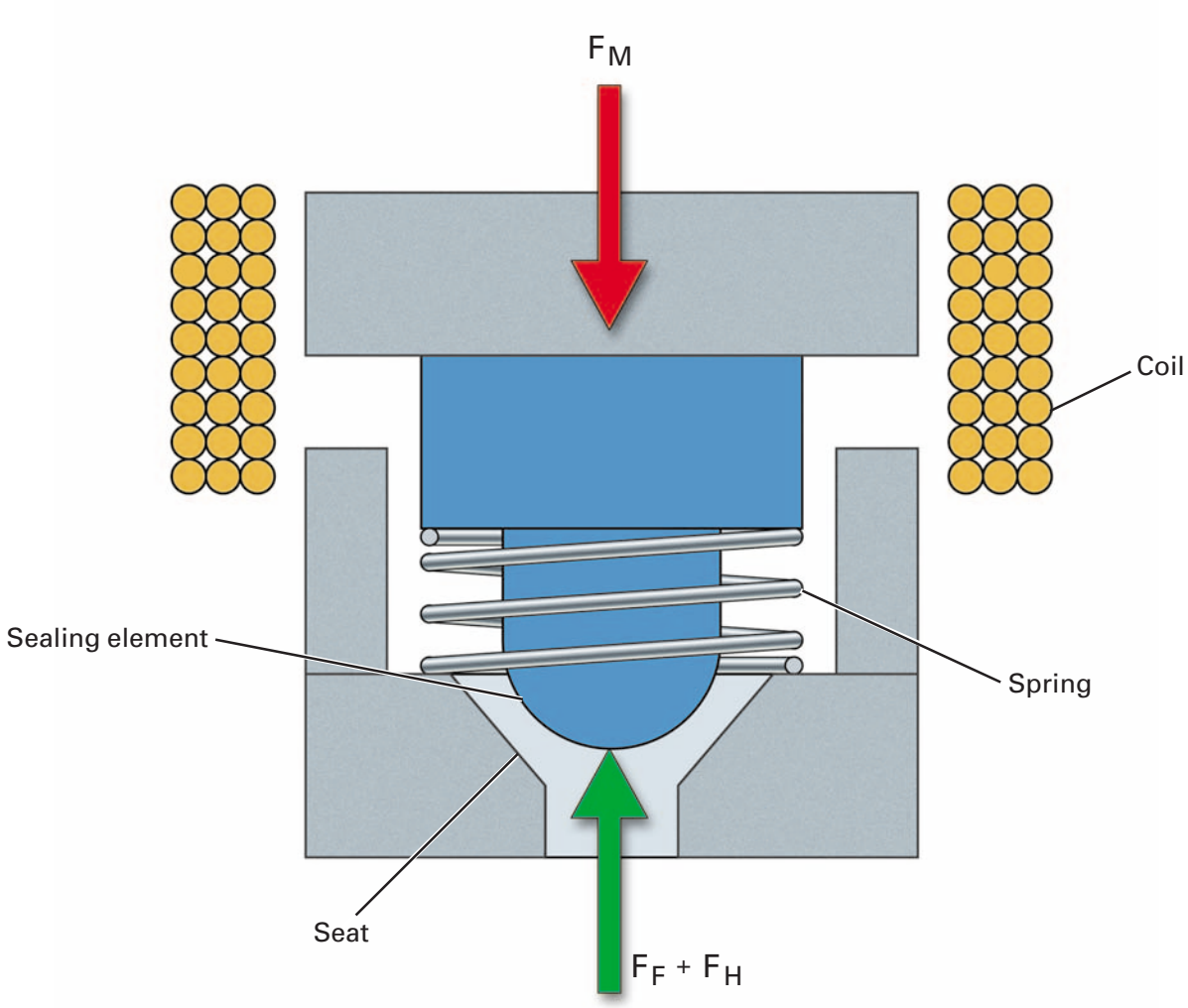
ABS Request Not Active: Valves de-energized, driver can regulate brake pressure by open solenoid switching and inlet valves.

Pressure Build-Up in Response to ABS Request: Solenoid switching and intake valves energized, return pump suction action by open solenoid intake valve and pump regulates brake pressure.

Linear Solenoid Valves Mode of Operation

When current is applied to the solenoid valve coil, a magnetic force (F_M) acts on the sealing element.
The sealing element is pressed onto the seat in the valve housing. The forces exerted by the spring (F_F) and the hydraulic fluid (F_H) act in opposition to the magnetic force. If F_F+F_H becomes greater than F_M, the sealing element is lifted off the seat and the valve opens. The higher the current, the greater the hydraulic fluid pressure must be to open the valve.

Changing the current level can set different opening pressures. In addition, the valve stroke (valve opening cross-section) can be set in the range between fully closed to fully open. This mode enables the brake pressure to be varied as required.
Such action is a prerequisite for comfortable vehicle deceleration.

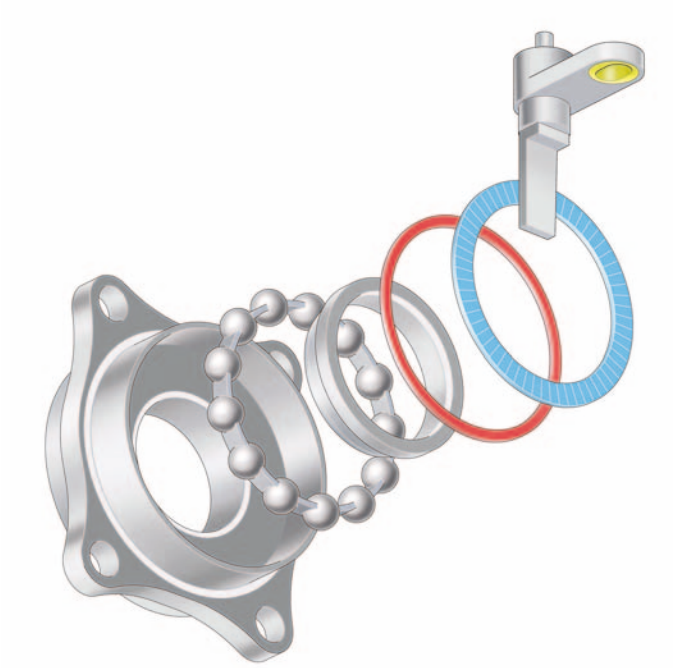


Electronic Stability Program (ESP)

Speed Sensors (G44-47)

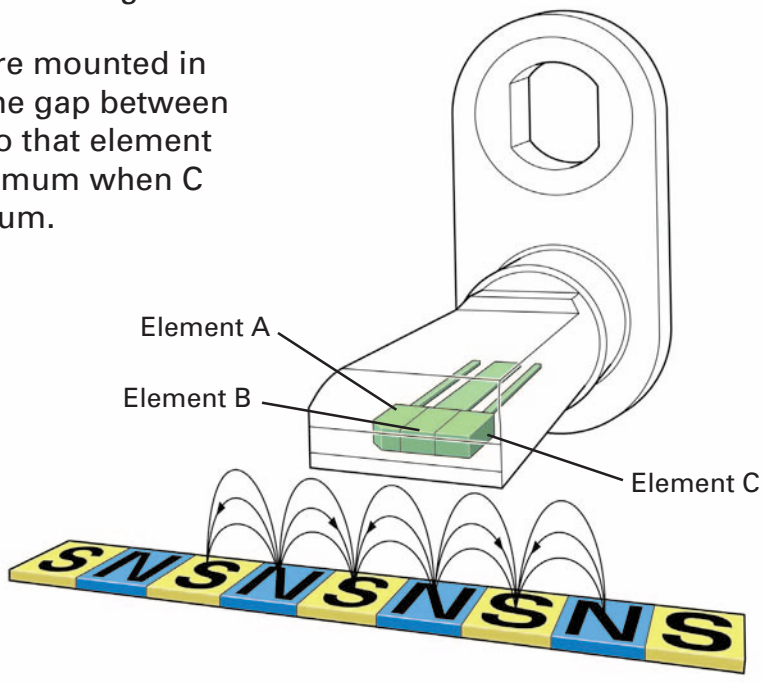
Design

The measuring element is a Hall Sensor consisting of three Hall Elements.
The previous sensor ring has been replaced by a magnetized wheel bearing seal with 48 pairs of North/South poles (multi-pole).

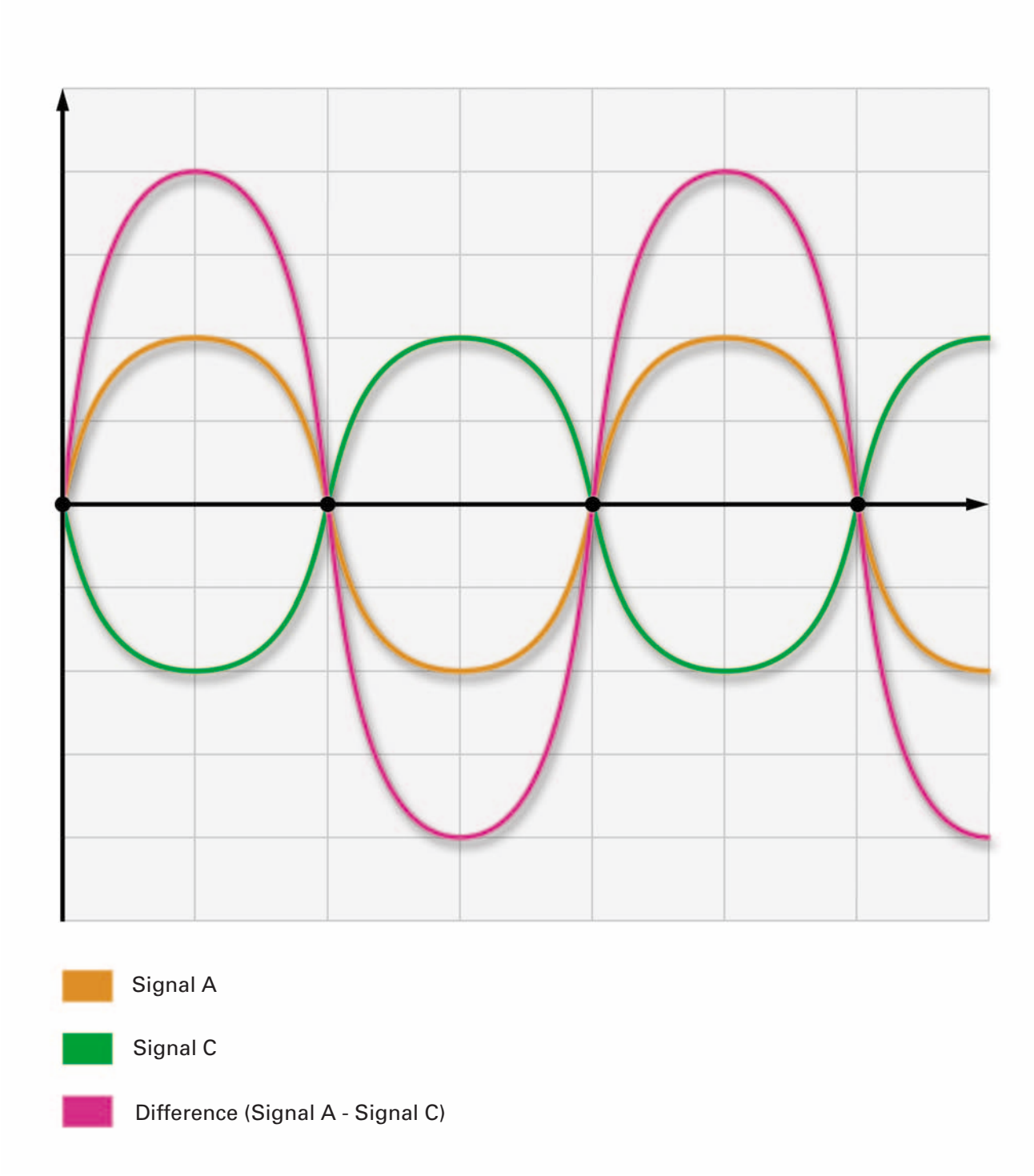


Operation

The sensor detects changes in magnetic flux density.
The three Hall Elements are mounted in an offset arrangement. The gap between the elements is selected so that element A senses a magnetic maximum when C detects a magnetic minimum.

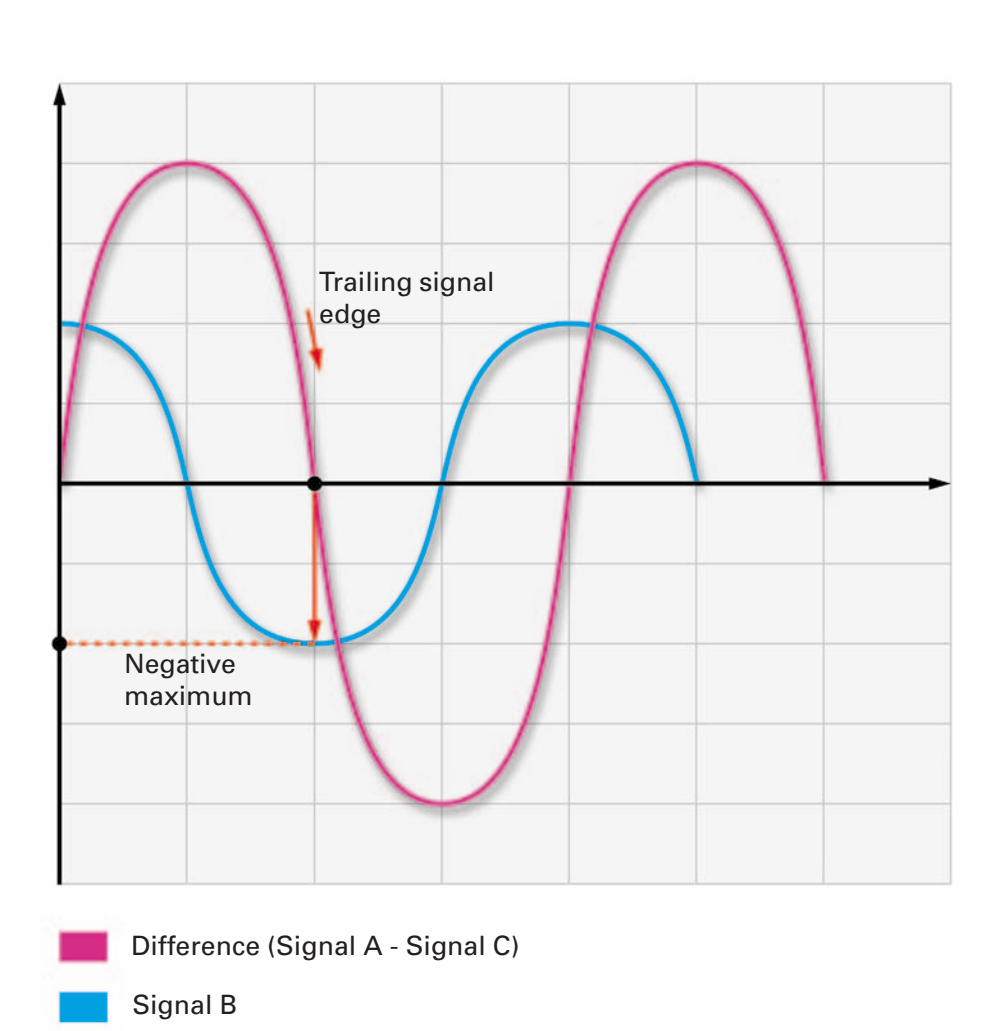


A difference signal A-C is formed in the sensor.



Hall Element B is located between A and C. Element B detects a magnetic maximum if signals A and C and thus the difference signal are at zero.
The point at which signal B reaches its maximum value (positive or negative) is evaluated to detect the direction of rotation.

If, for example, zero crossing of the difference signal A-C is reached by a trailing signal edge and the signal B maximum is then negative, anti-clockwise rotation is recognized.

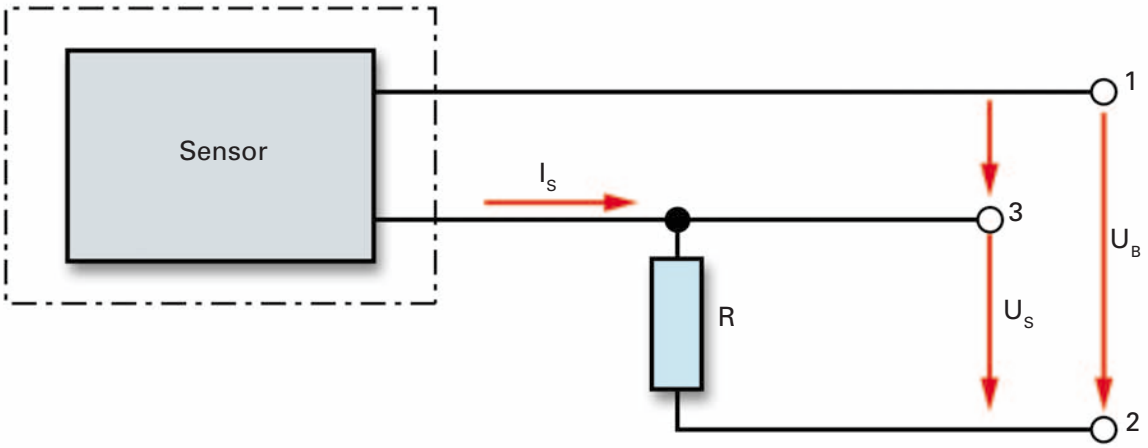


Electrical Configuration

The speed sensor is connected with a current interface to the ESP Control Module, which has a low-impedance shunt (R). The speed sensor has two electrical connections and forms a voltage divider together with the shunt.

Battery voltage (U_B) is applied between connections 1 and 2. The sensor signal produces a drop in voltage U_S at the shunt. This signal voltage is evaluated by the ESP Control Module.

Electronic Stability Program (ESP)

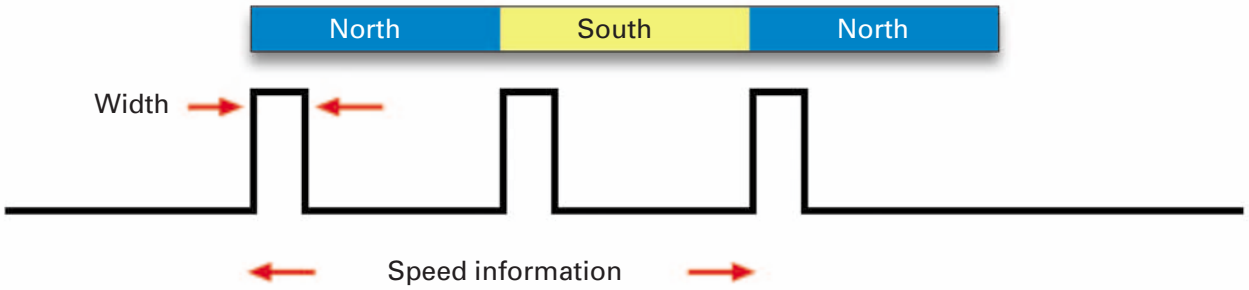


The output of the speed sensor is a Pulse Width Modulated (PWM) signal. The number of pulses in a specific time unit provides the speed information.

The following information is provided through the pulse width signal:

- Direction of Rotation
- Size of Air Gap
- Installation Position
- Detection of Stop

The correct air gap size is important for system operation and system self-diagnosis.



Diagnosis

Within the scope of self-diagnosis, the system is monitored for mechanical faults, electrical faults and implausible signals.
The most important system data are stored in the Measured Value Blocks and can be read with the VAS5051.

Detailed information is in the Workshop Manual.

Tire Pressure Monitoring

Introduction

The 2004 Audi A8L is equipped with a new version of the Tire Pressure Monitoring System.

Antennas

Active antennas are used. The radio signals transmitted by the tire pressure sensors are converted into digital signals by the antennas.

There are two antenna versions that have different carrier frequencies: 433 MHz and 315 MHz.

Data Transfer

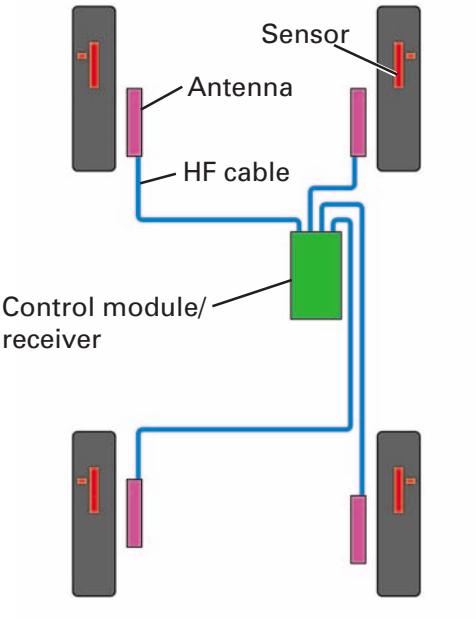
The digital signals are transferred from the antennas to the Tire Pressure Monitoring Control Unit over the LIN bus.

The major advantage of this data transfer method is the minimal susceptibility to electromagnetic interference.

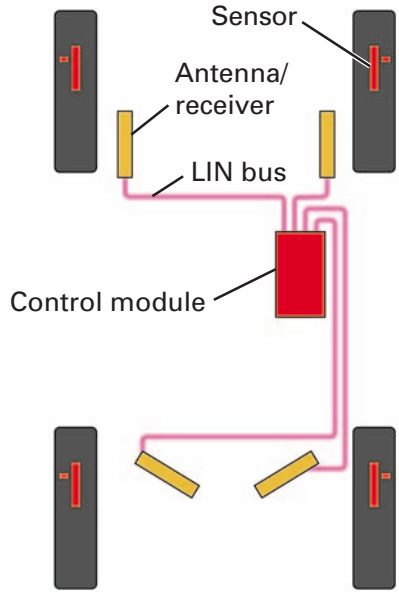
Tire Pressure Monitoring Control Unit

The Tire Pressure Monitoring Control Unit is located under the rear seat. There is no sensor signal conditioning in the Control Unit.

Only one control unit frequency version is required because the signals are already conditioned in the antennas.



1st Generation Components and Networking (Audi A8 up to '03)



2nd Generation Components and Networking (Audi A8L as of '04)

Tire Pressure Monitoring

Control Concept

Pressing the CAR button and selecting "Systems," then "Tire Pressure Monitoring System" displays the current tire pressures and temperatures or allows the following settings to be made:

- System activation/deactivation
- Storage of tire pressures

Refer to the Owner's Manual for more information.

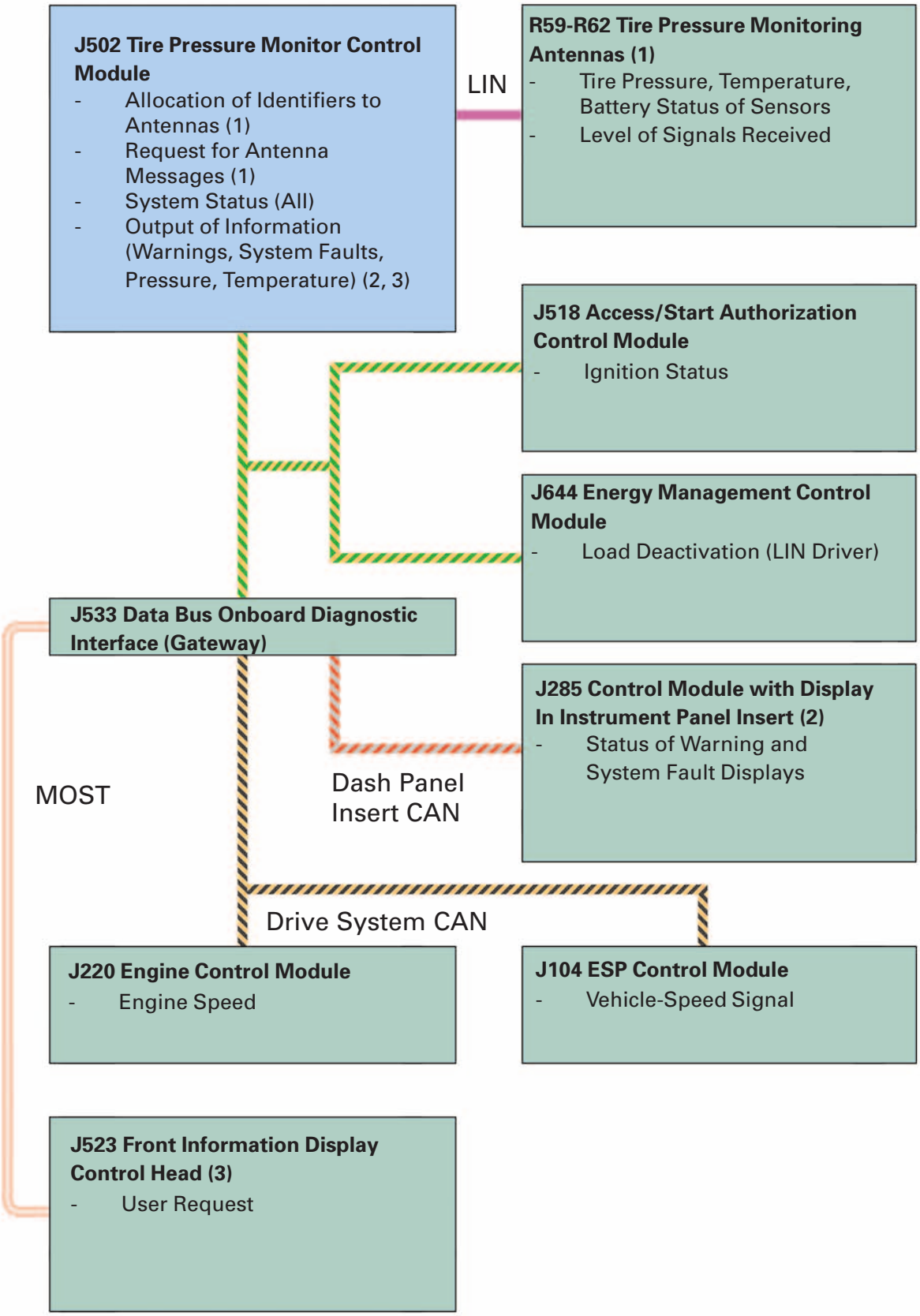


Warning Displays

Warnings are still displayed in the Instrument Panel Insert. The two-stage warning priority system has been retained. Refer to the Owner's Manual for more information.

Tire Pressure Monitoring

Tire Pressure Monitoring System CAN Data Exchange



Service

The range of service diagnosis options has been extended.
Antenna diagnosis is performed constantly and does not have to be started separately.

For more information, refer to the current Workshop Manual and Guided Fault Finding.

Notes

Knowledge Assessment

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

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

You can find this Knowledge Assessment at:

www.accessaudi.com

From the accessaudi.com homepage:

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

For assistance, please call:

Audi Academy

Learning Management Center Headquarters

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

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

Audi of America, Inc.
3800 Hamlin Road
Auburn Hills, MI 48326
Printed in U.S.A.
March 2003