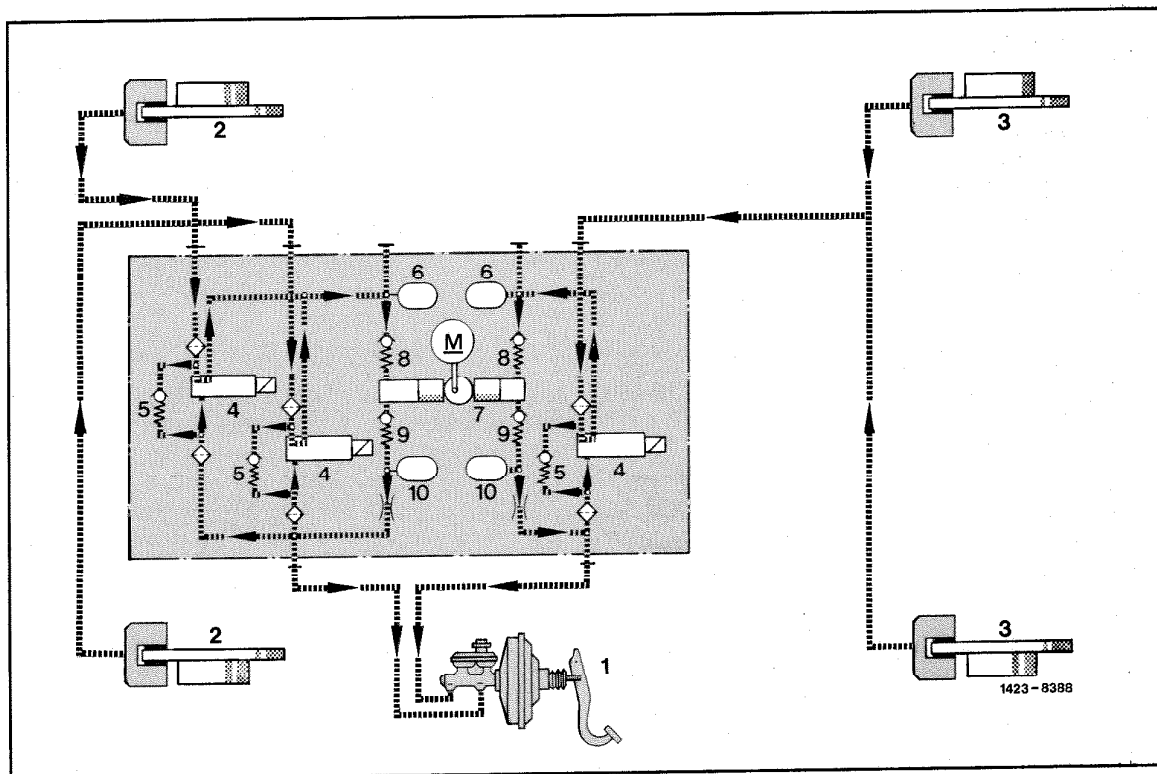


42-700 Design and function of anti-lock braking system

Pressure reduction stage

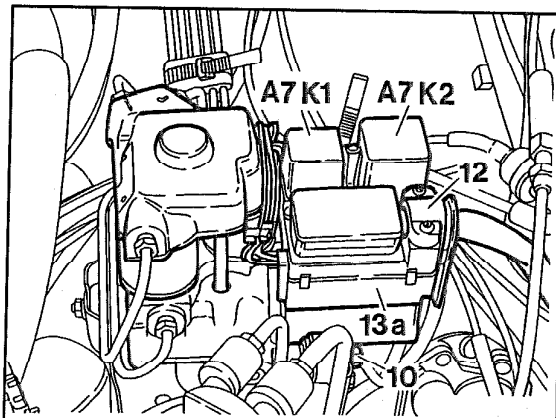
During the pressure reduction stage the brake fluid flows via a reservoir (6) into return pump (7). To maintain the fluid volume of the master cylinder, the return pump returns the brake fluid into the master cylinder against the prevailing pressure. To dampen the delivery noise, each circuit is provided with a noise damper (10).



- | | | | |
|---|---|----|-------------------|
| 1 | Brake booster with tandem brake master cylinder | 6 | Pump reservoir |
| 2 | Front wheel brake | 7 | Return pump |
| 3 | Rear wheel brake | 8 | Pump input valve |
| 4 | Solenoid valve | 9 | Pump output valve |
| 5 | Check valve | 10 | Noise damper |

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On plug socket (13a) of the hydraulic unit there is a relay (A7K1) for solenoid valves and relay (A7K2) for the return pump. The hydraulic unit is connected to the vehicle ground at the hexagon nut (10) via a grounding strap.



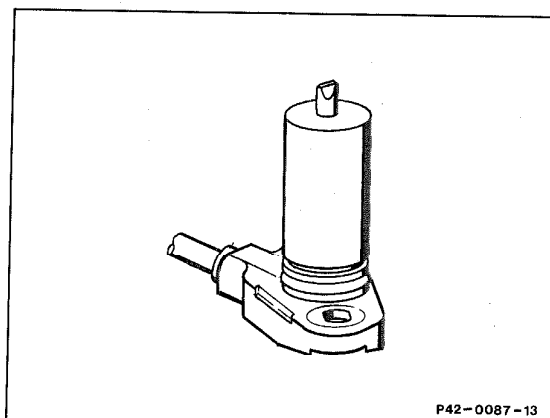
P42-2150-13

- 10 Hexagon nut
- 12 Harness stress relief
- 13a Plug socket
- A7K1 Solenoid valve relay
- A7K2 Return pump relay

F. Electronics

Vehicle speed signal sensors

Rod-shaped vehicle speed signal sensors or impulse sensors are used for measuring wheel speeds. In the three-channel system with three vehicle speed signal sensors installed in our vehicles (excluding vehicles with ASR), the wheel speed of each front wheel is measured separately.

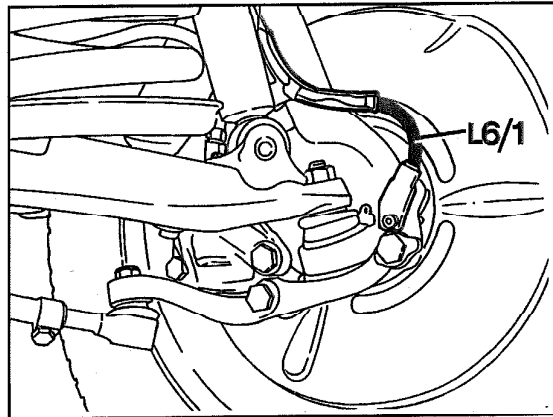


P42-0087-13

P42-0087-13

42-700 Design and function of anti-lock braking system

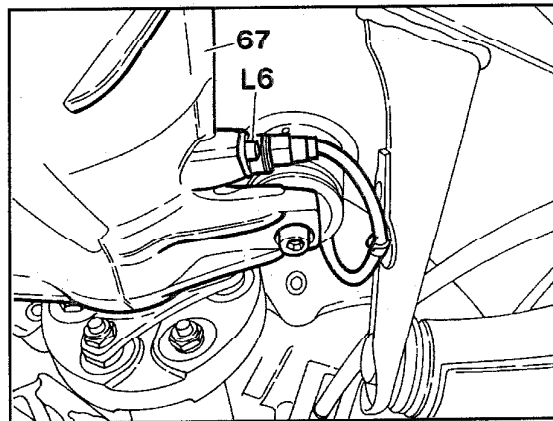
The vehicle speed signal sensors (L6/1 or L6/2) for the front axle are installed in the steering knuckles.



L6/1 Left front axle VSS sensor

P42-2119-13

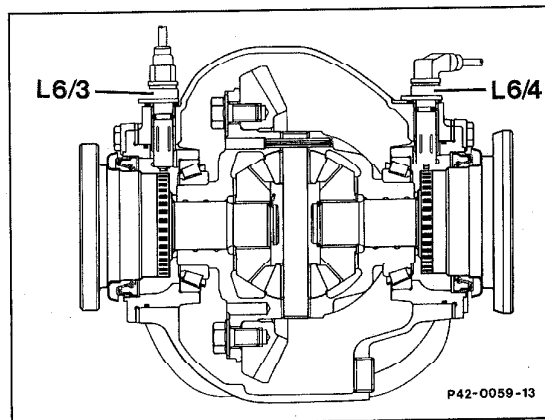
The vehicle speed signal sensor (L6) is located on the rear axle casing (67). The drive pinion serves to measure the mean speed of both rear wheels.



P42-2149-13

Note

The four-channel system is used on vehicles with ASR I. In this system, the wheel speed of each rear wheel is measured separately. The vehicle speed signal sensors (L6/3 and L6/4) are located in the rear axle casing above the rear axle shaft flange.



P42-0059-13

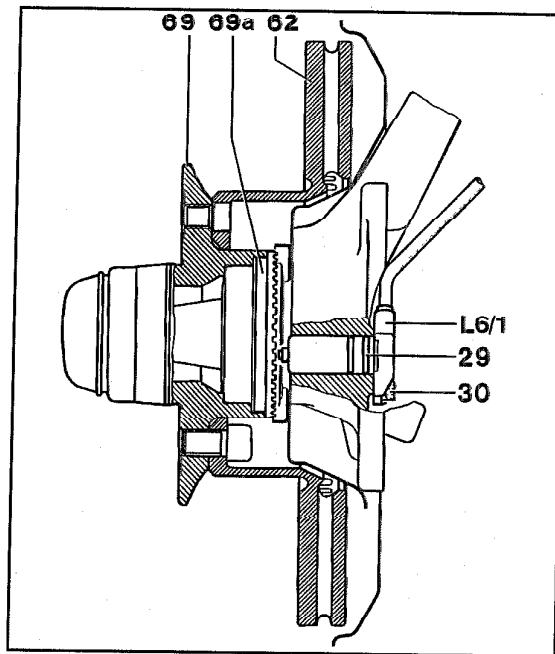
P42-0059-13

42-700 Design and function of anti-lock braking system

The vehicle speed signal sensors sense wheel speeds by way of the rotor teeth. On the front axle, the rotor teeth (69a) are machined into the front wheel hub (69).

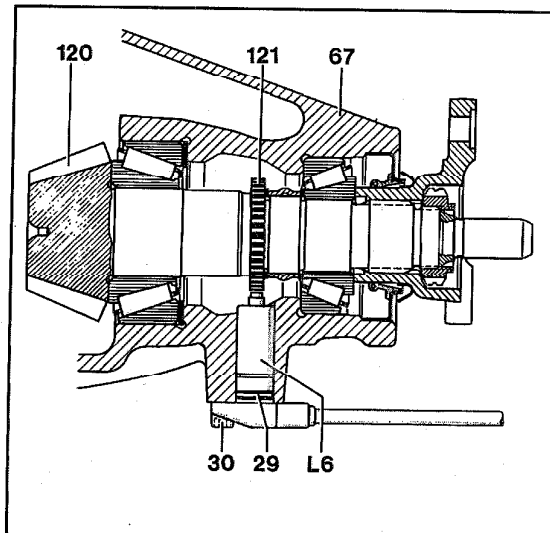
The vehicle speed signal sensors (L6/1, L6/2) on the front axle have a diameter of 18 mm.

- L6/1 Left front axle VSS sensor
- 29 O-ring
- 30 Hexagon socket screw
- 62 Brake disc
- 69 Front wheel hub
- 69a Teeth (rotor)



P33-0053-15

On the rear axle, the rotor is a toothed wheel (121) and pressed onto the differential pinion (120). For each rear axle ratio there is a corresponding gear wheel with a different number of teeth. Refer to "42-714 Removal and installation of vehicle speed signal sensor on rear axle" for assignment of rotor to rear axle. The vehicle speed signal sensor for the rear axle has a diameter of 15 mm.



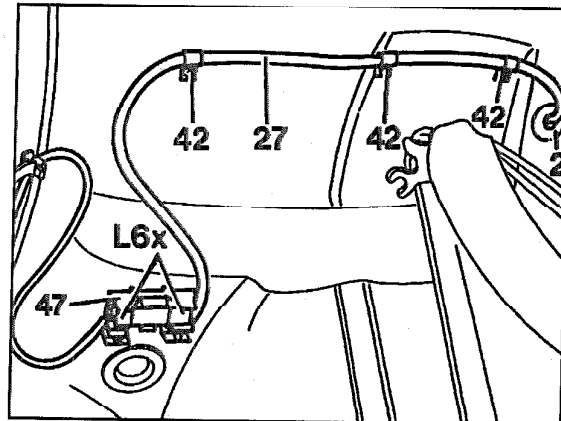
P42-0061-14

- L6 Vehicle speed signal sensor
- 29 O-ring - vehicle speed signal sensor
- 30 Hexagon socket screw
- 67 Rear axle casing
- 120 Differential pinion
- 121 Toothed wheel (rotor)

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The vehicle speed signal sensor on the rear axle is connected to the cable harness under the rear seat via the plug connection (L6x).

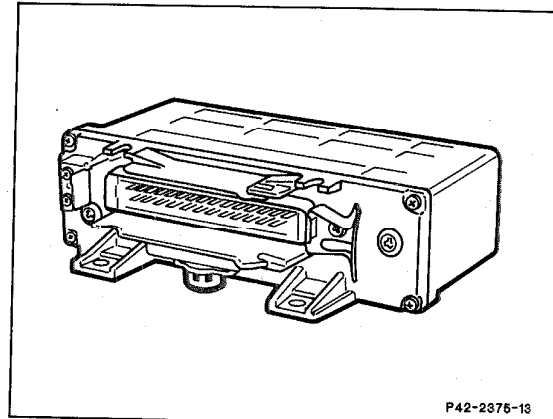
- Location - rear axle
- L6x Plug connection
 - 27 Cable - vehicle speed signal sensor
 - 42 Clip



0142-24339/2

ABS control module

The ABS control module is designed as a circuit board version. The circuit boards are provided with printed circuits on both sides and fitted on one side with components such as resistors, diodes, transistors and so-called large-scale integrated circuits. The circuit boards are inside the control module enclosed in a light alloy housing or in a plastic housing phased in as of 04/86. The control modules with aluminum and plastic housings are interchangeable. Different control modules are installed on vehicles with ASR, 4MATIC and ASD.



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P42-2375-13

42-700 Design and function of anti-lock braking system

The control module processes the signals from the vehicle speed signal sensors and controls the valves in the hydraulic unit.

The entire signal conditioning and signal processing is digital.

The control module is connected to the ABS main cable harness via a 35-pin plug connection.

The electronic control module is functionally divided into:

- the signal conditioning section
- the logic section and
- the safety circuit.

42-700 Design and function of anti-lock braking system

Signal conditioning section

In the signal conditioning section the signals supplied by the vehicle speed signal sensors are converted into a form suitable for use by the logic section.

To prevent problems while measuring the wheel speed, which may be caused by production tolerances and by movements in the steering knuckle, the input signals are filtered prior to use. Deceleration and acceleration signals obtained from the wheel speed signals are processed in the logic section.

Logic section

The logic section of the ABS control module employs the following input signals for each controlled wheel or the controlled rear wheels:

- wheel slip
- wheel speed acceleration
- wheel deceleration

Output signals from the logic section control the solenoid valves of the hydraulic unit. As a result, the following hydraulic functions can be generated in the brake calipers of the wheel brakes:

- pressure holding
- pressure reduction
- pressure build-up

Safety circuit

The safety circuit has the job of recognizing faulty signals in the ABS control module and faults outside the ABS control module in the electrical installation. In addition, the safety circuit intervenes in the control sequence during extreme driving conditions such as aquaplaning. When a fault is recognized, the system should be switched off, a condition which is indicated to the driver by the indicator lamp coming on.

The safety circuit continuously monitors the battery voltage. If the voltage is below specific requirements (11 V), the system is also switched off until the voltage returns to the specified range.

In addition to this monitoring function, the safety circuit also includes an active section, the test cycle or bite (built-in test equipment).

The test cycle begins as soon as the wheel speed in all three speed channels is higher than 5-7 km/h. The cycle is activated by the vehicle speed signal sensor voltage, which is monitored automatically at the same time. The test cycle itself checks parts of the monitoring circuit as well as the logic section. For this purpose, the electronic control module is fed with the specific test sample signals to check whether the correct output signals are available.

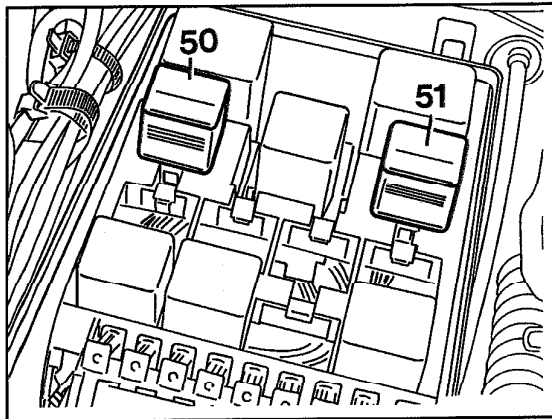
42-700 Design and function of anti-lock braking system

Relay with overvoltage protection

To guarantee the function of the ABS system under all operating conditions, the power supply is switched via a relay, which is actuated by terminal 15 (ignition lock).

1st version up to 08/81
Separate relay for power supply and overvoltage protection

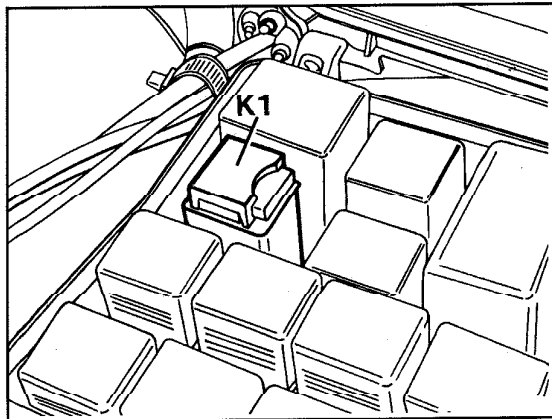
The overvoltage protection, which protects the electronic control modules against overvoltages is connected in series between the battery and the relay (ABS, CIS-E, ASD or ASR).



P42-2132-13

The relay and the overvoltage protection form one unit. The overvoltage protection has a replaceable fuse.

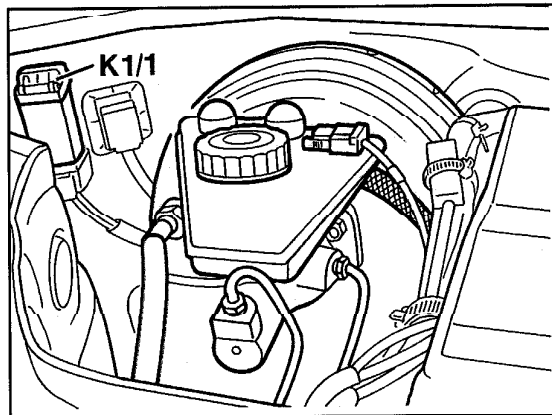
2nd version as of 08/81
Relay and overvoltage protection in one unit



P42-2134-13

5-pin relay with additional pin 87 for the CIS-E injection system.

K1/1 = 3rd version as of 09/85



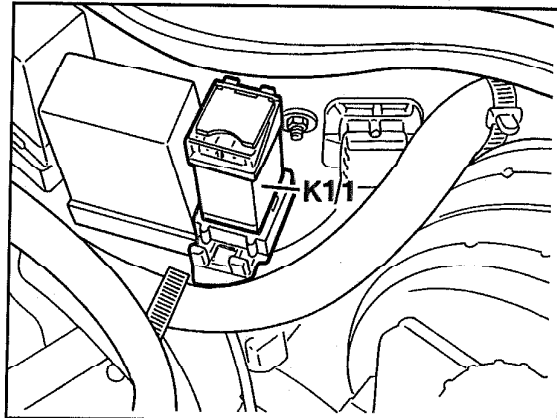
P42-2384-13

42-700 Design and function of anti-lock braking system

On vehicles as of from 05/87, depending on the vehicle model and special equipment, a 5-, 7- or 9-pin overvoltage protection relay can be installed.

- 5-pin K1
- 7-pin K1/1
- 9-pin K1/2

4th version as of 05/87
K1/1 or K1/2, 7- or 9-pin
overvoltage protection

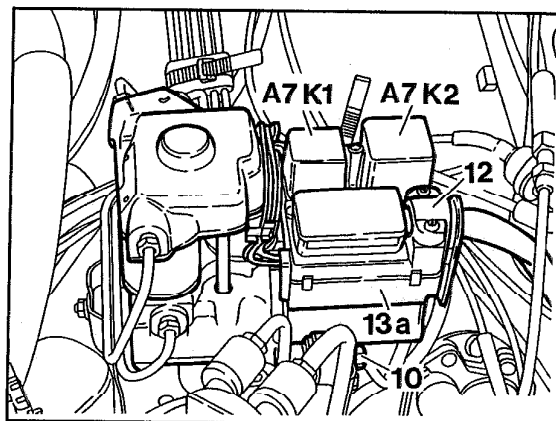


P42-2102-13

ABS (A7) hydraulic unit

Two relays are located under the cover of the hydraulic unit. Relay (A7K2) activates the return pump and current flows to the solenoid valves via relay (A7K1).

The plug socket (13a) has a soldered-in diode by means of which, with the multiple plug on the electronic control module pulled out, the indicator lamp in the instrument cluster is activated.

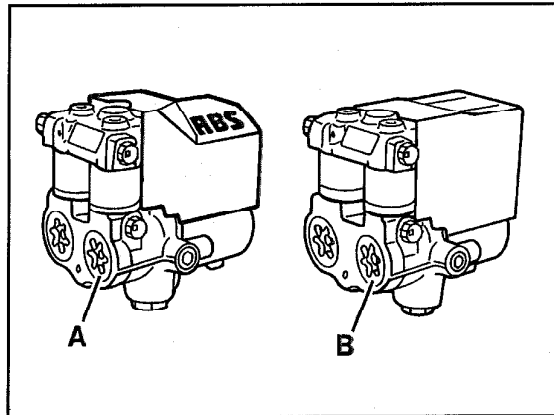


P42-2150-13

Phased in as of the beginning of 1986, the diode is no longer located in the plug socket but in the solenoid valve relay. The new relay has six contact pins (previously five).

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In conjunction with the appropriate relay and fixing clamps the modified hydraulic unit can also be installed in vehicles produced earlier. It can be recognized on the outside by the inclined cover with the letters ABS (item A).



P42-2097-13

Electric wiring diagrams

For electric wiring diagrams, locations of the cable and plug connections as well as the location of the relays and the control module, refer to "Electric wiring diagrams" volumes 1 and 2.