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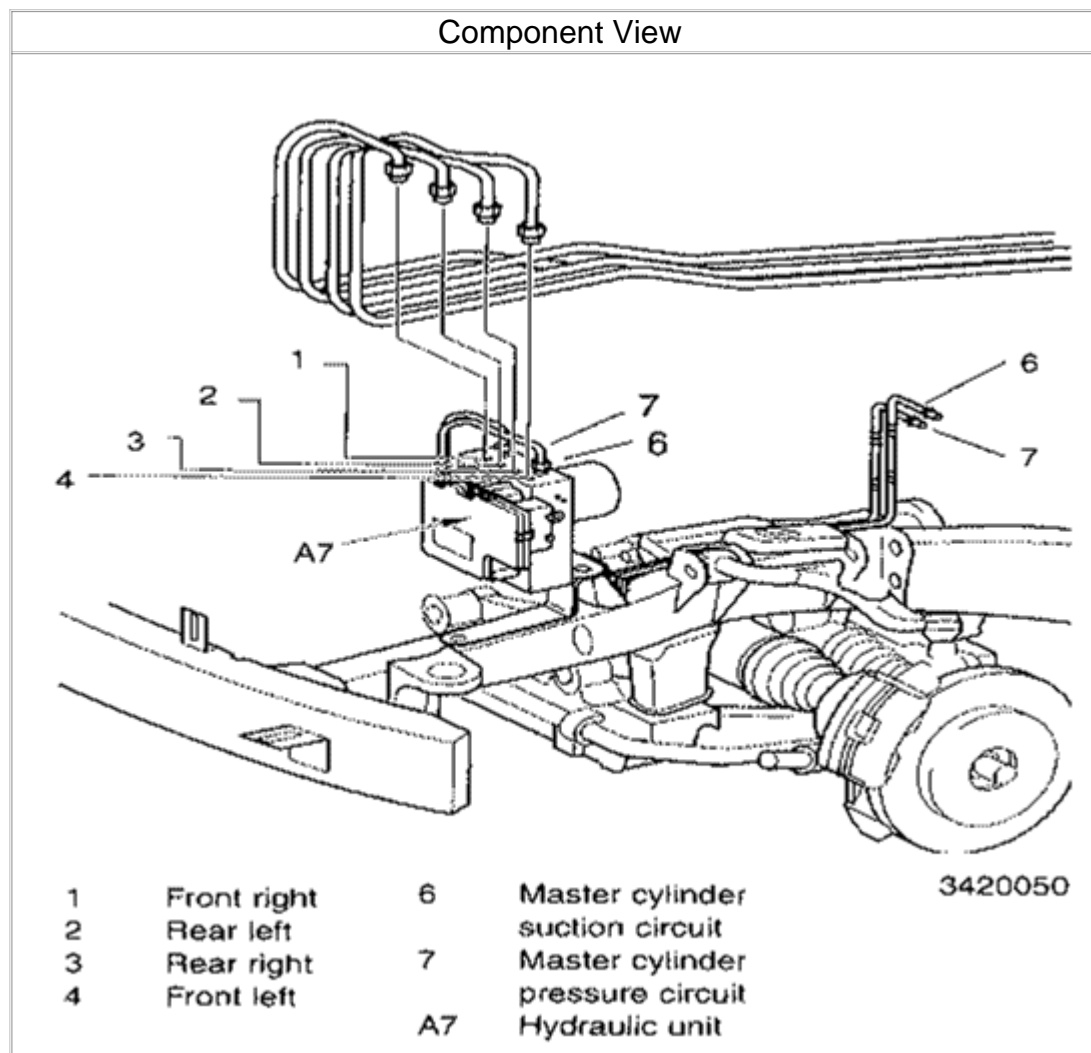
[Conversion Calculator](#)**2002 Mercedes Benz Truck ML 320 (163.154) V6-3.2L (112.942)**[Vehicle Level](#) → [Brakes and Traction Control](#) → [Antilock Brakes / Traction Control Systems](#) → [Description and Operation](#) → [ABS, 4-ETS and EBP](#) ←

ABS, 4-ETS and EBP

[Notes](#)

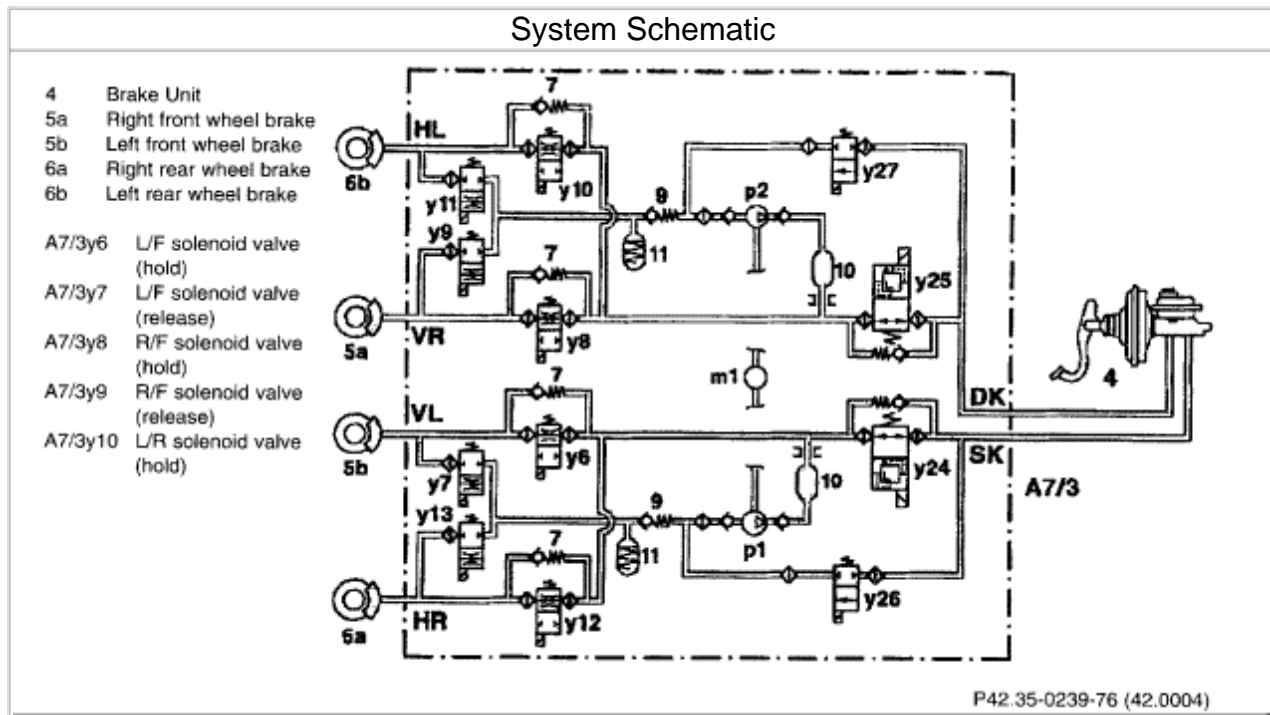
BRAKES ANTI-LOCK BRAKE SYSTEM (ABS) 4-WHEEL ELECTRONIC TRACTION CONTROL SYSTEM (4-ETS) ELECTRONIC BRAKE PROPORTIONING (EBP)

System Description



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The hydraulic pressure from the dual master cylinder is split diagonally between the right front/left rear and left front/right rear wheel brake circuits, providing a balanced braking response should a malfunction occur in a brake line.

The proportioning valve function is produced by the Electronic Brake Proportioning System (EBP). EBP dynamically adjusts the application of hydraulic pressure to the rear brakes.

Both front and rear brakes are disc type with single piston floating calipers. The front discs are internally ventilated while the rear discs are solid.

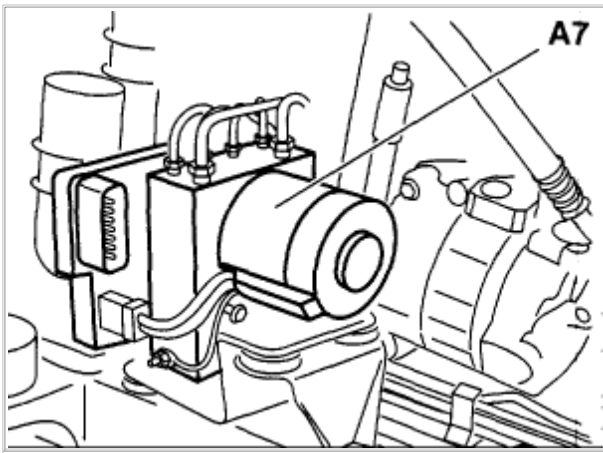
To ensure better ventilation of the brakes, additional openings for cooling air have been integrated into the bumper.

The parking brakes are drum type with the drum located in the hub area of the rear disc.

The self adjusting brake mechanism is like the W140 and is located under the passenger compartment second seat row.

Component Location

4-ETS/ABS Hydraulic Unit

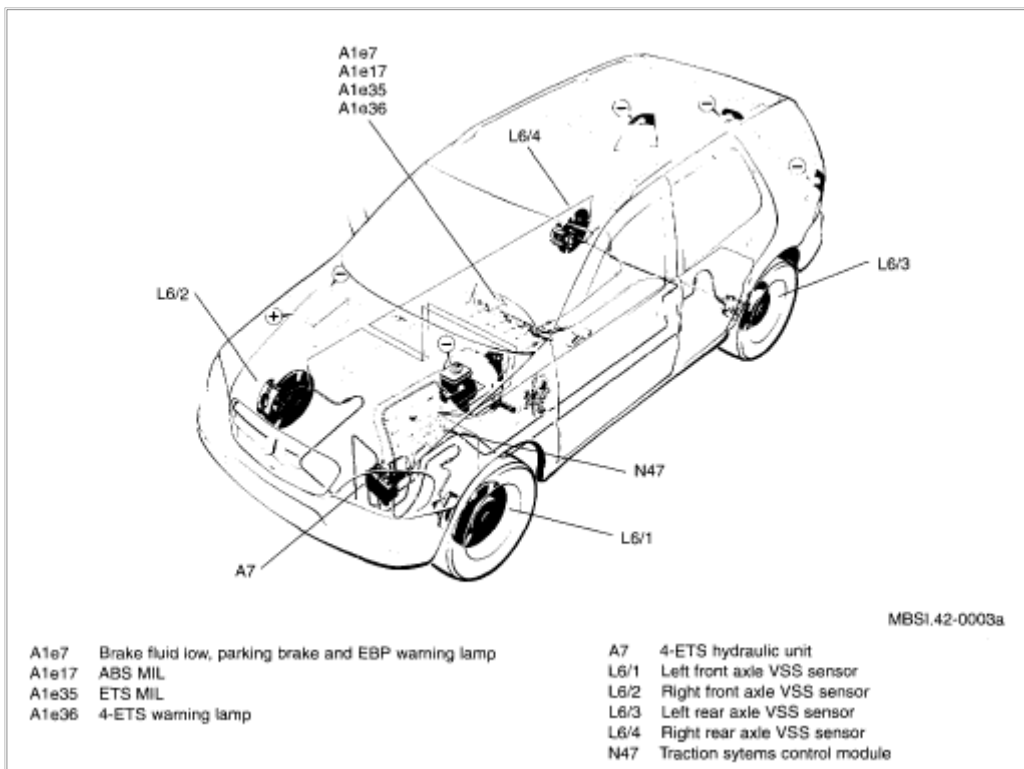


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The 4-ETS/ABS (A7) unit is mounted on the driver's side frame rail next to the engine.

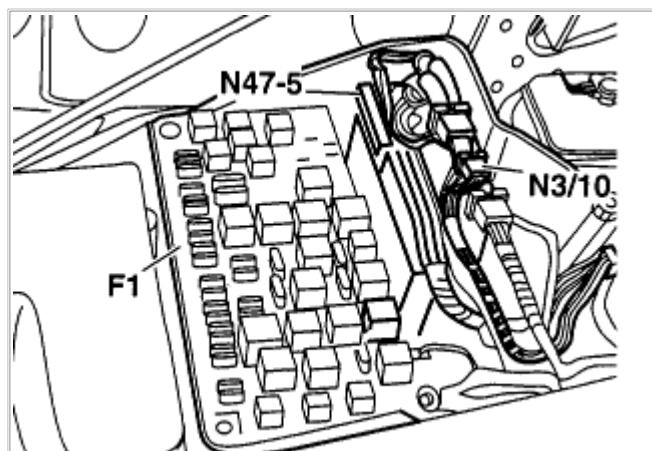
4-ETS, ABS and EBP Component Locations



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4-ETS/ABS Control Unit

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The circuits for ABS, ETS and EBP systems are combined into a single control unit (N47) housed in the E-box.

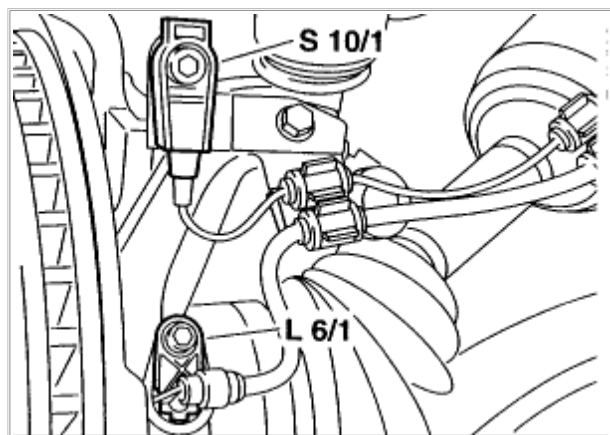
Component Description

4ETS/ABS/EBP

Hydraulic unit A7 is a 4 channel valve body with a servo motor. The [brake master cylinder](#) feeds hydraulic unit A7. The front hydraulic line provides fluid pressure to the hydraulic unit. The rear hydraulic line at the master cylinder is the fluid return.

Within hydraulic unit A7, the servo motor (pump) and internal accumulators provide brake pressure, brake pressure reduction and brake pressure hold as required. The hydraulic unit A7 with control unit N47 perform 4-ETS, ABS and EBP functions.

[Brake Caliper](#)

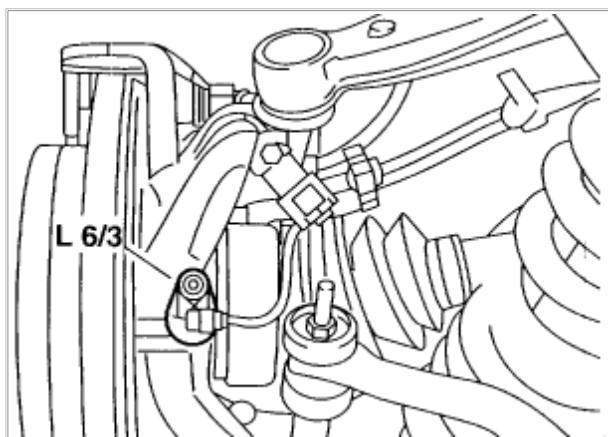
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The four wheel disc brakes use a single piston, floating caliper. The [brake pad wear sensor](#) is located on the left front wheel (S10/1).

System Operation

Electronic Driving Dynamics Control Systems :

All of the driving dynamics systems are actuated through the service brakes. The driving system functions are: ABS Anti-lock Brake System EBP Electronic Braking Proportioning 4-ETS 4-Wheel Electronic Traction System



ABS, EBP and 4-ETS are interrelated and depend on the operation of shared components. For example, the intervention of the system that is needed (ABS, 4-ETS or EBP) starts with the [wheel speed sensors](#). The wheel spin is recognized by the ABS/4-ETS/EBP control unit (N47) which is able to determine which function is needed. The control unit then signals the hydraulic assembly (A7) to apply, hold, release or proportion the brake pressure as needed.

ETS / EBP / ABS Control :

The ETS Control Module is sectioned as follows:

- Signal processing
- Logic
- Safety circuit
- Additional functions

Signal Processing Input :

The following input signals are processed for the logic section:

- 4 speed sensors
- Stop lamp switch
- Brake fluid level switch
- CAN data from ME-SFI, Transfer Case, ETC, and instrument cluster The above signals are processed in the logic section and converted to proper output signals.

Output:

The outputs signalled by the ETS control unit are the following:

- Solenoid valves
- Pump (pressure / return) via relay

- ETS warning lamp
- ABS MIL
- ETS MIL
- Low [brake fluid](#) level/parking brake indicator/EBP warning lamp
- Warning Buzzer

Four Operating Modes:

The following are the operations performed by the system:

- Normal mode (at rest)
- EBP control mode
- ABS control mode (x 2: on-road and off-road)
- ETS control mode

Normal Mode:

This is the "at rest" position. In this case no wheel speed differences are recognized which require control. The solenoid valves are at rest and deenergized.

Electronic Brake Proportioning Mode (EBP) :

The EBP is regulated by the ABS/4-ETS hydraulic modulator. The [wheel speed sensors](#) send a signal to the ABS/4-ETS control unit which is capable of discriminating between wheel locking and front to rear brake proportioning.

During braking, EBP senses if both rear wheels are tending to lock in equal amounts and limits or reduces the brake pressure to the rear wheels. This ensures proper brake proportioning for differing vehicle load and maneuvering conditions.

If the braking force proportioning system fails (when the engine is running), the brake warning lamp illuminates in the speedometer pod and an audible signal sounds for 5 seconds.

Whenever the brakes are applied at speeds exceeding 25 mph (40 kp/h), the warning buzzer sounds for 5 seconds.

Since the EBP and the ABS are directly connected, EBP is interrupted automatically if the ABS fails. For safety, the vehicle can be driven to the nearest repair shop at a reduced speed.

ABS Control Mode:

On-Road ABS Program

Upon recognition of wheel slip the ETS/ABS control unit operates the appropriate solenoid valves separately in the hydraulic unit A7/3 until wheel slip is optimized. The rear wheel solenoid valves are operated together in the case of one slipping wheel.

Off-Road ABS Program

On road surfaces with good traction characteristics ABS works in the same manner as in other Mercedes-Benz passenger cars. However, in low range off-road driving, the anti-lock and anti-skid operations are altered by an "Off-Road" program.

The required conditions required for this program to operate are:

- Low range engaged
- Rough road sensed
- Vehicle speed less than 30km/h (18mph)

The Off-Road ABS program is part of the ABS/ 4-ETS (N47) control unit. A rough road, typical of off-road driving is recognized by uneven wheel rotation signalled by the wheel sensors. If the rough road condition no longer exists, the Off Road ABS Control switches to the road program.

Another aspect of the ABS Off-Road program is that it operates only on the front wheels. The brake apply phase is lengthened to allow the wheel to "dig in" momentarily during a wheel lock control. This can shorten off-road stopping distances compared to the "normal" ABS braking mode. However, in this mode steering control is somewhat affected.

Special considerations:

- 12.5 mph (20kmh) to 18.5 mph (30kmh) Off Road ABS is operated on a short term basis
- More than 18.5 mph (30 km/h) off-road situations are recognized, but the Off-Road ABS program does not operate until the speed drops below 18.5 mph (30kmh)
- Deceleration between 3.5 M/S² and 1.2 M/S²: the system checks for off-road conditions and selects on or off-road program

4-Wheel Electronic Traction Control Mode (4-ETS) General Function :

It is absolutely necessary for the driver to operate the accelerator pedal for the 4-ETS control mode to function. 4-ETS prevents the driven wheels from spinning while under power. Similar in operation to 2-ETS but applied to both front and rear axles, and with modified operating parameters, 4-ETS ensures good driving stability on and off-road by applying a braking force to any of the four wheels that may lose traction when starting up, accelerating, or driving on loose surfaces. There is no engine intervention and no reduction in torque.

Braking is maintained on the spinning wheel until it is slightly above speed of the wheel(s) with traction, in other words, it "fools" the open differential into thinking there is equal traction. Therefore, torque is applied at the wheel where it can be used. This provides the benefits of a locking differential without the negative handling characteristics.

Under critical driving conditions, when the speeds of one or more wheels deviate from the reference speed of the vehicle, the driver is alerted by a flashing warning lamp (info-lamp) in the speedometer. This enables the driver to better adapt his/her driving style to the change in road conditions.

4-ETS never overrides ABS because 4-ETS does not function when braking. If there is a malfunction in the Anti-lock Brake System, the ABS warning lamp in the instrument cluster (All) alerts the driver.

Compared to mechanically locking or limited slip-type differentials, 4-ETS has cost, weight and system complexity advantages. At the same time, the automatic process of 4-ETS intervention reduces the demands on the driver.

4-ETS Specific Function :

A distinction is made between:

- Comfort oriented control in high range
- Traction oriented control in low range

4-ETS On road - High Gear:

If one or more wheels begins to spin, the ABS/ 4-ETS hydraulic unit applies brake pressure to the caliper(s) of the spinning wheel(s) reducing the speed of the spinning wheels until they are approximately 5 km/h (3mph) above the speed of the reference speed / wheels with traction. This allows torque to be applied on the wheels that have traction.

The ETS control mode:

- Can be engaged in the speed range of 0 - 60 km/h (0-36 mph).
- If the engagement conditions are maintained, beyond 60km/h during acceleration, ETS control is effective up to 80 km/h (48 mph).

4-ETS Off-Road-Low Gear:

The same basic functions as when on-road control is engaged, but the speed above which the wheel spin is modulated is reduced to 2km/h (1.2 mph). If there is a continued loss of traction and the vehicle speed is less than 20 km/h (12 mph), the pressure at which the hydraulic fluid is modulated is also influenced.

Brake Temperature Monitoring :

4-ETS has an algorithm for monitoring [brake pad](#) temperatures because of the double functions of 4-ETS and ABS. The temperature is calculated continuously in the control module for each individual wheel. The system shuts down temporarily after very long phases of intervention by the 4-ETS or in cases of misuse. In these instances the ETS warning lamp will illuminate to indicate the system is not available and remain illuminated (minimum 7 seconds) until the calculations signal the temperature has dropped to an effective level. The excessive temperature is also recorded in the fault memory. The ETS control module retains a voltage supply when the ignition is switched off in this mode, so that calculations can continue. When a calculated temperature of 70 degrees Celsius is reached, the power is switched off. This prevents resetting the ETS by cycling the ignition key.

Service Tips

- [Brake Bleeding](#): The brake system is bled the same as on other Mercedes-Benz vehicles with ABS. No special procedure is necessary.
- Parking Brake Test: Only with the ignition key off, otherwise there is ETS intervention.
- Chassis Dynamometer: Use a 4 wheel chassis dynamometer.

WARNING: Danger of injury or death if a two wheel dynamometer is used!

- Towing-axles not raised: Key in ignition lock, position 1, transmission in "N", towing

speed max. 50 km/h (30 mph) for no longer than 50 km (30 miles).

- Towing, one axle raised: Ignition key off, otherwise ETS intervenes.

CAUTION:

- Only tow with propeller shafts disconnected for longer distances!
- Do not tow in reverse or emergency start by towing!

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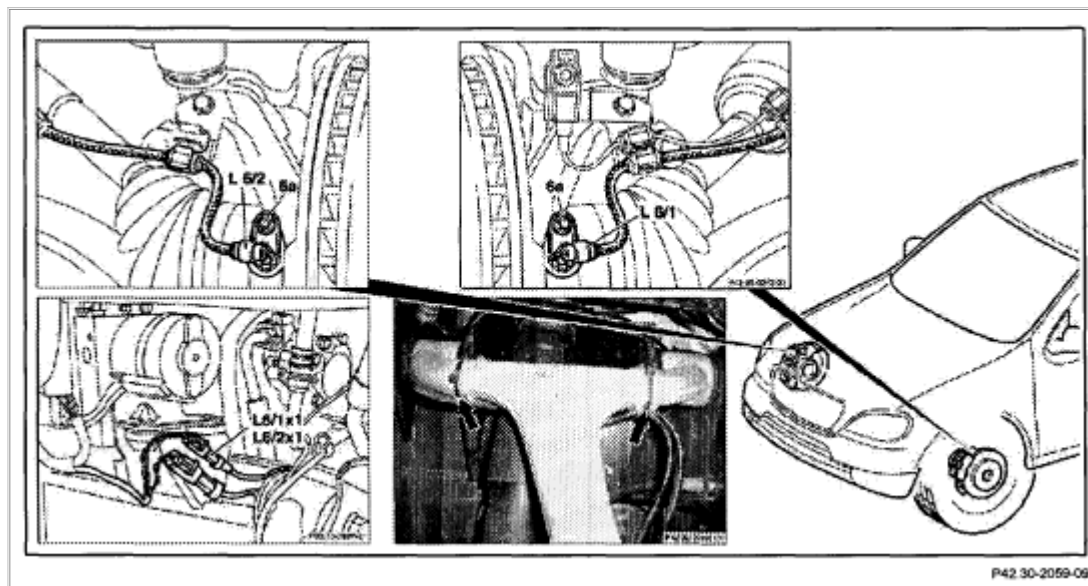
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AR42.30-P-0712GH Remove/Install Left or Right Front RPM Sensor

[Notes](#)

Remove/Install Left Or Right Front rpm Sensor



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Work instructions

6a Rpm sensor bolts

NOTE: Installation: Install new bolts.

L6/1, L6/2 Left front rpm sensor and right front rpm sensor

NOTE:

- **Installation:** Check rotor on wheel hub for damage. Pay attention to cleanliness of magnetic tip. Fasten cables for rpm sensor on upper transverse control arm with cable straps (arrows) so that the cables are not damaged when the suspension is

- fully compressed and rebounded.
- Lightly grease bore for rpm sensor in wheel carrier with MB long-term grease: I MB long-term grease.

L6/1x1,L6/2x1 Rpm sensor connector

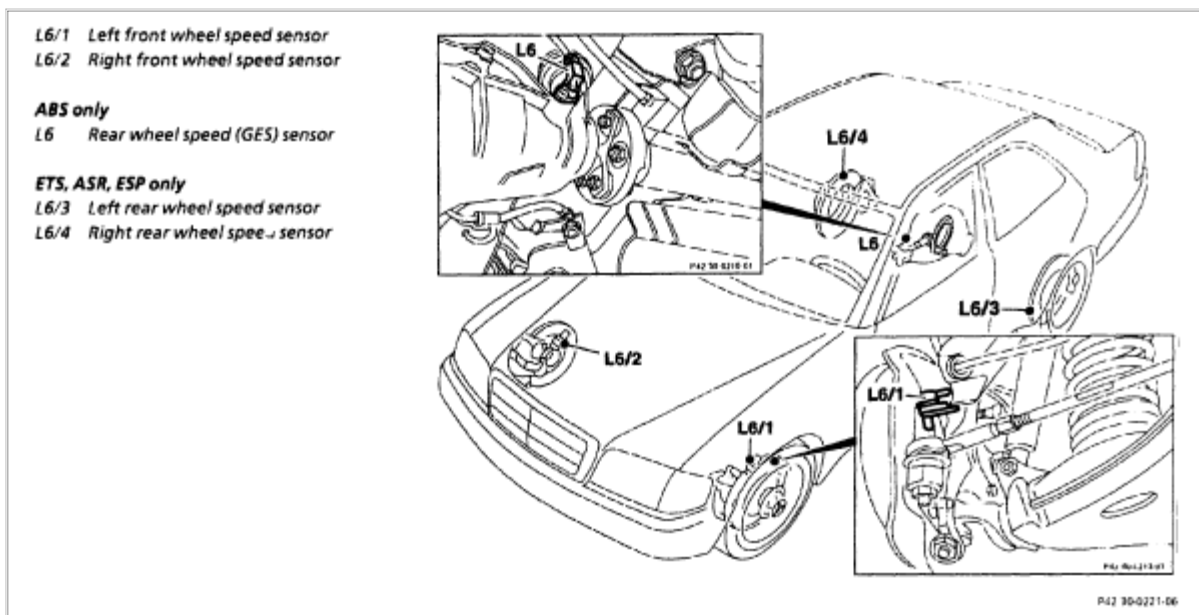
NOTE: Installation: Pay attention to correct routing.

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Location**Front**

The front wheel speed sensors (L6/1 and L6/2) are mounted on the front axle steering knuckle.

Rear**ABS**

The rear wheel speed sensor (L6) is mounted on the rear axle center assembly.

ETS, ASR, ESP

The rear wheel speed sensors (L6/3 and L6/4) are mounted on the rear axle wheel carrier.

Task

To supply the current wheel speed to ABS, ETS, ASR or ESP control modules (N47-7, N47-2, N47-1 or N47-5).

Design

Inductive sensor: Coil with magnetic core at a defined distance from the rotor which is attached to the front wheel hub, rear axle shafts or rear axle drive pinion.

Function

The magnetic field of the speed sensor is cut by the teeth of A rotor. As a result the magnetic field changes and the coil induces an alternating voltage. The frequency of this alternating voltage changes according to the wheel speed and the number of teeth, i.e. the frequency is proportional to the wheel speed.

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