

Document title AIRmatic suspension, function

Document number gf3222p4011sx

MODEL 221

**with CODE (489) Airmatic (semi-active air suspension)
up to Model Year 08 /modification year 07**

Level control, function description

Level control is realized by means of four suspension struts with integral bellows. If the AIRmatic compressor unit (A9/1) or AIRmatic central reservoir delivers air to a bellows, the vehicle level is raised at the associated wheel. Vice versa the vehicle level reduces if the air is drained out of the bellows via the corresponding level valve (integrated in the level control valve unit (Y36/6)) and the AIRmatic pressure reduction valve (A9/1y1) (integrated in the AIRmatic compressor unit) is drained.

i The following values for the levels and the transient conditions may differ from variant to variant.

Levels:

- Raised level (EN1)
 - Comfort performance map: 30 mm
 - Sport performance map: 30 mm
- Normal level (NN)
 - Comfort performance map: 0 mm
 - Sport performance map: 0 mm
- Lowered level 1 (AN1)
 - Comfort performance map: -10 mm
 - Sport performance map: -20 mm
- Lowered level 2 (AN2)
 - Comfort performance map: -20 mm
 - Sport performance map: -20 mm

The switch operations of the level adjustment switch with function LED (integrated in the cockpit switch group) are read in by the upper control panel control unit (N72/1) via the upper control panel LIN [local interconnect network]. The driver can choose between normal level (NN) and higher level (EN1).

The level adjustment switch has two switch positions:

- Adjust level (switch operated)
- Neutral (switch not operated)

The operation of the level adjustment switch is read in by the upper control panel control unit via the upper control panel LIN and is supplied to the AIRmatic with ADS control unit (N51) via the interior CAN, central gateway control unit (N93) and via the chassis CAN. Actuation of the function LED in the switch is reciprocal.

Shock absorber adjustment, function description

The control response of the AIRmatic with ADS control unit can be influenced by the driver using the transmission modes button (A40/9s8).

The system is equipped with a central reservoir as a compressed-air reservoir. This reservoir increases the adjustment speed at which the vehicle level is raised and permits control even if the ignition is switched off.

By pressing the level adjustment switch (S6/2s10) in the cockpit switch group (S6/2), the driver can choose between normal level (NN) and a raised level (EN1), whereby the currently inactive mode is activated each time the button is pressed.

Transition conditions:

- From EN1 to NN
 - Over 120 km or 3 minutes > 80 km
 - Irrespective of comfort or sport
- From NN to AN1
 - Comfort performance map: >120 km
 - Sport performance map: >100 km
- From AN1 to AN2
 - Comfort performance map: >160 km
 - Sport performance map: >140 km
- From AN2 to AN1
 - Comfort performance map: <120 km
 - Sport performance map: <100 km
- From AN1 to NN
 - Comfort performance map: <80 km
 - Sport performance map: <60 km

Lock position (when working on vehicle and during diagnosis)

So that when the vehicle is raised intentionally, e.g. with a jack, air is not continuously drained out of the suspension struts in order to lower the vehicle, it is necessary to automatically detect this unloading of the wheels and from it to derive a blocking position.

The lock position is purely a software function which prevents actuation of the level valves (drain process). If the blocking position is detected by the AIRmatic with ADS control unit, there is no display in the instrument cluster (A1) and there is no fault storage.

The lock position is canceled automatically by the AIRmatic with ADS control unit provided that the condition "left/right front wheel speed > 0 km/h" exists. The level position functions are then reactivated. Actuation of the output stages by the AIRmatic with ADS control unit via the diagnosis function is performed irrespective of the lock position status, i.e. actuation is always possible.

The function algorithm of the AIRmatic with ADS control unit distinguishes between two damper modes:

Actuation of the transmission modes button is read in by the front central operating unit (A40/9) and placed on the telematics CAN. The instrument cluster receives the signal via the COMAND controller unit (A40/3) and places it on the central CAN to the central gateway control unit.

The selection **Comfort-**, **Sport** program and **Manual**, (not with (code 494) USA version), is stored in the instrument cluster so that after an engine start the same performance map is valid as before switching off the ignition. The AIRmatic with ADS control unit receives the signal "S", "C" or "M"(not with code (494) USA version) from the central gateway control unit via the chassis CAN.

- soft damping (valve energized)
- skyhook mode (valve regulated)

One of two damper modes is selected depending on the calculated vehicle excitation. The Comfort mode is selected individually for each wheel (if the degree of vehicle excitation permits this). For this purpose, both damping valves on a shock-absorber strut are constantly energized resulting in the softest shock absorber setting for the wheel in question. If the vehicle excitation exceeds a certain level, skyhook damping is activated for the wheel. If the vehicle excitation has diminished, the Comfort mode is reactivated.

When the vehicle is stationary, damping at all four wheels is set to soft. If the vehicle exceeds a defined minimum speed, the system switches to skyhook mode.

i The initial phase of a braking or acceleration operation also causes the shock absorber mode to shift toward "hard" in order to prevent the vehicle from pitching. If system components (e.g. valves or sensors) fail, the system automatically switches back to the fallback level "hard" (de-energized valves).

Display of fault and system messages

The instrument cluster has a multifunction display (A1p13) for displaying system and fault messages together with advice for the driver.

To output messages the AIRmatic with ADS control unit transmits corresponding messages to the central gateway control unit via the chassis CAN and on to the instrument cluster via the central CAN. There are various fault messages and system messages with different fault priorities.

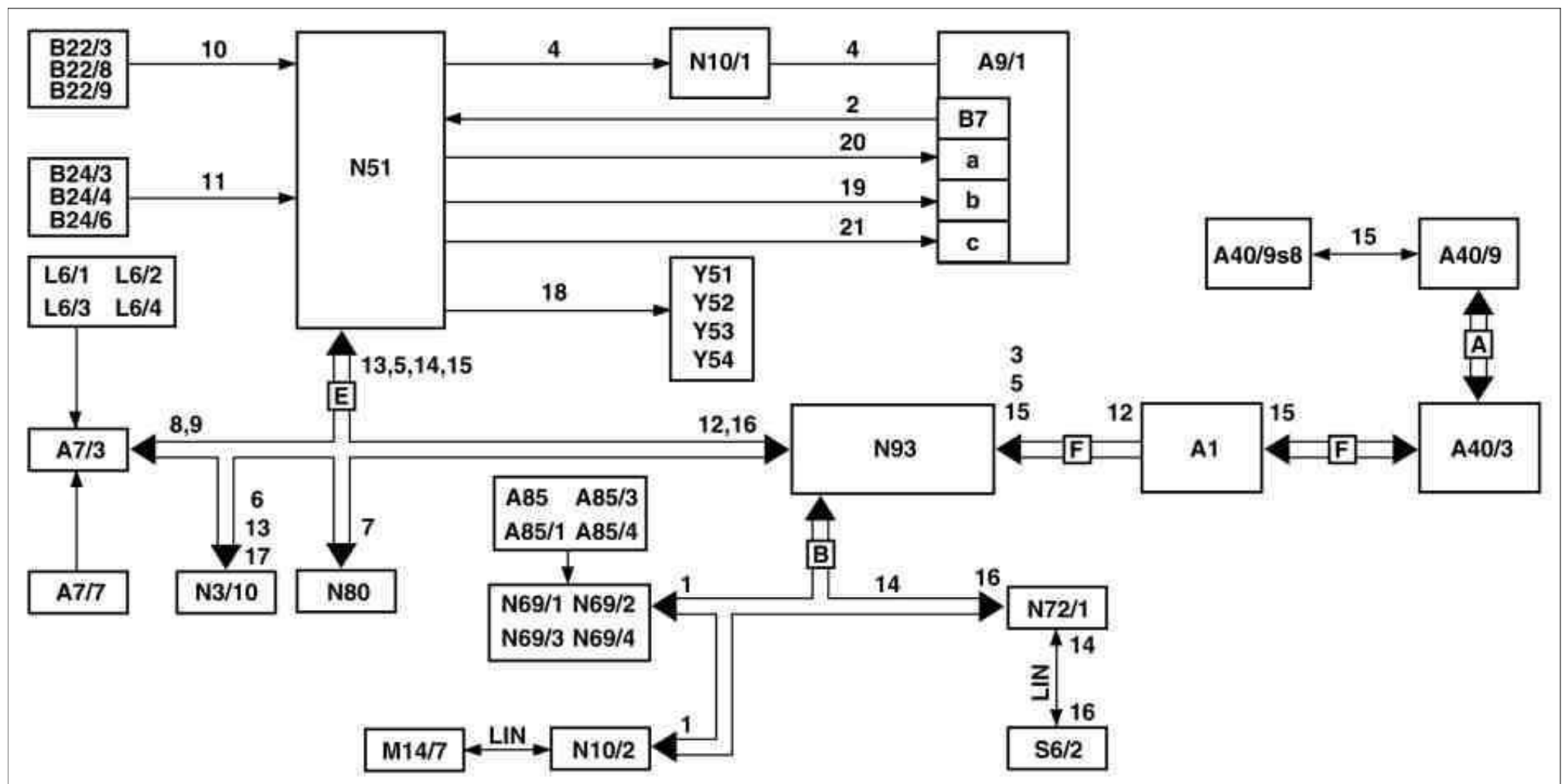
If several faults exist at the same time, several fault messages will be output accordingly.

Texts displayed in instrument cluster:

- "Stop, car too low", in addition a signal tone
- "Please wait for a short time, vehicle lifts up", in addition a signal tone
- "Nonfunctional", no signal tone

The following system message is also displayed in the instrument cluster:

- "Vehicle lifts up", no signal tone



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Block diagram for air suspension with adaptive damping system (ADS)

| | | | | | |
|---|--|----|--|---------|------------------------------|
| 1 | Wake-up signal for door/luggage compartment contact OPEN | 14 | Change vehicle level signal | A9/1 | AIRmatic compressor unit |
| 2 | Air suspension pressure signal | 15 | Change chassis alignment signal | A40/3 | COMAND controller unit |
| 3 | Displayed speed signal | 16 | Signal for status LED | A40/9 | Front central operating unit |
| 4 | Compressor actuation via relay | 17 | Intake air temperature signal for compressor control | A40/9s8 | Transmission modes button |
| 5 | Outside temperature signal | 18 | Actuation of damping valves | A85 | Left front door lock unit |
| 6 | Atmospheric pressure signal | 19 | Actuation of level valves | A85/1 | Right front door lock switch |
| 7 | Steering angle sensor signal | 20 | Level control valve unit actuation | A85/3 | Left rear door lock unit |
| | | | | A85/4 | Right rear door lock unit |

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|-------|---|-------|-------------------------------------|--------|--|
| 8 | Service brake applied signal | 21 | Actuation of drain valve | B7 | AIRmatic pressure sensor |
| 9 | Wheel speed signals | A1 | Instrument cluster | B22/3 | Rear axle level sensor |
| 10 | Level sensor signals | A7/3 | Traction system hydraulic unit | B22/8 | Left front level sensor |
| 11 | Vertical acceleration signal | A7/7 | BAS brake booster | B22/9 | Right front level sensor |
| 12 | System/fault messages | | | B24/3 | Left front body lateral acceleration sensor |
| 13 | Vehicle data | | | | |
| | | | | | |
| B24/4 | Right front body lateral acceleration sensor | N51 | AIRmatic with ADS control unit | a | AIRmatic central reservoir charge valve integrated in the level control valve unit |
| B24/6 | Right rear body lateral acceleration sensor | N69/1 | Door control module front left | | |
| | | N69/2 | Door control module front right | b | Four level valves integrated in the level control valve unit |
| L6/1 | Left front rpm sensor | N69/3 | Door control module rear left | | |
| L6/2 | Right front rpm sensor | N69/4 | Door control module rear right | c | AIRmatic pressure reduction valve (A9/1y1) integrated in AIRmatic compressor unit (A9/1) |
| L6/3 | Left rear rpm sensor | N72/1 | Upper control panel control unit | | |
| L6/4 | right rear rpm sensor | N80 | Steering column module | | |
| M14/7 | Trunk lid CL [ZV] motor | N93 | Central gateway control unit | A | Telematics CAN |
| N3/10 | ME-SFI [ME] control unit | S6/2 | Cockpit switch group | B | Interior CAN |
| N10/1 | Front SAM control unit with fuse and relay module | Y51 | Left front axle damping valve unit | E | Chassis CAN |
| | | Y52 | Right front axle damping valve unit | F | Central CAN |
| N10/2 | Rear SAM control unit with fuse and relay module | Y53 | Left rear axle damping valve unit | LIN B3 | OBF LIN |
| | | Y54 | Right rear axle damping valve unit | | |

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|--|---|-------------------------------|-------------------|
| | Pressure supply, function | | GF32.22-P-4010SX |
| | Central reservoir component description | | GF32.22-P-5102SX |
| | Compressor unit, component description | | GF32.22-P-5103SX |
| | Pressure sensor, component description | | GF32.22-P-5104SX |
| | AIRmatic with ADS control unit, component description | | GF32.22-P-5108SX |
| | Suspension strut component description | | GF32.25-P-5101SX |
| | Level sensor, component description | | GF32.31-P-5105SX |
| | Acceleration sensor, component description | | GF32.31-P-5106SX |
| | Level adjustment switch, component description | | GF32.31-P-5109SX |
| | Comfort and sport switch, component description | with code (494) USA version | GF32.31-P-5110SXU |
| | Damper valve, component description | | GF32.31-P-5112SX |
| | AIRmatic relay, component description | | GF32.31-P-5114SX |
| | Level control valve unit, component description | | GF32.31-P-5115SX |
| | Comfort/sport/manual switch, component description | except CODE (494) USA version | GF32.31-P-5116SX |
| | Steering angle sensor, component description | | GF42.45-P-5107SX |