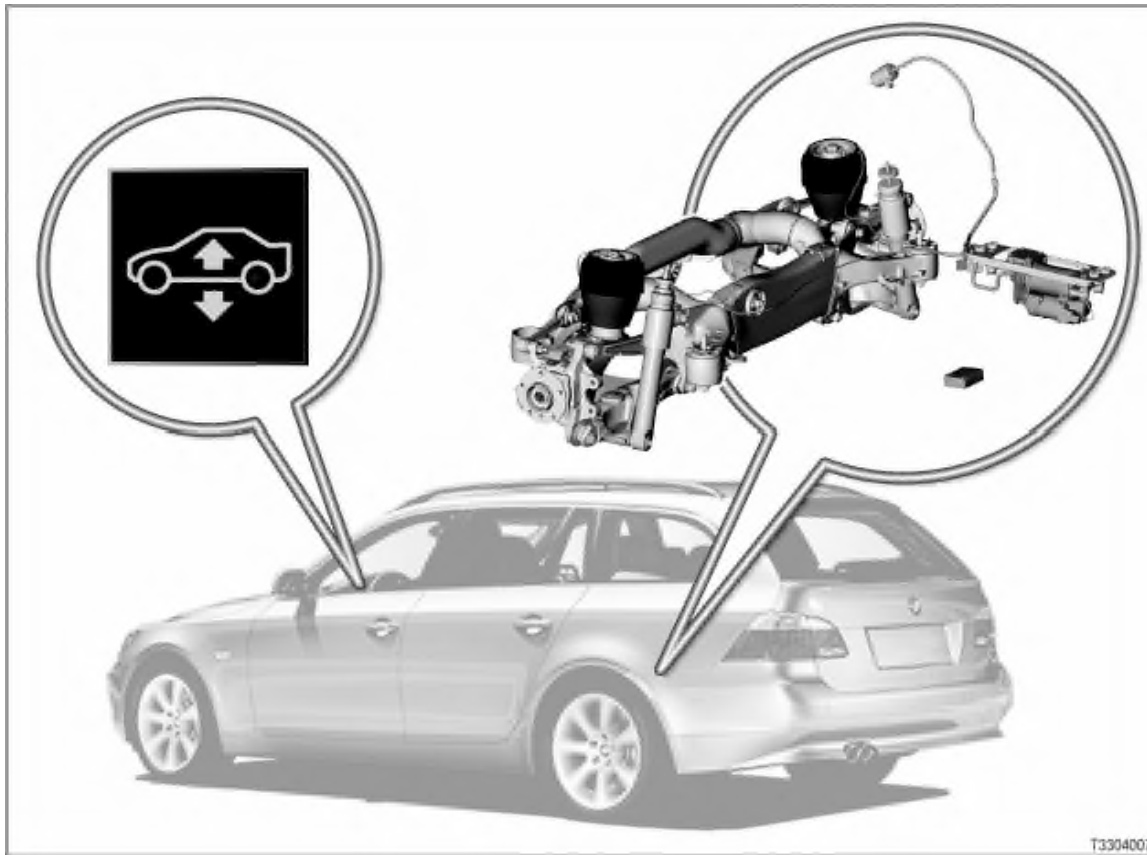


Single-axe air suspension

E61



Introduction

The E61 is equipped as standard with an electronic height control system that uses air suspension on the rear axle. [System overview ...]

This single-axe air suspension has the task of maintaining the a constant ride at a specified level height at the rear axle, regardless of load.

There are 2 versions of the electronic height control system in the E61:

- for vehicles with standard suspension
- for vehicles with sports suspension

New features of single-axe air suspension:

- Air springs with contoured gaiter and 2 plies

Brief description of components

The single-axe air suspension consists of the following key components:

- Air supply unit

The air supply unit includes the following components:

- Electric motor for driving compressor
- Compressor with air drier
- Drain valve with pressure-holding and pressure-limitation function
- Electric control valve
- Solenoid valve block with 2 solenoid valves (2/2-way valves)

[more ...]

- **EHC control unit**

The EHC control unit (EHC = electronic height control) decides on a case-by-case basis whether there is a need for intervention to compensate for changes in load.

Besides height control, the EHC control unit also has the task of monitoring system components and of storing and displaying faults.

[more ...]

- **2 air springs**

The air springs are located in place of the steel springs. The air springs form the airtight, moving connection between the body and the wheel carrier. The air pressure in the air spring supports the vehicle's weight. The air springs and the impact absorbers are separate components.

[more ...]

- **2 level sensors**

The EHC control unit receives information about the ride height on the left and right-hand sides of the vehicle from the level sensors. The level sensors are installed on the rear axle.

[more ...]

- **Check Control**

A fault in the single-axle air suspension is indicated on the LCD display with a Check-Control symbol (yellow). The text for the Check-Control message can be called up in the Central Information Display (CID).

[more ...]

The following control units are involved in the operation of the single-axle air suspension (in alphabetical order):

- **Car Access System**

The CAS (Car Access System) controls the relay for terminal 30g on the rear electrical distributor. This allows the EHC control unit to be activated and deactivated in a defined manner.

The CAS supplies the terminal status (e.g. terminal 15 ON or OFF) to the EHC control unit via the K-CAN.

- **Digital engine electronics or digital diesel electronics**

The DME or DDE (digital engine electronics / digital diesel electronics) supplies the EHC control unit with the "engine running" signal.

Signal path: DME or DDE -> PT-CAN -> SGM or KGM -> EHC control unit

- **Dynamic Stability Control**

DSC (Dynamic Stability Control) supplies the following signals to the EHC control unit:

- Vehicle road speed
- Lateral acceleration

- **HUD: Head-up display**

A fault in the single-axle air suspension system is shown in abbreviated form in the head-up display.

The Check-Control symbol in the instrument cluster lights up. The related Check-Control message is displayed in abbreviated form.

- **KBM: Body basic module**

The KBM (basic body module) emits a signal concerning the status of the tailgate (open or closed) and the rear doors.

Signal path: Boot-lid contact switch, rear door contact -> direct wire -> KBM -> K-CAN -> EHC control unit

- **KGM: Body gateway module from 09/2005**

From 09/2005, the vehicle electrical system has been modified. The body gateway module (KGM) replaces the safety and gateway module (SGM). The KGM forms the gateway between the PT-CAN (powertrain CAN) and the K-CAN (body CAN).

The diagnosis wire is connected to the SGM.

- **KOMBI: Instrument cluster**

The EHC control unit (EHC = electronic height control) sends a message through the bus communications system

to the instrument cluster. The instrument cluster supplies a Check Control via the Check-Control symbol in the LCD display.

- **SGM: Safety and gateway module up to 09/2005**

The SGM (safety and gateway module) is the gateway between:

- PT-CAN (powertrain CAN)
- K-CAN (body CAN)
- **Byteflight**

The diagnosis wire is connected to the SGM.

- **Driver's door module and front-passenger door module up to 09/2005**

The door modules (driver's door module = TMFA, front-passenger door module = TMBF) supply a signal about the status of the front doors (OPEN or CLOSED).

Signal path: Door contact -> TMFA/TMBF -> **byteflight** -> SGM -> K-CAN -> EHC control unit

From 09/2005, the body gateway module (KGM) delivers a signal confirming the status of the front doors (OPEN or CLOSED).

Signal path: KGM -> K-CAN -> EHC control unit

System functions

The following system function for the single-axle air suspension is described:

- **Electronic height control**

Ride height is controlled by air being fed into or withdrawn from the air springs. The EHC control unit receives information about the ride height on the left and right-hand sides of the vehicle from the level sensors.

If the ride height is outside defined tolerances, the system will automatically activate the air supply unit to regulate to the specified level.

The system is activated and starts to regulate whenever a door or the tailgate is opened. The system is deactivated after a certain time (approx. 20 minutes).

The signals from the level sensors are filtered to distinguish between changes in load and other disturbances such as an uneven road surface. For correct use, two signals filtered at different frequencies are computed for each signal (loW-pass filter with fast and slow filtering).

Fast filtering is always employed when regulation is in progress. This prevents the regulated height from exceeding the specified level.

Slow filtering is employed when the vehicle is in motion. This mode of filtering eliminates oscillations induced by the road surface.

Both sides of the vehicle are regulated independently. In other words, the comparison of specification to actual value is performed separately for each side (exception: minimum height check in pre-mode and in "twist" control function. In these control functions, the mean value of the left and right-hand sides of the vehicle are considered).

The EHC control unit recognises the different operating conditions from the incoming signals and messages. Depending on operating conditions, appropriately adapted control functions are activated.

The following control functions are described for the single-axle air suspension:

- Sleep mode
- Pre-mode (temporary start/run-on)
- Post-mode (readjustment)
- Normal operation
- Drive mode
- Cornering
- Twist
- Level-up function (E61 All-wheel drive only)
-

Lifting platform

- Transport mode
- Production mode

Transport and production modes can be set and cancelled with the BMW diagnosis system. If transport or production mode is set, "power economy mode active" will be stored in the fault memory.

Sleep mode

No regulation is performed in sleep mode. Control functions that were started in other control modes are cancelled when sleep mode is activated.

Pre-mode

In pre-mode (temporary start/run-on), changes in load are equalised even as the vehicle occupants are getting in and then again for a certain time (approx. 20 minutes) after the vehicle is shut down.

In pre-mode, the ride height is only regulated to the specified height if it differs significantly from this height. The tolerance range for regulation is approx. 40 millimetres under the mean value (the tolerance range stipulates when the electronic circuitry in the EHC control unit performs regulation).

This tolerance ensures that regulation is only initiated for large loads, to increase ground clearance before pulling away. Small loads produce smaller amounts of spring travel, which are not equalised until the engine is started. These control characteristics reduce load on the battery.

In pre-mode, only the mean value of the two level sensor signals is considered.

Post-mode (readjustment)

Post-mode is used to equalise any inclination before sleep mode is initiated (fast filtering).

Control function is time-limited (approx. 1 minute).

In post-mode, regulation is restricted to a defined tolerance range (+7/-10 mm).

Normal mode

Normal mode refers to the normal operating conditions for the vehicle. Normal mode is initiated by the "engine running" signal. Regulation is performed within a defined tolerance range on each side (± 10 mm, fast filtering).

Drive mode

If a road-speed signal greater than 1 km/h is detected, the EHC control unit will switch to drive mode.

In drive mode, regulation employs slow filtering. For example, in drive mode, changes in ride height caused by the reduction in the vehicle's weight due to fuel consumption are equalised.

Cornering

The "cornering" control function prevents adjustments being made when cornering is detected. Slow filtering is suspended and ongoing regulation sequences suspended. Cornering is detected from an incoming transverse acceleration signal (e.g. cornering greater than 2 m/s^2 , less than 1.4 m/s^2 when leaving bend). The DSC control unit transmits the transverse acceleration signal via the K-CAN.

Twist

"Twist" mode prevents equalisation of an inclination caused by driving over an obstacle with one wheel. Equalisation would cause a new inclination after the vehicle is driven off the obstacle, making a new regulation sequence necessary.

If the vehicle is driven onto the kerbstone and stopped, the EHC control unit will switch from drive mode to normal mode. In this control function, the signals from the left and right level sensors are evaluated.

"Twist" control function is activated if the difference in height between the left and right-hand sides exceeds a certain value (e.g. 28 mm).

In this control function, the vehicle's ride height in the middle of the axle is evaluated by the EHC control unit.

If the vehicle is loaded or unloaded, the degree of spring deflection is considered. If this value is outside the defined tolerance range (e.g. ± 10 millimetres), regulation is initiated.

The left and right-hand sides of the vehicle are raised or lowered in parallel.

The difference in height between the two sides is maintained.

When the EHC control unit goes into drive mode, control function

"Twist" is terminated. An ongoing regulation sequence will be cancelled. The "Twist" control function is ended if the height differential between the left and right sides of the vehicle drops below a predefined value.

Level-up function (E61 All-wheel drive only)

The level-up function is used to automatically raise the rear of the vehicle after stopping and getting out of the vehicle.

After stopping, the vehicle is automatically raised as follows:

- Vehicle left
and
vehicle "secured" with central locking.

The height is automatically adjusted after a short delay.

Alternatively

- Vehicle left
and
vehicle **not** "secured" with central locking.

The height is automatically adjusted after a longer delay.

When the EHC control unit goes into drive mode, the level-up function is ended. The vehicle is lowered to its normal height.

Lifting platform

In the "Lifting platform" control function, any adjustment is prevented during a wheel change or other work carried out on the lifting platform.

The following conditions trigger the "Lifting platform" control function:

- Permissible spring extension exceeded (e.g. more than 50 millimetres, recorded by left and/or right-hand level sensor)
- Vehicle raised slightly (spring extension e.g. less than 55 millimetres), regulation starts but vehicle is not lowered

The height is stored in the EHC control unit.

A reset is performed when the vehicle is again e.g. 10 millimetres under this stored height or when drive mode is detected.

Transport mode

The specified height is raised in transport mode (e.g. 30 mm). The increased ground clearance guarantees risk-free transportation of the vehicle.

Production mode

Production mode is employed for assembly on the production line and prevents regulation sequences from being initiated.

New EHC control units are delivered with production mode set. Production mode must be cancelled after the new EHC control unit has been installed.

Notes for service staff

- General note: [more ...]
- Diagnosis: [more ...]
- Encoding/programming: [more ...]

Subject to change.