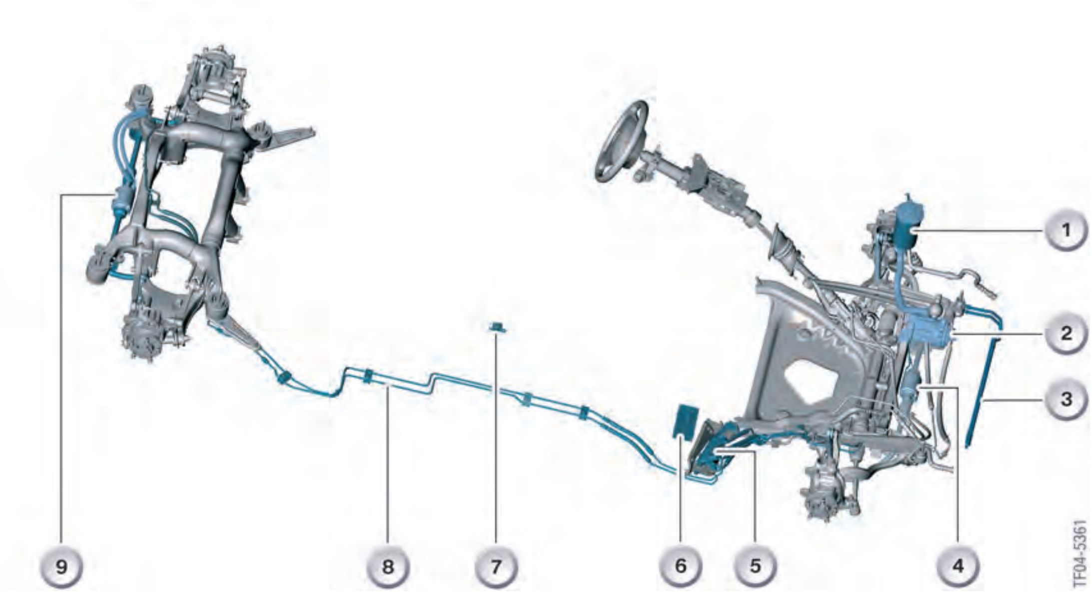
Introduction
Transverse dynamics systems

Dynamic Drive

DynamicDrive is a suspension control system that counteracts rolling forces. DynamicDrive is also known as ARS. This stands for Active Roll Stabilization. DynamicDrive prevents vehicle roll (= turning motion around longitudinal axis during cornering). When a vehicle is cornering, a centrifugal force acts on the centre of gravity which builds up a rolling moment via the vehicle longitudinal axis. This force tilts the vehicle body towards the wheel on the outside of the bend and the vehicle rapidly approaches its dynamic limits. Stabilizer bars are used to counteract the varying forces which act on the wheels as a result of the body angle. During cornering, the wheel suspension on the outside of the bend is compressed and the wheel suspension on the inside of the bend rebounds. This causes the spine of the stabilizer bar to turn. The forces occurring at the mounting points of the stabilizer bar produce a moment. The moment counteracts the tilt of the body, thus achieving more effective distribution of the load over both wheels. DynamicDrive therefore enhances driving stability. Vertically divided stabilizer bars on both axles are the basic elements of this system. Both halves of the stabilizer bars are connected by a hydraulic oscillating motor which adapts the suspension to the road situation within milliseconds. DynamicDrive also improves driving comfort - especially ride comfort - when travelling straight ahead. If potholes are present on one side of the road, in vehicles with conventional stabilizer bars this has a negative effect on the suspension on the other side. Not so with DynamicDrive.

E60 Mechanical system



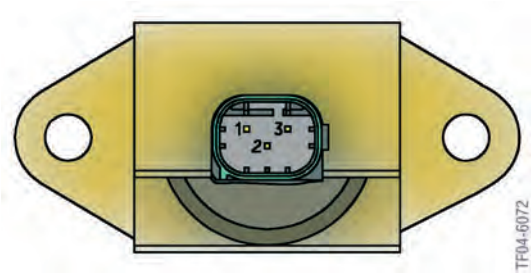
1 - Overview of mechanical system

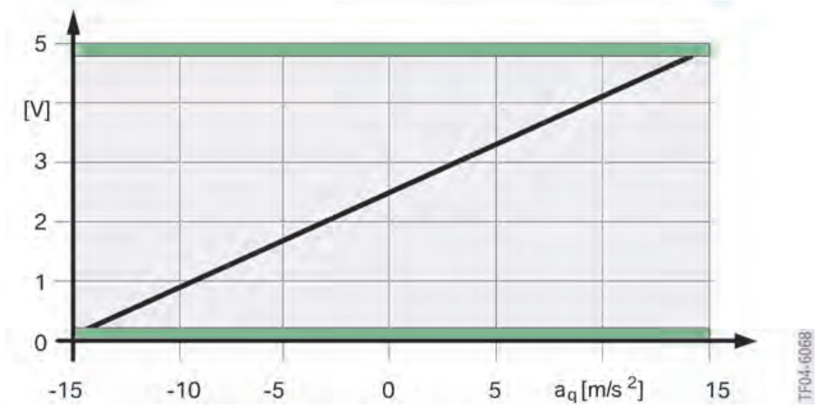
Index	Explanation	Index	Explanation
1	Fluid reservoir	6	Control unit
2	Tandem pump	7	Transverse acceleration sensor
3	Hydraulic-fluid cooler	8	Hydraulic lines
4	Front oscillating motor	9	Rear oscillating motor
5	Valve block		

Components and their functions

Transverse acceleration sensor

The transverse acceleration sensor supplies the main sensor signal. It measures the transverse acceleration of the vehicle during cornering up to a measurement range of ±1.1 g. The transverse acceleration sensor is installed on the base plate under the right front seat.





Oil level sensor

The oil level sensor detects the fluid supply in the oil reservoir.
It is installed on the oil reservoir. Short-circuit/ open circuits cannot be detected by the oil level sensor. A line break is interpreted as a loss of fluid.

DynamicDrive control unit

The DynamicDrive control unit is located on the right side of the passenger compartment in the A-pillar area.

The control unit is supplied with power via terminal 30 and is protected by a 10 A fuse.

A vehicle authentication process takes place when the system is started. This compares the vehicle identification number from CAS with the vehicle identification number which is encoded in the DynamicDrive control unit.

Then the control unit's hardware and software is checked.

All the outputs (valve magnets) are subjected to a complex check for short circuits and breaks. If there is a fault, the system switches the actuators into a safe driving condition.

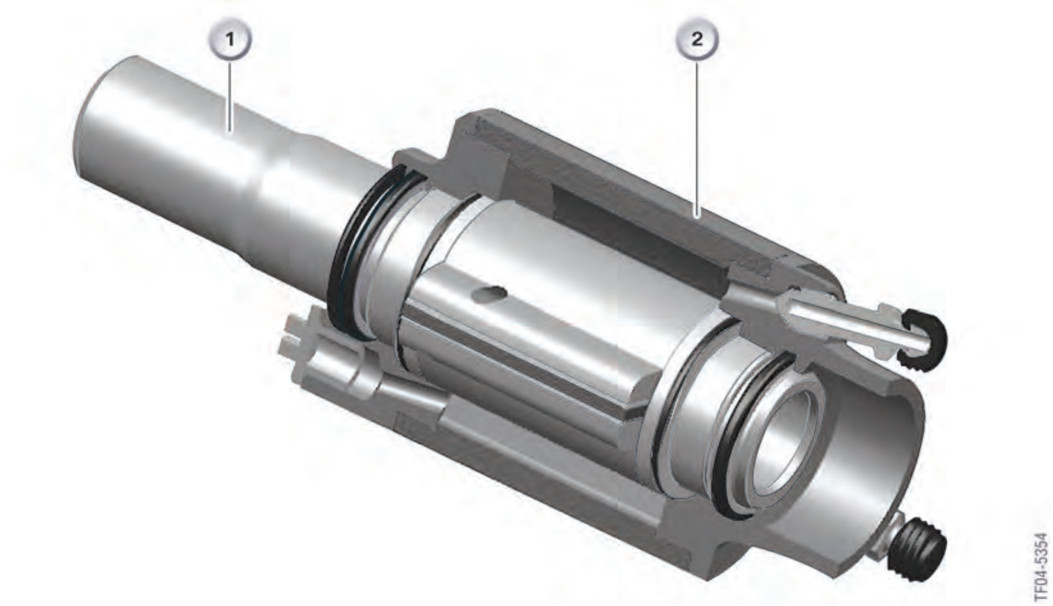
The control unit switches off if there is undervoltage or overvoltage.

The control unit learns the "offset" for the steering angle and the transverse acceleration during start-up and during driving.

Active stabilizer bar

The active stabilizer bar consists of the oscillating motor and the halves of the stabilizer bar with press-fitted roller bearings which are mounted on the oscillating motor. The roller bearings provide the connections to the axle carrier. The use of roller bearings ensures optimum comfort thanks to better response and reduced control forces.

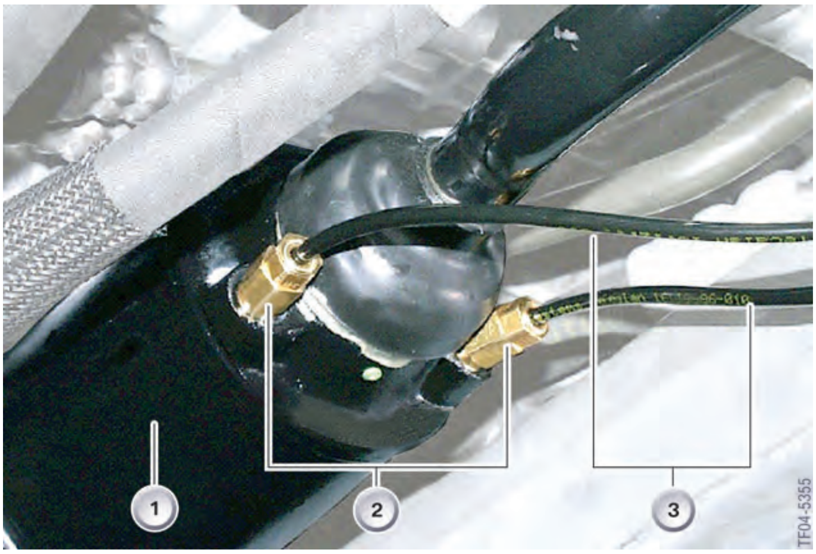
The oscillating motor and the oscillating motor housing are joined by one half of the stabilizer bar.



1 - Oscillating motor

Index	Explanation	Index	Explanation
1	Oscillating motor shaft	2	Oscillating motor housing

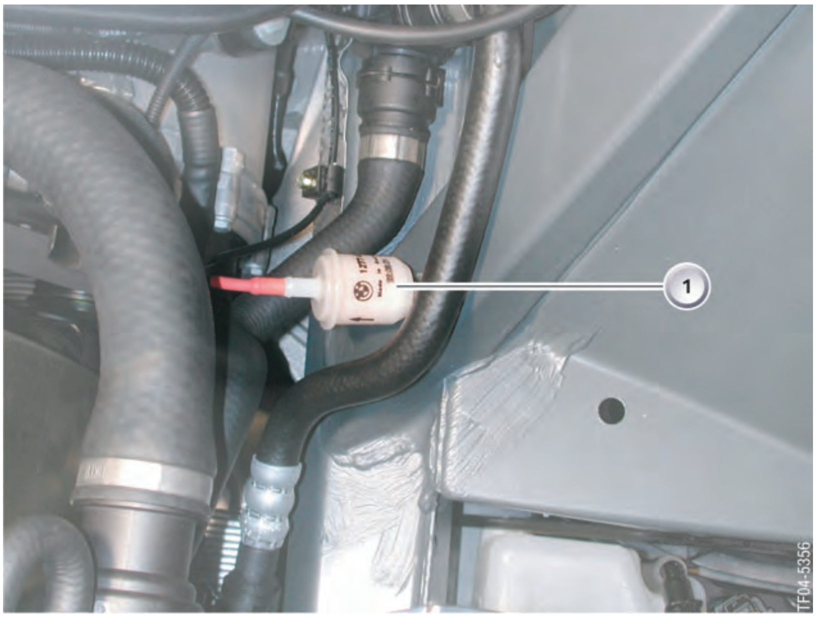
The oscillating motor of the front-axle stabilizer bar is fitted with 2 pressure relief valves.



2 - Pressure relief valves

Index	Explanation	Index	Explanation
1	Oscillating motor	3	Pneumatic lines
2	Pressure relief valves		

Pneumatic lines are mounted on the pressure relief valves (venting valves).
The pneumatic lines lead to a filter element (conventional fuel filter) which is inserted in the diagonal strut on the left wheel arch.



3 - Filter element

Index	Explanation
1	Filter element

The filter element is located in different positions in the engine compartment, depending on the mounting position of the various engines.

The positions for the pressure relief valves are fitted with screw plugs on the oscillating motor of the rear-axle stabilizer bar.

Function of pressure relief valves

When the vehicle is driven on poor road surfaces, the stabilizer bar movements give rise to brief underpressures (cavitation) in the oscillating motors which in turn cause rattling noises.

Pressure relief valves have been fitted on the front oscillating motor in order to eliminate these noises. These pressure relief valves allow filtered air to flow into the oscillating motor through the connected pneumatic lines. This prevents cavitation.

This small quantity of air is absorbed by the hydraulic fluid (Pentosin) to form an emulsion, which is discharged during subsequent activations of the oscillating motor. The air is separated in the expansion tank.

Since no noises can be heard at the rear axle, the pressure relief valves have been omitted from the rear oscillating motor.

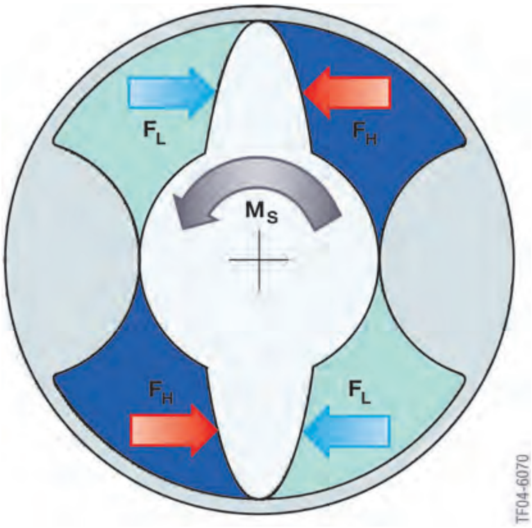
Operating principle of oscillating motors

The oscillating motor has three functions to perform:

- It guides the torque into the two halves of the stabilizer bar.
- It decouples the two halves of the stabilizer bar.
- In the event of system failure (fail-safe mode), the front axle stabilizer bar creates sufficient damping via the hydraulic fluid of the oscillating motor. It now works like a conventional stabilizer bar.

  Exception: If the oscillating motor chambers no longer contain any fluid as a result of a leak, the front axle stabilizer bar can no longer create damping.

The opposing chambers in the oscillating motor are connected to one another. The same pressure exists in both chambers. Two chambers are supplied with high-pressure fluid using one connection. The two other chambers are connected to the tank via the return line. The forces F_H (High) or F_L (Low) are created as a result of the differences in pressure. As F_H is greater than F_L, a torque M_S is generated. The shaft turns in the opposite direction to the housing as a result.



4 - Generating torque

Since one half of the stabilizer bar is connected to the shaft, and the other with the housing, the two halves turn in opposite directions.

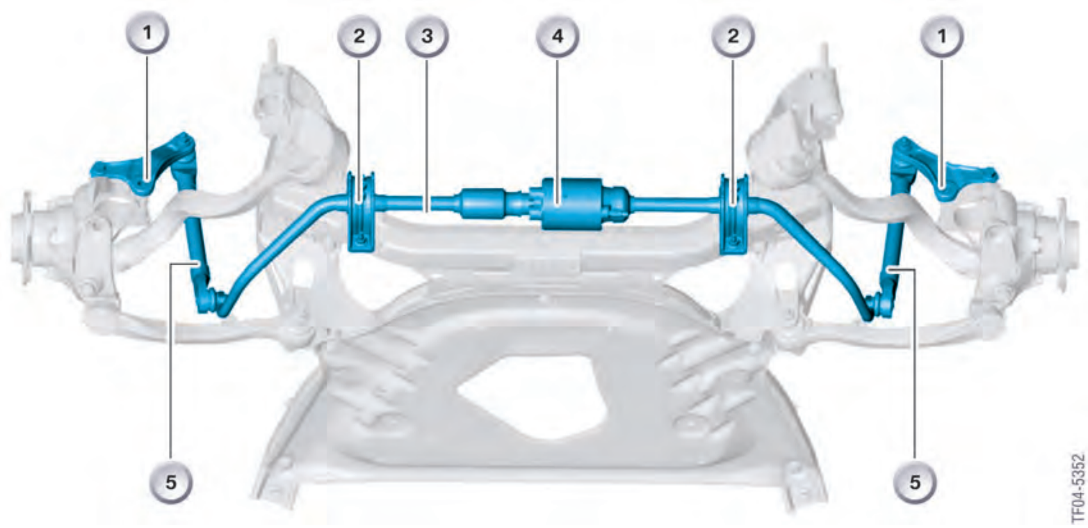
This torque M_S at the stabilizer bar connections produces the active moment M_A about the vehicle longitudinal axis. The active moment counteracts the rolling moment M while cornering. The body is forced upwards on the outside of a bend, and dragged down on the inside of a bend.

The maximum body torque on the front and rear axle occurs when there is a high degree of transverse acceleration. The system pressure is then 180 bar at the front axle and 170 bar at the rear axle.

Front-axle stabilizer bar

The stabilizer bar is mounted on the front-axle carrier.

The stabilizer links are connected to the "goosenecks" of the swivel bearings.



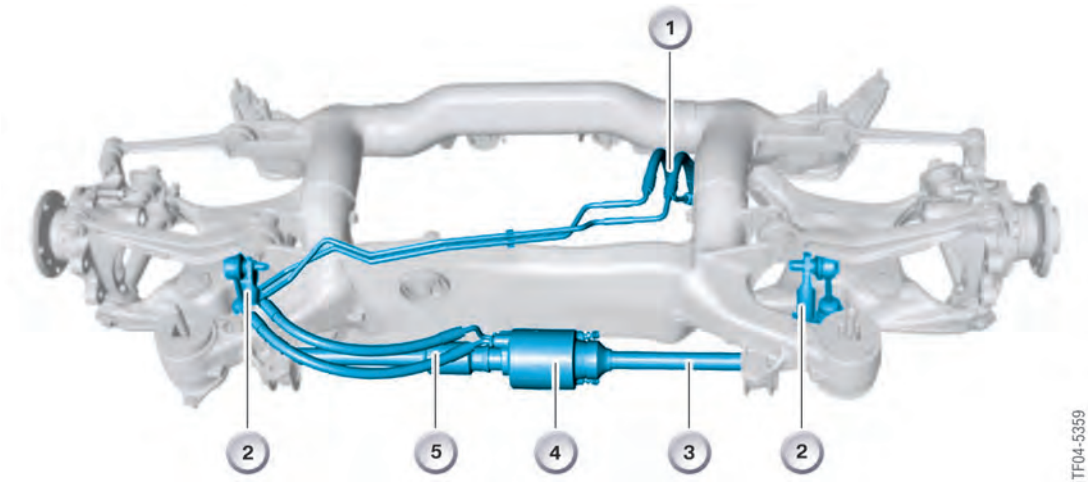
5 - DynamicDrive front axle

Index	Explanation	Index	Explanation
1	Anti-roll bar link connection to swivel bearing	4	Oscillating motor
2	Anti-roll bar bracket	5	Anti-roll bar links
3	Anti-roll bar		

Rear-axle stabilizer bar

The stabilizer bar is mounted behind the rear-axle carrier.

The stabilizer links are connected to the rear-axle swinging arms.

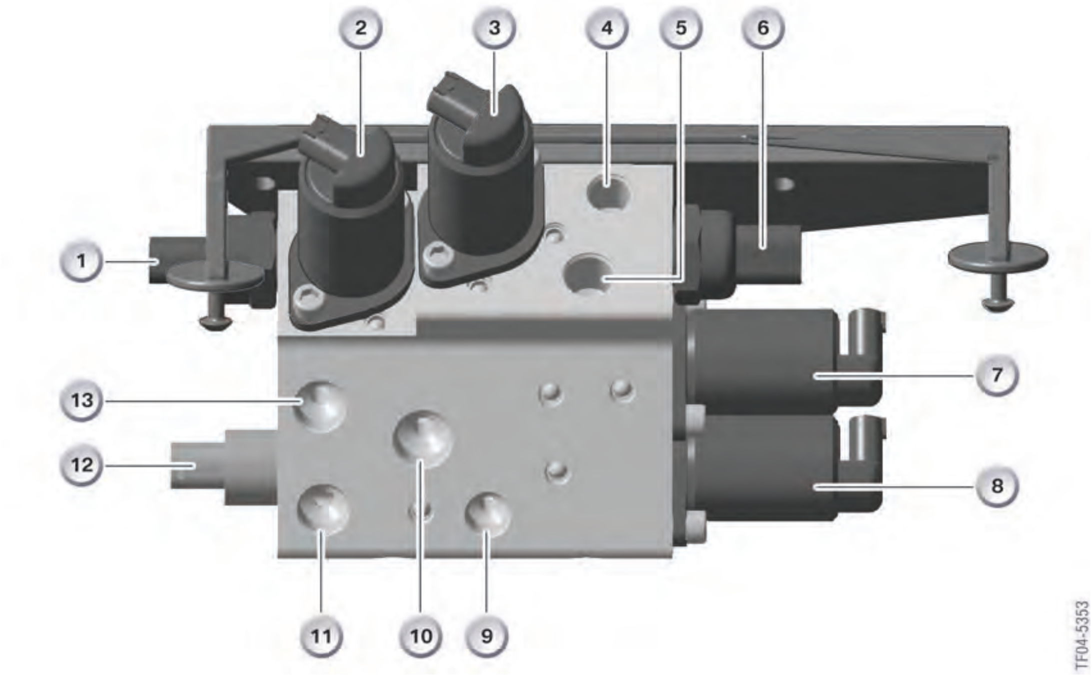


6 - DynamicDrive rear axle

Index	Explanation	Index	Explanation
1	Hydraulic lines from valve block	4	Oscillating motor
2	Anti-roll bar links	5	Hydraulic lines
3	Anti-roll bar		

Valve block

The valve block is located on the floor plate behind the front right wheel-arch trim.



7 - Valve block

Index	Explanation	Index	Explanation
1	Rear-axle pressure sensor	8	Directional valve
2	Rear-axle pressure-limiting valve	9	Line 1, rear-axle oscillating motor
3	Front-axle pressure-limiting valve	10	Line to hydraulic fluid reservoir
4	Line 1, front-axle oscillating motor	11	Line 2, rear-axle oscillating motor
5	Line 2, front-axle oscillating motor	12	Switching position recognition sensor
6	Front-axle pressure sensor	13	Line to tandem pump
7	Fail-safe valve		

Pressure control valves

There is a pressure control valve on both the front and rear axles. They both adjust the actuation pressures for the front- and rear-axle stabilizer bars.

Directional valve

The directional valve is electrically actuated. It specifies the direction of the high-pressure fluid (active pressures) and the reservoir fluid for right-hand and left-hand bends.

Fail-safe valve

The fail-safe valve (safety valve) is electrically actuated. The fail-safe valve responds in the event of a power supply failure or if a fault is detected in the system.
When de-energized, the fail-safe valve locks the oscillating motor for the front axle. Thus the active stabilizer bar behaves like a normal mechanical stabilizer bar and brings about understeering.

Switching position recognition sensor

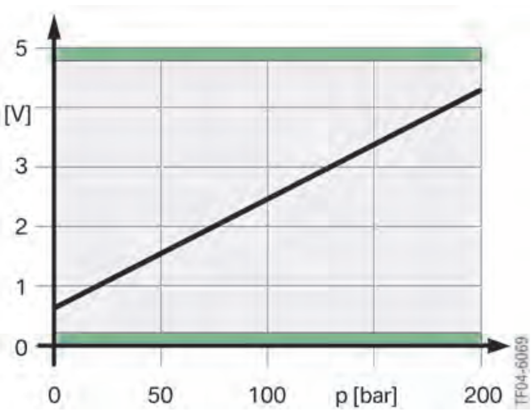
The task of this sensor is to detect the specific position of the directional valve.

2 positions can be detected:

- Left-hand control
- Right-hand control

Front-axle/rear-axle pressure sensors

The pressure sensors are responsible for detecting the front and rear axle stabilizer bar hydraulic pressures. The sensors are mounted on the valve block. The pressure sensor offset values are taught-in by the control unit once, during commissioning.



8 - Pressure sensor characteristic curve

Tandem pump

The engine drives the tandem pump via a ribbed V-belt. The tandem pump consists of a radial piston part for DynamicDrive and a vane cell part for the power steering.

When idling, the pump speed is approximately 750 rpm.

The pump's minimum fluid flow rate is 4.5 l/min at approximately 5 bar and 3.3 l/min at 200 bar. This means that sufficient system dynamics are also guaranteed when the engine is idling.

The maximum fluid flow rate is limited to 7 l/min from a pumping speed of approximately 1165 rpm and upwards.

The DynamicDrive and power steering share a common oil reservoir and power steering cooler.

Oil reservoir

The oil reservoir is identical on all vehicles, whether they have the DynamicDrive function or not. The reservoir incorporates a fluid filter.

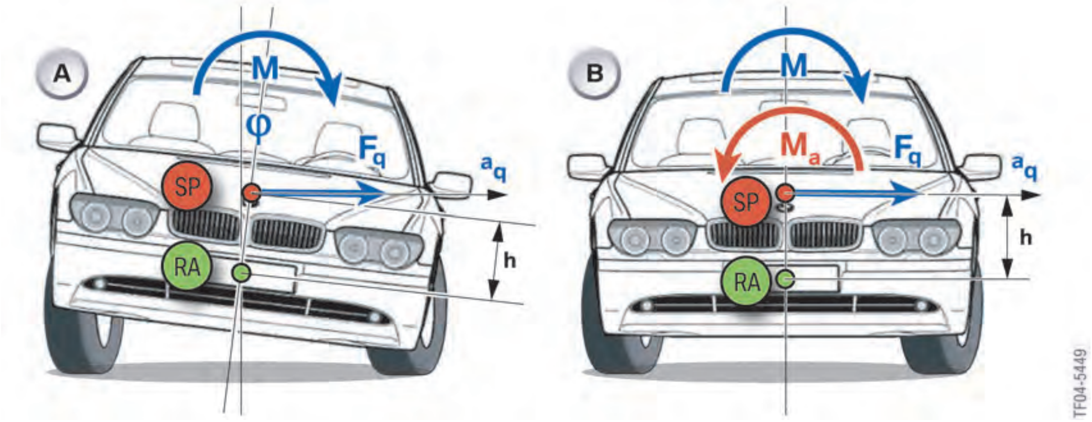
An oil level sensor is provided for the minimum quantity.

Cooler

The cooler ensures a long-term fluid temperature of < 120 °C and a short-term fluid temperature of < 135 °C in all hydromechanical components under all conditions.

System functions

Transverse acceleration a_q is exerted on the vehicle while cornering. The transverse acceleration is applied at the centre of gravity of the vehicle body.
The body rolls about the vehicle longitudinal axis (rolling axis) RA which is defined by the kinematics of the front and rear axle. The roll angle is formedφ (max. 5°). This produces a maximum change in level at the wheel arch of 10 cm.



9 - Rolling

Index	Explanation	Index	Explanation
A	Vehicle without DynamicDrive	Ma	Active body moment
B	Vehicle with DynamicDrive	SP	Centre of gravity
M	Rolling moment	RA	Vehicle longitudinal axis (rolling axis)
aq	Transverse acceleration	F_q	Transverse force
φ	Roll angle	h	Lever arm centre of gravity height

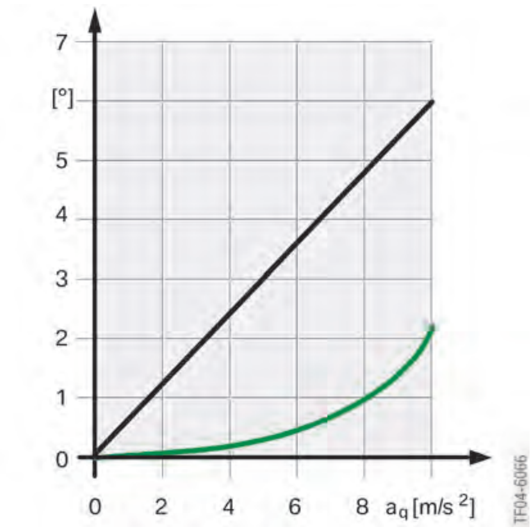
In a passive vehicle with conventional suspension, the rolling moment M is absorbed by the stabilizer bars and springs. The springs on the outside of the curve are compressed. The springs on the inside of the curve are elongated. In addition, the stabilizer bars rotate. A roll angle between the vertical axis and the body results.

On vehicles with DynamicDrive, the rolling moment M is compensated up to a transverse acceleration a_q of approx. 3 m/s^2 (0.3 g). The active stabilizer bars alone are responsible for this function. A roll angle only builds up once the rolling moment M has exceeded the moment actively set M_a by the stabilizer bar. The additional rolling moment M is then absorbed by the passive springs.

The active body moments M_a at (the front and rear axle) counter the rolling moment M. Using this approach, the roll angle is compensated for in accordance with the characteristic curve specified in the control unit. The roll angle is fully compensated for up to a transverse acceleration of approximately 3 m/s^2 (0.3 g). A roll angle also builds up with DynamicDrive but only with a high transverse acceleration. The roll angle together with an increasing understeering trend therefore provide the driver with an indication that the vehicle is approaching its limit range.

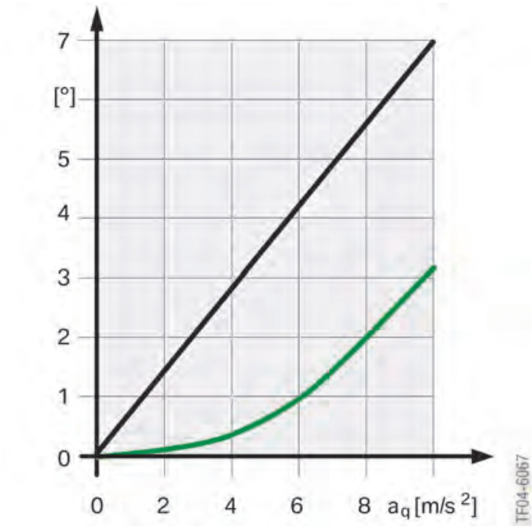
⚠ Note: The tyre suspension created by the rolling moment (M) is not compensated for. ◄

Roll angle diagram



10 - Roll angle diagram 1

The roll angle shown is achieved with an unladen vehicle with the driver in the vehicle.



11 - Roll angle diagram 2

When a vehicle is fully laden, the greater body weight effects a greater transverse force on the vehicle. Depending on the configuration of the vehicle load (in the vehicle or on the roof), this also results in a change to the lever arms h. The vehicle will in this case form a slightly greater roll angle than specified in the control curve.

By the same token, however, the fully laden passive vehicle also forms higher roll angles.

The distribution of the active body torque between the front and rear axle depends on the road speed.

Affect of the self-steering behaviour

The self-steering behaviour can be decisively influenced by the distribution of the stabilizing torque on the axles. The greater the stabilizing torque on an axle, the lower the transverse forces transmitted on this axle.

Two cases are described below with different distribution of stabilizing torque on the axles:

1. Identical stabilizing torque on both axles

Handling is NEUTRAL.

The front wheels can apply about the same amount of transverse force on the road as the rear wheels without drive torque. The handling conditions are neutral.

The handling of a vehicle with neutral tuning is very agile and precise. The steering response is very direct.

Even an inexperienced driver can control a vehicle which is tuned to neutral handling very well at low speeds.

2. Greater stabilizing torque on the front axle

Handling is UNDERSTEERING.

The front axle wheels cannot apply the same amount of transverse force on the road as the rear axle wheels. The vehicle suffers understeer.

A greater steering-wheel angle is required to be able to follow the desired course.

A vehicle with understeer can generally also be controlled well by an inexperienced driver at higher speeds and higher cornering speeds.

This very sensitive handling reduces the vehicle's agility.

DynamicDrive sets different stabilization moments at the front and rear axle. This results in different vehicle response for low and high speeds.

The passive vehicle is configured as slightly understeering irrespective of the speed range.

The active vehicle with DynamicDrive is configured neutrally in the low speed range. Less steering is required by the driver to drive round the same bend. The result is optimum handling and agility.

In the upper speed range, both vehicles behave almost identically with regard to the required steering angle on the same bend.

The hydromechanical concept is designed so that a greater active stabilizing torque cannot occur on the rear axle than on the front axle. This means that mechanically and hydraulically the vehicle with DynamicDrive is safeguarded such that no oversteering and therefore for normal customers no critical handling characteristics can occur under any circumstances.

Comparison between the conventional stabilizer bar and the active stabilizer bar

Active stabilizer bars introduce fewer comfort-reducing forces into the body than conventional stabilizer bars. In this case a differentiation must be made depending on the frequency with which the forces were introduced.

Road stimulus	Stabilizer bar behaviour
At approximately 1 Hz (body natural frequency)	At smaller strokes the active stabilizer bar is easier to turn than a conventional stabilizer bar.Consequently, the forces applied in the body are lower. The vehicle is more comfortable and body stability is improved.
From 8 Hz (wheel natural frequency)	Both stabilizer bars behave in a similar way.The active stabilizer bar becomes harder because the fluid is not displaced as quickly.

Operating states

Straight-ahead travel:

When the engine is started, the pump delivers hydraulic fluid to the system and a back pressure builds up. The pressure difference that occurs between the chambers of the actuator motor has no effect on the stabilizer bar. The reason for this is that, at approx. 1 bar, the pressure difference is very low. No power is applied to the high pressure control valves for the front axle stabilizer bar and the rear axle stabilizer bar. The valves are therefore open. The hydraulic fluid can flow back into the tank directly. This condition remains unchanged as long as the vehicle is travelling straight ahead.

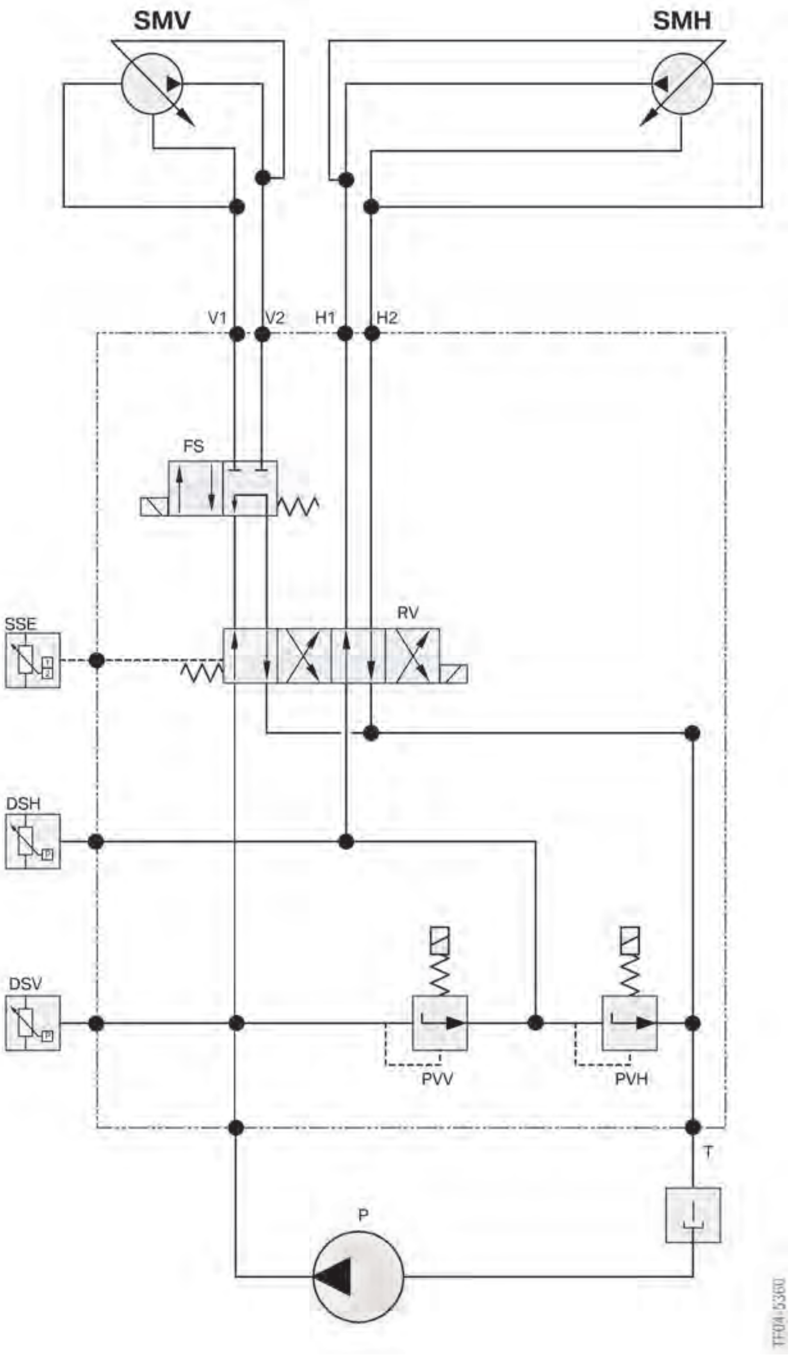
The system function is displayed continuously up to 15 km/h. The full stabilization potential is available from 15 km/h onwards.

Cornering:

When approaching a bend, signals from the transverse acceleration sensor are sent to the DynamicDrive control unit. The control unit now sends a pulse-width-modulated signal (PWM) to the high pressure valves for the front and rear axle stabilizer bars. The stronger the transverse acceleration, the greater the signal will be (current). The higher the power applied to the valves, the more they close. A correspondingly higher pressure is built up in the stabilizer bars. The pressure at the stabilizer bar is registered by the respective pressure sensor on the front axle and on the rear axle and sent to the control unit.

The direction valve (RV) is activated by the control unit to create a pressure build-up which corresponds with the characteristic of the bend (left or right-hand bend). A sensor (SSE) detects the switch position of the direction valve.

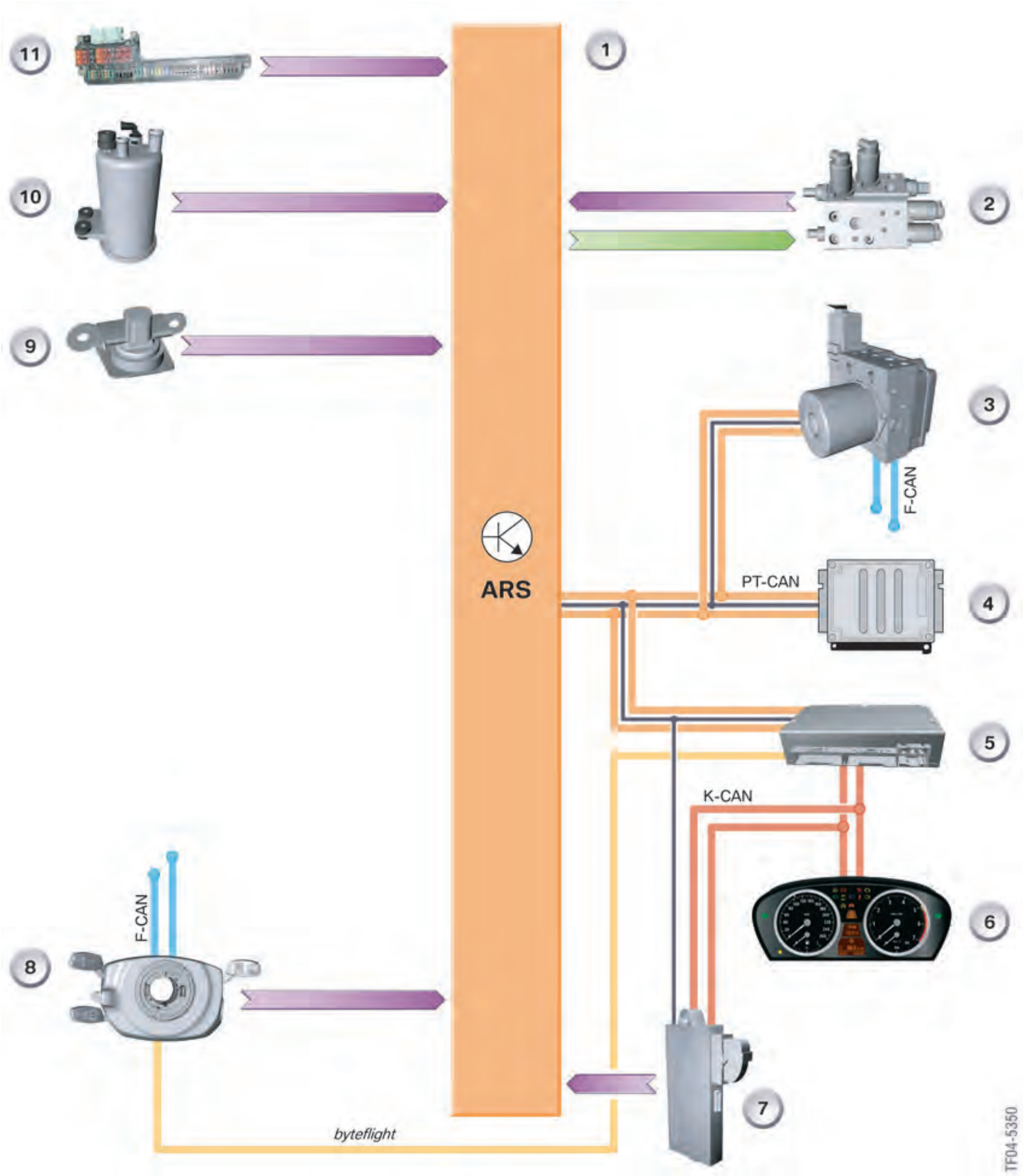
The fail-safe valve is also activated with this function.



12 - Hydraulic schematic

Index	Explanation	Index	Explanation
SMV	Front oscillating motor	RV	Directional valve
SMH	Rear oscillating motor	DSH	Rear-axle pressure sensor
V1	Front-axle hydraulic circuit 1	DSV	Front-axle pressure sensor
V2	Front-axle hydraulic circuit 2	PVV	High-pressure control valve, front axle
H1	Rear-axle hydraulic circuit 1	PVH	High-pressure control valve, rear axle
H2	Rear-axle hydraulic circuit 2	P	Tandem pump
FS	Fail-safe valve	T	Fluid reservoir
SSE	Switching position recognition sensor		

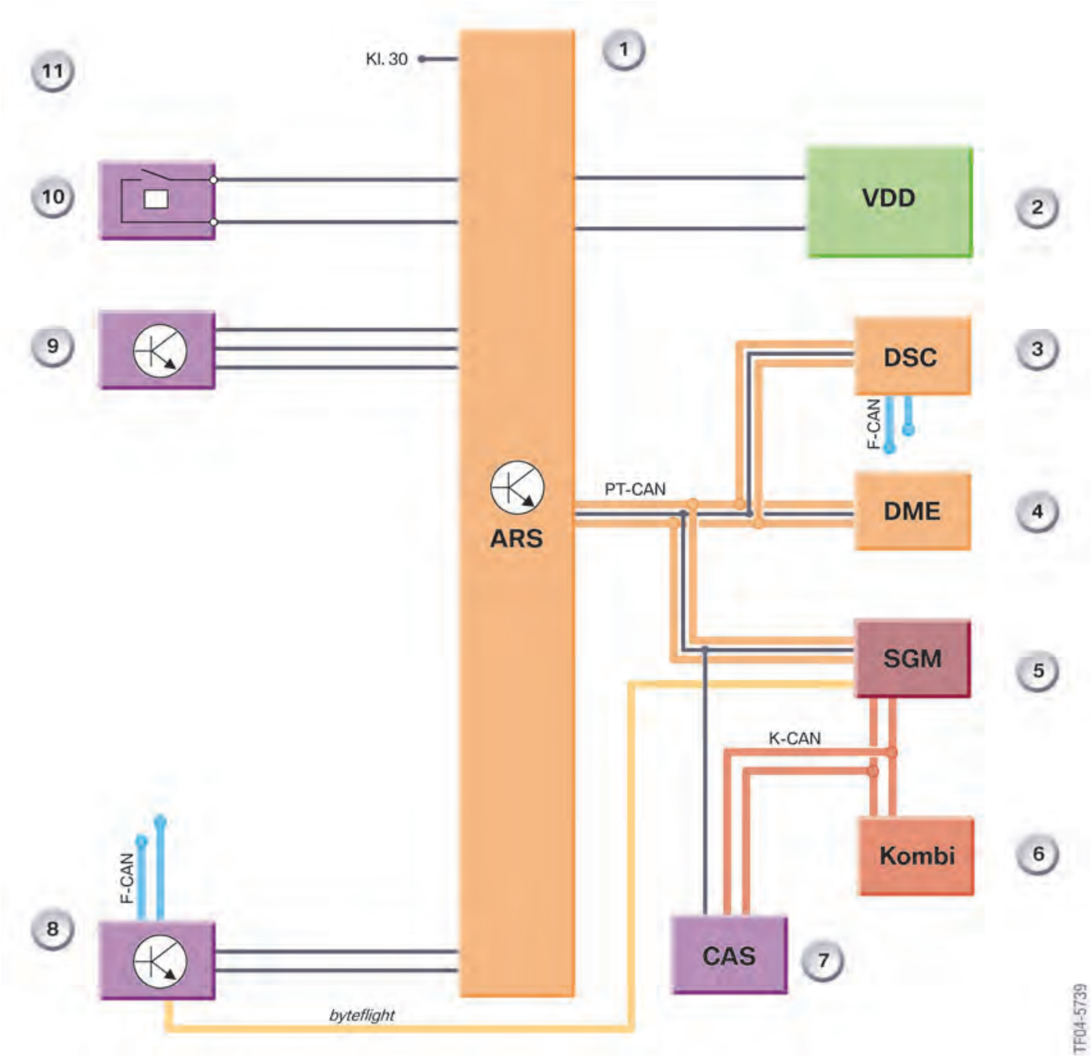
E60 inputs/outputs



1 - System overview

Index	Explanation	Index	Explanation
1	DynamicDrive control unit	9	Transverse acceleration sensor
2	Valve block, DynamicDrive	10	Hydraulic reservoir, fluid level sensor
3	DSC module	11	Current distributor, front, power supply
4	Digital motor electronics	***byteflight***	***byteflight***
5	Safety and Gateway Module	PT-CAN	Powertrain CAN
6	Instrument cluster	K-CAN	Body CAN
7	Car Access System control unit	F-CAN	Chassis CAN
8	Steering angle sensor		

E60 system circuit diagram



2 - DynamicDrive system diagram

Index	Explanation	Index	Explanation
1	DynamicDrive control unit	9	Transverse acceleration sensor
2	Valve block, DynamicDrive	10	Hydraulic reservoir, fluid level sensor
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5	Safety and Gateway Module	PT-CAN	Powertrain CAN
6	Instrument cluster	K-CAN	Body CAN
7	Car Access System control unit	F-CAN	Chassis CAN
8	Steering angle sensor		

Notes for service staff

Service information

If the DynamicDrive fails, DSC can no longer be deactivated or if it is already deactivated it does not switch back on automatically.

The connections for all the hydraulic components are designed in different dimensions and lengths so that they cannot be transposed.

A disturbing noise may be heard in the vehicle interior, predominantly caused by assembly and cable connections.
The cables must not make contact. They must not be overtightened or loose in the holders. They are covered by the underbody panelling.

Steering angle sensor adjustment

After work on the steering, it is necessary to adjust the steering angle sensor with the steering column switch cluster (SZL) control unit.

The DynamicDrive system is dependent on the exact zero balance of the steering angle. The maximum deviation tolerance is ±1°. Precise wheel alignment check and adjustment is a prerequisite.
The steering angle sensor for ARS 1 must always be adjusted on a model by model basis in accordance with BMW specifications.

Adaptive tuning is carried out for ARS 2.

The zero position is lost each time the DynamicDrive control unit or the SZL is flash programmed.
Steering angle sensor adjustment is then required.

DynamicDrive initialization

The initialization procedure must always be carried out once the system has been opened or a part has been replaced. This also applies after the transverse acceleration sensor has been replaced.

The following conditions must be guaranteed for matching the transverse acceleration sensor and the two pressure sensor offset values:

- The vehicle must stand level on all four wheels
- The vehicle must be unladen
- The engine must be idling
- Rest status (doors closed, persons are not allowed in the vehicle)

No persons may remain within the vicinity of moving chassis parts during the commissioning (both in the works and the workshop). In addition you must ensure that the basic initialization conditions (temperature range, constant engine speed etc.) are observed. The ground clearance must not be restricted. The doors must be closed. The arms of the hoist may no longer be situated beneath the car.

The initialization procedure is split into five stages which follow on from each other automatically:

I: Direction valve test (from 3 to 3.4 s)	First the direction valve is tested by evaluating the signal of the switch-position recognition sensor.
II: Low-pressure test (from 3.4 to 4.3 s)	During this phase, the fail-safe and direction valve are not supplied with current. Checks are then carried out using de-energized and energized pressure control valves at the front and rear axle. This will cause the body to roll. The sides of the vehicle must be clear.
III: High-pressure test front axle (from 4.3 to 9.9 s)	Pressure of 180 bar is applied to the front-axle oscillating motor. Air in the system, internal leaks and a blocked oscillating motor are detected.
IV: High-pressure test rear axle (from 9.9 to 15 s)	Pressure of 170 bar is applied to the rear-axle oscillating motor. Air in the system, internal leaks and a blocked oscillating motor are detected.
V: Pressure control valve test (from 15 to 25 s)	The characteristic curves of the front and rear axle are checked (setpoint/actual value comparison). Faulty pressure control valves are detected.

Bleeding DynamicDrive

A bleeding routine must be carried out using the BMW diagnostic tester if the DynamicDrive system was opened hydraulically.

The bleeding operation must be performed only using the initialization routine of the BMW diagnosis system. The bleeding operation must not be performed at the pressure relief valves or at the screw plugs of the oscillating motors!

If the test still detects air in the system, a short movement trip should be made if necessary.

The initialization routine must then be repeated after the short trip.

In the event of an extreme leak or suspected partial function of the pressure relief valves (noticeable by rattling noises in the front end), the pressure relief valves and the pneumatic lines must be replaced with new components.

Diagnosis

The following faults can be detected at the components:

Component	Fault type	Fault detection via:
Control unit	De-energized or faulty	No alive counter in the instrument cluster, VIN not recognized during authentication, software reset
Pump	No pressure	Setpoint/actual-value comparison pressures
Directional valve	Jammed in "energized" position (spring break, swarf)	Directional-valve sensor
	Jammed in "de-energized" position (line break)	Direction valve sensor and current monitoring
Pressure control valve front axle	Open (de-energized, p = pRA)	Setpoint/actual-value comparison, pressure at front axle current measurement
	Closed (mechanical fault) (pFA = pmax)	Setpoint/actual-value comparison, pressure, front axle
Pressure control valve rear axle	Open (de-energized) (p = 0)	Setpoint/actual-value comparison, pressure, rear axle and current measurement
	Closed (mechanical fault) (pRA and pFA = pmax)	Setpoint/actual-value comparison, pressure, rear axle,
Fail-safe valve	Jammed open	Predrive check
	Jammed closed (line)	Current measurement
Actuator, front/ rear axle	Leaking (no torque)	Setpoint/actual-value comparison pressure
	Blocked	Setpoint/actual-value comparison pressure
CAN bus	Total failure (line disconnected)	CAN timeout
Steering angle, vCar, a_q, φ	Implausible or omitted	Plausibility monitoring and CAN bus signal fault detection

Component	Fault type	Fault detection via:
Sensor a_q	Total failure (line disconnected)	Voltage monitoring
	Incorrect signal	Check plausibility via CAN messages
Oil level sensor	No signal (line)	
Pressure sensor, front axle	No signal (line)	Voltage monitoring
	Incorrect signal	Setpoint/actual-value comparison, pressure, front axle
Pressure sensor, rear axle	No signal (line)	Voltage monitoring
	Incorrect signal	Setpoint/actual-value comparison, pressure, rear axle,
Sensor, direction valve	no signal	Voltage monitoring
	Incorrect signal	Setpoint/actual-value comparison, direction valve and switch-position recognition sensor

System shutdown (fail-safe status)

Depending on the fault, the system displays one of the following responses.

The following faults result in system shutdown, i.e. all output stages are de-energized:

- Fault in the front axle stabilizer bar
- Fault at the front-axle pressure sensor
- Fault in the pressure build-up (pump, pressure-limiting valve on the front axle)
- Fault in the control unit
- VIN is not sent via the CAS / absent / incorrect
- Direction-valve position fault, faulty switch-position recognition sensor
- No PT-CAN signal

The de-energized fail-safe valve shuts off the chambers of the active stabilizer bar. Fluid balancing is only carried out through internal leakage of the oscillating motor and valve block.
The check valves in the valve block enable fluid feed to prevent cavitation in the front axle oscillating motor.

The chambers of the rear axle oscillating motor must not be shut off.

The handling corresponds virtually to that of a conventional vehicle. The crossover to the fail-safe status can also be controlled in the event of extreme manoeuvring.

Warning message	Instruction
Cornering stability! Drive slowly around bends 	Driving-stability system not functioning, driving stability restricted. No high cornering speeds. Continued driving possible, contact BMW Service immediately.

In the event of a fluid loss in the DynamicDrive hydraulic system or in the steering circuit, the oil level sensor in the oil reservoir responds.

The driver is alerted so that damage to the tandem pump caused by continued driving is avoided.

Warning message	Instruction
Fluid loss! Pull over carefully, switch off engine 	Fluid loss in the chassis and steering systems. Continued driving not possible, contact BMW Service immediately.

Restricted control comfort

A transverse acceleration is calculated from the road speed and steering wheel angle from the CAN messages. This signal is faster than the actual transverse acceleration and compensates the time delay of the hydromechanical system. In the event of a fault in these two signals, the system responds with a delayed roll compensation. This arises only in the case of extremely quick steering manoeuvres and is barely noticeable in normal cornering manoeuvres.

If a transverse acceleration sensor is defective, the transverse acceleration is calculated. No impairment of function can be detected by the customer.

The customer notices that the vehicle roll is greater if a fault occurs on the rear axle. The agility decreases at road speeds < 120 km/h.

The system also responds if the fault "Fail-safe valve stuck open" is detected in the predrive check.

An electrical fault in the rear-axle pressure sensor may result in minor failures in roll-angle compensation. To be on the safe side, slightly more stabilizing torque is exerted on the front axle than in normal operation. This can be felt by the driver.

Warning message	**Instruction**
Cornering stability slightly restricted	Chassis stabilization slightly restricted around bends. Continued driving possible, contact BMW Service at next opportunity.

Restricted system monitoring

DynamicDrive receives the following sensor signals from DSC and SZL via PT-CAN :

- Transverse acceleration
- Yaw velocity
- Road speed
- Steering-wheel angle

These signals are used to check the transverse acceleration sensor.

Drop-out of the engine-speed signal (DME) results in restricted control comfort.

In the event of a fault in the transverse acceleration and yaw velocity CAN messages, the system is lacking two items of redundant information. Since this information is used exclusively for checking the other signals, the DynamicDrive function is preserved with full control comfort.

Although no restriction of the DynamicDrive function exists, the message "Chassis and suspension-control system comfort restricted" is displayed for the driver who is requested to drive to the workshop at the next opportunity.

Warning message	Instruction
Cornering stability slightly restricted	Chassis stabilization slightly restricted around bends. Continued driving possible, contact BMW Service at next opportunity.

A "dynamic" driver will notice the absence of the steering angle sensor signal.

The warning messages must be acknowledged by the driver. Each warning message goes out only after it has been acknowledged.

Once the cause of the fault has been rectified, the control unit can be returned to full function.

There are two reset conditions depending on how fast a fault is to be detected:

- All faults which are no longer present are reset with ignition OFF. It is necessary to wait until the vehicle has entered sleep mode before the ignition is switched ON again.
- Sporadic faults which can mostly be traced back to communication faults in the CAN bus are then automatically reset while the vehicle is moving straight ahead or stationary provided they have only occurred briefly and rarely. In this case, the customer cannot detect the activation while the vehicle is moving or stationary.
- The associated faults with important additional information are stored in the fault code memory. This additional information contains the kilometre reading/mileage at which the fault occurred, whether the fault is currently present and the frequency with which the fault in question has occurred. Thus, when the vehicle is brought into the garage/workshop, it is possible to carry out a specific analysis of the currently present fault and also an analysis of a sporadic fault.