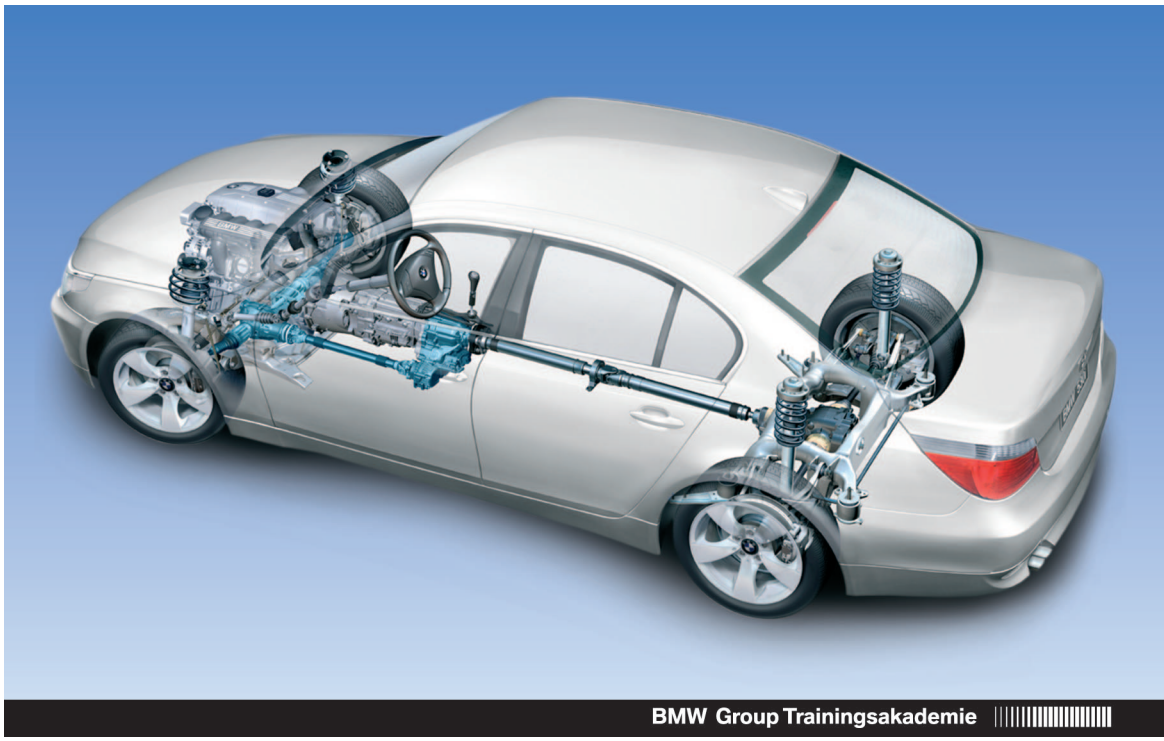
Participant's Manual

E60/E61 Changes as from 03/2005



BMW Service

Aftersales Training

The information contained in this participant's manual is intended solely for the participants of this seminar run by BMW Aftersales Training.

Refer to the latest relevant "BMW Service" information for any changes/supplements to the Technical Data.

Information status: February 2005

conceptinfo@bmw.de

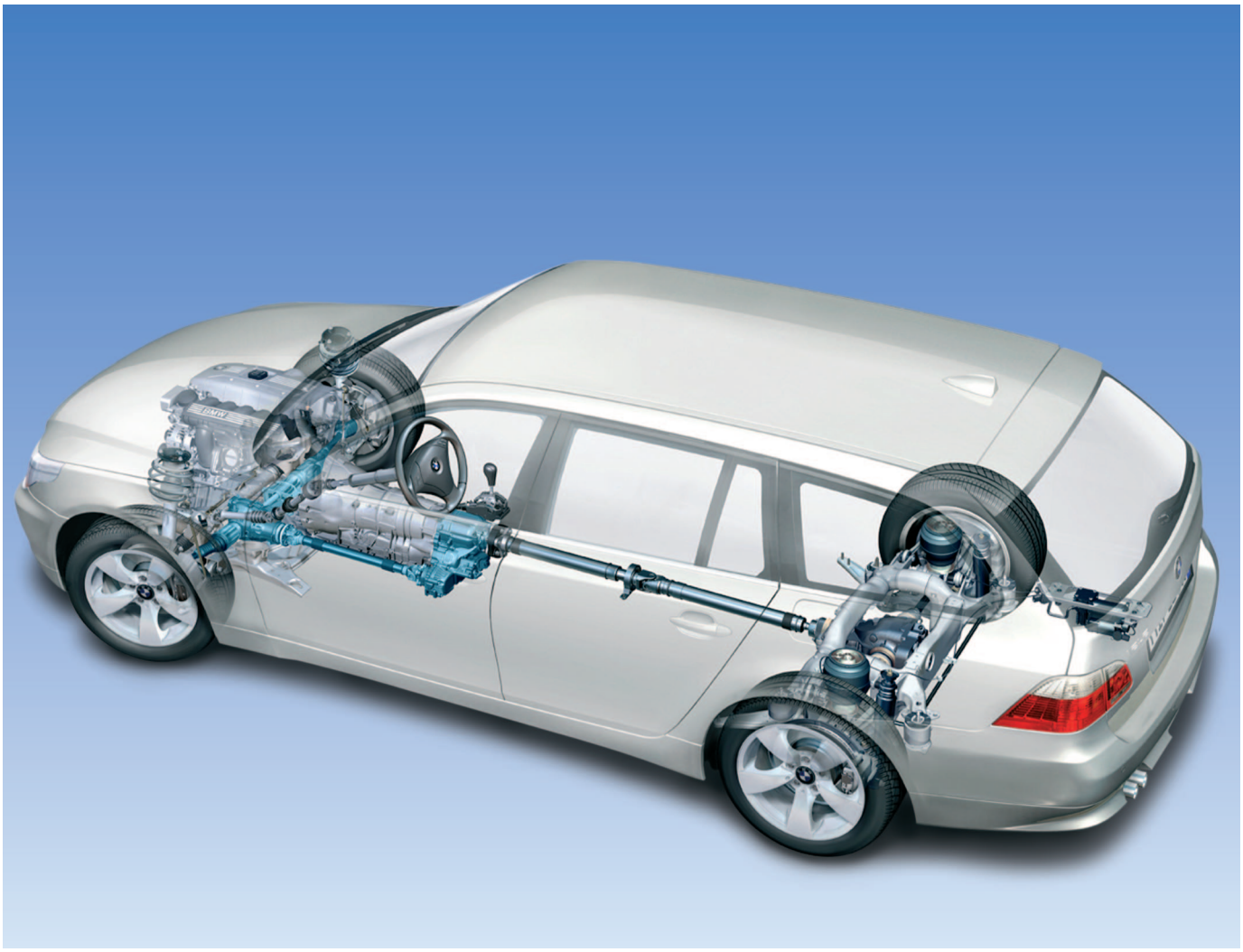
Participant's Manual
E60/E61 Changes as from 30/2005

New NG6 engines in the 5 Series

xDrive intelligent all-wheel drive

Active backrest width adjustment for increased comfort

New interior trim packages in the 5 Series



Information on this participant's manual

Symbols used

The following symbols are used in this participant's manual to facilitate better understanding and to highlight important information:

⚠ contains information that facilitates better understanding of the described systems and their functions.

◄ identifies the end of a specific item of information.

Information status of the participant's manual

In view of the continuous further-development in the design and equipment of BMW vehicles there may be variations between the information provided in this participant's manual and the vehicles used for the training course.

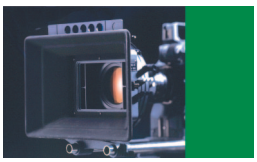
The information provided in this participant's manual refers to left-hand drive vehicles only. The controls in right-hand drive vehicles are, in part, arranged differently than illustrated in the graphics in this participant's manual.

Additional information sources

You will find further information on the individual topics in the BMW diagnosis and repair systems as well as on the Internet under www.bmw.com

Contents

E60/E61 Changes as from 03/2005



Objectives
E60/E61 Changes as from 03/2005

Reference material for practical applications to accompany you throughout the training course

This Participant's Manual describes the model year measures 03/2005 implemented in the 5 Series (E60/E61).

This manual is designed to provide essential information throughout the training course and complements the seminar material used in the BMW Aftersales Training course. It can be used both as a self-study tool as well as reference material.

Previous technical and practical knowledge of the E83 and E60 will facilitate better understanding of the corresponding systems and their functions.

Most important points in brief

A series of technical modifications and new features will be implemented in the BMW 5 Series as from March 2005.

In the BMW 523i, BMW 525i and BMW 530i models, the new BMW in-line, 6-cylinder engines (N52), featuring VALVETRONIC and extremely light-weight crankcase made from the light alloys magnesium and aluminium, will provide increased power while reducing fuel consumption. Added to this, BMW will offer the xDrive, the innovative sports interpretation of all-wheel drive, in the BMW 525xi and BMW 530xi models.

1 - The engines as well as the xDrive all-wheel drive system will be available for the BMW 5 Series Saloon and BMW 5 Series Touring.

In addition, the BMW 5 Series with xDrive will feature an extended dynamic stability control system (DSC) with new safety and comfort functions. All models of the BMW 5 Series will boast new interior trim and upholstery highlights such as IHKA rotary knobs in chrome and leather-covered handle on the handbrake lever.

As already featured on the Touring, as from March 2005 the Saloon will be equipped as standard with speed-dependent Servotronic steering.

New in-line, 6-cylinder engine: Unsurpassed in power output and efficiency

The new in-line, 6-cylinder petrol engine N52, which is already used in the BMW 6 Series, will be offered in the BMW 5 Series as from March 2005. This engine is one of the lightest and most future-oriented 6-cylinder engines in the world, providing even higher levels of efficiency and dynamics. These advantageous qualities are in part achieved by unique innovations such as:

- Second generation VALVETRONIC
- Composite magnesium-aluminium crankcase
- Electric water pump
- Magnesium cylinder head cover

The advantages for the driver are noticeably improved power output, outstanding torque range and reduced fuel consumption. Compared to the predecessor models, the values for the spring from 0 to 100 km/h have improved on average by 5 %, e.g. 530i Saloon with automatic gearbox previously 7.1 s; now 6.7 s.

2 - The new BMW in-line, 6-cylinder engine: Lighter, more powerful, more efficient

At the same time, an impressive fuel saving of 7 % has been achieved compared to the predecessor models, e.g. 530i Saloon with manual gearbox previously 9.5 litres, now 8.8 litres.

The engines and models in detail

BMW 523i:

By increasing the displacement from 2.2 l to 2.5 l, compared to the predecessor model BMW 523i, the power output in the entry-level model BMW 520i has been boosted by 5 kW/ 7 bhp (130 kW/177 bhp instead of 125 kW/ 170 bhp in the BMW 520i). The maximum torque is 20 Nm higher and at least 90 % of the maximum torque of 230 Nm is made available in a very wide engine speed range from 1500 to 6000 rpm.

BMW 525i:

Compared to the predecessor model, the power output of the BMW 525i with 2.5 l displacement has been increased by 19 kW/ 26 bhp to 160 kW/218 bhp and the maximum torque by 5 Nm to 250 Nm with more than 90 % of the maximum torque of 250 Nm made available between 1750 and 6700 rpm.

BMW 530i:

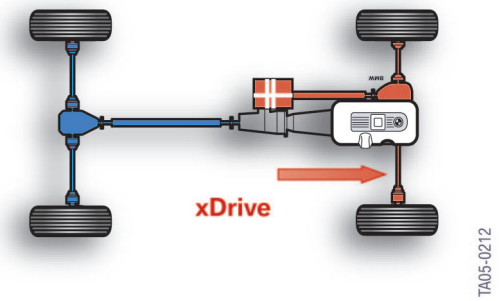
The power output of the 3.0 l engine of the BMW 530i has been increased by 20 kW/ 27 bhp to 190 kW/258 bhp. At 63.3 kW/l or 86.1 bhp/l, the engine therefore achieves the highest specific power output in its class. At least 90 % of the maximum torque of 300 Nm is made available between 1500 and 6700 rpm.

All models no longer have air flaps fitted behind the front radiator grille (kidney).

Innovation xDrive: Intelligent all-wheel drive in the BMW 5 Series

3 - The BMW 5 Series with xDrive is available in two model variants: 525xi and 530xi

As used for the first time in the SAV models BMW X3 and BMW X5, BMW is now introducing the xDrive intelligent all-wheel drive system in a further-developed form in the BMW 525xi and BMW 530xi Saloon/ Touring models.



4 - The xDrive can divert the driving power also to the front axle in extreme situations in order to accelerate smoothly on slippery surfaces and to avoid understeer or oversteer.

With its variable highly-dynamic power distribution to the front and rear axle, BMW xDrive combines for the first time all the advantages of the BMW rear-wheel drive (high dynamics) and an innovative all-wheel drive system (optimum traction). As a result, with the power distribution predominantly to the rear axle on dry roads, the xDrive offers vehicle response with unique handling and the characteristics of a typical BMW rear-wheel drive.

The system distributes the drive power proactively in milliseconds between the front and rear axle, permanently or variable corresponding to traction conditions and faster than all other all-wheel drive systems. The result is line-hugging vehicle handling with precision steering response. The tendency to oversteer or understeer is detected already in the incipient stages and prevented by the variable power distribution.

xDrive therefore ensures particularly safe and agile vehicle handling in all situations. These enhanced safety and agility functions maximize driving pleasure also with all-wheel drive.

Please refer to the Section "E60/E61 xDrive" in this participant's manual for a more detailed description of the xDrive system.

DSC with new innovative safety and comfort functions .

The latest generation of the Dynamic Stability Control (DSC) in the BMW 5 Series features five new innovative assistance functions. With intelligent intervention in the braking process, safety and comfort are further increased in many everyday situations:

- Drive-off assistant: ensures the vehicle drives off comfortably on uphill gradients without rolling back.
- Brake standby: reduces the stopping distance in connection with emergency braking.
- Dry braking: improves the response characteristics of the brakes in wet conditions.
- Fading compensation: enables a constantly high level of braking power even when the brakes become extremely hot.
- Soft stop: reduces the stopping jolt and vehicle dip when the vehicle is brought to a standstill by braking lightly.

HDC for safe, controlled hill descent

As on the BMW X3 and BMW X5, the DSC stability control in the BMW 525xi and BMW 530xi comprises a hill descent control facility for steep downhill inclines. It ensures the vehicle is driven downhill with a constant degree of safety on loose or slippery surfaces. Without the need for driver intervention, the BMW 5 Series with xDrive moves forward at a constant crawling speed.

BMW trailer stabilization control

The innovative trailer stabilization control offers additional safety, preventing dangerous "pitching" of a trailer.

The DSC avoids such uncontrolled movement of the trailer by appropriate brake intervention.

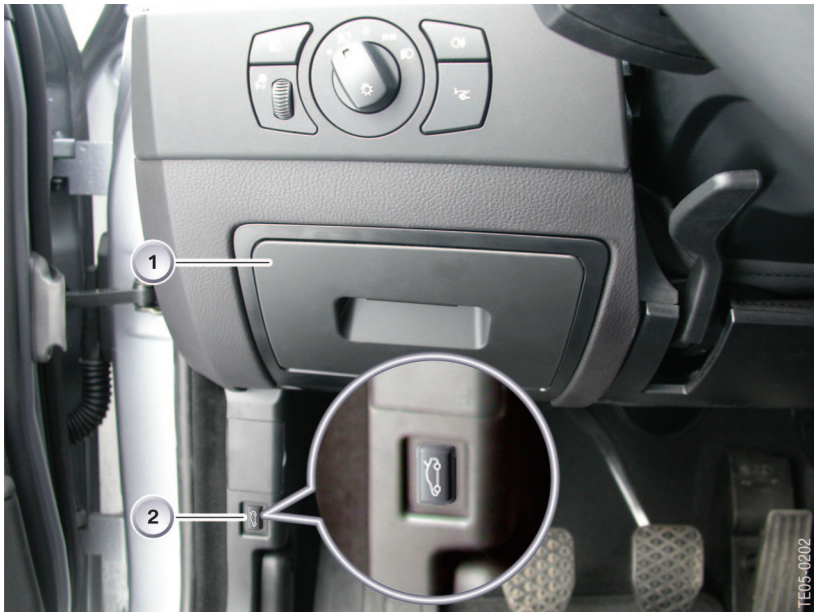
New and expanded trim and equipment packages for the BMW 5 Series

5 - The interior in the BMW 5 Series has been upgraded

Index	Explanation	Index	Explanation
1	Fresh air grille trim in ruthenium silver	2	Chrome-finish IHKA rotary knobs

The interior of the BMW 5 Series will have undergone a major upgrade when presented in March 2005 - e.g. with the use of soft-paint surfaces and air conditioning controls in ruthenium silver. The handle of the handbrake lever is now leather-coated and the storage compartment to the left of the steering wheel has been enlarged and equipped with a lid.

The boot lid on E61 vehicles with automatic boot lid operation (SA 316) can now be opened by pressing a button in the vehicle interior.



6 - Storage compartment is larger and lockable. Boot lid can be opened by means of a button in the vehicle interior.

Index	Explanation	Index	Explanation
1	Storage compartment left of steering wheel is larger and lockable	2	Button for automatically opening boot lid on E61

Further new interior trim and upholstery options include:

- Active backrest width adjustment for comfort seat (option): The backrest width and therefore the lateral support adapt automatically to the respective driving situation. The driver decides by means of a button in the centre console which of the three programs
  - Comfort
  - Normal
  - Sports

  is to be active.

  You will find a detailed description of this feature in the section "Active backrest adjustment" in this participant's manual.
- The opening height of the rear hatch of the Touring can be individually programmed in five stages with the iDrive system.
- 19 inch wheels, based on attractive double-spoke design, with mixed tyres in the format 245 front and 275 rear can now be ordered in combination with the M sports package for the Saloon model.
- Navigation system:
  Both navigation systems feature new icon bars as well as perspective map presentation in the navigation system Professional.

- Bluetooth mobile phone preparation (SA 633):

  The option SA633 combines the features of SA644 "Universal mobile phone preparation" and SA638 "Car telephone Professional".

  As with the option SA644, the customer can link his/her mobile phone with bluetooth capabilities to the vehicle. Connections can be set up exclusively through the customer's mobile phone.

  Services such as telematics, TeleService, BMW Assist and BMW Online are additionally enabled. For this purpose, the TCU of SA633 features a fixed SIM card (Prefit-SIM) with a fixed number group.

  The following connections can be set up through this number group independent of the presence of a mobile phone:

  - TeleService
    - CBS data [1)]
    - Manual service call[1) 4)]
    - Automatic service call[1) 4)]
  - Telematics
    - Manual emergency call with location to service provider[1) 4)]
    - Automatic emergency call with location to service provider[1) 4)]
    - Breakdown call with location and service data to service provider[1) 4)]
  - BMW Assist
    - Information services [1) 4)]
    - BMW Info[1)]
    - V-Info Plus[2)]
    - Floating Car Data[1)]
  - BMW Online
    - Mobile Office[3)]
    - Messages, weather, market prices [3)]

  1) Data SMS

  2) Data via CA-TMC

  3) Data via WAP

  4) Voice connection

  ⚠ These services are country-specific. BMW Assist requires initialization prior to first-time use. ◄

Changes to vehicle network as from 03/2005

No AHL control unit (adaptive headlight) is installed as the adaptive headlight function is integrated in the lights module. The lights module receives the information from the DSC control unit (yaw rate, vehicle speed and steering angle) via direct PT-CAN connection.

With the introduction of the new "active backrest width adjustment" function, the PT-CAN has been extended by two control units:

- ALBVFA - Active backrest width adjustment, driver
- ALBVBF - Active backrest width adjustment, front passenger

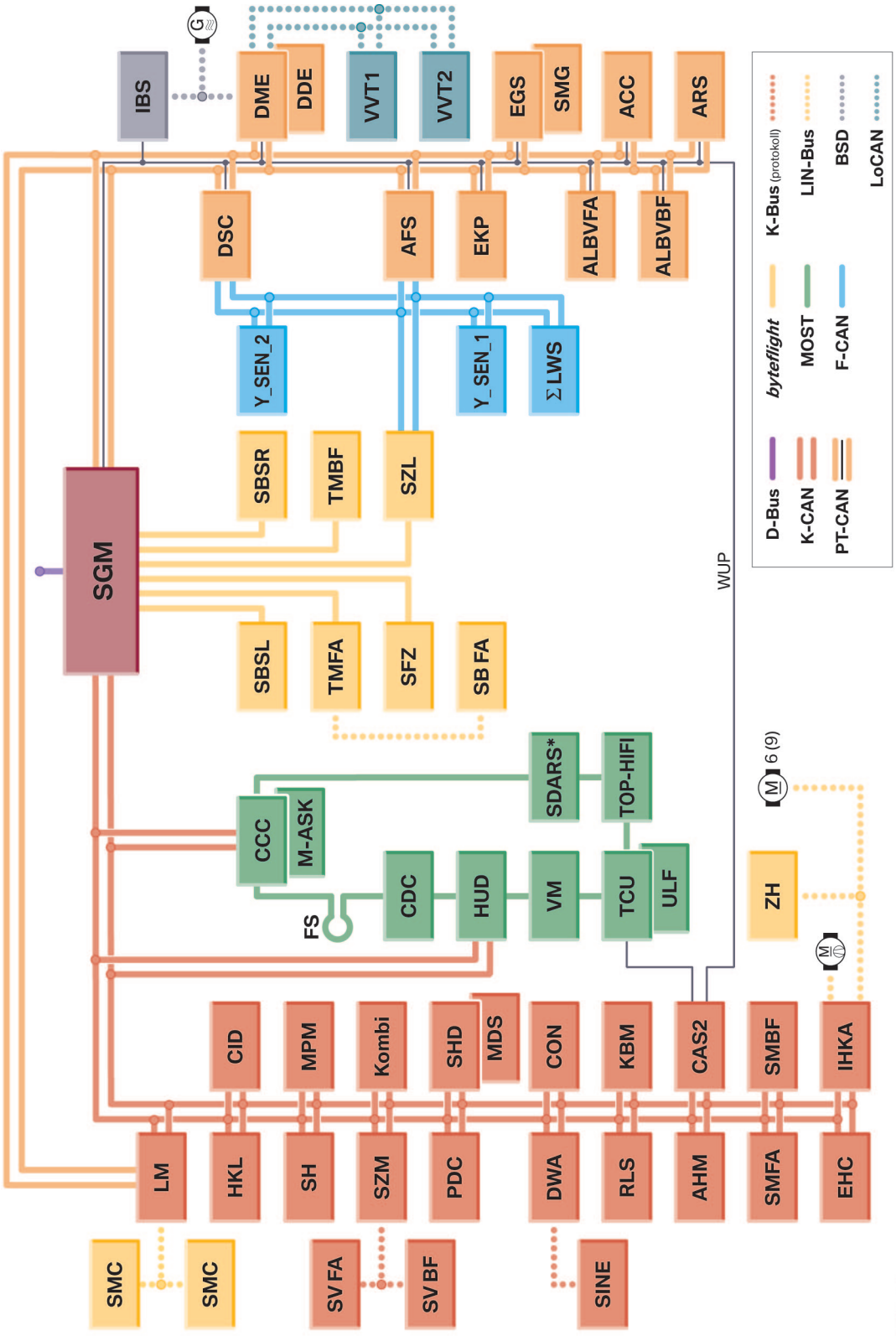
The control units are located in the respective driver's or front passenger's seat.

A connection to the PT-CAN is necessary in view of the many vehicle dynamics parameters of the DSC and DME control unit and the short response time of the system.

The changes to the system network to cater for the introduction of the xDrive are described in the section "E60/E61 xDrive" in this participant's manual.

In contrast to the previous system network configurations in the E60 or E61, in addition to the main bus systems, the network now also features sub-bus systems.

Bus overview



1 - E60/E61 Bus systems as from 03/2005

Index	Explanation	Index	Explanation
SMC	Stepper motor controller	SGM	Safety and gateway module
SV FA	Driver's seat adjustment switch	SBSL	B-pillar satellite, left
SV BF	Passenger's seat adjustment switch	TMFA	Driver's door module
SINE	Emergency current siren with integrated tilt alarm sensor	SFZ	Vehicle centre satellite
LM	Light module	SB FA	Driver's door switch cluster
HKL	Boot lid lift	SZL	Steering column switch cluster
SH	Auxiliary heating	TMBF	Passenger's door module
SZM	Centre console switch cluster	SBSR	B-pillar satellite, right
PDC	Park distance control	Y_SEN_2	DSC sensor (together with active steering only)
DWA	Antitheft alarm system	Y_SEN_1	DSC sensor
RLS	Rain/driving lights sensor	Σ LWS	Cumulative steering angle sensor (with active steering only)
AHM	Trailer module	DSC	Dynamic stability control
SMFA	Driver's seat module	AFS	Active steering
EHC	Electronic height control	EKP	Electric fuel pump control unit
IHKA	Integrated automatic heating/air conditioning	ALBVFA	Active backrest width adjustment, driver
ZH	Electric auxiliary heater based on PTC principle	ALBVBF	Active backrest width adjustment, front passenger
SMBF	Passenger's seat module	ARS	Dynamic drive
CAS2	Car access system 2	ACC	Active cruise control
KBM	Body basic module	EGS	Electronic transmission control unit
CON	Controller	SMG	Sequential manual transmission
SHD	Slide/tilt sunroof	VVT1	Valvetronic 1
MDS	Multi-drive sunroof	VVT2	Valvetronic 2
Kombi	Instrument cluster	DME	Digital motor electronics
MPM	Micro-power module	DDE	Digital diesel electronics
CID	Central information display	IBS	Intelligent battery sensor
CCC	Car communication computer	WUP	Wake-up line
M-ASK	Multi-audio system controller	D-Bus	Diagnosis bus
FS	MOST direct access	K-CAN	Body CAN
CDC	CD changer	MOST	Media oriented system transport
HUD	Head-up display	***byteflight***	***byteflight***
VM	Video module	PT-CAN	Powertrain CAN
TCU	Telematics control unit	K-Bus	Body bus (protocol)
ULF	Universal charging and hands-free facility	BSD	Bit-serial data interface
TOP-HIFI	Top HiFi amplifier	LIN-Bus	Local Interconnect Network bus
SDARS	Satellite radio (US only)		

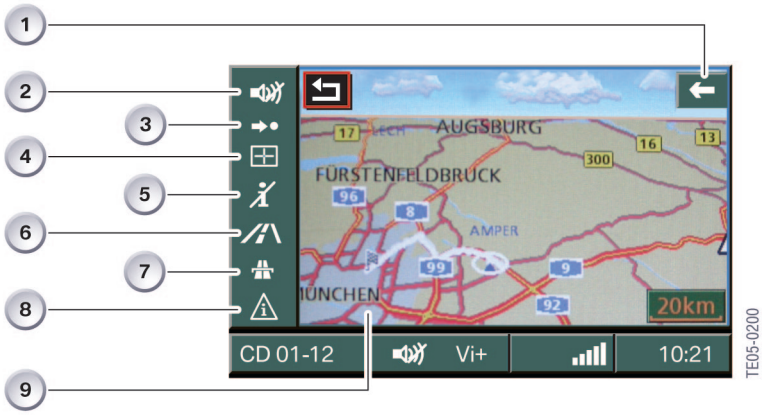
Car communication computer

Navigation system Professional

The navigation system Professional now features a bird's-eye view or perspective map presentation at scales smaller than 500 km.

The icon bar on the left-hand side is a new feature. By selecting the corresponding icons, it is now possible to activate functions such as "start/end route guidance" or "change route criteria" out of the map view.

The functions that can be selected through the icons are listed in the following table.



1 - Navigation menu with bird's-eye view and icon bar

Index	Explanation	Index	Explanation
1	Arrow pointing towards destination (as the crow flies) Voice announcements ON/OFF	6	Change map view: - Map pointing north - Map pointing in direction of travel - Perspective
2	Voice announcements ON/OFF	7	Change route criteria
3	Start/end route guidance	8	Select traffic information
4	Select destination on map	9	Perspective map presentation
5	Display information		

The traffic information messages outside motorways are also displayed in the map and listed accordingly in the traffic information list.

This means traffic information concerning problems outside the motorways is also taken into account in the dynamic route guidance system.

Brightness and contrast of TV picture

TE05-0217

2 - The brightness and contrast of the TV picture can be adjusted

Index	Explanation	Index	Explanation
1	Contrast selection	2	Brightness selection

The contrast and brightness of the TV picture can be adjusted in E60/E61 vehicles equipped with TV function. The functions are adjusted via the iDrive system:

- Settings
  - Entertainment settings
    - Video settings

The brightness/contrast can also be adjusted directly from the TV menu.

Opening height of boot lid

TE05-0203

3 - The opening angle of the boot lid on the E61 can be set in 5 stages

On the E61 with automatic boot lid operation (SA 316), the opening height of the boot lid can be adjusted individually in 5 stages between 90 and 100 % of the maximum opening height.

The opening height can therefore be adapted to a low garage height, for instance.

The functions are adjusted via the iDrive system:

- Settings
  - Vehicle settings
    - Door locking
    - Boot lid

Multi-audio system controller

Navigation system Business

New icons have been added in the upper line of the graphic representation of the Business navigation system.

By selecting the corresponding icons, it is now possible to activate functions such as "start/ end route guidance" or "change route criteria".

The functions that can be selected through the icons are listed in the following table.

4 - New icons in Business navigation system

Index	Explanation
1	Voice announcements ON/OFF
2	Select traffic information
3	Change route criteria
4	Start/end route guidance

MP3 Function

The M-ASK can play CDs/DVDs with MP3 files.

When reprogrammed, the M-ASK with older software status is upgraded to the MP3 function.

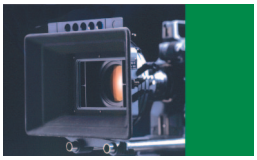
Thiefproofing navigation DVD (SA 6UE)

Unauthorized removal of the navigation DVD is avoided by disabling the Eject button in vehicle fleets (such as Sixt, Europcar etc.). A code only known to the vehicle owner (car hire company) is requested when the Eject button is pressed.

This function can be enabled or disabled by encoding the M-ASK.

The playing of copied navigation DVDs is also prevented.

Contents
E60/E61 xDrive



Introduction
E60/E61 xDrive

Innovative all-wheel drive also available in the BMW 5 Series

As from 04/2005, the BMW 5 Series Saloon and Touring can be optionally ordered with the tried and tested all-wheel drive system xDrive of the X3 and X5.

The innovative all-wheel xDrive is a system for controlling and regulating the infinitely variable drive torque distribution over the front and rear axle. The xDrive uses the system functions of the DSC to positively influence the vehicle handling by specifically distributing the power in the event of understeer or oversteer.

With the controlled multi-disc clutch in connection with the xDrive it is now possible to resolve the conflict between traction and vehicle handling.

This is been achieved in that the xDrive does not predefine the torque distribution by a fixed transmission ratio as is the case with the previous systems. Instead, distribution of the drive torque is dependent on the clutch lockup torque of the controlled multi-disc clutch in the transfer case and on the transmitted torque at the front and rear axle.

⚠ For technical and package space reasons, the xDrive all-wheel drive system is **not** possible together with the options dynamic drive, active steering or sequential manual gearbox. ◄

Driver benefits

In addition to the previous functions, a series of additional safety and comfort functions will now be available to the driver with the introduction of the DXC8+ in the E60/E61 as from 04/2005.

The DXC8+ will be used with the functions of the DSC8+ as well as the specific all-wheel drive function in all-wheel drive vehicles.

The expanded DSC8+ functions include:

- Dry braking
- Brake standby
- Automatic soft-stop
- Fading warning and assistance
- Drive-off assistant
- Trailer stabilization control

  (already standard in the DSC8)

The function:

- **Hill descent control HDC**
  - Hill Decent Control

is additionally available on all-wheel drive vehicles.

Besides the outstanding chassis characteristics of the BMW 5 Series, the all-wheel drive system offers traction advantages not only on snow and ice but also on unsurfaced roads.

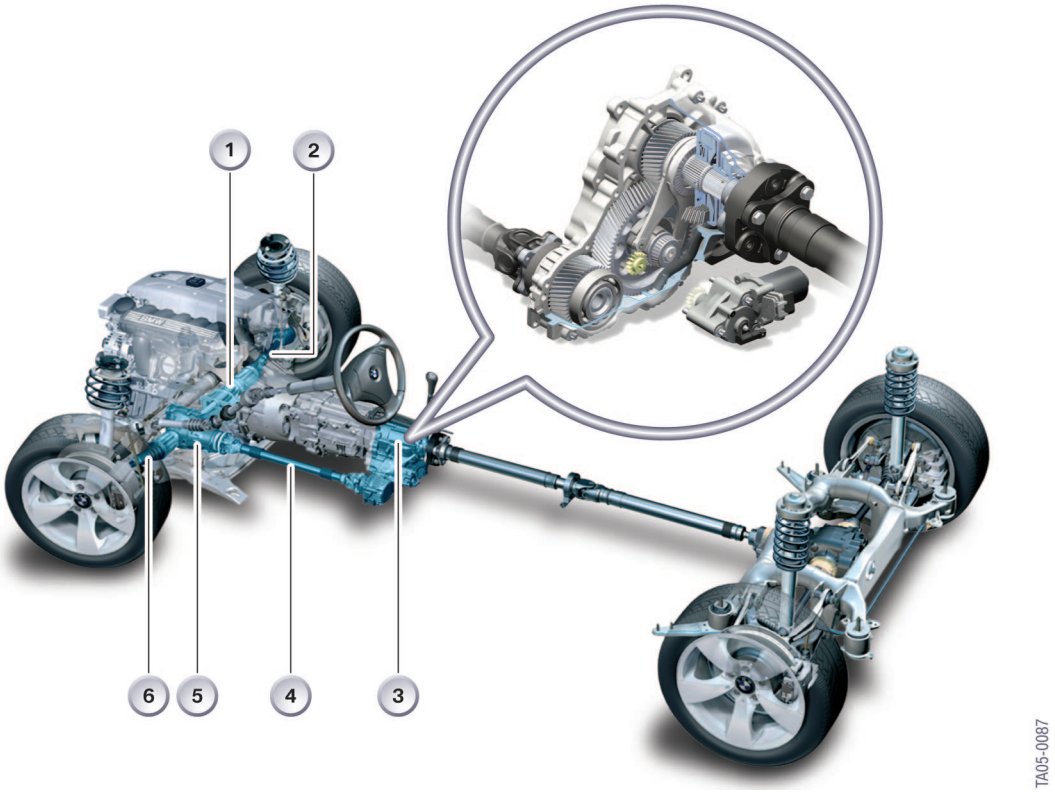
All-wheel drive components

In addition to the xDrive described in detail in the following section, the entire all-wheel drive system consists of a range of other components. The components are known in terms of their function and are therefore not described again here.

- Transfer case
- Front propeller shaft with two universal joints
- Front axle steering gear VAG 156 AL with aluminium casing
- Output shaft, left
- Output shaft, centre with leadthrough through oil pan
- Output shaft, right
- Left and right wheel carrier adapted to front wheel drive
- Chassis modifications and adaptations

System overview
E60/E61 xDrive

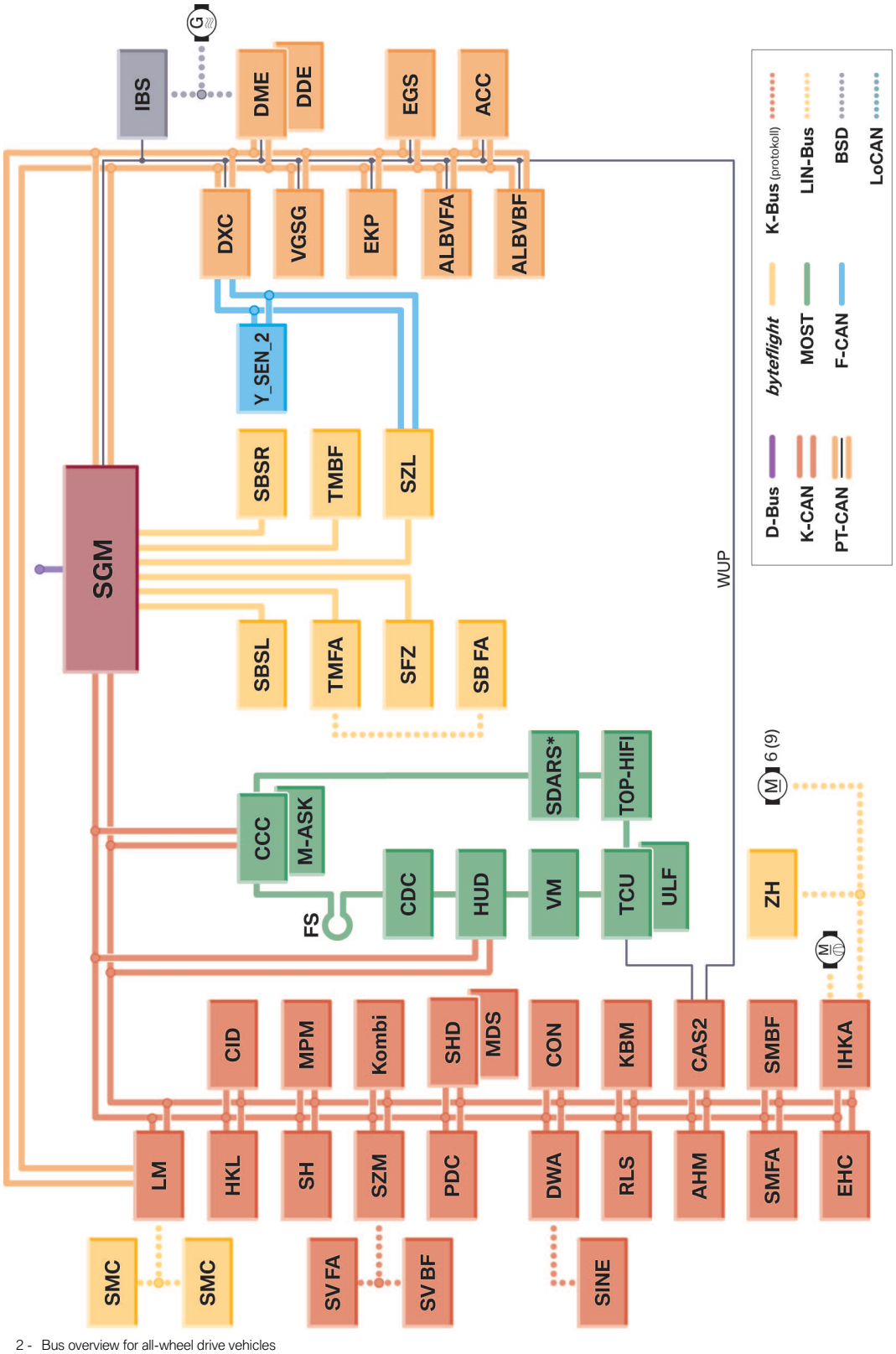
System overview - Mechanical system



1 - E60/E61 All-wheel drive components

Index	Explanation
1	Oil pan leadthrough
2	Right drive shaft, front
3	Transfer case
4	Propeller shaft to front axle
5	Front axle differential
6	Left drive shaft, front

Bus overview



2 - Bus overview for all-wheel drive vehicles

Index	Explanation	Index	Explanation
SMC	Stepper motor controller	TMFA	Driver's door module
LM	Lights module	TMBF	Passenger's door module
HKL	Boot lid lift	SFZ	Vehicle centre satellite
SH	Auxiliary heating	SBFA	Driver's door switch cluster
SZM	Centre console switch cluster	SZL	Steering column switch cluster
SV FA	Driver's seat adjustment switch	IBS	Intelligent battery sensor
SV BF	Passenger's seat adjustment switch	DXC	Dynamic traction control
PDC	Park distance control	Y-SEN-2	DSC sensor
DWA	Antitheft alarm system	DME	Digital motor electronics
SINE	Emergency current siren with integrated tilt alarm sensor	DDE	Digital diesel electronic (not for US vehicles)
RLS	Rain/driving lights sensor	VGSG	Transfer case control unit
AHM	Trailer module	EKP	Electric fuel pump control unit
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SMBF	Passenger's seat module	WUP	Wake-up line
CAS2	Car access system 2	D-Bus	Diagnosis bus
KBM	Body basic module	K-CAN	Body CAN
CON	Controller	PT-CAN	Powertrain CAN
SHD/MDS	Slide/tilt sunroof/multi-drive sunroof	MOST	Media oriented system transport
KOMBI	Instrument cluster	F-CAN	Chassis CAN
MPM	Micro-power module	K-Bus	Body bus (protocol)
CID	Central information display	LIN-Bus	Local Interconnect Network bus
CCC	Car communication computer	Byteflight	Safety bus system
MASK	Multi-audio system controller	BSD	Bit serial data bus
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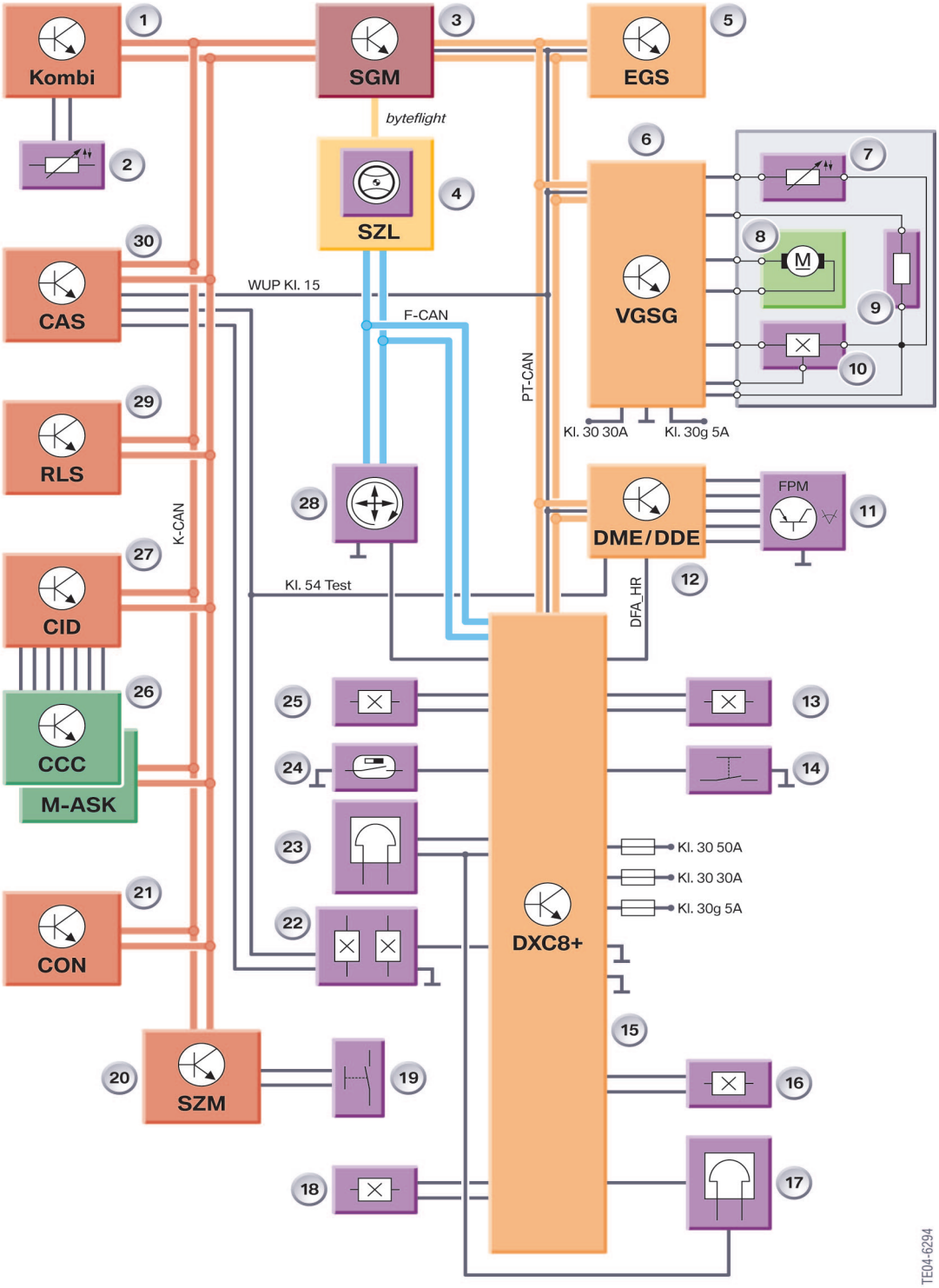
CDC	CD changer		
HUD	Head-up display		
VM	Video module (not for US vehicles)		
TCU	Telematics control unit		
ULF	Universal charging and hands-free facility		
TOP-HIFI	Top HiFi amplifier		
SDARS	Satellite radio (US only)		
SGM	Safety and gateway module		
SBSL	B-pillar satellite, left		
SBSR	B-pillar satellite, right		

System circuit diagram



3 - System circuit diagram for xDrive E60/E61

Key to system circuit diagram

Index	Explanation
1	Instrument cluster
2	Outside temperature sensor
3	Safety and gateway module SGM
4	Steering column switch cluster SZL with electronic steering wheel module and HDC button
5	Electronic transmission control (EGS)
6	Transfer case control unit VGSG
7	Actuator temperature sensor
8	Electric motor, actuator drive
9	Coding resistor
10	Motor position sensor
11	Accelerator pedal module FPM
12	Digital diesel electronics/digital motor electronics DME/DDE
13	Wheel-speed sensor, front right
14	Handbrake switch
15	Dynamic traction control DXC8+
16	Wheel-speed sensor, rear right
17	Brake wear sensor, rear right
18	Wheel speed sensor, rear left
19	DSC button
20	Centre console switch cluster SZM
21	Controller
22	Brake light switch (two-channel)
23	Brake wear sensor, front left
24	Brake fluid level sensor
25	Wheel-speed sensor, front left
26	Car communication computer/multi-audio system controller CCC/M-ASK
27	Central Information Display (CID)
28	Yaw rate, longitudinal acceleration and transverse acceleration sensor (Y-sensor-2)
29	Rain/lights sensor RLS
30	Car access system CAS

Functions
E60/E61 xDrive

xDrive, innovative all-wheel drive with distributed functions

The xDrive in the E60/E61 essentially consists of the two control units DXC8+ and the transfer case control unit VGSG. DXC8+ is the all-wheel drive variant of the DSC8+ control unit which is a further development of the DSC8 control unit that was introduced with the E60.

The further development of the DSC8 module involves the use of improved changeover valves (USV) that achieve more precision control quality especially in the low pressure range. The changeover valves reduce the control noise and improve the control comfort, thus enabling additional functions, indicated by the + suffix to the DSC8 designation.

The transfer case control unit VGSG serves the purpose of controlling the lockup torque of the multi-disc clutch.

The DXC8+ control unit is located as an add-on control unit on the DSC module that is responsible for the hydraulic control of the functions. The input information relating to vehicle dynamics is calculated in the DXC8+ and the required lockup torque signalled to the VGSG via the PT-CAN.

The transfer case control unit (VGSG) controls the actuator in the transfer case which then sets the necessary lockup torque with the aid of a control lever. In this way, the power is distributed over the front and rear axle corresponding to the transmitted drive torque.

Known DSC/DXC functions

The previous DSC8 functions comprise following systems:

- **ABS** Antilock Braking System
- **ASC** Automatic Stability Control
- **ADB** Automatic Differential Brake
- **DSC** Dynamic Stability Control
- **EBV** Electronic Braking Power Distribution
- **DBC** Dynamic Brake Control
- **CBC** Cornering Brake Control
- **MSR** Engine Drag Torque Control

The previous DXC functions comprise:

- **TCC** Transfer Case Control (control of multi-disc clutch in transfer case)
- **ASC-X** Automatic Stability Control X (special function for all-wheel drive vehicles)
- **ADB-X** Automatic Differential Brake X (special function for all-wheel drive vehicles)
- **HDC** Hill Decent Control

New DSC/DXC8+ functions

The previous DSC/DXC functions have been extended by the following functions in the DSC/DXC8+:

- Dry braking
- Brake standby
- Automatic soft stop
- Fading assistance
- Drive-off assistant
- Trailer stabilization control

Additional special DXC8+ function

- Hill descent control HDC

New functions

Dry braking

The water spray produced in wet conditions coats the brake discs with a water film, causing delayed response of the brakes. In connection with previous systems it was therefore recommended to operate the brakes from time to time.

The dry braking function is dependent on the position of the wiper switch and therefore on the signal of the rain/lights sensor. The brake discs are kept dry by lightly applying the brake pads cyclically as required, this achieving improved braking response in wet conditions.

While doing so, the pressure in the brake system is increased by approx. 1 bar and the brake pads are applied for approx. 1.5 seconds.

Dry braking takes place under following conditions:

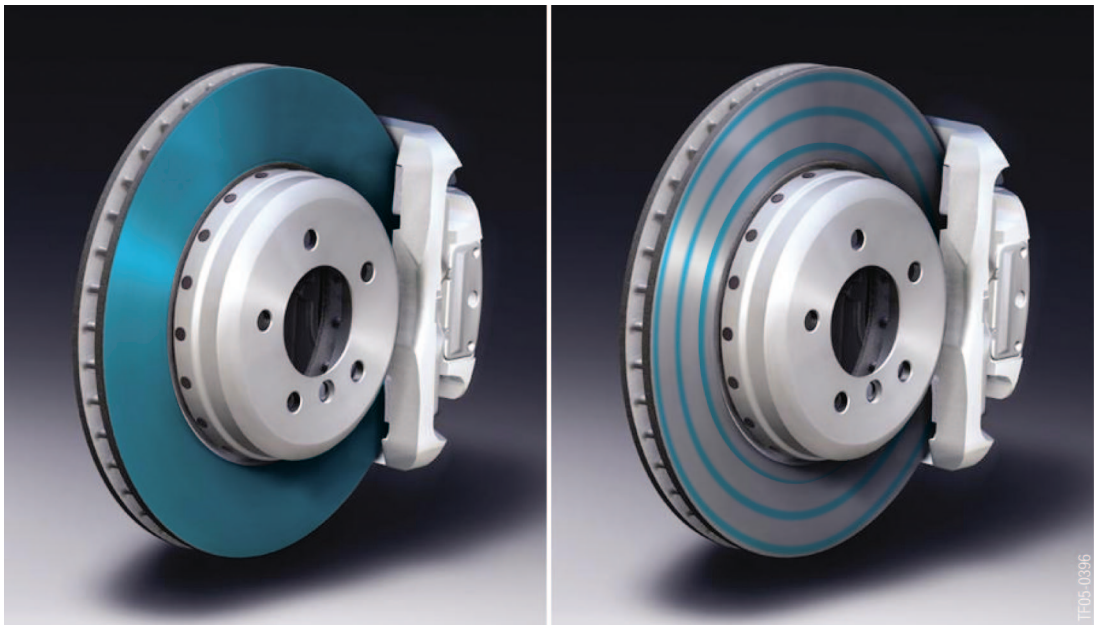
- Driving speed > 70 km/h
- Continuous wipe operation in stage 1 or 2

The repeat interval depends on the wiper stage:

- Continuous wipe stage 1 200 s
- Continuous wipe stage 2 120 s
- Generally 90 s as from 09/2005

This applies only when the driver himself does not apply the brake during this time.

The driver notices no deceleration or noise.



1 - Left brake disc with water film before dry braking Right brake disc after dry braking

Brake standby

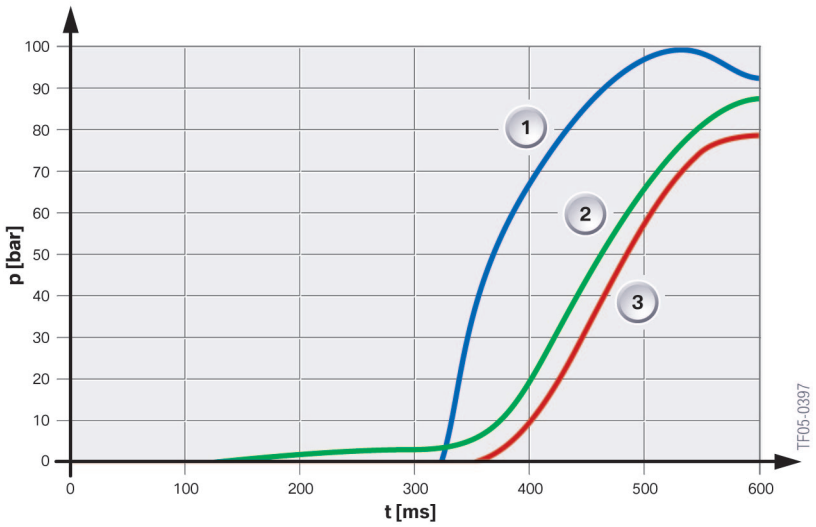
Quick release of the accelerator pedal causes the brake pads to be applied against the brake disc thus reducing the stopping distance (by approx.. 30 cm/100 km/h) during emergency braking. The DSC module builds up slight brake pressure (approx. 2.5 bar) temporarily (approx. 0.5 seconds) in order to eliminate the clearance between the brake pad and brake disc by applying the brake pads.

The brake standby function is activated under following conditions:

- Driving speed > 70 km/h
- Minimum time between brake application 8 s
- The brake standby function is not activated in connection with sudden acceleration (sports driving style).

The DME/DDE control unit makes available the signal indicating quick release of the accelerator pedal via the PT-CAN.

The sensitive driver may perceive a slightly harder brake pedal. No delay or noise is dicernible for the driver.



2 - Diagram showing the braking pressure with and without brake standby

Index	Explanation
P	Braking pressure in bar
T	Time in milliseconds
1	Pilot pressure applied by driver
2	Braking pressure progression with brake standby
3	Braking pressure progression without brake standby

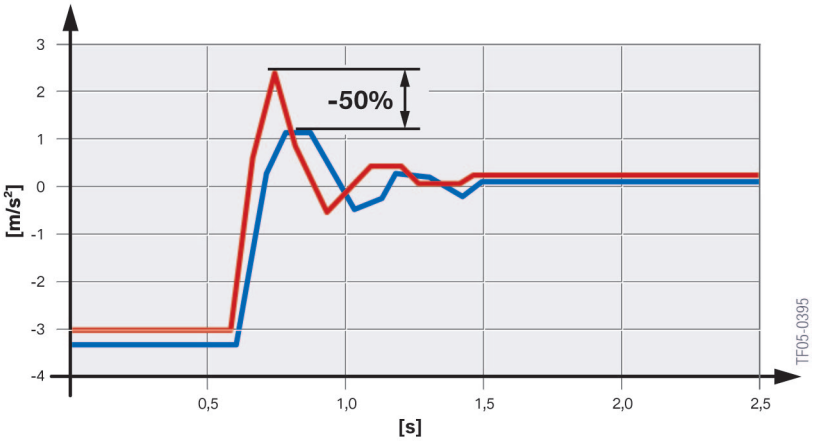
Automatic soft stop

Due to the transition from sliding friction to static friction on the brake disc, a stopping jolt occurs when braking to a standstill where the occupants perceive an increased feeling of deceleration.

When braking lightly (< 25 bar) at constant pressure to bring the vehicle to a halt, the soft stop function automatically reduces the braking pressure at the rear axle just before the vehicle comes to a stop. This consequently reduces the positive acceleration peak perceived by the occupants by approx. 50 % while extending the action time.

⚠ This function is inactive at medium to high deceleration or in the event of ABS control in order not to lengthen the stopping distance. ◄

The speed and standstill status are recognized by way of the wheel speed sensors.



3 - Diagram showing braking deceleration

Index	Explanation
m/s^2	Deceleration
s	Time in seconds
Red	Deceleration without soft stop
Blue	Deceleration with soft stop
-50%	Reduction of occupant deceleration

Fading compensation

High temperatures (> 550 °C) can occur at the brake discs when driving downhill over long periods or as the result of extreme multiple braking operations (> 80 bar). These high temperatures cause a change in the coefficient of friction of the brake pads resulting in the braking effect diminishing (fading).

For this purpose, the temperature of the brake disc is calculated by means of a temperature model contained in the DXC8+ software. The braking pressure applied by the driver is measured by the delivery pressure sensor and compared with the current vehicle deceleration (target/actual value).

When the braking effect diminishes, the fading compensation provides assistance for the driver in that pressure is additionally built up by the DSC module.

4 - Brake disc with fading

Trailer stabilization control

The trailer stabilization control function provides additional security in preventing dangerous pitching of the trailer about the vertical axis.

Two items of information are required to activate the trailer stabilization control function:

- Speed > 65 km/h
- The trailer power socket is used to establish whether a trailer is hitched to the vehicle.

The DSC monitors the yaw characteristics of the vehicle with the aid of the DSC sensor. The engine output is reduced on exceeding the defined limits of the yaw rate sensor. If this measure is not sufficient to bring the pitching tendency under control, the vehicle is braked by building up pressure at all four wheels, thus preventing uncontrolled movement of the car-trailer combination.

Drive-off assistant

When negotiating uphill gradients, the drive-off assistant holds the vehicle for a short time (approx. 1.5 s) after releasing the brake so that the vehicle drives off comfortably without the need to use the handbrake. The braking pressure required by the driver to hold the vehicle is maintained automatically in the system.

When driving off, the braking pressure is not reduced before the torque is sufficient for the vehicle to drive off. The holding pressure in the brake system (10 to max. 70 bar) is dependent on the uphill gradient and on whether a trailer is hitched to the vehicle.

Uphill gradients are detected by the DSC sensor with the aid of a longitudinal acceleration sensor.

The function is active both when driving forwards and when reversing on uphill gradients (up to 50 %).

TF05-0394

5 - Drive-off assistant function

DSC/DXC8+ Control unit

As in the earlier DSC control units, there are two microprocessors incorporated in the add-on DSC8+ control unit. The difference is that in the DSC8 and DSC8+ both processors do not calculate the same algorithms but rather one processor is responsible for performing control and monitoring calculations and checking the plausibility of the wheel speeds. There are also two semiconductor relays integrated in the DSC8+ control unit, one for the pump motor and the other for the solenoid valves.

On exceeding a road speed of 6 km/h, an electronic self-test is started, during which the pump motor and all solenoid valves are briefly actuated. If the brake is operated at a driving speed of
6 km/h, as may be the case with "two-foot drivers", the self-test will be performed at a speed of 15 km/h.

The check of the wheel speed signals is already started at a speed of 2.75 km/h.

In connection with the xDrive, the DXC8+ control unit also undertakes the task of calculating the lockup torque for the multi-disc clutch in the transfer case.

The lockup torque is always optimally set and controlled to suit the corresponding driving situation.

The drive torque distribution over the front and rear axles is based on the lockup torque. The lockup torque to be set is derived from the pilot control and from a higher-ranking traction and vehicle dynamics regulator corresponding to the driving situation.

The DXC8+ control unit sends the data, concerning the lockup torque, on the PT-CAN to the transfer case control unit VGSG. Conversely, the transfer case control unit signals the lockup torque actually set as well as the load on the transmission fluid, electric motor and multi-disc clutch.

Transfer case control unit VGSG

The transfer case control unit serves the purpose of regulating the lockup torque of the multi-disc clutch in the transfer case and therefore to distribute the drive forces between the front and rear axle corresponding to requirements.

The transfer case control unit receives the necessary torque request from the DXC8+ control unit and adjusts the currently required clutch lockup torque accordingly.

The function required for this task is the transfer case control (TCC). The control and power electronics circuitry required for the actuator drive is integrated in the transfer case control unit.

The requirement to set the necessary clutch lockup torque is converted to a corresponding rotary movement of the actuator motor. After turning off the engine, a reference run is performed in order to be able to assign a corresponding clutch lockup torque to a defined angle setting of the actuator motor, while also taking into account the effects of wear.

During the course of the reference run, the clutch is fully closed and opened once. The power intake is measured at the respective angle setting of the actuator motor during the opening and closing operation so as to determine the beginning and end of the clutch closing procedure. The angle setting is determined by means of a Hall sensor integrated in the actuator motor.

A clutch and oil wear model is additionally calculated in the transfer case control unit. Where necessary, this model limits the lockup torque in order to reduce friction.

In the event of DSC failure, an emergency strategy for driving the transfer case clutch is integrated as a fall-back level in the transfer case control unit in order to maintain all-wheel drive also in this case.

Transfer case control TCC

Control of the lockup torque of the multi-disc clutch in the transfer case facilitates infinitely variable coupling of the front axle to the drive train.

As a result, the drive torque at the front axle can be increased or reduced corresponding to the driving situation and the condition of the road. When the torque at the front axle is increased, the drive torque at the rear axle is, of course, reduced by this torque.

The advantages of variable distribution of the drive torque at the front and rear axles are:

- Optimum utilization of the lateral cornering and wheel peripheral forces applied at the front and rear axles.
- Brake interventions by the DSC are required considerably later, thus increasing overall comfort.
- Compared to a transfer case with fixed transmission ratio (open longitudinal differential) and DSC, with xDrive the drive torque distribution is considerably improved in connection with greatly differing friction values at the front and rear axles.

Even when DSC is turned off, TCC is still active to ensure maximum traction and vehicle dynamics.

Permanent all-wheel drive is cancelled to a large extent or completely in only three control situations:

- When negotiating extremely tight corners with little engine torque in order to allow speed equalization between the front and rear axle (e.g. parking)
- At speeds in excess of 180 km/h
- In extreme understeer driving situations

The control algorithm of the transfer case clutch control can be described in three main modules:

- Pilot control
- Tyre tolerance logic
- Traction control/vehicle dynamics control

Pilot control

The pilot control algorithm reflects the driver's choice and calculates the necessary lockup torque as a function of

- accelerator pedal value,
- engine torque,
- engine speed,
- vehicle speed,
- gear and
- steering angle

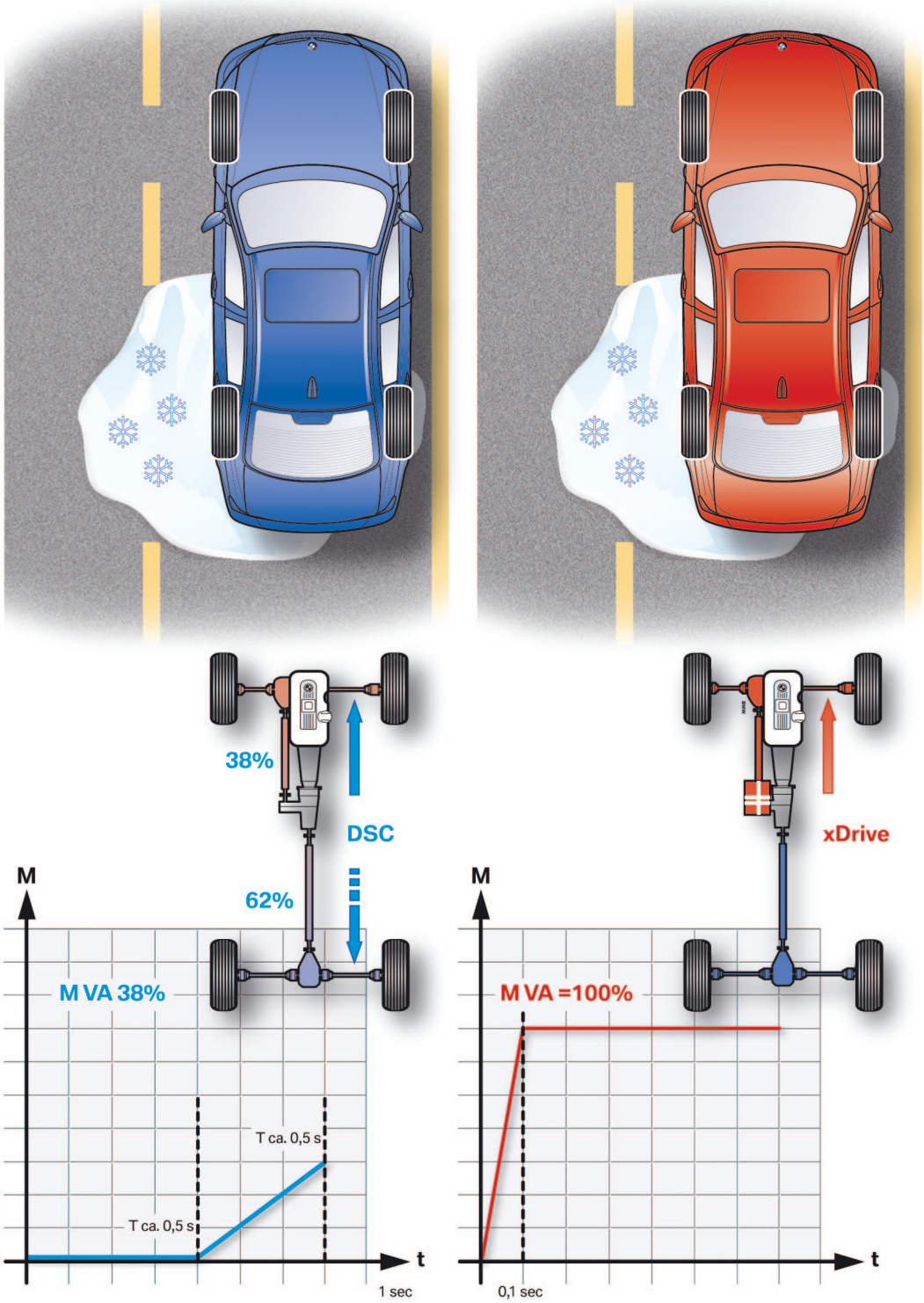
while taking into account the maximum load on the clutch, transfer case and axle drive.

The clutch is operated with minimum slip during normal vehicle operation, making available permanent all-wheel drive with a drive torque distribution of 40 % at the front axle and 60 % at the rear axle.

Even in the case of greatly differing frictional values at the front and rear axle, e.g. when the rear axle is on a sheet of ice, the pilot control ensures extremely rapid system response as illustrated in the graphic below.

In addition, as opposed to a transfer case with fixed gear ratio (open longitudinal differential), with xDrive no brake intervention is required at the rear axle in this case as no slip can occur.

In the open longitudinal differential system, the brake is applied on detecting slip at the rear axle. Consequently, 62 % of the drive torque is applied at the two rear brake discs so that only 38 % of the drive force is available at the front axle for the purpose of driving off the sheet of ice.



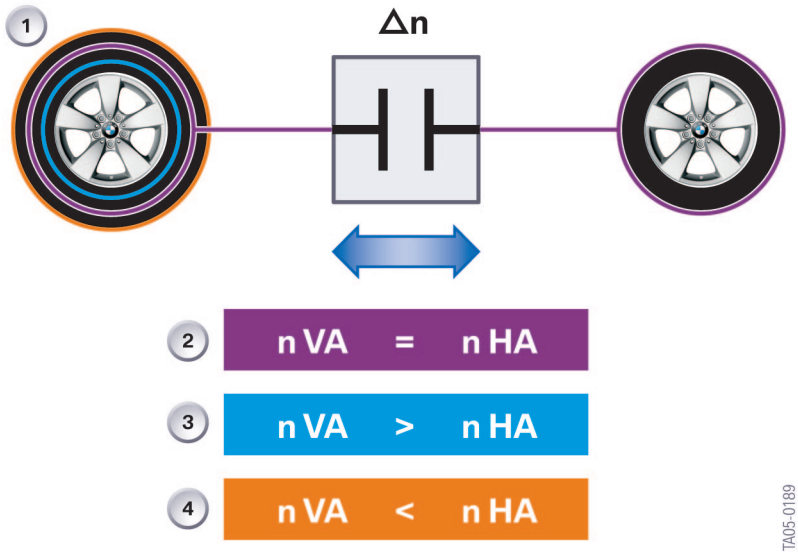
6 - Blue vehicle on left with transfer case and fixed gear ratio // Red vehicle on right with xDrive without interlock and DSC brake intervention

Tyre tolerance logic

The tyre tolerance logic detects differences in the tyre rolling circumferences on the front and rear axles. This difference can occur in the case of

- Mixed tyres
- Space-saver wheel fitted
- Greatly varying tyre wear patterns

In connection with a normally pilot-controlled multi-disc clutch, variations in the tyre circumferences result in distortion in the drive train. The axle rotating faster is braked and the other axle is driven by the same amount.



7 - Tyre circumference tolerances

Index	Explanation	Index	Explanation
n VA	Wheel speed at front axle	2	Identical rolling circumference on FA-RA
n HA	Wheel speed at rear axle	3	Rolling circumference on FA smaller than on RA
1	Different rolling circumferences on front axle	4	Rolling circumference on FA greater than on RA

The tyre rolling circumference can fluctuate by up to 1 % if mixed tyres are fitted or in the case of greatly different tyre wear patterns on the front and rear axles.

Based on the driver's choice (pilot control) and driving situation (slip controller/vehicle dynamics controller), the tyre tolerance logic decides whether the slip is to occur at the transfer case clutch or at the contact area between the tyre and road.

If slip is permitted to occur at the transfer case clutch, the lockup torque determined by the pilot control is reduced in order to minimize the work loss.

The clutch lock is increased when the vehicle dynamics control is applied so that the slip between the tyre and road is reduced, thus ensuring all-wheel drive is always available as required.

Traction control/vehicle dynamics control

The traction control monitors the slip conditions at the front and rear axle. The wheel speeds, yaw rate and transverse acceleration are used as the input signals for this purpose.

The task of the traction control/vehicle dynamics control is to achieve optimum traction and keep the vehicle stable.

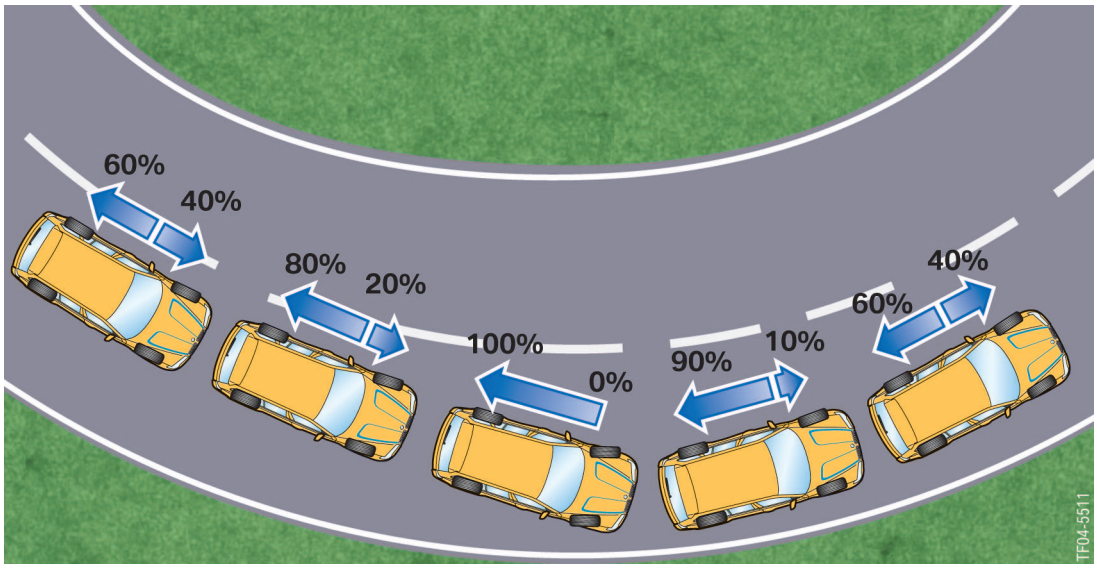
The roll steer effect and therefore the vehicle dynamics can be actively influenced by the variable torque distribution between the front and rear axle. xDrive enables neutral and safe vehicle handling up to the limit range. The DSC intervenes very late when the stabilization options of the xDrive have been exhausted. Consequently, the interventions take place considerably less often thus substantially improving driving comfort.

By constantly evaluating all the information supplied by the DXC, the xDrive always detects whether the vehicle can carry out the driver's choice. The xDrive intervenes in a corrective capacity by correspondingly distributing the forces when the vehicle detects a tendency towards wheel spin as well as understeer or oversteer.

Drive torque distribution in response to a tendency to understeer

If there is a tendency to understeer, the clutch can be completely opened, thus taking the force away from the front axle and re-routing 100 % of the drive force to the rear axle.

⚠ This, however, only takes place within defined physical limits. ◄

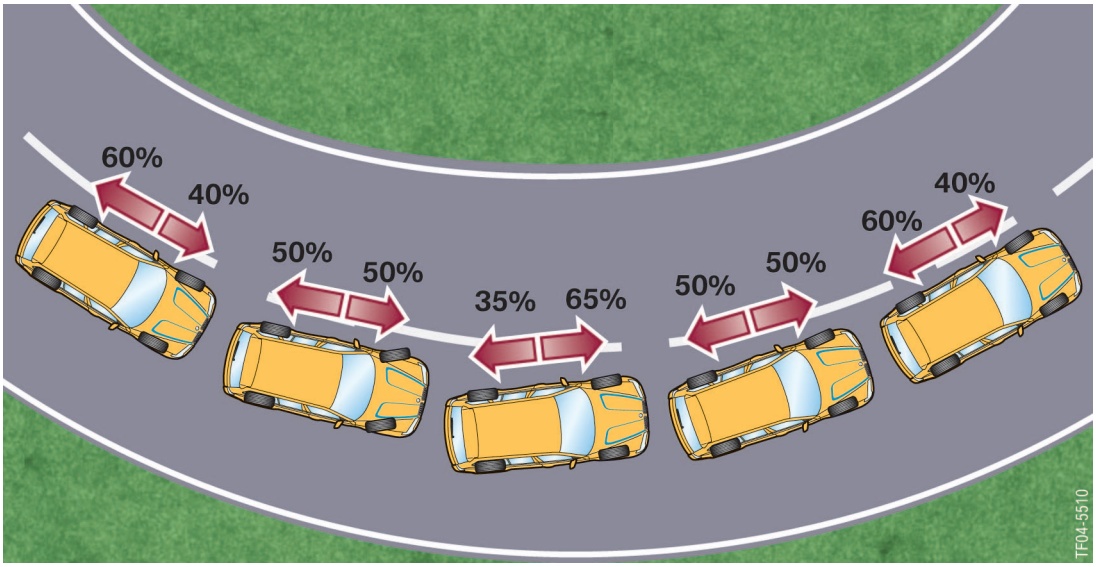


8 - Drive torque distribution at understeer

Drive torque distribution in connection with a tendency to oversteer

If there is a tendency to oversteer, the multi-disc clutch is fully closed (100 %) and the maximum transmittable drive torque is applied at the front axle.

⚠ This, however, only takes place within defined physical limits. ◄



9 - Drive torque distribution at oversteer

Emergency operation (limp-home)

An emergency operation controller is integrated in the transfer case control unit in order to maintain all-wheel drive for as long as possible even in the event of failure of important sensor signals or of the DSC control unit.

This controller represents a redundancy function for the transfer case clutch control in the DSC control unit.

The emergency operation (limp-home) controller contains only two control modules, the pilot control and the traction control.

The wheel speed signals are the decisive factor for the traction control.

The engine signals, steering angle and rotation rate are predominantly used for the pilot control.

In the event of individual sensor signals failing, corresponding substitute values are calculated and the respective functions are operated with extended control thresholds. This strategy is pursued until effective all-wheel drive control is no longer possible. In this case, the driver is informed by the DSC/ xDrive indicator lamp in the instrument cluster and additionally by an audible warning signal.

Failed wheel speed signals at the rear axle are calculated based on the drive or engine speed.

The rear axle values are adopted in the event of the front wheel speed signal failing.

If no steering angle signal is received, a substitute value can be produced based on the wheel speeds.

Automatic stability control for all-wheel drive ASC-X
Automatic differential brake for all-wheel drive ADB-X

The ASC-X contains a recognition algorithm to distinguish between paved roads and poor road surfaces (gravel) in order to make available the optimum propulsion with sufficient lateral cornering force both on normal roads as well as on poor road surfaces.

ASC-X is enhanced by then ADB-X function which brakes spinning wheels to the defined slip so as to make available more drive torque to the wheels that are on a surface with a high coefficient of friction.

ADB-X remains active when DSC is switched off. In this case, ADB-X can develop its full performance potential as the engine output is no longer reduced but only the wheel that is in contact with a low coefficient of friction surface is braked.

The brake disc of the braked wheel can overheat it ADB-X intervention is too long with DSC switched off. In this case, the control procedure is interrupted at a brake disc temperature of approx. 700 °C and is activated again when the temperature drops below approx. 400 °C.

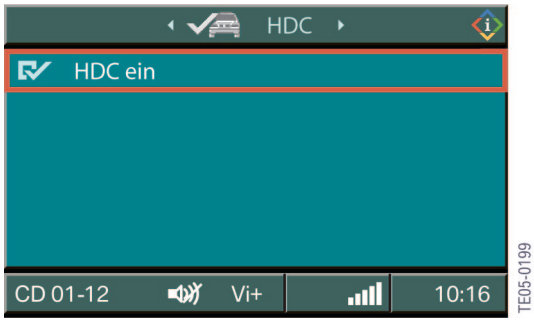
Hill decent control HDC

HDC for safe downhill operation

As on the X3 and X5, the E60/E61 all-wheel drive also features the hill descent control facility for safe vehicle operation on steep downhill inclines. The HDC stabilizes the vehicle and prevents the wheels locking. The DXC8+ module controls the build-up of braking pressure at all four wheels so that the vehicle drives downhill at a speed of approx. 12 km/h.

The HDC function is activated in the central information display via the menu:

- Settings
  - Vehicle settings
    - HDC



10 - Menu HDC ON

The HDC ON function can be activated by setting a tick in the menu and deactivated by removing the tick.

Furthermore, the HDC ON/OFF function can be selected with one of the two free buttons (asterisk, hash) in the steering wheel button menu.

Components overview xDrive/DXC8+

The xDrive/DXC8+ systems essentially consist of the components known from the DSC8. A new feature is the controlled multi-disc clutch in the transfer case.

- DSC8+ module
- Transfer case control unit
- DSC sensor
- Wheel speed sensors
- Pressure sensor
- Steering angle sensor
- Brake fluid warning switch
- Brake light switch
- DSC button
- Actuator motor, transfer case
  - Motor position sensor, transfer case
  - Coding resistor
  - Temperature sensor

This chapter describes the following components in detail:

- Transfer case ATC 300 (Active Torque Control)
- Actuator motor for transfer case with motor position sensor
- Coding resistor
- Control lever
- DSC8+ module
- Transfer case control unit VGSG
- DSC sensor
- Wheel-speed sensor

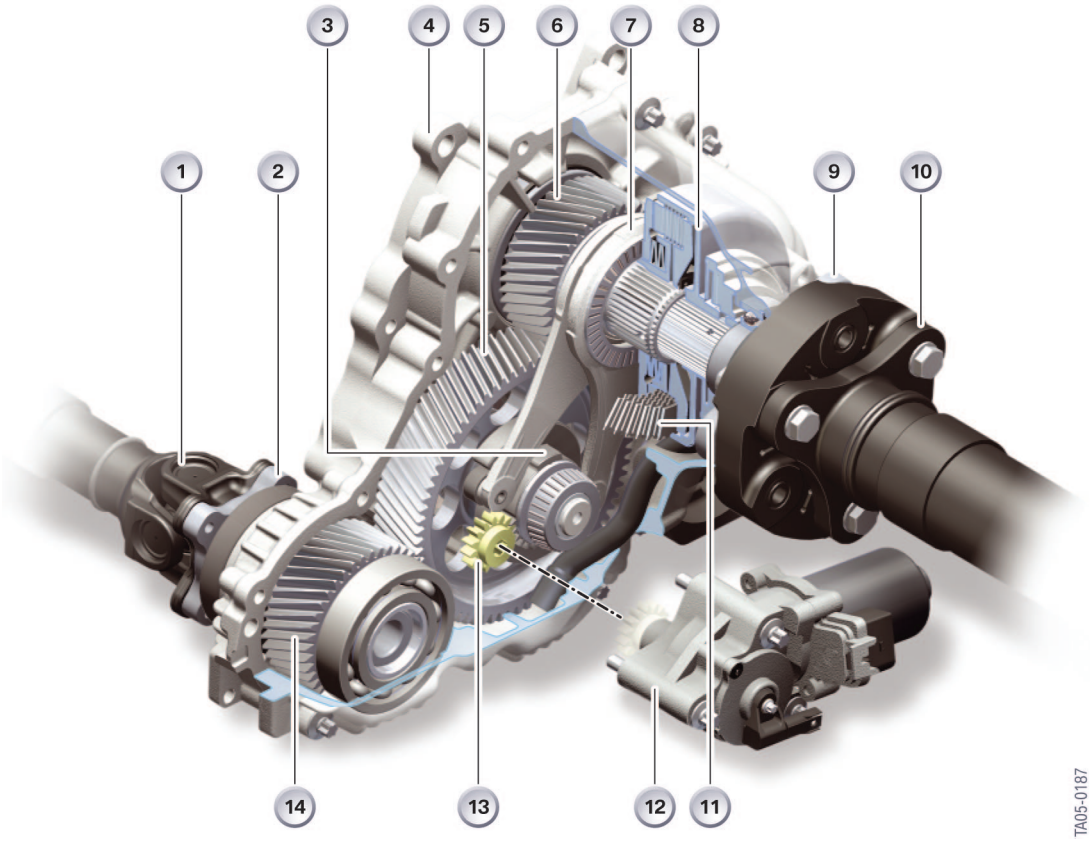
Transfer case ATC 300

Transfer case components

The transfer case ATC 300 (Active Torque Control) is used on the E60/E61.
In view of the restricted package space of the transmission tunnel in the BMW 5 Series, it was not possible to adopt the transfer case from the BMW X3 (ACT400) with the same torque rating.

On the BMW 5 Series it was not possible to pick off the forward power flow diagonally as is the case on the X3 but rather it is necessary to divert it L-shaped with the aid of spur gears (pinions), resulting in a modified design of the transfer case.

The actuator drive and the actuation of the control lever were also modified. The clutch package remains unchanged. The forward connection is provided by a screwed propeller shaft.



1 - Section through transfer case ACT 300

Index	Explanation	Index	Explanation
1	Propeller shaft to front axle	8	Clutch housing
2	Drive flange to front axle	9	Output flange to rear axle
3	Control cam	10	Propeller shaft to rear axle
4	Transfer case	11	Disc package
5	Idler gear	12	Actuator drive
6	Drive gear	13	Drive pinion
7	Control lever	14	Output gear

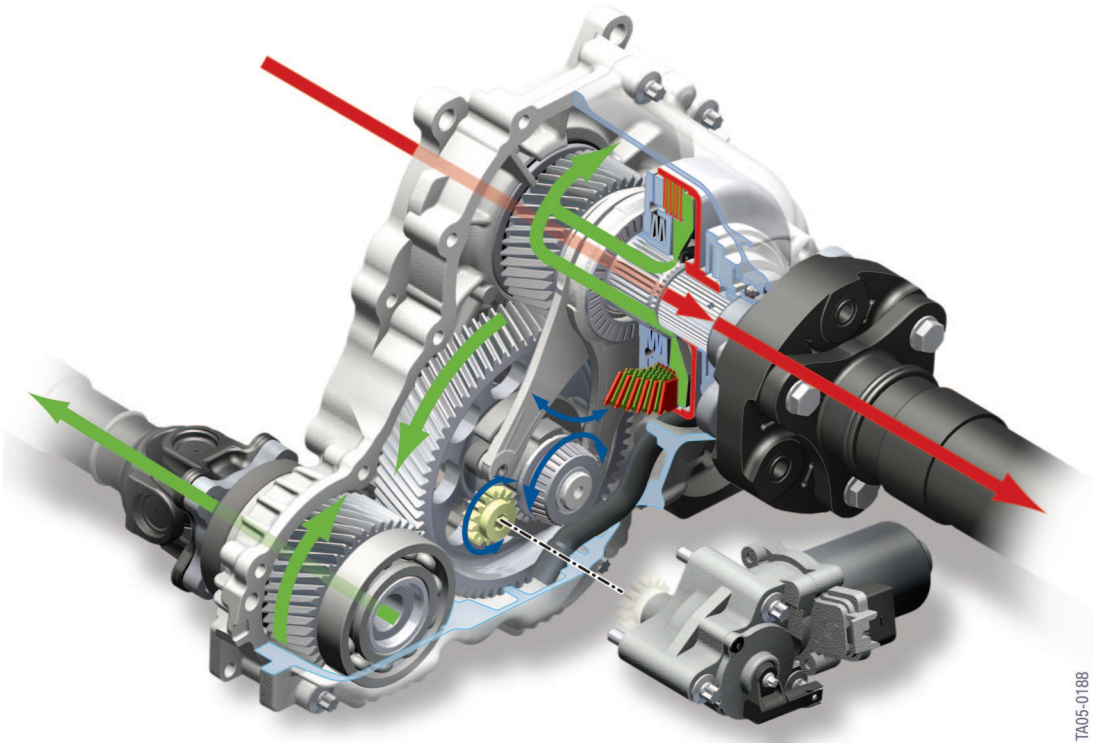
Power flow

No drive torque is transmitted to the front axle when the multi-disc clutch in the transfer case is open but rather the entire drive torque is routed to the rear axle final drive unit.

The front and rear axle turn at the same speed when the multi-disc clutch is completely closed. The torque distribution depends on the torque applied at each axle.

For example, when driving off at full throttle in first gear at a signal start, the dynamic axle load displacement results in a higher axle load on the rear axle. Proportioned accordingly, this can also result in higher drive torque application at the rear axle. With the same coefficient of friction at the front and rear axle, this means the transmittable drive torque correspond to the axle load distribution.

An exception to this rule is when the front axle is on a surface with a high coefficient of friction and the rear axle on a slippery surface such as ice. In this case, almost 100 % of the available drive torque is transmitted through the front axle as virtually no torque can be supported at the rear axle.



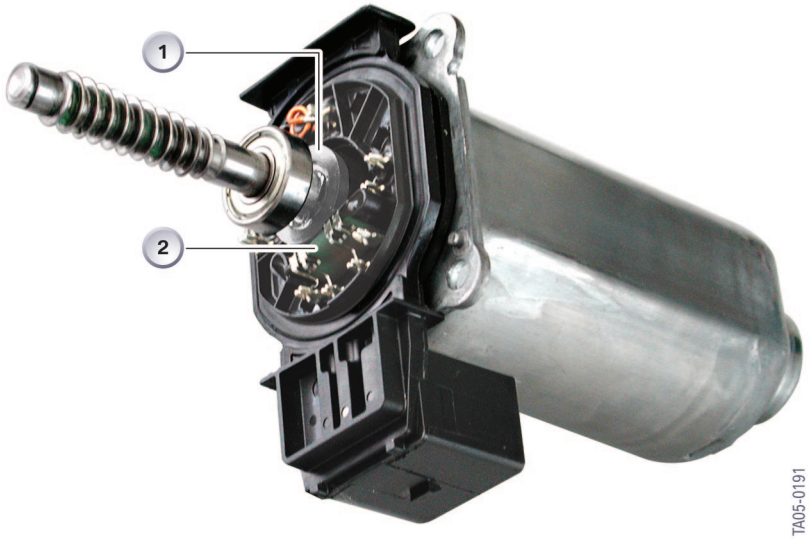
2 - Power flow in transfer case

Colour	Explanation
Red	Torque from engine to rear axle
Green	Controlled torque to front axle
Dark blue	Rotation to drive multi-disc clutch

Actuator drive unit with motor position and temperature sensor

The actuator drive unit is a DC motor with worm drive. It also features a Hall sensor that serves the purpose of determining the position and the adjustment speed of the motor shaft. The position of the motor shaft determines the closing rate of the multi-disc clutch.

There is also a temperature sensor installed in the motor that signals the temperature to the transfer case control unit (VGSG). A temperature model is calculated in the VGSG for the purpose of protecting the motor from overload. For this purpose, the maximum closing rate is reduced in various stages. If these measures are not sufficient to protect the motor from overload, the control is interrupted and the clutch completely opened so that only rear axle drive is now possible.



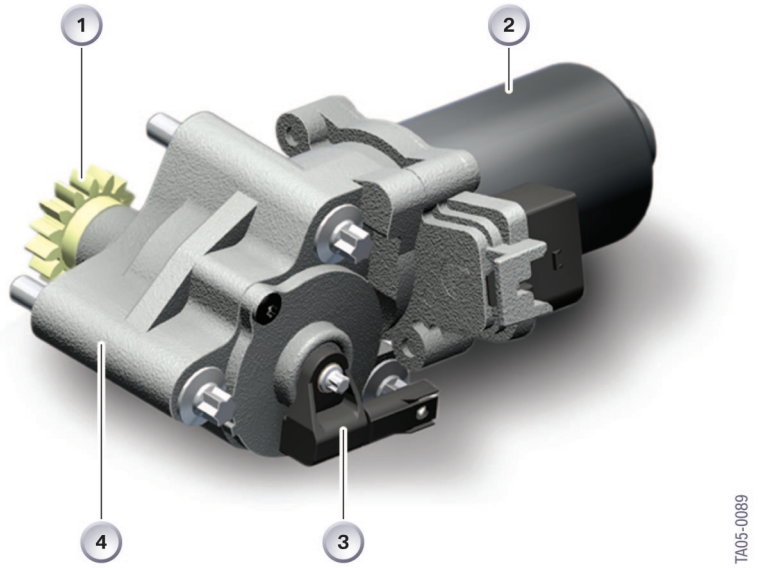
3 - Actuator drive

Index	Explanation
1	Magnetic ring
2	Motor position sensor (Hall sensor)

Coding resistor

The characteristic curve of the lockup torque of the multi-disc clutch can vary slightly due to mechanical tolerances in the production process. After measuring the actual lockup torque on the clutch test rig, a resistor is fitted on the actuator motor. The value of this resistor represents a reference for the characteristic progression of the lockup torque.

Every time the engine is started, the transfer case control unit measures the resistance, thus enabling selection of the optimum characteristic map for the installed transfer case.



4 - Actuator drive with coding resistor

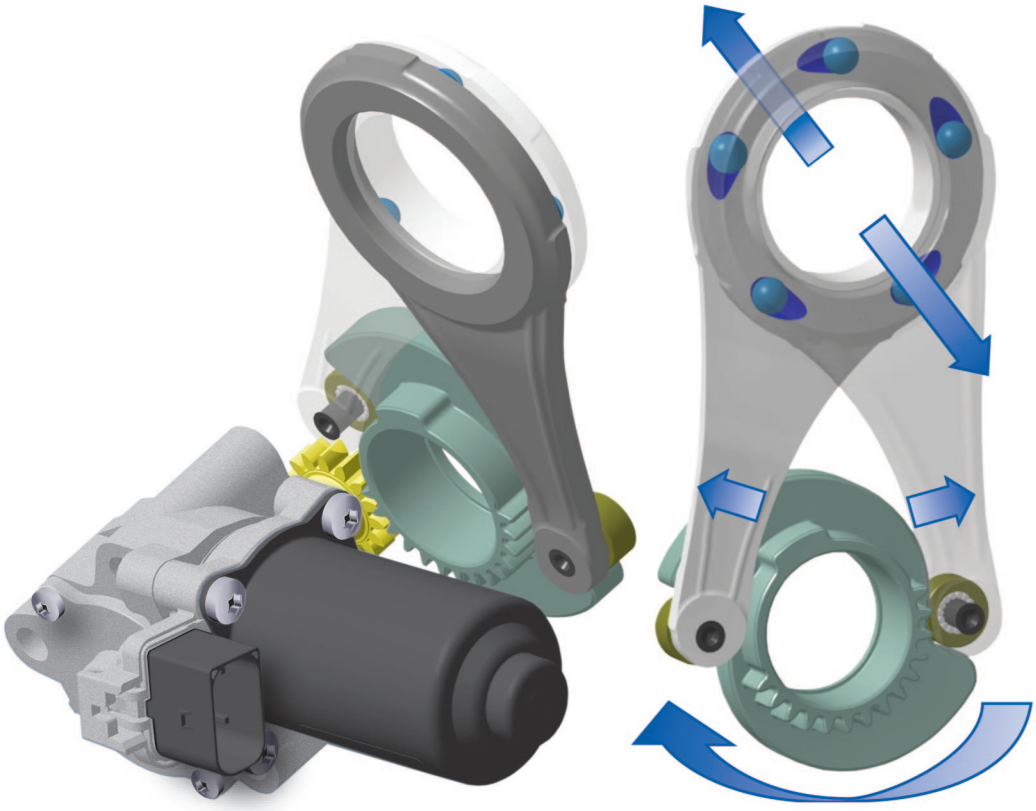
Index	Explanation
1	Drive pinion
2	Electric motor
3	Coding resistor
4	Actuator drive housing

Control lever

The actuator drive unit operates such that the drive pinion rotates and engages via the gearing in the control cam. In turn, the control cam is rotated and the control lever pressed apart.

The rotary motion is converted into an axial force by the ball ramps in the control lever. The axial force that compresses the disc package in the multi-disc clutch is proportional to the transmitted torque of the multi-disc clutch.

The proportional assignment of position of the control lever to the transmitted torque facilitates exact regulation of the control cam by the actuator drive unit.



5 - Actuator drive with control can and control lever (left) Direction of movement as multi-disc clutch closes (right)

Control unit

DXC8+ module

The DXC8+ module installed in the engine compartment essentially consists of three components:

- Add-on control unit
- Valve block with integrated pressure sensor
- Pump motor

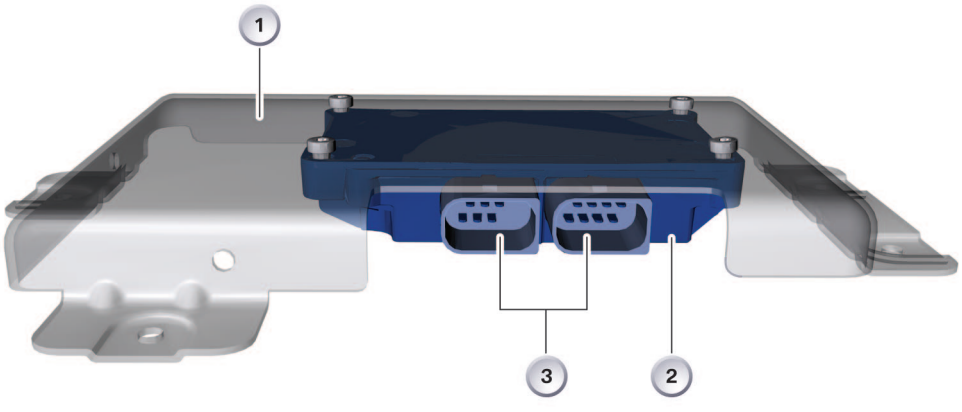
The DSC8 module introduced with the E60 has been further developed to produce the DXC8+ module.

The newly developed changeover valves permit even more exact control in the low pressure range, resulting in the following advantages:

- Reduction of control noise
- Improvement in control quality and control comfort
- Improvement in automatic brake intervention by the active/dynamic cruise control ACC/DCC
- Improvement in the control accuracy of the HDC function
- Realization of additional brake functions

Transfer case control unit

The transfer case control unit in the E60/E61 is installed on the floor pan in the area of the footwell under the kick guard in front of the passenger's seat.



6 - Transfer case control unit

Index	Explanation
1	Kick guard
2	Transfer case control unit
3	Connector

Sensors

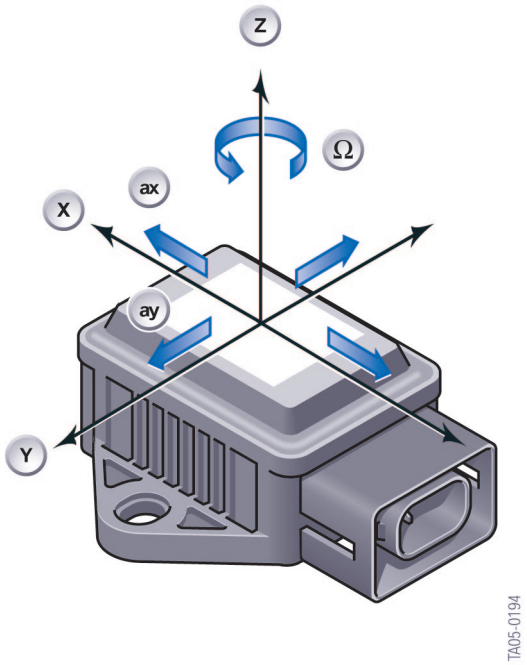
DSC sensor

The DSC sensor (Y-sensor 2) is installed on the assembly under the front passenger's seat next to the transmission tunnel.

In addition to the previous yaw rate and transverse acceleration sensor, the DSC sensor also contains an additional longitudinal acceleration sensor for the drive-off assistant function.

The yaw rate sensor provides information for the trailer stabilization control function.

Index	Explanation
X	Longitudinal axis
Y	Transversal axis
Z	Vertical axis
ax	Longitudinal acceleration
ay	Lateral acceleration
Ω	Yaw rate



7 - DSC sensor

Wheel-speed sensor

Active wheel speed sensors with an integrated evaluator circuit are used together with the xDrive.

The active wheel speed sensors require a power supply for their operation and make available a speed-independent square-wave signal.

The output signal is sent as a data protocol based on the pulse-width modulation method (PWM). The PWM signal is used for the purpose of determining the road speed. The pulse width contains additional information relating to the direction of rotation, standstill detection, installation position detection and air gap reserve to the sensor ring.

The direction of rotation is determined by the internal signal offset of three correspondingly arranged Hall-effect elements in the sensor IC.

The rpm sensor sends one pulse every 0.75 s when the wheel is stationary.

The installation position is detected for the purpose of establishing whether the change in the magnetic field strength is sufficient to guarantee the function with a high degree of security.

8 - Wheel speed sensor with sensor ring

Index	Explanation
1	Sensor ring
2	Sensor-IC with Hall sensor
3	Sensor housing

Indicator lamps and check control messages

The indicator lamps and check control messages concerning the DXC are listed in the following table. Driver information is additionally shown in the central information display.

Fixed indicator lamp	Variable indicator lamp	Check control message	Information in central information display
		DSC disabled!	You have disabled DSC. Restricted vehicle stability while accelerating and cornering.
		DTC enabled, DSC restricted!	DTC enabled. Dynamic traction control DTC increases forward propulsion on unpaved surfaces, however, it decreases vehicle stability.
		DSC failed! Drive with moderation	DBC failed. No additional braking assistance from DBC in emergency braking situations. Drive with moderation. Have checked by your BMW dealer as soon as possible.
		DSC failed! Drive with moderation	DSC failed. Restricted vehicle stability while accelerating and cornering. Drive with moderation. Have checked by your BMW dealer as soon as possible.
		Control systems! Drive with moderation	Brake and vehicle control systems failed. Reduced braking and vehicle stability. Avoid abrupt braking where possible. Have checked by nearest BMW dealer.
		Control systems! Drive with moderation	Brake and vehicle control systems failed. Drive with moderation, avoid abrupt braking where possible. Have checked by nearest BMW dealer.
		Brake pads! Replace	The brake pads are worn. Have replaced by nearest BMW dealer.
		Brake fluid! Stop cautiously	Brake fluid level too low. Reduced braking efficiency. Stop cautiously. Contact nearest BMW dealer.
		Brakes too hot! Allow to cool down	Brakes too hot Critical temperature as a result of permanent heavy load. Danger - reduced braking efficiency. Allow brakes to cool down. Stop if necessary.

Fixed indicator lamp	Variable indicator lamp	Check control message	Information in central information display
		Brakes overheated! Allow to cool down	Brakes overheated Critical temperature exceeded. Braking efficiency no longer guaranteed. Stop at the next opportunity and allow to cool down substantially.
		4x4 system and DSC failed!	4x4 system and DSC failed! Vehicle stability restricted. Drive with moderation. Have checked by your BMW dealer as soon as possible.
		4x4 system defective! Drive with moderation	4x4 system defective Vehicle stability restricted. Drive with moderation. Have checked by your BMW dealer as soon as possible.
		4x4 system, DSC and ABS failed!	4x4 system, DSC and ABS failed! Vehicle stability restricted. Drive with moderation. Have checked by your BMW dealer as soon as possible.
		4x4 System, DSC, ABS and emergency EBV failed!	4x4 System, DSC, ABS and emergency EBV failed! Vehicle stability restricted. Drive with moderation. Have checked immediately by your BMW dealer.
		HDC enabled!	
		HDC disabled!	HDC disabled. Hill descent control HDC is disabled at speed above 60 km/h (37 mph). System can be re-enabled at speed below 35 km/h (22 mph).
		No HDC control! Drive slower	HDC not possible! Control range ends at 35 km/h (22 mph). To use HDC, reduce speed accordingly.
		HDC currently not available!	HDC not available. Automatic brake intervention interrupted for safety reasons as brakes are overheated. Shift down and drive carefully in order to reduce temperature.
		Drive-off assistant inactive!	Drive-off assistant inactive Caution, vehicle can roll back! Have checked by your BMW dealer at next opportunity.
		Electronics fault! Stop cautiously	Central vehicle electronics failed. Continued journey not possible. Contact nearest BMW dealer.

Operation on brake test rigs

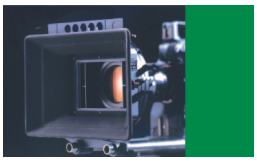
Selector lever position N must be engaged on vehicles with xDrive and automatic gearbox for testing on brake test rigs. In this setting, the transfer case clutch remains open and the vehicle cannot be pulled out of the test rig.

In the case of vehicles with xDrive and manual gearbox, the accelerator must not be pressed when the vehicle is on the test rig to ensure the transfer case clutch is not closed.

Programming

Both the transfer case control unit as well as the add-on DXC8+ control unit can be programmed.

Contents
Active backrest width adjustment



Introduction
Active backrest width adjustment

Enhanced driving enjoyment with innovative seat system

Manual backrest width adjustment is optionally available in many BMW vehicles. The backrest width adjustment system serves the purpose of optimally adapting the side sections of the backrest to the individual upper body of the occupants with the aim of achieving improved support of the upper body when cornering.

BMW M GmbH has developed the active backrest width adjustment in M-vehicles for performance-oriented drivers. The active backrest width adjustment (ALBV) changes the setting of the side sections of the backrest dynamically when cornering. The dynamic setting of the backrest is dependent on various parameters.

As from 03/05, the backrest width adjustment system will also be introduced in the E60/E61. The system can be ordered as option SA 4MF in connection with SA 455 Comfort seat.

For the M5/M6 vehicles, the active backrest width adjustment system can be ordered only together with the option SA 4MA Multifunction seat.

⚠ The active backrest width adjustment is not possible together with the active seat as sufficient package space is not available for the components. ◄

Customer benefits

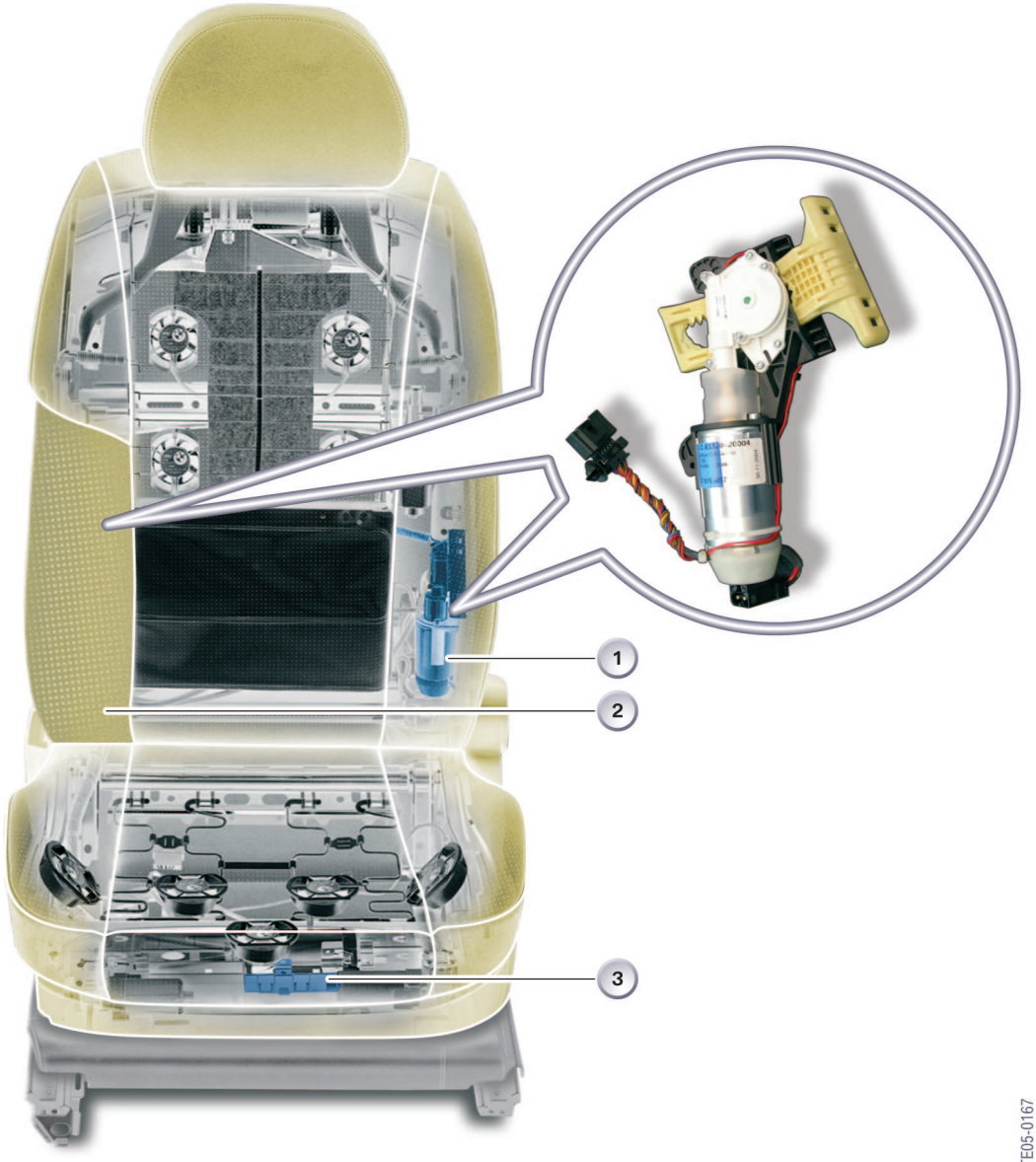
Due to the centrifugal forces exerted on the upper body, forces acting towards the outer edge of a bend occur when driving through corners dynamically. The upper body is displaced towards the outer edge of the bend.

The active backrest width adjustment system activates the respective side section of the backrest to counteract the forces and to keep the upper body stable in the seat. The driver can concentrate fully on steering.

1 - Cornering enjoyment

System overview
Active backrest width adjustment

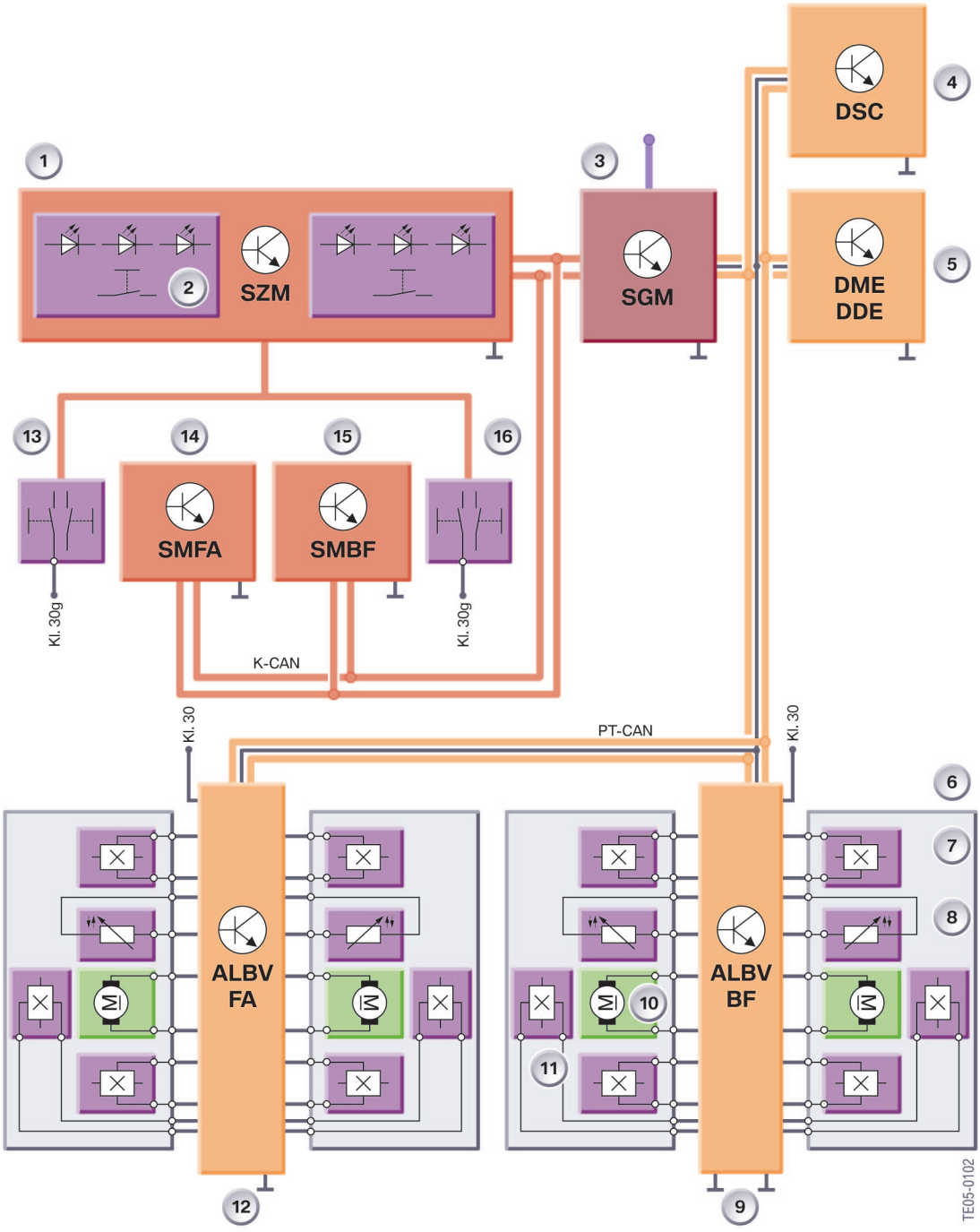
System components - Seat



1 - Comfort seat with components of the active backrest width adjustment system

Index	Explanation
1	Drive unit for active backrest width adjustment (two drive units installed)
2	Adjustable backrest side section
3	ALBV control unit

System circuit diagram ALBV



2 - Active backrest width adjustment ALBV

Key to system circuit diagram ALBV

Index	Explanation
1	Centre console switch cluster SZM
2	Button for active backrest width adjustment
3	Safety and gateway module SGM
4	Dynamic stability control DSC
5	Digital diesel electronics/digital motor electronics DME/DDE
6	Drive units for active backrest width adjustment (2 per seat)
7	End position sensor
8	Temperature sensor
9	Control unit for active backrest adjustment, front passenger ALBV BF
10	Servomotor
11	2 Hall sensors for direction of rotation and position recognition
12	Control unit for active backrest adjustment, driver ALBV FA
13	Backrest width adjustment switch, driver
14	Driver's seat module
15	Passenger's seat module
16	Backrest width adjustment switch, front passenger

Functions
Active backrest width adjustment

System integration

The active backrest width adjustment system consists of the control units:

- Active backrest width adjustment, driver (ALBV FA)
- Active backrest width adjustment, front passenger (ALBV BF).

Both control units are located in the respective driver's or front passenger's seat. The control units feature a PT-CAN bus link. This connection to the PT-CAN is necessary in view of the high number of parameters relating to the vehicle dynamics from the DSC and DME control unit and the short response time of the system.

System activation

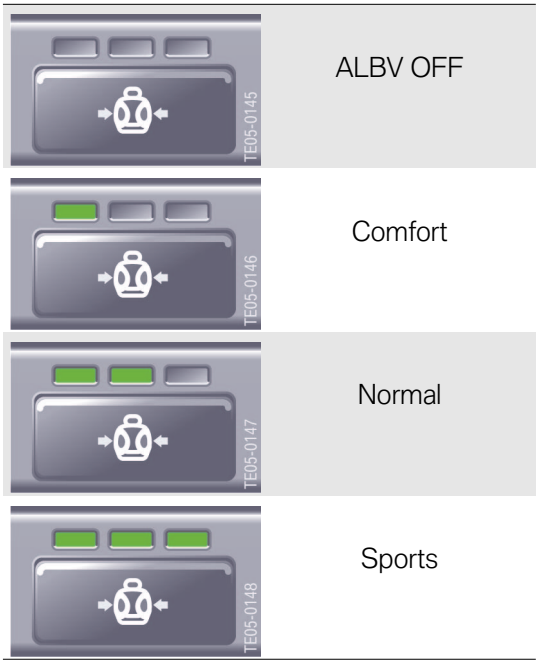
The active backrest width adjustment system cannot be activated before the engine is running. There are buttons for the driver's and front passenger's side located in the centre console switch cluster (SZM) to switch on the system.

A green LED lights when the button is pressed with the engine running. The indicator switches to two LEDs or three LEDs when the button is pressed again.

The active backrest width adjustment system is switched off immediately if the button is pressed for longer than 1.2 seconds and all LEDs go out.

Each of these LEDs represents a specific characteristic map that is stored in the ALBV FA / ALBV BF.

The actuators for setting the side sections of the backrest are actuated corresponding to the selected characteristic map. The actuators are controlled by means of a PWM signal (pulse-width modulation).



System functions

The ALBV system features the following functions:

- **Basic function**
  - Active backrest width adjustment
- **Additional functions**
  - Easy-entry for driver's and front passenger's side
  - Backrest width adjustment
  - Readjustment of the backrest width
  - Soft start/stop of the drive unit for backrest width adjustment
  - Backrest width memory function
  - Special features in M-Drive mode

These functions are outlined in the following.

Basic function

After activation of a corresponding characteristic curve (comfort, normal, sports) the outer (closest to the curve) side section of the backrest is controlled during vehicle operation depending on various parameters. The side sections of the backrest are adjusted to such an extent as to take up the transverse forces and to keep the position of the upper body stable in the seat.

Various control units make available information on the PT-CAN to the ALBV control units for the purpose of controlling the respective side sections. The DSC control unit provides the most important information. The following information is made available:

- Road speed
  - The mean value of the signals of all four wheel speed sensors is determined and sent as the road speed signal on the PT-CAN.
- Longitudinal and transverse acceleration
  - The longitudinal and transverse acceleration is calculated in the DSC control unit from the signals of the Y-sensor 2.
- Yaw rate
  - The yaw rate, i.e. the rotation about the vertical axis, is also calculated in the DSC control unit from the signals of the Y-sensor 2.
- Steering angle
  - The steering angle is determined by the steering angle sensor in the steering column switch cluster SZL. The SZL sends a data telegram via the F-CAN to the DSC control unit.
- Steering angle speed
  - The steering angle speed is also determined by the steering angle sensor and sent via the SZL to the DSC control unit.

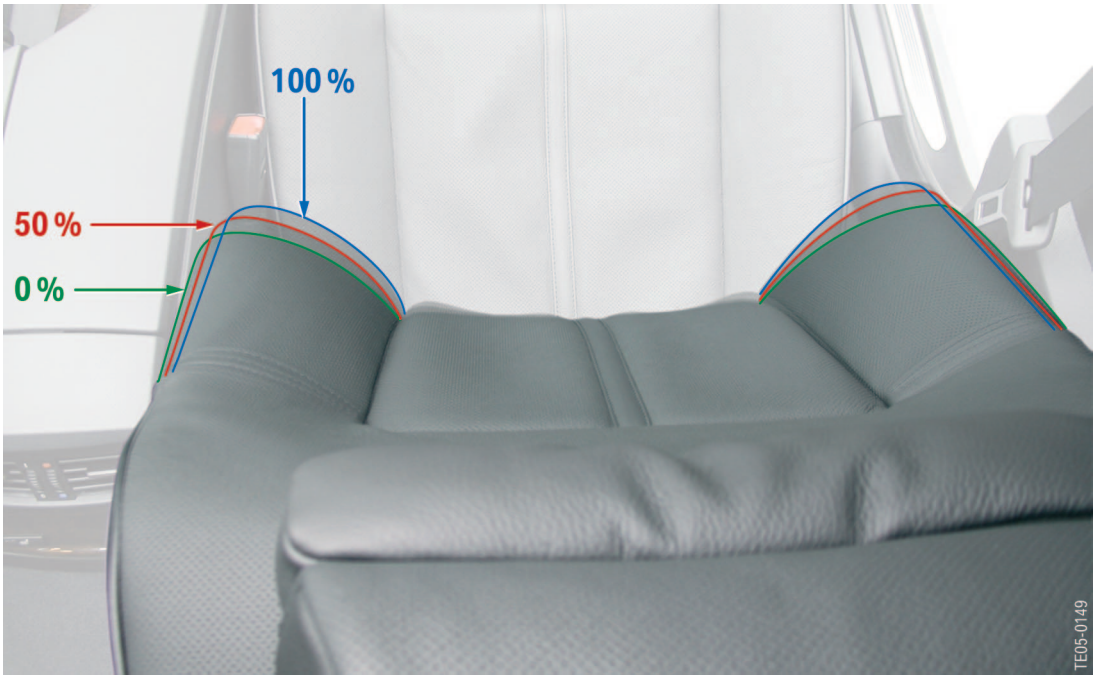
Further information from the DME/DDE and driver's/front passenger's seat modules

- Engine speed information
  - The DME/DDE sends an engine speed signal so that the ALBV control unit recognizes that the engine is running and the system can be activated.
- Memory information
  - The backrest width memory is integrated in the seat memory located in the respective driver's/front passenger's seat module. The seat module initiates the backrest width memory by means of a K-CAN telegram.

Drive unit for backrest width adjustment

The drive unit consists of a DC motor with a step-down gear mechanism flanged to it. The gear mechanism engages in the adjustment assembly on which the side sections of the backrest are mounted. The side sections of the backrest are adjusted from maximum open (0 %) to maximum closed (100 %) by the adjustment assembly.

An electric motor is driven by a PWM signal (pulse-width modulation) for this purpose. The adjustment speed can be influenced corresponding to the pulse width. At maximum closing speed, the side section of the backrest is adjusted from completely open (0 %) to completely closed (100 %) within approx. 1 second.



1 - View of backrest adjustment ranges towards inside

2 - Side view of forward adjustment ranges

The drive units are controlled with following pulse width corresponding to the characteristic curve.

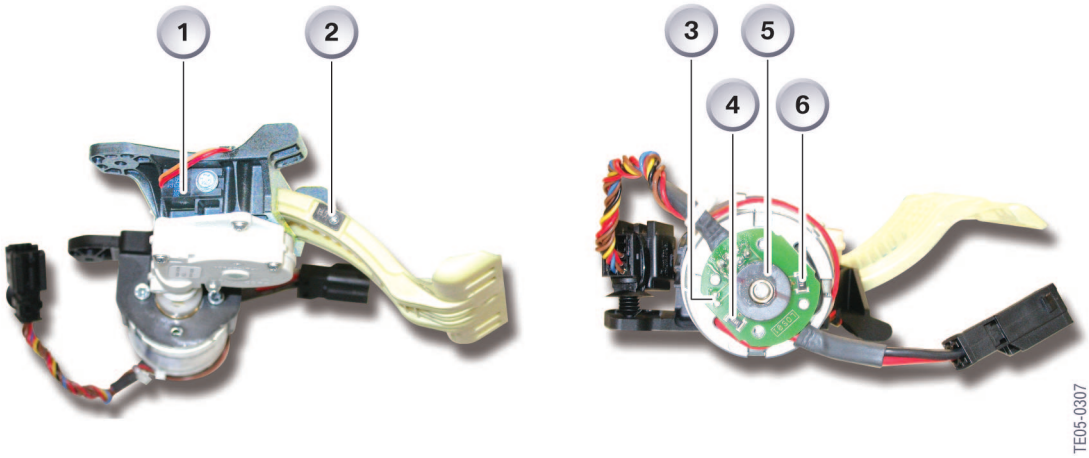
Characteristic curve	Adjustment range in %	Pulse width modulation in %
Comfort	50-100	50
Normal	0- 100	65
Sports	0- 100	80
Sports*	0- 100	85

* A modified characteristic curve for PWM control is used in the sports setting on M GmbH vehicles.

The drive unit additionally features various sensors. The end position sensor, a two-wire Hall sensor, recognizes the fully opened backrest width (0 %).

Two Hall sensors, offset by 120 degrees, are additionally installed for determining the direction of rotation and position. The signals of the Hall sensors are counted up or down, enabling the ALBV control unit to determine the direction of rotation and position. The Hall sensors are monitored by the ALBV control unit and sampled every 200 ms.

A temperature sensor is additionally installed in the drive unit. At excessively high temperatures, the drive unit is no longer activated until the temperature has dropped below a permissible value.



3 - Actuators of the active backrest width adjustment with sensors

Index	Explanation	Index	Explanation
1	End position sensor	4	Hall sensor 1
2	Contact for end position sensor	5	Magnetic ring
3	Temperature sensor connection	6	Hall sensor 2

Initialization of the drive units

An initialization procedure must be performed to ensure smooth operation after replacing a control unit or a drive unit. As part of this initialization procedure, the zero position of the drive units is defined by the signal from the end position sensors. For this purpose, the drives are moved to the fully opened position and the switch pressed and held for at least 15 seconds. Initialization can be performed with the aid of the BMW diagnosis system.

For this purpose select the path:

- Service functions
  - Body
    - Active backrest width adjustment

and perform the initialization procedure.

Additional functions

Easy-entry for driver and front passenger

To make it easier for the driver and passenger to get in and out of the vehicle the side sections of the backrest are completely opened (0 %) and held in this position. The side sections of the driver's seat backrest are opened under the following conditions:

- Terminal R OFF
- Terminal R ON and driver's door opened
- Driver's door open and terminal 15 OFF

The side sections of the front passenger's seat backrest are opened under the following conditions:

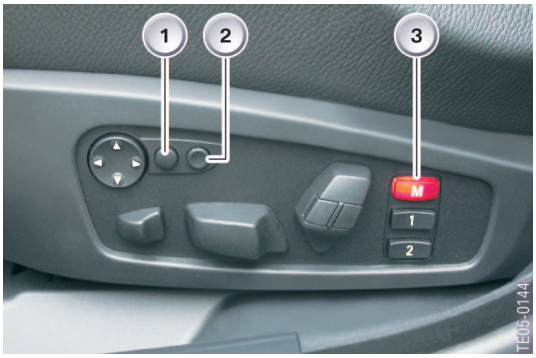
- The front passenger's door is opened and the seat belt not buckled.

⚠ The easy-entry facility is deactivated when the active backrest width adjustment is enabled, i.e. the engine is running and the side sections of the backrest are in the position last stored. ◄

Backrest width adjustment

The backrest width can be preset manually by means of a seat adjustment switch on the control panel.

The customer has the option of setting the backrest width to his/her individual requirements. Adjustment is possible as from terminal 30.



4 - Control panel for seat adjustment

Index	Explanation
1	Backrest width OPEN
2	Backrest width CLOSED
3	Memory button

The switches for backrest width adjustment are connected via the K-bus to the centre console switch cluster (SZM). The SZM is connected via the K-CAN to the SGM and the PT-CAN.

After selecting a characteristic curve for the active backrest width adjustment, only the presetting between completely open (0 %) and half closed (50 %) is possible otherwise subsequent adjustment would no longer be possible if the side sections of the backrest were completely closed (100 %).

Only the open backrest side section can be adjusted during control of the active backrest width.

Readjustment of the backrest width

Readjustment is intended to balance out the asymmetry in the side sections of the backrest after manual adjustment of the backrest width or after assuming a memory position. Readjustment takes place when the electronic circuitry in the ALBV control unit recognizes a difference of > 5 Hall pulses between the left and right actuator motors.

Readjustment takes place 1 second after the end of the backrest width adjustment procedure. If the adjustment was not successful, the procedure is repeated after 2 seconds.

No readjustment takes place while the active backrest width adjustment is in operation.

Soft start/stop of drive unit

A special control facility is responsible for starting and stopping the electric motor. The controlled start function minimizes starting current peaks and avoids mechanical noise during the adjustment procedure.

The controlled soft stop function prevents afterrunning of the drive unit.

Backrest width memory

The backrest width memory is located in the respective driver's and passenger's seat module. With the aid of the memory buttons in the seat control panel, two positions can be stored for each personalized key in the backrest width adjustment memory.

The setting of the driver's seat last selected is additionally stored in the current key under following conditions:

- 10 seconds after manual backrest width adjustment
- When retrieving a memory position
- When switching terminals from 15 to R

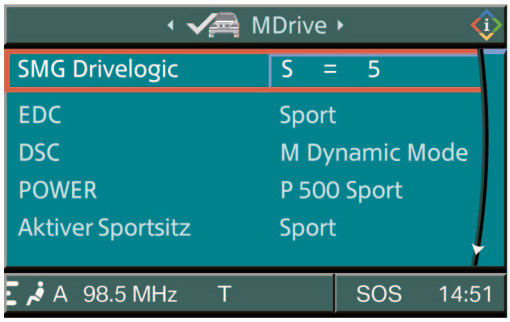
M-Drive

An M-Drive button is incorporated in the steering wheel on M-vehicles. This button is used for special settings in various systems that the customer selects individually via the iDrive in the central information display.

5 - M-Drive button in steering wheel

Changes can be made in following systems:

- Digital motor electronics
  - Faster throttle valve response
- Chassis and suspension
  - Electronic damper control
  - Special characteristic curve for Servotronic
- Dynamic stability control
  - M-Dynamic mode with higher thresholds for longitudinal and transverse dynamics
- Active backrest width adjustment
  - Special characteristic curve for PWM actuation in sports mode



6 - M-Drive menu with setting options

When the M-Drive button is pressed, the set characteristic is adopted in the central information display and the corresponding LEDs activated. The setting in the central information display is not overwritten if the customer selects a different characteristic curve by means of the button.

Initialization of the drive units

An initialization procedure must be performed to ensure smooth operation after replacing a control unit or a drive unit.

As part of this initialization procedure, the zero position of the drive units is defined by the signal from the end position sensors. For this purpose, the drives are moved to the fully opened position and the switch pressed and held for at least 15 seconds.

Initialization can be performed with the aid of the BMW diagnosis system. For this purpose select the path:

- Service functions
  - Body
    - Active backrest width adjustment

and perform the initialization procedure.

Test questions
E60/E61 Changes as from 03/2005

Questions

Consolidating and revising what you have learned.

In this section you have the opportunity of checking what you have learned by answering the following questions on the subject of the E60/E61 Changes as from 03/2005.

1. As from April 2005, the BMW 5 Series will be available with a new in-line, 6-cylinder N52 engine and all-wheel drive system xDrive. What are the model designations?

- ☐ 520xi
- ☐ 523xi
- ☐ 525xi
- ☐ 530xi

2. Why, in addition to the K-CAN connection, does the lights module also have a PT-CAN connection?

- ☐ The lights module features the gateway function
- ☐ The adaptive headlight function is integrated in the lights module

3. What properties of the TV picture in vehicles with TV function can be adjusted?

- ☐ Brightness
- ☐ Contrast
- ☐ Colour

4. On vehicles equipped with xDrive, what is the power distribution between the front and rear axle during normal operation?

- ☐ 50:50%
- ☐ 38:62%
- ☐ 0:100%
- ☐ 40:60%

5. Where is the lockup torque for the multi-disc clutch calculated?

- ☐ In the digital engine electronics DME
- ☐ In the dynamic stability control DSC
- ☐ In the dynamic traction control DXC
- ☐ In the transfer case control unit VGSG

6. How is the torque distributed when the multi-disc clutch is open?

- ☐ 50:50% at front and rear axle
- ☐ 100% at front axle
- ☐ 100% at rear axle
- ☐ Not at all, the vehicle comes to a halt

7. At what terminal setting can the active backrest width adjustment be activated?

- ☐ Terminal 30
- ☐ Terminal R
- ☐ Terminal 15
- ☐ Engine running

8. Describe the signal path for the backrest width adjustment from the switch up to the actuator?

_____

_____

_____

9. What is the function of the driver's and front passenger's seat modules in the active backrest width adjustment system?

- ☐ Power supply of the actuators
- ☐ Evaluation of the Hall sensors
- ☐ Storage of the memory function
- ☐ Storage of the characteristic curves (comfort, normal, sports)

Answers to questions

1. As from April 2005, the BMW 5 Series will be available with a new in-line, 6-cylinder N52 engine and all-wheel drive system xDrive. What are the model designations?

☑ 525xi

☑ 530xi

2. Why, in addition to the K-CAN connection, does the lights module also have a PT-CAN connection?

☑ The adaptive headlight function is integrated in the lights module

3. What properties of the TV picture in vehicles with TV function can be adjusted?

☑ Brightness

☑ Contrast

4. On vehicles equipped with xDrive, what is the power distribution between the front and rear axle during normal operation?

☑ 40:60%

5. Where is the lockup torque for the multi-disc clutch calculated?

☑ In the dynamic traction control DXC

6. How is the torque distributed when the multi-disc clutch is open?

☑ 100% at the rear axle

7. At what terminal setting can the active backrest width adjustment be activated?

☑ Engine running

8. Describe the signal path for the backrest width adjustment from the switch up to the actuator?

Switch -> K-bus -> **Centre console switch cluster** -> K-CAN -> **Safety and gateway module** -> PT-CAN -> **Active backrest width adjustment control unit** -> **Actuator**

9. What is the function of the driver's and front passenger's seat modules in the active backrest width adjustment system?

☑ Storage of memory function

Abbreviations

ACC	Active cruise control
AHM	Trailer module
ARS	Dynamic drive
BSD	Bit-serial data interface
CAN	Controller area network
CAS	Car access system
CBS	Condition based service
CCC	Car communication computer
CDC	CD changer
CID	Central information display
CON	Controller
DDE	Digital diesel electronics
DME	Digital motor electronics
DSC	Dynamic stability control
DWA	Antitheft alarm system
EGS	Electronic transmission control
EHC	Electronic ride-height control (level control)
EKP	Electric fuel pump
F-CAN	Chassis CAN
FS	MOST direct access
HUD	Head-up display
IBS	Intelligent battery sensor
IHKA	Integrated automatic heating/air conditioning
K-Bus	Body bus
K-CAN	Body Controller Area Network
KBM	Body basic module
LM	Light module
M-ASK	Multi-audio system controller
MDS	Panoramic glass roof
MOST	Media oriented system transport
PDC	Park distance control
PT-CAN	Power Train Controller Area Network
RLS	Rain/driving light sensor
SA	Option
SBFA	Driver's door switch cluster
SBSL	B-pillar satellite, left
SBSR	B-pillar satellite, right
SDARS	Satellite Digital Audio Radio Service
SFZ	Vehicle centre satellite

SH	Auxiliary heating
SHD	Slide/tilt sunroof
SIM	Safety and information module
	Subscriber identification module
SINE	Emergency current siren with integrated tilt alarm sensor
SMC	Stepper motor controller
SMBF	Passenger's seat module
SMFA	Driver's seat module
SMS	Short Message System
SZL	Steering column switch cluster
SZM	Centre console switch cluster
TCU	Telematics control unit
ULF	Universal charging/hands-free facility
VM	Video module
WAP	Wireless application protocol
WUP	Wake-up line
ZH	Auxiliary heater

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