BMW
Service Training

E65/E66 Rear Compartment Entertainment System
Seminar Working Material

NOTE
The information contained in this training course manual is intended solely for participants of the BMW Service Training course.
Refer to the relevant "Technical Service" information for any changes/ supplements to the Technical Data.

VS-42 MFP-HGK-BRK-E65-E66_0970

Contents

Introduction

To date, virtually all components and functions in the E65 can only be operated by the driver or front passenger. Corresponding to ever increasing customer demands for more comfort in the rear compartment, a "rear compartment-oriented entertainment system" will be offered as an optional package for the E65 and E66.

- Benefits for the customer

- Pioneering display and operating concept, identical both at front and rear
- Identical controls
- Front control options are also available in the rear compartment
- Front and rear functions can be used independent of each other
- Two different audio sources can be used simultaneously in the vehicle (speaker/headset)
- The system can be expanded at any time

- New system features

The rear compartment entertainment equipment comprises the following new features that will be available from 03/2002:

- 6.5" rear compartment display (FD)
- Rear compartment display control unit (SG FD)
- Rear compartment controller (FCON)
- Rear centre armrest control centre (BZMF)
- DVD changer (DVD)
- Headset interface (KHI)
- Headset connection module (KHA)
- Video module 5 Drive (VM 5 Drive)

- System advantages

The rear compartment entertainment equipment offers the following advantages:

- Additional entertainment functions (e.g. DVD, video)
- Radio operation from rear compartment
- CD changer operation from rear compartment
- Simultaneous output of different audio sources via vehicle speakers and headset
- Television while driving (in rear compartment only)

System overview

- Block diagram

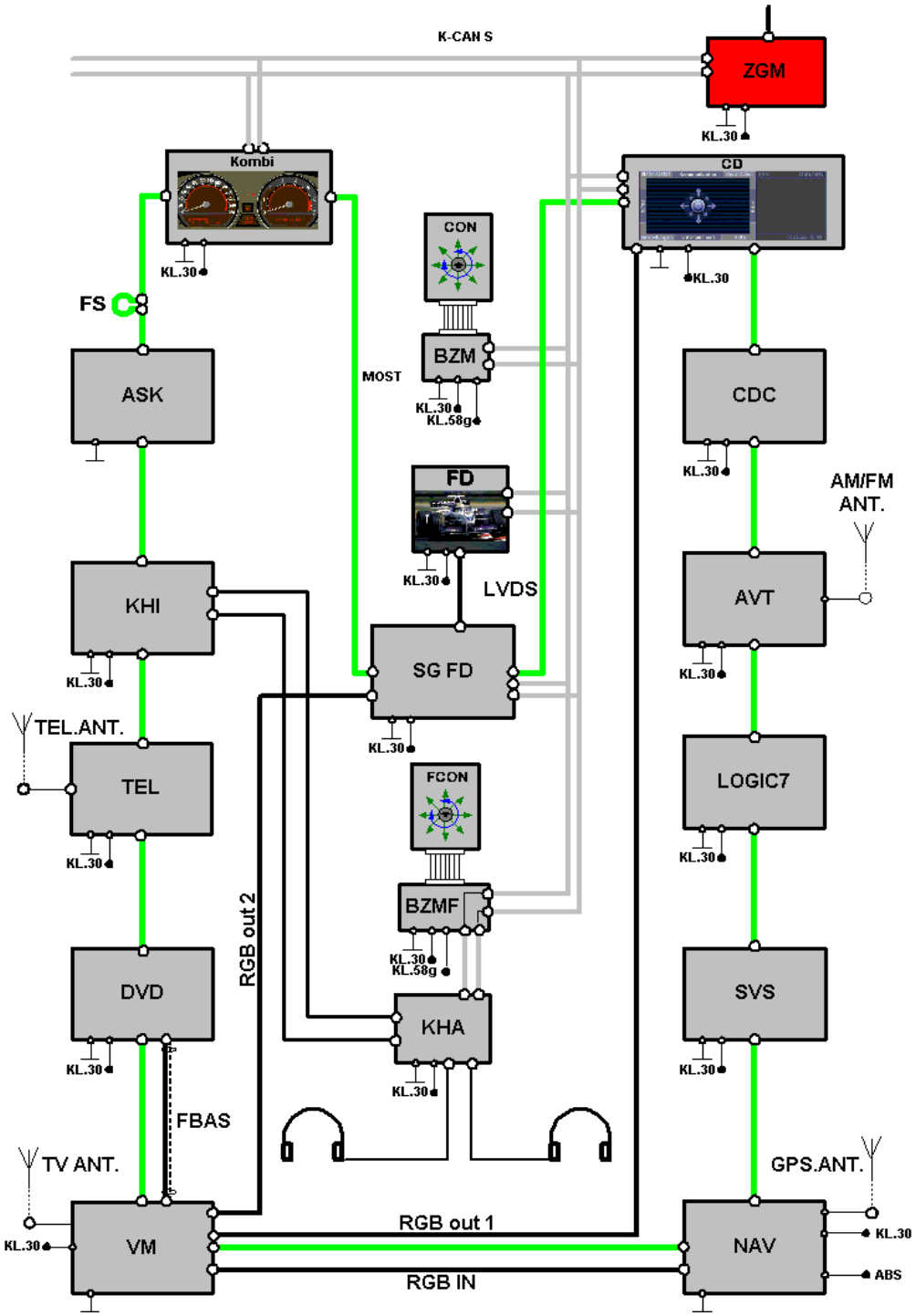


Fig. 1: System overview of rear compartment entertainment equipment KT-9592

Index	Description
ZGM	Central gateway module
Kombi	Instrument cluster
CD	Control display
CDC	Audio CD changer
BZM	Centre console control centre
CON	Controller
FCON	Rear compartment controller
BZMF	Rear centre armrest control centre
FD	Rear compartment display
SG FD	Rear compartment display control unit
ASK	Audio system controller
FS	Flash connector
AM/FM ANT.	Radio aerial
TV ANT.	TV aerial
TEL.ANT.	Telephone aerial
GPS.ANT.	GPS aerial
TEL	Telephone
KHI	Headset interface
KHA	Headset connection module
AVT	Aerial amplifier/tuner
DVD	DVD changer
VM5 Drive	Video module 5 Drive
NAV	Navigation computer
SVS	Voice control module
KL.30	Terminal 30 positive supply
KL.58g	Terminal 58g instrument lighting
ABS	ABS signal for wheel speed
RGB IN	Video signal cable from navigation computer to video module
RGB out 1	Video signal cable to control display
RGB out 2	Video signal cable to rear compartment display
FBAS	Video signal line
LVDS	Digital video signal cable
K-CAN S	K-CAN system
MOST	Media oriented system transport

Components

The following systems were newly added for the rear compartment entertainment equipment:

- 6.5" rear compartment display
- Rear compartment display control unit
- Rear compartment controller
- Rear centre armrest control centre
- DVD changer
- Headset interface
- Headset connection module
- Video module 5 Drive

- 6.5" rear compartment display

The rear compartment display (FD) represents the central display unit for the rear compartment entertainment system.

The folding rear compartment display is mounted centrally on the centre console such that it can be used unchanged on left-hand drive as well as right-hand drive vehicles. It can be folded down to facilitate the use of a ski bag.

Installation location

KT-9602

Fig. 2: Rear compartment display on centre console

Design of rear compartment display

The rear compartment display basically consists of two parts:

- Folding arm
- Display

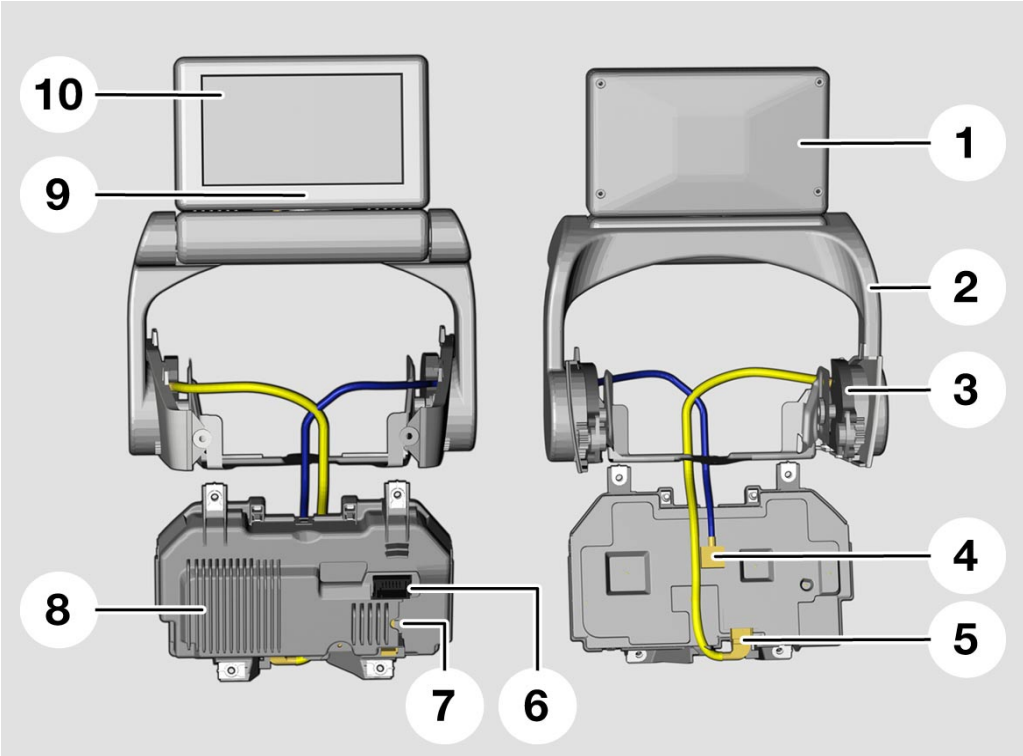


Fig. 3: Components of the rear compartment display

Index	Description	Index	Description
1	Display casing	6	RGB cable input
2	Folding arm	7	MOST connector
3	Locking module	8	Rear compartment display control unit
4	Power supply	9	Photocell
5	LVDS data cable	10	6.5" display

Folding arm

KT-9791

Fig. 4: Folding arm with display in rest position

The mechanical folding arm is mounted such that it can be rotated on the locking module. It is folded up/down manually. The locking module can be heard to release by pressing on the upper edge of the display. It can now be folded down. The locking module provides a reliable catch mechanism also under vibration conditions (poor roads) as well as in the event of a crash.

A Hall sensor detects when the rotary joint is in the folded up/folded down position.

The supply lines for the rear compartment display are routed through the locking module and the folding arm.

The shaft that accepts the adjustment element for the rear compartment display casing is mounted on the folding arm. The rear compartment display can be additionally tilted or swivelled by +/- 20 degrees.

Display

The rear compartment display is designed as a 6.5" advanced TFT display with a 16:9 picture format. The visible area is 144 mm x 79.5 mm and the resolution 400 x 240 pixels.

The TFT display is accommodated in a plastic casing.
A photocell for measuring the ambient brightness for the purpose of correspondingly dimming the display is also located in the plastic casing.

For the physical design and function of the display refer to the E65 Seminar Working Material "**iDrive/ConnectedService**."

- Rear compartment display control unit (SG FD)

The rear compartment display features its own control unit that is located beneath the rear compartment display in the centre console.

The rear compartment display control unit is integrated in the MOST system network.

Installation location

KT-9784

Fig. 5: Installation location of rear compartment display control unit

Functional principle

The rear compartment display control unit processes several data formats.
It features an MOST connection for receiving digital data packages such as travel guides for instance.
It receives the analog video signals from the video module via an RGB input (red-green-blue).
The control unit signals are transferred via the K-CAN SYSTEM.

The rear compartment display control unit generates the digital image data that are transferred via the LVDS* cable (digital RGB cable) to the rear compartment display. The image data provide the graphic representation on the rear compartment display.
Other cables are used to supply the rear compartment display with power and the control data of the K-CAN SYSTEM.

*LVDS = Low Voltage Differential Signalling for transmitting digital image data

- Rear compartment controller (FCON)

The rear compartment controller is the device for controlling the rear compartment entertainment equipment.

With regard to design and control, the rear compartment controller is identical to the controller at the front.

Installation location

KT-9792

Fig. 6: Rear compartment controller in centre armrest

The rear compartment controller is located in an ergonomically favourable position in the rear centre armrest control centre.

For the physical design and function of the controller refer to the E65 Seminar Working Material "**iDrive/ConnectedService**."

- Rear centre armrest control centre (BZMF)

In principle, the rear centre armrest control centre has the same functions as the centre console control centre at the front.

It serves the purpose of accepting the rear compartment controller as well as the switches for the seat settings. The headset connection module is located at the end face of the centre armrest.

Installation location

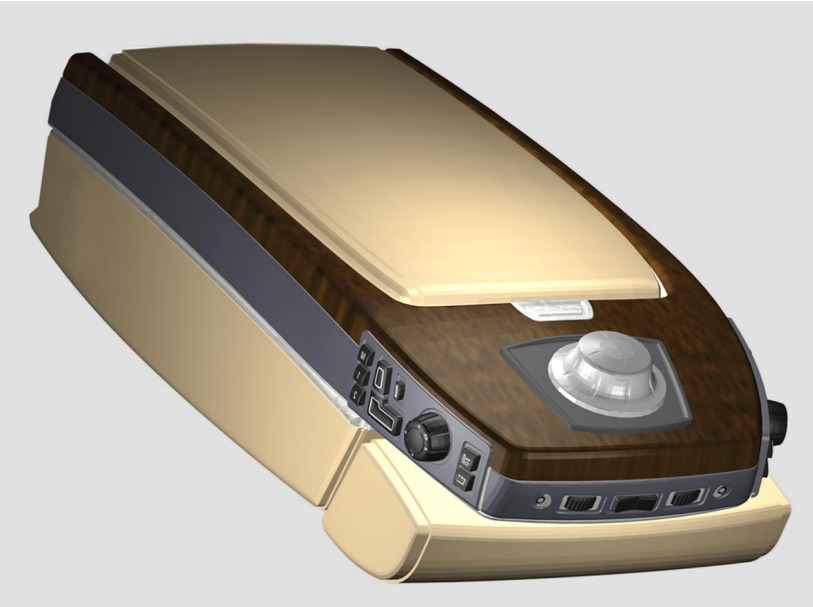


Fig. 7: Rear centre armrest control centre

KT-9786

Design

Compared to the centre console control centre at the front, the following components have been added to the rear centre armrest control centre (BZMF):

- Two connection jacks for the left/right headsets
- Two rotary controls for controlling the volume in the headsets
- A search rocker switch for changing CD tracks or radio stations

For the physical design and function of the operating centre refer to the E65 Seminar Working Material "**iDrive/ ConnectedService**."

- DVD changer (DVD)

For the first time in a motorcar worldwide, a DVD changer will be offered for the E66 to give the customer the highest digital picture quality on an interactive disc.
The customer will enjoy digital surround sound in connection with the TOP-HiFi (Logic 7) option.

The DVD changer is both a DVD as well as an audio CD player and can accept up to six different DVD or CD media in the magazine. The DVD changer offers the following advantages:

- Up to six different DVDs or audio CDs possible
- High memory capacity (up to 8 h movie time on one DVD)
- Outstanding picture and sound quality (Logic 7 surround sound)
- No loss in quality as is the case with video tape
- Increased comfort (e.g. track skip, top quality still frame, fast mode)
- Multiangle functions (view from different perspectives provided this function is supported by the respective DVD)
- Easy-to-use interactive functions
- Up to 8 language versions and 32 subtitle languages possible on one DVD
- Worldwide medium with uniform standards

Installation location

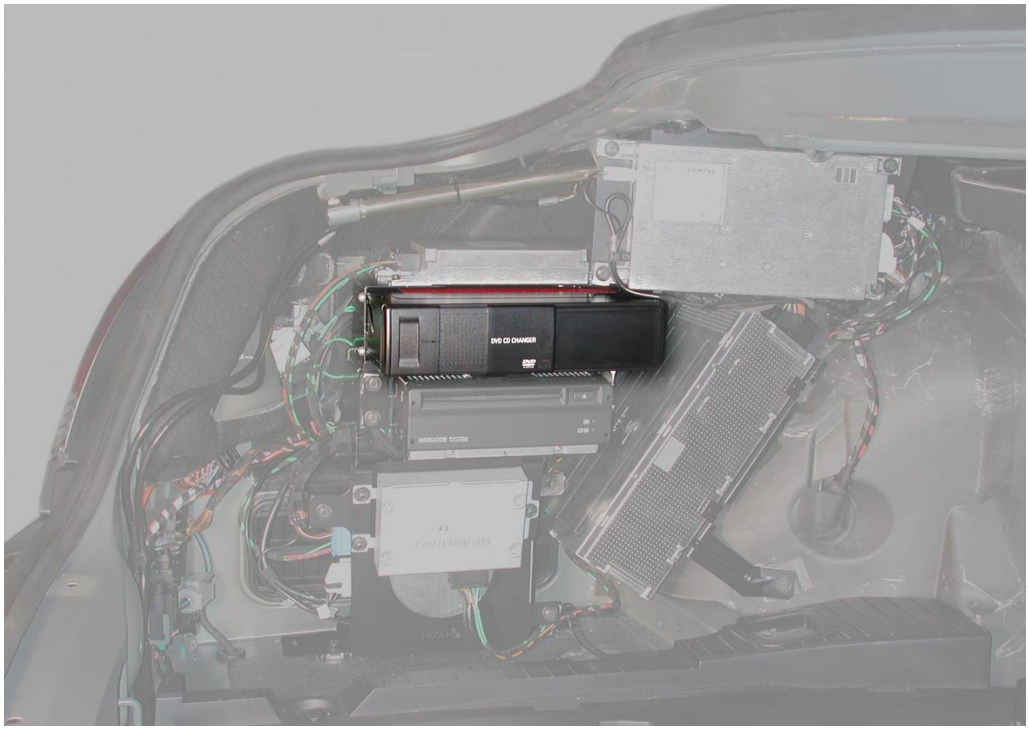


Fig. 8: Installation location of DVD changer in the rear compartment KT-9788

The DVD changer is installed at the rear left in the luggage compartment above the navigation computer.

The magazine can be inserted/removed only from the luggage compartment.

Design

In principle, the design of the DVD changer corresponds to that of the CD changer. The DVD changer is a consistent further development of the CD changer. The DVD changer, however, cannot only play back DVDs but also any audio CD, giving it multimedia capabilities.

The DVD changer features an MOST connection for transmitting digital audio data. The image (picture) data are transmitted via a colour-image-blanking-synchronous signal cable (FBAS) to the video module 5 Drive. Here, the data are duplicated and routed via RGB cables (red-green-blue) to the two displays.

Functions

Picture

In contrast to the cassettes of video recorders and laser discs, the video DVD stores digitized full-format pictures at very high resolution. Despite data reduction in accordance with the MPEG-2 Standard, the result for automobile applications is phenomenal.

At 540 lines, the horizontal resolution of the DVD is more than double as high as that of VHS videos (250 lines).
At its full width, the vertical resolution supports the 16:9 picture format.

The DVD provides a top quality still frame without annoying picture noise (interference) as well as outstanding colour fidelity. Thanks to contactless laser scanning, the overall quality is not impaired even after frequent playback.

Sound

In addition to image data, there can be up to eight sound tracks on one DVD. This makes it possible to accommodate several languages. In addition, up to 32 subtitles can be stored for additional information (translations, subtitles for the hard of hearing, karaoke etc.).

The audio signals are output digitally in the form of a linear PCM signal (Pulse Code Modulation) via the optical MOST bus.

Surround sound is achieved in connection with the Logic7 amplifier that can distribute the received PCM signals based on 5.1 multichannel technology.

The channels consist of 5 sound channels (front left, front centre, front right, rear left, rear right) over the full frequency response of 50 - 20,000 Hz. The sixth channel supplies the subwoofers for ".1" Dolby Digital with a frequency of 20 - 120 Hz.

Further functions

If supported by the DVD, various interactive functions can be set with the controller, e.g.:

- Seamless branching of the action in a film to different sequences of events (selection of story sequence)
- Seamless change of camera perspective (multi-angle)

Regional codes

As the result of pressure from the American film industry, so-called regional codes (1 to 6) have been set up and involve dividing the world into 6 regions.

The regional codes give the film industry the control when and in what version a film can be introduced to the market in any country in the world.

The DVD player first checks the regional code before playing back a DVD. This code must be identical to that of the player. If this is not the case, the DVD will be ejected and cannot be played.

In Europe, only regional code 2 DVD players and DVDs are available. Consequently, it is not possible, for example, to play a DVD from the USA (code 1) on a EURO model. Only DVDs with code 2 or without a code (code 0) can be played.

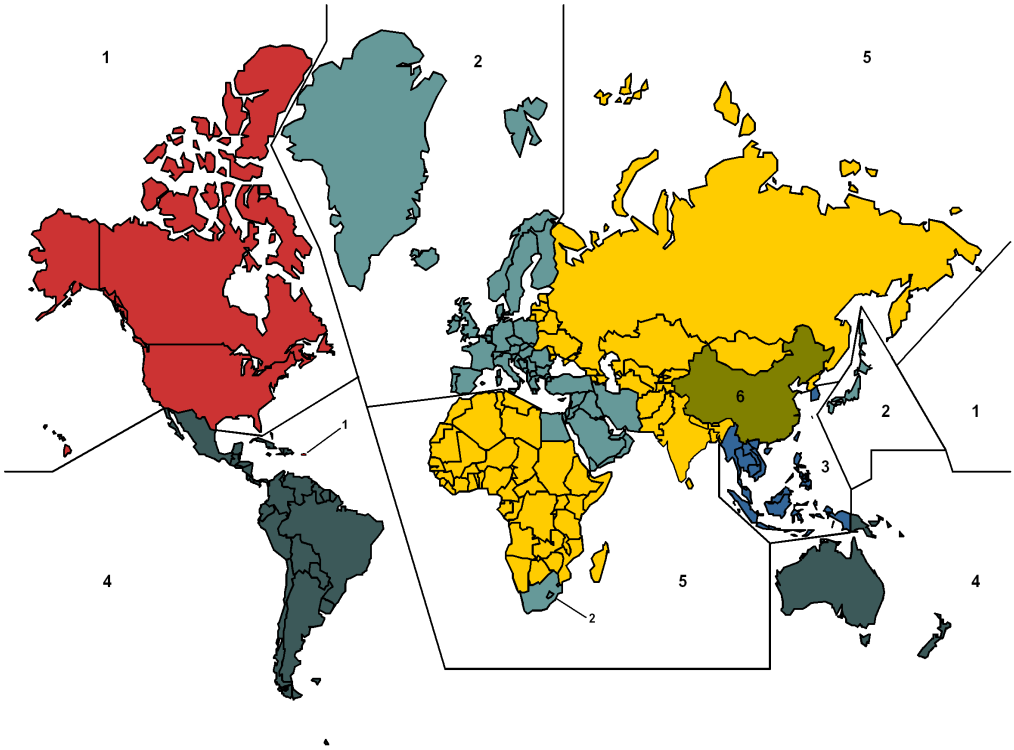


Fig. 9: World map showing distribution of regional codes KT-9621

Code	Country
0	No coding; can be played in any player
1	USA, Canada, American territories
2	Europe, Japan, South Africa, Middle East, Egypt
3	South-East Asia, East Asia, Hong Kong
4	Australia, New Zealand, Pacific Islands, South/Central America, Caribbean
5	Ex-Soviet Union, Indian Subcontinent, Africa, North Korea, Mongolia
6	China

- Headset interface

The headset interface forms the interface between the optical MOST bus and the headsets.

Installation location

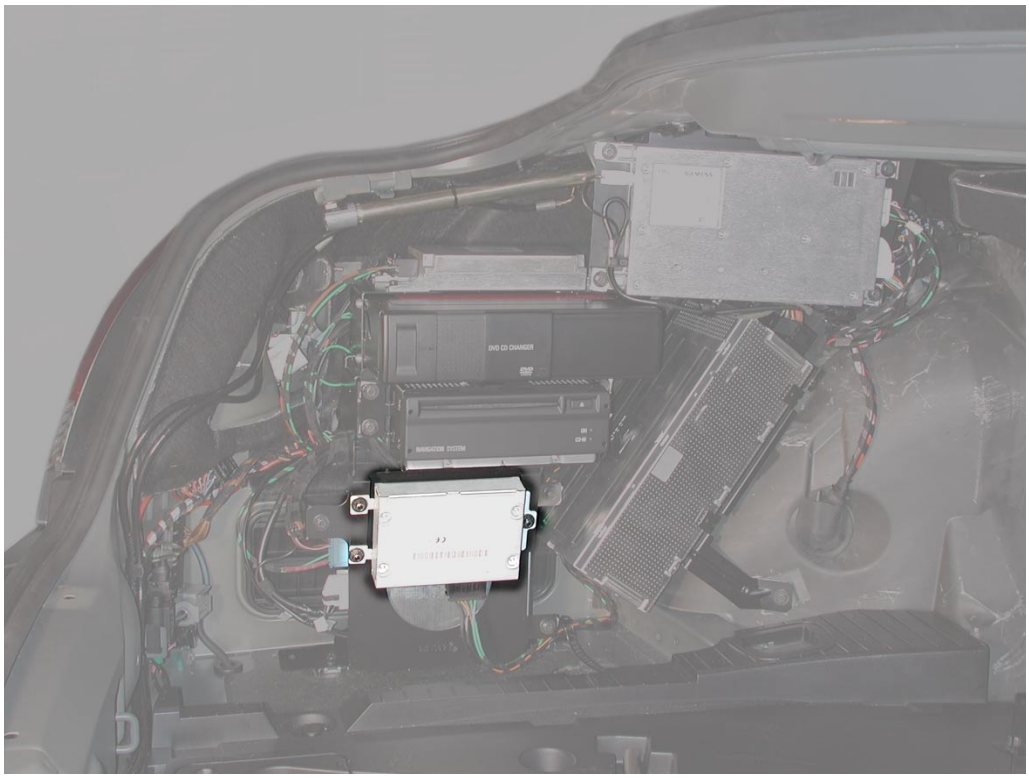


Fig. 10: Installation location of headset interface in luggage compartment KT-9789

The headset interface is located on the rear left in the luggage compartment in front of the video module 5 Drive.

Functional principle of headset interface

The audio and control data are routed via the MOST bus to the headset interface. The audio data generated by the various control units (e.g. tuner, CD, DVD, etc.) are supplied to the headset interface at a scanning rate of 44.1 kHz.

The headset interface accepts the audio data from the MOST bus and processes the data separately for each headset connection.

The audio data is output analogously for each headset via stereo cables to the headset connection module in the centre armrest.

The user can set the following functions
(the functions are configured in the headset interface):

- Volume
- Balance
- Treble/bass

- Video module 5 Drive

The video module 5 Drive (i.e. picture in rear compartment while driving) is the central processing unit for the video signals from the DVD changer and navigation computer.
In addition, the video module 5 Drive contains several TV tuners to ensure optimized TV reception also while driving.

Installation location

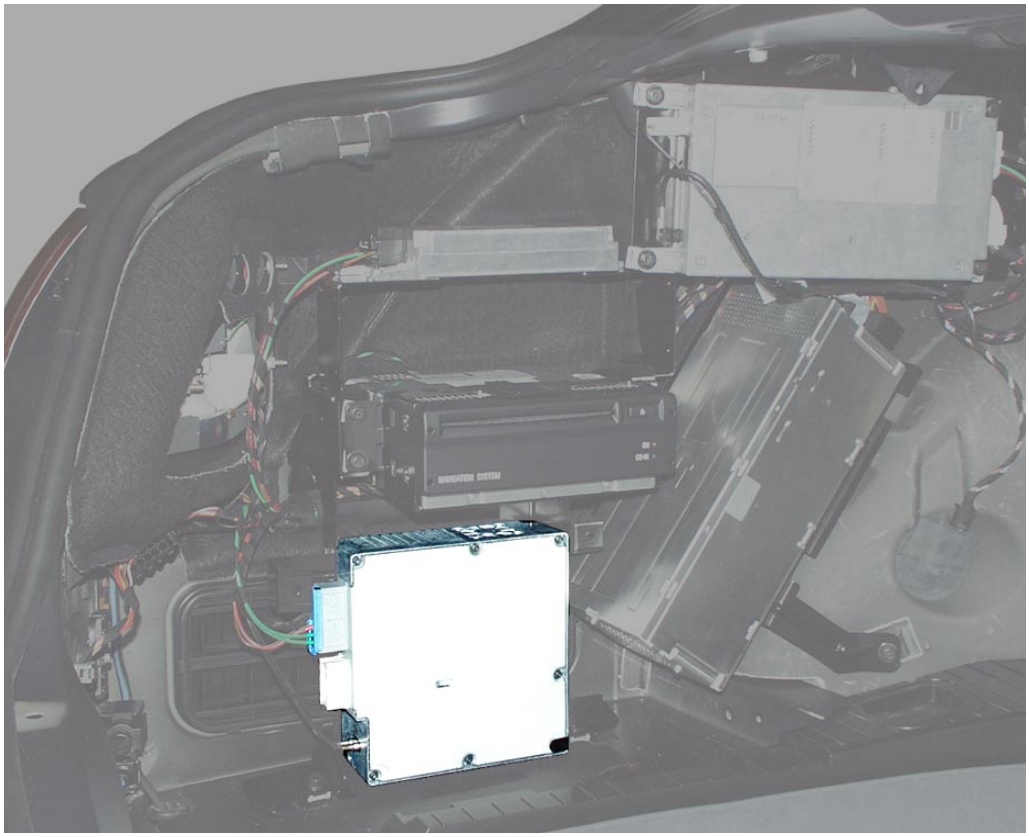


Fig. 11: Installation location of video module 5 Drive KT-9239

The video module 5 Drive is installed at the rear left in the luggage compartment beneath the navigation computer. The video module 5 Drive is installed instead of the video module 5 when option 603 Rear Compartment Entertainment System is ordered.

Design

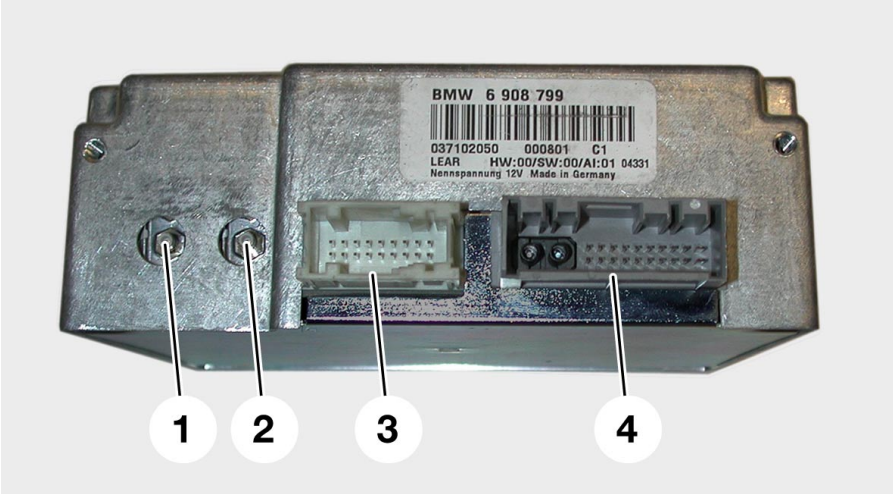


Fig. 12: Connector view, video module 5 Drive KT-9215

Index	Description	Index	Description
1	Aerial connector, aerial 1	3	Connector, ELO 18-pin Coding B (natural)
2	Aerial connector, aerial 2	4	Hybrid connector 20+2-pin with MOST coding C (blue)

The video module 5 Drive consists of a metal DIN casing and offers the following advantages:

- Optimum electromagnetic compatibility (EMC)
- Good heat dissipation
- High mechanical strength

The video module 5 Drive contains the following components:

- Three TV tuners
- Colour decoder
- Matrix
- Flash memory
- Fault code memory
- MOST bus link

Functional principle

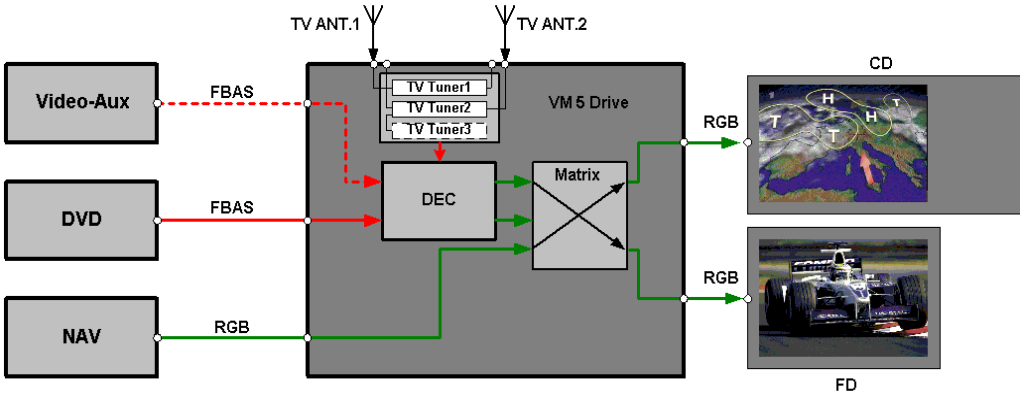


Fig. 13: Block diagram of video module 5 Drive

Index	Description	Index	Description
TV ANT.1	TV aerial 1	DEC	Colour decoder
TV ANT.2	TV aerial 2	Matrix	Component for copying and distributing video data
TV Tuner1	Main tuner 1	CD	Control display
TV Tuner2	Main tuner 2	FD	Rear compartment display
TV Tuner3	Background tuner	RGB	Red-green-blue data cable
Video-AUX	Auxiliary video input	FBAS	Colour-image-blanking-synchronous signal
DVD	DVD changer	NAV	Navigation

The video module 5 Drive offers the following functions:

- TV reception also while driving (in rear compartment only)
- Copying data and output on both monitors
- Output of different sources on both monitors
- Colour decoding of colour-image-blanking-synchronous signals
- Connection option for a video camera signal (e.g. for BMW Individual special solutions)

Inputs

The video module 5 Drive features the following inputs for realizing the functions.

External source	Signal	Remark
DVD changer	FBAS	For PAL 50 Hz, for NTSC 60 Hz
Navigation	RGB	Red-green-blue with synchronization on the green channel
Navigation Japan	RGBC	RGB signal with external synchronization signal
Video-AUX	FBAS	For PAL/SECAM 50 Hz for NTSC can be switched to 60 Hz for special solutions of BMW Individual
Internal source	**Signal**	**Remark**
TV	FBAS	Converted into an RGB signal in the colour decoder

Note: The DVD changer transfers the standard (PAL 50 Hz / NTSC 60 Hz) together with the control data via the MOST bus. Depending on the country-specific version, the standard is set to 50 Hz for PAL/SECAM and 60 Hz for NTSC for the video-AUX input. The standard can be changed via the DISplus at the dealer.

Outputs

The video module 5 Drive features two outputs. Consequently, it can output any source parallel to both outputs or different sources at each output.
At the start of series production, only the output of DVD video and TV will be possible on the rear compartment display in the E66 (03/2002).

Data sink	Signal	Remark
Control display	RGB	All functions
Rear compartment display	RGB	DVD video and TV only

System functions

The following system functions have been newly added:

- Rear compartment display
- Rear compartment controller
- DVD changer
- Headset connection module
- Video module 5 Drive

The general system functions will be described in the following sections.

- System description - rear compartment display

The structure and function of the display and control concept in the rear compartment corresponds to that of the control display. The rear compartment display features the same operator control interface. The rear compartment display is controlled solely by the rear compartment controller.

Switching ON and OFF

Initially, terminal R must be active and the rear compartment display must be opened up by hand from its rest position on the centre console in order to activate the rear compartment display. A Hall sensor detects the direction in which the display is folded and correspondingly switches the display ON/OFF.

When power is supplied to the display, the same mask as in the control display appears provided the entertainment menu is selected. Otherwise, the last setting of the rear compartment entertainment menu will be reestablished. A function can now be selected with the rear compartment controller.

Fig. 14: Possible entry mask in the rear compartment display KT-9866

Operation of the rear compartment display is also possible at terminal 30. For this purpose, however, the system must be activated by means of an ON/OFF switch in the audio system controller.

If the battery capacity drops below a defined value, the power module will switch off the rear compartment entertainment system.

Brightness adaptation

The ambient brightness of the display is measured by means of a built-in photocell and compared with the set brightness values. The display is adapted to the ambient brightness by correspondingly reducing or increasing the brightness setting. This ensures good viewing quality of the image at all times.

Scope of functions

The scope of functions that can be selected in the rear compartment display are based on the overall vehicle configuration as well as the equipment scopes integrated in the rear compartment.

The use of TV and separate telephone functions by the driver while driving is not only dangerous but also prohibited by law in virtually all countries.
These functions are permitted in the rear compartment while driving. For this reason, in addition to many identical functions, there are also several different functions in the rear compartment.

The entertainment functions that will be possible in the rear compartment at E66 series launch (03/2002) are listed in the following table:

- Radio (FM, AM)
- Audio system controller drive (CC, CD, MD)
- CD changer
- Sound settings for vehicle speakers and headsets
- TV while driving
- TV settings
- DVD changer
- DVD video settings

The following functions are not displayed or are not possible in the rear compartment:

- Settings
  (parking brake, park distance control, electronic damper control, active cruise control, tyre pressure control, tyre pressure warning, language)
- Climate control
- On-board data (on-board computer settings, stop watch, limit, service)
- Assistance window (not shown)
- Voice control

Multi-user control

The functions in the vehicles are made available by the various control units. The rear compartment passengers access the same control units (radio, telephone, DVD, etc.) as the front passengers. The following rules were defined to avoid conflicts during control unit access:

Headset not plugged in

Sound is output via the vehicle speakers if no headsets are plugged in. In this case, access to only once source is possible (e.g. radio, CD, TV, etc.). If both users access the same source, the value last set by the other user is overwritten (e.g. change radio station, volume, etc., "last come, last served").

If a user wishes to change the source (e.g. from radio to CD), the system switches over to the source last selected and outputs it through the vehicle speakers. The respective status indicators are correspondingly updated in the displays.

Headsets plugged in

Two different audio sources can be used if at least one headset is plugged in. The audio source that was selected at the front in the control display (e.g. radio) is output via the vehicle speakers. The audio source that was selected via the rear compartment display (e.g. CD) is output through the rear headsets.
This configuration renders the simultaneous use of two different audio sources possible.

Exceptions

Playback of a DVD on the rear compartment display with sound output through the headsets as well as simultaneously listening to an audio CD from the DVD changer via the vehicle speakers is not possible. The DVD changer can play back only one medium at a time.

Rear compartment lockout

To prevent users in the rear compartment from changing the source, it is possible to activate a rear compartment lockout in the control display. The rear compartment lockout is switched on and off in the "Settings" main menu under the menu item "Rear compartment." The possibility of changing the sources is still retained at the front. Overwriting the source by the rear compartment user is then no longer possible.

KT-9868

Fig. 15: Control display mask with "Rear compartment" menu item

Index	Description
1	"Rear compartment" menu item for activating the rear compartment lockout

Flash memory

The rear compartment display control unit features a flash memory in order to be able to implement software updates. Furthermore, the rear compartment display also has an EEPROM for storing fault codes for diagnosis purposes.

Different presentation on the control display

If the rear compartment entertainment equipment option is not fitted, in the E65/E66 it is possible to show TV and navigation simultaneously in the control display.

The TV data from the video module are sent to the navigation computer and mixed with the navigation data. The navigation system transfers the data via RGB cables to the control display that separates the data again and shows them in two pictures.

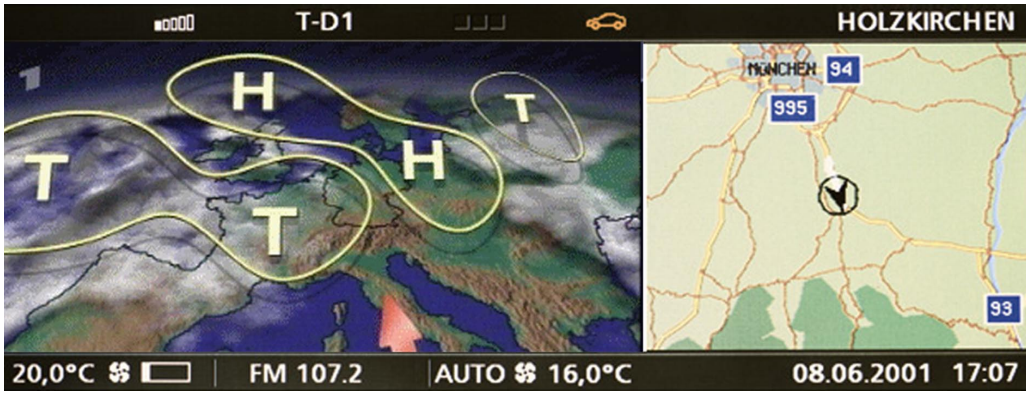


Fig. 16: Simultaneous presentation of TV and navigation without option 603 KT-9778

This function is no longer possible in the E65/E66 with rear compartment entertainment equipment. In this case, the navigation data are sent via an RGB cable to the video module.

The video module 5 Drive cannot mix these data. The signals from the navigation system or DVD changer are only duplicated and distributed to the front and rear. Consequently, only one function per display can be shown.

Fig. 17: Only one display possible with option 603 KT-9777

- System description - rear compartment controller

Operation of the rear compartment controller is identical to that of the front controller. The rear compartment controller is solely responsible for the functions in the rear compartment display.

For physical design and function of the controller refer to the E65 Seminar Working Material "**iDrive/ConnectedService**."

- System description - DVD changer

The DVD changer is capable of reproducing the following media:

- Audio CD (music CDs)
- DVD video (e.g. movies)

The DVD changer recognizes whether the loaded media is a CD or DVD and indicates this on the control display and rear compartment display (CD changer or DVD menu). The CDs shown in the CD changer menu can be assigned as follows:

CD 01 to CD 06 are CDs loaded in the CD changer. CD 07 to CD 12 are CDs loaded in the DVD chanter. Video DVDs are shown in the "Video" menu.

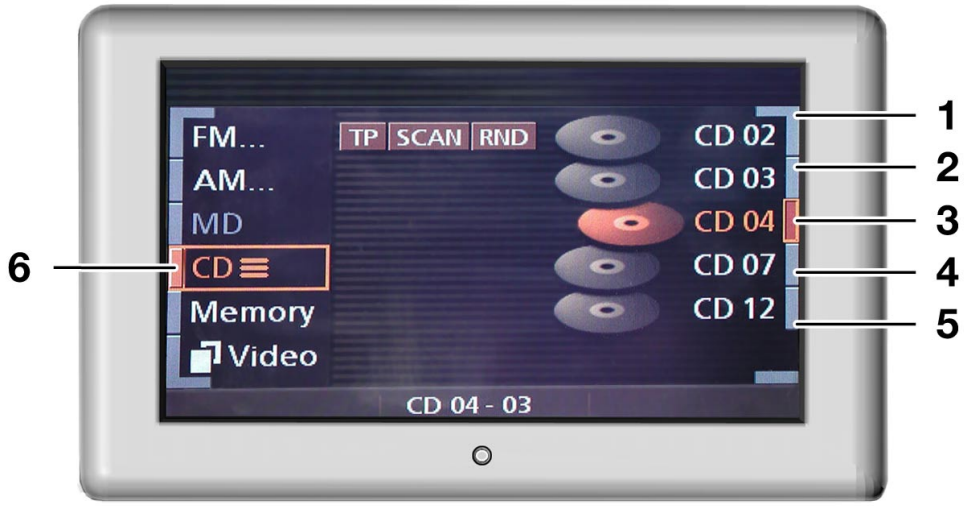


Fig. 18: Display of loaded audio CDs KT-9857

Index	Description	Index	Description
1	Audio CD in CD changer	4	Audio CD in DVD changer
2	Audio CD in CD changer	5	Audio CD in DVD changer
3	CD currently selected	6	CD changer button

The DVD changer receives its control commands via the MOST bus. The corresponding status is sent back also via the MOST bus to the respective control unit.

The audio signals are transmitted in the form of digital signal on the MOST bust. The audio system controller, headset interface and LOGIC7 amplifier process the signals and output them to the speakers.

The video signals are transferred in the form of analogue data via the FBAS cable to the video module. Here, the data are duplicated and distributed in parallel via RGB cables to the two displays. In this way, simultaneous presentation is possible at the front and rear. However, for legal and safety reasons, presentation in the control display is interrupted while driving.

Flash memory

The DVD changer features a flash memory for the purpose of implementing possible software updates. Furthermore, the DVD changer also has an EEPROM for storing fault codes for diagnosis purposes.

- System description - headset interface

The user can set the following functions
(the functions are configured in the headset interface):

- Treble
- Bass
- Balance
- Volume
- Loudness (automatic)

The functions are set under the "Tone" item (sound) in the audio menu. The "Tone" menu item is integrated in the "Memory" menu item.

Fig. 19: Possible sound settings for the headset KT-9862

Index	Description	Index	Description
1	Treble button	3	Balance button
2	Bass button	4	Sound setting button

The treble, bass and balance functions can be set with the headset plugged in; they are the same for both headsets. Only the volume can be varied separately for each headset using the regulator next to the connections.

Treble

Fig. 20: Treble setting in headset menu KT-9817

The sound can be changed in 1 dB steps in the range from +/- 10 dB for the treble and bass settings. The setting is implemented by means of the rear compartment controller in the "Tone" menu item.

Bass

Fig. 21: Bass setting in headset menu KT-9839

Balance

KT-9823

Fig. 22: Balance setting in headset menu

The balance is achieved by changing the volume on the left and right channels of the headset. When a maximum value is set (e.g. max. left), the other side (e.g. right) is muted.
The setting is implemented by means of the rear compartment controller in the "Tone" menu item.

Volume

Fig. 23: Volume setting in headset connection module KT-9783

Index	Description
1	Headset connection, rear right
2	Volume control for rear right headset
3	Search rocker switch
4	Volume control for rear left headset
5	Headset connection, rear left

The volume is set by the customer using a volume control in the centre armrest control centre. The volume is set separately for each headset.

Loudness (automatic)

The loudness function is not adjustable and takes place automatically. To achieve an improved sound impression, the low frequencies are raised slightly at low volume.

Outputting audio data

The headset connection module features two switched headset connections. Output takes place through the headsets when at least one headset is plugged in. The same source can always be heard through both headsets.

The user in the rear compartment has the option of selecting a different source than the front passenger as it is possible to output two different sources simultaneously in the front and rear. In such cases, the vehicle speakers are reserved for the source selected at the front and the rear headsets for the sources selected in the rear compartment.

Headsets

The headsets are not included in the standard scope of delivery. Any commercially available headsets with an impedance of 8 - 600 Ohm can be connected. The connection plug has a diameter of 3.5 mm. The output power of the headset interface is 200 mW with respect to 32 Ohm.

Power intake

Mode	Power intake	Remark
Sleep mode	< 100 µA	MOST bust rest status
Audio mode	Approx. 300 mA	Average value with headset connected, depending on RF signal and volume

Flash memory

The headset interface features a flash memory in order to implement possible software updates. Furthermore, the headset interface has an EEPROM for storing fault codes for diagnosis purposes.

- System description - video 5 Drive

TV reception

With the previous video module 5, TV reception was only possible while the vehicle was stationary. Legal requirements and safety regulations worldwide do not permit any TV functions while driving (distraction risk for the driver).

With the introduction of the rear compartment entertainment system in the E66 in 03/2002 with an additional rear compartment display, TV reception is now legally permitted while driving as the driver cannot see the rear compartment display positioned behind him.

The video module 5 Drive is designed for worldwide reception of all TV standards and TV frequencies. However, for transmission reasons and due to their functional principle, the analogue TV systems (PAL, NTSC, SECAM) are not suitable for reception while driving.
For this reason, intricate technical solutions had to be found with the aim of minimizing reception interference that is caused by the constant change in the vehicle and thus of the reception aerials. As a result, the video module 5 Drive makes it possible to present a stable image also while driving.

This technology involves:

- Three-tuner concept
- Tuner and frequency diversity
- Image stabilization circuit

Three-tuner concept

The video module 5 Drive consists of three tuners. Two tuners serve as the main tuner while a further tuner operates as a background tuner.

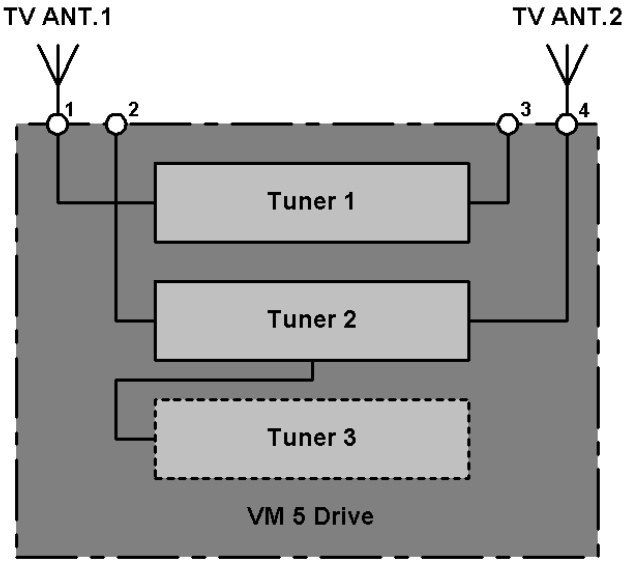


Fig. 24: Three-tuner concept, video module 5 Drive KT-9876

Index	Description	Index	Description
TV ANT.1	TV aerial 1	4	Aerial connection assigned
TV ANT.2	TV aerial 2	Tuner 1	Main tuner 1
1	Aerial connection assigned	Tuner 2	Main tuner 1
2	Aerial connection not used	Tuner 3	Background tuner
3	Aerial connection not used	VM 5 Drive	Video module 5 Drive

Main tuners

The main tuners each feature two aerial connections in their hardware. On the E65/E66 only one connection on each tuner is assigned as a total of only two TV aerials are fitted.

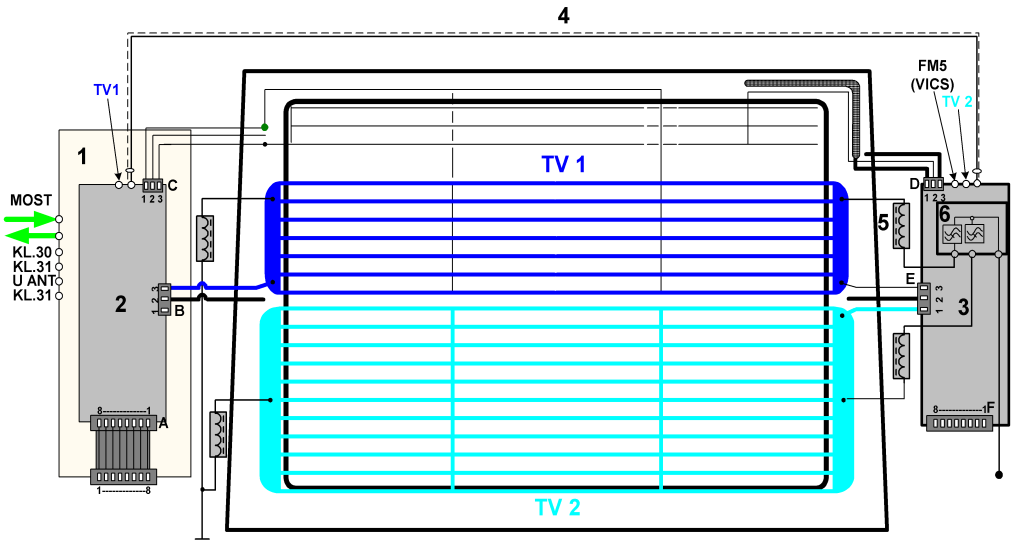


Fig. 25: TV aerials E65/E66

Index	Description
1	Aerial tuner
2	Aerial diversity
3	Aerial amplifier
4	Coaxial cable
5	Inductors are integrated in the connection lines
6	Inhibit circuit
KL.30	Voltage supply, battery positive
KL.31	Ground supply
MOST	Media oriented system transport
TV 1	TV aerial for worldwide TV reception
TV 2	TV aerial for worldwide TV reception
U ANT	Power supply, aerial assemblies
FBD	Remote control services
VICS	Traffic announcements in Japan

In the video module 5, both aerials are connected to one tuner. For technical reasons, it is possible to switch over from one aerial to the other only every 20 ms.

Each main tuner has its own aerial. As a result, it is possible to switch between the aerials as fast and often as required. Only in this way it is possible to ensure that low-interference TV reception is possible at speeds in excess of 80 km/h.

Background tuner

The background tuner does not have its own aerial as it is supplied by a main tuner.

The background tuner constantly searches for alternative frequencies for the currently received TV signal and recognizes the broadcasting stations by the transmitted channel label (e.g. "ZDF").
The video module 5 Drive offers the further advantage of automatically updating the receivable stations. Manual update of the station list by pressing "Autostore" is no longer necessary.

Diversity

The diversity feature in the video module 5 Drive consists of two functions: tuner diversity and frequency diversity.

To ensure the highest possible reception power, the video module 5 Drive selects the most favourable aerial and the best frequency.

Tuner diversity

Each of the two main tuners features an aerial. The best aerial is selected by connecting the corresponding tuner.

The use of tuner diversity makes it possible to change over between the aerials at any rate. This is necessary in order to use the best aerial also at high vehicle speeds and under conditions subject to reception interference.

Frequency diversity

The frequency diversity function selects the best frequency of the required channel provided several frequencies of the channel are available.

The background tuner constantly searches through the entire frequency range and constantly compiles an up to date broadcast station list in the memory of the video module 5 Drive.

There are two ways of searching for alternative frequencies:

- VPS diversity
- Diversity by image comparison

VPS diversity (Video Program System)

Data for broadcasting station identification are transmitted with the VPS signal. Alternative frequencies can be detected by evaluating the station name (e.g. "ZDF").

Diversity by image comparison

The pictures of the currently tuned-in channel and of a possible alternative frequency are compared with each other for a defined period. If the picture sequences are identical, the diversity function assumes that it is the same channel on different frequencies.

Image stabilization circuit

The vertical and horizontal pulses are regenerated to improve the subjectively perceived picture quality. For this purpose, the synchronization signals are selected in the receive signal, prepared synchronously and fed back into the receive signal. Even if reception is weak, this function ensures that the position of the image on the monitor remains stable.

Audio

The video module 5 Drive receives the TV sound via the aerial inputs in mono. The TV sound is applied and output in mono through the right and left audio channel.

Technical data

Operating voltage	6.5 - 16 V	Full function
Current	1.1 A	Normal operation
Closed-circuit current	0.1 µA	MOST bus in sleep mode (light off)

Flash memory

The video module 5 Drive features a flash memory in order to implement possible software updates. Furthermore, the video module 5 Drive has an EEPROM for storing fault codes for diagnosis purposes.

Control

The following controls have been changed or newly added:

- Rear compartment display
- DVD changer
- Headset connection module
- Video module 5 Drive

- Control of rear compartment display

The rear compartment display is operated with the rear compartment controller only.

- Control of DVD changer

As in the familiar CD changer, the DVD changer is also equipped with a 6-compartment magazine. The magazine system offers the following advantages:

- Less intricate and therefore less susceptible mechanism
- Insensitive to vibration and impact
- Increased comfort as the magazine can be loaded at home

Magazine coding

The magazines for the CD changer and the DVD changer are very similar in appearance. They do, however, have different coding (highlighted in blue in Fig. 26) to avoid loading the CD changer in the instrument panel with unreadable media (DVD, CD ROM) by mistake, thereby possibly damaging the CD changer.

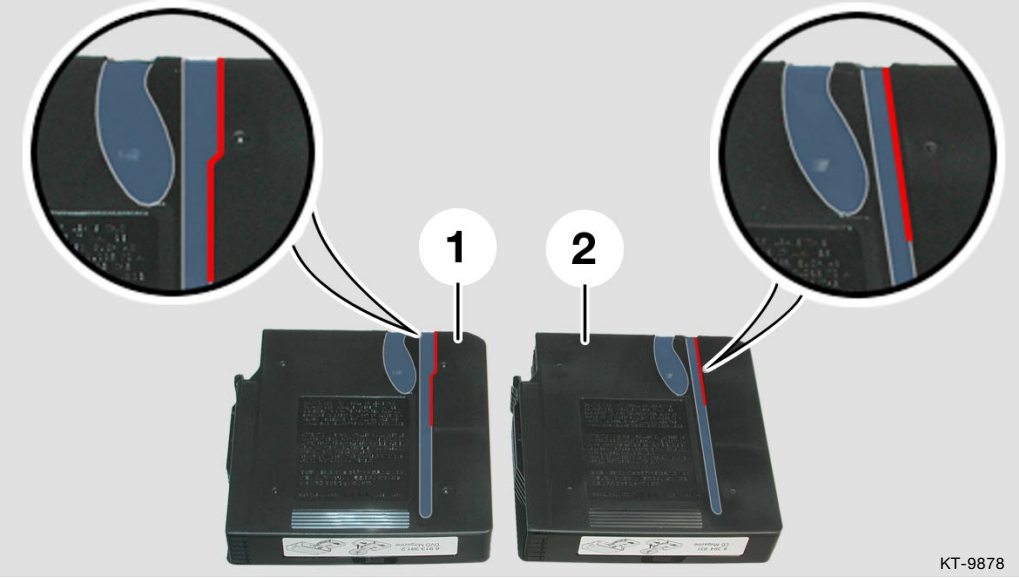


Fig. 26: Different coding on DVD (left) and CD magazine (right)

Index	Description
1	DVD magazine
2	CD magazine

Operation with menu buttons

KT-9858

Fig. 27: Display of loaded DVDs

Index	Description
1	DVD button
2	Current DVD in DVD changer (e.g. compartment 4)

After loading the magazine in the DVD changer, the magazine is checked for the types of media (CD, DVD). The contents (number of tracks, title of the media) of the CD or DVD are scanned and the information made available to the displays. The audio CDs are presented in the menu item CD 07 to CD 12. The loaded DVDs are managed under the menu item DVD.

The respective menu buttons are activated by the controller or rear compartment controller.

DVD navigator

DVD playback is controlled by means of the DVD navigator that is activated by pressing the controller while the DVD is running. The DVD navigator features several buttons for following functions:

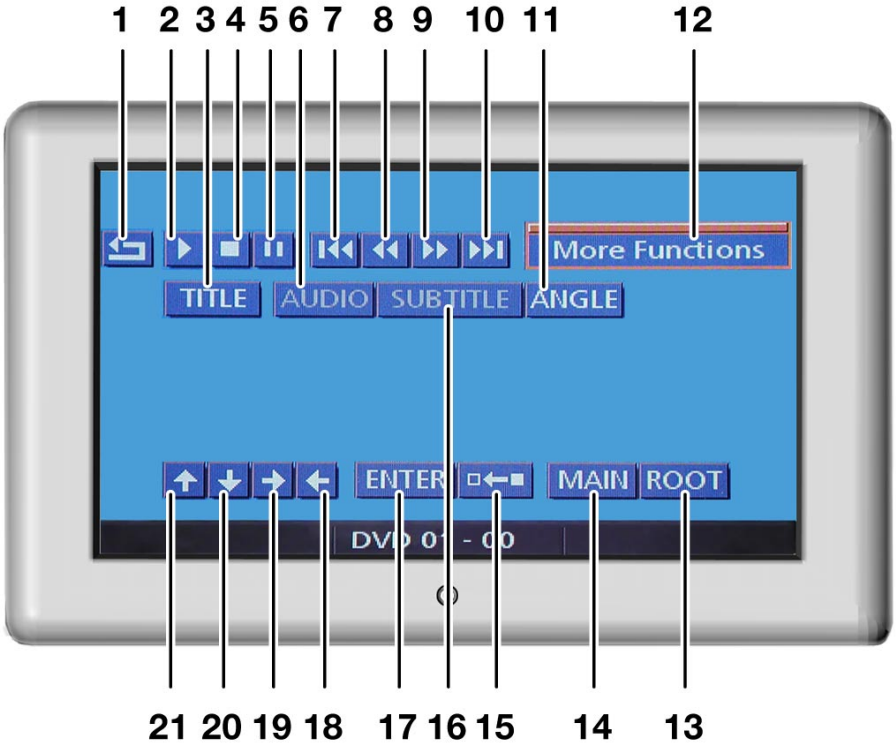
- Play
- Stop
- Pause
- Fast forward
- Fast return
- Next title
- Previous title
- Next chapter
- Previous chapter
- Language settings
- Activation of interactive menu (root)
- Control of interactive DVD menu (up, down, etc.)
- Subtitle selection
- Camera settings
- Selection of sequence of events (plot)
- Enter

Speeds of 2, 4, 8, 16 and 32 times the standard speed are available for the fast forward and rewind functions. The speeds can be selected by pressing the rear compartment controller.

Fast forward and rewind (picture search) is also possible while the film is running without having to change back to the DVD navigation menu. The speed is changed by turning the (rear compartment) controller.

Fig. 28: DVD navigator with main menu

KT-9860



KT-9859

Fig. 29: DVD navigator with submenu

Index	Designation	Description
1	Back	Back to main menu
2	Play	Start up film
3	Title (submenu)	Shows the titles of several films
4	Stop	Stops the film
5	Pause	Pauses the film
6	Audio	Language selection
7	Chapter jump back	Back to start of chapter
8	Fast return	Return at 2, 4, 8, 16, 32 times the speed
9	Fast forward	Forward at 2, 4, 8, 16, 32 times the speed
10	Chapter jump forward	Forward to start of next chapter
11	Angle	To view various camera perspectives
12	Button to open the submenu	For the title, audio, subtitle, angle functions
13	Root	Button to access interactive menu
14	Main	Back to main menu
15	Back	Back to function last selected
16	Subtitle	Selection of a subtitle
17	Enter	To start up film
18	LEFT arrow key	To navigate in DVD menu
19	RIGHT arrow key	To navigate in DVD menu
20	DOWN arrow key	To navigate in DVD menu
21	UP arrow key	To navigate in DVD menu

DVD interactive menu

An alternative option for settings such as chapter selection, language, subtitle, special effects and start of film is offered in the interactive menu of the DVD.

DVD menus consist of graphics that contain selection options. Navigation through the available menus takes place with the aid of the arrow, enter and return keys.

Fig. 30: Interactive menu on the DVD KT-9861

Picture settings in DVD menu

The following settings are available in the DVD menu:

- Brightness
- Colour
- Contrast
- Picture format

Fig. 31: Menu for DVD picture settings KT-9819

Brightness

Fig. 32: Menu for brightness setting KT-9821

Colour

Fig. 33: Menu for colour setting KT-9820

Contrast

Fig. 34: Menu for contrast setting KT-9822

Picture format

Fig. 35: Menu for setting picture format KT-9818

- Operation - headset connection module

The headsets are switched on and off by plugging the headset connectors in the headset connection module. The headset settings are controlled and changed with the aid of the rear compartment controller and the rear compartment display. The volume is controlled by means of the volume regulator in the headset connection module.

- Operation - video module 5 Drive (TV functions)

The following functions are available for controlling the TV functions in the video module 5 Drive:

- Picture settings
- Country-specific settings (TV standard)
- Channel list

Picture settings

The customer has the option of setting the picture to his/her personal requirements. The following picture settings can be varied for this purpose:

- Colour
- Brightness
- Contrast
- Tint (NTSC only)

The picture settings for colour, brightness, contrast correspond to those of the DVD and can be set only jointly for the front and rear.

Fig. 36: Menu for TV picture settings

KT-9863

Country-specific settings

The customer has the option of making country-specific settings. As a result, the correct TV standard and the correct frequency grid are selected in the video module so that the channels of the respective country can be received.

Fig. 37: Menu for setting TV standard KT-9824

Diversity ON/OFF

Pseudo alternative frequencies can occur as the result of similar image content (e.g. different football matches are transmitted simultaneously by different broadcasting companies) in connection with the "diversity by image comparison" function. The video module mistakenly interprets a frequency as an alternative frequency and changes channel.

For this reason, the diversity function can be deactivated in the Service menu if required by the customer. The "diversity ON/OFF" message via the MOST bus informs the video module 5 Drive of this setting.

Channel list

The video module manages a channel list containing all channels that can be currently received. A maximum of 25 channels are shown in the channel list. The list is constantly updated. If broadcast names of the individual channels can be determined, the list will start with the broadcaster name in alphabetical order (ARD, BR3, RTL, SAT1, ZDF, etc.).

These are then followed by the channels for which a broadcaster name cannot be determined, in ascending order of the specified channel (CH3, CH7, CH12, etc.). Alternative frequencies exist if there are several channels with the same broadcaster name in the list (e.g. 3 times ZDF).

If diversity is active, each broadcasting company is shown only once in the list (once ZDF). If the diversity function is deactivated each channel is shown corresponding to the number of alternative frequencies on which it can be currently received. The required channel is then freely selectable in the list.

Fig. 38: Channel list in TV menu KT-9825

Notes for Service

The following notes for Service have been changed or newly added:

- DVD changer (regional codes)
- Magazine for DVD
- Double-sided DVD
- Self-recorded CD
- DVD audio
- Diversity ON/OFF

Regional codes for DVD changer

Particular care must be taken when replacing the DVD changer to ensure that it has the correct regional code. Otherwise, it will not be possible to play back locally available DVDs.

DVD magazine

The DVD magazine and the CD magazine are not interchangeable although they are very similar in appearance. Forced insertion of a DVD magazine would damage the laser and magazine mount of the CD changer.

Double-sided DVD

Commercially available double-sided DVDs contain data on both sides and bear no inscription. To play back the information on the other side, the magazine should be removed and the DVD turned through 180° in the magazine.

Self-recorded CD

In the case of self-recorded CDs, the subsequently affixed labels can detach due to the effects of heat during playback and may cause irreparable damage to the player.

Disturbances (cutout, non-recognition of the CD) can occur when playing back self-recorded CDs in audio format.

DVD audio

The DVD changer does not support the DVD audio format. In addition to the DVD audio track, many commercially available audio DVDs additionally contain a video track in DVD format that can be reproduced by the DVD changer.
In this case, the titles are selected via the DVD menu on the control display or rear compartment display. Read the information on the audio DVD to establish whether the audio DVD features an additional video track.

Diversity ON/OFF

In the case of customer complaint, the "diversity by image comparison" function can be deactivated or activated in the Service menu.

Glossary

Index	Description
ABS	Antilock brake system
AM/FM ANT.	Radio aerial
ASK	Audio system controller
AVT	Aerial amplifier/tuner
BZM	Centre console control centre
BZMF	Rear centre armrest control centre
CD	Control display
CDC	Compact disc changer
CON	Controller
DEC	Colour decoder
DVD	DVD changer
EEPROM	Electrically erasable programmable read only memory
ELO	Standardized connector
FBD	Remote control service
FBAS	Colour image control and synchronization signal, carrying colour, brightness and synchro pulses on a signal line.
FCON	Rear compartment controller
FD	Rear compartment display
FS	Flash connector
GPS.ANT.	GPS aerial
K-CAN S	Body Controller Area Network system
KHA	Headset connection module
KHI	Headset interface
Kombi	Instrument cluster
LOGIC 7	Top HiFi amplifier
LVDS	Low voltage differential signalling
MOST	Media oriented system transport
MPEG	Motion Picture Experts Group
NAV	Navigation computer
PCM	Pulse code modulation

Index	Description
RGB	Red-green-blue data cable
SG FD	Rear compartment display control unit
SVS	Voice control module
TEL	Telephone
TEL.ANT.	Telephone aerial
TFT	Thin film transistor
TV ANT.	TV aerial
VM	Video module
VM5 Drive	Video module 5 Drive
VPS	Video program system
ZGM	Central gateway module