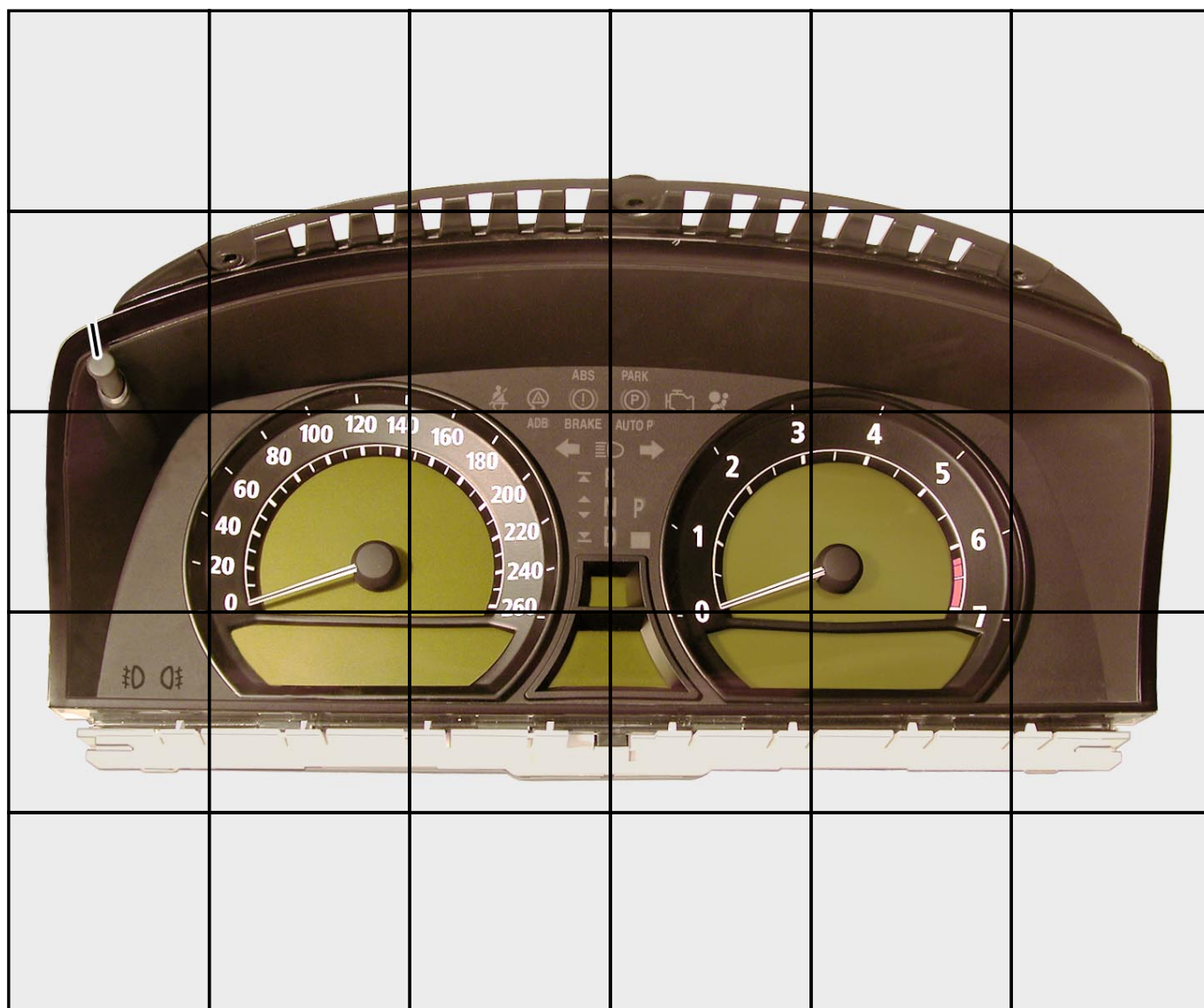




E65 Instrument Cluster

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.

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VS-42 MFP-HGK-BRK-E65_0645

Contents

	Page
CHAP 1 E65 Instrument Cluster	1
Introduction	1
Design and networking	2
- Hardware	2
- Displays	4
- Display area 1: LC display	5
- Display area 2: speedometer	8
- Display area 3: revolution counter	8
- Display area 4: indicator and warning lamps	9
Turn indicator acoustic signal	10
Vehicle electrical system connection	11
Functions	14
Pointer instruments	15
- Speedometer	15
- Revolution counter	16
Indicator and warning lamps	17
- Pre-drive check	18
Master functions	19
- Time master	19
- Outside temperature master	20
- Dimming master	20
Redundant data storage	21
On-board computer	26
- On-board computer I	26
- On-board computer II	30
Check Control	32
- Display location	33
- Display characteristics	35
- Operation	36
Diagnosis / test functions	37
- Selecting test functions	39

E65 Instrument Cluster

Introduction

For consistent implementation of the new display and operating concept, iDrive, a completely new instrument cluster has been developed for the E65.

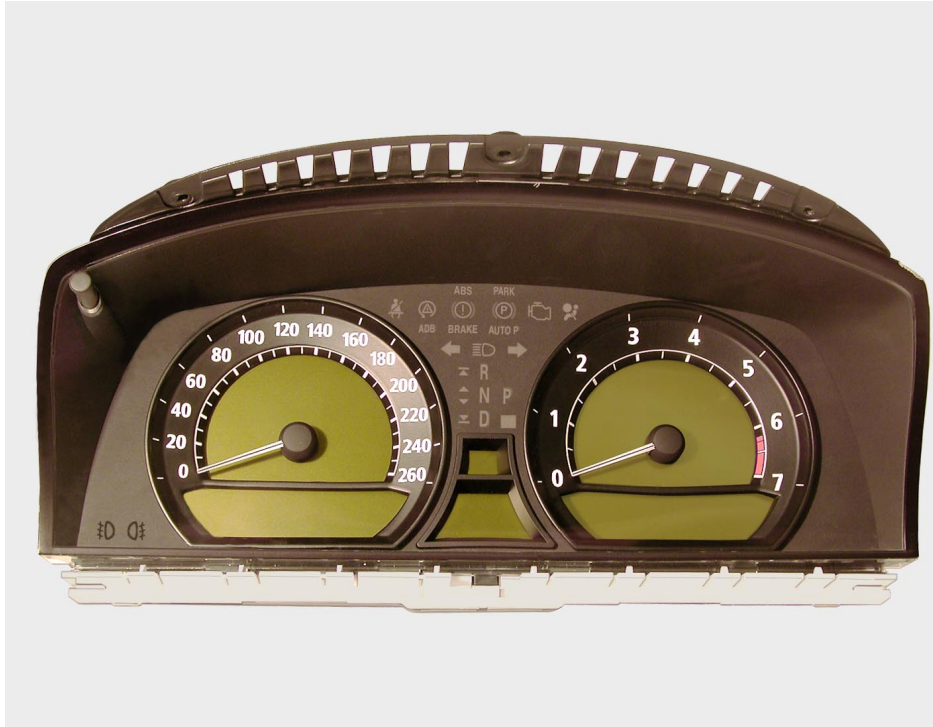
The following aims were taken into account during development:

- The instrument cluster is an integral part of iDrive/Driving Area.
- All of the necessary information for driving the vehicle must be on display in the direct field of vision of the driver in a simple and quickly understandable form.
- Display technology with outstanding ergonomics due to graphic displays.
- New type of Check Control system with clear, understandable texts and graphical symbols.

Taking these aims into account, the instrument cluster has become a multifunctional display unit that links the benefits of various display technologies into a composite unit.

Design and networking

- Hardware



KT-8761

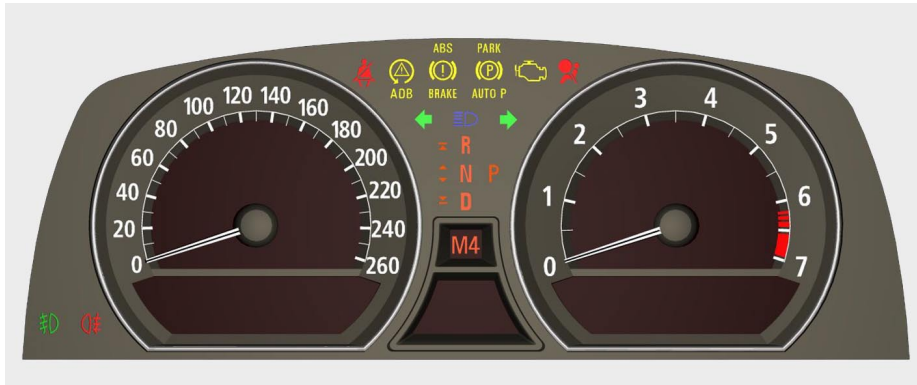
Fig. 1: Instrument cluster

The instrument cluster is configured as a one-part component. For control of the functions, two powerful processors are integrated.

Variants

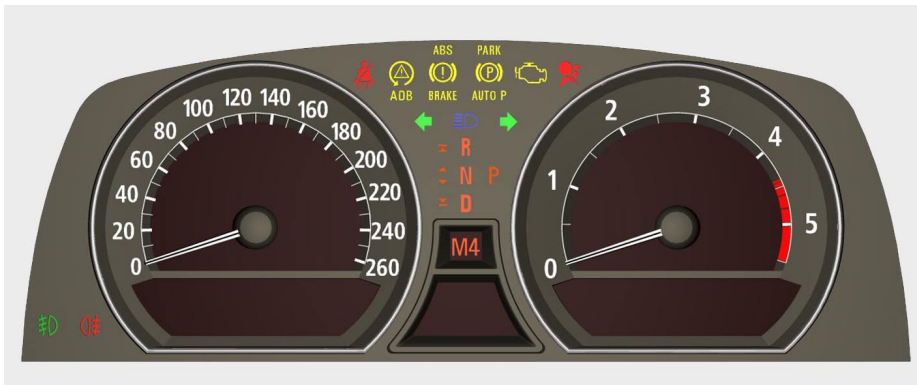
The instrument cluster is available in four hardware versions.

E65 Instrument Cluster



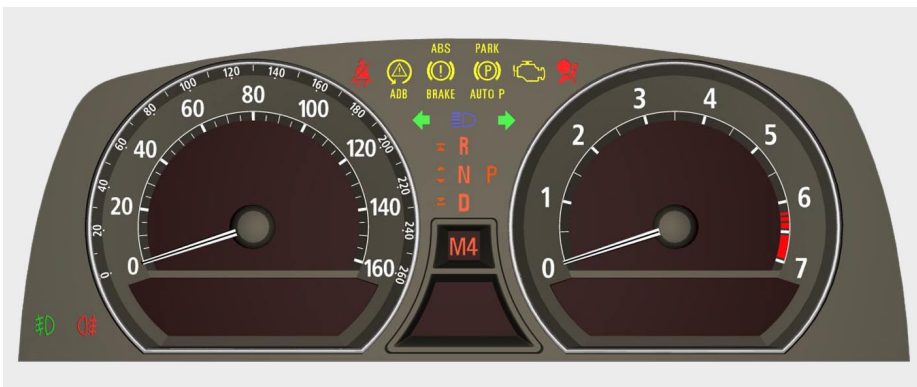
KT-8857

Fig. 2: Speedometer with km/h scale and revolution counter for petrol engines



KT-8860

Fig. 3: Speedometer with km/h scale and revolution counter for diesel engines



KT-8856

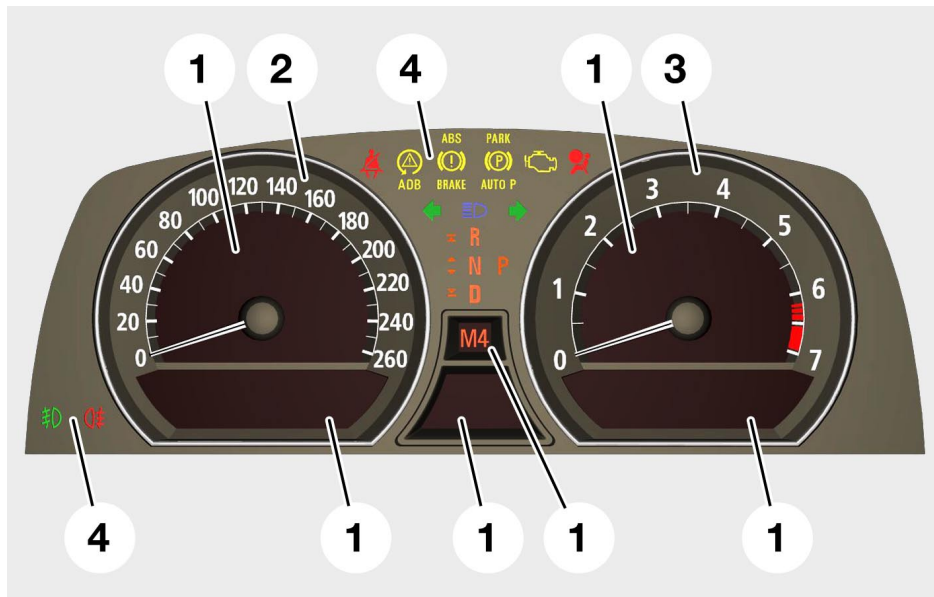
Fig. 4: Speedometer with mph scale and revolution counter for petrol engines

In order to be able to display languages such as Chinese, Japanese or Korean with their lettering, a larger language memory (8 MB instead of 4 MB) is used in the fourth instrument cluster version.

E65 Instrument Cluster

- Displays

General



KT-8767

Fig. 5: Layout of the display areas

Index	Description
Display area 1	LC display
Display area 2	Fixed-position speed scale
Display area 3	Fixed-position engine speed scale
Display area 4	Indicator and warning lamps

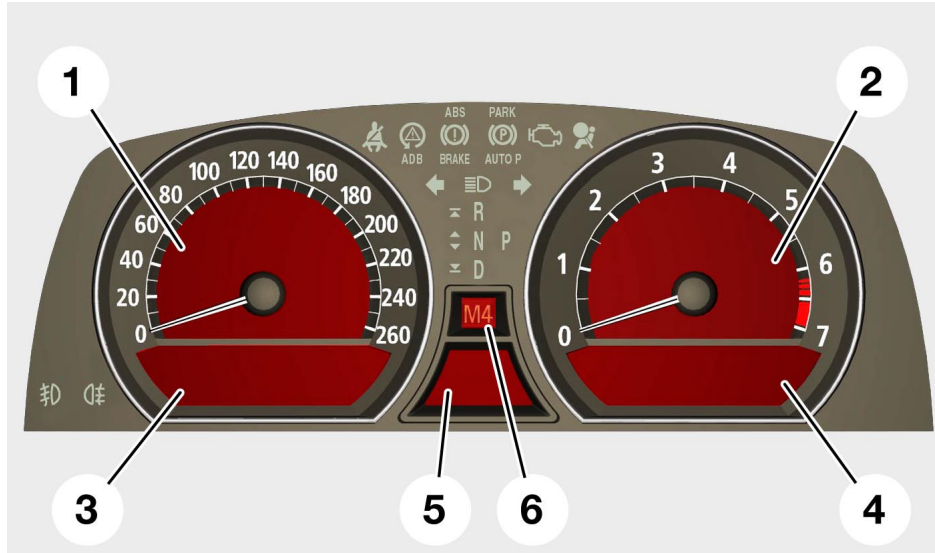
The instrument cluster is divided into the display areas

- LC display
 - pointer instruments
 - fixed-position indicator lamps
- described below.

E65 Instrument Cluster

- Display area 1: LC display

General



KT-8989

Fig. 6: Layout of the display areas

Index	Description
1	Display area 1, within the speedometer
2	Display area 2, within the revolution counter
3	Display area 3, below the speedometer
4	Display area 4, below the revolution counter
5	Display area 5, variable display and warning field
6	Display area 6, gear display

In addition to the analog pointer instruments and the indicator lamps, the LCD unit serves as a digital display medium. The perforated mask above visually separates it into six display areas for the indicator and warning lamps.

E65 Instrument Cluster

In order to ensure that the LC display can also be read easily at low temperatures, display heating has been fitted.

The heating consists of current-bearing conductors on a sheet behind the display.

When the driver's door is opened, the switch-on signal is sent by the CAS via the K-CAN SYSTEM bus to the instrument cluster. The display heating is activated at display temperatures below 10 °C and deactivated when 30 °C is reached.

So as not to subject the vehicle electrical system to excessive loads, the display heating is switched on and off depending on the vehicle voltage. This information is made available to the instrument cluster by the power module.

Display area 1, within the speedometer

In this display area, the following content can be displayed in the form of text and graphics:

- Speed limit
- Step cruise control
- Diagnosis test functions
- CBS reset

Display area 2, within the revolution counter

In this display area, the following content can be displayed in the form of text and graphics:

- Engine speed warning field
- Navigation display
- Diagnosis test functions

Display area 3, below the speedometer

In this display area, the following content can be displayed in the form of text and graphics:

- Service requirement display (SBA)
- On-board computer (BC) (fuel gauge, range)

Display area 4, below the revolution counter

Both BC and CC text messages are shown in this display area. The BC text messages are overwritten by the CC text messages.

Display area 5, variable display and warning field

This area serves as a variable display and warning field.

In this display area, the following content can be displayed in the form of text or graphics:

- CC warning symbols
- Ambient temperature
- Time

Display area 6, gear display

In the Steptronic mode, the gear engaged by the gearbox is displayed in this display area (**M1** to **M6**).

In driving program position D and activated S program, an **S** is displayed here.

- Display area 2: speedometer



KT-8916

Fig. 7: Speedometer

The speedometer scale and the scale lettering are shown on the fixed-position dial.

- Display area 3: revolution counter



KT-8917

Fig. 8: Revolution counter

The revolution counter scale and the scale lettering are shown on the fixed-position dial.

The dial of the revolution counter contains an engine speed advance warning field in the form of a fixed red circle segment.

E65 Instrument Cluster

- Display area 4: indicator and warning lamps

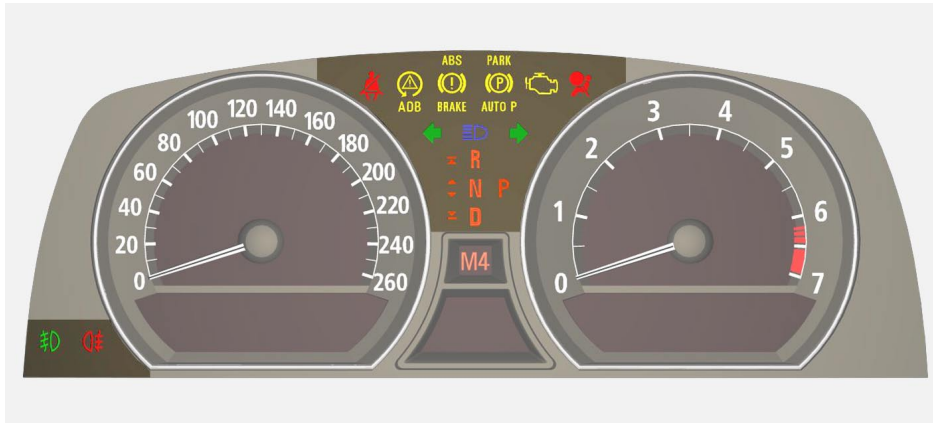


Fig. 9: Fixed-position indicator and warning lamps

KT-9037

The indicator and warning lamp are arranged in fixed positions between and beside the pointer instruments in the instrument cluster.

Turn indicator acoustic signal

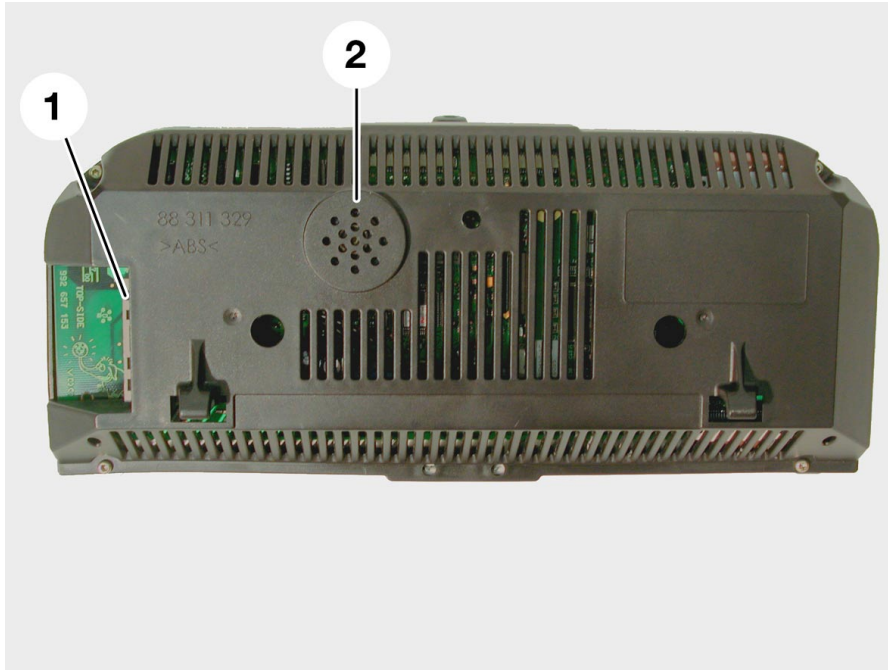


Fig. 10: Instrument cluster

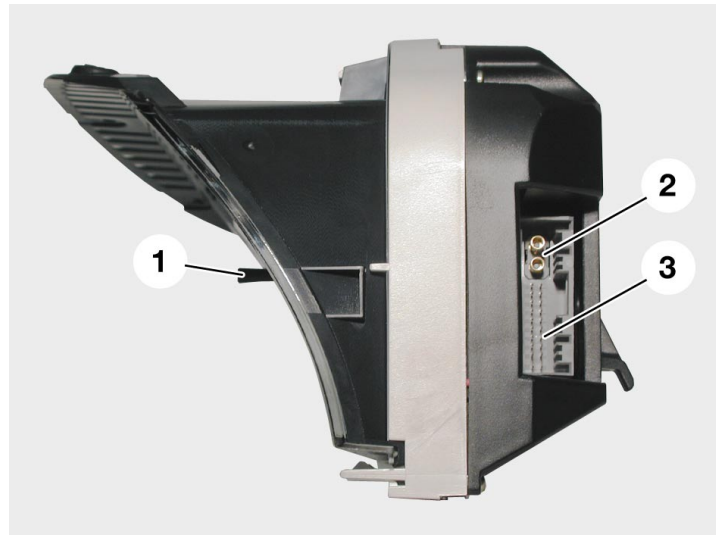
KT-8803

Index	Description
1	Plug connection
2	Opening for loudspeaker

The turn indicator acoustic signal is output through a loudspeaker integrated in the instrument cluster. The sound signals are generated by a sound generator in the instrument cluster.

All other acoustic signals are generated by the audio system controller ASK and output through the vehicle loudspeakers.

Vehicle electrical system connection



KT-8762

Fig. 11: Plug connection

Index	Description
1	Trip distance reset button
2	Connection for the MOST data bus
3	Connector 20-pin

The connection of the instrument cluster to the vehicle electrical system is by means of a 20-pin ELO connector.

The connections of the

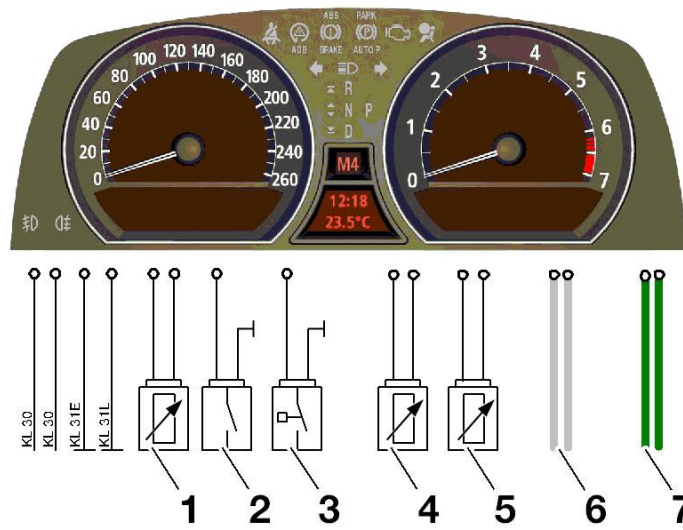
- outside air temperature sensor
- windscreen washer fluid level sensor
- coolant level sensor
- fuel-tank sensor

to the instrument cluster have been implemented using conventional cables.

All other information/requests to or from the instrument cluster are transferred as data telegrams across the bus connection.

For this purpose, the instrument cluster is connected to the vehicle electrical system via the K-CAN SYSTEM bus and the MOST bus.

E65 Instrument Cluster



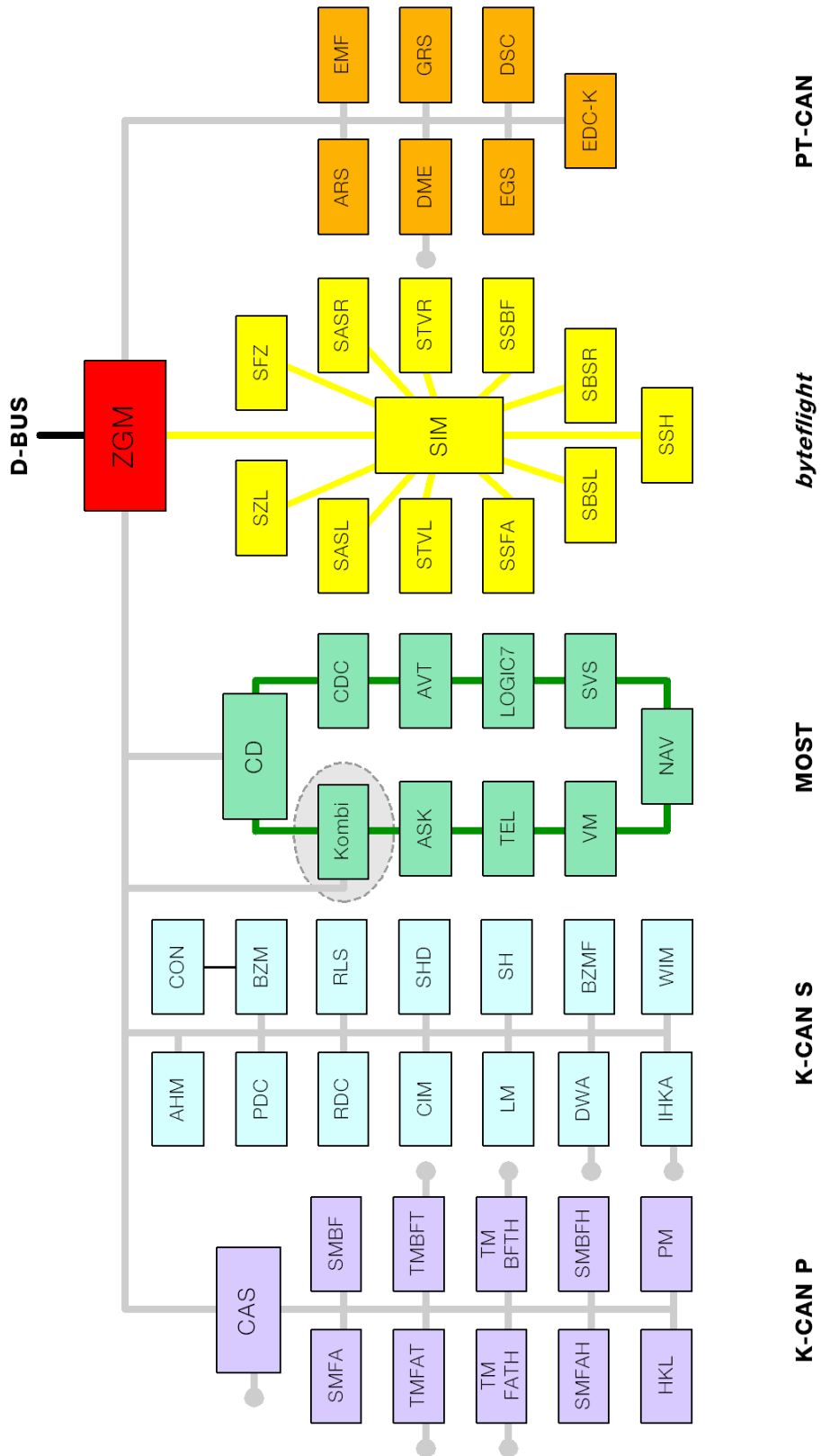
KT-9172

Fig. 12: Block diagram of instrument cluster

Index	Description
1	Outside air temperature sensor
2	Windscreen washer fluid level sensor
3	Coolant level sensor
4	Fuel-tank sensor, left
5	Fuel-tank sensor, right
6	K-CAN SYSTEM bus
7	MOST bus

The following summary shows the networking of the instrument cluster with the other control units of the vehicle.

E65 Instrument Cluster



KT-9213

Fig. 13: Networking of instrument cluster with the bus system E65

Functions

The following functions are integrated in the instrument cluster:

- Pointer instruments for road speed and engine speed
- Indicator and warning lamps
- Master functions
 - Dimming master
 - Time master
 - Outside temperature master
- Redundant data storage
- On-board computer (BC)
- Check Control CC
- Diagnosis / test functions

Pointer instruments

- Speedometer



KT-8916

Fig. 14: Speedometer

For display of the travelling speed, the travel signal is routed from the DSC control unit via the PT-CAN to the ZGM, and from there via the K-CAN SYSTEM to the instrument cluster.

The raw signal used by the DSC control unit is the signal from the rear left wheel sensor.

This travel signal leads to activation of the step motor and thus to motion of the pointer for the speedometer.

- Revolution counter



KT-8917

Fig. 15: Revolution counter

For display of the engine speed, the travel signal is routed from the DME/DDE control unit via the PT-CAN to the ZGM, and from there via the K-CAN SYSTEM to the instrument cluster.

This travel signal leads to activation of the step motor and thus to motion of the pointer for the revolution counter.

In addition to the fixed position engine speed warning field, an additional variable engine speed advance warning field can be displayed on the E65.

Activation of this engine speed advance warning field depends on the signal from the engine control.

The engine control uses various parameters, e.g. coolant temperature, to calculate the engine speed thresholds that are ideal for this operating status, and these are displayed to the driver as a maximum engine speed recommendation.

When the engine is at operating temperature, this display disappears.

Indicator and warning lamps

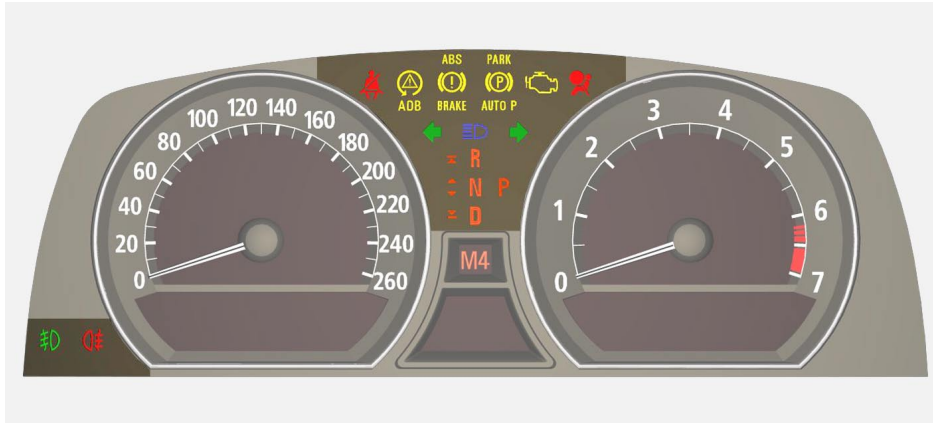


Fig. 16: Fixed-position indicator and warning lamps

KT-9037

For activation, the symbols are given background lighting (LEDs) in one or more colours.

This enables display of symbols depending on the degree of importance in red, yellow, green or blue.

The legally prescribed and standardized indicator and warning lights include:

- Turn indicators
- Full beam headlight
- Belt warning
- Airbag
- General brake warning
- Rear fog lights, fog lights
- OBD II Check Engine (MIL)

There are also indicator and warning lights for:

- Dynamic Stability Control DSC
- Program display of the automatic gearbox

- Pre-drive check

The pre-drive check serves to check the internal functions of the instrument cluster and to monitor the alive signals of all control units that can issue a CC message.

All of the fixed-position indicator lamps are activated shortly after terminal 15 On (exception: airbag as of terminal R).

Indicator lamps that can be activated as red and yellow (parking brake and brake warning) light up first as yellow then after approx. 2 seconds are switched to red.

The entire pre-drive check takes at least 4 seconds.

On conclusion of an error-free pre-drive check, all the indicator lamps are switched off together.

If any faults occur during the pre-drive check, the check of the relevant systems is interrupted.

The indicator lamps concerned remain on and the Check Control issues the corresponding messages.

Master functions

- Time master

There is an integrated quartz crystal clock in the instrument cluster. The time and date can be set manually by the driver using the controller in the CD.

In the case of vehicles with navigation system, the manually set time (minutes) is corrected on the basis of the world time UTC (United Time Coordinated) received by the navigation system.

That is, the hour display must be set manually by the driver; only the minute display is corrected by the navigation system.

However, the time is only corrected within a range of ± 2.5 min outside the real time.

A manually set clock outside the range of ± 2.5 mins of real time runs as a normal quartz crystal clock and is not corrected by the navigation system.

The date and time are made available to other control units as a telegram via the K-CAN SYSTEM.

Relative time

In addition, this telegram is made available to other control units by the instrument cluster for time calculations.

A timer counts the seconds synchronous to the system/vehicle clock. This signal can be used to measure relative times.

The time cannot be used for this purpose, as it can be set by the customer.

The counter runs following reset (e.g. disconnecting the battery in the workshop) from 0 and counts in second increments from 0 to over 4 billion, which corresponds to approximately 140 years.

The DME, for example, needs the relative time to determine the immobilization period of the engine (engine OFF) and thus to improve the starting capability of the engine. The immobilization period is calculated by the DME from the relative time of terminal R OFF to terminal R ON again.

E65 Instrument Cluster

- Outside temperature master

Only one outside temperature sensor is fitted in the E65. Its signal is only sent to the instrument cluster. Here, the values of the engine-coolant temperature, outside temperature sensor and vehicle speed are used to calculate the outside temperature signal.

The instrument cluster makes this outside temperature mean value available to the other control units, e.g. CD or IHKA (integrated automatic heating / air conditioning system), as a telegram via the K-CAN SYSTEM.

- Dimming master

The brightness signal is calculated in the instrument cluster from the values of the phototransistor in the instrument cluster and the dimmer wheel.

This brightness signal is also made available as a telegram via the bus system to other control units in the vehicle.

Redundant data storage

In the event of repairs, it is necessary that the kilometre reading and the data for the CBS intervals are retained on replacement of the instrument cluster.

To this end, the following data in the Car Access System CAS is redundant, i.e. stored a second time:

- Vehicle identification number
- Total mileage (kilometre reading)
- CBS scope

Every time terminal 15 is switched on, a data check takes place. In order to enable detection of manipulations, an orange point (manipulation point) is shown in display area 4 below the revolution counter.

The manipulation point is set under the following conditions:

- The vehicle identification number stored in both control units does not match.
- In one of the two control units, no vehicle identification number is stored, e.g. new component.
- The component for storage of the total mileage in the instrument cluster is defective; the display for the kilometre reading shows 999999.

E65 Instrument Cluster

When replacing an instrument cluster or a CAS control unit, the following point must be observed:

1. Installation of a new Car Access control unit CAS:

A new CAS is ordered on a vehicle-specific basis (key number, vehicle identification number, standard equipment) and installed in the relevant vehicle.

The new CAS must then be coded using the BMW diagnosis unit (MoDiC or DISplus) (adjustment function "engine control/ CAS"). Only then can the engine be restarted.

Note

Installation of a used CAS control unit makes no sense, as it will neither be possible to open the vehicle nor start the engine.

2. Installation of a new instrument cluster:

The manipulation point is set when terminal 15 is switched on, as the vehicle identification number is not coded in the instrument cluster.

The instrument cluster is now assigned to the vehicle using the BMW diagnosis unit (MoDiC or DISplus) by means of coding, i.e. the vehicle identification number is entered in the instrument cluster.

Then switch off terminal 15.

When terminal 15 is switched on again, the instrument cluster fetches the current mileage and CBS data from the CAS. The manipulation point is deleted.

E65 Instrument Cluster

3. Installation of a new or used instrument cluster for test purposes:

Although the vehicle identification number (Kombi/CAS) differs and/or has not yet been entered in the instrument cluster, there is bidirectional communication between the instrument cluster and the CAS.

For example, the kilometre reading / mileage stored in the CAS is transferred into the working memory for the total mileage display in the instrument cluster and displayed.

If there is now a test drive, the distance driven is counted further in the working memory of the total mileage and transferred every 10 kilometres (E38 every 100 kilometres) to the CAS.

If at least 24 hours have elapsed between switching terminal 15 on and off, another calibration is performed, independent of the distance driven.

If the instrument cluster is removed again following the test drive, the working memory loses the stored kilometre reading. This data is not stored; the instrument cluster is returned to its initial state.

E65 Instrument Cluster

4. Simultaneous replacement of CAS and instrument cluster (two new components):

Where possible, this should be avoided, as the current km reading and all the CBS data are irretrievably lost!

If both control units have to be replaced at one time, the following installation sequence is recommended:

- Replacement of the instrument cluster
 - Coding of vehicle identification number
 - Terminal 15 OFF/ON (possible data transfer)
- Replacement of the CAS
 - Coding of vehicle identification number
 - Terminal 15 OFF/ON

When terminal 15 is switched on again, the manipulation point is deleted. The communication between the instrument cluster and the CAS for redundant data storage is now ensured.

E65 Instrument Cluster

In summary, the following apply in the case of replacement of CAS or instrument cluster:

- **The manipulation point is set if the vehicle identification number in the CAS differs from the vehicle identification number in the instrument cluster.**
- **If the vehicle identification numbers are different, data exchange takes place in the working memory of the instrument cluster; however, no data is stored permanently.**
- **The instrument cluster adopts the data from the CAS if the CAS has a higher kilometre reading than the instrument cluster and the vehicle identification numbers match.**
- **The CAS adopts the data from the instrument cluster if the instrument cluster has a higher kilometre reading and the vehicle identification numbers match.**
- **The trip distance is transferred from the instrument cluster to the CAS every 10 km of the journey. If at least 24 hours have elapsed between switching terminal 15 on and off, another calibration is performed, independent of the distance driven.**

On-board computer

The on-board computer in the E65 is not only to be viewed as a computing system; it also provides the indicating instrument with important vehicle information.

The displays are divided into two function groups:

- "Main" on-board computer (BC I)
- Travel computer (BC II)

- On-board computer I

The on-board computer I is assigned the following displays:

- Total mileage
- Trip recorder reading
- Current consumption
- Tank contents

These displays can only appear in the instrument cluster.

- Distance
- Range
- Average consumption
- Limit
- Average speed

can be displayed both in the instrument cluster (display area 3) and in the Control Display (CD) (main menu for on-board data).

The stopwatch function can only be displayed in the CD.

E65 Instrument Cluster

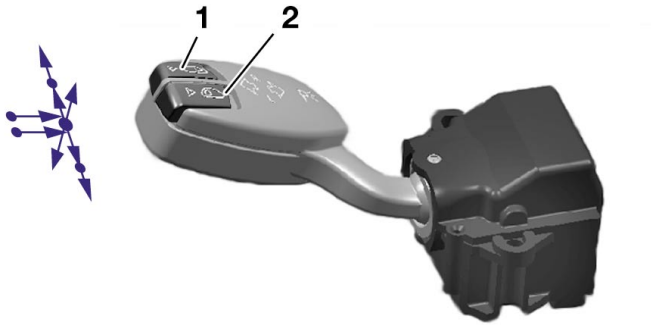
Note

Note that the features

- total mileage
- trip recorder reading
- current consumption
- tank contents

have no fixed-position displays. They are scrolled like all other BC I functions, i.e. they are only displayed when the driver actively queries them. Only the fuel gauge is automatically displayed as soon as the reserve segment is reached.

Operating options BC I



KT-9189

Fig. 17: FAS with CC button (1) and BC button (2)

The displays are scrolled and shown in the instrument cluster by means of buttons in the turn indicator and dipped-beam switch (FAS).

The top button (1) operates the displays in the display area below the revolution counter.

The bottom button (2) operates the displays in the display area below the speedometer.

Brief touching of the buttons scrolls in the display elements.

Pressing the top button (1) for a longer period toggles between Check Control messages and on-board computer displays in the display area below the revolution counter.

Pressing the bottom button (2) for a longer period darkens the display areas.

Note

Darkening is not possible when a Check Control message is active or the fuel gauge is at reserve. A single display area cannot be darkened - the fields are always active or dark as a pair.

E65 Instrument Cluster

The following content is shown in the display area below the speedometer:

- Tank contents
- Range
- Distance

The following content is shown in the display area below the revolution counter:

- Total mileage
- Trip recorder reading
- Current consumption
- Average consumption
- Average speed
- Arrival time

When terminal 15 is ON, it is always the information that was last selected that is displayed in the two display areas of the instrument cluster.

If the display area below the revolution counter contains a Check Control message, no function of the on-board computer is displayed there. The earliest point at which this is possible is when a specified minimum display time has elapsed or if the message is acknowledged by the press of a button.

A message with priority 1 cannot be removed from the display.

Reset of BC I displays

The following displays of the BC I can be reset using the controller.

- Average consumption
- Average speed

The controller is used to select the display to be reset. Pressing the controller causes the selection menu to appear: RESET YES/NO.

If RESET YES is selected and confirmed by pressing the controller, the corresponding display is reset to the value 0.

- On-board computer II



KT-9184

Fig. 18: Menu of the travel computer in the Control Display with display of starting time, driving time, distance travelled, average fuel consumption and average speed.

The on-board computer II is assigned the following displays:

- Starting time
- Starting date
- Driving time
- Travel distance
- Starting date
- Average consumption
- Average speed

The BC II information is displayed exclusively in the Control Display.

E65 Instrument Cluster

The travel computer serves to monitor individual journeys.

It must be selected and activated separately in the on-board computer menu in the Control Display. The basis of data and calculation algorithms for the displays in the travel computer are identical to the corresponding functions in the on-board computer.

Operating options

The selection field START - selected via the controller - activates the travel computer. If a journey is interrupted, the calculation of the average values is halted as of terminal 15 OFF and only continued when the journey is resumed.

The selection field STOP freezes the displays; continued calculation is then no longer possible. Selecting START again resets all the displays of the travel computer; a selective reset of an individual function is not possible in the travel computer.

Check Control

Until now, the Check Control has been a reporting system for vehicle faults. For the E65, the scope of functions has been extended considerably. The number and information content of the messages have increased considerably in comparison to the E38. In total, 196 CC messages can be displayed (status 23.03.2001).

The Check Control now also displays operating states and provides detailed instructions. This provides the driver with concrete assistance, enabling the appropriate reactions in the event of a system failure or fault despite the increasing complexity of the vehicle electronics.

The message texts in the instrument cluster are greater in scope (40 characters instead of 20 to date).

The combination of text and graphic ensures faster assimilation of the information on the part of the driver.

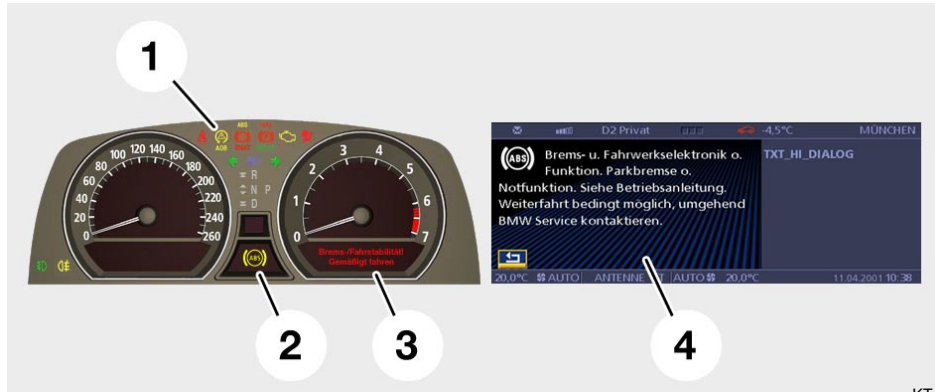
The Check Control is easy to expand, as the evaluation of the message conditions for the individual functions and systems has been shifted to the relevant control unit in each case.

Note

A special feature is that the coolant-temperature gauge in the E65 is no longer designed as a separate dial instrument but as a part function of the Check Control. It is **only** displayed when required.

- Display location

The messages of the Check Control are displayed in a number of locations.



KT-9376

Fig. 19: Display locations of CC messages

Index	Description
1	Fixed-position indicator and warning lamps
2	Variable display and warning field
3	Display area for BC and CC text messages
4	Control Display (CD)

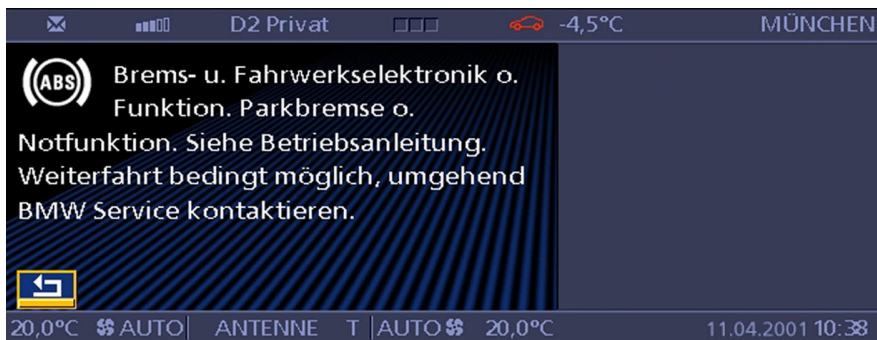
The variable indicator lamps are displayed in yellow or red in display area 2. Normally, the time and outside temperature are displayed in this position, and these can be overwritten by the Check Control where required.

The text messages of the Check Control appear in display area 3. If data from the on-board computer is located here while a message is being issued, it is overwritten by the Check Control.

E65 Instrument Cluster

For most of the messages of the Check Control, there are also supplementary explanations and instructions. These can be opened on the Control Display via the on-board data menu. In the case of particularly important messages, they appear automatically.

CC messages of up to 170 characters in length can be displayed in the Control Display.



KT-9289

Fig. 20: Supplementary instruction for CC message in the Control Display:
"Brake and chassis electronics without function. Parking brake without emergency braking function. Refer to Owner's Manual. Driving can continue under certain conditions; contact BMW Service immediately."

- Display characteristics

Check Control messages are output as

- text messages with a fixed-position and/or variable indicator lamp, the text in the display area below the revolution counter and usually with additional supplementary information in the Control Display

or

- as non-text notification with a fixed-position indicator lamp.

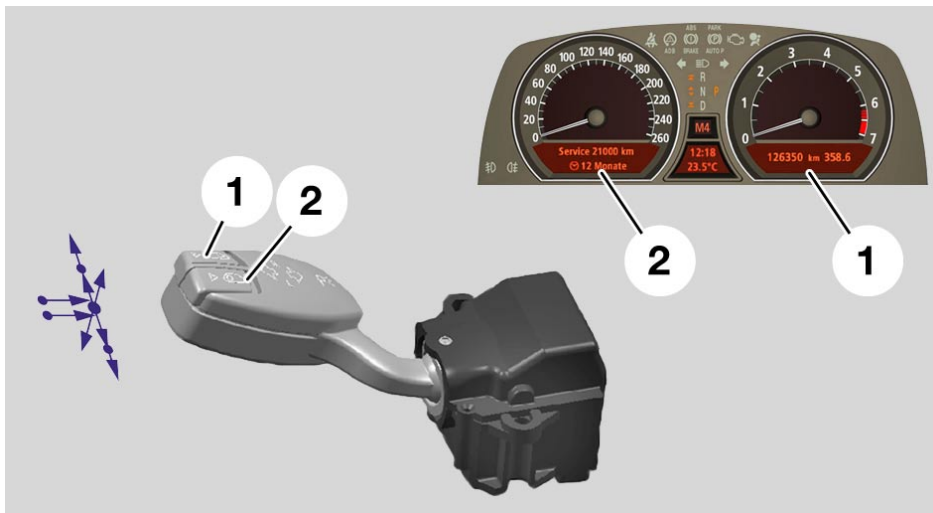
All messages of the Check Control are triggered by the control units of the monitored function and transferred as data telegrams via the MOST bus or the K-CAN SYSTEM to the instrument cluster. From there, they are distributed - depending on requirements - to the individual output locations (within the instrument cluster with fixed lines and/or via MOST to the Control Display).

In the event that a number of messages are to be output at one time, the message with the highest priority is displayed first. The same applies when different non-text notifications want to light up the same indicator lamp.

In addition to the visual display, the Check Control also calls attention with acoustic signals. A gong or double gong are generated by the audio system controller (ASK) - in different tones depending on the importance of the associated message (friendly or urgent, quiet or loud). The signals are output, depending on the reason for the acoustic warning, via the front left-hand and/or right-hand vehicle loudspeakers.

- Operation

The messages of the Check Control appear automatically and overwrite any other information in the display area under the gear display and revolution counter in the instrument cluster.



KT-9375

Fig. 21: Operation of Check Control (1) and on-board computer (2)

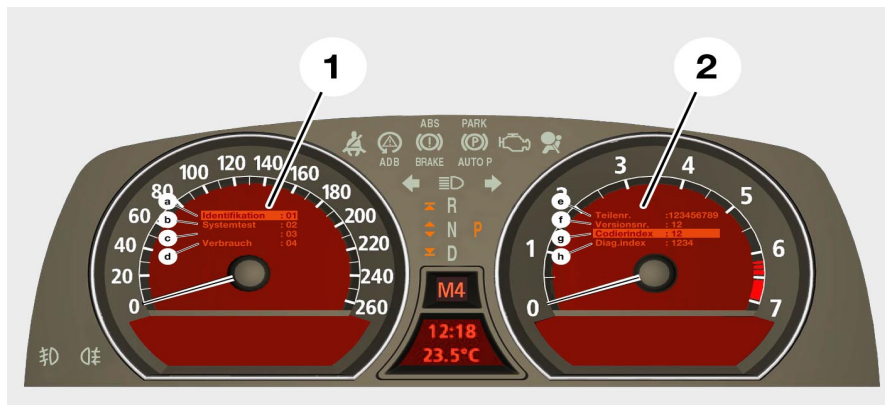
The button (1) in the turn indicator and dipped-beam switch (FAS) can be used - if present - to browse through all the CC messages issued (press briefly), or to toggle between the on-board computer and Check Control in the display area below the revolution counter.

Eight seconds after the last touch to the button, the display switches back automatically to the initial state (darkened or on-board computer). Darkening is not possible when a message of priority 1 is displayed in the Check Control (e.g. engine overheating).

Diagnosis / test functions

In addition to the comprehensive diagnostic options via the BMW diagnosis units, there are also a number of internal test functions.

These test functions are a simple aid for checking the instrument cluster and requesting important vehicle data.



KT-8987

Fig. 22: Display areas of the test functions

E65 Instrument Cluster

The following test functions can be displayed using the trip distance reset button in display areas 1 and 2 of the instrument cluster:

Test No.:	Function
01	Identification Instrument Cluster
02	System test
03	Not used
04	Current consumption values in l/100 km and l/h
05	Range consumption and current range value
06	Fuel tank values and displayed value
07	Current values for coolant temperature, outside temperature, dimming (sensor values)
08	Current speed in km/h
09	Display of operating voltage, terminal 30 in Volts
10	Read out country code
11	Read out units (AM/PM or mm.dd/dd.mm etc.)
12	Average speed for arrival calculation and current arrival value
13	Trigger acoustic signals
14	Read out error bytes (self-diagnosis)
15	Display of I/O port statuses
16	Display test bitmaps
17	Analog-digital converter ADC
18	Display of PWM value (lighting/instrument dimmer)
19	Lock and release of test functions
20	Entry of a correction factor for average consumption
21	Software reset/RAM reload

- Selecting test functions

The test functions can be selected at terminal R (radio position) or at terminal 15 ON.

The test functions are started by pressing the trip recorder reset button. Keep the button pressed for longer than 5 seconds.

Another possibility to start the test functions is - with terminal R switched off - to hold down the trip distance reset button and then switch on terminal R.

In the left-hand display area (1) within the speedometer, the following appears:

Identification	: 01
System test	: 02
(not used)	: 03
Consumption	: 04

A maximum of 4 test functions can be displayed at one time.

Each brief press of the trip distance reset button increases the selected test function number, displayed inversely (orange background).

All test functions, apart from functions one and two, are locked and must be unlocked by means of test function number 19.

Starting a selected test function:

Longer pressing of the button (> 2 seconds) starts the inversely displayed test function (e.g. **System test:01**).

The display of the selected test function appears in display area (2) within the revolution counter.

The test functions are closed by switching off terminal R (radio position) or pressing the button for a longer period (> 6 seconds).

Note

To prevent unauthorized access to the test functions, they have to be locked once again before they are closed (see test function 19).

Test function 01: identification

The following list appears in display area 2 within the revolution counter: a maximum of 4 lines can be displayed at one time. Brief pressing of the trip distance reset button enables scrolling in the list.

Part no.	: 123456789012
K-number v (1/KM)	: 44734
Version number	: 12
Coding index	: 12
Diagnosis index	: 1234
Variant index	: 1234
Identification	: 123456789
Production date	: 13.3.03
Manufacturer no.	: 12
Can-NK version	: 12. 12. 12
SW version	: 12. 12. 12
Standard Core	: 12. 12. 12
Slave SW	: 12. 12. 12
Bus_Ind. CAN	: 1234
Bus_Ind. MOST	: 1234

Test function 02: system test

The system test permits simple, visual assessment of the following functions in the instrument cluster:

- Pointer instruments
- Displays
- Backlighting of all displays
- Warning and indicator lamps

Activating this test function automatically activates the following components/functions:

Test function 04: consumption

This function serves to assess consumption. The following list appears in display area 2:

Consumption 14.3 : l/100 km
Stationary consumption 20.3 : l/h

Test function 05: range consumption, current range value

The internal on-board computer cruising range consumption is used together with the average tank value to calculate the range. The following list appears in display area 2:

CR consumption 12.7 : l/100 km
Range 238 : km

Test function 06: fuel tank and displayed value

In this function, the total tank contents and the contents of the left and right half of the tank are displayed separately. The following list appears in display area 2:

Tank L, R, total	: 29.5 l, 34.2 l, 63.7 l
Displayed value	: 60.2 l
Tank phase	: 1

Tank phase 1:

Normal calculation procedure via sensor, no error.

Tank phase 2:

Calculation from fuel consumption signal and/or CAN signal running (sensor fault). The fuel level indicator is guided via the calculated consumption towards the 0 mark. Refuelling can no longer be recognized.

Tank phase 3:

No more calculation of the tank contents possible (at least 1 sensor defective, no fuel consumption signal). The fuel level indicator is guided towards the 0 mark and the "fuel reserve" display is activated.

E65 Instrument Cluster

Test function 07: current values for coolant temperature, outside temperature, phototransistor, engine speed

The current values for coolant temperature, engine speed, phototransistor, and the current outside temperature are displayed.

The following list appears in display area 2:

Engine coolant temp.	105	°C
Engine speed	2480	rpm
Outside temp.	+20.0	°C
Dimming	02E3	ADC

Test function 08: current vehicle speed

The current driving speed appears in display area 2. For example: V: 98 km/h

This value can be used, for example, to check the plausibility of the pointer instrument.

Test function 09: operating voltage

The operating voltage at the instrument cluster is displayed in display area 2.

Test function 10: read out country code

The currently set and selectable country codes/languages appear in display area 2. The languages are set using the CD.

Test function 11: read out units

The currently set and selectable units (AM/PM and/or mm.dd/dd.mm etc.) appear in display area 2. The units are set using the CD.

Test function 12: displays for arrival

The average speed, displayed for calculation of the arrival time (customer function DISTANCE) and the current arrival time/date, appear in display area 2.

V arrival 136.5 km/h
Arrival time 23:46
Arrival date 2.2.03

Test function 13: trigger acoustic signals

When this test function is started, the following acoustic signals are triggered in succession. Here, there is a break of 2.5 seconds after each signal.

- CCG (Check Control Gong 1X)
- DG (double gong)
- Hour signal
- Intermittent gong for 5 seconds
- 3 times turn indicator acoustic signal

Test function 14: read out error bytes (self-diagnosis)

When this test function is started, a fault code memory table appears in display area 2. Occurring faults are output in this table in the form of fault codes (DTC).

Test function 15: display of I/O port statuses

When this test function is started, the statuses at the I/O ports (connections of the instrument cluster) appear in display area 2.

Test function 16: display test bitmap

When this test function is started, a test bitmap (BMW logo), which can be used to check the positioning accuracy and state of the display, appears in display area 2.

Test function 17: analog-digital converter ADC

When this test function is started, the following list appears in display area 2.

Fuel-tank sensor 1	165	Ohm
Fuel-tank sensor 2	264	Ohm
Coolant level	001	ADC
Terminal voltage	11850	mV
Temp. outside	207 / 10	°C
Temp. glass (display)	32	°C
Phototr.	670	ADC
Gear	P5	ADC
Gear R	R885	ADC
Gear D	D885	ADC
Gear N	N885	ADC
Washer fluid	341	ADC

The analog-digital converter ADC values are primarily for the purposes of evaluation by vehicle development. Changes to the ADC values enable assessment of the function of components (e.g. phototransistor).

In the case of switches (e.g. coolant level sensor), the ADC value 0 = switch closed and the ADC value 1023 = switch opened.

Test function 18: PWM values

When this test function is started, the following list appears in display area 2.

Contrast display	4615
Background lighting	3148
Dimm. Gear	10000
Dimm. Ring	10000
Dimm. Warning field	10000

The contrast and dimming values are primarily for the purposes of evaluation by vehicle development. Changes to the values enable assessment of the activation of contrast and dimming.

The values are displayed from 0 (lowest value) to 10000 (highest value).

Test function 19: lock and release test functions

All test functions, apart from functions one and two, are protected against unauthorized access. It is only possible to unlock the test functions by entering a code.

The required input code is calculated from the total of the last 5 digits of the vehicle identification number stored in the instrument cluster e.g. $1+2+3+4+5 = 15$.

- To unlock the test functions:

1. Select test function 19. The following appears in display area 2:

LOCK: ON
CODE: 0

2. Enter the total of the vehicle identification number. The total is set by pressing the trip distance reset button and displayed in the field CODE: each pressing of the button increases the total number by one digit.

If the trip distance reset button is pressed more than 45 times, the total input number jumps back to 00.

3. The input is terminated by pressing the trip distance reset button for a longer period. Now, all the test functions have been enabled and can be selected using the trip distance reset button in the left-hand display area.

The test functions remain unlocked until they are locked again using test function 19.

E65 Instrument Cluster

- To lock the test functions:

1. Select test function 19. The following appears in display area 2 within the revolution counter:

LOCK: OFF

2. When the trip distance reset button is pressed, the following appears:

LOCK: ON

3. The input is terminated by pressing the trip distance reset button for a longer period. Now all the test functions are locked.

Test function 20: correction factor for average consumption

This function is for checking and entering a correction factor for the fuel consumption figures.

When this test function is started, the correction factor for the average consumption appears in display area 2.

Entry of the correction factor is only possible within the range of 750 to 1250. At production, the factor 1000 is stored in the EEPROM.

The correction factor is reduced by a numerical value of 1 with each brief touch of the trip distance reset button. Pressing the BC button on the FAS counts down in steps of ten to shorten the time required for the resetting procedure.

If the minimum value of 750 is reached, the display jumps to the maximum value 1250 and the counting resumes backwards.

The input is terminated by pressing the trip distance reset button on the instrument cluster.

The correction factor CC is calculated from the actual quantity of fuel consumed CON ACT. and the displayed value CON DIS:

$$CC = (CON ACT./CON DIS) \times 1000 \text{ l}/100 \text{ km}$$

Test function 21: software reset/RAM reload

This test function triggers a software reset and/or a RAM reload of the instrument cluster processor.

During the software reset, all customer-relevant displayed values from the on-board computer, for example time, date and trip distance recorder, are reset.

In the case of a RAM reload, the RAM is re-initialized, with the exception of the date and time.

When this test function is started, the following list appears in display area 2.

RAM reload	?
SW RESET	?

The RAM reload is started by pressing the trip distance reset button for a longer period. A brief press switches to the software reset, which is then triggered by another longer press on the trip distance reset button.

If the test function is to be closed without triggering a RESET, the remote control must be removed or one of the two buttons (BC/CC) must be pressed on the FAS.

Note

A software reset should be performed after replacement of a tank lever sensor or a temperature sensor, as otherwise the attenuation function in the software will only display the current value after considerable delay.