BMW NA

BMW E31 - 8 Series

Electrical Troubleshooting Manual

Diagnostic Procedures

ZU-E Printed in U.S.A.

Part Number 01 001 467 857

Index

General

The Electrical Troubleshooting Manual consists of 2 parts:

– Schematics
– Diagnosis

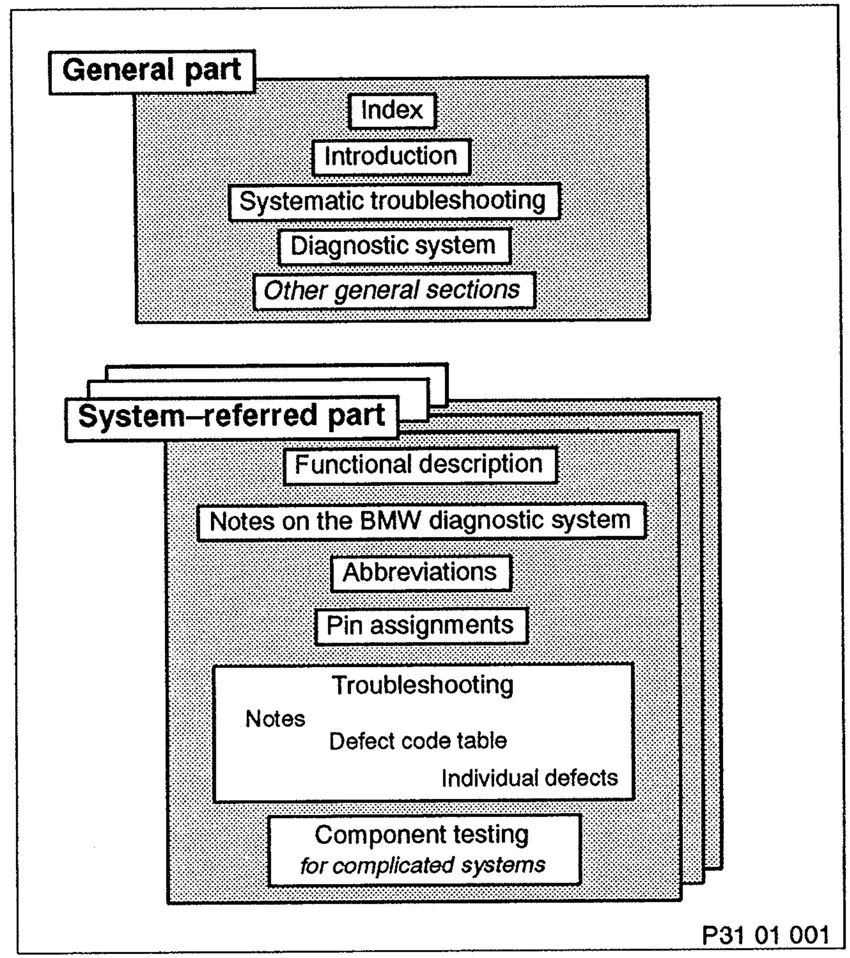
Diagnosis

The purpose of the diagnosis part is to provide assistance in troubleshooting of the complete vehicle electrical system. It also serves as a supplement to the BMW DIAGNOSTIC SYSTEM.

This manual covers the 8 Series (E31) as of model year 1990.

The diagnosis part is divided into individual sections. The individual system–related sections are subdivided into chapters.

In the case of complicated systems, the chapter Component Testing may be added as an additional supplement. This chapter assists troubleshooting and contains additional information, e.g. nominal values.



Organisation of diagnostic procedures

Numbering

Sheet Number

Each section of this troubleshooting manual is identified by a special number.

The first four numbers refer to the known main assembly numbers and subassembly numbers.

Additional identifier: If there are several systems within the same main assembly and subassembly differentiation is achieved by an additional number.

Reference letter: A letter follows the section number. This letter stands for:

A	= Diagnosis part of test instructions, troubleshooting
B	= Diagnosis part of test instructions, troubleshooting
No letter	= schematics

Page numbers: Consecutive page numbering is provided only within the sections (A/text part, B/component testing, schematic).

Numbering Example:

6211.0A-2

62 = Main design assembly, here: *instruments*

11 = Design subassembly, *here: instrument cluster*

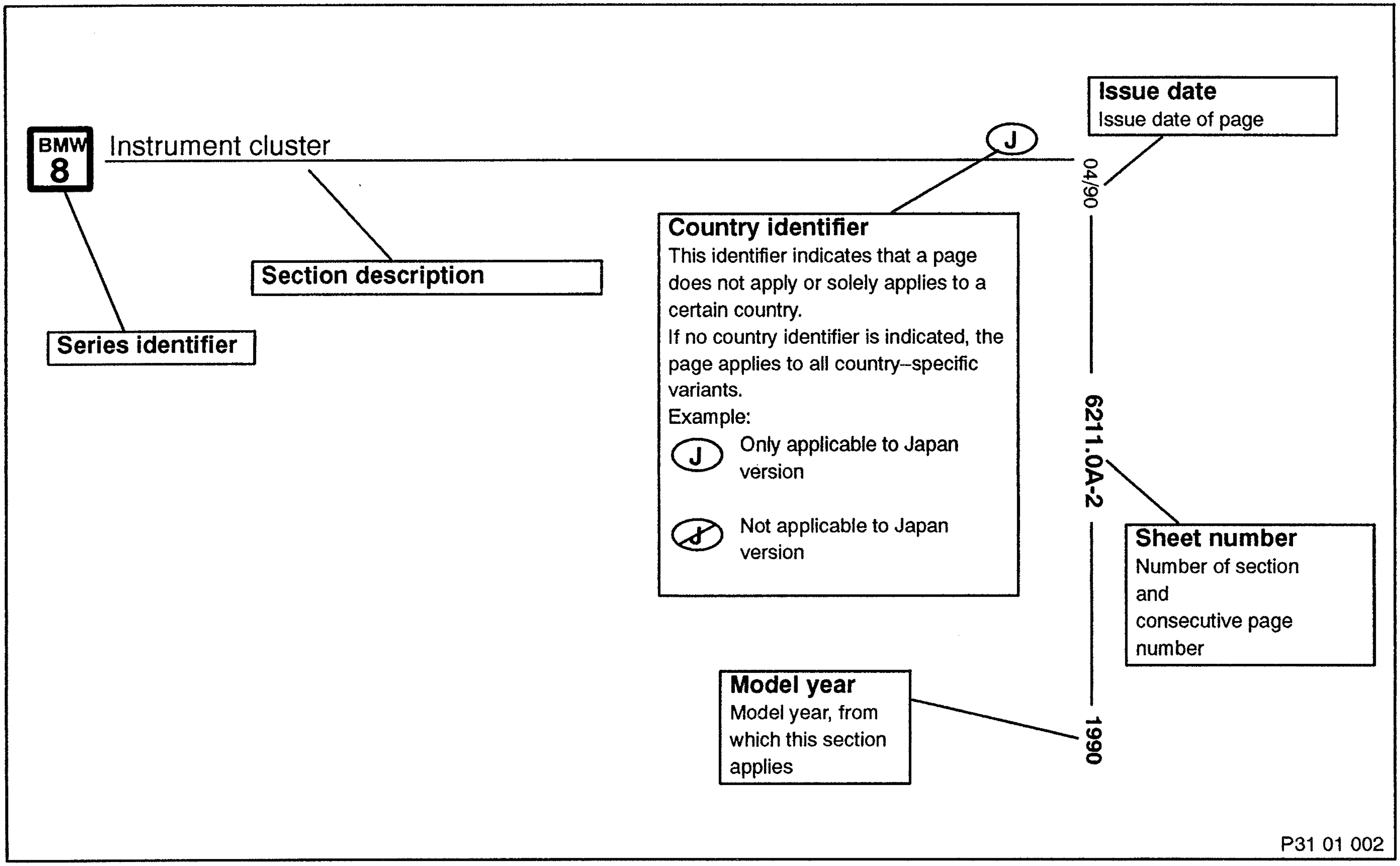
0 = Identifier *(.1 is still not used)*

A = Reference letter, *here diagnosis*

-2 = Consecutive page number within the section

Numbering Example:

– Series
– Section description
– Country identifier
– Date of issue
– Model year


BMW 8
Instrument cluster
J
04/90
Issue date
Issue date of page
Section description
Series identifier
Country identifier
This identifier indicates that a page does not apply or solely applies to a certain country.
If no country identifier is indicated, the page applies to all country–specific variants.
Example:
J
Only applicable to Japan version
J
Not applicable to Japan version
6211.0A-2
Sheet number
Number of section and consecutive page number
Model year
Model year, from which this section applies
1990
P31 01 002

Important Information

Pin Assignments

The following prerequisites must be observed when performing tests on the vehicle:

- Vehicle battery charged, **U-min > 12 V.**
- All values apply to the control unit when connected and **fully operable**.
- The **special adaptors** are used for measurements.
- The control unit must be in **operating status**, the ignition (terminal 15) switched on
- All measured values are **average values**. If no tolerances are specified, a permissible measured value deviation of 10% will apply.
- Measured data at 0 V have a permissible voltage range of **0 to 2 V**.
- Only use the **measuring equipment recommended** by BMW AG for all measurements.

Troubleshooting

The following prerequisites must be observed for troubleshooting on the vehicle:

- Vehicle battery charged, **U–min >12 V**.
- Only disconnect control units from the wiring harness when the **ignition is switched off**.
- All **fuses** required for trouble–free operation of the system are OK.
- **Wires** are checked in accordance with the schematics.
- **Perform continuity tests** (resistance measurement) on wires only with the control unit or component connectors detached.
- Refer to general information on **wire testing** in section 0130.0A, Systematic Troubleshooting.
- When control units are removed and installed, **defect codes are set in the defect code memory** of the control units without there actually being a malfunction. Therefore:
  - **Print out** defect code memory prior to **removal**
  - Clear **defect code memory** on completion of troubleshooting
- Correct installation and removal of components as described in the **repair manual**.
- Perform checks at the plug connections only with the **special adaptor leads** provided for this purpose.

Symbols

♦M♦ Multimeter.
Select multimeter on the BMW SERVICE TESTER. Select indicated multimeter function.

♦D♦ Diagnostic mode.
Connect the BMW DIAGNOSTIC SYSTEM to the vehicle.
Select control unit and assume diagnostic mode with the control unit. Refer to notes on diagnostic procedure.

♦⇑♦ Push button arrow up.
Press specified button on the BMW SERVICE TESTER.

♦⇓♦ Push button arrow down.
Press specified button on the BMW SERVICE TESTER

♦⇒♦ Push button arrow to right.
Press specified button on the BMW SERVICE TESTER.

♦⇐♦ Push button arrow to left.
Press specified button on the BMW SERVICE TESTER.

General

A large number of control units with self–diagnosis capabilities is used in the 8 Series (E31). In addition to the control of the relevant system, these control units are capable of making available or receiving data for diagnostic procedures. The data can be read out or entered with the BMW DIAGNOSTIC SYSTEM.

The data exchange between the control unit and the BMW DIAGNOSTIC SYSTEM takes place via 2 diagnostic links (RxD and TxD). The diagnostic links of all control units are combined in the diagnostic socket (Pin 15 RxD, Pin 20 TxD) where they can be connected to the BMW SERVICE TESTER or the BMW MoDiC.

To avoid faults occurring during vehicle operation, the RxD link is connected to battery voltage and the TxD link to ground when the diagnostic socket is closed.

After the tester disks have been loaded, the general overview of control units appears on the display screen. The diagnostic procedure is initiated by selecting the relevant control unit and the corresponding diagnostic program is assigned from the tester disk.

Diagnostic Functions

Note

Important information on the control unit or on the diagnostic procedure can be called up from any screen page by way of the note button.

Read Defect Code Memory

The majority of control units are capable of automatically detecting a defect and to store it permanently. The contents of the defect code memory can be read out with the BMW DIAGNOSTIC SYSTEM. Additional information is, in part, also stored when a defect code is stored. This additional information indicates the operating conditions under which the defect occurred. More extensive troubleshooting is then carried out in accordance with the instructions provided in the diagnostic program or in the test instructions (chapter on troubleshooting). Provided in the chapters of this troubleshooting manual *Notes on the BMW DIAGNOSTIC SYSTEM* and *Troubleshooting* is detailed information on how and under what circumstances the relevant control unit detects a defect and its significance.

Important! On no account clear the defect codes before repair, otherwise important information (troubleshooting, additional information etc.) will no longer appear on the display screen.

Status Monitoring

With this function, it is possible to read out current statuses and values applied at the inputs and outputs of the control unit. This display must be compared with the actual status at the vehicle and its plausibility must be checked. If a signal is found to be defective or if the status detected by the control unit deviates from the actual status on the vehicle, troubleshooting must be carried out at the associated input or output. In the majority of cases, a defect can be localised by simple measurement (voltage, resistance, etc.).

Test Sequence

– only in the diagnostic program of the BMW SERVICE TESTER –

This function makes it possible to perform a guided check of the system. The test sequence incorporates status monitoring, activation of components and, if necessary, also reading the defect code memory. The display screen pages contain detailed information texts on testing and troubleshooting.

Activating Components

With this function, components can be activated without the control unit–internal switch–on conditions being set. The actual statuses at the input of the control unit are ignored. In this way, to locate defects, the function of components can be checked while they are still installed.

Special Functions

Special control unit functions can, in part, be called up via the diagnostic procedure (e.g.: system test, reading out coded data etc.).

Test Code

The test code must be printed out before renewing a control unit or an important component of the system. The printout is sent in together with the control unit or component.

The test code contains the coded defect code memory of the control unit. It facilitates fast analysis of the defective component by the Warranty and Quality Assurance departments.

Important! Print out test code before the defect code memory is cleared!

Clearing Defect Code Memory

The defect code memory must be cleared after all defects of the system have been rectified.

Quick Test

The quick test makes it possible to check all control units with self–diagnosis capabilities installed in the vehicle for stored defect codes.

The ignition must be switched on before starting the quick test (ignition switch in position 2!). The quick test is started from the overview of control units. "Quick Test Active" is masked in on the last line. The relevant line flashing shows the operator how far the quick test has progressed.

When the BMW DIAGNOSTIC SYSTEM detects a control unit, the corresponding line of the control unit overview is marked with a star.

When a defect code is stored in the defect code memory of a control unit, the line is displayed inversely (white highlighted) and marked with an "F".

On conclusion of the quick test, "Quick Test Completed" is masked in on the last line.

It is possible to terminate a currently running quick test at any time by pressing any key.

Quick Test in MoDiC

Start with the ♦⇓♦ key in the overview of control units.

On conclusion of the quick test, an overview of control units appears which have been detected by the MoDiC diagnostic program. If a defect code is stored in a control unit, the corresponding line is highlighted in black.

General Information

Series Identification

A separate set of disks is used for E31 series.

Every time a control unit is selected, the BMW DIAGNOSTIC SYSTEM checks whether a series E31 vehicle is connected. The tester initially checks whether an EKM (Electronic Vehicle Module) is installed in the vehicle.

If the EKM is defective or if data transfer is faulty, proceed in accordance with the instructions provided on the display screen.

Identification of Control Unit Version

After selection of a control unit from the control unit overview, the BMW DIAGNOSTIC SYSTEM defines which control unit version (software version, country–specific version etc.) is installed and automatically allocates the correct troubleshooting program. If a different car or if a control unit has been changed, return to the general overview of control units in the BMW DIAGNOSTIC SYSTEM and reselect the corresponding control unit to ensure correct program allocation and to avoid incorrect displays.

Important Notes on Operation

– Applicable to the Diagnostic Program in the BMW SERVICE TESTER –

0.....9	Digits can only be selected when they are displayed inversely. All entries must be confirmed with the acknowledgement key.
♦⇐♦ ♦⇒♦ ♦⇑♦ ♦⇓♦	Arrows can only be selected when they are displayed inversely.
♦⇐♦	Back one page
♦⇒♦	Forward one page
♦⇑♦	Return to next higher level. E.g. from read defect code memory back to selection.
♦⇓♦	Continue to next lower level. E.g. from defect code explanation to troubleshooting.
#	This key can be used to turn back to the general information from any page even when it is not displayed on the screen. This character displayed inversely indicates that there is special information on this page.

– Applicable to the Diagnostic Program in the BMW MoDiC –

♦⇐♦ ♦⇒♦ ♦⇑♦ ♦⇓♦	Arrows can only be selected when they are displayed in the top right field of the MoDiC display. Significance of the arrows as in the diagnostic program of the BMW SERVICE TESTER
C	Special operating steps and information
Y	Yes key for troubleshooting
N	No key for troubleshooting

Secret Number:
The MoDiC program can only be loaded when a secret number is entered.

Dealer Number:
The dealer number must be entered after loading the MoDiC program. It facilitates distinct identification of the MoDiC.

Authorisation Code:
Important for coding!
If the coding program is selected after loading, a 5–digit number must be entered (freely selected). This code is of no significance for the diagnostic program. However, the coding program can only be called by the persons who know this authorisation code.

Functional Description

Note: The following description refers to the digital motor electronics DME M 1.7 on the 12–cylinder engine M70.

Two DME units operate ***independently,*** each with 6 cylinders. If not otherwise specified, the explanations, therefore, refer to only one row of cylinders.

New Features Compared to the Previous 12–Cylinder DME M 1.2
- 88–pole control unit connector
- Integrated ignition circuit monitoring
- A/C compressor cut–out

The DME control unit I supplies the cylinders 1...6 the identical control unit II the cylinder 7...12. To differentiate between them for diagnosis, Pin 85 of the control unit II is connected to ground. The associated components are mainly provided double. Exceptions are:

- Relay for oxygen sensor heating
- Engine temperature sensors

The relay is activated by the DME control unit I and supplies the heaters of both oxygen sensors. This relay will be omitted in series production. On models without a relay for oxygen sensor heating, the sensor heaters are activated directly by the EKP relay.

The engine temperature sensors for the DME control unit I and II are mounted together in one housing.

The DME M 1.7 makes it possible to precisely control fuel injection and ignition under variable operating conditions. The system also operates in conjunction with other systems such as:

- Electronic throttle control EML
- Electronic transmission control EGS
- Automatic stability control ASC
- Engine drag torque control MSR
- Antitheft system DWA
- Electronics vehicle module EKM
- On–board computer BC

which can influence the entire engine control system depending on requirements.

The DME system assumes functions which are listed briefly here and are described in more detail in the following.

- Injection control
- Ignition timing control
- Cold start control
- Engine speed control
- Acceleration enrichment
- Dynamic torque cut–out
- Catalytic converter protection function (ignition circuit monitoring)
- Adaptive emission (Lambda) control
- Adaptive fuel evaporation control
- Intervention in ignition and injection with ASC or MSR active
- Characteristics map switchover for EH transmission
- Relay control
- A/C compressor cut–out
- Self–diagnosis with defect code storage

The following components supply the DME control unit with input signals.

- Pulse generator – engine speed/position I and II
- Pulse generator – cylinder reference I and II
- Intake air temperature sensor I and II
- Engine temperature sensor I and II (in one housing)
- Air mass meter I and II
- Oxygen sensor I and I
- Battery
- EML control unit
- EGS control unit
- ABS/ASC/MSR control unit

The outputs of the DME are connected via output stages. They supply the following components with the necessary signals:

- Injector valves for cylinders 1–3–5 or 7–9–11 (group 2)
- Injector valves for cylinders 2–4–6 or 8–10–12 (group 1)
- Ignition coil I and II
- Fuel evaporation control valve I and II
- EKP relay I and II
- Main relay (control unit supply) I and II
- Oxygen sensor heater relay (only on DME control unit I)
- Oxygen sensor I and II
- Defect lamp (US only)
- Air mass meter I and I
- EML control unit
- EGS control unit
- ABS/ASC/MSR control unit

Ignition Control

The supplied intake air is routed through the air mass meter free of back-pressure and pulses. Here the air flow is registered independently of the air temperature, air humidity and altitude. The DME control unit then calculates the correct injection timing on the basis of the engine speed, air flow rate, engine temperature and intake air temperature. The fuel–air mixture is changed by way of the opening duration of the injector valves.

Injection Control

The supplied intake air is routed through the air mass meter free of back-pressure and pulses. Here the air flow is registered independently of the air temperature, air humidity and altitude. The DME control unit then calculates the correct injection timing on the basis of the engine speed, air flow rate, engine temperature and intake air temperature. The fuel–air mixture is changed by way of the opening duration of the injector valves.

Air Flow Measurement

During operation, a heated platinum wire is subjected to the flow of intake air in the inner tube of the hot–wire air mass meter (HLM). Heat is dissipated from the hot wire by the flow of air. This heat is compensated by the control of the heating current. The supplied current also flows via a precision resistor whose voltage drop represents a direct measure for the air flow drawn in. Air temperature fluctuations are detected by way of a compensation resistor and taking into account in the measurement. Approximately 5 seconds after switching off the engine a short current surge is applied to the hot wire in order to burn the wire clean of impurities.

Fuel Injection

One output stage drives 3 injector valves. The injection cycle is therefore divided into groups (semi–sequential injection). This also ensures restricted engine operation in the event of failure of one group.

As of a speed of 600–800 rpm, fuel is injected only once per 720° crankshaft angle into one cylinder group. This facilitates precise metering of the quantity of fuel since the injector valves need not be actuated so often.

Parallel injection (activation of all injector valves simultaneously) as in the DME M 1.2 is no longer possible (see catalytic converter protection function).

Catalytic Converter Protection Function (Ignition Circuit Monitoring)

In the DME M 1.7 system, the cylinder reference point sensor is used for ignition circuit monitoring. If the cylinder reference point sensor detects no ignition signal on the ignition lead 6 (or 12), the supply of fuel is cut by shortening the injection signal. However, the signal is not cut completely to ensure that the EML system does not revert to the emergency program. The vehicle can still be driven with the remaining row of cylinders.

The cylinder reference point sensor therefore monitors the entire primary side and the cylinder 6 or 12 on the secondary side.

Overheating Protection Function

Consumer loads are switched off, the air conditioning system operates cyclically and the ignition timing is retarded dependent on the engine temperature.

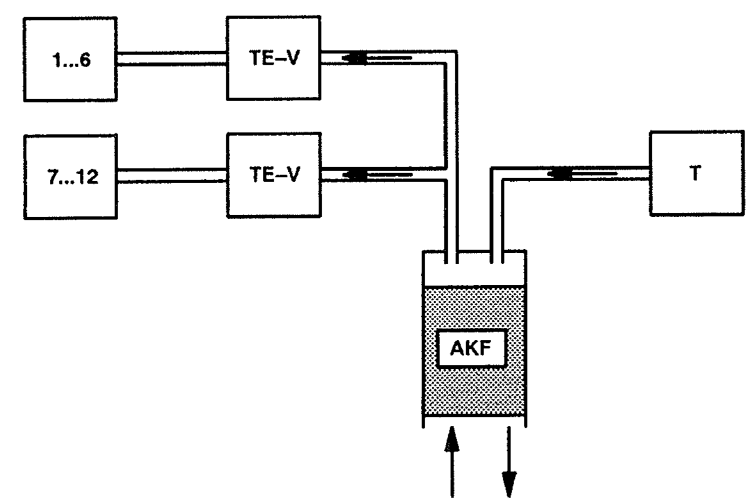
Cold Start Control

During the start phase, an increased quantity of fuel is injected 3 times for each cylinder group for up to 5 revolutions of the crankshaft. This function is dependent on the engine temperature.

This is then followed by a reduction of the initial injected quantity depending upon the temperature and engine speed in order to avoid an excessively rich mixture. If start is repeated within one minute, the total initial starting quantity is not longer injected.

During the warm–up phase up to an engine temperature of 70° C the injection timing is also correspondingly extended, dependent upon the engine speed and temperature. These values are programmed in the control units.

Fuel Evaporation Control for Models with Catalytic Converter



P31 12 001

1...6	Engine, cylinders 1...6
7...12	Engine, cylinders 7...12
TE–V	Fuel evaporation control valve
AKF	Activated carbon filter
T	Tank

The fuel evaporation control line of the fuel tank is connected to an activated carbon filter, in which the fuel vapours which accumulate in the tank are collected. The activated carbon filter is linked by means of 2 further lines to the 2 air manifolds. A fuel evaporation control valve is installed in each of these 2 lines. When a fuel evaporation control valve is open, the vacuum in the air manifold draws in fresh air through the activated carbon filter. The fresh air flushes out the fuel collected in the filter and routes it to the engine for combustion.

Since this additionally supplied mixture influences combustion to a considerable extent, the fuel evaporation control valve consists of a non–return valve and an electrically operated valve. Due to the non–return valve, the fuel evaporation control valve is initially closed when no power is applied. The non–return valve prevents fuel collecting in the air manifold when the vehicle is parked. The non–return valve opens as the vacuum in the air manifold increases. Electric actuation takes place separately for both rows of cylinders dependent on the engine speed and load. The venting cycle (flushing phase) begins as soon as the emission (lambda) control system is active. On completion of one cycle, the valve is closed for approx. 1 min. (rest phase).

Emission (Lambda) Control for Models with Catalytic Converter

In order to maintain the optimum degree of efficiency of the catalytic converter, this system aims at achieving the ideal air–fuel mixture (lambda = 1) for combustion. A heated oxygen sensor is used for this purpose which measures the residual oxygen in the exhaust gas and transmits a corresponding voltage value to the control unit where the mixture ratio is correspondingly corrected, if necessary, by varying the ignition timing. In the event of failure of an oxygen sensor, the DME control unit assumes control with a fixed programmed substitute value (0.45 V).

Since a temperature of approx. 300 °C is necessary for efficient operation of the oxygen sensors power is supplied by way of ***one*** relay to both heating resistors in the oxygen sensors. The DME control unit I activates the relay. This relay will be omitted in series production. On models without a relay for oxygen sensor heating, the sensor heaters are activated directly by the EKP relay.

Adaptions

The fuel–air mixture formed in the intake tract requires a certain period of time until it reaches the oxygen sensor in the form of exhaust gas. This time decreases as load and engine speed increase. For this reason, the response time of the emission control system is also dependent on load and engine speed. Fuel–air mixture deviations detected by the oxygen sensor result in storage of adaption values (learned correction values) by way of the adaptions, the injection can be brought close to the nominal values in advance. A reduction in the response time is achieved in this way.

For instance, if the basic injection values of the DME characteristics map are too low during idling in order to maintain the ideal fuel–air mixture, the emission control system would have to constantly increase the injection timing. In this case, an adaption value is learnt which corrects the basic injection value. The emission (lambda) control then only needs to undertake the fine adjustment.

Following adaptions are performed during engine operation:

Fuel Evaporation Control Adaption

When the fuel evaporation control valve is open, an additional combustible mixture or air is supplied from the activated carbon filter to the engine. The shift in the air–fuel ratio detected by the oxygen sensor is almost completely compensated by way of the fuel evaporation control adaption value.

Idle Air Adaption

The EML undertakes idle air adaption. By way of the throttle valve, it ensures constant idle speeds.

Idle Mixture Adaption

If the idle signal is applied during the rest phase of the fuel evaporation control system, idle mixture adaption takes place at certain intervals.

Part Load Mixture Adaption

Also in the part load range, mixture adaption takes place at certain intervals. The determined adaption value is taken into account in all part load ranges.

The correction values stored in the control unit are intended as additional information **only in the case of acute engine problems.**

If problems occur during engine operation and no defect codes are stored in the defect code memory, the mixture adaption values can be read out on the BMW service tester. These values can provide an indication as to which direction troubleshooting is to be continued.

The adaption values are forgotten when the voltage supply to the DME is cut. This can lead to starting and idle running problems. Depending on how far the adaption values deviated from the basic values, a considerable period of time is required until the adaption values are relearned.

For this reason, idle operation or test runs are of little use in order to observe the change in the adaption values.

CO–Potentiometer

On models without a catalytic converter, the CO setting can be corrected by way of a potentiometer (on the HLM).

Engine Speed Control

The idle speed control and maximum speed limitation are achieved by way of the throttle valve position. The EML undertakes the control – refer to EML functional description.

The DME receives the idle and full load signal from the EML control unit. On the basis of these signals. The DME can differentiate between idle, part load and full load operation.

EKP–Relay

The relays of the electric fuel pumps (EKP) are operated by the DME main relay. At ignition ON, power is briefly applied to the EKP relays for approx. 0.5 seconds in order to build up the fuel pressure. The fuel pumps run constantly after engine start.

A/C Compressor Cut–Out

When starting off at full load (below 8 km/h), the voltage supply to the magnetic clutch of the A/C compressor is temporarily cut by the A/C compressor cut–out relay. This ensures the full engine output is available for accelerating.

Drive–Away Protection

When the drive–away protection function is activated on the on–board computer (code entered) or when the antitheft system DWA is armed, a signal (>10 V) is sent to the DME control units which consequently switch off the ignition and injection.

Automatic Stability Control ASC

To different systems are installed in the E31:

- ASC, as standard in automatic vehicles
- ASC+T, as standard in vehicles with manual transmission and as an optional extra in automatic vehicles.

Wheel spin of the drive wheels is signalled by the wheel sensors to the ABS control unit. As a result, the EML control unit is instructed to reduce the throttle opening. If the wheel spin is still too high, the DME control unit is instructed to shift the ignition timing towards the retard direction.

- As a further measure in ASC (without T), the ignition and the injection are temporarily switched off,
- whereas in the case of ASC+T the spinning drive wheel is braked by way of the brake system.

The ASC is integrated in the ABS control unit – refer chapter 3450. It operates in conjunction with DME and EML.

Engine Drag Torque Control MSR

In the same way as the ASC, the MSR is also integrated in the ABS control unit – see Chapter 3450. The engine is influenced by DME and EML.

A signal is sent to the DME control unit when increased slip occurs at the drive wheels while the vehicle is coasting. As a result, the torque cut–out function is deactivated. In addition, the EML control unit is instructed to adapt the throttle position until the wheel slip returns to within the permissible range.

Characteristics Map Changeover for EH Transmission

During the gear shift procedure, the EGS control unit transfers a signal to the DME control units which causes the ignition timing to be retarded. This ensures a smoother transmission into the newly selected range.

As soon as the torque converter clutch is engaged, the DME control units are instructed to switch over to a different ignition timing characteristic map.

EML Functions

The EML undertakes the idle speed control and engine speed limitation by way of the throttle valve.

The idle and full load signal is also transferred by the EML to the DME.

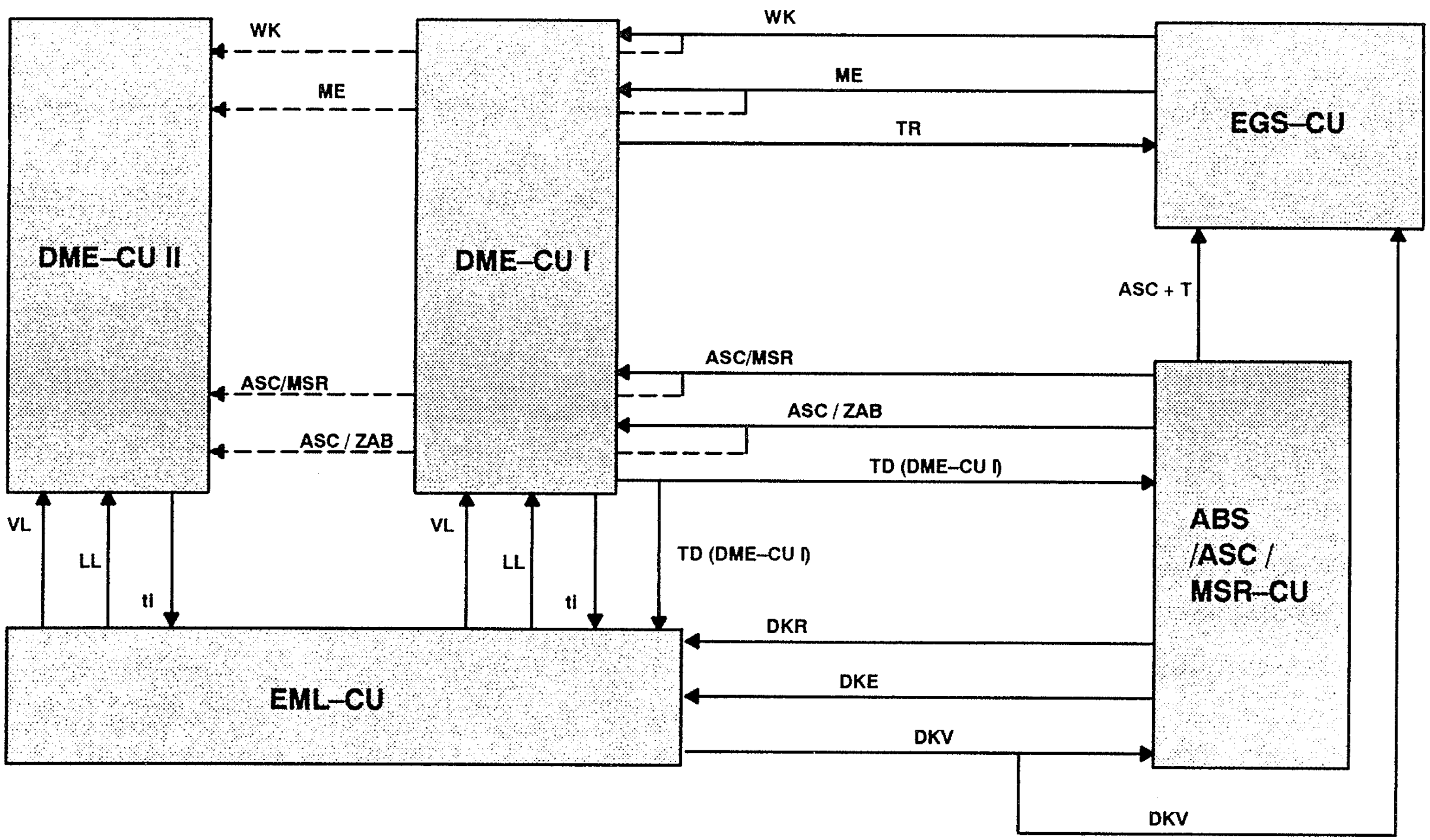
Self–Diagnosis

The task of the self–diagnosis feature is to detect malfunctions in the control unit or in the DME components and to initiate subsequent defect code storage. Troubleshooting is assisted by the self–diagnosis function in the form of status monitoring and component activation.

In the case of failure of the engine temperature sensor, intake air temperature sensor, Air mass meter or oxygen sensor, the relevant DME control unit provides substitute values. These substitute values are cancelled once again when normal operation can be resumed.

For further information, refer to the notes on the BMW DIAGNOSTIC SYSTEM.

Interconnected System of Signals to the Drive Control Units (CU)



P31 12 002

Abbr.	Signal Description	Type of Signal	Effect
WK	Torque converter clutch	Ground = torque converter clutch engaged (ON)	DME selects corresponding characteristics map
ME	Engine intervention (ignition angle intervention)	Ground = ON	DME reduces the torque during the gearshift procedure (ignition timing retarded).
TR	Engine speed signal (3 times per crankshaft revolution)	Square–wave voltage	EGS receives information relating to the engine speed.
ASC / MSR	Automatic stability control or engine drag torque control	U–Batt	2 functions within the DME control unit: complete torque cut–out if currently active (MSR). Otherwise, ignition timing set towards retard (ASC).
ASC / ZAB	Automatic stability control, ignition fade–out	U–Batt	DME fades out the ignition and fuel injection (not in ASC+T)
TD	Engine speed signal (once per ignition cycle)	Square–wave signal	EML undertakes idle control and engine speed limitation. ASC requires this information to ensure it does not stall the engine.
ASC + T	Automatic stability control + traction	U–Batt = ON	With ASC+T active, EGS prevents alternate gearshifts in transmission.
DKR	Throttle reduction	Square–wave voltage with fixed frequency and variable duty factor	EML reduces the throttle opening angle
DKE	Throttle increase	Square–wave voltage with fixed frequency and variable duty factor	EML increases the throttle opening angle
DKV	Set throttle value	Square–wave voltage with fixed frequency and variable duty factor	ASC/MSR receives information on the current status of the pedal position sensor (driver requirement).
LL	Idle signal	Ground = ON	DME selects corresponding characteristics map
VL	Full load signal	Ground = ON	DME selects corresponding characteristics map
ti	Injection signal	Square–wave voltage	EML synchronises the throttle valves

Notes on the BMW DIAGNOSTIC SYSTEM

Initiation of Diagnostic Procedure

Communication with the control unit via the DIAGNOSTIC SYSTEM can be set up after selecting the DME on the BMW SERVICE TESTER. If data transfer is interrupted, information appears on the display screen indicating the possible causes:

- Ignition not switched on
- Voltage supply for control unit <10 V
- DME relay not supplied with B+ (if not: bypass terminal 30 and 87)
- Control unit not connected
- Diagnostic link defective
- Data traffic inhibited by a defective control unit in the vehicle

Control Unit Assignment

Correct assignment of the control units to the engine can be determined by means of the control unit identification and the parts microfiche.

Test Code

See 0150.

Storing Defect Code

The first step should always be to monitor the defect code memory. If one or several defect codes are stored, it is advisable to immediately print out these data (R key). Since it is often necessary during the testing procedure to cut the power supply or to disconnect the connector from the control unit, the contents of the defect code memory will be unintentionally deleted as a consequence.

The memory stores the defect codes in the order they occurred.

With the exception of defect code 200, defect codes are stored only when the engine is running. For an overview of the monitored components and functions, refer to the overview table in the section on component testing.

Substitute values can be active when a defect code is stored and the DME is not malfunctioning. The troubleshooting procedure should still, however, be carried out.

The learned adaption values are lost if the battery or the DME control unit is disconnected. This may result in difficulties in starting and idling.

In US models, defects which influence the mixture are indicated by an "engine check" lamp in the instrument cluster. As a check, this lamp lights constantly during the period of time between "ignition ON" and engine start.

Clearing the Defect Code Memory

Carry out this step only when all defects have been rectified or when they have been stored by way of defect simulation. When the battery or the DME control unit are disconnected, ***all*** stored defect codes, the current substitute values and the adaption values are lost. After clearing, current defect codes are restored during the next start procedure.

Status Monitoring

Inputs and Outputs can be monitored independently of the defect code storage function. In this case, current values or operating statuses are displayed. Status enquiries can be compiled as required.

From the status monitoring functions, the nominal values can be displayed on the screen on special information pages.

Component Activation

To facilitate fast fault finding, various components can be activated with the DIAGNOSTIC SYSTEM. The actuators can be checked by acoustic means.

Activation of the injector valves should be kept as short as possible.

Abbreviations

ABS	Anti–lock brake system
AG	Automatic transmission
ASC	Automatic stability control
ASC + T	Automatic stability control plus traction control
CO	Carbon monoxide
DK	Throttle valve
DKB	Throttle–brake intervention
DKE	Throttle lift
DKR	Throttle reduction
DKV	Set throttle value
DME	Digital motor electronics
EGS	Electronic transmission control
EH	Electrohydraulic transmission
EKM	Electronic vehicle module
EKP	Electric fuel pump
EML	Electronic throttle control
EV	Injector valve(s)
HG	Manual transmission
HLM	Hot–wire air mass meter
Hz	Hertz
KD	Kick–down
KW	Crankshaft
LL	Idle
ME	Engine intervention (ignition timing)
MF	Microfiche
MSR	Engine drag torque control
MV	Solenoid valve
PWG	Pedal position sensor
RxD	Diagnosis initiation line
SG	Control unit
TE	Fuel evaporation control
TD	Engine speed signal once per ignition
TR	Engine speed signal once per revolution
ti	Injection time
tL	Load signal
TxD	Diagnostic data line
U–Batt	Battery voltage
U–Vers	Supply voltage
WK	Torque converter clutch
ZAB	Ignition fade–out

Pin Assignments

If not otherwise specified, the information on the type of signal refers to engine operation at idle speed

Assignments on the 88–Pole DME Control Unit Connectors X 6010 (DME Control Unit) and X 6020 (DME Control Unit II)

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
1	A	EKP relay and TR signal (crankshaft reference)	EKP relay and EGS control unittorque converter clutch	Ground with superimposed engine speed signal	ON	Can only be measured when crankshaft rotating (the EKP relay does not switch if the TR signal is not applied)
2	–	–	–	–	–	–
3	A	Injector valves cyl. 2–4–6 or cyl 8–10–12	Injector valve EV	Ground clocked	Injection time ti	Ground => injector valves open, see component activation
4	–	–	–	–	–	–
5	–	–	–	–	–	–
6	M	Ground EV output stages	Ground point	Ground	–	–
7	–	–	–	–	–	–
8	A	Defect lamp (US only	Instrument cluster	Ground	–	–
9	–	–	–	–	–	–
10	–	–	–	–	–	–
11	–	–	–	–	–	–
12	E	Full load signal VL	EML control unit	Ground	ON	At full load (kick–down)

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
13	A	Free combustion	Air mass meter	Voltage increase for approx. 0.5 sec	–	See chapter component testing
14	M	Ground air mass meter	Air mass meter	Ground	–	–
15	–	–	–	–	–	–
16	E	Cylinder reference sensor (ignition)	Cylinder reference sensor (connection B)	–	ON / OFF	See status monitoring
17	A	ti measuring signal (KVA signal)	EKM	Square wave signal	Multimeter function Pulse duration	–
18	–	–	–	–	–	–
19	–	–	–	–	–	–
20	–	–	–	–	–	–
21	–	–	–	–	–	–
22	–	–	–	–	–	–
23	–	–	–	–	–	–
24	–	–	–	–	–	–
25	A	Ignition terminal 1	Ignition coil	Primary signal	Oscilloscope	Engine test, test step 05
26	E	Steady pulse, terminal 30	B + terminal point	U–Batt	–	Diagnosis not possible if not fitted
27	A	DME main relay	DME main relay terminal 85 (additionally, jumper to second DME main relay)	Ground	ON	Diagnosis not possible if not fitted – connect jumper at relay terminal 30 and 87
28	M	Ground for electronics and shielding the sensors	Ground point	Ground	–	–
29	–	–	–	–	–	–
30	–	–	–	–	–	–

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
31	–	–	–	–	–	–
32	A	Injector valves cyl. 1–3–5 or cyl 7–9–11	EV and EML	Ground clocked	Injection time ti	Ground => Injector valves open,see component activation
33	–	–	–	–	–	–
34	M	Ground, remaining output stages (except for ignition and EV)	Ground point	Ground	–	–
35	–	–	–	–	–	–
36	A	Fuel evaporation control valve	TE valve	Ground clocked	CLOSED / OPEN	Perform component activation, ground => closed
37	A	Oxygen sensor heater	Sensor heater relay terminal 85	Ground	ON	Ground = > sensor heater activated
38	–	–	–	–	–	–
39	–	–	–	–	–	–
40	–	–	–	–	–	–
41	E	Signal air mass meter	Air mass meter	0...5 V	Load signal in ms	See status monitoring
42	–	–	–	–	–	–
43	M	Ground for sensors	Temperature sensor	Ground	–	–
44	E	Cylinder reference (ignition)	Cylinder reference (connection A)	–	ON/OFF	See status monitoring
45	–	–		–	–	–
46	–	–	–	–	–	–
47	–	–	–	–	–	–
48	–	–	–	–	–	–
49	–	–	–	–	–	–

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
50	–	–	–	–	–	–
51	–	–	–	–	–	–
52	–	–	–	–	–	–
53	–	–	–	–	–	–
54	E	U–Batt from DME main relay	Main relay terminal 87	U–Batt	Voltage value	Perform status monitoring. Diagnosis not possible if signal not applied – connect jumper terminal 30 and 87 on relay
55	M	Ground ignition	Ground point	Ground	–	–
56	E	Ignition terminal 15	Ignition coil	U–Batt	–	–
57	–	–	–	–	–	–
58	–	–	–	–	–	–
59	–	–	–	–	–	–
60	E	Programming voltage	Diagnostic connector	–	–	Only activated for control unit programming
61	–	–	–	–	–	–
62	E	Idle signal LL	EML	Ground	ON	See status monitoring
63	E	Torque converter clutch (WK)	EGS	Ground	ON (with engine running)	when WK engaged, see status monitoring
64	E	Ignition timing intervention	EGS	Ground	ON	Only active during gear-shift
65	E	Drive range P/N	Transmission selector lever switch	Ground	ON	When position P/N
66	–	–	–	–	–	–

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
67	E	Inductive pulse generator (connection B)	Pulse generator Engine speed/position	A/C voltage	Engine speed	Between Pins 67 and 68 (can only be measured with crankshaft rotating)
68	E	Inductive pulse generator (connection A)	Pulse generator Engine speed/position	A/C voltage	Engine speed	Between Pins 67 and 68 (can only be measured with crankshaft rotating)
69	–	–	–	–	–	–
70	E	Oxygen sensor signal	Oxygen sensor	Pulsating voltage up to approx. 1 V	Voltage value	Can only be measured with engine running at operating temperature
71	M	Ground oxygen sensor	Oxygen sensor	Ground	–	–
72	–	–	–	–	–	–
73	E	Road speed signal	EKM	Square–wave signal	km/h	–
74	A	Drehzahlsignal TD	EKM	Square–wave signal	–	one signal per ignition
75	–	–	–	–	–	–
76	E	Idle CO–potentiometer	Air mass meter	0...5 V	Voltage value	–
77	E	Intake air temperature sensor	Intake air temperature sensor	0...5 V	°C	Temperature–dependent
78	E	Engine temperature sensor	Engine temperature sensor	0...5 V	°C	Temperature–dependent
79	–	–	–	–	–	–
80	–	–	–	–	–	–
81	E	DWA	EKM	Ground	OFF	U–Batt applied when DWA armed
82	E	ASC/MSR	ASC or ASC + T	U–Batt	ON	U–Batt => signal active
83	E	ASC/ZAB	Only for ASC without T	U–Batt	ON	U–Batt => signal active

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
84	–	–	–	–	–	–
85	E	Identifier DME control unit II	Ground point	Ground	DME cyl. 7...12	The DME control unit can only be selected with the diagnostic procedure when this link is set up.
86	E	A/C switch	A/C relay	12 V	ON / OFF	
87	E	RxD diagnostic data line	Diagnostic connector	U–Batt	–	When cover of diagnostic connector closed
88	E/A	TxD diagnostic data line	Diagnostic connector	Ground	–	When cover of diagnostic connector closed

E = Input A = Output M = Ground

Adaptors

Component	Connector Number	Description	Adaptor Number
Control unit	X 6010, X 6020	88–pole	Universal adaptor, Cartool 61 4 410 Accessories: Test lead, black, Cartool 61 4 412 Test lead, red, Cartool 61 4 413 Extensions (2), Cartool 61 4 430
Pulse generator, cylinder reference	X 6211, X 6221	3–pole, black	V–adaptor lead, Cartool 61 1 491
Pulse generator, engine speed/ position	X 6212, X 6222		
Ignition coil		1–pole	Ignition lead adaptor, Cartool 61 2 010

Troubleshooting

Notes

Relevant safety codes and accident prevention regulations must be observed when carrying out tests and work on the engine electrical and electronic systems.

Caution!
Dangerous high voltage in the primary and secondary circuit of the ignition system.

Wherever possible, the battery should not be disconnected otherwise the defect codes stored in **all** the control units will be deleted.

Disconnected control units from the wire harness **only** when the ignition is switched off.

Conduct wire tests **only** with the control unit or component connectors disconnected.

Test Equipment

The 88–pole universal adaptor can be used for picking–off from the DME control unit or from the engine wire harness.

Use only suitable test leads, terminals and probe tips

Display of a stored Error Code on the Screen.

– **Defect location:** The defect can be in the vicinity of the component, the associated wiring or in the control unit. The number of the defect code indicates the pin assignments at the control unit.

– **Type of defect:** Short–circuits, wire breaks or range transgressions are indicated. Further indication is provided as to whether the defect is momentary, or whether it occurred in the past and the code is presently not stored (intermittent defect).

– **Defect frequency:** Indication of how often the defect has been detected, or the number of starts is indicated which have taken place since the defect was last detected.

– **Detected during:** Additional defect information on the operating status during defect detection.

Evaluation of Stored Defect Codes

To facilitate effective troubleshooting, it is first advisable to print out the contents of the defect code memory.

During repairs, it is often necessary to disconnect plug connections, causing a defect code to be set in many cases. This may lead to incorrect diagnosis after monitoring the defect codes.

For this reason, all defect codes should be cleared after performing the necessary repairs (also EML, EGS, ASC/MSR). Monitor the defect code memory once again after a test run.

Some defects cause a defect code to be set in several systems (EML, EGS, ASC/MSR). Such interrelationships can be determined by comparing the ambient conditions (e.g. engine speed, temperature etc.).

Malfunction: Engine Operation Not Possible

Prerequisites for engine operation:

– Starting system OK. (Battery charge, ignition switch ...)
– Ground connection from battery to engine or body OK.
– Specified fuel in tank
– Engine mechanically OK. (timing, compression ...)

a) Check voltage supply for DME control units in accordance with schematic.

b) Measure input signals

– Check engine speed signals of the pulse generators at starting speed – ♦D♦ 2.
– Check air mass meter signals – ♦D♦ 2.

c) Measure output signals.

– Drive fuel pump relay in accordance with schematic
– Ignition output stages by means of ENGINE TEST test step 09
– Injector valves with ♦D♦ 3

d) Check fuel pressure

e) Check EML for defects
For technical data refer to chapter – Component activation.

Defect Code Table

Defect Code 0

♦D♦ 1 Defect Code Memory: 0 UNDEFINED FAULT

Explanation: Data have been stored in the defect code memory for no apparent reason.

Corrective Measures: Perform test run after clearing the defect code. The defect code can be ignored if there are no noticeable effects in the system.

Defect Code 1

♦D♦ 1 Defect Code Memory: 1TR SIGNAL/EKP RELAY

Explanation: This defect code is stored when a short occurs at the EKP relay or on the control wire (from control unit Pin 1).

Effects of Defect: The fuel pump relay is not activated. If the defect occurs in the DME control unit for cylinders 1...6, the EGS takes up the emergency program.

Troubleshooting: The TR signal (engine speed signal once per revolution) is output, when the engine is running, at Pin 1 of the DME control unit for cylinders 1...6 and is routed via the EKP relay to the EGS control unit.

Possible Causes: Wires, connector or EKP relay defective.

Defect Code 3

♦D♦ 1 Defect Code Memory: 3 FUEL INJECTORS cyl. 2–4–6 or 8–10–12

Explanation: This defect code is stored when shorts or breaks occur on the fuel injector valves cyl. 2–4–6 or 8–10–12 or on their supply wires.

Effects of Defect: The entire group of injector valves is always deactivated when a short occurs at one injector valve or on its supply wire. The 3 other cylinders of the same row of cylinders remain in operation.

Troubleshooting:

– Activate injector valves (see component testing).
– Check connections and wires in accordance with schematic.
– Replace failed injector valves.

For test values, see chapter – Component Testing.

Defect Code 8

♦D♦ 1 Defect Code Memory: 8 DEFECT LAMP

Explanation: Applicable to US models only. This defect code is stored when shorts occur at the defect lamp or on its supply wire.

Effects of Defect:

– The defect lamp does not light in the case of short to plus.
– The defect lamp lights continuously in the case of a short to ground.

Troubleshooting: Normally, the defect lamp is activated by the control unit (ground signal at Pin 8) when an emission–related defect code is stored in the defect code memory.

Test defect lamp: See Component Testing.

Defect Code 16

♦D♦ 1 Defect Code Memory: 16 IGNITION

Explanation: This defect code is stored when the cylinder reference sensor on cylinder 6 or 12 no longer detects an ignition signal for a certain period of time.

Effects of Defect: The injection signal is reduced to a minimum. Fuel is no longer injected (protection of catalytic converter) however, the EML does not take up the emergency program since an injection signal is still applied.

Possible Causes:

- Cylinder reference sensor or supply wires defective
- Cylinder 6 or 12 receives no ignition voltage signal
- No spark–over at the spark plug of cylinder 6 or 12
- Ignition coil defective
- Ignition output stage of DME control unit defective

For test values see chapter – Component Testing.

Defect Code 18

♦D♦ 1 Defect Code Memory: 18 FINAL STAGE PIN 18

Explanation: This defect code is stored when a short occurs at Pin 18. This defect code can be ignored since this pin is not connected to the wiring harness.

Defect Code 32

♦D♦ 1 Defect Code Memory: 32 FUEL INJECTORS cyl. 1–3–5 or 7–9–11

Explanation: As defect code 03.

Defect Code 36

♦D♦ 1 Defect Code Memory: 36 TANK VENTING VALVE

Explanation: This defect code is stored when a short occurs at the fuel evaporation control valve or on its supply wire.

Effects of Defect:

- Short to ground: No fuel evaporation control since the solenoid valve remains closed.
- Short to plus (or break): The solenoid valve constantly remains open. As a result, the fuel vapours supplied via the fuel evaporation control valve can lead to malfunctions when idling and during acceleration.

Troubleshooting: Activate TE valve with ♦D♦ 3 component activation

Does the TE valve respond?

- YES: Check wire and connector for loose contact
- NO: Connect test lamp (12 V,10 W) and activate component.

Does test lamp flash?

- YES: Check function of TE valve, see test instructions.
- NO: Check voltage supply at TE valve. Check wires. Check output at DME control unit (pin 36).

Defect Code 37

♦D♦ 1 Defect Code Memory: 37 SENSOR HEATER RELAY

Explanation: The oxygen sensor heating relay is activated by the DME control unit I. For this reason, a detected defect is only stored in the DME control unit I. The control unit detects a short or break at the relay or on its supply wire.

Effects of Defect: After a cold start, operation of the oxygen sensors is delayed.

This defect code can be ignored if no sensor relay is installed.

Troubleshooting: Drive components with **♦D♦ 3** activate the sensor heating relay. When the relay is active, ground is applied to terminal 85 of the relay (check with 12 V 3 W lamp).

Defect Code 41

♦D♦ 1 Defect Code Memory: 41 AIR MASS SENSOR (HLM)

Explanation: This defect code is stored when a short or a break occurs at the HLM or on its supply wires.

Effects of Defect: The DME control unit operates with fixed substitute values:

– When idling, the load signal TI = 2.2 ms.
– During part load and full load operation the load signal TI = 0 ms.

Troubleshooting: Observe the load signal with **♦D♦ 2** status monitoring. The nominal value is 1.8...2.2 ms when the battery is charged, air conditioning switched off and gear selector lever in position P or N. If the nominal value is not achieved:

– Check voltage supply of the HLM, wires and connector.
– Check HLM.

Defect Code 48

♦D♦ 1 Defect Code Memory: 48 A/C COMPRESSOR SHUTOFF

Explanation: This defect is stored when a short occurs at Pin 48.

Effects of Defect:

- Short to plus: Below a speed of 8 km/h, the A/C compressor is not switched off during acceleration with full load.
- Short to ground: The A/C compressor does not operate.

Troubleshooting: Check A/C cut–out relay and supply wires.

Defect Code 54

♦D♦ 1 Defect Code Memory: 54 CONTROL UNIT POWER SUPPLY

Explanation: This defect code is stored when the voltage supply exceeds 16 V. A drop in the voltage supply below 9 V is detected 3 minutes after the start at the earliest.

Troubleshooting:

- Check battery acid level
- Check charged battery under load
- Check B + wire to the DME relay
- Check charging current of alternator with consumer loads switched on
- Check voltage regulator

Defect Code 63

♦D♦ 1 Defect Code Memory: 63 CONVERTER LOCKUP CLUTCH

Explanation: The control unit receives simultaneously the signals gear selector lever in position P/N and torque converter clutch closed (ground signal). This operating status is impossible.

Effects of Defect: A permanently applied ground signal is ignored by the DME control unit. EGS may be in the emergency program.

Troubleshooting: Check the plausibility of the signals gear selector lever and torque converter clutch with ♦D♦ **2** status monitoring. The torque converter clutch inquiry is only displayed correctly when the engine is running.

Defect Code 64

♦D♦ 1 Defect Code Memory: 64 IGNITION TIMING TAP

Explanation: This defect code is stored when a short to ground occurs on the wire from the EGS to DME control unit Pin 64 (>2.5 sec.).

Effects of Defect: The ignition angle intervention occurs in such a case only once, the signal is then ignored. The automatic transmission is in the emergency program.

Troubleshooting:

- Check wire at connector to the EGS
- Perform defect monitoring on EGS. Monitor status once again after test run.

Defect Code 70

♦D♦ 1 Defect Code Memory: 70 OXYGEN SENSOR

Explanation: This defect code is stored when a short or a break occurs at the oxygen sensor or on its supply wires, or when no oxygen is installed (provisions for catalytic converter). A prerequisite for defect detection is an engine temperature of 70° C and a load signal of >3.5 ms for >20 sec.

Effects of Defect: Emission control is no longer possible, the control unit operates with a substitute value.

Troubleshooting: Observe the emission control and sensor voltage with ♦D♦ 2. After the sensor has reached operating temperature, the sensor voltage between 0.02 and 0.085 V.

- If sensor voltage not OK.: Detach connector for oxygen sensor, switch on ignition and measure voltage at the connector (control unit side) (nominal value = 0.45 V). As displayed on screen.
- Check wire and oxygen sensors
- If the oxygen sensors have been interchanged (DME control unit I operates with sensor II and vice versa), this defect code will be stored in both control units. The mixture is too rich in one group of cylinders and too lean in the other.

Defect Code 73

♦D♦ 1 Defect Code Memory: 73 ROAD SPEED SIGNAL

Explanation: This defect code is stored when, despite high load and engine speed, no road speed signal is applied.

Effects of Defect:

- For manual transmission: Irregularities at engine speeds close to the idle speed (EML controls the idle speed)
- Power loss (EML limits the throttle angle).
- FGR failure.

Troubleshooting:

- If road speed signal is in instrument cluster: check wire from DME Pin 73 to EKM.
- Otherwise check wire from instrument cluster to reed contact.

Defect Code 76

♦D♦ 1 Defect Code Memory: 76 IDLE SPEED CO POTENTIOMETER

Explanation: Only applicable to vehicles without a catalytic converter. This defect code is stored when shorts or breaks occur at the potentiometer or on its supply wire.

Effects of Defect: A substitute value of 1.25 V is set. The emission CO value may deviate from the nominal value.

Troubleshooting:

– Read out CO–potentiometer actual value with ♦D♦ 2 status monitoring.
– Check CO–potentiometer (in HLM) and supply wires.
– Measure CO content in exhaust emission.

Defect Code 77

♦D♦ 1 Defect Code Memory: 77 INTAKE AIR TEMP. SENSOR (LMM)

Explanation: This defect is stored when shorts or breaks occur at the temperature sensor or on its supply wires. A prerequisite for detecting a break is a time interval of 3 min after start and idling for at least 30 sec.

Effects of Defect: After defect detection, a substitute value o 50 °C is used.

Troubleshooting: Read out the actual value with ♦D♦ 2.

If not plausible: Check wire to DME Pin 77 and temperature sensor. For temperature sensor test values see chapter – Component Testing.

Defect Code 78

♦D♦ 1 Defect Code Memory: 78 COOLANT TEMP. SENSOR (ENGINE)

Explanation: This defect is stored when shorts or breaks occur at the temperature sensor or on its supply wires. A prerequisite for detecting a short to plus or break is an intake air temperature above – 9 °C.

Effects of Defect: After defect detection, a substitute value of 50 °C is used.

Troubleshooting: Read out the actual value with ♦D♦ 2.

If not plausible: Check wire to DME Pin 78 and temperature sensor. For temperature sensor test values see chapter – Component Testing.

Defect Code 82

♦D♦ 1 Defect Code Memory: 82 ENGINE DRAG TORQUE CONTROL

Explanation: This defect code is stored when the MSR signal (U–Batt at DME Pin 82) is applied constantly for more than 5 sec.

Effects of Defect: The MSR signal is subsequently ignored by the DME control unit

Troubleshooting: With ♦D♦ 2 status monitoring. With the ignition switched on or with the engine idling, the nominal value for the MSR signal = OFF. If the display shows ON, this indicates a short to plus.

Defect Code 83

♦D♦ 1 Defect Code Memory: 83 ASC

Explanation: This defect code memory is stored when the ASC signal (U–Batt at DME Pin 83) is applied for more than 1 sec.

Effects of Defect: The ASC signal is subsequently ignored by the DME control unit.

Troubleshooting: With **♦D♦ 2** status monitoring. With the ignition switched on or the engine idling, the nominal value for the ASC signal = OFF. If the display shows ON, this indicates a short to plus at Pin 83 (ASC) or Pin 81 (DWA).

Defect Code 100

♦D♦ 1 Defect Code Memory: 100 OUTPUT STAGE

Explanation: This defect code is stored when the function of an output stage is not plausible and the control unit could not distinctly identify the output stage. If, at the same time, one of the following components is stored as defective, then this is the cause of defect code 100 being set and can be ignored:

- Idle speed actuator
- Injector valves
- Sensor heating relay (only DME control unit for cylinders 1...6)
- Fuel evaporation control valve
- Defect lamp (US only)
- EKP relay

Troubleshooting: Activate the corresponding components with **♦D♦ 3** component activation or check wires.

Defect Code 200

♦D♦ 1 Defect Code Memory: 200 DME CONTROL UNIT

Explanation: This defect code is stored when the internal self–test has found a defect in the control unit.

Possible Causes: Program error or disturbed program sequence in the DME control unit. This defect code is also stored when manipulations have been made in the program of the control unit. In this case, the sealing tabs on the control unit housing will be damaged.

Corrective Measures: Perform test run after clearing the defect code memory. If defect reoccurs, the DME control unit must be replaced.

Defect Code 201

♦D♦ 1 Defect Code Memory: 201 OXYGEN CONTROL

Explanation: This defect code is stored in the case of excessive deviations in the air–fuel mixture (mixture too rich or too lean for longer than 10 sec). The prerequisite is that the oxygen sensor is ready for operation.

Effects of Defect: Poor engine reaction since the DME operates with a substitute value.

Possible Causes:

– Incorrect fuel pressure
– Defective or coked injector valves
– Defective engine temperature sensor
– Secondary air (lean mixture)
– Defective fuel evaporation control system
– Defective air mass meter
– Disturbed combustion (ignition or compression not OK)

Troubleshooting: Perform emission test. For test values, see section – Component Testing.

Component Testing

Notes

Relevant safety codes and accident prevention regulations must be observed when carrying out tests and work on the engine electrical and electronic systems.

Caution!
Dangerous high voltage in the primary and secondary circuits of the ignition system.

Important!

Whenever possible, the battery should not be disconnected otherwise the defect codes stored in ***all*** the control units will be deleted. If the voltage supply to the DME is interrupted, the adaption values will be additionally forgotten (lost). This can lead to problems in starting and idling. Depending on how far the adaption values deviated from the basic values, some time will be required until the adaption values are relearned.

Disconnect control units from the wire harness ***only*** when the ignition is switched off.

Conduct wire tests ***only*** with the control unit or component connectors disconnected.

Test Equipment

Refer to section 1210 in the corresponding files for the schematics.

The 88–pole universal adaptor can be used for picking–off from the DME control unit or from the engine wire harness.

Only use suitable test leads, terminals and probe tips.

The test values for component testing are listed in the appendix. For further technical values, refer to the microfiche – technical data.

Removal and installation are described in the microfiche – Repair Instructions.

Overview of the Defect Codes and Component Tests

Component / Function	Quick Test after Entry ♦D♦ ...	Defect Code after Storage
DME control unit	–	200
Ignition coil 1)	See engine test	–
TR signal/EKP relay	–	1
Fuel evaporation control valve 1)	2, 3	36
Air mass meter	2	41
Pulse generator – cylinder reference 1) (ignition)	2	16
Emission (lambda) control	2	201
Defect lamp	–	8
Injector valves 1)	3	3, 32
Sensor heating relay	3	37
Oxygen sensor	2	70
Road speed signal	2, also see instrument cluster/CC	73
DME main relay	2	–
Voltage supply	2	54
ASC	2, also see ABS/ASC	83
Intake air temperature sensor 1)	2	77
Engine temperature sensor 1)	2	78
Pulse generator – engine speed/position 1)	2	–
MSR	2, also see ABS/ASC	82
Ignition timing intervention	2, also see EGS	64

Idle/full load signal	2	–
Torque converter clutch	2, also see EGS	63
Drive range P/N	–	–
A/C compressor cut–out	–	48
LL–CO–potentiometer	2	76

1) The resistance values are listed in the appendix

DME Control Unit

Check Function:

Individual function blocks, e.g. ignition, fuel injection, emission control etc., can only be checked when the necessary input signals are applied beforehand at the control unit – see chapter – Pin Assignments.

Ignition Coil

Check Function:

Perform engine test, step 09. With the engine at operating temperature, the ignition voltage is 10 ± 2 kV. The maximum difference of the individual cylinders should not exceed 3 kV.

Resistance Test:

Siehe technische Daten im Anhang.

TR–Signal / EKP–Relais

Check Function:

The EKP relay switches on as soon as the DME control unit outputs at Pin 1 a ground signal with superimposed engine speed signal (once per crankshaft revolution).

In addition, at ignition on, the EKP relay is briefly activated by the DME in order to build up the necessary fuel pressure before starting. The voltage increase can be measured at fuse 23.

Possible Causes:

- Wire to the EKP relay defective
- EKP relay or main relay defective
- Supply voltage for DME control unit, DME relay 1 or 2 not OK:
- No signals from engine speed/position sensor

Fuel Evaporation Control Valve

Check Electrical Function:

♦D♦ **3** – The fuel evaporation control valve is actuated at intervals of 1 sec. The actuation cycles can be heard at ignition ON and felt with the hand.

Check Actuation Phases:

♦D♦ **2** – The valve is actuated at idle speed (display: CLOSED) and is therefore closed. As soon as the emission control system is active and the engine is increased, the valve can be seen to open step–by–step (display:OPEN).

After switching off the engine, the valve is held closed for 3...5 sec.

Checks for Leaks:

Detach hose from valve, switch on vacuum pump at the service tester and connect to the 8 mm connection (note arrow indicating direction of flow). Set vacuum to 600 mbar and apply a voltage of 12 V to the valve.

Switch off vacuum pump – the pressure drop must not exceed 50 mbar after 20 sec.

When power is not applied, the fuel evaporation control valve is closed by a non–return valve to a vacuum of 20 mbar

Air Mass Meter (HLM)

Check Voltage Supply HLM:

U–Batt supplied between Pins 2 and 4 on the HLM connector.

Check HLM Signal:

♦D♦ 2 – The load signal TI provides an indication of the measured air flow rate in the HLM. When idling, the value should be 2.0 ms ± 20%. In the case of a break in the voltage supply or in the signal line, the value is a constant 2.2 ms (substitute value) at idle speed and 0 ms under part load and full load.

The load signal is formed dependent upon the voltage (<5 V) applied at the hot wire of the HLM. The load signal is displayed in the BMW SERVICE TESTER only when the engine is in operation.

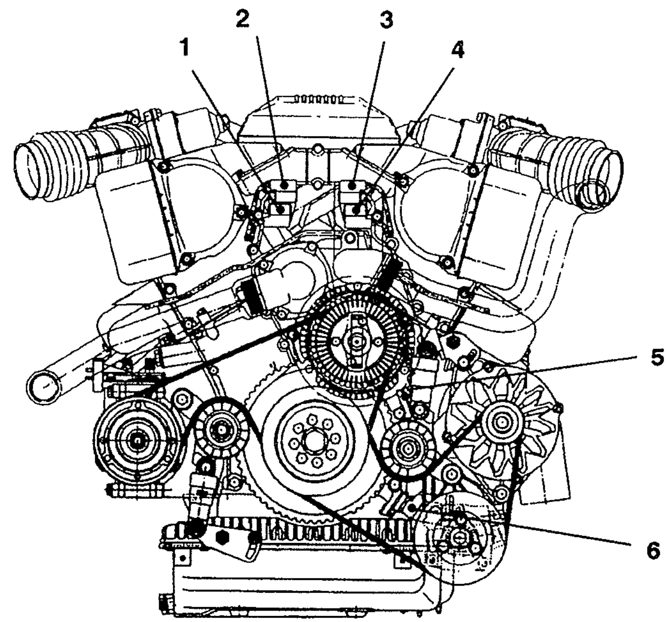
The voltage value of the hot wire can be measured between Pin 14 (sensor ground) and Pin 41 (signal HLM) of the DME control unit. This measurement can also be conducted with the ignition ON (nominal value approx. 1.4 V).

The load signals of the 2 rows of cylinders must scarcely deviate from each other. Check the burn–clear function if the load signal is permanently too low. A load signal which is too low tends to produce a lean mixture, thus reducing the engine output.

Check Burn–Clear Function::

Increase engine speed once to above 2000 rpm (engine temperature >6O °C). Approx. 5 sec after switching off the engine, the hot wire can be seen to briefly light up (burn–clear) at the HLM (air cleaner cover removed).

The signal can also be measured between Pin 13 and Pin 26 (U–Batt) of the 88–pole universal adaptor. A voltage of approx. 3.5 V is applied at Pin 13 to facilitate the burn–clear function (i.e. at the moment of actuation, the system voltage measured at Pin 26 reduces by this value).
The signal, however, can only be measured with a fast multimeter.



P31 12 003

1	Connector cylinder reference	DME control unit I
2	Connector engine speed/position	DME control unit I
3	Connector cylinder reference	DME control unit II
4	Connector engine speed/position	DME control unit II
5	Pulse generator engine speed/position	DME control unit I
6	Pulse generator engine speed/position	DME control unit II

Pulse Generator – Engine Speed/Position

The DME does not produce an ignition and injection signal if the engine speed signal is not applied.

Check Function:

♦D♦ 2 – The engine speed signal can be monitored at starting speed or when the engine is running.

Further test options are possible with the oscilloscope ♦M♦ **23/24**. Disconnect terminals at the component connector and start engine. An alternating voltage characteristic curve with positive and negative half wave should appear on the display screen.

Possible Causes:

If wire, plug connection and resistance are OK.: check distance of pulse generator to the increment wheel on the vibration damper. Nominal value: 0.15...1.5 mm.

Pulse Generator – Cylinder Reference (Ignition)

Check Function:

♦M♦ **22** – Attach connections for oscilloscope at the component connector (adaptor: Cartool 61 1 491) and operate engine at idle speed. From the point the engine starts, an alternating voltage characteristic curve with positive and negative half wave should appear on the display screen. If no signal is applied, the DME control unit cuts out fuel injection.

Resistance Test:

The resistance can be measured directly at the component connector (at the connector strip for injector valves). For wiring diagram, refer to schematics. For technical data, see appendix.

Defect Lamp 'Check Engine' (US only)

Check Function:

The control unit supplies the defect lamp with ground potential as soon as an exhaust emission–related defect is detected. As a check, the lamp lights constantly after ignition ON and as soon as the engine is running (if no exhaust emission–related defect code is stored).

Simulated defect: For example, detach connector from the air mass meter and start engine. The defect lamp must then light when the defect code 41 air mass meter is detected by the control unit.

– Does the control unit output the ground signal?
– Are wires at defect lamp OK.?

Injector Valves

Check Electrical Functions:

♦D♦ 3 – In this case, the fuel injector valves are actuated with a frequency of 10 Hz. The pulse period is 1 ms. Activation time should be kept as short as possible in order to avoid fuel being injected. Activation can be felt with the hand. The pulses can be checked with the multimeter ♦M♦ 15 at the injector valve connector or at the 88–pole universal adaptor.

Testing with oscilloscope ♦M♦ 22 and universal adaptor:

Connect terminal frequency OFF (+) to terminal 1 of the universal adaptor lead of the BMW SERVICE TESTER and apply a frequency of 70 Hz. Connect the 88–pole universal adaptor (Cartool 61 4 410) to the DME control unit and connect the terminal D+ (blue) to Pins 3 or 32. The injection signal should be displayed on the oscilloscope. In contrast to measuring the pulse duration, injection fade–out during coasting can also be seen on the oscilloscope.

Resistance Test:

The resistance of an injector valve must be measured directly at the component. Only the entire group of injector valves (3 valves) can be measured at the universal adaptor. For technical data, see appendix.

Sensor Heating Relay

This relay will not be fitted in series production! The voltage for the sensor heaters will then be supplied via the EKP relay.

Check Function:

♦D♦ 3 – Activation is only possible at the cylinder row 1...6 (the relay supplies both sensor heaters) and takes place at 1 sec intervals.

During normal operation, the relay remains switched on until higher speeds or loads occur.

Possible Causes:

- Wire to DME control unit Pin 23 defective
- Relay or voltage supply not OK.
- Fuse F28 defective

Oxygen Sensor

Check Function:

♦D♦ **2** – To carry out this check, the oxygen sensor must be at operating temperature. The indicated voltage signal is picked off in steps and fluctuates between 0.02 and 0.85 V.

When the oxygen sensor is not in operation, or the wire to the DME control unit is interrupted, the constant value of 0.45 V is indicated. This value is also indicated when no oxygen sensor is installed.

An oxygen sensor may be defective (e.g. due to deposits) and still indicate the required voltage signals. An indication for such cases is CO measured values deviating from the nominal value despite the emission control system being active. Test option: Disconnect DME control unit from the voltage supply for at least 5 min. Then disconnect the oxygen sensor and perform CO measurement once again. If the CO value approaches the nominal value, the oxygen sensor should be replaced and the CO measurement repeated.

Emission Control

Check Function:

♦D♦ **2** – To carry out this check, the oxygen sensor must be at operating temperature. The emission control system is dependent on the engine temperature and can have a duration of up to 5 min (at – 30 ° C). At starting temperatures > 20 ° C, the control can take up operation after approx. 30 sec.

The control system can effectively compensate wear–related deviations in the air–fuel mixture and thus conceal other defects. If necessary, disconnect the oxygen sensor when the checking the air–fuel mixture system.

Adaptions

The correction values stored in the control unit should **only** be used as additional information **in the case of acute engine problems**.

The correction values stored in the control unit can be of assistance in the case of acute engine problems.

If the set range is exceeded in the minus direction, the air–fuel mixture will be too rich and the DME attempts to adjust the mixture, i.e. make it leaner.

Reasons for an excessively rich mixture:

– Injector valves leaking
– Fuel pressure too high

If the set range is exceeded in the plus direction, the air–fuel mixture will be too lean and the DME attempts to adjust the mixture, i.e. make it richer.

Reasons for an excessively lean mixture:

– Leaks in intake or exhaust system (ahead of the oxygen sensor). the oxygen sensor measures the additional oxygen and signals to the DME that the mixture is too lean.
– Hot wire in the HLM defective (load signal too low). The mixture is too lean.

The adaption values are forgotten (lost) when the voltage supply to the DME is interrupted. This can lead to problems in starting and idling. Depending on how far the adaption values have deviated from the basic values, some time will be required until the adaption values are relearned.

For this reason, idle operation or test runs in order to observe the change in the adaption values are of little use.

CO–Potentiometer (without Catalytic Converter)

Check Function:

♦D♦ 2 – Measure CO content and set to nominal value with CO–potentiometer (adjusting screw on HLM). The basic setting on the potentiometer is 1.25 V. For CO nominal values, see technical data at the end of the chapter.

Check Voltage Supply::

A voltage of approx. 5 V must be applied at the HLM connector between Pins 3 and 4.

Road Speed Signal

♦D♦ 2 – With the drive wheels raised, the vehicle speed should be limited to max. 30 km/h. The road speed signal is sent by the EKM to the DME..

DME Main Relay

Check Function:

♦D♦ **2** – With ignition ON or during engine operation, the main relay is actuated with ground potential at terminal 85 (display: ON). The relay switches on and supplies voltage to the control units DME, EGS, EML and ABS.

Possible Causes:

- Wire to the DME control unit Pin 27 defective
- Relay or voltage supply not OK.
- Voltage supply for DME control unit not OK.
- The control unit is defective if no ground potential is output at control unit Pin 27 (display:OFF) although the above points are OK.

Control Unit Supply Voltage

♦D♦ **2** – The indicated voltage is currently applied at the control unit . It should not be below 10 V.

Intake Air Temperature Sensor

Check Function:

♦D♦ **2** – With the engine at operating temperature, the intake air temperature is at 50...70 °C (ambient air temperature 23 ±5 °C).

A display below – 40 °C indicates a break in the temperature sensor or in the supply wire to the DME control unit.

Resistance Test:

For technical data, see appendix.

Engine (Coolant) Temperature Sensor

Check Function:

♦D♦ **2** – The indicated engine temperature should correspond to the coolant temperature. A value below – 30 °C indicates a break in the temperature sensor or in the wire to the DME control unit.

Resistance Test:

For technical data, see appendix.

Idle/Full Load Signal

Check Function:

♦D♦ **2** – The signals are sent by the EML control unit to the DME. The full load signal is sent shortly before the full load limit stop.

Technical Data

Resistance Values Measured at 23 ±5 °C

Engine Type	M70 B50
Injector valve	15...17 Ω
Injector valve group (3 valves)	5,5 ± 0,5 Ω
Pulse generator – engine speed/position	540 ± 50 Ω
Pulse generator – cylinder reference	0,1...1 Ω
Engine temperature sensor	
at coolant temperature 20 ±3 °C	2,2...2,7 kΩ
at coolant temperature 80 ±3 °C	0,3...0,36 kΩ
Intake air temperature sensor	
at air temperature 20 ±3 °C	2,2...2,7 kΩ
at air temperature 50 ±3 °C	0,8...1,2 kΩ
Fuel evaporation control valve	45 ± 20 Ω
Ignition coil	
Primary winding (terminal 15/1)	0,5 ± 0,1 Ω
Secondary winding (terminal 15/4)	–
Manufacturer: May and Christie	9,0 ± 1,0 kΩ
Primary winding (terminal 15/1)	6,0 ± 1,0 kΩ

The nominal values apply at: Idle speed, oil temperature > 60 °C or coolant temperature > 80 °C, no load switched on.

Status Inquiry	Nominal Values	Signal Comes From:
67 Engine speed		DME control unit
Idle speed	700 ± 50 rpm	Control by EML
Cut–out speed	6000 ± 40 rpm	Control by EML
17 Injection signal	3,8 ms ± 20 %	DME control unit
41 Load signal	2,0 ms ± 20 %	DME control unit
90 Ignition angle	15 ± 3 ° crankshaft angle (automatic transmission) 10 ± 3 ° crankshaft angle (manual transmission)	DME control unit
70 Oxygen sensor voltage	0,02...0,85 V; in the case of interruption or defective oxygen sensor = 0.45 V	Oxygen sensor
77 Intake air temperature	Dependent on ambient temperature, approx. – 50 ° C = break	Intake air temperature sensor
78 Engine temperature	Dependent on coolant temperature, approx. – 30 ° C = break	Engine temperature sensor
91 Voltage supply control unit	> 10 V	DME relay
37 Oxygen sensor heater	ON	DME control unit
92 Emission control	ON, when oxygen sensor at operating temp.	DME control unit
93 Mixture adaption II	Minus 48 to plus 32	DME control unit

Status Inquiry	Nominal Values	Signal Comes From:
94 Mixture adaption TL	Minus 16 to plus 16	DME control unit
16 Cylinder reference	ON	Cylinder reference sensor
36 Fuel evaporation control	As soon clock cycle active = OPEN	DME control unit
76 Co–potentiometer (without cat) CO volume (no status inquiry)	Basic setting = 1.25 V 0,7 ± 0,5 %	Co–potentiometer Measured ahead of the catalytic converter, – engine test, test step 09
62 Idle signal	ON	EML control unit
12 Full load signal	OFF, at full load = ON	EML control unit
73 Road speed	In km/h, with drive wheels raised, speed limited to max. 30 km/h	Instrument cluster
1 EKP relay	At start or during engine operation = ON	DME control unit
27 DME main relay	With ignition switched on = ON	DME control unit
63 Torque converter clutch	OFF	EGS control unit
64 Ignition angle intervention	OFF, briefly set to ON during gearshifts	EGS control unit
65 Drive range P/N	In selector lever position P or N = ON	Gear selector lever switch
81 DWA/ASC signal	OFF	DWA or ABS/ASC control unit
82 MSR signal	OFF	ABS/ASC/MSR control unit

Status Inquiry	Nominal Values	Signal Comes From:
73 Road speed	In km/h, with drive wheels raised, speed limited to max. 30 km/h	Instrument cluster
1 EKP relay	At start or during engine operation = ON	DME control unit
27 DME main relay	With ignition switched on = ON	DME control unit
63 Torque converter clutch	OFF	EGS control unit
64 Ignition angle intervention	OFF, briefly set to ON during gearshifts	EGS control unit
65 Drive range P/N	In selector lever position P or N = ON	Gear selector lever switch
81 DWA/ASC signal	OFF	DWA or ABS/ASC control unit
82 MSR signal	OFF	ABS/ASC/MSR control unit

Functional Description

The electronic throttle control system EML replaces the previous mechanical transmission and transfer linkage of the accelerator pedal angle between the accelerator pedal and throttle valve.

The most important components involved in the EML control unit are the pedal position sensor PWG and the EML throttle valves DK.

In addition to the transmission of the accelerator pedal angle from the accelerator pedal to the throttle valve, the EML system performs several other functions.

- Idle speed control
- Engine speed limitation
- Vehicle speed limitation
- Cruise control FGR
- Throttle valve opening in accordance with various characteristic progression curves which are selected from a pedal characteristic map corresponding to the drive status.
- Synchronisation of the throttle valves
- Interface for data exchange with other control units (e.g. ASC, DME and EGS).
- Safety test of important components used by the EML system
- Maintaining vehicle operability in the event of component failure by making available substitute values
- Self–diagnosis

All functions are monitored by the control unit program. This monitoring function also includes the program run of the control unit. The program run is controlled by the hardware. When the hardware detects a defect, the program run is terminated and then restarted.

Pedal Position Sensor PWG

The pedal position sensor is supplied by the EML control unit with a controlled voltage of 5 V. As regards electrical functions, the pedal position sensor contains a potentiometer, a switch for monitoring the potentiometer, and a switch for the external safety circuit.

Attention! The 5 V component supply voltage coming from the EML control unit is not completely short circuit–proof.

The potentiometer (voltage divider) of the pedal position sensor divides the voltage dependent upon the angle of rotation. The part voltage fed back by the potentiometer is converted in an analogue/digital converter into a form which can be processed by the microcomputer and converted into angle degrees. The valid angle range is from approx. minus 4.7° to approx. 100.8°.

The EML control unit performs a switching range check in that it compares the switch on point of the switch (typically value approx. 9ø PWG angle) with the angle setting of the pedal position sensor (PWG). If the EML control unit finds that the deviation is too great, the output is limited and the EML warning lamp lights.

The position "kick–down depressed" is derived from the PWG angle. When the EML control unit detects that the PWG angle is >70°, it sends the "kick–down" signal to the EGS control unit.

The switch for the external safety circuit opens at approx. 2.5°. The switch output is connected in series with a diode and arranged externally.

EML Throttle Valve DK

By way of a servo motor, the EML throttle valve is opened by the output stage in the EML control unit against the force of a spring. The output stage activates the servo motor with a square–wave voltage which has a fixed frequency. The different settings of the EML throttle valve are achieved by altering the ratio between the cut–in and cut–out duration.

When the EML control unit or the EML throttle valve are renewed or power is cut to the control unit, the information relating to the lower throttle valve (DK) limit stop is lost or incorrect. The EML control unit therefore has a teach–in feature which learns the throttle valve (DK) limit stop position once again. When learning this throttle valve (DK) limit stop, the EML system determines the relationship between the mechanical limit stop and the throttle valve (DK) potentiometer angle. The learning procedure assumes that the vehicle is in cruising mode, the detected water temperature is >60 °C and the engine speed is >1920 rpm. When all these conditions are fulfilled, the servo motor slowly moves the throttle valve against the lower mechanical limit stop. When this limit stop is reached, the EML system stores this teach–in value. This learning procedure is carried out during each vehicle start until the new value can be stored.

Throttle Valve Synchronisation

Synchronisation of both throttle valves is conducted at idling speed by the EML control unit. Both ti signals of the DME control unit are used for the synchronisation procedure. The EML control unit can set a maximum difference of ± 1.7°. It starts the synchronisation procedure when

– the EML coolant temperature sensor detects > 80 °C
– the engine speed is within the range from 600 rpm to 800 rpm
– the pedal position sensor (PWG) is not in operation
– 20 min have elapsed since the start
– the 2 small ti signals are applied by the DME control units and are plausible
– the EML warning lamp is not on
– the throttle valve (DK) limit stop has been learned

Synchronisation takes approx. 3 min and is repeated after approx. 20 min at the earliest. The condition "20 min have elapsed since the start" does not apply if the teach–in values have been lost by a longer interruption in the voltage supply (control unit, instrument cluster or battery disconnected).

Attention! The output stage of the EML control unit for the throttle valve (DK) actuator is not short circuit–proof.

By way of the throttle valve (DK) potentiometer, the EML control unit detects the position of the throttle valve and moves the throttle valve to the calculated position with the throttle valve actuator.

The throttle valve (DK) potentiometer (voltage divider) is supplied by the EML control unit with a controlled voltage of 5 V. It divides this voltage depending upon the angle of rotation. The part voltage fed back by the potentiometer is converted in an analogue/digital converter into a form which can be processed by the microcomputer and is further converted into angle degrees. The valid angle range is from approx. minus 3° to approx. 94°.

The EML control unit performs a switching range check in that it compares the cut–out point of the switch (approx. 17°) with the angle setting of the throttle valve (DK) potentiometer. If the EML control unit finds that the deviation is too great, the output is limited and the EML warning lamp lights.

A further test of both switches, i.e. PWG switch and DK switch, is the switch plausibility check. The control unit logic checks whether *one* of the following conditions is fulfilled:

– PWG switch (closes at approx. 9°)closed
– DK switch (opens at approx. 17°) closed
– cruise control FGR active

If one of the conditions is not fulfilled, all 3 cut–out paths which the EML control unit has available are activated.

The cut–out paths of the EML control unit all result in engine output limitation or deactivation of the throttle valve (throttle valve closed by actuator (servo motor) or by the return spring). The various cut–out paths are activated corresponding to the relevant defect in component operation. The control unit can activate 3 different cut–out paths:

- Output idle (LL) to the DME system. The idle (LL) is sent to the DME, this system deactivates cruise mode at a speed > approx. 1500 rpm.
- Deactivation of the opening branch of the throttle valve (DK) actuator output stage. When this opening branch is deactivated, the throttle valve can only be closed via the return spring or the closing branch of the throttle valve (DK) actuator output stage.
- Output limitation by limiting throttle valve (DK) opening range. The throttle valve (DK) opening speed is also limited when limiting DK opening.

A further cut–out path which passes the EML control unit is the external safety path. This sends idle signal (LL) to the DME 1...6 cylinder and 7...12 cylinder when the pedal value sensor is not operated and the brake pedal is depressed. The brake light test switch switches this ground signal through to the DME via the switch for the external safety path in the pedal position sensor (switch opens at approx. 2.5°).

Idle Control

When the pedal position sensor is not operated, the idle speed of the engine is kept constant to the nominal engine speed by way of controlled opening of the throttle valve. The working range of the idle controller depends upon the coolant temperature which is detected by the EML coolant temperature sensor. The nominal idle speed is influenced by 3 data variables:

- By the coolant temperature (the nominal idle speed is increased at low temperatures)
- By the setting of the gear selector lever in vehicles equipped with automatic transmission (the nominal idle speed is reduced with gear engaged and at low temperatures)
- By the operating status of the air conditioning system (the nominal idle speed is increased by approx. 100 rpm when the A/C compressor is switched on)

When starting the engine, the throttle valve opening is increased dependent on temperature to a start opening position.

The idle control system is active at an engine speed of <1600 rpm. Apart from this condition, either the engine speed must be <nominal speed, the road speed <8 km/h, or gear P or N engaged.

The throttle valve opening is increased depending upon the engine speed in order to reduce the vacuum in the intake pipe during cruising cut–out.

Engine Speed Limitation

The EML control unit limits the engine speed by closing the throttle valve opening before reaching the limit speed. The limit speed is 6000 rpm. To avoid control problems between the EML and DME systems when limiting the engine speed, in the case of the DME control unit the engine speed limitation is set to 6200 rpm. The EML control unit detects the engine speed by way of the engine speed signal (TD) from the DME control unit. Engine speed limitation by the EML control unit is only active when a drive range is engaged.

Road Speed Limitation

The EML control unit limits the road speed by closing the opening position of the throttle valves before reaching the maximum speed. If no road speed signal is received, the throttle valves are limited to 30° by way of the idle opening function.

Cruise Control FRG

The cruise control is activated by the FRG switch. The road speed signal (speed–A) from the instrument cluster is used for the cruise control system. The various switch positions of the FGR switch are detected by the EML control unit by way of different voltage values.

In addition to the various switch positions, the EML control unit also detects "interruption/break" and "short to ground" (♦D♦ status list).

The EML control unit assigns the following values to the various voltage values:

Voltage Value	Function	♦D♦ Display	Typical Value	Remarks
4,58 – 5 V	None	♦D♦ Interruption	5 V	FGR switched off
3,75 – 4,58 V	Off	♦D♦ Off	4,23 V	FGR switches off
2,90 – 3,75 V	Neutral position	♦D♦ Not operated	3,47 V	FGR switch not operated
2,00 – 2,90 V	Set/decelerate	♦D♦ Decelerate	2,64 V	Road speed is set/reduced
1,25 – 2,90 V	Call up	♦D♦ Call up	1,72 V	Reassume stored speed
0,41 – 1,25 V	Set/accelerate	♦D♦ Accelerate	0,86 V	Road speed is set/increased
0,00 – 0,41 V	None	♦D♦ Short to ground	0 V	FGR switched off

In the functions "set/accelerate", the cruise control system accelerates until the FGR switch is released. After releasing the FGR switch, the cruise control system maintains the speed constant to the achieved value plug 0.5 to 2km/h. The achieved value plus 0.5 to 2 km/h forms the nominal FGR speed value which is stored in the EML control unit (♦D♦ Status list). After ignition "OFF", the stored FGR speed value is 0 km/h once again.

In the functions "set/decelerate", the cruise control system reduces the speed until the FGR switch is released. After releasing the FGR switch, the cruise control system maintains the speed constant to the achieved value minus 0.5 to 2 km/h. The achieved value minus 0.5 to 2 km/h forms the nominal FGR speed which is stored in the EML control unit.

In the "call" function, the cruise control system sets the road speed to the nominal FGR speed value which is stored in the EML control unit.

In the "OFF" function, the cruise control system switches off smoothly. Cruise control is also deactivated or cannot be activated when one of the following cut–out conditions occurs.

- Brake is operated
- Clutch is operated (manual transmission
- Gear disengaged without clutch (manual transmission)
- Gear selector lever set in P or N range or detected by control unit as engaged (automatic transmission)
- Control unit detects road speed <36 km/h
- Actual speed is greater by 16 km/h or less by 8 km/h than the nominal FGR speed value.
- Vehicle acceleration greater than 1.5 m/s*s (speed increase greater than 5.4 km/h per second)
- External safety path sends ground and therefore idle signal (LL) to DME and EML systems.

If cruise control is deactivated by one of these conditions, it cannot be reactivated before the FGR switch has been set to "neutral position" and the cut–out condition no longer exists. This ensures that cruise control remains deactivated in the case of a permanently defective FGR switch (faulty control voltage).

In "neutral position" (FGR switch not operated), the function of the cruise control system last activated is retained.

All functions are activated by briefly pressing the switch. In the case of the "set/accelerate" and "set/decelerate" functions, by briefly pressing the switch (less than approx. 0.5s), the speed is increased/decreased by 1 km/h each time this switch is pressed when "set/accelerate" or "set/decelerate" is already active.

Interfaces to Other Control Units

General

The EML control unit sends data to and receives data from other control units via various lines (interfaces). In many cases, data transfer requires more than simple "ON"/"OFF" functions. Dynamic values must also be represented up to date. A square–wave voltage is therefore used for several lines to facilitate data exchange between EML, DME, EGS, ASC and the instrument cluster.

In vehicles with EML, the signals of the throttle valve (throttle switch) are not sent from the EML throttle valve to the EGS and DME control units. The information is routed from the EML control unit to the EGS and DME control units.

Interface to ASC

The EML control unit is linked via three lines to the ASC control unit. By way of the DKV signal (DKV = throttle valve setting) it informs the ASC control unit of the position of the throttle valve. The signal is a square–wave voltage with fixed frequency and variable pulse duty factor. Via the two other lines (DKR = throttle reduction, DKE = throttle increase), the ASC control unit informs the EML system when a change in the throttle angle is necessary. This status is also signalled to the EML control unit by way of a square–wave voltage with fixed frequency and variable pulse duty factor.

In order to facilitate external data exchange, when the ignition is switched on, synchronisation takes place between the EML and ASC control units on these three lines (DKV, DKR, DKE). If this synchronisation does not take place, then throttle valve intervention by the ASC control unit is also not possible.

Interface to EGS

The EGS control unit is informed by the EML as regards the position of the throttle valve via the DKV line (DKV = throttle valve setting). This line is the same as that leading to the AS control unit. Also the kick–down position of the pedal position sensor (PWG) is routed from the EML control unit to the EGS control unit. The EML system switches over to a corresponding characteristic map for the S–program of the EGS control unit. The information "program switch at S–program" comes directly from the program switch to the EML control unit.

Interface to DME

Direct data exchange between EML and DME takes place via seven lines. One line each is provided for the information "idle (LL)" and "full load (VL)" to the DME 1...6 cylinder and DME 7...12 cylinder. Three further lines receive the ti signal 1...6 cylinder and the tD signal from the DME control unit 1...6 cylinder. The ti signal 7...12 cylinder comes from the DME control unit 7...12 cylinder.

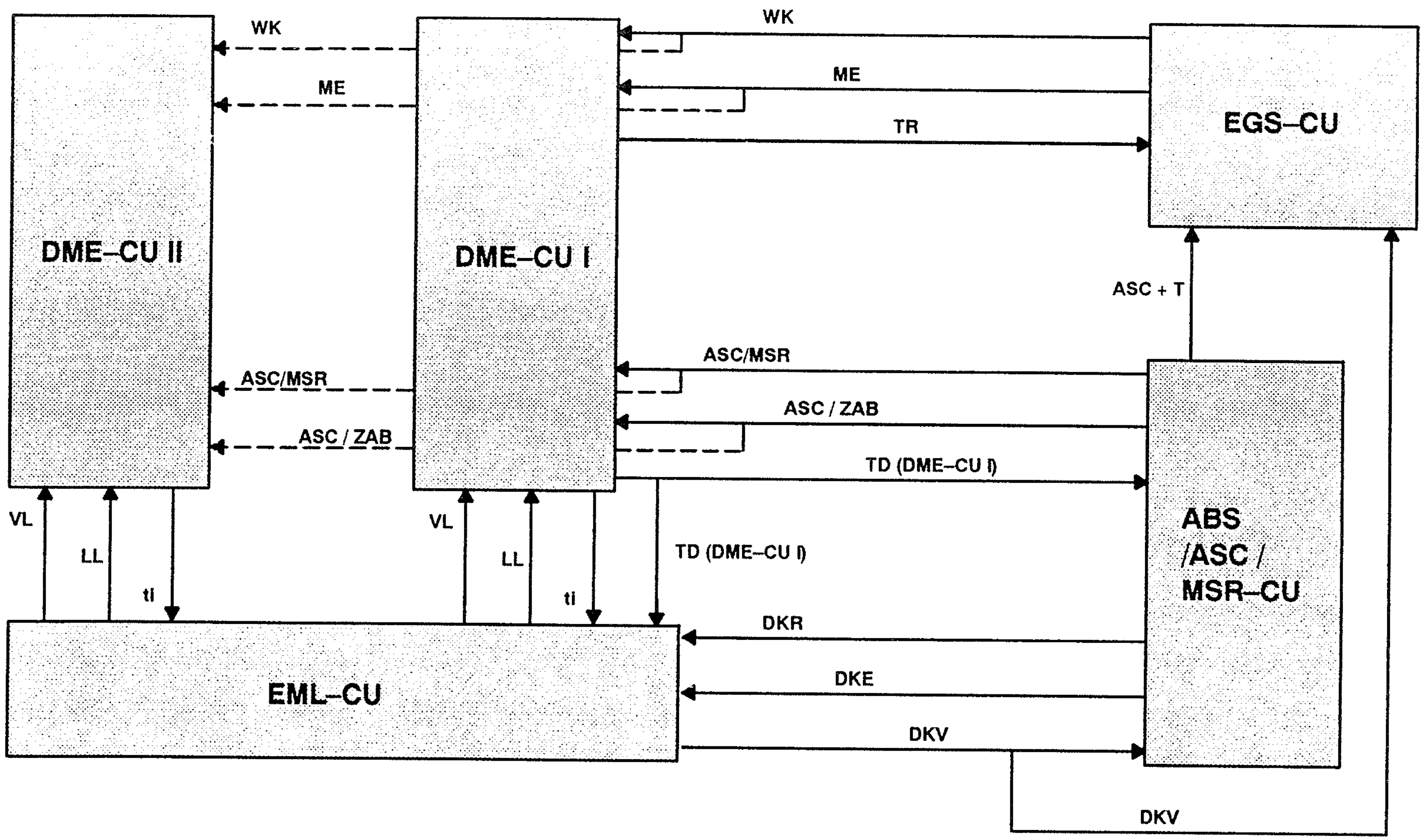
Interface to Instrument Cluster

The EML system has a line link (3 lines) to the instrument cluster to facilitate operation of the cruise control (FGR) and to maintain the stored information in the EML control unit.

The EML receives the current road speed from the instrument cluster by way of the speed–A signal. The EML memory receives a voltage supply in order to retain the stored information in the EML when the ignition is switched off.

The voltage supply is routed via the two special lamps (EML warning lamp) soldered in the instrument cluster. The two lamps are linked to the EML system via two separate lines.

Interconnected System of Signals to the Drive Control Units (CU)



P31 12 002

Providing Substitute Values/Self–Diagnosis

Engine Speed Signal

The EML derives the current engine speed from the speed signal (tD) which comes from the DME 1...6 cylinder. When this signal corresponds to an engine speed greater than 6900rpm, a speed of 4000rpm is used to calculate the characteristic map. The EML control unit recognizes the engine speed range >600 rpm as being valid for characteristic map calculations.

Road Speed Signal

The EML derives the current road speed from the road speed signal (speed–A signal) which comes from the instrument cluster. The EML recognizes the range from 0 to 280 km/h as being valid. When the signal corresponds to a speed in excess of 280 km/h, a speed of 32km/h is used for the function.

Engine Temperature

The EML detects the engine temperature with the aid of its own temperature sensor. The EML recognizes the range from –40 °C to 140 °C as being valid. A substitute value of approx. 40 °C is used for the function outside this range (♦D♦ Status list).

Safety Check

After switching on the ignition, the EML control unit checks its vital components (safety check) and causes the EML warning lamps to light for approx. 2 seconds. The purpose of this is to check whether the EML warning lamp can be set in the event of a defect. If a defect of priority 8 to 22 (♦D♦ # Notes) occurs, then the EML warning lamp lights. The EML system reduces the output if the EML warning lamp cannot be set due to a defect in the lamps or associated lines.

Table of Substitute Values

Not plausible	Substitute value
Engine speed signal	4000 rpm
Road speed signal (speed–A signal)	32 km/h
Engine temperature	approx. 40°C

Notes on BMW DIAGNOSE–SYSTEM

Defect Code Memory

The component functions and signals listed below are processed or controlled by the DML control unit, but not stored as a defect code in the case of defect:

- LL–signal (sends the "idle" information to the DME)
- VL–signal (sends the "full load" information to the DME)
- A/C switch
- A/C compressor clutch (lock sensor)
- Range selector switch ("P" or "N" position in automatic transmission)
- Clutch switch (manual transmission)
- Brake light switch
- External safety path

The external safety path cannot be read out in the status lists of the BMW DIAGNOSTIC SYSTEM.

Defect Code Priority

The EML control unit stores a maximum of 5 defect codes. When the defect code memory is full, a new defect code with higher priority displaces a lower priority defect code already stored (see ♦D♦ # Notes).

Status Monitoring

Since all inputs and outputs and their plausibilities are not covered by the defect code memory of the EML control unit, the status monitoring functions must be used to facilitate troubleshooting.

The nominal values and actual values indicated in the status lists need not necessarily agree exactly. The EML control unit stores a defect code if the deviation between the nominal value and the actual value is outside the permissible range.

For the permissible ranges, refer to the functional description or the troubleshooting description in the BMW DIAGNOSTIC SYSTEM. If the permissible range has been exceeded and the EML control unit has detected this as a defect, the component and its line connection can be checked without complex measurements with the aid of the actual value display.

Abbreviations

ABS	Anti–lock brake system
ASC	Automatic stability control
DME	Digital engine electronics
EGS	Electronic transmission control
EML	Electronic throttle control
MSR	Engine drag torque control
A	Output
E	Input
DK	EML throttle
DKV	Set throttle value
DKR	Throttle reduction
DKE	Throttle increase
HG	Manual transmission
ME	Engine intervention
PWG	Pedal position sensor
Poti	Potentiometer
TD	Engine speed signal (once per ignition)
TR	Engine speed signal (three times per crankshaft revolution)
TMOT	Engine temperature sensor
ti	Injection signal
LL	Idle signa
VL	Full load signal
WK	Torque converter clutch
ZAB	Ignition fade–out

Pin Assignments

Pin Assignments at the EML 12–cyl. Control Unit Connector X6004

Pin	Type	Description/Function	Connection	Type of signal	Test display	Measurement notes
1	A	5V (not short-circuit–proof)	PWG switch	approx. 5 V	None	
2	A	Ground (electronic ground)	Component ground PWG			
3		Not used				
4	E	DK angle reduction (DKR)	ASC control unit	Square–wave signal	Defect code is stored	♦M♦ 14 approx. 100Hz
5	A	Full load signal	DME control unit 1...6. cylinder	approx.0 V open	ON OFF	
6	A	Idle signal	DME control unit 1...6. cylinder	approx. 0 V open	ON OFF	
7	E	PWG setting	PWG potentiometer	approx. 0,4 V to 4 V	Winkel	
8	E	Road speed signal	Instrument cluster	Square–wave signal	None	♦M♦ 14
9	A	5V (not short–circuit–proof)	PWG potentiometer	approx. 5 V	None	
10	A	Ground (electronic ground)	Component ground DK – 7..12. cylinder			
11	A	5V (nicht Kurzschlußfest)	DK potentiometer DK 7..12. cylinder	approx. 5 V	None	
12	A	5V (nicht Kurzschlußfest)	DK potentiometer DK 1...6. cylinder	approx. 5 V	None	

BMW 8

Electronic Throttle Control (EML, 12–Cylinder)

Pin	Type	Description/Function	Connection	Type of signal	Test display	Measurement notes
13	E	Diagnosis	Diagnostic socket RxD			
14	E	Ground (Output ground)	Output ground DK 1...6. cylinder			
15	A	EML warning lamp	Instrument cluster	approx. 0 V	ON	*) With ignition switched off
*)	E	Voltage supply for defect code memory		approx. 12 V	None	
16	A	Drive throttle (DK) actuator	DK actuator DK – 7..12. cylinder	Square–wave signal	Defect code is stored	
17	A	Drive throttle (DK) actuator	DK actuator DK 1...6. cylinder	Square–wave signal	Defect code is stored	
18	E	Voltage supply plus	DME main relay 1...6. cylinder	On–board voltage	None	
19	E	Ground	Ground point			
20	A	Kick–down signal	EGS control unit	approx. 0 V approx. 12 V	ON OFF	
21		Not used				
22	E	DK angle increase (DKE)	ASC control unit	Square–wave signal	Defect code is stored	♦M♦ 14 approx. 100Hz
23	A	Drosselklappensignal (DKV)	ASC / EGS	Square–wave signal	Defect code is stored	♦M♦ 14 approx. 100Hz
24		Not used				
25	A	5 V (not short–circuit–proof)	DK – 1...6. cylinder (not used)	approx. 5 V		
26	A	Ground (electronic ground)	Component ground DK 1...6. cylinder			

BMW 8

Electronic Throttle Control (EML, 12–Cylinder)

Pin	Type	Description/Function	Connection	Type of signal	Test display	Measurement notes
27	E	Throttle position	DK potentiometer DK 1...6. cylinder	approx. 4,6 V to 1 V	Angle	
28	E	Throttle position	DK potentiometer DK 7..12. cylinder	approx. 4,6 V to 1 V	Angle	
29	A	5 V (not short–circuit–proof)	DK – 1...6. cylinder (not used)			
30	E	Ground (output ground)	Output ground DK – 7..12. cylinder			
31	A	Ground (electronic ground)	TMot/FGR switch			
32	A	Idle signal	DME control unit 7..12. cylinder	approx. 0 V open	ON OFF	
33	A	Full load signal	DME control unit 7..12. cylinder	approx. 0 V open	ON OFF	
34	A	Drive throttle (DK) actuator	DK actuator DK – 7..12. cylinder	Square–wave signal	Defect code is stored	
35	A	Drive throttle (DK) actuator	DK actuator DK 1...6. cylinder	Square–wave signal	Defect code is stored	
36	E	Voltage supply plus	DME main relay 7..12. cylinder	On–board voltage	None	
37	E	Ignition ON terminal 15	DME main relay 7..12. cylinder			
38	E	Throttle 17° switch	DK switch DK 1...6. cylinder	approx. 5 V open	ON OFF	
39		Not used				

Pin	Type	Description/Function	Connection	Type of signal	Test display	Measurement notes
40	E	Throttle 17° switch	DK switch DK – 7..12. cylinder	approx. 5 V open	ON OFF	
41	E	A/C compressor ON	Lock sensor	On–board voltage open	ON OFF	
42	E	P and N identifier (EGS)	Gear selector lever switch	approx. 12 V open	ON OFF	
43	E/A	FGR identifier	FGR switch	approx. 0 V to 5 V	Detected position	
44	E	A/C switch	A/C relay/DME	approx. 12 V open	ON OFF	
45	E/A	Engine–coolant temperature	TMot EML sensor	approx. 0 V to 5 V	°C	
46	E	PWG 9° switch	PWG switch	approx. 5 V open	ON OFF	
47	E	Engine speed signal (TD)	DME control unit 1...6. cylinder	Square–wave signal	None	
48		Not used				
49	E	Injection signal (ti)	DME control unit 1...6. cylinder	Square–wave signal	Defect code is stored	
50	E	Injection signal (ti)	DME control unit 7..12. cylinder	Square–wave signal	Defect code is stored	
51		Not used				
52	E	S–program identifier (EGS)	EGS control unit	ca. 0 V open	ON OFF	

Pin	Type	Description/Function	Connection	Type of signal	Test display	Measurement notes
53	E	Brake light switch	Brake light switch	approx. 12 V	ON	
				open	OFF	
54		Not used				
55	E/A	Diagnosis	Diagnostic socket TxD			

Adapters

Component	Connector No.	Description	Adapternumber	
Control unit	X 6004	55–pole	Connection lead, periphery	HWB 81 12 9 428 907
		55–pole	Connection lead, control unit	HWB 81 12 9 428 908
		55–pole	Universal adapter	HWB 81 12 9 425 091
EML safety path		Safety path testing	EML adapter	Cartool 12 7 010

Troubleshooting

Notes

– Relevant safety codes and accident prevention regulations must be observed when carrying out all tests and work on the engine electronic system. Do not touch an EML throttle valve when it is in operation.

Important!

Wherever possible, the battery and the instrument cluster should not be disconnected otherwise all defect codes and teach–in values stored in the EML control unit will be deleted (see ♦D♦ # Notes).

Disconnect control unit from the wire harness **only** when the ignition is switched off

Attention! The stage outputs of the EML control unit for the throttle (DK) actuators are not short–circuit–proof. In the same way, the 5 V component supply voltage coming from the EML control unit is not absolutely short–circuit–proof.

Organisation of the Defect Code Pages on the Display Screen

– **Defect location:** The defect can be in the vicinity of the component, the associated wires or in the control unit. The number before the defect code indicates the priority of the defect code (♦D♦ # Notes).
– **Type of defect:** Range transgression or illogical (wrong sequence) functions are indicated.
– **Detected at:** Additional defect information on the operating statuses during defect detection (compare values with substitute values). This information can provide an indication relating to plausibility (correct sequence), shorts, breaks and range transgressions.

EML Warning Lamp

After switching on the ignition, EML control unit checks its vital components (safety check) and causes the EML warning lamp to light for approx. 2 seconds. The EML reduces the output if the EML warning lamp cannot be set due to a defect in the lamps or associated wires. The warning lamp continues to light if one of the defects 8 to 22 occurs after the safety check (♦D♦ # Notes).

Defect Code Table

♦D♦ Defect code memory – stored defect codes

One or several defect codes stored → troubleshooting in accordance with BMW DIAGNOSTIC SYSTEM.

Note: This diagnostic procedure applies to the electrohydraulic transmission 4 HP–24 EH (M 70) for the 8 Series, in conjunction with the control units GS 1.21, GS 1.22, GS 1.26 and GS 1.27. These control units differ in the use of the A–button (US), of the P/N shift–lock and P/N shift–lock with ASC+T

Control unit	ASC+T	P/N shift-lock	US version (A-button)
GS 1.21	possible	no	no
GS 1.22	possible	yes	no
GS 1.26	no	no	yes
GS 1.27	yes	yes	yes

Functional Description

The transmission control unit communicates with the following components:

- Gear selector lever switch: L1, L2, L3, L4
- Program switch: E, M, S, (US version: A, M)
- Instrument cluster
- Kick–down switch (via EML control unit)
- Brake light switch (with P/N shift–lock only)
- Lifting solenoid P/N shift–lock (with P/N shift–lock only)
- Solenoid valves: MV 1, MV 2, MV–WK
- Pressure regulator
- Road speed sensor
- DME control unit
- EML control unit

Functional Requirements

The control unit sends the shift pulses for upshifts and downshifts to the transmission control unit (solenoid valves, modulation pressure) and decides upon the corresponding torque converter clutch engagement taking comfort and safety into consideration. For this purpose, it processes in a computer program the input variables such as engine speed, output speed, injection signal, throttle (accelerator pedal) position, kick–down switch, drive program and selector lever position.

Torque Converter Bypass Control

The torque converter clutch (WK) is activated dependent upon the accelerator pedal position, transmission output speed, drive program as well as the engaged gear (only in 3rd and 4th gear). The torque converter clutch opens in coasting mode.

Adaptive Gearshift Characteristic Control

When pulling a trailer or driving on steep gradients, the changed acceleration capacity of the vehicle is evaluated by the control units. For this purpose, the control unit selects (adapts) suitable gearshift programs to avoid pedal shifts. The changed shifting points are intentional and normal.

Gearshift Comfort Control

The gearshift quality is controlled by way of the modulation pressure and the engine intervention function (torque reduction by retarding the ignition timing). The main pressure is constantly calculated by way of an algorithm with tuning–specific parameters (engine torque, differential speed [engine speed difference before and after shifting], output speed and constant pressure component).

Drive Programs

The shift points for the E (Economy) and S (Sports) program as well as for kick–down are stored in the form of characteristic curves in the control unit. Selection can be made with the program switch between these programs and manual shifting.

The program switch is designed as a push button connected with respect to ground.

ECE version: 3 programs selected via push button (E/S/M).

US version: 2 programs selected via push button (A/M).

- E–program: Characteristic curves consumption and comfort–oriented.
- S–program: Characteristic curves performance–oriented.
- M–program: Manual drive program
  Assignment of the gears to the selector lever position in the manual drive program:

Position:	→	D	3	2	1
Gear:	→	3	3	2	1

- A–program (US only):
  Characteristic curves in position "D" consumption and comfort–oriented.
  Characteristic curves in position "3" and "2" performance–oriented.

Drive program display: The drive programs are displayed in the instrument cluster, coded via the lines L6 (E) Pin 10 and L7 (M) Pin 12. The line L5 (S) is only evaluated by the EML control unit and not by the instrument cluster.

Instrument cluster	L6 (E) Pin 10	L7 (M) Pin 12
E	low	high
M	high	low
S	high	high
–	low	low

Safety Features

Manually engaged downshifts are not performed at high speeds. At a speed above approx. 8 km/h, the reverse lock prevents reverse gear being shifted hydraulically.

By way of plausibility checks and checking the line connections for shorts or breaks, the control unit can detect and store defects (see troubleshooting).

In the event of failure of the transmission control or when defects are detected which lead to critical driving situations (e.g.: impermissible downshift), the mechanical emergency program is activated, i.e. the solenoid valves in the transmission control unit are switched off and the failure display activated. The main pressure assumes its maximum value. The reverse lock and P/N shift–lock, if installed, of the selector lever are not active.

4th gear is engaged in the event of failure of the control unit during driving. After restarting the emergency program, the hydraulic control ensures the vehicle can only be driven in 3rd gear or reverse, thus remaining operable but with restrictions. The self–test of the entire safety hardware is initiated during each new start.

Fault Display

Activation of the fault display is switched by the control unit at Pin 33. Normally (engine running, no fault), the level is referred to ground. If there is a break or a short to plus on the wire from the instrument cluster, the error message "transmission" is indicated as of an engine speed greater than 500 rpm.

Shift-lock

It is only possible to shift out of the positions "P" or "N" after evaluation of the signals

– brake
– road speed
– engine speed
– time.

The selector lever is locked when no brake signal is detected with the engine running and the vehicle stationary. A time delay function of approx. 0.5s is used for operation under winter conditions. The brake switch is designed as a normally open contact referred to 12 V. The shift lever is locked by way of a solenoid on the selector lever switch.

Switching Logic of the Solenoid Valves

	Solenoid valve 1		Solenoid valve 2	
	Pin 48 +	(Pin 54 –)	Pin 43 +	(Pin 54 –)
1st gear	0 V		12 V	
2nd gear	12 V		12 V	
3rd gear	12 V		0 V	
4th gear	0 V		0 V	

Switching Logic of the Position Inputs

Coding table for the gear switch (switch referred to 12 V).
"1" corresponds to approx. 12 V and "0" to approx. 0 V.

	Conductors			
	L1	L2	L3	L4
Selector lever position	Pin 23	Pin 26	Pin 8	Pin 33
P	1	1	0	0
R	1	0	0	1
N	0	1	1	0
D	0	0	0	1
3	0	0	1	0
2	1	0	0	0
1	1	0	1	0

Notes on the BMW DIAGNOSTIC SYSTEM

The diagnostic software of the EGS control units will be modified and improved.

For users of the BMW service tester, the "new" diagnostic procedure differs primarily in the more convenient, uniform operator structure. In addition to more extensive defect detection functions, component activation is also improved. It is no longer necessary that the selector lever position "N" or "P" is detected in order to initiate the diagnostic procedure.

In the following description, the different software statuses are identified by the terms "diagnosis version 1" and "diagnosis version 2". Where not otherwise specified, both versions do not differ.

Conditions for Initiating the Diagnostic Procedure

- Ignition on
- n–ab <300 rpm
- "Diagnosis version 1": Selector lever position "P" or "N"
- "Diagnosis version 2": Any selector lever position

Select EH transmission EGS with ♦D♦ 3

After successful set–up of communication between the tester and control unit, the EGS control unit is in diagnostic mode and behaves as follows:

- Transmission relay in control unit is energized (ground supply for solenoid valves and pressure regulator is active)
- All solenoid valves are switched off (control unit does not switch plus)
- The lifting solenoid P/N shift–lock is switched off (control unit does not switch plus)
- A pressure regulator current of 200 mA is applied
- The condition n–ab <300 rpm no longer applies.

Conditions for Component Activation

- Data transfer OK.
- Selector lever in position P or N
- Output speed less than 300 rpm
- "Diagnosis version 2": If the message "current defect detected and stored" is indicated, first print out the contents of the defect code memory then clear the defect code memory and repeat component activation.

Abbreviations:

A	Output
EGS	Electronic transmission control
AG	Automatic transmission
Brs	Brake signal
DK	Throttle valve
DKV	Set throttle angle
DME	Digital motor electronics
DR	Pressure regulator
DZF	Output speed sensor
E	Economy
E	Input
KD	Kick–Down
L x	Conductor x
M	Manual
ME	Engine intervention/ignition angle intervention
MV	Solenoid valve
n-ab	Output speed
n-mot	Engine speed
PWM	Pulse width–modulated
RxD	A link initiation
S	Sports
SG	Control unit
TD	Ignition measuring signal (speed diagnosis)
ti	Injection signal (time injection)
TR	Crankshaft reference (once per revolution) (tacho rotati-on)
TxD	Diagnostic link telegram
U-Batt	Battery voltage
U-Vers	Supply voltage
WK	Torque converter clutch

Pin Assignments GS 1.21 / 1.22 / 1.26 / 1.27

Pin	Type	Description / function	Connection	Type of signal	Test display	Notes
1	A	Plus supply, solenoid valves and pressure regulators	Gearshift unit	active high	Component activation	This supply is switched off during mechanical emergency program, i.e. transmission relay in control unit deenergizes.
2	E	Kick-Down	EML	active low	Status display	
4	E/A	S-program	Program button, EML	active low	Status display	Only connection to EML in US version (GS 1.26 / 1.27)
5	E	Ground control unit				
6	A	Ground program button	Program button			
8	E	Output speed n–ab (+)	Gearshift unit		Status display	
10	E	A–program button	Program button	active low	Status display	Only in GS 1.26/1.27
11	E	Fuel consumption display (ti signal)	DME control unit 1, EKM		Status display	
12	E/A	TxD				
13	E	RxD				
14	E/A	E–program, or A–program	Program button, instrument cluster	active low	Status display	
15	E/A	M–program	Program button, instrument cluster	active low	Status display	
16	A	Solenoid valve 1	Gearshift unit	active low	Component activation	
17	A	Solenoid valve 2	Gearshift unit	active low	Component activation	

Pin	Type	Description / function	Connection	Type of signal	Test display	Notes
18	E	Position switch L1	Selector lever	active high	Status display	
19	E	Terminal 31, ground pressure regulator and solenoid valves				
20	A	Lifting solenoid shift–lock	Selector lever	active low	Component activation	Only in GS 1.22, 1.27
21	E	Engine speed n–mot (TR signal)			Status display	
22	A	Solenoid valve pressure regulator	Gearshift unit	Current control	Component activation	
23	A	Shield speed sensor		Ground		
24	A	Engine intervention	DME control unit	active low	Component activation	
25	A	Solenoid valve torque converter clutch	Gearshift unit	active low	Component activation	
26	E	Brake light switch		active high		Only in GS 1.22, 1.27
27	E	Output speed n–ab (–)	Gearshift unit		Status display	
28	E	Position switch L2	Selector lever	active high	Status display	
29	E	Position switch L3	Selector lever	active high	Status display	
30	E	Position switch L4	Selector lever	active high	Status display	
31	E	ASC active	ABS/ASC+T	active low		Only in GS 1.27
32	E	Set throttle signal	EML control unit	Pulse width–modulated	Status display	Correspond to accelerator pedal position
33	A	Fault display	Instrument cluster	active high		
34	E	Voltage supply terminal 30				Continuous pulse supply
35	E	Voltage supply from relay 2				Holding circuit DME

Adapters

Component	Connector No.	Description	Adapternumber	
Control unit	X 8500	35–pole	Universal adapter	HWB 81 12 9 425 091
			Connection lead for control unit	HWB 81 12 9 425 093
			Connection lead for periphery	HWB 81 12 9 425 0 92

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- The diagnosis versions can be distinguished by the display of the BMW service tester
- Diagnosis version 1:→ 3–digit selection numbers
- Diagnosis version 2:→ 1–digit selection numbers

Fuses

Fuse	Fault when fuse is defective
No. F17	Engine does not start (start interlock relay) diagnostic procedure not possible
No. F12	Reversing lamp failure

Explanation of Defect Code Memory

The EGS control unit can detect 22 different defect codes with a series of additional information. It has room for 5 defect locations and their additional information in its defect code memory.

- **Defect location:** Here, the defect text from the table of defect codes is supplemented by the corresponding pin numbers of the control unit.
- **Type of defect:** Indicated here is whether the defect is a break, a short to plus, a short to ground or a plausibility error.
- **Defect currently set** ("Diagnosis version 2"): The response of the control unit to this statement can be in the affirmative, negative or conditionally affirmative or conditionally negative. In the case of a restricted reply to the question as to whether the defect code is currently set, the additional information "statement not sure since test condition is not currently fulfilled" appears. This means that the control unit cannot currently check the indicated defect code since, for example, the component is not active. However, the defect code was set or not set the last time the test condition was fulfilled.
- **Intermittent defect** ("Diagnosis version 2"): The reply to this statement is in the affirmative when the defect disappeared at least once and the reappeared. Intermittent defect codes additionally indicated how often the defect disappeared and reappeared.

Defect Codes which can be detected and stored by the control unit

Selection No.	Defect location	Pins at control unit	
01	Transmission relay	1	→ Defect code 1
02	Check sum eprom	–	→ Defect code 2
03	Kickdown switch	2	→ Defect code 3
04	Program switch	4, 14, 15	→ Defect code 4
05	Throttle valve signal, accelerator pedal signal	32	→ Defect code 5
06	Solenoid MV 1	16	→ Defect code 6
07	Solenoid MV 2	17	→ Defect code 7
08	MV 1, MV 2	16, 17	→ Defect code 8
09	Lifting magnet P/N lock	20	→ Defect code 9
10	MV 1, lifting magnet P/N lock	16, 20	→ Defect code 10
11	MV 2, lifting magnet P/N lock	17, 20	→ Defect code 11
12	MV 1, MV2, lifting magnet P/N lock	1, 16, 17, 20	→ Defect code 12
13	Conv. lockup clutch solenoid	25	→ Defect code 13
14	MV 1, MV-WK	16, 25	→ Defect code 14
15	MV 2, MV-WK	17, 25	→ Defect code 15
16	MV 1, MV 2, MV-WK	16, 17, 25	→ Defect code 16
17	Lifting magnet P/N lock, MV–WK	20, 25	→ Defect code 17
18	MV 1, Lifting magnet P/N lock, MV–WK	1, 16, 20, 25	→ Defect code 18
19	MV 2, Lifting magnet P/N lock, MV–WK	1, 17, 20, 25	→ Defect code 19
20	Power supply for MV and DR	1	→ Defect code 20
21	Speed signal TR	21	→ Defect code 21
22	Pressure regulator DR	22	→ Defect code 22
23	Ignition timing tap	24	→ Defect code 23
24	Speed sensor n–ab, downshift protection	8, 27	→ Defect code 24
25	Overrev guard		→ Defect code 25
26	Injection signal ti	11	→ Defect code 26
27	SPEED SENSOR or TORQUE CONVERTER		→ Defect code 27
28	Fault display		→ Defect code 28
29	Check sum program island		→ Defect code 29
30	Battery voltage		→ Defect code 30
31	Selector lever position		→ Defect code 31

Defect codes which can be defined by way of status monitoring but do not appear in the defect code memory

No kick–down shifts	→ Defect code 200
Only kick–down shifts	→ Defect code 201
No S–program	→ Defect code 202
No M–program	→ Defect code 203
No program switchover	→ Defect code 204
No engine intervention	→ Defect code 205
Incorrect fault display	→ Defect code 206

Possible causes if diagnostic procedure cannot be initiated

Diagnostic link defective	→ Defect code 300
Power supply to control unit defective	→ Defect code 301
Selector lever position	→ Defect code 302
Selector lever position not detected	→ Defect code 303

Defect Code 1

♦D♦ Defect code memory: 1 Transmission relay

Explanation: This defect code is stored when the relay in the transmission control unit cannot energize or deenergize. Activation or deactivation of the solenoid valves no longer possible.

Effect: Mechanical emergency program

Possible causes: Relay sticking

Troubleshooting: Replace control unit

Defect Code 2

♦D♦ Defect code memory: 2 Check sum eprom

Explanation: This defect code is stored when the checksum no longer agrees with the original. Diagnostic procedure not possible for current defect.

Effect: Mechanical emergency program

Possible causes: Change in transmission program (software)

Troubleshooting: Replace control unit.

Defect Code 3

♦D♦ Defect code memory: 3 Kickdown switch

Explanation: This defect code is stored when ground is constantly applied at Pin 2. As a result, only kick–down shifts are performed.

Effect:

"Diagnosis version 1": Only kick–down shifts.

"Diagnosis version 2": Diagnosis shifts are suppressed.

Possible causes: Line to control unit Pin 2 or KD switch defective.

Troubleshooting: As displayed on screen.

Defect Code 4

♦D♦ Defect code memory: 4 Program switch

Explanation: This defect code is stored when, at the same time, two or three of the wires to the control unit Pins 4 (S–program), 14 (E–program), 15 (M–program) are applied to ground. As a result, no program switchovers are possible.

Effect: The E–program is set by the control unit.

Possible causes: Wires from the program switch to the EGS control unit or to the instrument cluster defective, or program switch defective.

Note: Observe display in instrument cluster during troubleshooting.

Troubleshooting: As displayed on screen.

Defect Code 5

♦D♦ Defect code memory: 5 Throttle valve signal, accelerator pedal signal

Explanation: This defect code is stored when the control unit receives no signal from the EML control unit relating to the set throttle angle. As a result, no braking effect when coasting and upshift too early.

Effect:
"Diagnosis version 1": Incorrect shifting points
"Diagnosis version 2": Mechanical emergency program

Possible causes: Wire to Pin 32 or EML control unit defective.

Troubleshooting: Check wires to EML and ASC control unit in accordance with schematics.

Defect Code 6

♦D♦ Defect code memory: 6 Solenoid MV 1

Explanation: This defect code is stored when the wire from the control unit Pin 16 to MV 1 has a break or a short to ground.

Effect: Mechanical emergency program

Possible causes: Wire or winding of the solenoid valve MV 1 defective.

Troubleshooting: As displayed on screen.

Defect Code 7

♦D♦ Defect code memory: 7 Solenoid MV 2

Explanation: This defect code is stored when the wire from the control unit Pin 17 to MV 2 has a break or a short to ground.

Effect: Mechanical emergency program

Possible causes: Wire or winding of the solenoid valve MV 2 defective.

Troubleshooting: As displayed on screen.

Defect Code 8

♦D♦ Defect code memory: 8 MV 1, MV 2

Explanation: This defect code is stored when the wires from the control unit Pin 16 and Pin 17 to MV 1 and MV 2 are interconnected or have a short to ground.

Effect: Mechanical emergency program

Possible causes: Wires or winding of the solenoid valves MV 1 and MV 2 defective.

Troubleshooting: As displayed on screen.

Defect Code 09

♦D♦ Defect code memory: 09 Lifting magnet P/N lock

Explanation: This defect code is stored when the wire from the control unit Pin 20 to the lifting solenoid shift–lock has a break or short to ground or is linked to MV 1 or MV 2.

Effect: Mechanical emergency program

Possible causes: Wire or winding of the lifting solenoid shift–lock defective.

Troubleshooting: As displayed on screen.

Defect Code 10

♦D♦ Defect code memory: 10 MV 1, lifting magnet P/N lock

Explanation: This defect code is stored when the wires from the control unit Pin 16 and Pin 20 to MV 1 and lifting solenoid shift–lock are interconnected or have a short to ground.

Effect: Mechanical emergency program

Possible causes: Wires or winding of the solenoid valve MV 1 and lifting solenoid shift–lock defective.

Troubleshooting: As displayed on screen.

Defect Code 11

♦D♦ Defect code memory: 11 MV 2, lifting magnet P/N lock

Explanation: This defect code is stored when the wires from the control unit Pin 17 and Pin 20 to MV 2 and lifting solenoid shift–lock are interconnected or have a short to ground.

Effect: Mechanical emergency program

Possible causes: Wires or winding of the solenoid valve MV 2 and lifting solenoid shift–lock defective.

Troubleshooting: As displayed on screen.

Defect Code 12

♦D♦ Defect code memory: 12 MV 1, MV 2, lifting magnet P/N lock

Explanation: This defect code is stored when the wires to the specified valves have a break or short to ground. It is also set when one or several solenoid valves have a short to plus or a short among each other.

Effect: Mechanical emergency program

Possible causes: Wires defective or winding short of solenoid valves.

Troubleshooting: As displayed on screen.

Defect Code 13

♦D♦ Defect code memory: 13 Conv. lockup clutch solenoid

Explanation: This defect code is stored when the wire from the control unit Pin 25 to the MV–WK has a break or a short to ground.

Effect: Mechanical emergency program

Possible causes: Wire or winding of the MV–WK defective

Troubleshooting: As displayed on screen.

Defect Code 14

♦D♦ Defect code memory: 14 MV 1, MV-WK

Explanation: This defect code is stored when the wires from the control unit Pin 16 and Pin 25 to MV 1 and MV–WK are interconnected or have a short to ground.

Effect: Mechanical emergency program

Possible causes: Wires or winding of MV 1 or MV–WK defective.

Troubleshooting: As displayed on screen.

Defect Code 15

♦D♦ Defect code memory: 15 MV 2, MV-WK

Explanation: This defect code is stored when the wires from the control unit Pin 17 and Pin 25 to MV 2 and MV–WK are interconnected or have a short to ground.

Effect: Mechanical emergency program

Possible causes: Wires or winding of MV 2 or MV–WK defective.

Troubleshooting: As displayed on screen.

Defect Code 16

♦D♦ Defect code memory: 16 MV 1, MV 2, MV-WK

Explanation: This defect code is stored when the wires from the control unit Pin 16, Pin 17 and Pin 25 to MV 1, MV 2 and MV–WK are interconnected or have a short to ground or in the case of a winding short in lifting solenoid shift lock.

Effect: Mechanical emergency program

Possible causes: Wires or winding of MV 1, MV 2, MV–WK or lifting solenoid shift–lock defective.

Troubleshooting: As displayed on screen.

Defect Code 17

♦D♦ Defect code memory: 17 Lifting magnet P/N lock, MV–WK

Explanation: This defect code is stored when the wires from the control unit Pin 20 and Pin 25 to the lifting solenoid shift–lock and MV–WK are interconnected or have a short to ground.

Effect: Mechanical emergency program

Possible causes: Wires or winding of lifting solenoid shift–lock and MV–WK defective.

Troubleshooting: As displayed on screen.

Defect Code 18

♦D♦ Defect code memory: 18 MV 1, Lifting magnet P/N lock, MV-WK

Explanation: Explanation: This defect code is stored when the wires to the specified valves have a break or a short to ground. It is also set when one or several solenoid valves have a short to plus or a short among each other.

Effect: Mechanical emergency program

Possible causes: Wires defective or winding short of solenoid valves.

Troubleshooting: As displayed on screen.

Defect Code 19

♦D♦ Defect code memory: 19 MV 2, Lifting magnet P/N lock, MV-WK

Explanation: This defect code is stored when the wires to the specified valves have a break or a short to ground. It is also set when one or several solenoid valves have a short to plus or a short among each other.

Effect: Mechanical emergency program

Possible causes: Wires defective or winding short of solenoid valves.

Troubleshooting: As displayed on screen.

Defect Code 20

♦D♦ Defect code memory: 20 Power supply for MV and DR

Explanation: This defect code is stored when all solenoids are interconnected or have a break, or when one or several solenoid valves or the pressure regulator or the voltage supply have a short to plus.

Effect: Mechanical emergency program

Possible causes: Wires, windings of solenoid valves or voltage supply at Pin 1 defective.

Troubleshooting: As displayed on screen.

Defect Code 21

♦D♦ Defect code memory: 21 Speed signal TR

Explanation: This defect code is set when the control unit receives no engine speed signal.

Effect: Mechanical emergency program

Possible causes: Wire to Pin 21 defective or wire to DME control unit Pin 3 defective.

Troubleshooting: As displayed on screen.

Defect Code 22

♦D♦ Defect code memory: 22 Pressure regulator DR

Explanation: This defect code is stored when the wire from the control unit Pin 22 to the pressure regulator in the transmission control unit has a break or a short to plus or ground.

Effect: Mechanical emergency program

Possible causes: Wire or winding of pressure regulator defective.

Troubleshooting: As displayed on screen.

Defect Code 23

♦D♦ Defect code memory: 23 Ignition timing tap

Explanation: This defect code is stored when the wire from the control unit Pin 24 has a break or is applied to ground for longer than 3 seconds. it can also be set when the wires to the program switch Pin 4, 14 or 15 have a short to U–batt.

Effect: Mechanical emergency program

Possible causes: Wire defective

Troubleshooting: As displayed on screen and observe status monitoring of the program switch. If display incorrect, check wires from Pin 4, 14 and 15 in accordance with schematic for a short or break.

Defect Code 24

♦D♦ Defect code memory: 24 Speed sensor n–ab, downshift protection

Explanation: This defect code is stored when the output speed fails at high engine speeds and the downshift protection facility is active.

Effect: Mechanical emergency program

Possible causes: Wire from control unit Pin 8 to speed sensor or engine speed sensor defective.

Troubleshooting: As displayed on screen.

Defect Code 25

♦D♦ Defect code memory: 25 Overrev guard

Explanation: This defect code is stored when the DME does not cut–out at maximum engine speed.

Possible causes: DME control unit defective.

Troubleshooting: As displayed on screen.

Defect Code 26

♦D♦ Defect code memory: 26 Injection signal ti

Explanation: This defect code is stored when the increase in engine speed depending on the throttle position is not plausible.

Effect: Mechanical emergency program

Possible causes: Wire to Pin 11 or injection signal from DME defective.

Troubleshooting: As displayed on screen.

Defect Code 27

♦D♦ Defect code memory: 36 SPEED SENSOR or TORQUE CONVERTER

Explanation: This defect code is stored when, at engine speeds above 3000 rpm, the control unit receives no output speed signal in a drive range (R, D, 3, 2, 1).

Effect: Mechanical emergency program

Possible causes: Wire from the control unit Pin 8 and 27 to speed sensor, engine speed sensor, torque converter or clutch defective.

Troubleshooting: As displayed on screen.

Defect Code 28

♦D♦ Defect code memory: 28 Fault display

Explanation: This defect code is stored when the fault display wire has a short to plus or ground.

Effect: No or incorrect fault display

Possible causes: Wire from Pin 33 to instrument cluster defective.

Troubleshooting: The fault display is activated by the control unit at Pin 33. Normally (engine running, no fault), the level is referred to ground. If the line has a break or a short to plus the instrument cluster sends the error message ”transmission” at an engine speed greater than approx. 500 rpm. Check wire in accordance with schematic.

Defect Code 29

♦D♦ Defect code memory: 29 Check sum program island

Explanation: This defect code is stored when a change occurs in a part of the memory area.

Effect: Mechanical emergency program

Possible causes: Change in transmission program (software).

Troubleshooting: Replace control unit.

Defect Code 30

♦D♦ Defect code memory: 30 Battery voltage

Explanation: This defect code is stored when the on–board voltage is within the range between 8.0 V and 9.5 V at engine speeds greater than 1600 rpm.

Effect: Mechanical emergency program

Possible causes: Alternator or battery defective.

Troubleshooting: Check voltage supply.

Defect Code 31

♦D♦ Defect code memory: 31 Selector lever

Explanation: This defect code is stored when the engine can be started although there is no plus at Pin 28 (identifier position P or N).

Effect: Vehicle can be started with gear range engaged.

Possible causes: Wire to Pin 28 has a break or start relay defective.

Troubleshooting: Check wire in accordance with schematic.

Defect Code 200

Explanation: No kick–down shifts are performed

Possible causes: Wire from EML control unit to EGS control unit Pin 2 has a break or a short to plus, or pedal position sensor defective.

Troubleshooting: ♦D♦ Status monitoring kick–down switch. If display incorrect, check wire to Pin 2 or pedal position sensor.

Defect Code 201

Explanation: Only kick–down shifts are performed.

Possible causes: The wire from the EML control unit to control unit Pin 2 has a short to ground or pedal position sensor or EML control unit defective.

Troubleshooting: ♦D♦ Status monitoring kick–down switch. If display incorrect, check wire to Pin 2 and pedal position sensor.

Defect Code 202

Explanation: S–program cannot be switched.

Possible causes: Wire from program switch to control unit Pin 4 has a break.

Troubleshooting: ♦D♦ Status monitoring program switch. Ground must be applied at Pin 4 when program switch S is operated.

Defect Code 203

Explanation: M–program cannot be switched.

Possible causes: Wire from program switch to control unit Pin 15 has a break.

Troubleshooting: ♦D♦ Status monitoring program switch. Ground must be applied at Pin 15 when the program switch M is operated.

Defect Code 204

No program switchover

Explanation: Program switchover is not possible. Only E–program.

Possible causes: No ground from control unit Pin 6 to program switch, connector of program switch detached, program switch defective, wire has a break.

Troubleshooting: ♦D♦ Status monitoring. Operate program switch and compare to test display.

Defect Code 205

No engine intervention

Explanation: No torque reduction due to retarded ignition during gearshift. This results in long slip times and premature wear of the clutches.

Possible causes: Wire from control unit Pin 24 has a short to plus.

Troubleshooting: ♦D♦ Activate components. Activate engine intervention (ignition timing intervention). A short drop in engine speed can be detected when the engine is running at operating temperature, if not, connect universal adapter and check wire Pin 24.

Defect Code 206

Incorrect fault display

Explanation: The error message **transmission** appears in the instrument cluster despite normal operation of the transmission.

Possible causes: The wire from control unit Pin 33 to instrument cluster has a break or a short to plus.

Troubleshooting: Connect universal adapter and check wire.

– With ignition on measure between:
– Pin 33 and 19 – U–Batt
– With engine on measure between:
– Pin 33 and 19 – approx. 0 V

Defect Code 300

Diagnostic link defective

Explanation: The diagnostic link TxD or RxD has a break or has a short to plus or ground.

The TxD link leads from the diagnostic socket Pin 20 to the EGS control unit Pin 13 and is bypassed to ground when the diagnosis cover is closed.

The RxD leads from the diagnostic socket Pin 15 to the EGS control unit Pin 25 and is bypassed to terminal 30 when the diagnosis cover is closed.

Troubleshooting: Check wire.

Defect Code 301

Voltage supply to control unit defective

Explanation: The power supply to the EGS control unit Pin 35 is interrupted.

Troubleshooting: Check wire.

Defect Code 302

Selector lever position

Explanation: The selector lever is not in position P or N.

Troubleshooting: Set selector lever to correct position.

Defect Code 303

Selector lever position not detected

Explanation: The selector lever position cannot be detected by the EGS control unit. As a result, the diagnostic procedure cannot be initiated in "diagnosis version 1".
Compare display of selector lever position in instrument cluster.

Possible causes:

– The wires from the selector lever switch to control unit Pin 18, 28, 29, 30 have a break or a short to plus.
– The voltage supply to the selector lever switch is interrupted.
– The selector lever switch (conductors) is defective.

Troubleshooting: Check fuse 17.
Check selector lever switch (see component testing).
Check wires to EGS control unit Pin 18, 28, 29, 30 (see component testing).

Explanation: The power supply to the EGS control unit Pin 34 is interrupted.

Troubleshooting: Check wire

Component Testing

The following instructions serve as a supplement to EGS self–diagnosis and assumes that the BMW Service Tester is used to monitor the system statuses.

Notes on Test Procedure

Observe safety codes and accident prevention regulations when performing work on the engine and transmission electrical systems.

If not otherwise specified, always switch off the ignition.

Important

Before disconnecting the control unit or the battery, read out the defect code memory and print out complete with troubleshooting. Detach control unit connector only when the ignition is switched off.

Check wires only with the control unit connector or component connector detached.

Always check in accordance with the schematics (note connector and pin numbers).

The specified nominal values refer to a room temperature of 23 ± 5°C.

Refer to repair instructions for information on removal and installation as well as technical data (→ microfiche).

Tests during troubleshooting are performed at the universal adapter with the transmission wire harness or EGS control unit connected.

Ensure good contacting in order to avoid contact resistances.

Only use suitable test equipment (test leads, terminals, probe tips etc.).

Kick-Down Signal

Check the kick–down signal from the EML control unit by way of the universal adapter with the ignition switched on and control unit connected.

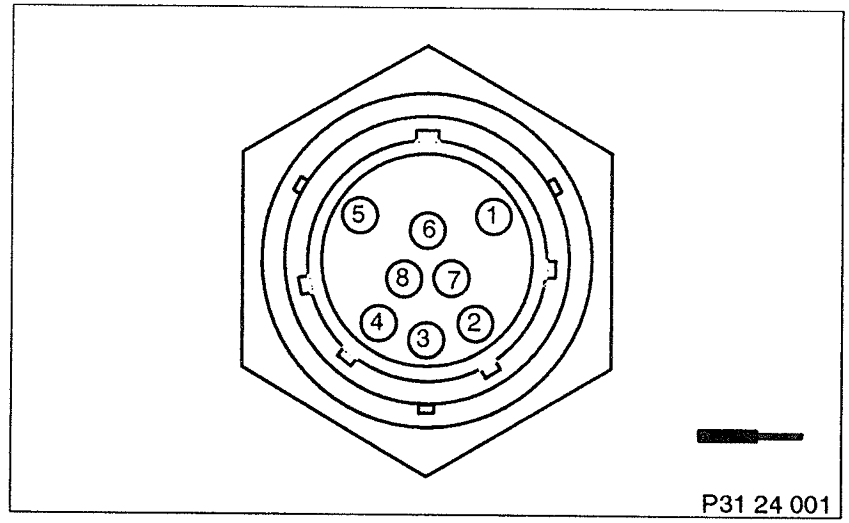
Pin-No.	Accelerator pedal fully depressed	Nominal value
5–/2+	Yes	< 1 V
	No	> 10 V

If values deviate, perform ♦D♦ Status monitoring EML control unit.

Solenoid Valves, Speed Sensors and Hydraulic Pressure Regulator in the Transmission Control Unit

Measure resistance of solenoid valves, speed sensors and of the hydraulic pressure regulator by way of the universal adapter with the control unit disconnected and ignition switched off.

Component	Pin No. at universal adapter	Pin No. at transmission connector	Nominal value
MV 1	16 / 1	5 / 8	22....60 Ω
MV 2	17 / 1	6 / 8	22....60 Ω
MV-WK	25 / 1	7 / 8	22....60 Ω
MV-DR	22 / 1	1 / 8	1,7....6,5 Ω
DZF	27 / 8	3 / 4	22....60 Ω



Connector at gearshift unit

If values deviate, repeat test at gearshift unit if OK., replace wire, if not, remove gearshift unit and repair defective component, replace if necessary, see repair instructions.

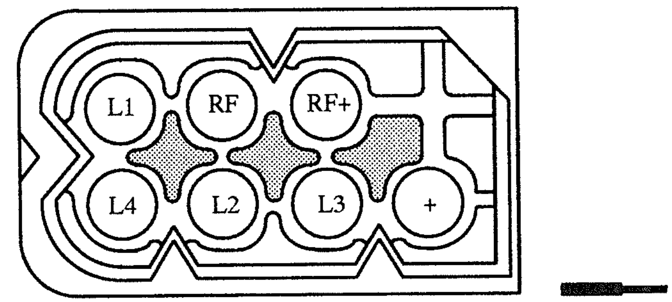
Gear Selector Lever Switch

Check the gear selector lever switch by means of the universal adapter with the control unit connected and ignition switched on. (Measure between Pin 19 and the specified pins. "0" corresponds to approx. 0 V, "1" corresponds to approx. 12 V).

Selector lever in position	Pin 18 (L1)	Pin 28 (L2)	Pin 29 (L3)	Pin 30 (L4)
P	1	1	0	0
R	1	0	0	1
N	0	1	1	0
D	0	0	0	1
3	0	0	1	0
2	1	0	0	0
1	1	0	1	0

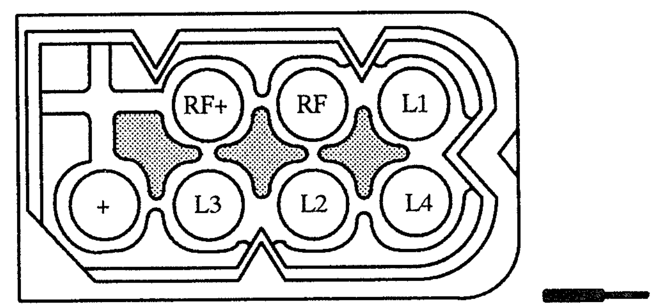
If a voltage is not measured at any position, check pulse supply of selector lever switch. If activation is defective, remove selector lever switch and check in accordance with table, replace if necessary. (Pin + referred to Pin L1...L4; "1" corresponds to approx. 0Ω and "0" more than 10 kΩ). If OK., replace wires or plug connections.

The reversing light is switched via the pins RF and RF+ in the selector lever position R.



P31 24 002

Selector lever switch left–hand drive



P31 24 003

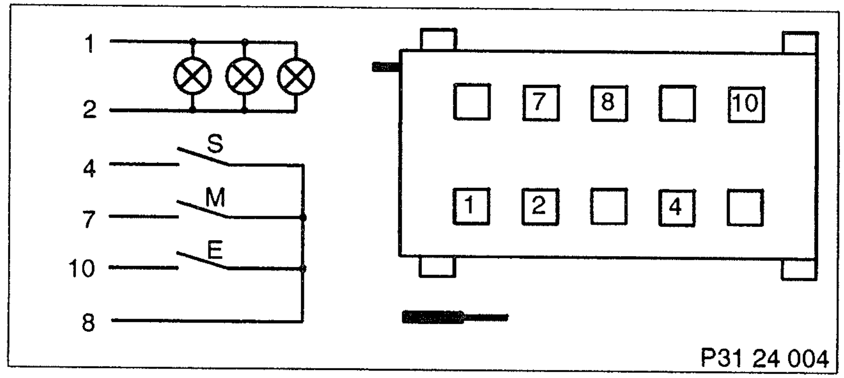
Selector lever switch right–hand drive

Program Button

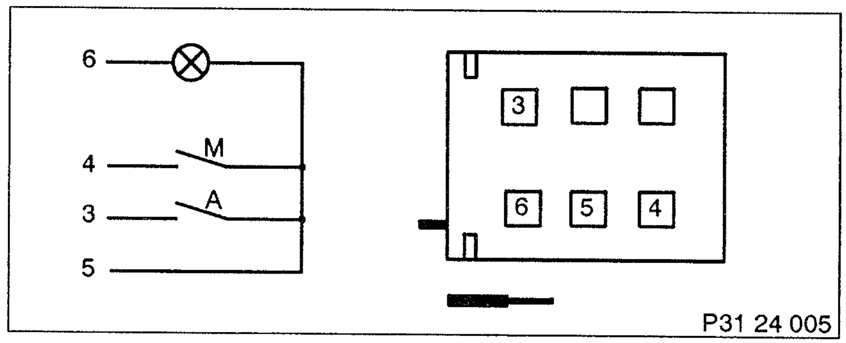
Check the program button with the aid of universal adapter with the control unit connected and ignition switched on. (Measure between Pin 19 – and the specified pins. "0" corresponds to approx. 0 V, "0*" corresponds to approx. 1 V, "1" corresponds to approx. 12 V).

Program button depressed			**Pin number at control unit**		
S	**E**	**M**	**4**	**14**	**15**
yes	–	–	0	1	1
no	–	–	0*	1	1
–	yes	–	1	0	1
–	no	–	1	0*	1
–	–	yes	1	1	0
–	–	no	1	1	0*

If values deviate, check ground connection of program button and replace if necessary. If OK., remove program button, check in accordance with block diagram and switch view and replace if necessary. Check wires and connectors and replace if necessary. Otherwise replace control unit.



Program button S–E–M with switching diagram



Program button A–M with switching diagram (US version)

Functional Description

The electric steering column adjustment basically consists of the following components:

Steering column switch
Control unit
Steering column with electric gear motors

Inclination and longitudinal adjustment of the steering wheel enables individual and ideal adaption to the driver's requirements.

With the aid of the steering column switch, two electric gear motors are driven which move the upper section of the steering column into the required position by way of flexible drive shafts and threaded spindles.

Notes on the BMW DIAGNOSTIC SYSTEM

Not applicable

Abbreviations

Not applicable

Pin Assignments

Pin assignments at connector X 1229 (4-pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Terminal 31	Load ground for gear motors			
2	E	Terminal 30	Fuse F40	12 Volt		
3	E	Input handbrake contact	Handbrake	12 Volt	insignificant for function	
4	E	Terminal 31	Electronic ground			

Pin assignments at connector X 18098 (5-pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Gear motor connection Inclination down	Gear motor inclination	+/-12 Volt		
2	A	Gear motor connection Inclination up	Gear motor inclination	+/-12 Volt		
3	A	Gear motor connection Longitudinal forward	Gear motor longitudinal adjustment	+/-12 Volt		
4		not used				
5	A	Gear motor connection Longitudinal back	Gear motor longitudinal adjustment	+/-12 Volt		

Pin assignments at connector X 18099 (12-pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1-7	not used					
8	E	Switch signal	Steering column switch Inclination up	12 Volt		
9	E	Switch signal	Steering column switch Inclination down	12 Volt		
10	E	Switch signal	Steering column switch Longitudinal adjustment forward	12 Volt		
11	E	Switch signal	Steering column switch Longitudinal adjustment back	12 Volt		
12	A	Ground connection	Steering column switch			

Troubleshooting

Precondition:

Battery charged U > 11.5 V,
Fuse F 40 in rear fuse distributor III OK.

Disconnect connector X 18093 under instrument panel to the left next to steering column. Do not operate switch. Is there continuity between Pin 3 and:
Pin 1 "longitudinal adjustment forward"
Pin 2 "longitudinal adjustment back"
Pin 4 "inclination up"
Pin 5 "inclination down"? — yes → Renew switch

—*—

| no ↓

With switch set in corresponding position, is there continuity between Pin 3 and Pin 1/2/4/5? — no → Replace switch

—*—

| yes ↓

Detach connector X 1229 from control unit behind multi-information display on the heater. Is ground applied to connector at Pin 1 and Pin 4? — no → Repair wire to negative pole of battery for Pin 1 or to body ground for Pin 4.

—*—

yes ↓

Is U > 11.5 V applied at Pin 2? — no → Repair wire to power distributor III.

—*—

yes ↓

Reattach connectors X 18093 and X 1229. Detach connector X 18098 (5-pole) on control unit. With switch set to corresponding position is
U > 11.5 V applied
at Pin 3 "longitudinal adjustment forward"
at Pin 5 "longitudinal adjustment back"
at Pin 2 "inclination up"
at Pin 1 "inclination down"? — no → Replace control unit

—*—

yes ↓

Is there continuity on the wires between connector X 18098 and X 18096/X 18097? — no → Repair wire

—*—

yes ↓

Are drive shafts and threaded spindles OK.? —no→ Renew drive shafts or renew steering column

—*—

yes ↓

Renew gear motor.

—*—

Functional Description

The steering column memory (LSM) represents an extension of the seat–mirror memory. The position of the steering wheel (inclination and longitudinal adjustment) can be set in an optimum driving position by means of two electric motors. The switch mounted on the left–hand side of the steering column is used for this purpose. The control unit activates the motors via a relay corresponding to the required adjustment direction. A set steering column position can be stored by the LSM control unit. The voltage values of the feedback potentiometers serve as data for the control unit indicating the relevant status of the steering column. The corresponding voltage is stored fail–safe in an EEPROM. A certain steering column position can be programmed and called up via the keypad (three position keys, one memory key) of the SM/SPM system. The LSM system also includes an entrance/exit function: For description, refer to Section "Entrance/Exit Function" 3231.1A–2.

System Components

- Electrically adjustable steering column with two electric motors for inclination and longitudinal adjustment.
- Two feedback potentiometers flanged onto the electric motors
- Steering column switch for operation
- Wire harness LSM

Note: The steering column memory control unit is only installed in conjunction with the seat/mirror memory. This steering column memory function is not possible in vehicles without a seat/mirror memory, only manual adjustment is possible in this case. A relay module (without self–diagnosis capabilities!) is installed instead of the LSM control unit.

Location of the Control Unit

In the E31, the control unit is mounted above the heater/air conditioning unit. The control unit is accessible after removing the heater outlet in the centre console or the MID and the radio.

Entrance/Exit Function

To provide convenient entrance and exit for the driver, at the end of a trip, the steering column is moved to the topmost inclination position (= entrance/exit position). The drive position is reassumed when the vehicle is used once again.

In order to detect whether the driver wishes to enter/exit the vehicle (entry/exit position) or whether he wishes to drive (drive position), the control unit uses the following inputs for evaluation: Driver's door, handbrake, terminal R, terminal 15. Certain signals must be applied at these inputs in order to inform the control unit whether the steering column is in the drive position or entry/exit position. The table below shows the 10 combinations relevant for the control unit:

Note: In the event of faults in the entry/exit function, refer to Chapter "Troubleshooting" defect code 21.

	1	2	3	4	5	6	7	8	9	10
Handbrake	applied	applied	applied	applied	applied	released	released	released	released	released
Terminal 15	off	off	off	on	on	off	off	off	on	on
Terminal R	off	off	on	on	on	off	off	on	on	on
Door contact	closed	open	open	closed	open	closed	open	open	closed	open
Drive position	**no**	**no**	**no**	**yes**	**no**	**no**	**no**	**no**	**yes**	**yes**

Definition of Potentiometer Voltages

To ensure perfect operation of the LSM, the following potentiometer voltage progressions are defined for the adjustment procedure:

During positive direction of movement of the drives, the voltages of the corresponding feedback potentiometer must increase and decrease in negative direction of movement. Positive direction of movement is defined as: Inclination adjustment up, longitudinal adjustment towards the driver.

Adjustment procedure

The effective adjustment range (manual and memory adjustment) is restricted in order to relieve the load on the mechanical limit stops of the steering column. The drive motors are switched off before reaching the mechanical limits.

The mechanical limits are determined by the control unit in an adjustment procedure. Call: Via diagnosis request or during initial operation of the system.

Procedure: After a delay period of approx. 6 seconds, the following directions of movement are each activated for 6 seconds one after the other.

1. Inclination down
2. Longitudinal adjustment forward (towards driver)
3. Inclination up
4. Inclination down
5. Longitudinal adjustment back

On completion of the adjustment procedure, the steering column stops in the "zero position", the assumed position is stored as the zero position in the EEPROM of the control unit. The adjustment procedure has a duration of approx. 50 seconds.

Notes on the BMW DIAGNOSTIC SYSTEM

ATTENTION: ACCIDENT RISK IN ADJUSTMENT RANGE OF THE STEERING COLUMN DURING THE ADJUSTMENT PROCEDURE!

The adjustment procedure can be terminated by switching on the terminal 15.

Abbreviations

LSM	Steering column memory
LSS	Steering column switch
SG	Control unit

Pin Assignments

Pin assignments at connector X 1229

Pin	Type	Description/Function	Connection	Type of signal	Status display	Measurement notes
1	E	Terminal 31	Load ground for adjustment motors	–	–	–
2	E	Terminal 30	Fuse	12 Volt	–	–
3	E	Input handbrake contact	Handbrake	12 Volt	Status display	active low
4	E	Terminal 31	Electronic ground	–	–	–

Pin assignments at connector X 18098

Pin	Type	Description/Function	Connection	Type of signal	Status display	Measurement notes
1	A	Motor connection, inclination down	Inclination adjustment motor	+/–12 Volt	–	–
2	A	Motor connection, inclination up	Inclination adjustment motor	+/–12 Volt	–	–
3	A	Motor connection, longitudinal adjustment forward	Longitudinal adjustment motor	+/–12 Volt	–	–
4	A	not used	– – –	– –	–	–
5	A	Motor connection, longitudinal adjustment back	Longitudinal adjustment motor	+/–12 Volt	–	–

Pin assignments at connector X 18099

Pin	Type	Description/Function	Connection	Type of signal	Status display	Measurement notes
1	A	Potentiometer supply	Longitudinal adjustment +	5 Volt	Potentiometer measured value	–
2	A	Potentiometer supply	Inclination +	5 Volt	Potentiometer measured value	–
3	A	Potentiometer ground	Longitudinal adjustment –	>0 Volt	–	–
4	A	Potentiometer ground	Inclination –	>0 Volt	–	–
5	A	Potentiometer feedback	Potentiometer inclination	5 Volt	–	–
6	A	Potentiometer feedback	Potentiometer longitudinal adjustment	5 Volt	–	–
7	–	not used	–	–	–	–
8	E	Switch signal	Switch inclination up	12 Volt	Status display	active low
9	E	Switch signal	Switch inclination down	12 Volt	Status display	active low
10	E	Switch signal	Switch longitudinal adjustment forward	12 Volt	Status display	active low
11	E	Switch signal	Switch longitudinal adjustment back	12 Volt	Status display	active low
12	A	Ground	Steering column switch	–	–	–

Pin assignments at connector X 18131

Pin	Type	Description/Function	Connection	Type of signal	Status display	Measurement notes
1	A	Diagnosis TXD	Diagnostic connector	–	–	–
2	E	Diagnosis RXD	Diagnostic connector	–	–	–
3	E	Connection Terminal 15	Connector memory	12 Volt	–	–
4	E	Connection Terminal R	Connector memory	12 Volt	–	–
5	–	not used	–	–	–	–
6	–	not used	–	–	–	–
7	–	not used	–	–	–	–
8	A	Memory LED	LED	2 Volt	Status display	active high
9	A	Connection keypad	Keypad	5 Volt	–	–
10	E	Connection door contact	Door contact	12 Volt	Status display	active low
11	–	not used	–	–	–	–
12	–	not used	–	–	–	–

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X 18099	12–pole black	Cartool 614 4 80
Control unit	X 18131	12–pole white	Cartool 614 4 80

Troubleshooting

Notes

- Troubleshooting with the BMW diagnostic system
- Battery charged, Umin = 12 Volt
- Removal and installation of control unit only with the ignition switched off

Defect Code Table

♦D♦ Defect code memory – Defect codes which can be stored by the control unit:

Defect code 1 : Inclination adjustment

Defect code 2 : Longitudinal adjustment

Defect code 3 : Calibration error adjustment logic

Defect code 4 : Relay monitoring inclination

Defect code 5 : Relay monitoring longitudinal adjustment

Defect code 6 : Position–time monitoring inclination

Defect code 7 : Position–time monitoring longitudinal adjustment

Defect code 8 : Signal steering column switch

Defect code 9 : Signal steering column switch

Defect code 10: Signal steering column switch

Defect code 11: Signal steering column switch

Defect code 12: Keypad

Defect code 13: Terminal R

Defect code 14: Memory LED

Defect code 15: Relay monitoring

Defect code 16: Relay monitoring

Malfunctions – Defect codes which cannot be stored

Defect code 20: LSM not in operation

Defect code 21: Entry/exit function

Defect Code 1

♦D♦ Defect code memory: 1 Inclination adjustment

Explanation: This defect code is stored when the adjustment system moves beyond the operating range of inclination adjustment. Steering column adjustment is no longer accepted if the defect code is set (inclination and longitudinal adjustment).

Possible cause: The measured voltage value of the potentiometer feedback is outside the permissible range.

Troubleshooting: The measured voltage value of the potentiometer feedback is outside the permissible range.Troubleshooting: Check wires to the adjustment motor for inclination adjustment, repair if necessary: Adjustment direction "down": From control unit connector X 18098 Pin 1 to connector X 18096 Pin 2. Adjustment direction "up": From control unit connector X 18098 Pin 2 to connector X 18096 Pin 1. If defect is not repaired, check wires from the LSM control unit to potentiometer for inclination adjustment and repair if necessary: Potentiometer connection "feedback": From control unit connector X 18099 Pin 5 to connector X 18904 Pin 2. Potentiometer connection supply adjustment direction "up": From control unit connector X 18099 Pin 2 to connector X 18094 Pin 3. Potentiometer connection supply adjustment direction "down": From control unit connector X 18099 Pin 4 to connector X 18094 Pin 1. If all wires and connections are OK., check potentiometer and drive motors for inclination adjustment and repair if necessary.

Defect Code 2

♦D♦ Defect code memory: 2 Longitudinal adjustment

Explanation: This defect code is stored when the adjustment system moves beyond the operating range of longitudinal adjustment. Steering column adjustment is no longer accepted if the defect code is set (inclination and longitudinal adjustment).

Possible cause: The measured voltage value of the potentiometer feedback is outside the permissible range.

Troubleshooting: Check wires from the LSM control unit to the adjustment motor for longitudinal adjustment, repair if necessary: Adjustment direction "forward": From control unit connector X 18098 Pin 3 to connector X 18097 Pin 1. Adjustment direction "back": From control unit connector X 18098 Pin 5 to connector X 18097 Pin 2. If the defect is not repaired, check wires from LSM control unit to potentiometer for longitudinal adjustment and repair if necessary: Potentiometer connection "feedback": From control unit connector X 18099 Pin 6 to connector X 18905 Pin 2. Potentiometer connection supply adjustment direction "forward": From control unit connector X 18099 Pin 1 to connector X 18095 Pin 3. Potentiometer connection supply adjustment direction "back": From control unit connector X 18099 Pin 3 to connector X 18095 Pin 1. If all wires and connections are OK., check potentiometer and drive motors for longitudinal adjustment and repair if necessary.

Defect Code 3

♦D♦ **Defect code memory: 3 Error adjustment logic**

Explanation: This defect code is stored when the inclination adjustment potentiometer moves although no activation command for the corresponding adjustment motor has been given.

Possible cause: Potentiometer or motor connections interchanged.

Troubleshooting: Ensure all motor and potentiometer connections are correct in accordance with pin assignment/schematic (longitudinal and inclination adjustment) and correct/repair if necessary.

Defect Code 4

♦D♦ **Defect code memory: 4 Relay monitoring inclination**

Possible cause: Relay connections interchanged

Troubleshooting: Correct relay connections.

Defect Code 5

♦D♦ **Defect code memory: 5 Relay monitoring longitudinal direction**

Possible cause: Relay connections interchanged

Troubleshooting: Correct relay connections.

Defect Code 6

♦D♦ Defect code memory: 6 Position–time monitoring inclination

Possible cause: Change in potentiometer voltage during adjustment not correct. Can be caused, for instance, by blocking of the steering column adjustment due to external obstruction (objects) or stiffness in the adjustment kinematics.

Effect of defect: Steering column adjustment is deactivated in the blocked inclination direction.

Troubleshooting: Check adjustment motors and adjustment kinematics for inclination adjustment and repair if necessary. Clear the defect code memory if no defect is found.

Defect Code 7

♦D♦ Defect code memory: 7 Position–time monitoring longitudinal adjustment

Possible cause: Change in potentiometer voltage during adjustment not correct. Can be caused, for instance, by blocking of the steering column adjustment due to external obstruction (objects) or stiffness in the adjustment kinematics.

Effect of defect: Steering column adjustment is deactivated in the blocked longitudinal direction.

Troubleshooting: Check adjustment motors and adjustment kinematics for longitudinal adjustment and repair if necessary. Clear the defect code memory if no defect is found.

Defect Code 8

♦D♦ Defect code memory: 8 Signal steering column switch, adjustment direction back

Possible cause: Input of steering column switch signal active for longer than 24 seconds.

Effect of defect: The corresponding signal is ignored for the time the defect code is set.

Troubleshooting: Check wire and repair if necessary: From steering column switch S 119 connector X 18093 Pin 2 to control unit connector X 18099 Pin 11; if wire is OK., check steering column switch and renew if necessary. Also check the ground wire from the control unit to the steering column switch and repair if necessary; From steering column switch S 119, connector X 18093 Pin 3 to control unit connector X 18099 Pin 12.

Defect Code 9

♦D♦ Defect code memory: 9 Signal steering column switch, adjustment direction forward

Possible cause: Input of steering column switch signal active for longer than 24 seconds.

Effect of defect: The corresponding signal is ignored for the time the defect code is set.

Troubleshooting: Check wire and repair if necessary: From steering column switch S 119 connector X 18093 Pin 1 to control unit connector X 18099 Pin 10; if wire is OK., check steering column switch and renew if necessary. Also check the ground wire from the control unit to the steering column switch and repair if necessary; From steering column switch S 119, connector X 18093 Pin 3 to control unit connector X 18099 Pin 12.

Defect Code 10

♦D♦ Defect code memory: 10 Signal steering column switch, adjustment direction inclination down

Possible cause: Input of steering column switch signal active for longer than 24 seconds.

Effect of defect: The corresponding signal is ignored for the time the defect code is set.

Troubleshooting: Check wire and repair if necessary: From steering column switch S 119 connector X 18093 Pin 5 to control unit connector X 18099 Pin 9; if wire is OK., check steering column switch and renew if necessary. Also check the ground wire from the control unit to the steering column switch and repair if necessary; From steering column switch S 119, connector X 18093 Pin 3 to control unit connector X 18099 Pin 12.

Defect Code 11

♦D♦ Defect code memory: 11 Signal steering column switch, adjustment direction inclination up

Possible cause: Input of steering column switch signal active for longer than 24 seconds.

Effect of defect: The corresponding signal is ignored for the time the defect code is set.

Troubleshooting: Check wire and repair if necessary: From steering column switch S 119 connector X 18093 Pin 4 to control unit connector X 18099 Pin 8; if wire is OK., check steering column switch and renew if necessary. Also check the ground wire from the control unit to the steering column switch and repair if necessary; From steering column switch S 119, connector X 18093 Pin 3 to control unit connector X 18099 Pin 12.

Defect Code 12

♦D♦ Defect code memory: 12 Keypad

Possible cause: Short to ground

Effect of defect: Keypad signal is ignored

Troubleshooting: Check wire from control unit connector X 18131 Pin 9 via connector memory X 678 B Pin 12 to keypad (memory switch) and repair if necessary; if wire is OK., check keypad (memory switch) and repair if necessary.

Defect Code 13

♦D♦ Defect code memory: 13 Terminal R

Possible cause: Control unit does not detect terminal R when terminal 15 is active.

Effect of defect: Defect is ignored, unit operates as for terminal 15.

Troubleshooting: Check wire and repair if necessary: From terminal R (connector memory X 394 B Pin 8) to control unit connector X 18131 Pin 4; if wire is OK., check ignition lock/wires and repair if necessary.

Defect Code 14

♦D♦ Defect code memory: 14 Memory LED

Possible cause: The voltage which corresponds to the "memory" function is not detected by the control unit.

Effect of defect: Defect is ignored. Memory standby is not derived from the LED itself but rather from the LED signal. There are no restrictions in operation.

Troubleshooting: Check wire and repair if necessary: From control unit connector X 18131 Pin 8 to connector memory X 678 B Pin 11 and further to memory LED; if wire/contacts OK., check LED and renew if necessary.

Defect Code 15

♦D♦ Defect code memory: 15 Relay monitoring

Possible cause: Relay monitoring signal detected as active although no relay activation command was given; Reason: Relay defect.

Effect of defect: Relay remains in operating position after activation.

Troubleshooting: Renew control unit.

Defect Code 16

♦D♦ Defect code memory: 16 Relay monitoring

Possible cause: No signal during relay activation.

Effect of defect: Relays do not respond during activation or internal defect in control unit.
Troubleshooting: Renew control unit.

Defect Code 20

Malfunction: LSM failure

Effect of defect: Partial/total failure of LSM

Troubleshooting: The following causes are possible and should be investigated:

- Fuse No. 40
- Terminal 30 – Connection of the control unit: Control unit connector X 1229 Pin 2
- Terminal 15 – Connection of the control unit: Control unit connector X 18131 Pin 3
- Ground connection of control unit: Control unit connector X 1229 Pin 1 (terminal 31L = load ground for motor currents) and Pin 4 (terminal 31 D = electronic ground; connected to E ground of the SM/SPM control unit)

Defect Code 21

Malfunction: Entry/Exit Function

Effect of defect: Entry/exit function defective

Funktionsprüfung: Perform following function checks (order of operating steps must be followed!):

Operating step	*Set position steering wheel*
1. Sit in driver's seat	Entry/exit position
2. Close driver's door	Entry/exit position
3. Apply handbrake	Entry/exit position
4. Switch on terminal R	Entry/exit position
5. Switch on terminal 15	Drive position
6. Open driver's door	Entry/exit position
7. Release handbrake	Drive position

Troubleshooting: If, during the individual operating steps, the actual status of the steering wheel position does not correspond to the set status, check the corresponding inputs with the aid of the status monitoring function in the diagnostic program. Check the inputs not detected by the control unit:

– Input terminal R: Check wire and repair if necessary: From terminal R (connector memory X 394 B Pin 8) to control unit connector X 18131 Pin 4; if wire is OK., check ignition lock/wires and repair if necessary.

– Input terminal 15: Check wire and repair if necessary: From terminal 15 (connector memory X 394 B Pin 9) to control unit connector X 18131 Pin 3.

– Input driver's door: Check wire and repair if necessary: From driver's door contact via connector memory X 394 B Pin 12 to control unit connector X 18131 Pin 10. If wire is OK. and defect not rectified, check driver's door contact and renew if necessary (see Repair Instructions Group 61).

– Handbrake contact: Check wire and repair if necessary: From handbrake contact to control unit connector X 1229 Pin 3. If wire is OK. and defect not rectified, check handbrake contact and renew if necessary (see Repair Instructions Group 61).

Functional Description

General

The airbag is a component part of the passive safety system.

Two different versions of the system are available:

– Driver's airbag
– Full airbag (driver's airbag and passenger's airbag)

The systems basically consist of the following components:

– Diagnostic unit with ignition capacitor
– 2 crash sensors
– Crash sensor wire harness
– Airbag unit for driver (in steering wheel)
– Passenger's airbag unit
– Passenger's airbag unit (only full airbag)
– Cover plate (only full airbag)
– Wire harness for passenger's airbag unit (only full airbag)

The airbag is triggered in the event of a head–on collision at a speed in excess of 30 km/h within the range from 30^0 to the left and right with respect to the longitudinal axis of the vehicle

The ignition current flows when at least one front crash sensor and the safety sensor in the diagnostic unit are closed simultaneously.

The ignition energy is made available by an ignition capacitor (35 V voltage).

Function of Failure Warning Lamp

As of terminal R (ignition lock position 1), the failure warning lamp begins to light for approx. 6 seconds and then goes out. The airbag system is in standby mode. If a defect occurs in the airbag system, the failure warning lamp begins to flash for approx. 60 seconds and then lights with a steady light. This shows the driver that the airbag system is not in standby mode. The airbag system does not resume standby mode until the defect is rectified and the defect code memory in the diagnostic unit has been cleared.

Attention! The safety regulations in accordance with Repair Instructions Group 32 must be observed when working on the airbag system.

Notes on the BMW DIAGNOSTIC SYSTEM

The diagnostic procedure is not possible if the plug connection X74 is interrupted.

Performing the diagnostic procedure without sufficient ground connection (by way of screw connection) at the casing of the diagnostic unit can cause damage to the diagnostic unit.

The diagnostic program detects which version of the airbag system is installed in the vehicle and automatically assigns the corresponding troubleshooting procedure.

The text "data transfer error" which may appear in the last line during troubleshooting can be ignored (appears when battery disconnected).

If the text "airbag control unit found" appears in the identification page, this indicates that although the diagnostic program has detected an airbag control unit, the troubleshooting procedure has been allocated incorrectly.

Abbreviations

AB	Airbag
E	Input
A	Output

Pin assignments

Connectors

Number	Type	Description
X 74	8–pole, orange	Plug connection airbag diagnostic unit
X 75	6–pole, orange	Plug connection sensors airbag diagnostic unit
X 81	3–pole, orange	Plug connection left front crash sensor
X 86	3–pole, orange	Plug connection right front crash sensor
X 781	2–pole, orange	Plug connection generator passenger I
X 782	2–pole, orange	Plug connection generator passenger II
X 783	2–pole, orange	Plug connection generator driver
X 784	2–pole, orange	Plug connection airbag diagnostic unit connection line generator driver
X9997	2–pole red	Plug connection driver's airbag unit

Pin assignments at connector X 74 (plug connection airbag diagnostic unit)

Pin	Type	Description/function	Connection	Type of signal	Measurement notes
1	E	B+ (terminal R not fuse–protected)	Wire harness	approx. 12V	Ignition lock position 1 (terminal R)
2	E	Start signal	Wire harness	approx. 12V	During start procedure
3	not used				
4	A	Failure warning lamp signal	Instrument cluster	approx. 12V	Ignition lock position 1 (terminal R)
5	not used				
6	E	Diagnostic link RxD	Diagnostic bus	–	–
7	A	Diagnostic link TxD	Diagnostic bus	–	–
8	not used				

Adapters

Component	Connector No.	Description	Adapter No.
Two–pole wire harness connector on diagnostic unit	X 781, X782, X784	Lead for airbag in conjunction with airbag test connector	Cartool 62 1 280 / Cartool 62 1 260
Two–pole wire harness connector in steering column trim panel	X 783	Airbag test connector	Cartool 62 1 260

Troubleshooting

Defect Code Storage

Defect Code Detection

When in standby mode, all components of the airbag system (as of terminal R) are constantly monitored for defects. Depending on the type of defect, every fault must be applied for a certain period of time (200 ms...80 s) in order to be detected as a fault and to be stored. If a defect code is stored, the airbag system remains out of operation until the defect code is cleared by an external diagnostic unit (BMW diagnostic system, BMW MoDiC, airbag diagnostic reset). The diagnostic unit, however, still continues to monitor the system. If the defect conditions no longer exist while diagnosis is being performed, the defect is indicated as a long–term defect. If the defect no longer exists, the type of defect is changed to an intermittent defect. The defect code, however, still remains in the defect code memory.

Intermittent Defect

In this case, measuring the relevant defect path is of little use since the defect no longer exists at the time the test is carried out. In the case of wire defects, troubleshooting could be carried out in accordance with the instructions provided on the display screen. Wherever possible, the complete wire as well as all plug connections on the defect path should be visually inspected. Repair or renew any pinched wires and defective or loose plug connections.

Attention! When elements of the system, such as steering wheel or instrument cluster are removed when the airbag system is in standby mode (as of terminal R), this is also detected by the diagnostic unit as a defect and entered in the defect code memory. Therefore, it is absolutely necessary to clear the airbag defect code memory after installation of these components.

After selecting "read defect code memory", a note appears on the screen indicating whether the first defect code entry took place more than or less than an hour ago. This helps to determine whether a defect occurred in the workshop by removing system components.

Long–term Defects

n this case, perform troubleshooting as displayed on the screen. If no defect can be found in the periphery, check the disconnected plug connection for dirt and defects and if necessary repair or renew defective parts.

Defect Code Table

Defects which can be stored by the airbag diagnostic unit

Number	Driver's airbag	Full airbag
01	Ignition capacitor defective	Ignition capacitor defective
02	Diagnostic unit malfunction	Diagnostic unit malfunction
03	Driver's airbag supply line, insufficient insulation	Driver's airbag supply line, insufficient insulation
04	Driver's airbag supply line defective	Driver's airbag supply line defective
07	Left front front crash sensor, faulty contact	Left front front crash sensor, faulty contact
08	Left front crash sensor defective	Left front crash sensor defective
09	Left front crash sensor, ground contact defective	Left front crash sensor, ground contact defective
10	Right front crash sensor, faulty contact	Right front crash sensor, faulty contact
11	Right front crash sensor defective	Right front crash sensor defective
12	Right front crash sensor ground contact defective	Right front crash sensor ground contact defective
13	Left front crash sensor supply line, insufficient insulation	Left front crash sensor supply line, insufficient insulation
14	Left front crash sensor supply line defective	Left front crash sensor supply line defective

Number	Driver's airbag	Full airbag
15	Right front crash sensor, insufficient insulation	Right front crash sensor, insufficient insulation
16	Right front crash sensor supply line defective	Right front crash sensor supply line defective
17	Warning lamp short–circuit	Warning lamp short–circuit
18	Warning lamp defective	Warning lamp defective
19	Defect memory set	Defect memory set
20	Diagnostic unit defective	Diagnostic unit defective
21	–	Passenger's airbag supply line, insufficient insulation
22	–	Passenger's supply line defective

Functional Description

General

The task of the system is to control the slip of the drive wheels, irrespective of the condition of the road surface and corresponding to the coefficient of friction with the aim of achieving optimum driving stability and propulsion.

During a control phase, the engine torque is reduced by way of the EML (throttle control system). If this measure is not sufficient, the ignition angle is displaced towards retard by DME control units or the ignition pulses faded out. Fuel injection is interrupted during ignition fade–out.

Display and Switching Logic

The ASC multi–function lamp in the instrument cluster lights constantly when the ignition is switched on (lamp check). The system is switched on after engine start and can be switched off as required with the passive button. The ASC multi–function lamp is off when the system is switched on.

The ASC multi–function lamp flashing in the instrument cluster indicates to the driver that the ASC control is active.

If the ASC multi–function lamp lights permanently with the engine running, this indicates that the system has switched off automatically due to a defect or it was switched off by hand.

Safety Information

The ASC system must be switched off before testing the vehicle on a brake or output test stand.

The ignition must be switched off before towing a vehicle with the front axle raised.

Throttle Control via EML

The throttle is controlled by means of the electronic throttle control system (EML).

If impermissibly high wheel slip occurs in a certain driving situation, the ASC determines the maximum drive torque which can be transmitted and constantly signals the necessary throttle position to the EML for the duration of the control phase.

The EML constantly signals the current throttle angle (set by driver) to the ASC via the DKV line. If the throttle angle is to be reduced, the EML receives this information by the DKR line. If the ASC requires that the throttle angle is increased (engine drag torque control), this information is signalled to the EML via the DKE line.

Ignition Intervention via DME

A further measure to reduce the engine torque is to retard the ignition timing.

In ASC mode (control) the digital motor electronics (DME) receives a digital signal from the ASC and consequently adjusts the ignition timing towards retard.

An ignition fade–out additionally takes place under one of the following conditions:

– Large control deviation
– Control deviation plus high drive wheel acceleration
– Long control deviation

Engine Drag Torque Control (MSR)

The wheel slip caused by the engine on road surfaces with a low coefficient of friction is controlled to a value corresponding to optimum handling stability by way of the throttle control (EML). In this case, irrespective of the accelerator pedal position, the throttle valve is opened to such an extent until the optimum slip value is reached. Thrust cut–out by the DME is avoided during MSR. MSR is deactivated in the upper gear ranges since here critical brake slip due to the engine drag torque cannot occur even at low coefficients of friction.

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with flash code

In the case of defects in the interfaces to other systems such as DME and EML, always also read out the defect code memories of these systems.

Abbreviations

ASC	Automatic stability control
ABS	Antilock brake system
DME	Digital motor electronics
EML	Electronic throttle control
DKV	Set throttle data
DKR	Throttle reduction
DKE	Throttle increase
ZWV	Ignition timing adjustment
ZA	Ignition fade–out
MSR	Engine drag torque control
VL	Front left
VR	Front right
HL	Rear left
HR	Rear right
SG	Control unit
E	Input
A	Output
Sila	Safety lamp

Pin Assignments

Connector

Number	Type	Description
X 11	55--pole	ABS/ASC unit connector
X 31	12–pole, black	ABS hydraulic unit connector
X 113	2–pole, white	Plug connection, front part Front right ABS sensor
X 114	2–pole, white	Plug connection, front part Front left ABS sensor
X 142	2–pole, white	Plug connection, front part Rear left ABS sensor
X 143	2–pole, white	Plug connection, front part Rear right ABS sensor

Pin assignments at connector X 11 (ABS/ASC unit connector)

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
1	E	B + (terminal 15)	Overvoltage protection relay	approx. 12V	Ignition on
2	A	Rear right solenoid valve activation	ABS hydraulic unit	Ground	Cannot be measured statically
3	E	Control unit ground	Body ground	Ground	None
4	E	Voltage signal valve relay	Plunger/ABS hydraulic unit	approx. 12V	Ignition on
5	A	Motor relay activation	ABS hydraulic unit	Ground	Cannot be measured statically

Automatic Stability Control (ASC)

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
6	E	Voltage signal ABS Sila	Instrument cluster	0V/approx. 12V	Ignition on/engine on
7	not used				
8	E	Front left speed signal	Speed sensor	AC voltage	Cannot be measured statically
9	not used				
10	E	Rear right speed signal	Speed sensor	AC voltage	Cannot be measured statically
11	not used				
12	A	Front right speed sensor ground	Speed sensor	Ground	None
13	E	Front right speed signal	Speed sensor	AC voltage	Cannot be measured statically
14	not used				
15	E	Brake light switch signal	Brake light switch	approx. 0V/12V	Ignition on, brake released/applied
16	A	Stabilized voltage ASC	No connection	5V	None
17	not used				
18	E	Control unit ground	Body ground	Ground	None
19	A	Rear left solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
20	A	Voltage signal motor relay	ABS hydraulic unit	approx. 12V	None
21	A	Front left solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
22	not used				
23	A	Activation, valve relay	ABS hydraulic unit	approx. 0V	Ignition on
24	A	Stabilized voltage ABS	No connection	5V	None
25	E	Engine relay signal	ABS hydraulic unit	approx. 12V	Cannot be measured statically
26	A	Front left speed sensor ground	Speed sensor	Ground	None
27	not used				
28	A	Rear right speed sensor ground	Speed sensor	Ground	None

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
29	A	Rear left speed sensor ground	Speed sensor	Ground	None
30	E	Rear left speed signal	Speed sensor	AC voltage	Cannot be measured statically
31	not used				
32	not used				
33	E	Terminal 61d D+	Alternator	> 12V	Engine on
34	not used				
35	not used				
36	E	Control unit ground	Body ground	Ground	None
37	A	Front right solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
38	E	Terminal 1 – signal	DME	approx. 12V	Ignition on
39	not used				
40	not used				
41	E	Ground signal terminal 1 – shielding	Shielded line terminal 1	Ground	None
42	E	B+ (terminal 30)	Battery	approx. 12V	None
43	E	Set throttle valve data	EML	Pulse width–modulated square–wave signal	Cannot be measured statically
44	not used				
45	A	Signal ignition fade–out (ZA)	DME	9,6...15 V	Cannot be measured statically
46	A	Throttle reduction	EML	Pulse width–modulated square–wave signal	Cannot be measured statically
47	A	Ignition timing	DME	approx.12V	Cannot be measured statically
48	A	Throttle increase	EML	Pulse width–modulated square–wave signal	Cannot be measured statically
49	not used				

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
50	not used				
51	A	Activation ASC multi–function lamp	Instrument cluster	0V/approx. 12V	Ignition on/engine and ASC on
52	E	Handbrake switch signal	Handbrake switch	> 7V/approx. 0V	Ignition on, handbrake released/ applied
53	not used				
54	E	ASC button signal	ASC button	approx. 0V/approx. 12V	Ignition on/ASC button depressed
55	not used				

Pin assignments at connector X31 (ABS hydraulic unit connector)

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
1	–	Front left solenoid valve activation	–	Ground	–
2	–	Valve relay activation	–	Ground	–
3	–	Front right solenoid valve activation	–	Ground	–
4	–	Voltage signal valve relay	–	approx. 12V	–
5	–	Rear left solenoid valve activation	–	Ground	–
6	–	B+ (terminal 30)	Battery	approx. 12V	–
7	–	Rear right solenoid valve activation	–	Ground	–
8	–	Engine relay voltage	–	approx. 12V	–
9	–	Engine relay signal	–	approx. 12V	–
10	–	B+ (terminal 30)	Battery	approx. 12V	–
11	–	Signal ABS–Sila	Instrument cluster	Ground	Ignition on
12	–	Motor relay activation	–	Ground	–

Adapters

Component	Connector No.	Description	Adapter No.
ABS/ASC+T control unit	X 7	Universal adapter	HWB 81 12 9 425 091
		Connection lead for periphery, 55–pole	HWB 81 12 9 428 907
		Connection lead for control unit, 55–pole	HWB 81 12 9 428 908

Troubleshooting

Note on Differentiation between ABS/ASC and ABS/ASC+T

The ABS/ASC+T system can be identified by the plunger hydraulic unit which is arranged in the engine compartment above the left–hand engine mount or by its vent connection on the left–hand side in the engine compartment.

The following test instructions are to be used corresponding to the variant:

ABS/ASC: 3450.1A

ABS/ASC+T: 3450.2A

Defect Code Storage

If a defect occurs in the ASC system when the control unit is active (ignition on), the system is switched off immediately and the ASC multi–function lamp activated. If a defect is detected during a current control function, the ASC system is switched off after the end of the control function, however, the ASC multi–function lamp is activated immediately.

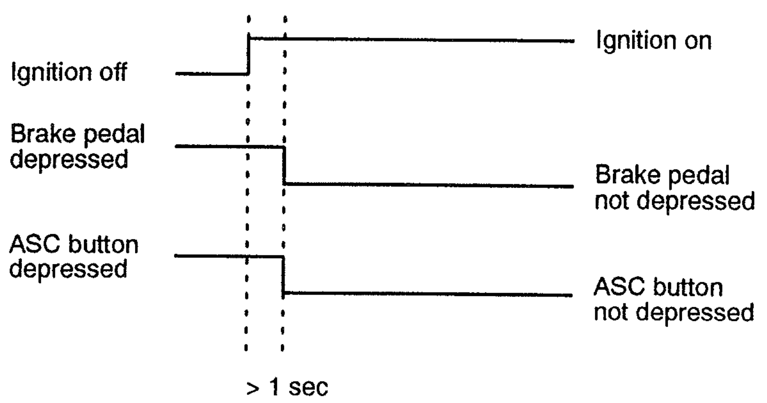
Defects at the wheel sensors can only be stored during vehicle operation at speeds above 12 km/h. If two or more defects occur simultaneously, the one with the highest priority is stored. The lower the number of flash pulses, the higher the priority of the defect. The system remains switched off if the defect has not been rectified before the next start (ignition on). If, however, this is not the case, the ASC once again assumes standby mode.

The stored defect code remains set in the defect code memory until it is either cleared (refer to "clearing defect code memory") or overwritten by another defect code. There are 9 different defect codes, however, only one can be stored at a time.

Defect Code Memory Readout

Activating the flash code

- Switch off ignition
- Press ASC button and depress brake pedal simultaneously
- Hold ASC button and brake pedal depressed simultaneously and switch on ignition
- Keep depressed for at least 1 second and then release ASC button and brake pedal



P31 34 001

Note:

The steps to activate the flash code must be repeated if the ASC multi–function lamp remains on.

Reading out the flash code

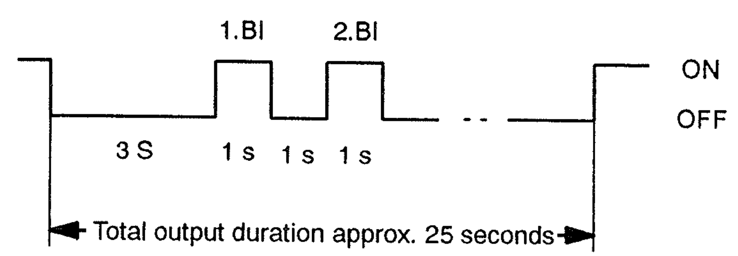
The flash code is output for approx. 25 seconds irrespective of which defect code is stored.

After activation of the defect code, the ASC multi–function lamp goes out for 3 seconds and then begins outputting the flash pulses at a flash frequency in a pulse/pause ratio of 1sec/1 sec.

The number of flash pulses indicates which defect code is stored. Refer to the table of defect codes below.

Example:

2 flash pulses (Bl) = Defect code 02



P31 34 002

Clearing Defect Code Memory

There are three possible ways of clearing the defect code memory:

Within 3 seconds after the end of the flash code output (after 25 seconds) when the ASC multi–function lamp lights permanently once again, press the ASC button for at least 1 second.

Disconnect vehicle battery. (Attention! Defect code memories of other systems may be cleared)

Disconnect control unit. (Attention! Ignition must be switched off)

Troubleshooting Procedure

- Check system for mechanical and hydraulic defects (refer to Repair Instructions Group 34)
- Read out defect code memory via flash code

  Note:

  If the defect code cannot be read out, then continue troubleshooting as described under the point "other system defects".
- Note down number of flash pulses
- In order to exclude the possibility of the counting errors, read out the defect code memory once again
- Clear defect code memory
- Perform troubleshooting with schematic
- Rectify defect
- Perform test run

  Note:

  During the test run, the car should be driven for at lest 20 seconds at a speed in excess of 30 km/h or for at least 3 seconds at a speed above 50 km/h.
- When defect code is stored once again, repeat procedure until no defect code is stored

Simulating ASC Control Mode

- Raise vehicle on floor jack (all wheels must turn freely)
- Set automatic selector lever to "Neutral (N)"
- Start engine
- Set engine speed by means of accelerator pedal or adapter EML No. 12.7010 (see Repair Instructions 12 70 500) to approx. 2000 rpm
- Quickly accelerate rear left or right wheel by hand in forward direction

Reaction: The engine speed must drop noticeably

Dynamic Testing of the Speed Sensors

Connect oscilloscope of BMW Service Tester as follows:

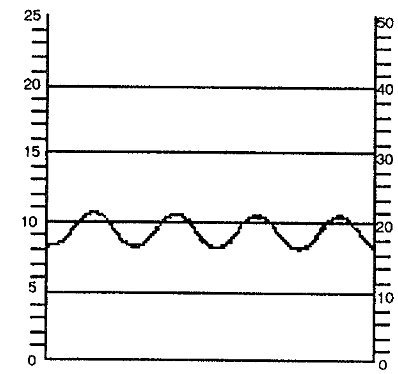
- Terminal D+ blue to speed sensor signal
- Frequency (–) black to speed sensor ground
- Frequency (+) blue to terminal 1 black

♦M♦ 13 Select frequency and enter 80 Hz

♦M♦ 22 Select oscilloscope

Uniformly turn wheel by hand. A sinusoidal curve must appear (amplitude and period duration change depending upon the rotary speed).

Example:



P31 34 003

Uniform progression of speed signal (signal OK.)

Defect Symptoms

Defect symptom	Troubleshooting
The ASC multi–function lamp lights after engine start or during the trip although the ASC has not been switched off by hand. The flash code can be read out.	Defect code 01 – Defect code10
The ASC multi–function lamp lights constantly when the engine is running. The system cannot be switched on. Flash code readout is not possible.	Defect code 11
The ASC multi–function lamp does not light after ignition on.	Defect code12
The ASC system cannot be switched off by means of the ASC button. The ASC system is constantly in standby mode.	Defect code13
The ASC multi–function lamp remains on despite ignition off.	Defect code14
MSR operation despite handbrake being applied.	Defect code15
No ASC operation, ASC multi–function lamp on, no flash code	Defect code16
Signal for ignition fade–out to DME control unit cylinder 7...12 faulty	Defect code 17

Defect symptom	Troubleshooting
The ASC multi–function lamp goes out correctly after engine on, but the ASC system does not operate although the slip is sufficiently high	Defect code 18

Defect codes which can be stored by the control unit (readout via flash code possible)

Number of flash pulses	Troubleshooting
1 Flash pulse	Defect code 01
2 Flash pulses	Defect code 02
3 Flash pulses	Defect code 03
4 Flash pulses	Defect code 04
5 Flash pulses	Defect code 05
6 Flash pulses	Defect code 06
7 Flash pulses	Defect code 07
8 Flash pulses	Defect code 08
9 Flash pulses	Defect code 09
10 Flash pulses	Defect code10

Defect Code 01

Explanation:

No defect code stored in the ABS/ASC control unit despite ASC malfunction

Troubleshooting:

See "defect symptoms"

Defect Code 02

Explanation:

Defect on the connection links (interface) to EML (DKV, DKE, DKR signal) or faulty signals for the ignition timing or torque cut–out.

Defect on the signal line for ignition timing or for preventing torque cut–out to the DME control units (MSR mode) or the function "preventing torque cut–out" faulty in one of the DME control units.

Defect detection:

This defect can only be detected in MSR mode. The ASC sends a DKE signal to the EML which consequently increases the throttle angle. At the same time, the DML checks whether the injection signal from the DME control units does not revert to torque cut–out. If torque cut–out is detected by the EML, it switches off the interface to the ASC.

Possible causes:

Short or break on one of the lines to the EML (DKV, DKE, DKR)

Fault during synchronisation with the EML control unit

Short or break on the signal line for ignition timing or for preventing torque cut–out to the DME control units

Troubleshooting:

Switch off ignition and detach control unit connector.

Check DKV, DKR, DKE line from ABS/ASC Pin 43, 46, 48 to the EML.

Connect control unit and switch on ignition.

Measure frequency of the DKV, DKR, DKE signal with ♦M♦ , nominal value approx. 100 Hz. (Pulse width–modulated signal)

Switch off ignition and detach control unit connector.

Check signal line for ignition timing or for preventing the torque cut–out Pin 47 to the DME control units.

If necessary, repair defective line.

If no defect can be found, clear defect code memory.

Defect Code 03

Explanation:

Ignition fade–out function faulty

Possible causes:

Short or break on the wire to the DME control units

Ignition fade–out malfunctioning in the DME control unit cylinder 1...6

ABS/ASC control unit defective

Troubleshooting:

Switch off ignition and disconnect both DME control units

Check wire from ABS/ASC control unit Pin 45 to the DME control units for a short to ground; repair wire if necessary

If wire is OK.:

Switch off ignition and reconnect both DME control units

Start engine and set engine speed to approx. 2000 rpm

Bypass Pin 1 and Pin 45 at the ABS/ASC control unit. The engine speed must drop temporarily

Engine speed drops:

Replace ABS/ASC control unit and repeat test

Engine speed remains constant:

Check wire from ABS/ASC control unit Pin 45 to the DME control units for a short to plus or a break; repair wire if necessary.

If wire is OK., replace DME control unit cylinder 1...6 and repeat test.

Defect Code 04

Explanation:

No or faulty sensor signal from rear left wheel sensor

Possible causes:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 30/29; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 30/29.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 05

Explanation:

No or faulty sensor signal from rear right wheel sens

Possible causes:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 10/28; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 10/28.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 06

Explanation:

No or faulty sensor signal from front right wheel sensor

Possible causes:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 32/12; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 32/12.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 07

Explanation:

No or faulty sensor signal from front left wheel sensor

Possible causes:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 8/26; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 8/26.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 08

Explanation:

Wire for ignition fade–out signal defective

Possible cause:

Short or break on the wire for ignition fade–out from the ABS/ASC control unit to DME control unit cylinder 1...6

Troubleshooting:

Check wire from ABS/ASC control unit Pin 45 to DME control unit cylinder 1...6 and repair if necessary.

Also check wire from ABS/ASC control unit Pin 45 to DME control unit cylinder 7...12 (not stored in the defect code memory!)

Defect Code 09

Explanation:

Ignition signal (terminal 1) defective

Possible causes:

Short or break on the wire for the ignition signal from the ABS/ASC control unit to DME control unit cylinder 1...6

Function ignition signal (terminal 1) from DME control unit cylinder 1...6 faulty

Troubleshooting:

Check wire from ABS/ASC control unit Pin 38 to DME control unit cylinder 1...6 and repair if necessary.

Attention!

Do not start engine during this test

High voltage pulses are applied to the ABS/ASC control unit Pin 38 when the engine is running. On no account come in contact with current carrying parts. Risk of fatal injury!

Defect Code 10

Explanation:

ABS/ASC control unit defective

Possible cause:

Hardware defect in the control unit

Troubleshooting:

Switch off ignition, renew ABS/ASC control unit

Other Defects in the System:

Defect Code 11

Defect symptom:

The multi–function lamp remains on after ignition on and engine start.

Flash code readout is not possible.

Possible causes:

Short to ground on the wire from the ABS/ASC control unit Pin 51 to the instrument cluster

Malfunction in the ABS/ASC control unit

Troubleshooting:

Switch off ignition and disconnect the ABS/ASC control unit.

Switch on ignition.

ASC multi–function lamp lights:

Check wire from ABS/ASC control unit Pin 51 to instrument cluster for a short and repair wire.

ASC multi–function lamp does not light:

Replace ABS/ASC control unit.

Defect Code 12

Defect symptom:

The ASC multi–function lamp does not light after ignition on.

Possible causes:

ASC multi–function lamp defective

Fault in voltage supply to multi–function lamp

ABS/ASC control unit not connected and poor connection at control unit connector

Troubleshooting:

Switch ignition off and on

Check plug connection at ABS/ASC control unit and repair if necessary

Switch off ignition and disconnect ABS/ASC control unit

Apply ground to ABS/ASC control unit Pin 51 (short–circuit jumper) and observe ASC multi–function lamp

The ASC multi–function lamp does not light:

Remove instrument cluster, check ASC multi–function lamp and renew if necessary

Check voltage supply at the socket of the multi–function lamp and repair defective wire if necessary.

The ASC multi–function lamp lights:

Replace ABS/ASC control unit

Defect Code 13

Defect symptom:

The ASC system cannot be switched off by means of the ASC button. The ASC system is constantly in standby mode.

Possible causes:

ASC button defective

Short to plus or break on the wire from the ASC button or from the ASC button to the ABS/ASC control unit.

Troubleshooting:

Measure resistance at the ABS/ASC control unit between Pin 1 and Pin 54;

Nominal value: Line break

Nominal value OK.:

Press ASC button and measure resistance once again.

Resistance >1 Ohm:

Check ASC button and wires, and repair or renew if necessary

Resistance <1 Ohm: Replace ABS/ASC control unit

Defect Code 14

Defect symptom:

The ASC multi–function lamp remains on despite ignition off

Possible causes:

Overvoltage protection relay sticking

Short to plus on the terminal 15 wire

Troubleshooting:

Disconnect overvoltage protection relay and observe ASC multi–function lamp

The ASC multi–function lamp goes out:

Renew overvoltage protection relay

The ASC multi–function lamp does not go out:

Check terminal 15 wire and repair if necessary.

Defect Code 15

Defect symptom:

MSR mode although handbrake is applied

Possible causes:

Handbrake switch defective

Short or break on the wire to the handbrake switch or from the handbrake switch to the ABS/ASC control unit or to the instrument cluster

Troubleshooting:

Switch on ignition

Measure voltage at ABS/ASC control unit Pin 3 and Pin 52; nominal value: approx. 12 V;

Nominal value not OK.:

Check wire to instrument cluster and indicator lamp and repair or replace as necessary

Nominal value OK.:

Apply handbrake and measure voltage once again; nominal value < 0.5 V;

Check handbrake switch, wire and ground connection and repair or renew as required

Defect Code 16

Defect symptom:

No ASC function, ASC multi–function lamp on, no flash code

Possible causes:

Terminal 30 wire faulty

Troubleshooting:

Measure voltage at ABS/ASC control unit Pin 3 and Pin 42; nominal value: approx. 12 V;

Check battery connection and wire to ABS/ASC control unit Pin 42 and repair if necessary.

Defect Code 17

Defect symptom:

Signal for ignition fade–out to DME control unit cylinder 7...12 faulty

Possible causes:

Short or break on the wire to the DME control unit cylinder 7...12

Troubleshooting:

Check wire from ABS/ASC control unit Pin 45 to DME control unit and repair if necessary

Defect Code 18

Defect symptom:

The ASC multi–function lamp goes out correctly after engine start.

The ASC system does not operate although the slip of the rear wheels is sufficiently high. (the ASC multi–function lamp remains off)

Possible causes:

Brake light switch defective

Short on the wire from the brake light switch to ABS/ASC control unit

Troubleshooting:

Disconnect ABS/ASC control unit and switch on ignition

Measure voltage at Pin 15:

Nominal value <1 V;

Depress brake pedal and measure voltage once again:

Nominal value approx. 12 V;

if nominal values are not achieved, renew brake light switch or check wire from brake light switch to ABS/ASC control unit Pin 15 and repair if necessary.

Functional Description

General

The task of the system is to control the slip of the drive wheels, irrespective of the condition of the road surface and corresponding to the coefficient of friction with the aim of achieving optimum driving stability and propulsion.

During a control phase, the engine torque is reduced by way of the DME (ignition intervention) and EML (throttle control system). If this measure is not sufficient, the drive wheel which is spinning too fast is additionally braked by means of the wheel brake in conjunction with a hydraulic actuator (plunger).

Display and Switching Logic

The ASC multi–function lamp in the instrument cluster lights constantly when the ignition is switched on (lamp check). The system is switched on after engine start and can be switched off as required with the passive button. The ASC lamp is off when the system is switched on.

The ASC lamp flashing in the instrument cluster indicates to the driver that the ASC+T control is active.

If the ASC lamp lights permanently with the engine running, this indicates that the system has switched off automatically due to a defect or it was switched off by hand.

Safety Information

The ASC+T system must be switched off before testing the vehicle on a brake or output test stand.

The ignition must be switched off before towing a vehicle with the front axle raised.

Throttle Control via EML

The throttle is controlled by means of the electronic throttle control system (EML).

If impermissibly high wheel slip occurs in a certain driving situation, the ASC+T determines the maximum drive torque which can be transmitted and constantly signals the necessary throttle position to the EML for the duration of the control phase.

The EML constantly signals the current throttle angle (set by driver) to the ASC+T via the DKV line. If the throttle angle is to be reduced, the EML receives this information by the DKR line. If the ASC+T requires that the throttle angle is increased (engine drag torque control), this information is signalled to the EML via the DKE line.

Ignition Intervention via DME

A further measure to reduce the engine torque is to retard the ignition timing.

In ASC+T mode (control) the digital motor electronics (DME) receives a digital signal from the ASC+T and consequently adjusts the ignition timing towards retard.

Transmission Intervention via EGS

When the ASC+T is active, a digital signal is sent to the electronic transmission control. As a result, the gearshift characteristic is changed within the EGS in order to facilitate smooth shifting or to temporarily suppress pending gearshifts.

Brake Intervention via the Plunger Hydraulic Unit

General

The fastest way of reducing the slip of a drive wheel is direct braking of the spinning wheel with the relevant wheel brake.

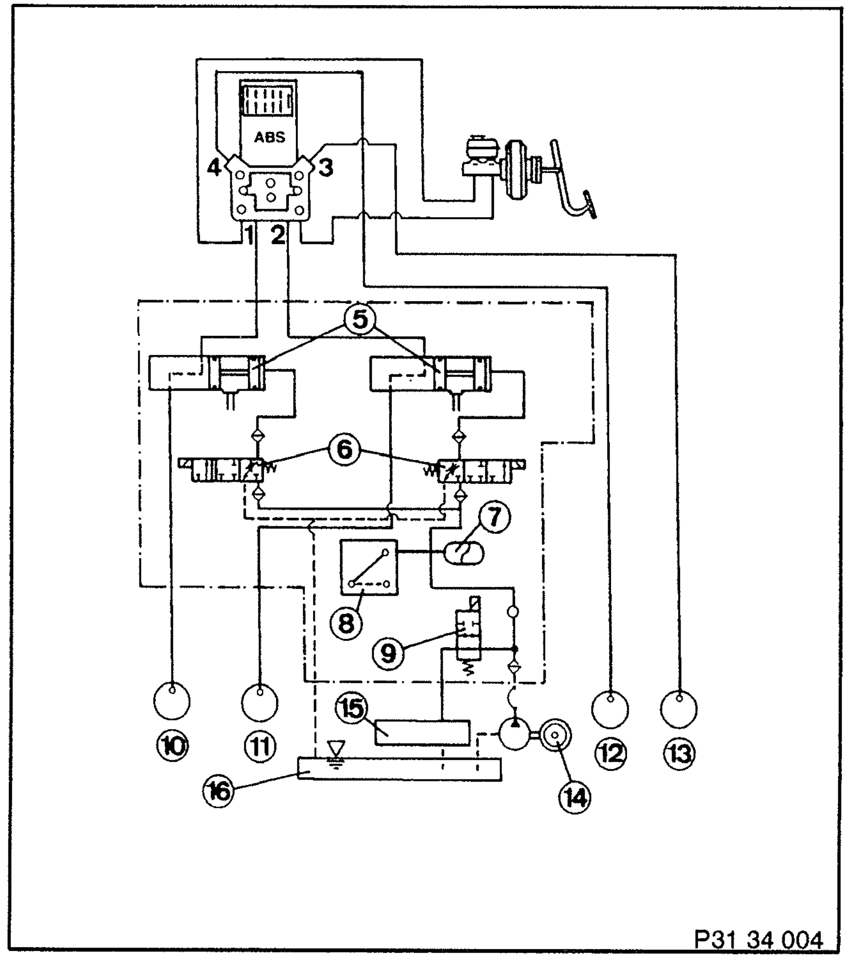
This brake intervention increases the stability and steerability of the vehicle and complements the measures: Throttle control and ignition angle adjustment. In addition, individual wheel–controlled braking can achieve a differential lock effect on the power axle on road surfaces with differing grip conditions.

Individual braking of the drive wheels occurs only within a speed range of 0...40 km/h. When starting off on a regular road surface and generally at speeds above 40 km/h, the brake is used only temporarily to reduce the drive torque.

Operating Principle

The brake pressure necessary for braking the wheel is applied via the two–plunger hydraulic unit. This hydraulic component is installed between the ABS hydraulic unit and the rear wheel brakes.

Via two solenoid valves, compressed oil (mineral oil) is applied from the pressure accumulator to the primary side of the plungers, thus displacing them. Due to this displacement, brake pressure is built up in the relevant wheel brake on the secondary side (brake fluid). if the brake pressure is to be reduced once again, the pressure in the primary circuit is reduced once again by way of the solenoid valves and the plunger moves back to its initial position.



Block Diagram of Hydraulic Plunger System

1,2	Rear brake line
3,4	Front brake line
5	Plunger
6	Solenoid valves
7	Pressure accumulator
8	Pressure switch
9	Accumulator charge valve
10,11	Rear wheel brakes
12,13	Front wheel brakes
14	Hydraulic tandem pump
15	Level control
16	Oil reservoir (mineral oil)

Safety Circuit

The control unit itself, as well as all components of the ASC+T system are constantly monitored for defects irrespective of the switching status of the ASC passive button. In the same way, the connections (interfaces) to other systems (DME, EML, EGS) are constantly checked or checked during a control procedure. If a fault occurs in the overall system, the ASC lamp in the instrument cluster is activated and the system switched off. If a defect occurs during a control procedure, the control function can be completed via the intact control circuit depending on the severity of the defect. The ABS/ASC+T control unit concept allows for separate deactivation of both individual systems, whereby any ABS defect results in deactivation of the ASC+T system..

Automatic Stability Control plus Traction (ASC+T)

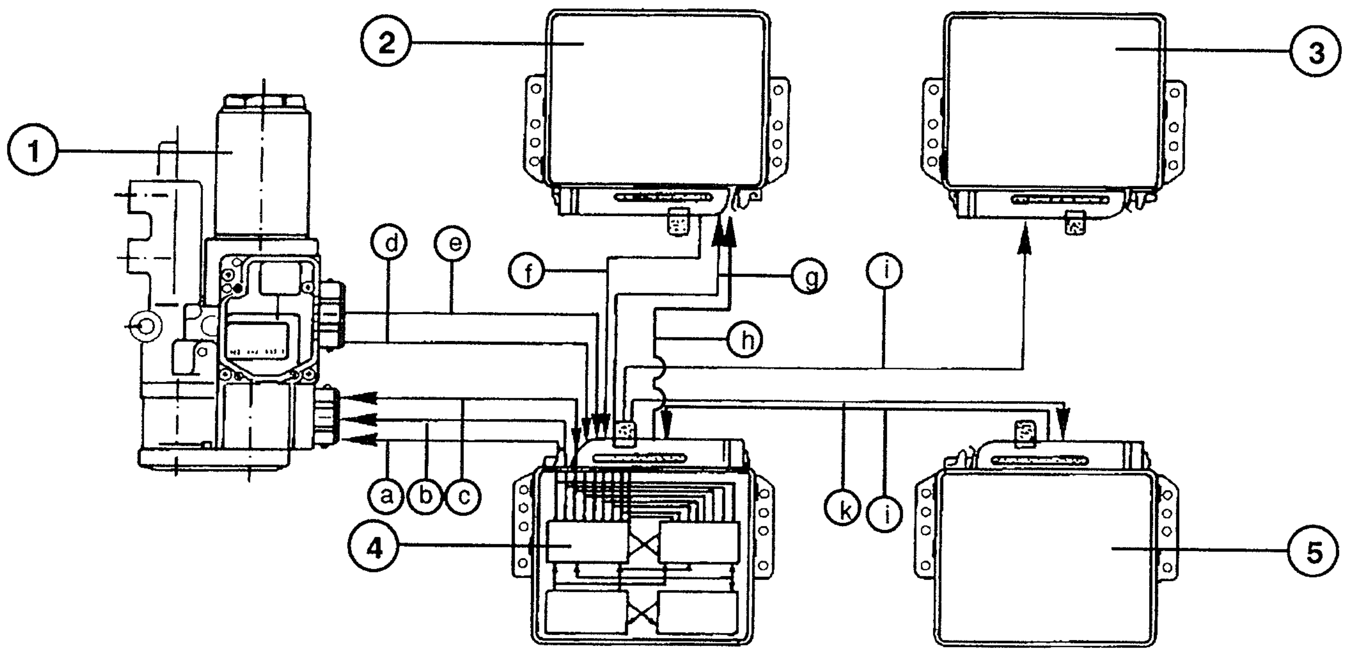
System components	Monitoring mode	Reaction of control circuit in the case of system component faults			
		Throttle control	Brake control	Ignition angle adjust-ment	ABS
EML interface	Constant monitoring	X	X	X	–
Speed sensor	Constant monitoring	O	O	O	O
Ignition angle adjustment	Constant monitoring	O	O	X	–
EGS intervention	Constant monitoring	O	O	O	–
Solenoid valve plunger: – Break, short to ground Constant monitoring	Constant monitoring	X	X	X	X
– Short to +12 V, power output stage defective	Monitoring only during control	X	X	X	X
Pressure supply	Constant monitoring	O	O	O	–
Control unit defect (processor defect)	Constant monitoring	X	X	X	X

X Immediate shut–down of the control circuit

O Emergency control can be performed via this control circuit up to the end of the ASC+T control phase

– No switch–off

ASC+T Interconnected System



P 31 34 005

System components		Signal routing between the individual system components			
1	ASC+T plunger hydraulics	a	Charging valve	g	DKR (Drosselklappenreduzierung)
2	EML	b	Control valve 1	h	DKE (throttle increase)
3	EGS	c	Control valve 2	i	Transmission intervention
4	ABS/ASC+T	d	Warning pressure	k	Ignition angle adjustment
5	DME	e	Accumulator pressure	l	Engine speed (TD)
		f	DKV (set throttle value)		

Notes on the BMW DIAGNOSTIC SYSTEM

Attention!

Only the ABS/ASC+T control unit with the BMW No. 1 159 494 (crimson red adhesive label) can be read out with the BMW diagnostic system.

This variant is installed in vehicles with manual transmission and as of approx. 9/90 also in vehicles with electronic transmission control.

The following diagnostic functions are possible with this control unit:

- Read control unit identification
- Read defect code memory
- Clear defect code memory

Diagnosis with the ABS/ASC+T control unit with the BMW No. 1 158 804 (red–violet adhesive label) is only possible via the flash code.

If a defect occurs in the vicinity of the interfaces to the other systems (DME, EML, EGS), the defect code memory of the system concerned should always be read out with the BMW diagnostic system in the case of both control unit variants.

Abbreviations

ASC + T	Automatic stability control plus traction
ABS	Antilock brake system
DME	Digital motor electronics
EML	Electronic throttle control
EGS	Electronic transmission controi
DKV	Set throttle data
DKR	Throttle reduction
DKE	Throttle increase
ZWV	Ignition timing adjustment
VL	Front left
VR	Front right
HL	Rear left
HR	Rear right
SG	Control unit
E	Input
A	Output
Sila	Safety lamp

Pin Assignments

Connector

Number	Type	Description
X 11	55–pole	ABS/ASC+T unit connector
X 31	12–pole, black	ABS hydraulic unit connector
X 113	2–pole, white	Plug connection, front part Front right ABS sensor
X 114	2–pole, white	Plug connection, front part Front left ABS sensor
X 376	2–pole, white	Plug connection, front part Rear left ABS sensor
X 377	2–pole, white	Plug connection, front part Rear right ABS sensor
X 18024	4–pole, black	Plug connection, ASC+T pressure sensor
X 18025	6–pole, black	Plug connection ASC+T plunger

Pin assignments at connector X 11 (ABS/ASC+T unit connector)

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
1	E	B + (terminal 15)	DME main relay	approx. 12V	Ignition on
2	A	Rear left solenoid valve activation	ABS hydraulic unit	Ground	Cannot be measured statically
3	E	Control unit ground	Body ground	Ground	None
4	E/A	Diagnostic link TxD	Diagnostic bus	–	–
5	A	Motor relay activation	ABS hydraulic unit	Ground	Cannot be measured statically
6	A	Throttle reduction	EML	Pulse width–modulated square–wave signal	Cannot be measured statically
7	A	Valve relay activation	ABS hydraulic unit	approx. 0V	Ignition on
8	A	Throttle valve increase	EML	Pulse width–modulated square–wave signal	Cannot be measured statically
9	not used				
10	not used				
11	E	B+ (terminal 30)	Battery	approx. 12V	Only for control unit with the BMW No. 1 158 804 (red–violet adhesive label)
12	not used				
13	E	Operating pressure signal	Plunger hydraulic unit	< 1,5V/ > 3,5V	Ignition on
14	E	Set throttle value	EML	Pulse width–modulated square–wave signal	Cannot be measured statically
15	A	Coding jumper manual transmission	Pin 34 (stabilized voltage)	5V	None
16	not used				
17	E	Voltage signal valve relay	Plunger/ABS hydraulic unit	approx. 12V	Ignition on
18	A	Rear right solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
19	A	Front left solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
20	A	Voltage signal motor relay	ABS hydraulic unit	approx. 12V	None
21	A	Rear left solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
22	A	Front right solenoid valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
23	E	Voltage signal solenoid valves	Plunger hydraulic unit	approx. 12V	Ignition on
24	E	Voltage signal ABS–Sila	Instrument cluster	approx. 0V/approx. 12V	Ignition on/engine on
25	E	Accumulator warning pressure threshold	Plunger hydraulic unit	< 1,5V/ > 3,5V	Ignition on
26	not used				
27	E	Terminal 61d D+	Alternator	> 12V	Engine on
28	E	ASC button signal	ASC button	approx. 0V/approx. 12V	Ignition on/ASC button depressed
29	E	Brake light signal	Brake light switch	approx. 12V	Ignition on
30	E	Diagnostic link RxD	Diagnostic bus	–	–
31	E	Motor relay signal	ABS hydraulic unit	approx. 12V	Cannot be measured statically
32	E	Handbrake switch signal	Handbrake switch	approx. 12V	Ignition on
33	A	Accumulator charging valve activation	Plunger hydraulic unit	Ground	Cannot be measured statically
34	E	Coding jumper manual transmission	Pin 15	–	–
35	not used				
36	A		ABS hydraulic unit	Ground	Cannot be measured statically
37	E	Control unit ground	Body ground	Ground	None
38	not used				
39	A	Ignition angle adjustment	DME	approx.12V	Cannot be measured statically
40	A	ASC multi–function lamp	Instrument cluster	approx. 0V/approx. 12V	Ignition on/engine on

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
41	not used				
42	A	Rear right wheel speed sensor ground	Speed sensor	Ground	None
43	E	Rear right wheel speed signal	Speed sensor	AC voltage	Cannot be measured statically
44	A	Rear left wheel speed sensor ground	Speed sensor	Ground	None
45	E	Rear left wheel speed signal	Speed sensor	AC voltage	Cannot be measured statically
46	A	Front right wheel speed sensor ground	Speed sensor	Ground	None
47	E	Rear left wheel speed signal	Speed sensor	AC voltage	Cannot be measured statically
48	A	Front left wheel speed sensor ground	Speed sensor	Ground	None
49	not used				
50	E	Front left wheel speed signal	Speed sensor	AC voltage	Cannot be measured statically
51	not used				
52	E	Control unit ground	Body ground	Ground	None
53	not used				
54	A	Signal transmission intervention	EGS	approx. 12V	Ignition on
55	E	Engine speed signal	DME	Square–wave signal	Cannot be measured statically

Pin assignments at connector X31 (ABS hydraulic unit connector)

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
1	–	Front left solenoid valve activation	ABS/ASC+T control unit	Ground	–
2	–	Valve relay activation	ABS/ASC+T control unit	Ground	–

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
3	–	Front right solenoid valve activation	ABS/ASC+T control unit	Ground	–
4	–	Voltage signal valve relay	Solder point in wiring harness	approx. 12V	–
5	–	Rear left solenoid valve activation	ABS/ASC+T control unit	Ground	–
6	–	B+ (terminal 30)	Battery	approx. 12V	–
7	–	Rear right solenoid valve activation	ABS/ASC+T control unit	Ground	–
8	–	Motor relay voltage	ABS/ASC+T control unit	approx. 12V	–
9	–	Motor relay signal	ABS/ASC+T control unit	approx. 12V	–
10	–	B+ (terminal 30)	Battery	approx. 12V	–
11	–	Signal ABS–Sila	Instrument cluster	Ground	Ignition on
12	–	Motor relay activation	ABS/ASC+T control unit	Ground	–

Pin assignments at connector X 18024 (Plug connection plunger ASC+T)

Pin	Ty-pe	Description/function	Connection	Type of signal	Measuring notes
1	–	Voltage signal plunger solenoid valves	Solder point in wiring harness	approx. 12V	–
2	–	Accumulator charging valve activa-tion	ABS/ASC+T control unit	Ground	–
3	–	Rear right solenoid valve activation	ABS/ASC+T control unit	Ground	–
4	–	Rear left solenoid valve activation	ABS/ASC+T control unit	Ground	–

Pin assignments at connector X 18025 (plug connection pressure sensor)

Pin	Type	Description/function	Connection	Type of signal	Measuring notes
1	–	Operating pressure signal	–	< 1,5 V / > 3,5V	–
2	–	Pressure sensor ground connection	Body ground	Ground	–
3	not used				
4	not used				
5	–	Voltage signal pressure sensor	ABS/ASC+T control unit	approx. 12V	–
6	–	Accumulator warning pressure threshold	ABS/ASC+T control unit	< 1,5 V / > 3,5V	–

Adapters

Component	Connector No.	Description	Adapter No.
ABS/ASC+T control unit	X 7	Universal adapter	HWB 81 12 9 425 091
		Connection lead for periphery, 55–pole	HWB 81 12 9 428 907
		Connection lead for control unit, 55–pole	HWB 81 12 9 428 908

Troubleshooting

Note on Differentiation between ABS/ASC and ABS/ASC+T

The ABS/ASC+T system can be identified by the plunger hydraulic unit which is arranged in the engine compartment above the left–hand engine mount or by its vent connection on the left–hand side in the engine compartment.

The following test instructions are to be used corresponding to the variant:

ABS/ASC: 3450.1A

ABS/ASC+T: 3450.2A

Defect Code Storage

If a defect occurs in the ABS or ASC+T system when the control unit is active (ignition on), this defect is stored permanently and the relevant system or the entire system is switched off. Defects at the wheel sensors can only be stored when the vehicle is driving at speeds in excess of 12 km/h. All faults which result in the ABS system switching off also cause the ASC+T system to switch off, i.e. all ABS components are monitored by the ASC+T system.

However, the ABS system is not switched off in the case of every defect in the ASC+T system. If two or more defects occur simultaneously, the one with the highest priority is stored. The lower the number of flash pulses, the higher the priority of the defect.

The ABS/ASC+T is fully operable once again if the defect no longer exists at the next start (ignition on). The defect code still remains stored in the defect code memory until it is either cleared (see "clearing defect code memory") or is overwritten by another defect code.

There are 20 different defect codes, however, only one can be stored at a time.

With the ABS/ASC+T control unit BMW No. 1 159 494 (diagnostic capabilities via the diagnostic links), 3 different defect codes from a total of 22 can be stored at any one time.

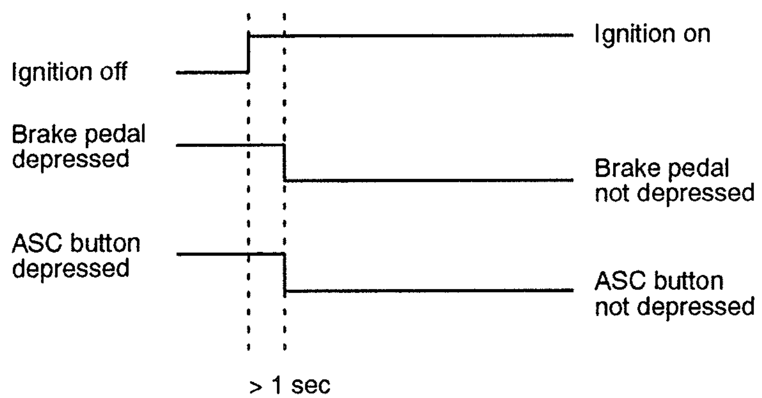
Note:

In extreme driving situations (skidding) with the ASC+T system switched off, it is possible that the ABS system cuts out and the defect code 14 (valve relay) is stored. Simply clear the defect code memory in this case.

Defect Code Memory Readout

Activating the flash code

- Switch off ignition
- Press ASC button and depress brake pedal simultaneously
- Hold ASC button and brake pedal depressed simultaneously and switch on ignition
- Keep depressed for at least 1 second and then release ASC button and brake pedal



P31 34 001

Note:

The steps to activate the flash code must be repeated if the ASC lamp remains on.

Reading out the flash code

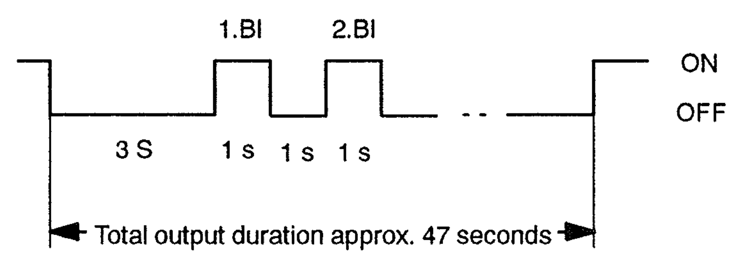
The flash code is output for approx. 47 seconds irrespective of which defect code is stored.

After activation of the defect code, the ASC lamp goes out for 3 seconds and then begins outputting the flash pulses at a flash frequency in a pulse/pause ratio of 1sec/1 sec.

The number of flash pulses indicates which defect code is stored. Refer to the table of defect codes below.

Example:

2 flash pulses (Bl) = Defect code 02



P31 34 002

Clearing Defect Code Memory

There are three possible ways of clearing the defect code memory:

Within 3 seconds after the end of the flash code output (after 47 seconds) when the ASC lamp lights permanently once again, press the ASC button for at least 1 second.

Disconnect vehicle battery. (Attention! Defect code memories of other systems may be cleared)

Disconnect control unit. (Attention! Ignition must be switched off)

In the case of ABS/ASC+T control units with the BMW No. 1 159 494 (diagnostic capability via the diagnostic links), the contents of the defect code memory can be cleared with the BMW diagnostic system. The contents of the defect code memory are not deleted if the control unit is disconnected.

Troubleshooting Procedure

- Check system for mechanical and hydraulic defects (refer to Repair Instructions Group 34)
- Read out defect code memory via flash code

  Note:

  If the defect code cannot be read out, then continue troubleshooting as described under the point "other system defects".
- Note down number of flash pulses
- In order to exclude the possibility of the counting errors, read out the defect code memory once again
- Clear defect code memory
- Perform troubleshooting with schematic
- Rectify defect
- Perform test run

  Note:

  During the test run, the car should be driven for at lest 20 seconds at a speed in excess of 30 km/h or for at least 3 seconds at a speed above 50 km/h.
- When defect code is stored once again, repeat procedure until no defect code is stored

Simulating ASC Control Mode

- Raise vehicle on floor jack (all wheels must turn freely)
- Set automatic selector lever to "Neutral (N)"
- Start engine
- Set engine speed by means of accelerator pedal or adapter EML No. 12.7010 (see Repair Instructions 12 70 500) to approx. 2000 rpm
- Quickly accelerate rear left or right wheel by hand in forward direction

Reaction: The engine speed must drop noticeably

Dynamic Testing of the Speed Sensors

Connect oscilloscope of BMW Service Tester as follows:

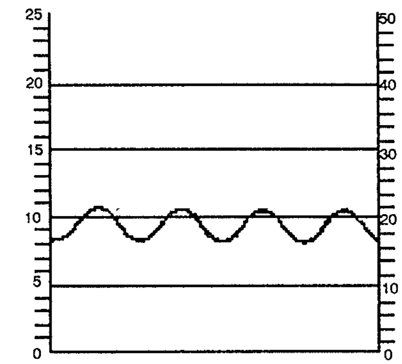
- Terminal D+ blue to speed sensor signal
- Frequency (–) black to speed sensor ground
- Frequency (+) blue to terminal 1 black

♦M♦ 13 Select frequency and enter 80 Hz

♦M♦ 22 Select oscilloscope

Uniformly turn wheel by hand. A sinusoidal curve must appear (amplitude and period duration change depending upon the rotary speed).

Example:



P31 34 003

Uniform progression of speed signal (signal OK.)

Checking for Interchanged Wheel Speed Sensors

Perform dynamic wheel speed sensor test in accordance with schematic or to "pin assignments" at each wheel.

If no signal can be seen on the oscilloscope from one wheel, turn the opposite wheel. If a signal is displayed, this indicates that the wheel speed sensor wiring has been interchanged.

Defect codes which can be stored by the control unit (BMW No. 1 158 804 – red–violet adhesive label)

Number of flash pulses	Defect description	Defect code
1	No defect code stored	–
2	EML interface defect	Defect code 02
3	DME interface defect	Defect code 03
4	Rear left wheel sensor defect	Defect code 04
5	Rear right wheel sensor defect	Defect code 05
6	Front right wheel sensor defect	Defect code 06
7	Front left wheel sensor defect	Defect code 07
8	Rear left ABS valve defect	Defect code 08
9	Rear right ABS valve defect	Defect code 09
10	Front right ABS valve defect	Defect code 10
11	Front left ABS valve defect	Defect code 11
12	Rear left plunger valve defect	Defect code 12
13	Rear right plunger valve defect	Defect code 13
14	ABS valve relay defect	Defect code 14
15	ABS return pump defect	Defect code 15
16	ASC+T accumulator charging valve defect	Defect code 16
17	Charging time defect plunger accumulator	Defect code 17
18	Leak defect plunger accumulator	Defect code 18
19	Accumulator warning pressure threshold defect	Defect code 19
20	EGS interface defect	Defect code 20
21	Internal control unit defect	Defect code 21

Additional defects control unit (BMW No. 1 159 494 – crimson red adhesive label)

Number of flash pulses	Defect description	Defect code
22	Wheel speed signal defect	Defect code 22
23	Transmission coding defect (option pin)	Defect code 23

Defect Code 02

Explanation:

Defect on the connection links (interface) to EML (DKV, DKE, DKR signal).

Possible cause:

Short or break on one of the wires to the EML

Defect during synchronisation with the EML control unit

Troubleshooting:

Switch off ignition and detach control unit connector.

Check DKV, DKR, DKE line from ABS/ASC+T Pin 14, 6, 8 to the EML.

Connect control unit and switch on ignition.

Measure frequency of the DKV, DKR, DKE signal with ♦**M**♦ , nominal value approx. 100 Hz.

Repair defective wire if necessary.

If no defect can be found, clear defect code memory.

Note:

The same DKV signal is supplied to the EGS control unit. Read out EGS defect code memory and, if necessary, also check wire to the EGS.

Defect Code 03

Explanation:

Defect on the connection link (interface) to the DME (ignition angle adjustment)

Possible cause:

Short or break on the wire to the DME control unit

Troubleshooting:

Switch off ignition and detach control unit connector

Check ZWV wire from ABS/ASC+T Pin 9 to the DME and repair if necessary

Connect control unit and switch on ignition.

Read out ignition angle (dynamic) by way of the DME diagnostic program ♦**D**♦ 200 status monitoring for both DME control units.

Simulate ASC+T control mode; the ignition angle must be set towards retard.

If the ignition timing is not adjusted, there is a defect either in the ABS/ASC+T or in a DME control unit.

Defect Code 04

Explanation:

No or faulty sensor signal from rear left wheel sensor

Possible cause:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC+T control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 44/45; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 44/45.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 05

Explanation:

No or faulty sensor signal from rear right wheel sensor

Possible cause:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC+T control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 42/43; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 42/43.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 06

Explanation:

No or faulty sensor signal from front right wheel sensor

Possible cause:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC+T control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 46/47; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 46/47.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 07

Explanation:

No or faulty sensor signal from front left wheel sensor

Possible cause:

Short or break to ground – or the signal line to/from the speed sensor

Different tyres on rear axle (different wheel circumferences)

Defective pulse wheel (corrosion, dirt, tooth damage)

Incorrect number of teeth on pulse wheel

Air gap (clearance) too large or too small

Wheel speed sensor defective or dirty

Troubleshooting:

Perform following checks and repair or renew defective components as necessary:

- Check tyres of correct tyre size on all four wheels
- Check wheel bearing play at all four wheels and renew bearings if necessary
- Check pulse wheel (number of teeth 48, damage, corrosion, dirt build–up)
- Check air gap (clearance) (nominal value 0.05...0.9 mm)
- Check wheel speed sensors (mechanical damage, dirt build–up e.g. metal particles)
- Check wheel speed sensor line (mechanical damage e.g. pinched points)
- Check plug connections under the left rear seat (firm connection, corrosion, connection interchanged)

Switch off ignition and disconnect the ABS/ASC+T control unit.

Perform following measurements and in the case of deviation renew defective components:

Resistance wire harness side Pin 48/50; nominal value: 650...1600 Ohm; move wires and plug connection (loose contact); if necessary detach plug connection and repeat resistance measurement to locate defect.

Perform dynamic speed signal test at Pin 48/50.

Ensure waves are uniform, if necessary, renew pulse wheel or wheel speed sensor.

Defect Code 08

Explanation:

Rear left ABS solenoid valve malfunction

Possible cause:

Short or break on the wire to the ABS–hydraulic unit

Solenoid valve defective

Troubleshooting:

Ensure plug connection is firmly fitted at the ABS hydraulic unit and check for corrosion

Switch off ignition and detach control unit connector

Detach connector X31 at the ABS hydraulic unit

Check wire from the ABS/ASC+T control unit Pin 2 to ABS hydraulic unit Pin 5

Attach connector X31 at ABS hydraulic unit

Measure resistance at the control unit connector (X11) Pin 2/17;

Nominal value: 0.8...1.5 Ohm

Measure inductance at control unit connector (X11) Pin 2/17 (see SVT Operating Manual);

Nominal value: approx. 3 mH

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 09

Explanation:

Rear right ABS solenoid valve malfunction

Possible cause:

Short or break on the wire to the ABS–hydraulic unit

Solenoid valve defective

Troubleshooting:

Ensure plug connection is firmly fitted at the ABS hydraulic unit and check for corrosion

Switch off ignition and detach control unit connector

Detach connector X31 at the ABS hydraulic unit

Check wire from the ABS/ASC+T control unit Pin 36 to ABS hydraulic unit Pin 7

Attach connector X31 at ABS hydraulic unit

Measure resistance at the control unit connector (X11) Pin 36/17;

Nominal value: 0.8...1.5 Ohm

Measure inductance at control unit connector (X11) Pin 36/17 (see SVT Operating Manual);

Nominal value: approx. 3 mH

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 10

Explanation:

Front right ABS solenoid valve malfunction

Possible cause:

Short or break on the wire to the ABS–hydraulic unit

Solenoid valve defective

Troubleshooting:

Ensure plug connection is firmly fitted at the ABS hydraulic unit and check for corrosion

Switch off ignition and detach control unit connector

Detach connector X31 at the ABS hydraulic unit

Check wire from the ABS/ASC+T control unit Pin 22 to ABS hydraulic unit Pin 3

Attach connector X31 at ABS hydraulic unit

Measure resistance at the control unit connector (X11) Pin 22/17;

Nominal value: 0.8...1.5 Ohm

Measure inductance at control unit connector (X11) Pin 22/17 (see SVT Operating Manual);

Nominal value: approx. 3 mH

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 11

Explanation:

Front left ABS solenoid valve malfunction

Possible cause:

Short or break on the wire to the ABS–hydraulic unit

Solenoid valve defective

Troubleshooting:

Ensure plug connection is firmly fitted at the ABS hydraulic unit and check for corrosion

Switch off ignition and detach control unit connector

Detach connector X31 at the ABS hydraulic unit

Check wire from the ABS/ASC+T control unit Pin 19 to ABS hydraulic unit Pin 1

Attach connector X31 at ABS hydraulic unit

Measure resistance at the control unit connector (X11) Pin 19/17;

Nominal value: 0.8...1.5 Ohm

Measure inductance at control unit connector (X11) Pin 19/17 (see SVT Operating Manual);

Nominal value: approx. 3 mH

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 12

Explanation:

Rear left plunger solenoid valve malfunction

Possible cause:

Short or break on control wire to plunger hydraulic unit

Short or break on B+ supply wire from ABS hydraulic unit to plunger hydraulic unit

Solenoid valve defective

Troubleshooting:

Switch off ignition and detach control unit connector

Measure resistance at control unit connector (X11) Pin 21/23;

Nominal value: 0.8...1.8 Ohm

Measure inductance at control unit connector (X11) Pin 21/23 (see SVT Operating Manual);

Nominal value: approx. 20 mH

If necessary, remove plunger hydraulic unit (see Repair Instructions Group 34), ensure plug connection is firmly fitted and check for corrosion, measure internal resistance of the solenoid valve directly at the plunger hydraulic unit.

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 13

Explanation:

Rear right plunger solenoid valve malfunction

Possible cause:

Short or break on control wire to plunger hydraulic unit

Short or break on B+ supply wire from ABS hydraulic unit to plunger hydraulic unit

Solenoid valve defective

Troubleshooting:

Switch off ignition and detach control unit connector

Measure resistance at control unit connector (X11) Pin 18/23;

Nominal value: 0.8...1.8 Ohm

Measure inductance at control unit connector (X11) Pin 18/23 (see SVT Operating Manual);

Nominal value: approx. 20 mH

If necessary, remove plunger hydraulic unit (see Repair Instructions Group 34), ensure plug connection is firmly fitted and check for corrosion, measure internal resistance of the solenoid valve directly at the plunger hydraulic unit.

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 14

Explanation:

Valve relay not operating or defective

Possible cause:

Short or break on the control wire to the ABS hydraulic unit

Short or break on B+ supply wire from return pump motor relay to valve relay

Short or break on a monitoring wire from ABS hydraulic unit to ABS/ASC+T control unit

Valve relay defective

See note on Page 3450.2A–14

Troubleshooting:

Ensure valve relay is firmly fitted and check for corrosion at the contacts, renew if necessary.

Switch on ignition and check whether the valve relay energizes.

Valve relay energizes:

- Switch off ignition and detach control unit connector
- Check monitoring wires from the ABS hydraulic unit Pin 4 to ABS/ASC+T control unit Pin 17 and Pin 23 and repair if necessary

Valve relay does not energize:

- Switch off ignition and detach control unit connector
- Check B+ supply wire from the ABS/ASC+T control unit Pin 20 to valve relay Pin 86 and repair if necessary
- Check control wire from the ABS/ASC+T control unit Pin 7 to ABS hydraulic unit Pin 2 and repair if necessary

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 15

Explanation:

Return pump defective or not operating

Possible cause:

Short or break on the control wire to the ABS hydraulic unit (motor relay)

Short or break on the B+ supply wire from ABS/ASC+T control unit to ABS hydraulic unit

Short or break on a monitoring wire from ABS hydraulic unit to ABS/ ASC+T control unit

Motor relay defective

Ground connection for pump motor defective

Pump motor defective

Troubleshooting:

Switch off ignition and attach control unit connector

Ensure motor relay is firmly fitted and check for corrosion at the contacts, renew if necessary.

Check B+ supply wire from the ABS/ASC+T control unit connector (X11) Pin 20 to ABS hydraulic unit Pin 8 and repair if necessary.

Check control wire from the ABS/ASC+T control unit connector (X11) Pin 5 to ABS hydraulic unit Pin 12 and repair if necessary.

Check ground connection to ABS hydraulic unit and repair if necessary

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 16

Explanation:

Accumulator charging valve malfunction

Possible cause:

Short or break of control wire to plunger hydraulic unit

Short or break on B+ supply wire from ABS hydraulic unit to plunger hydraulic unit

Solenoid valve defective

Troubleshooting:

Switch off ignition and detach control unit connector

Measure resistance at control unit connector (X11) Pin 33/23;

Nominal value: 3.3...4.3 Ohm

Measure inductance at control unit connector (X11) Pin 33/23 (see SVT Operating Manual);

Nominal value: approx. 20 mH

If necessary, remove plunger hydraulic unit (see Repair Instructions Group 34), ensure plug connection is firmly fitted and check for corrosion, measure internal resistance of the solenoid valve directly at the plunger hydraulic unit.

Replace ABS/ASC+T control unit if no defect can be found on the wiring harness side.

Defect Code 17

Explanation:

Plunger accumulator charging longer than 15 seconds or incorrect pressure signal

Possible cause:

Mechanical or hydraulic defect in plunger system

Short to ground or break on the pressure signal wire from the plunger hydraulic unit to the ABS/ASC+T control unit

Accumulator charging valve does not open

Pressure sensor defective

Troubleshooting:

Switch on ignition and measure voltage at the control unit connector (X11) Pin 13; nominal value: <1.5 V or >3.5 V;

Nominal value OK.:

- Visually inspect all hydraulic lines and connections, renew defective parts if necessary
- Check function of tandem hydraulic pump in accordance with Repair Instructions Group 32/34 and renew defective parts if necessary

Nominal value not OK.:

- Remove plunger hydraulic unit in accordance with Repair Instructions Group 34
- Ensure plug connections are firmly fitted and check for corrosion
- Check B+ supply wire from control unit connector (X11) Pin 17 to pressure sensor connector (X 18025) Pin 5 and repair if necessary
- Check pressure signal wire from control unit connector (X11) Pin 13 to pressure sensor connector (X 18025) Pin 1 and repair if necessary
- Check ground wire to pressure sensor connector (X 18025) Pin 2 and repair if necessary

Defect Code 18

Explanation:

Drop in plunger accumulator pressure

Possible cause:

Plunger accumulator leaking due to internal or external leaks

Troubleshooting:

Remove plunger hydraulic unit in accordance with Repair Instructions Group 34

Visually inspect plunger hydraulic unit and, if necessary, renew in accordance with Repair Instructions Group 34

Ensure plug connections are firmly fitted and check for corrosion

Check pressure signal wire from control unit connector (X11) Pin 13 to pressure sensor connector (X 18025) Pin 1 and repair if necessary.

Defect Code 19

Explanation:

Plunger accumulator pressure too low or signal for plunger warning pressure threshold faulty

Possible cause:

Short to plus on the pressure signal wire from plunger hydraulic unit to the ABS/ASC+T control unit

Break or short to ground on the warning pressure signal wire from plunger hydraulic unit to the ABS/ASC+T control unit

Troubleshooting:

Switch on ignition and measure voltage at the control unit connector (X11) Pin 13; nominal value: <1.5 V or >3.5 V;

Nominal value OK.:

- Remove plunger hydraulic unit in accordance with Repair Instructions Group 34
- Ensure plug connections are firmly fitted and check for corrosion
- Check warning pressure signal wire from control unit connector (X11) Pin 25 to pressure sensor connector (X 18025) Pin 6 and repair if necessary

Nominal value not OK.:

- Remove plunger hydraulic unit in accordance with Repair Instructions Group 34
- Ensure plug connections are firmly fitted and check for corrosion
- Check B+ supply wire from control unit connector (X11) Pin 17 to pressure sensor connector (X 18025) Pin 5 and repair if necessary
- Check pressure signal wire from control unit connector (X11) Pin 13 to pressure sensor connector (X 18025) Pin 1 and repair if necessary
- Check ground wire to pressure sensor connector (X 18025) Pin 2 and repair if necessary

Defect Code 20

Explanation:

Defect on connecting link (interface) to the EGS (transmission intervention)

Possible cause:

Short or break on the wire to the EGS control unit

Troubleshooting:

Switch on ignition and measure voltage at control unit connector (X11) Pin 54; nominal value: approx. 12 V

Nominal value OK.:

- Check wire from control unit connector (X11) Pin 54 to the EGS for continuity and repair if necessary
- Simulate control mode
- Voltage must drop to approx. 0 V, if necessary, renew ABS/ASC+T control unit

Nominal value not OK.:

- Repair wire, if necessary renew ABS/ASC+T control unit

Defect Code 21

Explanation:

ABS/ASC+T control unit defective

Possible cause:

Hardware defect in the control unit

Troubleshooting:

Switch off ignition, renew ABS/ASC+T control unit

Defect Code 22

Explanation:

Ineffective control when starting off due to lack of engine speed

In vehicles with manual transmissions, the engine may stall in control mode

Possible cause:

Short or break on the wire from the DME control units to the ABS/ASC+T control unit

The defect code can be stored due to deactivation of terminal 15 during driving (e.g. ignition switched off and on during driving)

Troubleshooting:

Check speed signal wire from ABS/ASC+T control unit Pin 55 to the DME control units and repair if necessary

Clear defect code memory if no defect can be found

Defect Code 23

Explanation:

The ABS/ASC+T does not detect whether an EGS or a manual transmission is installed. Incorrect switchover of the transmission characteristic may result. This can cause less effective ASC operation when starting off.

Possible cause:

Short to plus or to ground at the option pin

Incorrect option pin coding is detected in the case of manual transmission with defect code 20.

Troubleshooting:

EGS:

Connecting wire at ABS/ASC+T control unit from Pin 15 to Pin 34 (wire jumper) must be open

Check wires (Pin 15, 34) for a short and repair if necessary.

Manual transmission:

Check connecting wire at ABS/ASC+T control unit from Pin 15 to Pin 34 for a short and repair if necessary.

Attention:

A break in this wire in vehicles with manual transmission is detected by way of defect code 20.

Other system defects

The system defect is not stored by the ABS/ASC+T control unit or the flash code cannot be read out.

Troubleshooting

Can the flash code be read out? — yes → Start engine. Is a voltage of more than 12 V applies at control unit connector Pin 27? — ja → Replace ABS/ASC+T control unit. If necessary, remove plunger hydraulic unit in accordance with Repair Instructions Group 34. measure voltage at pressure sensor connector (X 18025) Pin 2 and Pin 5 and repair or replace wires as necessary.

— * —

Start engine. Is a voltage of more than 12 V applies at control unit connector Pin 27? — no → Repair B+ wire

— * —

Can the flash code be read out? — no ↓

Is a voltage of approx. 12 V applied at control unit Pin 11? — no → Repair wire

— * —

Is a voltage of approx. 12 V applied at control unit Pin 11? — yes ↓

Are system functions OK.? — no → Switch off ignition. Measure voltage at control unit Pin 1. is approx. 12 V applied? — no → Check fuse and wire from DME main relay to ABS/ASC+T control unit Pin 1, repair or renew defective part yes ↓

yes ↓ Renew ABS/ASC+T control unit.

— * —

yes ↓

— * —

Switch on ignition. Does ASC lamp light? — no → Measure voltage at control unit Pin 40. Is ground applied? — no → Check wire to instrument cluster (short to plus), if necessary renew ABS/ASC+T control unit.

— * —

yes ↓

yes ↓ Check wire from control unit Pin 40 to instrument cluster, wire terminal 15 and ASC lamp, repair or renew defective part.

— * —

yes ↓

Does ASC lamp flash in control mode? — no → Renew ABS/ASC+T control unit.

— * —

yes ↓

Switch off ASC system. Does ASC lamp light?	— no →	Press ASC button and measure voltage at control unit Pin 28. Is approx. 12 V applied?	— no →	Check wires to ASC button and repair or renew defective part.
— * —		yes ↓		— * —
		Replace ABS/ASC+T control unit		
		— * —		

Functional Description

The electronic damper control III (EDC III) is an electronic control system for the running gear. The characteristics of the shock absorbers are adapted to the dynamic driving requirements depending on the driving conditions recorded by system sensors and the program (sports/comfort) selected by the driver.

The following sensors integrated in the EDC system supply data to the EDC control unit:

Sensors	**Recorded data**
Front acceleration sensor	Front body acceleration
Rear acceleration sensor	Rear body acceleration
Longitudinal acceleration sensor	Longitudinal acceleration
Speed sensor	Vehicle speed
Steering angle sensor	Steering angle and steering angle speed

On the basis of the influencing sensor measured values, the EDC control unit activates the solenoid valves integrated in the damper with stages "soft", "medium" and "hard". Activation takes place separately for each axle. To avoid unnecessary power consumption, the damper valves are switched off when the vehicle is stationary (vehicle speed 0 km/h), i.e. power is cut ("hard" setting). After starting off, the dampers are set in the "medium" stage up to approx. 5 km/h, irrespective of the selected EDC program.

With the comfort program selected, the dampers assume the "soft" setting at speeds in excess of 5 km/h. "Medium" is the basic stage for the damper setting in the sports program. To avoid unnecessary switching of the damper valves in town traffic (many changes in steering angle but low speeds), the steering angle sensor is ignored up to a speed of approx. 40 km/h.

In the "comfort" (K) program, the damper stages "soft", "medium" and "hard" are activated, in the "sports" (S) program, only the stages "medium" and "hard" are activated. The programs are selected by way of the EDC program switch in the centre console.

Safety Circuit

The EDC control unit and all components of the system are constantly monitored for malfunctions. Faults which occur in the EDC system are stored in the defect code memory. In addition, defects – depending on type and severity – lead to certain reactions of the control unit (safety circuit) in order to maintain complete driving safety even in the event of serious faults.

TTable of Defect Reactions EDC III

Defect	System reaction
Longitudinal acceleration sensor	Acceleration signal is ignored
Rear vertical acceleration sensor	Dampers are only operated in the "medium" stage
Front vertical acceleration sensor	Dampers are only operated in the "medium" stage
Speed sensor	Dampers are only operated in the "medium" stage
Steering angle sensor	Dampers are only operated in the "medium" stage
"Soft" damper stage electrically defective	Damper stage "soft" replaced by "medium"
"Medium" damper stage electrically defective	Damper stage "medium" replaced by "hard"
Control unit defective	System is switched off, dampers fixed in "hard" setting

Notes on the BMW DIAGNOSTIC SYSTEM

The vehicle variant is also specified in the identification page (model/engine type e.g. E 31 M70). If necessary, the EDC control unit can be newly coded or recoded under Point 5 Special Functions (selection page).

Abbreviations

EDC	Electronic damper control
SG	Control unit
VL	Front left
HL	Rear left
VR	Front right
HR	Rear right
a	Acceleration

Pin assignments

Pin assignments at connector X 263 (10–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measuring notes
1	A	Front control line, comfort	Damper valve	approx. 4,5 Volt	Voltage value	Switched off max. 1 Volt
2	A	Front control line, normal	Damper valve	approx. 4,5 Volt	Voltage value	Switched off max. 1 Volt
3	A	Rear control line, comfort	Damper valve	approx. 4,5 Volt	Voltage value	Switched off max. 1 Volt
4	A	Terminal 15	Sensors	U–Batt	–	–
5	A	Rear control line, normal	Damper valve	approx. 4,5 Volt	Voltage value	Switched off max. 1 Volt
6	E	Ground connection	Body ground	–	–	–
7	E	Ground connection	Body ground	–	–	–
8	–	not used	–	–	–	–
9	A	Supply line valve coils	Valve coils	approx. 2A holding current	Current value	Switched off 0 A
10	–	not used	–	–	–	–

Pin assignments at connector X 945 (26–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measuring notes
1	E	Acceleration sensor	Acceleration sensor	0–5 Volt	Status display	a = 0 = 2,5 Volt
2	A	Sports lamp	Sports indicator lamp	12 Volt	–	–
3	–	not used	–	–	–	–
4	–	not used	–	–	–	–
5	–	not used	–	–	–	–
6	E	Comfort switch	Program switch	Ground	Status display	–
7	E	Sports switch	Program switch	Ground	Status display	–
8	–	not used	–	–	–	–
9	–	not used	–	–	–	–
10	E	Inquiry headlight ON/OFF	Terminal 58	12 Volt	–	–
11	E	Terminal 15 connection	Rear part	12 Volt	–	–
12	E	Diagnostic link RXD	Diagnostic connector	–	–	–
13	E	Speed signal	EKM	Square–wave signal	Speed value	–
14	E	Steering angle signal connection, red	Steering angle sensor	0–5 Volt	Steering wheel angle	–
15	E	Steering angle signal connection, green	Steering angle sensor	0–5 Volt	Steering wheel angle	–
16	E	Longitudinal acceleration signal	Acceleration sensor	0–5 Volt	Status display	a = 0 = 2,5 Volt
17	A	Comfort lamp	Comfort indicator lamp	12 Volt	–	–
18	–	not used	–	–	–	–
19	A	Diagnostic link TXD	Diagnostic connector	–	–	–

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measuring notes
20	E	not used	–	–	–	–
21	E	Analog ground	Body ground	–	–	–
22	–	not used	–	–	–	–
23	E	EDC relay activation	EDC relay	12 Volt	–	Ignition on
24	E	Front acceleration signal	Acceleration sensor	0 – 5 Volt	Status display	a = 0 = 2,5 Volt
25	A	Supply voltage steering angle sensor	Steering angle sensor	5 Volt	–	Ignition on
26	E	Terminal 30 connection	Fuse F 32	12 Volt	–	–

Adapters

Component	Connector No.	Description	Adapter No.
Control unit	X 945	26–pole, black	Cartool 61 4 460

Troubleshooting

Notes

- Troubleshooting with BMW diagnostic system
- Battery charged, Umin = 12 Volt
- Removal and installation of control unit only with ignition switched off

Attention: The EDC system is protected by way of the EDC relay K 67. The EDC does not operate if this relay fails. The EDC system is deactivated by means of the safety circuit integrated in the software of the control unit. Operation is then only possible in the fixed stage "hard" of the dampers.

Notes on working on the EDC system:

After all work on the EDC system which renders disconnection of connecters, removal/installation of electrical/electronic components necessary, the defect code memory of the EDC system must be monitored and cleared if a defect code has been entered to the above specified work.

On completion of work on the front axle system (front wheel suspension, shock absorbers, steering), perform the steering angle offset with the aid of the diagnostic program.

Defect Code Table

♦D♦ Defect code memory – defects which can be stored by the control unit:

Defect codes 10, 11, 12, 13	: Steering angle signal
Defect code 20	: Road speed signal
Defect codes 30, 31, 32	: Acceleration signal front axle (vertical)
Defect codes 40, 41, 42	: Acceleration signal rear axle (vertical)
Defect codes 50, 51, 52	: Acceleration signal (axial)
Defect codes 60, 61, 62, 63	: Valve coil fault
Defect codes 70, 71, 72, 73	: Front axle valve fault
Defect codes 80, 81, 82, 83	: Rear axle valve fault

Malfunctions – defect codes which cannot be stored:

EDC does not operate	: Defect code 90
Malfunction program selector switch	: Defect code 91

Defect Codes 10, 11, 12, 13

♦D♦ Defect code memory: 10, 11, 12, 13 Steering angle signal

Explanation: This defect code is stored when the steering angle signal received by the control unit is faulty.

Possible causes: Loose contact, contact corrosion, steering angle sensor installed in wrong position, short of sensor supply wire (5 Volt) to ground, sensor defective.

Troubleshooting: Check installation position of steering angle sensor and correct if necessary; refer to Repair Instructions "EDC III".

If installation position is OK., check steering angle sensor and renew if necessary (Repair Instructions "EDC III").

If steering angle sensor is OK., measure voltage at connector X 945 Pin 25 (voltage supply of steering angle sensor). Is a voltage of 5 Volt applied?

If no, check connections at the control unit (connection terminal 30; X 945 Pin 26).

If yes, check signal wire of steering angle sensor to the EDC control unit and repair if necessary; from connector X 945 Pins 14 and 15 to steering angle sensor.

Is defect rectified?

If no, check ground connection of steering angle sensor and repair if necessary: from steering angle sensor to ground point.

Note: After defect has been repaired, perform steering angle offset (in diagnostic program) and check function of steering angle sensor in accordance with screen display (test procedure).

Defect Code 20

♦D♦ Defect code memory: 20 Road speed signal

Explanation: This defect code is stored when the speed signal received by the control unit is faulty.

Possible causes: Wire from rear axle contact to EKM damaged, wire from EKM to EDC control unit damaged.

Troubleshooting: Check wire and repair if necessary. From connector X 945 Pin 13 to EKM. If defect is not rectified, check rear axle contact and renew if necessary.

If defect is still not rectified, check speed–A signal: Simulation in diagnostic program EKM.

Defect Code 30

♦D♦ Defect code memory: 30 Acceleration signal front axle (vertical)

Troubleshooting: Check wire and repair if necessary: From connector X 945 Pin 24 to acceleration sensor. If defect is not rectified, check acceleration sensor:

Procedure: Remove acceleration sensor (see Repair Instructions "EDC III").

The acceleration sensor features 3 connections: Terminal 15, ground, signal output to the control unit.

In order to check outside the vehicle, a voltage of approx. 12 Volt must be applied at terminal 15 – input of sensor, the ground input must be connected to negative.

Now measure the voltage at the signal output: At rest (acceleration = 0), a voltage of approx. 2.5 Volt must be measured if the acceleration sensor is intact.

During movement of the sensor (acceleration greater than zero), the measured value must be greater than or less than 2.5 Volt. For the sensor, maximum acceleration means 0 Volt or 5 Volt depending on the direction of acceleration.

Replace defective sensors. Note: The 3 acceleration sensors of the EDC system (1 sensor for front body acceleration, 1 sensor for rear body acceleration, 1 sensor for longitudinal acceleration) are of identical design.

Defect Code 31

♦D♦ Defect code memory: 31 Acceleration signal front axle (vertical)

Troubleshooting: Check wire and repair if necessary: From EDC relay connector X 18068 to the acceleration sensor. If wire OK., measure voltage at the EDC relay. Is a voltage of 12 Volt applied? If yes, check acceleration sensor and renew if necessary. For checking the acceleration sensor refer to defect code 30. If no, check wire from EDC relay to connector X 306 and repair if necessary. Is defect rectified? If no, renew EDC relay.

Defect Code 32

♦D♦ Defect code memory: 32 Acceleration signal front axle (vertical)

Troubleshooting: Renew acceleration sensor.

Defect Code 40

♦D♦ Defect code memory: 40 Acceleration signal rear axle (vertical)

Troubleshooting: Check wire and repair if necessary: From connector X 945 Pin 1 to the acceleration sensor; is defect rectified? If no, check acceleration sensor and renew if necessary (for type of testing, please refer to defect code 30).

Defect Code 41

♦D♦ Defect code memory: 41 Acceleration signal rear axle (vertical)

Troubleshooting: Check wire and repair if necessary: From EDC relay connector X 18068 to the acceleration sensor. If wire OK., measure voltage at the EDC relay:

Is a voltage of 12 V applied?

If yes, check acceleration sensor and renew if necessary. (For check, please refer to defect code 30).

If no, check wire from EDC relay to connector X 299 and repair if necessary. If defect has still not been rectified, renew EDC relay.

Defect Code 42

♦D♦ Defect code memory: 42 Acceleration signal rear axle (vertical)

Troubleshooting: Renew acceleration sensor.

Defect Code 50

♦D♦ Defect code memory: 50 Acceleration signal (axial)

Troubleshooting: Check wire and repair if necessary: From connector X 945 Pin 16 to the acceleration sensor; is defect rectified? If no, check acceleration sensor and renew if necessary (for type of testing, please refer to defect code 30).

Defect Code 51

♦D♦ Defect code memory: 51 Acceleration signal (axial)

Troubleshooting: Check wire and repair if necessary. From EDC relay connector X 18068 to the acceleration sensor.

If wire is OK., measure voltage at the EDC relay connector X 18068 Pin 2.

Is a voltage of 12 Volt applied?

If yes, check acceleration sensor and renew if necessary (for type of testing, please refer to defect code 30).

If no, check wire from EDC relay to connector X 306 and repair if necessary. If defect has still not been rectified, renew EDC relay.

Defect Code 52

♦D♦ Defect code memory: 52 Acceleration signal (axial)

Troubleshooting: Renew acceleration sensor.

Defect Codes 60, 61

♦D♦ Defect code memory: 60, 61 Valve coil fault

Note: The EDC control unit can only register faults in the electrical/electronic

Determine damper valve in question by reading out the measured values (status monitoring or during troubleshooting) and by alternately detaching the connections at the damper (connector at front right/left and rear right/left on damper).

If the cause of the defect is not found with the aid of the following troubleshooting procedure, there could be mechanical damage to the damper system (e.g. solenoid valves). See: Repair Instructions EDC III.

Troubleshooting: Check valve control wires and repair if necessary:

- Comfort front: From connector X 263 Pin 1 to corresponding left/right damper valve
- Comfort rear: From connector X 263 Pin 3 to corresponding left/right damper valve
- Normal front: From connector X 263 Pin 2 to corresponding left/right damper valve
- Normal rear: From connector X 263 Pin 5 to corresponding left/right damper valve

Defect Code 63

♦D♦ Defect code memory: 63 Valve coil fault

Note: See defect codes 60, 61

Troubleshooting: See defect code 90.

Defect Codes 70, 71, 72, 73

♦D♦ Defect code memory: 70, 71, 72, 73 Front axle valve fault

Determine damper valve in question by reading out the measured value tables (appear in the diagnostic program, during troubleshooting of the relevant defect or in the status lists) and by alternately detaching the connections at the dampers (connector of front left or front right damper).

Troubleshooting defect code 70

Check wire and repair if necessary: From connector X 263 Pin 1 via connector of activation lines to corresponding device connector and further to the damper.

Troubleshooting defect code 71

Check wire and repair if necessary: From connector X 263 Pin 9 via connector of activation lines to corresponding device connector and further to the damper.

Troubleshooting defect code 72

Check wire and repair if necessary: From connector X 263 Pin 2 via connector of activation lines to corresponding device connector and further to the damper.

Troubleshooting defect code 73

Check wire and repair if necessary: From connector X 263 Pin 9 via connector of activation lines to corresponding device connector and further to the damper.

Defect Codes 80, 81, 82, 83

♦D♦ Defect code memory: 80, 81, 82, 83 Rear axle valve fault

Determine damper valve in question by reading out the measured value tables (appear in the diagnostic program, during troubleshooting of the relevant defect or in the status lists) and by alternately detaching the connections at the dampers (connector of rear left or rear right damper).

Troubleshooting defect code 80

Check wire and repair if necessary: From connector X 263 Pin 3 via connector of activation lines to corresponding device connector and further to the damper.

Troubleshooting defect code 81

Check wire and repair if necessary: From connector X 263 Pin 8 via connector of activation lines to corresponding device connector and further to the damper.

Troubleshooting defect code 82

Check wire and repair if necessary: From connector X 263 Pin 5 via connector of activation lines to corresponding device connector and further to the damper.

Troubleshooting defect code 83

Check wire and repair if necessary: From connector X 263 Pin 8 via connector of activation lines to corresponding device connector and further to the damper.

Defect Code 90

Malfunction: Malfunction in EDC

Effect of defect: Partial/total failure of the EDC

Troubleshooting: The following causes are possible and should be investigated:

– Fuse No. 32

– Fault in 12–Volt supply to control unit:

Terminal 15: Check wire and repair if necessary: From control unit connector X 263 Pin 4 to EDC relay K 67 and further to the connector chassis X 306 B.

Terminal 30: From connector X 945 Pin 26 to connector X 18134.

If defect is not rectified, check wire from connector X 945 Pin 11 to connector X 18134 and renew if necessary.

– Ground connection of control unit defective: Check wire and repair if necessary: From connector X 263 Pin 6 to EDC relay K 67 and from connector X 945 Pin 20 to ground.

Defect Code 91

Malfunction: Lighting of EDC program selection buttons defective

Possible effect of defect: Function light of selected program does not operate, search light (light switched on) does not operate.

Troubleshooting: Check EDC program switch with lighting unit by activating as described in the test procedure section in the diagnostic program.

Does lighting operate?

If no, check following wires and repair if necessary: From control unit connector X 945 Pins 2, 6, 7, 17 to the EDC program selector switch.

Is defect rectified?

If not, check wire and repair if necessary: From control unit connector X 945 Pin 10 to terminal 58 K.

Functional Description

General

The door lock heating system (TSH) is activated and monitored by the driver's door module (TMFA) of the central body electronics (ZKE II). The door lock heating (TSH) is activated by the door handle contact of the driver's door. A heating coil which heats the lock is mounted on the locking cylinder of the driver's door.

Switch–On Conditions

– 1. Door locked for at least 35 seconds.
– 2. Lift door handle of driver's door for at least 5 seconds.

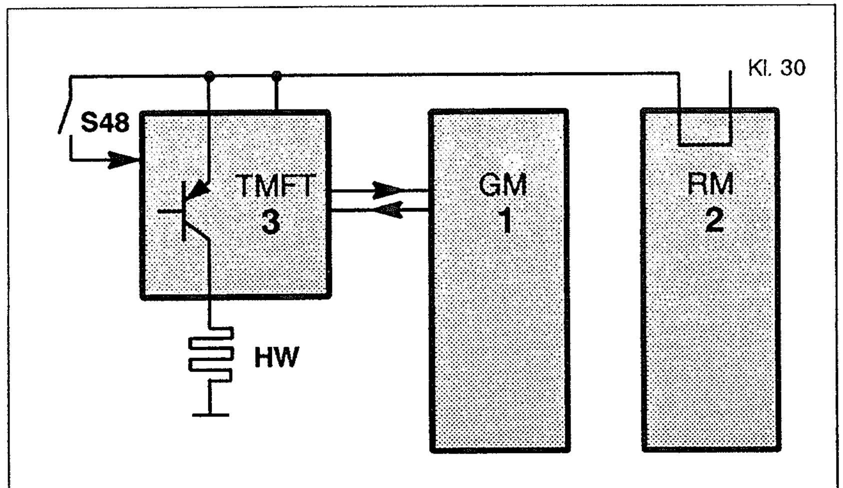
The door lock heating switches on for approx. 35 seconds. The door lock heating can be activated 3 times in 16 minutes. An inhibit function is then active for 16 minutes. This function can only be reset prematurely by unlocking the vehicle.

Switch–Off Conditions

– 1. Automatically after 35 seconds.
– 2. Vehicle is unlocked.

Block Diagram Door Lock Heating TSH

Block diagram ZKE, see Section 6100.0A ZKE



P31 51 001

No.	Abb.	Description
1	GM	General module
2	RM	Relay module
3	TMFT	Driver's door module
HW		Heating coil
S48		Driver's door handle contact

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with ZKE II

For general information on diagnosis with ZKE II (central body electronics) refer to Section 6100.0A

Defect Code Memory

Defects which occur in the vicinity of the heating coil and door module are stored in the defect code memory. The door handle contact is checked during the diagnostic procedure.

Test Procedure

The test procedure enables guided inspection of the door lock heating system.

Abbreviations

A	Outputs
E	Inputs
GM	General module
RM	Relay module
TMFT	Driver's door module
TSH	Door lock heating
ZKE	Central body electronics
ZV	Central locking system

Pin assignments

Connector overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module
X887	26–pole, black	TMFT	Driver's door module

Pinbelegung am Stecker GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronic system	Terminal 30	approx. 12V		
16	E	Interface from driver's door module	TMFT–A Pin 9	dymamic	Defect is stored with defect code No. 2	
26	E	Ground for electronic system	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronic system	Terminal 30	approx. 12V		
26	E	Ground for electronic system	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
9	A	Interface to driver's door module	TMFT	dymamic	Defect is stored with defect code No. 2	
26	E	Ground for electronic system	Terminal 31	0–2V		

Pinbelegung am Stecker RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
6	E	U–batt for electronics of all ZKE modules	Terminal 30	approx. 12V		
7	A	U–batt for driver's door module electronics	TMFT–A Pin 22,23	approx. 12V		

Door Lock Heating (ZKE/TSH)

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		

Pin assignments at connector TMFT X887

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
7	E	Ground for electronic system	Terminal 31	0–2V		
8, 10	A	Door lock heating (TSH)	heating coil	approx. 12V		For activation of door lock heating, see functional description TSH
9	A	Interface to general module	GM–A Pin 15	dymamic	Defect is stored with defect code No. 2	
16	E	Door handle contact	Door handle contact	approx. 12V		operated
				0–2V		not operated
22, 23	A	U–batt for electronics and load	RM–A Pin 7	approx. 12V		
24	A	Interface from general module	GM–C Pin 8	dymamic	Defect is stored with defect code No. 2	

Adapter

Component	Connector No.	Description	Adapter number
General module, door module, relay module	X332, X253, X254, X259, X887	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- If all functions of the ZKE have failed, perform troubleshooting in accordance with Section 6100.0A ZKE.
- If the central locking system is defective, perform troubleshooting in accordance with Section 5126.0A central locking system

Defect Code Table

♦D♦ Defect code memory – stored defect codes

35 Door lock heating (TSH) activation faulty → Defect code 35

Malfunctions:

Door lock heating not operating → Defect code 100

Defect Code 35

♦D♦ Defect code memory: 35 Door lock heating (TSH) activation defective

Explanation: This defect code is stored when a TSH activation defect is detected in the driver's door module.

Possible caus:

- Wire driver's door module – heating coil
- Ground wire to heating coil
- Heating coil
- Driver's door module

Troubleshooting: As displayed on screen

Defect Code 100

Door lock heating failure

Explanation: General malfunction

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse)
- Ensure that the central locking system is operating properly (refer to Section 5126.0A ZV)
- ♦D♦ Perform diagnostic procedure for door lock heating system. Note! It is necessary to activate the door lock heating system two or three times in order to establish the heating effect in the door lock when performing test step "activate door lock heating".

Functional Description

General

The central locking system (ZV) is controlled by the general module (GM) of the central body electronics (ZKE II). The relays for locking, unlocking and arresting the driver's and passenger's door are located in the relay module (RM).

The rear lid is unlocked (opened) via one single relay. This relay is not located in the relay module (RM), however, it is controlled by the relay module (RM).

The system load circuits are fuse–protected by the electronic power fuse ES–relay K15 (see Section 6100.0).

Central Locking Functions

Locking, unlocking: Possible from the door locks of the driver's door and passenger's door (with doors closed). Also by means of the infrared locking system if fitted as an optional extra. From the inside, unlocking and locking are possible by depressing the locking buttons on the doors or by depressing the button on the power window switch block – unarresting is, however, not possible (antitheft).

Rear lid: With the vehicle unlocked, the rear lid is unlocked (opened) by pressing the rear lid button. When the glove compartment is locked, the rear lid can also not be opened even with the vehicle unlocked (detection via microswitch on glove compartment lock).

Locking and unlocking are not possible by way of the rear lid lock. The lock is only provided as an emergency facility for mechanically unlocking the rear lid drive.

Arresting: Arresting is possible from the driver's or passenger's door locks or by way of the infrared locking system. The ZV motor drives are blocked mechanically and can no longer be opened by means of the lock button (antitheft). Arresting is possible only with the ignition off (ignition switch in 0 position), and subsequent opening and closing the driver's door.

Infrared Locking System: Optional Extra

The same central locking functions as when using the key can be performed with the infrared locking system. The same lockout functions also apply. Two separate inputs are provided on the general module for the infrared locking system.

Contacts

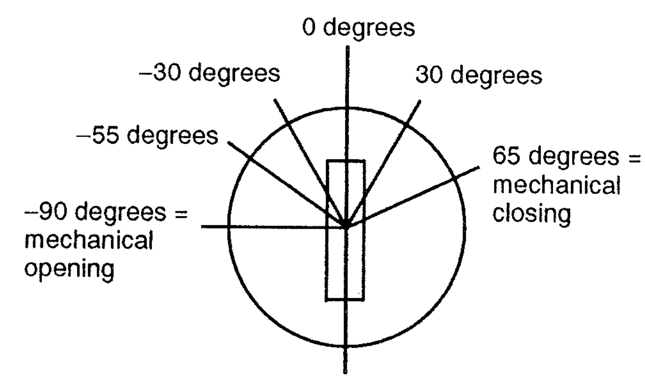
Pin contacts: Integrated in the ZV motor drives of the doors are microswitches which signal the current status (unlocked or locked) to the door modules. The contacts switch battery voltage (U–batt) for the current status (locked, unlocked) to the corresponding door module input.

The pin contacts are operated via the lock button. With the doors closed, the vehicle can be locked and unlocked from both doors via the pin contacts.

Lock contacts: Microswitches are mounted on the door locks which are linked mechanically to the door locks. These switches signal the position of the door lock to the driver's door or passenger's door module. The contacts switch battery voltage (U–batt).

Command	Key position		Door lock inputs at the door modules			
	Driver	Passenger	Pin 13	Pin 26	Pin 12	Pin 25
Unlock + unarrest	– 55degrees	55degrees	0	1	0	1
Unlock	– 30degrees	30degrees	0	0	1	1
Rest position	0 degrees	0 degrees	0	0	1	0
Lock	30 degrees	– 30 degrees	1	0	1	0
Lock + central arrest	65 degrees	– 65 degrees	1	1	0	0

Key positions by way of example of driver's door:



P31 51 002

Door contact: Microswitches on cylinder lock. The microswitches switch ground when the passenger's or driver's door is open.

Lock button: Button in power window switch block. The vehicle can be locked and unlocked by pressing this button. The message "button pressed" is sent via the data link FH switch block – general module to the general module.

Special Features

Function suppression: When the doors are open, the vehicle cannot be locked via the central locking system. The central locking system (ZV) operates as follows:

- When the driver's door is open, central locking is not possible with the key, the button in the power window switch block and the infrared remote control. If the lock button is pressed, the system is unlocked immediately after locking.
- When the passenger's door is open, central locking is not possible by way of the lock button (pin contact).

Note: In the event of failure of the door contact (door is always detected as being open), the driver's door can be locked with the key. The passenger's door can then be locked mechanically.

Repeat lockout: To avoid overloading, the central locking system is inhibited (lockout) when the system is operated more than 32 times within 2 minutes. The lockout feature is cancelled after a defined waiting time.

See: Key positions

Note: The lock button does not move.

Repeat lockout: To avoid overloading, the central locking system is inhibited (lockout) when the system is operated more than 32 times within 2 minutes. The lockout feature is cancelled after a defined waiting time.

Defect information: If a defect occurs in the central locking system (ZV) the driver is made aware of this by the central locking system reverting automatically to its initial status. The required function is performed only after operation for a second time. Example: Vehicle is locked – driver's door defective, is not locked – the central locking system (ZV) locks the doors, the doors are unlocked once again a few seconds later.

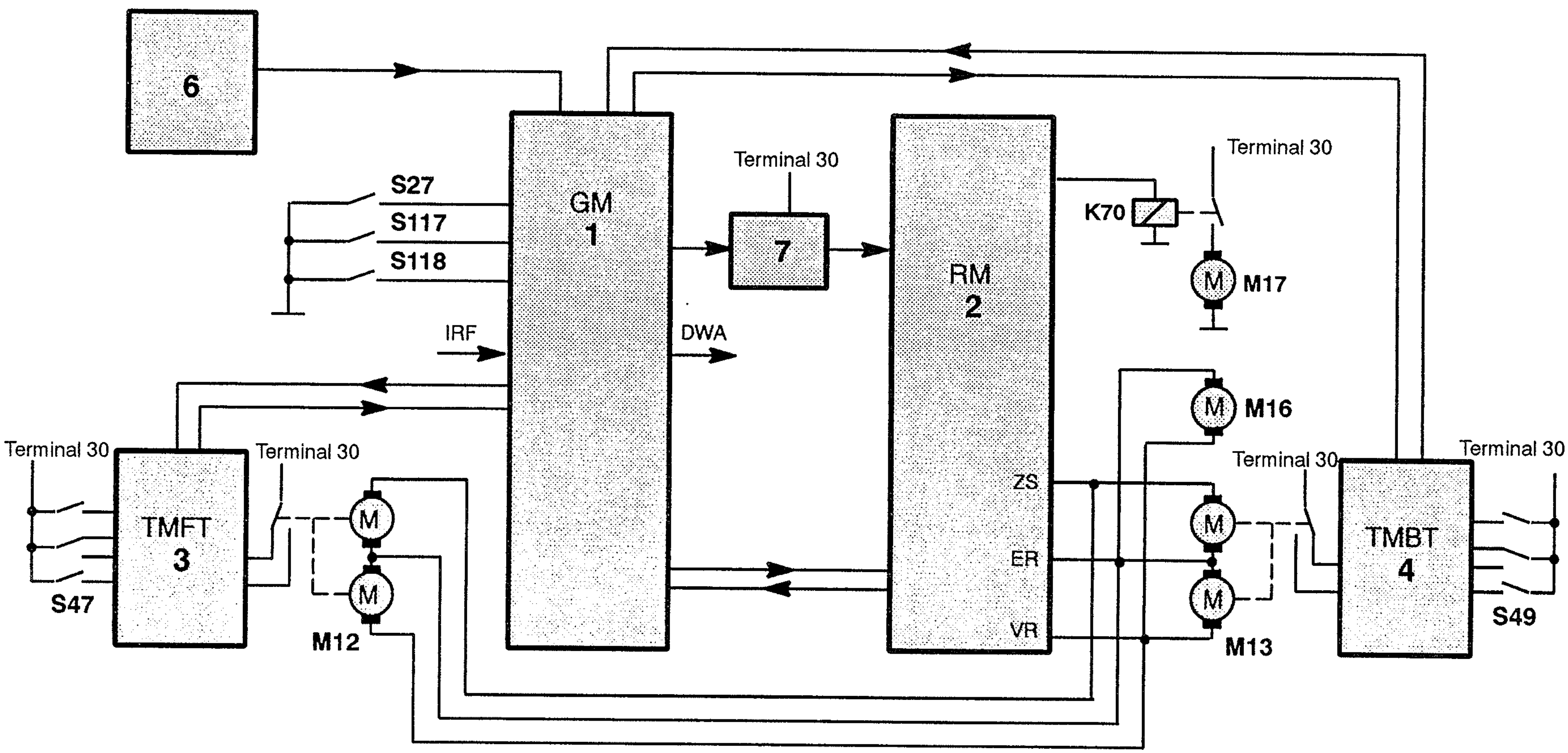
CRASH sensor: Installation location: On the A–post driver's side. The CRASH sensor is only effective when the ignition switch is set to R or 15 (Position 1 or 2). At the point of impact, the sensor briefly switches a ground signal (approx. 2 milliseconds) to the input of the general module (GM). The vehicle is unlocked/unarrested, the interior lights are switched on, the hazard warning system is activated and the central locking functions are blocked.Cancelling the ZV lockout: By turning the door lock in the unlock/unarrest direction.

Antitheft system (DWA): The antitheft system (DWA) is armed and unarmed via the central body electronics (ZKE). The antitheft system is activated only when the corresponding ZV command is given.

The antitheft system (DWA) can therefore not be activated when the central locking system (ZV) is defective.

Block Diagram Central Locking System (ZV)

For ZKE block diagram, see Section 6100.0A ZKE



P31 51 003

No.	Abb.	Description
1	GM	General module
2	RM	Relay module
3	TMFT	Driver's door module
4	TMBT	Passenger's door module
6		Power window switch block
7		Electronic power fuse relay, driver's side K15
K70		Rear lid relay
M12		Driver's door ZV motor drive
M13		Passenger's door ZV motor drive
M16		Fuel tank lid ZV motor drive
M17		Rear lid ZV motor drive
S27		Crash sensor
S47		Driver's door lock switch A, B, BN, C
S49		Passenger's door lock switch A, B, BN, C
S117		Rear lid unlocking button
S118		Glove compartment lock

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with the ZKE II

For general information on the diagnostic procedure with ZKE II (central body electronics), refer to Section 6100.0A

Defect code memory

Defects involving the activation systems (wires, relay module) are stored in the defect code memory.

Test procedure

The test procedure enables guided inspection of the central locking system. It is subdivided into two groups:

– Central locking for driver's/passenger's door and fuel tank lid
– Rear lid locking/rear lid opening

To check the door locks, the ignition can be switched off and the vehicle key removed. However, due to the diagnostic procedure in conjunction with the EKM, after switching off the ignition, the driver's door must not be opened and closed, since this would immediately interrupt the diagnostic procedure. it is therefore recommended to remove the key through the passenger's door.

Abbreviations

General

ZKE	Central body electronics
ZV	Central locking system
A	Outputs
E	Inputs

Modules

GM	General module
RM	Relay module
TMFT	Driver's door module
TMBT	Passenger's door module

Pin assignments

Connector overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module
X887	26–pole, black	TMFT	Driver's door module
X889	26–pole, white	TMBT	Passenger's door module

Pin assignments at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
6	E	Passenger's door contact	Contact in cylinder lock	0–2V		Door open
7	E	Driver's door contact	Contact in cylinder lock	0–2V		Door open
8	E	Interface IRF–B	IR module	0–2V ca.12V		For logic, see ZV functional description
9	E	Interface IRF–A	IR module	0–2V approx. 12V		——— " ———

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
11	E	Interface from power window (FH) switch block	Power window switch block	dynamic	Defect is stored with defect code No. 14	
15	E	Interface from passenger's door module	TMBT–A Pin 9	dynamic	Defect is stored with defect code No. 3	
16	E	Interface from driver's door module	TMFT–A Pin 9	dynamic	Defect is stored with defect code No. 2	
19	E	Unlock rear lid	Glove compartment lock	0–2V		With glove compartment closed
21	E	Interface from relay module; diagnostic feedback RM functions	RM–B Pin 3	dynamic		
23	E	Interface from relay module; current measurement RM functions	RM–B Pin 4	dynamic		
24	E	Crash sensor	Crash sensor	approx. 12 V when at rest; 0–2 V in event of crash	Defect is stored with defect code No. 48	Sensor must not have continuity when at rest; continuity for approx. 2 msec during crash
25	E	Command unlock rear lid	Rear lid button	0–2V		Button pressed
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		
3	E	Terminal R	Terminal R	approx. 12V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Starter	Terminal 50	approx. 12V		
17	A	Interface to hazard warning flasher	Crash alarm generator	0–2V		Ground pulse during crash
26	E	Ground for electronic	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	Relay module interface	RM–B 26	dynamic		
3	A	Relay module interface	RM–B 11	dynamic		
4	A	Relay module interface	RM–B 13	dynamic		
5	A	Interface to SHD module	SHDM	dynamic	Defect is stored with defect code No. 6	
8	A	Interface to passenger's door module	TMBT	dynamic	Defect is stored with defect code No. 3	
9	A	Interface to driver's door module	TMFT	dynamic	Defect is stored with defect code No. 2	
19	A	Interface to DWA	DWA	approx. 12V	key in neutral position	
20	A	Interface to DWA	DWA	0–2V	key in neutral position	
25	A	Electronic power fuse: Activation for ES relay, driver's side	ES relay, driver's side	0–2V		ES relay is not activated during operation of FH, ZV or SHD
26	E	Ground for electronic	Terminal 31	0–2V		

Pin assignments at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Activation of ZV motors: Unlock	ZV motors	approx. 12V	Defect is stored with defect code No. 47	On activation, electronic power fuse
2	A	U–batt for power circuit on driver's side, from electronic power fuse	SHDM–B Pin 2	approx. 12 V		Only during operation of FH, ZV or SHD
3	A	Activation of ZV motors: Lock	ZV motors	approx. 12V	Defect is stored with defect code No. 46	On activation, electronic power fuse
4	E	Ground for electronics	Terminal 31	0–2V		
6	E	U–batt for electronics of all ZKE modules	Terminal 30	approx. 12V		
7	A	U–batt for driver's door module electronics	TMFT–A Pin 22,23	approx. 12V		
8,9	E	Ground for ZV and FH motors	Terminal 31	0–2V		
11	E	U–batt for power circuit, driver's side from electronic power fuse	ES relay driver's side	approx. 12 V		Only during operation of FH, ZV or SHD
13	A	Activation ZV motors: Central arrest	ZV motors	approx. 12V	Defect is stored with defect code No. 45	On activation, electronic power fuse

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	U–batt for passenger's door module electronic	TMBT–A Pin 22	approx. 12V		
3	A	Interface to general module diagnostic feedback RM functions	GM–A Pin 21	dynamic		
4	A	Interface to general module Current measurement RM	GM–A Pin 23	dynamic		
5	A	Relay activation rear lid unlocking	Relay rear lid unlocking	0–2V		On activation
7	A	U–batt for sunroof module electronics	SHDM–B Pin1	approx. 12V		
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		
13	A	General module interface	GM–C Pin 4	dynamic		
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
25	E	Ground for electronics	Terminal 31	0–2V		
26	A	General module interface	GM–C Pin 2	dynamic		

Pin assignments at connector TMFT X887

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Pin contact driver's door ZV motor: locked	Driver's door ZV motor	approx. 12V		
2	E	Pin contact driver's door ZV motor: unlocked	Driver's door ZV motor	approx. 12V		
7	E	Ground for electronics	Terminal 31	0–2V		
9	A	Interface to general module	GM–A Pin 15	dynamic	Defect is stored with defect code No. 2	
11	E	Inner door contact	Inner door contact	approx. 12V; 0–2V		When operated; not operated
12	E	Door lock contact B, n/c contact	Locking cylinder	— " —		——— " ———
13	E	Door lock contact A	Locking cylinder	— " —		——— " ———
16	E	Door handle contact	Door handle contact	— " —		——— " ———
22, 23	A	U–batt for electronics and load	RM–A Pin 7	approx. 12V		
24	A	Interface from general module	GM–C Pin 8	dynamic	Defect is stored with defect code No. 2	
25	E	Door lock contact C	Locking cylinder	approx. 12V; 0–2V		When operated; not operated
26	E	Door lock contact B n/o contact	Locking cylinder	— " —		——— " ———

Pin assignments at connector TMBT X889

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Pin contact passenger's door ZV motor: locked	Passenger's door ZV motor	approx. 12V		
2	E	Pin contact passenger's door ZV motor: unlocked	Passenger's door ZV motor	approx. 12V		
7	E	Ground for electronics	Terminal 31	0–2V		
9	A	Interface to general module	GM–A Pin 16	dynamic	Defect is stored with defect code No. 3	
11	E	Inner door contact	Inner door contact	approx. 12V; 0–2V		When operated; not operated
12	E	Door lock contact B, n/c contact	Locking cylinder	— " —		—— " ——
13	E	Door lock contact A	Locking cylinder	— " —		—— " ——
16	E	Door handle contact	Door handle contact	approx. 12V; 0–2V		When operated; not operated
22	A	U–batt for electronics and load	RM–B Pin 1	approx. 12V		
24	A	Interface from general module	GM–C Pin 9	dynamic	Defect is stored with defect code No. 3	
25	E	Door lock contact C	Locking cylinder	approx. 12V; 0–2V		When operated; not operated
26	E	Door lock contact B n/o contact	Locking cylinder	— " —		—— " ——

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- If all functions of the ZKE are faulty, perform troubleshooting in accordance with Section ZKE 6100.0
- ZV motor drives of the driver's and passenger's door must by synchronized – see functional description, defect information –.
- If the electronic power fuse is signalled as faulty (♦D♦ 95 Electronic power fuse: Overcurrent in power circuit in driver's side), go to Section ZKE 6100.0.

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

45 ZV central arrest. Defect when activating the ZV motor drives → Defect code 46

46 ZV lock. Defect when activating the ZV motor drives → Defect code 46

47 ZV unlock. Defect when activating the ZV motor drives → Defect code 47

Malfunction:

Central locking system (ZV) not operating properly→ Defect code 100

Defect Codes 45–47

♦D♦ Defect code memory:
45 ZV central arrest.
Defect during activation of ZV motor drives
46 ZV lock.
Defect during activation of ZV motor drives
47 ZV unlock.
Defect during activation of ZV motor drives

Explanation: This defect code is stored when an incorrect level is detected at the UV output of the RM after activation of the corresponding ZV relay (in the RM).

Possible cause:

- Wires from RM to the ZV motor drives
- Relay module

Troubleshooting: As displayed on screen

Defect Code 100

ZV does not operate properly

Explanation: General malfunction in the central locking system.

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse, door module)
- ♦D♦ Perform diagnostic procedure for central locking system.

Functional Description

General

The front power windows (FH) are controlled by the corresponding door module. The rear power windows by the general module (GM) of the ZKE II. The power window relays are located in the relay module (RM).
The load circuits are fuse protected by means of the electronic power fuse ES relay K15 (see Section 6100.0 ZKE).

Operation

The power windows can be operated by way of the power window switch block or by means of the power switch (driver's door). The power window switch block is located on the driver's door and is linked via a data line to the general module (GM). The power window motor drive is switched off automatically on reaching the end position.

Switch–on conditions: Ignition (terminal 15) ON

Switch–off conditions:

ECE version: Windows can still be operated after switching off the ignition. Power window system deactivated after opening and closing the driver's or passenger's door.

US version, Australia: Operation deactivated after switching off the ignition and opening the driver's or passenger's door

Finland version: Switch–off conditions as ECE version but no toll circuit for driver's window and sunroof.

Special features:

Toll circuit

Wird der FH-Schalter für das Fenster von der ersten Raststellung in die zweite Raststellung durchgedrückt, so öffnet bzw. schließt sich das betroffene Fenster automatisch. Der Ablauf kann durch Betätigen eines beliebigen FH-Schalters unterbrochen werden.

Central opening and closing

The windows and the sunroof can be closed and opened by way of the door locks. For this purpose, the key must be held for longer than 2 seconds in the lock or unlock position. The sequence for the central closing function is rear power windows, front power windows, sunroof (SHD). The reverse sequence applies to central opening.

Lowering window

To avoid wind noises and instability, the closed door windows are positioned in a rubber lip in the roof. When operating the door handles on the inside or outside, the corresponding window is lowered by several millimetre to facilitate easy opening and closing of the door.

Jamming protection, position sensor

The position of the front power windows is monitored by position sensors. If, while closing a door window, the position sensor detects jamming of a part in the closing range of the window, the closing operation of the power window is interrupted and the window is opened once again by approx. 10 cm. The anti–jamming feature is only active until the last 4 mm of the power window closing range (window up) are reached. The anti–jamming feature is not active when the power window button is constantly pressed in the second rest position. This facilitates emergency closing.

Initialization

If battery voltage is disconnected or the general module, relay module or one of the door modules is removed, the position sensors must be initialized after reconnection or reinstallation.

Check for non–initialized condition: Toll circuit not possible.

Initialization instructions:

- Close doors
- Close front power windows as far as they will go by pressing and holding the power window switch in the second rest position.
- When window is closed, hold switch pressed for at least 3 seconds
- Power window is initialized – check toll circuit

Speed–dependent window closing

The front windows are closed automatically at a speed above 150 km/h.

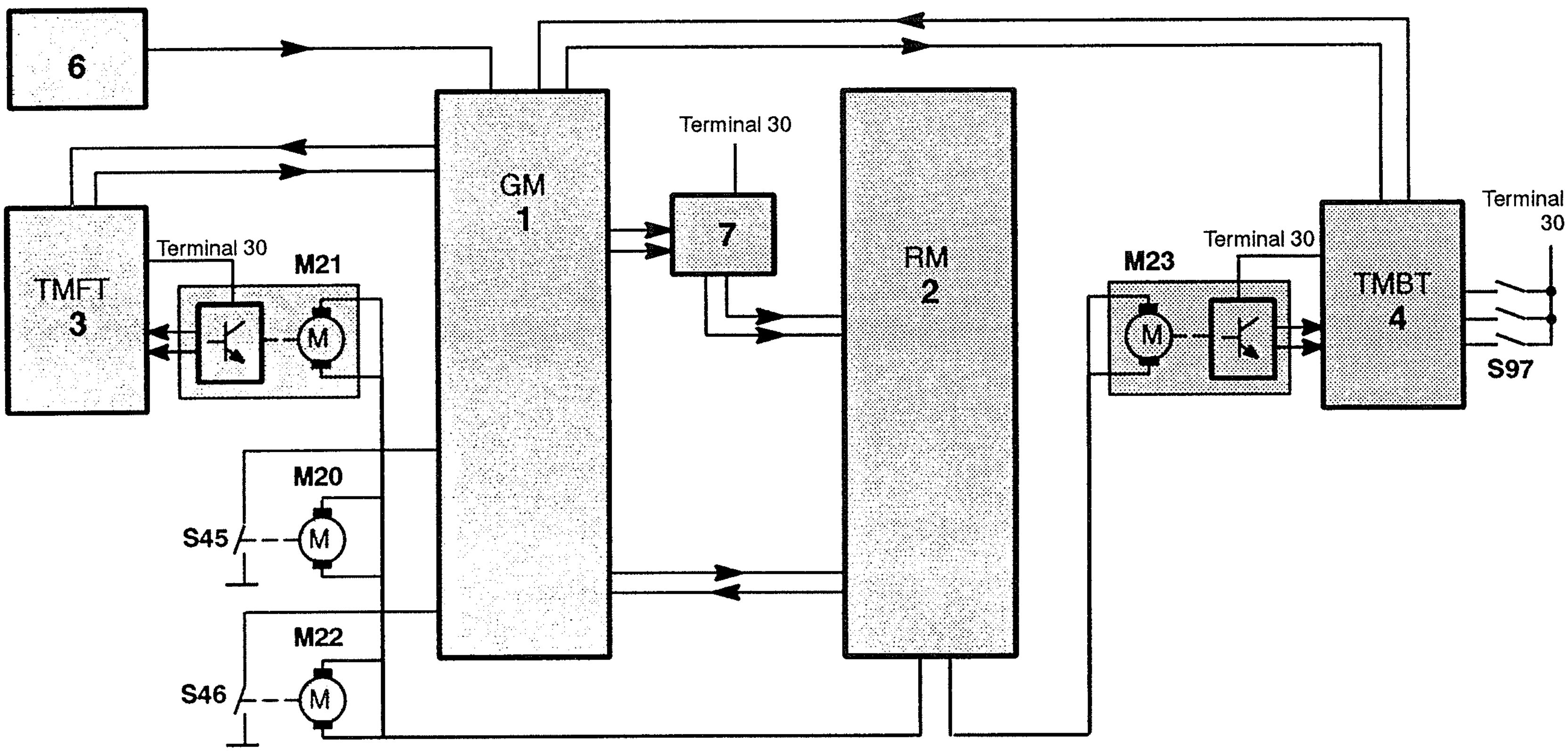
Country–specific variants

The country coding is achieved by way of the software in the ZKE coding data.

No.	Abb.	Description
1	GM	General module
2	RM	Relay module
3	TMFT	Driver's door module
4	TMBT	Passenger's door module
6		Power window switch block S40
7		Electronic power fuse relay: Driver's side K15 Passenger's side K30
M20		Power window motor driver's door, rear
M21		Power window motor driver's door
M22		Power window motor passenger's door, rear
M23		Power window motor passenger's door
S45		Driver's window contact, rear
S46		Passenger's window contact, rear
S97		Power window switch, passenger's door

Block Diagram Power Windows

For ZKE block diagram see Section 6100.0A ZKE



P31 51 004

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with ZKE II

For general information on diagnosis with ZKE II (central body electronics), see Section 6100.0A

Defect Code Memory

Defects involving the activation system (relay, wires) are stored in the defect code memory. In addition, the ZKE also detects a defective power window motor as well as defects in the data transfer to the power window switch block and to the door modules.

Test Procedure

The test procedure enables guided inspection of the power window switches and components for the automatic window lowering function.

Abbreviations

General

ZKE	Central body electronics
FH	Power window
A	Outputs
E	Inputs

Modules

GM	General module
RM	Relay module
TMFT	Driver's door module
TMBT	Passenger's door module

Pin assignments

Connector overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module
X887	26–pole, black	TMFT	Driver's door module
X889	26–pole, white	TMBT	Passenger's door module

Pin assignments at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
6	E	Passenger's door contact	Contact in cylinder lock	0–2V		With door open
7	E	Driver's door contact	Contact in cylinder lock	0–2V		With door open
10	E	Driver's window contact, rear	Window contact	0–2V		With window open
11	E	Interface from power window (FH) switch block	Power window switch block	dynamic	Defect is stored with defect code No. 14	
15	E	Interface from passenger's door module	TMBT–A Pin 9	dynamic	Defect is stored with defect code No. 3	

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
16	E	Interface from driver's door module	TMFT–A Pin 9	dynamic	Defect is stored with defect code No. 2	
21	E	Interface from relay module; diagnostic feedback RM functions	RM–B Pin 3	dynamic		
22	E	Speed signal	EKM	dynamic		
23	E	Interface from relay module; current measurement RM functions	RM–B Pin 4	dynamic		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ingition	Terminal 15	approx. 12V		
3	E	Terminal R	Terminal R	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	Relay module interface	RM–B 26	dynamic		
3	A	Relay module interface	RM–B 11	dynamic		
4	A	Relay module interface	RM–B 13	dynamic		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
8	A	Interface to passenger's door module	TMBT	dynamic	Defect is stored with defect code No. 3	
9	A	Interface to driver's door module	TMFT	dynamic	Defect is stored with defect code No. 2	
10	E	Window contact, passenger's side, rear	Window contact	0–2V		With window open
24	A	Electronic power fuse: Activation for ES relay, passenger's side	ES relay, passenger's side	0–2V		ES relay is only activated during operation of power window on passenger's side
25	A	Electronic power fuse: Activation for ES relay, driver's side	ES relay, driver's side	0–2V		ES relay is only activated during operation of FH, ZV or SHD
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	U–batt for power circuit on driver's side, from electronic power fuse	SHDM–B Pin 2	approx. 12 V		Only during operation of FH, ZV or SHD
4	E	Ground for electronics	Terminal 31	0–2V		
5	A	U–batt for power circuit passenger's side from electronic power fuse		approx. 12V		Only during operation of power window on driver's side
6	E	U–batt for electronics of all ZKE modules	Terminal 30	approx. 12V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
7	A	U–batt for driver's door module electronics	TMFT–A Pin 22,23	approx. 12V		
8,9	E	Ground for ZV and FH motors	Terminal 31	0–2V		
10	A	Activation FH motor: Driver's door open	Driver's door FH motor	approx. 12V	Defect is stored with defect code No. 58	On activation, electronic power fuse
11	E	U–batt for power circuit, driver's side from electronic power fuse	ES relay driver's side	approx. 12 V		Only during operation of FH, ZV or SHD
12	E	U–batt for power circuit, passenger's side from electronic power fuse	ES relay passenger's side	approx. 12V		Only during operation of power window on passenger's side
14	A	FH motor activation: Rear passenger's side closed	Rear passenger's side FH motor	approx. 12V	Defect is stored with defect code No. 64	——— " ———
15	A	FH motor activation: Driver's door open	Driver's door FH motor	approx. 12V	Defect is stored with defect code No. 59	——— " ———
16	A	FH motor activation: Driver's door closed	Driver's door FH motor	approx. 12V	Defect is stored with defect code No. 62	On activation, electronic power fuse
17	A	FH motor activation: Rear passenger's side open	Rear passenger's side FH motor	approx. 12V	Defect is stored with defect code No. 61	——— " ———
18	A	FH motor activation: Passenger's door closed	Passenger's door FH motor	approx. 12V	Defect is stored with defect code No. 63	——— " ———
19	A	FH motor activation: Rear driver's side open	Rear driver's side FH motor	approx. 12V	Defect is stored with defect code No. 60	——— " ———
20	A	FH motor activation: Rear passenger's side closed	Rear passenger's side FH motor	approx. 12V	Defect is stored with defect code No. 65	——— " ———

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	U–batt for passenger's door module electronic	TMBT–A Pin 22	approx. 12V		
3	A	Interface to general module diagnostic feedback RM functions	GM–A Pin 21	dynamic		
4	A	Interface to general module Current measurement RM	GM–A Pin 23	dynamic		
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		
13	A	General module interface	GM–C Pin 4	dynamic		
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
25	E	Ground for electronics	Terminal 31	0–2V		
26	A	General module interface	GM–C Pin 2	dynamic		

Pin assignments at connector TMFT X887

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Voltage at driver's door FH motor connection "closed"	Wire RM–A Pin 16 to driver's door FH motor	approx.12V	Defect is stored with defect code No. 66	Driver's power window closed on activation
5, 18	E	Position sensor, driver's door FH motor	Driver's door FH motor	dynamic	Defect is stored with defect code No. 54	
6	A	Power supply for FH position sensor	Driver's door FH motor	approx. 12V	——— " ———	When driver's power window operated

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
7	E	Ground for electronics	Terminal 31	0–2V		
9	A	Interface to general module	GM–A Pin 15	dynamic	Defect is stored with defect code No. 2	
11	E	Inner door handle contact	Inner door handle contact	approx. 12V; 0–2V		when operated; not operated
16	E	Door handle contact	Door handle contact	— " —		——— " ———
17	E	Voltage at driver's door FH motor connection "open"	Wire RM–A Pin 10 to driver's door FH motor	approx. 12V	Defect is stored with defect code No. 66	Driver's power window open on activation
22, 23	A	U–batt for electronics and load	RM–A Pin 7	approx. 12V		
24	A	Interface from general module	GM–C Pin 8	dynamic	Defect is stored with defect code No. 2	

Pin assignments at connector TMBT X889

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Voltage at passenger's door FH motor connection "closed"	Wire RM–A Pin 18 to passenger's door FH motor	approx.12V	Defect is stored with defect code No. 67	Passenger's power window closed on activation
5, 18	E	Position sensor, passenger's door FH motor	Passenger's door FH motor	dynamic	Defect is stored with defect code No. 55	
6	A	Power supply for FH position sensor	Driver's door FH motor	approx. 12V	——— " ———	When driver's power window operated
7	E	Ground for electronics	Terminal 31	0–2V		
9	A	Interface to general module	GM–A Pin 16	dynamic	Defect is stored with defect code No. 3	

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
11	E	Inner door handle contact	Inner door handle contact	approx. 12V; 0–2V		when operated; not operated
16	E	Door handle contact	Door handle contact	approx. 12V; 0–2V		when operated; not operated
17	E	Voltage at passenger's door FH motor, connection "open"	Wire RM–A Pin 15 to passenger's door FH motor	approx.12V	Defect is stored with defect code No. 67	Passenger's power window open on activation
19	E	Passenger's door FH switch: Hit function	GM–C Pin 8	0–2V; approx. 12V		when operated; not operated
20	E	Passenger's door FH switch: closed	GM–C Pin 8	— " —		—— " ——
21	E	Passenger's door FH switch: open	GM–C Pin 8	— " —		—— " ——
22	A	U–batt for electronics	RM–B Pin 1	approx. 12V		
24	A	Interface from general module	GM–C Pin 9	dynamic	Defect is stored with defect code No. 3	

Adapters

Component	Connector No.	Description	Adapter number
General module, door module, relay module	X332, X253, X254, X258, X259, X887, X889	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- If all functions of the ZKE are faulty, perform troubleshooting in accordance with Section 6100.0 ZKE.

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

14 Data exchange power window switch block with GM faulty → Defect code 14

50 Malfunction front driver's power window switch → Defect code 50

51 Malfunction front passenger's power window switch → Defect code 51

52 Malfunction rear driver's side power window switch → Defect code 52

53 Malfunction rear passenger's side power window switch → Defect code 53

54 Front driver's side power window defective → Defect code 54

55 Front passenger's side power window defective → Defect code 55

58 Activation defect: Open front driver's side power window → Defect code 58

59 Activation defect: Open front passenger's side power window → Defect code 59

60 Activation defect: Open rear driver's side power window → Defect code 60

61 Activation defect: Open rear passenger's side power window → Defect code 61

62 Activation defect: Close front driver's side power window → Defect code 62

63 Activation defect: Close front passenger's side power window → Defect code 63

64 Activation defect: Close rear driver's side power window → Defect code 64

65 Activation defect: Close rear passenger's side power window → Defect code 65

66 Wire from relay module to front driver's side FH motor defective → Defect code 66

67 Wire from relay module to front passenger's side FH motor defective → Defect code 67

Malfunctions:

General malfunction → Defect code 100

Defect Code 14

♦D♦ Defect code memory: 14 Data exchange power window switch block with general module (GM) faulty

Explanation: This defect code is stored when the data exchange between the power window switch block and the general module is interrupted.

Possible causes:

- Voltage supply at power window switch block
- Data link power window switch block to general module (GM)
- Power window switch block

Troubleshooting: As displayed on screen

Defect Codes 50 – 53

♦D♦ Defect code memory:
50 Malfunction front driver's side power window switch
51 Malfunction front passenger's side power window switch
52 Malfunction rear driver's side power window switch
53 Malfunction rear passenger's side power window switch

Explanation: The power window switches are monitored for impermissible output signals (plausibility check).

Possible cause:

- Power window switch

Troubleshooting: As displayed on screen

Defect Codes 54, 55

♦D♦ **Defect code memory:**
54 Front driver's side power window defective
55 Front passenger's side power window defective

Explanation: No pulses are applied from power window position sensor at the corresponding door module.

Note: The position sensor is located on the power window motor.

Possible causes:

- Wires
- Position sensor
- Power window motor
- Supply line

Troubleshooting: As displayed on screen

Defect Codes 66, 67

♦D♦ **Defect code memory:**
66 Wire from relay module to front driver's side FH motor defective
67 Wire from relay module to front passenger's side FH motor defective

Explanation: The FH wires between RM and front FH motors are monitored by way of voltage measurement at the FH motor. The defect codes 66 and 67 are stored when the measured voltage at the FH motors does not agree with activation by the RM.

Possible cause:

- Wire from RM to corresponding front FH motor

Troubleshooting: As displayed on screen

Defect Codes 58 – 65:

♦D♦ Defect code memory:
58 Activation defect:
Open front driver's side power window
59 Activation defect:
Open front passenger's side power window
60 Activation defect:
Open rear driver's side power window
61 Activation defect:
Open rear passenger's side power window
62 Activation defect:
Close front driver's side power window
63 Activation defect:
Close front passenger's side power window
64 Activation defect:
Close rear driver's side power window
65 Activation defect:
Close rear passenger's side power window

Explanation: The RM outputs for the power windows are monitored by way of voltage measurement in the RM and signalled to the general module (GM). The defect codes 58 – 65 are stored when the measured output voltage does not correspond to activation by the general module (GM) (e.g. relay defect in RM).

Possible causes:

- Wires from RM to FH motors
- Relay modules

Troubleshooting: As displayed on screen

Defect Code 100

General malfunction

Explanation: General malfunction on the power window or in the automatic window lowering function

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse, door module)
- ♦D♦ Perform diagnostic procedure for power windows. Note! The power window switches must remain pressed for at least 5 seconds until the BMW Service Tester detects the switch position.

Functional Description

General

The electric sunroof is controlled and monitored by the sunroof module (SHDM). The sunroof (SHD) is connected via two data links with the general module (GM) of the ZKE II. The SHD motor is fuse protected by means of the electronic fuse relay on the driver's side (ES relay K15).

Note: For electronic power fuse, see ZKE diagnostic procedure

Operation

The sunroof is operated by way of the SHD switch. The switch switches ground to the sunroof module (SHDM).

Special Features:

Toll circuit

When the switch for opening and closing is briefly hit, the sunroof completely opens or closes automatically (= toll circuit). This function is interrupted immediately when the SHD switch is pressed once again. The toll circuit is not effective for the "raising" function.

Central opening and closing

The windows and the sunroof can be closed and opened by way of the door locks. For this purpose, the key must be held in the lock or unlock position for longer than 2 seconds. The sequence for the central closing function is rear power windows, front power windows, sunroof. The reverse sequence applies to central opening.

Position sensor

The position of the sunroof is monitored by an incremental position sensor which is mounted directly on the sunroof (SHD) motor.

Initialization

If battery voltage is disconnected or the general module, relay module or one of the door modules removed, the position sensors must be initialized after reconnection or reinstallation.

Check for non–initialized condition: Toll circuit not possible.

Initialization instructions:

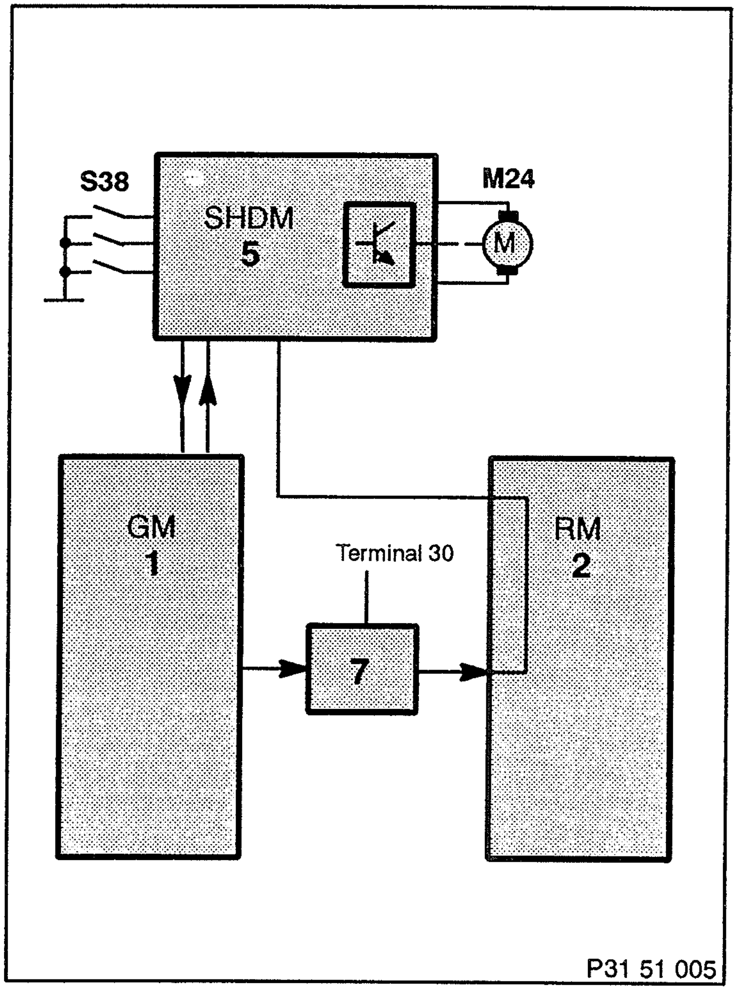
Press SHD switch in lift position until the sunroof (SHD) is completely raised 15 seconds afterwards.

Country–specific variants

The country coding is achieved by way of the software in the ZKE coding data.

Block diagram SHD

For ZKE block diagram, see Section 6100.0A



No.	Abb.	Description
1	GM	General module
2	RM	Relay module
5		Sunroof module with position sensor
7		Electronic power fuse relay: Driver's side K15
M24		Sunroof motor
S38		Sunroof switch

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with ZKE II

For general information on diagnosis with ZKE II (central body electronics), see Section 6100.0A

Defect Code Memory

Defects involving activation and the sunroof module are stored in the defect code memory. A defective sunroof (SHD) motor drive is also detected.

Test Procedure

The test procedure enables guided inspection of the sunroof switch.

Abbreviations

General

ZKE	Central body electronics
SHD	Sunroof
A	Outputs
E	Inputs

Modules

GM	General module
RM	Relay module
SHDM	Sunroof module

Pin assignments

Connector overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module
X910	4–pole, black	SHDM–A	Sunroof module
X916	5–pole, black	SHDM–B	Sunroof module
X917	6–pole, black	SHDM–C	Sunroof module

Pin assignments at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
12	E	Interface from SHD module	SHDM–C Pin 2	dynamic	Defect is stored with defect code No. 6	
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal50	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
5	A	Interface to SHD module SHDM	SHDM	dynamic	Defect is stored with defect code No. 6	
25	A	Electronic power fuse: Activation for ES relay, driver's side	ES relay, driver's side	0–2V		ES relay is only activated during operation of FH, ZV or SHD
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	U–batt for power circuit on driver's side, from electronic power fuse	SHDM–B Pin 2	approx. 12 V		Only during operation of FH, ZV or SHD
4	E	Ground for electronics	Terminal 31	0–2V		
6	E	U–batt for electronics of all ZKE modules	Terminal 30	approx. 12V		
11	E	U–batt for power circuit, driver's side from electronic power fuse	ES relay driver's side	approx. 12 V		Only during operation of FH, ZV or SHD

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
7	A	U–batt for sunroof module electronics	SHDM–B Pin 1	approx. 12V		
12	E	Ground for electronics	Terminal 31	0–2V		
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
25	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector SHDM–A X910

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	SHD motor activation: open	SHD motor	approx. 12V	Defect is stored with defect code No. 81	
2	A	SHD motor activation: closed	SHD motor	approx. 12V	Defect is stored with defect code No. 81	

Pin assignments at connector SHDM–B X916

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	RM–B Pin 7	approx. 12V		
2	E	U–batt for load	RM–A Pin 2	approx. 12V		Electronic power fuse
3	E	Ground for electronics and load	Terminal 31	0–2V		

Pin assignments at connector SHDM–C X917

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Interface from general module	GM–C Pin 5	dynamic	Defect is stored with defect code No. 6	
2	A	Interface to general module	GM–A Pin 12	dynamic	Defect is stored with defect code No. 6	
3	E	SHD switch : Slide open	SHD switch	0–2V; approx. 12V		when operated; not operated
4	E	SHD switch : close	SHD switch	—— " ——		—— " ——

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
5	E	SHD switch : hit function	SHD switch	— " —		— " —
6	E	SHD switch : open	SHD switch	— " —		— " —

Adapter

Component	Stecker–Nr.	Description	Adapter – Nummer
General module, door module, relay module	X332, X253, X254, X258, X259, X887, X889	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- If all functions of the ZKE are faulty, perform troubleshooting in accordance with Section ZKE 6100.0.

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

06 Data exchange sunroof module (SHDM) with general module (GM) faulty → Defect code 06

11 Sunroof module defective → Defect code 11

80 Malfunction sunroof switch → Defect code 80

81 Malfunction sunroof motor or SHD module → Defect code 81

82 Sunroof motor activation faulty → Defect code 82

Malfunctions:

Sunroof failure → Defect code 100

Defect Code 06

♦D♦ Defect code memory:

06 Data exchange sunroof module (SHDM) with general module (GM) faulty

Explanation: This defect code is stored when data exchange is not possible between the SHD module and the general module.

Possible causes:

- Voltage supply of the SHDM
- Data links SHDM and general module
- Data input or output in SHDM
- Data input or output in GM

Troubleshooting: As displayed on screen

Defect Code 11

♦D♦ Defect code memory: 11 Sunroof module faulty

Explanation: This defect code is stored when an internal defect occurs in the corresponding module (TMFT, TMBT, SHDM)

Possible causes:

– Module

Troubleshooting: As displayed on screen

Defect Code 80

♦D♦ Defect code memory: 80 Malfunction sunroof switch

Defect codeerkennung: Sunroof switch is monitored for impermissible output signals (plausibility check).

Mögliche Defect codeursache:

– SHD switch

Defect codebehebung: As displayed on screen

Defect Code 81

♦D♦ Defect code memory: 81 Malfunction sunroof motor or SHD module

Explanation: No pulses from SHD position sensor at SHD motor

Note: The position sensor is mounted on the SHD motor.

Possible causes:

– Wires
– Position sensor
– SHD motor

Troubleshooting: As displayed on screen

Defect Code 82

♦D♦ Defect code memory: 82 Sunroof motor activation faulty

Explanation: Activation voltage for SHD motor in the SHD module cannot be measured.

Note: Is the electronic power fuse (ES relay) OK.?, see functional description ZKE

Possible causes:

– Wires
– SHD module

Troubleshooting: As displayed on screen

Defect Code 100

Sunroof failure

Explanation: General malfunction in sunroof

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse)
- ♦D♦ Perform diagnostic procedure for sunroof.

Functional Description

Set seat and mirror positions are signalled as a voltage value via a potentiometer (mounted on the relevant actuator) to the control unit and – if the driver requires – these positions can be stored. Voltage ranges covered by the potentiometers:

- Seat motor drive: 0.1 V to 4.5 V
- Mirror motor drive: 0 V to 4.5 V

When the driver calls up a stored position, the control unit compares the voltage currently applied to the stored voltage. Adjustment takes place by way of the drive motors (actuator) until the voltage values agree.

Operation

A required seat or mirror position is set by way of the adjustment switches (on the driver's seat). The system is ready to store values after switching on the ignition and pressing the "memory". The current seat/mirror position is stored by pressing the store buttons "1", "2" or "3".

Stored positions are called up by:

Pressing the required button until the position is reached.

The adjustment procedure stops immediately as soon as the button is released.

Relay Monitoring (only Seat Motor Drives)

All seat relays are switched off if one relay sticks in the operating position (relay freeze). The status of the relays is monitored every time the adjustment switch is operated. Deactivation of the relays is cancelled when the relevant relay no longer sticks.

Deactivation of the relays by way of the relay monitoring function results in a closed–circuit current consumption of approx. 1.4 A to 2.0 A (normally 10 s after adjustment <1 mA).

Defective seat relays can be detected by way of the diagnostic program (defect code memory).

System Components/Control Unit Location

The SM/SPM control unit is located under the driver's seat. The control unit drives 4 (5 for sport seat) seat and mirror adjustment motors. Attention: No head–restraint adjustment motors in integral seat version.

Seat motors: One motor each for seat tilt, seat movement, seat height, backrest adjustment and, if sport seat is installed, adjustment of the thigh support.

Mirror motors: Two motors each (driver/passenger side) for left/right adjustment.

Notes on the BMW DIAGNOSTIC SYSTEM

After selection of the SM/SPM diagnostic program, the system assumes a fixed diagnostic mode. It is not possible to adjust the seat and mirror positions by means of the adjustment switches and it is also not possible to store/call stored positions in diagnostic mode. A defect code is not stored.

Diagnostic mode is terminated by returning from the SM/SPM program to the overview of control units. The control unit can only store defects which occur during automatic adjustment (memory mode). Defects which occur during manual operation (adjustment with the control buttons) are not stored. After the automatic procedure and detection of a fault, the corresponding defect code is not stored before the control unit assumes its rest status.

The following defect codes can be detected and stored by the control unit (defect code memory):

- Adjustment drives faulty
- Potentiometer faulty
- Drive or potentiometer incorrectly connected
- ROM defective
- Short to ground of the memory switch

Abbreviations

SM/SPM	Seat–mirror–memory
SG	Control unit

Pin assignments

Pin assignments at connector X 601 (SM/SPM control unit connector 26–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Potentiometer connection	Driver's mirror	0–4,5Volt	Voltage value	–
2	E	Potentiometer connection	Driver's mirror	0–4,5Volt	Voltage value	–
3	E	Potentiometer connection	Driver's mirror	0–4,5Volt	Voltage value	–
4	E	Potentiometer connection	Driver's mirror	0–4,5Volt	Voltage value	–
5	–	Not used	–	–	–	–
6	E	Potentiometer connection	Passenger's mirror	0–4,5Volt	Voltage value	–
7	–	Not used	–	–	–	–
8	–	Not used	–	–	–	–
9	–	Not used	–	–	–	–
10	E	Potentiometer connection	Passenger's mirror	0–4,5Volt	Voltage value	–
11	E	Mirror adjustment	Mirror adjustment switch	Ground	Status display	–
12	E	Mirror adjustment	Mirror adjustment switch	Ground	Status display	–
13	E	Mirror adjustment	Mirror adjustment switch	Ground	Status display	–
14	A	Connection, driver's mirror adjustment motor	Mirror adjustment motor	12Volt	Voltage value	–
15	A	Connection, driver's mirror adjustment motor	Mirror adjustment motor	12Volt	Voltage value	–
16	A	Connection, driver's mirror adjustment motor	Mirror adjustment motor	12Volt	Voltage value	–
17	–	Not used	–	–	–	–

18	–	Not used	–	–	–	–
19	–	Not used	–	–	–	–
20	–	Not used	–	–	–	–
21	E	Potentiometer connection	Passenger's mirror	0–4,5Volt	Voltage value	–
22	A	Connection, passenger's mirror adjustment motor	Passenger's mirror adjust-ment motor	12Volt	Voltage value	–
23	A	Connection, passenger's mirror adjustment motor	Passenger's mirror adjust-ment motor	12Volt	Voltage value	–
24	A	Connection, passenger's mirror adjustment motor	Passenger's mirror adjust-ment motor	12Volt	Voltage value	–
25	E	Potentiometer connection	Passenger's mirror	0–4,5Volt	Voltage value	–
26	–	Not used	–	–	–	–

Pin assignments at connector X 602 (SM/SPM control unit connector 26–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	–	Not used	–	–	–	–
2	E	Tilt down	Seat adjustment switch	Ground	Status display	–
3	E	Height down	Seat adjustment switch	Ground	Status display	–
4	–	Not used	–	–	–	–
5	E	Tilt up	Seat adjustment switch	Ground	Status display	–
6	E	Height up	Seat adjustment switch	Ground	Status display	–
7	E	Thigh support back	Seat adjustment switch	Ground	Status display	–
8	E	Seat movement back	Seat adjustment switch	Ground	Status display	–
9	E	Backrest back	Seat adjustment switch	Ground	Status display	–

10	E	Seat movement forward	Seat adjustment switch	Ground	Status display	–
11	E	Thigh support forward	Seat adjustment switch	Ground	Status display	–
12	E	Memory switch Pin 2	Memory switch	Ground	Status display	–
13	E	Backrest forward	Seat adjustment switch	Ground	Status display	–
14	–	Not used	–	–	–	–
15	E	Ground	Seat adjustment switch	Ground	–	–
16	–	Not used	–	–	–	–
17	–	Not used	–	–	–	–
18	A	Lights	Memory switch	12Volt	–	–
19	A	Lights	Memory switch	12Volt	–	–
20	–	Not used	–	–	–	–
21	–	Not used	–	–	–	–
22	–	Not used	–	–	–	–
23	–	Not used	–	–	–	–
24	E	Memory switch connection	Memory switch	Ground	–	–
25	E	Memory switch connection	Memory switch	Ground	–	–
26	E	Memory switch connection	Memory switch	Ground	–	–

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X 601	26–pole yellow	Cartool 611 4 51
Control unit	X 602	26–pole white	Cartool 611 4 51

Troubleshooting

Notes

- Troubleshooting with BMW diagnostic system
- Battery charged, U–min = 12 V
- Only remove and install the control unit with the ignition switched off
- In diagnostic mode, manual adjustment, storage and calling of settings (memory mode) and defect code storage are not possible.

Defect Code Table

♦D♦ Defect code memory – defect codes which can be stored by the control unit:

Defect code 1	:	Storage/Call unit
Defect code 2	:	Relay monitoring activated
Defect code 4 – 14	:	Drive defects (drive/potentiometer)
Defect code 16 – 26	:	Drive defects (polarity)
Defect code 27 – 44	:	Potentiometer defects
Defect code 45	:	ROM

Malfunctions – defects which cannot be stored

Failure of all seat/mirror adjustment functions	: Defect code 46
Failure of all seat adjustment functions	: Defect code 47
Failure of all mirror adjustment functions	: Defect code 48
Failure of individual seat/mirror adjustment functions	: Defect code 49
Memory function not possible	: Defect code 50
Diagnosis with defect code not possible	: Defect code 51
Other malfunctions	: Defect code 52

Defect Code 1

♦D♦ Defect code memory: 1 Storage/Call Unit

Explanation: Input of the memory switch has a short to ground.

Troubleshooting: Check wire for short to ground and repair if necessary: From control unit connect X 602 Pin 12 and Pin 26 to memory switch connector X 650 Pin 4 and Pin 1. If wires are OK., check wire from connector X 18100 to connector steering column memory and renew if necessary. If wire is OK., check memory switch and renew if necessary.

Defect Code 2

♦D♦ Defect code memory: 2 Relay Monitoring Activated

Explanation: Relay has been switched off by the relay monitoring facility.

Troubleshooting: Renew SM/SPM control unit

Defect Code 3

♦D♦ Defect code memory: 4 – 14; One or Several Defect Codes between 4 and 14 Stored (Drive Defect: Drive/Potentiometer)

Explanation: During the memory function (automatic adjustment), the control unit measures whether the voltage value of the feedback potentiometers changes correspondingly within a certain period of time.

Possible cause: Adjustment kinematics/adjustment motors blocked/stiffness or feedback potentiometers defective.

Troubleshooting: For further troubleshooting, see defect code 49

Defect Codes 5 – 26

♦D♦ Defect code memory: 5 – 26; One or Several Defect Codes between 5 and 26 Stored (incorrect polarity)

Explanation: Motor or potentiometer poles have been interchanged.

Note: The connectors at the adjustment buttons may also be interchanged. Check switch logic with diagnostic program.

Troubleshooting: Check motor polarity: Activate drives with diagnostic program; if the polarity is incorrect, the corresponding drive runs in the opposite direction. Correct polarity in this case. If the defect is not rectified, check the potentiometer polarity: For this purpose, activate drives and observe the voltage value of the corresponding motor during activation (indicated on screen): The voltage value must increase in the following movement directions: Seat height up, backrest forward, tilt up, seat movement forward, mirror vertically up, mirror horizontally to right. Correct polarity of corresponding potentiometer.

Defect Codes 27 – 44

♦D♦ Defect code memory: 27 – 44; One or Several Defect Codes between 27 and 44 Stored (Defective Polarity)

Explanation: The voltage value exceeds or drops below the permissible voltage range of the potentiometer (0.1 V to 4.5 V).

Possible causes: Short or break on wire from the control unit to the corresponding potentiometer.

Troubleshooting: Check wire from control unit to corresponding potentiometer and repair if necessary:

Backrest potentiometer: Control unit connector X 655 Pin 1, 2, 3 to potentiometer connector X 690 Pin 1, 2, 3.

Seat height potentiometer: Control unit connector X 654 Pin 1, 2 3 to potentiometer connector X 688 Pin 1, 2, 3.

Seat movement potentiometer: Control unit connector X 657 Pin 1, 2, 3 to potentiometer connector X 686 Pin 1, 2, 3.

Seat tilt potentiometer: Control unit connector X 656 Pin 1, 2, 3 to potentiometer connector X 687 Pin 1, 2, 3.

Thigh support (only sports seat!): Control unit connector X 18181 Pin 1, 2, 3 to potentiometer connector X 884 Pin 1, 2, 3.

Passenger's mirror: Control unit connector X 601 Pin 6, 10, 21, 25 to potentiometer connector X 18172 Pin 6, 7, 8, 9.

Driver's mirror: Control unit connector X 601 Pin 1, 2, 3, 4 to potentiometer connector X 18171 Pin 6, 7, 8, 9.

If wires are OK., renew corresponding potentiometer. Check voltage ranges by activation and screen display.

Defect Code 45

♦D♦ Defect code memory: 45 ROM

Explanation: Control unit detects that seat/mirror positions are not stored exactly over a longer period of time.

Troubleshooting: Clear ROM by means of diagnostic program, terminate diagnostic mode; set several different seat/mirror positions, store and when calling up the positions check that the required settings are actually assumed.

Defect Code 46

Malfunction: Failure of all Seat and Mirror Adjustment Functions

Possible cause: Power supply, ground

Troubleshooting: Check fuse. If fuse OK., remove driver's seat. Measure voltage at control unit connector X 649 Pin 4; is battery voltage applied? If no, repair wire; if yes, check wires from connector X 649 Pin 5 and 6 to ground and repair if necessary. If all wires/contacts are OK. but defect still not rectified, renew control unit.

Defect Code 47

Malfunction: Failure of All Seat Adjustment Functions

Possible cause: Relay, adjustment switch

Note: Mirror adjustment must be OK. otherwise see defect code 46.

Troubleshooting: Does the relay monitoring function indicate that the relay/seat motors are OK. (diagnostic program)? If yes, renew control unit; if no, check buttons as displayed on screen; are all switch positions detected (note: switch must be held pressed for at least 5 s)? If yes, go to defect code 49; if no, remove seat adjustment switch and check switch, renew if necessary: The resistance at connector X 603 between Pin 5 and the Pins 1, 2, 3, 4, 8, 9, 10, 11, 12 (depending on switch position) must always be less than 1 Ohm. If switch OK., check wire from adjustment switch connector X 603 Pin 5 to connector X 602 Pin 15 and repair if necessary. If wires OK., check all wires from adjustment switch to connector X 602 and renew if necessary.

Defect Code 48

Malfunction: 48 Failure of All Mirror Adjustment Functions

Possible cause: Wires, adjustment switch, control unit

Note: Seat adjustment must be OK., otherwise see defect code 46.

Troubleshooting: Check mirror adjustment switch by means of diagnostic program (hold switch pressed for at least 5 s). If all switch positions are detected, go to defect code 49, otherwise check ground connection from mirror adjustment switch connector X 18173 Pin 5 and repair if necessary. If wire OK., check all wires from the control unit connector X 601 (Pin 11, 12, 13) to the mirror adjustment switch and repair if necessary.

Defect Code 49

Malfunction: 49 Failure of Individual Adjustment Functions

Possible cause: Switch, drive, potentiometer, wires

Attention: The control unit must not be in diagnostic mode. Excessive dirt build–up or icing can cause temporary difficulty in movement of the mirror motor drives. Further more, a temporary mechanical blocking (e.g. foreign object in area of adjustment kinematics) may be the cause of the defect code being entered in the defect code memory. Check defects which have occurred in this way (check mechanics for stiffness/blocking) and clear defect code memory.

Troubleshooting: Is movement of the faulty drive possible via the adjustment switches?

Yes: Read out defect code memory and check corresponding defect, clear defect code memory.

No: Activate corresponding drive(s) in diagnostic program. Is the relevant drive operable?

Yes: Check adjustment switch in diagnostic program. If adjustment switch is OK., check wires from adjustment switch to control unit in accordance with schematic and repair if necessary.

No: Check all wires from the motor drive in accordance with the schematic and repair if necessary. If wires are OK. and defect is still not rectified, renew corresponding motor and perform test run.

Defect Code 50

Storage and Call–Up of Settings not Possible

Possible cause: Memory switch, wires

Note: Manual adjustment of all motor drives must be OK., otherwise go to defect codes 46, 47, 48, 49

Troubleshooting: Check the memory call keypad in the diagnostic program (switch 1, 2, 3 and memory LED). Are all buttons detected? If yes, renew control unit. If no, remove memory switch and measure resistance at memory switch connector X 650 between Pin 6 and 5; nominal values: Button 1 = 500 – 600 Ohm, button 2 = 170 –210 Ohm, button 3 = 60 – 80 Ohm, memory button = 0 – 1 Ohm. Are the measured values correct?

Yes: Check wires to connector X 602 and repair if necessary.

No: Renew switch

Defect Code 51

Malfunction: Diagnostic Mode with Control Unit not Possible

Possible cause: Power supply, ground, RxD/TxD link

Note: Refer to notes in the BMW DIAGNOSTIC SYSTEM

Troubleshooting: Is it possible to adjust the seat or mirror from the vehicle?

Yes: Check RxD and TxD link from the diagnostic socket to connector X 648 Pin 5 and 6 and repair if necessary.

No: Go to defect code 46.

Defect Code 52

Malfunction: Other Defects

Terminal R or 15 not detected: Check fuse and wire to connector X 694 Pin 3 and Pin 1 and repair if necessary.

Reverse not detected: Check wire to connector X 648 Pin 1 and repair if necessary.

This section describes the central body electronics (ZKE II) in general. If a defect occurs solely in a parts system of the central body electronics (ZKE) then follow the diagnostic procedure for the corresponding part system.

Functional Description

General

In order to increase its reliability, the central body electronics system (ZKE II) comprises several components which are connected to the general module (only the components 1 – 6) by way of data lines. Each of these components undertakes certain control and monitoring tasks.

Components of the ZKE:

1. **General Module (GM)**: Central unit of the ZK

- controls the data exchange with other control units
- controls the data exchange with the ZKE components 2 – 6c
- ontrols the relay module functionscontrols the electronic power fuse

2. **Sunroof Module (SHDM):** Control module linked to general module (GM) controls and monitors the SHD motor

3. **Driver's Door Module (TMFT):** Control module linked to general module (GM)

- controls and monitors door lock heating (TSH)
- monitors front power window on driver's side
- monitors central locking motor drive on driver's side

4. **Passenger's Door Module (TMBT):** Control module linked to general module (GM)

- monitors front power window on passenger's side
- monitors central locking motor drive on passenger's side

5. **Relay Module (RM):** Driven by the general module (GM)

- contains the relays for power windows and central locking system
- switches the relays for wiper, wash pump, intensive wash, unlocking rear lid and consumer load cut–out
- switches the ADV module (ADM)
- switches the SRA module (SRM)

General: The power supply to all ZKE modules is interrupted when the relay module is removed

6. Power Window Switch Block on Driver's Door

7. **ADV Module (ADM):** Relay module for windscreen wiper pressure control

8. **SRA Module (SRM):** Relay module for headlamp washer system and auxiliary wash pump in luggage compartment

9. **Electronic Power Circuit Protection:** Fuse protection of load circuits

Electronic Power Circuit Protection

Electronic power circuit protection for the motor drives of the power windows (FH), sunroof (SHD) and central locking system (ZV) is provided by the electronic power fuse. It consists of the power measurement circuit in the relay module (RM), the control in the general module (GM) and the 2 fuse relays (ES relays) K15 and K30.
- ES relay K15: Driver's power window, ZV, SHD
- ES relay K30: Passenger's power window

Power measurement circuit: Constant current measurement of the drives for FH, ZV and SHD in the relay module (RM) and transfer of measured values to the general module (GM).

Control: If a current limit value is exceeded, the general module no longer activates the corresponding ES relay.

Note: The ES relay is always only on for as long as an FH, ZV or SHD function is active.
Repeat lockout: If the relay module (RM) detects excess current, the corresponding ES relay is not activated for 60 s. The relay can be driven once again after 60 s. It is switched off again if the fault still applies. This automatic switching cycle takes place 6 times in succession, it is then followed by activation of the repeat lockout. The repeat lockout can be cancelled by switching the ignition off and on (terminal 15).

ES–relay: The ES relays K15 and K30 switch battery voltage to the power circuits for the power windows and central locking system in the relay module (RM) and to the sunroof module. The relays are driven by the general module (GM).

Fuse link: Additional fuse protection (30 A) of the power circuits in the case of the ES relays being defective.

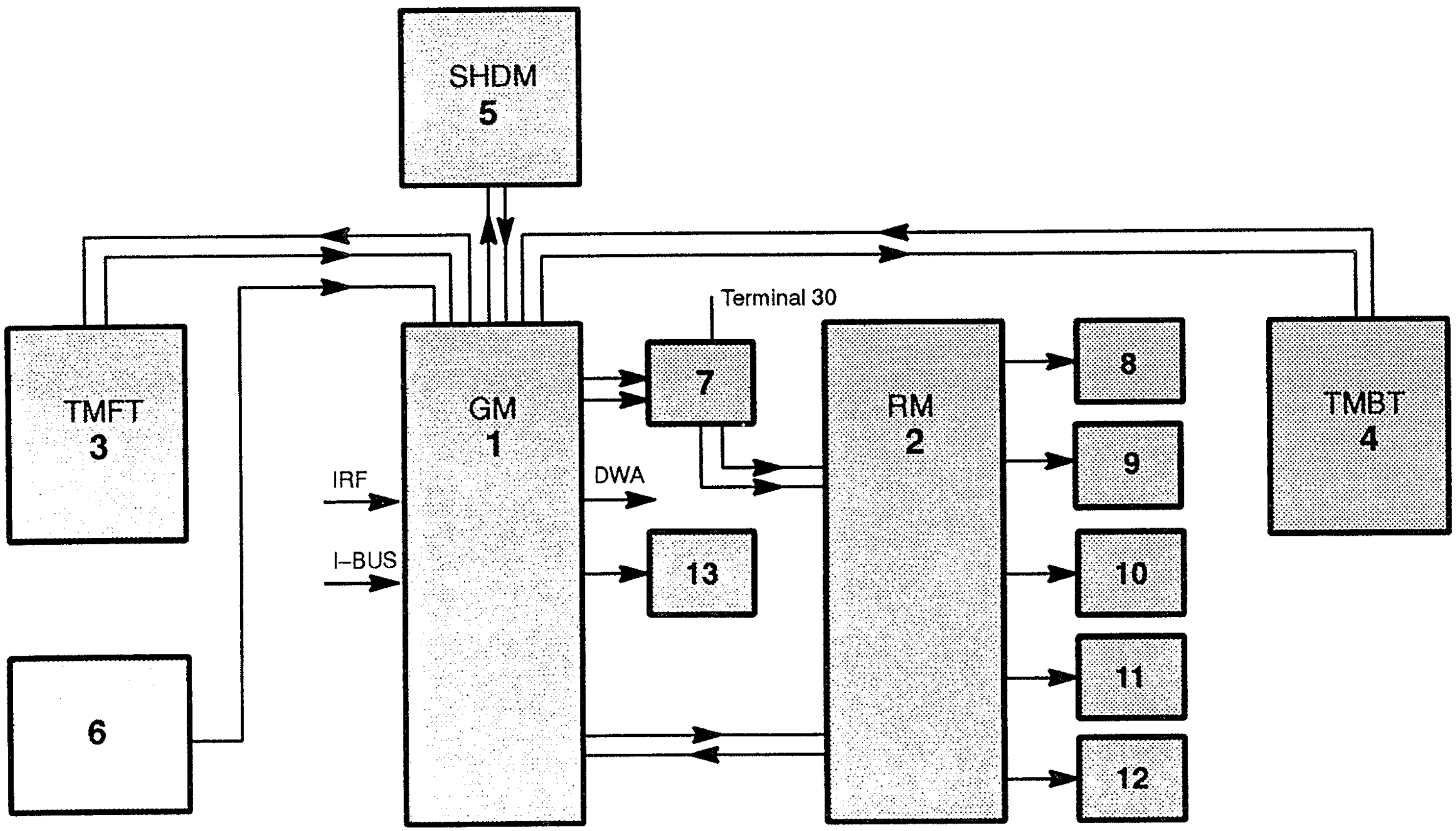
Load Cut–Out

The interior lights (IB), the glove compartment, engine compartment and luggage compartment lights can be switched on when the vehicle is parked. This places an unnecessary load on the battery when switched on permanently. To avoid this situation, the battery supply to the above specified lamps is cut 16 minutes after parking the vehicle.

Nr.	Abbreviation	Description
1	GM	General module
2	RM	Relay module
3	TMFT	Driver's door module
4	TMBT	Passenger's door module
5	SHDM	Sunroof module
6		Power windows switch block
7		Electronic power circuit protection relays: K15, K30
8		SRA module
9		ADV module
10		3 x wiper relay
11		SIR relay, washer pump relay
12		Rear lid relay, consumer load cut–out
13		Interior light relay

Block Diagram ZKE II

For block diagrams of the ZKE subsystems, refer to the corresponding sections in the troubleshooting manual



P31 61 001

Notes on the BMW DIAGNOSTIC SYSTEM

Defect Code Memory

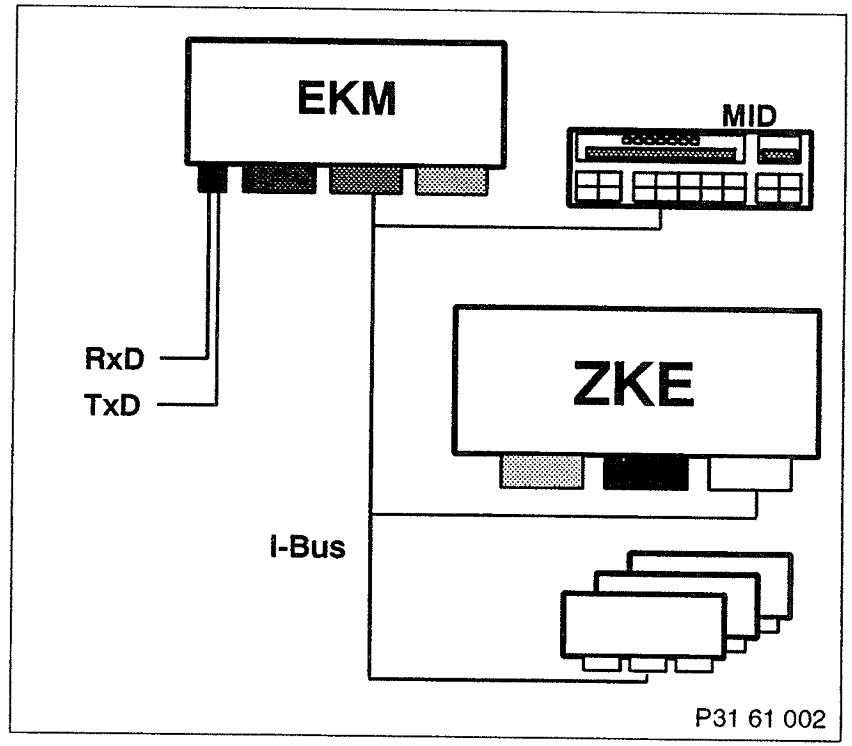
A large number of defects are detected automatically by the general module and stored in the defect code memory. The stored defect codes are retained also after disconnecting the battery or removing the module. The defects are displayed arranged in the order of the time they first occurred.

Test Procedure

A separate diagnostic procedure has been compiled for each part–system of the ZKE, thus enabling guided troubleshooting.

Diagnosis via I–Bus

The general module (GM) has no direct diagnostic bus connection. The general module (GM) is linked via the instrument bus (I–bus) to the electronic body module (EKM). The total data traffic is handled via this link (for more detailed description of the I–bus, refer to section 6211.0A EKM)



Diagnostic mode via I–bus (instrument bus)

Abbreviations

General

A	Outputs
ADV	Wiper pressure control
E	Inputs
FH	Power window
SHD	Sunroof
SIR	Intensive wash
SRA	Headlamp washer
ZKE	Central body electronics
ZV	Central locking system

Modules

GM	General module
RM	Relay module
SDHM	Sunroof module
TMFT	Driver's door module
TMBT	Passenger's door module

Pin assignments

Connector Overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module
X887	26–pole, black	TMFT	Driver's door module
X889	26–pole, white	TMBT	Passenger's door module
X910	4–pole, black	SHDM–A	Sunroof module
X916	5–pole, black	SHDM–B	Sunroof module
X917	6–pole, black	SHDM–C	Sunroof module

Pin assignments at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Kl. 30	approx. 12V		
6	E	Passenger's door contact	Contact in cylinder lock	0–2V		With door open
7	E	Driver's door contact	Contact in cylinder lock	0–2V		With door open
8	E	Interface IRF–B	IR module	0–2V approx.12V		For logic, see functional description ZV
9	E	Interface IRF–A	IR module	0–2V approx. 12V		———— " ————
10	E	Rear window contact, driver's side	Window contact	0–2V		With window open
11	E	Interface from FH switch block	Power window switch block	dynamic	Defect is stored with defect code No. 14	
12	E	Interface from SHD module	SHDM–C Pin 2	dynamic	Defect is stored with defect code No. 6	
15	E	Interface from passenger's door module	TMBT–A Pin 9	dynamic	Defect is stored with defect code No. 3	
16	E	Interface from driver's door module	TMFT–A Pin 9	dynamic	Defect is stored with defect code No. 2	
17	E/A	I–bus interface	EKM	dynamic		
19	E	Lock rear lid	Glove compartment lock	0–2V		With glove compartment locked
21	E	Interface from relay module; diagnostic feedback RM functions.	RM–B Pin 3	dynamic		
22	E	Speed signal	EKM	dynamic		
23	E	Interface from relay module; power measurement RM functions	RM–B Pin 4	dynamic		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
24	E	Crash sensor	Crash sensor	approx. 12V at rest; 0–2V in the case of crash	Defect is stored with defect code No. 48	Sensor has no continuity when at rest; continuity for approx. 2 msec during crash
25	E	Command unlock rear lid	Rear lid button	0–2V		Button pressed
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal 50	approx. 12V		
6	E	Wiper reset contact	Reset contact	approx. 12V; 0–2V	Defect is stored with defect code No. 21	Wiper in parked position Wiper not in parked position
7	E	Wash	Wiper switch	0–2V		Switch operated
8	E	Intermittent wipe	Wiper switch	0–2V		Switch operated
9	E	Wipe stage 1	Wiper switch	0–2V		—— " ——
10	E	Intensive wash	Wiper switch	0–2V		—— " ——
11	E	Headlamp on	Terminal 58	approx. 12V		
12	E	Foglamp on		approx. 12V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
13	E	Diagnosis wiper relay stage 1/2	Wire wiper relay to wiper motor		Defect is stored with defect code No. 24, 25	
14	E	Diagnosis wiper park relay	Wire wiper park relay to wiper motor		Defect is stored with defect code No. 23	
15	E	Diagnosis ADV module	ADV module		Defect is stored with defect code No. 28	
16	E	Wipe stage 2	Wiper switch	0–2V		Switch operated
17	A	Interface to hazard warning lights	Crash alarm generator	0–2V		Ground pulse during crash
19	E	Level wash water reservoir engine compartment too low	Level switch	0–2V; approx. 12V		Level OK. : Level too low
20	E	ADV cam switch	Cam Switch	0–2V; approx. 12V	Defect is stored with defect code No. 22	Cam not reached; Cam reached (parked position)
22	E	Diagnosis SRA module	SRA module		Defect is stored with defect code No. 29	
23	E	Diagnosis SIR relay	Wire SIR relay to SIR pump		Defect is stored with defect code No. 27	
24	E	Diagnosis wash pump relay	Wire wash pump to wash pump relay		Defect is stored with defect code No. 26	
25	E	Diagnosis wiper relay stage 1/2	Wire wiper relay to wiper motor		Defect is stored with defect code No. 24, 25	
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	Relay module interface	RM–B 26	dynamic		
3	A	Relay module interface	RM–B 11	dynamic		
4	A	Relay module interface	RM–B 13	dynamic		
5	A	Interface to SHD module	SHDM	dynamic	Defect is stored with defect code No. 6	
8	A	Interface to passenger's door module	TMBT	dynamic	Defect is stored with defect code No. 3	
9	A	Interface to driver's door module	TMFT	dynamic	Defect is stored with defect code No. 2	
10	E	Rear window contact passenger's side	Window contact	0–2V		With window open
12	A	Interior light relay activation	Interior light relay	0–2V		During activation
19	A	Interface to DWA	DWA	approx. 12V		
20	A	Interface to DWA	DWA	approx. 12V		
24	A	Electronic power fuse: Activation for ES relay passenger's side	Es relay passenger's side	0–2V		ES relay is only activated during window operation on passenger's side
25	A	Electronic power fuse: Activation for ES relay driver's side	ES relay driver's side	0–2V		ES relay is only activated during operation of FH, ZV or SHD
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Activation of ZV motors: Unlock	ZV motors	approx. 12V	Defect is stored with defect code No. 47	During activation, electronic power fuse
2	A	U–batt for power circuit on driver's side from electronic fuse	SHDM–B Pin 2	approx. 12 V		Only during operation of FH, ZV or SHD
3	A	Activation of ZV motors: Lock	ZV motors	approx. 12V	Defect is stored with defect code No. 46	During activation, electronic power fuse
4	E	Ground for electronics	Terminal 31	0–2V		
5	A	U–batt for power circuit on passenger's side from electronic power fuse		approx. 12V		Only during power window operation on passenger's side
6	E	U–batt for electronics for all ZKE modules	Terminal 30	approx. 12V		
7	A	U–batt for driver's door module electronics	TMFT–A Pin 22,23	approx. 12V		
8,9	E	Ground for ZV and FH motors	Terminal 31	0–2V		
10	A	FH motor activation: driver's door open	FH motor driver's door	approx. 12V	Defect is stored with defect code No. 58	During activation, electronic power fuse
11	E	U–batt for power circuit on driver's side from electronic power fuse	ES relay driver's side	approx. 12 V		Only during operation of FH, ZV, or SHD
12	E	U–batt for power circuit on passenger's side from electronic power fuse	ES relay passenger's side	approx. 12V		Only during power window operation on passenger's side
13	A	Activation ZV motors: Central arrest	ZV motors	approx. 12V	Defect is stored with defect code No. 45	During activation, electronic power fuse

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
14	A	Activation FH motor : Rear driver's side closed	FH motor rear driver's side	approx. 12V	Defect is stored with defect code No. 64	——— " ———
15	A	Activation FH motor : Passenger's door open	FH motor passenger's door	approx. 12V	Defect is stored with defect code No. 59	——— " ———
16	A	Activation FH motor : Driver's door closed	FH motor driver's door	approx. 12V	Defect is stored with defect code No. 62	During activation, electronic power fuse
17	A	Activation FH motor : Rear passenger's side open	FH motor rear passenger's side	approx. 12V	Defect is stored with defect code No. 61	——— " ———
18	A	Activation FH motor : Passenger's door closed	FH motor passenger's door	approx. 12V	Defect is stored with defect code No. 63	——— " ———
19	A	Activation FH motor : Rear driver's side open	FH motor rear driver's side	approx. 12V	Defect is stored with defect code No. 60	——— " ———
20	A	Activation FH motor : Rear passenger's side closed	FH motor rear passenger's side	approx. 12V	Defect is stored with defect code No. 65	——— " ———

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	U–batt for passenger's door module electronics	TMBT–A Pin 22	approx. 12V		
3	A	Interface to general module, diagnostic feedback RM function	GM–A Pin 21	dynamic		
4	A	Interface to general module, power measurement RM	GM–A Pin 23	dynamic		
5	A	Relay activation, unlock rear lid	Relay unlock rear lid	0–2V		During activation
6	A	Relay activation, load cut–out	Relay load cut–out	0–2V		During activation
7	A	U–batt for sunroof module electronics	SHDM–B Pin1	approx. 12V		
8	A	Relay activation, wiper park position	Relay wiper park position	0–2V	Defect is stored with defect code No. 23	During activation
9	A	Relay activation, wash pump	Relay wash pump	0–2V	Defect is stored with defect code No. 26	——— " ———
10	A	SRA module activation: Headlamp washer	SRA module	0–2V	Defect is stored with defect code No. 29	——— " ———
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		
13	A	General module interface	GM–C Pin 4	dynamic		
15	A	SRA module activation: Wash pump luggage compartment	SRA module	0–2V	Defect is stored with defect code No. 29	During activation

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
17	A	ADV module activation: Reduce pressure	ADV module	0–2V	Defect is stored with defect code No. 28	——— " ———
18	A	Ansteuerung ADV–module : Druck erhöhen	ADV module	0–2V	Defect is stored with defect code No. 28	——— " ———
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
21	A	Relay activation, wiper stage 2	Relay wiper stage 2	0–2V	Defect is stored with defect code No. 24, 25	During activation
22	A	Relay activation, Intensive wash (SIR)	Relay intensive wash	0–2V	Defect is stored with defect code No. 27	——— " ———
24	A	Relay activation, wiper stage 1	Relay wiper stage 1	0–2V	Defect is stored with defect code No. 24, 25	——— " ———
25	E	Ground for electronics	Terminal 31	0–2V		
26	A	General module interface	GM–C Pin 2	dynamic		

Pin assignments at connector TMFT X887

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Pin contact ZV motor driver's door: Locked	ZV motor driver's door	approx. 12V		
2	E	Pin contact ZV motor driver's door: Unlocked	ZV motor driver's door	approx. 12V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Voltage at FH motor driver's door connection "closed"	Wire RM–A Pin 16 to FH motor driver's door	approx.12V	Defect is stored with defect code No. 66	Driver's power window closed during activation
5, 18	E	Position sensor FH motor driver's door	FH motor driver's door	dynamic	Defect is stored with defect code No. 54	
6	A	Power supply for FH position sensor	FH motor driver's door	approx. 12V	——— " ———	During operation of driver's power window
7	E	Ground for electronics	Terminal 31	0–2V		
8, 10	A	Door lock heating (TSH)	Heating coil	approx. 12V		For activation of door lock heating, see functional description TSH
9	A	Interface to general module	GM–A Pin 15	dynamic	Defect is stored with defect code No. 2	
11	E	Inner door handle contact	Inner door handle contact	approx. 12V; 0–2V		When operated; Not operated
12	E	Door lock contact B N/C contact	Locking cylinder	— " —		——— " ———
13	E	Door lock contact A	Locking cylinder	— " —		——— " ———
16	E	Door handle contact	Door handle contact	— " —		——— " ———
17	E	Voltage at FH motor driver's door, connection "open"	Wire RM–A Pin 10 to FH motor driver's door	approx. 12V	Defect is stored with defect code No. 66	Driver's power window open during operation
22, 23	A	U–batt for electronics and load	RM–A Pin 7	approx. 12V		
24	A	Interface from general module	GM–C Pin 8	dynamic	Defect is stored with defect code No. 2	
25	E	Door lock contact C	Locking cylinder	approx. 12V; 0–2V		When operated; Not operated
26	E	Door lock contact B N/O contact	Locking cylinder	— " —		——— " ———

Pin assignments at connector TMBT X889

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Pin contact ZV motor passenger's door: Locked	ZV motor passenger's door	approx. 12V		
2	E	Pin contact ZV motor passenger's door: Unlocked	ZV motor passenger's door	approx. 12V		
4	E	Voltage at FH motor passenger's door connection "closed"	Wire RM–A Pin 18 to FH motor passenger's door	approx.12V	Defect is stored with defect code No. 67	Passenger's door power window closed during activation
5, 18	E	Position sensor FH motor passenger's door	FH motor passenger's door	dynamic	Defect is stored with defect code No. 55	
6	A	Power supply for FH position sensor	FH motor driver's door	approx. 12V	——— " ———	During operation of driver's power window
7	E	Ground for electronics	Terminal 31	0–2V		
9	A	Interface to general module	GM–A Pin 16	dynamic	Defect is stored with defect code No. 3	
11	E	Inner door contact	Inner door contact	approx. 12V; 0–2V		When operated; Not operated
12	E	Door lock contact B N/C contact	Locking cylinder	— " —		——— " ———
13	E	Door lock contact A	Locking cylinder	— " —		——— " ———
16	E	Door handle contact	Door handle contact	approx. 12V; 0–2V		When operated; Not operated
17	E	Voltage at FH motor passenger's door "open"	Wire RM–A Pin 15 to FH motor passenger's door	approx.12V	Defect is stored with defect code No. 67	Passenger's power window open during activation
19	E	H switch passenger's door:	GM–C Pin 8	0–2V; approx. 12V		When operated; Not operated

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
20	E	FH switch passenger's door: Closed	GM–C Pin 8	— " —		——— " ———
21	E	FH switch passenger's door: Open	GM–C Pin 8	— " —		——— " ———
22	A	U–batt for electronics	RM–B Pin 1	approx. 12V		
24	A	Interface from general module	GM–C Pin 9	dynamic	Defect is stored with defect code No. 3	
25	E	Door lock contact C	Locking cylinder	approx. 12V; 0–2V		When operated; Not operated
26	E	Door lock contact B N/O contact	Locking cylinder	— " —		——— " ———

Pin assignments at connector SHDM–A X910

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	SHD motor activation: Open	SHD motor	approx. 12V	Defect is stored with defect code No. 81	
2	A	SHD motor activation: Closed	SHD motor	approx. 12V	Defect is stored with defect code No. 81	

Pin assignments at connector SHDM–B X916

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	RM–B Pin 7	approx. 12V		
2	E	U–batt for load	RM–A Pin 2	approx. 12V		Electronic power fuse
3	E	Ground for electronics and load	Terminal 31	0–2V		

Pin assignments at connector SHDM–C X917

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Interface from general module	GM–C Pin 5	dynamic	Defect is stored with defect code No. 6	
2	A	Interface to general module	GM–A Pin 12	dynamic	Defect is stored with defect code No. 6	
3	E	SHD switch : Slide open	SHD switch	0–2V; approx. 12V		When operated; Not operated
4	E	SHD switch : Close	SHD switch	— " —		— " —
5	E	SHD switch : Hit function	SHD switch	— " —		— " —
6	E	SHD switch : Open	SHD switch	— " —		— " —

Troubleshooting

Notes

- Troubleshooting with BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12V
- The power supply to the general module, sunroof module and door modules is interrupted when the relay module is removed.
- Only remove and install the above mentioned modules with the ignition switched off. After reinstallation, clear defect code memory with ♦D♦ defect code memory.
- Windscreen wiper control defective → section 6160.0
- Power windows defective→ section 5133.0
- Sunroof defective → section 5410.0
- Central locking system defective → section 5126.0
- Door lock heating defective → section 5120.0
- Headlamp washer defective → section 6167.0
- Wiper pressure control defective → section 6164.0
- Interior light control defective → section 6330.0

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

Overview of all defect codes:

01 General module defective

02 Data exchange driver's door module (TMFT) with general module (GM) faulty

03 Data exchange passenger's door module (TMBT) with general module (GM) faulty

06 Data exchange sunroof module (SHDM) with general module (GM) faulty

07 Driver's door module defective

08 Passenger's door module defective

11 Sunroof module defective

12 Closed–circuit current relay module: Limit value exceeded

14 Data exchange power window switch block with general module (GM) faulty

15 Input signal terminal R at general module defective

21 Signal from wiper reset contact faulty

22 Signal from ADV cam switch faulty

23 Wiper park position relay defective

24 Wiper stage 1 relay defective

25 Wiper stage 2 relay defective

26 Wash pump relay defective

27 Headlamp intensive wash relay (SIR relay) defective

28 ADV module defective
29 SRA module defective
35 Activation of door lock heating (TSH) defective
45 ZV central arrest. Defect during activation of ZV motors
46 ZV lock. Defect during activation of ZV motors
47 ZV unlock. Defect during activation of ZV motors
48 Crash sensor
50 Fault, power window switch for front FH driver's side
51 Fault, power window switch for front FH passenger's side
52 Fault, power window switch for rear FH driver's side
53 Fault, power window switch for rear FH passenger's side
54 Front power window driver's side defective
55 Front power window passenger's side defective
58 Defect during activation: Open front power window driver's side
59 Defect during activation: Open front power window passenger's side
60 Defect during activation: Open rear power window driver's side
61 Defect during activation: Open rear power window passenger's side
62 Defect during activation: Close front power window driver's side
63 Defect during activation: Close front power window passenger's side
64 Defect during activation: Close rear power window driver's side
65 Defect during activation: Close rear power window passenger's side
66 Wire from relay module to front FH motor driver's side defective
67 Wire from relay module to front FH motor passenger's side defective
80 Sunroof switch defect
81 Sunroof motor or SHD module defect
82 Activation of sunroof motor defective
95 Electronic power fuse: Excess current in power circuit on driver's side
96 Electronic power fuse: Excess current in power circuit on passenger's side
97 Excess current at general module outputs
98 Excess current at relay module outputs

Defect Code 01

♦D♦ **Defect Code Memory: 01 General module defective**

Explanation: This defect code is stored when an internal defect module defect occurs.

Possible cause: General module

Troubleshooting: As displayed on screen

Defect Codes 02, 03, 06

♦D♦ **Defect Code Memory:**
02 Data exchange driver's door module (TMFT) with general module (GM) faulty
03 Data exchange passenger's door module (TMBT) with general module (GM) faulty
06 Data exchange sunroof module (SHDM) with general module (GM) faulty

Explanation: These defect codes are stored when data exchange between the corresponding module (TMFT, TMBT, SHDM) and the general module is not possible.

Possible causes:

- Voltage supply of the module
- Data link module GM
- Data input or output in module
- Data input or output in general module

Troubleshooting: As displayed on screen

Defect Codes 07, 08, 11

♦D♦ Defect Code Memory:
07 Driver's door module defective
08 Passenger's door module defective
11 Sunroof module defective

Explanation: This defect code is stored when an internal module defect occurs in the corresponding module (TMFT, TMBT, SHDM).

Possible cause:

– Module

Troubleshooting: As displayed on screen

Defect Code 12

♦D♦ Defect Code Memory: 12 Closed–circuit current relay module: Limit value exceeded

Explanation: This defect code is stored when the general module detects an excessively high closed–circuit consumption for FH or ZV activation in the relay module (RM).

Note: The current is measured 16 minutes after switching off the ignition.

Possible causes:

– Wire RM connector 26–pole Pin 4 to GM connector white Pin 23
– Relay module

Troubleshooting: As displayed on screen

Defect Code 14

♦D♦ Defect Code Memory: 14 Data exchange power window switch block with general module (GM) faulty

Explanation: This defect code is stored when the data exchange between the power window switch block and general module is interrupted.

Possible causes:

- Voltage supply at power window switch block
- Data link power window switch block to general module (GM)
- Power window switch block

Troubleshooting: As displayed on screen

Defect Code 15

♦D♦ Defect Code Memory: 15 Input signal terminal R at general module faulty

Explanation: This defect code is stored when terminal R is applied at the general module without terminal 15.

Troubleshooting: As displayed on screen

Defect Code 21

♦D♦ Defect Code Memory: 21 Signal from wiper reset contact faulty

Explanation: This defect code is stored when no wiper reset signal is applied at the general module (GM) 16 s after activation of the wiper.

Possible causes:

- – Wires
- – Reset contact
- – Wiper motor
- – Icing/dirt build–up

Troubleshooting: As displayed on screen

Defect Code 22

♦D♦ Defect Code Memory: 22 Signal from ADV cam switch faulty

Explanation: This defect code is stored when no cam switch signal (on reaching the next cam) is applied at the general module (GM) 4 s after activation of the ADV motor.

Possible causes:

- – Wires
- – Cam switch
- – ADV motor
- – Icing/dirt build–up

Troubleshooting: As displayed on screen

Defect Code 23

♦D♦ Defect Code Memory: 23 Wiper park position relay defective

Explanation: This defect code is stored when the general module (GM) detects a fault in activation via the diagnostic link between the wiper park relay and the wiper motor.

Possible causes:

- Wires
- Voltage supply wiper park relay K36
- Wiper park relay K36
- Relay module

Troubleshooting: As displayed on screen

Defect Code 24

♦D♦ Defect Code Memory: 24 Wiper stage 1 relay defective

Explanation: This defect code is stored when the general module (GM) detects a fault in activation via the 2 diagnostic links between the wiper relay stage 2 K38 and the wiper motor.

Possible causes:

- Wires
- Voltage supply K37 wiper relay stage 1
- K37 wiper relay stage 1
- Relay module

Troubleshooting: As displayed on screen

Defect Code 25

♦D♦ Defect Code Memory: 25 Wiper stage 2 relay defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the 2 diagnostic links between the K38 wiper relay stage 2 and the wiper motor.

Possible causes:

- Wires
- Voltage supply K38 wiper relay stage 2
- K38 wiper relay stage 2
- Relay module

Troubleshooting: As displayed on screen

Defect Code 26

♦D♦ Defect Code Memory: 26 Wash pump relay defective

Explanation: This defect code is stored when the general module (GM) detects a fault in activation via the diagnostic link between the wash pump relay and the wash pump.

Possible causes:

- Wires
- Voltage supply K5 wash pump relay
- K5 wash pump relay
- Relay module

Troubleshooting: As displayed on screen

Defect Code 27

♦D♦ Defect Code Memory: 27 Headlamp intensive wash relay (SIR relay) defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the diagnostic link between the SIR relay and the SIR motor.

Possible causes:

- Wires
- Voltage supply K42 SIR relay
- K42 SIR relay
- Relay module

Troubleshooting: As displayed on screen

Defect Code 28

♦D♦ Defect Code Memory: ADV module defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the diagnostic link from the ADV module.

Possible causes:

- Wires
- Voltage supply K12 ADV module
- K12 ADV module
- Relay module

Troubleshooting: As displayed on screen

Defect Code 29

♦D♦ Defect Code Memory: 29 SRA module defective

Explanation: This defect code is stored when the general module (GM) detects a fault in activation via the diagnostic link from the SRA module.

Possible causes:

- Wires
- Voltage supply N6 SRA module
- N6 SRA module
- Relay module

Troubleshooting: As displayed on screen

Defect Code 35

♦D♦ Defect Code Memory: 35 Activation of door lock heating (TSH) defective

Explanation: This defect code is stored when a defect in TSH activation is detected in the driver's door module.

Note: Not all possible defects of the TSH can be detected.

Possible causes:

- Wire driver's door module heating coil
- Ground wire to heating coil
- Heating coil
- Driver's door module

Troubleshooting: As displayed on screen

Defect Codes 45–47

♦D♦ Defect Code Memory:
45 ZV central arrest
Defect during activation of ZV motors
46 ZV lock.
Defect during activation of ZV motors
47 ZV unlock.
Defect during activation of ZV motors

Explanation: These defect codes are stored when an incorrect level is detected at the ZV output of the RM after activation of the corresponding TV relay (in the relay module (RM)).

Possible causes:

– Wires
– Relay module

Troubleshooting: As displayed on screen

Defect Code 48

♦D♦ Defect Code Memory: 48 Crash sensor

Explanation: This defect code is stored when a ground signal is applied for longer than 1 sec at the general module input crash sensor.

Note: During normal operation, the GM input is open, when the crash sensor is triggered, it is applied to ground for approx. 2 msec.

Possible cause:

– Crash sensor

Troubleshooting: As displayed on screen

Defect Codes 50 – 53

♦D♦ Defect Code Memory:
50 Fault, power window switch for front FH driver's side
51 Fault, power window switch for front FH passenger's side
52 Fault, power window switch for rear FH driver's side
53 Fault, power window switch for rear FH passenger's side

Explanation: The power window switches are monitored for impermissible output signals (plausibility check).

Possible causes:

– FH switch

Troubleshooting: As displayed on screen

Defect Codes 54–55

♦D♦ Defect Code Memory:
54 Front power window driver's side defective
55 Front power window passenger's side defective

Explanation: No pulses are applied from the FH position sensor to the corresponding door module.

Note: The position sensor is mounted on the FH motor.

Possible causes:

– Wires
– Position sensor
– FH motor
– Supply wires

Troubleshooting: As displayed on screen

Defect Codes 58 – 65:

♦D♦ **Defect Code Memory:**
58 Defect during activation: Open front power window driver's side
59 Defect during activation:
Open front power window passenger's side
60 Defect during activation:
Open rear power window driver's side
61 Defect during activation:
Open rear power window passenger's side
62 Defect during activation:
Close front power window driver's side
63 Defect during activation:
Close front power window passenger's side
64 Defect during activation:
Close rear power window driver's side
65 Defect during activation:
Close rear power window passenger's side

Explanation: The RM outputs for power windows are monitored by way of voltage measurement in the relay module (RM) and the measured values transferred to the general module (GM). The defect codes 58–65 are stored when the measured output voltage does not correspond to activation by the general module (GM) (e.g. defective relay in the RM).

Possible causes:

- Wires from relay module (RM) to FH motors
- Relay module

Troubleshooting: As displayed on screen

Defect Codes 66, 67

♦D♦ **Defect Code Memory:**
66 Wire from relay module to front FH motor driver's side defective
67 Wire from relay module to front FH motor passenger's side defective

Explanation: The FH wires between the relay module (RM) and FH motors are monitored by way of voltage measurement at the FH motor. The defect codes 66 and 67 are stored when the measured voltage at the FH motors does not agree with activation by the relay module (RM).

Possible cause:

– Wire from RM to corresponding front FH motor

Troubleshooting: As displayed on screen

Defect Code 80

♦D♦ **Defect Code Memory: 80 Sunroof switch defect**

Explanation: The sunroof switch is monitored for impermissible output signals (plausibility check).

Possible cause:

– SHD switch

Troubleshooting: As displayed on screen

Defect Code 81

♦D♦ Defect Code Memory: 81 Sunroof motor or SHD module defect

Explanation: No pulses from SHD position sensor at SHD motor

Note: The position sensor is mounted on the SHD motor.

Possible causes:

– Wires
– Position sensor
– SHD motor

Troubleshooting: As displayed on screen

Defect Code 82

♦D♦ Defect Code Memory: 82 Activation of sunroof motor defective

Explanation: Activation voltage for SHD motor can not be measured in SHD module.

Note: Is the electronic power fuse (ES relay) OK.?, see functional description ZKE

Possible causes:

– Wires
– SHD module

Troubleshooting: As displayed on screen

Defect Code 95

♦D♦ Defect Code Memory: 95 Electronic power fuse: Excess current in power circuit on driver's side

Explanation: This defect code is stored when an impermissibly high current is measured in the relay module (RM) for the power circuit of the electronic power fuse on the driver's side.

Note: For electronic power fuse, refer to section 6100.00

Possible causes:

- Wires
- Central locking drives defective or blocked.
- Power window motor drives on driver's side defective or blocked.
- Sunroof motor drive defective or blocked
- SHD module

Troubleshooting: As displayed on screen

Defect Code 96

♦D♦ Defect Code Memory: 96 Electronic power fuse: Excess current in power circuit on passenger's side

Explanation: This defect code is stored when an impermissibly high current is measured in the relay module (RM) for the power circuit of the electronic power fuse on the passenger's side.

Note: For electronic power fuse refer to section 6100.00

Possible causes:

- Wires
- Power window motor drives on passenger side defective or blocked.

Troubleshooting: As displayed on screen

Defect Code 97

♦D♦ Defect Code Memory: 97 Excess current at general module outputs

Explanation: The output current of following GM outputs are monitored internally in the general module (GM). The defect code is set when an impermissibly output current is measured.

Monitored GM outputs:

- Interior light: GM connector yellow Pin 12 (K29)
- ES relay activation: GM connector yellow Pin 24 (for K30 relay) and Pin 25 (for K15 relay)
- Activation lines from GM to RM: all RM functions, power windows, ZV, wiper etc controlled via these lines. All RM functions are deactivated in the case failure of these lines.
- (GM connector yellow to RM connector 26–pole)
- GM Pin 4 to RM Pin 13
- GM Pin 3 to RM Pin 11
- GM Pin 2 to RM Pin 26

Possible causes:

- Wires
- Defective components

Troubleshooting: As displayed on screen

Defect Code 98

♦D♦ Defect Code Memory: Excess current at relay module outputs

Explanation: The output currents of following RM outputs are monitored internally in the RM. The defect code is stored when an impermissibly high output current is measured.

Monitored RM outputs:

- Water pump RM Pin 9 (K5)
- Intensive wash RM Pin 22 (K42)
- Wiper: Park position RM Pin 8 (K36), stage 1 RM Pin 24 (K37), stage 2 RM Pin 21 (K38)
- Intensive wash RM Pin 22 (K42)
- Consumer load cut–out RM Pin 6 (K72)
- Unlock rear lid RM Pin 5 (K70)

Possible causes:

- Wires
- Defective components

Troubleshooting: As displayed on screen

Functional Description

The electric sunshade system makes it possible to open and close the sunshade from the driver's seat. The sunshade is extended by means of a gear motor and the control, both mounted under the parcel shelf. The switch is located in the centre console.

Notes on the BMW DIAGNOSTIC SYSTEM

Not applicable

Abbreviations

Not applicable

Pin Assignments

Connector

Number	Type	Description
X947	4-pole, green	Connector A
X949	5-pole, green	Connector B

Pin assignments at connector X947, 4-pole (green)

Pin	Type	Description/function	Connection
1	A	Terminal 30/Extend motor	Motor Pin 1
2	A	Terminal 30/Retract motor	Motor Pin 2
3	Not used		
4	Not used		

Pin assignments at connector X949, 5-pole (green)

Pin	Type	Description/function	Connection
1	E	Terminal R/Extend motor	Connector switch Pin 3
2	E	Terminal R/Retract motor	Connector switch Pin 5
3	A	Terminal 31/Ground connection X492	
4	Not used		
5	E	Terminal 30/B+	

Troubleshooting

For troubleshooting, perform steps 1 to 10

Preconditions for troubleshooting
Battery charged.
Fuse OK.. Terminal R must be switched during all test steps.

Test Step 1:

Remove switch for sunshade (SSR).
Detach switch from wire harness connector.

Measure voltage at wire harness connector between Pin 5 and Pin 4: Nominal value approx. U-batt — no → Repair wires

—*—

| yes ↓

Measure voltage at wire harness connector between Pin 5 and Pin 1: Nominal value approx. U-batt — no → Repair wires

—*—

| yes ↓

Measure voltage between Pin 6 and Pin 2 with terminal 58 switched on: Nominal value approx. U-batt — no → Repair wires for switch lights

—*→

Continue with test step 2

Test Step 2

Checking the switch functions.
Remove switch.

Connect jumper (short) at wire harness connector Pin 5 and Pin 4. Does SSR move up (extend) — no → Go to test step 4

—*—

| yes ↓

Connect jumper (short) at wiring harness connector Pin 5 and Pin 1. Does SSR move down (retract) — no → Go to test step 4

—*—

| yes ↓

Continue with test step 3

Test Step 3

Check switches.
Remove switch.
Measure resistance between Pin 4 and Pin 5. Switch pressed in extend direction: Nominal value approx. 0.2 Ω to 1Ω. — no → Switch defective

—*—

yes ↓

Measure resistance between Pin 1 and Pin 5. Switch pressed in retract direction. Nominal value approx. 0.2 Ω. — no → Switch defective

—*—

yes ↓

Continue with test step 4

Test Step 4:

Checking wires from switch to 4-pole connector at the right C-post. Measure resistance on blue wire from switch to 4-pole connector, nominal value approx. 0.3 Ω. — no → Actual value = ∞ = check wire and repair if necessary.

—*—

yes ↓

Check resistance on black wire from switch to 4-pole connector, nominal value approx. 0.3 Ω. — no → Actual value = ∞ = check wires for damage and repair if necessary.

—*—

yes ↓

Continue with test step 5

Test Step 5:

Checking the voltage supply of the control unit. 4-pole connector detached at C-post. Measure at connector on wire harness side. Is approx. U-batt applied at red/white wire with respect to vehicle ground? — no → Check wire, fuse and repair if necessary.

—*—

| yes ↓

Is approx. U-batt applied between red/white wire and brown wire? — no → Check ground wire and repair if necessary.

—*—

| yes ↓

Continue with test step 6

Test Step 6:

Checking the control line from the switch to control unit. Plug connection detached at the C-post. Press switch in extend direction. Measure voltage on blue wire with respect to vehicle ground. Nominal value approx. U-batt — no → Check wire and repair if necessary.

—*—

yes ↓

Press switch in retract direction. Measure voltage at black wire with respect to vehicle ground. Nominal value approx. U-batt. — no → Check wire and repair if necessary.

—*—

yes ↓

Continue with test step 7

Test Step 7

Check voltage supply for control unit. Connect 4-pole connector at the C-post. Completely remove parcel shelf. Detach 5-pole connector from control unit. Measure voltage at wiring harness connector between Pin 5 and vehicle ground. Nominal value approx. U-batt.

— no → Repair 4-pole plug connection at the C-post or wire from plug connection at the C-post to the control unit.

—*—

yes ↓

Measure voltage between Pin 5 and Pin3, Nominal value approx. U-batt.

— no → Repair 4-pole plug connection at the C-post or ground wire from the plug connection at the C-post to the control unit.

—*—

yes ↓

Continue with test step 8

Test Step 8:

Checking the control voltages from the switch to the control unit. 4-pole connector plugged in at C-post. 5-pole connector detached from control unit. Press switch in open direction, measure voltage at 5-pole connector between Pin 1 and vehicle ground. Nominal value approx. U-batt. — no → Repair 4-pole plug connection at C-post or wire from plug connection at C-post to control unit.

—*—

| yes ↓

Press switch in close direction. Measure voltage at 5-pole connector between Pin 2 and vehicle ground, nominal value approx. U-batt. — no → Repair 4-pole plug connection at the C-post or wire from plug connection at C-post to control unit.

—*—

| yes ↓

Continue with test step 9

Test Step 9:

Checking the output voltage of the control unit, 5-pole connector plugged in. Detach 4-pole control unit connector. Measure voltage at 4-pole control unit connector between Pin 1 and vehicle ground. Press switch in retract direction. Nominal value approx. U-batt — no → Control unit defective

—*—

| yes ↓

Measure voltage between Pin 2 and vehicle ground. Press switch in extend direction. Nominal value approx. U-batt. — no → Control unit defective

—*—

| yes ↓

Continue with test step 10

Test Step 10:

Checking the prerequisites for the motor drive: Drive is not blocked mechanically. To facilitate check, remove motor drive from parcel shelf. Connect motor drive directly at the connector to 12 V voltage. Does the motor drive operate?	— no →	Motor drive defective

—*—

—*—

Functional Description

General

The windscreen wiper and washer system is controlled by the general module (GM) of the ZKE II. The wiper relays (3 individual relays), the wash relay (and the intensive wash relay if SIR is installed) are activated by the relay module (RM). The relay outputs are routed via diagnostic links to the general module (GM). All functions can be switched on and off with the wiper switch. The ignition switch must at least be in position 1 (terminal R).

During intermittent wipe, stage 1 and stage 2, the wipe speed and the wipe cycle are dependent on the vehicle speed.

Wipe/Wash Functions

Park position: After completing a wipe or wash function, the wiper returns to a recessed park position (for reasons of aerodynamics). This function is achieved with a single relay which changes the polarity of the wiper motor.

Reset contact: By way of a reset contact integrated in the wiper motor, the general module (GM) detects the return of the wiper in the lower turn–round position.

Hold wipe function: The wiper motor operates in stage 1 for as long as the wiper switch is held in this position.

Intermittent wipe: The intermittent wipe cycle time depends upon the vehicle speed.

Intermittent wipe cycle time dependent on vehicle speed::

Speed in km/h Speed class	< 12 0	12 – 30 1	30 – 70 2	70 – 100 3	100 – 140 4	140 –180 5	> 180 6
Intermittent wipe cycle time (s)	14	8	7	6	5	4	4

The intermittent wipe cycle time can also be freely programmed.

Procedure: Switch off wiper → briefly switch on intermittent wipe function and immediately switch off again → the time counter now begins to run, wait for the required cycle time → switch on intermittent wipe function once again → the time reading in the time counter is now stored as the intermittent wipe cycle time. It is retained for several seconds after the wiper is switched off. It is immediately lost with terminal R OFF/ON. The newly programmed intermittent wipe cycle time is also influenced by the vehicle speed, however, the time can never drop below 3 s or exceed 25 s.

Wipe functions in stage 1 and 2: The wiper is switched over to another wipe cycle dependent on the vehicle speed.

Wiper stage switch over:

Switch setting	Intermittent	Stage 1	Stage 2
v < 12 km/h	See table "intermittent wipe time cycle dependent on vehicle speed"	Interval 5 s for ECE, FIN. Interval 3 s for US, AUS	Stage 1
v > 12 km/h	See table "intermittent wipe cycle time dependent on vehicle speed"	Stage 1	Stage 2

Wash:

Procedure: Wash pump operating → Wiper starts time–delayed in stage 1 → Wash pump stops → Wiper continues to operate. → Below 100 km/h, a delayed dry wipe cycle takes place a few seconds later.

Optional extra intensive wash (SIR):

Procedure: Intensive wash pump operating, intensive wash fluid is applied to windscreen → Wiper starts time–delayed in stage 1 → Intensive wash pump stops → Wash pump starts up → Wash pump stops → Wiper continues to operate and wipes the windscreen dry pr Below 100 km/h, a delayed dry wipe cycle is performed a few seconds later

Special Features

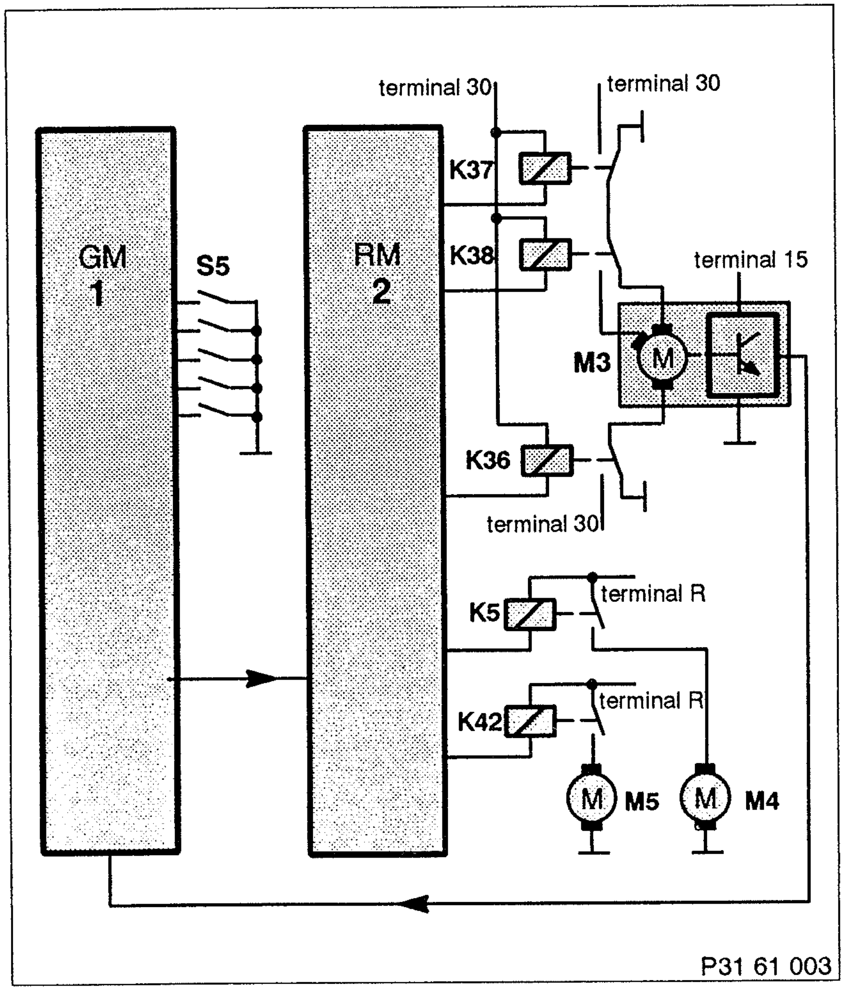
Anti–blocking function: The signal of the reset contact is used for monitoring operation of the wiper motor. The wiper is switched off by the general module (GM) (anti–blocking function) if, with the wiper active, the general module (GM) receives no signal from the reset contact for longer than 16 s. Reasons for this could be mechanical stiffness of the wiper or breaks in the wiring. All activation signals of the wiper are inhibited when the anti–blocking function is active. The wiper does not return to the park position. The wiper can be switched on once again after 3 min (= time lockout). The anti–blocking function is triggered up to 10 times in succession, after this, the wiper motor remains blocked (= repeat lockout). The repeat lockout can only be reset by terminal R OFF/ON.

Fold–down position: It is not possible to fold down the wiper arms in the park position. The wiper arms must be set in the fold–down position for this purpose.

Procedure: Terminal R On → Wiper switch in interval wipe setting → Switch off terminal R at the moment, at which the wiper is in the rest position → Wiper assumes the fold–down position

Block Diagram Windscreen Wipe/Wash System

For ZKE block diagram, see section 6100.0A



No.	Abb.	Description
1	GM	General module
2	RM	Relay module
K5		Wash pump relay
K36		Wiper relay park position
K37		Wiper relay stage 1
K38		Wiper relay stage 2
K42		Intensive wash relay
M3		Wiper motor with reset contact
M4		Wash pump
M5		Intensive wash pump
S5		Wiper switch

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with ZKE II

For general information on diagnosis with the ZKE II (Central body electronics), see section 6100.0A

Defect Code Memory

Defects involving activation functions and the reset contact are stored in the defect code memory.

Test Procedure

The test procedure enables guided inspection of the wipe/wash system.

Resetting in the park position does not take place automatically when the wiper motor is activated. After activation, therefore, the wiper must be briefly switched on and off by means of the wiper switch.

Abbreviations

General

ZKE	Central body electronics
SIR	Intensive wash
A	Outputs
E	Inputs

Modules

GM	General module
RM	Relay module

Pin Assignments

Connector Overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module

Pin Assignments at Connector GM–A X332

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin Assignments at Connector GM–B X253

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal50	approx. 12V		
6	E	Wiper reset contact	Reset contact	approx. 12V; 0–2V	Defect is stored with defect code no. 21	Wiper in parked position; Wiper not in parked position
7	E	Wash	Wiper switch	0–2V		Switch operated
8	E	Intermittent wipe	Wiper switch	0–2V		Switch operated
9	E	Wipe stage 1	Wiper switch	0–2V		—— " ——
10	E	Intensive wash	Wiper switch	0–2V		—— " ——
13	E	Diagnosis wiper relay stage 1/2	Wire wiper relay to wiper motor		Defect is stored with defect code no. 24, 25	
14	E	Diagnosis wiper park relay	Wire wiper park relay to wiper motor		Defect is stored with defect code no. 23	
16	E	Wipe stage 2	Wiper switch	0–2V		Switch operated
19	E	Level wash water reservoir engine compartment too low	Level switch	0–2V; approx. 12V		Level OK.: Level too low
23	E	Diagnosis SIR relay	Wire SIR relay to SIR pump		Defect is stored with defect code no. 27	
24	E	Diagnosis wash pump relay	Wire wash pump to wash pump relay		Defect is stored with defect code no. 26	
25	E	Diagnosis wiper relay stage 1/2	Wire wiper relay to wiper motor		Defect is stored with defect code no. 24, 25	
26	E	Ground for electronics	Terminal 31	0–2V		

Pin Assignments at Connector GM–C X254

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
2	E	Ignition	Terminal 15	approx. 12V		
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal 50	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin Assignments at Connector RM–A X258

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
4	E	Ground for electronics	Terminal 31	0–2V		
6	E	U–batt for electronics for all ZKE modules	Terminal 30	approx. 12V		

Pin Assignments at Connector RM–B X259

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
8	A	Relay activation, wiper park position	Relay wiper park position	0–2V	Defect is stored with defect code no. 23	During activation
9	A	Relay activation, wash pump	Relay wash pump	0–2V	Defect is stored with defect code no. 26	——— " ———
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		

Pin	Type	Description/Function	Connection	Type of Signal	Tester Display	Measurement Notes
13	A	General module interface	GM–C Pin 4	dynamic		
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
21	A	Relay activation, wiper stage 2	Relay wiper stage 2	0–2V	Defect is stored with defect code no. 24, 25	During activation
22	A	Relay activation, Intensive wash (SIR)	Relay intensive wash	0–2V	Defect is stored with defect code no. 27	——— " ———
24	A	Relay activation, wiper stage 1	Relay wiper stage 1	0–2V	Defect is stored with defect code no. 24, 25	——— " ———
25	E	Ground for electronics	Terminal 31	0–2V		
26	A	General module interface	GM–C Pin 2	dynamic		

Adapter

Component	Connector No.	Description	Adapter No.
General module, door module, relay module	X332, X253, X254, X259, X259, X887, X889	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- The power supply to the general module, sunroof module and the door module is interrupted when the relay module is removed.
- Only remove and install the above modules with the ignition switched off. After reinstallation, clear defect code memory with ♦D♦ defect code memory.
- Wiper pressure control defective → section 6164.0

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

21 Signal from wiper reset contact faulty → Defect code 21

23 Wiper park position relay defective → Defect code 23

24 Wiper stage 1 relay defective → Defect code 24

25 Wiper stage 2 relay defective → Defect code 25

26 Wash pump relay defective → Defect code 26

27 Intensive wash relay (SIR relay) defective → Defect code 27

Malfunction:

Windscreen wiping or washing defective → Defect code 100

Defect Code 21

♦D♦ Defect code memory: 21 Signal from wiper reset contact faulty

Explanation: This defect code is stored when the general module (GM) receives no wiper reset signal 16 s after activation of the wiper.

Possible causes:

- Wires
- Reset contact
- Wiper motor
- Icing/dirt build–up

Troubleshooting: As displayed on screen

Defect Code 23

♦D♦ Defect code memory: 23 Wiper park position relay defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the diagnostic link between the wiper park relay and the wiper motor.

Possible causes:

– Wires
– Voltage supply K36 wiper park relay
– K36 wiper park relay
– Relay module

Troubleshooting: As displayed on screen

Defect Code 24

♦D♦ Defect code memory: 24 Wiper stage 1 relay defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the 2 diagnostic links between the K 38 wiper relay stage 2 and the wiper motor.

Possible causes:

– Wires
– Voltage supply K 37 wiper relay stage 1
– K37 wiper relay stage 1
– Relay module

Troubleshooting: As displayed on screen

Defect Code 25

♦D♦ Defect code memory: 25 Wiper stage 2 relay defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the 2 diagnostic links between the K38 wiper relay stage 2 and the wiper motor.

Possible causes:

- Wires
- Voltage supply K38 wiper relay stage 2
- K38 wiper relay stage 2
- Relay module

Troubleshooting: As displayed on screen

Defect Code 26

♦D♦ Defect code memory: 26 Wash pump relay defective

Explanation: This defect code is stored when the general motor (GM) detects a defect in activation via the diagnostic link between the wash pump relay and the wash pump.

Possible causes:

- Wires
- Voltage supply wash pump relay K5
- K5 wash pump relay
- Relay module

Troubleshooting: As displayed on screen

Defect Code 27

♦D♦ Defect code memory: 27 Intensive wash relay (SIR relay) defective

Explanation: This defect code is stored when the general motor (GM) detects a defect in activation via the diagnostic link between the SIR relay and the SIR motor.

Possible causes:

- Wires
- Voltage supply K42 SIR relay
- K42 SIR relay
- Relay module

Troubleshooting: As displayed on screen

Defect Code 100

Windscreen wiping or washing defective

Explanation: General malfunction

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g) power fuse
- ♦D♦ Perform diagnostic procedure for wiper/washer system.

Functional Description

General

The windscreen wiper pressure control (ADV) is controlled and monitored by the general module (GM) of the ZKE II. Activation of the ADV module takes place in the relay module (RM).

Operating Principle

The ADV system controls the contact pressure of the wiper arm on the driver's side dependent on the vehicle speed and on the active wipe and wash functions by way of a DC motor.

The wiper arm is in a relieved setting at terminal R OFF. The ADV drive is set to stage 1 when the windscreen is washed with the vehicle stationary. The assignment of the vehicle speed and contact pressure are dependent on the current wipe and wash function. (See characteristic map ADV stages).

Integrated in the ADV motor is a cam switch which signals to the general module (GM) when the relevant contact pressure is reached. The switch switches ground to the general module (GM) for as long as the ADV motor operates. When the ADV motor reaches the next cam, the cam switch interrupts the ground connection and the motor stops.

Characteristic Map ADV Stages

Speed in km/h	0 – 12	12 – 100	100 – 140	140 – 180	> 180
Wipe OFF AND wash OFF	0	1	1	2	3
Wipe ON AND wash OFF	0	1	2	3	4
Wipe OFF AND wash ON	1	2	3	4	4
Wipe ON AND wash ON	1	2	3	4	4

Wipe = Stage 1, stage 2, intermittent
Wash = Wash, intensive wash
No contact pressure = 0, ..., 4 = maximum contact pressure

Anti–Blocking Function

If the general module (GM) detects a fault in the ADV system, it activates an anti–blocking function which switches off the ADV motor. The anti–blocking function can be cancelled by ignition OFF/ON.

Function Monitoring

The general module (GM) uses the signals of the cam switch in the ADV motor for monitoring operation. If the signals are not received or if a ground is applied at the general module (GM) for too long, the general module considers this as a defect and the ADV motor is switched off by the anti–blocking function (see defect code 22).

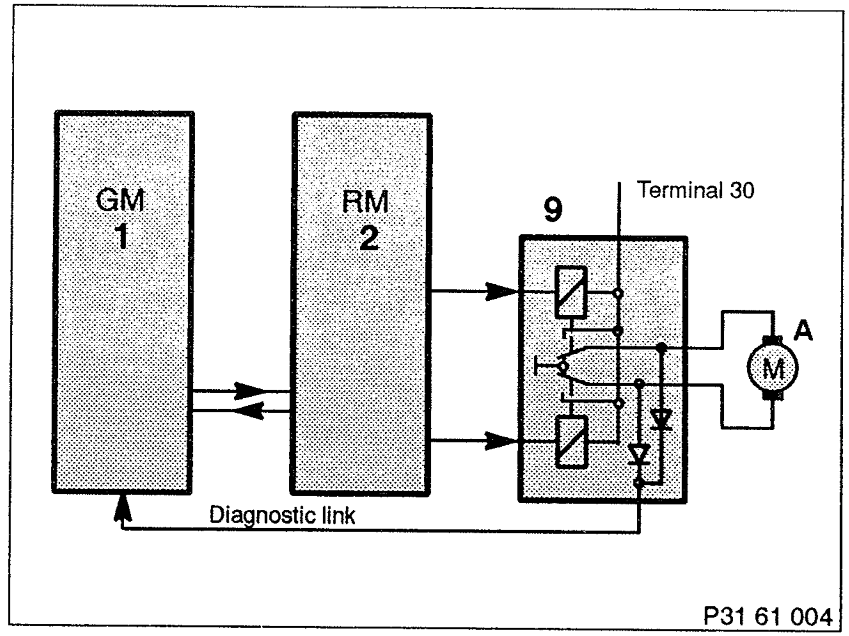
The 2 ADV relays in the ADV module are monitored via a diagnostic link. If a relay sticks, then the second relay is also switched on (for potential equalisation) in order to stop the ADV motor. This function is cancelled when the vehicle travels faster than 12 km/h or the wash feature is operated and the ADV relay is intact once again.

The potential equalisation can also be activated by removing and installing the ADV module.

Attention: Potential equalisation is also active when the ignition is switched off. This results in an excessively high closed–circuit current consumption (battery discharge!).

Block Diagram ADV

For ZKE block diagram, see section 6100.0A



No.	Abb.	Description
1	GM	General module
2	RM	Relay module
9		ADV module K12
A		ADV motor (on wiper rmotor)

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with the ZKE II

For general information on diagnosis with the ZKE II (central body electronics), see section 6100.0A

Defect Code Memory

Defects involving activation are stored in the defect code memory.

Test Procedure

The test procedure makes it possible to check the ADV motor by way of activation. Blocking of the motor must be avoided during activation.
Note! Activation must be as short as possible. Activation 2/3 times until an increase in the contact pressure can be determined.

Abbreviations

General

ZKE	Central body electronics
ADV	Wiper pressure control
A	Outputs
E	Inputs

Module

GM	General module
RM	Relay module
TMFT	Driver's door module
TMBT	Passenger's door module

Pin assignments

Connector Overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module

Pin assignments at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal 50	approx. 12V		
15	E	Diagnosis ADV module	ADV module		Defect is stored with defect code No. 28	
20	E	ADV cam switch	cam switch	0–2V; approx. 12V	Defect is stored with defect code No. 22	Cam not reached; Cam reached (rest position)
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	Relay module interface	RM–B 26	dynamic		
3	A	Relay module interface	RM–B 11	dynamic		
4	A	Relay module interface	RM–B 13	dynamic		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Ground for electronics	Terminal 31	0–2V		
6	E	U–batt for electronics of all ZKE modules	Terminal 30	approx. 12V		

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		
13	A	General module interface	GM–C Pin 4	dynamic		
17	A	ADV module activation: reduce pressure	ADV–Modul	0–2V	Defect is stored with defect code No. 28	During activation
18	A	ADV module activation: increase pressure	ADV–Modul	0–2V	——— " ———	——— " ———
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
25	E	Ground for electronics	Terminal 31	0–2V		
26	A	General module interface RMTR	GM–C Pin 2	dynamic		

Adapter

Component	Connector No.	Description	Adapter No.
General module, door module, relay module	X332, X253, X254, X258, X259, X887, X889	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12V
- The power supply to the general module, sunroof module and door modules is interrupted when the relay module is removed.
- Only remove and install the above modules with the ignition switched off. After reinstallation, clear defect code memory with ♦D♦ defect code memory.
- Windscreen wiper/washer functions defective → section 6160.0A

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

22 Signal from ADV cam switch faulty → Defect code 22

28 ADV module defective → Defect code 28

Malfunction:

ADV malfunction → Defect code 100

Defect Code 22

♦D♦ Defect code memory: 22 Signal from ADV cam switch faulty

Explanation: This defect code is stored when no cam switch signal (on reaching the next cam) is received at the general module (GM) 4 s after activation of the ADV motor.

Possible causes:

- Wires
- Cam switch
- ADV motor
- Icing/Dirt build–up

Troubleshooting: As displayed on screen

Defect Code 28

♦D♦ Defect code memory: 28 ADV module defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the diagnostic link from ADV module.

Possible causes:

- Wires
- Voltage supply K12 ADV module
- K12 ADV module
- Relay module

Troubleshooting: As displayed on screen

Defect Code 100

ADV malfunction

Explanation: General malfunction in ADV

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse)
- Check that the windscreen washer is operating correctly (see section 6160.0A)
- ♦D♦ perform diagnostic procedure for windscreen wiper pressure control.

Functional Description

General

The windscreen intensive wash (SRA) is controlled and monitored by the general module (GM) of the ZKE II. Activation of the SRA module takes place in the relay module (RM).

When the intensive wash system (SRA) is installed, an additional wash water reservoir is installed in the luggage compartment. The wash water is delivered by a pump to the wash water reservoir in the engine compartment. The rear wash water pump is switched on for 30 s when the level switch in the wash water reservoir in the engine compartment indicates a low level and the wash or intensive wash function is activated.

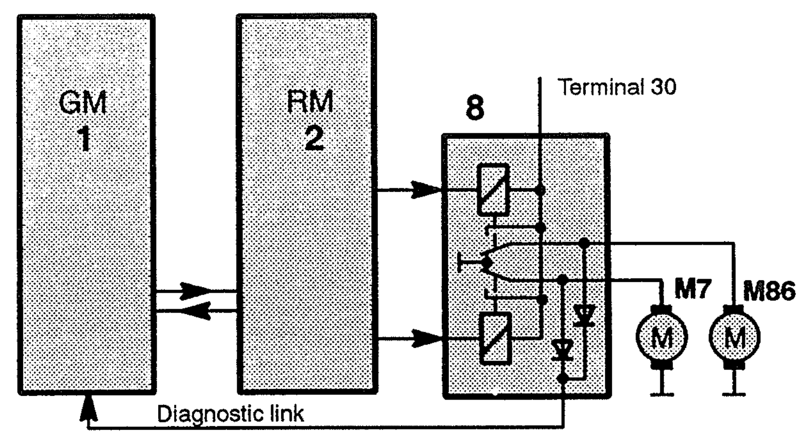
Switch–On Conditions

1. Parking light on
2. The headlight washer is activated during every fifth wash or intensive wash operating cycle.

To avoid excessive water consumption, the SRA is blocked for 3 min after every use. This period of time can be reset by terminal R = OFF.

Block Diagram SRA

For ZKE block diagram, see section 6100.0A



P31 61 005

No.	Abb.	Description
1	GM	General module
2	RM	Relay module
8		SRA module N6
M7		SRA motor
M86		Wash pump luggage compartment

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with the ZKE II

For general information on diagnosis with the ZKE II (central body electronics), see section 6100.0A

Defect Code Memory

Defects involving activation are stored in the defect code memory.

Test Procedure

The test procedure makes it possible to check the headlight washer system. The auxiliary pump and high pressure pump are checked by way of activation.

Abbreviations

General

ZKE	Central body electronics
SRA	Headlight washer system
A	Outputs
E	Inputs

Modules

GM	General module
RM	Relay module

Pin assignments

Connector Overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module

Pin assignments at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal50	approx. 12V		
11	E	Headlamps ON	Terminal 58	approx. 12V		
19	E	Level wash water reservoir engine compartment too low	Level switch	0–2V; approx. 12V		Level OK.: Level too low
22	E	Diagnosis SRA module	SRA module		Defect is stored with defect code No. 29	
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	Relay module interface	RM–B 26	dynamic		
3	A	Relay module interface	RM–B 11	dynamic		
4	A	Relay module interface	RM–B 13	dynamic		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Ground for electronics	Terminal 31	0–2V		

Pin assignments at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
10	A	SRA module activation: Headlamp washer	SRA–Modul	0–2V	Defect is stored with defect code No. 29	——— " ———
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		
13	A	General module interface	GM–C Pin 4	dynamic		
15	A	SRA module activation: Wash pump luggage compartment	SRA–Modul	0–2V	Defect is stored with defect code No. 29	During activation
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		

Adapter

Component	Connector No.	Description	Adapter No.
General module, door module, relay module	X332, X253, X254, X258, X259, X887, X889	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- If all functions of the ZKE are defective, perform troubleshooting in accordance with section ZKE 6100.0.
- If the windscreen wiper/washer is defective, perform troubleshooting in accordance with section 6160.0

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

29 SRA module defective → defect code 29

Malfunction:

SRA malfunction → defect code 100

Defect Code 29

♦D♦ Defect code memory: 29 SRA module defective

Explanation: This defect code is stored when the general module (GM) detects a defect in activation via the diagnostic link from SRA module.

Possible causes:

- Wires
- Voltage supply N6 SRA module
- N6 SRA module
- Relay module

Troubleshooting: As displayed on screen

Defect Code 100

SRA malfunction

Explanation: General malfunction of SRA

Troubleshooting:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse)
- Check that the windscreen wiper/washer is operating correctly (see section 6160.0A)
- ♦D♦ perform troubleshooting for headlamp washer system.

Functional Description

General

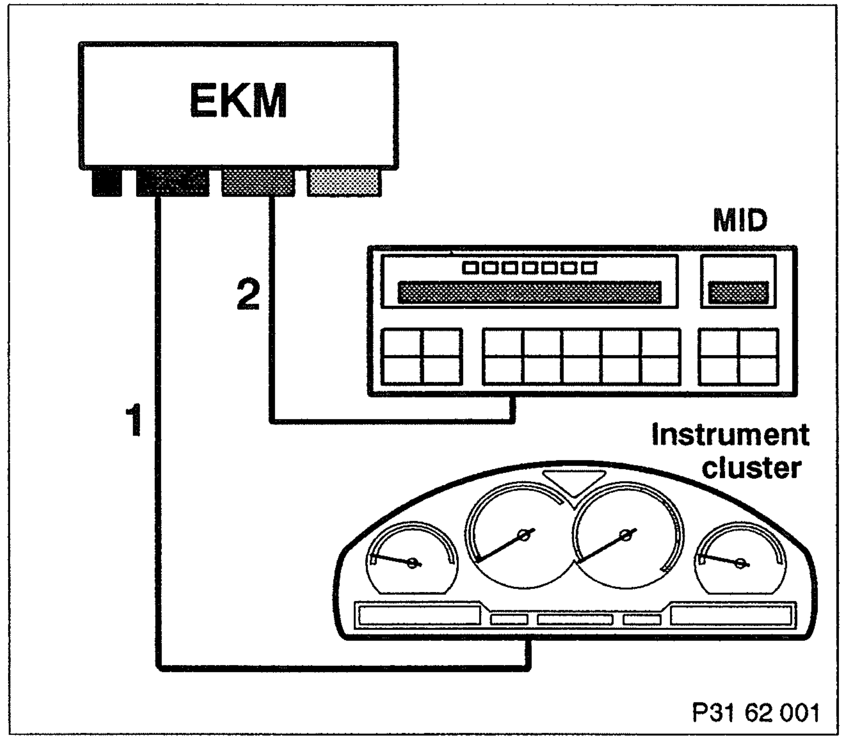
The electronic vehicle module (EKM) processes the signals of a large number of sensors and control units. The information and messages are displayed via the

Instrument cluster, for description see Section 6211.0A

and

Multi–information display (MID), for description see Section 6581.0A

The EKM calculates all values to be indicated/displayed (exception: tD signal for tachometer connected directly to instrument cluster) and transfers the data via two separate data links to the instrument cluster and the MID.



Data transfer between EKM, instrument cluster and MID.
1 = Data link to instrument cluster
2 = Instrument bus (I–bus)

Instrument Cluster

The following functions are detected by the EKM and displayed in the instrument cluster:

- Position signal for speedometer and odometer
- Coolant temperature
- Tank content measurement
- Handbrake warning lamp
- Seat belt indicator lamp (USA only)
- Brake fluid level/brake pressure warning lamp
- CC indicator lamp
- Gear and program display (EGS transmission)

Engine speed measurement

The tD signal (engine speed signal) for the tachometer is connected directly at the instrument cluster. The tD signal connected at the EKM is only used as part of the check control function.

Tank content measurement

The tank contents are measured by way of two lever–type sensors which are connected in series. Since the measured value of the sensors fluctuates considerably when driving at high speeds, in order to improve display accuracy, the consumption is additionally calculated on the basis of the ti signal (injection signal) and then subtracted from the tank contents last measured. As soon as the measured value of the lever–type sensor is sufficiently accurate once again (e.g. steady driving or when stationary), a balance takes place between the calculated and measured tank contents.

No reserve contact is provided for the reserve lamp. On the basis of the tank content measurement/calculation, the lamp is switched on at a reserve content of approx. 10 litre.

Data transfer

The EKM transfers the data to the instrument cluster via a separate data link. This data link (serial interface) to the instrument cluster is independent of the I–bus (instrument bus).

Multi-Information Display (MID)

The following functions are detected by the EKM and displayed by the multi–information display (MID):

On–board computer functions

- Clock/date
- Timer for independent heating/ventilation or stopwatch
- Average consumption (derived from ti signal from DME I and II and position signal)
- Outside temperature
- Average speed
- Distance entry and calculation of expected time of arrival
- Calculation of range referred to tank contents
- Entry of limit speed
- Entry of a code number for drive–away protection/antitheft

Code number

After entering a code number in the MID, the drive–away protection and antitheft function is active. The front lid and the radio are monitored as part of the antitheft system. The alarm horn is activated in the event of unauthorized intervention.

The EKM switches a B+ signal to the DME I and II for as long as the drive–away protection function is active. The engine can not be started before the correct code number has been entered after switching on the ignition.

Entering the code number:

– Ignition switch in terminal R setting
– Enter code number in MID, acknowledge entry with Set/Res
– The drive–away protection/antitheft function is active when terminal R is switched off

Disarming the system:

– Switch on ignition
– Enter code number in MID, acknowledge entry with Set/Res
The alarm horn is activated after three incorrect entries

For measures to be taken when the code number has been forgotten, refer to Section 6581.0A Multi–information display (troubleshooting!)

Check–control messages

The EKM processes the signals of a large number of sensors and control units. If a defect occurs, the driver is informed by way of a text message. This text is shown in the MID. In addition, the CC indicator lamp is switched on in the instrument cluster.

Data transfer

The EKM transfers the data to the multi–information display via the I–bus (instrument bus).

Outputs at the EKM

The EKM controls the following outputs:

– 3 acoustic outputs for acoustic generator (gong). The acoustic generator can be activated with different frequencies.

– Speed signal output to DWA. Position signals sent to DWA when vehicle is pushed.

– Alarm to DWA. A relay switched in the DWA control unit.

– Start blocking to DME I/II when a code number (drive–away protection) is entered at the MID.

– Switching on the independent heating/independent ventilation after entry of a switch–on time at the MID.

– Speed A signal. Position signal for other control units.

I-Bus (Instrument Bus)

The instrument bus (I–bus) is a data link, to which a large number of control units are connected. The control units can exchange data with the EKM via this data link. The EKM controls and monitors the entire data flow on the I–bus.

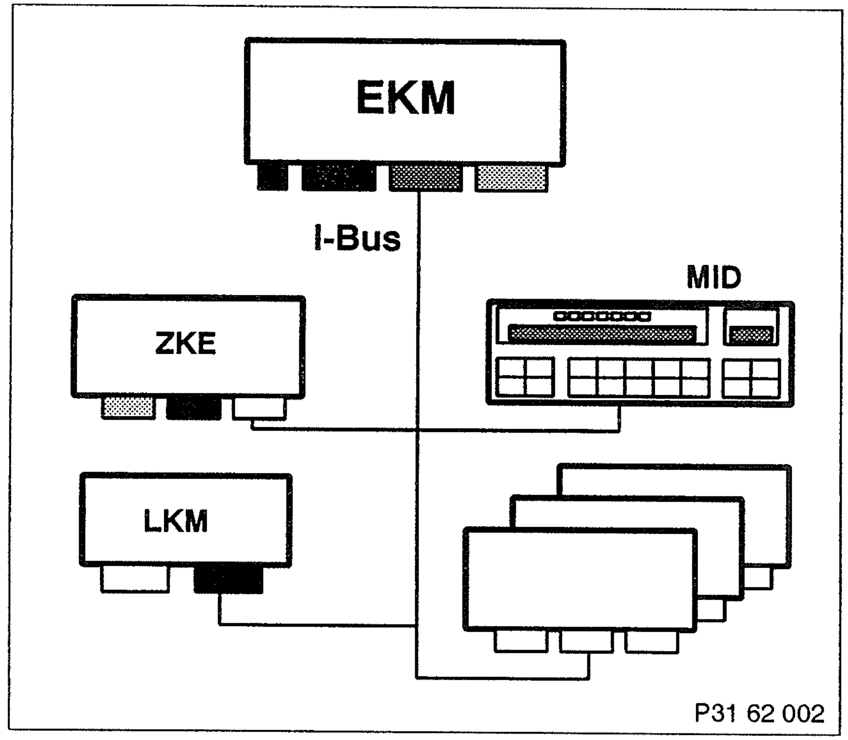
Examples:

– The ZKE (central body electronics) signals to the EKM the status of the passenger's door and rear lid (open/closed) via the I–bus.

– The LKM (lamp control module) signals to the EKM the status of the lamps (OK./not OK.) via the I–bus.

– The EKM sends the current time to the MID.

In the ♦D♦ diagnostic program, an inquiry can be made under the selection "special functions – coding data" as to which control units are connected to the I–bus.



Control units connected to the I–bus. In addition to ZKE, LKM and MID, other control units can also be connected.

Diagnostic mode of I–bus users

Diagnostic mode between the BMW Service Tester/MoDiC and control units which are connected to the I–bus (e.g. LKM, ZKE, MID) takes place via the I–bus. The diagnostic links RxD and TxD are connected to the EKM. (See schematics Section 0670.5 Diagnostic link).

Example

Example of the diagnostic procedure with ZKE

– BMW Service Tester sends a diagnosis command to the ZKE, e.g. read defect code memory.

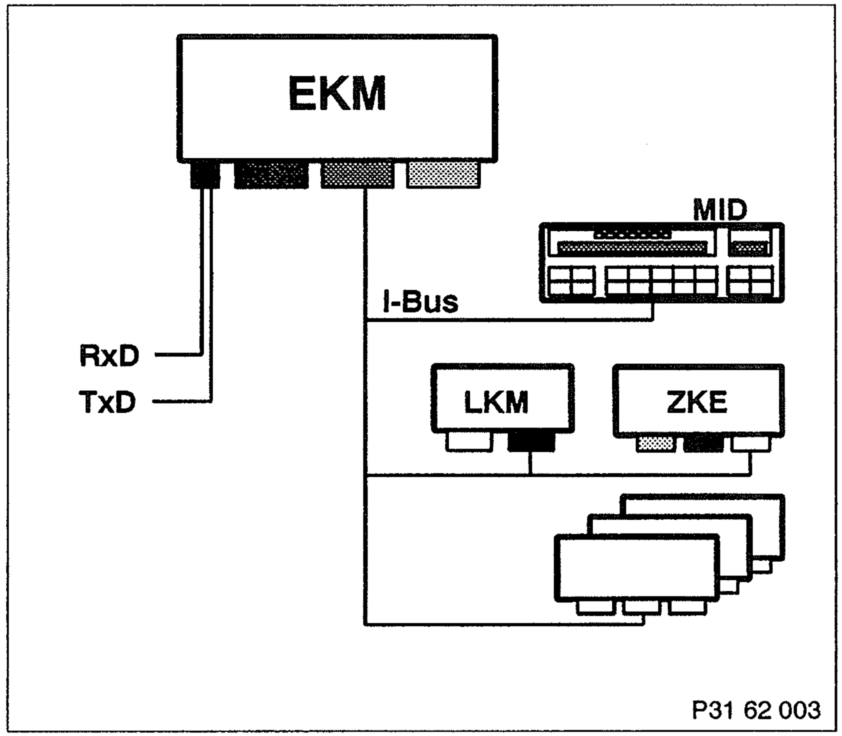
– The command is sent via the RxD link to the EKM.

– The EKM receives the command and recognizes by way of a control word that the command concerns the ZKE.

– The EKM transfers the command via the I–bus to the ZKE.

– The ZKE receives the command and performs the instruction; e.g. the contents of the defect code memory are sent via the I–bus to the EKM.

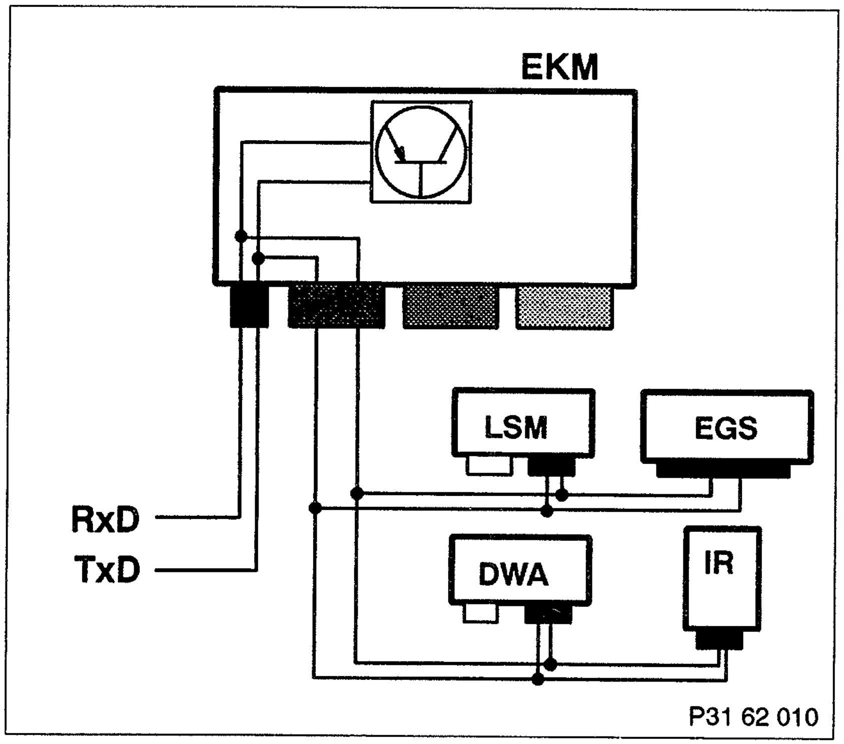
– The EKM receives the data from the ZKE and transfers them via the TxD link to the BMW Service Tester.



Diagnostic mode of I–bus users

Diagnostic mode via EKM

In order to reduce the number of plug–and–socket connections, the diagnostic links RxD and TxD are looped through in the EKM. A large number of control numbers are therefore connected to the EKM. (See schematics Section 0670.5 Diagnostic link).



Diagnostic link via EKM

Check Control

The check control is a comprehensive system of messages which inform the driver about various statuses in the vehicle. The display is in the form of a text message in the multi–information display (MID) and is accompanied by an acoustic signal (gong). The CC indicator lamp additionally lights in the instrument cluster.

The EKM detects the statuses:

– via sensors connected to the EKM,

– via control units which are connected to the I–bus and signal defects within their function range to the EKM. e.g. the lamp control module (LKM) monitors the lighting.

Priority groups

The CC messages are subdivided into three priority groups.

Priority 1:

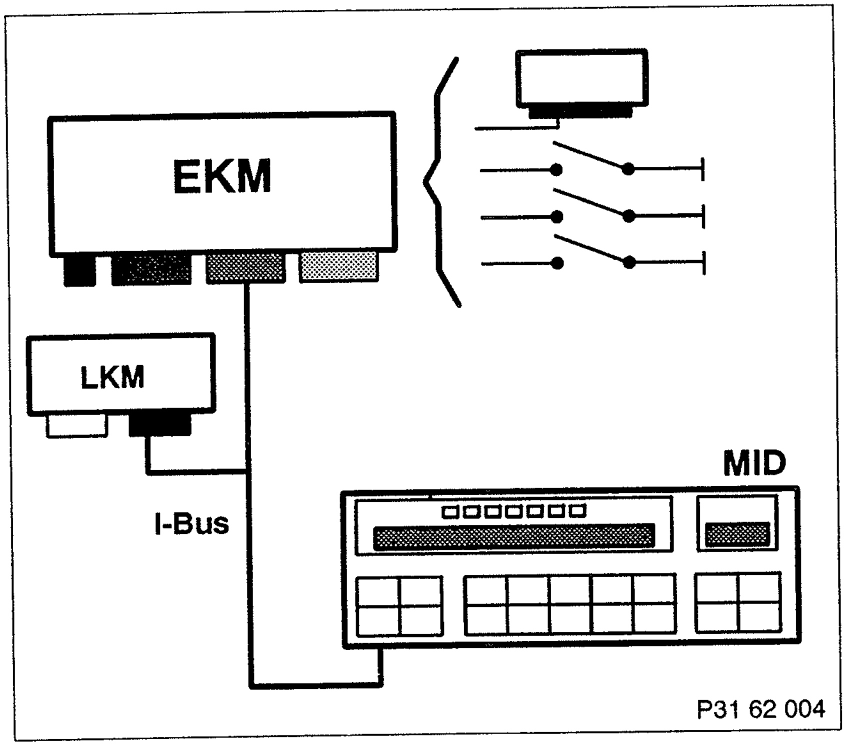
Faults which directly endanger driving safety. Indicated by flashing arrows in the display. The message, as well as the CC indicator lamp cannot be cleared.

Priority 2:

Faults which do not directly endanger driving safety. The message text can be deleted, however, it is cleared automatically after approx. 2 minutes. After being cleared indicator arrows signal that a message is still pending.

Priority 3:

Messages relating to fluid levels, "light ON" warning, seat belt. They are indicated only when the ignition is switched on and off and are cleared after approx. 2 minutes.



The messages of a large number of sensors and control units are processed by the EKM. Check control messages are displayed in the MID.

Clearing and calling messages

Priority 2 and 3 messages can be cleared with the "CHECK" key on the multi–information display (MID).

If several messages are pending at the same time, they can be selected by way of this "CHECK" key. A cleared priority 2 message can be recalled.

Languages

The language of the CC message texts is programmed in the EKM. It can be changed by taking corresponding measures at the MID, see Section 6581.0A.

Coding Data

All coding data for the EKM and instrument cluster are stored in both control units.

Replacement of a control unit

If one of the two control units is replaced, immediately after switching on terminal R, the coding data are transferred to the new control unit.

The data exchange lasts approx. 10 seconds. During this period of time, there is no distance display in the instrument cluster. Also in the MID, no message and no time are indicated during this data exchange period.

Data exchange does not take place if a used control unit is installed (e.g. EKM from another vehicle).

Note: All ♦D♦ diagnostic functions and the instrument cluster system test (see Section 6211.0A) are also possible when data exchange has not taken place.

Test mode of a control unit and used identifier

A new EKM or instrument cluster can be installed in a vehicle for test purposes. After data transfer, a counter is activated which counts the operating hours, i.e. operation with terminal R switched on.

After 8 hours of operation, an identifier is stored, indicating that the installed control units are "used". The data are now permanently stored and can no longer be overwritten.

However, identification does not take place if the control unit is removed once again before the 8 hours of operation have elapsed. The control unit can once again be installed in another vehicle. The data contained in the control unit are then overwritten by new data. The operating hours counter is reset to zero when the EKM is removed.

♦D♦ control unit identification of EKM and instrument cluster shows whether the control units are "used" or in the "test phase".

Error messages

The following messages can be displayed in the display unit of the instrument cluster (field for trip odometer):

EEEE : Instrument cluster and EKM from different vehicles, therefore data exchange not possible.

PPPP : EKM and instrument cluster not coded or faulty data record in EKM. Recode EKM.

Note

If the EKM is renewed, during automatic data exchange, **EEEE** or **PPPP** are indicated for 10 seconds depending on whether the installed EKM is uncoded (EEEE) or coded (PPPP).

Notes on the BMW DIAGNOSTIC SYSTEM

♦D♦ Test Procedure

The inputs of the EKM can be checked with the test procedure. The screen pages contain detailed information on the operation and trouble-shooting of the connected switches and sensors.

The check control displays are shown irrespective of whether a message is output in the MID. An additional condition is frequently necessary for output of a message.
Example:
The message "door open" is not output when the vehicle is moving.
The message "wash water" is only indicated when the ignition is switched off or on.

♦D♦ Activating Components

The outputs of the EKM can be checked by way of activation.

A frequency or a speed can be preset for checking the speed–A signal. Observe information on screen pages.

♦D♦ Defect Code Memory

The EKM can detect a large number of defects. However, it can not differentiate whether a defect has occurred once or several times, or whether the defect is a current defect.

Therefore, before starting extensive tests, determine by way of checking the function or with the ♦D♦ test procedure whether the indicated defect is a current in the vehicle.

The defect code is not cleared by disconnecting the battery or removing the EKM.

♦D♦ Special Functions – System Test

The EKM system test makes it possible to check the inputs. The frequency inputs (tD, ti, position signal), the data link to the instrument cluster as well as the analogue inputs (temperature sensor etc.) are not checked.

All 26–pole connectors must be disconnected from the EKM in order to perform the test. The 5–pole connector must remain connected!

After the test has started, the EKM automatically switches all inputs on and off and checks by way of diagnostic feedback whether the switching procedures are performed correctly.

Defective inputs are indicated on the display screen.

Abbreviations

I–Bus	Instrument bus
MID	Multi–information display
LKM	Lamp control module
AHM	Trailer module
EGS	Electronic transmission control
CC	Check control
ASC	Automatic stability control
EDC	Electronic damper control
KVA	Fuel consumption indicator
SIA	Service interval indicator
tD–Signal	Engine speed signal
ti–Signal	Injection signal

Pin assignments

Connector

Number	Type	Description
X39	26–pole, green	
X40	26–pole, brown	
X41	26–pole, blue	
X42	5–pole, black	

Pin assignments at connector X39, 26–pole (green)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Terminal R	Fuse	12 V	ON	
2	E/A	Diagnostic link (TxD)	TxD connection of various control units	Square–wave signal	none	
3	E/A	Diagnostic link (RxD)	RxD connection of various control units	Square–wave signal	none	
4		not used				
5		not used				
6		not used				
7	A	Acoustic output 1 (hour reminder signal)	Acoustic generator (gong)	B–(active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
8		not used				
9	E	EGS program	Program selector switch	0 V 12 V	0 1	
10	E	EGS defects	EGS control unit	0 V 12 V	OK. Not OK.	Valid when engine running
11	E	EGS program	Program selector switch	0 V 12 V	0 1	
12	E	Start position, terminal 30h	Starter, terminal 30h	12 V	ON	When ignition switch in start position
13	E	Drive range	Transmission selector lever switch	0 V 12 V	0 1	12 V is switched by selector lever switch
14	A	Speed–A signal	Various control units	Square–wave signal	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
15		not used				
16		not used				
17	E/A	Instrument cluster interface/data transfer to instrument cluster	Instrument cluster	Square–wave signal	Defect code is stored	
18	A	Sensor ground (reserve)	not used	Ground	none	No resistance measurement with respect to vehicle ground! Check by voltage measurement with respect to U–batt.
19		not used				

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
20	A	Acoustic output 2 (outside temperature warning)	Acoustic generator (gong)	B– (active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
21	A	Acoustic output 3 (check control message)	Acoustic generator (gong)	B– (active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
22	A	Trigger alarm at DWA/horn with drive–away protection active	DWA control unit	B– (active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
23	E	Radio anti–theft	Radio contact	0 V 12 V	Radio removed Radio installed	
24	E	Drive range	Transmission selector lever switch	0 V 12 V	0 1	12 V is switched by selector lever switch
25	E	Drive range	Transmission selector lever switch	0 V 12 V	0 1	12 V is switched by selector lever switch
26	E	Drive range	Transmission selector lever switch	0 V 12 V	0 1	12 V is switched by selector lever switch

Pin assignments at connector X40, 26–pole (brown)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E/A	I–bus (instrument bus)	I–bus user	Square–wave signal	Defect code is stored	
2		not used				
3		not used				

Electronic Vehicle Module (EKM)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4		not used				
5	A	Sensor ground	Fuel supply sensor and tachogenerator	Ground	Defect code is stored	No resistance measurement with respect to vehicle ground! Check by voltage measurement with respect to U–batt.
6	E	Seat belt	Buckle switch	0 V 12 V	In buckle switch Not in buckle switch	Only installed in US version
7	E	Ignition key	Ignition start switch	0 V 12 V	Key in Key removed	Only installed in US version
8		not used				
9		not used				
10	E	EDC defect	EDC control unit	0 V 12 V	Not OK. OK.	
11		not used				
12		not used				
13		not used				
14	E	Position signal	Tachogenerator	Square–wave signal	none	
15	A	Speed signal for DWA	DWA control unit	0 V/12 V	none	Signal change when vehicle is pushed
16		not used				

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
17	E	Left backrest lock	Microswitch in left seat	0 V to 12 V	Interruption in measuring range short circuit	Nominal values of switches: – Switch L = 1180 Ω – Switch R = 620 Ω Switch not pressed: – Switch L = 560 Ω – Switch R = 0 Ω (+/– 10 Ω)
18	E	Right backrest lock	Microswitch in right seat	0 to 12 V	See pin 17	See pin 17
19	E	Front lid	Microswitch	0 V 12 V	none	Switch closed, front lid open
20	E	Brake pad wear indicator	Brake pad sensor	0 V 12 V	OK. Not OK.	
21	E	Driver's door	Microswitch on lock	0 V 12 V	OPEN CLOSED	
22	E	Catalytic converter overheating	Thermal switch	0 V 12 V	Not OK. OK.	Only installed in Japan version
23		not used				
24	E	Handbrake	Microswitch on handbrake lever	0 V 12 V	ON OFF	
25	E	Rear lid	Switch for rear lid lights	0 V 12 V	OPEN CLOSED	
26	E	Tank contents	Fuel sensor	0 to 12 V	Interruption in measuring range short–circuit	Nominal value of tank sensor 10 Ω to 250 Ω

Pin assignments at connector X41, 26–pole (blue)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1		not used				
2		not used				
3		not used				
4	E	ti signal 1/Injection signal	Control unit DME	Square–wave signal	Defect code is stored	
5	E	Outside temperature	Temperature sensor	0 V to 4 V	Interruption in measuring range short–circuit	
6	E	Engine oil pressure	Oil pressure switch	0 V 12 V	Not OK. OK.	Oil pressure switch switches ground when oil pressure too low
7	E	tD signal/Engine speed	Control unit DME I	Square–wave signal	Speed values in rpm	
8	E	SIA reset	Diagnostic Pin 7	0 V 12 V	none	0 V when ground signal applied at Pin 7 – for reset
9	E	Power steering oil level	Level switch	0 V 12 V	OK. Not OK.	Level switch switches ground when oil level OK.
10		not used				
11	E	Wash water	Level switch	0 V 12 V	OK. Not OK.	Level switch switches ground when water level OK.
12		not used				
13		not used				

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
14	A	Sensor ground	Temperature sensor for coolant and outside temperature	Ground	Defect code is stored	No resistance measured with respect to vehicle ground! Check by voltage measurement with respect to U–batt.
15	E	Dynamic engine oil level	Level switch	0 V 3,4 V	Defect and defect information in ♦D♦ test procedure	Internal resistance in level switch1kΩ when dynamic oil level too low
16	E	Coolant temperature	Temperature sensor	0 V to 4 V	Interruption in measuring range short–circuit	
17	E	ti signal 2/injection signal	Control unit DME II	Square–wave signal	Defect code is stored	
18	A	Starter blocking	Control units DME I and DME II	0 V 12 V (active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
19	A	Independent ventilation	Relay box independent heating/ventilation	B– (active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
20	A	Independent ventilation	Relay box independent heating/ventilation	B– (active status)	Defect code is stored in the case of a short circuit	Check by ♦D♦ activate components.
21	E	Brake fluid level	Level switch	0 V 12 V	Not OK. OK.	Level switch switches ground when brake fluid too low

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
22	E	Brake pressure	Brake pressure switch	0 V 12 V	Not OK. OK.	Switch switches ground when brake pressure too low
23		not used				
24		not used				
25	E	ASC defect	ASC control unit	0 V 12 V	Not OK. OK.	Valid when engine running
26	E	Static engine oil level	Level switch	0 V 12 V	Defect and test information in ♦D♦ test procedure	Level switch switches ground when static oil level OK.

Pin assignments at connector X42, 5–pole

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Voltage supply terminal 30	Fuse	12 V	none	
2	E/A	Diagnostic link RxD	Diagnostic socket Pin 15	Square–wave signal	none	
3	E/A	Diagnostic link TxD	Diagnostic socket Pin 20	Square–wave signal	none	
4	E	Ground terminal 31	Ground connection	B–	none	
5	E	Terminal 15	Fuse	12 V	ON	

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X39, X40, X41	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

– Troubleshooting is mainly performed in accordance with information provided in the BMW DIAGNOSTIC SYSTEM. Observe notes shown on the display screen.

Defect Code Table

♦D♦ Defect code memory– stored defect codes:

One or several defect codes are stored → Defect codes 01 to 58

Malfunctions:

Diagnostic procedure not possible with EKM → Defect code 59

General troubleshooting when individual functions are faulty → Defect code 60

Display **EEEE** or **PPPP** in instrument cluster display →

see functional description of coding data.

Defect Code 01

♦D♦ Defect code memory: Terminal 15 defective

Explanation: This defect code is stored when terminal R, tD and ti signals are detected but terminal 15 is not detected

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ test procedure – general inquiries.

Defect Code 02

♦D♦ Defect code memory: Start position without terminal 15

Explanation: This defect code is stored when the start position (terminal 30h) is detected without terminal 15 being detected

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ test procedure – general inquiries.

Defect Code 03

♦D♦ **Defect code memory: Start position (terminal 30h) defective**

Explanation: this defect code is stored when plus is applied at the EKM input for terminal 30h for 60 s.

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ test procedure – general inquiries. Function test of module with ♦D♦ Despecial functions – system test.

Defect Codes 04, 05

♦D♦ **Defect code memory: Alarm output to DWA defective**

Explanation: The wire to the DWA has a break or a short to ground or plus.

Note: The EKM switches the horn relay via the alarm output in the DWA. The relay is energised when the engine is started with the drive protection function active.

Troubleshooting: As displayed on screen. Check the output with ♦D♦ activate components. Function test of module with ♦D♦ special functions – system test.

Defect Codes 06 – 11

♦D♦ Defect code memory: One of the acoustic outputs is defective

Explanation: Wire to acoustic generator (gong) has a break or a short to ground or plus.

Troubleshooting: As displayed on screen. Check the outputs with ♦D♦ activate components. Function test of module with ♦D♦ special functions – system test.

Defect Codes 12 – 17

♦D♦ Defect code memory: Ti signal 1 or 2 defective

Explanation: This defect code is stored when no or defective ti signals are detected for 10 s with the vehicle stationary but with the vehicle running (tD signals for idle range are detected)

Troubleshooting: As displayed on screen.

Defect Codes 19 – 21

♦D♦ Defect code memory: Engine speed signal faulty

Explanation: This defect code is stored when ti signals but no or faulty tD signals are detected.

Note: the tD signal is used by the EKM only in the area of the check control. The tD signal for the speedometer is connected directly to the instrument cluster.

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ test procedure – general inquiries.

Defect Codes 22, 23

♦D♦ Defect code memory: Position signal faulty

Explanation: Defect code 22 is stored when no position signals are detected by the tachogenerator for 15 min at an engine speed above 1500 rpm. Defect code 23 is stored when impermissibly high frequency values are detected.

Troubleshooting: As displayed on screen.

Defect Codes 24 – 27

♦D♦ Defect code memory: Output for independent heating/ventilation defective

Explanation: Wire to relay box for independent heating/ventilation has a break or a short to ground or plus.

Troubleshooting: As displayed on screen. Check the outputs with ♦D♦ activate components. Function test of module with ♦D♦ .special functions – system test.

Defect Codes 28 – 29

♦D♦ Defect code memory: Output for start blocking to DME defective

Explanation: Wire from EKM to DME or wire from DWA to DME has a break or a short to ground or plus.

Fehlersuche: Laut Bildschirmanzeige. Prüfung der Ausgänge mit ♦D♦ Bauteile ansteuern. Funktionstest des Moduls mit ♦D♦ Sonderfunktionen – Systemtest.

Defect Codes 30 – 31

♦D♦ Defect code memory: Output speed–A signal defective

Explanation: Wire has a break or a short to ground or plus.

Troubleshooting: As displayed on screen. Check the output with ♦D♦ .activate components.

Defect Codes 33 – 34

♦D♦ Defect code memory: Fuel supply sensor defective

Explanation: This defect code is stored when a fuel supply sensor or wire is defective (break or short to ground/plus).

Note:

The tank contents are recorded by 2 lever–type sending units. The sending units are connected in series. The tank contents are calculated by way of the fuel consumption (calculated from ti signal and vehicle speed). See functional description "recording tank contents".

Fuel sensor and tachogenerator have a common sensor ground.

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ .test procedure – indicator instruments.

Resistance nominal value of lever–type sending unit 10 Ω to 250 Ω.

Defect Codes 35 – 38

♦D♦ Defect code memory: Temperature sensor for coolant or outside temperature defective

Explanation: This defect code is stored when a temperature sensor or a wire is defective (break or short to ground/plus).

Note: The temperature sensors for coolant and outside temperature have a common sensor ground.

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ test procedure – indicator instruments. See display screen for defect information.

Defect Code 39

♦D♦ Defect code memory: Break in sensor ground for temperature sensor, outside temperature and coolant

Explanation: Wire has a break.

Troubleshooting: As displayed on screen. Check the current status with ♦D♦ test procedure – indicator instruments.

Note: he tank contents are recorded by 2 lever–type sending units. The sending units are connected in series. The tank contents are calculated by way of the fuel consumption (calculated from ti signal and vehicle speed). See functional description "recording tank contents". Fuel sensor and tachogenerator have a common sensor ground.

Defect Code 40

♦D♦ Defect code memory: Data transfer to instrument cluster faulty

Explanation: This defect code is stored when the data transfer between the EKM and instrument cluster is faulty.

Troubleshooting:

- If the defect code 41 or 42 is additionally stored, first rectify these defects in accordance with the instructions displayed on the screen.
- Check data link between EKM connector green Pin 17 and instrument cluster Pin 13. (Wire resistance< 1 Ω? Contacts of connector OK.? Short on wire?)
- If wire is OK.: Connect EKM and instrument cluster. Clear defect code memory. Then wait for at least 60 s to allow for sufficiently long data transfer between EKM and the instrument cluster. If the defect code is stored once again, as a check, renew electronic module of the instrument cluster. Observe information on test run.

Defect Codes 41 – 42

♦D♦ Defect code memory: Data link to instrument cluster defective

Explanation: Wire has a break or a short to ground or plus

Troubleshooting: As displayed on screen.

Defect Codes 43 – 52

♦D♦ Defect code memory: Data transfer to a unit connected to the I–bus defective

Explanation: This defect code is stored when the data transfer to one or several units connected to the I–bus is defective.

Note: The screen page ♦D♦ special function – coding data indicates which I–bus users (= control units connected to I–bus) are installed in the vehicle.

Troubleshooting

- f data transfer to all I–bus users installed in the vehicle is defective, check plug connection at the EKM (brown connector, Pin 1 = I–bus) and I–bus data link ahead of the branch to the control units
- If data transfer to only I–bus user is defective, check data link from the EKM to the control unit. .
- If the I–bus data link is OK.: Connect EKM and instrument cluster. Clear defect code memory. Then wait at least 60 s to allow for sufficiently long data traffic to take place between the EKM and I–bus user. If the defect code is stored once again, as a check, renew I–bus user.

Defect Codes 53 – 54

♦D♦ Defect code memory: I–bus data link defective

Explanation: I–bus data link has a short to plus or ground.

Troubleshooting: Check the wire..

Defect Code 55

♦D♦ Defect code memory: Data traffic via the I–bus defective

Explanation: This defect code is stored when the EKM receives or sends incorrect or faulty data

Note: As part of the troubleshooting procedure, a check is made as to whether the EKM or an I–bus user is defective.

Troubleshooting:

- Check the I–bus interface in the EKM: Detach blue and brown connector from EKM. Do not detach green connector and 5–pole connector. Switch on ignition, clear defect code memory, wait 60 s (EKM internally checks the I–bus).
  Select defect code memory and check whether the defect code 55 has been stored again (ignore all other defect codes)
  The EKM has an internal defect if defect code 55 is stored again. Renew EKM. (System test not necessary)
- Check the I–bus users: Reconnect all EKM connectors. Switch on ignition, clear defect code memory, wait 60 s (EKM checks the I–bus)
  Select defect code memory and check whether the defect code 55 has been stored again (if one or several defect codes between defect code no.s 43 and 54 are additionally stored, these defects must be rectified first)
  An I–bus user is defective if the defect code 55 is stored once again.
- Further procedure: Switch off ignition. Disconnect the individual I–bus users one after the other from the I–bus. Switch on ignition. Clear the defect code memory after each disconnected unit, wait 60 s and then check whether the defect code 55 has been stored again.
- If the defect code 55 is no longer stored as soon as a certain unit is disconnected from the I–bus, then it is this unit that is causing the defect. Renew the defective unit.

Defect Code 56

♦D♦ Defect code memory: Storage area in EKM defective

Troubleshooting:

- Clear defect code memory. Wait approx. 60 s with ignition switched on. Renew EKM if the defect occurs once again.
- Do not EKM if defect code is no longer stored.

Defect Code 57

♦D♦ Defect code memory: Code for drive–away protection function is stored incorrectly.

Troubleshooting

- Clear defect code memory. Ignition switch in position R.
- Enter code 9999 at MID and arm the drive–away protection function with set/res. (MID transfers the code via the I–bus to the EKM – the EKM stores the code)
- Switch off ignition, wait 10 s.
- Switch on ignition. Re–enter code 9999 with set/res, disarm drive–away protection function.
- Once again read out EKM defect code memory. Renew EKM if the defect code 57 is stored once again. (System test not necessary)
- Do not renew EKM if defect code is no longer stored.

Defect Code 58

♦D♦ Defect code memory: Incorrect coding data in EKM

Troubleshooting: Recode or renew EKM.

Defect Code 59

Diagnosis not possible with EKM

Note: Observe notes in the BMW DIAGNOSTIC SYSTEM (screen display).

Troubleshooting

- Check fuses for terminal 30, 15 and R for EKM and renew if necessary.
- Is a voltage of approx. 12 V applied at Pin 1 and Pin 5 of the 5–pole connector for the EKM? If necessary, repair wire to fuse.
- Is ground applied at Pin 4 of the 5–pole connector for the EKM? If necessary, repair ground connection.
- Check data link RxD from the 5–pole connector of the EKM Pin 2 to diagnostic socket Pin 15 and repair if necessary.
- Check data link TxD from the 5–pole connector of the EKM Pin 3 to diagnostic socket Pin 20 and repair if necessary.
- Disconnect all control units which are connected to the RxD and TxD data link (see electrical troubleshooting manual, schematics section 0670.5 diagnostic link). Check RxD and TxD wire for a short to plus or ground. Repair wire if necessary.
- If RxD and TxD wires are OK.: Only connect the EKM to the RxD and TxD link. Is diagnosis now possible with EKM?
- **NO:** Renew EKM
- **YES:** A control unit which is connected to the RxD and the TxD data link is defective. Determine defective control unit by connecting all control units one after the other and checking each time whether diagnosis is possible with the EKM and the control unit.

Defect Code 60

General troubleshooting when individual functions are defective.

Troubleshooting

- ♦D♦ select defect code memory: Is a defect code stored?
- ♦D♦ select test procedure: By paging with ♦⇐♦ or ♦⇒♦ , select the sensor to be tested. Perform testing in accordance with the instructions given on the display screen.
- ♦D♦ activate components: A defective output can be checked by way of activation.
- If a defect is determined in the area of the sensors but no defect can be found on the sensor or on the corresponding wire, perform ♦D♦ system test before renewing the EKM. The EKM should only be renewed when the corresponding input is found to be faulty during the test.

Functional Description

General

The instrument cluster contains indicator/display instruments, indicator lamps and an LCD module (display unit).

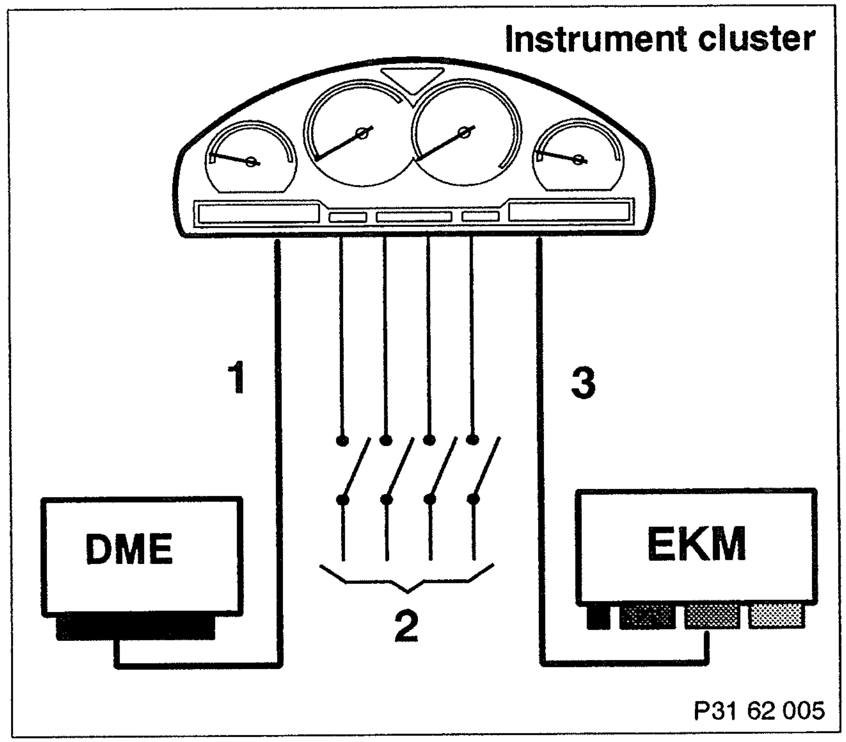
Connection with EKM

The EKM transfers a large number of data to the instrument cluster. These data are transferred via a data link, the instrument cluster data link (serial interface). This data link to the instrument cluster is independent of the I–bus (instrument bus).

For description of the EKM, see Section 6210.0A Electronic vehicle module.

Engine Speed Measurement

The tD signal (engine speed signal) for the tachometer is connected directly to the instrument cluster.



The instrument cluster processes:
1 = tD signal from DME for tachometer
2 = Switches and sensors for indicator lamps
3 = Data from the EKM (via instrument cluster data link)

Scope of Functions

The following functions are indicated:

Indication	Measured value recording
Trip and total mileage (distance covered) Vehicle speed Coolant temperature Tank contents Gear and program display (EGS transmission)	EKM, data transfer via instrument cluster data link (serial interface)
Engine speed	DME, tD signal is transferred via a link to the instrument cluster
Internal indicator lamps: Fuel reserve Handbrake Seat belt (USA only) Brake warning lamp (brake pressure, brake fluid) Engine oil pressure CC indicator lamp	EKM, data transfer via instrument cluster data link (serial interface), **Note:** The lamps for fuel reserve, handbrake and brake warning light are switched on for 3 seconds after switching on the terminal 15.
External indicator lamps: Turn signal indicator High beam Rear fog light Fog light	Instrument cluster, evaluation of switch position

Indication	Measured value recording
EML Airbag ABS Check Engine (USA only) ASC	Control unit, wire to instrument cluster. Lamp lights when ground signal is applied
Battery charge indicator lamp	

Notes on Operation

Measurement of tank contents: The tank contents are recorded and calculated by way of two lever–type sensors and the ti signals from the EKM (see Section 6210.0A EKM). No reserve contact is provided for the fuel reserve lamp. On the basis of the content measurement/calculation, the lamp is switched on at a fuel reserve of approx. 10 l.

Vehicle speed: The rear axle reed contact (speed sensor) is connected to the EKM. The speed–A signal (output for other control units) is also connected to the EKM. Only the speed and distance are indicated in the instrument cluster.

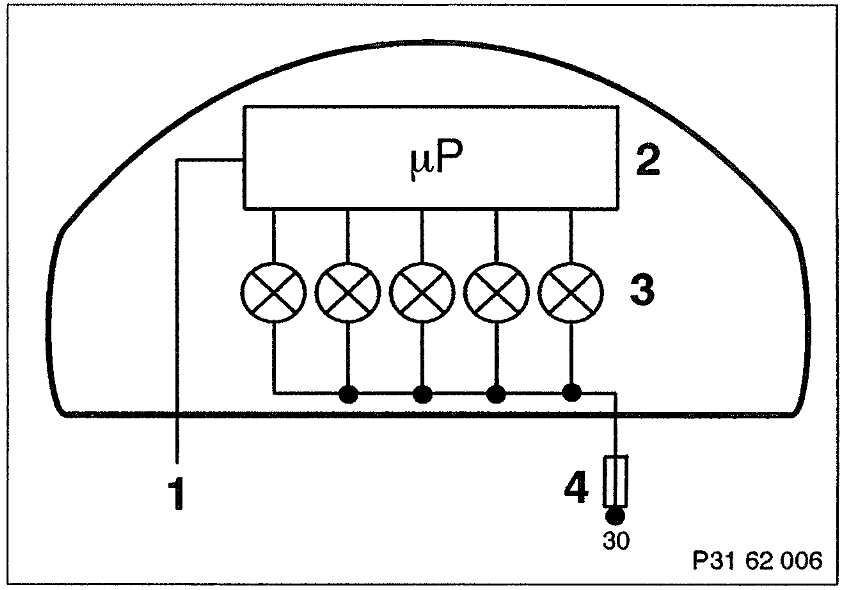
Total distance: The total distance is stored in the EKM and in the instrument cluster. When one unit is replaced, the value is adopted automatically.

Turn signal acoustic relay: An acoustic relay is installed in the instrument cluster which provides an acoustic signal when the turn signal indicator is switched on.

Internal and External Lamps

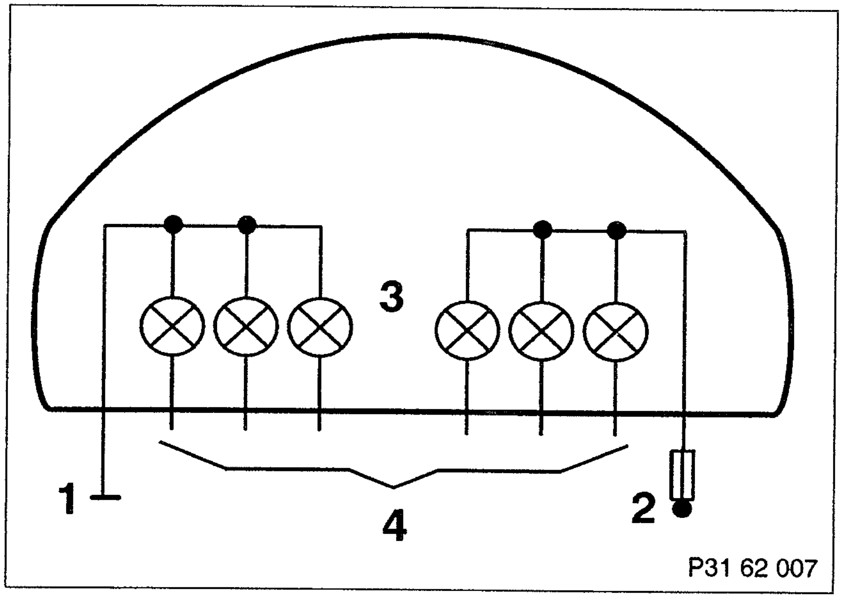
Internal lamps: Internal lamps are switched on by the microprocessor of the instrument cluster. They can be checked by way of the ♦D♦ system test (special functions).

The internal lamps for fuel reserve, handbrake and brake warning light are switched on for 3 seconds after switching on the terminal 15.



1 = Instrument cluster data link from EKM
2 = Microprocessor in instrument cluster
3 = Lamps, e.g. handbrake, brake warning light
4 = Connection to terminal 30 (fuse)

External lamps: External lamps have no connection to the electronics of the instrument cluster. They are connected to ground or B+ via the instrument cluster and are switched on by means of a switch (e.g. fog light) a relay (turn signal indicator) or a control unit (e.g. airbag, EML, ABS, etc.).



1 = Ground connection
2 = Connection to terminal 15 or R
3 = Lamps, e.g. high beam, turn signal indicator, ABS
4 = Switches and control units

System Test

The system test makes it possible to activate all indicator instruments, internal lamps and the display unit (LCD display). Internal data are output via the display unit. If the instrument cluster and the EKM are replaced and recoded at the same time, the exchange point is activated during the entire test.

Start System Test in Vehicle

- Switch off ignition (ignition in position 0)
- Press button for trip odometer reset and hold depressed
- Switch ignition from position 0 to position 1 (terminal R) or 2 (terminal 15).
- Start system test, the trip odometer reset button can be released.

End System Test

Switch off ignition in vehicle

Test Procedure

The pointers of the indicator instruments move from the zero position to full deflection and back.

The internal lamps are switched on.

The following appear in succession in the display unit:

Display 1)	Significance
All segments and the exchange point switched on	Test of display unit (LCD display)
H__S 01 02	Hardware and software number
COD E 123456	Number of the data record (only for production)

1) All numerical values are examples

If the instrument cluster and EKM are replaced, the manipulation point is switched on during the entire system test

Trip Odometer

Two independent trip odometer readings can be stored in the instrument cluster. The display can be switched over between the two readings by turning the trip odometer reset button. The displayed value is cleared by pressing the button.

The digits I or II to the right next to the trip odometer display indicate which reading is displayed.

Coding Data

For detailed description, see Section 6210.0A EKM.

All coding data as well as the stored values for:

- Total mileage
- Distance and time for service interval display
- Chassis number

are stored in the instrument cluster and in the EKM. If the instrument cluster is replaced, the data are immediately adopted from the EKM as soon as the terminal R is switched on. If a used unit is installed, e.g. from a different vehicle, this data exchange does not take place.

Identifier: Used/test phase

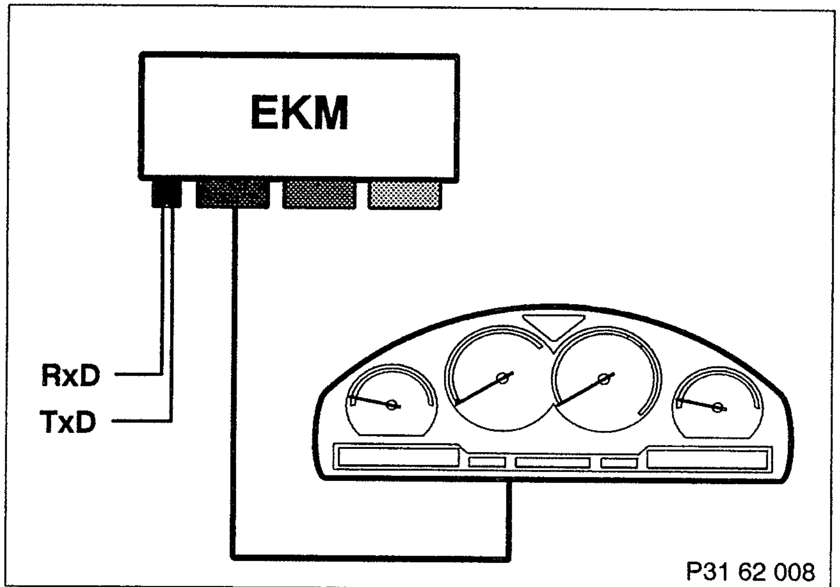
Test phase means: The instrument cluster is not permanently assigned to the vehicle. If the unit is installed in another vehicle, it adopts the data (coding data, distance and SIA data) of the EKM.

Used means: The instrument cluster has been installed in the vehicle for at least 8 running hours (running hour = terminal R ON) and is therefore permanently assigned to the vehicle. If the unit is installed in another vehicle, data exchange will not take place. If a new EKM is installed, it will adopt the data (coding data), distance and SIA data) from the instrument cluster.

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnostic Mode

Diagnosis takes place in conjunction with the EKM. The data from the BMW service tester to the instrument cluster are sent via the RxD and TxD data link to the EKM, from which they are transferred via the instrument cluster data link to the instrument cluster.



♦D♦ Special Functions System Test

Mit dem Prüfablauf können die Eingänge der Instrumentenkombination überprüft werden, die vom Microprozessor gesteuert werden.

♦D♦ Special Functions System Test

The instrument cluster system test (see functional description and troubleshooting) is initiated via the diagnostic system.

The system test is terminated by switching off the ignition.

♦D♦ Defect Code Memory

The instrument cluster can detect internal defects and an interruption or disturbances in the data exchange with the EKM and store them as defect codes. The defect code memory is not cleared by disconnecting the battery or removing the control unit.

Abkürzungen

I–Bus	Instrument bus
EKM	Electronic vehicle module
DME	Digital motor electronics
MID	Multi–information display
LKM	Lamp control module
AHM	Trailer module
EGS	Electronic transmission control
CC	Check control
KVA	Fuel consumption indicator
ASC	Automatic stability control
EDC	Electronic damper con
SIA	Service interval indicator
tD–signal	Engine speed signal
ti–signal	Injection signal
SIA	Service Interval Indicator

Pin assignments

Pin assignments at connector X16, 26–pole

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Check engine (USA only)	DME I/II	B–		Lamp on at B–
2	E	Indicator lamp (not connected at present)	active rear axle kinematics (AHK	B–		Lamp on at B–
3		Battery charge indicator lamp 1	Alternator			
4	E	Rear fog light indicator lamp	Switch	12 V		Lamp on at B+
5		Battery charge indicator lamp 2	Alternator 2	12 V		Lamp on at B+
6	E	Fog light indicator light	Switch	12 V		
7	E	EML warning light	EML control unit	B–		Lamp on at B–, also see Pin 20
8	A	Display lighting electronically dimmed	MID	Low pulses	Display bars	A check can be performed as to whether the display dimming in the instrument cluster is OK.
9	E	Terminal 58g, switch and instrument lighting	Dimmer	High pulses	Display bars	See screen display
10	E	High beam	Switch	12 V		
11	E	Left turn signal indicator	Turn signal indicator relay	12 V		
12	E	Right turn signal indicator	Turn signal indicator relay	12 V		
13	E/A	Serial interface – instrument cluster data link	EKM	Square–wave signal	Defect code stored in instrument cluster and EKM	Check wire in case of defect

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
14	E	Terminal 15	Fuses	12 V 0 V	ON OFF	On when ignition switch in position 2
15	E	Ground, terminal 31	Ground	Ground		
16		not used				
17	E	ASC indicator lamp	ASC control unit	B–		Lamp on at B–
18	E	ABS indicator lamp	ABS control unit	B–		Lamp on at B–
19	E	Trailer turn signal indicator	Turn signal indicator relay	12 V		
20	E	EML warning lamp	EML control unit	B–		Lamp on at B–, also see Pin 7
21	E	Terminal 30	Fuses	12 V		
22	E	Airbag warning lamp	Airbag control unit	B–		
23	E	Terminal R not protected	Power distributor	12 V		for airbag indicator lamp
24	A	Provisions sensor ground	Provisions for engine oil temperature sensor			Resistance measurement with respect to vehicle ground not possible
25	E	Engine oil temperature	Provisions for engine oil temperature sensor	0 – 5 V		
26	E	tD signal (engine speed)	DME I	Square–wave signal		

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X16	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

– Troubleshooting mainly takes place in accordance with the instructions provided in the BMW DIAGNOSTIC SYSTEM. Note information provided in the screen displays.

Defect Code Table

♦D♦ 900 Defect Code Memory – stored defect code:

Data link to EKM temporarily interrupted → Defect code 01

Internal memory defect → Defect code 02

Internal hardware defect → Defect code 03

Malfunctions:

General troubleshooting → Defect code 04

Indicator instrument defective → Defect code 05

Display **EEEE** or **PPPP** in display unit→

See Section 6210.0A EKM, functional description of coding data.

Defect Code 01

♦D♦ Defect code memory: Data link to EKM was temporarily interrupted.

Explanation: This defect code is stored when the instrument cluster data link to the EKM (serial interface to EKM) was temporarily interrupted or is defective.

Note: The instrument cluster cannot differentiate if the defect is permanent or whether it is only intermittent.

Troubleshooting:

– The defect code can be cleared if no apparent fault can be found in the instrument cluster.

– If a fault is found, e.g. all indicators defective, check data link from instrument cluster Pin 13 to EKM connector green Pin 17 for a break or short to plus/ground.

Defect Code 02

♦D♦ Defect code memory: Internal memory defect

Explanation: This defect code is stored when a defect is determined on the instrument cluster pc–board in the area of the memory modules.

Troubleshooting: Clear defect code memory. If the defect code is re-stored, renew instrument cluster pc–board.

Defect Code 03

♦D♦ Defect code memory: Internal hardware defect

Explanation: This defect code is stored when a defect is determined on the pc–board due to an internal overvoltage.

Troubleshooting: Renew pc–board.

Defect Code 04

General Troubleshooting

1. MID also not operating or malfunctioning:

Check EKM

2. Diagnostic procedure not possible:

Check voltage supply for instrument cluster.

Check data link between EKM and instrument cluster.

3. General defect:

♦D♦ Perform diagnostic procedure for instrument cluster.

4. Defect during system test:

Check defective indicator instrument, see defect code 05 and renew if necessary.

Renew defective lamps.

Defective LCD module:

- Check lamps for LCD module and renew if necessary.
- If all lamps are OK, renew LCD module.

Defect Code 05

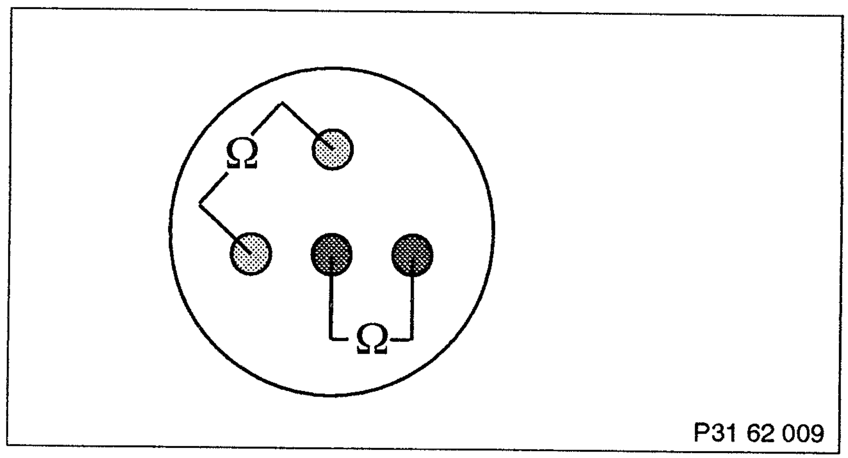
Indicator Instrument Defective

Check indicator instrument with system test. If the pointer does not deflect, check coil resistance.

- Renew defective instrument.
- If coil resistance is OK., renew instrument cluster pc–board.

Check coil resistance:

Nominal values: 280 Ω +/– 15 Ω



Indicator instrument, rear view (connector side)

Functional Description

General

The lamp control module (LKM) contains the relays for

- Low beam
- Fog lights

The tail lights, parking lights, brake lights, rear fog lights and licence plate lights are not switched on by the LKM but directly by the switches.

The LKM monitors the power circuit of the lamps, several fuses, the function of the brake light switch, the pop–up headlights and the function of the relays contained in the LKM (see scope of monitoring).

If one of the components included in the scope of monitoring is found to be defective, this is indicated by way of a corresponding message in the multi–information display (MID) and stored in the defect code memory of the LKM.

Activating control unit

The LKM is activated by the I–bus. The I–bus is active under the following conditions:

- as of ignition switch position "1" (terminal "R" ON)
- or pressing an MID button
- or opening the driver's door

Deactivating control unit

The LKM switches off under the following conditions:

- ignition switch in position "0", ignition key removed in USA version
- and the driver's door closed for 2 minutes or the closed driver's door opened and closed once

The I–bus is a data link to the EMK and can be tested by way of the diagnostic program belonging to this system.

Voltage supply

Complete operation of the LKM control unit is only guarantied at a supply voltage of minimum 9 V to maximum 18 V. The supply voltage is monitored at the control unit connector X12 (A/white) Pin 20.

Monitoring is restricted if the LKM detects a supply voltage above 18 V. Data telegrams are no longer sent at a voltage below 9 V (♦D♦ Data transfer defective).

Monitoring

Type of monitoring

The LKM differentiates between so–called hot and cold monitoring.

Hot monitoring: The power circuit is checked when the component is switched on.

Cold monitoring: The power circuit is checked when the component is switched off.

Scope of monitoring

The scope of monitoring depends on the country variant of the LKM. The LKM takes into consideration additional power circuits or power circuits which are not installed for the relevant country variant.

Component	Type of monitoring
Left/right low beam	hot/cold
Left/right parking light	hot/cold Parking light fuses and parking light switch function are also monitored
Left/right tail light (on the outside)	hot/cold
Left/right tail light (on rear lid)	not monitored
Left/right fog light	hot/cold
Left/right licence plate light	hot

Component	Type of monitoring
Left/right rear fog light	hot/cold
Left/right/centre brake light	hot/cold
Fog light fuse	hot/cold
Fuse for all fog lights and low beam/high beam control circuit	hot/cold When the ignition switch is in position "2" (terminal 15 ON).
Brake light fuse	hot/cold When the ignition switch is in position "1" (terminal R ON).
Low beam relay	hot/cold
Fog light relay	hot/cold
Right/left pop–up headlight	during closing/opening or when opened/closed
Brake light switch	hot When at least one brake light is okay.

Brake light

The brake light test switch is used to monitor operation of the brake light switch. A corresponding error message appears in the MID when the LKM detects brake light test switch ON and brake light switch OFF. The function is OK. for LKM monitoring if the LKM detects brake light test switch off and brake light switch ON.

Monitoring the function of the brake light switch is based on the assumption that at least one brake light is OK. It is therefore possible to close the power circuit.

Depending on the country variant, the left, right and centre brake lights are monitored by the LKM. The brake lights are activated directly by the brake light switch and routed via the LKM for monitoring. For safety reasons, they are not controlled by the LKM or a relay incorporated in the LKM.

Relays

The LKM controls the power circuits for the fog lights and low beam lights by way of two relays incorporated in the LKM. The low beam relay can be switched by the light switch or by the control unit. This interlinking ensures that the low beam relay can still be switched even in the event of failure of the control unit electronics.

The relays contained in the LKM are monitored as to whether they switch on the load circuit when they are activated and switch off the load circuit when they are not activated (sticking relay).

In order to switch the power circuit for the pop–up headlights and high beam/headlight flasher lamps, the LKM drives two double relays which are <u>not</u> accommodated in the LKM. The pop–up headlight relays are powered with 12 V and the high beam/headlight flasher relays with 5 V.

Headlight/headlight flasher

The function for high beam and headlight flasher differs depending on the country variant of the LKM (see country variants). In the ECE basic version, the high beam lamps in the pop–up headlights can be switched on together with the headlight flasher lamps in the lamp assembly. The prerequisite for switching on the high beam in the pop–up headlight is that the pop–up headlight is open.

Pop–up headlights

The pop–up headlights are opened when the LKM determines that the low beam or the fog lights are switched on. The LKM detects the position of the pop–up headlight motor by means of limit switches integrated in the motor.

If the pop–up headlights are switched on and off again more than 10 times within 1 minute, they remain in the open position at the tenth time.

If the LKM detects that the pop–up headlights are blocked, the LKM only permits the headlights to be switched on and off 3 times within one minute.

A pop–up headlight is considered as being blocked when it is driven for longer than 5 s by the pop–up headlight relay in the LKM and the LKM does not receive a signal from one of the limit switches (pop–up headlight open/pop–up headlight closed).

If, during activation, only one limit switch is detected, the time is measured till the one limit switch is detected once again. This time is halved and the pop–up headlight motor is activated for this time. This emergency function positions the pop–up headlights with a sufficient degree of accuracy.

The pop–up headlights can also be opened by hand in the event of failure of the control unit electronics or of the pop–up headlight relay.

Country variant

The country variant of the LKM can be read out via the BMW diagnostic system. At present, the LKM distinguishes between the following variants.

♦D♦ Display	Scope of function
ECE	Basic version
Scandinavia	as ECE, but only one rear fog light on the left
Norway	Norway as Scandinavia, but the fog lights can only be switched on with the low beam and high beam switched off.
Australia	as ECE, but with an additional third brake light
USA	as ECE, but with additional third brake light, no rear fog light and deviating high beam/headlight flasher function with headlights in open position (only the high beam lamps light in the pop–up headlights).

Notes on the BMW DIAGNOSTIC SYSTEM

The LKM has diagnostic capabilities and differs as regard function depending on the country variant can be read out via the BMW diagnostic system.

The LKM has no direct diagnostic links (RxD/TxD) to the diagnostic socket of the vehicle. This link is made via the I–bus and the EKM.

Status monitoring

The status of LKM switch inputs, relay control outputs and lamp power circuits can be monitored with the aid of ♦D♦ status monitoring.

In order to combine status monitoring, as required, the individually selected inquiries can be indicated in a ♦D♦ status list.

The indicated status corresponds to the condition as seen by the LKM. A defect can be localized faster by comparing the display in the BMW diagnostic system with the status in the vehicle.

Component activation

By way of component activation with ♦D♦ activate components, individual components can be driven separated from their logic operations.

It is possible to localize a defect faster by reading out the status at the input ♦D♦ status monitoring and activating the corresponding output.

When a function or a component is activated, the functions fog light, high beam and headlight flasher can no longer be operated from the vehicle. For this purpose, the screen page ♦D♦ activate components must be exited with ♦⇑♦ .

The function "low beam switch ON" can only be performed with ♦D♦ activate components when the low beam light is switched off.

The reason for this is in the internal logic operation, in which the relay can be activated by the switch and by the LKM electronics.

Abbreviations

A	Output
AL-L/R	Left/right low beam
BLS	Brake light switch
BL-L/R/M	Left/right/centre brake light
E	Input
EKM	Electronic vehicle module
FL	High beam
I-Bus	Instrument bus
KL	Terminal
KZL-L/R	Left/right licence plate light
KSW	Pop–up headlight
KSW-R	Pop–up headlight relay
KSW-O	Pop–up headlight position open
KSW-Z	Pop–up headlight position closed
LH	Headlight flasher
LS	Light switch
LÜ	Lamp monitoring
MID	Multi–information display
NS-L/R	Left/right rear fog light
NLS	Fog light switch
NSW	Fog light
RL-L/R	Left/right tail light
SL-L/R	Left/right parking light

Pin assignments

Pin assignments at connector X12 (A/white)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Right parking light	Right light assembly	approx. 12 V	ON	
				approx. 0 V	OFF	
2	E	Light switch/low beam	Light switch	approx. 12 V	ON	in ignition switch position "2", terminal 15 "ON"
				approx. 0 V	OFF	
3	E	Left KSW position switch/	Pop–up headlight motor	approx. 12 V	OFF	
		KSW position OPEN reached		approx. 0 V	ON	
4	E	Fuse for all fog lights/ power circuit for rear fog light, control circuit for fog lights, low beam, high beam/headlight flasher	Fuse	approx. 12 V	Stored as defect code and can be displayed	in ignition switch position "2", terminal 15 "ON"
5	A	Right fog light	Right pop–up headlight	approx. 12 V	ON	
				ca 0 V	OFF	
6	A	High beam relay (double relay high beam/headlight flasher)	High beam/headlight flasher relay	approx. 3,5–5 V	ON	
				approx. 0 V	OFF	
7	A	headlight flasher relay (double relay high beam/headlight flasher)	High beam/headlight flasher relay	approx. 3,5–5 V	ON	
				approx. 0 V	OFF	
8	A	Right pop–up headlight/pop–up headlight motor relay	Pop–up headlight relay	approx.7–12 V		KSW motor running
				approx. 0 V		KSW motor stopped

Lamp Control Module (LKM)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
9	A	Left pop–up headlight/pop–up headlight motor relay	Pop–up headlight relay	approx.7–12 V		KSW motor running
				approx. 0 V		KSW motor stopped
10	A	Left low beam	Left pop–up headlight	approx.12 V	ON	
				approx. 0 V	OFF	
11	A	Left parking light	Leuchtenband links	approx.12 V	ON	
				approx. 0 V	OFF	
12	E	Fuse for both fog lights/power circuit for fog lights	Fuse	approx.12 V	Stored as defect code and can be displayed.	
13	E	High beam–headlight flasher switch/high beam	High beam–headlight flasher switch	approx.12 V	ON	
				approx. 0 V	OFF	
14	E	Right KSW position limit switch/ KSW position open reached	Pop–up headlight motor	approx. 12 V	OFF	
				approx. 0 V	ON	
15	A	Left fog light	Left pop–up headlight	approx.12 V	ON	
				approx. 0 V	OFF	
16	E	Right KSW position limit switch / KSW position CLOSED reached	Pop–up headlight motor	approx. 12 V	OFF	
				approx. 0 V	ON	
17	E	Left KSW position limit switch / KSW position CLOSED reached	Pop–up headlight motor	approx. 12 V	OFF	
				approx. 0 V	ON	
18	A	Right low beam	Right pop–up headlight	approx.12 V	ON	
				approx. 0 V	OFF	

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
19	E	LKM voltage supply Terminal 15/control circuit	Fuse	approx. 12 V	None	
20	E	LKM voltage supply Terminal 30/power circuit	Power distributor	approx. 12 V	None	Power supply for low beam

Pin assignments at connector X38 (B/black)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Left tail light	Outside left tail light	approx. 12 V approx. 0 V	ON OFF	
2	A	Right tail light	Outside right tail light	approx. 12 V approx. 0 V	ON OFF	
3	E	Ground terminal 31	Body ground	approx. 0 V	None	
4	E	Licence plate light	Light switch	approx. 12 V approx. 0 V	ON OFF	
5	A	Right licence plate light	Right licence plate light	approx. 12 V approx. 0 V	ON OFF	
6	A	Left brake light	Outside left tail light	approx. 12 V approx. 0 V	ON OFF	
7	E	Brake light switch	Brake light switch	approx. 12 V approx. 0 V	Defect code is stored	

Lamp Control Module (LKM)

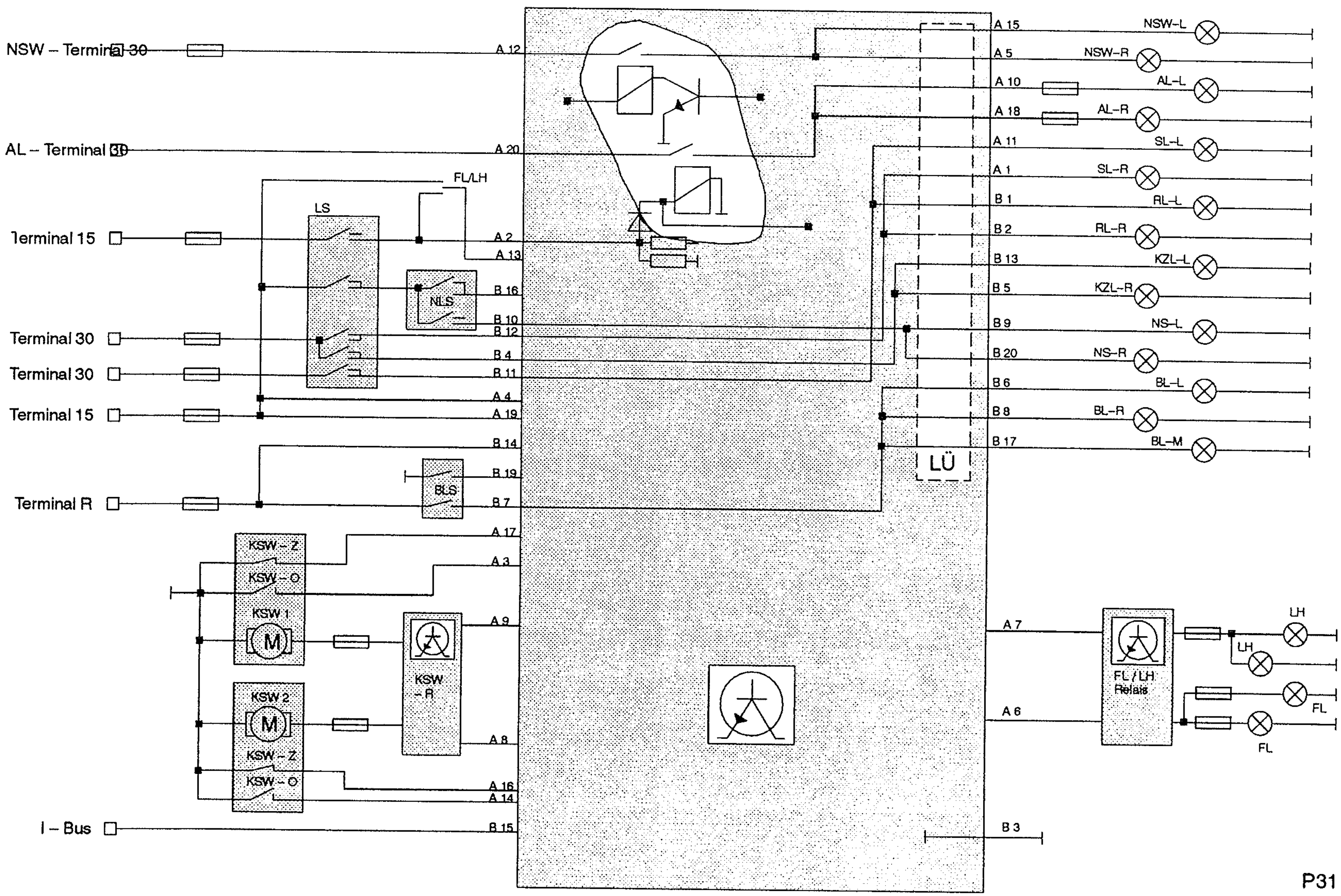
Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
8	A	Right brake light	Outside right tail light	approx. 12 V approx. 0 V	ON OFF	
9	A	Left rear fog light	Tail light left of rear lid	approx. 12 V approx. 0 V	ON OFF	Note country variant
10	E	Rear fog light switch/rear fog light	Fog light switch	approx. 12 V approx. 0 V	None	Note country variant
11	E	Parking light switch/left parking light	Light switch	approx. 12 V approx. 0 V	None	
12	E	Parking light switch/right parking light	Light switch	approx. 12 V approx. 0 V	None	
13	A	Left licence plate light	Left licence plate light	approx. 12 V approx. 0 V	ON OFF	
14	E	Fuse brake lights	Fuse	approx. 12 V	Defect code is stored	
15	E/A	E/A I–bus/data link	All control units with I–bus	Square–wave signal	None	When I–bus active/see EKM diagnostic program
16	E	Fog light switch	Fog light switch	approx. 12 V approx. 0 V	ON OFF	
17	A	Centre brake light	Centre brake light	approx. 12 V approx. 0 V	ON OFF	Note country variant
18		not used				

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
19	E	Brake light test switch	Brake light test switch	approx. 0 V	ON	
				approx. 12 V	OFF	
20	A	Right fog light	Tail light right of rear lid	approx. 12 V	ON	
				approx. 0 V	OFF	

Adapter

Component	Connector No.	Description	Adapter No.
LKM control unit	X 12 (A/white)	20–pole white 2.5 mm round connector	V–adapter 20–pole white Cartool 6 14 490
	X 38 (B/black)	20–pole black 2.5 round connector	V–adapter 20–pole black Cartool 6 14 450
			Periphery box for 26–pole V–adapter Cartool 6 11 459

Lamp Control Module (LKM)



P31 63 001

Troubleshooting

Notes

General

– Observe all safety codes and accident prevention regulations when performing all tests and work on the system.
– Battery charged, U–min = 12 V
– Wherever possible, the battery must not be disconnected otherwise the defects stored in all control units will be cleared.
– Perform wire checks only with control unit or component connectors disconnected

Caution!
Before monitored components are disconnected from the wire harness,

– deactivate LKM control unit

When the LKM is disconnected from the wire harness,

– deactivate LKM control unit
– check that pop–up headlights can move freely (danger of accident or damage to mechanics) or
– disconnect pop–up headlights and clear any stored defect codes after reconnection

Deactivating control unit

The LKM switches off under the following conditions:

– Ignition switch in position "0", ignition key removed in USA version
– and the driver's door closed for 2 minutes or the closed driver's door opened and closed once.

Test equipment

The adapters recommended for troubleshooting are listed in the chapter – Pin assignments.

Only use suitable test leads, terminals and test probes.

Defect Code Memory

The LKM stores defect codes (see scope of monitoring) which occur in the lighting system during vehicle operation. The defects are signalled to the driver by way of the MID.

The defect code counter is incremented in the case of defects which the LKM has already stored and are signalled once again.

When storing the defect codes, the LKM differentiates between defects relating to lamps, fuses, relays and pop–up headlights. A corresponding message is displayed in the MID when the LKM detects a defect.

If the detected defect is a lamp defect which no longer applies before the LKM switches off (loose contact), then this lamp defect is not stored in the defect code memory. However, if the lamp defect is present before the LKM switches off, then this lamp defect is stored.

If a defect concerning the fuses, relays or pop–up headlights is detected, the defect code is stored in the defect code memory when the LKM switches off. Whether this is a current defect or not is irrelevant in this case.

The stored defect codes are not cleared by interrupting the voltage supply. These defects can be cleared and displayed via the BMW diagnostic system. The LKM defect code memory is updated when the LKM switches off.

♦D♦ Status monitoring and ♦D♦ activate components can also be used for troubleshooting.

Defect Code Table

♦D♦ Defect code memory – stored defect codes:

One or several defect codes stored pr Troubleshooting in accordance with BMW DIAGNOSTIC SYSTEM

Displaying a stored defect code on the screen.

- **Defect location:** The defect may be in the component on the associated wires or in the control unit.
- **Defect frequency:** This shows how often the defect has occurred (defect code counter).
- **Type of defect:** Interruptions in the power circuit of the defect location are indicated.
- **Current defect:** The display shows "defect current" or "defect not current". The display "defect current" does not indicate whether, for example the low beam power circuit is interrupted on the left or right. The display "defect current" only shows that one of the low beam power circuits is interrupted.
- **Defect explanation:** This screen page can be accessed with ♦⇓♦ from the "defect" screen page. These screen pages indicate the conditions under which the defect code is stored, when the power circuit is monitored and whether a corresponding message is displayed in the MID.

Functional Description

General

The interior lights system (IB) is controlled by the general module (GM) of the ZKE II. During automatic operation, the IB lamps are switched by means of an individual relay which is driven by the general module (GM). The relay switches ground to the IB switch. U–batt for the IB lamps is switched via the load cut–out facility.

Operation

The interior lights (IB) can be switched by way of the interior light switch to "permanent light", "OFF" or "automatic" (control by the general module (GM)).

Permanent light: Ground is applied directly to the IB lamps via the IB switch.

OFF: IB switch prevents the IB lamps being switched on by the IB relay.

Automatic: General module: GM switches ground to the IB lamps via the IB relay. The ON time is influenced by door contacts, ignition switch position, central locking system, outer door handles and time sequences.

Automatic Mode

Switch–on conditions

- Doors open (door contact active)
- Turn ignition switch to position 0 (terminal R off) when terminal 58 (parking light) is switched on or 32 s before they were switched on.
- Raise outside door handle (door handle switch) when terminal R OFF
- Signal from crash sensor (see diagnostic procedure 6100.0)

Switch–off conditions

Immediate switch–off:

- Doors closed and switch on ignition (terminal R or 15)
- Doors closed and operate central locking system

Delayed switch–off:

- when IB switched on with outside door handle, deactivation after 8 seconds
- door opened longer than 16 min
- central locking system unlocked via remote control, switch–off after 8 seconds
- close doors, switch–off after 20 seconds
- IB activated by terminal R off and terminal 58 on, switch–off after 16 seconds.

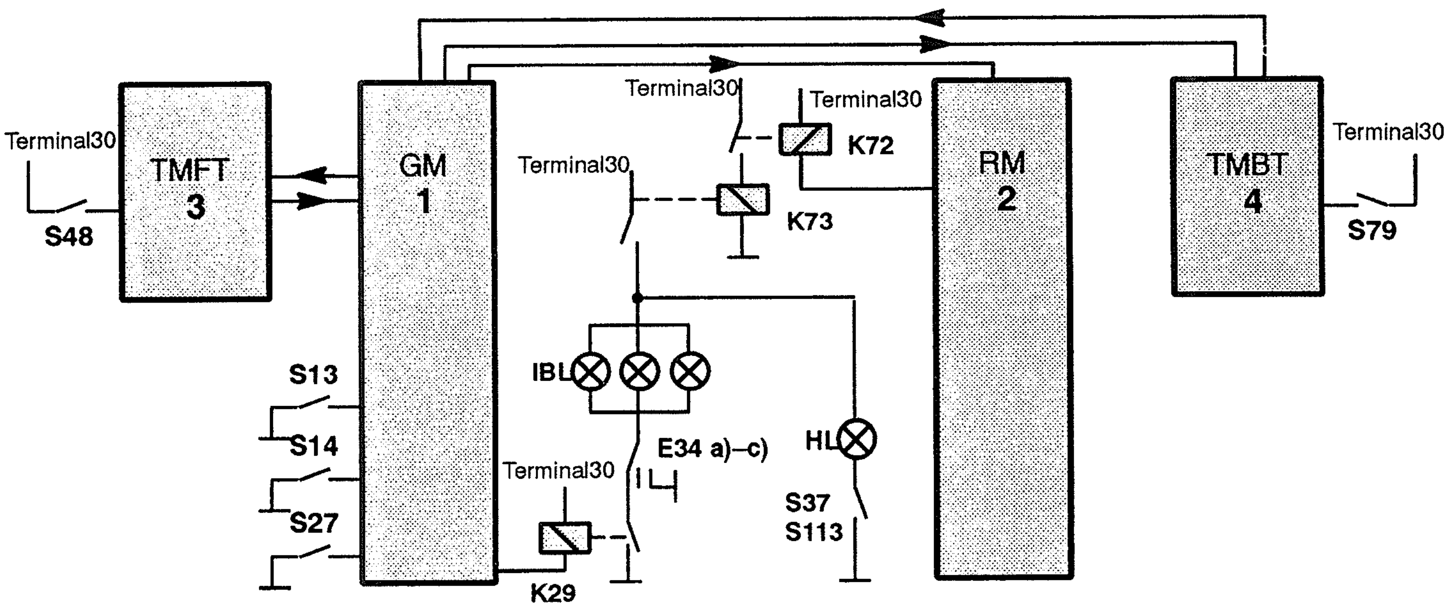
Repeat lockout

The interior lights (B) can only be switched on 3 times in 16 minutes by way of the outside door handle, further operation of the door handle is ignored. The system is reset by opening, closing the driver's door.

No.	Abb.	Description
1	GM	General module
2	RM	Relay module
4	TMFT	Driver's door module
4	TMBT	Passenger's door module
HL		Glove compartment lights
IBL		IB lamps (map reading lights, footwell lights)
E34		IB switch a) automatic b) OFF c) permanent light
K29		Interior light relay
K72		Load cut–out relay I
K73		Load cut–out relay II
S13		Passenger's door contact switch
S14		Driver's door contact switch
S27		Crash switch
S48		Driver's door handle contact
S79		Passenger's door handle contact
S37		Glove compartment light switch
S113		Glove compartment light switch

Block diagram IB

For ZKE block diagram, see Section 6100.0A



P31 63 002

Notes on the BMW DIAGNOSTIC SYSTEM

Diagnosis with the ZKE II

For general information on diagnosis with the ZKE II (central body electronics) see Section 6100.0A

Defect Code Memory

No defect codes are stored for the interior lights

Test Procedure

The test procedure makes possible guided inspection of the interior lights and the load cut–out function. The relays can be checked by way of activation.

Since the door handle and door contacts also influence the automatic window lowering function, troubleshooting is performed as part of the test procedure or the power windows.

Abbreviations

General

ZKE	Central body electronics
IB	Interior lights
A	Outputs
E	Inputs

Module

GM	General module
RM	Relay module

Pin assignments

Connector overview

Number	Type	Description	
X332	26–pole, white	GM–A	General module
X253	26–pole, black	GM–B	General module
X254	26–pole, yellow	GM–C	General module
X258	20–pole, black	RM–A	Relay module
X259	26–pole, black	RM–B	Relay module

Pin assignment at connector GM–A X332

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
6	E	Passenger's door contact	Contact in cylinder lock	0–2V		with door open
7	E	Driver's door contact	Contact in cylinder lock	0–2V		with door open
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignment at connector GM–B X253

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	U–batt for electronics	Terminal 30	approx. 12V		
2	E	Ignition	Terminal 15	approx. 12V		
3	E	Terminal R	Terminal R	approx. 12V		
4	E	Starter	Terminal50	approx. 12V		
11	E	Headlights ON	Terminal 58	approx. 12V		
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignment at connector GM–C X254

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
2	A	Relay module interface	RM–B 26	dynamic		
3	A	Relay module interface	RM–B 11	dynamic		
4	A	Relay module interface	RM–B 13	dynamic		
12	A	Interior light relay activation	Interior light relay	0–2V		on activation
26	E	Ground for electronics	Terminal 31	0–2V		

Pin assignment at connector RM–A X258

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
4	E	Ground for electronics	Terminal 31	0–2V		
6	E	U–batt for the electronics of all ZKE modules	Terminal 30	approx. 12V		

Pin assignment at connector RM–B X259

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
6	A	Relay activation load cut–out	Load cut–out relay	0–2V		on activation
11	A	General module interface	GM–C Pin 3	dynamic		
12	E	Ground for electronics	Terminal 31	0–2V		
13	A	General module interface	GM–C Pin 4	dynamic		
19, 20	A	U–batt for general module electronics	GM–B Pin1, GM–A Pin 1	approx. 12V		
25	E	Ground for electronics	Terminal 31	0–2V		
26	A	General module interface	GM–C Pin 2	dynamic		

Adapter

Component	Connector No.	Description	Adapter No.
General module, door module, relay module	X332, X253, X254, X258, X259, X887, X889	26-pole	Cartool 61 4 460 in conjunction with periphery box Cartool 61 1 459

Troubleshooting

Notes

- Troubleshooting with the BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 V
- If all functions of the ZKE are defective, perform troubleshooting in accordance with Section 6100.0 ZKE.

Defect Code Table

♦D♦ Defect code memory:

No defect codes are stored.

Malfunction:

Interior lights defective → Defect code 100

Defect Code 100

Interior lights defective

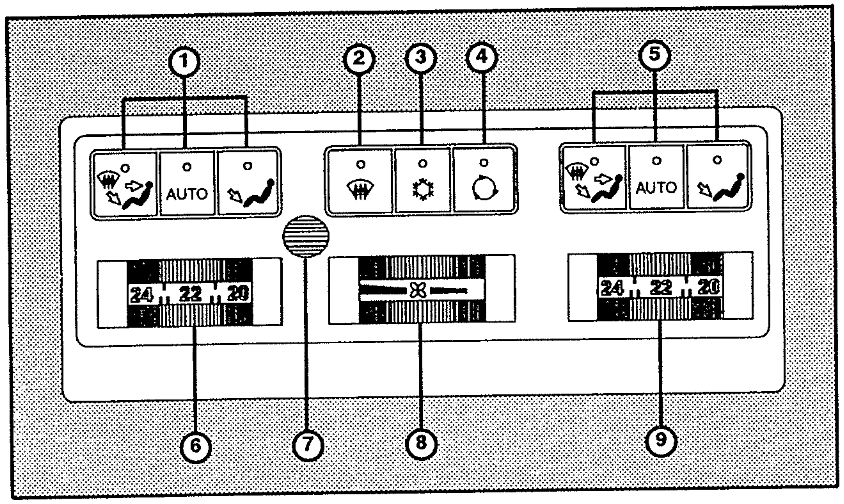
Explanation: General malfunction of the interior light system

Troubleshooting when individual lamps not operating:

- Check lamps and associated wires for defects

Troubleshooting when all lamps not operating:

- Select defect code memory and check whether a general defect code is stored (e.g. power fuse, door module)
- ♦D♦ Perform diagnostic procedure for interior lights.
- The door contacts (microswitch on cylinder lock) and the door handle contacts are checked during ♦D♦ diagnostic procedure for power windows. The automatic window lowering function is also affected in the case of defect.



P31 64 001

1 – Program, air distribution left side

2 – Push button for max. windscreen and side window deicing

3 – Push button for air conditioning system

4 – Push button for circulating air mode

5 – Program, air distribution right side

6 – Temperature control, left side

7 – Interior sensor

8 – Air flow control

9 – Temperature control, right side

Functional Description

The climate control system (IHKA) is a water–based automatic heating and air conditioning system. The control system on the water side is based on two electrically operated water valves in separate heat exchangers on the left and right sides.

The required temperature in the vehicle is controlled by the mixing flaps. The air is mixed ahead of the heat exchangers without being heated in the flow of ventilation air. Temperature control with the mixing flaps is therefore not possible when the ventilation outlet nozzles are closed manually. The control unit performs open–loop and closed–loop functions with the aid of a microcomputer:

- Control of air distribution flaps
- Air flow control
- Interior temperature control
- Cold start interlock
- Rear window defogger control
- Evaporator temperature control
- Auxiliary water pump control
- Defect detection and diagnosis and making available a substitute value for the failed component

All air distribution flaps are set corresponding to the flap program by means of the stepping motors. The left/right Y–value is calculated from the input data (outside temperature, heater temperatures, evaporator temperature, interior temperature, control wheel settings, push button settings etc.) and a corresponding flap program selected.

For safety reasons, the "defrost" flap program is set before the IHKA control unit switches off after approx. 4 minutes "ignition OFF" (defect code memory is cleared).

Control Wheel and Temperature Sensor Function

Air Flow Control Wheel

The IHKA control unit takes up operation when the ignition is switched on. The IHKA can be switched on and the nominal value for the air flow set with the air flow control wheel (exception, defrost program and rear window defogger).

An increase in the set air flow rate by the wind during driving is largely compensated by the fresh air flap closing dependent on the vehicle speed.

The blower is switched off via terminal 50 when starting the vehicle.

A switch is coupled with the air flow control wheel to ensure the blower can take up emergency operation in the case of a defect in the air flow control wheel, failure of the control unit or a defect in the output stage electronics. In the maximum position of the air flow control wheel, this switch switches plus to a relay integrated in the output stage, thus bypassing the output stage electronics.

The switch is not included in the diagnostic procedure for the control unit.

Temperature Control Wheels

The nominal value for the inside temperature is set with the temperature control wheels.

The temperature values printed on the selector wheels of the operating unit do not correspond to the values which are used by the control unit and which can be read out via the status list, but rather to a comfort temperature.

When setting the temperature, the control wheel on the driver's side has priority near the end positions over the control wheel on the passenger's side. When the temperature control wheel on the driver's side is set to maximum, the positive supply to the water valves is interrupted by way of a mechanically coupled switch.

In this position, the control unit interrupts the diagnostic procedure for the water valves which are open when no power is applied.

Relay Outputs

All relays (also water valves) are switched by applying ground to the corresponding output of the control unit. The diagnostic procedure for the control unit only covers the control circuit of the relays.

Cold Start Interlock

In order to avoid unpleasant draughts during the warm–up phase (up to 30 °C heater temperature on driver's side and Y left = 100 %), the blower is switched to minimum, the air distribution flaps to defrost program and the auxiliary water pump is switched to OFF.

The cold start interlock is reset to ON after ignition OFF → ON and heater sensor temperature < 30 °C.

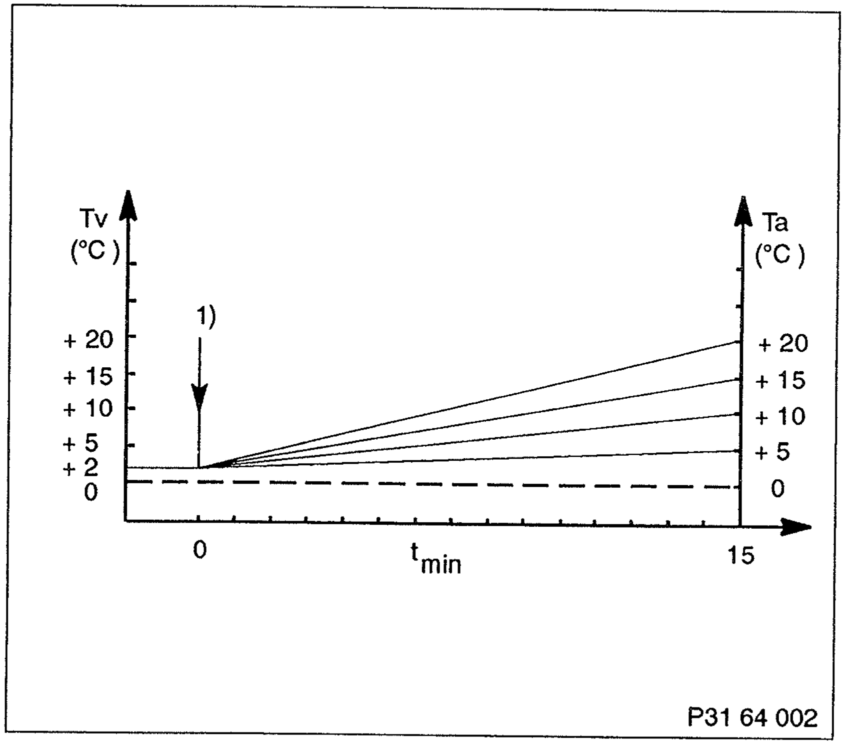
Air Conditioning Control

The A/C compressor and the evaporator control are switched on when the air conditioning or circulating air button is pressed. Parallel to this, the auxiliary fan stage 1 is also switched on and off at the A/C compressor output.

The switching status of the auxiliary fan stage 1 can, however, deviate from that of the A/C compressor since the magnetic clutch can be disconnected from the DME by means of an opener relay (in the working circuit of the A/C compressor relay).

The prerequisite for disengaging the magnetic clutch (for approx. 7 seconds) is detection of the full load signal at the DME at a speed of <8 km/h.

To avoid a drop in the engine speed, a signal which serves to adapt the idle speed is sent to the DME when the air conditioning system is switched on via the DME/EML decoupling relay.



1) A/C compressor OFF or terminal 15 ON (new start)

Tv Evaporator temperature

Ta Outside temperature

To avoid condensation forming on the windows, the evaporator temperature is adapted to the outside temperature after switching off the A/C compressor or after a new start terminal 15.

The control and therefore also the compressor are switched off when the evaporator temperature has reached the value of the outside temperature after approx. 15 minutes.

Evaporator sensor: The magnetic clutch of the A/C compressor disengages from the A/C relay when the evaporator sensor reaches a temperature of <2 °C.

This prevents the evaporator from icing up. At an evaporator sensor temperature of >3 °C, the control unit switches on the A/C relay once again and the magnetic clutch energizes.

Pressure switch: In order to improve the cooling capacity, the auxiliary fan stage 2 is switched on and off depending on the medium pressure switch.

Activation circuit of the A/C compressor clutch goes from the output of the A/C relay (working circuit) to the coolant high pressure switch and via the low pressure switch to the A/C compressor clutch.

When one of the pressure switches cuts out because there is too little or too much pressure in the coolant circuit (no or too little coolant or too much coolant), the A/C compressor clutch disengages in order to prevent the compressor being damaged.

Push buttons

The push buttons are arranged in 4 blocks.

- Air distribution buttons, driver's side
- Air distribution buttons, passenger's side
- Higher–ranking buttons: Defrost, air conditioning, circulating air or circulating air/AUC
- Rear window button

The air distribution buttons are mutually interlocked by mechanical means. The AUTO button is set by the control unit when no button is pressed.

The defrost program is activated by pressing the defrost button. All current programs are interrupted and the function indicator lights (with the exception of the rear window defogger) of the previously selected program go out.

With the exception of the fresh air and defroster flaps, all flaps are closed and the mixing air flap is set to "warm".

The Y–value becomes 100 % (maximum heating capacity) when the outside temperature is >10 °C. The heating is controlled in normal mode (water valves switch in cycles) at an outside temperature >10 °C.

The rear window defogger is additionally switched on automatically when the defrost function is activated for the first time.

The defrost program is switched off again by pressing the defrost button a second time and the automatic climate control system (IHKA) continues to operate with the previously set program.
With the IHKA switched on and the engine running, the rear window button switches on the rear window defogger when pressed for the first time (defrost stage).

The function lights light up and the defrost time runs for 10 minutes.

After the defrost time has elapsed, the function LED goes out and the rear window defogger is switched off for 80 seconds and switched on for 40 seconds.

After 20 minutes modulation (cyclic mode), the rear window defogger switches off automatically. The system is switched to defrost stage if the rear window button is pressed during modulation mode. The rear window defogger is switched off when the button is pressed once again.

The rear window defogger relay is switched off if a voltage terminal 15 <11.8 V is detected at the control unit. The relay switches on once again when the voltage exceeds 12.7 V.

In order to maintain the defrost function, voltage monitoring begins 10 minutes after initial activation of the rear window defogger.

Auxiliary Water Pump

An electrical auxiliary water pump is installed in order to maintain the necessary hot water throughput at low engine speeds.

The auxiliary water pump is switched on when the outlet temperature on one heat exchanger side has exceeded the value of 30 °C after a new start and the control variable YL OR YR is above 30 %.

The auxiliary water pump is switched off when the control variables YL AND YR drop below the value of 25 %.

Independent heating / Independent ventilation

If an independent heating or independent ventilation system is installed, the switch–on time can be entered via the multi–information display (MID). The EKM activates the relays which switch the independent heating or independent ventilation program in the IHKA control unit. At the selected time, the EKM switches on the independent heating at an outside temperature <16 °C and the independent ventilation at an outside temperature >16 °C.

The flaps and the blower are set as follows:

Flaps	Independent heating	Independent ventilation
Defrosting	100 %	0 %
Footwell	100 %	0 %
Mixing	100 %	0 %
Ventilation	0 %	100 %
Fresh air	100 %	100 %
All others	0 %	0 %
Blower	5 V	5 V
Water valves	open	open

100 % = open
0 % = closed

Stepping motors

Stepping motors are installed in order to move the various flaps. The control unit assumes that, after completing the calibration phase, the stepping motors are in a defined position since the stepping motors cannot signal back their position to the control unit.

The calibration phase is triggered when the power supply (terminal 15 and terminal 30) of the control unit was interrupted. The calibration phase is then started after ignition ON.

The corresponding motor is switched off if the control unit detects a stepping motor defect.

It resumes operation when the ignition was switched off for >4 minutes or a calibration run is triggered and the motor is found to be okay.

The stepping motors have an adjustment time of approx. 12 – 16 seconds. An exception to this is the fresh air motor which has an opening time of approx. 12 seconds and a closing time of approx. 2 seconds.

Interior Sensor Blower

The interior sensor blower ventilates the interior sensor. This ventilation prevents overheating of the interior sensor and the control unit operates with the current interior temperature value.

To ensure effective operation, unobstructed air flow through the ventilation grille in the component must be ensured (no dirt build–up).

Notes on the BMW DIAGNOSTIC SYSTEM

The component functions and signals listed before are processed or controlled by the IHKA control unit, however, they are not stored as a defect code in the event of a defect:

- * Speed signal output from EKM
- * All keys in the operating panel, independent heating and independent ventilation of the relay box, diode for right–hand drive coding in the operating unit
- Signal from terminal 30h of the starter solenoid switch
- Voltage supply of function LEDs
- Control of function light for the rear window defogger in the rear window defogger button.
- Blower control voltage to blower motor output stage
- Diagnostic links RxD/TxD to the BMW SERVICE TESTER

Component functions and signals marked with * can be read out in the status list of the BMW SERVICE TESTER.

The IHKA control unit clears the defect code memory when the voltage supply (terminal 30, terminal 15) is interrupted or the ignition was switched off for longer than 4 minutes.

The defective components or functions are stored as defect codes after the ignition is switched on.

The display "defect current" shows that the defect currently exists.

The component or the function is then not used by the control unit. For instance, a relay is no longer activated by the control unit.

If a "defect current" applies to the temperature sensors or control wheels, a substitute value provided by the control unit is used for these components.

The substitute value is replaced by the current value when the defect no longer applies.

The control unit makes an exception as regards defect code detection and storage in the case of the stepping motors.

Here, a defect is only detected after ignition "ON", under the condition that the ignition was switched off for longer than 4 minutes beforehand or the voltage supply was interrupted.

If a stepping motor defect occurs when the IHKA is in operation (ignition "ON"), this defect is not stored in the form of a defect code.

Pin assignments

Pin assignments at IHKA – control unit connector X 610 (white)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1 – 4		Not used				
5	A	Blower output stage activation	Blower output stage	approx. 0 V – 4,3 V	0 – 12 V at blower	
6	A	Decoupling relay activation	DME/EML decoupling relay	approx. 0,8 V approx.12 V	ON OFF	
7	A	Rear window defogger relay activation	Rear window defogger relay	approx. 0,4 V approx.12 V	ON OFF	approx. 12 V only with engine running
8	A	A/C relay/auxiliary fan relay stage 1 activation	A/C relay/auxiliary fan relay stage	approx. 0,8 V approx. 12 V	ON OFF	
9 – 11		Not used				
12 13 25 26	E	Plus terminal 30	Front power distribution box	approx. 12 V		
14 – 17	A	Circulating air flap motor activation	Circulating air flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
18	A	Function light activation	Operating unit	approx. 12 V approx. 0,7 V		Air flow control wheel OFF Air flow control wheel ON

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
19	A	Rear window defogger function light activation	Rear window defogger switch	approx. 12 V approx. 0,7 V		Rear window defogger OFF Rear window defogger ON
20	A	Diagnosis	Diagnostic socket TxD			
21	A	Left water valve activation	Left water valve	Frequency (square–wave voltage)	0% – 100%	at 0% approx. 0 V = at 100% approx. 12 V =
22	A	Auxiliary water pump relay activation	Auxiliary water pump relay	approx. 0,3 V approx.12 V	ON OFF	
23	A	Right water valve activation	Right water valve	Frequency (square–wave voltage)	0% – 100%	at 0% approx. 0 V = at 100% approx. 12 V =
24		Not used				

Pin assignments at IHKA – control unit connector X 611 (green)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1 14 – 16	A	Left footwell flap motor activation	Left footwell flap motor	Frequency (square–wave voltage	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
2 – 5	A	Left mixing air flap motor activation	Left mixing air flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
6 – 9	A	Fresh air flap motor activation	Fresh air flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 24 Ω /winding with flap motor disconnected

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
10 – 13		Not used				
17 – 20	A	Defroster flap motor activation	Defroster flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
21 – 24	A	Left ventilation flap motor activation	Left ventilation flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
25 26		Not used				

Pin assignments at IHKA – control unit connector X 613 (blue)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1 2 14 15	E	Ground	Groundpoint	0 V		
3		Not used				
4	E	Nominal temperature value, left (potentiometer)	Operating unit	approx. 0,7 V – 4,4 V	14°C –34°C	
5	E	Nominal air flow value (potentiometer)	Operating unit	approx. 0,7 V – 4,4 V	OFF – 100%	
6	A	Interior sensor blower (ground)	Operating unit	approx. 0 V		
7	A/E	Outside temperature	Outside temperature senso	approx. 0,5 V – 4,5 V	–50°C – +60°C	approx. 5 V with temperature sensor disconnected

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
8	E	Nominal temperature value, right (potentiometer)	Operating unit	approx. 0,7 V – 4,4 V	14°C –34°C	
9	A/E	Evaporator temperature	Evaporator sensor	approx. 0,5 V – 4,5 V	–40°C – +90°C	approx. 5 V with temperature sensor disconnected
10 11 23 24	A	Plus for stepping motors	Plus connector for stepping motors	approx. 12 V		
12 13 25 26	E	Ignition terminal 15	Blower rela	approx. 12 V		
16	A	Ground for sensor and control wheels	Sensor and control wheels	approx. 0 V		
17	E	Nominal mixing air value	Mixing air control wheel	approx. 0,7 V – 4,4 V	0% – 100%	
18	A/E	Left heater temperature	left heater sensor	approx. 1,5 V – 3,5 V	–30°C – +110°C	approx. 5 V with temperature sensor disconnected
19	E	Starter terminal 50	Solenoid switch	approx. 12 V		
20	A	Plus for control wheels	Control wheels	approx. 5 V		
21	A/E	Inside temperature	Inside temperature sensor	approx. 0,5 V – 4,5 V	–25°C – +100°C	approx. 5 V with temperature sensor disconnected
22	A/E	Right heater temperature	Right heater sensor	approx. 1,5 V – 3,5 V	–30°C – +110°C	approx. 5 V with temperature sensor disconnected

Pin assignments at IHKA – control unit connector X 614 (yellow)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1 – 4	A	Right footwell flap motor activation	Right footwell flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
5	E	Switch for circulating air and air conditioning	Operating unit	Frequency (square–wave voltage)	ON/OFF	
6	E	Switch for rear window, max left, bottom left	Operating unit, rear window switch	Frequency (square–wave voltage)	ON/OFF	
7	E	Switch for defrost, independent heating, independent ventilation	Operating unit, relay box independent heating/independent ventilation	Frequency (square–wave voltage)	ON/OFF	
8	E	Switch for max right, bottom right, right–hand drive coding diode	Operating unit	Frequency (square–wave voltage)	ON/OFF right–hand drive/left–hand drive	
9	E	Speed "A" signal	Electronic body module Frequency	Frequency (square–wave voltage)	0 – 250 km/h	
10	E	Diagnosis	Diagnostic connector RxD			
11	A	Switch for rear window, independent heating, right–hand drive coding diode	Operating unit, rear window switch	Frequency (square–wave voltage)	ON/OFF right–hand drive/left–hand drive	
12	A	Switch for circulating air, max left, max right, independent ventilation	Operating unit	Frequency (square–wave voltage)	ON/OFF	

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
13	A	Switch for air conditioning, bottom left, defrost, bottom right	Operating unit	Frequency (square–wave voltage)	ON/OFF	
14 – 17	A	Right ventilation flap motor activation	Right ventilation flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
18 – 21	A	Right mixing air flap motor activation	Right mixing air flap motor	Frequency (square–wave voltage)	0% – 100%	approx. 84 Ω /winding with flap motor disconnected
22 – 26		Not used				

Pin assignments at IHKA – Bedienteil X 612 (blue)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Function light night circuit	Light switch	approx. 12 V		with light ON
2	A	Switch for max left, bottom left	Control unit connector X 614 Pin 6	Frequency (square–wave voltage)	ON/OFF	
3	E	Switch independent heating, right–hand drive coding diode	Control unit connector X 614 Pin 11	Frequency (square–wave voltage)	ON/OFF right–hand drive/left–hand drive	
4	A	Switch for defrost, independent heating, independent ventilation	Control unit connector X 614 Pin 7	Frequency (square–wave voltage)	ON/OFF	

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
5	E	Switch for circulating air, max left, max right, independent ventilation	Control unit connector X 614 Pin 12	Frequency (square–wave voltage)	ON/OFF	
6	A	Switch for circulating air, air conditioning	Control unit connector X 614 Pin 5	Frequency (square–wave voltage)	ON/OFF	
7	A	Function light, night circuit rear window defogger	Rear window switch	approx. 12 V approx. 2,7 V approx. 2,6 V		Rear window defogger OFF light OFF Rear window defogger ON light OFF Rear window defogger ON light ON
8	A	Switch for max. right, bottom right, right–hand drive coding diode	Control unit connector X 610 Pin 8	Frequency (square–wave voltage)	ON/OFF right–hand drive/left–hand drive	
9	E	AUC switch	AUC control unit Pin 6	Frequency (square–wave voltage)		
10	A	AUC switch	AUC control unit Pin 5	Frequency (square–wave voltage)		
11	E	Terminal 30 for water valves	Connector terminal 30	approx. 12 V		
12	A	Terminal 30 for water valves	Left and right water valves	approx. 12 V		
13	A/E	Interior temperature sensor	Control unit connector X 613 Pin 21	approx. 5 V	–25°C to +100°C	with sensor disconnected
14	E	Plus for control wheels	Control unit connector X 613 Pin 20	approx. 5 V		

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
15	E	Ground for interior temperature sensor and control wheels	Control unit connector X 613 Pin 16	approx. 0 V		
16	E	Function light activation Control unit connector X 610 Pin 18	Control unit connector X 610 Pin 18	approx. 12 V approx. 0,7 V		Air flow control wheel OFF Air flow control wheel ON
17	E	Switch air flow control wheel max	Ignition switch terminal 15	approx. 12 V		
18	E	Terminal 15 for electronics	Connector terminal 15	approx. 12 V		
19	E	Operating unit lighting	Dimmer for instrument light- ing	approx. 2,5 – 12 V		with light ON
20	E	Ground for function and operating unit lighting	Ground point	0 V		
21	A	Nominal temperature value, right	Control unit connector X 613 Pin 8	approx. 0,7 V – 4,4 V	14°C – 34°C	
22	A	Nominal temperature value, left	Control unit connector X 613 Pin 4	approx. 0,7 V – 4,4 V	14°C – 34°C	
23	A	Nominal air flow value	Control unit connector X 613 Pin 5	approx. 0,7 V – 4,4 V	OFF – 100%	
24	E	Switch for air conditioning, bottom left, defrost, bottom right	Control unit connector X 614 Pin 13	Frequency (square–wave voltage)	ON/OFF	
25	A	Switch air flow control wheel max	Blower output stage X 671 Pin 3	approx. 12 V		
26	E	nterior sensor blower (ground)	Control unit connector X 613 Pin 6	approx. 0 V		

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X 610	26–pole, white, top left	Cartool 61 4 460 V–adapter 26–pole Cartool 61 1 459 periphery box
	X 611	26–pole, green, bottom left	Cartool 61 4 460 V–adapter 26–pole Cartool 61 1 459 periphery box
	X 613	26–pole, blue, top right	Cartool 61 4 460 V–adapter 26–pole Cartool 61 1 459 periphery box
	X 614	26–pole, yellow, bottom right	Cartool 61 4 460 V–adapter 26–pole Cartool 61 1 459 periphery box
Operating unit	X 612	26–pole, blue	Cartool 61 4 453 V–adapter 26–pole Cartool 61 1 459 periphery box
Output stage	X 671	5–pole, green	

Troubleshooting

Notes

- Troubleshooting with BMW DIAGNOSE SYSTEM
- Battery charged, U–min > 12 V
- Fuses associated with the IHKA are okay
- The suitable adapter must be used for testing and the IHKA must be connected such that it is fully operable. The control unit stores defect codes when disconnecting components and during testing. The defect codes stored prior to testing must therefore be printed out.
- The inputs and outputs listed in the following are not stored in the defect code memory of the IHKA control unit:
- Inputs (E): Buttons (matrix circuit), terminal 50, terminal 15, terminal 30, vehicle speed signal, diagnostic link RxD
- Outputs (A): LEDs for function lights, blower control voltage, buttons (matrix circuit), diagnostic link TxD

A short to ground or a break is detected at the relay outputs when the relay is not driven. A short to plus can only be detected when the relay is activated.

Table of substitute values

Defective components	Substitute value
Left heater sensor	55 °C
Right heater sensor	55 °C
Outside sensor	0 °C
Evaporator sensor	– 5 °C
Interior sensor	24 °C

Table of substitute values

Defective components	Substitute value
Left temperature control wheel	24 °C
Right temperature control wheel	24 °C
Air flow control wheel	50 %
Mixing air control wheel	50 %

◆D◆ Defect code memory – stored defect codes:

Defect Code No.	Defect location	Connector	Pin
01	Temp. control wheel right	Blue	8
04	Heater sensor, right	Blue	22
07	Evaporator sensor	Blue	9
10	Outside sensor	Blue	7
13	Inside sensor	Blue	21
16	Inside sensor, blower	Blue	6
25	Temp. control wheel left	Blue	4
28	Heater sensor, left	Blue	18
31	Air volume control wheel	Blue	5
34	Mixing control wheel	Blue	16, 17, 20
38	Additional water pump relay	White	22
40	Water valve, left	White	21
44	AC relay extra fan relay	White	8
46	Water valve, right	White	23
47	Decoupling relay DME/EML	White	6
48	Rear window heating relay	White	7
52	Fresh air flap motor	Green	6, 7, 8, 9
55	Circulating air flap motor	White	14, 15, 16, 17
58	Ventilation flap motor left	Green	21, 22, 23, 24
61	Mixing flap motor right	Yellow	18, 19, 20, 21
64	Mixing flap motor left	Green	2, 3, 4, 5
70	Footwell flap motor left	Green	1, 14, 15, 16

73	Footwell flap motor right	Yellow	1, 2, 3, 4
76	Defrosting flap motor	Green	17, 18, 19, 20
79	Ventilation flap motor right	Yellow	14, 15, 16, 17

Defect Code 01

♦D♦ Defect code memory: 01 Temp. control wheel right

Explanation: This defect code is stored when there is a short to ground, to plus or a break at the connector blue Pin 8.

Effect of defect: When the defect is a current defect, a substitute value of 24 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or pc–board of operating unit defective.

Troubleshooting: Check voltage supply (approx. 5 V) of control wheels as well as wires and repair or renew component as required.

Defect Code 04

♦D♦ Defect code memory: 04 Heater sensor, right

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 22.

Effect of defect: If the defect is a current defect, a substitute value of 55 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or right heater sensor defective.

Troubleshooting: Check voltage supply (approx. 5 V with temperature sensor disconnected) as well as wires and repair or renew component as required.

Defect Code 07

♦D♦ Defect code memory: 07 Evaporator sensor

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 9.

Effect of defect: If the defect is a current defect, a substitute value of –5 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or evaporator sensor defective.

Troubleshooting: Check voltage supply (approx. 5 V with temperature sensor disconnected) as well as wires and repair or renew component as required.

Defect Code 10

♦D♦ Defect code memory: 10 Outside sensor

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 7.

Effect of defect: If the defect is a current defect, a substitute value of 0 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or outside sensor defective.

Troubleshooting: Check voltage supply (approx. 5 V with temperature sensor disconnected) as well as wires and repair or renew component as required.

Defect Code 13

♦D♦ Defect code memory: 13 Inside sensor

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 21.

Effect of defect: If the defect is a current defect, a substitute value of 24 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or interior sensor defective.

Troubleshooting: Check voltage supply (approx. 5 V with temperature sensor disconnected) as well as wires and repair or renew component as required.

Defect Code 16

♦D♦ Defect code memory: 16 Inside sensor, blower

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 6.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or interior sensor blower defective.

Troubleshooting: Check wire and repair or renew component as required.

Defect Code 25

♦D♦ Defect code memory: 25 Temp. control wheel left

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 4.

Effect of defect: If the defect is a current defect, a substitute value of 24 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or pc–board of operating unit defective.

Troubleshooting: Check voltage supply (approx. 5 V) of control wheels as well as wires and repair or renew component as required.

Defect Code 28

♦D♦ Defect code memory: 28 Heater sensor, left

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 18.

Effect of defect: If the defect is a current defect, a substitute value of 55 °C is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or left heater sensor defective.

Troubleshooting: Check voltage supply (approx. 5 V with temperature sensor disconnected) as well as wires and repair or renew component as required.

Defect Code 31

♦D♦ Defect code memory: 31 Air volume control wheel

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 5.

Effect of defect: If the defect is a current defect, a substitute value of 50 % is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or pc–board of operating unit defective.

Troubleshooting: Check voltage supply (approx. 5 V) of control wheels as well as wires and repair or renew component as required.

Defect Code 34

♦D♦ Defect code memory: 34 Mixing control wheel

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector blue Pin 17.

Effect of defect: If the defect is a current defect, a substitute value of 50 % is used.

Possible cause: Voltage supply (approx. 5 V) not OK., wire or mixing air control wheel defective.

Troubleshooting: Check voltage supply (approx. 5 V) of control wheels as well as wires and repair or renew component as required.

Defect Code 38

♦D♦ Defect code memory: 38 Additional water pump relay

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector white Pin 22.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or auxiliary water pump relay defective.

Troubleshooting: Check wire and repair or replace component as required.

Defect Code 40

♦D♦ Defect code memory: 40 Water valve, left

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector white Pin 21.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or left water valve defective.

Troubleshooting: Check wire and repair or renew component as required.

Defect Code 44

♦D♦ Defect code memory: 44 AC relay extra fan relay

Explanation: This defect code is stored when there is a short to ground, to plus or a break of both relays at the same time at connector white Pin 8.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or component defective.

Troubleshooting: Check wire and repair or renew component as required.

Defect Code 46

♦D♦ Defect code memory: 46 Water valve, right

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector white Pin 23.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or right water valve defective.

Troubleshooting: Check wire and repair or renew component as required.

Defect Code 47

♦D♦ Defect code memory: 47 Decoupling relay DME/EML

Explanation: This defect code is stored when there is a short to ground, to plus or a break at connector white Pin 6.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or decoupling relay defective.

Troubleshooting: Check wire and repair or replace component as required.

Defect Code 48

♦D♦ Defect code memory: 48 Rear window heating relay

Explanation: This defect code is stored when there is a short to plus at connector white Pin 7.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Wire or rear window defogger relay defective.

Troubleshooting: Check wire and repair or replace component as required.

Defect Code 52

♦D♦ Defect code memory: 52 Fresh air flap motor

Explanation: This defect code is stored when there is a short to plus or a break at connector green Pin 6, 7, 8 or 9.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or fresh air flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 55

♦D♦ Defect code memory: 55 Circulating air flap motor

Explanation: This defect code is stored when there is a short to plus or a break at connector white Pin 14, 15, 16 or 17.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or circulating air flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 58

♦D♦ Defect code memory: 58 Ventilation flap motor left

Explanation: This defect code is stored when there is a short to plus or a break at connector green Pin 21, 22, 23 or 24.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or left ventilation flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 61

♦D♦ Defect code memory: 61 Mixing flap motor right

Explanation: This defect code is stored when there is a short to plus or a break at connector yellow Pin 18, 19, 20 or 21.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or right mixing air flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 64

♦D♦ Defect code memory: 64 Mixing flap motor left

Explanation: This defect code is stored when there is a short to plus or a break at connector green Pin 2, 3, 4 or 5..

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or left mixing air flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 70

♦D♦ Defect code memory: 70 Footwell flap motor left

Explanation: This defect code is stored when there is a short to plus or a break at connector green Pin 1, 14, 15 or 16.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or left footwell flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 73

♦D♦ Defect code memory: 73 Footwell flap motor right

Explanation: This defect code is stored when there is a short to plus or a break at connector yellow Pin 1, 2, 3 or 4.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or right footwell flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 76

♦D♦ Defect code memory: 76 Defrosting flap motor

Explanation: This defect code is stored when there is a short to plus or a break at connector green Pin 17, 18, 19 or 20.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or defroster flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Defect Code 79

♦D♦ Defect code memory: 79 Ventilation flap motor right

Explanation: This defect code is stored when there is a short to plus or a break at connector yellow Pin 14, 15, 16 or 17.

Effect of defect: If the defect is a current defect, the component is no longer activated.

Possible cause: Voltage supply (approx. 12 V) not OK., wire or right ventilation flap motor defective.

Troubleshooting: Check voltage supply (approx. 12 V) as well as wires and repair or replace component as required.

Functional Description

The task of the antitheft system (DWA) in the E 31 is to detect attempts at breaking into, stealing or towing the vehicle to give acoustic and visual warning signals and to prevent the engine from being started by way of a starter blocking feature.

The antitheft system (DWA) is switched on and off (armed/disarmed) via the door locks or the infrared locking system.

The status LED lights after the antitheft system (DWA) has been armed (switched on).

If, at the start of the arming procedure, an element to be monitored is not in its rest position, the status LED flashes (arranged on the centre console next to the automatic or gearshift lever) until the switch/element (trigger) assumes its rest status, after a maximum of 10 seconds (= flash time).

The trigger lockout time is started (approx. 10 seconds) after this time has elapsed. The trigger lockout time prevents unwanted alarms, e.g. by incorrectly closed doors.

No triggers are monitored during this lockout time. After the lockout time has elapsed, all triggers are included in the monitoring, the DWA is armed (switched on).

After the DWA has been armed, the status LED lights continuously for 36 hours. After this period, the LED goes out (power saving), however, the DWA is still armed.

If an alarm is triggered, an acoustic alarm is given (DWA horn) for a duration of approx. 30 s. A visual alarm is also triggered (hazard warning flashers/low beam light depending on country–specific variant).

Note: The DWA is armed and disarmed via the ZKE. The DWA is activated only when the corresponding ZV command is given. The DWA cannot be activated if the central locking system (ZV) is defective.

System Components

The antitheft system includes the following elements:

DWA control unit

Status LED

Alarm horn

Switching elements

Further if equipped with interior protection/tilt alarm generator:

Auxiliary module with glass break sensors (glass break sensors at bottom end of window panes)

Tilt sensor

Scope of Functions

The door locks or the infrared locking system are the operating elements.

Monitored components:

- Lock contacts, driver's and passenger's door
- Rear lid
- Driver's door
- Passenger's door
- Glove compartments
- Rear axle contact (towing the vehicle)
- Radio
- Engine start
- Disconnection/connection of battery
- Front lid

If equipped with interior protection and tilt alarm generator, also monitored:

–Vehicle tilt (towing/lifting)

–Driver's and passenger's window, left and right side windows, rear window (rearscreen)

Locations: Control unit/auxiliary module/tilt sensor

Control unit	: Front right on door sill, near the A–post
Auxiliary module	: Next to DWA control unit
Tilt sensor	: Rear left luggage compartment

Abbreviations

DWA	Antiheft system
EKM	Electronic vehicle module
NG	Tilt sensor
ZM	Auxiliary module
SG	Control unit

Notes on the BMW DIAGNOSTIC SYSTEM

At the start of the program, observe the selection page "with/without auxiliary module and tilt sensor".

Pin Assignments

Pin assignments at connector X 252 (DWA control unit connector 26–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	E	Diagnostic link RXD	Diagnostic connector	–	–	–
2	A	Diagnostic link TXD	Diagnostic connector	–	–	–
3	E	Tilt monitoring	Tilt sensor	Ground	Defect code counter	–
4	E	Window monitoring	Auxiliary module	Ground	Defect code counter	–
5	A	Tilt sensor/auxiliary module control	Tilt sensor/auxiliary module	Ground	Defect code counter	–
6	E	CH country version coding	Coding plug	Ground	–	CH: Plug oppen
7	–	not used	–	–	–	–
8	A	Status–LED	LED	Ground	–	–
9	E	Lock signal ZS1N	General module	12Volt	Status display	–
10	E	Lock signal ZS1	General module	12Volt	Status display	–
11	E	Lock signal ZS21 simulation	Connector terminal ”30”	12Volt	–	–
12	–	not used	–	–	–	–
13	E	Lock signal ZS22 simulation	Connector terminal ”30”	12Volt	–	–
14	–	not used	–	–	–	–
15	E	Lock signal HKS simulation	Connector terminal ”30”	12Volt	–	–
16	E	Passenger’s door contact input	Passenger’s door contact	Ground	Status display	–
17	E	Connection terminal R	Terminal R	12 Volt	Status display	–
18	E	CH country version coding	Coding plug	Ground	–	CH: Plug connected

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
19	E	Position pulse	EKM	Square–wave signal	0–12Volt	–
20	E	Front lid contact input	Front lid contact	Ground	Status display	–
21	E	Driver's door contact input	Driver's door contact	Ground	Status display	–
22	E	Glove compartment contact input	Glove compartment contact	Ground	Status display	–
23	E	Radio contact input	Radio contact	Ground	Status display	–
24	E	Glove compartment contact input	Glove compartment contact	Ground	Status display	–
25	–	not used	–	–	–	–
26	E	Rear lid contact input	Rear lid contact	–	–	–

Pin assignments at connector X 331 (DWA control unit connector 5–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Drive–away protection	DME control unit	12 Volt	–	–
2	E	Ground	Body ground	–	–	–
3	E	Terminal 15	Fuse 17	12 Volt	Status display	–
4	E	Terminal 61E	Battery charge indicator	12 Volt	–	–
5	–	not used	–	–	–	–

Pin assignments at connector X 335 (DWA control unit connector 4–pole)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	A	Alarm horn connection	Alarm horn	12 Volt	Tester display	–
2	A	Terminal 30 for tilt sensor/auxiliary module	Connector NG/ZM	12 Volt	–	–
3	E	EKM connection	EKM	Ground	–	–
4	E	Terminal 30	Connector	12 Volt	–	–

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X 252	26–pole, green	Cartool 6 14 4 60

Troubleshooting

Notes

- Troubleshooting with BMW Diagnostic System
- Battery charged, U–min = 12 Volt
- Note selection page "with/without tilt sensor/auxiliary module"
- DWA control unit fuse (directly on control unit) OK.
- The antitheft system (DWA) is armed and disarmed via the ZKE. The antitheft system (DWA) is only activated when the corresponding ZV command is given. The antitheft system (DWA) cannot be activated if the central locking system (ZV) is defective.

Malfunctions

Malfunctions – defect codes which cannot be stored:

Tilt sensor	: Defect code 1
Auxiliary module (window monitoring)	: Defect code 2
Terminal R	: Defect code 3
Terminal 15	: Defect code 4
Rear lid contact	: Defect code 5
Front lid contact	: Defect code 6
Radio contact	: Defect code 7
Glove compartment contact	: Defect code 8
Rear axle contact	: Defect code 9
Central arrest	: Defect code 10
Status LED	: Defect code 11
Alarm horn mode	: Defect code 12
Door locks	: Defect code 13

Defect Code 1

Malfunction: Tilt sensor (installed ?)

Troubleshooting: If tilt sensor OK., check wire and repair if necessary.

From tilt sensor connector X 296 Pin 1 to DWA control unit connector X 252 Pin 3.

If wire OK., check following wires and repair if necessary:

From tilt sensor connector X 296 Pin 2 to DWA connector X 335 Pin 2 and from X 296 Pin 5 to DWA control unit connector X 252 Pin 5.

If all wires OK. and defect still not rectified, check ground wire of tilt sensor and repair if necessary: From connector X 296 Pin 4 to ground.

Pin assignments at tilt sensor connector X 296

Pin 1: Signal wire from tilt sensor to DWA control unit

Pin 2: Terminal 30

Pin 3: not used

Pin 4: Ground wire (B–)

Pin 5: Control wire from DWA control unit to tilt sensor for arm/disarm commands

Defect Code 2

Malfunction: Auxiliary module (installed ?)

Troubleshooting: If auxiliary module OK., check wire and repair if necessary: From DWA control unit connector X 252 Pin 4 to auxiliary module connector X 301 Pin 15 and from X 301 Pin 14 to connector X 894 (terminal 30) and further to the DWA control unit connector X 335 Pin 2. If defect not rectified, check ground wire and repair if necessary: From auxiliary module connector X 301 Pin 1 and 13 to ground. In case of faults in the window monitoring function, check following wires and repair if necessary:

– Driver's window: From auxiliary module connector X 301 Pin 12 to connector X 936 Pin 2 and further from X 936 Pin 1 to ground.

– Passenger's window: From auxiliary module connector X 301 Pin 25 to connector X 937 Pin 2 and further from X 937 Pin 1 to ground.

– Rear left window: From auxiliary module connector X 301 Pin 11 to connector X 1204 Pin 2 and further from X 1204 Pin 1 to ground.

– Rear right window: From auxiliary module connector X 301 Pin 24 to connector X 1205 Pin 2 and further from X 1205 Pin 1 to ground.

– Rear window (rearscreen): From auxiliary module connector X 301 Pin 26 via connector to rear window.

Pin assignments at auxiliary module connector X 301:

Pin 1:	Ground wire
Pin 2:	Control wire from DWA control unit to auxiliary module for arm/disarm commands
Pin 3 – 10:	not used
Pin 11:	Plug connector, rear left window monitoring
Pin 12	: Plug connector, front left window monitoring
Pin 13	: Ground wire (B–)
Pin 14	: Terminal 30 connection at DWA control unit X 335 Pin 2
Pin 15	: Signal wire auxiliary module to DWA control unit
Pin 16 – 23 :	not used
Pin 24	: Plug connector, rear right window monitoring
Pin 25	: Plug connector, front right window monitoring
Pin 26	: Rear window (rearscreen) monitoring

Defect Code 3

Malfunction: Terminal R

Effect of defect: Screen display, terminal R not detected.

Troubleshooting: Check ignition lock and supply wires and repair if necessary. If ignition lock and supply wire OK., check wire and repair if necessary:

From DWA control unit connector X 252 Pin 17 to terminal R.

Status monitoring (ON/OFF) as displayed on screen.

Defect Code 4

Malfunction: Terminal 15

Effect of defect: Screen display, terminal 15 not detected.

Troubleshooting: Check ignition lock and supply wires and repair if necessary. If ignition lock and supply wire OK., check wire and repair if necessary:

From DWA control unit connector X 331 Pin 3 to fuse No. 17.

Status monitoring (ON/OFF) as displayed on screen.

Defect Code 5

Malfunction: Rear lid contact

Effect of defect: Screen display, closing/opening of rear lid not detected.

Troubleshooting: Check wire and repair if necessary:

From DWA control unit connector X 252 Pin 26 to rear lid contact.

If wire OK., check rear lid contact and replace if necessary.

Status monitoring of rear lid contact (closed/open) as displayed on screen.

Defect Code 6

Malfunction: Front lid contact

Effect of defect: Screen display, closing/opening of front lid not detected.

Troubleshooting: Check wire and repair if necessary:

From DWA control unit connector X 252 Pin 20 to front lid contact connector X 371 Pin 2 and further from X 371 Pin 1 to ground.

If defect is not rectified, check wire from connector X 267 to EKM and repair if necessary.

If wire OK., status monitoring of front lid contact (closed/open) as displayed on screen.

If necessary replace defective front lid contact.

Defect Code 7

Malfunction: Radio contact

Effect of defect: Although radio is installed, the screen display shows "open" for the radio contact.

Troubleshooting: Are radio and radio contact correctly installed?

If installation location and radio contact OK., check wire and repair if necessary.

From DWA control unit connector X 252 Pin 23 to radio contact connector X 539 Pin 2 and further from X 539 Pin 1 to ground.

If defect is not rectified, check wire from connector X 486 to EKM and repair if necessary.

If wire OK., status monitoring of radio contact (open/close) as displayed on screen.

Replace defective radio contact.

Defect Code 8

Malfunction: Glove compartment contact

Effect of defect: Screen display, opening/closing of glove compartment not detected.

Troubleshooting: Check wire and repair if necessary:

From DWA control unit connector X 252 Pin 22/24 to glove compartment contact.

If wire OK., check glove compartment contact and replace if necessary.

Status monitoring of glove compartment monitoring as displayed on screen.

Defect Code 9

Malfunction: Rear axle contact

Effect of defect: Screen display, no response from status display for rear axle contact (turn wheels by hand with rear of vehicle raised).

Troubleshooting: Check rear axle contact and repair if necessary.

If rear axle contact OK., check wire and repair if necessary:

From DWA control unit connector X 252 Pin 19 to EKM connector X 40 Pin 15.

If wire OK. but defect not rectified, continue troubleshooting in the diagnostic program/"EKM" troubleshooting.

Defect Code 10

Malfunction: Central arrest

Troubleshooting: Check wires and repair if necessary.

From DWA control unit connector X 252 Pins 9 and 10 to general module connector X 254 Pins 19 and 20.

If wires OK., continue troubleshooting in accordance with instructions given in diagnostic program/"ZKE" troubleshooting.

Attention: The vehicle can only be locked correctly and the DWA armed when the ignition is switched off and the driver's door opened and closed.

Defect Code 11

Malfunction: Status LED

Effect of defect: Defect during arming/disarming the DWA.

Troubleshooting: Check whether DWA is operable:

Check fuse No. 17 and DWA unit fuse (15 A, directly on control unit).

If fuses OK., check all connections on the DWA control unit (loose contacts, bent pins etc.).

If connections OK., check wire from DWA control unit connector X 252 Pin 8 to LED connector X 514 Pin 4 and repair if necessary.

If defect still not rectified, check wire from LED connector X 415 Pin 1 to terminal 30 (fuse 31).

If defect not rectified, check LED and replace if necessary.

Defect Code 12

Malfunction: Alarm horn mode

Troubleshooting: Coding Switzerland:

Coding plug X 392 connected (acoustic alarm with continuous tone) and coding plug X 395 (visual alarm) open.

Defect Code 13

Malfunction: Door locks

Effect of defect: Defects during arming/disarming of DWA, alarm triggered during arming/disarming.

Troubleshooting: Check mechanics of corresponding door lock.

If door lock OK., check wire and repair if necessary.

From DWA control unit connector X 252 Pins 9/10 to general module connector X 254 Pins 19/20.

If wires OK., and defect not rectified, continue troubleshooting in accordance with instructions provided in diagnostic program/"ZKE" troubleshooting.

Functional Description

The multi–information display (MID) is a display and operating instrument.

On the request of the driver (function keys of the MID), vehicle information (on–board computer information) are transferred from the EKM to the MID and displayed. The driver can also call up information in the MID via the steering drop arm.

In contrast to the E 32/34, this information is not displayed in the instrument cluster.

Differing from the on–board computer installed in the E 32/34, the MID itself does not perform any mathematical calculations.

System Components

20–segment dot matrix display for vehicle information and check control messages

Dot matrix display for time of day/date indication

Service interval display (coloured LEDs)

Keyboard with 11 on–board computer function keys

Switchover button for unit changeover

Acknowledgement button for check control

4 buttons for digit entry and input acknowledgement button (set/reset)

Steering drop arm for remote control

MID Function Displays

The MID contains the following driver information:

Check control

Memory function clock

Clock/date indication

Two average consumption values

Outside temperature with ice warning

Average speed

Distance (distance to destination and expected time of arrival)

Range

Speed limit

Timer (when equipped with independent heating timer, otherwise stop-watch)

Coding function (antitheft: monitoring front lid, radio, drive–away protection)

Diagnostic Procedure

The MID is connected to the instrument bus. The diagnostic procedure of the MID is therefore performed via the EKM.

Special functions of the MID

Similar to the instrument cluster in the E 32/34, the MID displays check control messages.

When a check control message is indicated, the on–board computer functions can be briefly called by the push of a button.

CC messages of lower priority can be cancelled with the CC button integrated in the MID keyboard.

In this case, the two triangles on the left and right of the display act as a reminder that there is a defect and also the "+" sign when more than one message is pending.

Priority "1" defects cannot be acknowledged.

The two triangles flash.The unit of a BC function can be switched over with the km/mls button.

Notes on the BMW DIAGNOSTIC SYSTEM

If defect codes are stored in the defect code memory of the MID, then the defect code memory of the EKM must also be checked. Note information provided in the defect code memory of the MID, troubleshooting also in accordance with instructions provided in the diagnostic program/EKM troubleshooting.

Abbreviations

MID	Multi–information display
SG	Control unit
CC	Check control
EKM	Electronic vehicle module

Pin Assignments

Pin assignments at connector X 501 (18–pole, black)

Pin	Type	Description/function	Connection	Type of signal	Tester display	Measurement notes
1	–	not used	–	–	–	–
2	–	not used	–	–	–	–
3	–	not used	–	–	–	–
4	–	not used	–	–	–	–
5	–	not used	–	–	–	–
6	–	not used	–	–	–	–
7	–	not used	–	–	–	–
8	–	not used	–	–	–	–
9	–	not used	–	–	–	–
10	E	Terminal 30	Fuse F 31	12 Volt	–	–
11	E	Terminal 31	Ground	–	–	–
12	E	Terminal 58g	Inquiry parking light ON/OFF	12 Volt	–	–
13	–	not used	–	–	–	–
14	E	LCD	Control LCD lights	Pulse width–modulated signal	–	–
15	–	not used	–	–	–	–
16	E	Steering drop arm signal	Steering drop arm	Ground	Status display	–
17	E/A	Instrument bus	IBUS link	–	–	–
18	–	not used	–	–	–	–

Adapter

Component	Connector No.	Description	Adapter No.
Control unit	X 501	18–pole, black	Cartool 61 4 470

Troubleshooting

Notes

- Troubleshooting with BMW DIAGNOSTIC SYSTEM
- Battery charged, U–min = 12 Volt
- Removal and installation of control unit only with ignition switched off

Defect Code Table

♦D♦ Defect code memory – defect stored by control unit:

Defect code 1 : Terminal R

Defect code 2 : I–Bus defect

Malfunctions – defects which cannot be stored:

MID not operating	: Defect code 3
Steering drop arm	: Defect code 4
Test functions	: Defect code 5
Emergency disarming code function	: Defect code 6
MID–lights	: Defect code 7

Defect Code 1

♦D♦ Defect code memory: 1 Terminal R

Explanation: The terminal R is only checked as regards plausibility. The information relating to the logic status of the terminal R and 15 is transferred from the EKM via the I–bus to the MID. The defect code 1 is stored when the terminal 15 is ON and the terminal R OFF.

Troubleshooting: Troubleshooting in accordance with information provided in diagnostic program/EKM troubleshooting.

Defect Code 2

♦D♦ Defect code memory: I–Bus defect

Explanation: An open line can be detected; a permanent defect can only be sensed by the EKM (I–bus is blocked in the case of permanent defect) since, in this case, the MID can no longer send its error message.

Troubleshooting: Check I–bus link and repair if necessary. From MID connector X 501 Pin 17 via rear connector I–bus to EKM connector brown Pin 1. If link OK. and defect not rectified, continue troubleshooting with information provided in diagnostic program/EKM troubleshooting.

Defect Code 3

Malfunction: MID not operating

Troubleshooting: Check wire from MID to steering drop arm and repair if necessary. From MID connector X 501 Pin 16 to steering drop arm; if wire OK., check steering spindle and repair if necessary.

Defect Code 4

Malfunction: Steering drop arm

Troubleshooting: Check wire from MID to steering drop arm and repair if necessary. From MID connector X 501 Pin 16 to steering drop arm; if wire OK., check steering spindle and repair if necessary.

Defect Code 5

Test functions

Calling the test functions:

To a large extent, the test functions available provide information on the EKM since the calculations for the on–board computer functions are performed in the EKM. Observe following procedure (follow the sequence of operating steps as indicated):

1. Simultaneously press the numerical keys "10" and "1000". The large MID display shows: TEST–NO.: –

Since the test functions are interlocked to protect them from unauthorized access, this interlock must first be cancelled:

2. With the numerical keys, select the test function "19"; now enter the sum of the month and day numbers of the date set in the MID; e.g. 15.11: Sum = 15 + 11 = 26. The test functions can be accessed after pressing the S/R button. The S/R button must always be pressed after pressing a numerical button.

Attention: The test functions must be interlocked once again on completion of the test.

Interlocking the test functions: Select function "19" and press S/R button: Test functions are interlocked.

The following functions are available:

Enter number "1" : Display test; all elements and LEDs in both displays light up

Enter number "2" : Current consumption 1/100 km

Enter number "3" : Current consumption l/h

Enter number "4" : Average consumption; the expected range is calculated with this value

Enter number "5" : Calculate current range

Enter number "6" : Current tank content

Enter number "7" : Average tank content; used to determine the expected range

Enter number "8" : Current speed km/h

Enter number "9" : Operating voltage terminal "15"

Enter number "10" : Information relating to the MID: ab cd ef gh ij kl

where: ab = Generation number

cd = Hardware number

ef = Software number

gh = Test schedule number diagnosis

ij = Calendar week of manufacture

kl = Year of manufacture

Enter number "11" : Country coding;

Attention: The setting must not be changed!

Enter number "12" : Average speed for expected time of arrival

Enter number "13" : Calculate current time of arrival

Enter number "14" : Date ROM of MID

Enter number "15" : Production diagnosis

Enter number "16" : Production diagnosis

Enter number "17" : Horn mode (intermittent/continuous tone)

Enter number "18" : not used

Enter number "19" : Lock/unlock test functions

Enter number "20" : Keyboard test; a bar appears in the display equivalent to the point at which a key of the MID is pressed. Attention: The keyboard test is exited by ignition off/on.

After leaving the test functions, activate the interlock (see Point 2)

Defect Code 6

Malfunction: MID lights defective

If the CODE number has been forgotten, the function can be disarmed by disconnecting and reconnecting the battery and waiting 15 minutes in ignition switch position "R". A clock running in reverse can be seen in the multi–information display during this waiting period. The correct code can still be entered during the waiting period. Press the CODE button and complete entry within 10 seconds.

Defect Code 7

Malfunction: MID lights defective

Four 1.5 Watt lamps are installed in the unit to provide the MID lighting (after removing the MID, accessible from the top of the unit). Replace defective lamps.