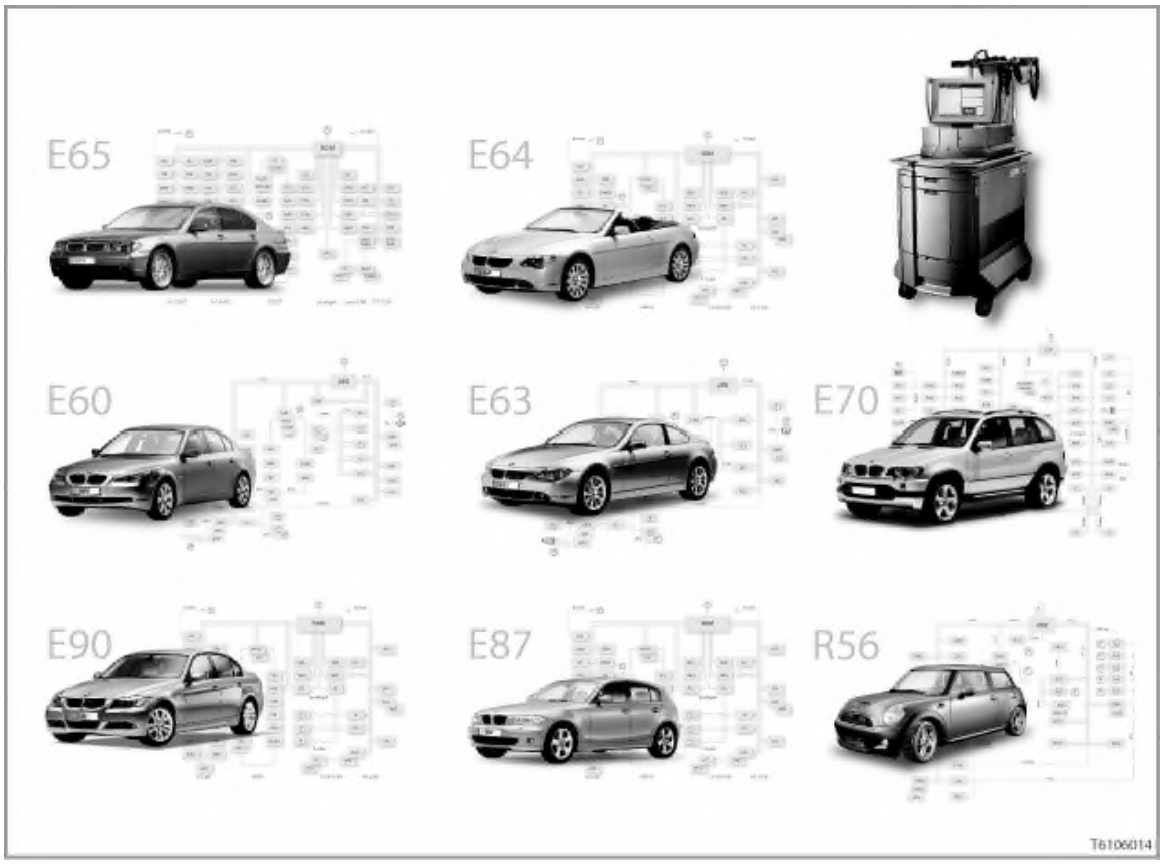
Bus diagnosis

All models from E60



Introduction

In the vehicles of today, components and control units are networked by means of data buses. Data buses are capable of transmitting messages with signals.
The connected control units only read off those messages and signals that are of relevance to their operation.

Most buses are CAN buses (CAN: Controller Area Network). There are several CAN buses with different data transmission rates in each car.
For example, the PT-CAN has a fast data transmission rate, the K-CAN a slower data transmission rate.
A fibre-optic cable is used for navigation and entertainment: the MOST bus (MOST = "Media Oriented System Transport")
There is a separate data wire for diagnosis: the diagnosis wire, also known as the "K-wire".
[for more information, please refer to SI Technology (SBT) 61 03 05 144]

The following options are available for locating faults in data buses and in control units:

- **Test module for CAN bus diagnosis in the BMW diagnosis system:**
  "Bus system analysis"

  The test module is called up in the DIS (Diagnosis and Information System) as follows: "Function selection" button -> Complete vehicle -> Body -> Bus functions -> Bus analysis -> System analysis

- **Checking the terminating resistances:**

  Checking the terminating resistances can also be important for bus diagnosis.

- **Test module for diagnosis on the MOST buses:**
  "MOST system analysis"

  The test module is called up in the DIS (Diagnosis and Information System) as follows: "Function selection" button -> Complete vehicle -> Body -> Bus functions -> MOST functions -> MOST system analysis.

These two test modules and the installation points of the terminating resistances are described in detail below.

Bus system analysis

The bus system analysis narrows down the cause of **intermittently** occurring faults in the area of the data buses and control units.

The test results of bus system analysis state the following possible causes of fault:

- Data bus XY defective
- Gateway XY defective (= interface for data exchange)
- Control unit XY defective

Note: Diagnosis of intermittent faults and permanent faults.

All cases where a data bus or control unit only fails **temporarily** (i.e. intermittently) are difficult for diagnosis. In such cases, the entries in the control units' fault memories do not point unambiguously to an intermittent failure of a particular data bus or control unit.

Intermittent failure of a particular data bus or control unit causes many different fault memory entries in several control units.

If a data bus fails **completely** and **permanently**, the affected control units are no longer available for diagnosis. The fault is thus easy to locate.

Note: Path details for the "bus system analysis" test module

The test module is called up in the DIS (Diagnosis and Information System) as follows:

"Function selection" button -> Complete vehicle -> Body -> Bus functions -> Bus analysis -> System analysis

In order to determine the cause of a system fault in the bus system the following prerequisites have been established:

- If a communication fault occurs in the control units of the bus system, then this communication fault is not shown in the fault memory of the control unit concerned. This also means that no "x" appears before this control unit in the short test.
- The quick-test list contains "real" installed control units and a "virtual" control unit with following names:
  - "CAN/**byteflight** system analysis" on the E65, E66 and on the E60, E61, E63, E64 up to 09/2005
  - "CAN system analysis" on the E70, E81, E87, E90, E91, E92, E93 and R56 and on the E60, E61, E63, E64 from 09/2005

  In this case, "virtual" means that this is not a real control unit but a wild card for all control units on the CAN bus or **byteflight**.
- The short test for this "virtual" control unit reads the communication fault from all control units.
- An "x" in front of this "virtual" control unit indicates that the short test has analysed one of the following faults:
  - Breaks in the wiring in a bus
  - Intermittent fault in control unit or gateway

Functions of bus system analysis

Bus system analysis is a test module that automatically executes the following steps:

Step 1: Identification of engine type

Identifying the engine type is a prerequisite for bus system analysis, since: different engines generate different fault code memory entries for the same cause of fault.

Step 2: Read fault memories of all control units

Step 3: Check fault memory entries for undervoltage

If the vehicle has suffered an undervoltage, the undervoltage is the most likely cause of the bus failure. Bus system analysis checks whether a fault memory entry indicating undervoltage is present in at least 2 control units.

If no undervoltage can be detected, continue with step 4.

Step 4: Check how many fault memory entries were found

If at least 1 fault memory entry is present, continue with step 5.

Step 5: Evaluation of fault memory entries and creation of a list of most probable fault causes

Bus system analysis computes the 3 most probable fault causes.

The 3 most probable fault causes are given in a list.

The most probable fault cause is at the top of the list.

Message in the BMW diagnosis system
The fault causes detected are as follows: [1] ** ** Cause of fault PT-CAN [2] ** Cause of fault ZGM [3] * Cause of fault ... [4] End test module The more stars (maximum 5) are allocated to a component, the more reliable the result that the cause of the fault is to be found in the area of the component.

Note: The number of stars denotes priority.

The stars in front of a cause of fault indicate how probable the cause of fault is. 5 stars denote the most likely cause of fault.
1 star is allocated to a cause of fault that has very low probability.

Step 6: Selection ofthe test module

The BMW diagnosis system proposes a separate test plan for each of the 3 most probable fault causes.

Terminating resistors

The installation locations are listed below for the purposes of measuring the terminating resistor values.

> **R56**

- **F CAN**
  - Vehicles with Dynamic Stability Control (DSC)

    1 resistor is in the DSC control unit
    1 resistor is in the DSC sensor (under the front-passenger seat)
- **PT-CAN**
  - 1 resistor is in the SZL control unit in the version with steering angle sensor (SZL: steering column switch cluster)

    1 resistor is in the EPS control unit (EPS: electro-mechanical power steering)

> **E60, E61, E63, E64**

- **F CAN**
  - Vehicles **with AS** (Active Steering)

    1 resistor is in the cumulative steering-angle sensor in the steering box.

    1 resistor is in the DSC sensor (under the front passenger seat).
  - Vehicles **without AS** (Active Steering)

    1 resistor is in the DSC control unit (DSC: Dynamic Stability Control

1 resistor is in the DSC sensor 2 (under the front-passenger seat; DSC sensor 1 is under the driver's seat).

- **PT-CAN**
  - 1 resistor is in the DSC control unit (DSC: dynamic stability control)
  - 1 resistor is in the SGM control unit (safety and gateway module)

    From 09/2005, this resistor is in the KGM control unit (body-gateway module)

> **E65, E66**

- **PT-CAN**
  - 1 resistor is in the wiring harness at the front on the right spring strut dome.
    This resistor can be disconnected from the PT-CAN.
  - 1 resistor is in the wiring harness under the back seat.

    This resistor cannot be disconnected.

> **E70**

- **F CAN**
  - 1 resistor is in the SZL control unit (SZL: steering column switch cluster)
  - 1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)
- **FlexRay**

  If the vehicle is equipped with option 2VA "Adaptive Drive", the 4 damper satellites are connected to the VDM control unit via the FlexRay data bus.

  This option (special equipment) comprises 2 systems: Vertical dynamics management (VDM) and active roll stabilization (ARS: sales designation "Dynamic Drive").

  A damper satellite is fitted to each shock absorber.
  - Vehicles with "Adaptive Drive"

    1 resistor in each damper satellite of the vertical dynamic management system (VDM)
- **PT-CAN**
  - 1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)
  - 1 resistor is in the EMF control unit (EMF: electromagnetic parking brake)

> **E81, E87, E90, E91, E92, E93**

- **F CAN**

  Different terminating resistors are used depending on the motorisation:
  - Vehicles with engine N4... (basic variant and High equipment)

    1 resistor is in the SZL control unit (SZL: steering column switch cluster)
  - Vehicles with engine M47, M57, N5... (basic variant and High equipment)

    1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)

    1 resistor is in the SZL control unit (SZL: steering column switch cluster)
- **PT-CAN**

  Different terminating resistors are used depending on the motorisation:
  - Vehicles with engine N4... (basic variant and High equipment)

    1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)

    1 resistor is in the JBE control unit (JBE: junction box electronics)
  - Vehicles with engine M47, M57, N5... (basic variant and High equipment)

    1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)

    1 resistor is in the EKP control unit (EKP: controlled fuel pump)

MOST system analysis

The MOST bus has a ring structure. This means that a fault in **one** control unit can have an effect on the entire system. The cause of a system fault (= communication fault) in the MOST network is not readily apparent.

The "MOST system analysis" test module (BMW diagnosis system from DIS CD 36) was developed in order to analyse faults in the communication of MOST control units.
The MOST system analysis has been improved in DIS-CD 38.

Note: Path details for the "MOST system analysis" test module

The test module is called up in the DIS (Diagnosis and Information System) as follows:

"Function selection" button -> Complete vehicle -> Body -> Bus functions -> MOST functions -> MOST system analysis

In order to determine the cause of a system fault in the MOST network, the following prerequisites have been established:

- If a communication fault occurs in MOST control units, then this communication fault is not shown in the fault memory of the control unit concerned. This also means that no "x" appears before this control unit in the short test.
- In addition to the list of "really" fitted control units in the short test, a "virtual" control unit appears called "MOST system analysis".

  In this case, "virtual" means that this is not a real control unit, but a wild card for all MOST control units.
- The short test for the "MOST system analysis" "virtual" control unit reads the communication faults of all the MOST control units.
- An "x" in front of this "MOST system analysis" "virtual" control unit indicates that the short test has analysed one of the following faults:
  - No communication with the following control units:
    > R56

      CCC: Car Communication Computer

      RAD2: radio 2 (Radio Boost)

    > E60, E61, E63, E64

      CCC or M-ASK or CHAMP: Car Communication Computer or multi-audio system controller or Central Head unit And Multimedia Platform

    > E65, E66

      CD: Control display

    > E70

      CCC or M-ASK or CHAMP: Car Communication Computer or multi-audio system controller or Central Head unit And Multimedia Platform

    > E81, E87, E90, E91, E92, E93

      CCC or M-ASK: car communication computer or multi-audio system controller

      RAD2: radio 2 (BMW radio "Professional")
  - MOST ring break
  - Fault in a MOST control unit

Functions of MOST system analysis

The "MOST system analysis" test module follows the following sequence:

Step 1: Read fault code memories of MPM, KGM, PM or JBE

- It first checks whether the communication with the following control units is in order:
  > R56

    JBE: Junction box electronics

> E60, E61, E63, E64 up to 09/2005

MPM: micro-power module

> E60, E61, E63, E64 from 09/2005

KGM: body gateway module

> E65, E66

PM: power module

> E70

JBE: Junction box electronics

> E81, E87, E90, E91, E92, E93

JBE: Junction box electronics

- Then the fault memories are read.

  The following fault code memory entries are read:

  > R56

  JBE: Junction box electronics

  Have the auxiliary consumer units been switched off?

  > E60, E61, E63, E64 up to 09/2005

  MPM: micro-power module

  Have the auxiliary consumer units been switched off?

  > E60, E61, E63, E64 from 09/2005

  KGM: body gateway module

  Have the auxiliary consumer units been switched off?

  > E65, E66

  PM: power module

  Is there a break in the connection from the control units to the battery?

  Is the battery fully discharged?

  > E70

  JBE: Junction box electronics

  Have the auxiliary consumer units been switched off?

  > E81, E87, E90, E91, E92, E93

  JBE: Junction box electronics

  Have the auxiliary consumer units been switched off?

Step 2: Check communication with CD or CCC or CHAMP or M-ASK or RAD2

A check is performed as to whether the communication with the following control units is OK:

> R56

CCC or RAD2: Car Communication Computer or radio 2 (Radio Boost)

> E65, E66

CD: Control display

> E60, E61, E63, E64

CCC or M-ASK or CHAMP: Car Communication Computer or multi-audio system controller or Central Head unit And Multimedia Platform

> E70

CCC or M-ASK or CHAMP: Car Communication Computer or multi-audio system controller or Central Head unit And Multimedia Platform

> E81, E87, E90, E91, E92, E93

RAD2: radio 2 (BMW radio "Professional")

If there is a problem with the communication, the appropriate fault is displayed.
The test module is ended.

If communications with the headset are OK, continue with step 3.
(Headset: In the field of automobiles, the headset is the user interface for systems that are not essential for driving, for example navigation, mobile telephone or radio. Headset is a collective term for various control units, for example CCC, CHAMP, M-ASK, e.g in MOST system analysis).

Step 3: Check MOST ring

Is the MOST ring closed?

If the MOST ring has been interrupted a fault message is displayed. The test module is ended and reference given to the ring interruption diagnosis.

If the MOST ring is closed, continue with step 4.

Step 4: Check MOST configuration

This step checks whether the fault "MOST-Ring: desired/actual configuration do not coincide" is stored.
Depending on the model series concerned, the fault is stored in the following control units:

> R56

CCC: Car Communication Computer

RAD2: radio 2 (Radio Boost)

> E60, E61, E63, E64

CCC or M-ASK or CHAMP: Car Communication Computer or multi-audio system controller or Central Head unit And Multimedia Platform

> E70

CCC or M-ASK or CHAMP: Car Communication Computer or multi-audio system controller or Central Head unit And Multimedia Platform

> E81, E87, E90, E91, E92, E93

CCC or M-ASK: car communication computer or multi-audio system controller

RAD2: radio 2 (BMW radio "Professional")

The test compares the desired configuration of the MOST bus with the actual configuration.

If the actual configuration differs from the desired configuration then the desired configuration for the control units is stored again in the MOST network.

If the desired configuration is stored, continue with the 5th step.

Step 5: Analyse fault memory of the MOST control units

The fault memory entries in all MOST control units are evaluated with regard to communication faults. The evaluation of the fault memory entries present will give the most probable cause of the fault.
At most the 2 most probable causes of the fault (control units) will be given as a result, e.g.:

- CDC CD changer (****)
- TEL Telephone (**)

Evaluation of quality of results:

(*****) stands for high quality (most probable fault)

(*) stands for poor quality

The number of stars varies between one star and five stars.

The necessary procedure is described.

Notes for service staff

- General information: ---

- Diagnosis: ---
- Encoding/programming: ---

Subject to change.