# ibaBM-DPM-S

## Simulation mode and mirror mode


# Manual

Issue 1.0

Measurement and Automation Systems

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The content of this publication has been checked for compliance with the described hardware and software. Nevertheless, deviations cannot be excluded completely so that the full compliance is not guaranteed. However, the information in this publication is updated regularly. Required corrections are contained in the following regulations or can be downloaded on the Internet.

The current version is available for download on our web site http://www.iba-ag.com.

**Protection note**

Windows® is a label and registered trademark of the Microsoft Corporation. Other product and company names mentioned in this manual can be labels or registered trademarks of the corresponding owners.

**Certification**

The device is certified according to the European standards and directives. This device corresponds to the general safety and health requirements. Further international customary standards and directives have been observed.

CE

| Issue | Date | Revision | Chapter | Author | Version HW / FW |
|---|---|---|---|---|---|
| | | | | | |

# Table of contents

# 1 About this manual

This manual is a supplement to the „ibaBM-DPM-S Profibus Sniffer“ manual and describes the use and the operation of ibaBM-DPM-S in simulation and mirror mode.

## 1.1 Target group

This manual addresses in particular the qualified professionals who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded to as professional if he/she is capable of assessing safety and recognizing possible consequences and risks on the basis of his/her specialist training, knowledge and experience and knowledge of the standard regulations.

## 1.2 Notations

The following designations are used in this manual:

| Action | Notations |
|---|---|
| Menu command | Menu „Logic diagram“ |
| Call of menu command | „Step 1 – Step 2 – Step 3 – Step x”<br>Example:<br>Select menu „Logic diagram – Add – New logic diagram” |
| Keys | <Key name><br>Example: <Alt>; <F1> |
| Press keys simultaneously | <Key name> + <Key name><br>Example:<br><Alt> + <Ctrl> |
| Buttons | <Button name><br>Example:<br><OK>; <Cancel> |
| File names, Paths | „File name“, „Path”<br>Example:<br>„Test.doc“ |

## 1.3 Used symbols

If safety instructions or other notes are used in this manual, they mean:

**⚠ DANGER**

The non-observance of this safety information may result in an imminent risk of death or severe injury:

- By an electric shock!
- Due to the improper handling of software products which are coupled to input and output procedures with control function!

**⚠ WARNING**

The non-observance of this safety information may result in a potential risk of death or severe injury!

**⚠ CAUTION**

The non-observance of this safety information may result in a potential risk of injury or material damage!

**Note**

A note specifies special requirements or actions to be observed.

**Important note**

Note if some special features must be observed, for example exceptions from the rule.

**Tip**

Tip or example as a helpful note or insider tip to make the work a little bit easier.

**Other documentation**

Reference to additional documentation or further reading.

# 2 Introduction

**Note**

The following description gives information about the operation of ibaBM-DPM-S in simulation and mirror mode.

The basic handling of ibaBM-DPM-S should be known.

**Other documentation**

For the precise description of the handling of ibaBM-DPM-S please observe the ibaBM-DPM-S manual.

### Simulation mode

The simulation mode is designed to test the software and the configuration of a DP master station, although the Profibus environment is physically not available.

When working in simulation mode ibaBM-DPM-S is able to simulate slaves, which can be addressed by the master, but which are not present at the bus. Any master station (e. g. Simatic S7, ibaLogic with SST card) can be used as master, when it is accordingly configured. The corresponding I/O data of the simulated slaves can be generated by a simulation program (e. g. ibaLogic).

### Mirror mode

The mirror mode is helpful during migration to a new control system (soft revamp). A new DP master system can be tested in parallel to a running master system, which is still in use.

As sniffer ibaBM-DPM-S reads all data of the slaves connected at Profibus interface 1. The data of the slaves are mirrored to the Profibus interface 2, where the second (new) master is connected. All data is available for the second master, just as if it would be the master of the Profibus line. ibaPDA can record the data of both systems, and the user can compare both systems.

Supplementary licenses are needed for the use of simulation and mirror mode. The simulation mode licenses are scaled according to the number of simulated slaves. Please contact the iba support.

# 3 Simulation mode

## 3.1 Requirements

- ❑ ibaBM-DPM-S firmware beginning with version B7.
- ❑ Simulation mode license. The license can be purchased later on and activated via the ibaBM-DPM-S Web interface.
  Order number simulation mode license: 13.321010
- ❑ Simulation PC with TCP/IP connection to ibaBM-DPM-S and any Internet browser e. g. Internet Explorer, Mozilla Firefox.

## 3.2 Simulation mode configuration

All necessary settings are to be done in the ibaBM-DPM-S Web interface, which requires a PC with a TCP/IP connection to ibaBM-DPM-S.

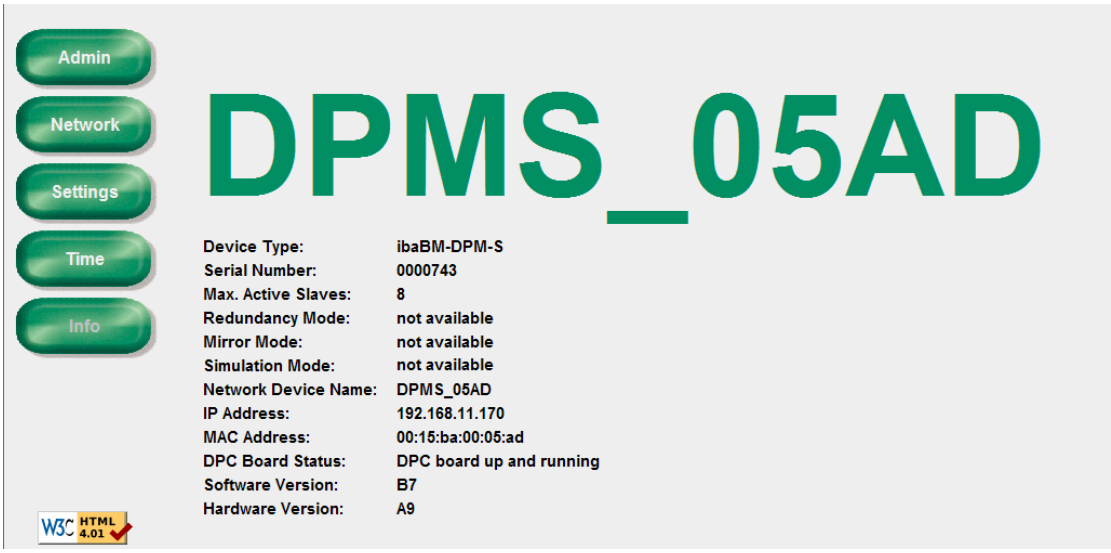
**Other documentation**

How to connect the PC and the device, please observe the "ibaBM-DPM-S" manual.

**Tip**

Basically the USB interface can also be used for simulation. But iba highly recommends the TCP/IP connection via Ethernet in order to minimize the reaction times of the slaves.

After having opened the website, the modes available on the device are displayed on the “Info” page.




When simulation mode is not available, it has to be activated. You will receive the necessary license key by E-Mail after purchasing at iba.

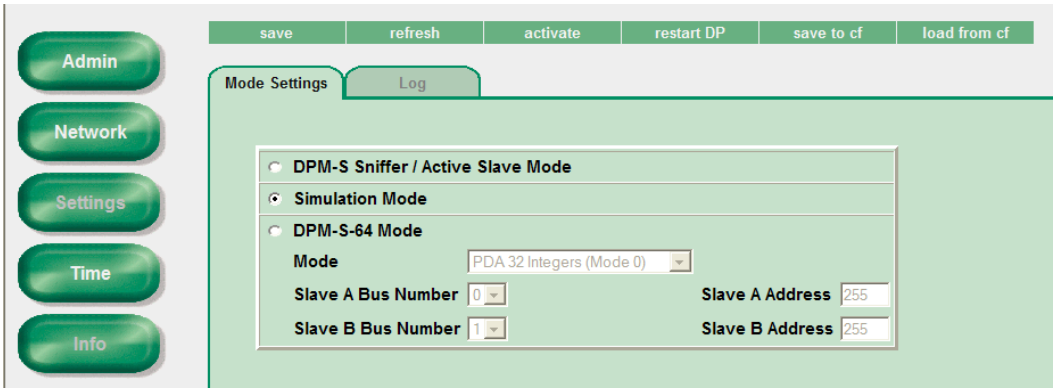
**Enter the license key:**

1. Login as user „admin“ on the „Admin“ page.
2. Enter the license key under „Activate simulation, mirror or redundancy mode“ in the fields „Key 1“ and „Key 2“. Click on <submit> to release the desired mode.


3. Check the result on the „Info“ page. When simulation mode is available, reboot the device (switch off and on), then it can work in simulation mode.


**Activate simulation mode:**

4. The simulation mode is available on the “Settings” page in the “Mode Settings” tab. Select this option and click on <activate> in the green menu bar.

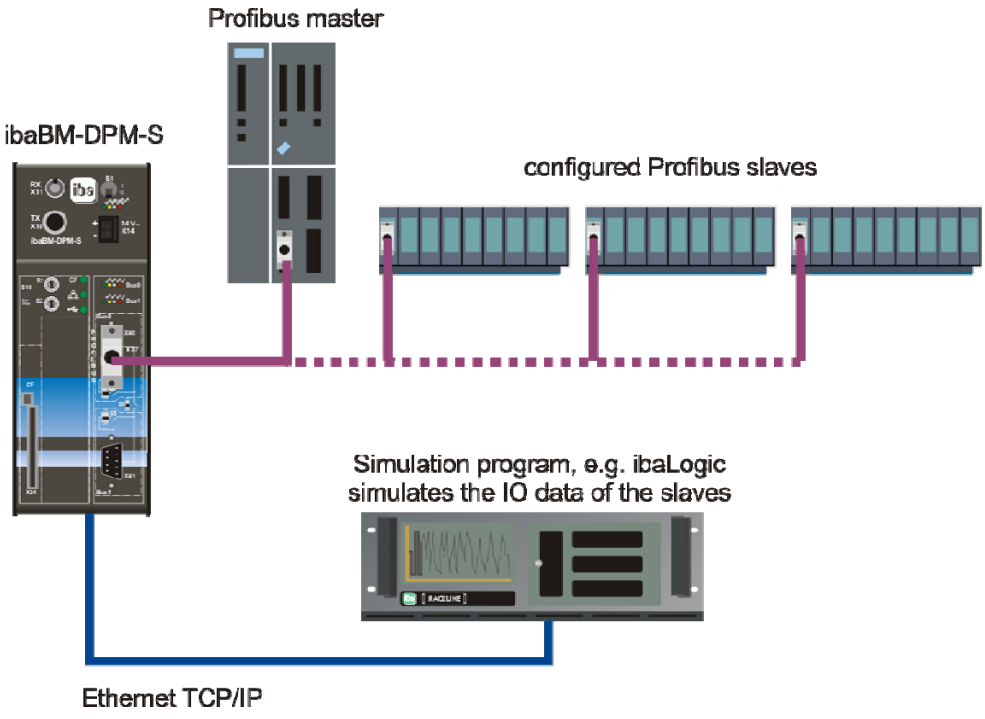



5. A click on <restart DP> reboots the device and simulation mode is active then.

**Note**

Previously configured active slaves are ignored in simulation mode.

## 3.3 System integration




ibaBM-DPM-S in simulation mode

The ibaBM-DPM-S device is connected to the Profibus. The configured Profibus slaves, which are not physically present at the bus, are simulated by the connected ibaBM-DPM-S. The data, sent by the master to these slaves, is sent to the simulation program via the TCP/IP interface. The simulation program simulates the data, the master wants to read from the slaves, and send it to ibaBM-DPM-S via TCP/IP.

It is also possible to combine real slaves with slaves that are not physically present.

### 3.3.1 Proceeding

1. Configure the Profibus master and start it, even when not all configured slaves are connected.
2. Connect the ibaBM-DPM-S device to the Profibus. Pay attention to the correct bus termination (via S4 or S5 switch or at the connector) and set the S6 switch to “OFF”.
3. Switch on ibaBM-DPM-S.
   While booting the device performs a baud rate detection. Then ibaBM-DPM-S searches “missing” slaves. These are all slaves, which are requested by the Profibus master, but are not present at the bus. These slaves are simulated by ibaBM-DPM-S, i.e. they are set-up as active slaves in ibaBM-DPM-S.
   This procedure is logged and can be read in the Web interface on the “Settings” page in the “Log” tab.

**Important note**

Switch on the device only, when the interface Bus0 is connected to the master, because the missing slaves are only detected while the device is booting.

**Important note**

The switch position S6=ON at ibaBM-DPM-S is not allowed (connecting the interfaces Bus0 and Bus1) and causes a bus error.

4. Now, all bus error indications at the Profibus master should disappear. Since ibaBM-DPM-S simulates the missing slaves, the Profibus master detects the configured slaves.
5. Start the simulation program and establish TCP/IP connection to ibaBM-DPM-S. The following settings apply to the TCP/IP connection:
   - The simulation program is the „active“ communication partner. Here you have to adjust the IP address (or name) and the port number of ibaBM-DPM-S. You find the IP address on the „Info“ webpage, the port number is „999“.
   - You can define a send and a receive telegram for each slave that should be simulated. The receive telegram contains the data, the master sends to the slave. Within the send telegram you can simulate the data, the slave sends to the master. The telegram structures are explained in chapter 3.4.2.

### 3.3.2 Boundary conditions

- ❑ Only when ibaBM-DPM-S is booting, the device scans the Profibus configuration. Subsequent changes of the configuration like adding or removing slaves or changing the baud rate, are not detected by ibaBM-DPM-S. Changes are accepted only after a restart (via Web interface or by switching off and on).
- ❑ Any number of slaves can be simulated. The limitation to 8 or 16 slaves does not apply to simulation mode.
- ❑ The switch position S6=ON at ibaBM-DPM-S is not allowed (connecting the interfaces Bus0 and Bus1) and causes a bus error.
- ❑ Although the FO interface of ibaBM-DPM-S is set to 32 MBit, no data telegrams are transmitted. The data is transferred only via TCP/IP between the simulation program and ibaBM-DPM-S.
- ❑ If ibaPDA is available, you can use it for diagnostic purposes.
  Requirements:
  - One free link on an ibaFOB-X or ibaFOB-D card,
  - A network connection between ibaPDA computer and ibaBM-DPM-S.

  Add an ibaBM-DPM-S module at the free ibaFOB link and enter the IP address or the name of the ibaBM-DPM-S device in the “General” tab. Then you can see the status of the slave in the “Profibus browser” tab as well as the output data and the simulated input data.

## 3.4 TCP/IP protocol

### 3.4.1 Telegram data transfer

Slave data is transferred to ibaBM-DPM-S via TCP/IP at port 999.

The telegrams **sent to ibaBM-DPM-S** are referred to as **request** in this manual, the telegrams **sent from ibaBM-DPM-S** as **response**.

The input data for a slave is sent to ibaBM-DPM-S with a request telegram. ibaBM-DPM-S takes all data and returns the output data of this slave with a response telegram.

The request telegrams are processed sequentially, i.e. it is not necessary to wait for a response after a request, before sending further requests.

Possible procedures:

**Procedure 1 (synchronous)**

| | | |
|---|---|---|
| Request 1 | → | |
| | ← | Response 1 |
| Request 2 | → | |
| | ← | Response 2 |
| | : | |
| Request X | → | |
| | ← | Response X |

**Procedure 2 (asynchronous)**

| | | |
|---|---|---|
| Request 1 | → | |
| Request 2 | → | |
| Request 3 | → | |
| | ← | Response 1 |
| | ← | Response 2 |
| Request 4 | → | |
| | ← | Response 3 |
| | ← | Response 4 |
| | : | |
| Request X | → | |
| | ← | Response (X-1) |
| | ← | Response X |

### 3.4.2 Telegram structure

The layout of the exchange request telegram corresponds identically to the response telegram and is shown in the table below. All 2/4 Byte fields are formatted as Little Endian (“Intel”).

| | | | | |
|---|---|---|---|---|
| 2 | 2 | fc | 7 | Exchange telegram identifier |
| 4 | 2 | length | 272 | Telegram length |
| 6 | 2 | reserved | 0 | |
| 8 | 4 | success | | **Response only:** error messages, see below |
| 12 | 1 | bus | 0..1 | Bus number, ibaBM-DPM-S interface |
| 13 | 1 | slave | 1..126 | Slave number |
| 14 | 1 | dummy1 | 0 | |
| 15 | 1 | dummy2 | 0 | |
| **16** | **244** | **Data** | **-** | **Slave I/O data.**<br>**- Request: input data (from DP Master's view)**<br>**- Response: output data (from DP Master's view)** |
| 260 | 1 | DataSize | 0..244 | **Response only:** actual user data length in the data field |
| 261 | 3 | Service1 | 0 | not used |
| 264 | 1 | MasterNr | - | **Response only:** Profibus address of the master, which wrote the output data into the slave |
| 265 | 1 | Service2 | 0 | not used |
| 266 | 6 | Timestamp | 0 | **Response only:** 48 Bits counter 33 ticks per 1 µs |

**Field "Success":**

| Value | Description |
|---|---|
| 1 | without error |
| -3 | Bus number is wrong |
| -5 | Slave number is wrong |
| -7 | Simulation mode is not available |

## 3.5 Example

A S7-400 is used as Profibus master station and ibaLogic-V4 as simulation program.

S7-project: "S7-DPMS-Mirror-Simulation_2012_0731.zip".
ibaLogic-project: "DPMS_Mirror_Simulation_2012_0731.zip"

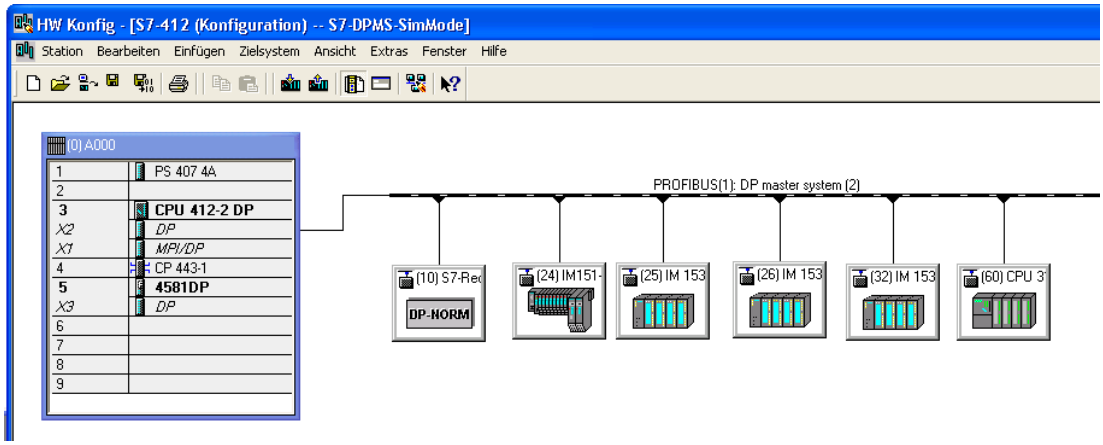
You'll find the S7-project and the ibaLogic-project on the CD included in delivery.

### 3.5.1 S7-project "S7-412 simulation"

#### Profibus configuration

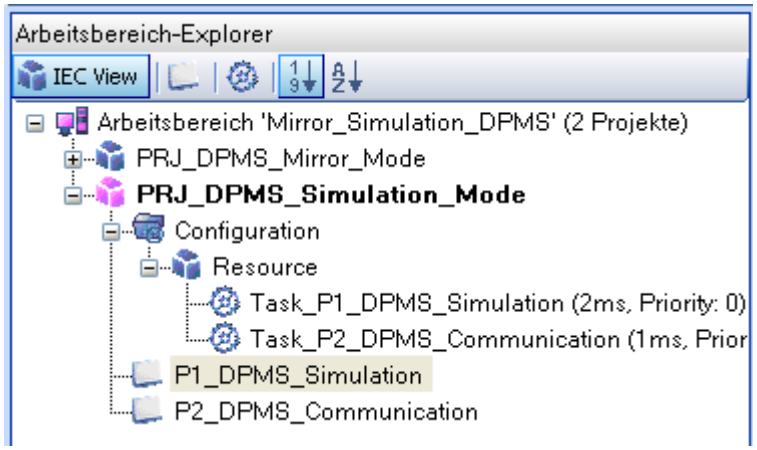
| Slave | Type | Inputs *) | Outputs *) | ibaLogic Data structure |
|---|---|---|---|---|
| 10 | S7-Request | - | 244 Byte | - |
| 24 | ET200S | 9 Byte | 9 Byte | STR_24 |
| 25 | IM153-2 | 17 Byte | 5 Byte | STR_25_OUT / ...IN *) |
| 26 | IM153-2 | 17 Byte | 5 Byte | STR_25_OUT / ...IN *) |
| 32 | IM153-1 | 9 Byte | 5 Byte | STR_32_OUT / ...IN *) |
| 60 | CPU-314C | 33 Byte | 33 Byte | STR_60 |

*) Please note: Inputs/Outputs are from DP-Master's view,
but STR_xx_IN /..._OUT are from ibaLogic's view, that means vice versa.




### 3.5.2 Simulation program (ibaLogic-V4)

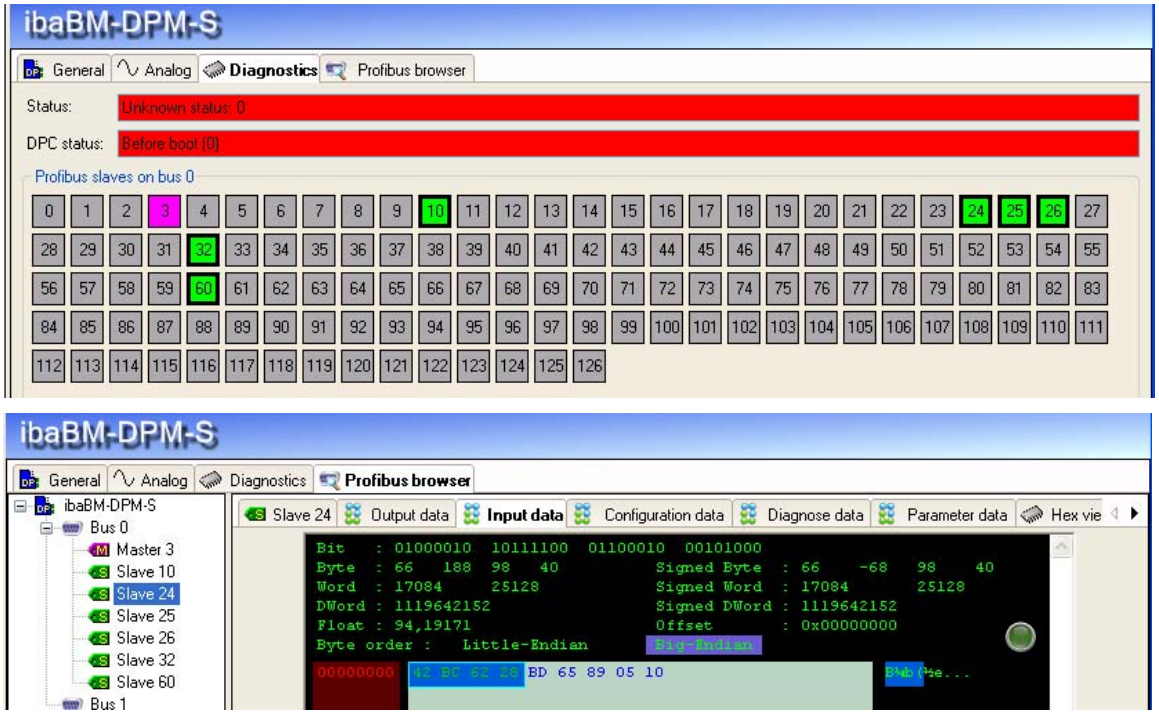
The ibaLogic-project contains two programs:



- P1_DPMS_Simulation:
  The data is evaluated by the DP master and the response data to the master is generated. The data is exchanged with the 2nd program as arrays with 244 Bytes. The following tasks are carried out:
  - Definition of the slaves to be simulated
  - Converting the input data (arrays) into the slave-specific data structures (see table above).
  - Processing the received values and generating the data to be sent (simulation)
  - Collecting and converting the data structure to be sent into the 224 Byte arrays for data transfer
- P2_DPMS_Communication:
  The TCP/IP communication with ibaBM-DPM-S is handled here. The user data is processed sequentially, i.e. the headers are added and the data are sent sequentially to ibaBM-DPM-S via TCP/IP. The following tasks are carried out:
  - Process control of sending and receiving TCP/IP telegrams
  - Selection of output data per slave
  - Calling the macro “transmit/receive”.
    The macro adds the headers before sending, and evaluates and removes them after the reception.
  - The receive telegram is copied into the slave specific data array.

### 3.5.3 Diagnostics with ibaPDA, ibaBM-DPM-S in simulation mode

You can see in ibaPDA, whether all slaves are simulated and whether input data are generated by the simulation program.



# 4 Mirror mode

When using ibaBM-DPM-S in mirror mode, it is possible to connect a new control system in parallel to a Profibus which is still in operation. The data of the slaves at the active Profibus are captured by ibaBM-DPM-S and mirrored to the second Profibus interface. There, the data are available for the new control system, as if it were the Profibus master.

## 4.1 Requirements

- ibaBM-DPM-S firmware beginning with version B7.
- License for mirror mode. The license can be purchased later on and activated via the ibaBM-DPM-S Web interface.
  Order number mirror mode license: 13.321030
- For monitoring:
  A computer with ibaPDA software (beginning with V6.20) and an ibaFOB card of ibaFOB-X or ibaFOB-D type or an ibaFOB-io-ExpressCard (for notebooks).
  A fiber optic connection (simplex) and a TCP/IP connection to the ibaBM-DPM-S device.

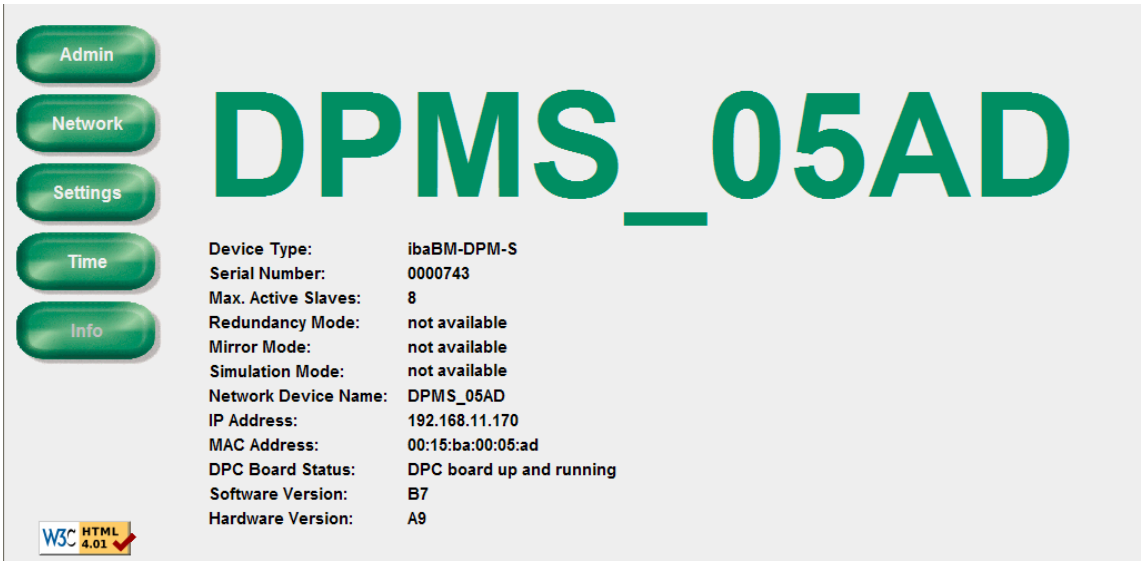
## 4.2 Mirror mode configuration

All necessary settings are to be done in the ibaBM-DPM-S Web interface, which requires a PC with a TCP/IP connection to ibaBM-DPM-S.

**Other documentation**

How to connect the PC and the device, please observe the "ibaBM-DPM-S" manual.

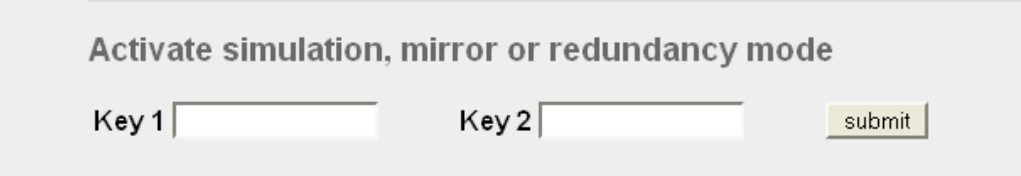
After having opened the website, the modes available on the device are displayed on the “Info” page.



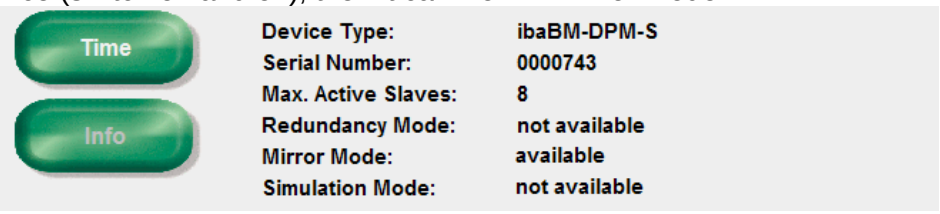

When mirror mode is not available, it has to be activated. You will receive the necessary license key by E-Mail after purchasing at iba.

**Enter the license key:**

1. Login as user „admin“ on the „Admin“ page.
2. Enter the license key under „Activate simulation, mirror or redundancy mode“ in the fields „Key 1“ and „Key 2“. Click on <submit> to release the desired mode.

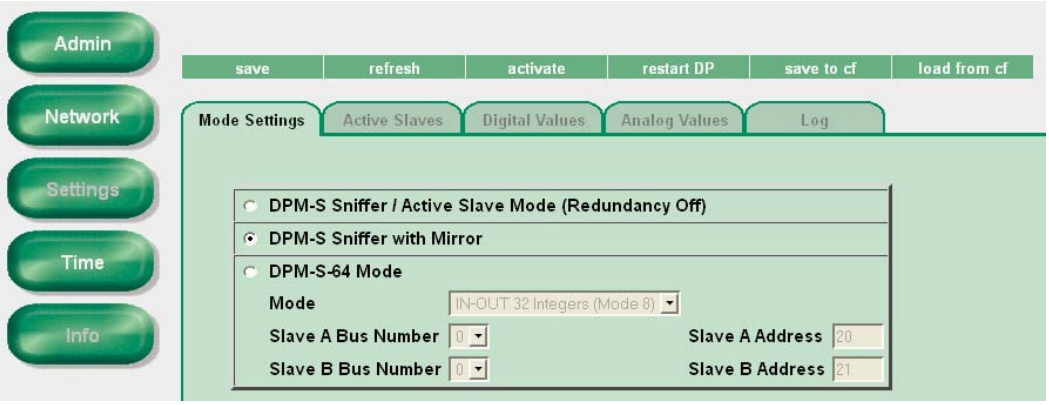



3. Check the result on the „Info“ page. When mirror mode is available, reboot the device (switch off and on), then it can work in mirror mode.




**Activate mirror mode:**

4. The mirror mode is available on the “Settings” page in the “Mode Settings” tab. Select the option "DPM-S Sniffer with Mirror" and click on <activate> in the green menu bar.

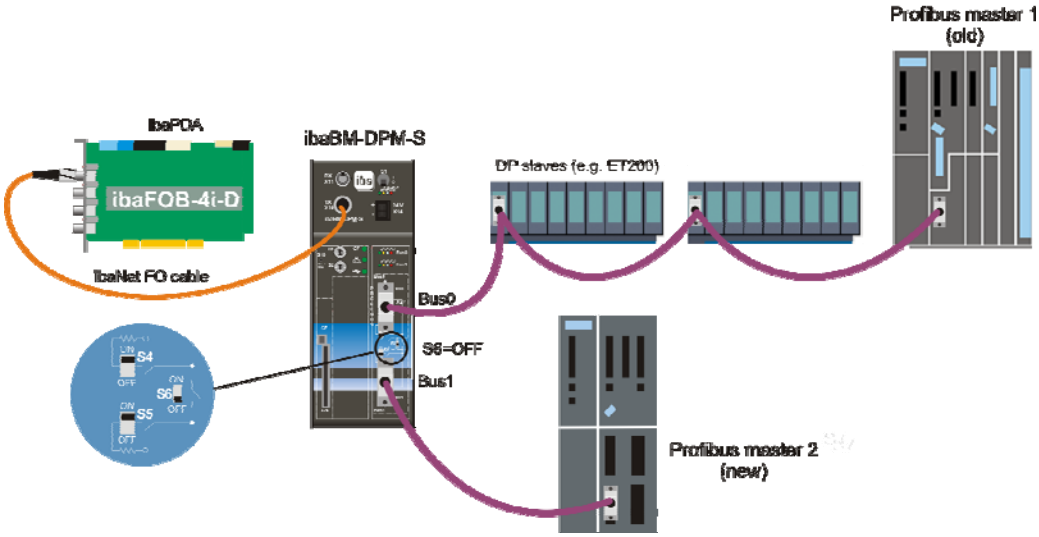



5. A click on <restart DP> reboots the device and mirror mode is active then.

**Note**

Previously configured active slaves are ignored in mirror mode.

## 4.3 System integration




ibaBM-DPM-S in mirror mode

Bus0 of ibaBM-DPM-S is connected to the existing Profibus system with master 1. The new Profibus master 2 is connected to the Bus1 interface with the same DP configuration. During mirror mode operation, all data from the slaves are copied from the Bus0 interface to the Bus1 interface. Hence, the data of the slaves are also available for the new Profibus master.

### 4.3.1 Proceeding

1. Configure the Profibus master 2 with the same configuration, which is already running on Profibus master 1. Start Profibus master 2, even if not all configured slaves are connected.
2. Connect ibaBM-DPM-S via Bus0 interface to the existing Profibus. Pay attention to the correct bus termination (via S4 switch or at the connector) and set the S6 switch to “OFF”.
3. Connect ibaBM-DPM-S via Bus1 interface to the Profibus master 2. Since ibaBM-DPM-S is the only slave, the bus must be terminated on both sides.
4. Switch on the device.
   While booting the device performs a baud rate detection. Then, ibaBM-DPM-S searches for slaves at the Bus0 interface and reads their configuration (station number, data length). These slaves are set up with the same configuration at Bus1 interface as active slaves. The connection of these slaves is established with the connected Profibus master 2 via Bus 1. Now mirror mode is active.
   This procedure is logged and can be read in the Web interface on the “Settings” page in the “Log” tab.
5. In order to compare the operation of both Profibus masters you can connect an ibaPDA system.
   Connect ibaBM-DPM-S to the ibaPDA computer via fiber optics and TCP/IP. Add an ibaBM-DPM-S module in the I/O Manager at the appropriate link and enter the IP address or the name of the ibaBM-DPM-S device (or use auto-detection).
   In the diagnostics tab you see now the existing slaves at Bus0 and the mirrored slaves at Bus1. Using the sniffer function you can record the values from the Profibus telegrams of both masters and compare them.

### 4.3.2 Boundary conditions

- ❑ Only while ibaBM-DPM-S is booting, the device scans the Profibus configuration. Subsequent changes of the configuration like adding or removing slaves or changing the baud rate, are not detected by ibaBM-DPM-S. Changes are accepted only after a restart (via Web interface or by switching off and on).
- ❑ Any number of slaves can be mirrored. The limitation to 8 or 16 active slaves does not apply for mirror mode.
- ❑ The switch position S6=ON at ibaBM-DPM-S (connecting the interfaces Bus0 and Bus1) is not allowed.
- ❑ Use ibaPDA for diagnostic purposes and to compare the data.

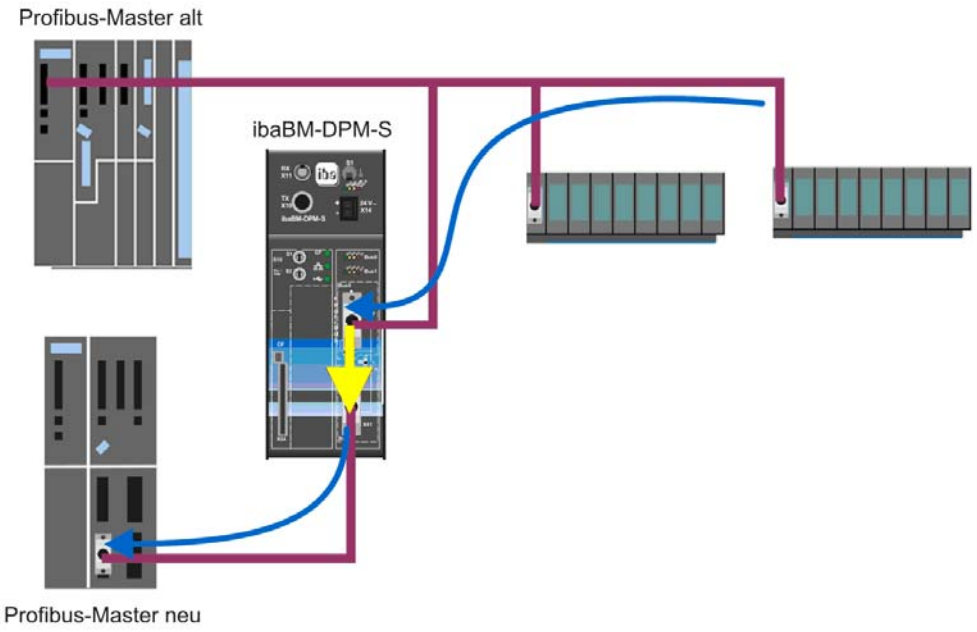
### 4.3.3 Time behavior

The time cycles in the Profibus lines 0 and 1 are not synchronous. In worst case these cycle times add up plus 1 ms for mirroring.

This has only an effect in parallel operation. In order to minimze the delay, you can decrease the cycle time for the second cycle in parallel operation.

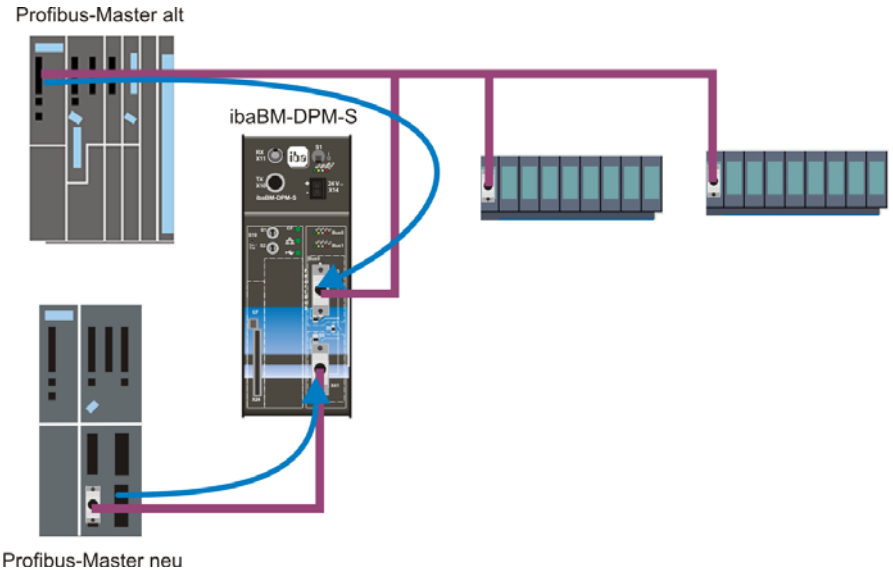
## 4.4 Comparing both master systems

The **input data** (data from the slaves) are read by ibaBM-DPM-S at Bus 0 and copied to Bus 1. The data is available for both master systems.




The data from the slaves are mirrored to the new master

The **output data** of both master systems (old and new) are captured by ibaBM-DPM-S independent from each other. The data of the old master (Bus0) and the data of the new master (Bus1) can now be compared in ibaPDA.




The data of both masters are captured by ibaBM-DPM-S, but not mirrored.

## 4.5 Example

A S7-400 is used as Profibus master 1 and ibaLogic-V4 as Profibus master 2. At the same time two slaves are simulated by a second ibaBM-DPM-S device and ibaLogic.

S7-project: "S7-DPMS-Mirror-Simulation_2012_0731.zip".
ibaLogic-project: "DPMS_Mirror_Simulation_2012_0731.zip"
ibaPDA- project: "ibaPDA_DPMS_Mirror_Simulation_2012_0731.zip"

You'll find the projects on the CD included in delivery.

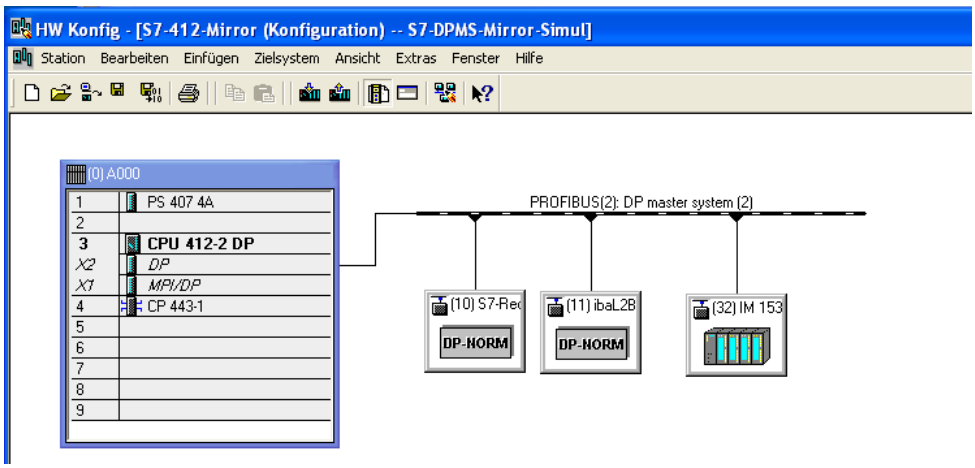
### 4.5.1 S7-project "S7-412-Mirror"

The complete receive telegram of slave 11 is mirrored to the output of slave 11 in the program and the analog input AI_00 of slave 32 is mirrored to the output AO_00.

**Profibus configuration**

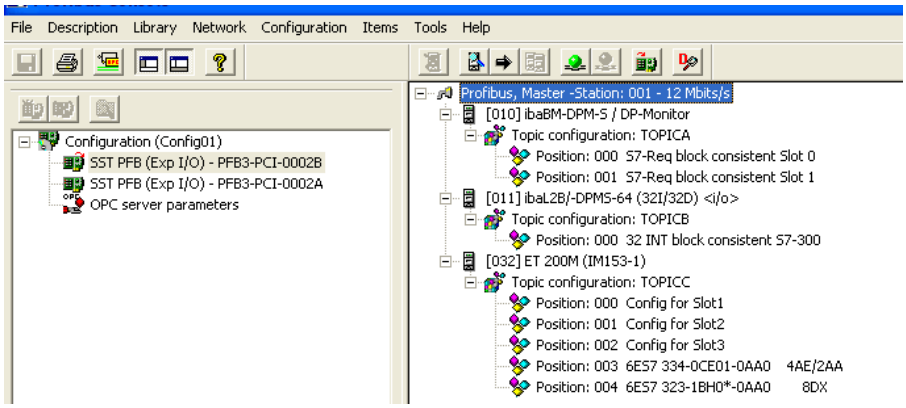
| Slave | Type | Inputs *) | Outputs *) | ibaLogic Data structure |
|---|---|---|---|---|
| 10 | S7-Request | - | 244 Byte | - |
| 11 | coupling | 76 Byte | 76 Bytes | Str_S11 |
| 32 | IM 153-1 | 9 Byte | 5 Byte | Str_S32_OUT / Str_S32_IN *) |

*) Note: Inputs/Outputs are from DP master's view,
but Strxx_IN /…_OUT are from ibaLogic's view, that means vice versa.



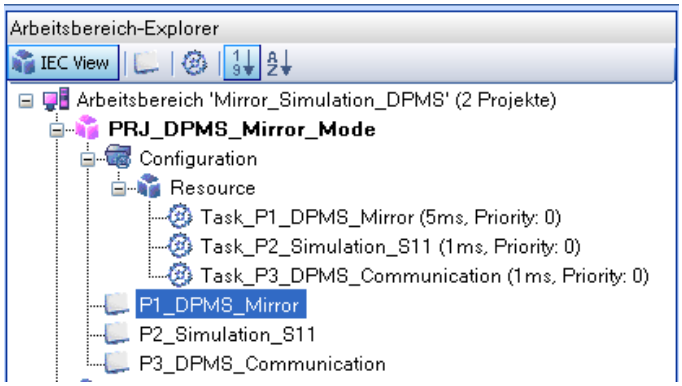
### 4.5.2 Profibus configuration ibaLogic / SST

The Profibus master card SST-PFB3-PCI is integrated in ibaLogic. The configuration is done with PROFIBUS CONSOLE, the resulting binary file DPMS_M.bss will be imported with ibaLogic I/O-Configurator and loaded onto the card.




### 4.5.3 Simulation program (ibaLogic-V4)

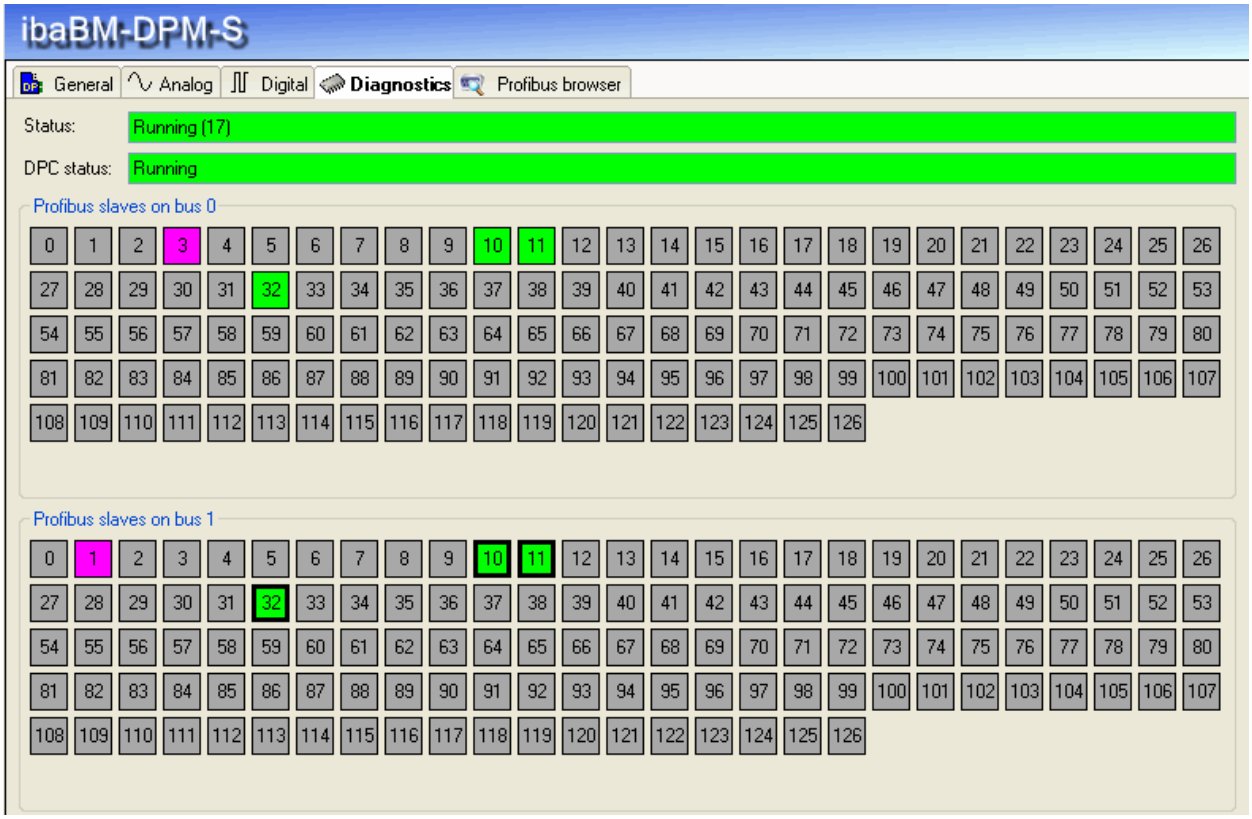
The ibaLogic-project contains three programs:




- P1_DPMS_Mirror:
  The Profibus input and output channels are processed in the same way as the S7-program.
  - Reception of the Profibus telegrams from the slaves which are actually connected to master 1 (Bus 0), but which are copied to Bus 1 in ibaBM-DPM-S.
  - Assignment of the slave specific data structures and swapping the byte sequence, since E200 and S7 are working in Big Endian, but ibaLogic works in Little Endian.
  - Evaluation of the receive data, and generating the send data are as response (program simulation of DP master 1).
  - Collecting and swapping the data structures to be sent.
  - Sending Profibus telegrams to the slaves, which are actually connected to master 1 (Bus 0), but which are simulated in ibaBM-DPM-S (Bus 1).
- P2_Simulation_S11 and P3_DPMS_Communication:
  Independent from the mirror function, the slaves 10 and 11 are simulated by a second ibaBM-DPM-S device. This is done by these two programs, see description in chapter 3.

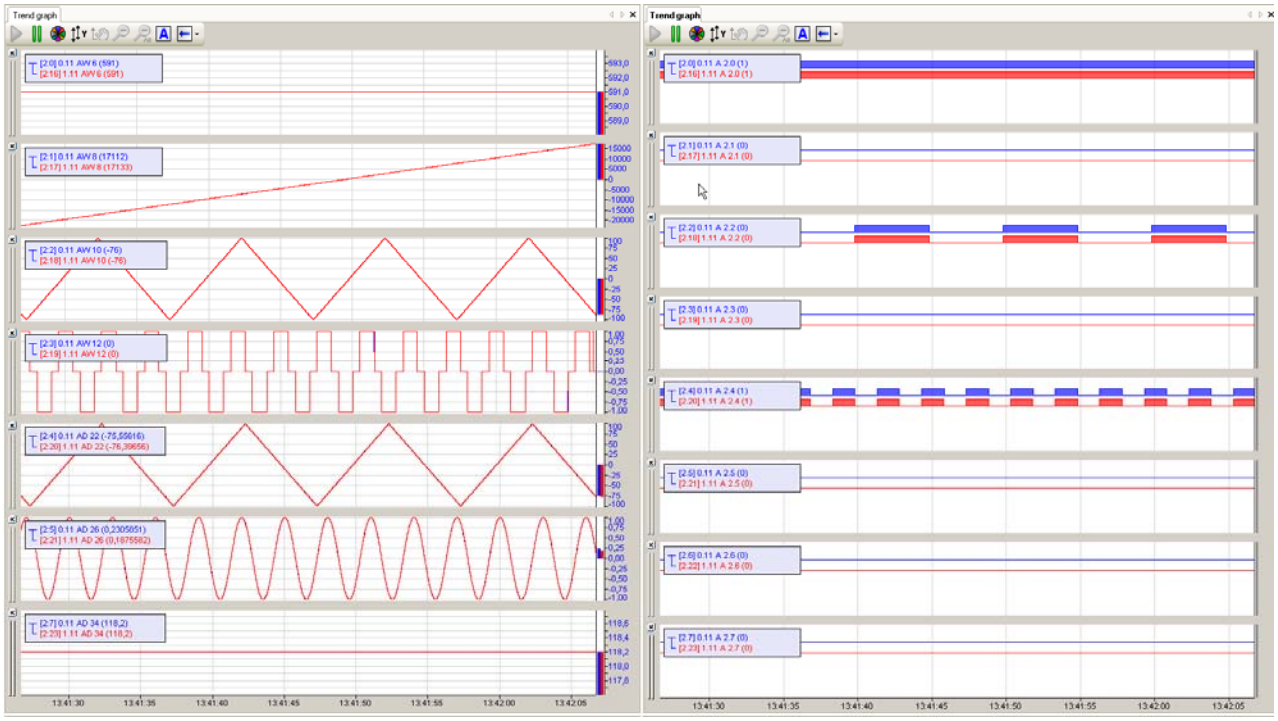
### 4.5.4 Diagnostics with ibaPDA

You can see in ibaPDA, whether all slaves, which are present at Bus 0, are defined as active slaves at Bus 1.




### 4.5.5 Compare the data with ibaPDA

The output data of DP Master 1 (Bus0) is compared with the output data of DP master 2 (Bus1). Ideally the data of both DP masters are identical.



# 5 Support and contact

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**Note**

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