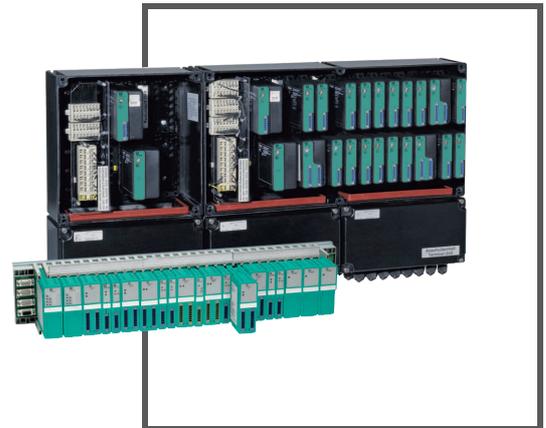


MANUAL

LB8109*/FB8209*
Unicom Com Unit for
PROFIBUS DP/DP-V1
DTM for FDT 1.2



With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Introduction

1.1 Content of this Document

This document contains information required to use the finished device or system in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Assembly and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



Note!

This document does not replace the instruction manuals for the components in use. The safety information for the components in use determines the specific safety instructions that apply to the system. The instruction manuals for the components in use must have been read and understood.



Note!

For complete information about the components in use, refer to the instruction manuals and further documentation available online at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This software manual
- Hardware manual for the remote I/O system in use
- Instruction manuals for the components in use
- Data sheets for the components in use

In addition, the documentation may comprise the following parts, if applicable:

- EC-type examination certificate
- EC declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols



Note!

This symbol brings important information to your attention.



Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2 Basics of the Remote I/O Systems

Remote I/O units are signal modification devices that act as an interface for signals between the field devices and the process control systems. The I/O modules are mounted on the prefabricated backplanes using slots. Com units are available for various standard buses and form the interface between the I/O modules and the process control system. Power supplies are used to power the I/O modules and com units.



Figure 2.1 Example of LB/FB remote I/O stations

- 1 LB remote I/O station for use in the safe area and Zone 2
- 2 FB remote I/O station for use in Zone 1

Configuration Tasks

The parameterization of the I/O modules is stored in the nonvolatile com unit memory. When an I/O module is replaced, the new module automatically adopts the configuration of the previous module, provided the same type of module is used.

Diagnostics

Diagnostics information is reported to the process control system via the bus. Moreover, queries can be submitted via an independent service bus. However, the service bus is not absolutely essential for obtaining a fully operational system.

Interfering signals are mostly filtered out. However, a state-of-the-art screening concept should still be applied. Some I/O modules have adjustable filter functions.

Redundancy

A redundant bus connection is possible if the bus system allows.

Output Shutdown

The output shutdown enables bus-independent shutting down of all or selected I/O modules within the Remote I/O system. This feature requires the use of appropriately equipped backplanes and I/O modules with shutdown input.

3 Features of the Unicom Com Unit 8x09

3.1 General

The Unicom com unit therefore provides the basis for the data structure of the PROFIBUS data telegram remaining unchanged when I/O modules are inserted, removed, or replaced. This prevents the breakdown of the PROFIBUS communication. This applies to non redundant systems.

Normally, adding an I/O module changes the structure of the PROFIBUS data telegram. Input or output data must be transferred to the previous empty slot by the additional I/O module.

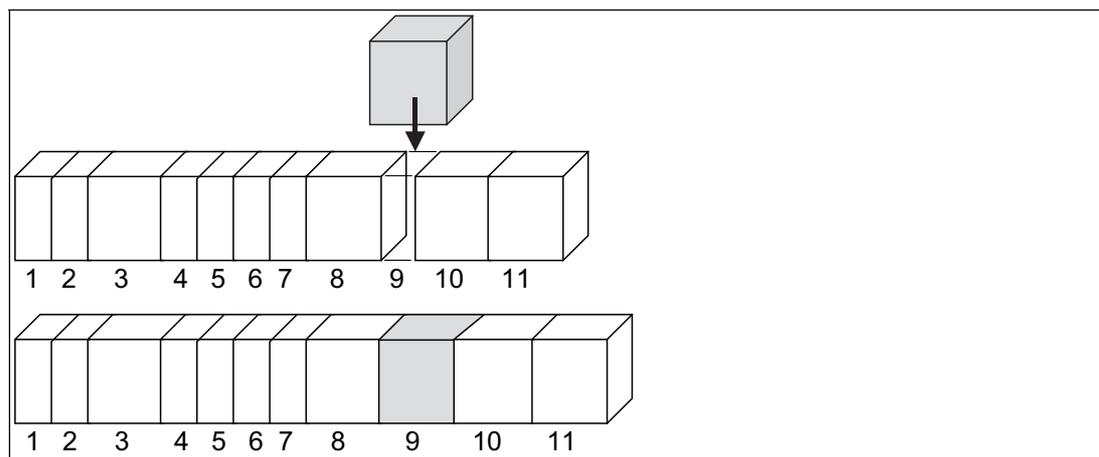


Figure 3.1 Changing the PROFIBUS data telegram by adding an I/O Module

Conversely, universal modules are available in the Unicom com unit. Universal modules are placeholders within the PROFIBUS data telegram that ensure a fixed length for the data telegram. If a remote I/O station is populated with universal modules, the slots configured can be used for any type of I/O module.

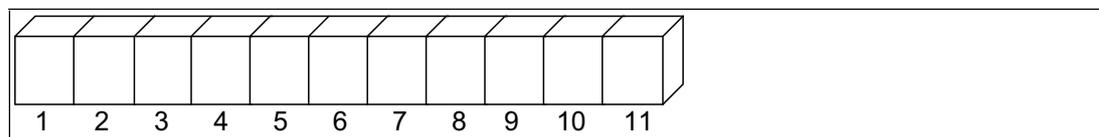


Figure 3.2 Structure of the PROFIBUS data telegram with fixed length universal modules

3.2 Universal Modules

A universal module is a placeholder of fixed length in the PROFIBUS data telegram. A universal module with, e.g., 4-byte input and 4-byte output data can be assigned to any slot in the remote I/O station. Thus the data can be acquired by almost all I/O modules. Later on it will be determined by which I/O module this placeholder should be replaced. Several I/O modules will then have a greater available data capacity than they require in their specific data format. Unused data fields will then automatically be filled with zeros. As a result, one output module then carries an excess of input data and vice versa. Even for single channel I/O modules, unnecessary, empty data is carried.

However, the advantage of this method lies in the fixed data structure. If an I/O module is added or replaced, there is no change to the data telegram and PROFIBUS need not be restarted.

The diagram below shows the data structure of a 4I4O universal module with 4 bytes of input data and 4 bytes of output data.

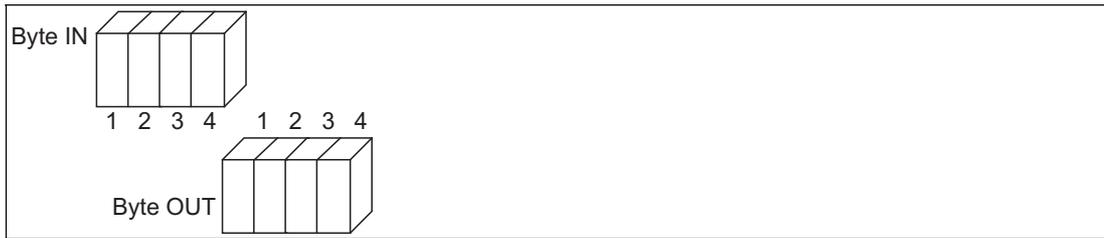


Figure 3.3 Universal module 4I4O with 4 bytes input data and 4 bytes output data

The illustration below shows how a universal module 4I4O is assigned with 2-byte input data by a 1-channel analog input. Even digital input would only take up 1 byte of input data.

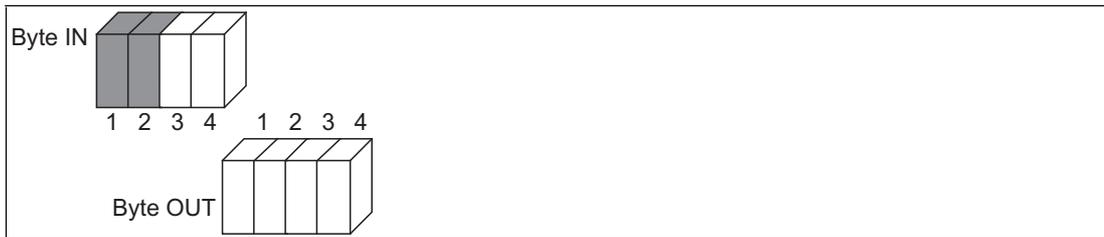


Figure 3.4 Universal module 4I4O populated with 2 bytes input data

Single width I/O modules can be configured as a universal module 2I2O with 2-byte input and 2-byte output data, in order to optimize the data telegram. The slot with this assignment can, however, be used for I/O modules with a maximum of 2-byte input and 2-byte output data. Multichannel, analog I/O modules have higher data volumes and must be configured as 4I4O or 8I8O universal modules.

3.3 Module Types

Unicom com units support all earlier I/O modules with their original data structure.

There are three new universal modules to choose from.

- **2I2O**
2-octet input data and 2-octet output data
- **4I4O**
4-octet input data and 4-octet output data
- **8I8O**
8-octet input data and 8-octet output data

The universal modules reserve different numbers of input octets and output octets per slot that can then be occupied by I/O modules. A mixture of slots with I/O modules and universal modules is also possible.

4 Maximum Number of Channels and I/O Modules

The maximum number of channels depends on the I/O modules in use, as the I/O modules offer a different number of channels depending on the module type and width.

The maximum number of I/O modules per remote I/O unit is determined by the following factors.

1. Slots on the backplane and width of the I/O modules
2. Size of the com unit memory for input and output data
3. Length of DP configuration string
4. Power supply via the relevant units on the backplane



Tip

Use an FDT frame application such as PACTware™ and the device type manager (DTM) for LB/FB to test different configurations of the remote I/O unit.

The DTM automatically checks the following aspects:

- Number of slots on the backplane
- Module types supported by the com unit firmware
- Size of the com unit memory for input and output data
- Compliance with the maximum length of the DP configuration string
- Power supply for all modules and whether sufficient power is available

Slots on the Backplane and Width of the I/O Modules

Fixed slots are reserved on the backplane for com units and power supplies. The slots for I/O modules have equal status, meaning functions can be arranged side by side as required. Depending on how many single-width and double-width I/O modules you use, varying numbers of I/O modules can be accommodated on the backplane.

Size of the Com Unit Memory for Input and Output Data

From firmware version 9.06 onwards, the memory for input and output data is a total of 240 octets. With symmetrical distribution, 120 octets are available for input data and 120 octets for output data. An asymmetric distribution of 0 octets input data and 240 octets output data to 240 octets input data and 0 octets output data is likewise possible. The distribution is made in steps of 8 octets.

With firmware version 9.06 and higher, the memory for input and output data totals 480 octets. There are 240 octets available for input data and 240 octets for output data. However, an asymmetric distribution is not possible.

Length of DP Configuration String

The DP configuration string contains the configuration code of the slots on a backplane and is limited to 96 octets. Ensure that the configuration code of the following I/O modules and com units is longer than that of the other I/O modules. See chapter 6.10

- LB4104, FB4204 output isolator
- LB4*05, FB4*05 HART output isolator
- LB4106 HART output isolator
- Com unit with global status/command register and module status

Empty slots located upstream of the last I/O modules also have a configuration code. These empty slots must also be taken into account when considering the length of the DP configuration string.

Power Supply via the Relevant Units on the Backplane

The level of power available is dependent on several factors.

- Type of power supply
- Number of power supply units
- Power supply redundancy
- Environmental conditions, e.g., use in explosion-hazardous areas
- Com unit in use
- Com unit redundancy

Example

The example below is based on an LB remote I/O unit.

- **LB9022 base backplane**
Provides slots for two com units, three power supplies, and 22 single-width I/O modules.
- **LB9024 extension backplane**
Provides slots for three power supplies and 24 single-width I/O modules. The com unit on the base backplane also controls the I/O modules on the extension backplane.
- **LB9006C power supply**
Provides 25 W of power for operating the com unit and I/O modules in Zone 2 applications.
- **LB8109* com unit**
Power consumption: 2 W

The DP configuration codes and details of the data volume of the I/O modules can be found in this manual. See chapter 8

Details of the number of channels and the power consumption of the I/O modules can be found in the data sheets.

Quantity	Module	DP configuration code	Width [slots]	Input		Output		Power consumption [W]
				[Channels]	[Octets]	[Channels]	[Octets]	
LB9022 base backplane								
1	LB8109*	C0 01 07 00 00						2
	Configuration: with status/command register and module status							
2	LB1*03	52	1	1	6	0	0	0.6
	Operating mode: combined 32-bit counter input and frequency input							
2	LB1*08	11 00	2	8	2	0	0	0.7
2	LB2101	30	1	2	1	1	1	1.6
1	LB5*01	50	1	1	2	0	0	0.45
1	LB5*02	50	1	1	2	0	0	0.45

5 Installing Configuration Software and DTM

5.1 Introduction

For process control systems that support the FDT concept, the remote I/O station can be configured using the device type manager (DTM). The DTM ensures that the master receives all configuration information and is adapted accordingly. In this case, make use of this manual, apart from the information concerning the PACTware™ FDT base application.

In the case of process control systems that do not support the FDT concept, you can configure the remote I/O station using the DTM and an external FDT base application, such as PACTware™. In this case, the remote I/O station connection is via a class 2 master. This manual describes the configuration with a class 2 master and the PACTware™ FDT base application. Note that the DTM cannot only be used with PACTware™, but also with other FDT base applications.

There are also process control systems that use separate drivers, such as Siemens SIMATIC. These systems have their own configuration instructions. This manual is of limited use in such cases.

You can download the DTM, including the GSD/GSE file, from the **Software** area on the www.pepperl-fuchs.com website.

5.2 System Requirements

Your computer must meet the following requirements to run the configuration software and Device Type Manager (DTM).

- Operating system: Windows NT 4.0, Service Pack 4 or later, Windows 2000, Windows XP, Windows Vista
- Processor: 500 MHz or faster
- Working memory: 128 MB or more
- Hard disk space: approx. 100 MB
- Network card
- Software: Microsoft .NET Framework
- Administrator rights for performing the installation

5.3 Installing the Software

1. Install the FDT base application, e.g., PACTware™.
2. Install the DTM for the PROFIBUS class 2 master.
3. Install the DTM LB/FB.

▶ Installing DTM LB/FB

The DTM LB/FB is suitable both for LB and FB remote I/O stations. You can download the DTM, including the GSD/GSE file, from the **Software** area on the www.pepperl-fuchs.com website.

1. Start the installation program.

↳ The installation process begins. The language selection window opens. If an older version of the software is already installed, the language selection from the older version is automatically copied. To install a different language, first uninstall the existing version.



Figure 5.1 Language selection window

2. Select the required language from the drop-down list.
3. Click **OK** to continue.
↳ A welcome window opens.
4. Click on **Next** to continue.
↳ The **User Information** window opens.

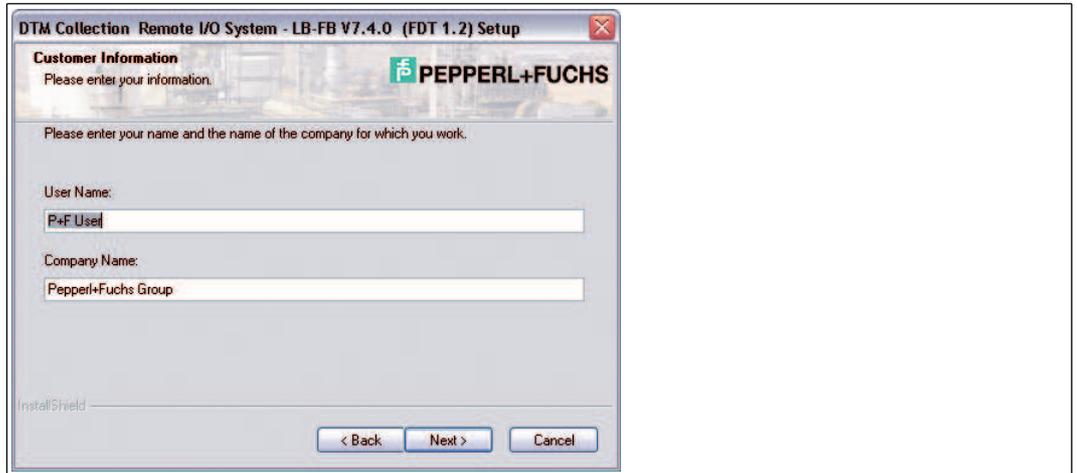


Figure 5.2 User information

5. Enter your name and the name of your company in the appropriate boxes.
6. Click on **Next** to continue.
↳ The **Select Installation Path** window opens.

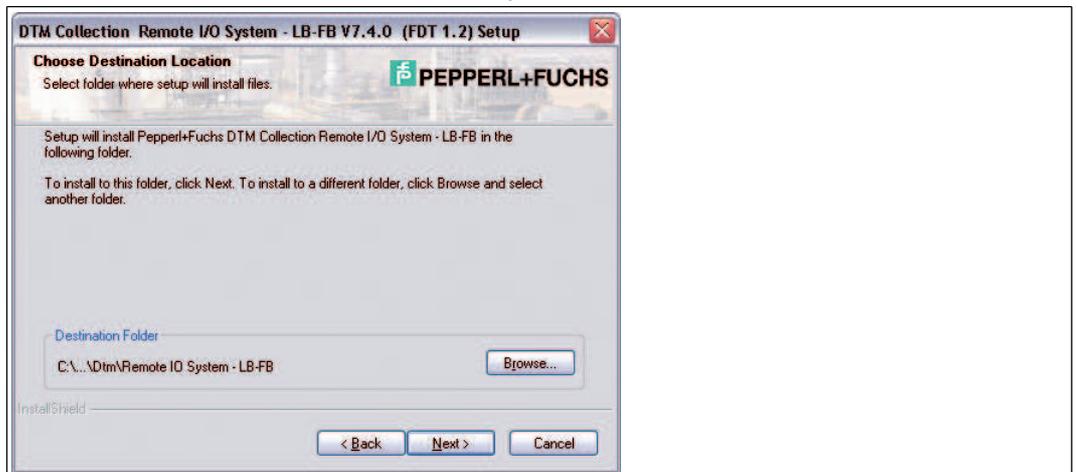


Figure 5.3 Selecting the target path

7. Click on **Next** to confirm the proposed installation path.
To specify an installation path other than the one proposed, click on **Browse**. Select a folder and then click on **OK**.
 - ↳ The selected path is copied as the destination folder.
8. Click on **Next** to continue.
 - ↳ The **Select Options** window appears. Here you can select the program components you wish to install.

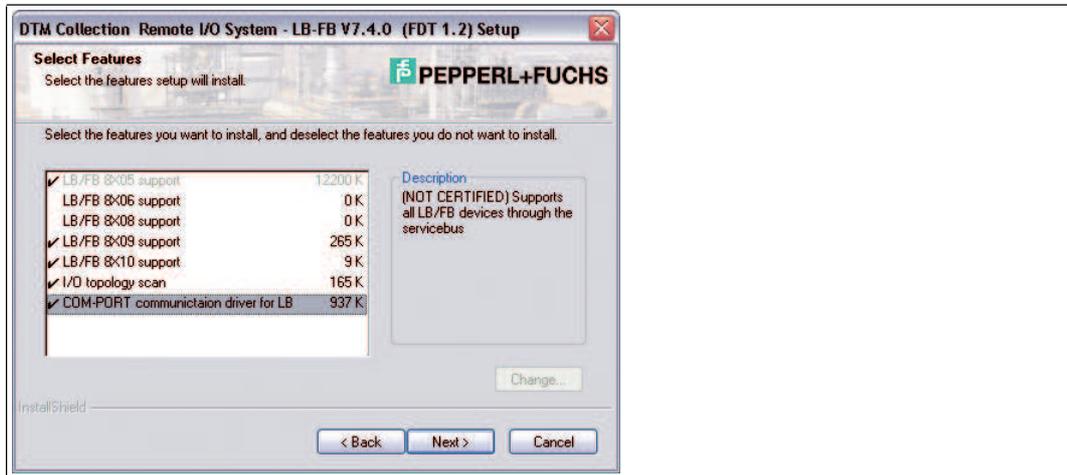


Figure 5.4 Select Features

9. In this list, select the program components to be installed. To activate or deactivate the desired entries, click to the left of the entries. When doing so, make sure the drivers for the com unit and communication link are enabled.
 - ↳ Only those program components that are checked will be installed.
10. Click on **Next** to continue.
 - ↳ Installation begins. A message window opens when the installation is complete.
11. If you wish to read the `Readme` file, check the box.
12. Click **Finish** to end the installation.

5.4 Updating the DTM Catalog

Once you have installed the FDT base application and the Device Type Manager (DTM) on the computer, the FDT base application's DTM catalog must be updated. The PACTware™ DTM catalog is called "Device Catalog" and is normally automatically updated when PACTware™ is launched.

If PACTware™ does not update the device catalog automatically, proceed as follows.

Updating the Device Catalog

1. Start PACTware™.
2. Select **View > Device Catalog** or click **Device Catalog** in the icon bar.
 - ↳ The **Device Catalog** window opens.
3. Click **Update Device Catalog** to update the device catalog.
4. Click **Yes** to continue.
 - ↳ The updated device catalog appears.

6 Configuring the Remote I/O station

This section describes how the remote I/O station can be integrated into PACTware™ and configured. You will learn how to create a PACTware™ project and how to set up communication with the field devices.



Note!

For more information about I/O modules and their configuration, see see chapter 8.

6.1 Communication with Remote I/O Station

Communication between the DTM software and the remote I/O station can be established via the PROFIBUS or the service bus. The configuration can be achieved via the PROFIBUS or in DTM version 7.3 and higher as well as via the service bus. Configuration of the remote I/O station works in almost the same way for both types of connection.

Components Required for a PROFIBUS Connection

- FDT base application, e.g., PACTware™
- DTM LB/FB
- PROFIBUS communication DTM
- PROFIBUS class 2 master + cable harness, e.g., Softing PROFlusb

Components Required for a Service Bus Connection

- FDT base application, e.g., PACTware™
- DTM LB/FB
- Interface converter (RS232 to RS485 converter or USB to RS485 converter) such as W&T RS232 to RS485 or ICP Con I-7561 USB to RS485
- Compatible cable harness

The communication DTM for the service bus is contained in the DTM LB/FB.

6.1.1 Service Bus Connection via RS-232



Danger!

Risk of explosion

When work is performed on the remote I/O unit in hazardous areas, there is a risk of explosion from spark formation.

Work must be performed with a hot work permit only, in other words when there is no potentially explosive atmosphere.

The W&T RS-232-RS-485 interface converter can be connected to the remote I/O unit using either a preassembled or self-made cable. You can order the preassembled cable together with the W&T RS-232-RS-485 interface converter from Pepperl+Fuchs.

Use the following wiring diagram if you intend to make your own cable.

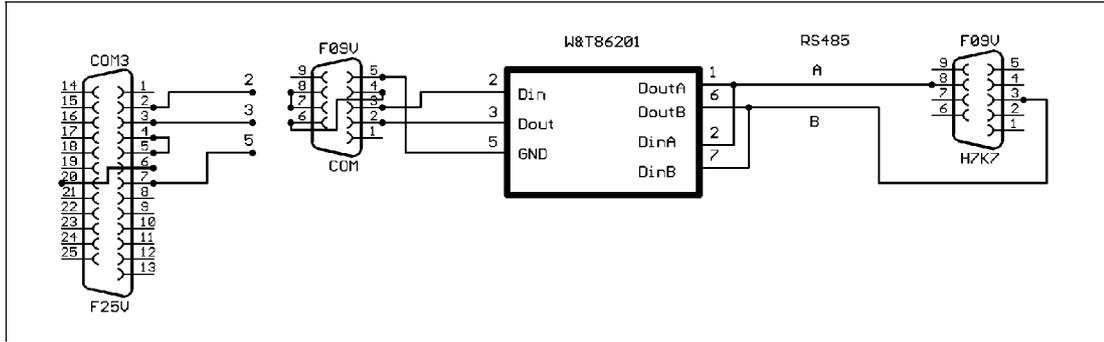


Figure 6.1 Wiring diagram for W&T RS-232-RS-485 interface converter

6.1.2 Service Bus Connection via USB

Connecting the USB Converter to the PC

1. Install the driver that accompanies the USB-RS-485 converter.
2. Connect the USB converter to any USB port on the PC.

↳ The hardware wizard automatically detects and installs a new USB device. The converter is listed under connections in the hardware manager COM port list. The COM port to which the converter was assigned can be seen in this list. The COM port in use can be modified via the same entry in the device manager if required (**Properties** context menu).

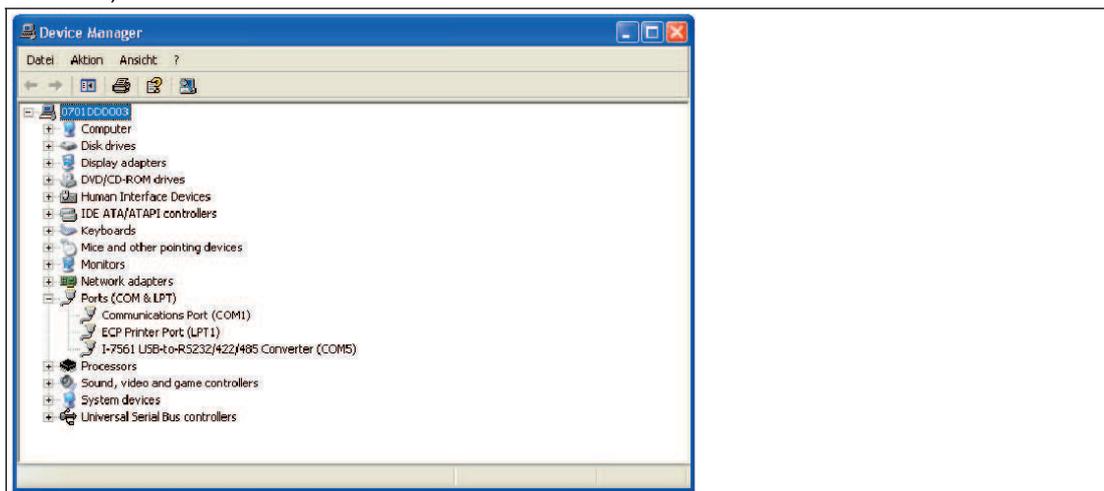


Figure 6.2 USB converter in device manager

6.2 Creating a New Project

Creating a new project in PACTware™?

Select **File > New** or click  **Create New Project**.

↳ A new, unnamed project appears in the main window. The project initially consists of the entry **HOST PC**.

6.3 Integrating the Service Bus Communication DTM

If you wish to establish a connection via the service bus, integrate the service bus communication DTM into the project as follows.

The service bus communication DTM is contained in the DTM LB/FB. The service bus communication DTM must be added to the project structure before all other DTMs.



Adding Communication DTMs

1. Select the entry **Host PC** in the project view.
2. Select **Device Data > Add Device** or click on the **Add Device** icon on the toolbar.



↳ A device selection window opens.

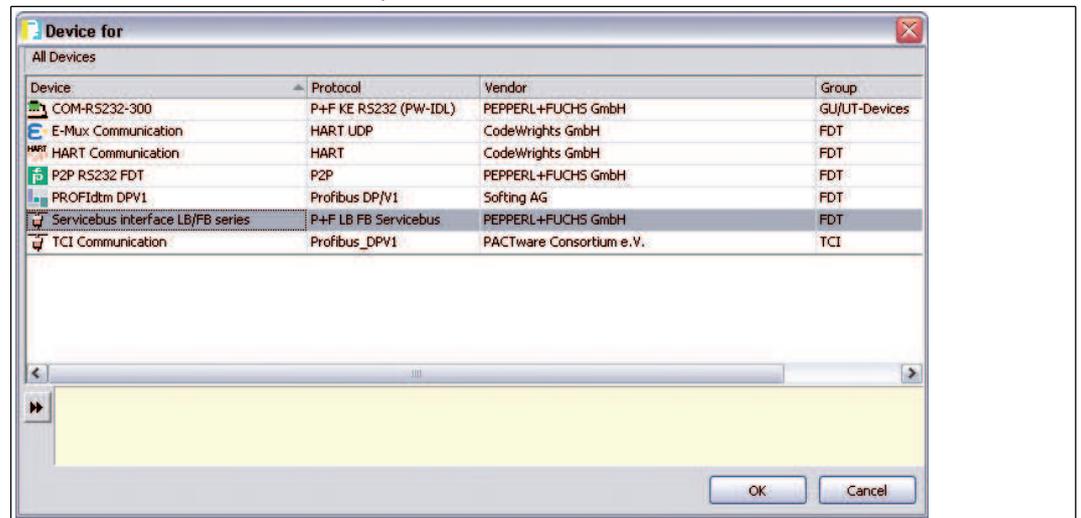


Figure 6.3 Selecting the communication DTM

3. Select the entry **Service bus interface LB/FB series**.
4. Click on **OK**.
↳ The service bus communication DTM is added and appears in the project structure.
5. As service bus communication is handled by a COM port on the computer, the service bus communication DTM must be allocated a COM port.
Right-click on the **LB/FB service bus** entry in the project structure.
6. In the context menu select **Parameter > Parameterization > Set COM Port**.

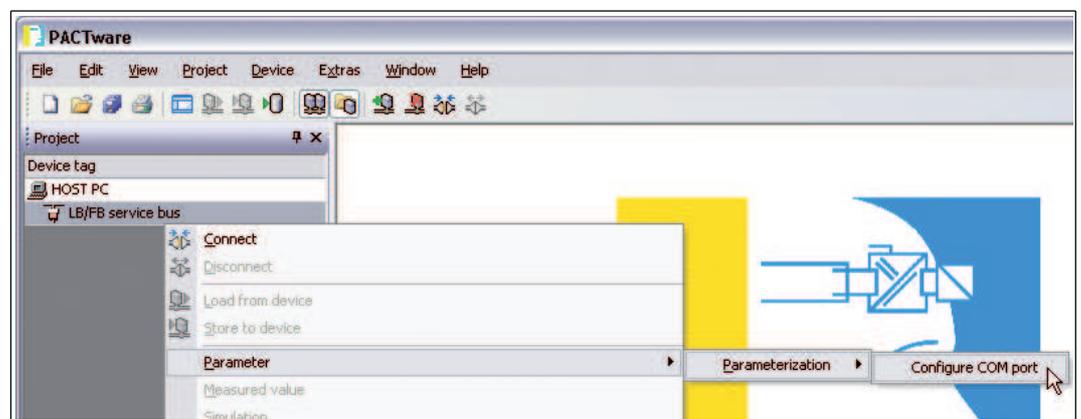


Figure 6.4 Setting the COM port

↳ The device data window containing the COM port settings opens.

7. Set the COM port.



Figure 6.5 Setting the COM port

8. Click on **OK**

6.4 Integrating the PROFIBUS Communication DTM

If you wish to establish a connection via the PROFIBUS, integrate the PROFIBUS communication DTM into the project as follows. The following example uses PROFIdtm from Softing.

Adding Communication DTMs

Before you can integrate the PROFIBUS communication DTM into the project, the PROFIBUS communication DTM must be installed on the computer.

1. Select the **Host PC** entry in the project view.
2. Select **Device Data > Add Device** or click on the **Add Device** icon on the toolbar.



↳ A device selection window opens.

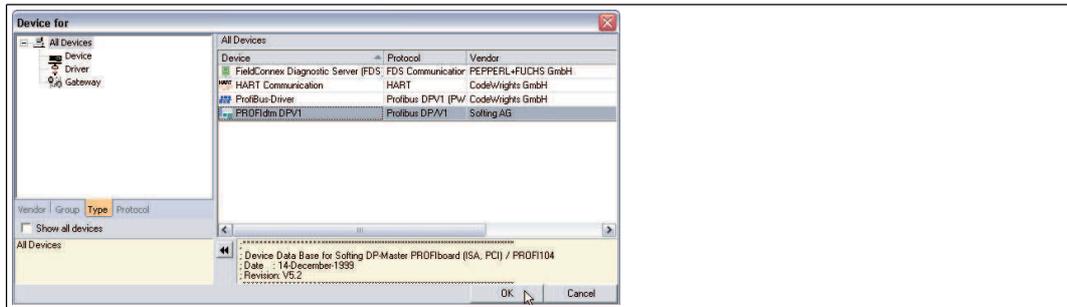


Figure 6.6 Selecting the communication DTM

3. Highlight the PROFIBUS communication DTM, in this example **PROFIdtm DPV1**.
4. Click on **OK**.

↳ The PROFIBUS communication DTM is added and appears in the project structure.



Caution!

Conflicts in the PROFIBUS system

In the case of parallel coupling within existing PROFIBUS systems, integrate the PROFIBUS master card as a class 2 master. Use the correct baud rate and make sure there are no address conflicts.

Numerous adjustments can be made on the PROFIBUS communication DTM. For a precise description of the adjustment options, refer to the instructions from the relevant manufacturer.

To modify the PROFIBUS settings in PACTware™, proceed as follows.

Modifying PROFIBUS Settings

1. Right-click on the PROFIBUS communication DTM in the project structure, in this example on **PROFIdtm DPV1**.
2. Select **Parameterize**.

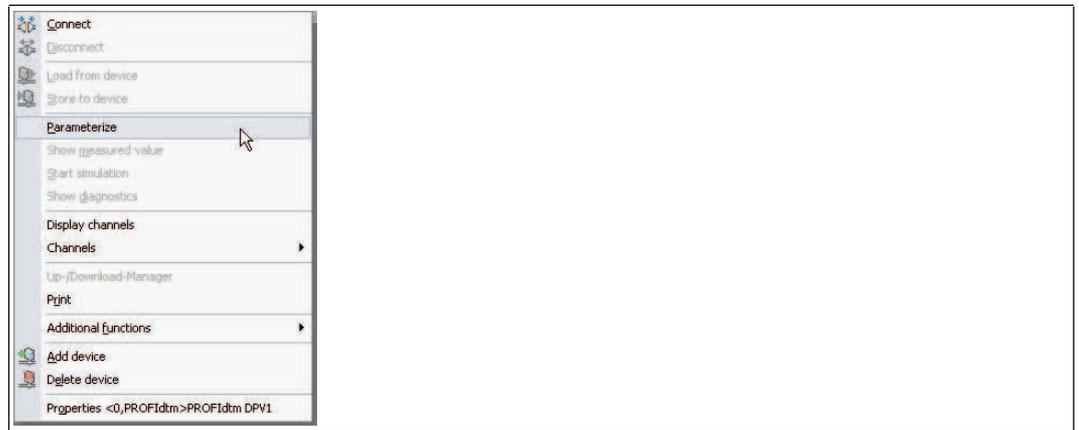


Figure 6.7 Parameterizing PROFIBUS Communication DTM

↳ The device data window containing the bus parameters opens.

3. Edit the relevant parameters.
4. To edit other parameters, right-click again on the **PROFIdtm DPV1** entry in the project structure.
5. Select **Additional functions**.
6. Here you can change DTM station addresses, open the PROFIBUS control panel, or access the online help.

6.5 Adding Com Units

There are two options available for integrating com units into the PACTware™ project.

- Integrate com units via the **Add Device** command
- Generating com units automatically

Adding Com Units via the "Add Device" Command

Before you can integrate a com unit into the PACTware™ project, DTM LB/FB must be installed on the computer and a communication DTM must be integrated into the project structure.

1. Select the entry for the previously integrated communication DTM in the project view.
2. Select **Device Data > Add Device** or click on the **Add Device** icon on the toolbar.



↳ A window opens displaying a list of available com units.

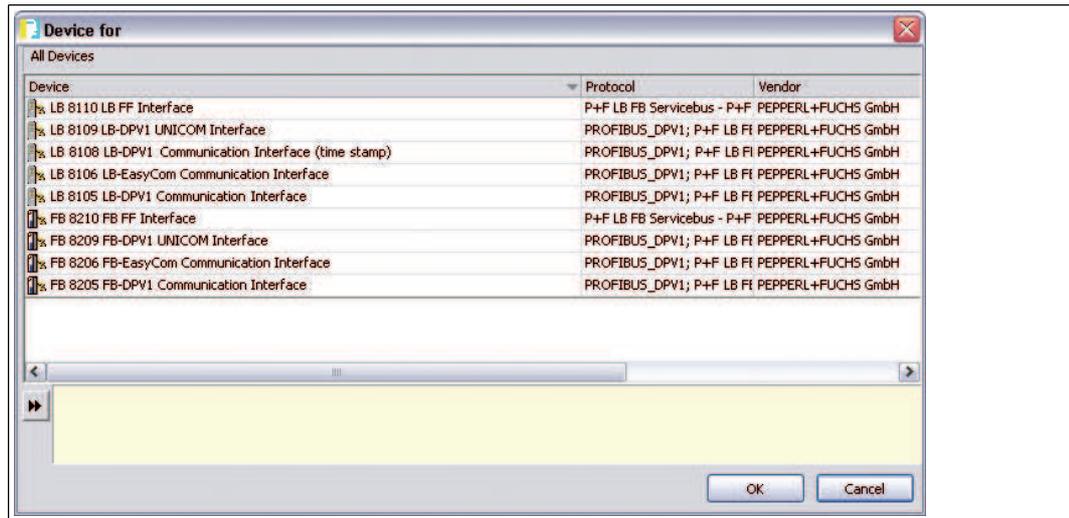


Figure 6.8 Selecting the Com Unit

3. Select the com unit installed in your Remote I/O station.
4. Click on the **OK** button.

↳ The com unit is added and appears under the communication DTM in the project structure.

In the right half of the program window, a device data window appears with a prompt asking you to enter the address of the Remote I/O station.

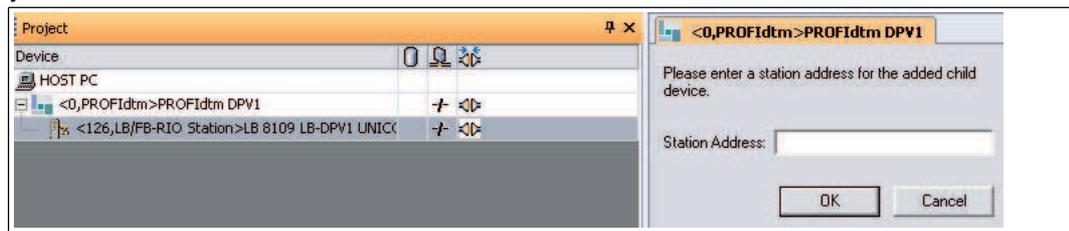


Figure 6.9 Entering the station address

5. Enter the station address.
6. Click on the **OK** button.

↳ The com unit has now been added to the project and can be parameterized. If the Remote I/O station contains multiple com units, repeat the steps for each com unit.

Generating Com Units Automatically



Note!

The com unit can only be generated automatically via a **service bus connection**.

Before allowing the com unit to be generated automatically, there must be a physical connection with the Remote I/O station via the service bus, and the service bus communication DTM must have been added to the project structure.

1. Right-click on the **LB/FB service bus** entry in the project structure.
2. Establish a connection to the Remote I/O station. Select **Connect** from the context menu.

↳ The communication DTM entry appears bold in the project structure as soon as the connection is established.

3. Right-click on the **LB/FB service bus** entry in the project structure.

4. Select **Additional functions > Scan Service Bus**.
↳ The **Scan Service Bus** window appears.
5. Enter the address range that you wish to scan in the **Scan Range** fields.
6. Click on **Start Scan**.
↳ A progress bar indicates the current status of the scanning process. When the scanning process finishes, all located com units are listed in a table.

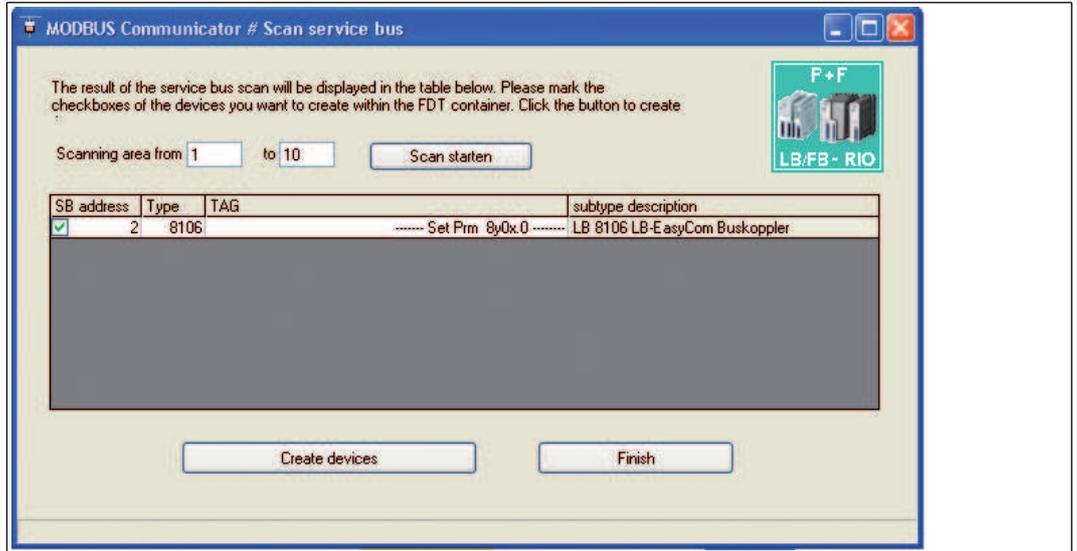


Figure 6.10 Service bus scan results

7. Select one or more com units by activating the relevant check boxes in the **SB Address** column.
8. If you would like to change the service bus address of a com unit, double-click on the relevant line from the list in the table.

↳ The **Set Service Bus Address** window appears.

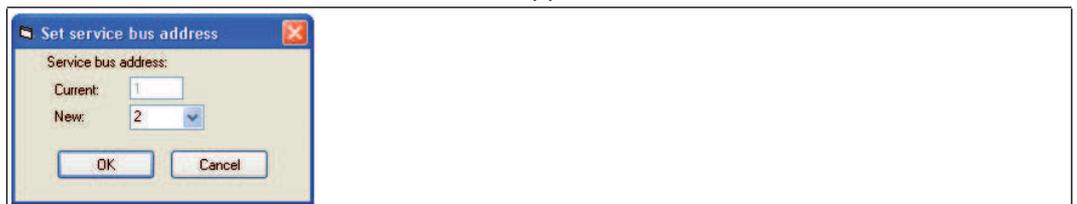


Figure 6.11 Setting the service bus address

9. Select the required service bus address from the **New** drop-down list and then click on **OK**.
↳ The service bus address has been changed.
10. Click on **Generate Devices** in the **Scan Service Bus** window to start configuring the generation process.
↳ All selected com units are created in the project structure. The progress is displayed in the PACTware™ status line.

6.6 Online and Offline Parameterization



Note!

The functions described in this section relate to the DTM, version 7.4 or later.

The FDT base application offers the ability to edit the offline or online data record of the DTM, depending on the connection status with the remote I/O station. When you edit an offline data record, you are editing the data saved in the project. When editing an online data record, the current data from the connected device is being edited. The online and offline data records are synchronized using the commands **Store to Device** and **Read from Device**.

A dialog box appears whenever parameters are changed. In the dialog box, the user can decide whether to store the changes in the device or whether to update the offline data record as well. The parameters of the individual I/O modules can be synchronized only directly via the dialog box. Otherwise the parameters of the I/O modules are synchronized when the com unit parameters are downloaded/uploaded using the commands **Store to Device** and **Read from Device**.

- **Not connected:** Only the offline data record can be edited.
- **Connected:** Both the offline and online data records can be edited. The online and offline windows can be edited simultaneously. The windows are updated whenever they are synchronized. The following com unit parameters of the offline data record cannot be edited when a connection is active.
 - **Structure** tab: redundancy check box
 - **PROFIBUS I** tab: bus addresses of the primary and secondary com unit; redundancy mode; synchronous data



Offline Parameterization

1. Right-click on the entry for the com unit or an I/O module in the project structure.
2. Select **Parameter > Parameterization > Edit Device Data (Offline)**.

↳ The **Edit Device Data (Offline)** window containing the offline data record opens. The gray box in the status bar indicates the offline status.

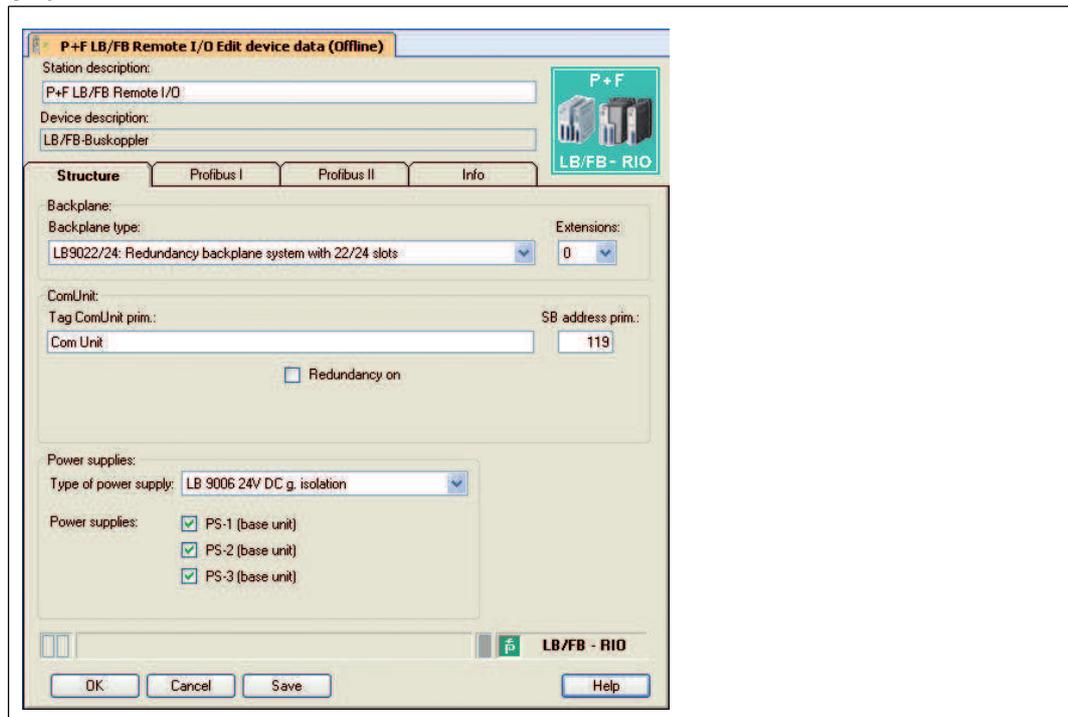


Figure 6.12 Editing Device Data (Offline)

3. Modify the relevant parameters.
4. Click on **OK** to save the settings and close the window or on **Save**.
↳ Depending on the FDT base application, user environment, and connection status, a message appears asking if you wish to write the data to the device and update the online data record as well.



Online Parameterization

1. Right-click on the entry for the com unit or an I/O module in the project structure.
2. Select **Parameter > Online Parameterization > Edit Device Data (Online)**.
↳ The **Edit Device Data (Online)** window containing the online data record opens. The yellow box in the status bar indicates the online status.

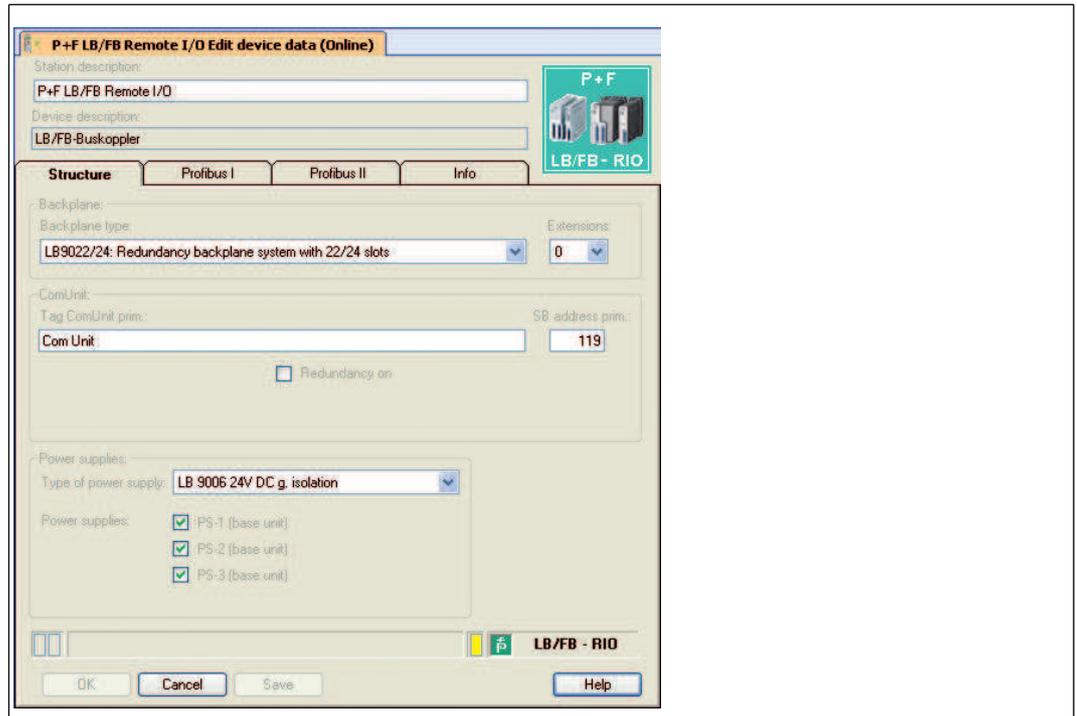


Figure 6.13 Edit device data (online) window

3. Modify the relevant parameters.
4. Click on **OK** to save the settings and close the window or on **Save**.
↳ Depending on the FDT base application and user environment, a message appears asking whether you wish to update the offline data record as well.

6.7 Setting the Application Mode

Select the appropriate parameters for your application.



Setting the Application Mode



Note!

If there is a PROFIBUS connection with the com unit, disconnect the connection. To do so, right-click on the com unit entry in the project structure and select **Disconnect**.

1. Right-click on the com unit entry in the project structure.
2. Select **Additional Functions > Set Application Mode**.

↳ The **Set Application Mode** window opens.

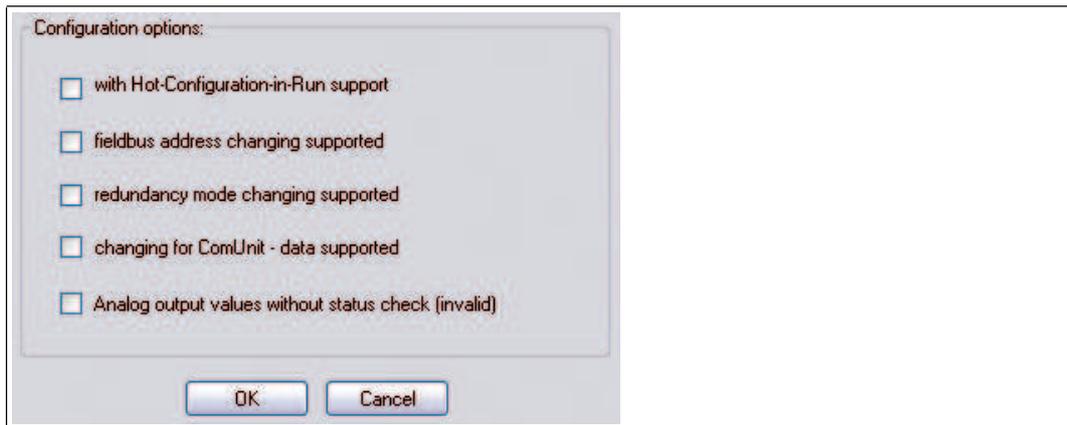


Figure 6.14 Edit the application mode parameters

3. The **With Hot Configuration in Run support** check box is enabled by default. In order to use the Unicom features of the universal modules, deactivate this check box.
4. If the master does not support the PROFIBUS address configuration, activate the **Selection option for fieldbus address supported** check box. You must enter the PROFIBUS address of the com unit manually if the check box is activated. To do so, open the device data window for the com unit and select the **PROFIBUS I** tab. See chapter 6.9.2
5. If you wish to select the media redundancy and application redundancy manually, activate the **Selection option for redundancy mode supported** check box. You can edit the redundancy type in the com unit device data window on the **PROFIBUS I** tab. See chapter 6.9.2
6. We recommend that you activate the **Selection option for additional com unit data supported** check box so that global status and command registers and the module status register can be integrated in the synchronous data traffic. You can edit the additional, synchronous data in the com unit device window on the **PROFIBUS I** tab. See chapter 6.9.2
Once you have edited all the required settings, disable this check box again to prevent structural data changes during operation.
7. Analog output values are transferred by default to the remote I/O system as a 16-bit date consisting of a 12-bit measured value and a 4-bit status area. The status area includes an invalidity bit, which indicates whether the 12-bit measured value is valid (0) or invalid (1). If the measured value is invalid, the preset substitute value strategy is initiated. Examples of the transferred substitute value include 0%, 100%, the current value, or the last valid value. If the process control system issues measured values that use all 16 bits, the invalidity bit may be set unintentionally depending on the measured value. The measured value then depends on the substitute value strategy and may not be realistic.
To disable the evaluation function for the invalidity bit, enable the **Analog output values without status check** check box. With 16-bit measured values, the transmitted value is always issued when the check box is enabled. The substitute value strategy is initiated only if an error such as a loss of communication occurs.
8. Click on **OK** to confirm your entries.

6.8 Selecting Firmware-Dependent Functions

Some com unit and I/O module functions are only supported from a certain com unit firmware version. You can activate and deactivate these functions in the **Firmware-Dependent Functions** window for the relevant com unit.

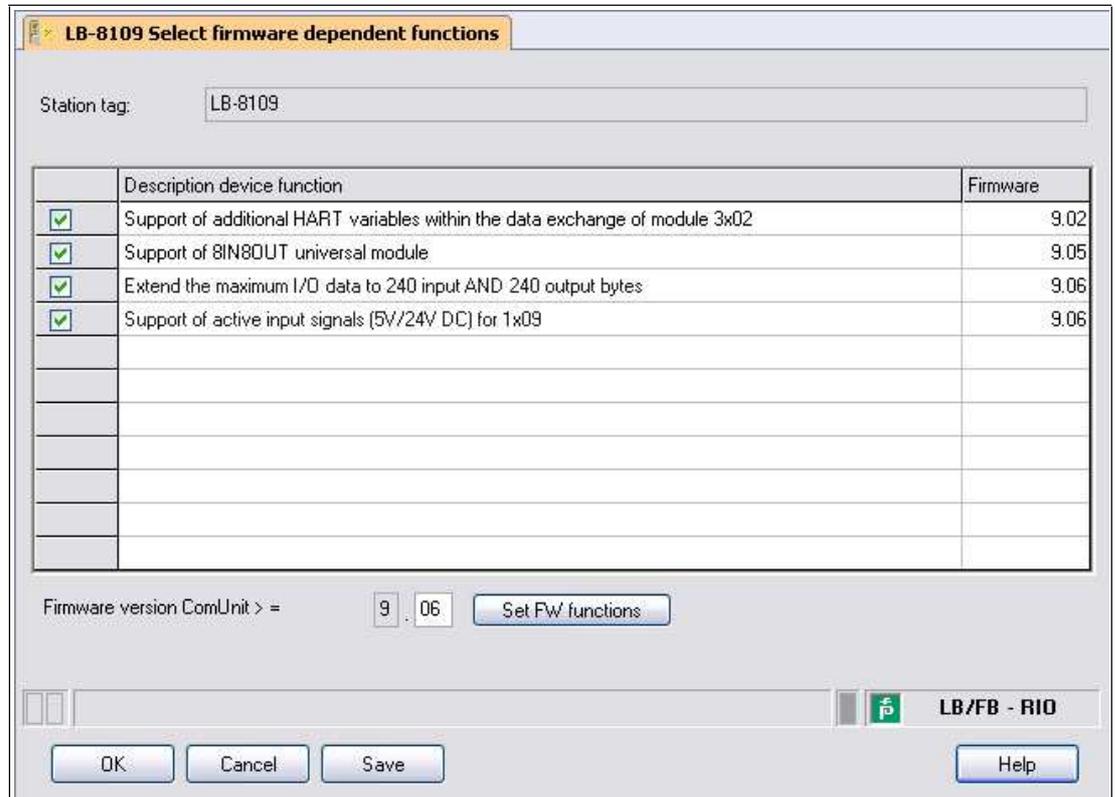


Figure 6.15 Selecting Firmware-Dependent Functions

Use of the extended PROFIBUS modes for 3x02 and HART auxiliary variables

This function is supported by Unicom com units with firmware version 9.02 and higher. The function integrates HART auxiliary variables into the synchronous data exchange.

If you activate this option, the **Measuring Method** drop-down list appears on the **Channel X** tab in the I/O module 3x02 device data window. Here you can activate the transfer of HART auxiliary variables in synchronous data traffic.

If you do not activate the option, no HART auxiliary variables are transferred as standard and the **Measuring Method** drop-down list does not appear.

Support of 8IN8OUT Universal Module

This function is supported by Unicom com units with firmware version 9.05 and higher. The 8I8O universal module is a supplement to the existing 2I2O and 4I4O universal modules. See chapter 6.13

If you activate this option, you can configure the 8I8O universal modules in the **UniCom PROFIBUS configuration** dialog box.

If you do not activate this option, you will not be able to configure any 8I8O universal modules.

Expanding the max. I/O data to 240 input AND 240 output octets

This function is supported by Unicom com units with firmware version 9.06 and higher. This function enables better exploitation of the remote I/O station's slots with Unicom configuration.

If you activate this option, 240 input octets and 240 output octets are available for synchronous data exchange. This allows more I/O modules to be operated in the remote I/O station with high data volumes.

If you do not activate this option, a total of 240 octets will be available for synchronous data exchange. These octets can be distributed to input and output signals as required in 8-octet increments, e.g., 160 input octets and 80 output octets.

Support for active input signals (5V/24V DC) for 1x09

This function is supported by Unicom com units with firmware version 9.06 and higher.

If you activate this option, in addition to mechanical contacts and NAMUR proximity switches, the LB1*09, FB1*09 digital input will support active signals from 2-wire initiators.

If you do not activate this option, the LB1*09, FB1*09 digital input will only support mechanical contacts and NAMUR proximity switches.



Note!

The **Select firmware-dependent functions** window is available in DTM version 7.2 or later.



Opening and Editing the "Select Firmware-Dependent Functions" Window

Close all other DTM windows and disconnect from the com unit before opening the **Select firmware-dependent functions** window. Otherwise the window cannot be opened.

If you connect to the com unit while the **Select firmware-dependent function** window is open, you will not be able to save your parameter changes.

1. Right-click on the com unit in the project structure.
2. In the context menu, select **Parameters > Parameterization > Select firmware-dependent functions**.
 - ↳ The **Select firmware-dependent functions** window opens. If there are no firmware-dependent functions, the window remains empty.
3. To activate a function, select the check box for the function in question. The required com unit firmware version is shown in the **Com unit firmware version** field according to the functional scope selected.
 - Alternatively, you can enter a firmware version in the **Com unit firmware version** field and click on **Set FW functions** to enable all firmware-dependent functions supported by this version.
4. To save your selection and close the window, click on **OK**.

6.9

Editing Com Unit Device Data



Note!

Remote I/O stations can be configured via the PROFIBUS using version 7.2 or earlier of the DTM only. Configuration via the service bus is also supported from DTM version 7.3 onwards.

The device data window of the com unit is divided into tabs: **Structure**, **PROFIBUS I**, **PROFIBUS II**, and **Info**. To edit the tabs, first open the device data window.



Opening the Device Data Window of the Com Unit



Note!

For more information about the general structure of the device data window, see chapter 7.1.

1. Right-click on the com unit entry in the project structure.
2. Depending on the connection status, select **Parameters > Parameterization > Edit Device Data** or **Parameters > Online Parameterization > Edit Device Data**.
↳ The **Edit Device Data** window opens.
3. If you wish to change the station description, enter new text in the **Station description** box (max. 32 characters). The **Device Description** box cannot be edited.
4. You can now edit the device data on the tabs.

6.9.1

"Structure" Tab

On the **Structure** tab, you can modify any settings affecting the structure of the remote I/O station, such as the backplane type, extensions, and connected power supplies used.

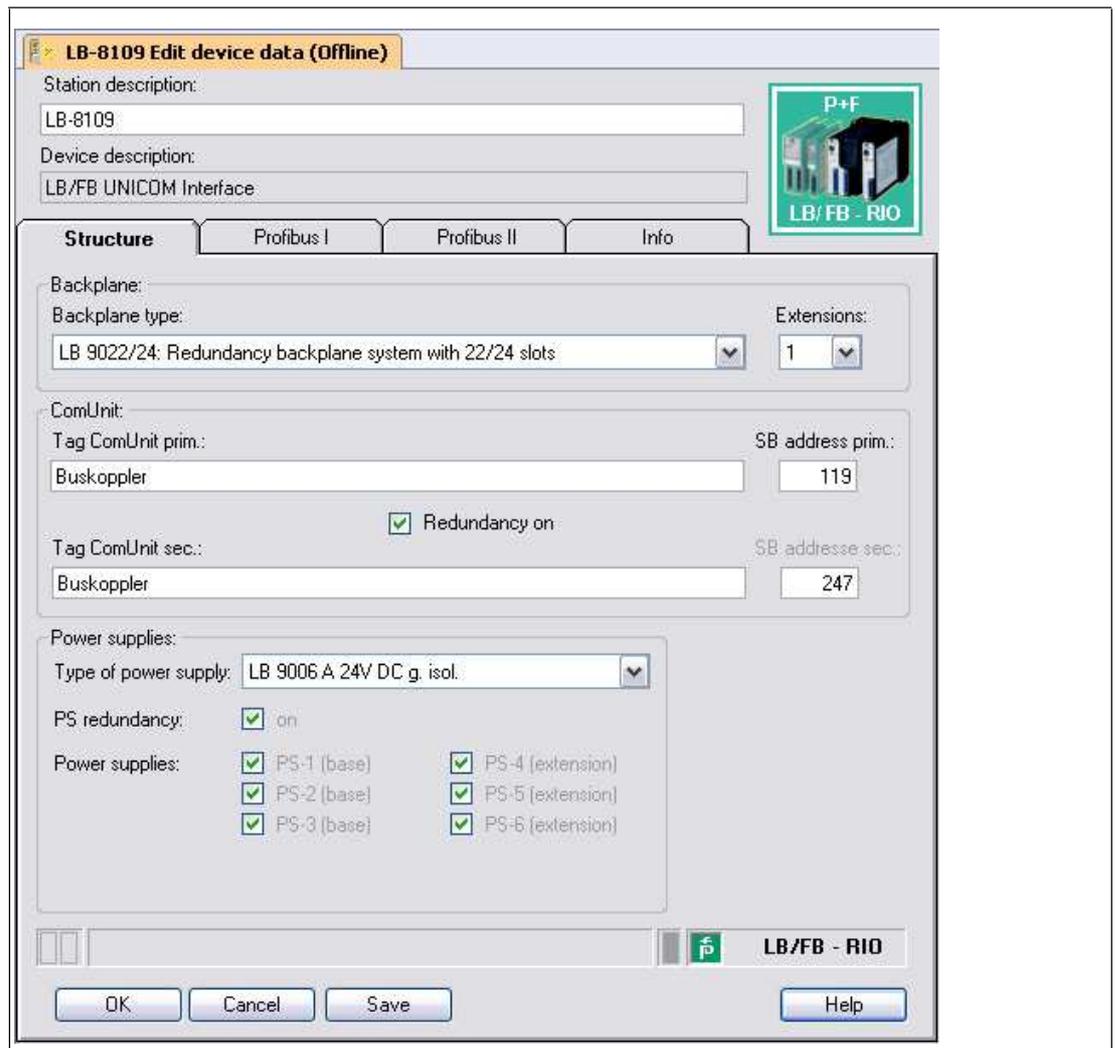


Figure 6.16 Structure tab

Field	Explanation
Station description	This field is prepopulated. You can overwrite this description with a new station description if you wish (max. 32 characters).
Device description	Contains a description of the com unit and cannot be edited.
Backplane type	Select the backplane type used in the remote I/O station. This setting determines which power supply types are available, as well as the number of possible extensions. The "redundant system with 22/24 module slots (LB 9022/24)" type is selected in the example.
Extensions	Specify here whether an extension to the base backplane is available. 0: no extension available 1: extension available The selection of available extensions depends on the backplane system and may vary from 0 ... 5 extensions. Example: You are using the base backplane LB9022 with 22 slots. If you select 1, a remote I/O station with 46 slots is configured (base backplane with 22 slots + extension backplane LB 9024 with 24 slots).
Primary com unit tag	Contains the description for the primary com unit. Enter up to 32 characters.
SB address pri.	Enter the service bus address of the primary com unit.
Enabling redundancy	The check box can only be edited offline without any active connection to the Remote I/O station. If Redundancy on is enabled, additional entry options for the secondary com unit tag and the service bus address appear on the Structure tab. The status of this check box affects the adjustment options for the connected power supplies displayed in the Power supplies area (redundancy = com unit and power supply redundancy).
Secondary com unit tag	Contains the description for the secondary com unit (redundant com unit). Enter up to 32 characters. This field only appears when Redundancy on is activated.
SB address sec.	Contains the service bus address of the secondary com unit. This address is allocated automatically based on the address of the primary com unit and cannot be edited. This field only appears when Redundancy on is activated.
Type of power supply	Select the power supply. The options depend on the item selected in the Backplane type drop-down list.
Power supply redundancy	If the overall Remote I/O station is supplied via redundant power supplies, the PS redundancy auxiliary function can be enabled in DTMs version 7.5.1 and higher. If PS redundancy is enabled, the remaining power available will be calculated such that the station is still adequately supplied in the event of a power supply failure. If Redundancy on is enabled, power supply redundancy is set automatically.
Connected power supplies	Activate the check boxes to specify which connected power supplies you wish to monitor. The number of check boxes depends on the settings in the Type of power supply , Backplane type , and Extensions drop-down lists. In redundant systems, power supply monitoring is automatically activated for all existing power supply slots and cannot be deactivated (power supply redundancy).



Note!
Information on Redundancy

Further information about redundancy (basics, redundancy types, power supply redundancy) can be found in the hardware manual for LB or FB Remote I/O systems.

6.9.2 "PROFIBUS I" Tab

On the **PROFIBUS I** tab, you can modify various settings affecting bus communication, such as bus addresses, redundancy mode, and synchronous data.

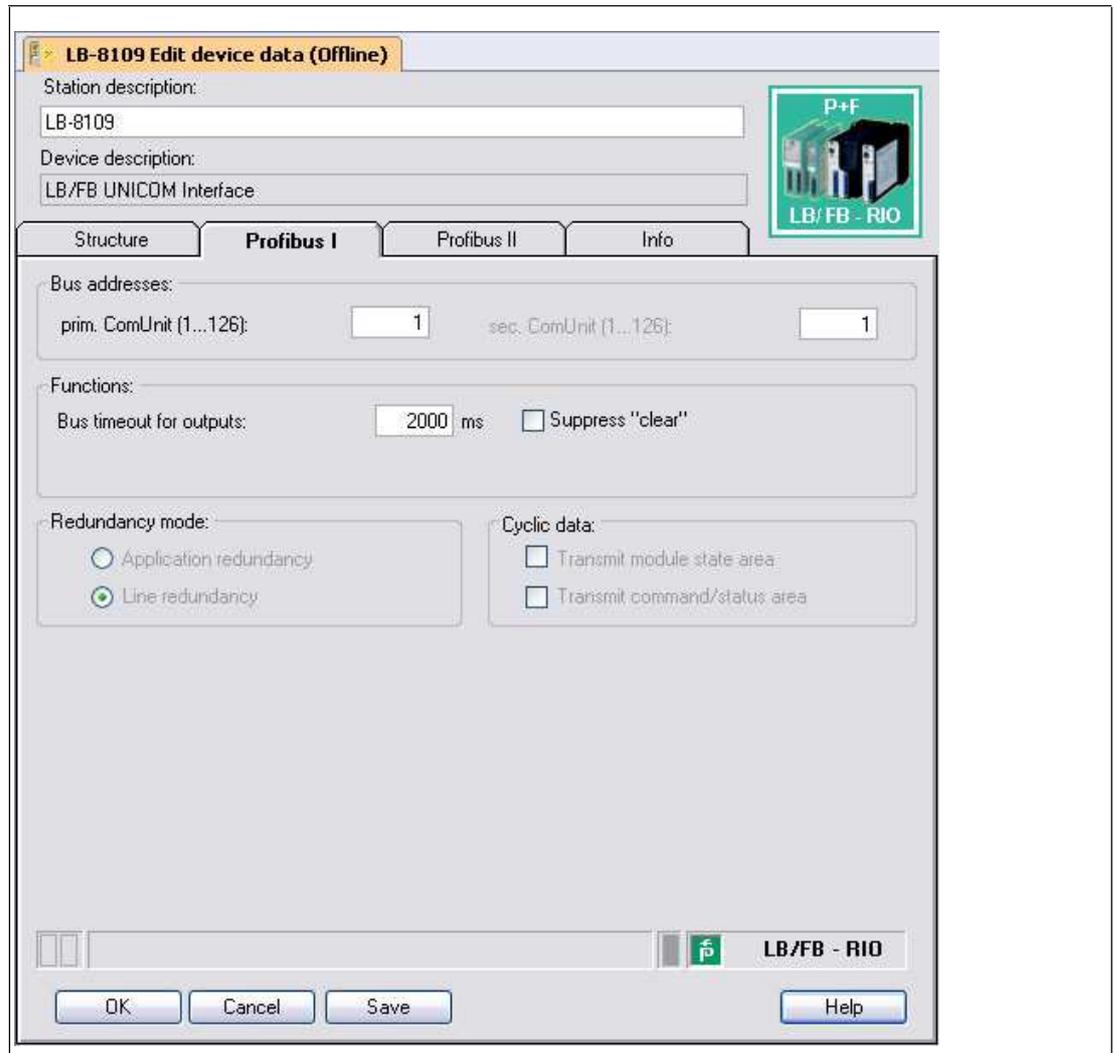


Figure 6.17 PROFIBUS I tab



Caution!

PROFIBUS restart in the event of parameter changes

If you modify the **Transmit module status** and **Transmit command/status area** parameters in the **Synchronous data** area, you must restart the PROFIBUS! These parameters can not be changed online, i.e., in the case of an active connection with the device.

If the process control system supports hot configuration in run (HciR) functionality, the parameters can be changed offline, in other words without any active connection to the remote I/O station, and then activated when the system is operative.

The parameters are supported from DTM version 7.1.



Caution!

Suppress "clear" check box

If only digital outputs are available in the Remote I/O station, you will only not be able to deactivate all outputs. One output always remains active because **Suppress "clear"** is enabled and zero telegrams are suppressed or ignored. Set a minimum of one output (virtual if necessary) in the telegram so that Clear is not suppressed.



Note!

Offline Parameters

The following parameters can be edited offline only.

- **Primary com unit (bus address) and secondary com unit (bus address)**
- **Redundancy mode**
- **Synchronous data**

Field	Explanation
Primary com unit (bus address)	<p>If the master does not support PROFIBUS address planning, you can enter the bus addresses of the primary com unit here. This field can only be edited when you enable the Selection Option for Fieldbus Address check box in the Edit Application Mode window.</p> <p>The configuration procedure varies depending on the FDT base application. The topology configuration is usually defined in the FDT base application. However, there are applications that are only suitable for configuration using a class 2 master card. In these applications, the address can be configured from the DTM of the com unit or the PROFIBUS master. For this reason, the Edit Application window offers the option of enabling or disabling the input box for the bus address of the primary com unit. If you enable the address input box, remember to disable it again after making your entries.</p>
Secondary com unit (bus address)	<p>Configure the bus address of the secondary com unit. This field can be viewed only if you have enabled the Redundancy on check box in the Structure tab. See chapter 6.9.1</p> <p>This box can only be edited when you enable the Selection option for fieldbus address check box in the Edit Application Mode window. See chapter 6.7</p> <p>If Line Redundancy is enabled in the Redundancy Mode area, the address of the secondary com unit is identical to that of the primary com unit. Otherwise the same applies as for the Primary com unit (bus address) field.</p>
Watchdog outputs	<p>Specify a time span in ms after which the outputs are to enter error mode in the event of a bus communication failure. Enter the value 0 here to disable the watchdog. See chapter 7.4.2</p>
Suppress clear	<p>After a restart or a redundancy switchover by the master, some systems issue a "Clear" signal (DataExchange with only 00...). If Suppress clear is disabled, the slave deactivates all outputs. If you do not want the system to disable all the slaves, because a redundant remote I/O station has to guarantee continuous operation in case a com unit/bus line fails, enable Suppress clear.</p>

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Field	Explanation
Redundancy mode	<p>Select the redundancy type. This area only appears if you have enabled the Redundancy on check box on the Structure tab. See chapter 6.9.1</p> <p>This area can only be edited when you enable the Selection option for redundancy mode supported check box in the Edit Application Mode window.</p> <p>Application redundancy: Enable this option if both com units are meant to participate in bidirectional data exchange. The master uses the global status register to check which com unit is active. Only supported from DTM version 7.1 or higher, otherwise read-only.</p> <p>Line redundancy: Enable this option if the process control system is meant to see both com units of a redundant remote I/O station as a single PROFIBUS device. Only the active com unit sends data to the master. In this case, we recommend implementing the PROFIBUS lines in redundant form.</p>
Synchronous data	<p>To obtain additional diagnostic data for the remote I/O station, you can integrate global status and command registers and the module status register in the synchronous data. This area can only be edited when you enable the Selection option for com unit data supported check box in the Edit Application Mode window.</p> <p>Transmit module status: Activate this check box to activate transmission of the module status in the synchronous data traffic (1 bit per slot, 1 = module OK, 0 = module faulty, 6 octets input).</p> <p>Transmit command/status register: Activate this check box to include transmission of the global status and command register in the synchronous data traffic. This function is important for application redundancy (2 octets input/output).</p> <p>For further information about diagnostics, see see chapter 9.</p>



Note!
Information on Redundancy

Further information about redundancy (basics, redundancy types, power supply redundancy) can be found in the hardware manual for LB or FB Remote I/O systems.

6.9.3 "PROFIBUS II" Tab

On the **PROFIBUS II** tab, you can modify various settings affecting bus communication, such as message parameters and extended functions.

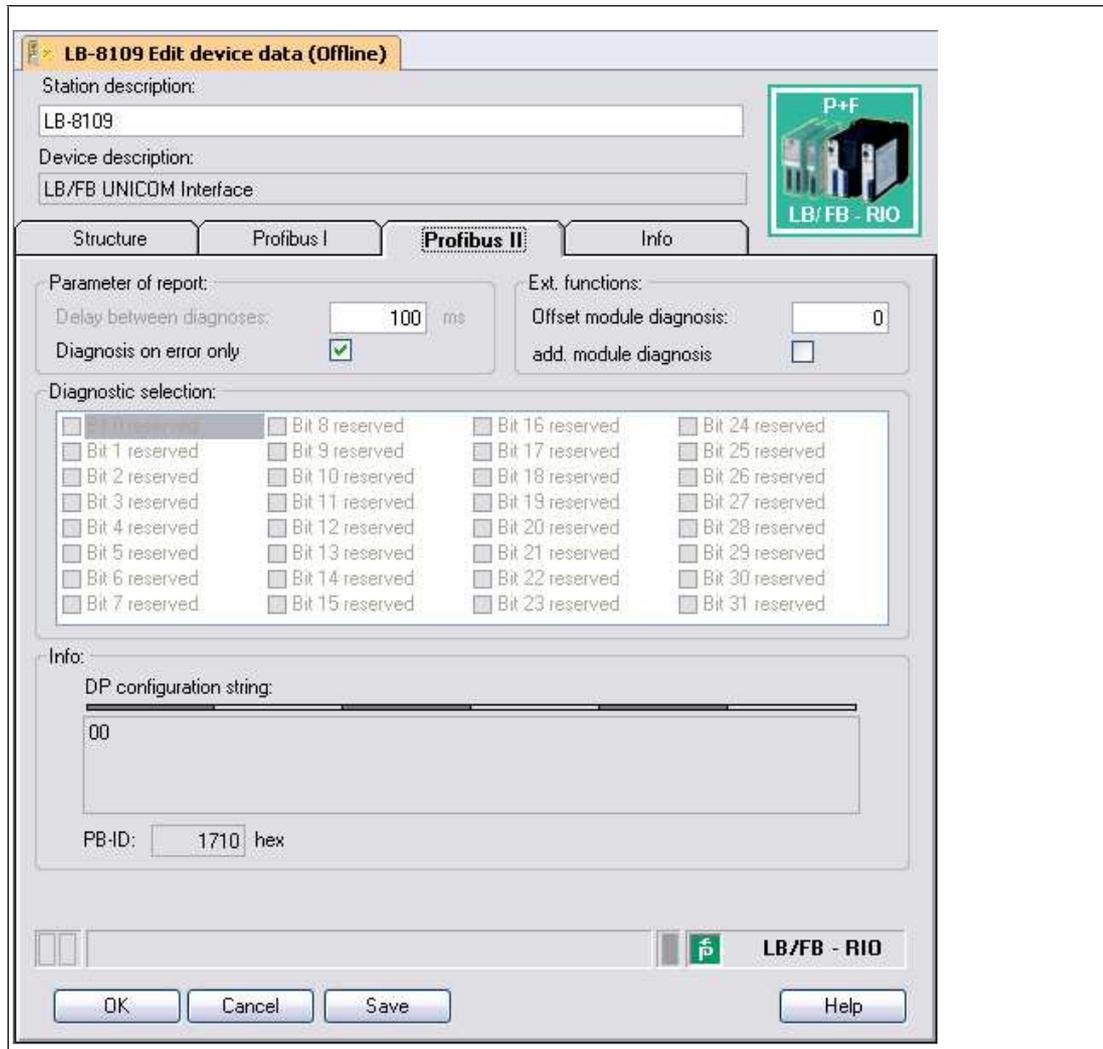


Figure 6.18 PROFIBUS II tab



Warning!

Offset module diagnostics parameter change

Changing the **Offset module diagnostics** parameter represents a serious manipulation of the diagnostics and alarm handling system.

We recommend changing the **Offset module diagnostics** parameter only if the modular counting methods for diagnostic assignment in the master and slave are different. It is advisable to check the modular counting method prior to commissioning or during a plant shutdown and then modify the parameter once if required.



Note!

Offset module diagnostics box for com unit 8x05

For com unit 8x05, **Offset module diagnostics** can be edited only if you have activated the **Offset adjustable for module-related PB diagnostics** function in the **Select firmware-dependent functions** window. This function is available in firmware versions 6.19 and higher.

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Note!

Additional module diagnostics for com unit 8x05

For com unit 8x05, **Add. module diagnostics** can be edited only if you have activated the **Additional 12-octet module-related diagnostics** function in the **Select firmware-dependent functions** window. This function is available in firmware versions 6.19 and higher.

Field	Explanation
Delay between diagnostics	Indicates the minimum delay time between two PROFIBUS diagnostics. This value is set to 100 ms and can not be edited.
Diagnostics on error only	Checks the behavior of the PROFIBUS diagnostics. If you enable the check box, the ExtDiag bit is only set for diagnostics when there is a fault. This bit is not set for an internal status change.
Offset module diagnostics	The assignment of diagnostics to I/O modules in different master and diagnostic systems may turn out differently due to the various counting methods. This field enables you to change the counting method. The parameter can adopt the value 0 or 1. The default value is 0. Changing the parameter is recommended if the diagnostic visualization in the process control system indicates a shift in the module assignment. If you enter the value 0, the diagnostics of I/O module 1 is transferred as module diagnostics 0. The value 1 transfers the diagnostics of I/O module 1 as module diagnostics 1. See chapter 9.5.2
Additional module diagnostics	If you enable Additional module diagnostics , 2 more bits are transferred per I/O module slot (I/O module OK, I/O module error, incorrect I/O module type, no I/O module available). The additional diagnostics are not transferred by default. The data volume for the device-specific diagnostics therefore increases by 12 octets (48 x 2 bits). This function is designed for systems where diagnostics via DTM is not possible or where the diagnostic options are limited. See chapter 9.5.2
Diagnostic message selection	Currently this area can not be edited.
DP configuration string	Sets out the current DP configuration. The entry in this box is generated from the I/O module arrangement on the backplane and from the synchronous data area on the PROFIBUS I tab. See chapter 6.9.2 The information is updated automatically when an I/O module is added or removed and cannot be edited.
PB ID	Shows the PROFIBUS identification number. The PROFIBUS ID is defined automatically as soon as the com unit is added and it cannot be edited.

6.9.4 "Info" Tab

The **Info** tab contains information on com units and power supplies. You also have the ability to enter notes.

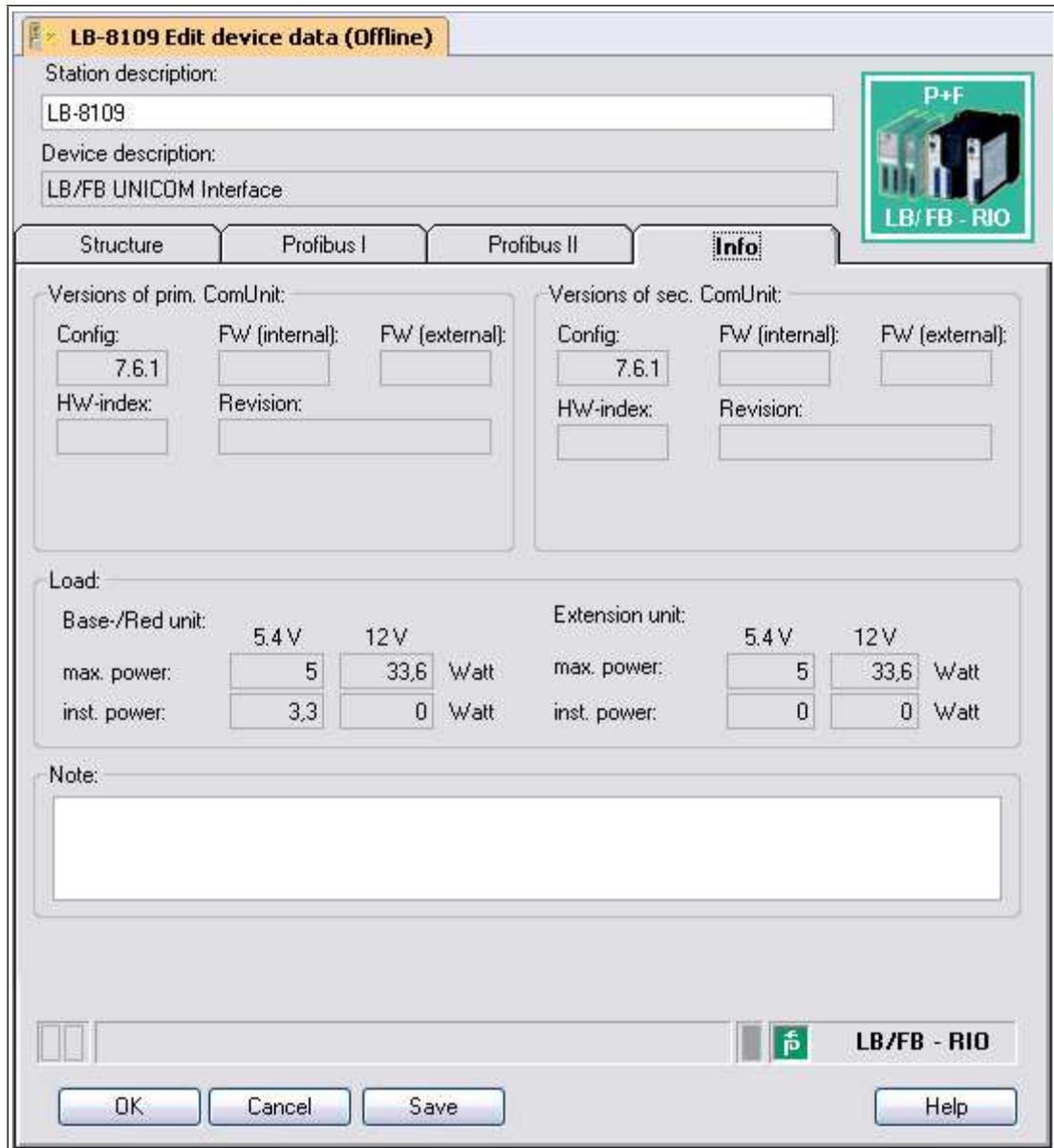


Figure 6.19 Info tab

Field	Explanation
Primary com unit versions	This area contains the following non-editable fields that contain information on the primary com unit. Config: DTM version FW (Internal): firmware version PIC (cannot be changed) FW (External): firmware version (can be changed by service) HW Index: com unit hardware version (currently not supported) Revision counter: revision status of the parameters
Secondary com unit versions	This area behaves in the same way as the primary com unit versions area. This area can only be viewed if you have enabled the Redundancy on check box in the Structure tab.
Load	This area includes non-editable fields that contain information about the load. Power rating values appear in the fields after the slots on the backplane are populated with I/O modules. During configuration, the Device Type Manager (DTM) identifies any potential overload situations and flags this to the user. The user is then prevented from adding another I/O module to the backplane in the case of overload.
Note	Enter any text. The text is saved in the database and not in the com unit.

6.10 Meaning of the DP configuration string

Process control systems that support the FDT concept use the operator interface of the DTM as a component of their own systems. Other process control systems have either a separate driver, e.g., Siemens SIMATIC PDM, or they use a text-based GSD/GSE file. In these cases, observe the operating instructions from the relevant manufacturer.

The following notes provide information about PROFIBUS communication and are particularly useful when using the GSD/GSE file.



Note!

If you are operating a master that supports the FDT concept or has drivers or libraries, you do not need to worry about the subsequent byte strings because the master adopts the details automatically.

The sequence of PROFIBUS data words can be found in the DP configuration string (1 data word = 16 bits). The sequence corresponds to the arrangement of the I/O modules on the backplane, where the input and output bytes of the I/O modules are sorted into input and output blocks. → see Figure 6.20 on page 42

The DP configuration string is a direct representation of the arrangement and configuration of the I/O module on the relevant backplane. Each I/O module has a DP configuration code. For example, the LB1*08 and FB1*08 digital input has the DP configuration code 11. The DP configuration string consists of the individual DP configuration codes.

It is essential for successful PROFIBUS communication that the DP configuration string in the master and in the remote I/O station are identical.

The table (see table "Data Structure on the PROFIBUS" on page 42) is a simplified version of the same module arrangement shown in the illustration (→ see Figure 6.20 on page 42) and represents the relationship between the data structure of the DP configuration string and the input and output bytes of the I/O modules.

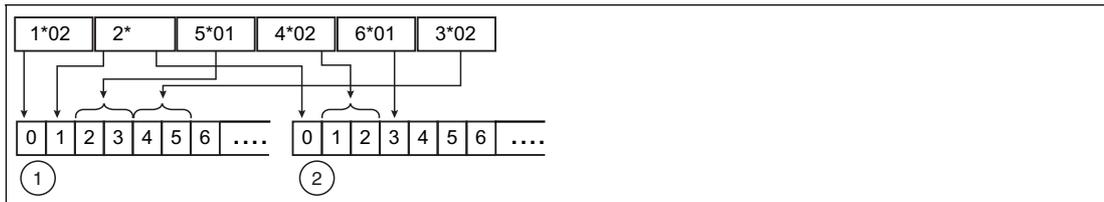


Figure 6.20 Effect of the module arrangement on the data structure

- 1 Input bytes
- 2 Output bytes

Data Structure on the PROFIBUS

Module arrangement						
Slot no.	1	2	3	4	5	6
I/O module	LB1*02, FB1*02	LB2002, LB21*, FB22*	LB5*01, FB5201	LB4*02, FB4*02	LB6101, FB6301	LB3*02, FB3*02
DP config. string	10	30	50	60	20	50
Data	1 byte ON	1 byte ON 1 byte OFF	1 word ON	1 word OFF	1 byte OFF	1 word ON
Byte ON	1	1	2			2
Byte OFF		1		2	1	
Input bytes						
Byte no.	0	1	2	3	4	5
I/O module (slot)	LB1*02, FB1*02 (1)	LB2002, LB21*, FB22* (2)	LB5*01, FB5201 (3)		LB3*02, FB3*02 (6)	
Output bytes						
Byte no.	0	1	2	3	4	5
I/O module (slot)	LB2002, LB21*, FB22* (2)	LB4*02, FB4*02 (4)		LB6101, FB6301 (5)	Empty	Empty

Initially, all output data is transferred to the slave as specified in the PROFIBUS standard (DataExchangeRequest). Then all input data is transferred to the process control system as a response (DataExchangeResponse). Refer to the following table for the individual hexadecimal values that make up the DP configuration string. The table contains the meaning and the input and output bytes of each hexadecimal value.

For more information about the data structure and bit structure within the input and output bytes for the individual I/O modules, see chapter 8.

You can view the DP configuration string of your remote I/O station in the **Diagnostics Register** tab within the FDT base application. See chapter 9.5

**Note!****Special feature of I/O modules LB1*03, FB1*03 and LB3*02, FB3*02**

Depending on the function type, the LB1*03, FB1*03 frequency/counter input is 2, 4, or 6 bytes in length and the DP configuration code is 50, 51, or 52.

Depending on the number of HART auxiliary variables, the length of the HART transmitter power supply LB3*02, FB3*02 current input is 2, 6, 10, 14, or 18 bytes and the DP configuration code is 50, 52, 54, 56, or 58.

DP Configuration Codes

DP config. code (hexadecimal)	DP config. code (decimal) ¹	Length	Description
00	0		Empty slot or com unit without data
10	16	1 octet ON	LB1*01, FB1*01, LB1*02, FB1*02 digital input
11	17	2 octets ON	LB1007, LB1*08, FB1*08, LB1*09, FB1*09, LB1014, LB1015 digital input
15	21	6 octets ON	LB8*0*, FB8*0* com unit with module status
20	32	1 octet OFF	LB6101, FB6301 relay contact output
30	48	1 octet ON 1 octet OFF	LB2002, LB21*, FB22* digital output with position feedback LB6005, FB6305 relay contact output LB6*1*, FB621* digital output
31	49	2 octets ON 2 octets OFF	LB8*0*, FB8*0* com unit with global status/command register LB6006, FB6306 relay contact output LB6*08, FB6*08 digital output 2I2O universal module
33	51	4 octets ON 4 octets OFF	4I4O universal module
37	55	8 octets ON 8 octets OFF	8I8O universal module

DP config. code (hexadecimal)	DP config. code (decimal) ¹	Length	Description
50	80	1 word ON	LB1*03, FB1*03 frequency/counter input in frequency input or 12-bit counter input function type LB3101, FB3201 transmitter power supply, input isolator LB3*02, FB3*02, LB3103, FB3203 HART transmitter power supply, input isolator LB5*01, FB5201 RTD converter LB5*02, FB5202 thermocouple converter LB5*06, FB5206 voltage converter
51	81	2 words ON	LB1*03, FB1*03 frequency/counter input in 32-bit counter input function type
52	82	3 words ON	LB1*03, FB1*03 frequency/counter input in combined 32- bit counter and frequency input function type LB3*02, FB3*02 HART transmitter power supply, input isolator with 1 HART auxiliary variable
53	83	4 words ON	LB3104, FB3204 transmitter power supply, input isolator LB3*05, FB3*05 HART transmitter power supply, input isolator LB3*06 HART transmitter power supply LB5*04, FB5204 RTD converter LB5*05, FB5205 thermocouple converter
54	84	5 words ON	LB3*02, FB3*02 HART transmitter power supply, input isolator with 1st + 2nd HART auxiliary variables

DP config. code (hexadecimal)	DP config. code (decimal) ¹	Length	Description
56	86	7 words ON	LB3*02, FB3*02 HART transmitter power supply, input isolator with 1st to 3rd HART auxiliary variables
58	88	9 words ON	LB3*02, FB3*02 HART transmitter power supply, input isolator with 1st to 4th HART auxiliary variables
60	96	1 word OFF	LB4101, FB4*01 output isolator LB4*02, FB4*02 HART output isolator
73	115	4 words ON 4 words OFF	LB7*04, FB7*04 universal input/output (HART)
C0 01 07	192 1 7	8 octets ON 2 octets OFF	LB8*0*, FB8*0* com unit with global status/command register and module status
C0 43 40	192 67 64	1 word ON 4 words OFF	LB4104, FB4204 output isolator LB4*05, FB4*05 HART output isolator LB4106 HART output isolator
¹ Under certain circumstances, many older process control systems require decimal figures instead of hexadecimal figures for parameterization.			

In the DP configuration string, the first configuration code is always assigned to the com unit. Redundant com units are implicitly included in the bus connection configuration code and are not listed separately. Depending on the configuration, the com unit can have four different DP identifiers.

The global status register occupies 2 input bytes. The 6 input bytes for the module status (1 bit per I/O module) follow the input bytes of the global status register. The module status bit adopts the status 1 if the associated I/O module is active and free of faults. Otherwise, the status is 0.

The DP configuration codes for the individual I/O modules only follow the com unit with the global status/command register and the module status (). See table "Sequence of the DP configuration code in the DP configuration string" on page 46

Sequence of the DP configuration code in the DP configuration string

Slot	Device	Description	DP config. code
0	Com unit (with one of the configurations on the right)	Without data	00
		With status/command register	31
		With module status	15
		With status/command register and module status	C0 01 07
1	I/O module	Type-dependent	Type-dependent
n	I/O module	Type-dependent	Type-dependent

6.11 Command Register

The command register comprises two bytes. The first byte is the parameter byte, the second the command byte. These bytes can be used to transfer commands from the master to the remote I/O station via the bus.

The command they contain is executed only if the command register has changed. Therefore, a command is only executed once, namely, when the changed command register has been transferred to the com unit for the first time.

The command register can be transferred together with the global status register as part of the cyclic com unit data. The global status register occupies the first two bytes in the response telegram (`DataExchangeResponse` from the remote I/O station to the master). The command register occupies the first two bytes in the request telegram (`DataExchangeRequest` from the master to the remote I/O station).

The following commands are supported.

Parameter (byte 1)	Command (byte 2)	Meaning
0x00	0x08	Clear all 32 bit counters.
0xnn	0x08	Clear 32 bit counter of slot nn.
0x00	0xF8	Cold start
0x00	0xF9	Warm restart
0x00	0xF5	Become passive (command to active com unit). Since the two com units of a redundant system cannot both be passive, the partner com unit becomes active because of this command. The command is meaningless if sent to the passive com unit.
0x00	0xF6	Become active (command to passive com unit). Since the two com units of a redundant system cannot both be active, the partner com unit becomes passive because of this command. The command is meaningless if sent to the active com unit.
0x00	0xF7	Redundancy switchover This command generates a redundancy switchover, whichever com unit it is sent to. Therefore, it is not essential to know which com unit is currently active/passive.

6.12 Configuring Dual Width I/O Modules

All GSD/GSE-based configurations use single width I/O modules. Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot.

Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot.



Example!

The 8-channel digital input 1x08 with the module identifier 11 is entered in the PROFIBUS configuration string. The additional slot occupied by the dual width module is automatically treated as an empty slot and has the code 00 in the PROFIBUS configuration string.

The table below shows how 1- or 2-channel and multichannel I/O modules appear in the PROFIBUS configuration string.

Example DP Configuration String

Slot	I/O module	DP config. code
1	Digital input, 2-channel	10
2	Digital output plus 2 inputs	30
3 + 4	Digital output, 8-channel	31 00
5	Digital input, 2-channel	10
6 + 7	Digital input, 8-channel	11 00
8	Analog Input	50



Note!

Different Slot Assignment for Redundant LB Backplanes

Slots 1 and 2 on redundant LB backplanes are reserved for the redundant com unit, regardless of whether a redundant com unit is actually present or not. Configure the I/O modules for these backplanes from slot 3.

6.13 Preconfiguring Unicom Com Units with Universal or Standard Modules

For Unicom com units, placeholders are available for any I/O modules — universal modules. See chapter 3

With the universal modules, you have the option of subsequently adding new I/O modules at a remote I/O unit during ongoing operation, irrespective of the process control system or PROFIBUS master. Configure the remote I/O unit slots **before commissioning** with standard or universal modules.



Tip

We recommend you preconfigure all remote I/O unit slots, including empty slots, with universal modules.



Warning!

Changes to the Unicom configuration require a PROFIBUS restart

The length of the PROFIBUS data telegram changes as soon as you change the Unicom configuration of the slots (e.g., from `standard` to `2I2O`, or from `4I4O` to `8I8O`). Such changes make a PROFIBUS restart necessary.

Never change the Unicom configuration while operation is ongoing.

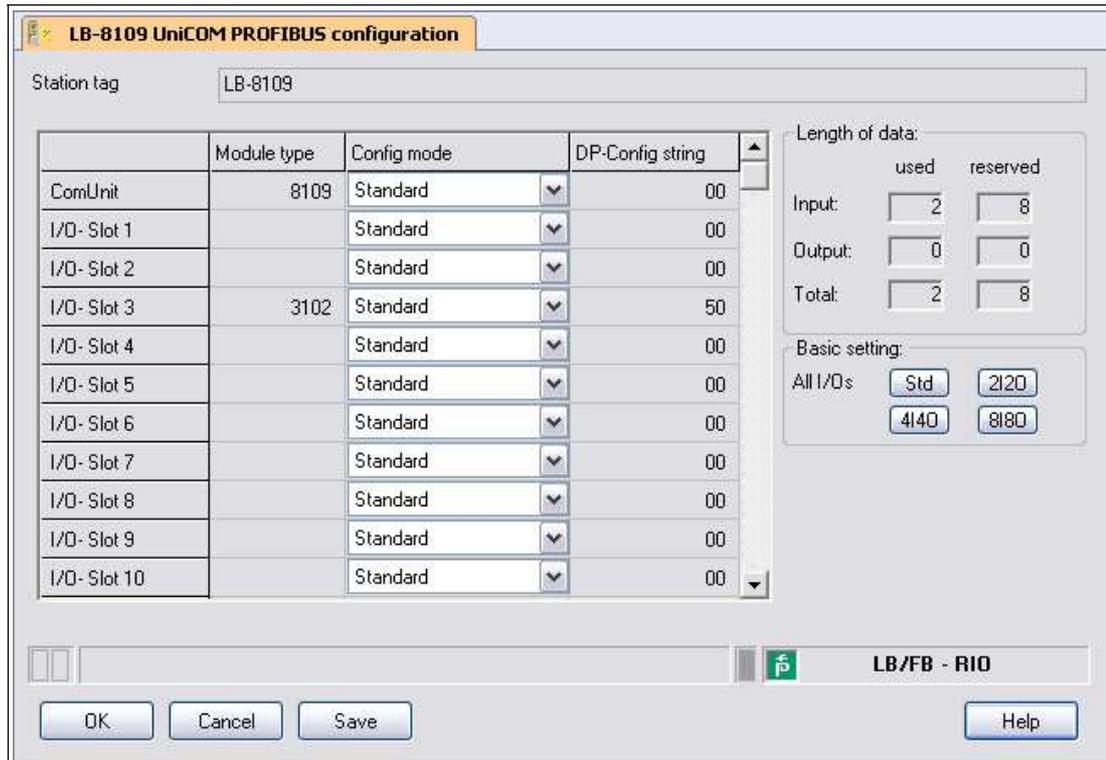


Figure 6.21 UniCOM PROFIBUS configuration in standard assignment

Ex-works, all slots are preassigned the standard configuration. Slots with the standard configuration can be populated with different I/O modules during operation only if the process control systems support hot configuration in run (HCiR). See chapter 6.16

For all other process control systems, we recommend that the slots be preconfigured with universal modules, so that new I/O modules can be inserted at a later point in time while operation is ongoing or can be replaced with other types of I/O modules. It is possible to have a combination of standard and universal modules within a remote I/O unit.

The following universal modules are available.

- **2I2O**
2 octets input data and 2 octets output data
Use this setting for 1-channel or 2-channel I/O modules.
- **4I4O**
4 octets input data and 4 octets output data
Use this setting for multichannel I/O modules.
- **8I8O**
8 octets input data and 8 octets output data
Use this setting for I/O modules with high data volumes, e.g., 1x03 in operating mode "32-bit counter + frequency".



Caution!

Restrictions in the operating mode **2I2O**

Do not operate the following I/O modules in the 2I2O configuration, since their data volume exceeds the 2 octets input and output data:

- 1x03 in the "32-bit counter" operating mode or "Frequency input + 32-bit counter"
- 3x02 with activated HART auxiliary variables
- 3x04, 3x05, 4x04, 4x05, 5x04, 5x05



Caution!

Restrictions in the operating mode **4I4O**

Do not operate the following I/O modules in the 4I4O configuration, since their data volume exceeds the 4 octets input and output data:

- 1x03 in the "Frequency input + 32-bit counter" operating mode
- 3x02 with activated HART auxiliary variables



Caution!

Restrictions in the **8I8O** operating mode

Do not operate the following I/O modules in the 8I8O configuration, since their data volume exceeds the 8 octets input and output data:

- 3x02 with more than one activated HART auxiliary variable



Note!

The 8I8O universal module can be selected only if the **Support for the 8IN8OUT universal module** option is enabled. See chapter 6.8

In the following illustration, all the slots are configured with 2I2O universal modules. Unlike the standard configuration, the DP configuration string and bit structure used in the data telegram are the same for all slots regardless of which I/O modules are later assigned to the slots.

The difference between the standard setting and the universal modules is visible in the **DP-Config string** column of the **UniCOM PROFIBUS configuration** window. While in the standard configuration, I/O module 3102 has the DP configuration code 50, the same module has the DP configuration code 31 with 2 octets input data and 2 octets output data in the universal configuration.

The used and the remaining data space in the data telegram are displayed during the configuration in the **Length of data** area. The data length is calculated automatically.

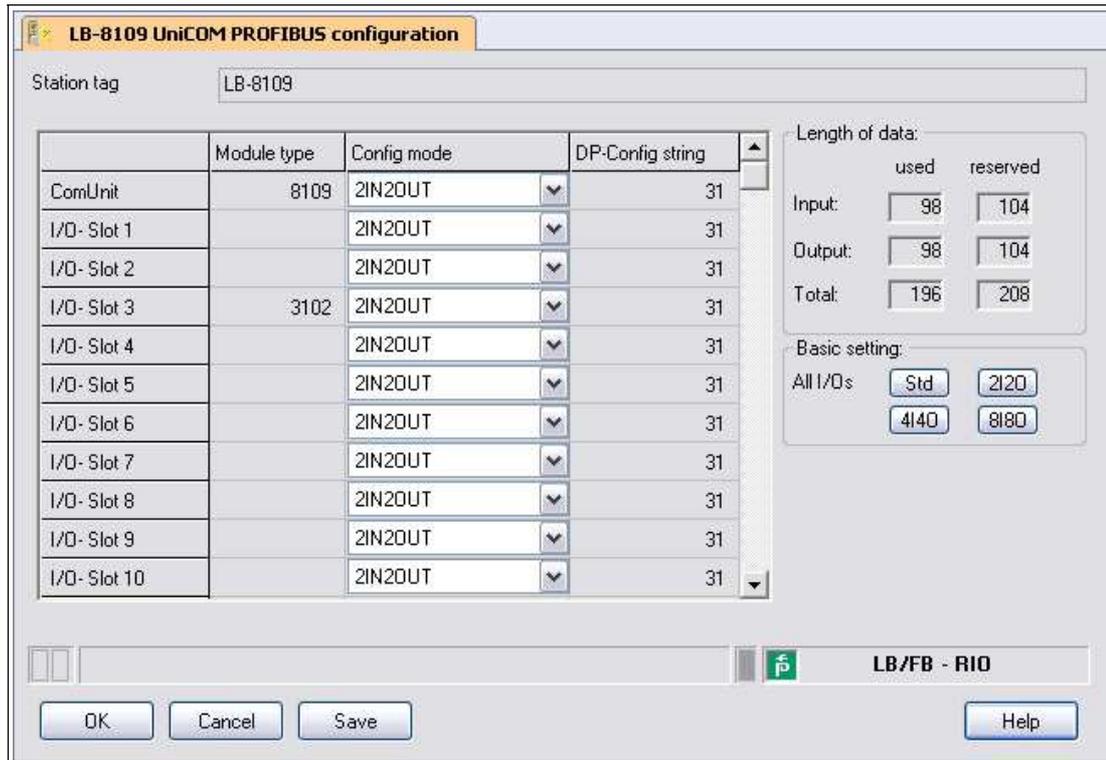


Figure 6.22 UniCOM PROFIBUS configuration in 2I2O universal configuration

Opening the Unicom PROFIBUS Configuration Window

1. Close all open device data and configuration windows. If this is not done, a warning with appropriate content appears when calling up the **UniCOM PROFIBUS configuration** window.
2. Right-click on the com unit entry in the project structure.
3. Select **Parameters > Parameterization > UniCOM PROFIBUS configuration**.
 - ↳ The **Unicom PROFIBUS configuration** window opens. → see Figure 6.21 on page 48
4. Configure the required settings. To preconfigure universal modules at a slot, in the **Config mode** column, select the entry **2IN2OUT**, **4IN4OUT**, or **8IN8OUT**. The factory setting for all slots is **Standard**.
 - To populate all slots with the same universal modes, select the desired module type in the **Basic setting** area.
 - ↳ As soon as you change the configuration, a warning triangle appears with the notice **Configuration change**. The configuration change alters the length of the PROFIBUS data telegram, making a PROFIBUS restart necessary.
5. To accept the changes, click on **OK**.



Note!

As soon as the number of reserved input and output octets is exceeded, a warning message appears.

Up to firmware version 9.06, the maximum number of input and output octets for the remote I/O unit as a whole is 240.

From firmware version 9.06, the maximum number of input and output octets can be doubled to 480 octets. See chapter 6.8

6.14 Adding or Deleting I/O Modules

Only the com unit has been incorporated into the project structure up to now. I/O modules are to be integrated into this step.

There are two options available for integrating the I/O modules into the PACTware™ project.

- Integrating the I/O modules via the **Add Device** command
- Reading and automatically generating I/O modules via the **Topology Scan** command.



Manually Integrating I/O Modules using the "Add Device" Command

1. Right-click on the com unit entry in the project structure.
2. Select **Add device**.

↳ A window opens displaying a list of all the available I/O modules.

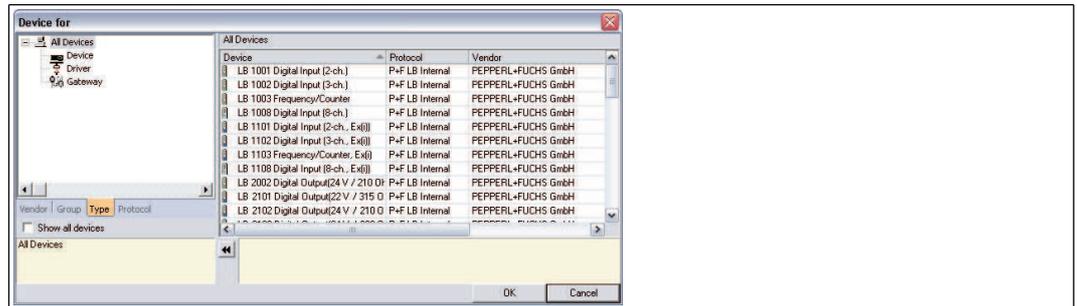


Figure 6.23 Selecting an I/O module

3. Select the I/O module that you wish to add to your project.
4. Click on **OK**.

↳ The **Channel selection** window opens displaying a list of slots.

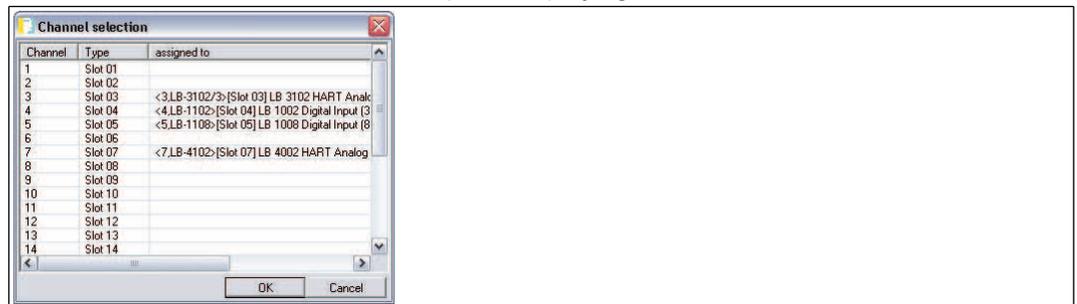


Figure 6.24 Channel selection window

5. Select the slot into which you wish to insert the I/O module. Remember that on redundant remote I/O stations, slots 1 and 2 are reserved for the redundant com unit. Also be aware that dual width I/O modules require 2 slots. See chapter 6.12

↳ If you have already added I/O modules to the project, these are displayed in the **Channel selection** window.

6. Click on **OK** to confirm your selection.

↳ If you have selected a slot that the selected I/O module can not accept (e.g., slot is already occupied or the subsequent slot for a dual width I/O module is not free), an error message will appear. In this case, repeat the previous step and select a different slot. The I/O module is added and appears under the com unit in the project structure.

7. If necessary, assign I/O modules to other slots by repeating these steps.

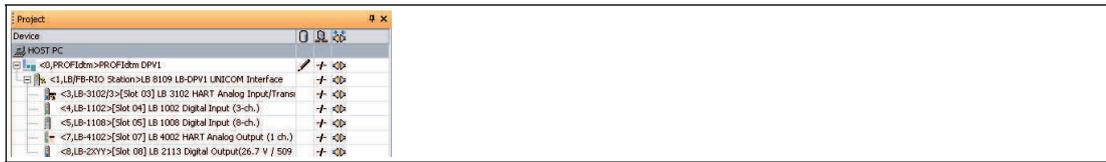


Figure 6.25 Project structure with I/O modules in PACTware™

Check your Unicom configuration in the connection by switching to the **Unicom PROFIBUS Configuration** window. See chapter 6.13

The following example shows a mixed assignment. Slots 1 ... 6 are occupied with universal modules 2I2O and 4I4O and can be populated with compatible I/O modules during actual operation. The remaining slots are configured with standard configuration and cannot be equipped with other modules during actual operation, unless the process control system supports Hot Configuration in Run (HCiR).

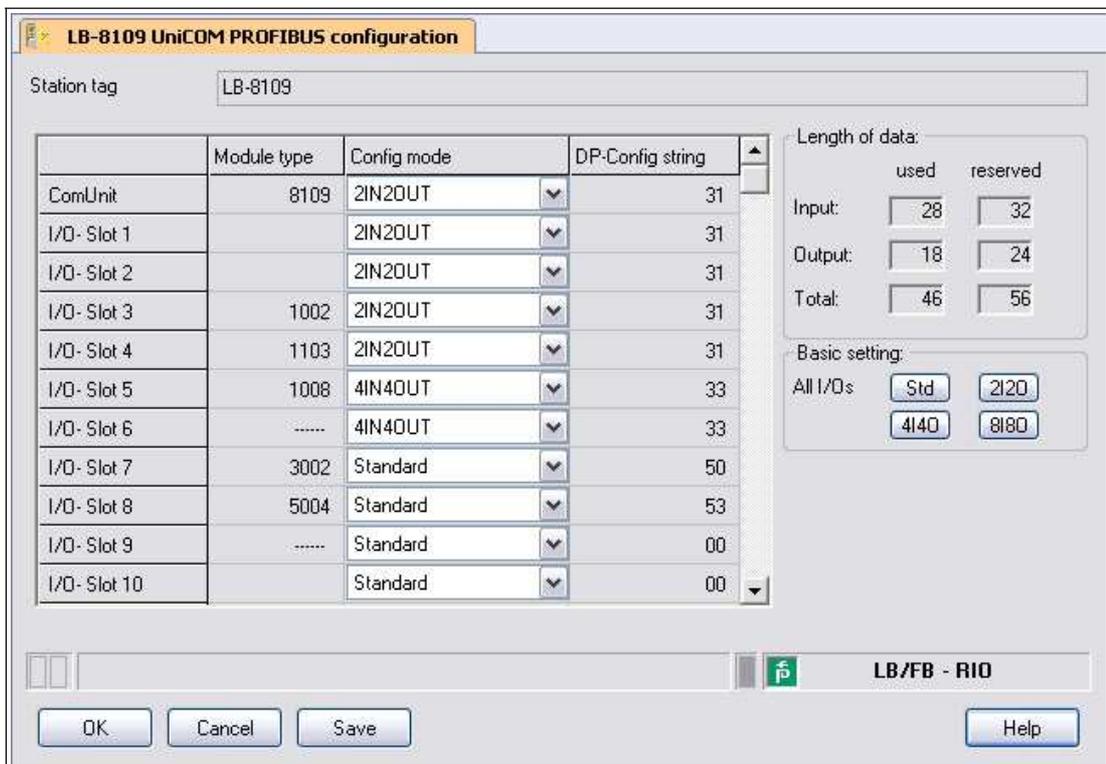


Figure 6.26 UniCOM PROFIBUS configuration in mixed assignment

To display the data structure of the PROFIBUS data telegram, e.g., for faster fault elimination, open the **Edit Device Data** window and switch to the **PROFIBUS II** tab. There you will see the data telegram in the **Info** area. → see Figure 6.27 on page 52

An identifier differing from 31 = 2I2O universal module, 33 = 4I4O universal module, or 37 = 8I8O universal module indicates that no universal module has been configured here.

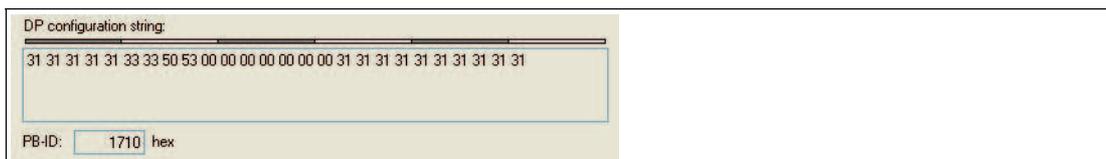


Figure 6.27 DP configuration string



Integrating I/O Modules Automatically by Scanning the Topology

Before allowing I/O modules to be installed automatically, there must be at least one com unit in the project structure. The **Backplane type**, **Extensions**, and **Power supplies** com unit parameters must already be configured.

1. Right-click on the entry for the required com unit in the project structure.
2. Establish a connection to the com unit. To do this, choose **Connect**.
 - ↳ The connection is established. The com unit entry appears bold in the project structure as soon as the connection is established.
3. Right-click on the entry for the com unit in the project structure again.
4. Select **Additional Functions > Topology Scan**.

↳ The **Topology Scan** window appears. The search begins automatically. The I/O modules that are found are listed in the same sequence as the slots in the backplane.

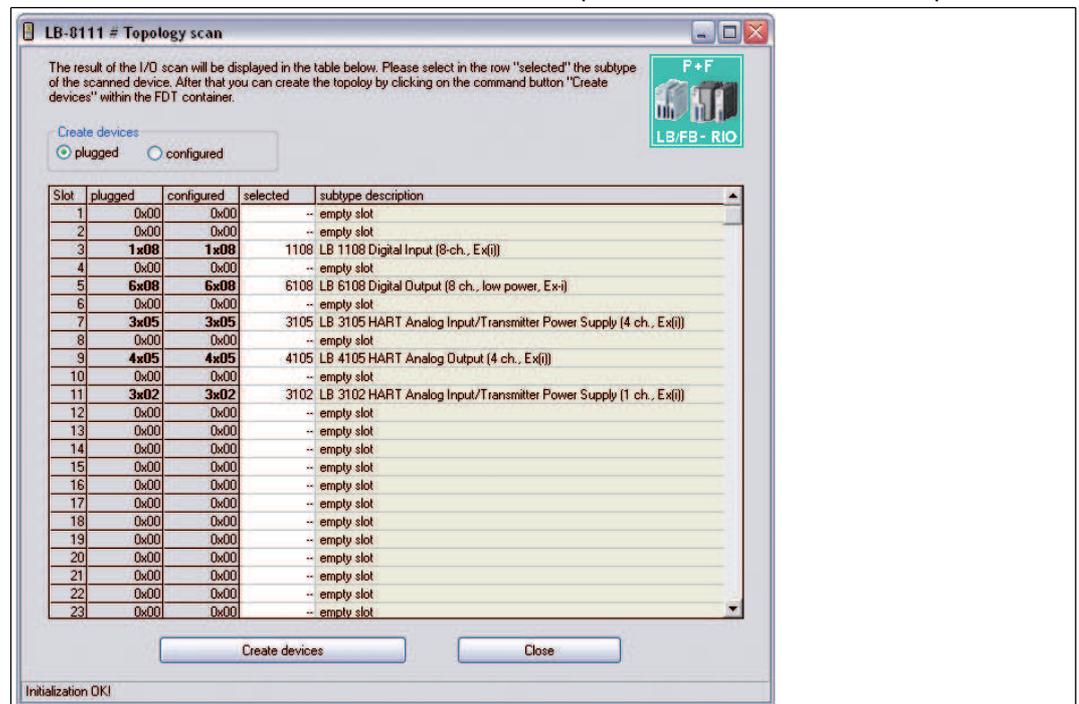


Figure 6.28 Topology scan window with a list of located I/O modules

5. The **Connected** column lists the I/O modules as they are actually connected in the backplane. The **Configured** column lists the I/O modules as they are currently parameterized in the com unit and project structure.
6. To integrate the I/O modules in the software in the same way as they are shown in the **Connected** column, choose the **Connected** option. To integrate the I/O modules in the same way as they are shown in the **Configured** column, choose the **Configured** option.
7. The **Selected** column allows the type of module to be specified more precisely or the I/O module to be deselected (--). To do so, click the cell in the **Selected** and make a selection. The options depending on the type of module in the **Connected** (or **Configured**) column, depend on which of the **Connected** or **Configured** options you selected in the **Create devices** area. The **Variant information** column contains more detailed information about the selected I/O module.
8. To generate the I/O modules as they are shown in the **Selected** column, click on **Create devices**.
 - ↳ The I/O modules will be integrated into the project structure with their standard parameter sets. A progress bar is displayed in the status line of the **Topology Scan** window.

Deleting I/O Modules

1. Right-click on the entry for the I/O module in the project structure that you wish to delete from the configuration.
2. Select **Remove device**.
3. Click on **Yes** in the dialog box.
 - ↳ The I/O module is removed from the configuration.
4. Repeat these steps to delete other I/O modules.

6.15 Converting I/O Module Type Retroactively



Note!

This feature is available from DTM version 7.5.1 and higher.

If the incorrect module type has been installed for an I/O module, the module type can be converted retroactively. During conversion, the parameters for the old module type are adopted for the new module type. You can convert a module type only if there is another module type with similar functions, e.g., converting LB1108A to LB1008A. The DTM suggests suitable module types for conversion.

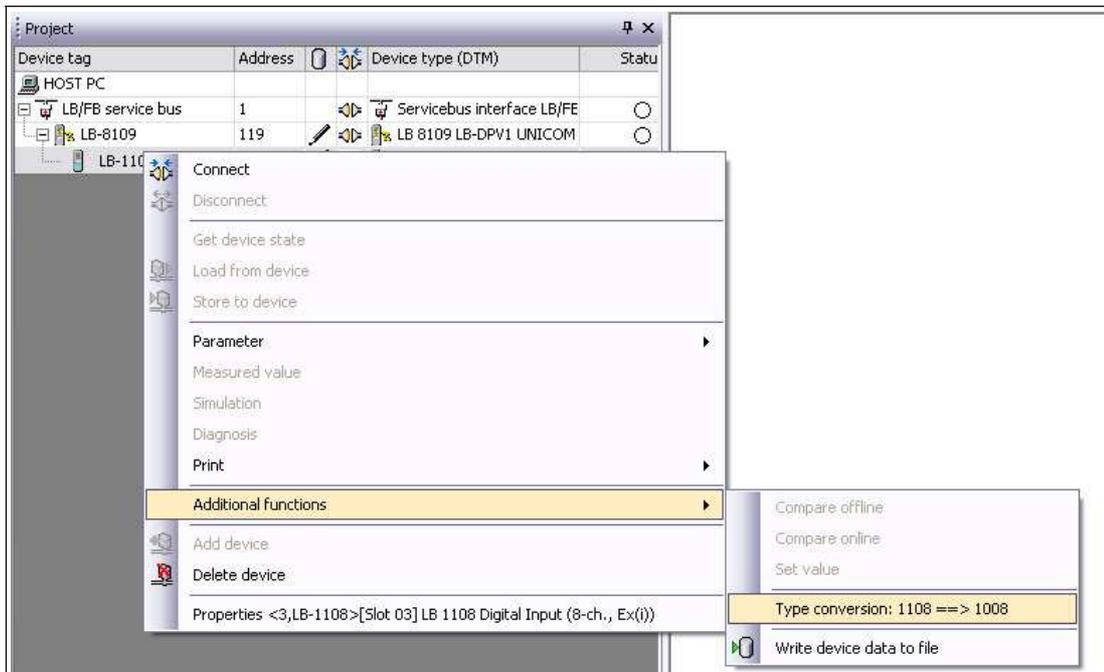


Figure 6.29 Convert module type

Converting I/O Module Type Retroactively

1. Right-click on the I/O module in the project structure that you want to convert.
2. Select **Additional functions > Type Conversion X ==> Y** (X = current module type, Y = possible new module type).
 - ↳ The module type is converted. The parameters of the old module type are retained.

6.16 Assigning I/O Modules (HCiR) to Standard Slots during Actual Operation



Note!

This chapter describes Hot Configuration in Run (HCiR) for applications that do not use the universal modules. The process control system must support HCiR.

Skip this description if you have already used the universal modules described. The use of universal modules is simpler and independent of the features of the process control system.

Hot Configuration in Run (HCiR) Function

The configuration of the master and slave in PROFIBUS systems must be the same at all times, otherwise data exchange will not be possible. As soon as the configuration of a remote-I/O station is changed, compliance of the configuration is no longer guaranteed. With HCiR, the difference in configuration between the master and slave is temporarily tolerated without disrupting the plant.

HCiR enables two configurations within the slave, regardless of the existence of a redundant system. If HciR is active, a new configuration can be transferred to the slave in the form of a passive data record. The master can access the slave using the old configuration until all the necessary modifications have been implemented in the master. The PROFIBUS restarts when the new configuration is activated in the master. When the new configuration in the slave matches the configuration in the master, the new configuration in the slave is activated automatically and the old configuration is deleted. However, if the PROFIBUS is started with a different configuration (e.g., because of a line failure or problems loading the master), the old configuration in the slave remains active.

Activating or Deactivating HCiR

You can activate or deactivate HCiR in the parameters for the application mode. See chapter 6.7

Note that new configurations and settings made using active HCiR only become effective when the master restarts the PROFIBUS. If you would like parameter changes to take effect immediately, do not activate HCiR.

In the following sections, you will learn how to add, delete, and replace I/O modules with HCiR, and how to change their operating mode.



Caution!

Differing Procedures for Different Process Control Systems

The procedure may differ from the one described in this manual depending on which process control system you are using.

The HCiR for a PROFIBUS system in which the master supports both class 1 services and class 2 services, allowing the integration of FDT 1.2 DTM and supporting HCiR, is described below.

Process control systems that support HCiR, such as ABB Symphony™, automatically control the parameter download and PROFIBUS restart process. Make sure in process control systems that do not support HCiR that the parameter download takes place in the com unit before the master is configured.

Changing configuration data relevant to the PROFIBUS while the system is running requires great care in process control systems without HCiR support. For such process control systems, we recommend preconfiguring empty slots in the master and slave with virtual I/O modules prior to commissioning. Deactivate these I/O modules to ensure that the data in the master and slave is consistent at all times. You can assign I/O modules to the slots and activate the I/O modules in the master at a later stage. The activation of these preconfigured I/O modules does not interrupt the exchange of PROFIBUS data. Alternatively, you can use universal modules from the Unicom com unit. This allows you to make configurations without HCiR functionality while the system is running.

6.16.1 Adding I/O Module with HcIR



Adding I/O Modules with HcIR



Danger!

Risk of explosion

When work is performed on the remote I/O unit in hazardous areas, there is a risk of explosion from spark formation.

Before starting any work on the remote I/O unit, familiarize yourself with the instruction manuals for the components and their relevant certificates.

1. Insert an I/O module in a free slot on the backplane and connect the wires correctly.
2. Run the FDT base application, e.g., PACTware™, that has access to the master's class 2 services.
3. Open the project file that contains the current configuration for the remote I/O station and the PROFIBUS master class 2 connection.
4. Add the new I/O module to the project structure. See chapter 6.14
The slot that you configure in the software must correspond with the actual slot of the new I/O module.
5. Establish a connection to the remote I/O station. Right-click on the com unit entry in the project structure.
6. Choose **Connect**.
↳ A connection to the com unit is established.
7. Right-click on the com unit entry in the project structure.
8. Select **Store to device**.
↳ The new configuration with the additional I/O module is written to the com unit as a passive data record (parameter download). The remote I/O station continues to run and use the old configuration that does not yet include the new I/O module.
9. Then configure the new I/O module in the class 1 master.
↳ The class 1 master restarts the PROFIBUS automatically.
Depending on the **watchdog time** parameter, the outputs of the remote I/O station retain their status prior to the restart while the PROFIBUS is restarted. The watchdog time is defined by the master. After the watchdog time has elapsed, the system switches to the preset substitute value strategy.
After the restart, the remote I/O station uses the new configuration that contains the new I/O module. The old configuration is deleted.



Note!

However, if the PROFIBUS is started with a different configuration (e.g., because of a line failure or problems loading the master), the old configuration in the remote I/O station remains active.



Tip

You can use the procedure described above to add several new I/O modules simultaneously.

6.16.2 Deleting or Replacing I/O Module with HCiR



Deleting or Replacing I/O Modules with HCiR



Danger!

Risk of explosion

When work is performed on the remote I/O unit in hazardous areas, there is a risk of explosion from spark formation.

Before starting any work on the remote I/O unit, familiarize yourself with the instruction manuals for the components and their relevant certificates.

1. Run the FDT base application, e.g., PACTware™, that has access to the master's class 2 services.
2. Open the project file that contains the current configuration for the remote I/O station and the PROFIBUS master class 2 connection.
3. Delete the relevant I/O module from the project structure. See chapter 6.14
If you would like to replace the deleted I/O module with a different module, add a new I/O module to the project structure underneath the com unit. The slot that you configure in the software must correspond with the actual slot of the new I/O module.
4. Now establish a connection to the remote I/O station. Right-click on the com unit entry in the project structure.
5. Choose **Connect**.
↳ A connection to the com unit is established.
6. Right-click on the com unit entry in the project structure.
7. Select **Store to device**.
↳ The new configuration with the deleted/replaced I/O module is written to the com unit as a passive data record (parameter download). The remote I/O station remains stable and continues to use the old configuration that still includes the previous I/O module.
8. Now delete the I/O module in the class 1 master as well. If you would like to replace the deleted I/O module with a new one, configure the new I/O module in the class 1 master.
↳ The class 1 master restarts the PROFIBUS automatically.
Depending on the **watchdog time** parameter, the outputs of the remote I/O station retain their status prior to the restart while the PROFIBUS is restarted. The watchdog time is defined by the master. After the watchdog time has elapsed, the system switches to the preset substitute value strategy.
After the restart, the remote I/O station uses the new configuration in which the old I/O module is no longer present or has been replaced with the new I/O module. The old configuration is deleted.
9. Remove the relevant I/O module from the backplane or replace the current I/O module with a new one.



Note!

However, if the PROFIBUS is started with a different configuration (e.g., because of a line failure or problems loading the master), the old configuration in the remote I/O station remains active.



Note!

You can use the procedure described above to delete/replace several I/O modules simultaneously.

6.16.3 Changing the Operating Mode of an I/O Module with HCiR

The data structure of some I/O modules may vary depending on the task. The frequency input 1x03 may be used as a counter or a frequency meter. Although the hardware remains unmodified, the data structure of the PROFIBUS data telegram changes depending on the operating mode. Changing the operating mode is therefore the same as replacing the I/O module with a new one.



Changing the Operating Mode of an I/O Module with HCiR

1. Leave the relevant I/O module unmodified in the backplane.
2. Run the FDT base application, e.g., PACTware™, that has access to the master's class 2 services.
3. Open the project file that contains the current configuration for the remote I/O station and the PROFIBUS master class 2 connection.
4. Change the operating mode in the device data window of the I/O module. See chapter 8
5. Establish a connection to the remote I/O station. Right-click on the com unit entry in the project structure.
6. Choose **Connect**.
 - ↳ A connection to the com unit is established.
7. Right-click on the com unit entry in the project structure.
8. Select **Store to device**.
 - ↳ The new configuration is written to the com unit as a passive data record (parameter download). The remote I/O station continues to run and still uses the old configuration with the I/O module's previous operating mode.
9. Then configure the I/O module in the class 1 master.
 - ↳ The class 1 master restarts the PROFIBUS automatically. Depending on the **watchdog time** parameter, the outputs of the remote I/O station retain their status prior to the restart while the PROFIBUS is restarted. The watchdog time is defined by the master. After the watchdog time has elapsed, the system switches to the preset substitute value strategy. After the restart, the remote I/O station uses the new configuration with the new I/O module operating mode. The old configuration is deleted.



Note!

However, if the PROFIBUS is started with a different configuration (e.g., because of a line failure or problems loading the master), the old configuration in the remote I/O station remains active.

6.17 Electrical Testing of Connections

Make sure that the terminators have been properly fitted to the fieldbus and service bus.



Test of Physical Connection Right to the End of the Segment



Tip

Perform the measurements from the control room.

1. Disconnect the bus connector from the master.
2. Deactivate the terminator on the bus connector (bus start).
3. Measure the voltage at the bus connector between A and B.

↳ A voltage of $U = 220 \Omega / (220 \Omega + 2 * 390 \Omega) * 5 \text{ V} = 1.1 \text{ V}$ must be present between A and B. This voltage comes from the field-side terminator.

If the 1.1 V voltage is not present, there is either no terminator connected at the end, the cable is faulty, or there is no terminating voltage at the remote I/O station.

4. Measure the current at the bus connector between A and B.

↳ It must be possible to measure a current of $I = 5 \text{ V} / (2 * 390 \Omega) \approx 6.4 \text{ mA}$ between A and B.

If the current is significantly higher, by a factor of 2 or more, the bus is terminated using more than one terminator.

If the current is $I \approx 0 \text{ mA}$, then either there is no terminator present, the cable is faulty, or there is no terminating voltage. In this case, a resistance of 220Ω should be measured between A and B.

If no current or resistance can be measured, the terminator at the end of the bus is missing or the cable is faulty.

5. Activate the terminator on the bus connector for the master.
6. Plug the bus connector back into the master.



Test of Physical Remote I/O Station Connection



Danger!

Risk of explosion

When taking measurements in hazardous areas, there is a risk of explosion from sparks forming.

Take measurements on the terminal connections of a remote I/O station, with a hot work permit only, in other words when there is no potentially explosive atmosphere.

1. Disconnect the bus connector from the master.
2. Deactivate the terminator on the bus connector (bus start).
3. Measure the voltage between A and B on the bus connection of each remote I/O station.
 - ↳ A voltage of $U = 1.1 \text{ V}$ must be present between A and B on each remote I/O station.
4. Activate the terminator on the bus connector for the master.
5. Plug the bus connector back into the master.



Note!

Please refer to the current literature for more information.

6.18 Commissioning of the Remote I/O Station

Do not start to operate all the slaves simultaneously, but connect each slave to the master in succession. For fault analysis, we recommend using a standard bus monitor that is capable of passively monitoring bus telegrams.

If the class 1 master does not have an option for modifying the PROFIBUS address of a slave, the address can be set via the class 2 master. See chapter 6.9.2

The default setting is 126 for the PROFIBUS address and 1 for the service bus address.

The I/O modules are addressed automatically relative to the station address.

LEDs on the front of the com unit indicate active data communication:

- If a yellow LED does not flash on the com unit when a slave is accessed, there is an interruption in the transmitting cable to the master, which can indicate an interface fault in the master or a cable fault.

- If communication cannot be established, the wrong station address may have been selected. Alternatively, the terminator may not be connected, or spurs may have been laid that are not permitted.

When installing the bus, make sure that the transmitting and receiving lines RTD-P and RTD-N have not been swapped. Swapping these lines may block access to one slave but allow access to all the others. If the lines are swapped when looping through to the terminals on the slave, access to all other subsequent stations is blocked.

Make sure that the parameterization of the master and slave corresponds and that the PROFIBUS ID number is correct.



Tip

You can check the configuration by viewing the DP configuration string.

In addition, note the following points to successfully commission the bus.

- There must be a terminator at the beginning and end of the bus. Corresponding Sub-D bus connectors with connectable terminator are available under product names LB9001A ... LB9003A.
- The master read cycle and the com unit watchdog must be adapted to one another. This is usually a standard function for the process control system.
- Remember that some process control systems can only process limited data records. Older Siemens Teleperm systems, for example, are able to process only 32 bytes of input and output data per slave. The accuracy of analog circuits requires the transfer of 2 bytes per channel. In this case, 16 analog inputs only can be used in the Remote I/O station.

More information about Remote I/O hardware can be found in the LB/FB hardware manual.

6.19 Replacing or Adding Com Units



Danger!

Risk of explosion

When work is performed on the remote I/O unit in hazardous areas, there is a risk of explosion from spark formation.

Before starting any work on the remote I/O unit, familiarize yourself with the instruction manuals for the components and their relevant certificates.



Note!

PROFIBUS Address Default Setting

The default PROFIBUS address of the com unit is set to 126 and the service bus address to 1. The PROFIBUS address 126 is a predefined address that is not available in PROFIBUS systems for operative slaves. When a new com unit is used, this predefined address prevents conflicts with the addresses of other slaves in the bus line.



Caution!

Bus conflicts

Incorrect PROFIBUS addresses can lead to bus conflicts.

Make sure that the PROFIBUS address of the new com unit is the same as the com unit being replaced.

In a redundant system, com units should be replaced while the plant is operating only if the com units have **line redundancy** and the PROFIBUS address in the com unit is preset to 126.



Replacing Com Units (1:1 Replacement)

1. Make sure that the firmware version of the new com unit is the same as the com unit being replaced.
2. Make sure that the PROFIBUS address of the new com unit is the same as the com unit being replaced. Use a separate remote I/O configuration slot to perform checks and configure the correct PROFIBUS address in the com unit.
3. Replace the old com unit with the new one.



Adding Redundant Com Units



Note!

A redundant com unit automatically adopts the parameters of the primary com unit via an internal connection. In FB remote I/O stations, the internal connection between the two com units is established via the front cable connection before the redundant com unit is installed. In LB remote I/O stations, the internal connection is established automatically via the backplane.

1. Make sure that the redundant com unit does not occupy a PROFIBUS address that is already used by another slave in the system. The default PROFIBUS address setting 126 is suitable here because another slave cannot occupy this address.
2. Add the redundant com unit.

7 Basic functions of the DTM LB/FB

7.1 Universal Screen Elements

Unsaved parameter changes are shown in blue in the device data window. As soon as the changes are saved, the values are shown in black.

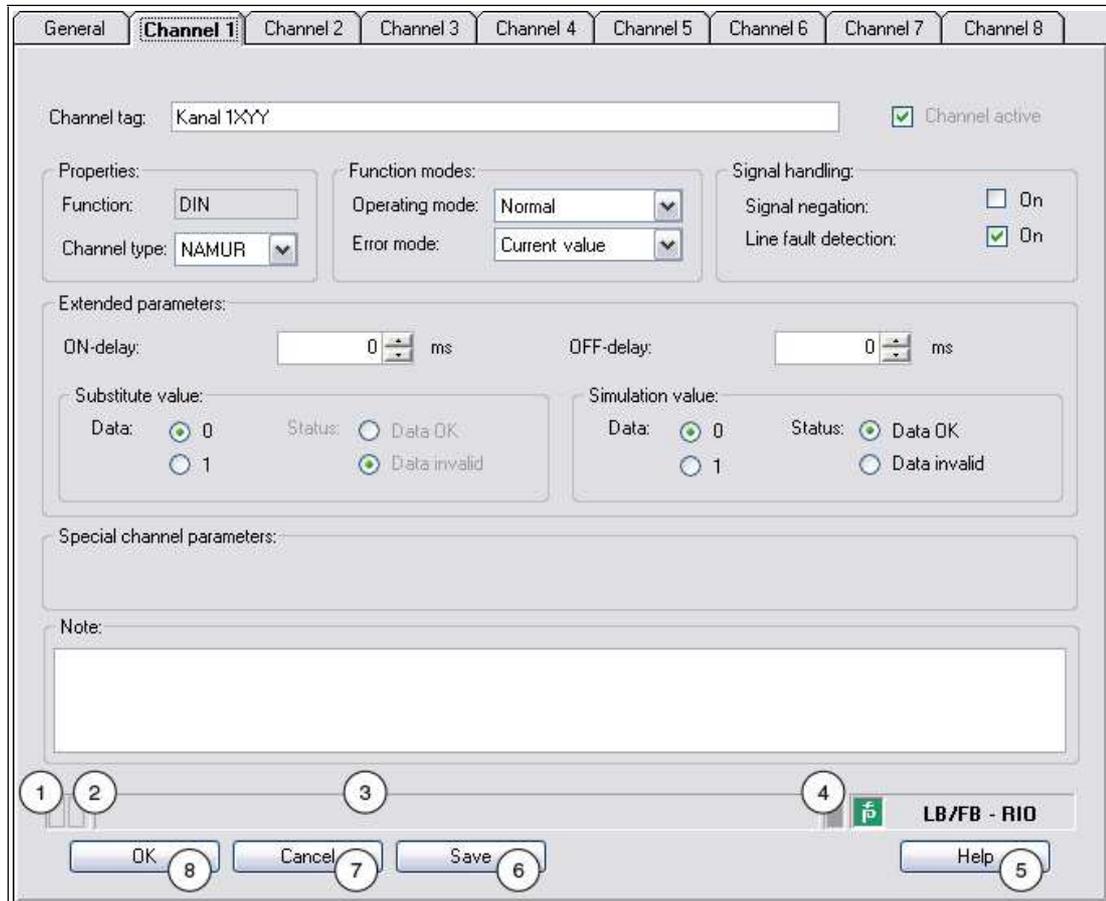


Figure 7.1 DTM status bar and buttons

Field		Explanation
1	Validity of settings	This box in the status bar indicates whether the modified settings are valid. The box is gray if the settings are valid and blue if the settings are invalid.
2	Memory status of settings	Indicates whether settings have been modified and not saved. The field appears blue if settings have not been saved.
3	Text box	Displays text messages relating to certain events.
4	Connection status	Indicates whether there is a connection with the device in question. <ul style="list-style-type: none"> ■ Yellow = online ■ Gray = offline
5	Help	Displays the Help file.
6	Save	Saves the settings made. The settings are saved in the database or directly on the device depending on the connection status. The configuration window remains open after the settings are saved.

Field		Explanation
7	Cancel	Closes the configuration window without saving any modifications you may have made.
8	OK	Saves modified settings and closes the configuration window.

7.2 User Administration



Note!

The functions described in this section relate to the DTM, version 7.4 or later.

How you set up different users and their passwords depends on your FDT base application.

In PACTware™, select **Extras > User Administration** to access the user administration options.

The FDT user concept distinguishes between the user roles **Observer**, **Operator**, **Maintenance personnel**, and **Configuration engineer**. The FDT base application already assigns rights and implements restrictions to the different user roles, e.g., relating to downloading or topology modifications.

User roles

User role	Restrictions
Configuration engineer	No restrictions
Maintenance personnel	Can modify all parameters with the exception of the fieldbus addresses. Not authorized to make topology modifications at the system end.
Operator	Can modify all parameters, with the exception of the fieldbus addresses, that have no impact on the data structure or data volume. The operator may not modify the following parameters: <ul style="list-style-type: none"> ■ Synchronous data from com units ■ Measuring method for I/O modules LB1*03, FB1*03 ■ Measuring method for I/O modules LB3*02, FB3*02
Observer	Not authorized to modify any parameters.

7.3 Editing Device Data



Note!

Before modifying the device data, you should be familiar with the concept of online and offline parameterization. See chapter 6.6



Opening the "Edit Device Data" Window

1. Right-click on the I/O module in the project structure.
2. Depending on the connection status, select **Parameters > Parameterization > Edit Device Data (Offline)** or **Parameters > Online Parameterization > Edit Device Data (Online)**.

↳ The **Edit Device Data** window opens.

The **Edit Device Data** window for the I/O modules is divided into several tabs.

The **General** tab contains parameters that affect the whole I/O module as well as information on the I/O module and available channels. The structure of the **General** tab is the same for all I/O modules.

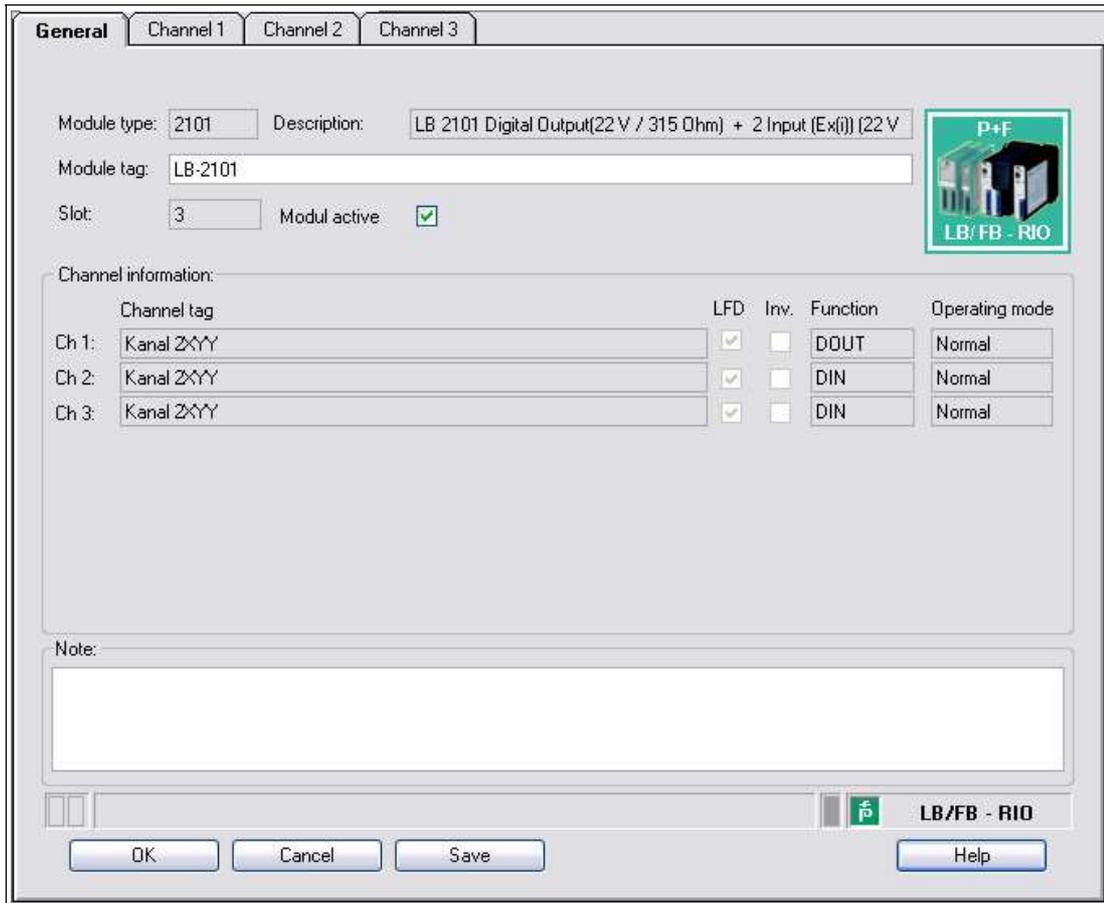


Figure 7.2 General tab

Field	Explanation
Module type	This field displays the four-digit type designation for the I/O module. This field can not be edited.
Description	This field displays the description of the I/O module. This field can not be edited.
Module tag	Enter any name for the I/O module. The maximum length is 32 characters.
Slot	This field indicates the slot number of the I/O module. The slot number cannot be edited. If you wish to position the I/O module in another slot, delete it from the project structure, and reinsert it in another slot. Note that the layout in the tree structure must match the layout on the backplane.

Field	Explanation
Active module	<p>Enable or disable this check box to activate or deactivate the I/O module.</p> <ul style="list-style-type: none"> ■ If you deactivate the I/O module, the module is present in the synchronous data traffic, but does not generate measured values or diagnostics data. This option is useful for process control systems that do not allow extensions during ongoing operation. In this case, any I/O module can be preconfigured, even if it has not yet been plugged into the backplane. This ensures that the I/O module is already included in the DP configuration string. The I/O module can be upgraded in the relevant slot on the backplane at a later time and activated using the Module active option without requiring a PROFIBUS restart. ■ If you activate the I/O module, it operates normally and generates measured values and diagnostics data.
Channel tag	<p>The names of the I/O module channels can be found here. You can enter the names in the Channel X tab in the Channel tag box of the relevant I/O module. The Channel tag fields cannot be edited on the General tab.</p>
LFD	<p>The check box is present only when the I/O module has line fault detection. Here you can see whether line fault detection is enabled for each channel. You can activate/deactivate line fault detection in the Channel X tab for the relevant I/O module. The Line fault detection check boxes cannot be edited on the General tab.</p>
Inv.	<p>This check box appears with digital I/O modules only. The check box indicates whether signal negation is active on each channel. You can activate or deactivate signal negation on the Channel X tab of the relevant I/O module. The Signal negation check boxes cannot be edited on the General tab.</p>
Channel type	<p>This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output</p>
Operating mode	<p>This field indicates the operating mode for each channel. You can set the operating mode in the Channel X tab for the relevant I/O module. The Operating mode fields cannot be edited on the General tab.</p>
Note	<p>You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.</p>

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on the **Channel X** tab.

More detailed, module-specific information about the **Channel X** tabs can be found in chapter Configuring I/O Modules. See chapter 8

7.4 Operating Mode and Error Mode

Different function modes for each channel of an I/O module can be selected in the **Edit Device Data** window.

- Operating modes
 - Standard
 - Simulation
- Error modes
 - Current value
 - Substitute value
 - Last valid value

7.4.1 Setting the operating mode

During commissioning or service work, you have the option of switching the channels of the I/O modules from **Normal** to **Simulation** operating mode.

In simulation mode, the channel adopts a defined simulation value. Both the operating mode and the simulation value can be set for each channel in the **Edit Device Data** window. Detailed descriptions of the I/O module simulation values can be found in chapter Configuring I/O Modules. See chapter 8



Figure 7.3 Setting the operating mode



Tip

Restoring the Original Configuration

We recommend saving a copy of the current configuration on the hard drive before switching multiple channels to **Simulation** operating mode. That way the channels can be easily switched back to normal mode later.

The simulation function can be used while the fieldbus is operating and does not interrupt data communication. Only the channel that is switched to **simulation** is processed with simulation values rather than field signals.

Input data is transferred via the fieldbus as preset data (simulation value). You can thus simulate sensor signals during commissioning without modifying the sensor to check that data is communicated correctly to the process control system.

Output data (simulation value) still has to run through the I/O module signal processing first. You can therefore check the function of valves, even if bus communication has not yet been established.

You can check the simulation result using the **Show measured value** function. See chapter 7.6

After finishing commissioning or service work, reset the operating mode to **Normal**.

7.4.2 Adjusting Error Mode Settings

In the event of a fault, the I/O modules automatically switch over to error mode.

In error mode, the channel concerned can adopt the current value, the last valid value, or a substitute value. The behavior in error mode and the substitute value can both be set for each channel in the **Edit Device Data** window. For details of the substitute values of the individual I/O modules, see see chapter 8.



Figure 7.4 Adjusting error mode settings

Error Mode for Outputs

Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status **Data invalid**, the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit.

If the watchdog is deactivated, the substitute value strategy will be invalid in the event of a bus failure. The watchdog time is set in the com unit. See chapter 6.9.2

If a fault state is detected during the startup phase, the outputs are transferred from the power off status to the selected error mode.

- **Current value**
The current value being transferred by the process control system is output in spite of the **Data invalid** status.
- **Substitute value**
The substitute value can be changed to any permissible value within the operating range of the I/O module.
- **Last valid value**
If a new incoming value has the status **Data invalid**, the com unit uses the last valid value to form the output value.

If communication between the I/O module and the com unit fails, the affected outputs are deactivated after a watchdog time of approx. 500 ms.

Error Mode for Inputs

When there is a lead breakage, a short circuit or a module fault, substitute values are transferred to the process control system in accordance with the substitute values strategy.

- **Current value**
The current, faulty value with the **Invalid data** status is transferred.
- **Substitute value**
The substitute value can be modified manually. In DTM version 7 and higher, the substitute value always has the **Invalid data** status.
- **Last valid value**
The com unit uses the last valid value before the fault occurred to form the input value. This value has the **Invalid data** status.

If communication between the I/O module and the com unit fails, the status of the affected inputs is set to **Invalid data**. An alarm bit is set in the corresponding module status area.

Responses

The following example shows the data flow from a digital output resulting from different situations and settings.

- In normal mode, the data is transferred directly from the com unit to the output.
- If signal negation has been configured, the signals are inverted beforehand according to their settings.
- If simulation values are output instead of the current bus data, these simulation values are treated in the same way as bus data and are inverted if necessary.
- If the error bit **Invalid data** is set, then either the current values, the substitute values, or the last valid values are transferred to the outputs depending on the error mode.

All processes are applied to each individual channel. The table shows a selection of the possible combinations that the diagram generates when the flow of data is traced.

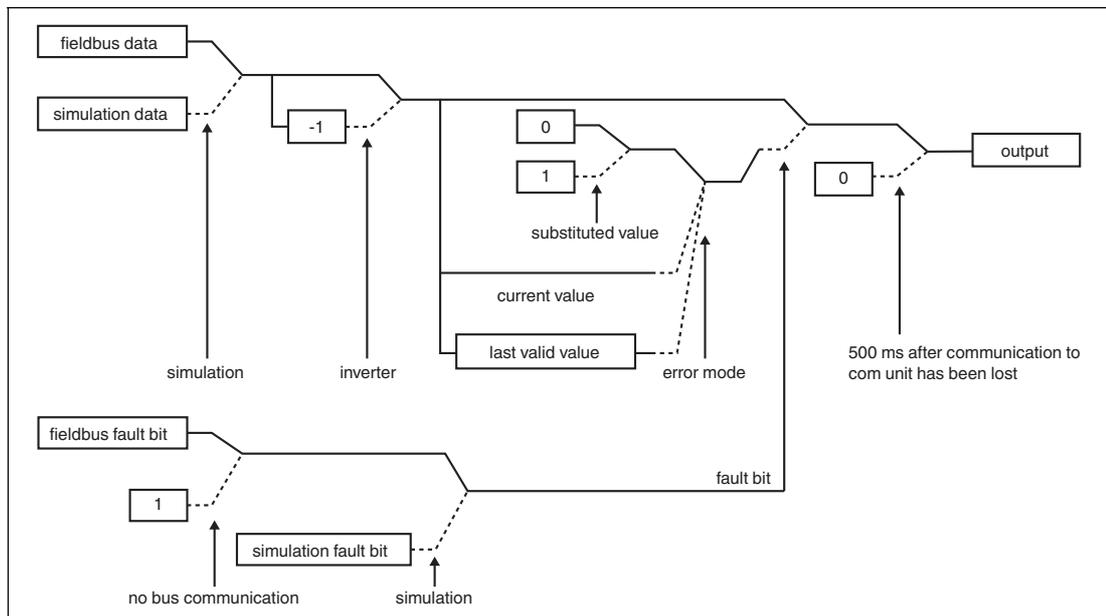


Figure 7.5 Data flow from com unit to a digital output

Solid line for normal position
Dashed line for if-then action
3 options in error mode

Function Table for Digital Output

Status	Com unit			I/O module					
	Data bit	Error bit	Communication with fieldbus	Simulation	Operating mode	Communication with com unit	Signal negation	Error mode	Output
Operation	0	0	Yes	-	Normal	Yes	0	-	0
Operation	1	0	Yes	-	Normal	Yes	0	-	1
Operation	0	0	Yes	-	Normal	Yes	1	-	1
Operation	1	0	Yes	-	Normal	Yes	1	-	0
Error bit operation	0	1	Yes	-	Normal	Yes	0	Current value	0
Error bit operation	1	1	Yes	-	Normal	Yes	0	Current value	1
Error bit operation	0	1	Yes	-	Normal	Yes	1	Current value	1

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Status	Com unit			I/O module					
	Data bit	Error bit	Communication with fieldbus	Simulation	Operating mode	Communication with com unit	Signal negation	Error mode	Output
Error bit operation	1	1	Yes	-	Normal	Yes	1	Current value	0
Bus fault	Old	-	No	-	Normal	Yes	-	Current value	Old

7.5 Scaling the Measuring Range

Normally, analog measured data is transferred in unsigned integers within a range between 10,000 (0%) and 50,000 (100%). For process control systems that are not capable of processing number ranges this large, you can adapt the number range for each channel of an analog I/O module separately.

Please note that scaling is based on live zero signals (0% = 4 mA, 100% = 20 mA). Therefore, when using 10,000 (beginning of range) to 50,000 (end of range) scaling, 50% is equal to the numerical value 30,000. If the value 0 is transferred by the bus, the output assumes the value 0 mA. Input signals of 0 mA are accordingly signaled to the process control system by the numerical value 0.

The scaling can also be set to between 4000 ... 20,000 so that correspondence with the 4 mA ... 20 mA signal range is maintained. This setting is suitable for signal ranges of 0 mA ... 20 mA with an extended range.



Note!

On control systems that support the FDT concept, scaling is neither necessary nor appropriate. The corresponding channel variables that are created by the Device Type Manager (DTM) and can be used in the process control system use the last 12 bits (bits 4 ... 15) of the 16-bit value and specify the validity of the measured value in bit 1.



Scaling the Measuring Range

1. Open the **Edit Device Data** window. See chapter 7.3
2. Select the **Channel X** tab for the channel for which you wish to scale the measuring range.
3. Enter the desired numeric range in the **Measuring range/scaling** area. Only whole numbers between 0 ... 65535 may be entered.

Figure 7.6 Scaling the measuring area

4. Click on **Save** to accept the changes or click on **OK** to accept the changes and close the device data window.



Example!

A process control system operates better within a range between 0 ... 4095 instead of 0 ... 65535. Select the following settings in the process control system to adapt the scaling.

- Start of range: 625
- End of range: 3125
- Scaling factor: 1.3107

Overranges and underranges of the 4 mA ... 20 mA signal can be displayed via the measured value.

7.6 Show Measured Value

The **Show Measured Value** window is used to display measured values and diagnostics information.



Opening the "Show Measured Value" window

1. Right-click on the entry for the required component in the project structure.
2. Choose **Connect**.
 - ↳ The connection is established. The entries appear in bold in the project structure once the connection is established. The connection status is also indicated by an icon.
3. Right-click on the entry for the connected device in the project structure.
4. In the context menu, select **Measured Value > Show Measured Value**. If the command is not available, there is no connection to the device.
 - ↳ The **Show Measured Value** window opens.

7.6.1 Measured Value Display for Digital I/O Modules

Depending on the module type (digital input, digital output, relay contact output), the measured value display for digital I/O modules differs in the number of channels displayed.

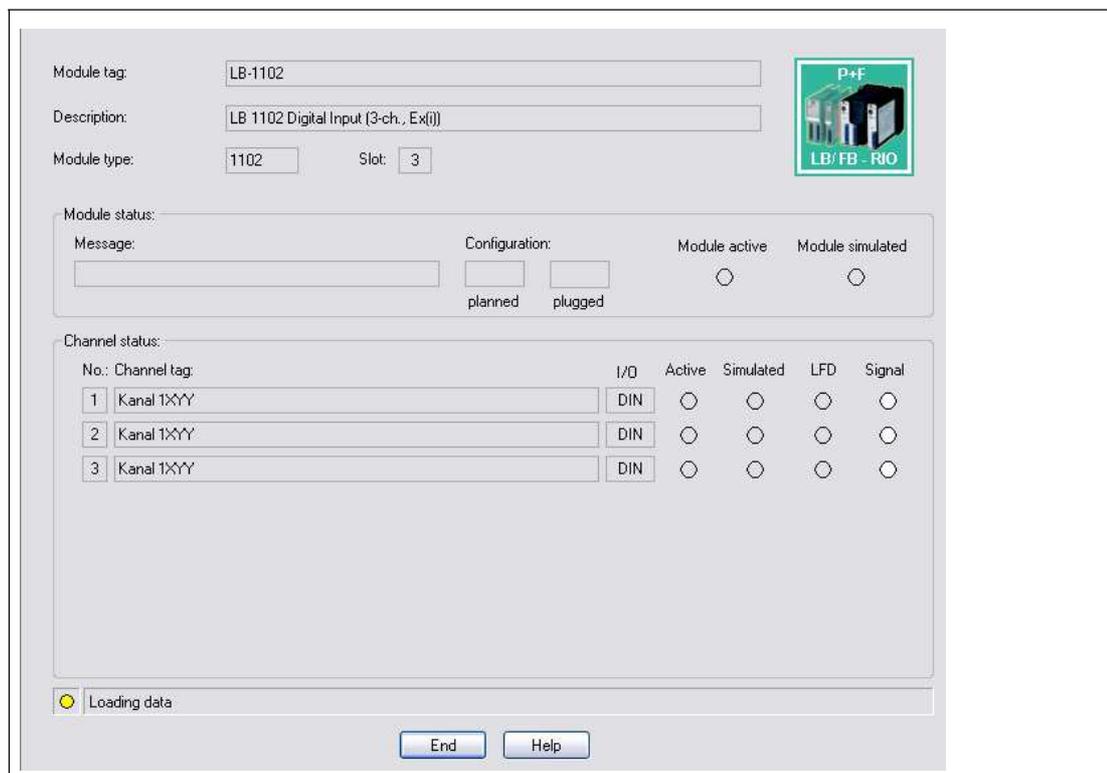


Figure 7.7 Show Measured Value window for digital modules

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Field	Explanation
Module tag	This field displays the name of the I/O module. You can edit the name on the General tab in the Edit Device Data window. See chapter 7.3
Module description	This field displays the description of the I/O module. This field can not be edited.
Module type	This field displays the four-digit type designation for the I/O module. This field can not be edited.
Slot	This field indicates the slot number of the I/O module. The slot number cannot be edited. If you wish to position the I/O module in another slot, delete it from the project structure, and reinsert it in another slot. Note that the layout in the tree structure must match the layout on the backplane.
Module messages	This field displays messages from the I/O module. Error messages are highlighted red.
Configuration	The Planned field indicates which I/O module is included in the active com unit configuration. The Connected field indicates which I/O module is actually plugged in on the backplane. If the scheduled and actual I/O module types differ, the fields appear red.
Module active	When the display lights up yellow, the I/O module is active. When the display is gray, the I/O module is deactivated. You can activate or deactivate the I/O module on the General tab of the Edit Device Data window. See chapter 7.3
Module simulated	When the display lights up yellow, at least one channel of the I/O module is in simulation mode.
Channel tag	This field displays the name of the channel in question. You can specify the name for each channel in the Channel X tab of the Edit Device Data window. The associated channel number is shown to the left of the field and the channel type to the right. <ul style="list-style-type: none"> ■ DIN = digital input ■ DOUT = digital output ■ AIN = analog input ■ AOUT = analog output
Active	When the display lights up yellow, the associated channel is active. As soon as an I/O module is active, all channels are also active.
Simulated	When the display lights up yellow, the associated channel is in simulation mode. Simulation mode can be activated or deactivated for each channel in the Channel X tab of the Edit Device Data window.
LFD	This display only appears if the I/O module has a line fault detection function. If the display lights up red, there is a line fault in the relevant channel. With some I/O modules, a distinction can be made between a lead breakage and a short circuit. In such cases, a B (for lead breakage) or K (for short circuit) is displayed in addition to the LFD indicator. Line fault detection can be activated or deactivated for each channel in the Channel X tab of the Edit Device Data window.

Field	Explanation
Signal	This display shows the current field signal. If the display lights up yellow, the signal 1 is transferred. If the display lights up gray, the signal 0 is transferred.
Status bar	The status indication flashes yellow in rhythm with the data transfer. If a communication error occurs, the display lights up red. The communication status is displayed as a text message in the text box.

7.6.2 Measured Value Display for Analog I/O Modules

Depending on the module type (analog input, analog output, frequency input, temperature input, voltage input), the measured value display for analog I/O modules differs in the number of channels displayed.

The **Overview** tab provides an overview of the status and the measured values of all input or output channels of the I/O module.

Figure 7.8 Show Measured Value window for analog modules

Field	Explanation
Module tag	This field displays the name of the I/O module. You can edit the name on the General tab in the Edit Device Data window. See chapter 7.3
Module description	This field displays the description of the I/O module. This field can not be edited.
Module type	This field displays the four-digit type designation for the I/O module. This field can not be edited.

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Field	Explanation
Slot	This field indicates the slot number of the I/O module. The slot number cannot be edited. If you wish to position the I/O module in another slot, delete it from the project structure, and reinsert it in another slot. Note that the layout in the tree structure must match the layout on the backplane.
Module messages	This field displays messages from the I/O module. Error messages are highlighted red.
Configuration	The Planned field indicates which I/O module is included in the active com unit configuration. The Connected field indicates which I/O module is actually plugged in on the backplane. If the scheduled and actual I/O module types differ, the fields appear red.
Module active	When the display lights up yellow, the I/O module is active. When the display is gray, the I/O module is deactivated. You can activate or deactivate the I/O module on the General tab of the Edit Device Data window. See chapter 7.3
Module simulated	When the display lights up yellow, at least one channel of the I/O module is in simulation mode.
Channel tag	This field displays the name of the channel in question. You can specify the name for each channel in the Channel X tab of the Edit Device Data window. The associated channel number is shown to the left of the field and the channel type to the right. <ul style="list-style-type: none"> ■ DIN = digital input ■ DOUT = digital output ■ AIN = analog input ■ AOUT = analog output
Active	When the display lights up yellow, the associated channel is active. As soon as an I/O module is active, all channels are also active.
Simulated	When the display lights up yellow, the associated channel is in simulation mode. Simulation mode can be activated or deactivated for each channel in the Channel X tab of the Edit Device Data window.
LFD	This display appears only if the I/O module has a line fault detection function. If the display lights up red, there is a line fault in the relevant channel. The line fault is specified in more detail on the Input/Output X tabs. Line fault detection can be activated or deactivated for each channel in the Channel X tab of the Edit Device Data window.
Value	This field displays the current measured value in the relevant unit.
Status bar	The status indication flashes yellow in rhythm with the data transfer. If a communication error occurs, the display lights up red. The communication status appears in the box to the right of the display in the form of a text message.

In addition to the **Overview** tab, the **Channel status** area contains one or more **Input X** and **Output X** tabs where X stands for the channel number, e.g., input 1, input 2.

The **Input X** and **Output X** tabs display the values of each individual input or output channel separately. The measured value is shown in figures on one side and as bars on the other, and the line fault detection status is specified in more detail.

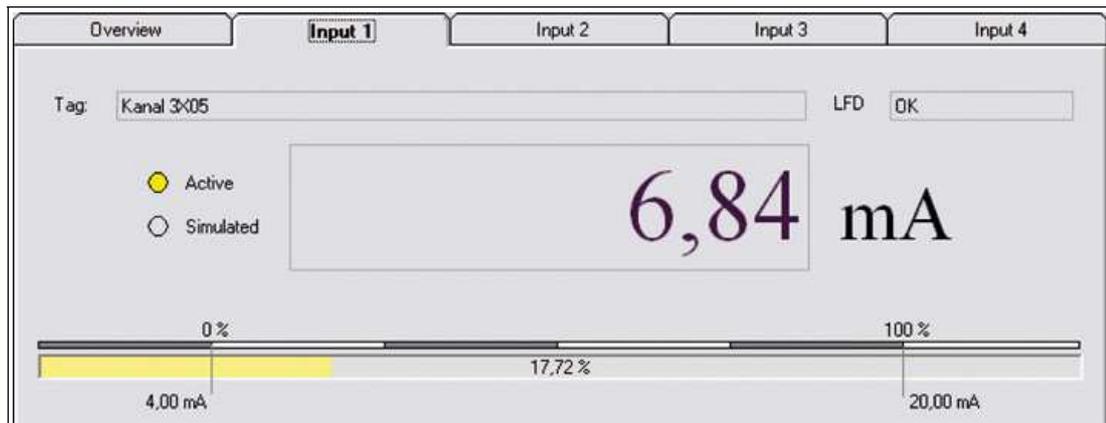


Figure 7.9 Input 1 tab

7.7 Configuring HART Communication

The following I/O modules are suitable for communication with intelligent field devices using the HART protocol.

- 3x02, 3x03, 3x05, 3x06
- 4x02, 4x05, 4x06
- 7x04

HART field devices can be addressed, activated, and operated via the PROFIBUS.



Note!

Note the connection layout of the I/O modules. The connection layout differs depending on whether you are using a 2-wire transmitter, 3-wire transmitter or 4-wire transmitter (externally powered) with the I/O module.

Make sure that the output current during HART communication is between 4 mA ... 20 mA.

Data transfer is based on the transmission of frequency packages according to the Bell standard (1200 Hz = 1, 2200 Hz = 0). The frequency packages are modulated onto the 4 mA ... 20 mA signals by the I/O modules in frequency shift keying mode. Two types of communication are possible.

- Communication with a handheld connected to the I/O module terminals for hazardous location. The required 250 Ω communication resistance is built into all analog I/O modules.
Transmitters that do not use the standard HART protocol may need to be reset after they have finished operating. This problem can be identified when the measurement circuit freezes.
- Communication via the PROFIBUS with the com unit using the acyclic DP-V1 services and with the I/O modules without auxiliary equipment. Use a suitable communication program to access the functions of the HART field devices via the PROFIBUS. Field device manufacturers provide separate DTMs for their field devices so that all the functions of the field devices are accessible via the PROFIBUS using the HART protocol. In addition, PROFIBUS class 2 masters can be used if the process control system does not provide HART functionality.

The DTM LB/FB contains a HART communication component that, together with a HART DTM (e.g., **generic HART DTM** from the PACTware™ standard setup), allows access to the connected HART devices.

Configuring HART Communication

Before setting up HART communication, the project file must be open and include a com unit and one or more I/O modules with HART support.

1. Right-click on an I/O module with HART support in the project structure.
2. Select **Add Device**.

↳ The **Device for** window opens displaying a list of available DTMs. Device manufacturers usually offer DTMs that are compatible with the relevant device. If you do not have any device-specific DTMs, you can set up the devices using a **generic HART DTM**.

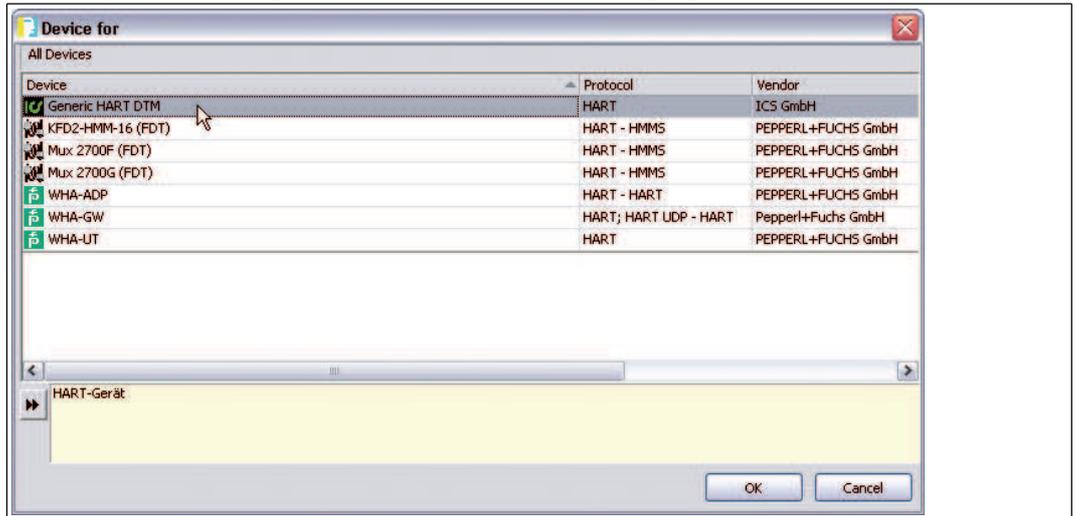


Figure 7.10 Device for window

3. Select the required HART DTM in the **Device for** window and then click on **OK**.

↳ If you are using a multichannel I/O module, the **Channel Selection** window opens. If you are using a single-channel I/O module, you do not need to select a channel.

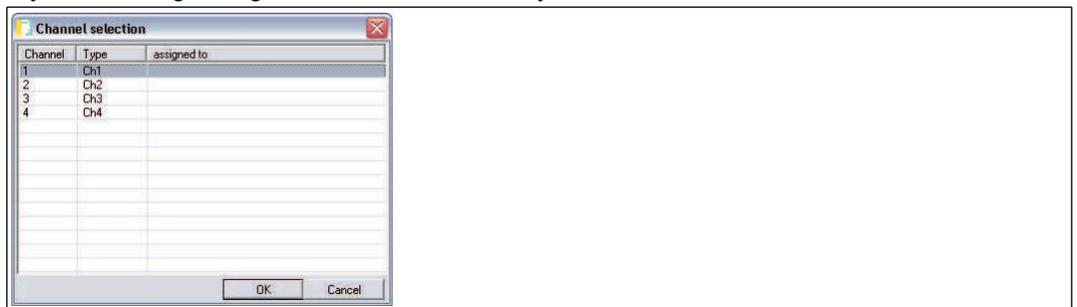


Figure 7.11 Channel Selection window

4. Select the required I/O module channel from the list and then click on **OK**.

↳ The HART DTM is added to the project structure under the corresponding I/O module.

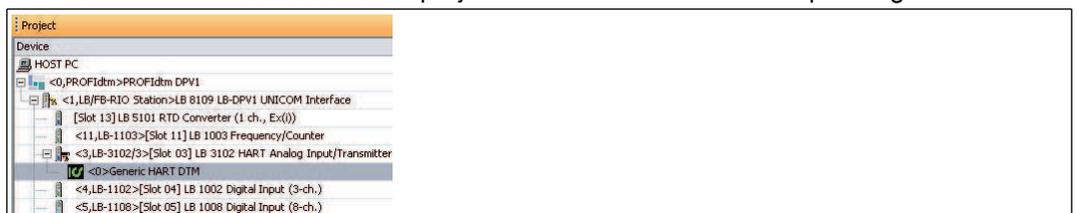


Figure 7.12 HART DTM in the PACTware™ project view

5. Right-click on the HART DTM.

6. Select **Parameterize > Parameterize** to configure additional settings, or establish a connection with the field device to read the data stored on the field device. Further information about configuring the field devices and field device DTMs can be found in the field device manufacturer's documentation.

**Note!****Com units from firmware version 6 and higher**

Com units from firmware version 6 and higher are equipped with HART cross-talk suppression. The cross-talk suppression makes sure that HART channels are signaled as faulty only if the fault is pending for more than 500 ms. The channel data is frozen until the HART signal faults are rectified. The channel becomes active again as soon as the HART fault is rectified.

In addition, the com unit resets I/O modules that have experienced a HART communication fault.

Practical Experiences

The following restrictions were found during tests in relation to HART communication.

- HART communication with measuring transmitters is possible in the operating range 4 mA ... 20 mA. Some measuring transmitters go overrange (22 mA) or underrange (< 4 mA) when there is no input signal, e.g., in the event of a lead breakage. In this situation, HART communication with this measuring transmitter is often not possible.
- There are measuring transmitters that work with device-specific HART commands. When device-specific, non-HART compliant commands are executed, the error counter in the I/O module may reach saturation depending on the I/O module firmware and hardware. In this case, perform a reset of the I/O module.
- In rare cases, field devices without HART support such as plunger coil positioners may generate HART-like signals in 20 mA loops. These signals can be produced by random vibrations at the installation location of the field device. The I/O module's error counter can therefore overflow and the I/O module cuts communication with the com unit. In this case, perform a reset of the I/O module.
You can avoid this problem by using an I/O module without HART support or by deactivating the HART function on the affected channel.

8 Configuring I/O Modules

The following sections describe the properties and configuration options for the I/O modules.

The sections are always similar in structure.

- Brief description of the relevant I/O module with block diagram
- Information on resolution, measuring time, and cycle time
- Information about data transmission and bit structure within the data telegram
- Information about line fault detection
- Description of adjustment options

8.1 LB1*01, FB1*01 Digital Input

8.1.1 Description

Versions

- LB1001, digital input, not intrinsically safe
- FB1301, digital input, increased safety terminals
- LB1101, digital input, intrinsically safe
- FB1201, digital input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Suitable sensors: mechanical contacts, NAMUR proximity switches, 2-wire initiators
- Number of channels: 2

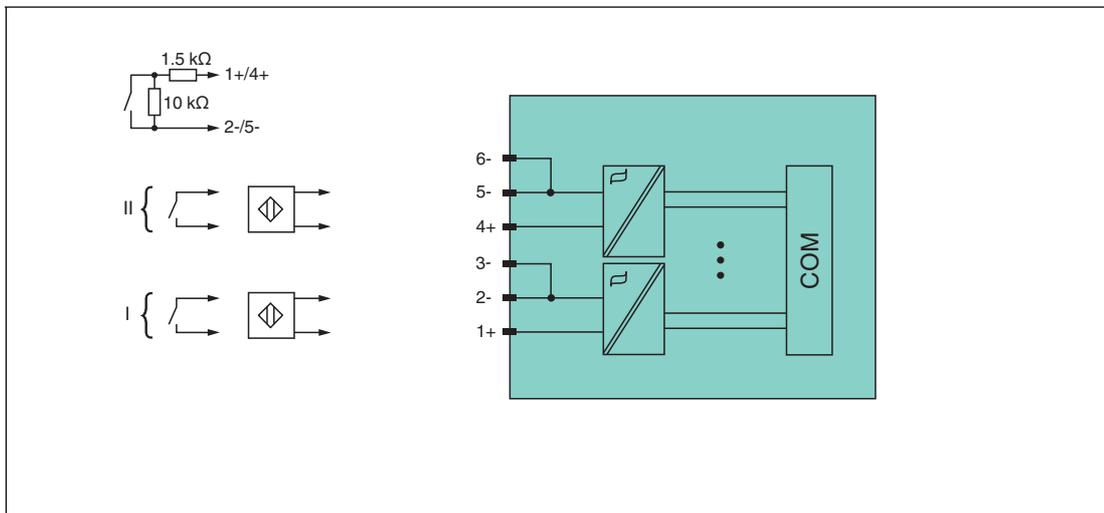


Figure 8.1 Block diagram LB1*01, FB1*01

Refer to the corresponding data sheet and operating instructions for further information.

8.1.2 Measuring Time and Cycle Time

The maximum input frequency of the signals is 50 Hz. However, the measurability of the input statuses is dependent on the cycle time of the data traffic on the bus, e.g., only 1 Hz with a sampling time of 500 ms.

Adjust short signals to the sampling cycles of the process control system by extending the signals using the configurable off delay. The signals are transmitted to the com unit every 6.5 ms irrespective of the sampling interval of the process control system.

8.1.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (10)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4 ... 7	Empty			
Input byte 2	0 ... 7	Not available	Empty	Empty	Empty
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.1.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.

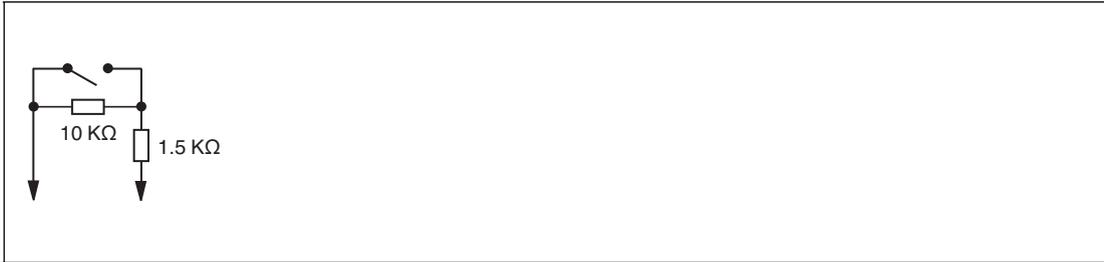


Figure 8.2 Resistor network for line fault detection

8.1.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

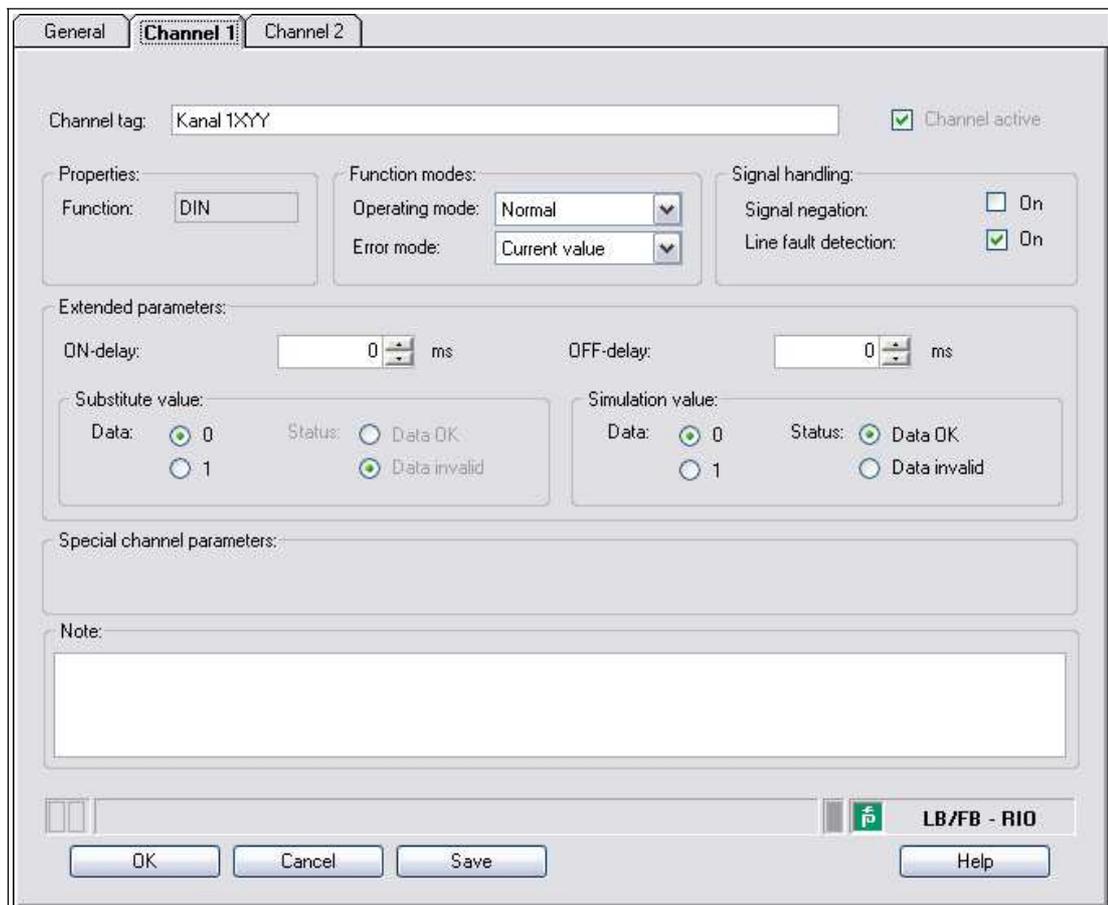
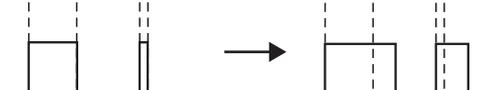


Figure 8.3 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.2 LB1*02, FB1*02 Digital Input

8.2.1 Description

Versions

- LB1002, digital input, not intrinsically safe
- FB1302, digital input, increased safety terminals
- LB1102, digital input, intrinsically safe
- FB1202, digital input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Suitable sensors: mechanical contacts, NAMUR proximity switches, 2-wire initiators
- Number of channels: 3

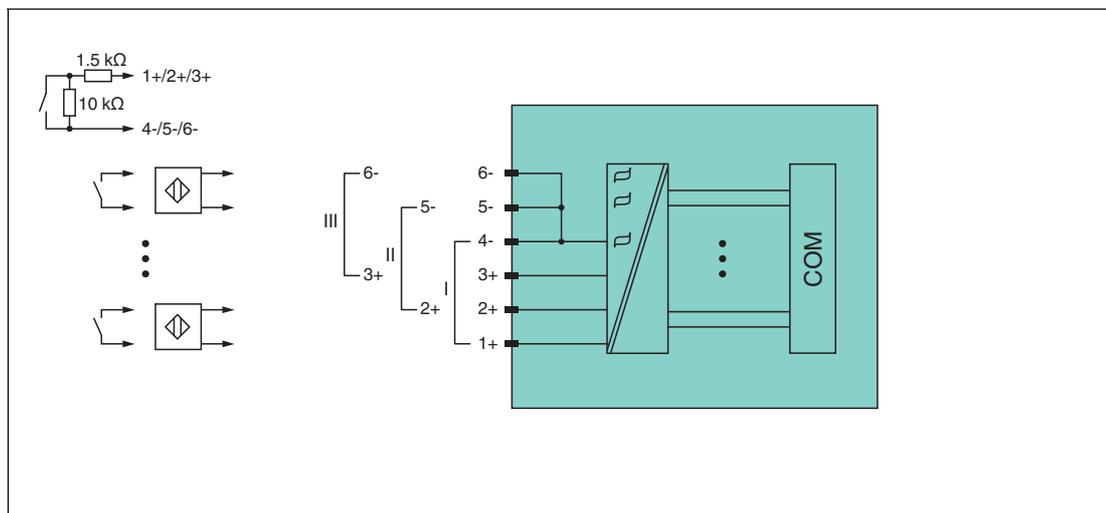


Figure 8.4 Block diagram LB1*02, FB1*02

Refer to the corresponding data sheet and operating instructions for further information.

8.2.2 Measuring Time and Cycle Time

The maximum input frequency of the signals is 50 Hz. However, the measurability of the input statuses is dependent on the cycle time of the data traffic on the bus, e.g., only 1 Hz with a sampling time of 500 ms.

Adjust short signals to the sampling cycles of the process control system by extending the signals using the configurable off delay. The signals are transmitted to the com unit every 6.5 ms irrespective of the sampling interval of the process control system.

8.2.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (10)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4	Status channel 3			
	5	Line fault detection channel 3 (0 = OK, 1 = error)			
	6 ... 7	Empty			
Input byte 2	0 ... 7	Not available	Empty	Empty	Empty
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.2.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.



Figure 8.5 Resistor network for line fault detection

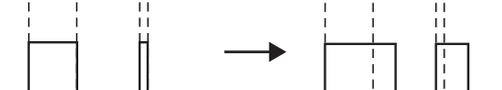
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8.2.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

Figure 8.6 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.3 LB1*03, FB1*03 Frequency/Counter Input

8.3.1 Description

Versions

- LB1003, frequency/counter input, not intrinsically safe
- FB1303, frequency/counter input, increased safety terminals
- LB1103, frequency/counter input, intrinsically safe
- FB1203, frequency/counter input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Suitable sensors: frequency, counter, direction of rotation, NAMUR proximity switches, 2-wire initiators, mech. contacts
- Number of channels: 1
 - Channel 1 for frequency measurement or pulse counting
 - Additional input for direction of rotation detection, e.g., for rotating machines, or counting direction, e.g., forwards or backwards. The additional input is not a separate channel.



Note!

Bandwidth limitation

The bandwidth of 15 kHz is not suitable for bouncing contacts. In this case, select a model with a bandwidth of 400 Hz.

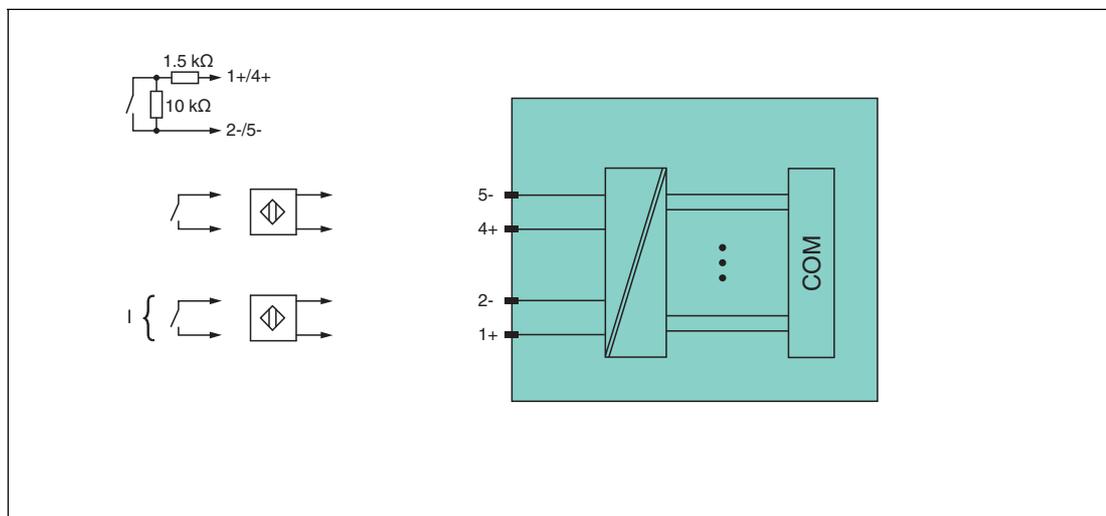


Figure 8.7 Block diagram LB1*03, FB1*03

Refer to the corresponding data sheet and operating instructions for further information.

8.3.2 Measuring Time and Cycle Time

The conversion time is approx. 50 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.3.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The I/O modules offer 3 types of function, each returning a different DP code. The following function types are available:

- Frequency input up to 15 kHz (with or without direction monitoring) or 12-bit counter input up to 15 kHz (with or without direction monitoring)
- 32-bit counter input (with or without direction monitoring)
- Combined 32-bit counter input and frequency input up to 50 Hz (with or without direction detection)



Caution!

Function interruption due to PROFIBUS restart

Each function type requires a specific data structure for the transmission of process values. This results in a change to the data structure due to the change of function type, a PROFIBUS restart forces this change, e.g., with a change of function type from **Frequency input** to **Combined 32-bit counter and frequency input**.

If the hot configuration in run (HCiR) control system is supported, you can carry out a change of function type during ongoing operation, even when the change of function type has involved a change to the data structure. See chapter 6.16

Alternatively, you can preconfigure the slot with universal modules. When doing so, bear in mind the minimum requirements for the various function types:

- Frequency input: 2I2O universal module
- 12-bit counter input: 2I2O universal module
- 32-bit counter input: 4I4O universal module
- Combined 32-bit counter and frequency input: 8I8O universal module

Bit Structure within the Data Telegram (Frequency Input or 12-Bit Counter Input)

		UniCOM PROFIBUS configuration (DP Code)			
		Standard (50)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Counter input status (channel 1)			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Empty			
	3	Direction detection (0 = forwards, 1 = backwards)			
	4 ... 7	Frequency measurement (12 bit) or Counter value (12 bit)			
Input byte 2	0 ... 7				
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

Bit Structure within the Data Telegram (32-Bit Counter Input or Combined 32-Bit Counter and Frequency Input)

		32-bit counter input	
		Standard (51) 4I4O (33) 8I8O (37)	32-bit counter input + frequency input up to 50 Hz Standard (52) 8I8O (37)
Byte	Bit	Meaning	Meaning
Input byte 1	0	High word of the counter value (16 bit)	Channel 1 status
	1		Line fault detection channel 1 (0 = OK, 1 = error)
	2		Empty
	3		Direction detection (0 = forwards, 1 = backwards)
	4 ... 7		Frequency measurement (12 bit)
Input byte 2	0 ... 7		
Input bytes 3 ... 4		Low word of the counter value (16 bit)	High word of the counter value (16 bit)
Input bytes 5 ... 6		Not available in standard or 4I4O configuration Empty in 8I8O configuration	Low word of the counter value (16 bit)
Input bytes 7 ... 8		Not available in standard or 4I4O configuration Empty in 8I8O configuration	Not available in standard configuration Empty in 8I8O configuration

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8.3.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.

If you are using direction detection, connect this input to a resistor circuit. The rotation direction input is ignored for devices without rotation direction detection.



Figure 8.8 Resistor network for line fault detection

8.3.5 Function Types

Frequency Input up to 15 kHz

Frequencies up to 15 kHz can be measured using this function type. The result of the frequency measurement is transferred to the com unit as an integer with a degree of accuracy of 0.1 %. New measured results are available in the com unit every 100 ms to 1000 ms (1 Hz) (every 10 seconds at 0.1 Hz) depending on the frequency. The frequency measurement operates with the internal 16 MHz quartz to measure the time between 2 pulses. The shortest pulse is 20 μs.

Counter Input

The module operates in the same way as a 12-bit counter input and records counter values up to 4095 (corresponds to 12 out of 16 bits), whereby the first 4 bits contain status information. In the same way as a 32-bit counter input, the I/O module uses a 4-byte counter in the com unit that records counter values up to 4294967295 (2^{32}).

A counter quotient can be applied to the counter inputs to prevent them from reaching the maximum counter reading (overflow) before the next bus query when the counting frequencies are high. When a counter input and frequency input are combined, the counter quotient is not available.

Combination of Counter Input and Frequency Input

When a counter input and frequency input are combined, the minimum pulse time/pulse pause is 10 ms. The maximum detectable frequency is then 50 Hz.

Frequency Input up to 400 Hz

A version of the I/O module is available with a maximum frequency of 400 Hz for sensors with bouncing contacts. Even if all functions of the 15 kHz version can be selected in the configuration software, a software package enables the suppression of pulses with a duration of < 1 ms. In spite of this, the 400 Hz version is treated in the same way as the 15 kHz version.

If the start of range setting is > 0 Hz, check whether the following formula produces a result of less than 400.

End of range / (1 - start of range / end of range)

The interrupt control prevents higher values from being processed.



Note!

32-Bit Counter Values

32-bit counter values are stored in the com unit. The counter values are deleted when removing a com unit, in the event of a power failure, when disconnecting the power supply, and in the case of a redundancy switchover.

12-bit counter values are accurate at all times because they are stored in the actual I/O module. The process control system must add up the difference between two successive queries in order to calculate the 12-bit counter total. When adding up the values after a counter overflow, make sure that the current counter value is less than the previous one. Values are usually counted at relatively low frequencies. The master is therefore in a position to retrieve counter values so regularly that a maximum of 1 counter overflow between 2 queries can be expected.



Note!

The bus cycle time is 500 ms and the value counted by the 12-bit counter is a maximum of 4095, resulting in a maximum frequency of $4095/0.5 \text{ sec} = 8190 \text{ Hz}$. If the bus cycle time does not match the counting frequency, the 32-bit counter can be used subject to restrictions in terms of redundancy switchover and disconnection from the power supply.

8.3.6 Direction Detection

The second input is used to determine the direction of rotation from the phase shift between the two incoming pulses.

If the direction detection has not been specified in the parameter settings, then the pulse count is incremented. If the direction detection has been specified in the parameter settings, the I/O module processes the field signals as follows:

- The counter increments the incoming pulses if the direction input is logic 0.
- The counter decrements the incoming pulses if the direction input is logic 1.

The master detects the counting direction of the 32-bit counter by comparing the count values of successive cycles. For the 12-bit counter, a direction bit is transmitted.

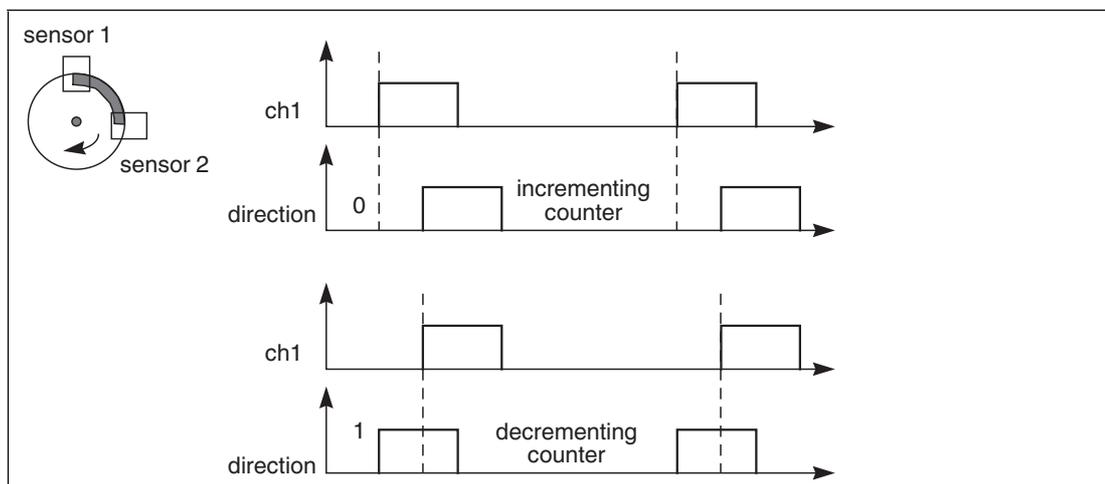


Figure 8.9 Direction detection

8.3.7 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

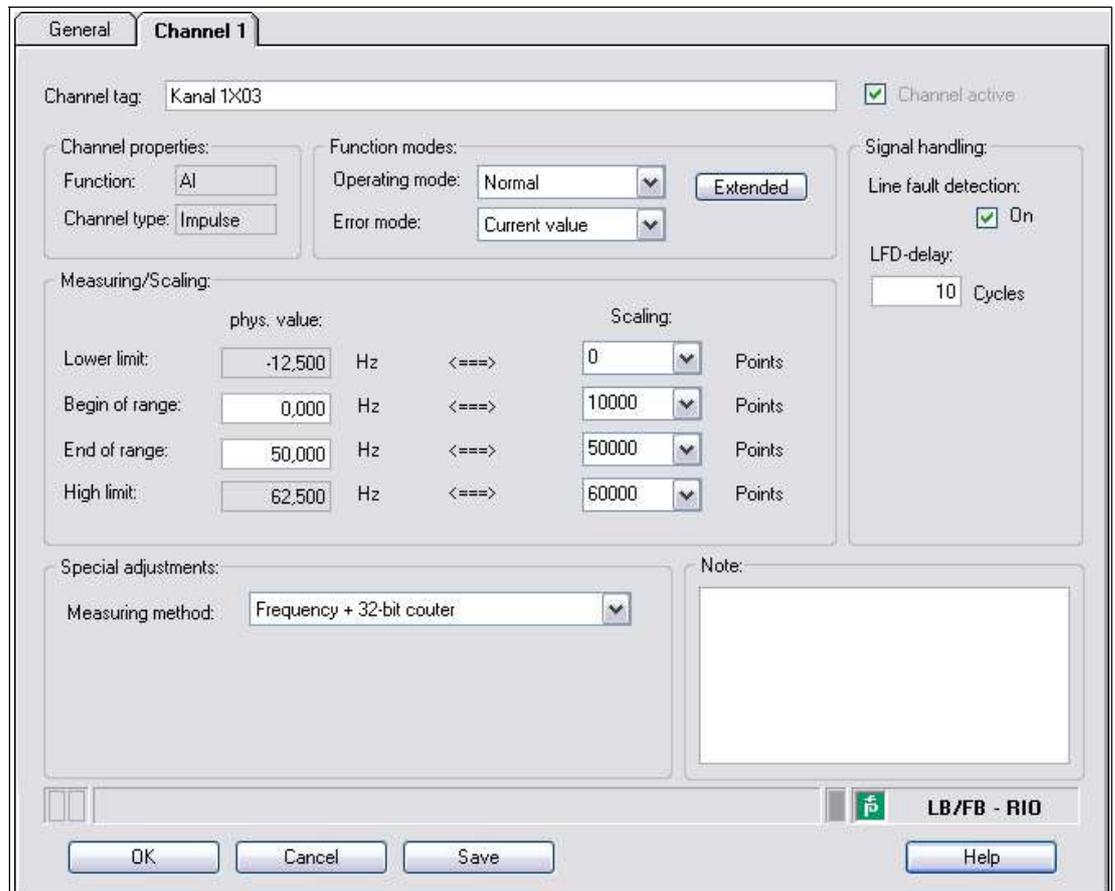


Figure 8.10 Channel 1 tab



Note!

Hidden Areas

The **Measurement range/scaling** area only appears when you select a frequency measurement from the **Measuring method** drop-down list.

The **Counter quotient** field only appears when you select a counter from the **Measuring method** drop-down list.

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.

Field	Explanation
Function	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value : The signal is transferred unchanged from the field in spite of the error. Substitute value : A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value : The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
LFD delay	This field only appears when Line fault detection is enabled. Specify the number of measuring cycles during which a measured value must be free of errors before the value is signaled as good. This function can be used for suppressing loose contacts, for example.
Measuring range/scaling	This area only appears if you have set a frequency measurement. If you have configured a frequency measurement combined with a 32-bit counter, the maximum input frequency is 50 Hz. The values for the start of range (0%) and end of range (100%) in the Phys. size column depend on the sensor and the measuring unit. The values for the lower and upper limits in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. The Lower limit indicates the smallest transferable value. The Start of range indicates the value equal to 0%. The End of range indicates the value equal to 100%. The Upper limit indicates the largest transferable value.

Field	Explanation
Measuring method	<p>Select the function type for the I/O module. Modification of the function type is restricted in online mode because the different function types have different data volumes.</p> <p>The following function types are available. The direction detection can be used either to count up or down or as a status indicator for the direction of rotation.</p> <ul style="list-style-type: none"> ■ Frequency input: Choose between Frequency and Frequency with direction. ■ Counter input: Choose between 32-bit counter, 32-bit counter with direction, 12-bit counter and 12-bit counter with direction. ■ Combined frequency input and counter input: The maximum input frequency in this mode is 50 Hz. Select between Frequency + 32-bit counter and Frequency + 32-bit counter with direction. Frequency measurement is the primary measuring method.
Counter quotient	<p>This field is only visible if you are using the I/O module as a counter. The counter quotient determines how frequently the pulse is counted. For example, if you enter 5, every fifth pulse is counted.</p>
Note	<p>You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.</p>



Figure 8.11 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Invalid data (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Invalid data (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (11)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status channel 5			
	1	Line fault detection channel 5 (0 = OK, 1 = error)			
	2	Status channel 6			
	3	Line fault detection channel 6 (0 = OK, 1 = error)			
	4	Status channel 7			
	5	Line fault detection channel 7 (0 = OK, 1 = error)			
	6 ... 7	Empty			
Input byte 2	0	Status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4	Status channel 3			
	5	Line fault detection channel 3 (0 = OK, 1 = error)			
	6	Status channel 4			
	7	Line fault detection channel 4 (0 = OK, 1 = error)			
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.4.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.

24 V and 5 V inputs can only be used when line fault detection is disabled.



Figure 8.13 Resistor network for line fault detection

8.4.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

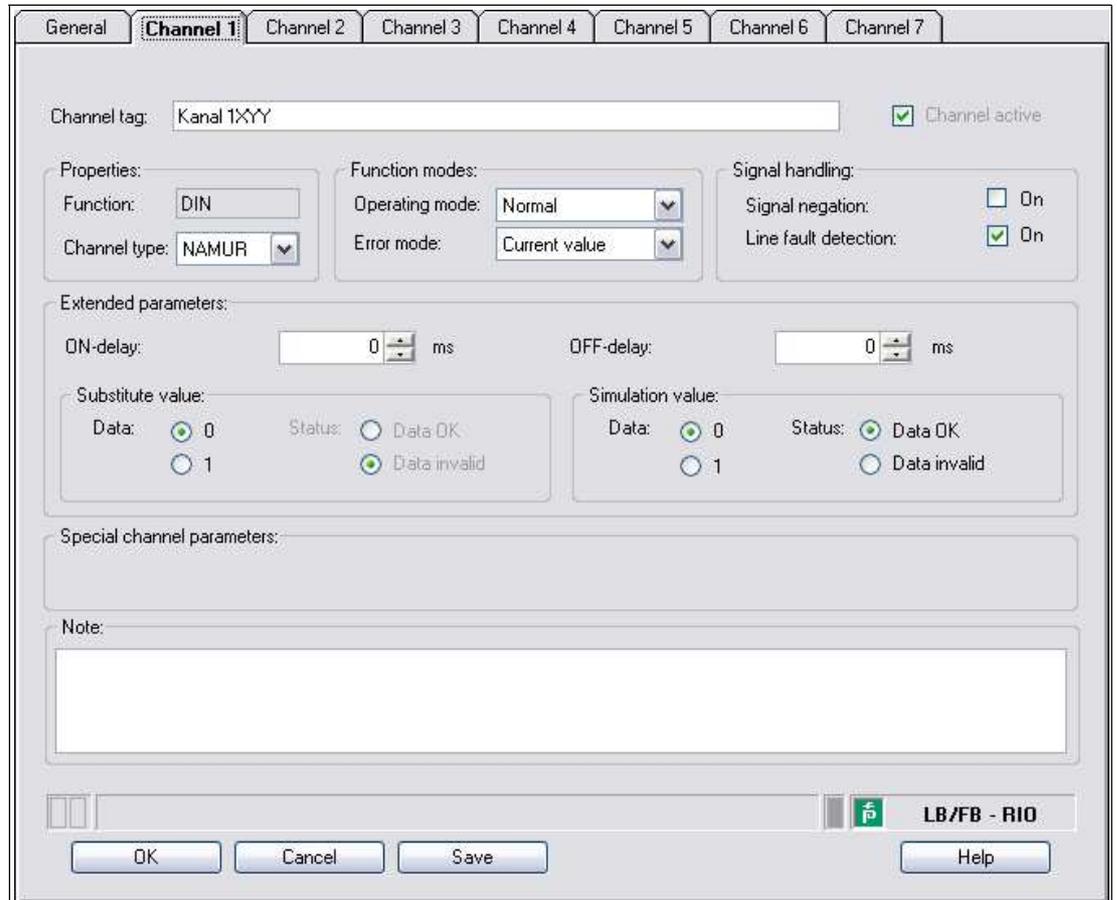
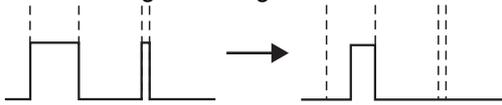
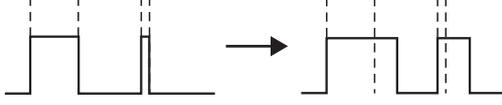


Figure 8.14 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.5 LB1*08, FB1*08 Digital Input

8.5.1 Description

Versions

- LB1008, digital input, not intrinsically safe
- FB1308, digital input, increased safety terminals
- LB1108, digital input, intrinsically safe
- FB1208, digital input, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 8
- Suitable sensors: mechanical contacts, NAMUR proximity switches
The FB1308 I/O module can read active inputs with 24 V or 5 VDC. This does not apply to I/O modules LB1008, LB1108, and FB1208.

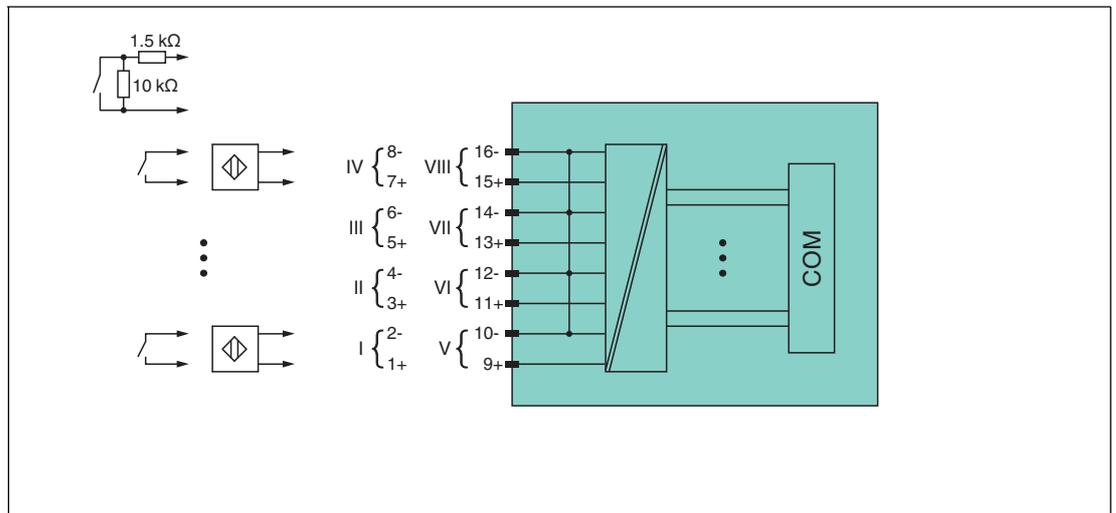


Figure 8.15 Block diagram: LB1*08, FB1208

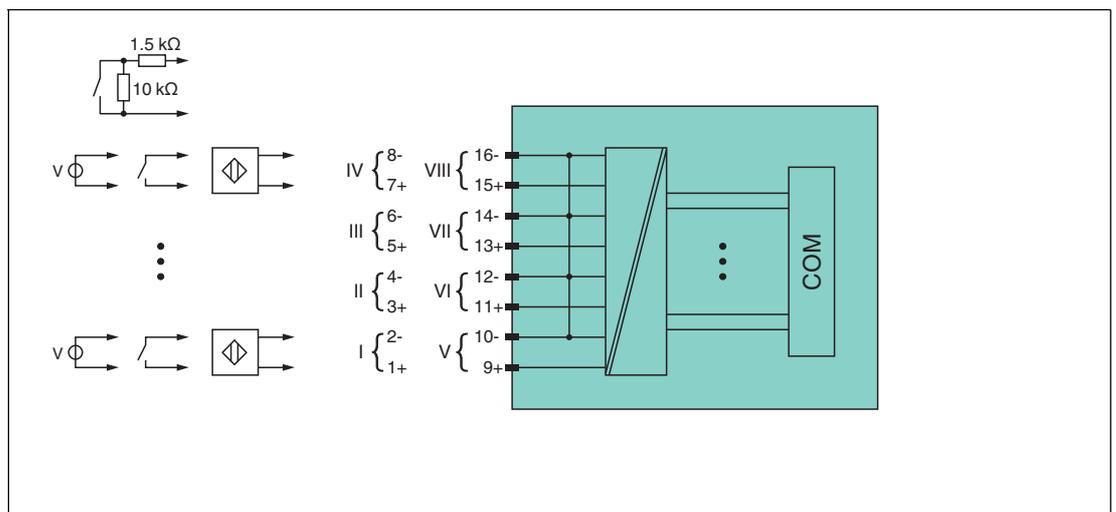


Figure 8.16 Block diagram: FB1308

Refer to the corresponding data sheet and operating instructions for further information.

8.5.2 Measuring Time and Cycle Time

The maximum input frequency of the signals is 50 Hz. However, the measurability of the input statuses is dependent on the cycle time of the data traffic on the bus, e.g., only 1 Hz with a sampling time of 500 ms.

Adjust short signals to the sampling cycles of the process control system by extending the signals using the configurable off delay. The signals are transmitted to the com unit every 6.5 ms irrespective of the sampling interval of the process control system.

8.5.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (11)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status channel 5			
	1	Line fault detection channel 5 (0 = OK, 1 = error)			
	2	Status channel 6			
	3	Line fault detection channel 6 (0 = OK, 1 = error)			
	4	Status channel 7			
	5	Line fault detection channel 7 (0 = OK, 1 = error)			
	6	Status channel 8			
	7	Line fault detection channel 8 (0 = OK, 1 = error)			
Input byte 2	0	Status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4	Status channel 3			
	5	Line fault detection channel 3 (0 = OK, 1 = error)			
	6	Status channel 4			
	7	Line fault detection channel 4 (0 = OK, 1 = error)			
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.5.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.

24 V and 5 V inputs can only be used when line fault detection is disabled.



Figure 8.17 Resistor network for line fault detection

8.5.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

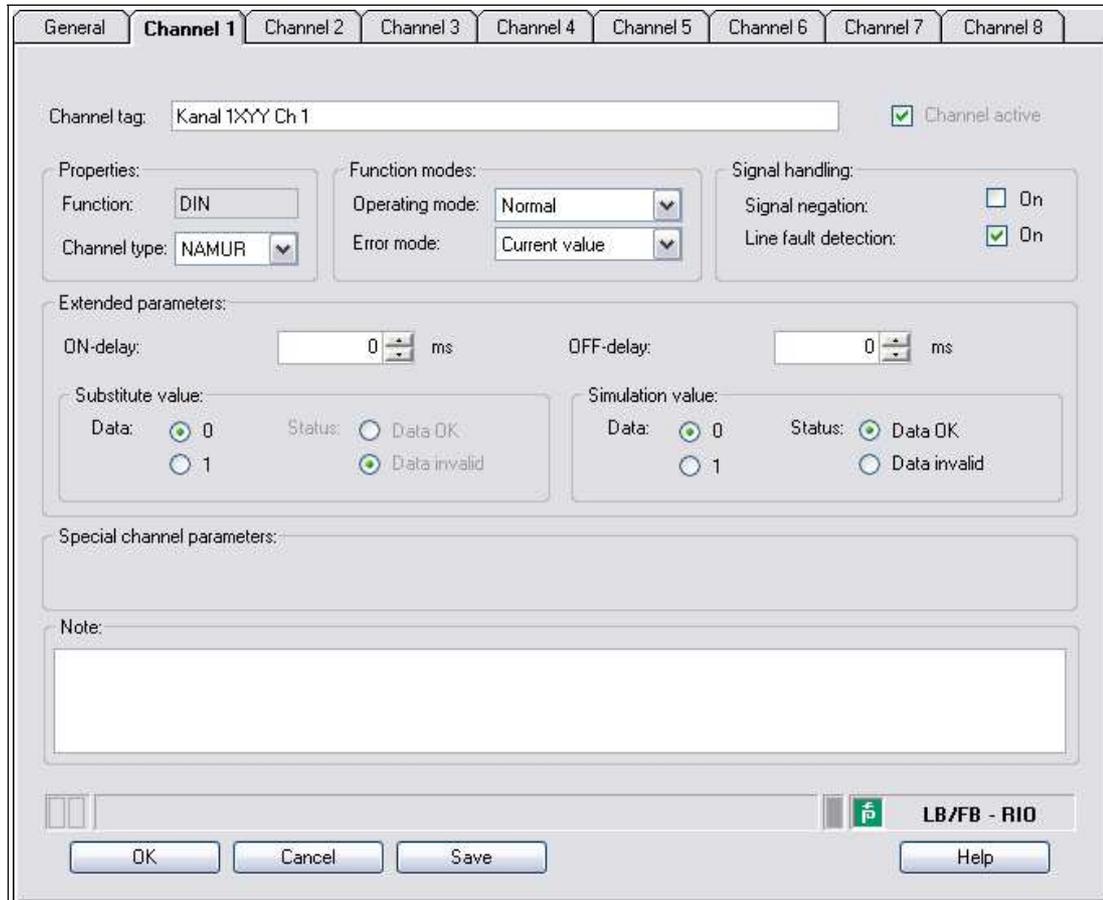


Figure 8.18 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.

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Field	Explanation
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.6 LB1*09, FB1*09 Digital Input

8.6.1 Description

Versions

- LB1009, digital input, not intrinsically safe
- LB1109, digital input, intrinsically safe
- FB1209, digital input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 8
- Suitable sensors: mechanical contacts, NAMUR proximity switches
The LB1009 I/O module can also read active inputs with 24 V or 5 VDC. This does not apply to I/O modules LB1109, LB1109, and FB1209.



Note!

By default the LB1*09, FB1*09 digital input only supports mechanical contacts and NAMUR proximity switches. Activate the **Support for active input signals (5 V/24 VDC) for 1x09** option in the firmware-dependent com unit settings to be able to process active signals from 2-wire-initiators. See chapter 6.8

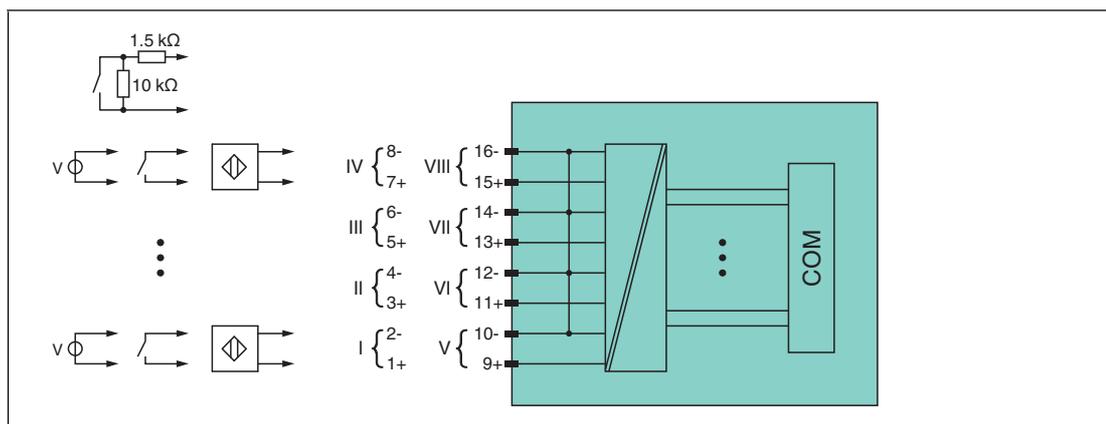


Figure 8.19 Block diagram LB1009

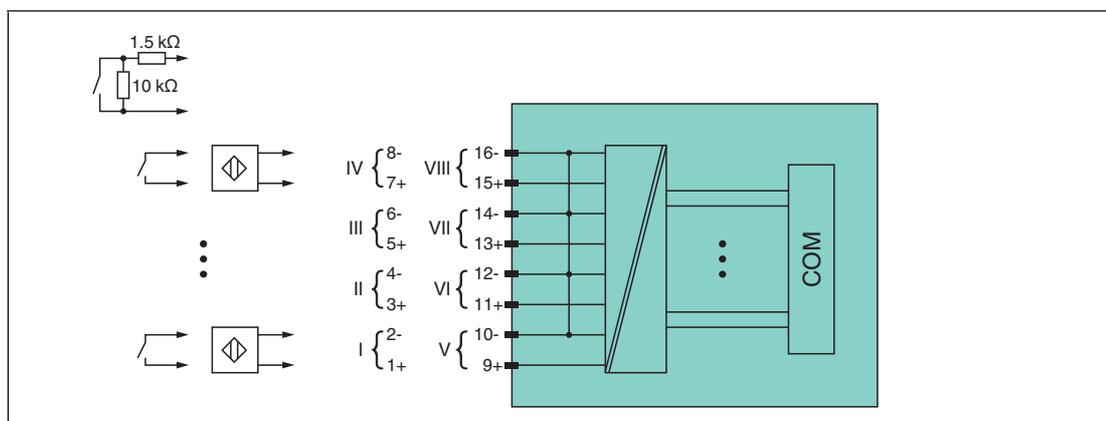


Figure 8.20 Block diagram LB1109, FB1209

Refer to the corresponding data sheet and operating instructions for further information.

8.6.2 Measuring Time and Cycle Time

The maximum input frequency of the signals is 50 Hz. However, the measurability of the input statuses is dependent on the cycle time of the data traffic on the bus, e.g., only 1 Hz with a sampling time of 500 ms.

Adjust short signals to the sampling cycles of the process control system by extending the signals using the configurable off delay. The signals are transmitted to the com unit every 6.5 ms irrespective of the sampling interval of the process control system.

8.6.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (11)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status channel 5			
	1	Line fault detection channel 5 (0 = OK, 1 = error)			
	2	Status channel 6			
	3	Line fault detection channel 6 (0 = OK, 1 = error)			
	4	Status channel 7			
	5	Line fault detection channel 7 (0 = OK, 1 = error)			
	6	Status channel 8			
	7	Line fault detection channel 8 (0 = OK, 1 = error)			

		UniCOM PROFIBUS configuration (DP code)			
		Standard (11)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 2	0	Status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4	Status channel 3			
	5	Line fault detection channel 3 (0 = OK, 1 = error)			
	6	Status channel 4			
	7	Line fault detection channel 4 (0 = OK, 1 = error)			
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.6.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.

24 V and 5 V inputs can only be used when line fault detection is disabled.

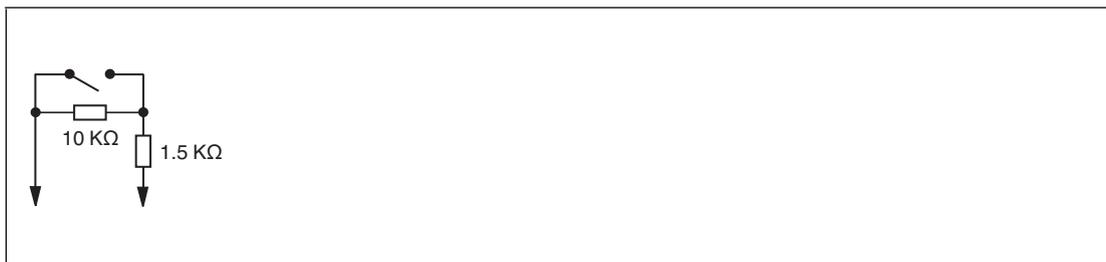


Figure 8.21 Resistor network for line fault detection

8.6.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

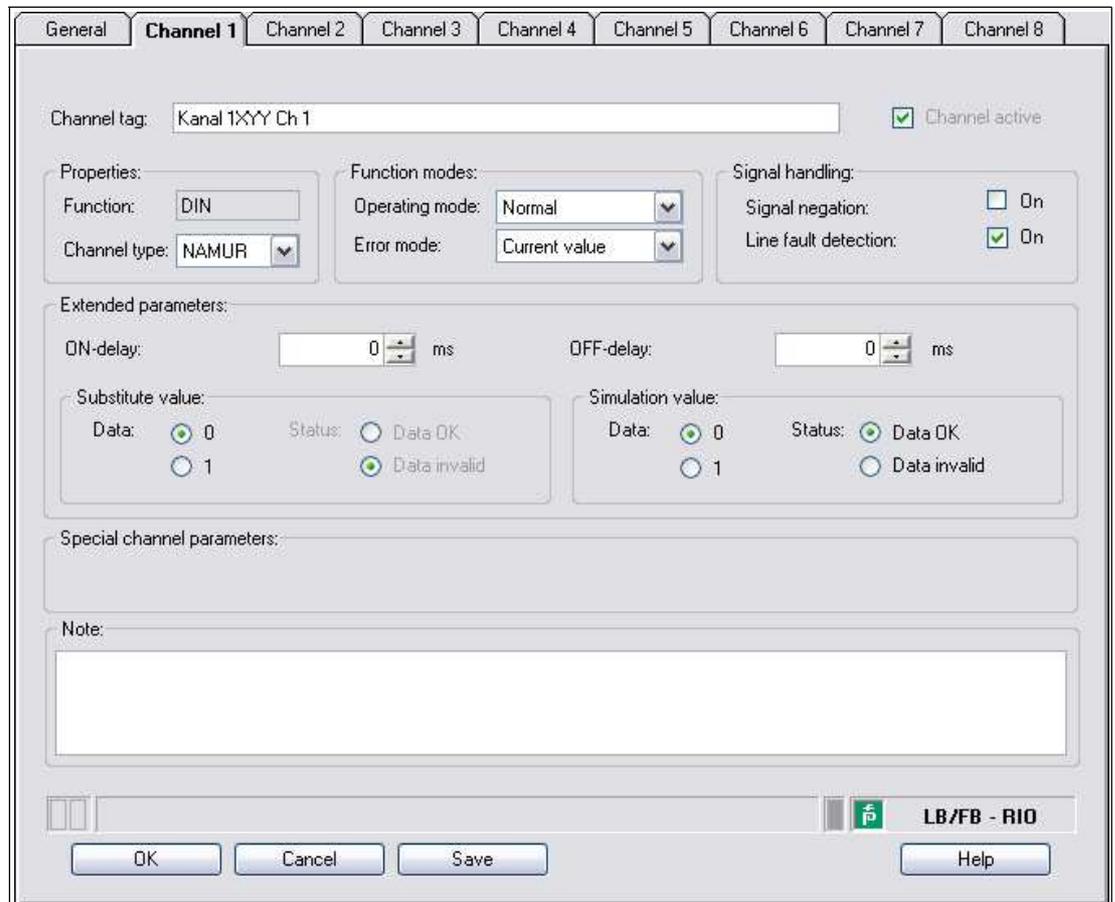
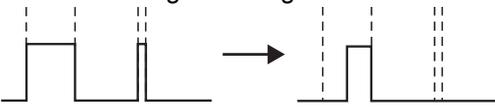


Figure 8.22 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.

Field	Explanation
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.7 LB1014, LB1015 Digital Input

8.7.1 Description

Versions

- LB1014, digital input, not intrinsically safe
- LB1015, digital input, not intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 15
- Digital signals
 - LB1014: AC 95 V ... 230 V (250 V max.) in phase
 - LB1015: DC 24 V (30 V max.)

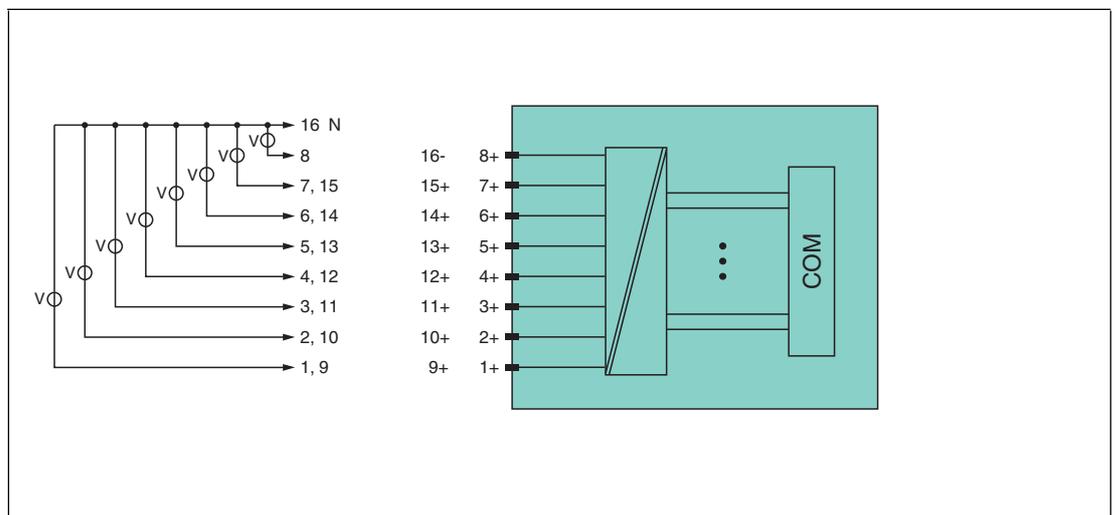


Figure 8.23 Block diagram LB1014, LB1015

Refer to the corresponding data sheet and operating instructions for further information.

8.7.2 Measuring Time and Cycle Time

The maximum input frequency of the signals is 50 Hz. However, the scope to measure this frequency depends on the cycle time of the data traffic on the bus, e.g., only 1 Hz with a sampling time of 500 ms.

The signals are transmitted to the com unit every 6.5 ms irrespective of the sampling interval of the process control system.

8.7.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (11)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status channel 9			
	1	Status channel 10			
	2	Status channel 11			
	3	Status channel 12			
	4	Status channel 13			
	5	Status channel 14			
	6	Status channel 15			
	7	Collective error message, channels 1 ... 15			
Input byte 2	0	Status channel 1			
	1	Status channel 2			
	2	Status channel 3			
	3	Status channel 4			
	4	Status channel 5			
	5	Status channel 6			
	6	Status channel 7			
	7	Status channel 8			
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.7.4 Line Fault Detection

The I/O module does not provide any line fault detection function.

8.7.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

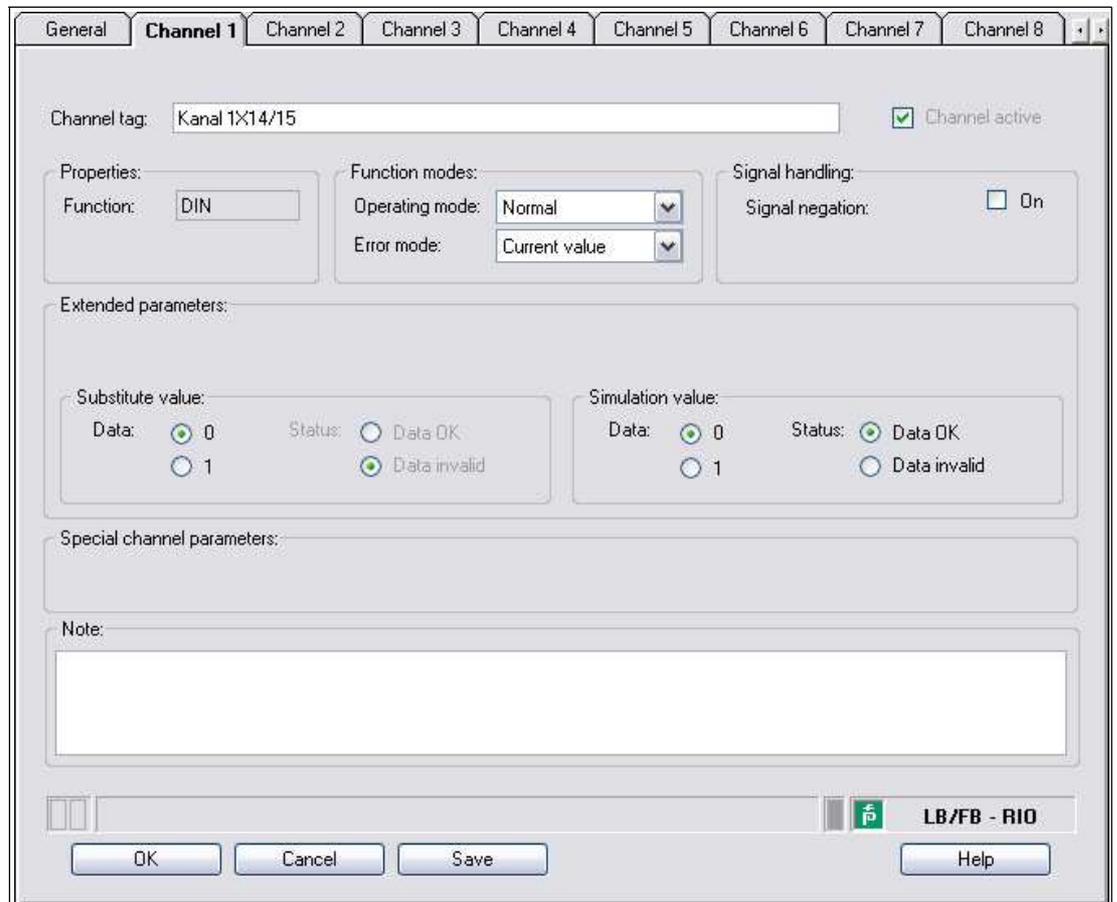


Figure 8.24 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.

Field	Explanation
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.8 LB20*, LB21*, FB22* Digital Output with Position Feedback

8.8.1 Description

Versions

- LB20*, digital output with position feedback, non-intrinsically safe
Versions available with bus-independent shutdown input
- LB21*, digital input with position feedback, intrinsically safe
Versions available with bus-independent shutdown input
- FB22*, digital input with position feedback, intrinsically safe
Versions available with bus-independent shutdown input

Features

- Occupies 1 slot on the backplane
- Number of channels
 - 1 output channel
 - 2 input channels, e.g., for position feedback

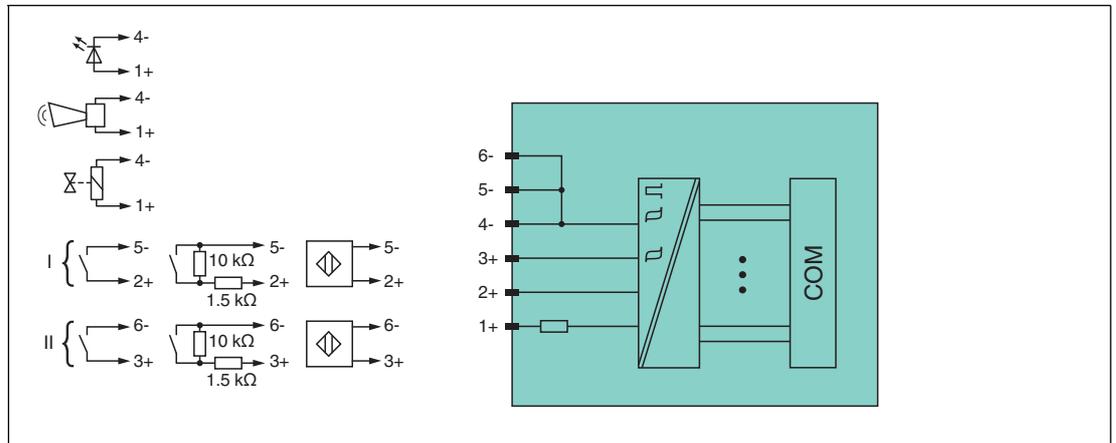


Figure 8.25 Block diagram: LB2002, LB2101 ... LB2113, FB22* without shutdown input

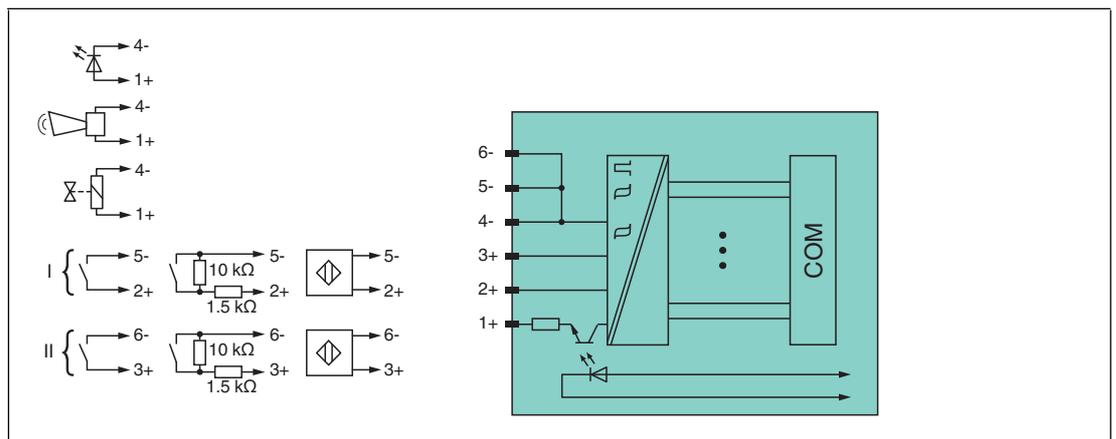


Figure 8.26 Block diagram: LB2101 ... LB2113, FB22* with shutdown input

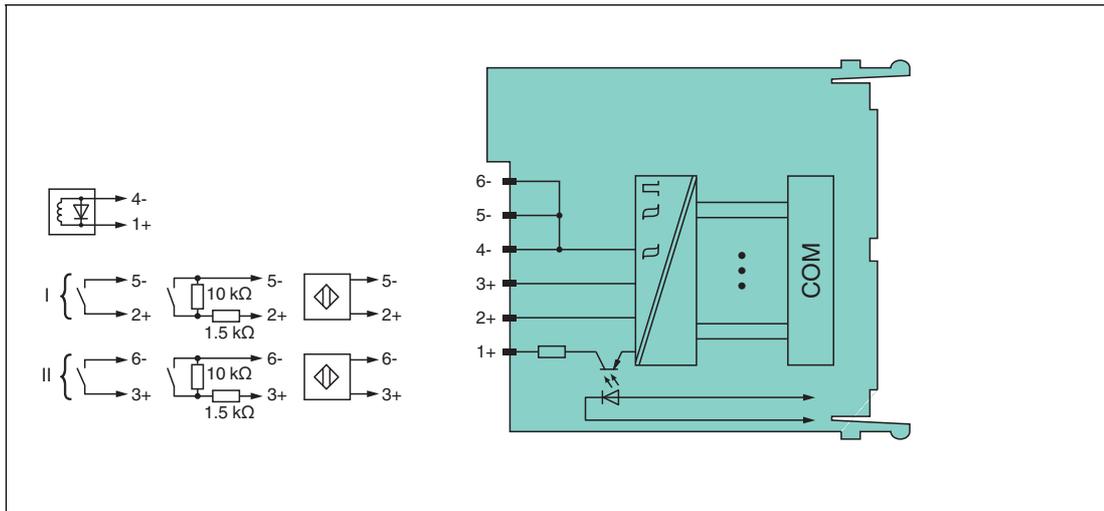


Figure 8.27 Block diagram: LB2*16, FB2216, LB2*17, FB2217 with shutdown input

Refer to the corresponding data sheet and operating instructions for further information.

8.8.2 Measuring Time and Cycle Time

The maximum input frequency of the signals is 50 Hz. However, the measurability of the input statuses is dependent on the cycle time of the data traffic on the bus, e.g., only 1 Hz with a sampling time of 500 ms.

Adjust short signals to the sampling cycles of the process control system by extending the signals using the configurable off delay. The signals are transmitted to the com unit every 6.5 ms irrespective of the sampling interval of the process control system.

8.8.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (30)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Status output (sent)			
	1	Line fault detection output (0 = OK, 1 = error)			
	2	Status channel 1			
	3	Line fault detection channel 1 (0 = OK, 1 = error)			
	4	Status channel 2			
	5	Line fault detection channel 2 (0 = OK, 1 = error)			
	6 ... 7	Empty			
Input byte 2	0 ... 7	Not available	Empty	Empty	Empty
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output byte 1	0	Status output			
	1 ... 7	Empty			
Other output bytes		Not available	1 additional empty output byte	3 additional empty output bytes	7 additional empty output bytes

8.8.4 Line Fault Detection

With NAMUR proximity switches, the line fault detection can detect a line breakage or short circuit and can be switched off on a channel-by-channel basis.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.

The valve control circuit is monitored by a current pulse. This current pulse is brief enough not to operate a connected valve. If the I/O module is being used with indicator lights or acoustic sensors, you can switch off the current pulse for each channel.

It is not always possible to monitor the valve circuit when booster valves are used because these valves have a storage capacitor that behaves like a short circuit when the valve is switched off. In such cases, depending on the valve, a 10 kΩ parallel resistor enables line fault detection for booster valves. If line fault detection is still detected when the valve is off, even with the parallel resistor connected, disable the line fault detection function.



Figure 8.28 Resistor network for line fault detection

8.8.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.8.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

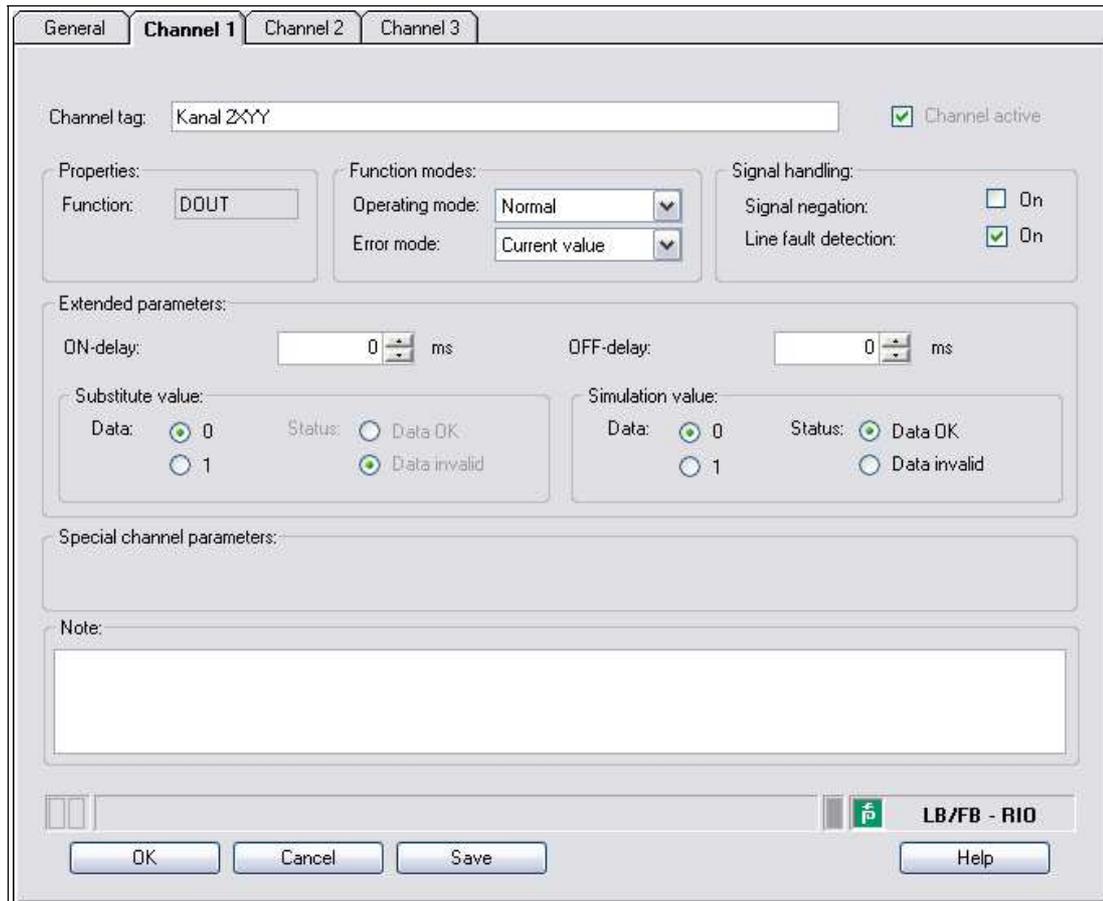
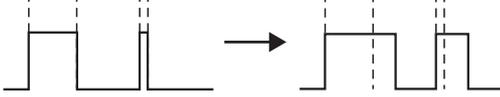


Figure 8.29 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output

Field	Explanation
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.9 LB3101, FB3201 Transmitter Power Supply, Current Input

8.9.1 Description

Versions

- LB3101, transmitter power supply, current input, intrinsically safe
- FB3201, transmitter power supply, current input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

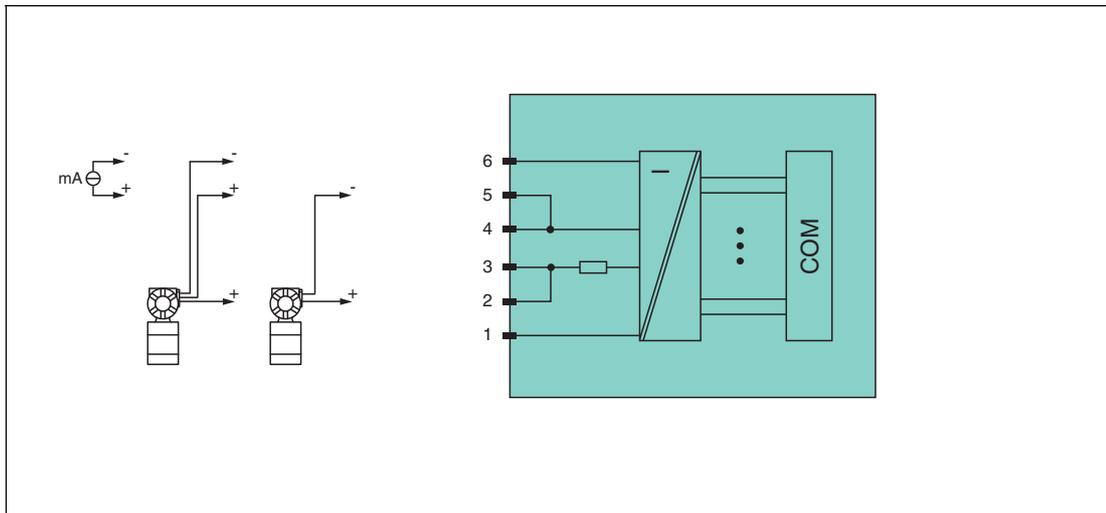


Figure 8.30 Block diagram LB3101, FB3201

2-wire transmitter

Supply circuit: 2/3+, 4/5-

3-wire transmitter

Supply circuit: 2/3+, 6-

Measuring circuit: 4/5+, 6-

4-wire transmitter (powered externally)

Measuring circuit: 4/5+, 6-

Input resistance at terminals 5 and 6: 15 Ω

Refer to the corresponding data sheet and operating instructions for further information.

8.9.2 Resolution

Input signals within a range of 0 mA ... 25 mA are detected with a resolution of 12 bits. The actual measuring range is calculated based on this resolution.

For the range between 4 mA ... 20 mA (corresponds to 0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %. Underranges and overranges are taken into consideration.

8.9.3 Measuring Time and Cycle Time

The conversion time is approx. 100 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.9.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (50)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Live zero if current ≤ 3.6 mA (*)			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2 ... 3	Empty			
	4 ... 7	Measured value (12 bit)			
Input byte 2 (high byte)	0 ... 7				
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

(*) The live zero monitoring transmits an error bit (= 1) if the current falls below the minimum of 3.6 mA.

8.9.5 Line Fault Detection

The line fault detection can detect a lead breakage or short circuit and can be switched off on a channel-by-channel basis.

You can preset the switching points at which a lead breakage or a short circuit is signaled, e.g., line breakage < 1 mA and short circuit > 21 mA.

The current circuit has Live Zero monitoring. If the current falls below the minimum of 3.6 mA, an error bit is set (= 1).

8.9.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

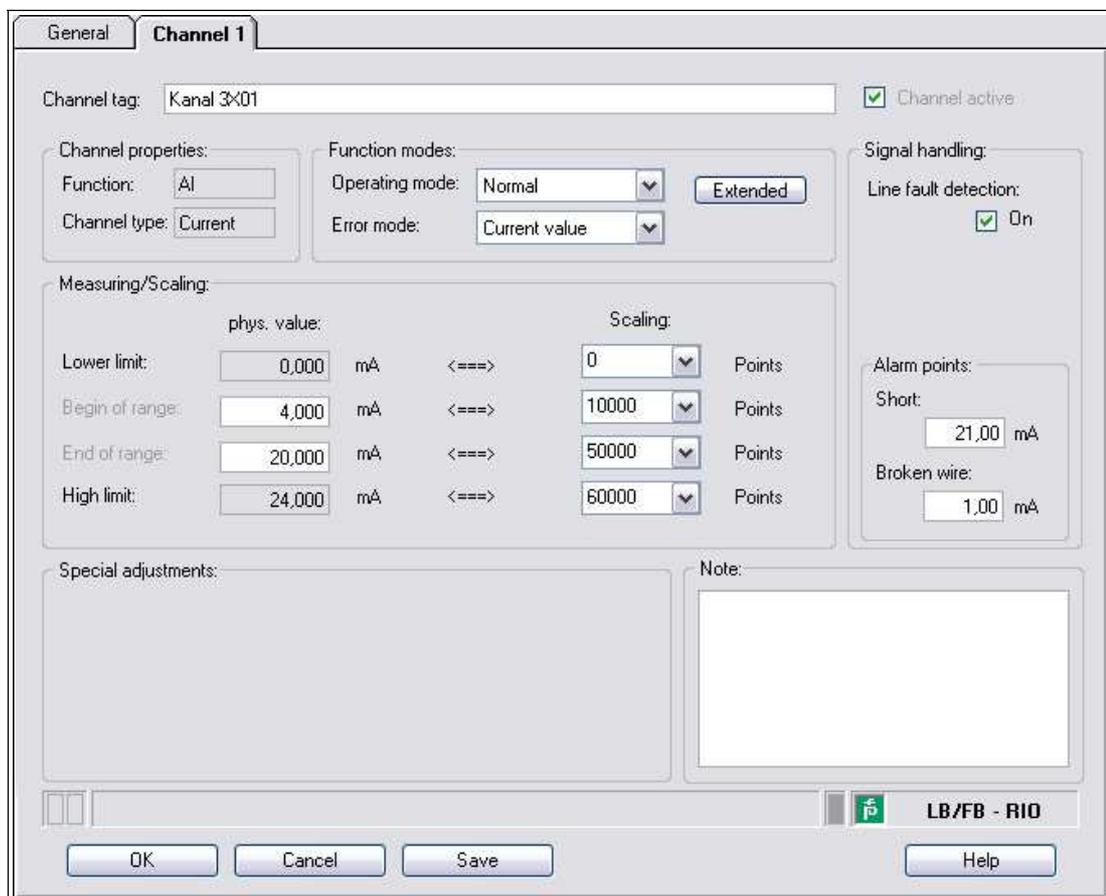


Figure 8.31 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
Short circuit	Enter the threshold value for short circuit detection, e.g., 21 mA. When the current strength exceeds this value, the line fault detection function reports a short circuit.
Lead breakage	Enter the threshold value for the lead breakage detection, e.g., 1 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA
Special settings	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

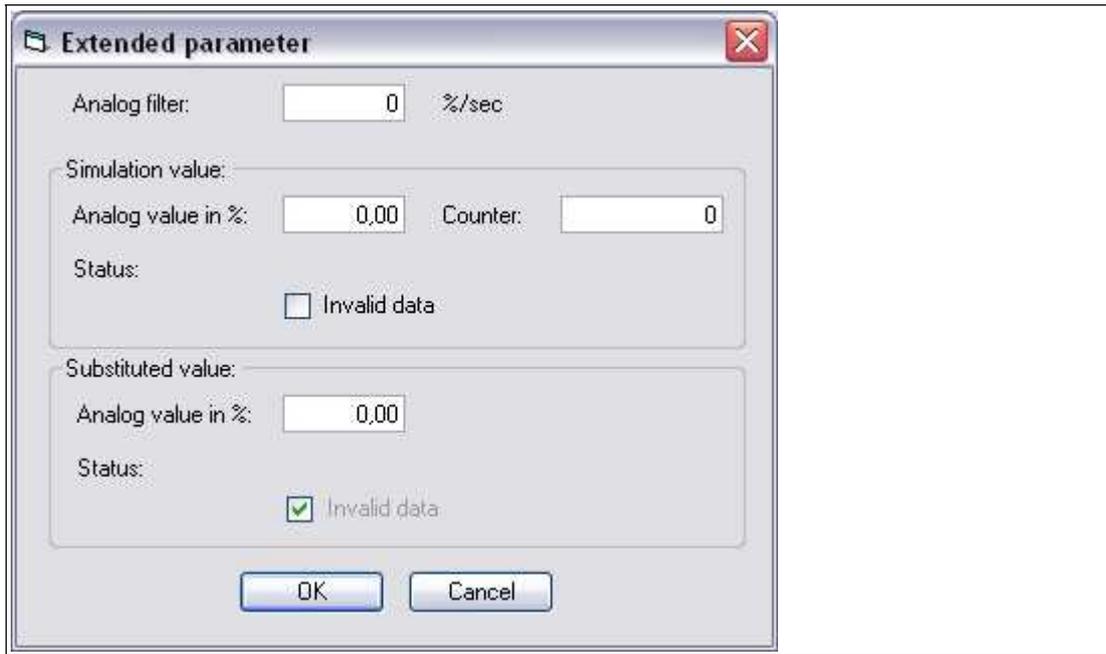


Figure 8.32 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.10 LB3*02, FB3*02, LB3103, FB3203 HART Transmitter Power Supply, current input

8.10.1 Description

Versions

- LB3002, HART transmitter power supply, current input, not intrinsically safe
- FB3302, HART transmitter power supply, current input, increased safety terminals
Terminals 3 and 4 are not passed through in this I/O module.
- LB3102, HART transmitter power supply, current input, intrinsically safe
- FB3202, HART transmitter power supply, current input, intrinsically safe
- LB3103, HART transmitter power supply, current input, intrinsically safe
- FB3203, HART transmitter power supply, current input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

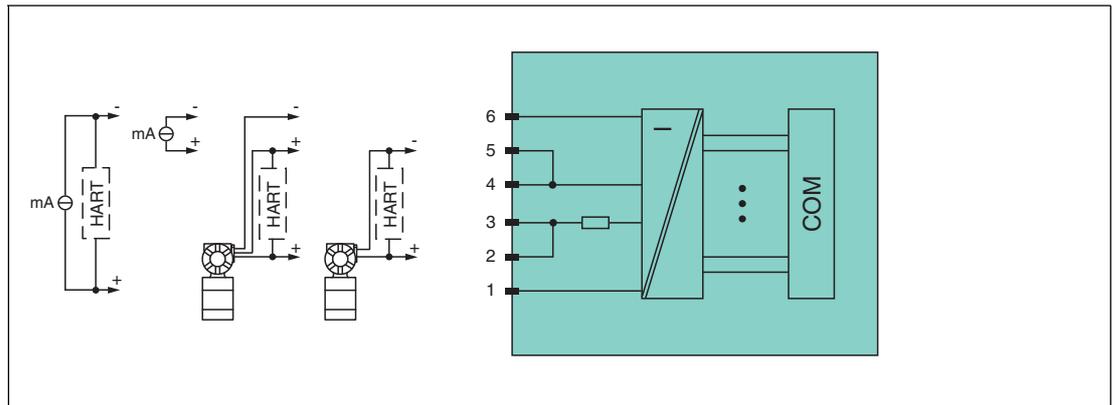


Figure 8.33 Block diagram LB3*02, LB3103, FB3*02, FB3203

2-wire transmitter (HART)

Supply circuit: 2/3+, 4/5-

3-wire transmitter (HART)

Supply circuit: 2/3+, 6-

Measuring circuit: 4/5+, 6-

4-wire transmitter (externally powered)

Measuring circuit: 4/5+, 6-

HART measuring circuit: 1+, 6-

Input resistance at terminals 5 and 6: 15 Ω

Input resistance at terminals 1 and 6 (HART): 236 Ω

Refer to the corresponding data sheet and operating instructions for further information.

8.10.2 Resolution

Input signals within a range of 0 mA ... 25 mA are detected with a resolution of 12 bits. The actual measuring range is calculated based on this resolution.
For the range between 4 mA ... 20 mA (corresponds to 0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %. Underranges and overranges are taken into consideration.

8.10.3 Measuring Time and Cycle Time

The conversion time is approx. 100 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.10.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.



Note!

Depending on the number of HART auxiliary variables to be transferred, I/O modules LB3*02 and FB3*02 have the DP configuration codes 50, 52, 54, 56, or 58. If you wish to transfer HART auxiliary variables, use the standard configuration only, as the data volumes in HART auxiliary variables exceed the input and output data in the universal configuration.

I/O modules LB3103 and FB3203 have the DP configuration code **50**.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (50)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Live zero if current ≤ 3.6 mA (*)			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2 ... 3	Empty			
	4 ... 7	Measured value (12 bit)			
Input byte 2 (high byte)	0 ... 7				
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

(*) The live zero monitoring transmits an error bit (= 1) if the current falls below the minimum of 3.6 mA.

8.10.5 Line Fault Detection

The line fault detection can detect a lead breakage or short circuit and can be switched off on a channel-by-channel basis.

You can preset the switching points at which a lead breakage or a short circuit is signaled, e.g., line breakage < 1 mA and short circuit > 21 mA.

The current circuit has Live Zero monitoring. If the current falls below the minimum of 3.6 mA, an error bit is set (= 1).

8.10.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

Figure 8.34 Channel 1 tab



Note!

HART Auxiliary Variables

HART auxiliary variables cannot be transferred in combination with the 2I2O and 4I4O universal modules. With the 8I8O universal module, a maximum of one HART auxiliary variable can be transferred. If you wish to transfer all HART auxiliary variables to the synchronous data traffic, configure the slot position with the standard configuration.



Caution!

Function interruption due to PROFIBUS restart

If you change the number of HART auxiliary variables in the **Measuring methods** drop-down list, this results in a change to the data structure of the PROFIBUS data telegram. This modification requires a restart of the PROFIBUS.

You can change the number of HART auxiliary variables during ongoing operation only if your process control system supports Hot Configuration in Run (HCiR). See chapter 6.16

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.

Field	Explanation
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
Short circuit	Enter the threshold value for short circuit detection, e.g., 21 mA. When the current strength exceeds this value, the line fault detection function reports a short circuit.
Lead breakage	Enter the threshold value for the lead breakage detection, e.g., 1 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA

Field	Explanation
Measuring method	<p>This Measuring methods drop-down list is only available for I/O modules LB3*02 and FB3*02. The Measuring methods drop-down list only appears if you have activated the Use of the extended PROFIBUS modes for 3x02 and HART auxiliary variables option in the Select Firmware-Dependent Functions window.</p> <p>Choose the number of HART auxiliary variables to be included in the synchronous data traffic. Each HART auxiliary variable occupies 4 bytes in the synchronous data traffic. The I/O module, together with all 4 HART auxiliary variables, occupies a total of 18 bytes within the synchronous data traffic. 13 of these I/O modules fill the entire data area. The HART auxiliary variables are updated less frequently than the standard process data.</p> <p>The following selection options are available.</p> <p>Standard: in standard mode 2 bytes are provided, see DP configuration code 50</p> <p>Standard + 1st HART variable: the first HART auxiliary variable is also provided (2 bytes + 4 bytes = 6 bytes), see DP configuration code 52</p> <p>Standard + 1st + 2nd HART variable: the first and second HART auxiliary variables (2 bytes + 8 bytes = 10 bytes), see DP configuration code 54</p> <p>Standard + 1st - 3rd HART variable: the first, second and third HART auxiliary variables are provided (2 bytes + 12 bytes = 14 bytes), see DP configuration code 56</p> <p>Standard + 1st - 4th HART variable: the first, second, third and fourth HART auxiliary variables are also provided (2 bytes + 16 bytes = 18 bytes), see DP configuration code 58</p> <p>If the remote I/O station receives a new parameter set, then HART communication must be restarted. During the initialization phase, no valid HART auxiliary variables are available. Following initialization, the HART auxiliary variables are read by a HART scan and made available again. The scan generally takes several seconds.</p>
HART on	<p>Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.</p>
Internal scan on	<p>This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.</p>
Note	<p>You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.</p>

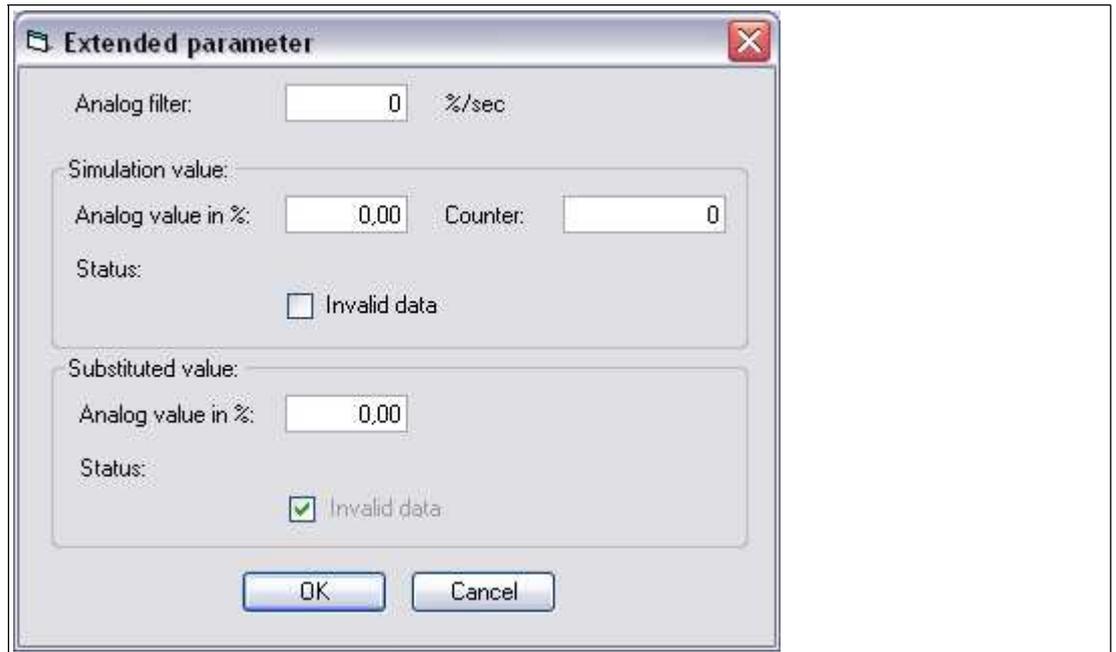


Figure 8.35 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.11 LB3104, FB3204 Transmitter Power Supply, Current Input
LB3*05, FB3*05 HART Transmitter Power Supply, Current Input

8.11.1 Description

Versions

- LB3104, transmitter power supply, current input, intrinsically safe
- FB3204, transmitter power supply, current input, intrinsically safe
- LB3005, HART transmitter power supply, current input, not intrinsically safe
- FB3305, HART transmitter power supply, current input, increased safety terminals
- LB3105, HART transmitter power supply, current input, intrinsically safe
- FB3205, HART transmitter power supply, current input, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

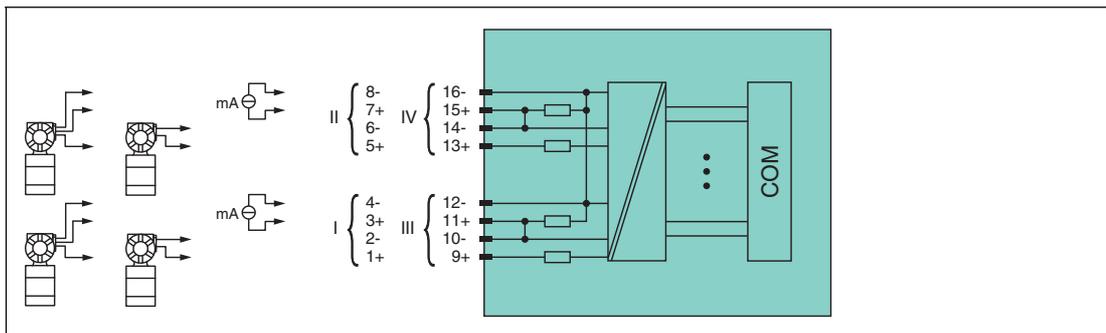


Figure 8.36 Block diagram LB3104, FB3204

2-wire transmitter

Supply circuit: channel I 1+, 2-, channel II 5+, 6-, channel III 9+, 10-, channel IV 13+, 14-

3-wire transmitter

Supply circuit: channel I 1+, 4-, channel II 5+, 8-, channel III 9+, 12-, channel IV 13+, 16-
Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

4-wire transmitter (powered externally)

Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-
Input resistance: 15 Ω (channel I: 3, 4; channel II: 7, 8; channel III: 11, 12; channel IV: 15, 16)

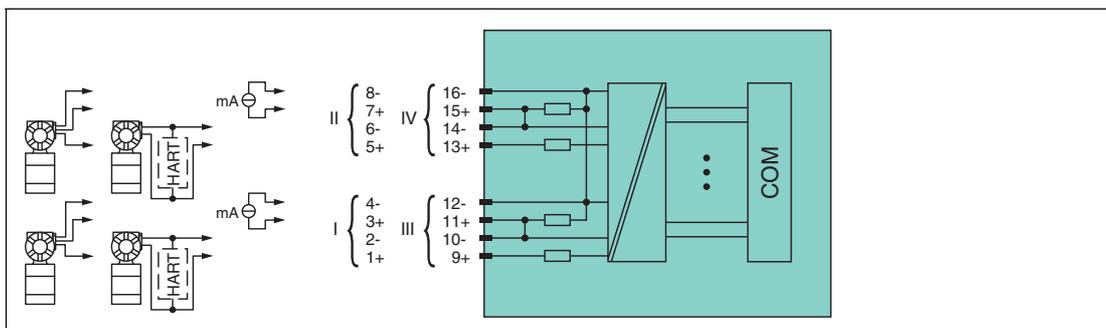


Figure 8.37 Block diagram LB3*05, FB3*05

199401 2016-03

2-wire transmitter (HART)

Supply circuit: channel I 1+, 2-, channel II 5+, 6-, channel III 9+, 10-, channel IV 13+, 14-

3-wire transmitter

Supply circuit: channel I 1+, 4-, channel II 5+, 8-, channel III 9+, 12-, channel IV 13+, 16-
Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

4-wire transmitter (powered externally)

Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

Input resistance: 15 Ω (channel I: 3, 4; channel II: 7, 8; channel III: 11, 12; channel IV: 15, 16)

Refer to the corresponding data sheet and operating instructions for further information.

8.11.2 Resolution

Input signals within a range of 0 mA ... 25 mA are detected with a resolution of 12 bits. The actual measuring range is calculated based on this resolution.

For the range between 4 mA ... 20 mA (corresponds to 0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %. Underranges and overranges are taken into consideration.

8.11.3 Measuring Time and Cycle Time

The conversion time for all 4 channels together is approx. 80 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

During HART communication, new values are only transmitted to the com unit every third internal data cycle. 50 ms is required for this. In the worst case scenario, the total time is therefore 130 ms.

8.11.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

In the cyclic data exchange process, data is communicated in the same order as the channels (channel 1, channel 2, etc.).



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)		
		Standard (53)	2 x 4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Live zero if current ≤ 3.6 mA (*)		
	1	Line fault detection channel 1 (0 = OK, 1 = error)		
	2 ... 3	Empty		
	4 ... 7	Measured value channel 1 (12 bit)		
Input byte 2 (high byte)	0 ... 7			
Input bytes 3 ... 8		Same structure as input bytes 1 and 2 for channel 1		
Output bytes		Without output bytes	2 x 4 empty output bytes	8 empty output bytes

(*) The live zero monitoring transmits an error bit (= 1) if the current falls below the minimum of 3.6 mA.

8.11.5 Line Fault Detection

The line fault detection can detect a lead breakage or short circuit and can be switched off on a channel-by-channel basis.

You can preset the switching points at which a lead breakage or a short circuit is signaled, e.g., line breakage < 1 mA and short circuit > 21 mA.

The current circuit has Live Zero monitoring. If the current falls below the minimum of 3.6 mA, an error bit is set (= 1).

8.11.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

The screenshot shows the 'Channel 1' configuration window. At the top, there are tabs for 'General', 'Channel 1', 'Channel 2', 'Channel 3', and 'Channel 4'. The 'Channel 1' tab is active. The 'Channel tag' is 'Kanal 3005'. The 'Channel active' checkbox is checked. Under 'Channel properties', 'Function' is 'AI' and 'Channel type' is 'Current'. Under 'Function modes', 'Operating mode' is 'Normal' and 'Error mode' is 'Current value'. There are 'Extended' and 'Current value' buttons. Under 'Measuring/Scaling', there are four rows: 'Lower limit' (0,000 mA), 'Begin of range' (4,000 mA), 'End of range' (20,000 mA), and 'High limit' (24,000 mA). Each row has a 'Scaling' dropdown menu with values 0, 10000, 50000, and 60000, and a 'Points' label. Under 'Signal handling', 'Line fault detection' is checked 'On'. Under 'Alarm points', 'Short' is 21,00 mA and 'Broken wire' is 1,00 mA. Under 'Special adjustments', 'HART options' includes 'HART on' and 'internal scan on', both checked. There is a 'Note' text area. At the bottom, there are 'OK', 'Cancel', 'Save', and 'Help' buttons. The bottom right corner shows the 'LB/FB - RIO' logo.

Figure 8.38 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value : The signal is transferred unchanged from the field in spite of the error. Substitute value : A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value : The last value that was valid before the fault occurred is transferred.

Field	Explanation
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
Short circuit	Enter the threshold value for short circuit detection, e.g., 21 mA. When the current strength exceeds this value, the line fault detection function reports a short circuit.
Lead breakage	Enter the threshold value for the lead breakage detection, e.g., 1 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA
HART on	This check box is available for the LB3*05 and FB3*05 I/O modules only. Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.
Internal scan on	This check box is available for the LB3*05 and FB3*05 I/O modules only. This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

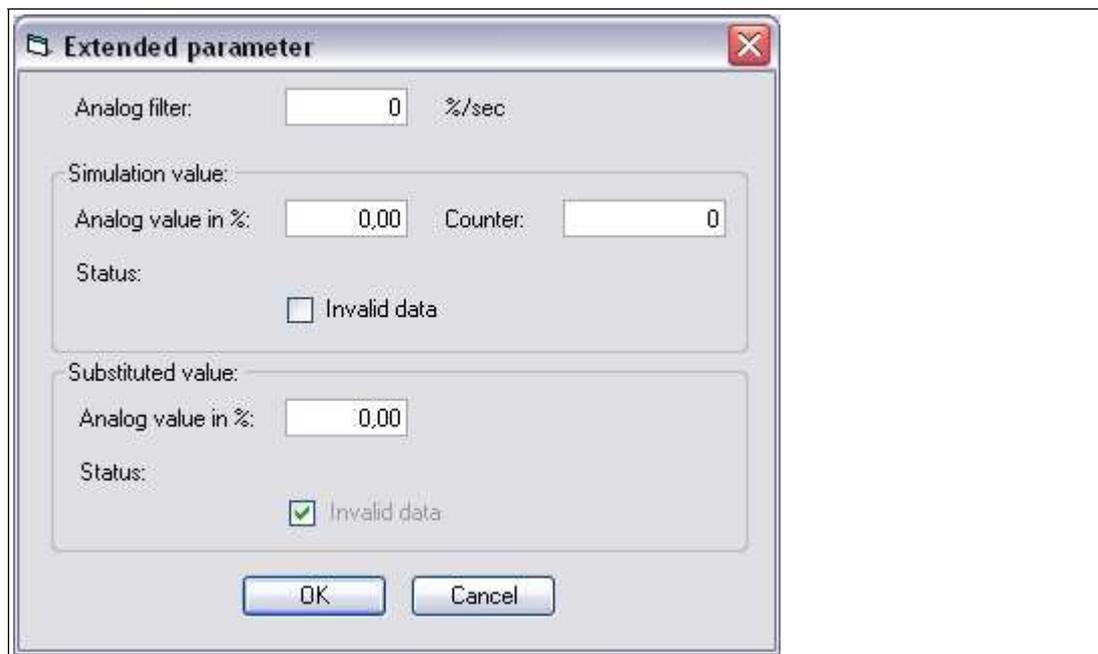


Figure 8.39 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.12 LB3*06 HART transmitter power supply

8.12.1 Description

Versions

- LB3006, HART transmitter power supply, not intrinsically safe
- LB3106, HART transmitter power supply, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 4
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

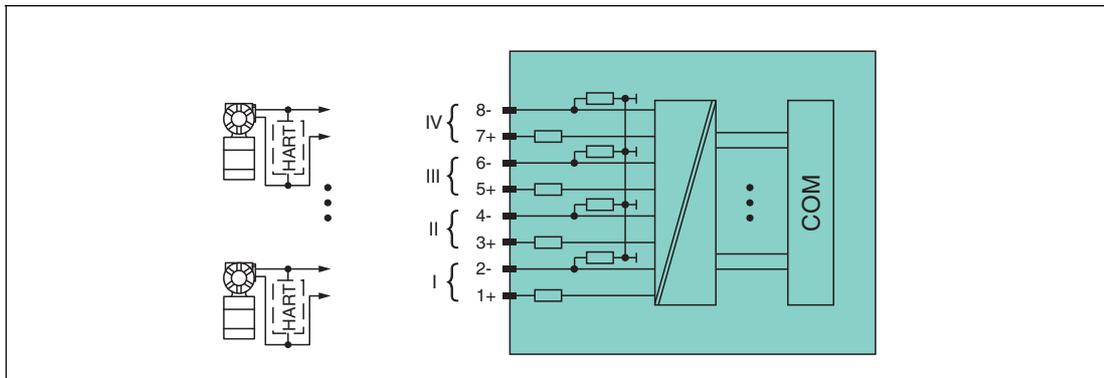


Figure 8.40 Block diagram LB3*06

The connection layout and other technical data can be found on the relevant data sheet.

8.12.2 Measuring Time and Cycle Time

The conversion time for all 4 channels together is approx. 80 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

During HART communication, new values are only transmitted to the com unit every third internal data cycle. 50 ms is required for this. In the worst case scenario, the total time is therefore 130 ms.

8.12.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 8.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

In the cyclic data exchange process, data is communicated in the same order as the channels (channel 1, channel 2, etc.).

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)	
		Standard (53)	8180 (37)
Octet	Bit	Description	Description
Input octet 1 (low octet)	0	Live zero if current ≤ 3.6 mA (*)	
	1	Line fault detection channel 1 (0 = OK, 1 = error)	
	2 ... 3	Empty	
	4 ... 7	Measured value channel 1 (12 bit)	
Input octet 2 (high octet)	0 ... 7		
Input octets 3 ... 8		Same structure as input octets 1 and 2 for channel 1	
Output octets		Without output octets	8 empty output octets

(*) The live zero monitoring transmits one error bit (= 1) if the current falls below the minimum of 3.6 mA.

8.12.4 Line Fault Detection

The line fault detection can detect a lead breakage or short circuit and can be switched off on a channel-by-channel basis.

You can preset the switching points at which a lead breakage or a short circuit is signaled, e.g., line breakage < 1 mA and short circuit > 21 mA.

The current circuit has Live Zero monitoring. If the current falls below the minimum of 3.6 mA, an error bit is set (= 1).

8.12.5 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

Figure 8.41 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.

Field	Explanation
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
Short circuit	Enter the threshold value for short circuit detection, e.g., 21 mA. When the current strength exceeds this value, the line fault detection function reports a short circuit.
Lead breakage	Enter the threshold value for the lead breakage detection, e.g., 1 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA
HART on	Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.
Internal scan on	This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

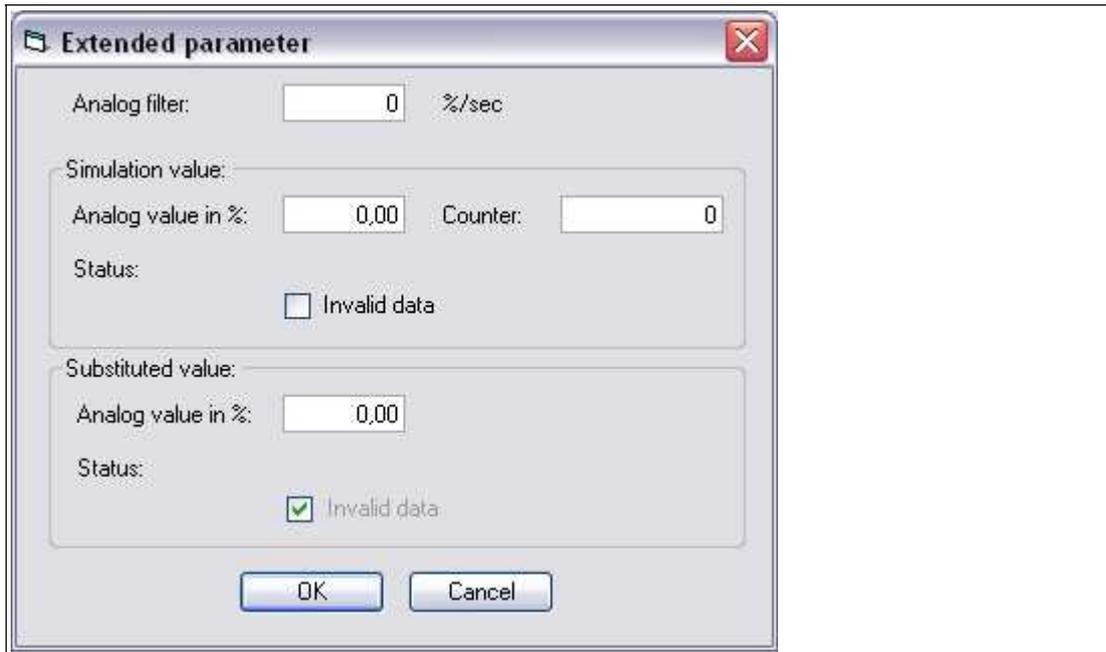


Figure 8.42 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.13 LB4101, FB4*01 Current Output
LB4*02, FB4*02 HART Current Output

8.13.1 Description

Versions

- LB4101, current output, intrinsically safe
- FB4201, current output, intrinsically safe
- LB4002, HART current output, not intrinsically safe
- FB4302, HART current output, increased safety terminals
Versions with bus-independent shutdown input are available
- LB4102, HART current output, intrinsically safe
Versions with bus-independent shutdown input are available
- FB4202, HART current output, intrinsically safe
Versions with bus-independent shutdown input are available.

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: proportional valves, I/P converters, local indicators

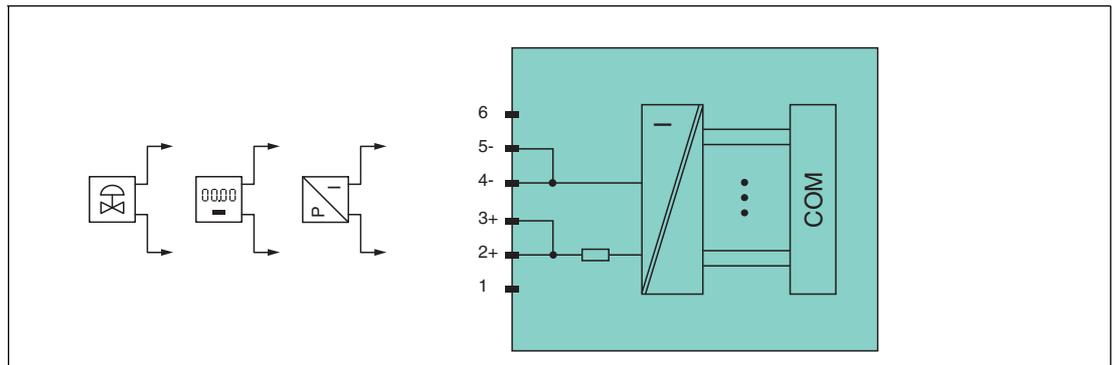


Figure 8.43 Block diagram LB4101, FB4*01

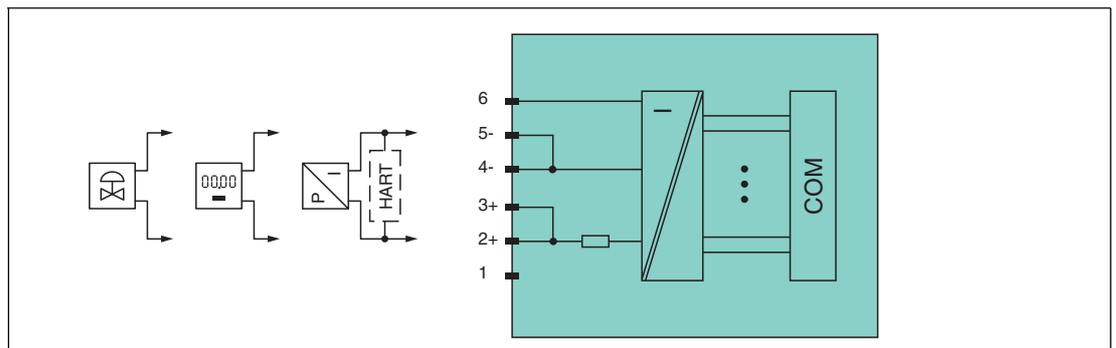


Figure 8.44 Block diagram LB4*02, FB4*02 without shutdown input

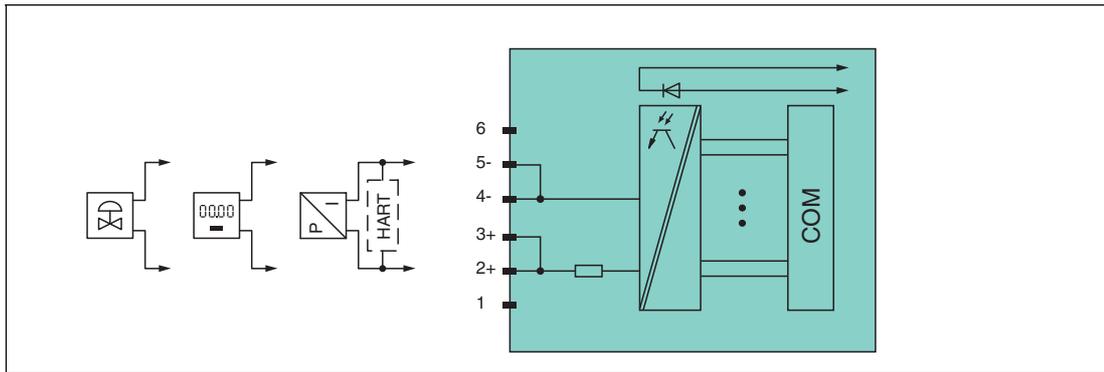


Figure 8.45 Block diagram LB4*02, FB4*02 with shutdown input

Refer to the corresponding data sheet and operating instructions for further information.

8.13.2 Resolution

Output signals within a range of 0 mA ... 25 mA are generated with a resolution of 12 bits. The actual measuring range is calculated based on this resolution. For the range between 4 mA ... 20 mA (corresponds to 0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

8.13.3 Measuring Time and Cycle Time

The conversion time is approx. 50 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.13.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

One data word (16 bit) word per channel is available for data transfer. The most significant 12 bits are used.

Digital information can be transmitted in the remaining 4 bits.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (60)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input bytes		Without input bytes	2 empty input bytes	4 empty input bytes	8 empty input bytes
Output byte 1 (low byte)	0	Empty			
	1	Invalid channel 1			
	2 ... 3	Empty			
	4 ... 7	Process value (12 bit)			
Output byte 2 (high byte)	0 ... 7				
Output bytes 3 ... 4		Not available	Not available	Empty	Empty
Output bytes 5 ... 8		Not available	Not available	Not available	Empty

8.13.5 Line Fault Detection

The line fault detection can detect a line breakage and can be switched off on a channel-by-channel basis.

Line fault detection works on the basis of measuring a minimum current of 1 mA. The current still flows even when the control system specifies 0 mA. The line fault detection function is therefore unsuitable for 0 mA ... 20 mA outputs. When currents < 0.1 mA are detected, a lead breakage is signaled.

8.13.6 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.13.7 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

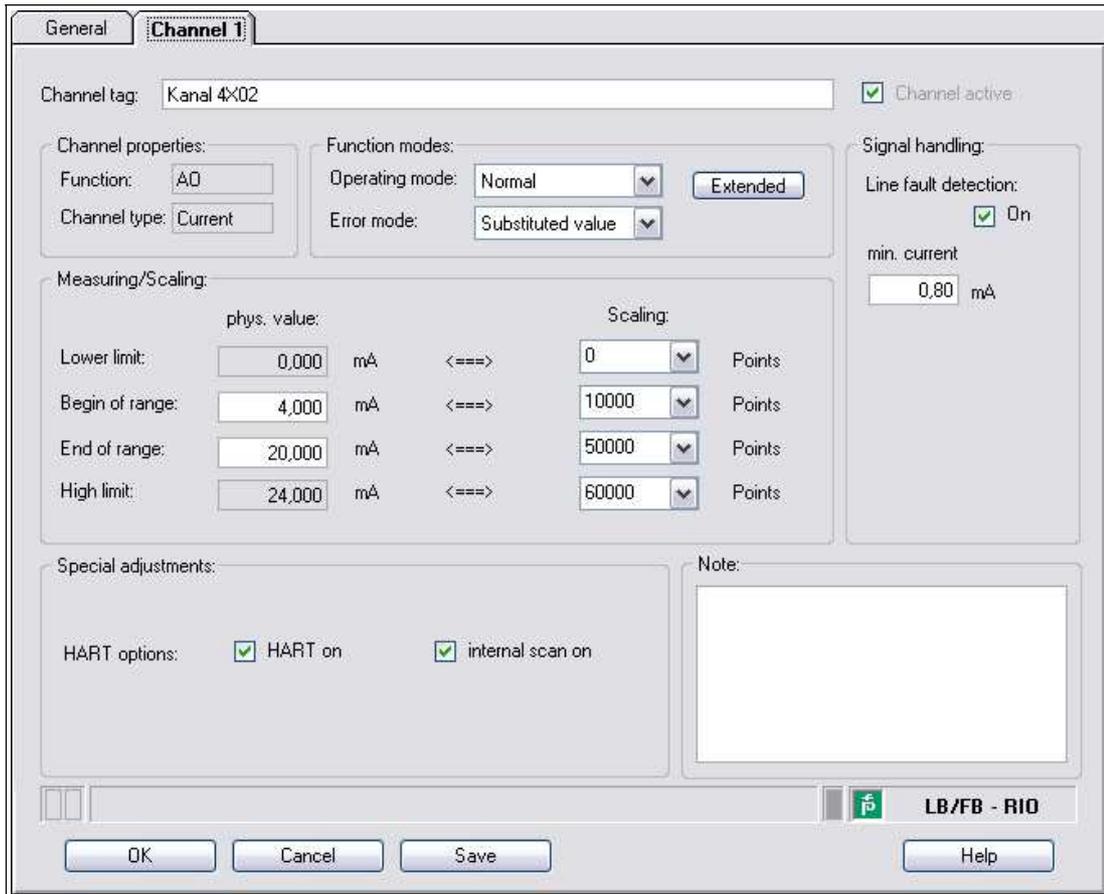


Figure 8.46 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal using the Extended button.

Field	Explanation
Error mode	<p>Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid, the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2</p> <p>Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal.</p> <p>Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button.</p> <p>Last valid value: The last value that was valid before the fault occurred is transferred.</p>
Extended	<p>This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode.</p>
Line fault detection	<p>Enable line fault detection to monitor the connection at the field end. If a lead breakage occurs, the error is reported via the status area for the process value.</p>
Minimum current	<p>Enter the threshold value for lead breakage detection, e.g., 0.8 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.</p>
Measuring range/scaling	<p>Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself.</p> <p>Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA</p> <p>Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA</p> <p>End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA</p> <p>Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA</p>
HART on	<p>This check box is available for the LB4*02 and FB4*02 I/O modules only.</p> <p>Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.</p>
Internal scan on	<p>This check box is available for the LB4*02 and FB4*02 I/O modules only.</p> <p>This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.</p>
Note	<p>You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.</p>

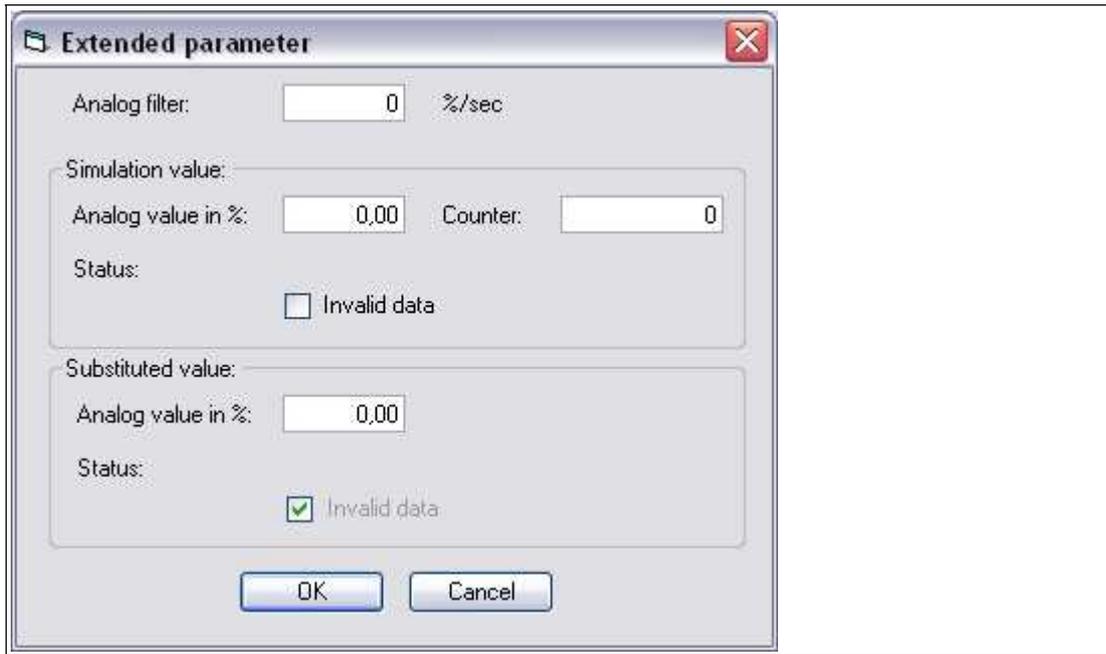


Figure 8.47 **Extended Parameters** window

Field	Explanation
Analog filter	The analog filters for damping the signal are activated if the output signals fluctuate. Enter a value in % per second for defining the rate of change of the output value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid and the substitute value strategy is initiated.
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.13.8 Configuring Strain Gauge Measurement

I/O modules LB4101 and LB5*02 or FB4*01 and FB5202 can be interconnected for strain gauge measurements. Use analog output LB4101 or FB4*01 to create a constant current, and the measuring input for the temperature input LB5*02 or FB5202 to process the millivolt signal for the resulting bridge voltage.

A constant current of 20 mA is sufficient for the bridge voltage for a 350 Ω bridge. A bridge voltage of 7 V is produced. With a bridge sensitivity of 2 mV/V, a voltage of 14 mV results at full load.



Configuring I/O Modules for Strain Gauge Measurement

Before configuring the I/O modules for strain gauge measurement, the project structure must contain a com unit and the LB4101 and LB5*02 or FB4*01 and FB5202 I/O modules. In addition, communication with the remote I/O station must work.

1. Either set the LB4101 or FB4*01 analog output operating mode to **simulation** and select 20 mA as the simulation value, or set a fixed value of 20 mA via the fieldbus.
2. Set the LB5*02 and FB5202 temperature input to a millivolt measurement **mV**.
3. Deactivate cold junction compensation for LB5*02 and FB5202 temperature input by setting the thermostat temperature for the external cold junction to **0 °C**.

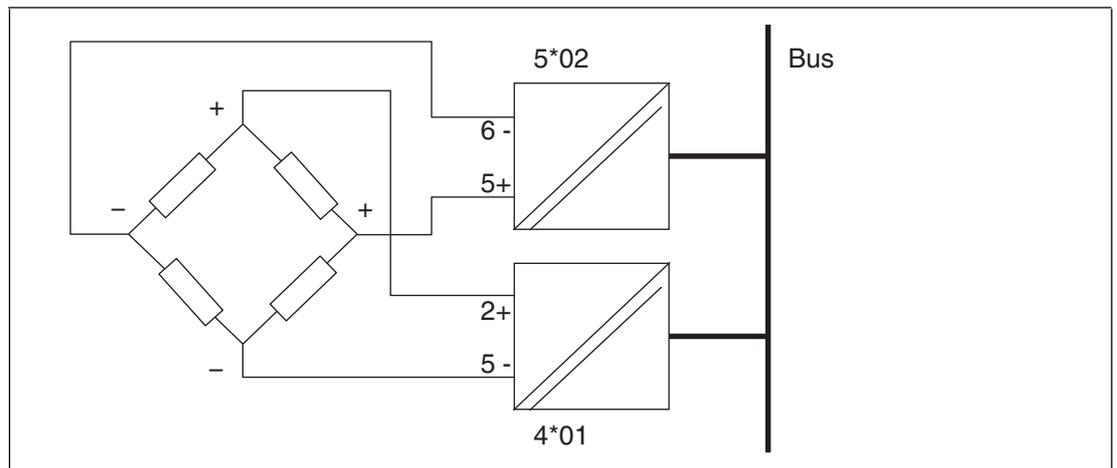


Figure 8.48 Example of a strain gauge bridge

8.14 LB4104, FB4204 Current Output
LB4*05, FB4*05 HART Current Output

8.14.1 Description

Versions

- LB4104, current output, intrinsically safe
- FB4204, current output, intrinsically safe
- LB4005, HART current output, not intrinsically safe
Versions available with bus-independent shutdown input
- FB4305, HART current output, increased safety terminals
Versions available with bus-independent shutdown input
- LB4105, HART current output, intrinsically safe
Versions available with bus-independent shutdown input
- FB4205, HART current output, intrinsically safe
Versions available with bus-independent shutdown input

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable field devices: proportional valves, I/P converters, local indicators

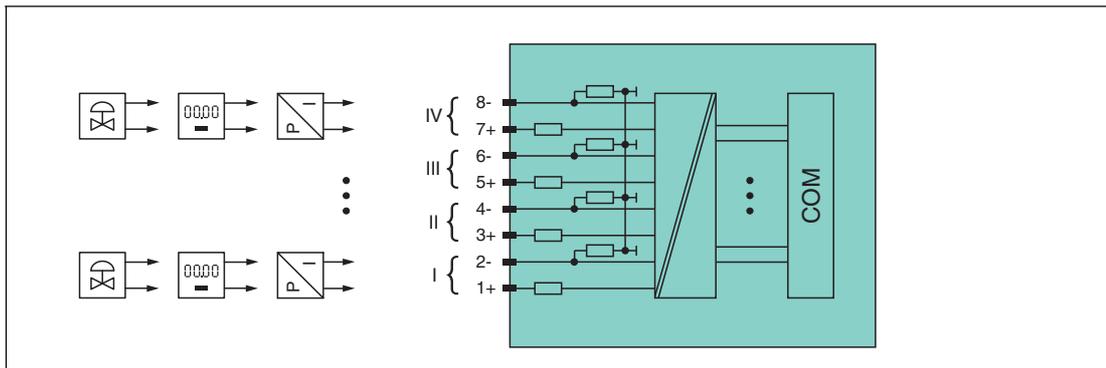


Figure 8.49 Block diagram LB4104, FB4204

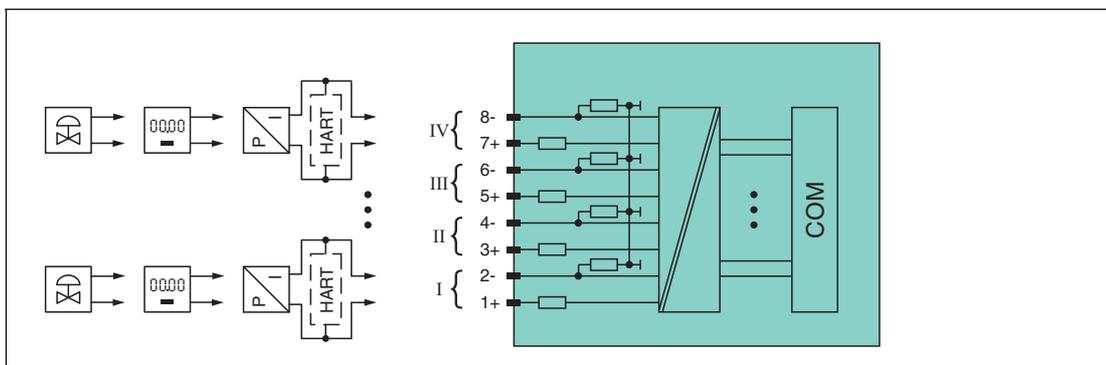


Figure 8.50 Block diagram LB4*05, FB4*05 without shutdown input

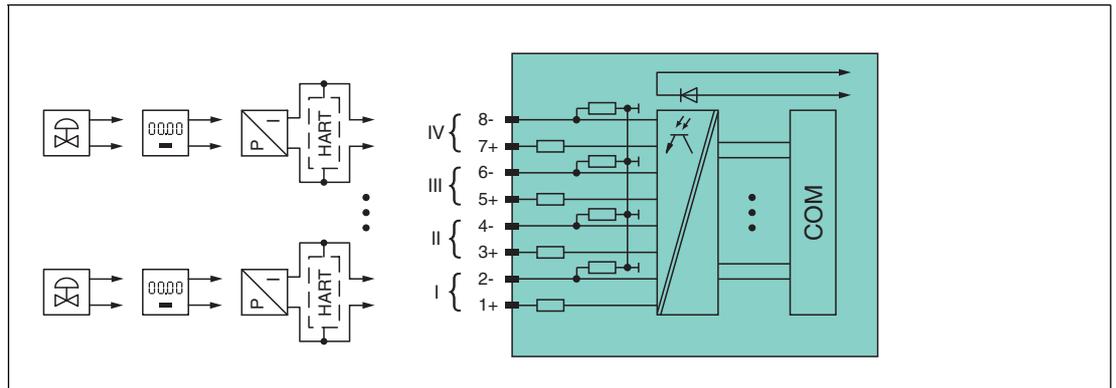


Figure 8.51 Block diagram LB4*05, FB4*05 with shutdown input

Refer to the corresponding data sheet and operating instructions for further information.

8.14.2 Resolution

Output signals within a range of 0 mA ... 25 mA are generated with a resolution of 12 bits. The actual measuring range is calculated based on this resolution. For the range between 4 mA ... 20 mA (corresponds to 0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

8.14.3 Measuring Time and Cycle Time

The conversion time for all 4 channels together is approx. 60 ms. During HART communication, this time increases to 110 ms. However, the accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.14.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)		
		Standard (C0 43 40)	2 x 4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning
Input byte 1	0	Empty		
	1	Line fault detection channel 1 (0 = OK, 1 = error)		
	2 ... 4	Empty		
	5	Line fault detection channel 2 (0 = OK, 1 = error)		
	6 ... 7	Empty		
Input byte 2	0	Empty		
	1	Line fault detection channel 3 (0 = OK, 1 = error)		
	2 ... 4	Empty		
	5	Line fault detection channel 4 (0 = OK, 1 = error)		
	6 ... 7	Empty		
Other input bytes		Not available	2 x 2 empty input bytes	6 empty input bytes
Output byte 1 (low byte)	0	Empty		
	1	Invalid channel 1		
	2 ... 3	Empty		
	4 ... 7	Process value channel 1 (12 bit)		
Output byte 2 (high byte)	0 ... 7			
Output bytes 3 ... 8		Same structure as output bytes 1 and 2 for channel 1		

8.14.5 Line Fault Detection



Note!

The LB4*05, FB4*05 I/O module is available with and without line fault detection. The com unit and the operator interface are the same across the various versions, however. Note, therefore, that the line fault detection settings relate to I/O modules with line fault detection only.

The line fault detection can detect a line breakage and can be switched off on a channel-by-channel basis.

Line fault detection works on the basis of measuring a minimum current of 1 mA. The current still flows even when the control system specifies 0 mA. The line fault detection function is therefore unsuitable for 0 mA ... 20 mA outputs. When currents < 0.1 mA are detected, a lead breakage is signaled.

8.14.6 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.14.7 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

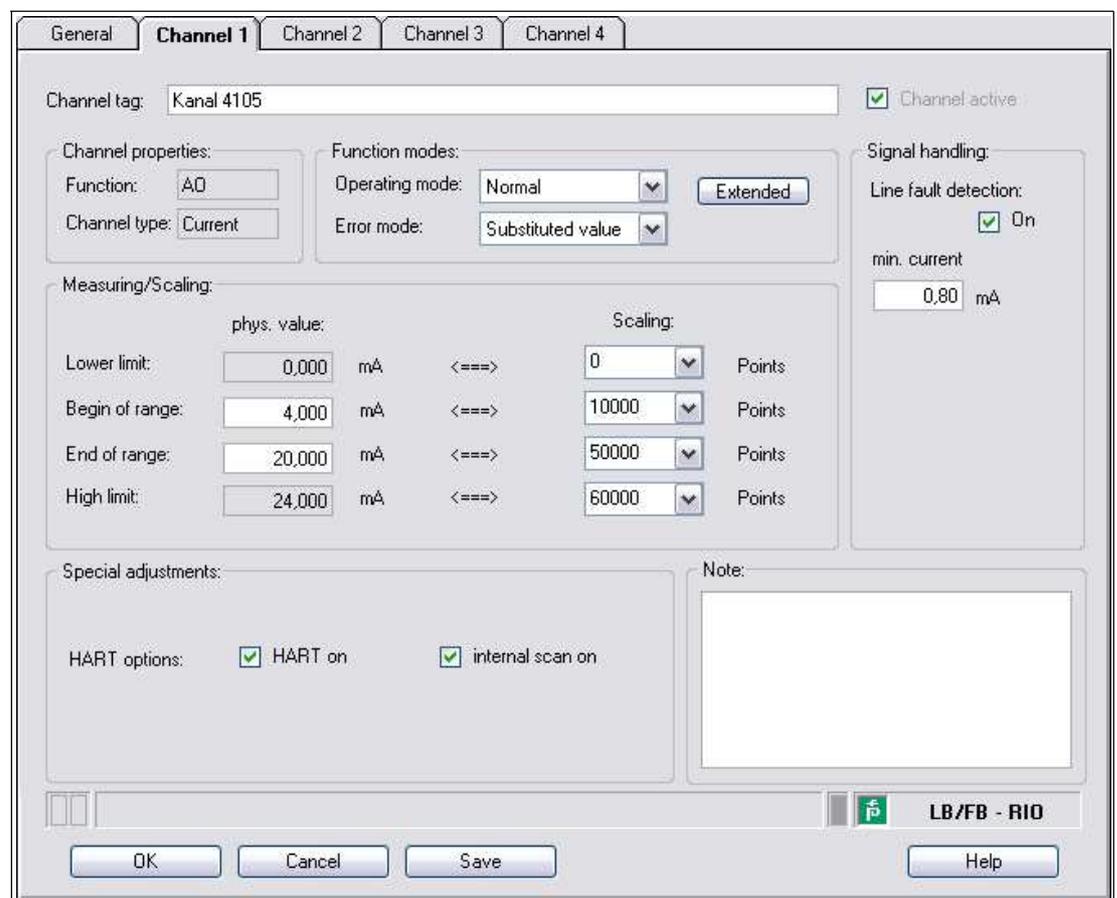


Figure 8.52 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.

Field	Explanation
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal using the Extended button.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	This check box is available for certain variants of the LB4*05 and FB4*05 I/O modules only. Enable line fault detection to monitor the connection at the field end. If a lead breakage occurs, the error is reported via the status area for the process value.
Minimum current	Enter the threshold value for lead breakage detection, e.g., 0.8 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA
HART on	This check box is available for the LB4*05 and FB4*05 I/O modules only. Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.

Field	Explanation
Internal scan on	This check box is available for the LB4*05 and FB4*05 I/O modules only. This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

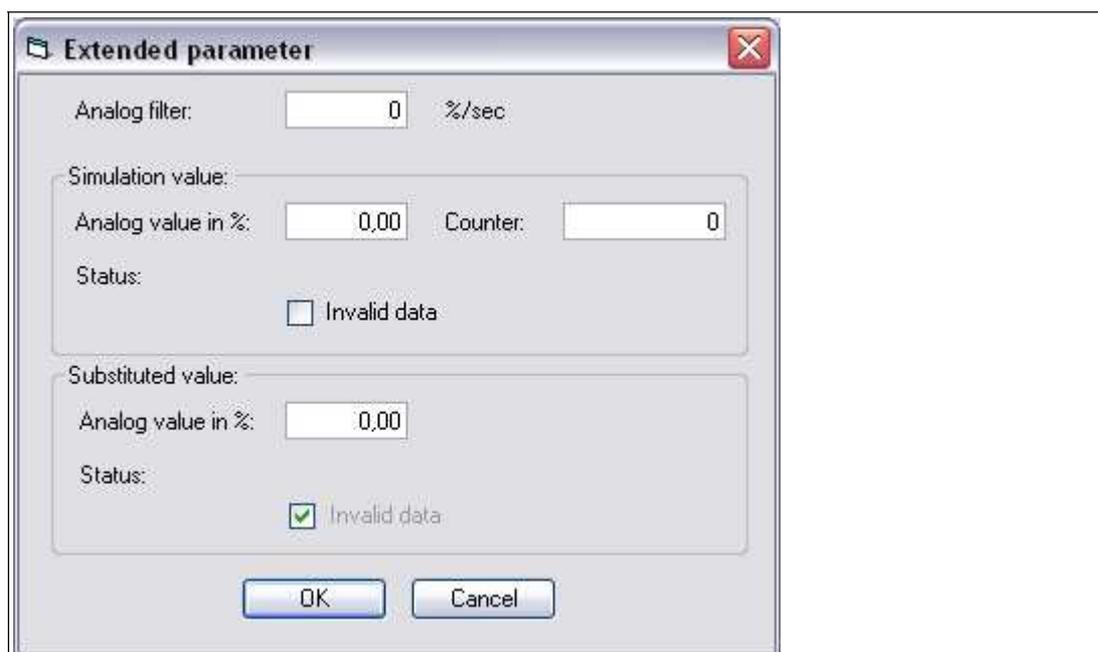


Figure 8.53 Extended Parameters window

Field	Explanation
Analog filter	The analog filters for damping the signal are activated if the output signals fluctuate. Enter a value in % per second for defining the rate of change of the output value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid and the substitute value strategy is initiated.
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.15 LB4106 HART Current Output

8.15.1 Description

Versions

LB4106, HART current output, intrinsically safe
Versions with bus-independent shutdown input are available.

Features

- Occupies 1 slot on the backplane
- Number of channels: 4
- Suitable field devices: proportional valves, I/P converters, local indicators

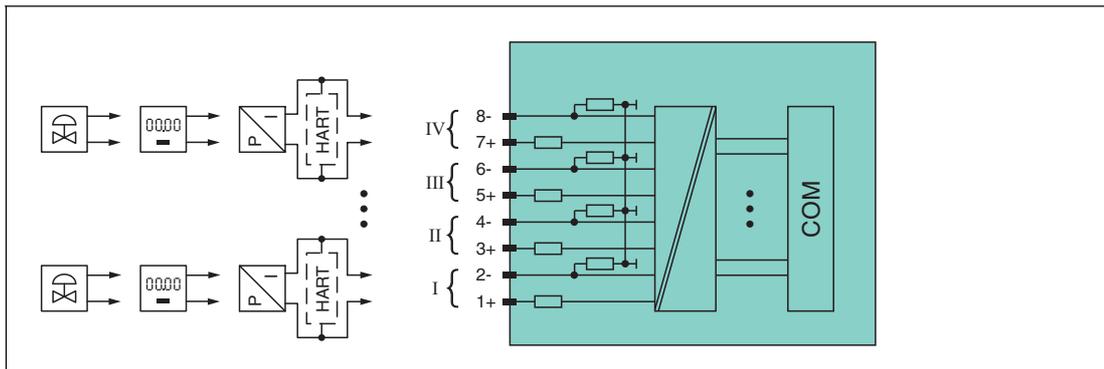


Figure 8.54 Block diagram LB4106 without shutdown input

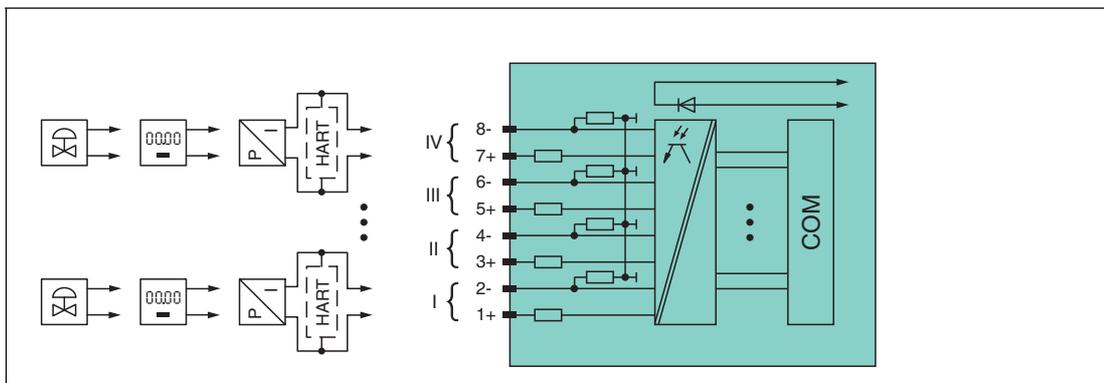


Figure 8.55 Block diagram LB4106 with shutdown input

The connection layout and other technical data can be found on the relevant data sheet.

8.15.2 Resolution

Output signals within a range of 0 mA ... 25 mA are generated with a resolution of 12 bits. The actual measuring range is calculated based on this resolution. For the range between 4 mA ... 20 mA (corresponds to 0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

8.15.3 Measuring Time and Cycle Time

The conversion time for all 4 channels together is approx. 60 ms. During HART communication, this time increases to 110 ms. However, the accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.15.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 8.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)	
		Standard (C0 43 40)	8180 (37)
Byte	Bit	Meaning	Meaning
Input byte 1	0	Empty	
	1	Line fault detection channel 1 (0 = OK, 1 = error)	
	2 ... 4	Empty	
	5	Line fault detection channel 2 (0 = OK, 1 = error)	
	6 ... 7	Empty	
Input byte 2	0	Empty	
	1	Line fault detection channel 3 (0 = OK, 1 = error)	
	2 ... 4	Empty	
	5	Line fault detection channel 4 (0 = OK, 1 = error)	
	6 ... 7	Empty	
Other input bytes		Not available	6 empty input bytes

		UniCOM PROFIBUS configuration (DP code)	
		Standard (C0 43 40)	8180 (37)
Byte	Bit	Meaning	Meaning
Output byte 1 (low byte)	0	Empty	
	1	Invalid channel 1	
	2 ... 3	Empty	
	4 ... 7	Process value channel 1 (12 bit)	
Output byte 2 (high byte)	0 ... 7		
Output bytes 3 ... 8		Same structure as output bytes 1 and 2 for channel 1	

8.15.5 Line Fault Detection

The line fault detection can detect a line breakage and can be switched off on a channel-by-channel basis.

Line fault detection works on the basis of measuring a minimum current of 1 mA. The current still flows even when the control system specifies 0 mA. The line fault detection function is therefore unsuitable for 0 mA ... 20 mA outputs. When currents < 0.1 mA are detected, a lead breakage is signaled.

8.15.6 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.15.7 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

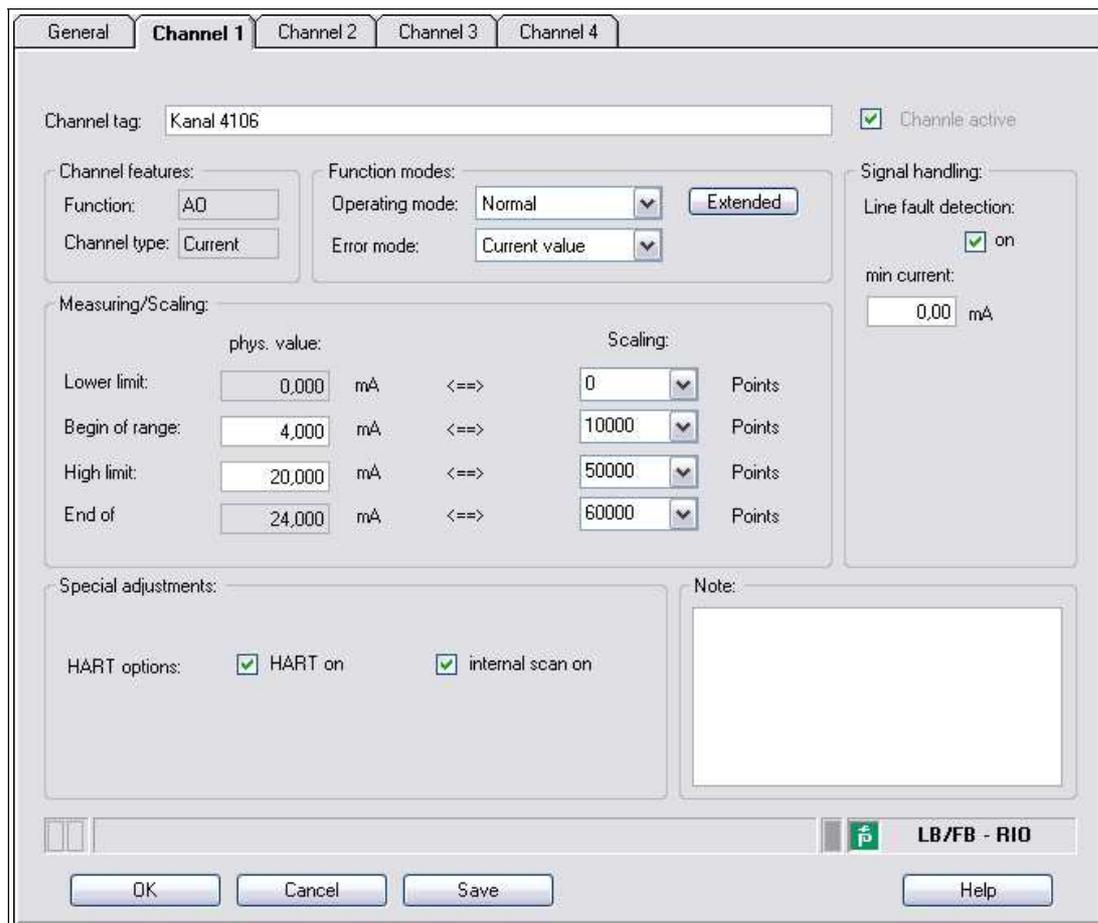


Figure 8.56 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal using the Extended button.

Field	Explanation
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	This check box is available for certain variants of the LB4*05 and FB4*05 I/O modules only. Enable line fault detection to monitor the connection at the field end. If a lead breakage occurs, the error is reported via the status area for the process value.
Minimum current	Enter the threshold value for lead breakage detection, e.g., 0.8 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA
HART on	This check box is available for the LB4*05 and FB4*05 I/O modules only. Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.
Internal scan on	This check box is available for the LB4*05 and FB4*05 I/O modules only. This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

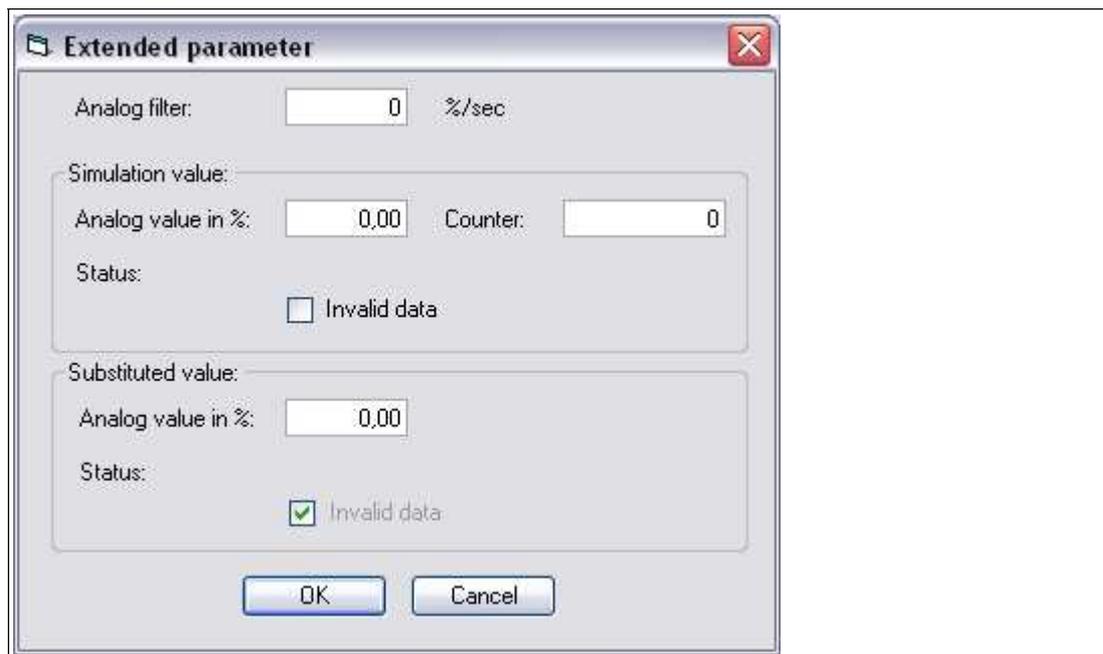


Figure 8.57 Extended Parameters window

Field	Explanation
Analog filter	The analog filters for damping the signal are activated if the output signals fluctuate. Enter a value in % per second for defining the rate of change of the output value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid and the substitute value strategy is initiated.
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.16 LB5*01, FB5201 RTD Converter

8.16.1 Description

Versions

- LB5001, RTD converter, not intrinsically safe
- LB5101, RTD converter, intrinsically safe
- FB5201, RTD converter, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable sensors: 2-, 3- and 4-wire connection, resistance thermometer, slide-wire sensor up to 400 Ω

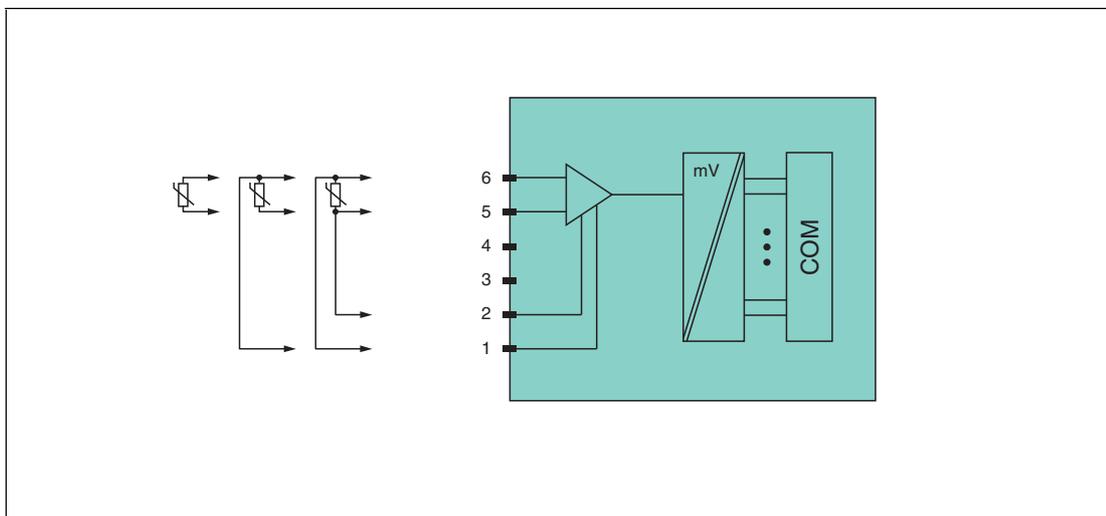


Figure 8.58 Block diagram LB5*01, FB5201

2-wire connection: 5, 6

3-wire connection: 1, 5, 6

4-wire connection: 1, 2, 5, 6

Refer to the corresponding data sheet and operating instructions for further information.

8.16.2 Resolution

Temperatures within a range of -200 °C ... 850 °C are detected with a resolution of 16 bits. The actual measuring range is calculated based on this resolution.

For the smallest span (0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

8.16.3 Measuring Time and Cycle Time

The processing times depend on the preset measurement process.

- 20 ms without line fault detection
- 125 ms with line fault detection

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time. A filter is available for smoothing the input signals.

8.16.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (50)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Empty			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2 ... 3	Empty			
	4 ... 7	Measured value (12 bit)			
Input byte 2 (high byte)	0 ... 7				
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.16.5 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages (resistance > 1 kΩ at Pt100) or short circuits (resistance < 10 Ω at Pt100). Line fault detection can be switched on and off in the Device Type Manager.

When a line fault occurs, the broken wire delay function waits until multiple faultless measuring cycles have been completed before enabling measured values to avoid constant toggling between OK/fault if there is a loose contact.

8.16.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

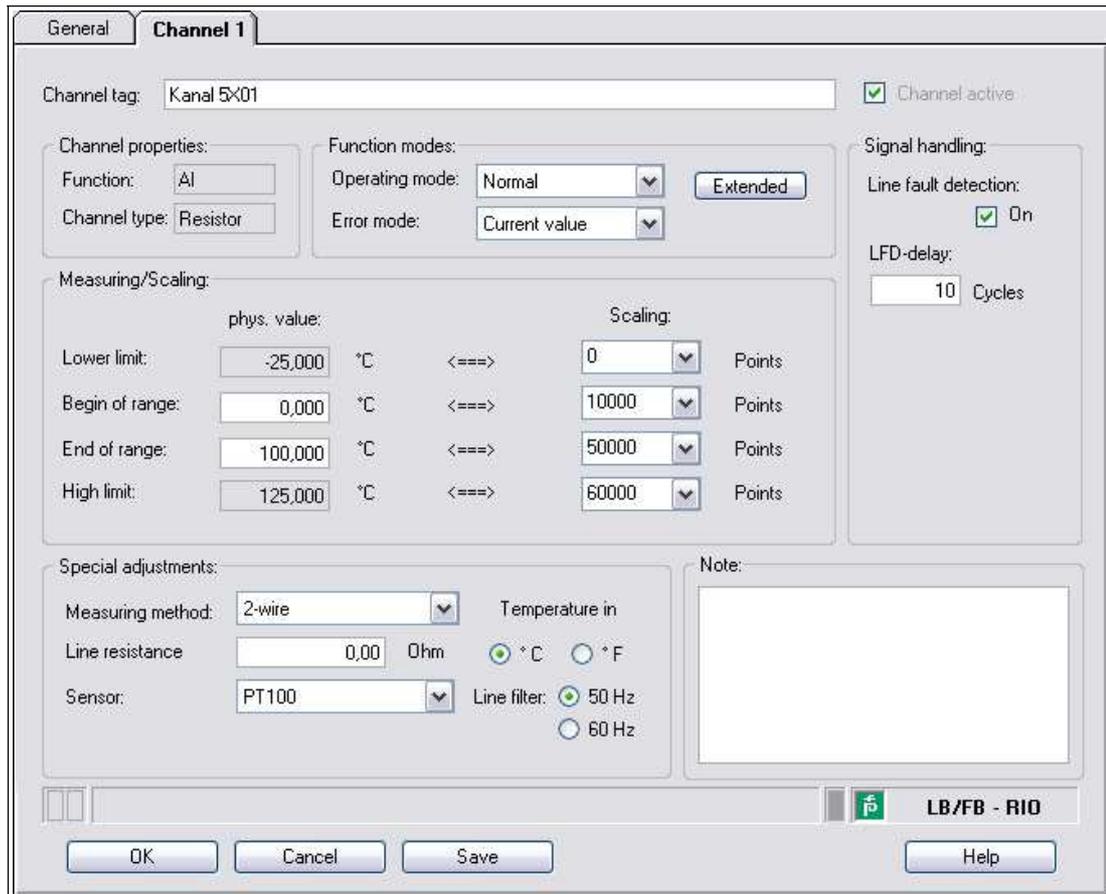


Figure 8.59 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DO = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.

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Field	Explanation
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value : The signal is transferred unchanged from the field in spite of the error. Substitute value : A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value : The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
LFD delay	This field only appears when Line fault detection is enabled. Specify the number of measuring cycles during which a measured value must be free of errors before the value is signaled as good. This function can be used for suppressing loose contacts, for example.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. The Lower limit indicates the smallest transferable value (e.g., 0 points or underrange). The Start of range indicates the value equivalent to 0% (e.g., 10,000 points or start of measuring range). The End of range indicates the value equivalent to 100% (e.g., 50,000 points or end of measuring range). The Upper limit indicates the largest transferable value (e.g., 60,000 points or overrange).
Measurement method	Set the measuring method used. Choose between a 2-, 3-, and 4-wire configuration. If you choose the 2-wire configuration, enter the line resistance in the Line resistance field.
Line resistance	This field is only visible if you have selected a 2-wire configuration from the measuring methods in the drop-down list. Enter the resistance value of the spur to compensate for measurement errors.
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the correct linearization is automatically used. ■ Resistance: start of range (min.) at 0 Ω, end of range (max.) at 400 Ω ■ Pt100: start of range (min.) at -200 °C, end of range (max.) at 850 °C
Temperature unit	This option can be edited only if you have selected a Pt or Ni sensor under Sensor . Select the temperature unit for the start of range, end of range, and measured value.
Line filter	Select a filter to compensate for system-related interference (50 Hz and 60 Hz).
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

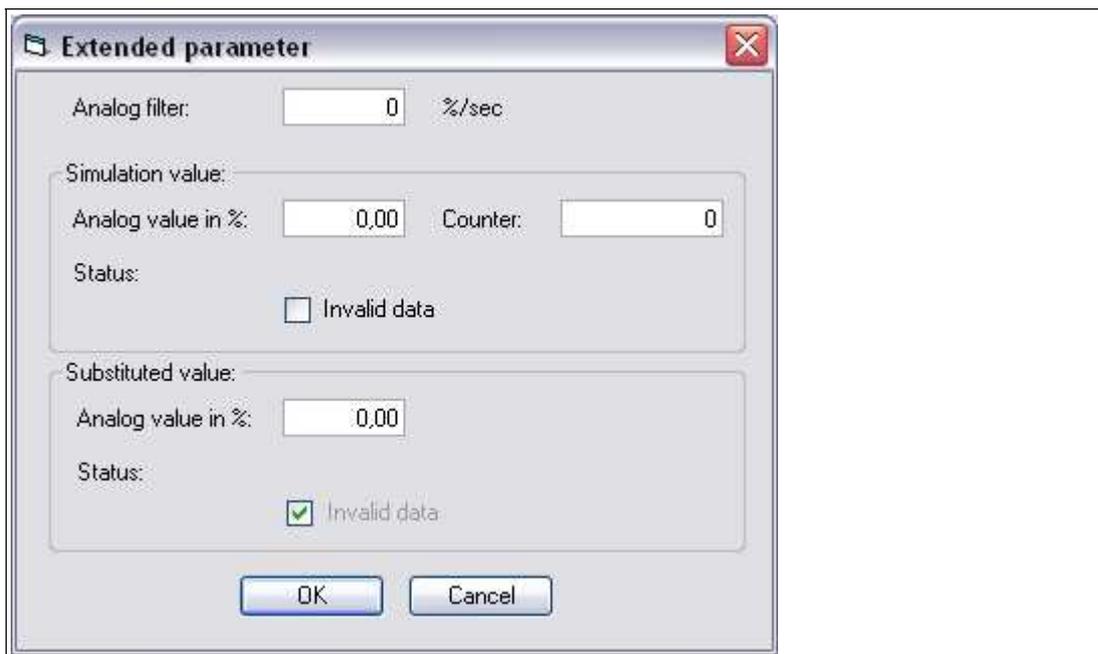


Figure 8.60 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.17 LB5*02, FB5202 Thermocouple Converter

8.17.1 Description

Versions

- LB5002, thermocouple converter, not intrinsically safe
- LB5102, thermocouple converter, intrinsically safe
- FB5202, thermocouple converter, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable sensors: thermocouple types U, B, E, T, K, S, R, L, J, N, pallaplat and mV sensors

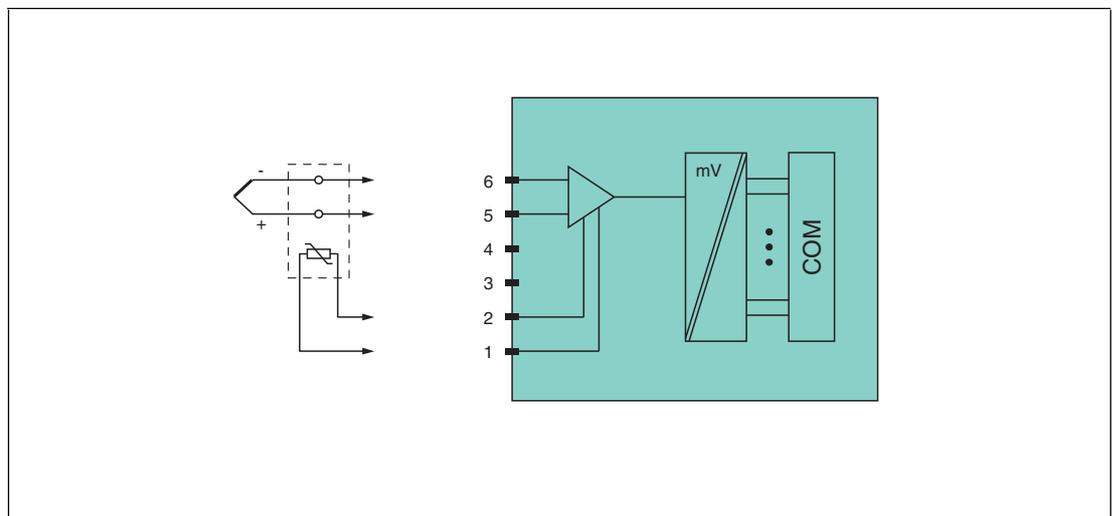


Figure 8.61 Block diagram LB5*02, FB5202

Cold junctions: 1, 2

Thermocouple: 5+, 6-

Refer to the corresponding data sheet and operating instructions for further information.

8.17.2 Resolution

Temperatures within a range of -200 °C ... 850 °C are detected with a resolution of 16 bits. The actual measuring range is calculated based on this resolution.

For the smallest span of 5 mV (0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

All conventional thermocouple curves and pallaplat are linearized.

8.17.3 Measuring Time and Cycle Time

The processing times depend on the preset measurement process.

- **External reference junction (CJC)**
 - 20 ms without line fault detection
 - 80 ms with line fault detection

■ **Internal reference junction (CJC)**

- 120 ms without line fault detection
- 240 ms with line fault detection

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time. A filter is available for smoothing the input signals.

8.17.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (50)	2120 (31)	4140 (33)	8180 (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Empty			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2 ... 3	Empty			
	4 ... 7	Measured value (12 bit)			
Input byte 2 (high byte)	0 ... 7				
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

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8.17.5 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages. Line fault detection can be switched on and off via the Device Type Manager.

The broken wire delay function prevents measured values from being enabled after a line fault occurs to avoid constant toggling between OK/fault if there is a loose contact.

- With external cold junction: 0 ms ... 250 ms x 160 ms
- With internal cold junction: 0 ms ... 250 ms x 240 ms

For internal cold junctions, you can set the ratio of temperature compensation measurements to actual thermocouple measurements to provide an optimum measuring time.

8.17.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

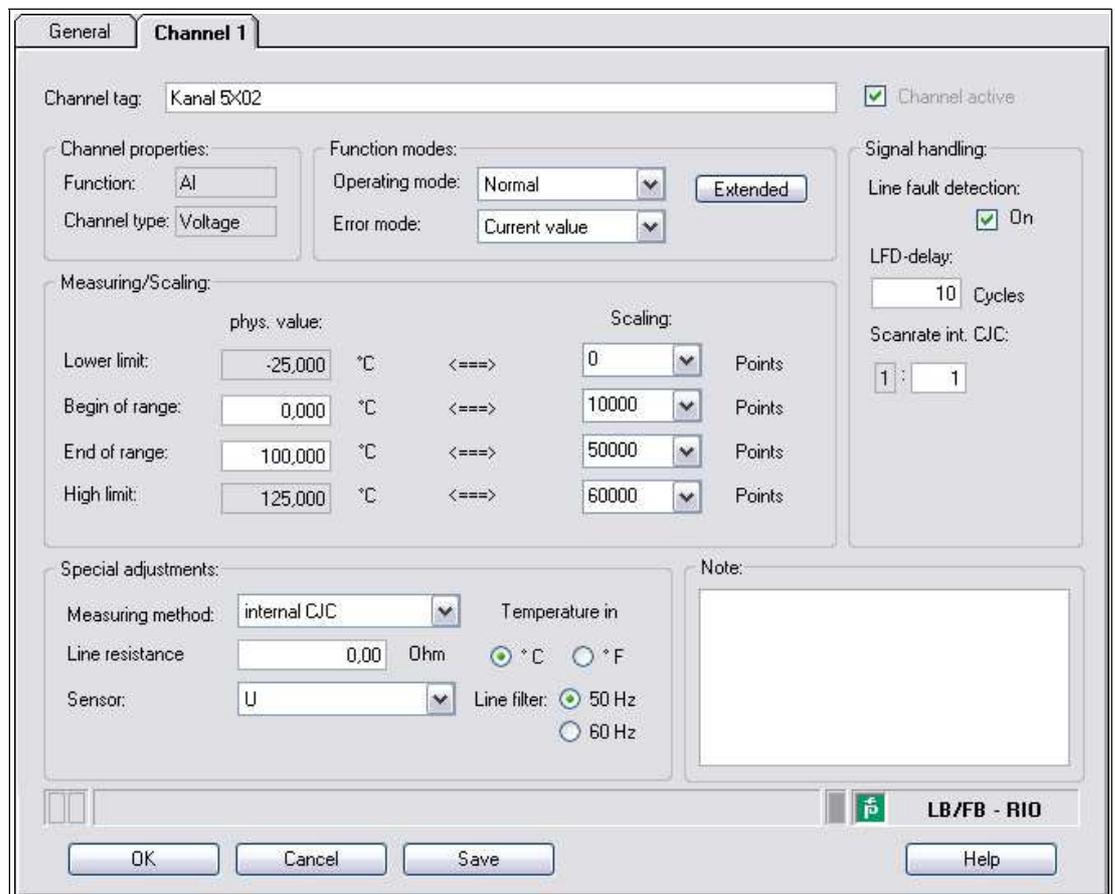


Figure 8.62 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DO = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value : The signal is transferred unchanged from the field in spite of the error. Substitute value : A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value : The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
LFD delay	This field only appears when Line fault detection is enabled. Specify the number of measuring cycles during which a measured value must be free of errors before the value is signaled as good. This function can be used for suppressing loose contacts, for example.
Scan rate internal CJC	This field is only visible if you have selected an external cold junction from the measuring methods in the drop-down list. Specify how often the cold junction temperature should be measured in relation to the actual measurement. If you specify the ratio 1:20, for example, the cold junction temperature is measured after every twentieth thermocouple measurement. The setting is effective for the duration of the measuring cycle. The more frequently the cold junction temperature is measured, the longer a measuring cycle lasts.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. The Lower limit indicates the smallest transferable value (e.g., 0 points or underrange). The Start of range indicates the value equivalent to 0% (e.g., 10,000 points or start of measuring range). The End of range indicates the value equivalent to 100% (e.g., 50,000 points or end of measuring range). The Upper limit indicates the largest transferable value (e.g., 60,000 points or overrange).
Measurement method	Select between an internal and external cold junction.

Field	Explanation
Line resistance or ext. cold junction	Enter the line resistance of the spur for internal cold junctions and the thermostat temperature for external cold junctions.
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the correct linearization is automatically used. <ul style="list-style-type: none"> ■ mV: start of range (min.) at -75 mV, end of range (max.) at 75 mV ■ U: start of range (min.) at -200 °C, end of range (max.) at 600 °C ■ B: start of range (min.) at 0 °C, end of range (max.) at 1820 °C ■ E: start of range (min.) at -270 °C, end of range (max.) at 1000 °C ■ T: start of range (min.) at -270 °C, end of range (max.) at 400 °C ■ K: start of range (min.) at -200 °C, end of range (max.) at 1370 °C ■ S: start of range (min.) at 0 °C, end of range (max.) at 1760 °C ■ R: start of range (min.) at -200 °C, end of range (max.) at 900 °C ■ L: start of range (min.) at -50 °C, end of range (max.) at 1760 °C ■ J: start of range (min.) at -210 °C, end of range (max.) at 1200 °C ■ N: start of range (min.) at -210 °C, end of range (max.) at 1200 °C ■ Pallaplat: start of range (min.) at -100 °C, end of range (max.) at 1300 °C
Temperature unit	This option is not visible if you have selected mV in the Sensor drop-down list. Select the temperature unit for the start of range, end of range, and measured value.
Line filter	Select a filter to compensate for system-related interference (50 Hz and 60 Hz).
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

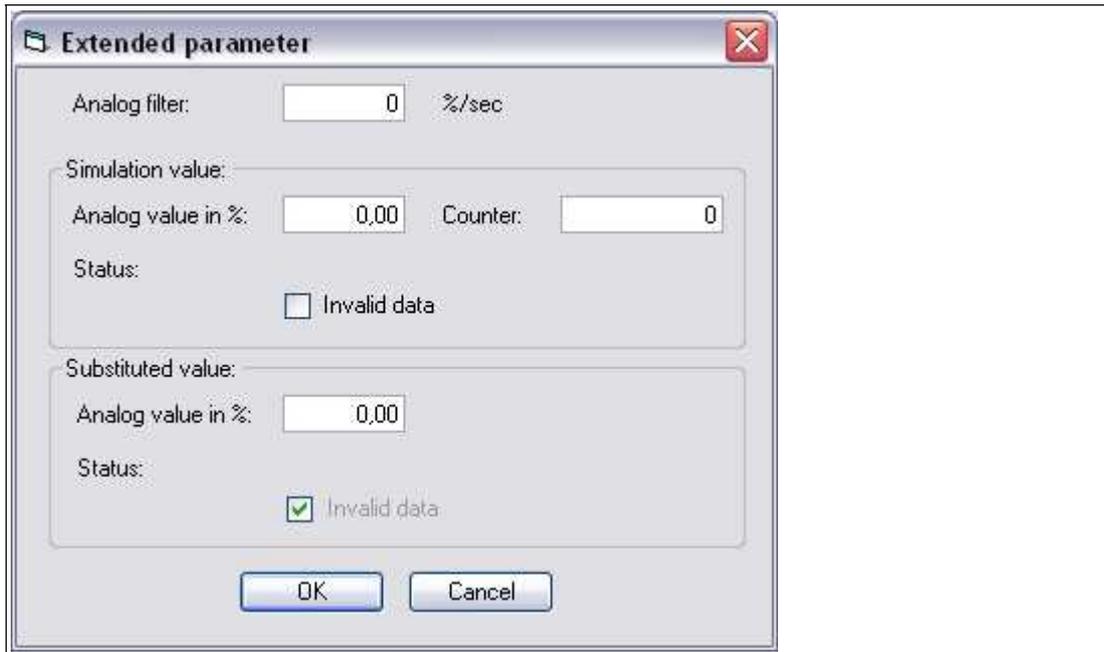


Figure 8.63 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.17.7 Configuring Strain Gauge Measurement

I/O modules LB4101 and LB5*02 or FB4*01 and FB5202 can be interconnected for strain gauge measurements. Use analog output LB4101 or FB4*01 to create a constant current, and the measuring input for the temperature input LB5*02 or FB5202 to process the millivolt signal for the resulting bridge voltage.

A constant current of 20 mA is sufficient for the bridge voltage for a 350 Ω bridge. A bridge voltage of 7 V is produced. With a bridge sensitivity of 2 mV/V, a voltage of 14 mV results at full load.



Configuring I/O Modules for Strain Gauge Measurement

Before configuring the I/O modules for strain gauge measurement, the project structure must contain a com unit and the LB4101 and LB5*02 or FB4*01 and FB5202 I/O modules. In addition, communication with the remote I/O station must work.

1. Either set the LB4101 or FB4*01 analog output operating mode to **simulation** and select 20 mA as the simulation value, or set a fixed value of 20 mA via the fieldbus.
2. Set the LB5*02 and FB5202 temperature input to a millivolt measurement **mV**.
3. Deactivate cold junction compensation for LB5*02 and FB5202 temperature input by setting the thermostat temperature for the external cold junction to **0 °C**.

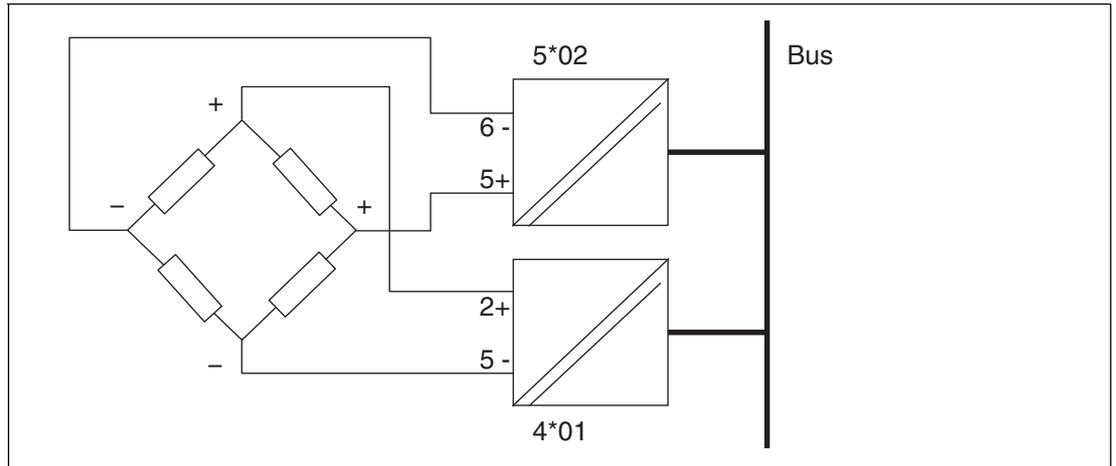


Figure 8.64 Example of a strain gauge bridge

8.18 LB5*04, FB5204 RTD Converter

8.18.1 Description

Versions

- LB5004, RTD converter, not intrinsically safe
- LB5104, RTD converter, intrinsically safe
- FB5204, RTD converter, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable sensors: 2-, 3- and 4-wire connection, resistance thermometer, slide-wire sensor

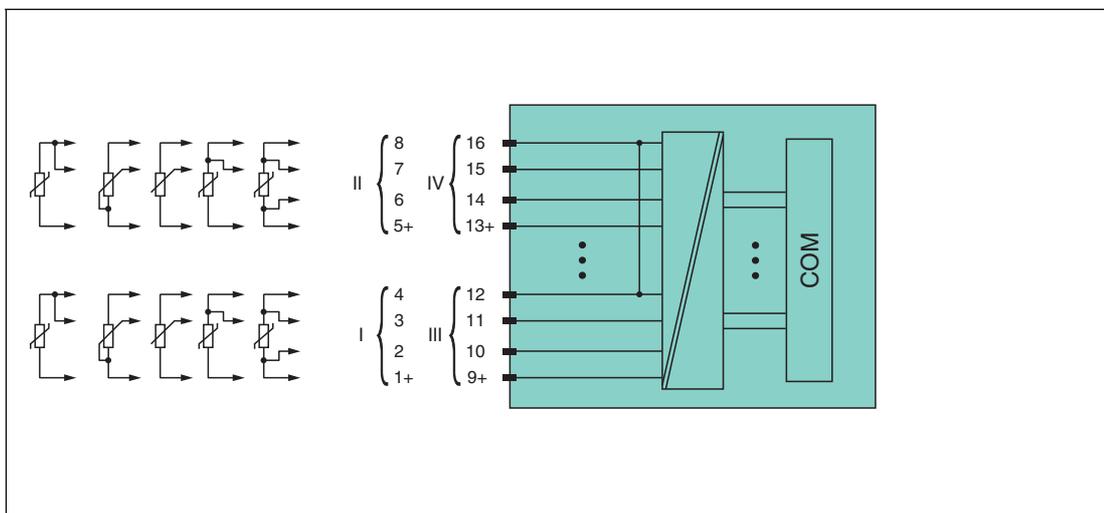


Figure 8.65 Block diagram LB5*04, FB5204

Channel I: resistance/potentiometer input 1 ... 4

Channel II: resistance/potentiometer input 5 ... 8

Channel III: resistance/potentiometer input 9 ... 12

Channel IV: resistance/potentiometer input 13 ... 16

Refer to the corresponding data sheet and operating instructions for further information.

8.18.2 Resolution

Temperatures within a range of -200 °C ... 850 °C are detected with a resolution of 16 bits. The actual measuring range is calculated based on this resolution.

For the smallest span (0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

8.18.3 Measuring Time and Cycle Time

The processing times depend on the preset measurement process.

- 120 ms per active channel or 480 ms for all 4 channels
- 240 ms for converting the signals of a resistive sensor channel in a 3-wire configuration

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time. It takes $4 \times 6.25 \text{ ms} = 25 \text{ ms}$ until the values of all 4 channels are present in the com unit because the values are transferred one after the other. This time must be added to the conversion time.

A filter is available for smoothing the input signals.

It can take 15 s after downloading a configuration before the I/O module parameters are applied.

8.18.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

In the cyclic data exchange process, data is communicated in the same order as the channels (channel 1, channel 2, etc.).



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)		
		Standard (53)	2 x 4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Empty		
	1	Line fault detection channel 1 (0 = OK, 1 = error)		
	2 ... 3	Empty		
	4 ... 7	Measured value channel 1 (12 bit)		
Input byte 2 (high byte)	0 ... 7	Measured value channel 1 (12 bit)		
Input bytes 3 ... 8		Same structure as input bytes 1 and 2 for channel 1		
Output bytes		Without output bytes	2 x 4 empty output bytes	8 empty output bytes

8.18.5 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages (resistance > 1 kΩ at Pt100) or short circuits (resistance < 10 Ω at Pt100). Line fault detection can be switched on and off in the Device Type Manager.

When a line fault occurs, the broken wire delay function waits until multiple faultless measuring cycles have been completed before enabling measured values to avoid constant toggling between OK/fault if there is a loose contact.

8.18.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

The screenshot shows the 'Channel 1' configuration window. At the top, there are tabs for 'General', 'Channel 1', 'Channel 2', 'Channel 3', and 'Channel 4'. The 'Channel 1' tab is active. The window contains several sections:

- Channel tag:** A text field containing 'Kanal 5x04'.
- Channel active:** A checked checkbox.
- Channel properties:** 'Function' is set to 'AI' and 'Channel type' is 'Resistor'.
- Function modes:** 'Operating mode' is 'Normal' (with an 'Extended' button) and 'Error mode' is 'Current value'.
- Measuring/Scaling:** A table with columns for 'phys. value' and 'Scaling'.

phys. value:	Scaling:
Lower limit: -25,000 °C <===>	0 Points
Begin of range: 0,000 °C <===>	10000 Points
End of range: 100,000 °C <===>	50000 Points
High limit: 125,000 °C <===>	60000 Points
- Signal handling:** 'Line fault detection' is checked 'On' with an 'LFD-delay' of 10 Cycles.
- Special adjustments:** 'Measuring method' is '2-wire', 'Line resistance' is '0,00 Ohm', 'Sensor' is 'PT100', and 'Line filter' is '50 Hz'.
- Note:** An empty text area.

At the bottom, there are 'OK', 'Cancel', 'Save', and 'Help' buttons, and a status bar showing 'LB/FB - RIO'.

Figure 8.66 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.

Field	Explanation
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
LFD delay	This field only appears when Line fault detection is enabled. Specify the number of measuring cycles during which a measured value must be free of errors before the value is signaled as good. This function can be used for suppressing loose contacts, for example.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. The Lower limit indicates the smallest transferable value (e.g., 0 points or underrange). The Start of range indicates the value equivalent to 0% (e.g., 10,000 points or start of measuring range). The End of range indicates the value equivalent to 100% (e.g., 50,000 points or end of measuring range). The Upper limit indicates the largest transferable value (e.g., 60,000 points or overrange).
Measurement method	Set the measuring method used. Choose between a 2-, 3-, and 4-wire configuration. If you choose the 2-wire configuration, enter the line resistance in the Line resistance field.
Line resistance	This field is only visible if you have selected a 2-wire configuration from the measuring methods in the drop-down list. Enter the resistance value of the spur to compensate for measurement errors.
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the correct linearization is automatically used. <ul style="list-style-type: none"> ■ Resistance: start of range (min.) at 0 Ω, end of range (max.) at 10000 Ω ■ Pt100, Pt200, Pt500, Pt1000: start of range (min.) at -200 °C, end of range (max.) at 850 °C ■ Ni100, Ni500, Ni1000: start of range (min.) at -70 °C, end of range (max.) at 230 °C
Temperature unit	This option can be edited only if you have selected a Pt or Ni sensor under Sensor . Select the temperature unit for the start of range, end of range, and measured value.
Line filter	Select a filter to compensate for system-related interference (50 Hz and 60 Hz).
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

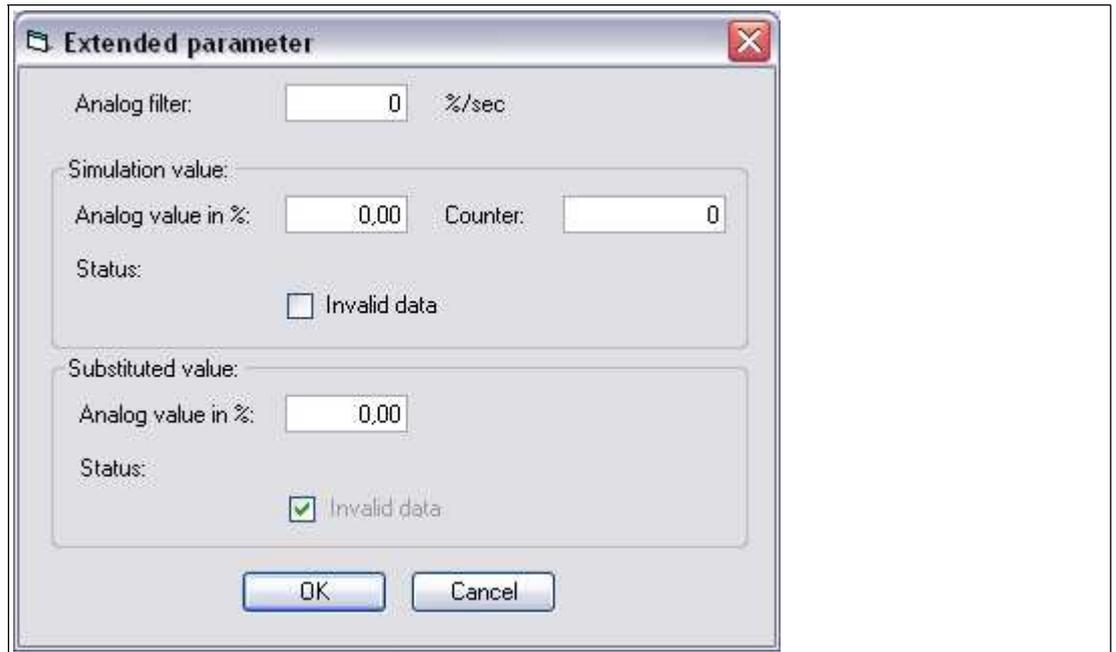


Figure 8.67 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.19 LB5*05, FB5205 Thermocouple Converter

8.19.1 Description

Versions

- LB5005, thermocouple converter, not intrinsically safe
- LB5105, thermocouple converter, intrinsically safe
- FB5205, thermocouple converter, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable sensors: thermocouple types U, B, E, T, K, S, R, L, J, N, pallaplat and mV sensors

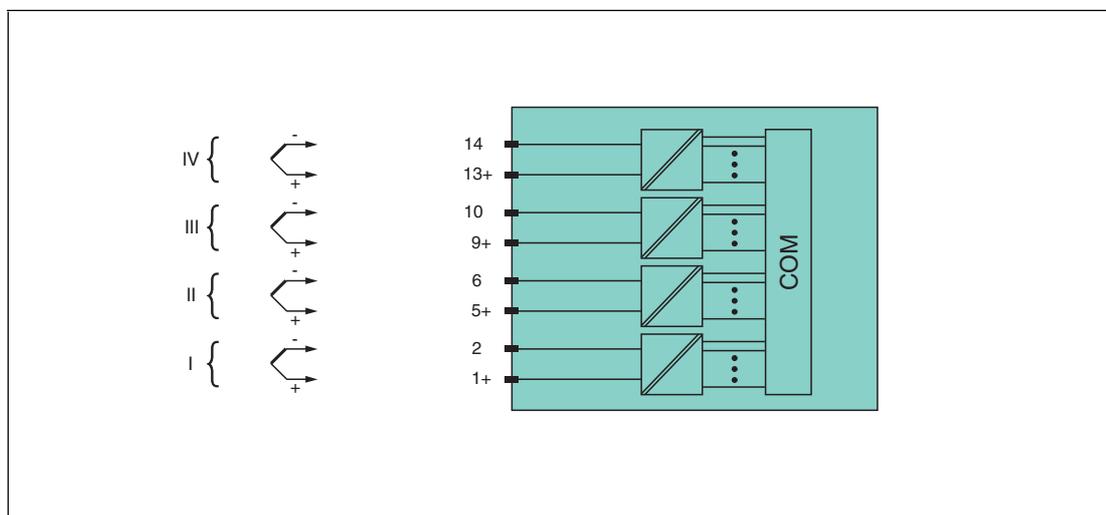


Figure 8.68 Block diagram LB5*05, FB5205

Channel I: 1+, 2-; channel II: 5+, 6-; channel III: 9+, 10-; channel IV: 13+, 14-

Refer to the corresponding data sheet and operating instructions for further information.

8.19.2 Resolution

Temperatures within a range of -200 °C ... 850 °C are detected with a resolution of 16 bits. The actual measuring range is calculated based on this resolution.

For the smallest span of 5 mV (0 % ... 100 %), a resolution of 2500 measurement points is obtained, which corresponds to 0.04 %.

All conventional thermocouple curves and pallaplat are linearized.

8.19.3 Measuring Time and Cycle Time

The processing times depend on the preset measurement process.

- 200 ms for all 4 channels without line fault detection (int./ext. cold junction)
- 350 ms for all 4 channels with line fault detection (int./ext. cold junction)

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time. It takes $4 \times 6.25 \text{ ms} = 25 \text{ ms}$ until the values of all 4 channels are present in the com unit because the values are transferred one after the other. This time must be added to the conversion time.

A filter is available for smoothing the input signals.

8.19.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

A data word (=16 bit) is available for each channel for the data transfer. The least significant 4 bits are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

In the cyclic data exchange process, data is communicated in the same order as the channels (channel 1, channel 2, etc.).



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)		
		Standard (53)	2 x 4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0	Empty		
	1	Line fault detection channel 1 (0 = OK, 1 = error)		
	2 ... 3	Empty		
	4 ... 7	Measured value channel 1 (12 bit)		
Input byte 2 (high byte)	0 ... 7			
Input bytes 3 ... 8		Same structure as input bytes 1 and 2 for channel 1		
Output bytes		Without output bytes	2 x 4 empty output bytes	8 empty output bytes

8.19.5 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages. Line fault detection can be switched on and off via the Device Type Manager.

The broken wire delay function prevents measured values from being enabled after a line fault occurs to avoid constant toggling between OK/fault if there is a loose contact.

- With external cold junction: 0 ms ... 250 ms x 160 ms
- With internal cold junction: 0 ms ... 250 ms x 240 ms

8.19.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

Figure 8.69 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.

Field	Explanation
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
LFD delay	This field only appears when Line fault detection is enabled. Specify the number of measuring cycles during which a measured value must be free of errors before the value is signaled as good. This function can be used for suppressing loose contacts, for example.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. The Lower limit indicates the smallest transferable value (e.g., 0 points or underrange). The Start of range indicates the value equivalent to 0% (e.g., 10,000 points or start of measuring range). The End of range indicates the value equivalent to 100% (e.g., 50,000 points or end of measuring range). The Upper limit indicates the largest transferable value (e.g., 60,000 points or overrange).
Measurement method	The LB5*05, FB5205 I/O modules have a built-in cold junction. This measures the temperature at the terminals inside the I/O module. Select between an internal and external cold junction.
Ext. cold junction	This field is only visible if you have selected an external cold junction from the measuring methods in the drop-down list. Enter the thermostat temperature of an external cold junction.
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the correct linearization is automatically used. <ul style="list-style-type: none"> ■ mV: start of range (min.) at -70 mV, end of range (max.) at 70 mV ■ U: start of range (min.) at -200 °C, end of range (max.) at 600 °C ■ B: start of range (min.) at 0 °C, end of range (max.) at 1820 °C ■ E: start of range (min.) at -270 °C, end of range (max.) at 1000 °C ■ T: start of range (min.) at -270 °C, end of range (max.) at 400 °C ■ K: start of range (min.) at -200 °C, end of range (max.) at 1370 °C ■ S: start of range (min.) at 0 °C, end of range (max.) at 1760 °C ■ R: start of range (min.) at -200 °C, end of range (max.) at 900 °C ■ L: start of range (min.) at -50 °C, end of range (max.) at 1760 °C ■ J: start of range (min.) at -210 °C, end of range (max.) at 1200 °C ■ N: start of range (min.) at -210 °C, end of range (max.) at 1200 °C ■ Pallaplat: start of range (min.) at -100 °C, end of range (max.) at 1300 °C
Temperature unit	This option is not visible if you have selected mV in the Sensor drop-down list. Select the temperature unit for the start of range, end of range, and measured value.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

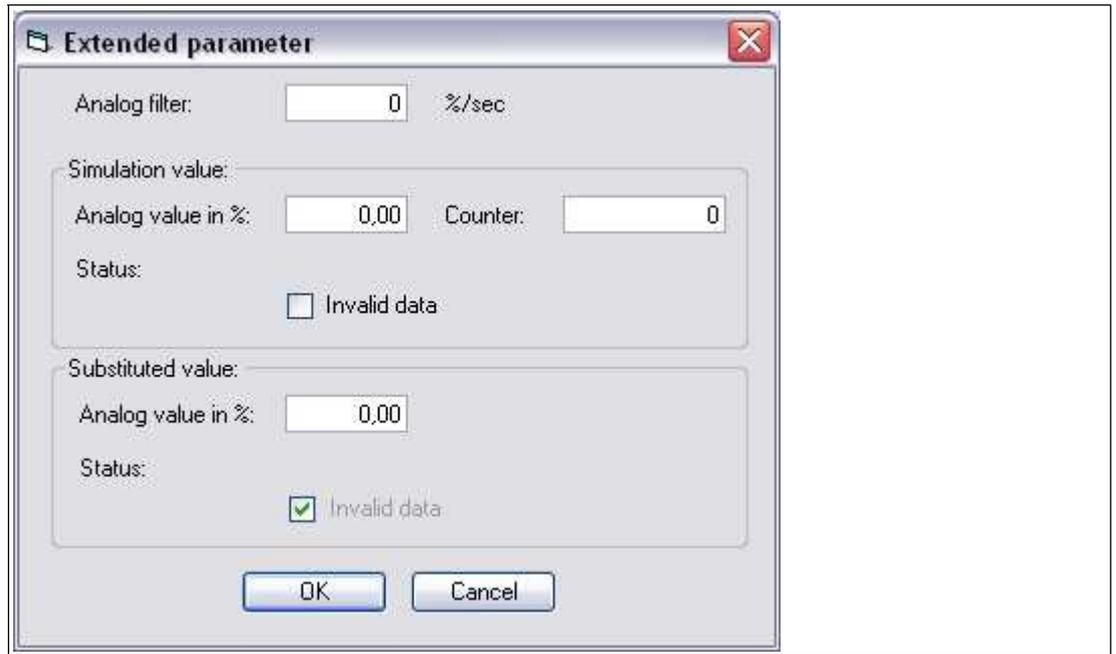


Figure 8.70 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.20 LB5*06, FB5206 Voltage Converter

8.20.1 Description

Versions

- LB5006, voltage converter, not intrinsically safe
- LB5106, voltage converter, intrinsically safe
- FB5206, voltage converter, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Input 0 V... 10 V

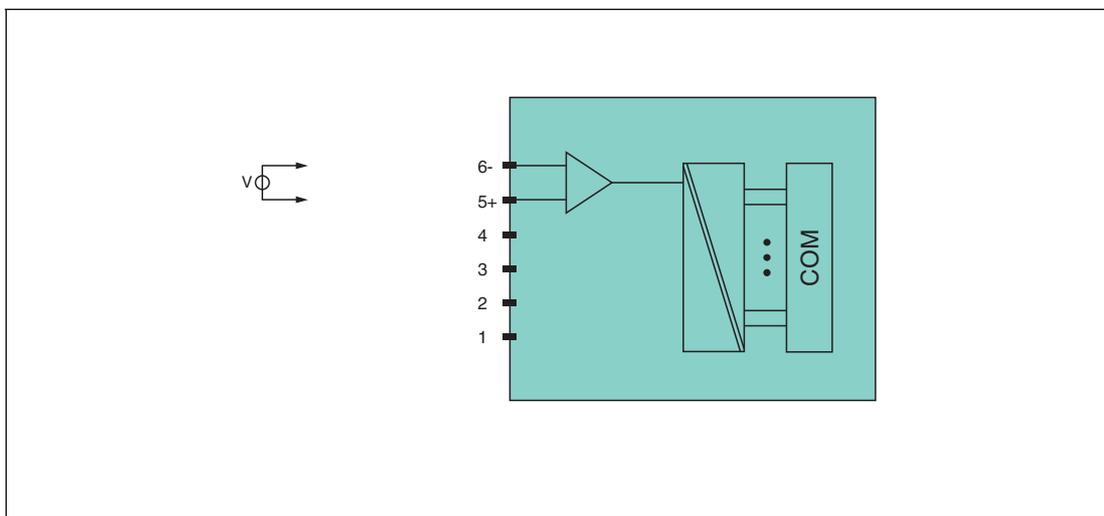


Figure 8.71 Block diagram LB5*06, FB5206

Refer to the corresponding data sheet and operating instructions for further information.

8.20.2 Resolution

Voltages within a range of 0 V... 10 V are detected with a resolution of 16 bits. The actual measuring range is calculated based on this resolution.

For the smallest span of 100 mV (0 ... 100 %) a resolution of 2500 measurement points is obtained, which corresponds to a degree of accuracy of 0.04%.

8.20.3 Measuring Time and Cycle Time

The internal module processing time is 100 ms.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time. A filter is available for smoothing the input signals.

8.20.4 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

The process data for each channel is transferred in unsigned integers within a range from 0 ... 65535.

One data word (16 bit) word per channel is available for data transfer. The most significant 12 bits are used.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (50)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1 (low byte)	0 ... 3	Empty			
	4 ... 7	Measured value (12 bit)			
Input byte 2 (high byte)	0 ... 7				
Input bytes 3 ... 4		Not available	Not available	Empty	Empty
Input bytes 5 ... 8		Not available	Not available	Not available	Empty
Output bytes		Without output bytes	2 empty output bytes	4 empty output bytes	8 empty output bytes

8.20.5 Line Fault Detection

The I/O module does not provide any line fault detection function.

8.20.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

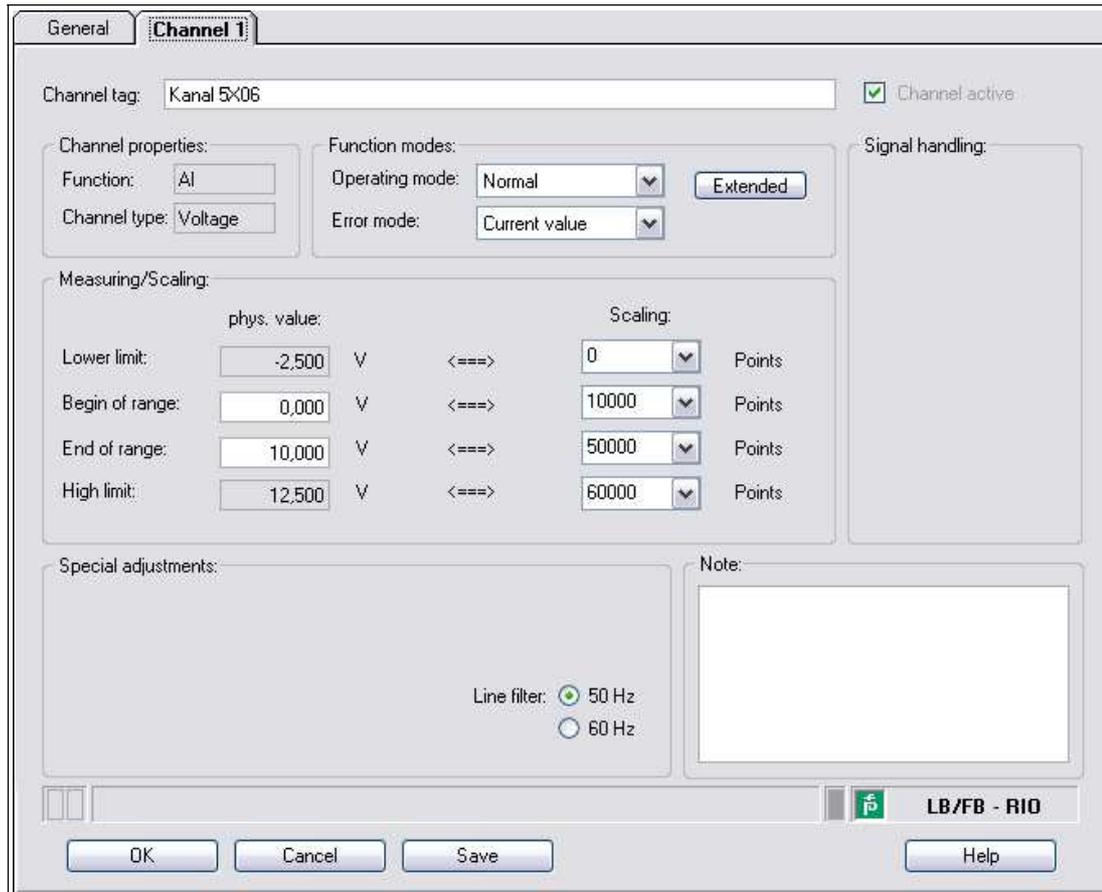


Figure 8.72 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value : The signal is transferred unchanged from the field in spite of the error. Substitute value : A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value : The last value that was valid before the fault occurred is transferred.

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Field	Explanation
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. The Lower limit indicates the smallest transferable value (e.g., 0 points or underrange). The Start of range indicates the value equivalent to 0% (e.g., 10,000 points or start of measuring range). The End of range indicates the value equivalent to 100% (e.g., 50,000 points or end of measuring range). The Upper limit indicates the largest transferable value (e.g., 60,000 points or overrange).
Line filter	Select a filter to compensate for system-related interference (50 Hz and 60 Hz).
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

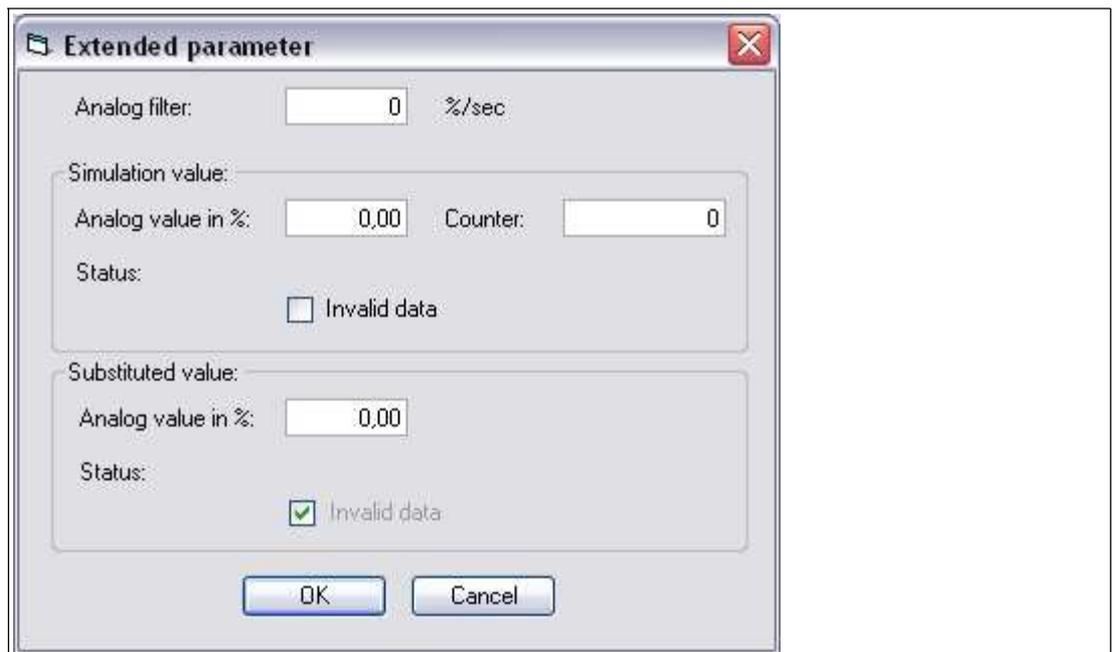


Figure 8.73 Extended Parameters window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

8.21 LB6101, FB6301 Relay Contact Output

8.21.1 Description

Versions

- LB6101, relay contact output, not intrinsically safe
- FB6301, relay contact output, wire ends for connection to separate increased safety terminal

Features

- Occupies 1 slot on the backplane
- Number of channels: 2
- LB6101
 - Switching voltage: 24 VDC/VAC (30 V max.)/230 VAC, 60 V (UL)
 - Switching current: 1 ADC/AAC resistive load
 - Switching power: 30 VA/30 W/230 VA, 60 W (UL)
- FB6301
 - Switching voltage: 24 VDC/230 VAC
 - Switching current: 1 ADC/AAC resistive load
 - Switching power: 30 W, 230 VA resistive load

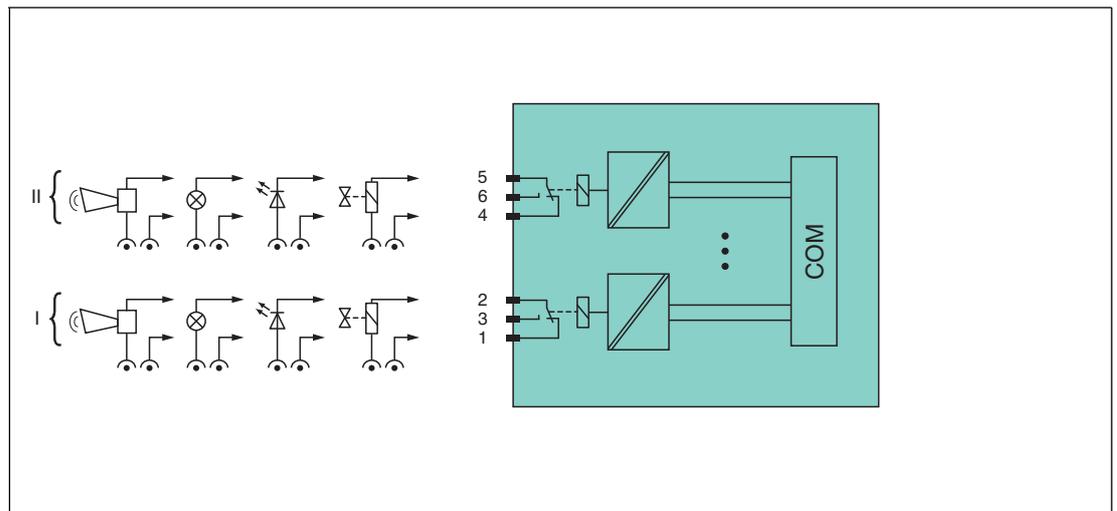


Figure 8.74 Block diagram LB6101, FB6301

LB6101: channel I: 1-2 NC, 3; channel II: 4-5 NC, 6

FB6301: wire ends 1 (white), 2 (brown), 3 (green), 4 (yellow), 5 (gray), 6 (pink), observe color marking or numbering

Refer to the corresponding data sheet and operating instructions for further information.

8.21.2 Measuring Time and Cycle Time

The response time of the relay output is 20 ms. However, this time depends on the cycle time of the data traffic on the bus.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.21.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (20)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input bytes		Without input bytes	2 empty input bytes	4 empty input bytes	8 empty input bytes
Output byte 1	0	Output channel 1			
	1	Output channel 2			
	2 ... 7	Empty			
Other output bytes		Not available	1 empty output byte	3 empty output bytes	7 empty output bytes

8.21.4 Line Fault Detection

The I/O module does not provide any line fault detection function.

8.21.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.21.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

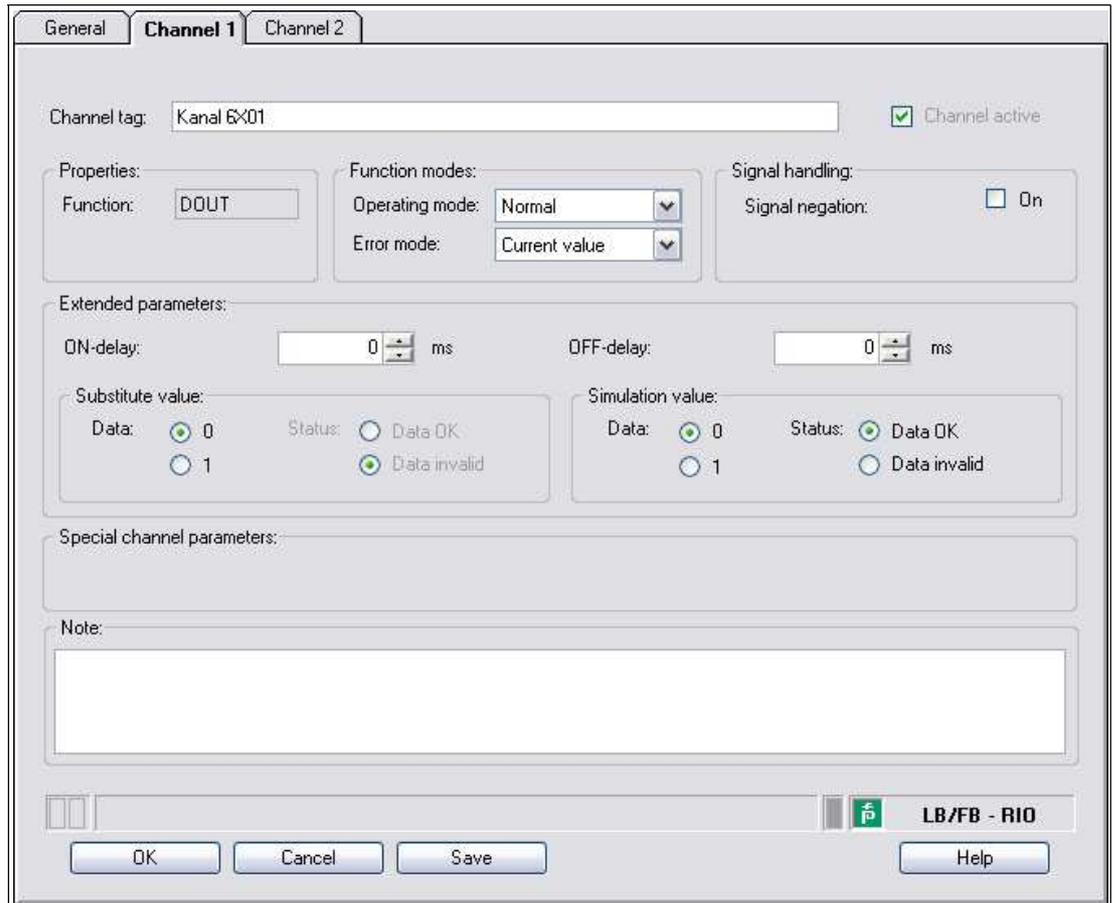
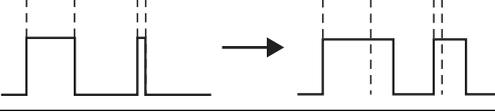


Figure 8.75 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value : The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value : A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value : The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.22 LB6005, FB6305 Relay Contact Output

8.22.1 Description

Versions

- LB6005, relay contact output, not intrinsically safe
- FB6305, relay contact output, wire ends for connection to separate increased safety terminal

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- LB6005
 - Switching voltage: DC: 30 V, AC: 230 V, 60 V (UL)
 - Switching current: 1 ADC/AAC resistive load
 - Switching power: 30 W, AC: 250 VA , 60 W (UL)
- FB6305
 - Switching voltage: DC: 30 V, AC: 230 V
 - Switching current: 1 ADC/AAC resistive load
 - Switching power: 30 W, AC: 250 VA

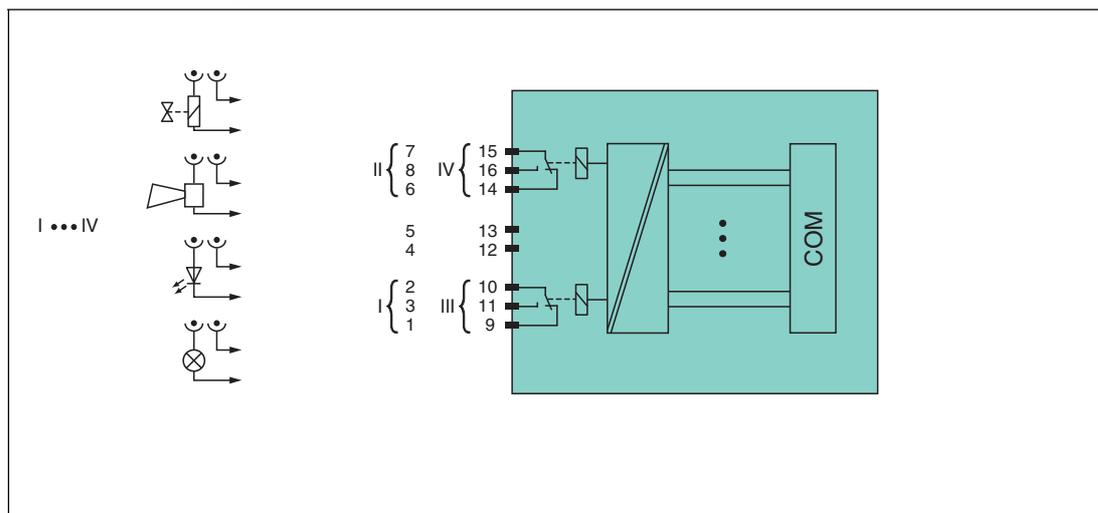


Figure 8.76 Block diagram LB6005, FB6305

LB6005: channel I: 1-2 NC, 3; channel II: 6-7 NC, 8; channel III: 9-10 NC, 11; channel IV: 14-15 NC, 16

FB6305: wire ends 1/9 (white), 2/10 (brown), 3/11 (green), 4/12 (yellow), 5/13 (gray), 6/14 (pink), 7/15 (blue), 8/16 (red), observe color marking or numbering

Refer to the corresponding data sheet and operating instructions for further information.

8.22.2 Measuring Time and Cycle Time

The response time of the relay output is 20 ms. However, this time depends on the cycle time of the data traffic on the bus.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.22.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Input and Output Data

The I/O module has input and output data.

The output data sets the control outputs and marks the data as valid or invalid. As soon as the **data invalid** error bit is set, the substitute values are used.

The input data allows the master to retrieve the current output status. This is particularly useful when ON delay and OFF delay are activated. The output reaches the required status only after the preset time has elapsed so the master can retrieve the current output status.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (30)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Output status channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output status channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4	Output status channel 3			
	5	Channel 3 = 0 enabled (1 = invalid)			
	6	Output status channel 4			
	7	Channel 4 = 0 enabled (1 = invalid)			

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		UniCOM PROFIBUS configuration (DP code)			
		Standard (30)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Other input bytes		Not available	1 empty input byte	3 empty input bytes	7 empty input bytes
Output byte 1	0	Output channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4	Output channel 3			
	5	Channel 3 = 0 enabled (1 = invalid)			
	6	Output channel 4			
	7	Channel 4 = 0 enabled (1 = invalid)			
Other output bytes		Not available	1 empty output byte	3 empty output bytes	7 empty output bytes

8.22.4 Line Fault Detection

The I/O module does not provide any line fault detection function.

8.22.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.22.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

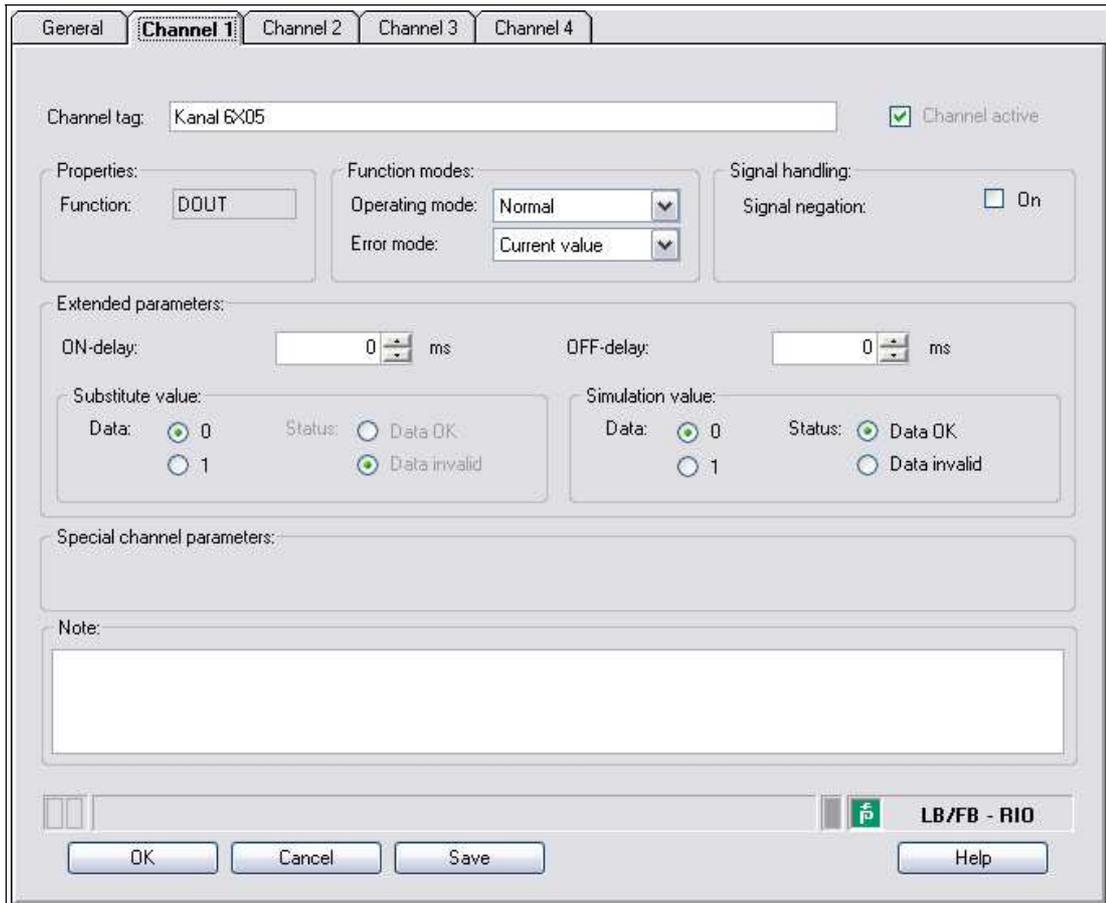


Figure 8.77 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.23 LB6006, FB6306 Relay Contact Output

8.23.1 Description

Versions

- LB6006, relay contact output, not intrinsically safe
- FB6306, relay contact output, increased safety terminals

Features

- Occupies 2 slots on the backplane
- Number of channels: 8
- Switching voltage: 24 VDC/VAC
- Switching current: 1 ADC/AAC resistive load
- Switching power: 30 VA/30 W

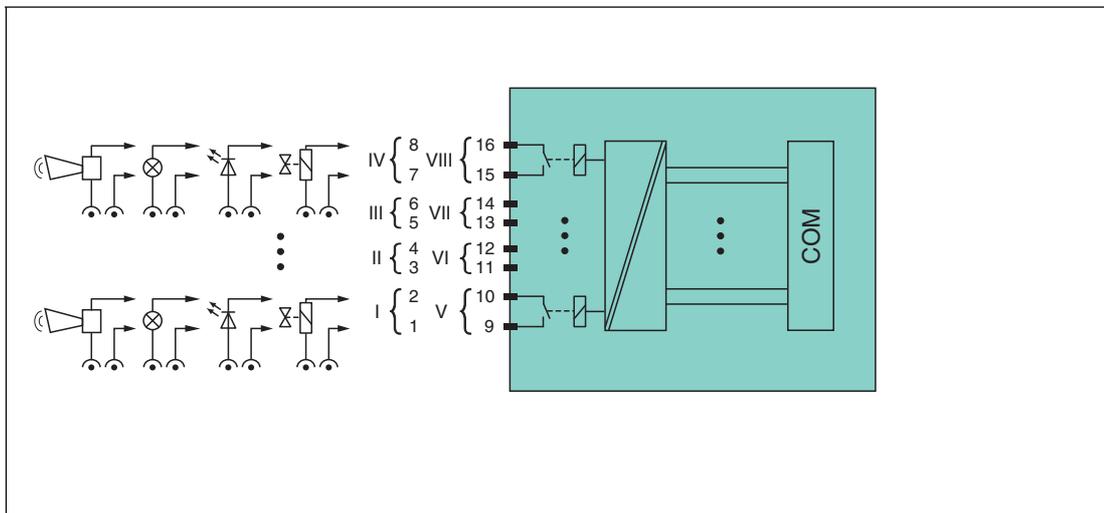


Figure 8.78 Block diagram LB6006, FB6306

Connection: channel I: 1-2 NO; channel II: 3-4 NO; channel III: 5-6 NO; channel IV: 7-8 NO; channel V: 9-10 NO; channel VI: 11-12 NO; channel VII: 13-14 NO; channel VIII: 15-16 NO

Refer to the corresponding data sheet and operating instructions for further information.

8.23.2 Measuring Time and Cycle Time

The response time of the relay output is 20 ms. However, this time depends on the cycle time of the data traffic on the bus.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.23.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Input and Output Data

The I/O module has input and output data.

The output data sets the control outputs and marks the data as valid or invalid. As soon as the **data invalid** error bit is set, the substitute values are used.

The input data allows the master to retrieve the current output status. This is particularly useful when ON delay and OFF delay are activated. The output reaches the required status only after the preset time has elapsed so the master can retrieve the current output status.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (31)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Output status channel 5			
	1	Channel 5 = 0 enabled (1 = invalid)			
	2	Output status channel 6			
	3	Channel 6 = 0 enabled (1 = invalid)			
	4	Output status channel 7			
	5	Channel 7 = 0 enabled (1 = invalid)			
	6	Output status channel 8			
	7	Channel 8 = 0 enabled (1 = invalid)			

		UniCOM PROFIBUS configuration (DP code)			
		Standard (31)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 2	0	Output status channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output status channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4	Output status channel 3			
	5	Channel 3 = 0 enabled (1 = invalid)			
	6	Output status channel 4			
	7	Channel 4 = 0 enabled (1 = invalid)			
Other input bytes		Not available	Not available	2 empty input bytes	6 empty input bytes
Output byte 1	0	Output channel 5			
	1	Channel 5 = 0 enabled (1 = invalid)			
	2	Output channel 6			
	3	Channel 6 = 0 enabled (1 = invalid)			
	4	Output channel 7			
	5	Channel 7 = 0 enabled (1 = invalid)			
	6	Output channel 8			
	7	Channel 8 = 0 enabled (1 = invalid)			
Output byte 2	0	Output channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4	Output channel 3			
	5	Channel 3 = 0 enabled (1 = invalid)			
	6	Output channel 4			
	7	Channel 4 = 0 enabled (1 = invalid)			
Other output bytes		Not available	Not available	2 empty output bytes	6 empty output bytes

8.23.4 Line Fault Detection

The I/O module does not provide any line fault detection function.

8.23.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.23.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

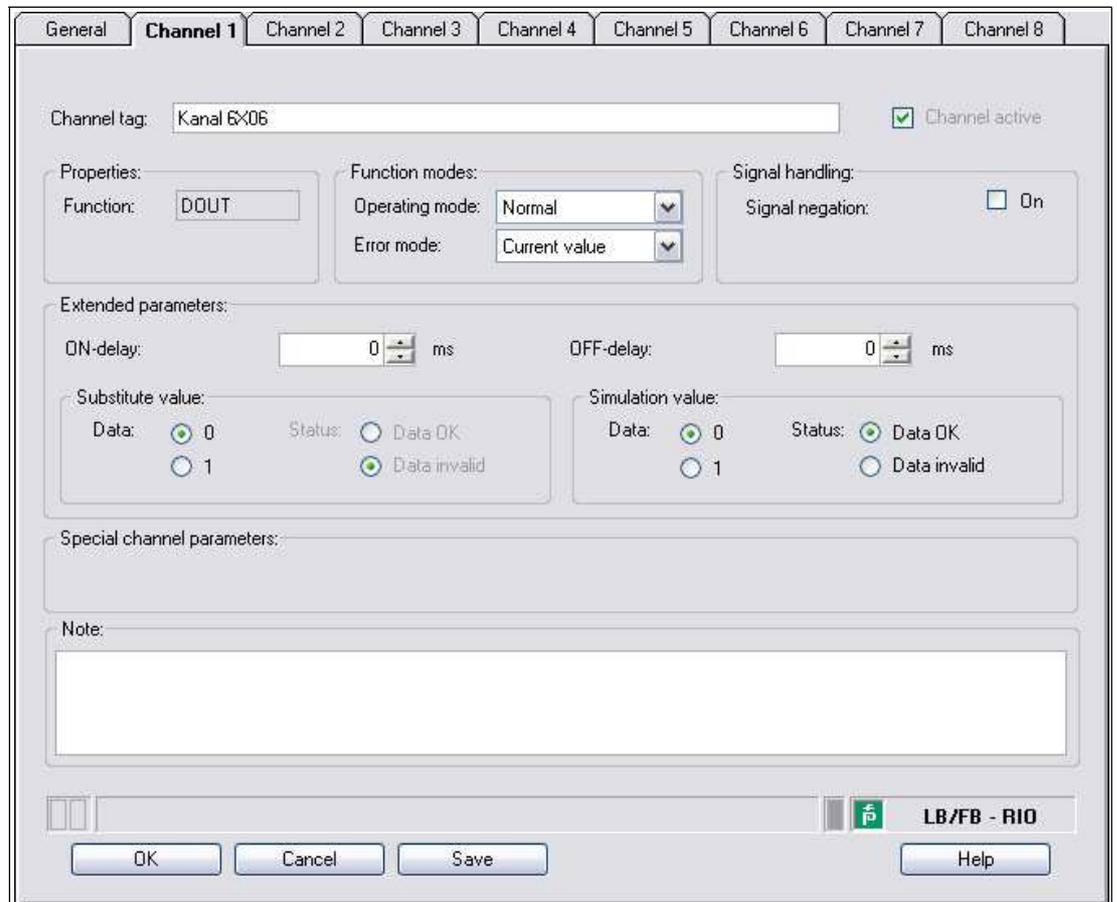
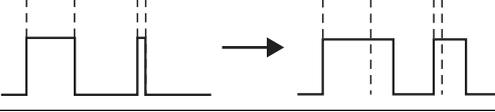


Figure 8.79 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value : The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value : A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value : The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.24 LB6*08, FB6*08 Digital Output

8.24.1 Description

Versions

- LB6008, digital output, not intrinsically safe
Versions available with bus-independent shutdown input
- FB6308, digital output with shutdown input, increased safety terminals
- LB6108, digital output with shutdown input, intrinsically safe
- FB6208, digital output with shutdown input, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 8
- Switching capacity: 20 VDC/8 mA

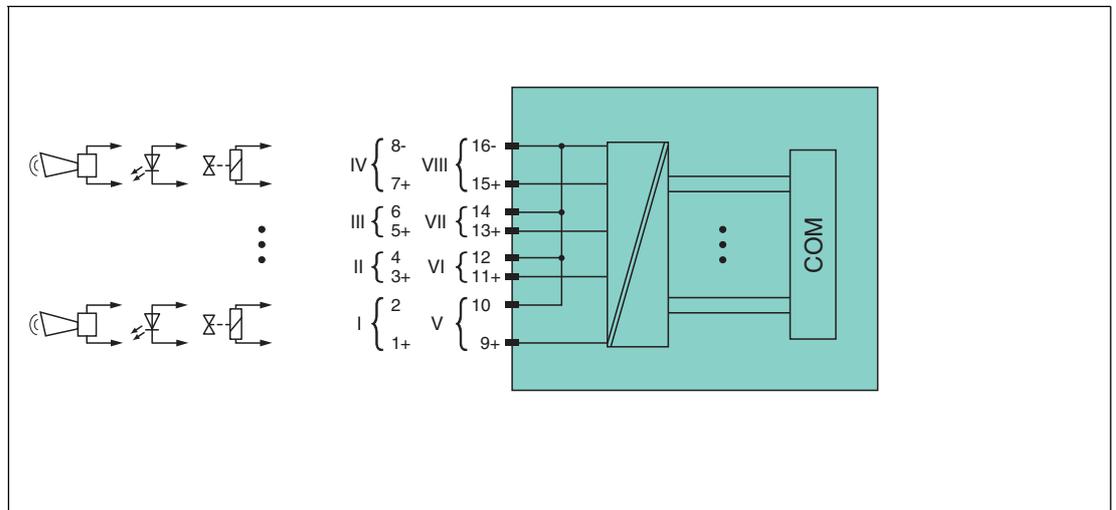


Figure 8.80 Block diagram LB6*08 without shutdown input

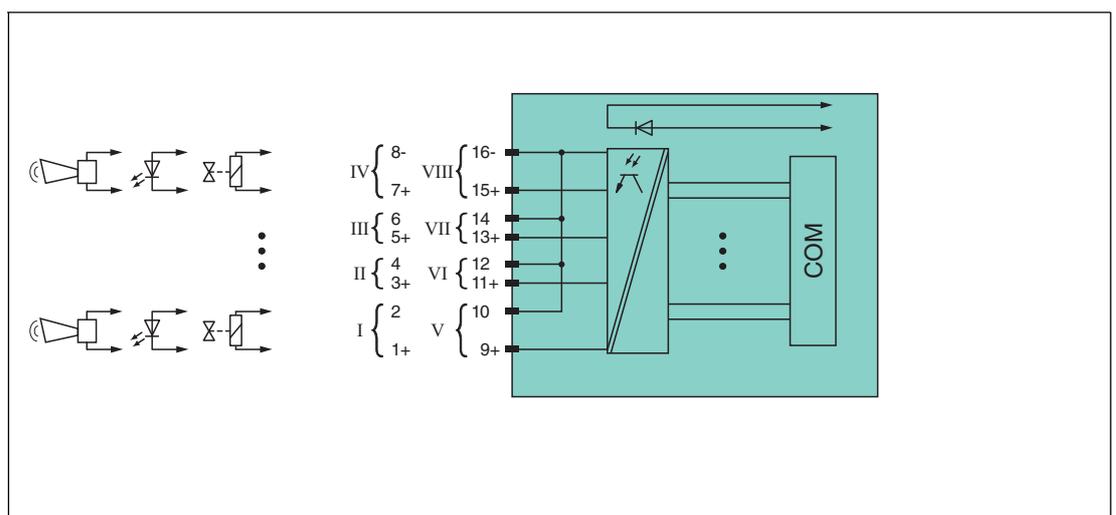


Figure 8.81 Block diagram LB6*08, FB6*08 with shutdown input

Refer to the corresponding data sheet and operating instructions for further information.

8.24.2 Measuring Time and Cycle Time

The response time of the digital output is 10 ms. However, this time depends on the cycle time of the data traffic on the bus.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.24.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Input and Output Data

The I/O module has input and output data.

The output data sets the control outputs and marks the data as valid or invalid. As soon as the **data invalid** error bit is set, the substitute values are used.

The input data allows the master to retrieve the current output status. This is particularly useful when ON delay and OFF delay are activated. The output reaches the required status only after the preset time has elapsed so the master can retrieve the current output status.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (31)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Output status channel 5			
	1	Line fault detection channel 5 (0 = OK, 1 = error)			
	2	Output status channel 6			
	3	Line fault detection channel 6 (0 = OK, 1 = error)			
	4	Output status channel 7			
	5	Line fault detection channel 7 (0 = OK, 1 = error)			
	6	Output status channel 8			
	7	Line fault detection channel 8 (0 = OK, 1 = error)			
Input byte 2	0	Output status channel 1			
	1	Line fault detection channel (0 = OK, 1 = error)			
	2	Output status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4	Output status channel 3			
	5	Line fault detection channel 3 (0 = OK, 1 = error)			
	6	Output status channel 4			
	7	Line fault detection channel 4 (0 = OK, 1 = error)			
Other input bytes		Not available	Not available	2 empty input bytes	6 empty input bytes
Output byte 1	0	Output channel 5			
	1	Channel 5 = 0 enabled (1 = invalid)			
	2	Output channel 6			
	3	Channel 6 = 0 enabled (1 = invalid)			
	4	Output channel 7			
	5	Channel 7 = 0 enabled (1 = invalid)			
	6	Output channel 8			
	7	Channel 8 = 0 enabled (1 = invalid)			
Output byte 2	0	Output channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4	Output channel 3			
	5	Channel 3 = 0 enabled (1 = invalid)			
	6	Output channel 4			
	7	Channel 4 = 0 enabled (1 = invalid)			
Other output bytes		Not available	Not available	2 empty output bytes	6 empty output bytes

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8.24.4 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages and short circuits. Line fault detection can be switched on and off in the device type manager.

The line fault detection function is based on the measurement of a trickle current so low that it does not activate a connected valve.

8.24.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.24.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

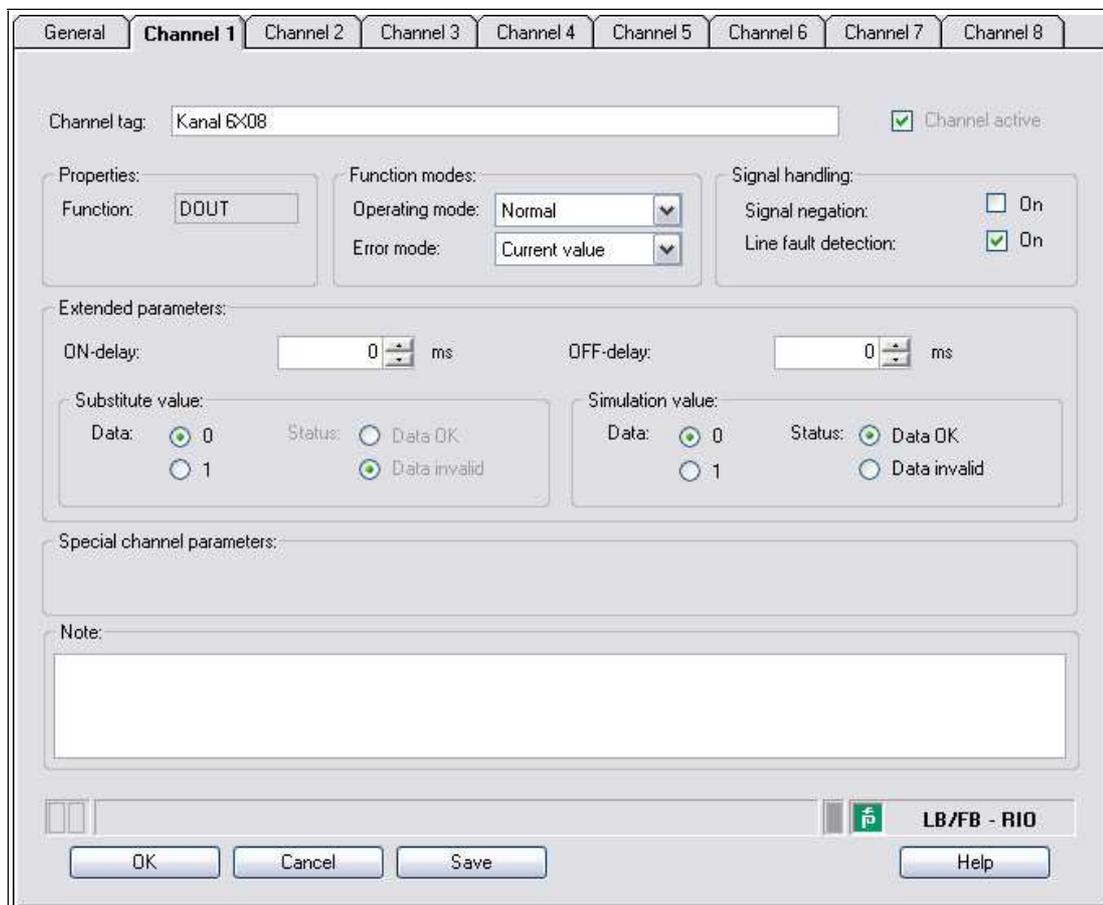
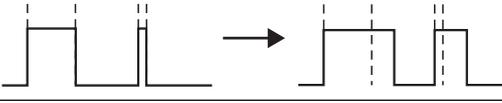


Figure 8.82 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value : The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value : A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value : The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.25 LB6*10 ... LB6115, FB6210 ... FB6215 Digital Output

8.25.1 Description

Versions

- LB6010, digital output, not intrinsically safe
Versions available with bus-independent shutdown input
- LB6110 ... LB6115, digital output, intrinsically safe
Versions available with bus-independent shutdown input
- FB6210 ... FB6215, digital output, intrinsically safe
Versions available with bus-independent shutdown input

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- The electrical data of the versions is different.

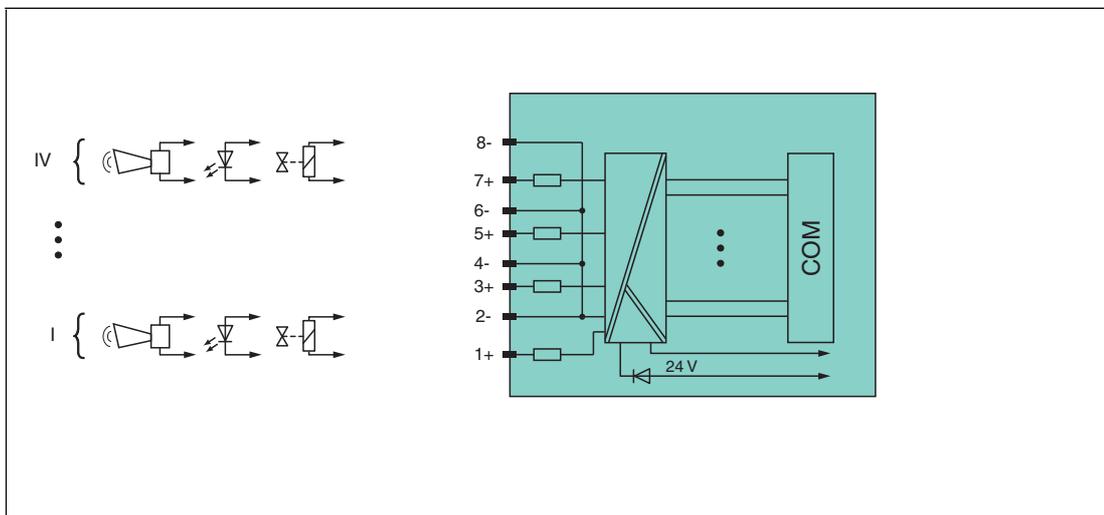
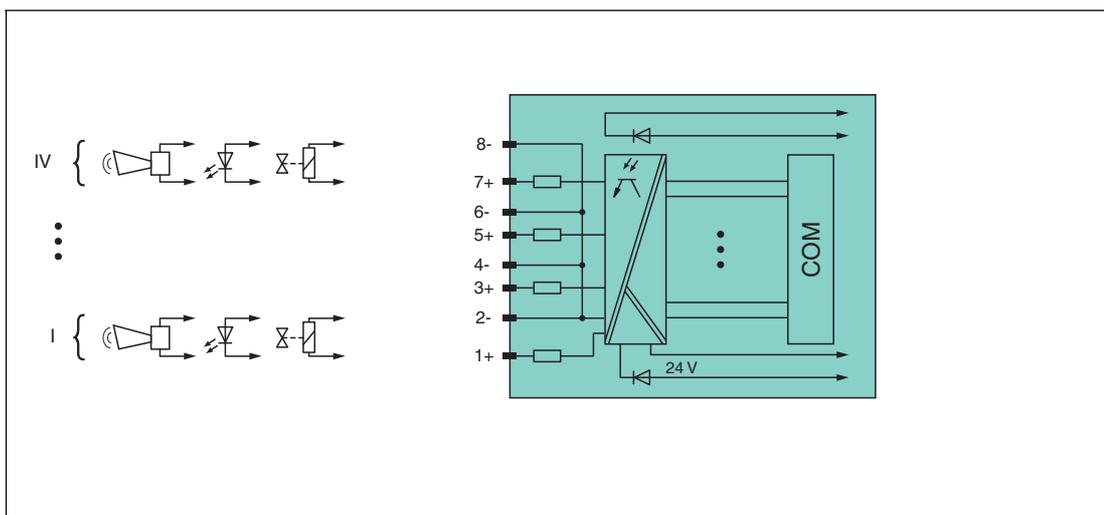


Figure 8.83 Block diagram LB6*1*, FB621* without shutdown input



Block diagram LB6*1*, FB621* with shutdown input

Refer to the corresponding data sheet and operating instructions for further information.

8.25.2 Measuring Time and Cycle Time

The response time of the digital output is 10 ms. However, this time depends on the cycle time of the data traffic on the bus.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.25.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Input and Output Data

The I/O module has input and output data.

The output data sets the control outputs and marks the data as valid or invalid. As soon as the **data invalid** error bit is set, the substitute values are used.

The input data allows the master to retrieve the current output status. This is particularly useful when ON delay and OFF delay are activated. The output reaches the required status only after the preset time has elapsed so the master can retrieve the current output status.



Note!

Dual Width I/O Module

Dual width modules that occupy two slots are configured in the same way as single width modules, followed by an empty slot. Be aware that the last slot may not be an empty slot. If the last I/O module is a dual width module, configure this in the same way as a single width module and omit the following empty slot. See chapter 6.12

If you are using universal modules for configuration, configure **both slots** using the appropriate universal module. In the case of a dual width I/O module that requires 8 input bytes, you may populate both slots with a 4I4O universal module.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (30)	2I2O (31)	4I4O (33)	8I8O (37)
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1	0	Output status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Output status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4	Output status channel 3			
	5	Line fault detection channel 3 (0 = OK, 1 = error)			
	6	Output status channel 4			
	7	Line fault detection channel 4 (0 = OK, 1 = error)			
Other input bytes		Not available	1 empty input byte	3 empty input bytes	7 empty input bytes
Output byte 1	0	Output channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4	Output channel 3			
	5	Channel 3 = 0 enabled (1 = invalid)			
	6	Output channel 4			
	7	Channel 4 = 0 enabled (1 = invalid)			
Other output bytes		Not available	1 empty output byte	3 empty output bytes	7 empty output bytes

8.25.4 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages and short circuits. Line fault detection can be switched on and off in the device type manager.

The line fault detection function is based on the measurement of a trickle current so low that it does not activate a connected valve.

8.25.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.25.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

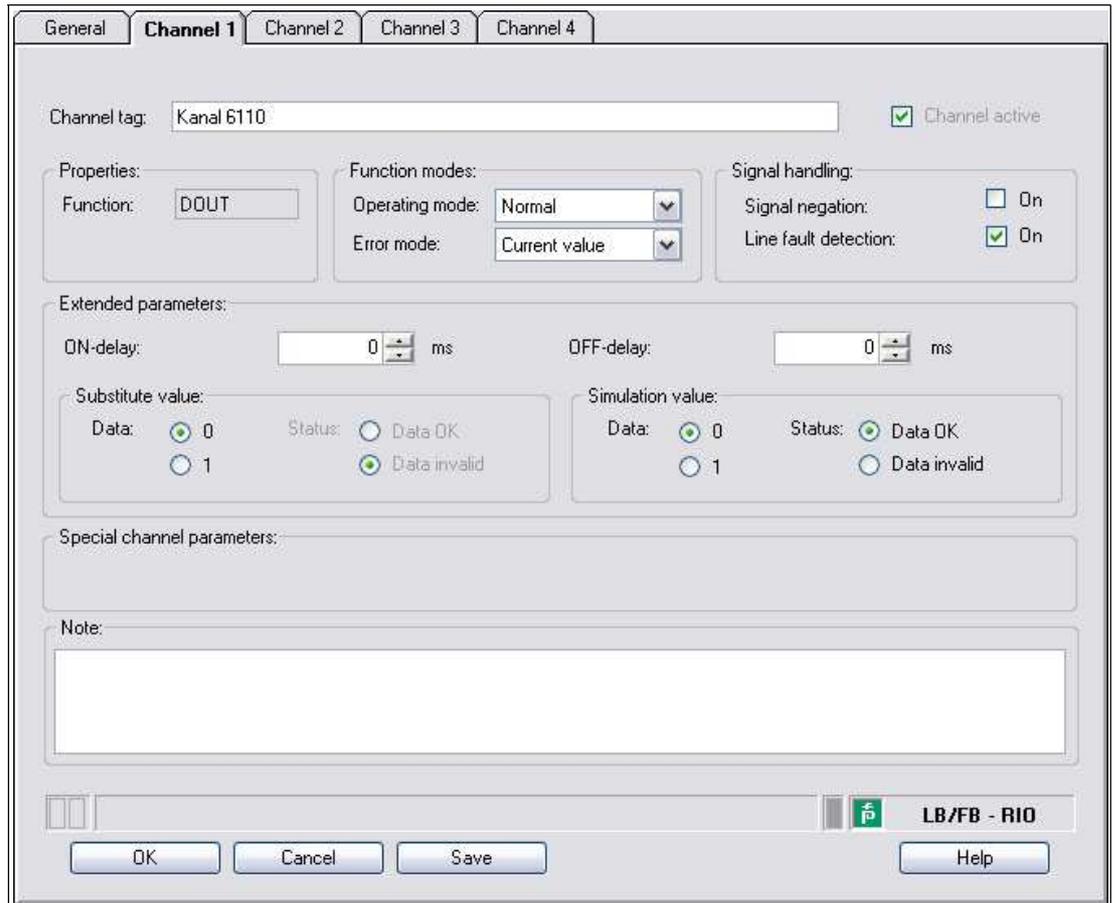
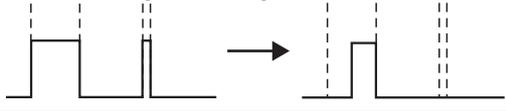


Figure 8.84 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.26 LB6*16, FB6216, LB6*17, FB6217 Digital Output

8.26.1 Description

Versions

- LB6016, LB6017, digital output, non-intrinsically safe, with bus-independent shutdown input
- LB6116, LB6117, digital output, intrinsically safe, with bus-independent shutdown input
- FB6216, FB6217, digital output, intrinsically safe, with bus-independent shutdown input

Features

- Occupies 1 slot on the backplane
- Number of channels: 2 (parallel operation possible)
- The electrical data of the versions is different.

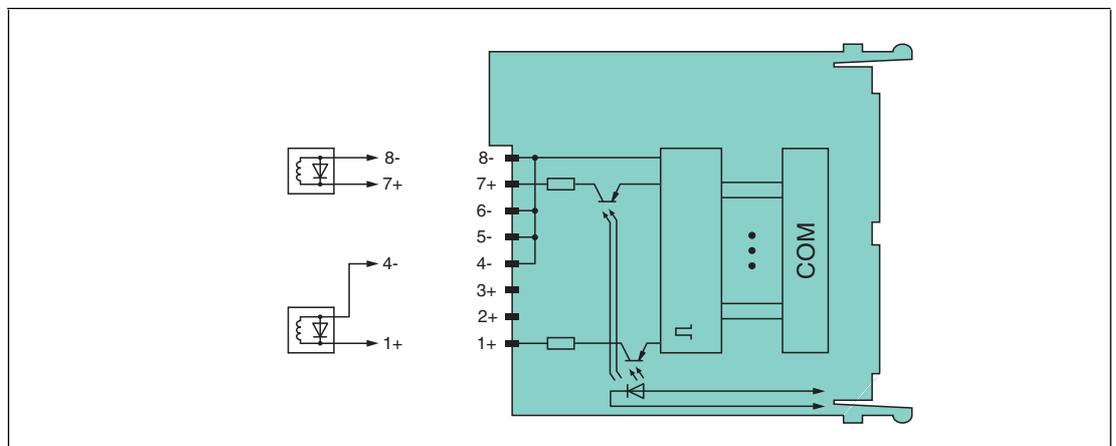


Figure 8.85 Block diagram: LB6*16, FB6216, LB6*17, FB6217 with shutdown input

Refer to the corresponding data sheet and operating instructions for further information.

8.26.2 Measuring Time and Cycle Time

The response time of the digital output is 10 ms. However, this time depends on the cycle time of the data traffic on the bus.

The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.26.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 4.

Input and Output Data

The I/O module has input and output data.

The output data sets the control outputs and marks the data as valid or invalid. As soon as the **data invalid** error bit is set, the substitute values are used.

The input data allows the master to retrieve the current output status. This is particularly useful when ON delay and OFF delay are activated. The output reaches the required status only after the preset time has elapsed so the master can retrieve the current output status.

Bit Structure within the Data Telegram

		UniCOM PROFIBUS configuration (DP code)			
		Standard (30)	2I2O (31)	4I4O (33)	8I8O (37)
Octet	Bit	Meaning	Meaning	Meaning	Meaning
Input octet 1	0	Output status channel 1			
	1	Line fault detection channel 1 (0 = OK, 1 = error)			
	2	Output status channel 2			
	3	Line fault detection channel 2 (0 = OK, 1 = error)			
	4 ... 7	Empty			
Other input octets		Not available	1 empty input octet	3 empty input octets	7 empty input octets
Output octet 1	0	Output channel 1			
	1	Channel 1 = 0 enabled (1 = invalid)			
	2	Output channel 2			
	3	Channel 2 = 0 enabled (1 = invalid)			
	4 ... 7	Empty			
Other output octets		Not available	1 empty output octet	3 empty output octets	7 empty output octets

8.26.4 Line Fault Detection

The I/O module has a line fault detection function that can detect lead breakages and short circuits. Line fault detection can be switched on and off in the device type manager.

The line fault detection function is based on the measurement of a trickle current so low that it does not activate a connected valve.

8.26.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.26.6 Editing Device Data

Open the **Edit device data** window. The **Edit device data** window for the I/O module is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module, see chapter 7.3

In addition there are two tabs for **Channel 1** and **Channel 2**. The channel-specific parameters are configured using these tabs.



Note!

If the **Channel 1 + 2 parallel** option is activated, the settings on the **Channel 1** tab apply to both channels and the **Channel 2** tab is automatically disabled.

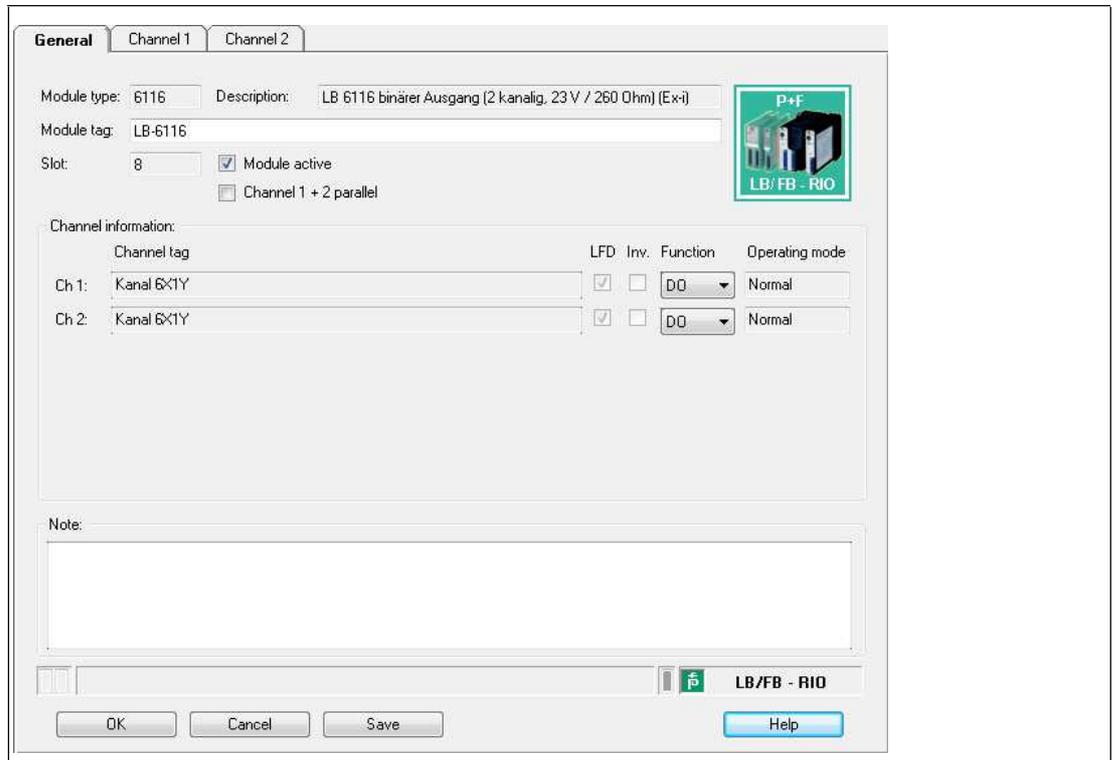


Figure 8.86 General tab

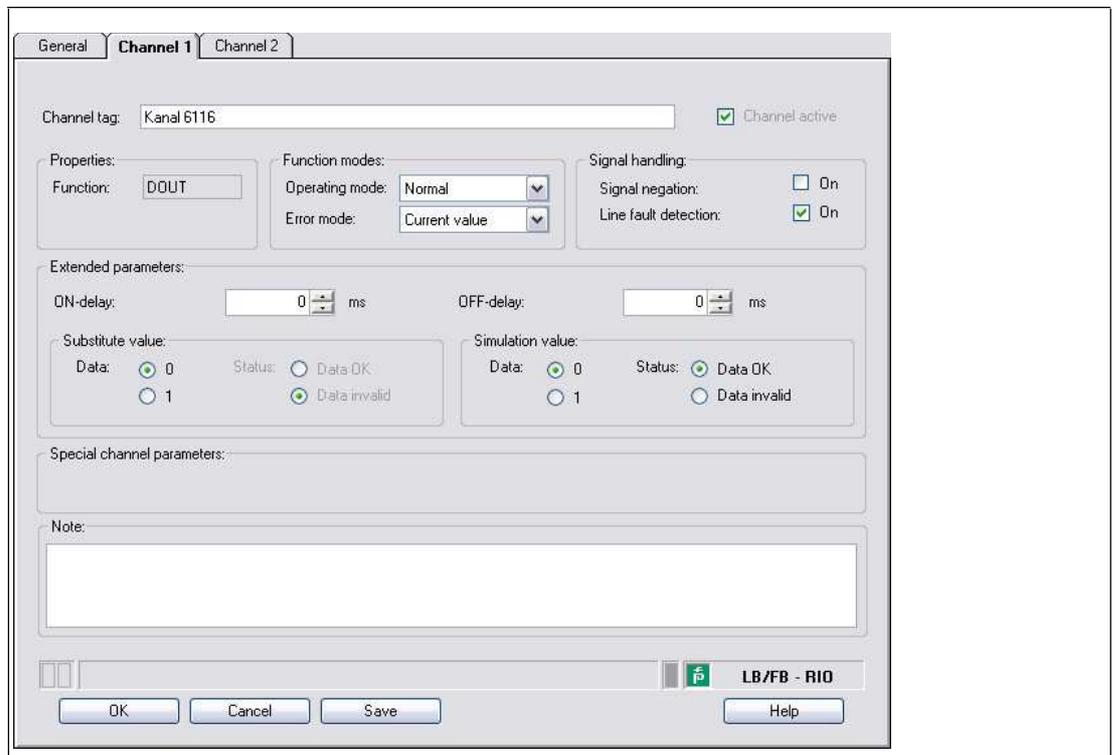
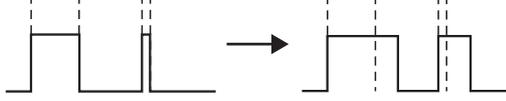


Figure 8.87 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Function	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.
Error mode	Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid , the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2 Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Line fault detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Special channel parameters	-
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

8.27 LB7*04, FB7*04 Universal Input/Output (HART)

8.27.1 Description

Versions

- LB7004, Universal Input/Output (HART), not intrinsically safe
- FB7304, Universal Input/Output (HART), increased safety terminals
- LB7104, Universal Input/Output (HART), intrinsically safe
- FB7204, Universal Input/Output (HART), intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 4
- Channels can be set as analog input (HART), analog output (HART), digital input or digital output.
 - Suitable sensors for analog inputs: pressure, differential pressure, filling level, flow rate and temperature converters, etc.
 - Suitable sensors for analog outputs: proportional valves, I/P converters, local indicators
 - Suitable field devices for digital inputs: mech. contacts and optocouplers
 - Suitable field devices for digital outputs: solenoid valves, acoustic sensors, and LEDs (line fault detection can be disabled)

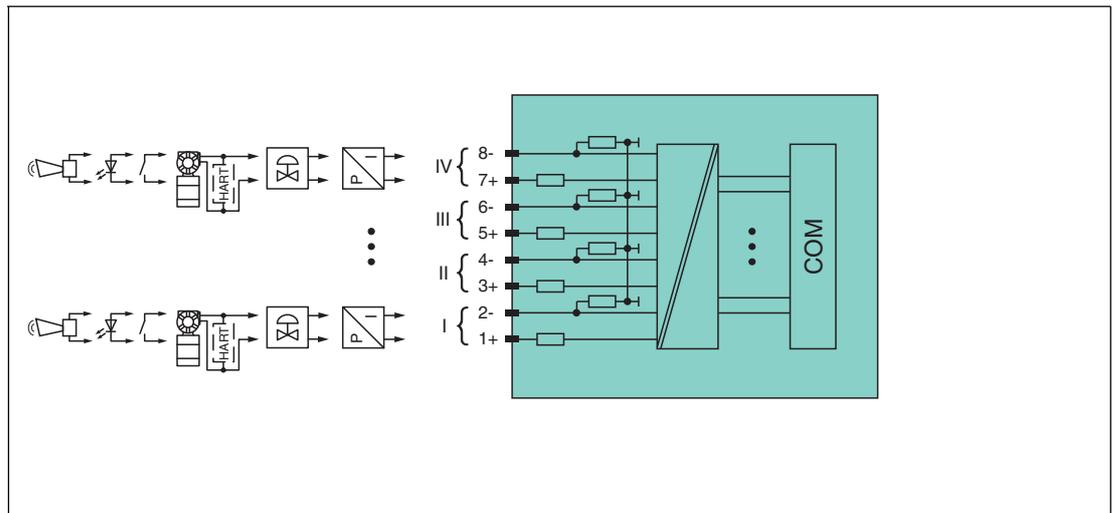


Figure 8.88 Block diagram LB7*04, FB7*04

The connection layout and other technical data can be found on the relevant data sheet.

8.27.2 Measuring Time and Cycle Time

The update rate for all 4 channels together is approx. 100 ms. The accuracy of the measured value depends on the cycle time of the data traffic on the bus. The signals are transmitted to the com unit every 6.5 ms irrespective of the measuring time.

8.27.3 Data Transfer

Data is transferred as specified in the PROFIBUS specification.

It is essential for successful PROFIBUS communication that the configuration, in particular the DP configuration string, in the master and the remote I/O station are identical. The configuration parameters are stored in the GSD/GSE file.

For process control systems that support the FDT concept, the remote I/O station can be configured directly using the Device Type Manager (DTM). The DTM ensures that the master receives all the key information for the configuration in question and is automatically adapted.

For process control systems that do not support the FDT concept, the configuration must be replicated in the master. If the GSD/GSE file can be incorporated into the master, the DP configuration code for the relevant I/O module is copied automatically. If the GSD/GSE file can not be incorporated, the configuration parameters must be entered in accordance with the table in this chapter.

Depending on the Unicom configuration, a different data structure results for this I/O module. See chapter 6.13

In the case of word-by-word data transfer (1 data word = 16 bits), the high byte of the data word is first transferred, otherwise the numerical byte sequence is 1 ... 8.

A data container with 16-bit input data and 16-bit output data is available for the data transfer for each channel. The four data containers can be filled with analog or digital process values in accordance with the selected channel type (AI, AO, DI, DO).

Analog process values are transferred via unsigned integers within the range 0 ... 65535. The 4 bits of the lowest order are of little importance for the accuracy of the measured value and are therefore used for transferring status information. Status information is omitted if the scaling is outside the range of 10000 ... 50000.

		UniCOM PROFIBUS configuration standard (73)			
		Channel type AI	Channel type AO	Channel type DI	Channel type DO
Word	Bit	Meaning	Meaning	Meaning	Meaning
Input word 1 Channel 1	0	Live zero if current ≤ 3.6 mA (*)	Empty	Measured value channel 1	Mirror process value channel 1
	1	Status (0 = OK, 1 = error)	Status (0 = OK, 1 = error)	Status (0 = OK, 1 = error)	Status (0 = OK, 1 = error)
	2 ... 3	Empty	Empty	Empty	Empty
	4 ... 15	Measured value channel 1 (12 bit)	Feedback measured value channel 1	Empty	Empty
Input words 2, 3, 4 Channels 2, 3, 4		Same structure as input word 1 for channel 1			
Output word 1 Channel 1	0	Empty	Empty	Empty	Process value channel 1
	1	Empty	Invalid identifier channel 1 (0 = OK, 1 = error)	Empty	Invalid identifier channel 1 (0 = OK, 1 = error)
	2 ... 3	Empty	Empty	Empty	Empty
	4 ... 15	Empty	Process value channel 1 (12 bit)	Empty	Empty

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		UniCOM PROFIBUS configuration standard (73)			
		Channel type AI	Channel type AO	Channel type DI	Channel type DO
Word	Bit	Meaning	Meaning	Meaning	Meaning
Output words 2, 3, 4 Channels 2, 3, 4		Same structure as output word 1 for channel 1			
(*) The live zero monitoring transmits an error bit (= 1) if the current falls below the minimum limit of 3.6 mA.					

		UniCOM PROFIBUS configuration 8180 (37)			
		Channel type AI	Channel type AO	Channel type DI	Channel type DO
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Input byte 1 (Low byte) Channel 1	0	Live zero if current ≤ 3.6 mA (*)	Empty	Measured value channel 1	Mirror process value channel 1
	1	Status (0 = OK, 1 = error)	Status (0 = OK, 1 = error)	Status (0 = OK, 1 = error)	Status (0 = OK, 1 = error)
	2 ... 3	Empty	Empty	Empty	Empty
	4 ... 7	Measured value channel 1 (12 bit)	Feedback measured value channel 1	Empty	Empty
Input byte 2 (High byte) Channel 1	0 ... 7			Empty	Empty
Input bytes 3, 5, 7 (Low byte) channels 2, 3, 4		Same structure as input byte 1 for channel 1			
Input bytes 4, 6, 8 (High byte) Channels 2, 3, 4		Same structure as input byte 2 for channel 1			
Output byte 1 (Low byte) Channel 1	0	Empty	Empty	Empty	Process value channel 1
	1	Empty	Invalid identifier channel 1 (0 = OK, 1 = error)	Empty	Invalid identifier channel 1 (0 = OK, 1 = error)
	2 ... 3	Empty	Empty	Empty	Empty
	4 ... 7	Empty	Process value channel 1 (12 bit)	Empty	Empty
Output byte 2 (High byte) Channel 1	0 ... 7	Empty		Empty	Empty

		UniCOM PROFIBUS configuration 8180 (37)			
		Channel type AI	Channel type AO	Channel type DI	Channel type DO
Byte	Bit	Meaning	Meaning	Meaning	Meaning
Output bytes 3, 5, 7 (Low byte) Channels 2, 3, 4		Same structure as output byte 1 for channel 1			
Output byte 4, 6, 8 (High byte) Channels 2, 3, 4		Same structure as output byte 2 for channel 1			
(*) The live zero monitoring transmits an error bit (= 1) if the current falls below the minimum limit of 3.6 mA.					

8.27.4 Line Fault Detection

Analog Input

For analog inputs the line fault detection can detect line breakages or short circuits. Line fault detection can be switched on and off in the Device Type Manager.

You can preset the switching points at which a lead breakage or a short circuit is signaled, e.g., line breakage < 1 mA and short circuit > 21 mA.

The current circuit has Live Zero monitoring. If the current falls below the minimum of 3.6 mA, an error bit is set (= 1).

Analog output

For analog inputs the line fault detection can detect line breakages. Line fault detection can be switched on and off in the Device Type Manager.

Line fault detection works on the basis of measuring a minimum current of 1 mA. This current still flows even when the control system specifies 0 mA. The line fault detection function is therefore unsuitable for 0 mA ... 20 mA outputs. When currents < 0.1 mA are detected, a lead breakage is signaled.

Digital Input

For NAMUR proximity switches, the line fault detection can detect line breakages or short circuits. Line fault detection can be switched on and off in the Device Type Manager.

If you are using mechanical contacts, deactivate line fault detection or connect the mechanical contact at the installation location using an additional resistor circuit. Using the resistor circuit, the electronic circuit can distinguish between a closed switch and a short circuit. The resistor circuit is available as an accessory.



Figure 8.89 Resistor network for line fault detection

Digital Output

For digital outputs, the line fault detection can detect line breakages or short circuits. Line fault detection can be switched on and off in the Device Type Manager.

The line fault detection is based on the measurement of a trickle current so low that it does not activate a connected valve.

8.27.5 Watchdog

The I/O module has a watchdog function. If the communication between the I/O module and com unit stops, the I/O module enters the safe state after 0.5 s.

8.27.6 Editing Device Data

Open the **Edit Device Data** window. The **Edit Device Data** window for the I/O modules is divided into several tabs. The **General** tab contains parameters that affect the whole I/O module. See chapter 7.3

There are also one or more **Channel X** tabs where X stands for the channel number, e.g., **Channel 1**, **Channel 2**, **Channel 3**. Set channel-specific parameters on these tabs.

The tab adjustment options depend on the channel type selected. The channel type can be configured in the **General** tab. Depending on the channel type selected, the relevant standard input form for AI, AO, DI, or DO is received via the corresponding tab.

Settings for channel type AI

The screenshot shows the 'Channel 1' configuration window. At the top, there are tabs for 'General', 'Channel 1', 'Channel 2', 'Channel 3', and 'Channel 4'. The 'Channel 1' tab is active. The window contains several sections:

- Channel tag:** A text field containing 'Kanal 7104'.
- Channel active:** A checked checkbox.
- Channel features:** 'Function:' dropdown set to 'AI', and 'Channel type:' dropdown set to 'Current'.
- Function modes:** 'Operating mode:' dropdown set to 'Normal' with an 'Extended' button next to it, and 'Error mode:' dropdown set to 'Current value'.
- Measuring/Scaling:** A table with two columns: 'phys. value:' and 'Scaling:'.

phys. value:	Scaling:
Lower limit: 0,000 mA <==>	0 Points
Begin of range: 4,000 mA <==>	10000 Points
High limit: 20,000 mA <==>	50000 Points
End of 24,000 mA <==>	60000 Points
- Signal handling:** 'Line fault detection:' checked 'on'.
- Alarm points:** 'Short:' 21,00 mA and 'Broken wire:' 1,00 mA.
- Special adjustments:** 'HART options:' with checked boxes for 'HART on' and 'internal scan on'.
- Note:** An empty text area.

At the bottom, there are buttons for 'OK', 'Cancel', 'Save', and 'Help'. A status bar at the bottom right shows 'LB/FB - RIO'.

Figure 8.90 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated signal using the Extended button.

Field	Explanation
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the status Invalid data in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button. Last valid value: The last value that was valid before the fault occurred is transferred.
Extended	This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode .
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
Short circuit	Enter the threshold value for short circuit detection, e.g., 21 mA. When the current strength exceeds this value, the line fault detection function reports a short circuit.
Lead breakage	Enter the threshold value for the lead breakage detection, e.g., 1 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.
Measuring range/scaling	Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself. Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA
HART on	Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.
Internal scan on	This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

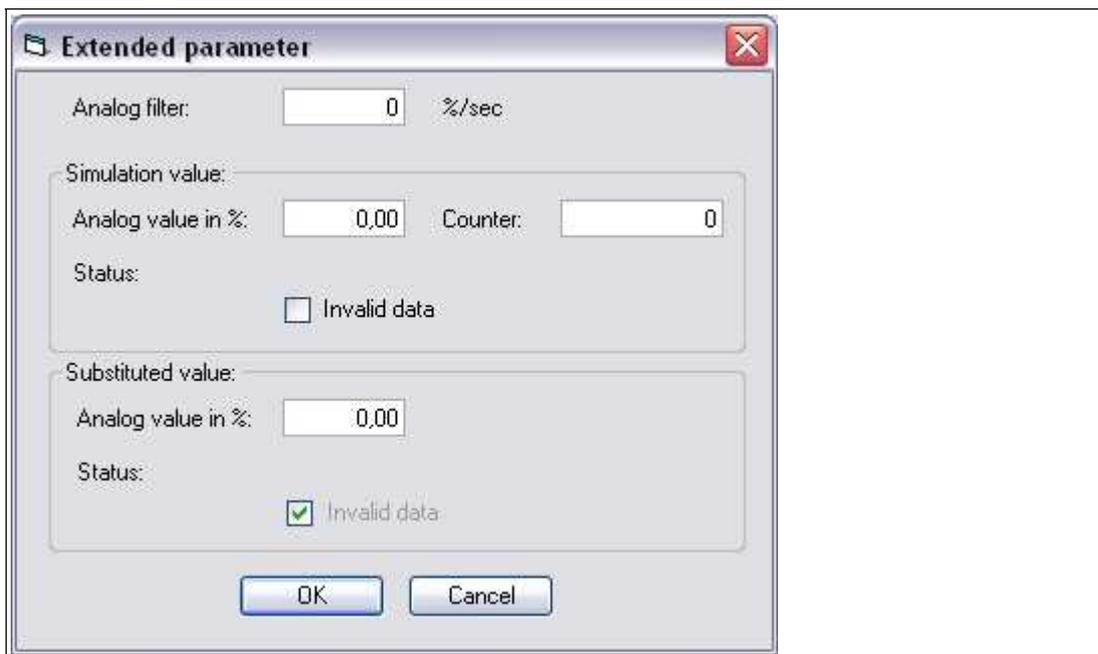


Figure 8.91 **Extended Parameters** window

Field	Explanation
Analog filter	The analog filter for damping the signal can be activated if the input signals fluctuate. Enter a value in % per second for defining the rate of change of the input value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid .
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.

Settings for channel type AO

Figure 8.92 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Channel type	Depending on the I/O module, this field shows the signal type, e.g., counter, current, resistance, NAMUR, or 24 V.
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal using the Extended button.

Field	Explanation
Error mode	<p>Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid, the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2</p> <p>Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal.</p> <p>Substitute value: A substitute value is transferred. You can adjust the substitute value using the Extended button.</p> <p>Last valid value: The last value that was valid before the fault occurred is transferred.</p>
Extended	<p>This button takes you to a window with more channel settings. Here you can adjust the simulation value for the operating mode and the substitute value for the error mode.</p>
Lead breakage detection	<p>Enable line fault detection to monitor the connection at the field end. If a lead breakage occurs, the error is reported via the status area for the process value.</p>
Minimum current	<p>Enter the threshold value for lead breakage detection, e.g., 0.8 mA. When the current strength falls below this value, the line fault detection signals a lead breakage.</p>
Measuring range/scaling	<p>Define the scaling for the measured values. The values are calculated in the Phys. size column using the values in the Scaling column. You can define the scaling yourself.</p> <p>Lower limit: indicates the smallest value to be transferred, e.g., 0 points or 0 mA</p> <p>Start of range: indicates the value equal to 0 %, e.g., 10,000 points and 4 mA</p> <p>End of range: indicates the value equal to 100 %, e.g., 50,000 points or 20 mA</p> <p>Upper limit: indicates the largest value to be transferred, e.g., 60,000 points at 24 mA</p>
HART on	<p>Activate or deactivate HART communication to the channel. Deactivate HART communication if no HART-compatible device is connected. This saves time available for communication with other HART devices.</p>
Internal scan on	<p>This check box only appears when HART communication is activated. Activate or deactivate the automatic scanning of IDs, tags, and variables for HART communication. All active HART channels are scanned automatically by default, such that HART data is retrieved and saved for quicker external access.</p>
Note	<p>You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.</p>

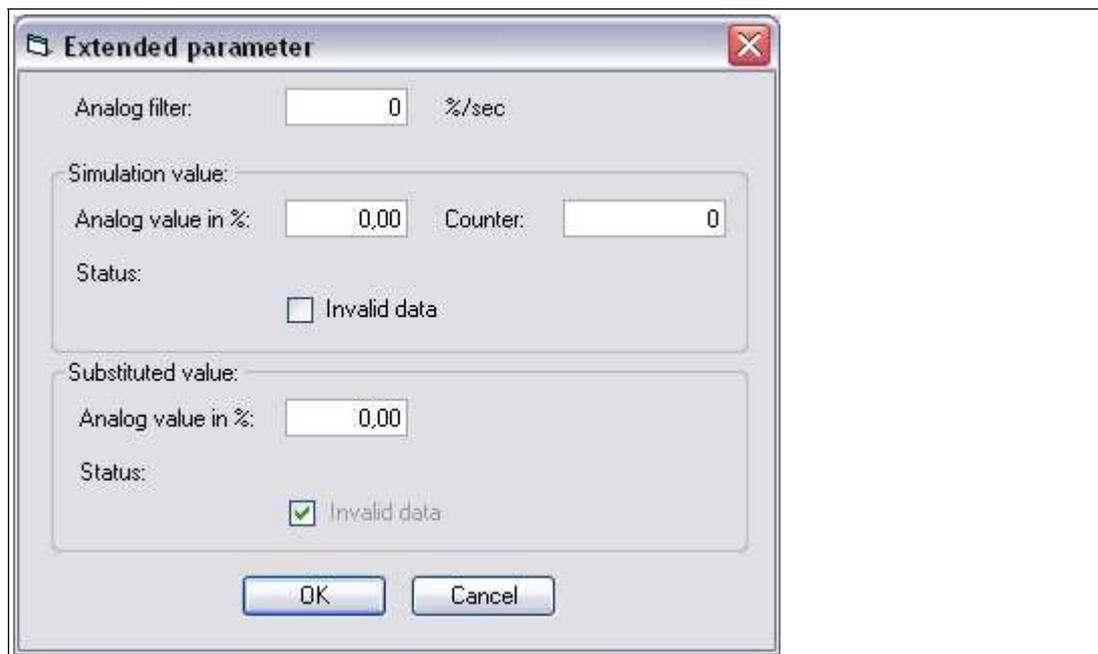


Figure 8.93 Extended Parameters window

Field	Explanation
Analog filter	The analog filters for damping the signal are activated if the output signals fluctuate. Enter a value in % per second for defining the rate of change of the output value. The measurement range is used as the reference value. Enter the value 0 here to deactivate the filter.
Analog value as % (simulation value)	The simulation value is transferred if you have selected the Simulation operating mode. Enter a simulation value in % relating to the measurement range (-25% ... 125%).
Data invalid (simulation value)	Define the status of the simulation value. If you enable the check box, the simulation value is transferred with the status Data invalid and the substitute value strategy is initiated.
Analog value as % (substitute value)	The substitute value is transferred when an error occurs and you have selected the Substitute value error mode. Enter a substitute value in % relating to the measurement range (-25% ... 125%).
Data invalid (substitute value)	This field can not be edited. The substitute value is always transferred with the Invalid data status.



Settings for channel type DI

General **Channel 1** Channel 2 Channel 3 Channel 4

Channel tag: Channel active

Channel features: Function:

Function modes: Operating mode: Error mode:

Signal handling: Signal negation: on Line fault detection: on

Extended parameters: ON-delay: ms OFF-delay: ms

Substitute value: Data: 0 1 Status: Data OK Data invalid

Simulation value: Data: 0 1 Status: Data OK Data invalid

Note:

OK Cancel Save Help

LB/FB - RIO

Figure 8.94 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current input signal is transferred to the process control system. An input signal is simulated in simulation mode. You can adjust the simulated input signal in the Simulation value area.
Error mode	Define the behavior of the I/O module in the event of an error. Substitute values transferred in the event of an error have the invalid data status in DTM version 7 or higher. See chapter 7.4.2 Current value: The signal is transferred unchanged from the field in spite of the error. Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute Value area. Last valid value: The last value that was valid before the fault occurred is transferred.
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value and the substitute value strategy configured under Error mode is initiated.
ON delay	You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1. 
OFF delay	You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0. 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

Settings for channel type DO

Figure 8.95 Channel 1 tab

Field	Explanation
Channel tag	Enter a description for the channel. You can enter up to 32 characters.
Channel active	The check box shows whether or not the channel is active. This check box is dependent on the Module active check box in the General tab and cannot be edited here.
Channel type	This field indicates the channel type for each channel. It cannot be edited. DIN = DI = digital input DOUT = DO = digital output AIN = AI = analog input AOUT = AO = analog output
Operating mode	Choose between Normal and Simulation . See chapter 7.4.1 In normal operation, the current bus signal is processed and output by the I/O module. A bus signal is simulated in simulation mode. The simulated bus signal is processed and output. You can adjust the simulated bus signal in the Simulation value area.

Field	Explanation
Error mode	<p>Define the I/O module's conduct in the event of an error. Once the watchdog time has expired, e.g., when a bus failure has been detected or when the com unit receives values with the status Data invalid, the outputs adopt substitute values in accordance with the substitute value strategy. The substitute value strategy is not activated by line faults in the output circuit. See chapter 7.4.2</p> <p>Current value: The signal from the process control system is transferred unchanged in spite of the error. The signal may also be a simulated signal.</p> <p>Substitute value: A substitute value is transferred. You can set the substitute value in the Substitute value area.</p> <p>Last valid value: The last value that was valid before the fault occurred is transferred.</p>
Signal negation	To invert the signal, activate Signal negation . When signal negation is active, a logical 1 may become 0.
Lead breakage detection	Enable line fault detection to monitor the connection at the field end. If an error occurs (e.g., lead breakage or short circuit), the error is reported via the status area for the process value.
ON delay	<p>You can use the ON delay to filter out short pulses. Enter a value in ms to shorten a signal change from 0 to 1.</p> 
OFF delay	<p>You can use the OFF delay to extend short pulses. Enter a value in ms to extend a signal change from 1 to 0.</p> 
Substitute value	Define a substitute value for when there is a fault. Choose either 0 or 1 as the substitute value. The substitute value is always transferred with the Invalid data status.
Simulation value	Define the simulation value and the status of this value. The simulation value is transferred if you activate "Simulation" mode. Choose either 0 or 1 as the simulation value. Choose between the Data OK and Invalid data status. If you select Invalid data , the substitute value strategy is initiated.
Note	You can enter a comment here. The maximum text length is 256 characters. The comment is saved in the database only and not in the I/O module. The comment applies to the entire I/O module and also appears on the other tabs in the window.

9 Diagnostic Functions

Com Unit Diagnostics Functions

The measured value display for the com unit provides you with diagnostics information relating to the remote I/O station as a whole. This chapter describes the structure of the measured value display and shows which diagnostics information is available to it.

Diagnostic functions of PACTware™

In version 4 and above, PACTware™ includes the **Device State Manager**. See chapter 9.10

9.1 Data Transfer



Note!

The following diagnostics can be accessed in the PROFIBUS class 2 master. If not, the diagnostics can be obtained using a PROFIBUS network analysis tool.



Data Transfer in Three Steps

The bus must have successfully passed the electrical test. See chapter 6.17

1. Make sure that the slave address is identical for both the master and slave.

↳ The slave can be activated via the bus.

```
DP Diagnostic Station_Non_Existent == 0
```

2. Make sure that the PROFIBUS ID in the slave is the same as the ID in the GSD file.

↳ The slave accepts the parameters of the master.

```
DP Diagnostics Prm_Fault == 0
```

3. Check that the configuration of the I/O modules in the master matches the configuration of the I/O modules in the remote I/O station.

Note that the data volumes in the I/O modules LB1*03, FB1*03, and LB3*02, FB3*02 depend on the **measuring methods** used.

Configure dual width I/O modules that occupy two slots in the same way as single width I/O modules, followed by an empty slot. Be aware that the last slot in the remote I/O station may not be an empty slot. If the last I/O module is a dual width I/O module, configure this I/O module in the same way as a single width I/O module and omit the following empty slot. The start number for the module slot numbering is changed by the command area (Cmd), status area (Status), and module status area (Mod.-status).

↳ The slave accepts the configuration of the master.

```
DP Diagnostics Cfg_Fault == 0
```

9.2 Opening the measured value display of the Com Unit



Opening the "Show Measured Value" window

1. Right-click on the entry for the required component in the project structure.

2. Choose **Connect**.

↳ The connection is established. The entries appear in bold in the project structure once the connection is established. The connection status is also indicated by an icon.

3. Right-click on the entry for the connected device in the project structure.

4. In the context menu, select **Measured Value > Show Measured Value**. If the command is not available, there is no connection to the device.

↳ The **Show Measured Value** window opens.

9.3 Layout of the Measured Values Display

The com unit measured values display is divided into four areas.

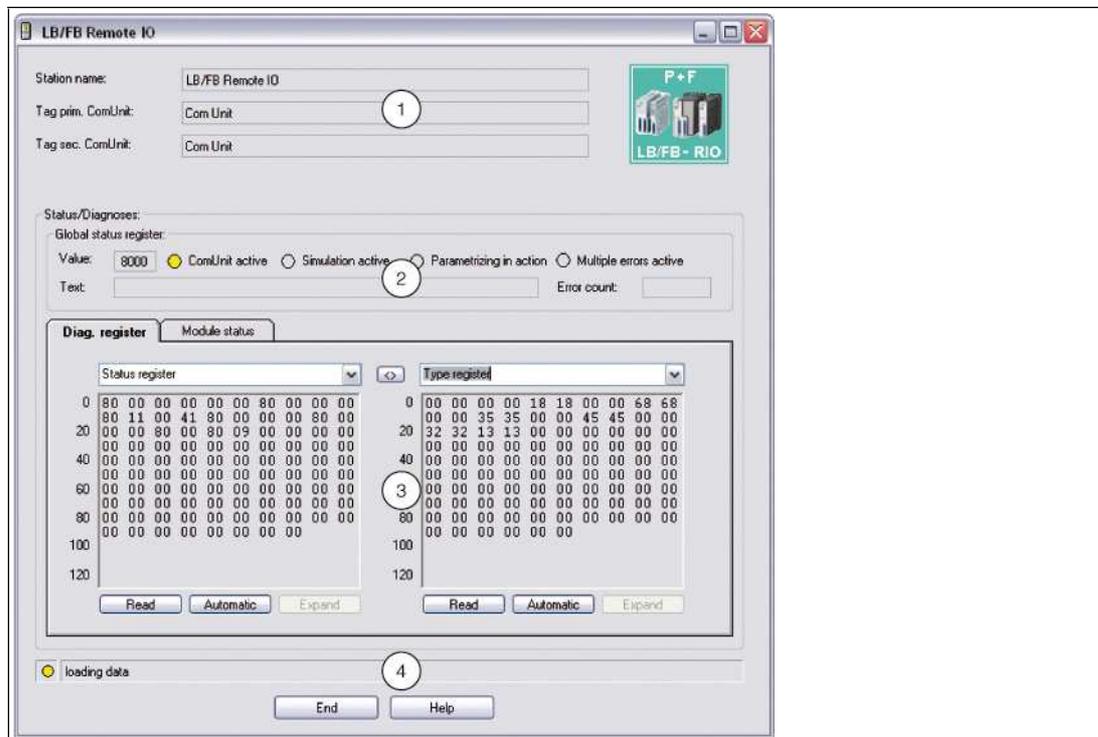


Figure 9.1 Display Measured Value window

Field	Explanation	
1	Station name Prim. com unit tag Sec. com unit tag	The fields contain the names of the station and the primary com unit. On redundant systems, the name of the secondary com unit (redundant com unit) is also displayed.
2	Global status register	The global status register contains information about the status of the com unit, the I/O modules, and the power supplies of a station. See chapter 9.4
3	Tabs	This area contains several tabs. The first Diagnostics register tab displays the raw data for the different diagnostic registers. Depending on the com unit type, additional diagnostic information is displayed via additional tabs. The Module Status tab is available from DTM version 7.3.
4	Status bar	The status bar provides information about the communication status. The display lights up yellow in the case of read access. The display lights up red if there is a communication error. The communication status is displayed as a text message in the text box. Data loading: The read request was successful. The measured value display waits for the requested data. Wait...: The read request was unsuccessful because the communication channel is currently in use. Communication error: The requested data could not be transferred.

9.4 Global Status Register

The global status register comprises 16 bits (= 1 data word) and contains information about the status of the com unit, I/O modules and power supplies of a remote I/O station. The global status register is displayed in the **Show Measured Value** window as a raw data value in the **Value** field and as a text message in the **Text** field.

In the com unit device data, you can set whether the global status register is transferred in synchronous data traffic. See chapter 6.9.2

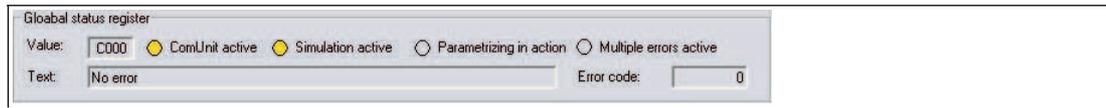


Figure 9.2 Com Unit measured value display, **Global status register** area

9.4.1 Structure of the Global Status Register

The global status register comprises 2 input bytes located at the start of the DP configuration string. See chapter 6

The following table explains the individual bits.

Structure of the Global Status Register

Byte	Bit/state	Meaning	
2	15	= 0	Com unit is passive
		= 1	Com unit is active
	14	= 0	Operating mode: no simulation
		= 1	Operating mode: a minimum of one I/O module is simulated.
	13	= 0	No fault
		= 1	Fault
	12	= 0	General fault
		= 1	Module fault
	11		The error code consists of bits 11 to 8, e.g., 0 1 1 1, produces an error code of 7 (hexadecimal) = power supply fault. The meaning of all error codes is shown in the table below.
	10		
	9		
	8		
1	7	= 0	1 fault
		= 1	Multiple faults
	6	= 0	No parameterization/processing
		= 1	Parameterization/processing in progress
	5		Bits 5 ... 0: ■ If a single error occurs (bit 7 = 0), the faulty slot can be determined with reference to these bits, e.g., 0 0 0 1 0 0 indicates slot 4 (hexadecimal). ■ If multiple errors occur (bit 7 = 1), the number of errors can be determined. ■ If only power supply faults occur (bit 11... 8 = 7, bit 7 = 0), one bit is assigned to each power supply (power supply 1 = bit 0, ..., power supply 6 = bit 5), whereby the status 1 represents a fault.
	4		
	3		
	2		
1			
0			

Error code of the global status register

Error code (hex)	Clear text message
0	No error
1	Memory error PIC (RAM)
2	Memory error PIC (register)
3	Memory error PIC (flash)
4	PIC internal error
5	Command error PIC
6	Module fault
7	Power supply fault
8	Memory error CPU32 (RAM)
9	Memory error CPU32 (flash)
A	CPU32 internal error (watchdog)
B	Redundancy error, arithmetic
C	Redundancy error, partner not present (no redundancy Com Unit)
D	Redundancy error, link
E	Redundancy error, parameter inconsistent
F	Reserved

9.4.2 Example of Global Status Register

There is a power supply fault in the following example. The **Value** field contains the raw data value A784.

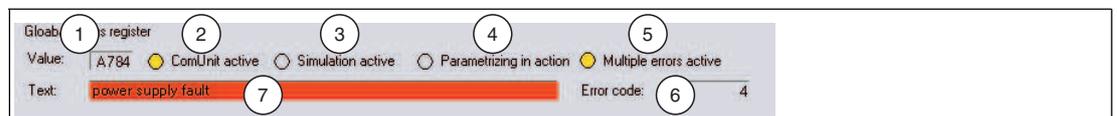


Figure 9.3 Com unit measured value display, **Global status register** area

The value is produced from the 16 bits in the status register. The table below outlines how the raw data value A784 is compiled and on which status displays the value appears.

Example of Global Status Register (Raw Data Value "A784")

A784	Bit/state	Meaning	Image reference
A	15	= 1 Com unit is active Status indicated by Com unit active yellow = active gray = passive	2
	14	= 0 Simulation is not active Status indicated by Simulation active yellow = min. 1 channel simulated gray = no simulation	3
	13	= 1 Error has occurred Status indicated by Text box red background = error gray background = no error	7
	12	= 0 General error no status indicator	

A784	Bit/state		Meaning	Image reference
7	11	= 0	Bits 11 ... 8 with states 0 1 1 1 produce the error code 7. The error with the highest priority is a power supply fault.	7
	10	= 1		
	9	= 1		
	8	= 1		
8	7	= 1	Multiple errors have occurred Status indicated by Multiple errors active yellow = multiple errors gray = no errors or single error	5
	6	= 0	No parameterization/processing Status indicated by Parameterization in progress yellow = parameterization in progress gray = no parameterization	4
	5	= 0	There are 4 active errors (multiple errors) Bits 5 ... 0 with the states 0 0 0 1 0 0 produce the number 4.	6
4	= 0			
4	3	= 0		
	2	= 1		
	1	= 0		
	0	= 0		

9.5 "Diagnostics Register" Tab

Different diagnostic areas in the com unit can be read out and compared with one another using the **Diagnostics Register** tab. Press the <> button in the middle of both areas to highlight differences between the diagnostic areas in the left- and right-hand text boxes in color until the data is updated again.

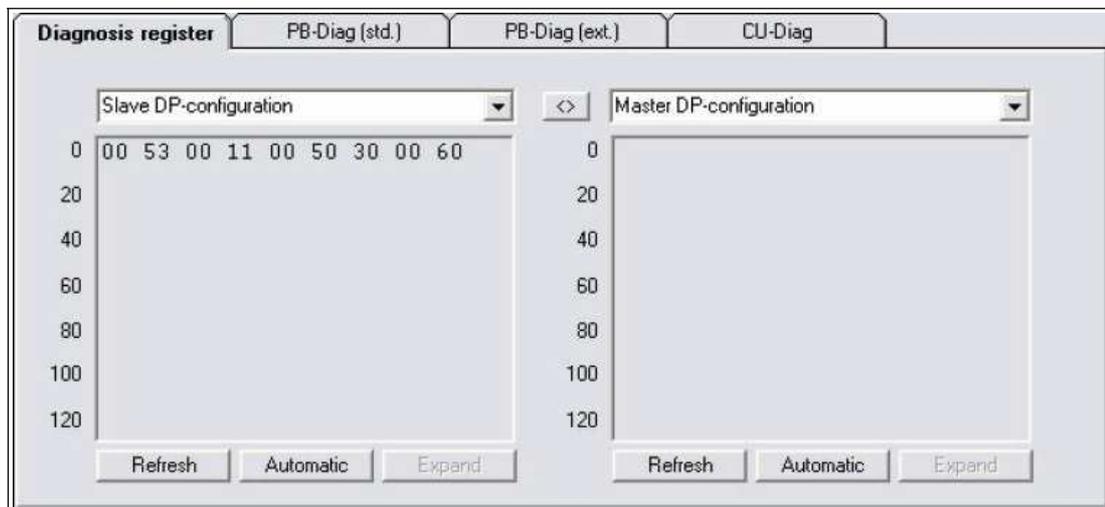


Figure 9.4 **Diagnostics Register** tab

9.5.1 DP Configuration

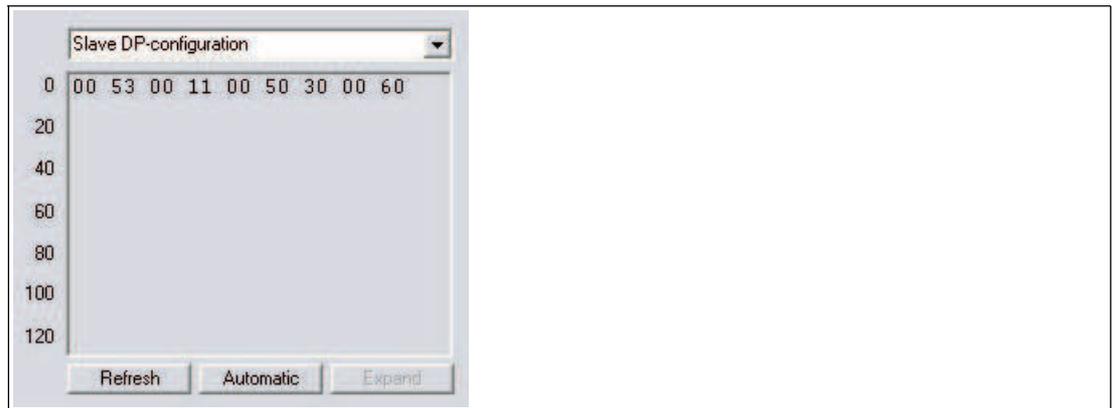


Figure 9.5 DP configuration

If you select the entry **Slave DP configuration** or **Master DP configuration** from the drop-down list, the DP configuration string for the slave or the master appears in the text box. You have the ability to compare the DP configuration string of the slave and the master directly with one another in the left and right hand area. When configured correctly, the DP configuration strings of the slave and master should be identical. → see Figure 9.4 on page 236

The DP configuration string comprises the hexadecimal DP configuration codes of the individual components of the remote I/O station. See chapter 6.10

Structure of the DP Configuration Code

Bit	Meaning
7	Data consistency: 0 = byte/word, 1 = total data
6	Data format: 0 = byte, 1 = word
5	Bits 5 ... 4: Data type: 00 = special type, 01 = input, 10 = output, 11 = input/output
4	
3	Bits 3 ... 0 Data length: e.g., 0000 = 1 byte/word, 0011 = 4 bytes/word, 1111 = 16 bytes/word
2	
1	
0	

9.5.2 DP Diagnostics

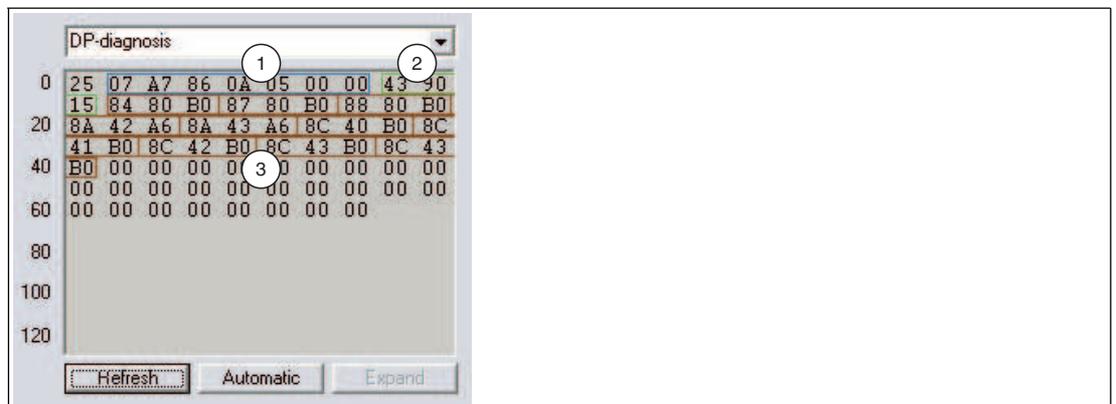


Figure 9.6 DP diagnostics

If you select the **DP Diagnostics** entry from the drop-down list, the extended PROFIBUS diagnostic octets are displayed in the box. This data is part of the diagnostic telegram, in addition to the PROFIBUS standard diagnostics. The remote I/O station then always transmits a diagnostic telegram as soon as the master issues a diagnostics request (DP Diag Response).

The data encoding is determined by the PROFIBUS specification and is described in brief below. The diagnostic data is evaluated on the **DP Diag (Ext.)** tab, which also forms part of the com unit measured values display. See chapter 9.7

The extended PROFIBUS diagnostics is divided into 3 areas.

1: Device-specific diagnostic octets

Device-specific diagnostic octets in the first area contain information on the status of the remote I/O station and depend largely on the parameterization of the com unit. The example involves octets 1 to 7.

- Octet 1: header octet with identifier for device-specific diagnostics (bit 7 = 0 and bit 6 = 0) and 6 bits (bit 5 ... 0) specifying the length of the device-specific diagnostics, including header octet (in the example: 07 = 7 octets).
- Octets 2 + 3: 2 octets global status register for the active com unit (in the example: A7 86). See chapter 9.4
- Octets 4 + 5: the first two standard diagnostic octets of the redundant com unit (in the example: 0A 05) → see Figure 9.11 on page 250
- Octets 6 + 7: 2 octets global status register for the redundant com unit. The passive com unit does not transfer error messages and so most transferred octets are set to 0. See chapter 9.4

The last four octets (7 ... 4) are only relevant for redundant systems with 2 com units and are filled with default values in single mode.

If you have enabled the **Additional module diagnostics** check box in the device data for the com unit, 2 more bits are transferred per slot in contrast to the example shown above. See chapter 6.9.3

The data volume of the device-specific diagnostics thus increases by 12 octets (48 slots x 2 bits), regardless of the I/O modules that are actually configured. The 2 bits for each slot represent the following states: 00 = no error, 01 = module error, 10 = incorrect module type, 11 = no module available. The transfer sequence is shown in the table below.

Additional Module Diagnostics

Octet	Bit	Description
Octet $n+1$ (*)	7	Status slot 4
	6	
	5	Status slot 3
	4	
	3	Status slot 2
	2	
	1	Status slot 1
	0	
...
Octet $n+12$ (*) Status slot 48
(*) octet n = last octet before the additional module diagnostics		

2: Module-Specific Diagnostic Octets

The second extended diagnostics area contains module-specific diagnostic octets (octets 8 ... 10, in the example: 43 90 15). Here, one bit is assigned to each com unit and I/O module of the remote I/O station or to each configuration code in the DP configuration string. If one bit is preset (= 1), diagnostics are available for the module assigned to this bit.

The number of octets in the module-specific diagnostics depends on the configuration of the remote I/O station. The more I/O modules that are assigned to slots, the higher the number of octets. The evaluation structure can also be applied for longer module diagnostics, regardless of the number of diagnostic octets. Each additional bit represents the next I/O module.

The assignment of diagnostics to I/O modules in different master and diagnostic systems may turn out differently due to the various counting methods. If necessary, select an appropriate counting method using the **Offset module diagnostics** com unit parameter. See chapter 6.9.3

Module-Specific Diagnostic Octets

Octet	Bit/state		General meaning	Example of meaning
Octet _n Example: 43 (*)	7	= 0	Diagnostics type: 0 0 = device-spec. diagnostics; 0 1 = module-spec. diagnostics; 1 0 = channel-spec. diagnostics; 1 1 = reserved	Module-specific diagnostics (0 1) 3 octets in length (0 0 0 0 1 1)
	6	= 1		
	5	= 0		
	4	= 0		
	3	= 0		
	2	= 0		
	1	= 1		
	0	= 1		
Octet _{n+1} Example: 90	7	= 1	Module 8 (diagnostic or error message)	Modules 5 and 8 have error or diagnostic messages
	6	= 0	Module 7 (no error)	
	5	= 0	Module 6 (no error)	
	4	= 1	Module 5 (diagnostic or error message)	
	3	= 0	Module 4 (no error)	
	2	= 0	Module 3 (no error)	
	1	= 0	Module 2 (no error)	
0	= 0	Module 1 (no error)		
Octet _{n+2} Example: 15			Modules 9 to 16	Modules 9, 11, and 13 have error or diagnostic messages
...	
Octet _{n+x}			Modules y to y + 7	Not included in the example
(*) octet _n = header octet of module-specific diagnostics				

3: Channel-Specific Diagnostic Octets

The module-specific diagnostics is followed by the channel-specific diagnostics. The channel-specific diagnostics contains information on the channel properties and the error/diagnostics type (in the example: octets 11 to 40). The channel-specific diagnostics is divided into blocks of 3 octets, where one block represents one channel.

The diagnostics are evaluated according to the structure displayed in the table below using the first 3 octets from the example (84 80 B0). Some parts of the error types, diagnostics types, and associated codes are predefined in the PROFIBUS specification. Other parts can be defined independently using the GSD/GSE file from the device manufacturer.

The memory for diagnostic information is limited. The maximum number of channel-specific diagnostics is also limited because each additional channel diagnostics requires 3 extra octets. If more diagnostics are present than can be transferred, the PROFIBUS standard diagnostic bit **Diagnostic Data Overflow** is displayed.

Channel-Specific Diagnostic Octets

Octet	Bit/state	General meaning	Example of meaning	
Octet _n Example: 84 (*)	7	= 1	Diagnostics type: 0 0 = device-spec. diagnostics; 0 1 = module-spec. diagnostics; 1 0 = channel-spec. diagnostics; 1 1 = reserved	Channel-specific diagnostics (1 0) for module 5 or configuration code 4 (0 0 0 1 0 0) (if diagnostics offset = 0 and the configuration code starts with 0)
	6	= 0		
	5	= 0		
	4	= 0		
	3	= 0		
	2	= 1		
	1	= 0		
	0	= 0		
Octet _{n+1} Example: 80	7	= 1	Input/output: 0 0 = reserved; 0 1 = input; 1 0 = output; 1 1 = input and output	Diagnostics are based on an output value (1 0) and apply to channel 1 (0 0 0 0 0 0)
	6	= 0		
	5	= 0		
	4	= 0		
	3	= 0		
	2	= 0		
	1	= 0		
	0	= 0		
Octet _{n+2} Example: B0	7	= 1	Data structure: 0 0 0 = reserved; 0 0 1 = 1 bit; 0 1 0 = 2 bits; 0 1 1 = 4 bits; 1 0 0 = 1 octet; 1 0 1 = 1 word; 1 1 0 = 2 words; 1 1 1 = reserved	Data structure = 1 word (1 0 1); diagnostic message = lead breakage or short circuit (1 0 0 0 0 = 16)
	6	= 0		
	5	= 1		
	4	= 1		
	3	= 0		
	2	= 0		
	1	= 0		
	0	= 0		
(*) octet _n = header octet of channel-specific diagnostics				

Channel-specific diagnostic messages

Identifier	Diagnostic message
PROFIBUS specification	
1	Short circuit
2	Undervoltage
3	Overvoltage
4	Overload
5	Excess temperature
6	Lead breakage
7	Upper limit exceeded
8	Lower limit undershot
9	Fault
10 ... 15	Reserved
Manufacturer specification (defined in GSD file)	
16	Short circuit or lead breakage
17 ... 31	Reserved

9.5.3 DP Parameters

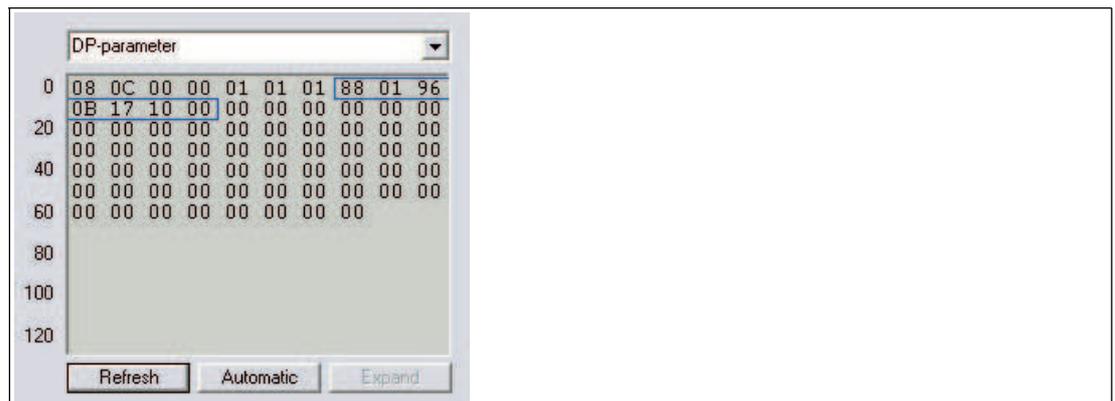


Figure 9.7 DP parameters

If you select the **DP Parameters** entry from the drop-down list and then click on the **Read** button, the data of the parameterization telegram (*SetParam*) is displayed in the text box (in the example: bytes 7 ... 13). The other listed bytes are not relevant for diagnostics purposes and are therefore not described here in more detail.

If you select the **DP Parameters (Partner)** entry from the drop-down list, you access the parameterization telegram for the redundant com unit (redundant systems only). The structure of the two DP parameter registers **DP parameters** and **DP parameters (partner)** is identical and is therefore only described once in the following section.

The first byte of the parameterization telegram (in the example: 88) represents PROFIBUS-specific modes and functions that can be activated and deactivated via the parameterization telegram. The meaning of the individual bits is shown in the table below.

DP parameters byte 1

Byte	Bit/state	Meaning, general	Example of meaning
Byte 1 Example: 88	7 = 1	Lock (0 = off; 1 = on)	Lock function and watchdog activated
	6 = 0	Unlock (0 = off; 1 = on)	
	5 = 0	SYNC mode (0 = off; 1 = on)	
	4 = 0	FREEZE mode (0 = off; 1 = on)	
	3 = 1	Watchdog (0 = off; 1 = on)	
	2 = 0	Reserved	
	1 = 0	Reserved	
	0 = 0	Reserved	

- Watchdog:** When the watchdog function is activated, the com unit monitors the communication with the master. If the master does not respond to the com unit correctly within the watchdog time, the com unit interprets this as an error and reacts accordingly. The watchdog time is usually calculated by the master and must always be longer than the maximum time required for a complete data cycle. The watchdog time is transferred in bytes 2 and 3 of the parameterization telegram (in the example: 01 96) and can be calculated as follows:

$$\text{watchdog time} = (\text{decimal value byte 2}) \times (\text{decimal value byte 3}) \times 10 \text{ ms}$$

$$= 1 (01_{\text{hex}}) \times 150 (96_{\text{hex}}) \times 10 \text{ ms} = 1500 \text{ ms}$$
- FREEZE mode:** The input data of different slaves is always retrieved in succession. The point in time when signals are retrieved in normal mode therefore varies from slave to slave. FREEZE mode is used to freeze the input data of different slaves at a defined point in time and then the data is transferred in succession.
- SYNC mode:** Like FREEZE mode, SYNC mode is used for synchronizing data, but only affects the outputs. This function allows you to transmit output data to different slaves in quick succession and then output this data simultaneously using the Sync command.
- Lock/unlock:** The lock/unlock function enables the master to grant or rescind access rights to a slave. If the lock bit is set and the unlock bit is not set, the slave is reserved for a certain master (identified by the master address). If the unlock bit is set, the slave is not reserved for a certain master (the status of the lock bit is irrelevant in this case). If both the lock bit and the unlock bit are not set, the slave is still not reserved for a specific master and can be locked by a master using an appropriate parameterization telegram.

Bytes 2 and 3 of the parameterization telegram contain the watchdog time for the watchdog function.

Byte 4 contains the minimum time that the slave must wait before a response telegram may be transmitted (min. T_{SDR} in bit times; in the example: 11 (0B_{hex}) bit times).

Bytes 5 and 6 contain the high and low bytes for the PROFIBUS ID number (in the example: 17 10). The ID number that the master transmits to the slave in the parameterization telegram must correspond to the PROFIBUS ID number of the slave. If the ID numbers do not correspond, the parameterization telegram is not accepted and data exchange with the slave is not possible.

Byte 7 is used to assign the slave to a specific component group (in the example: 00_{hex} = group 0). Grouping in this way enables multicast communication (telegram is valid for a group of components). By default, group 0 is assigned to the slave (00_{hex}).

9.5.4 Redundancy Status

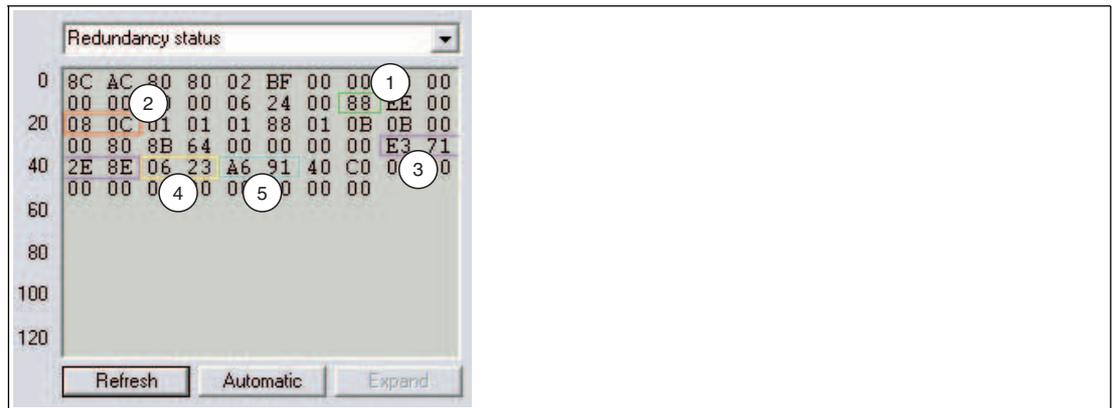


Figure 9.8 Redundancy status

The structure of the two redundancy status registers **Redundancy status** and **Redundancy status (partner)** is identical. If you select the entry **Redundancy status (partner)** from the drop-down list (only on redundant systems), you access the data record for the redundant com unit via the active com unit. Data is exchanged between the com unit and the redundancy com unit automatically.

Each redundancy status register contains a large amount of information. The most important information is highlighted in the illustration.

1: Communication Status

This octet contains information relating to PROFIBUS communication. The table below shows how this octet is interpreted. The example (88) shows that the slave has found a valid baud rate and has the status `DataExchange`.

Communication Status

Octet	Bit/state	General meaning	Example of meaning	
Octet n Example: 88	7	= 1	DataExchange (0 = inactive, 1 = active)	Slave has the status DataExchange, baud rate was found
	6	= 0	Reserved	
	5	= 0		
	4	= 0		
	3	= 1	Baud rate (0 = not found, 1 = found)	
	2	= 0	Reserved	
	1	= 0		
	0	= 0		

2: PROFIBUS Standard Diagnostic Octets

PROFIBUS standard diagnostic octets 1 and 2 are stored at the position indicated (in the example: 08 0C). The way in which this octet is interpreted is defined by the PROFIBUS specification. See chapter 9.6

3: Checksum Calculation Result

This area contains the result of the checksum calculation for the parameter set of the com unit. With the exception of EasyCom connections, the data records must be identical in both com units in redundant systems. You can compare data records with one another using the <> button.

The revision counter value for the parameter set is also included in the checksum calculation. The result is that the checksum changes when the revision version increases and provides confirmation of the transmission of new parameters.

4: Firmware Version

This area contains the com unit firmware version.

5: Global Status Register

This area contains the global status register. See chapter 9.4

9.5.5

Status Register

Address	0	1	2	3	4	5	6	7	8	9	10	11	12
0	A6	91	00	00	00	00	AA	33	2A	33			
1	A1	00	21	00	A1	00	21	00	A9	00			
20	29	00	A1	00	21	00	A1	00	21	00			
21	A1	00	21	00	A1	00	21	00	A1	00			
40	21	00	A1	00	21	00	A1	00	21	00			
41	A1	00	21	00	A1	00	21	00	A1	00			
60	21	00	A1	00	21	00	A1	00	21	00			
61	A1	00	21	00	00	00	00	00	00	00			
80	00	00	00	00	00	00	00	00	00	00			
81	00	00	00	00	00	00	00	00	00	00			
100													
120													

Figure 9.9 Status register

If you select the **Status register** entry from the drop-down list, the status bytes for the com unit and the I/O modules are displayed.

There are 2 status bytes available for each I/O module slot and for the bus connection (com unit or com unit + redundancy com unit). The first two bytes are allocated to the bus coupling and contain the global status register already described. This is followed by two bytes for each I/O module slot, beginning with slot 1. The meaning of the bytes is displayed in the following tables.

The first of the two status bytes contains module diagnostic information and has the same structure for each slot. The second status byte depends on the module type and contains channel diagnostic information. Since some dual-width I/O modules require two slots, these I/O modules are represented by 4 bytes (2 bytes per slot). In theory, bytes 1 and 3 have the same structure, in which only the first required module slot is assigned the **active** status. Bytes 2 and 4 contain the channel diagnostics information.

Module Status Register

Byte	Bit/state	General meaning	Example of meaning
Byte 1 Example: AA	7 = 1	Module active (0 = inactive, 1 = active)	The I/O module is active (bit 7 = 1) and faulty (bit 5 = 1). There is an internal module error (bit 3 ... 0 = 1 0 1 0 = error code 10 _{Hex})
	6 = 0	Simulation active (min. 1 channel) (0 = inactive; 1 = active)	
	5 = 1	Error (0 = no error; 1 = error)	
	4 = 0	Reserved	
	3 = 1	Error code (see table below)	
	2 = 0		
	1 = 1		
	0 = 0		
Byte 2		Channel diagnostics information	

Error codes bit 0 ... 3	Meaning
0	No fault
1	Timeout (module is not inserted in the slot)
2 ... 6	Internal bus error (communication problems between com unit and I/O module(s))
7 ... 8	Reserved
9	Incorrect module type (inserted and configured module types do not match)
10	Internal module error (e.g., lead breakage or short circuit)
11 ... 15	Reserved



Note!

The following I/O modules have **no** channel diagnostics information. In these I/O modules, byte 2 = 0.

- LB1007
- LB1*09, FB1*09
- LB1014
- LB1015
- LB3*06
- LB4106
- LB7*04, FB7*04

Channel diagnostics information

LB1*01, FB1*01, LB1*02, FB1*02, LB1*08, FB1*08, LB2002, LB21*, FB22*, LB6005, FB6305, LB6006, FB6306, LB6*08, FB6*08, LB6*1*, FB621*

Byte 2	Meaning	Byte 4 ^(*1)	Meaning
Bit 0	Digital data channel 1 (0/1)	Bit 0	Digital data channel 5 (0/1) ^(*2)
Bit 1	Status channel 1 (0 = valid, 1 = invalid)	Bit 1	Status channel 5 (0 = valid, 1 = invalid) ^(*2)
Bit 2	Digital data channel 2 (0/1)	Bit 2	Digital data channel 6 (0/1) ^(*2)
Bit 3	Status channel 2 (0 = valid, 1 = invalid)	Bit 3	Status channel 6 (0 = valid, 1 = invalid) ^(*2)
Bit 4	Digital data channel 3 (0/1) ^(*2)	Bit 4	Digital data channel 7 (0/1) ^(*2)
Bit 5	Status channel 3 (0 = valid, 1 = invalid) ^(*2)	Bit 5	Status channel 7 (0 = valid, 1 = invalid) ^(*2)
Bit 6	Digital data channel 4 (0/1) ^(*2)	Bit 6	Digital data channel 8 (0/1) ^(*2)
Bit 7	Status channel 4 (0 = valid, 1 = invalid) ^(*2)	Bit 7	Status channel 8 (0 = valid, 1 = invalid) ^(*2)

(*1) Byte 4 only affects dual-width I/O modules that occupy 2 slots.
(*2) This bit may only be reserved depending on the channel number of the I/O module.

LB6101, FB6301

Byte 2	Meaning
Bit 0	Digital data channel 1 (0/1)
Bit 1	Digital data channel 2 (0/1)
Bit 2 ... 7	Reserved

LB1*03, FB1*03

Byte 2	Meaning
Bit 0	Counter status
Bit 1	Status (0 = valid, 1 = invalid)
Bit 2	Reserved
Bit 3	Direction detection
Bit 4 ... 7	Reserved

LB3101, FB3201, LB3*02, FB3*02, LB3103, FB3203, LB3104, FB3204, LB3*05, FB3*05

Byte 2	Meaning	Byte 4 ^(*1)	Meaning
Bit 0	Live zero/breakage limit undershot channel 1	Bit 0	Live zero/breakage limit undershot channel 3 ^(*2)
Bit 1	Status channel 1 (0 = valid, 1 = invalid)	Bit 1	Status channel 3 (0 = valid, 1 = invalid) ^(*2)
Bit 2 ... 3	Reserved	Bit 2 ... 3	Reserved
Bit 4	Live zero/breakage limit undershot channel 2 ^(*2)	Bit 4	Live zero/breakage limit undershot channel 4 ^(*2)
Bit 5	Status channel 2 (0 = valid, 1 = invalid) ^(*2)	Bit 5	Status channel 4 (0 = valid, 1 = invalid) ^(*2)
Bit 6 ... 7	Reserved	Bit 6 ... 7	Reserved
(*1) Byte 4 only affects dual-width I/O modules that occupy 2 slots. (*2) This bit may only be reserved depending on the channel number of the I/O module.			

LB4101, FB4*01, LB4*02, FB4*02, LB4104, FB4204, LB4*05, FB4*05

Byte 2	Meaning	Byte 4 ^(*1)	Meaning
Bit 0	Reserved	Bit 0	Reserved
Bit 1	Status channel 1 (0 = valid, 1 = invalid)	Bit 1	Status channel 3 (0 = valid, 1 = invalid) ^(*2)
Bit 2 ... 3	Reserved	Bit 2 ... 3	Reserved
Bit 4	Reserved	Bit 4	Reserved
Bit 5	Status channel 2 (0 = valid, 1 = invalid) ^(*2)	Bit 5	Status channel 4 (0 = valid, 1 = invalid) ^(*2)
Bit 6 ... 7	Reserved	Bit 6 ... 7	Reserved
(*1) Byte 4 only affects dual-width I/O modules that occupy 2 slots. (*2) This bit may only be reserved depending on the channel number of the I/O module.			

LB5*01, FB5201, LB5*02, FB5202, LB5*04, FB5204, LB5*05, FB5205, LB5*06, FB5206

Byte 2	Meaning	Byte 4 ^(*1)	Meaning
Bit 0	Reserved	Bit 0	Reserved
Bit 1	Status channel 1 (0 = valid, 1 = invalid)	Bit 1	Status channel 3 (0 = valid, 1 = invalid) ^(*2)
Bit 2 ... 3	Reserved	Bit 2 ... 3	Reserved
Bit 4	Reserved	Bit 4	Reserved
Bit 5	Status channel 2 (0 = valid, 1 = invalid) ^(*2)	Bit 5	Status channel 4 (0 = valid, 1 = invalid) ^(*2)
Bit 6 ... 7	Reserved	Bit 6 ... 7	Reserved
(*1) Byte 4 only affects dual-width I/O modules that occupy 2 slots. (*2) This bit may only be reserved depending on the channel number of the I/O module.			

9.5.6 Type Register

Address	0	1	2	3	4	5	6	7	8	9	10	11	12
0	00	00	00	00	35	35	00	00	00	00	00	00	00
20	00	00	35	00	00	00	35	45	00	00	00	00	00
40	35	00	00	00	35	00	00	00	00	35	00	00	00
60	00	00	35	00	00	00	35	00	00	00	00	00	00
80	35	00	00	00	35	00	00	00	00	35	00	00	00
100	00	00	00	00	00	00	00	00	00	00	00	00	00
120	00	00	00	00	00	00	00	00	00	00	00	00	00

Figure 9.10 Type register

- 1 Slot 3
- 2 Slot 9

When you select the **Type register** entry from the drop-down list, an overview of the remote I/O station structure is displayed.

In the type register, two bytes are assigned to each slot. The first byte contains the identifier of the I/O module that is configured in the com unit. The second byte contains the identifier of the module that is actually plugged into the respective slot in the station. Check whether the planned I/O module configuration corresponds with the configuration of the inserted I/O modules by comparing the respective first and second bytes with one another.

The identifier consists of two hexadecimal characters. The first hexadecimal character corresponds to the first decimal number of the I/O module type designation. The second hexadecimal character corresponds to the last two decimal numbers of the I/O module type designation.



Example!

The identifier 2C_{hex} corresponds to I/O module LB2*12 or FB2*12. The first character 2_{hex} corresponds to the first number in the type designation 2*12. The second character C_{hex} corresponds to the last two numbers in the type designation 2*12.

The identifier 35_{hex} corresponds to the I/O module LB3*05 or FB3*05.

In the illustration, you will see two areas marked. The first example shows the identifier 35 35 for slot 3, so the configured I/O module type corresponds with the I/O module that is actually plugged in.

In the second example, 35 45 shows a discrepancy between the configured I/O module (35) and the I/O module plugged in (45). Either replace the I/O module in the remote I/O station or adapt the configuration accordingly to ensure the system functions correctly.

Identifiers for Module Types

Module type identifiers			
Digital I/O modules		Analog I/O modules	
11	LB1*01, FB1*01 digital input	13	LB1*03, FB1*03 frequency/counter input
12	LB1*02, FB1*02 digital input	31	LB3101, FB3201 transmitter power supply, current input
17	LB 1007 digital input	32	LB3*02, FB3*02 HART transmitter power supply, current input
18	LB1*08, FB1*08 digital input	33	LB3103, FB3203 HART transmitter power supply, current input
19	LB1*09, FB1*09 digital input	34	LB3104, FB3204 transmitter power supply, current input
1E	LB1014 digital input	35	LB3*05, FB3*05 HART transmitter power supply, current input
1F	LB1015 digital input	36	LB3*06 HART transmitter power supply
21	LB2*01, FB2*01 digital output with position feedback	41	LB4101, FB4*01 current output
...	...	42	LB4*02, FB4*02 HART current output
2D	LB2*13, FB2*13 digital output with position feedback	44	LB4104, FB4204 current output
61	LB6101, FB6301 relay contact output	45	LB4*05, FB4*05 HART current output
65	LB6005, FB6305 relay contact output	46	LB4106 HART current output
66	LB6006, FB6306 relay contact output	51	LB5*01, FB5201 RTD converter
68	LB6*08, FB6*08 digital output	52	LB5*02, FB5202 thermocouple converter
6A	LB6*10, FB6210 digital output	54	LB5*04, FB5204 RTD converter
...	...	55	LB5*05, FB5205 thermocouple converter
6F	LB6*15, FB6215 digital output	56	LB5*06, FB5206 voltage converter
Special modules			
74	LB7*04, FB7*04 universal input/output (HART)		
00	Empty slot		

9.5.7 Advanced Diagnostics

The **Advanced diagnostics** entry contains status and diagnostic information based on the version.

9.6 "PB Diag. (std.)" Tab

The **PB Diag (std.)** tab displays the PROFIBUS standard diagnostics.

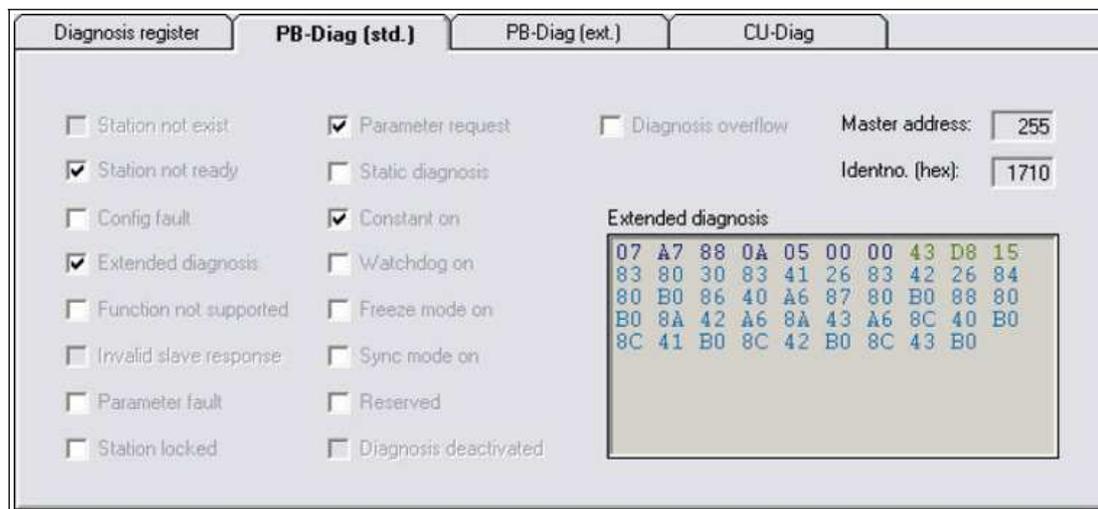


Figure 9.11 **PB Diag. (Hrs)** tab

The PROFIBUS standard diagnostics are generated partly by the master and partly by the slave. The **PB Diag (std.)** tab contains diagnostic data that is read from the slave only. The diagnostic data that the master sets by default appears as a grayed out check box to display the bit structure of the overall diagnostics. The current states of the master diagnostic bits can only be obtained from the master.

PROFIBUS standard diagnostics octet 1

PROFIBUS standard diagnostics octet 1		
Bit	Diagnostic message	Note/possible cause
0	Station does not exist	Set by the master only. Possible cause: physical bus error (e.g., interruption or short circuit), incorrect slave PROFIBUS address
1	Station not ready	Communication between master and slave is possible, but configuration or parameter faults are present that prevent data exchange (see bit 2 and bit 6).
2	Configuration error	The master and slave configurations do not match. The configured input and output data and the DP configuration string must match in the master and slave.
3	External diagnostics	The slave contains manufacturer-specific diagnostic data.
4	Function not supported	The slave cannot follow a function call.
5	Incorrect slave response	Set by the master if the slave does not transmit the expected response.
6	Parameter fault	Transmitted parameters are incorrect; the slave cannot be switched over to data exchange. Possible cause: transmitted PROFIBUS ID does not match the device.
7	Station blocked/locked	This bit shows that the slave has received correct configuration and parameter data from a master and makes the process data available solely to this master when in <code>DataExchange</code> mode. See the Master address field for the corresponding master address.

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PROFIBUS standard diagnostics octet 2

PROFIBUS standard diagnostics octet 2		
Bit	Diagnostic message	Note/possible cause
0	Parameter request	The slave informs the master that the slave requires new parameter data.
1	Statistical diagnostics	As soon as the slave sets this bit, the master only requests diagnostic data and not current process data. Communication remains in the <code>DataExchange</code> state and can therefore transmit process data as soon as the bit is cleared.
2	Constant set	
3	Watchdog function on	The watchdog function is used to monitor communication. We recommend that the watchdog function is always switched on. The function allows the slave to monitor the master and respond to communication problems such as a bus failure where necessary. The slave can activate the substitute value strategy stored for the I/O modules as a response to communication problems.
4	FREEZE mode on	The slave works in FREEZE mode see chapter 9.5.3
5	SYNC mode on	The slave works in SYNC mode see chapter 9.5.3
6	Reserved	
7	Diagnostics off	Diagnostics are not used by the master.

PROFIBUS standard diagnostics octet 3

PROFIBUS standard diagnostics octet 3		
Bit	Diagnostic message	Note/possible cause
0 ... 6	Reserved	
7	Diagnostic data overflow	The slave sets this bit if more diagnostic data exists than can be transmitted, e.g., if too many line faults occur during commissioning.

Following the PROFIBUS standard diagnostic octets 1 ... 3 are two octets for the master address (octets 4 and 5) and two octets for the PROFIBUS ID (octets 6 and 7). The values of these octets are displayed in the **Master address** and **Identno. (hex)** fields.

The value under **Master address** shows which master has blocked the slave (exclusive `DataExchange` access).

Identno. (hex) shows the PROFIBUS slave ID. For correct data exchange, the slave must be created in the master with its PROFIBUS ID number. On systems where the DTM can be integrated into the master configuration interface, the PROFIBUS ID number is entered automatically. If this is not possible, the correct GSD/GSE file must be integrated in the master.

The remaining octets in the **Advanced Diagnostics** field (from octet 8 onwards) display the manufacturer-specific diagnostic data for advanced diagnostics. See chapter 9.7

9.7 "PB Diag (Ext.)" Tab

The **PB Diag (ext.)** tab displays the extended PROFIBUS diagnostic octets.

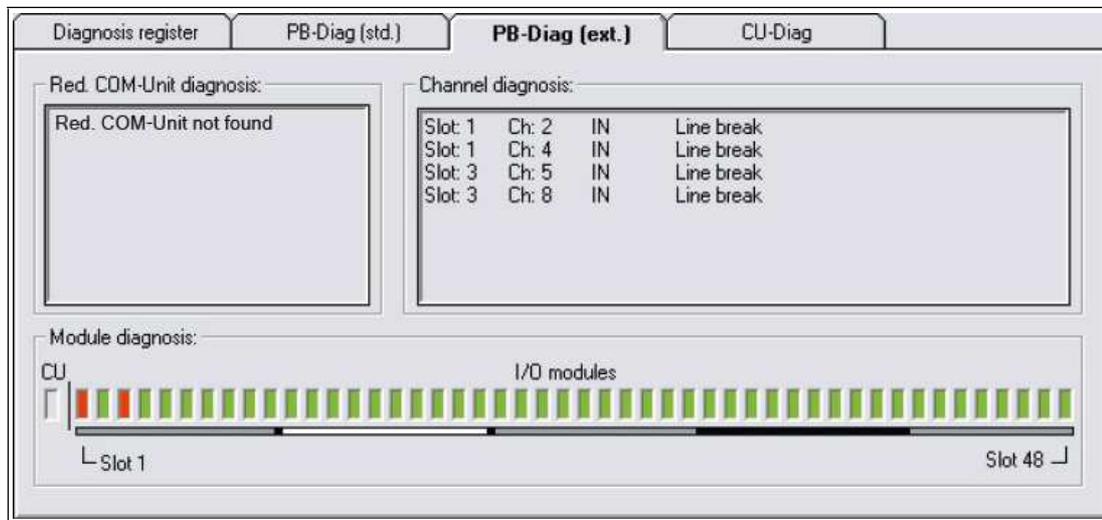


Figure 9.12 **PB Diag. (Ext.)** tab

The **PB- Diag (Ext.)** tab is divided into three areas, which are described in the following section.

Redundancy Com Unit Diagnostics

This area displays a text message evaluating the first two PROFIBUS standard diagnostic octets of the redundancy com unit (partner com unit). These octets are transferred during the device-specific diagnostics. See chapter 9.5.2

In contrast to the PROFIBUS standard diagnostics, the com unit sets the **Redundancy Com Unit Not Found** bit if there is no internal communication connection to the redundancy com unit (equivalent to the message **Station Does Not Exist** set by the master).

All other diagnostic messages correspond to the defined PROFIBUS standard diagnostics. See chapter 9.6

Channel Diagnostics

This area shows the channel-specific diagnostics. See chapter 9.5.2

The slot number, channel number, channel type details, and the cause of the error are displayed for every message.

If more diagnostic information is present than can be transferred, the message **Channel Diagnostic Overflow** appears and the text color changes from black to red.

ID/Module Diagnostics

This area shows the module-specific diagnostics. See chapter 9.5.2

A rectangular indicator is assigned to each slot on the remote I/O station. As soon as diagnostics are available for a slot, the color of the respective rectangle changes from green to red. To display the slot number, position the cursor over the relevant rectangle.

9.8.1 "Com Unit Status Register" Area

ComUnit-Status:		CU-S	GW-S	Cycle	DP-S	Ind.-C.	Error-C.	Diag 1	Diag 2	CRC	FW	Log.
My		E682	C473	DDEA	0000	20	00	0A	05	032013F4	0624	
Partner		xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	

Figure 9.14 Com Unit Status area

CU-S (com unit status) field

The box contains the global status register for the com unit. See chapter 9.4

GW-S (gateway status) field

The gateway status provides information on internal and external communication. The basic data in this field is displayed in the **GW status** area in encoded format. See chapter 9.8.2

Cycle (program cycle counter) field

This field indicates the status of the program cycle counter for the relevant com unit. The value on the counter is not relevant, but the counter must be moving continuously. A moving counter indicates that the program is running.

DP-S field (DP status)

Information relating to PROFIBUS communication is displayed here. The data in this field is displayed in the DP status area in partially encoded format. See chapter 9.8.3

IND C. (indication counter) field

The indication counter monitors PROFIBUS communication and enables the early detection of failures. The respective counter readings are displayed in the **IND. C** fields.

In redundant systems, the counter values must increase uniformly. If one counter starts to run slower than the other or stops running altogether, a PROFIBUS communication failure has occurred on the com unit concerned. If both counter values increase slowly or inconsistently, this does not mean that the process data transmission has failed completely. It is more an indication that a minor communication error has occurred.

In non-redundant systems, a counter that increases uniformly indicates that PROFIBUS communication is working properly.

Error C (error counter) field

The error counter is a component of the additional PROFIBUS monitoring system incorporating the indication counter and draws attention to potential faults by increasing the counter reading. The additional monitoring function is based on estimates relating to the reliability of future PROFIBUS communication. A prognosis resulting in a **fault** must be confirmed several times in succession by the value increasing on the error counter before a preventative redundancy switchover is initiated. The feasibility of switchover is checked first of all. As faults indicated by the error counter are based on prognosis, an increase in the counter value and a switchover to preventative redundancy are not indications that an error has occurred. The error counter is more a tool for increasing availability.

Continuous switching operations by the com units are not permitted and should be investigated.

Diag 1 and Diag 2 (DP diagnosis) fields

The **Diag 1** and **Diag 2** fields display the first two PROFIBUS standard diagnostic octets. A graphic representation of the PROFIBUS standard diagnostic octets is displayed on the **PB Diag (std.)** tab. However, displaying the **PB Diag (std.)** tab is only supported by com units with firmware version 6.19 or higher.

CRC (checksum calculation) field

The result of the checksum calculation is entered here. The checksum calculation ensures that the required data records are stored in the com unit correctly (parameter and configuration data). If the checksums of the com unit and the redundant com unit are identical, the two com units have been correctly synchronized with each other. Identical values mean that the data records are the same. The checksum changes every time a parameter change is successfully transferred, and the modification process is documented as a result.

FW (firmware) field

The field contains the firmware version of the com unit. In redundant systems, make sure that the firmware version of the com unit and redundant com unit is always the same.

9.8.2 "GW Status" Area



Figure 9.15 GW status area

Active check box (active com unit)

Only one com unit may be active in the remote I/O station at any one time. **Active** indicates which of the two com units is active. In the above illustration, the com unit in the **My** column is active.

Prim (primary com unit) check box

The **Prim** check box allows you to assign data to com unit hardware. Each redundant station has a primary and a secondary com unit slot. In the LB system, the primary slot is the first com unit slot. In the FB system, the primary com unit slot is the com unit slot in the base unit. If, for example, **Prim** is activated in the **My** area, this means that the data in the **My** area represents the com unit in the primary slot.

Fatal (serious error) check box

If the com unit detects a fatal error, this is indicated accordingly by the **Fatal** check box. The com units use error handling routines that are capable of clearing error states. If a fatal error is permanently displayed, or if a fatal error occurs repeatedly, the relevant com unit should be replaced.

Inconsist. (inconsistency) check box

The **Inconsist.** box is used to draw attention to system states that could prevent a redundant remote I/O station from operating correctly. The check boxes are activated in the following situations.

- If the com units have different firmware versions
- If the parameter data of the com units is different
- If both com units are active at the same time
- If both com units are passive at the same time
- If both com units indicate that they are the primary com unit
- If both com units indicate that they are the secondary com unit
- If both com units function as the master on the internal bus
- If both com units function as the slave on the internal bus

Note that short-term inconsistencies are permitted in the startup phase or a transitional phase.

NewPrm (new parameter) check box

This check box is active if the com unit has new parameters. This state is regarded as normal unless it does not clear after a parameterization process.

IL status (internal link status) check box

This box represents the communication path between the two com units. The status can be **Master, Slave, Alone, or Unknown**.

In redundant systems, one com unit must have **Master** status and the other **Slave** status. All other configurations are not allowed. If the **Alone** status is displayed, then the corresponding com unit cannot find its partner, e.g., if the external connection between the two com units is faulty in FB systems.

In non-redundant systems, the status **Alone** is the correct operating status. Here any deviation from the **Alone** status is classed as an error.

FB status (PROFIBUS status) field

This field indicates the status of the PROFIBUS. The status can be

- **Offline:** no PROFIBUS connection available
- **NotReady:** PROFIBUS connection available, but data exchange not possible
- **BadComm:** data exchange possible but malfunctioning
- **Online:** data exchange OK

The status of this field should always be **Online**. If another status is displayed, check the PROFIBUS communication.

Exception: In the case of line-redundant systems, the passive com unit only has read access to the bus and therefore only has limited abilities to maintain communication if a fault occurs. The consequence of this is that the passive com unit briefly loses **Online** status. However, the system automatically sets the passive com unit back to **Online** status after a short time.

LBStatus (internal system bus) field

LBStatus represents the internal system bus between the primary com unit, the secondary com unit and the I/O modules. In addition to start statuses, which are not dealt with in detail here, the **LB status** can display the following statuses.

- **Single:** OK in single systems
- **Alone:** com unit cannot find partner
- **Active:** com unit has bus read-write access
- **Passive:** com unit only has bus read access
- **NoSlots:** no I/O modules can be addressed

If other statuses are displayed permanently, then an error state exists. Note that for proper redundant operation, one com unit must be active and the other must be passive.

RedStatus field

This field contains status details relating to parameter and configuration changes. As part of a change with or without hot configuration in run (HCiR) functionality, the system runs through several individual statuses that will not be described here in detail. The field must show **OK** in normal operation.

If **HCiR** is displayed, a new data record is written to the corresponding com unit, but not yet put into operation by the master. This means that the old data record has not yet been processed and the HCiR process is not yet complete. The **HCiR** status is indicated by the flashing of the green LED on the com unit.

9.8.3 "DP status" area



Figure 9.16 DP status area

The most important information in the **DP status** area is visualized by enabling the **Baud rate** and **DataExch** check boxes. All other information is not suited to user diagnostics and will not be explained here.

Baud rate check box

If **Baud rate** is enabled, the baud rate has been found. If not, a baud rate has not been found.

DataExch check box

If **DataExch** is enabled, process data is transferred. If not, process data is not transferred.

9.9 "Module Status" Tab



Note!

The **Module status** tab is available from DTM version 7.3. The status of the power supplies in the **Power supplies** area is displayed in DTM version 7.5 and higher and depends on the com unit's firmware version.

The **Module status** tab provides an overview of the status of the I/O modules and the power supplies in the overall remote I/O station. Each of the fields in the status/simulation views represents a slot and therefore an I/O module or power supply on the remote I/O station.

The status of the power supplies is only displayed if the firmware of the com unit has a power supply diagnostic function. The power supplies used must also support this diagnostic function.

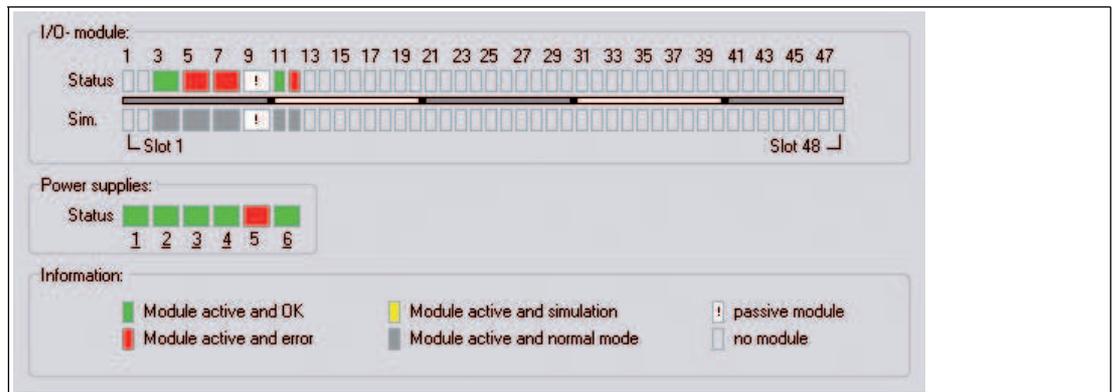


Figure 9.17 Module status tab

The status information is explained on the tab. The I/O module types (display of single/dual width module) and corresponding status areas are requested during each update cycle.

The status of the monitored power supplies is displayed in the **Power Supplies** area. An underlined power supply number indicates that a power supply is available at the relevant position. Power supply monitoring can be activated and deactivated in the com unit device data.



Accessing Information About an I/O Module

You have the option of viewing information about a specific I/O module directly on the **Module status** tab. An active connection to the I/O module may be required, depending on the FDT base application.

1. Right-click on an I/O module in the overview.
2. Access the required information via the context menu.

9.10 PACTware™ Device State Manager

Version 4 and above of PACTware™ includes the **Device State Manager** and **Device State View**. These add-ins enable a cross-device diagnosis based on the NAMUR recommendation NE 107.



Note!

The **Device State Manager** and **Device State View** add-ins may be deactivated. To activate add-ins, select **Extras > Add-ins** in the menu.



Note!

Detailed information on the add-ins described here can be found in the PACTware™ documentation.



Open the Device State Manager window

1. In the project view, right-click on either **HOST PC**, a CommDTM or a com unit.
2. Select **Device State Manager** from the context menu.

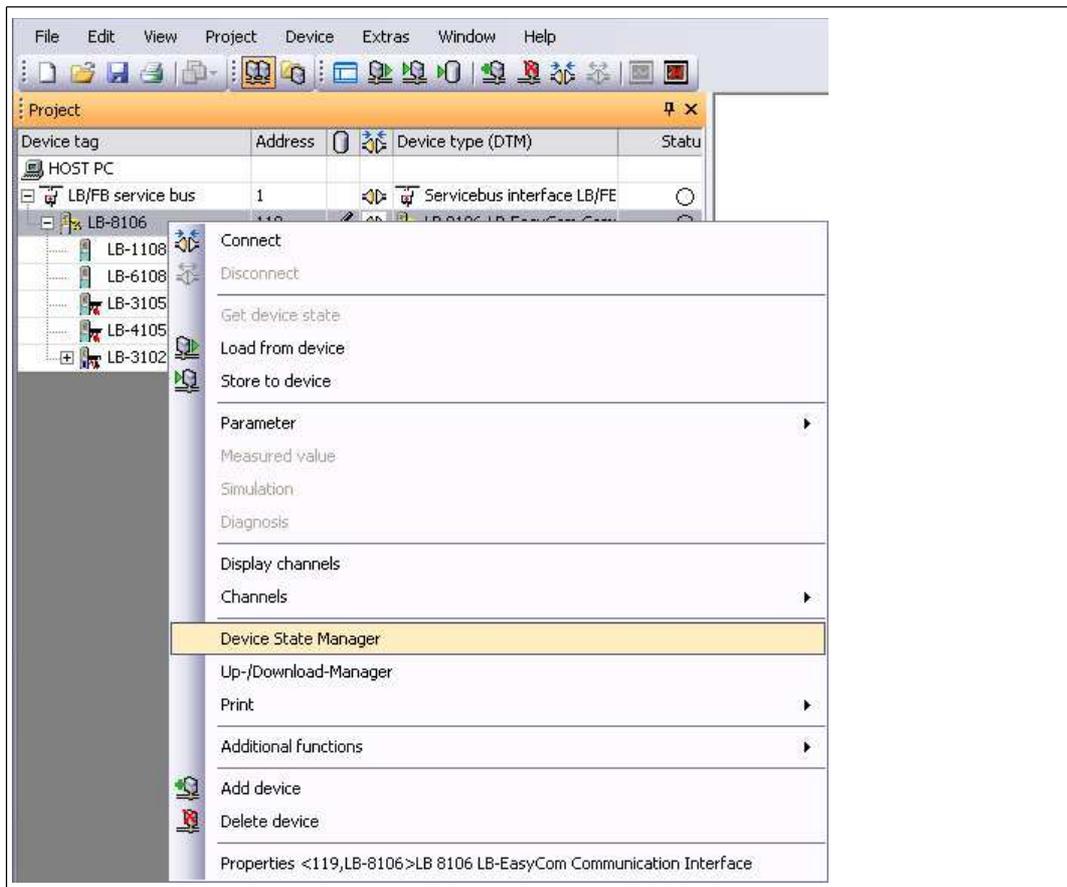


Figure 9.18 Activate Device State Manager

↳ The **Device State Manager** window appears.

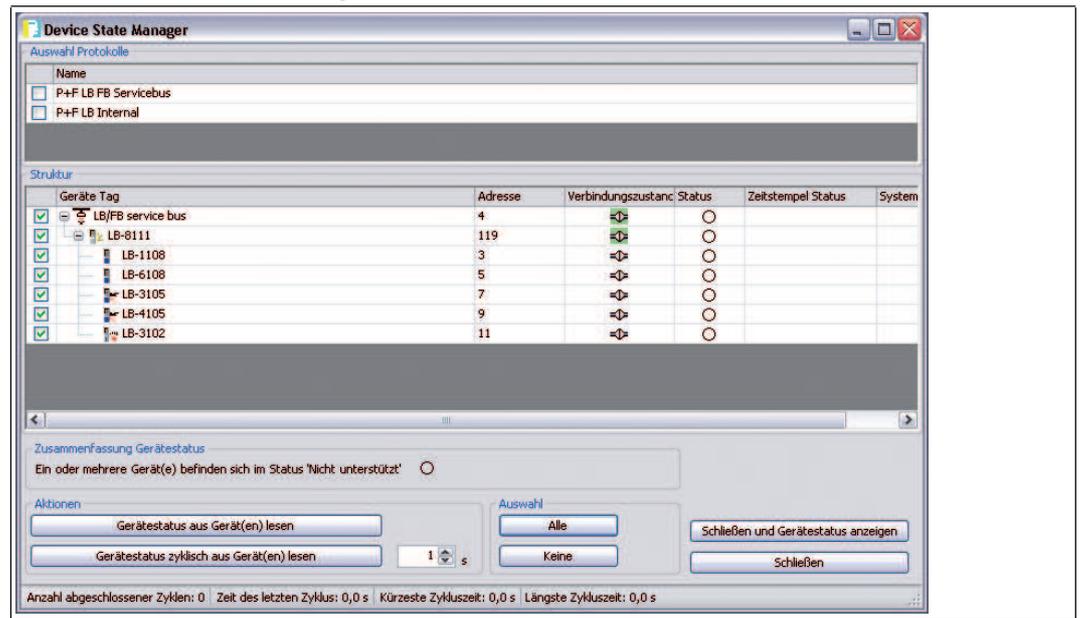


Figure 9.19 Device State Manager window

3. Select the devices that are to be monitored. Use either the check boxes or the buttons in the **Select** area.
4. To read the device status once or at regular intervals, select one of the buttons in the **Actions** area.

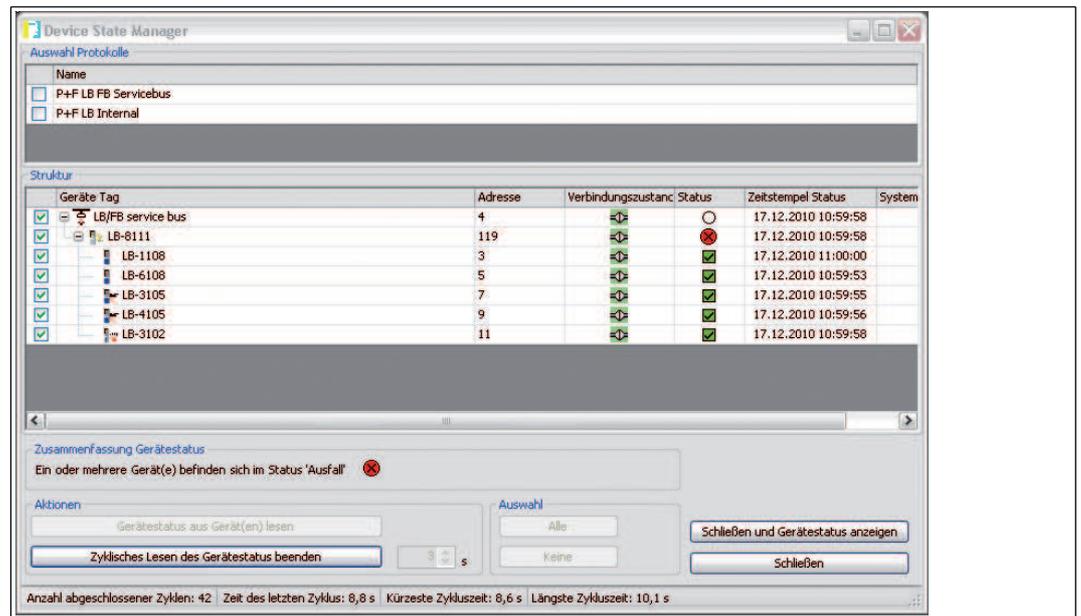


Figure 9.20 Read the device status

↳ A connection to the devices is established and the device status read.

5. Select **Close and Show Device Status**.

↳ The **Device Status** window is displayed. The **Device Status** window contains a list of available status reports. You can filter status reports according to certain criteria and save or delete the list.

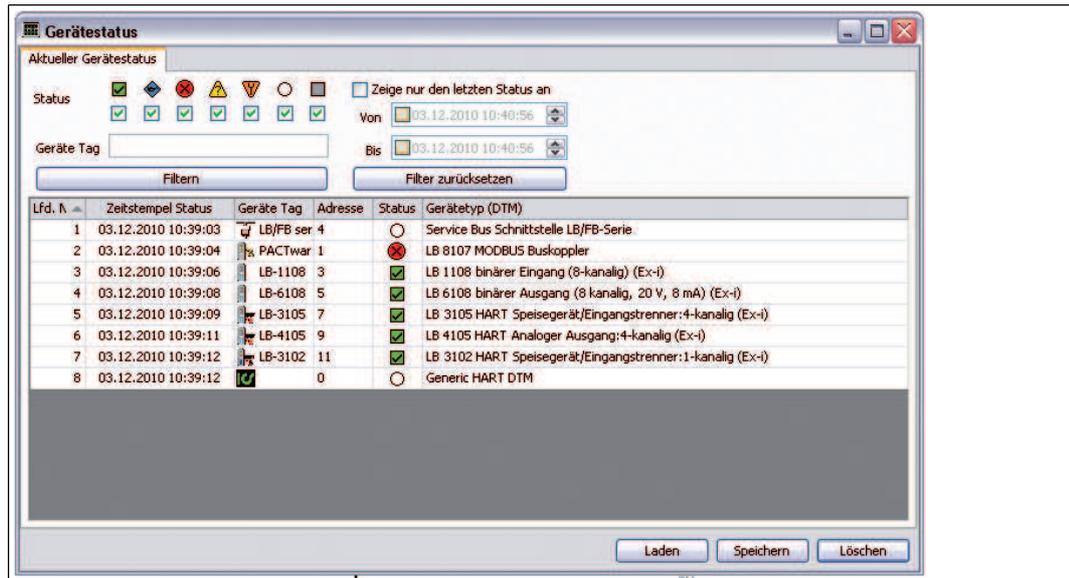


Figure 9.21 Device status window



Note!

Different views for status information

Alternatively, you can open the **Device Status** window via **View > Device Status**. The status symbols are displayed in the project view and the system view.

General meaning of the status symbols in accordance with NAMUR recommendation NE107

Symbol	Meaning
Green checkmark	Active diagnostics
Grey square	Passive diagnostics
Red circle with cross	Failure
Yellow triangle with cross	Function check
Yellow triangle with exclamation mark	Out of specification
Blue diamond	Maintenance required
White circle	Device status not supported

Specific meaning of the status symbols for remote I/O components

Component	Symbol	Possible meanings
I/O module		Error-free
		Diagnostics switched off (passive I/O module)
		Line fault detection (lead breakage or short circuit)
		I/O module missing
		Incorrect I/O module configured
		Simulation active
		–
		–
	Offline	
Com unit		Error-free
		–
		Field bus communication: no field bus available (for diagnostics scan via service bus only)
		Memory error: PIC/RAM/FLASH
		CPU/PIC fault
		Parameter or arithmetic error
		Redundancy link not available (LB; fault in internal redundancy link)
		–
		Fieldbus communication: fieldbus available, but no data exchange (with PROFIBUS com units only)
		Command error
		Fault in an I/O module
		Fault in power supply
		Redundancy com unit not available
Redundancy link not available (LB; fault in external redundancy link, possibly not connected)		
	Offline	

10 Troubleshooting



Danger!

Risk of explosion

When work is performed on the remote I/O unit in hazardous areas, there is a risk of explosion from spark formation.

Before starting any work on the remote I/O unit, familiarize yourself with the instruction manuals for the components and their relevant certificates.

10.1 Communications error

If there is a communications error, work through the following checklist and take any relevant action.

Fault	Action(s)
Error when communicating with the process control system	<ul style="list-style-type: none"> ■ Check that the cables are connected. ■ In the configuration software, check that the selected address is the same as the remote I/O station address. ■ Check whether the terminator has been activated. The PROFIBUS must have exactly 2 terminators per segment, one at the start and one at the end. ■ Check that the bus stations are positioned in linear form and without branches. A star-shaped layout is not permitted. ■ Check that the DP configuration strings of the master and slave are identical. The slave addresses of the master and slave on the fieldbus must be identical. ■ Check that the correct GSD/GSE file is being used.
Communication error on the service bus	<ul style="list-style-type: none"> ■ Check that the cables are connected. ■ In the configuration software, check that the selected address is the same as the remote I/O station address. ■ Check whether the terminator has been activated. The service bus must have exactly 2 terminators per segment, one at the start and one at the end. ■ Check that the bus stations are positioned in linear form and without branches. A star-shaped layout is not permitted. ■ Check that the correct interface is preset in the configuration software.
A new remote I/O station on a bus will not work if other remote I/O stations on the bus are already operating.	<ul style="list-style-type: none"> ■ Check that the terminators are still on the bus start and end after the extension.
The software cannot locate a com unit when establishing the connection	<ul style="list-style-type: none"> ■ Check that the yellow LEDs on the com unit are on while the connection is being established. ■ Check that the bus address is within the selected range. If necessary, increase the search range. ■ Check that the com unit is plugged in properly.

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Fault	Action(s)
Reading out the com unit results in an unexpected configuration	<ul style="list-style-type: none"> ■ The required configuration was not saved in the com unit. Select the menu item Store to device to save the configuration in the com unit.
Communication error on the service bus after successfully establishing a connection	<ul style="list-style-type: none"> ■ Check that the service bus is galvanically isolated. ■ If you are using a laptop, operate the laptop using a battery. ■ Use a standard interface converter (RS232-RS485 converter or USB RS485 converter) with automatic baud rate and transmission direction detection.
Data loaded from the remote I/O station is not complete	<ul style="list-style-type: none"> ■ Check that all data was first saved in the remote I/O station.
No HART communication	<ul style="list-style-type: none"> ■ Check that the I/O module in use supports the HART protocol. ■ Ensure that the HART field devices are operating within the permitted operating range of 4 mA ... 20 mA. ■ Check that the correct HART device address was used. ■ Check that the HART software has a DTM for the field device being used. If this is not the case, only basic HART functions will be available.

Fault	Action(s)
FB extension unit not working.	<ul style="list-style-type: none"> ■ Check that the wires on the base unit and extension unit are connected correctly. ■ On redundant systems, check that there is a connection between the extension unit and the redundancy unit.

10.2 Redundancy Faults

If there is a redundancy fault, work through the following checklist and take any relevant action.

Fault	Action(s)
Continuous redundancy switchover	<ul style="list-style-type: none"> ■ Check that the correct type of redundancy is selected (line redundancy or application redundancy). ■ Check that the switchover time been set to a sufficiently long period in the com unit. ■ In FB systems, check whether there is a front connection between the com units. ■ Check that the process control system is configured for this type of redundancy.
No redundancy switchover when a com unit is removed	<ul style="list-style-type: none"> ■ Check that redundancy has been configured at the com unit. ■ Check that there is an electrical connection between the two com units. If not, connect them.
Modules are continuously changing the data	<ul style="list-style-type: none"> ■ Check whether one of the com units has not been configured for redundancy mode. If this is the case, both com units actively try to access the I/O modules and interfere with each other.

10.3 Faults Indicated by LEDs

Fault elimination is supported by a series of LEDs on the com unit, the I/O modules, and the power supply. If the LEDs indicate an error, work through the following checklist and take any relevant action.

Depending on the load, the output circuit may show a lead breakage due to overload. With solenoid valves, this can result in their input resistance being outside the lead breakage detection range. In such cases, connect a high value resistor in parallel to improve the function.

If short-circuit detection is triggered with booster valves, the charging capacitor may be the cause of the error. If this is the case, connecting a small resistor in series may correct this behavior. If necessary, deactivate line fault detection.

LEDs on com units	
Fault	Action(s)
Red LED (2) on com unit is on	Collective error: there is a problem with at least one component (I/O module, power supply, or com unit). <ul style="list-style-type: none"> ■ Check all slots for I/O modules with red LEDs on. All red LEDs must be turned off, otherwise the com unit will continue to report an error. ■ Make sure that all configured components are plugged in and ready for operation (green LED on). ■ Check the global status register in the com unit measured value display to determine the cause of the collective error message.
Yellow LED (5) on the com unit is flashing without the bus being connected	<ul style="list-style-type: none"> ■ The com unit is ready for operation and working with the I/O modules.
Yellow LED (5) on the com unit is flashing at long intervals	<ul style="list-style-type: none"> ■ The com unit is ready for operation and working with the I/O modules. At least one I/O module is in simulation mode.
Fieldbus	
Yellow LEDs (3, 6) on the com unit are showing no activity while communication is being established (LEDs = off)	<ul style="list-style-type: none"> ■ Check that the physical connection between the configuration tool and the remote I/O station was established correctly.
Service bus	
Yellow LEDs (4, 7) on the com unit are flashing while communication is being established via the service bus	<ul style="list-style-type: none"> ■ Check that the configuration cable and the adapter are connected properly.

LEDs on I/O modules and power supplies	
Fault	Action(s)
Red LED on an I/O module is on	<ul style="list-style-type: none"> ■ Check that the field wiring is connected correctly. ■ Check that the sensor is working properly. ■ Check that the field devices are working properly.
Red LED on an I/O module is flashing	<p>No communication between the I/O module and the com unit.</p> <ul style="list-style-type: none"> ■ Check that the I/O module is plugged into the backplane properly. ■ Make sure that the connector pins are not bent. ■ Plug a different I/O module into this slot. If the new I/O module also does not work (red LED flashing), the fault may lie with the backplane.
Yellow LEDs on I/O modules are on	<ul style="list-style-type: none"> ■ For digital inputs, the yellow LEDs provide various status indicators. ■ For transmitter power supplies, the yellow LED indicates that operation is outside the normal range.
Green LEDs on all I/O modules are off	<ul style="list-style-type: none"> ■ Check that the power supply is connected to the backplane correctly. ■ Check that the power supply is working and is plugged into the backplane properly.
Green LED on one I/O module is off	<ul style="list-style-type: none"> ■ Check that the I/O module is plugged into the backplane properly. ■ If necessary, replace the I/O module. ■ If the problem persists, check that the backplane is working correctly.
Green LED on power supply is off	<ul style="list-style-type: none"> ■ Check that the correct voltage is connected to the power supply unit. ■ Check that the power supply is plugged into the backplane correctly and that it is making contact with the backplane. ■ Check the supply voltage. Under maximum load, the 24 VDC voltage must not drop below 20 V including any ripple voltage. ■ The fuse may have blown. FB power supplies do not contain any replaceable fuses and must be replaced with a new FB power supply.

10.4 Signal Fault

Deactivated I/O Modules

Deactivated I/O modules are often used for subsequent extensions. Before deactivating the I/O module, switch off its line fault detection. This prevents the I/O module from triggering an alarm if the com unit launches a query to verify whether an I/O module is installed in that slot.

Fault	Action(s)
No signal change when the parameters are changed	<ul style="list-style-type: none"> ■ Check whether the I/O module is in operation. ■ Check that the change in the Remote I/O station has been saved. ■ Download the parameterization to determine the current parameterization of the I/O module. ■ PROFIBUS com unit: check whether Hot Configuration in Run (HCiR) is active. If yes, the new setting will only be active after a HCiR switchover in the master.
Faulty signal	<ul style="list-style-type: none"> ■ Check if there is a short circuit or lead breakage within the circuit. ■ Check that the field devices and sensors are working properly. ■ If necessary, replace the I/O module. ■ Check the signal path to the I/O module.
All signals for a station are faulty	<ul style="list-style-type: none"> ■ Check that the power supply is working properly. ■ Check the bus connection. ■ Check the bus communication. ■ Use a bus monitor.
Output module switches to substitute values	<ul style="list-style-type: none"> ■ Check the settings for the watchdog on the com unit. The duration for the transition to replacement values must be longer than the duration of a bus cycle.
The output module turns off	<p>Communication with the com unit is interrupted.</p> <ul style="list-style-type: none"> ■ Check that the I/O module is plugged into the backplane properly. ■ If necessary, switch off the status bits for analog outputs.
Input module delivers no measured values sporadically	<p>Communication with the com unit is interrupted.</p> <ul style="list-style-type: none"> ■ Check that the I/O module is plugged into the backplane properly.
I/O module works fine in a certain slot but not in another	<ul style="list-style-type: none"> ■ Check that the connector is in good order on the faulty slot and that the I/O module pins are not bent. ■ If necessary, do not continue to use the slot.
Measured values occasionally incorrect	<ul style="list-style-type: none"> ■ Check whether the measured value is being distorted by external influences. ■ Check that the shielding is intact.
Signal does not change	<ul style="list-style-type: none"> ■ Check if simulation mode is activated for the channel (not for com units LB8*06 or FB8*06). ■ Check if the substitute value is active, because there is no bus communication. ■ Check if there is a line fault.

Fault	Action(s)
I/O module not issuing any diagnostic messages	<ul style="list-style-type: none"> ■ Check whether line fault detection is active. If not, activate line fault detection. ■ Check if the expected diagnostic information has been activated in the com unit (PROFIBUS com unit: additional module diagnostics).
No input/output data	<ul style="list-style-type: none"> ■ Check that the correct I/O module is connected and ready for operation. ■ Check that the analog input/output scaling is compatible with the system requirements. ■ Check that the wiring is in order.
I/O module reported to be faulty	<ul style="list-style-type: none"> ■ Check that the correct I/O module is plugged in. ■ Check that the green LED on the I/O module is lit and that the I/O module is correctly plugged in.
Module fault	<ul style="list-style-type: none"> ■ Check that the green LED on the I/O module is lit. If not, there is no contact with the backplane or the fuse is faulty. If all the I/O modules in a segment have failed, the fault is in the power supply or the backplane. ■ Using the measured values display, check the I/O module diagnostic information.

Fault	Action(s)
6/8 LB modules fail simultaneously (backplanes LB9121, LB9101).	<ul style="list-style-type: none"> ■ Check that the power supply to the segment is working correctly.

Fault	Action(s)
24 FB modules fail simultaneously.	<ul style="list-style-type: none"> ■ Check that the power supply is working perfectly. ■ Check that the extension wiring is correct and intact.

10.5 Faults and their effects

The table below shows what effect different faults will have.

Fault	Diagnostics	Effect
FB power supply failure (redundant)	<ul style="list-style-type: none"> ■ The master receives an error message in the global status register, provided this facility has been preconfigured. ■ The master also receives a redundancy error message. 	<ul style="list-style-type: none"> ■ Redundancy switchover from primary to redundant com unit.
FB power supply failure (non-redundant)	<ul style="list-style-type: none"> ■ The master receives 24 error messages in the global and module status register, provided this facility has been preconfigured. ■ The master receives 24 module-specific and channel-specific error messages if module diagnostics have been enabled. 	<ul style="list-style-type: none"> ■ 24 I/O modules are lost.

Fault	Diagnostics	Effect
Power supply failed (redundant remote I/O station)	<ul style="list-style-type: none"> ■ The master receives an error message in the global status register, provided this facility has been preconfigured (only with LB9022 and LB9024 backplanes). 	<ul style="list-style-type: none"> ■ Backplanes LB9022, LB9024, and LB9029: With 2 out of 3 redundancy when using 3 LB9006 power supplies, full functionality is retained even in the event of a power supply failure. ■ Backplanes LB9121 and LB9101: When using 2 LB9104 power supplies, 8 I/O modules fail as soon as a power supply fails. However, the com units continue to be supplied by the functioning power supply, so communication is maintained.
Power supply failed (non-redundant remote I/O station)	<ul style="list-style-type: none"> ■ The master receives 8 error messages in the global and module status register, provided this facility has been preconfigured. ■ The master receives 8 module-specific and channel-specific error messages if module diagnostics have been enabled. 	<ul style="list-style-type: none"> ■ Backplanes LB9022, LB9024, and LB9029: Only two power supplies are generally used in non-redundant use. This means that in the event of a power supply failure, the whole station may be affected (depending on the number of I/O modules being used). ■ Backplanes LB9121 and LB9101: When using 2 LB9104 power supplies, 8 modules fail as soon as a power supply fails. However, the com unit continues to be supplied by the functioning power supply, so communication is maintained.

Fault	Diagnostics	Effect
Bus communication failed	<ul style="list-style-type: none"> The master detects the failure. 	<ul style="list-style-type: none"> The outputs adopt substitute values provided this facility has been preconfigured.
Com unit or voltage failed	<ul style="list-style-type: none"> The master detects a faulty slave. 	<ul style="list-style-type: none"> The outputs have no voltage unless the system is redundant in design.
I/O module failed	<ul style="list-style-type: none"> The master receives an error message in the global and module status register, provided this facility has been preconfigured. The master receives the Module error message if module diagnostics have been activated. 	<ul style="list-style-type: none"> No signal change. The inputs adopt substitute values provided this facility has been preconfigured. The output has no voltage. In most cases the green LED is off. There are cases, however, when the green LED is on despite an error.
Incorrect I/O module	<ul style="list-style-type: none"> The master receives an error message in the global and module status register, provided this facility has been preconfigured. The master receives the Incorrect module message if module diagnostics have been activated. 	<ul style="list-style-type: none"> No signal change. The inputs adopt substitute values provided this facility has been preconfigured. The output has no voltage. The red LED in the dual width I/O module is flashing.
I/O module missing or has been removed	<ul style="list-style-type: none"> The master receives an error message in the global and module status register, provided this facility has been preconfigured. The master receives the Missing module message if module diagnostics have been activated. 	<ul style="list-style-type: none"> The input is frozen. The output has no voltage.
Module-specific errors		
Line fault in the input module	<ul style="list-style-type: none"> The master receives an error message in the global and module status register, provided this facility has been preconfigured. The master receives an Invalid data error message if module diagnostics have been activated. 	<ul style="list-style-type: none"> The red LED is on. No signal change. The inputs adopt substitute values provided this facility has been preconfigured. Temperature inputs only return to normal operation once the error has been corrected and the LFD delay has lapsed.

Fault	Diagnostics	Effect
Range overflow or underflow in I/O modules LB3101, FB3201, LB3*02, FB3*02, LB3103, FB3203, LB3104, FB3204, LB3*05, FB3*05	<ul style="list-style-type: none"> ■ The master receives an error message in the global and module status register, provided this facility has been preconfigured. ■ The master receives an Invalid data error message if module diagnostics have been activated. 	<ul style="list-style-type: none"> ■ The yellow LED is on. ■ The signal is limited to the predefined trip values.
Line fault in I/O modules LB2002, LB21*, FB22*, LB4101, FB4*01, LB4*02, FB4*02, LB6*08, FB6*08	<ul style="list-style-type: none"> ■ The master receives an error message in the global and module status register, provided this facility has been preconfigured. ■ The master receives an Invalid data error message if module diagnostics have been activated. 	<ul style="list-style-type: none"> ■ The red LED is on. ■ The output has no voltage.

PROCESS AUTOMATION – PROTECTING YOUR PROCESS



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