

MANUAL

LB Remote I/O System Hardware



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 Contents

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

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



Note!

This document does not substitute the instruction manual.



Note!

For full information on the product, refer to the instruction manual and further documentation on the Internet at www.pepperl-fuchs.com.

The documentation consists of the following parts:

- Present document
- Instruction manual
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Additional 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 Product Specifications

2.1 Prerequisites for Operating the Remote I/O Unit



Note!

Requirements for Equipment Protection Level Gc

The LB remote I/O system must only be installed and operated if installed in a surrounding enclosure

- that complies with the requirements for surrounding enclosures in accordance with IEC/EN 60079-0 and that
- is designed with IP54 protection in accordance with IEC/EN 60529.



Note!

Requirements for Non-Hazardous Areas

The LB remote I/O system must only be installed and operated if installed in a surrounding enclosure

- that complies with the requirements for surrounding enclosures in accordance with IEC/EN 60079-0 and that
- is designed with IP54 protection in accordance with IEC/EN 60529.

Alternatively, installation and operation of the system is permitted in a controlled environment where pollution degree 2 in accordance with IEC/EN 60664-1 is ensured.

2.2 Introduction

Remote I/O stations are signal modification devices that act as an interface for signals between field devices and process control systems. The individual components, i.e., the I/O modules, com units, and power supplies, are plugged into the slots on the backplane. 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.

The bus systems detailed below are supported.

Bus system	Com unit
PROFIBUS DP/DP-V1	LB8106*, LB8108*, LB8109*
MODBUS RTU	LB8107*
MODBUS TCP	LB8111*
FOUNDATION fieldbus H1	LB8110*

This manual sets out how to work with the hardware. For information on how to configure the com units and I/O modules, refer to the software manual for the relevant com unit in use.

2.3 System Components

System Overview

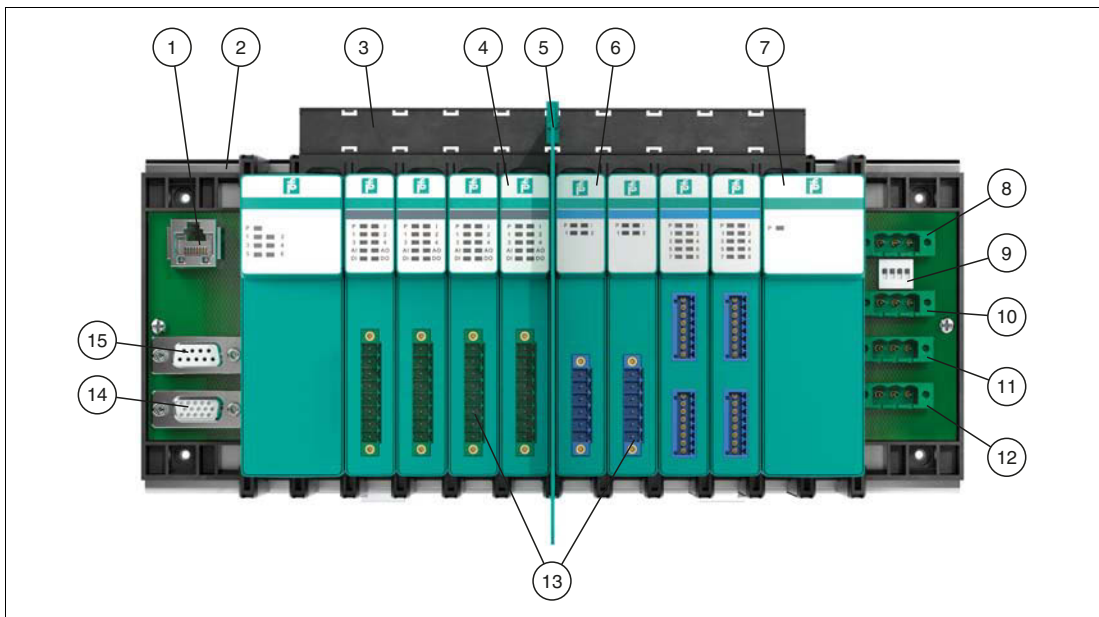


Figure 2.1 LB remote I/O system components

- 1 Fieldbus Connection
- 2 Backplane
- 3 Label carrier
- 4 I/O module
- 5 Separation wall
- 6 I/O modules with intrinsically safe circuits
- 7 Power supply
- 8 Booster connection
Connection for a 24 VDC auxiliary energy for 4-channel digital outputs LB6*10* ...
LB6*15*
- 9 Function switch
- 10 Bus-independent deactivation of the I/O modules
- 11 Redundant 24 V power supply
- 12 24 V power supply
- 13 Field connections
- 14 Extension connection
- 15 Service bus connection

2.4 Backplanes

2.4.1 Function

Backplanes are used to hold com units, power supplies, and I/O modules. Fixed slots are reserved on the backplane for com units and power supplies. Slots for I/O modules have equal status, meaning functions can be arranged side by side as required.

2.4.2 Design and Dimensions

LB9022*

- Base backplane with slots for redundant com units
- Slots for max. 22 single-width or 11 dual-width I/O modules
- Version with bus-independent deactivation of the I/O modules is available

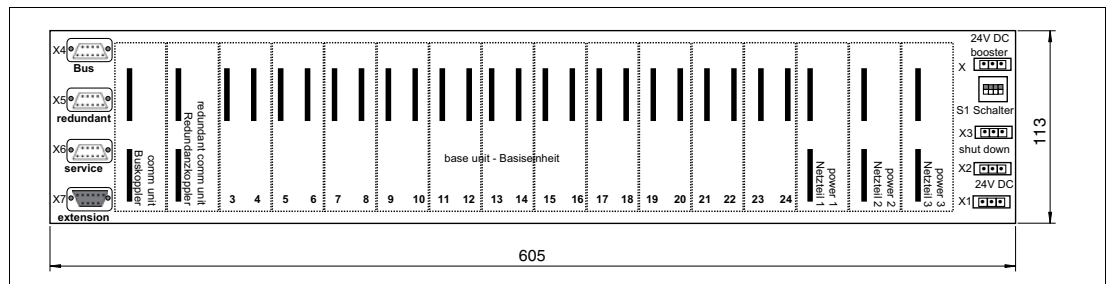


Figure 2.2 Dimensions of the LB9022*

LB9023*

- Base backplane
- Slots for max. 8 single-width or 4 dual-width I/O modules

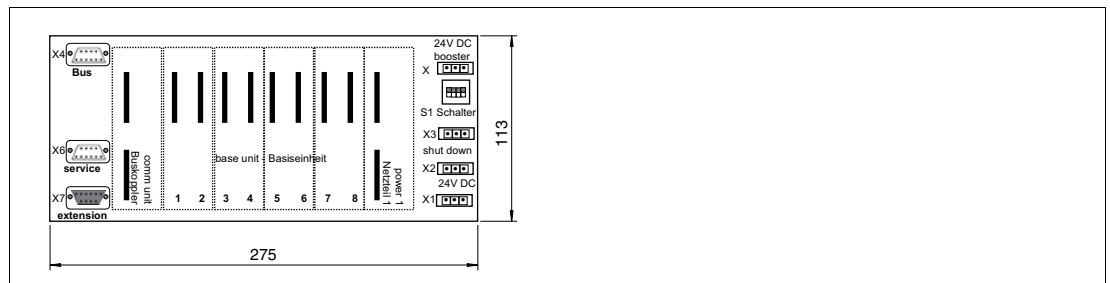


Figure 2.3 Dimensions of the LB9023*

LB9024S

- Extension backplane
- Slots for max. 24 single-width or 12 dual-width I/O modules
- Bus-independent deactivation of the I/O modules

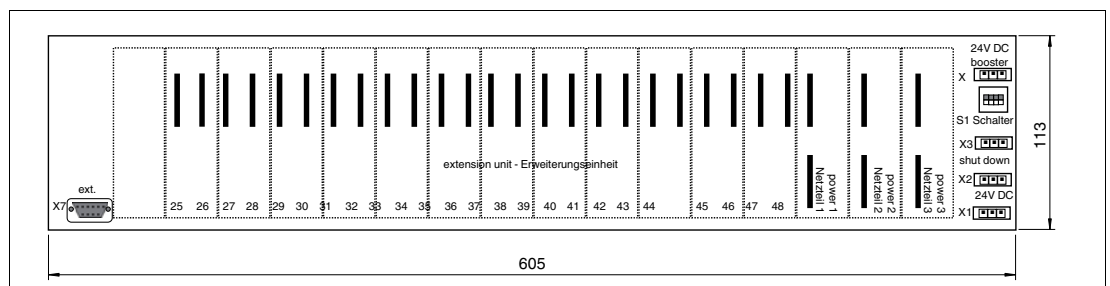


Figure 2.4 Dimensions of the LB9024S



LB9025A

- Extension backplane
- Slots for max. 8 single-width or 4 dual-width I/O modules

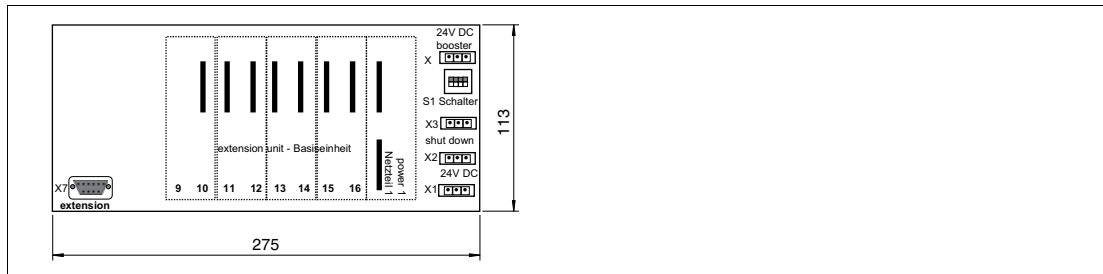


Figure 2.5 Dimensions of the LB9025A

LB9026*

- Base backplane
- Slots for max. 16 single-width or 8 dual-width I/O modules

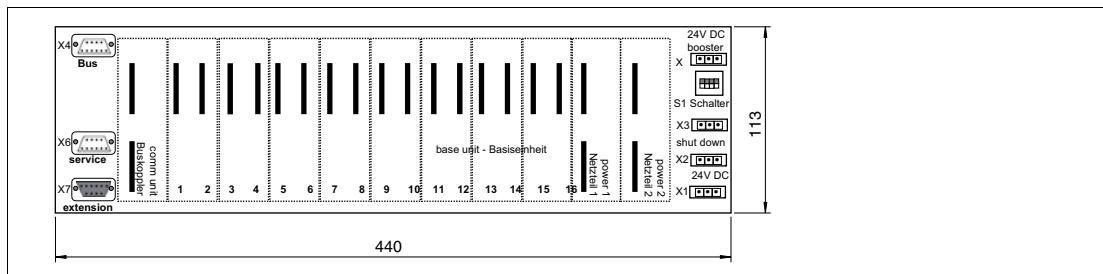


Figure 2.6 Dimensions of the LB9026*

LB9027A

- Extension backplane
- Slots for max. 16 single-width or 8 dual-width I/O modules

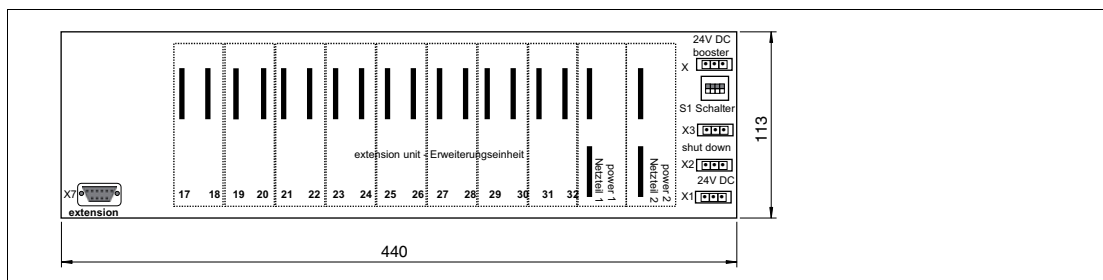


Figure 2.7 Dimensions of the LB9027A

LB9029A

- Base backplane with slots for redundant com units
- Slots for max. 12 single-width or 6 dual-width I/O modules

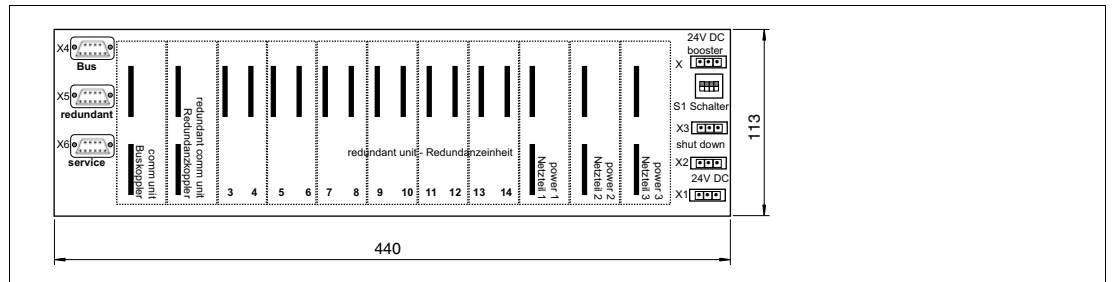


Figure 2.8 Dimensions of the LB9029A



Note!

This backplane cannot be extended.

LB9035A

- Base backplane
- Slots for 5 double-width I/O modules

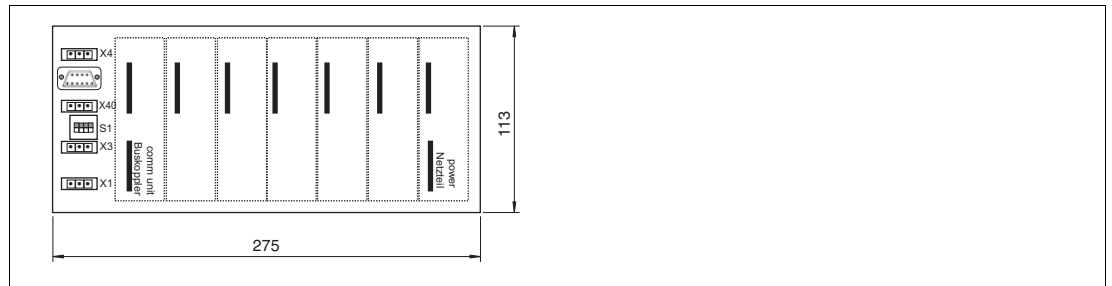


Figure 2.9 Dimensions of the LB9035A



Note!

This backplane cannot be extended.

Side view with separation wall

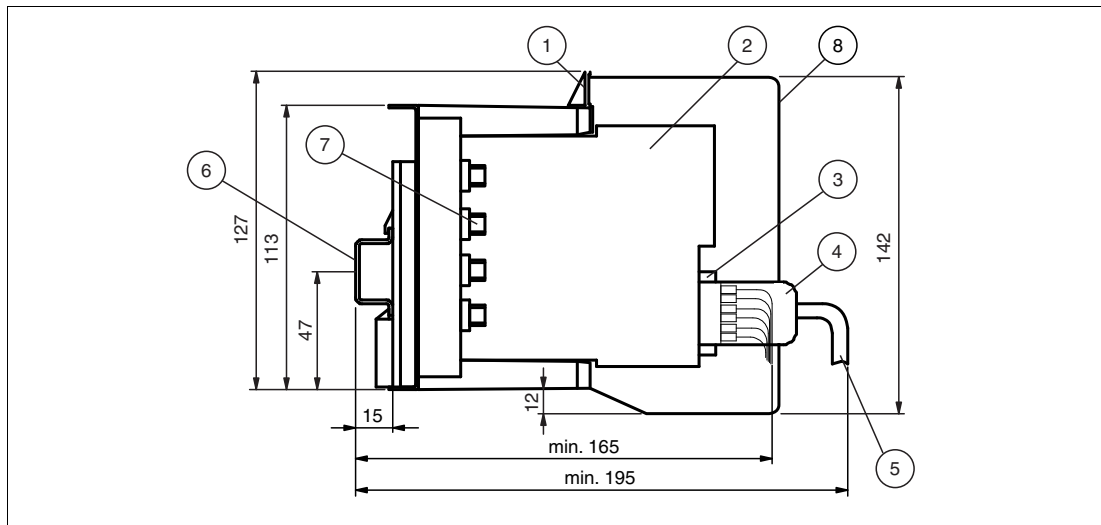


Figure 2.10 Side view of a populated backplane

- 1 Label carrier
- 2 I/O module
- 3 Front connector
- 4 Front connector with protective cover
- 5 Field cable
- 6 NS 35/15 DIN mounting rail
- 7 Fieldbus connection (number of bus connections varies depending on backplane)
- 8 Separation wall on the LB9182A

2.4.3 Backplane Combinations

Base backplanes can be extended using an extension backplane. The I/O modules on the extension backplane are controlled via the com units on the base backplane. The power supply for the additional I/O modules is provided by additional power supplies on the extension backplane.

Base backplane	Extension backplane
LB9022*	LB9024S
LB9023*	LB9025A
LB9026*	LB9027A
LB9029A	Cannot be extended
LB9035A	Cannot be extended

Other combinations are not provided.

2.4.4 Backplane and Module Compatibility

In principle, LB backplanes are compatible with all LB modules. Single-width I/O modules occupy one slot, while double-width I/O modules occupy two slots. However, please be aware of the following restrictions.

Temporary Overload of the Power Supply

To avoid an overload of the power supply in the startup phase as a result of increased startup currents, the number of certain I/O modules on the backplane is limited.

Use:

- A maximum of 11 LB3*, LB4*, and LB7* single-channel I/O modules. Each of these I/O modules consumes 9.09 % of the startup capacity.
- **Or** a maximum of 8 LB3* and LB7* four-channel I/O modules. Each of these I/O modules consumes 12.5 % of the startup capacity.

LB9035A

Only use this backplane with the following I/O modules:

- Digital input: LB1*08*
- Digital output: LB6005*, LB6006*, LB6*08*, LB6*10* ... LB6*15*
- Analog input: LB3*05*, LB5*04*, LB5*05*
- Analog output: LB4*05*

2.4.5 Scope of Delivery

Base backplanes are not delivered with any accessories.

Extension backplanes are delivered with a 1-m-long double-ended cordset (LB9140A). The double-ended cordset establishes the connection to the base backplane.

2.5 I/O Modules, Com Units, and Power Supplies

2.5.1 Function

I/O modules are signal conditioning devices. Field signals from a hazardous area are conditioned for controllers or process control systems in a safe area. The slots for the I/O modules on the backplane have equal status, meaning functions can be arranged side by side as required.

Com units form the interface between the I/O modules and the process control system. A com unit can control up to 46 I/O modules and transfer their signals across various standard buses. The com unit converts the protocol of the bus integrated in the backplane to the protocol of the higher-level bus system.

Power supplies provide power to the I/O modules and the associated com units on a backplane. The slots for com units are mechanically coded on the backplane and marked accordingly.



2.5.2 Design and Dimensions

Both single-width and dual-width modules are available. Com units and power supplies are always dual-width. I/O modules are single-width or dual-width depending on the model.

Both the I/O modules and the com units and power supplies are equipped with LEDs on the front that display the device status.

The I/O modules have connections on the front to which the relevant field devices are connected.

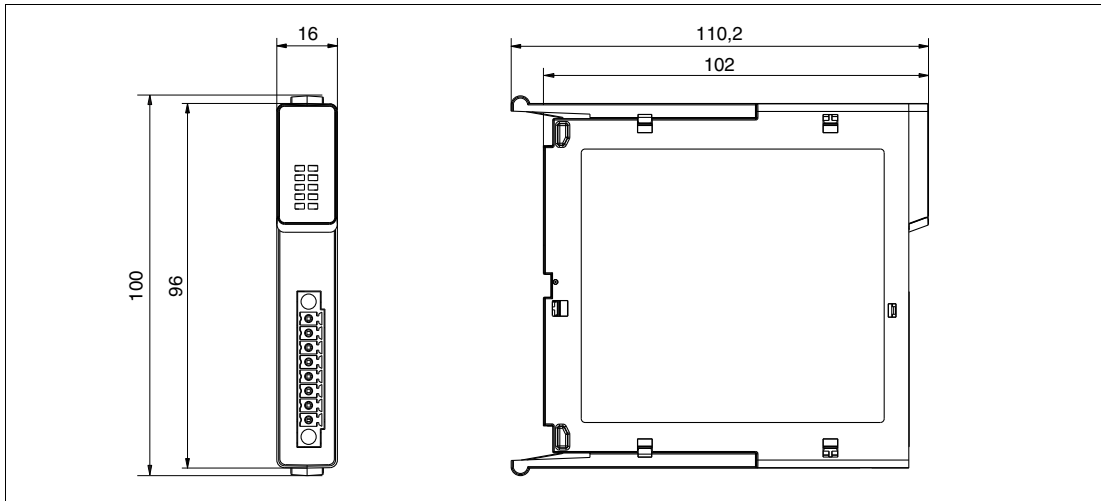


Figure 2.11 Single-width I/O module dimensions

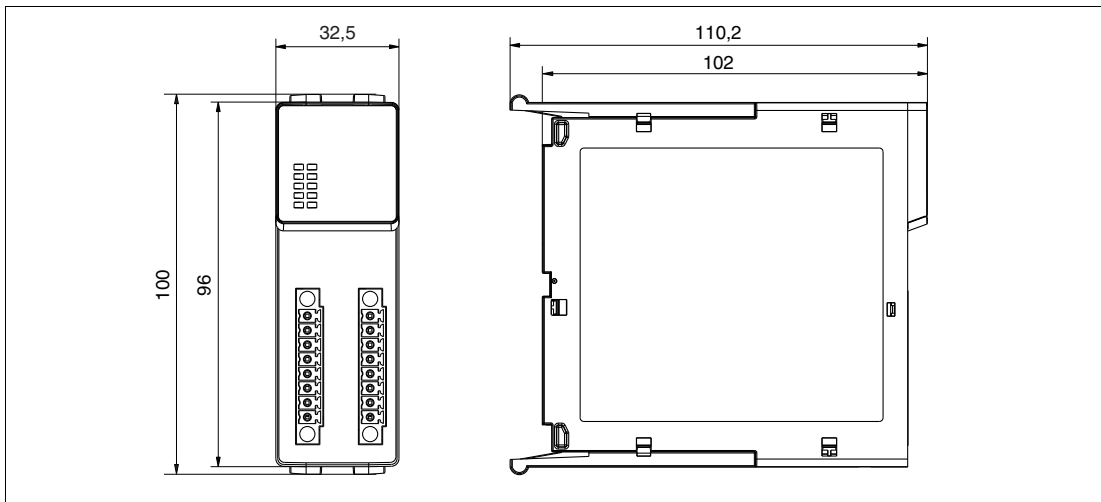


Figure 2.12 Dual-width I/O module dimensions

2.6 Accessories

2.6.1 Bus Connection

The following accessories are available for bus connections.

The service bus connection is provided via a 9-pin sub-D connector for all backplanes. The way in which the fieldbus is connected depends on the bus system.

Bus system	Fieldbus connection
PROFIBUS DP/DP-V1	9-pin sub-D connector
MODBUS RTU	
FOUNDATION fieldbus H1	
MODBUS TCP	RJ-45 socket

LB9001A

- Cable inlet at 35
- With connectible terminator
- With connection for a bus monitor or a class 2 master

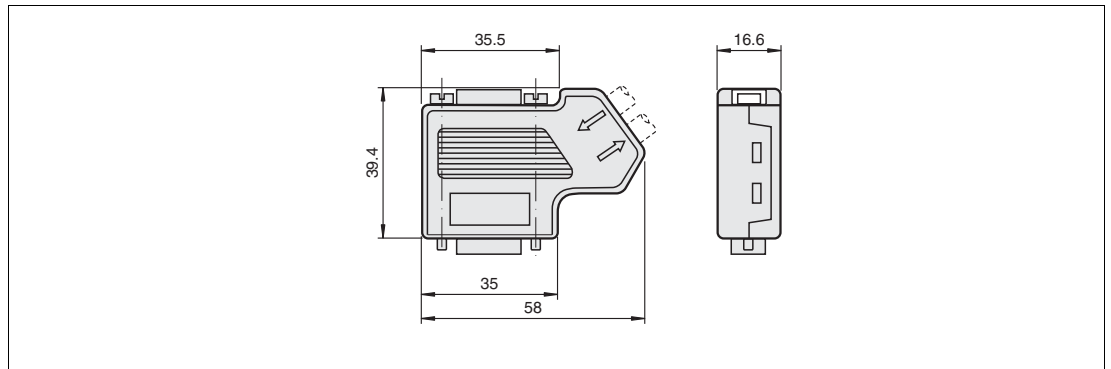


Figure 2.13 Dimensions of the LB9001A

LB9002A

- Axial cable inlet
- With connectible terminator

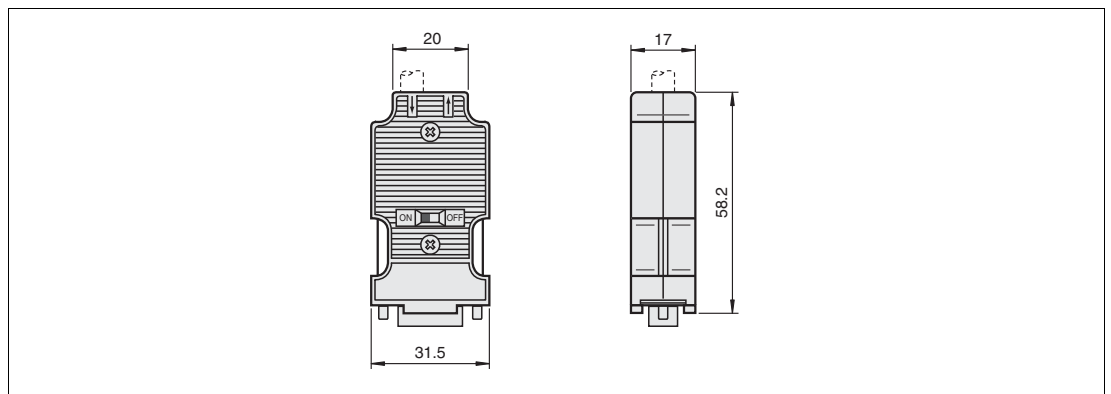


Figure 2.14 Dimensions of the LB9002A

LB9003A

- Cable inlet at 90°
- With connectible terminator
- With connection for a bus monitor or a class 2 master

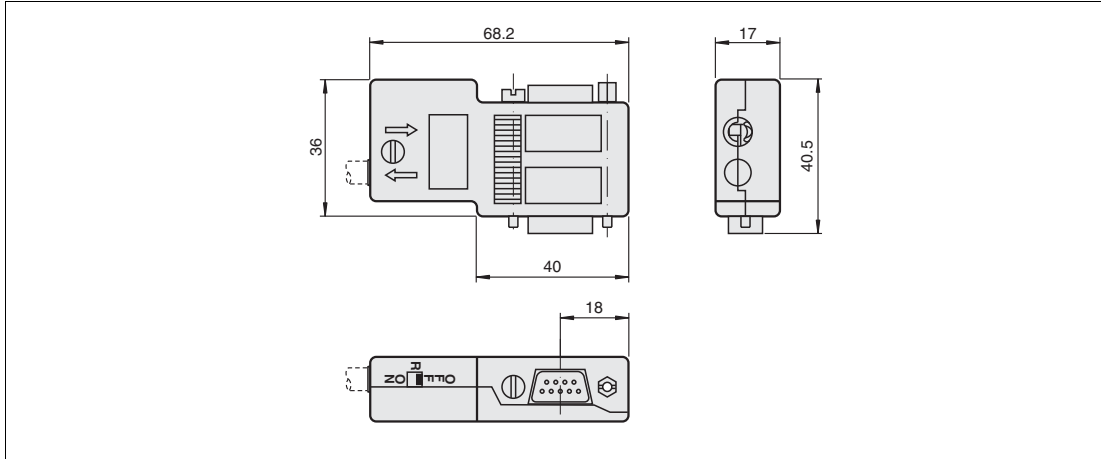


Figure 2.15 Dimensions of the LB9003A

2.6.2 Field Wiring

The following accessories are available for field wiring.

Terminal Blocks

Terminal blocks are wired to the field devices, attached to the front sockets of the I/O modules, and tightened using the side screws. Terminal blocks can come in the form of screw terminals, front screw terminals, or spring terminals. All versions are available in green and blue. Use green terminal blocks for non-intrinsically safe circuits and blue terminal blocks for intrinsically safe circuits.

- **Screw terminals**
 - Green: LB9007A, LB9013A, LB9014A
 - Blue: LB9107A, LB9113A, LB9124A, LB9125A
- **Front screw terminals**
 - Green: LB9017A, LB9018A, LB9019A
 - Blue: LB9117A, LB9118A, LB9119A, LB9127A
- **Spring terminals**
 - Green: LB9009A, LB9015A, LB9016A
 - Blue: LB9107P, LB9115A, LB9116A, LB9126A, LB9130A, LB9131A

Screw Terminals

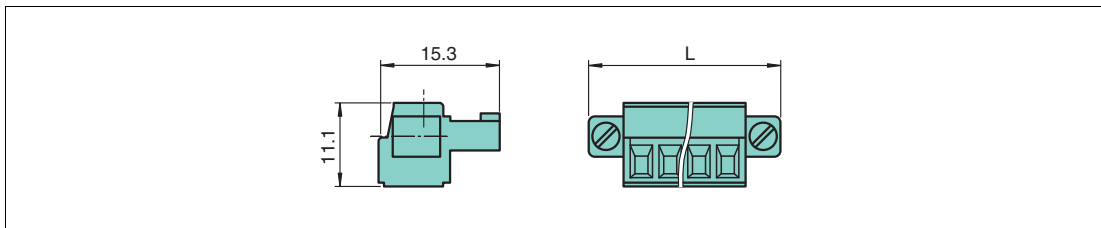


Figure 2.16 Screw terminal dimensions
L = 33.3 mm for 6-pin terminal and 40.9 mm for 8-pin terminal

Front Screw Terminals

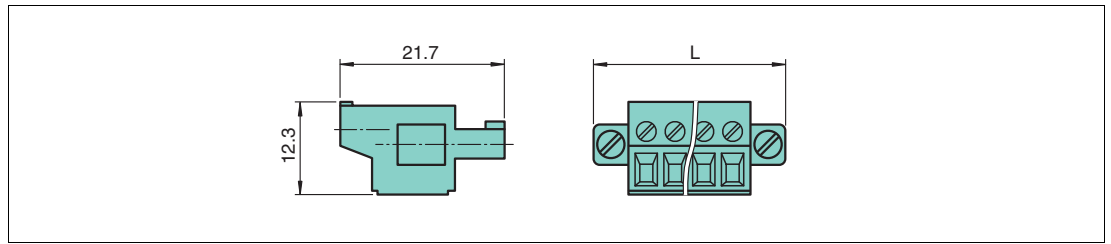


Figure 2.17 Front screw terminal dimensions
L = 33.3 mm for 6-pin terminal and 40.9 mm for 8-pin terminal

Spring Terminals

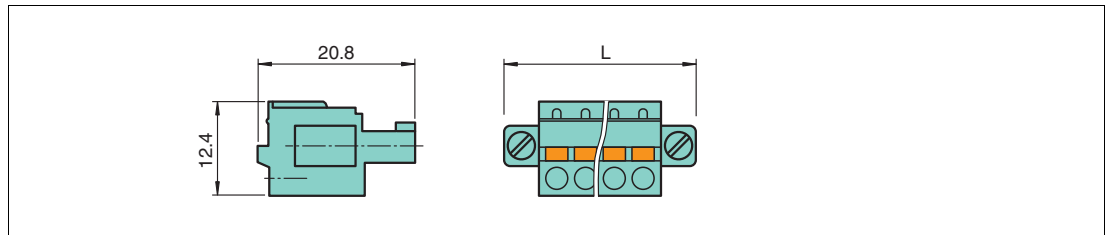


Figure 2.18 Spring terminal dimensions
L = 33.3 mm for 6-pin terminal and 40.9 mm for 8-pin terminal

Spring Terminals for Single-Width I/O Modules with 2x8 Connections

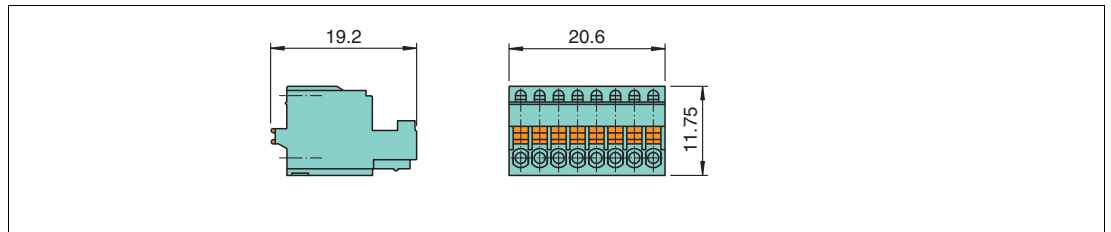


Figure 2.19 Spring terminal dimensions

Protective Covers

Protective covers are used to protect the wiring to the terminal blocks, so that no bare conductive parts are exposed. Protective covers are available in green and blue. Use green protective covers for non-intrinsically safe circuits and blue protective covers for intrinsically safe circuits.

- **Protective covers**
 - Green: LB9008A, LB9010A
 - Blue: LB9108A, LB9120A

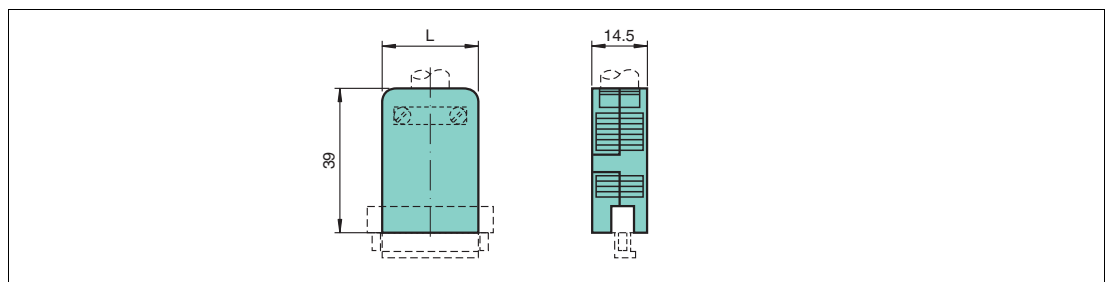


Figure 2.20 Protective cover dimensions
L = 25.25 mm for protective covers for 6-pin terminals and 32.87 mm for protective covers for 8-pin terminals

Cold Junctions

Cold junctions have a prewired Pt100 thermocouple on plug openings 1 and 2 for numerically correcting the thermoelectric voltage. Cold junctions are available in green and blue. Use green cold junctions for non-intrinsically safe circuits and blue cold junctions for intrinsically safe circuits.

- **Cold junctions**
 - Blue: LB9112A
- **Cold junctions with a protective cover**
 - Green: LB9011A
 - Blue: LB9111A

Cold Junction

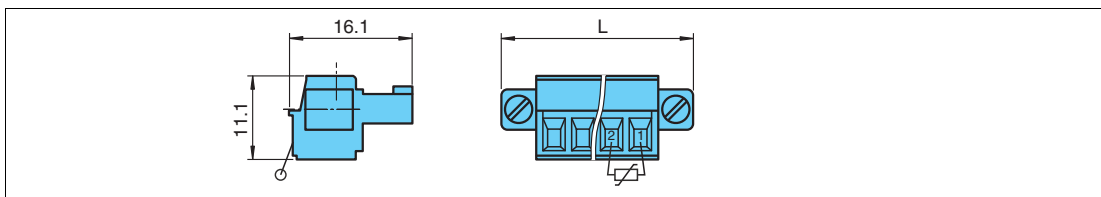


Figure 2.21 Cold junction dimensions
L = 33.3 mm for 6-pin terminal

Cold Junction with a Protective Cover

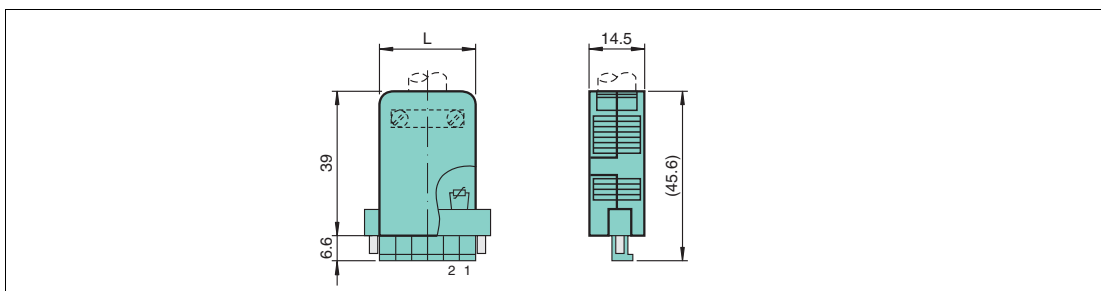


Figure 2.22 Dimensions of a cold junction with a protective cover
L = 33.3 mm for 6-pin terminal

Coding Pins

Coding pins provide a unique assignment between I/O modules and terminal blocks or the associated field devices. To do this, the coding pins are pushed into the grooves provided in the front sockets of the I/O modules. This prevents terminal blocks from being accidentally plugged into another I/O module.

- **Coding pins**
 - KF-CP for LB9007A, LB9009A, LB9013A ... LB9019A, LB9107A, LB9107P, LB9113A, LB9115A ... LB9119A, LB9124A ... LB9127A, LB9130A, LB9131A
 - CP-MC 0.5 (Phoenix Contact order number 1881435) for LB9130A, LB9131A

KF-CP

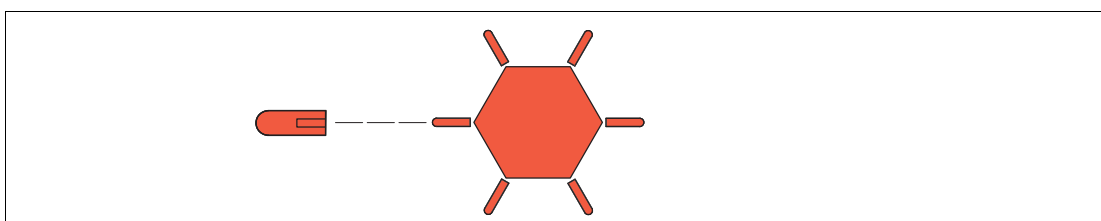


Figure 2.23 KF-CP coding pins

Watchdog Plugs

The watchdog plug is used with digital outputs with a feedback input (LB2101A ... LB2113E). The watchdog plug sends the output signal from the I/O module back to its input channel, making it possible to check the function of the I/O module, as well as the communication between the process control system and the I/O module.

LB9180A

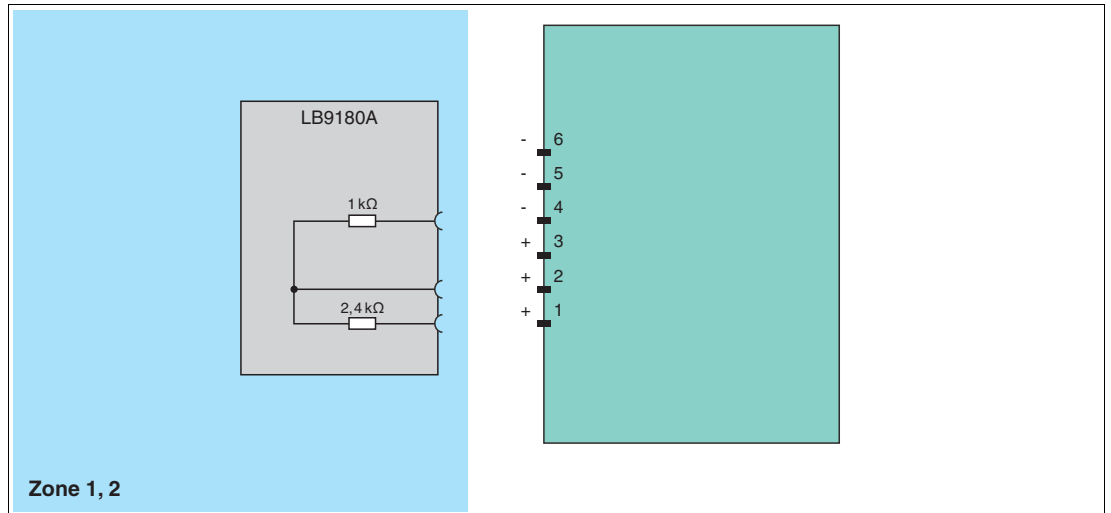


Figure 2.24 Block diagram for the LB9180A

Resistor Network

If binary I/O modules are used, for example with a mechanical contact, an additional resistor network must be installed to ensure that the line fault detection function can work correctly. Using the additional resistor network, the electronics can distinguish between a closed switch and a short circuit.

F-NR2-Ex1

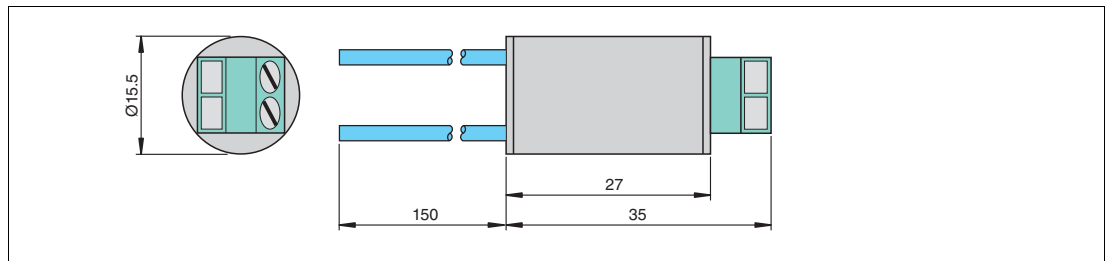


Figure 2.25 Dimensions of the F-NR2-Ex1 resistor network

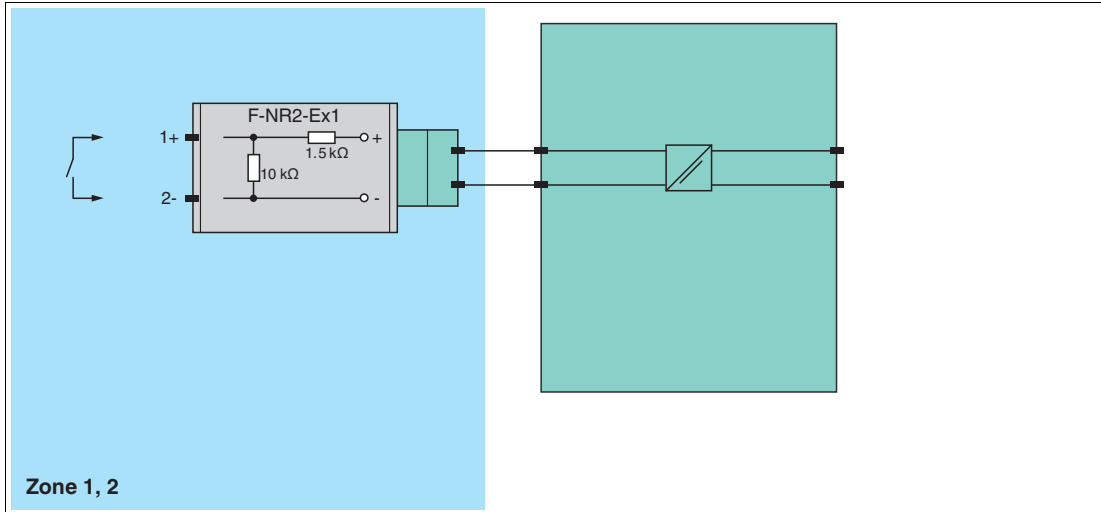


Figure 2.26 Block diagram of the F-NR2-Ex1 resistor network

2.6.3 Separation between Intrinsically Safe and Non-Intrinsically Safe I/O Modules

The separation wall is attached to the backplane between I/O modules with intrinsically safe circuits and I/O modules with non-intrinsically safe circuits to ensure a clearance of 50 mm between intrinsically safe circuits and other circuits. The separation wall can be installed on both backplanes with and without a label carrier.

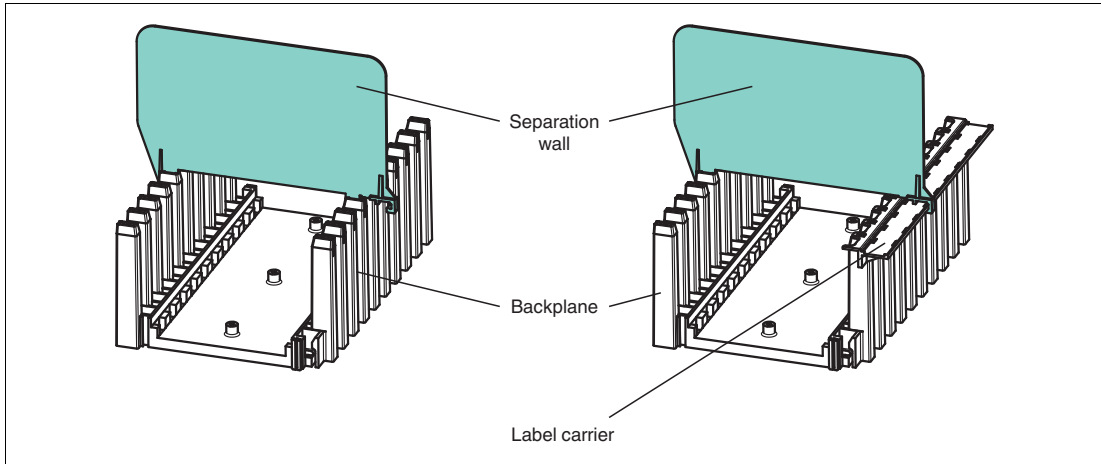


Figure 2.27 Separation wall on the LB9182A

3 Installation

3.1 Surrounding Enclosure



Note!

Requirements for Equipment Protection Level Gc

The LB remote I/O system must only be installed and operated if installed in a surrounding enclosure

- that complies with the requirements for surrounding enclosures in accordance with IEC/EN 60079-0 and that
- is designed with IP54 protection in accordance with IEC/EN 60529.



Note!

Requirements for Non-Hazardous Areas

The LB remote I/O system must only be installed and operated if installed in a surrounding enclosure

- that complies with the requirements for surrounding enclosures in accordance with IEC/EN 60079-0 and that
- is designed with IP54 protection in accordance with IEC/EN 60529.

Alternatively, installation and operation of the system is permitted in a controlled environment where pollution degree 2 in accordance with IEC/EN 60664-1 is ensured.

3.2 Mounting the Backplane



Mounting the Backplane

1. Mount the backplane horizontally, if possible, on a NS 35/15 DIN mounting rail.
2. If you install the backplane vertically, arrange the power supplies at the top to achieve a favorable heat distribution. Make sure that the maximum ambient temperature for the components used is not exceeded in this case.

3.3 Connections

At 24 VDC (SELV/PELV), 4 A T back-up fuses are required.



Caution!

Damage to Equipment

Equipment can be damaged by voltages that are too high, e.g., in temporary faulty operation.

Ensure that the supply voltage of the power supplies used in Zone 2 does not exceed 32 VDC (SELV/PELV).



3.3.1 LB9022E, LB9023*, LB9025A, LB9026*, LB9027A, LB9029A



Danger!

Risk of explosion

Accessories such as plugs and terminators that do not meet the requirements for use in hazardous areas can cause explosive mixtures to ignite.

Only use accessories approved for use in the respective environment.



Danger!

Risk of Explosion

Connecting and disconnecting from circuits such as terminals, plug-in jumpers or terminators can ignite potentially explosive mixtures.

Connecting and disconnecting from circuits is permitted only when not located in a potentially explosive atmosphere.



Danger!

Risk of Explosion

Actuating the operating elements can ignite potentially explosive mixtures.

Only actuate the operating elements when not located in a potentially explosive atmosphere.

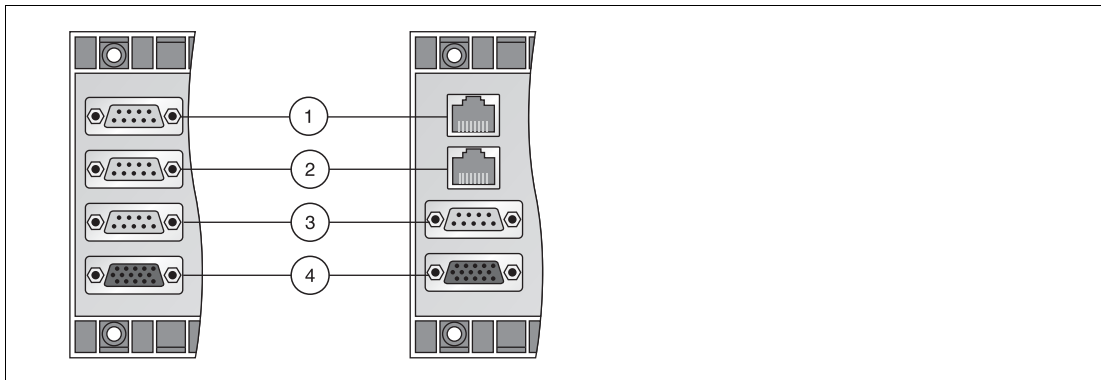


Figure 3.1 Connections on the left-hand side

- 1 **X4:** fieldbus connection
Not present for extension backplanes LB9025A and LB9027A
- 2 **X5:** redundant fieldbus connection
Only present for LB9022E and LB9029A
- 3 **X6:** service bus connection
Not present for extension backplanes LB9025A and LB9027A
- 4 **X7:** extension connection
Not present for backplane LB9029A

Pinning on Sub-D Plugs



- Pin 1** Optional shield
- Pin 2** -
- Pin 3** (B) RxD/TxD-P (+) receive/send data P
- Pin 4** Optional control signal P
- Pin 5** GND reference potential
- Pin 6** + 5 V, only at the end of the line
- Pin 7** -
- Pin 8** (A) RxD/TxD-N (-) receive/send data N
- Pin 9** Optional control signal N

When installing, make sure that the transmitting and receiving lines at pin 3 and pin 8 have not been swapped. If the lines have been swapped, the remote I/O station cannot be reached via the fieldbus. If the lines were swapped when looping through, all nodes after this point cannot be reached via the fieldbus.



Activating the Terminator

The fieldbus must have exactly two terminators per segment, one at the start and one at the end. A segment usually starts at the master, while the last remote I/O unit is taken to be the end of the segment.

Insert a terminator into the last remote I/O unit of each bus line. We recommend using sub-D sockets with an integrated, connectible terminator. See chapter 2.6.1

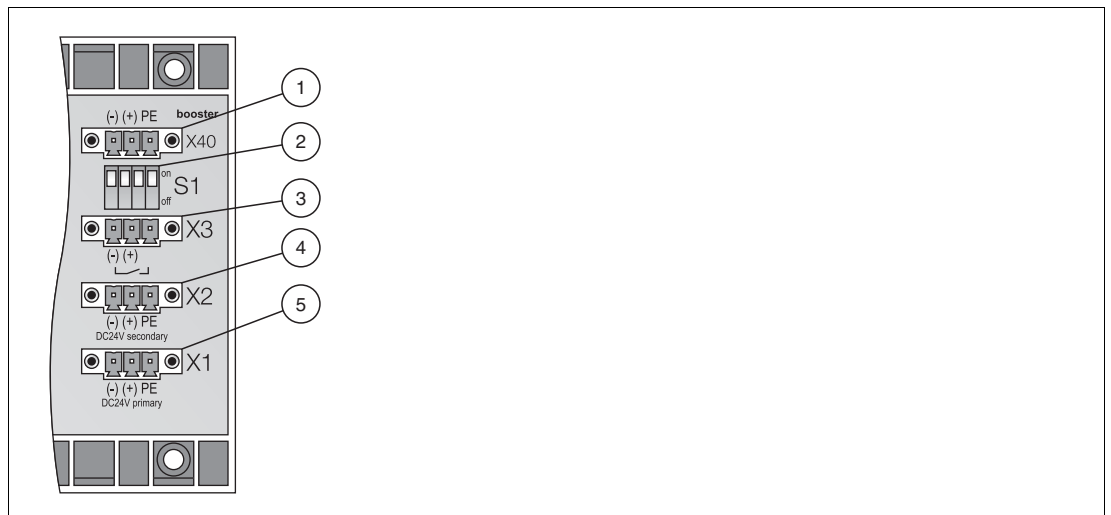


Figure 3.2 Connections on the right-hand side

- 1 **X40**: booster connection
- 2 **S1**: function switch
- 3 **X3**: bus-independent deactivation of the I/O modules
- 4 **X2**: 24 VDC redundant power supply (SELV/PELV)
- 5 **X1**: 24 VDC power supply (SELV/PELV)

X40 Terminal Assignment

Auxiliary energy for 4-channel digital outputs LB6*10* ... LB6*15* can be connected via the booster connection.

- X40.1 = 0 V
- X40.2 = + 24 VDC (SELV/PELV)
- X40.3 = earth

S1 Switch Positions and X3 Terminal Assignment

The S1 switch and X3 terminal control the bus-independent deactivation of the I/O modules.

The bus-independent deactivation of the I/O modules only works for I/O modules equipped with a shutdown input. I/O modules with and without a shutdown input can be installed on the same backplane; however, only the I/O modules that are equipped with a shutdown input are controlled by the bus-independent deactivation.

If I/O modules equipped with a shutdown input are installed on the backplane, these modules can be deactivated using an external switch, for example.



Caution!

Damage to Equipment

Handling the connections improperly can damage the backplane.

- Never supply a control voltage to X3.2 when the S1 switch is closed (S1.x = ON).
- Only operate multiple adjacent backplanes using a common control voltage or a common contact to avoid equalizing currents.



Figure 3.3 X3 terminals and S1 function switches

S1.1	S1.2	S1.3	S1.4	
ON	ON	ON	ON	Deactivation of the I/O modules is disabled.
OFF	OFF	OFF	OFF	Deactivation of the I/O modules equipped with a shutdown input is controlled by a control voltage at X3.
ON	OFF	ON	ON	Deactivation of the I/O modules equipped with a shutdown input is controlled by a voltage-free contact at X3.

- X3.1 = 0 V
- X3.2 = 12 VDC ... 24 VDC galvanically isolated control voltage (SELV/PELV), → see Figure 3.4 on page 25, item 1
Control current = $n \times \text{voltage} / 5.6 \text{ K}\Omega$ (where n = number of I/O modules equipped with a shutdown input)
- X3.1 to X3.3 for external, volt-free contact, galvanically isolated from other contacts and potentials, → see Figure 3.4 on page 25, item 2. This separation also applies to other contacts from other backplanes, unless this involves interconnecting the base backplane and the extension backplane, → see Figure 3.4 on page 25, item 3. The status information for the external contact can be read in using the LB1*08* I/O module.

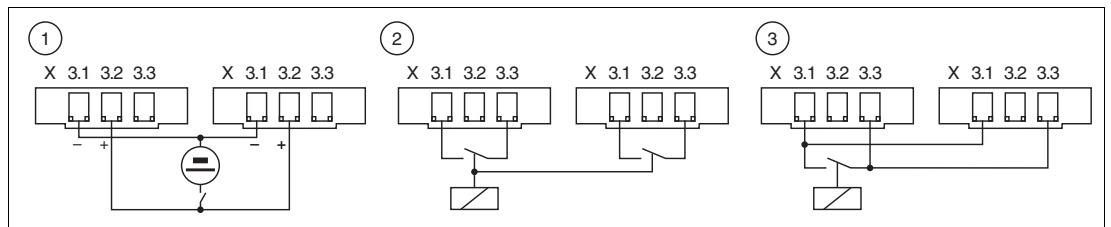


Figure 3.4 Connector X3

- 1 Voltage control for 1 remote I/O station
- 2 Control for 2 backplanes without external voltage
- 3 Base and extension backplane, controlled in common (without external voltage)

X2 Terminal Assignment

- X2.1 = 0 V
- X2.2 = + 24 VDC (SELV/PELV)
- X2.3 = earth

X1 Terminal Assignment

- X1.1 = 0 V
- X1.2 = + 24 VDC (SELV/PELV)
- X1.3 = earth



3.3.2 LB9022S, LB9024S



Danger!

Risk of explosion

Accessories such as plugs and terminators that do not meet the requirements for use in hazardous areas can cause explosive mixtures to ignite.

Only use accessories approved for use in the respective environment.



Danger!

Risk of Explosion

Connecting and disconnecting from circuits such as terminals, plug-in jumpers or terminators can ignite potentially explosive mixtures.

Connecting and disconnecting from circuits is permitted only when not located in a potentially explosive atmosphere.



Danger!

Risk of Explosion

Actuating the operating elements can ignite potentially explosive mixtures.

Only actuate the operating elements when not located in a potentially explosive atmosphere.

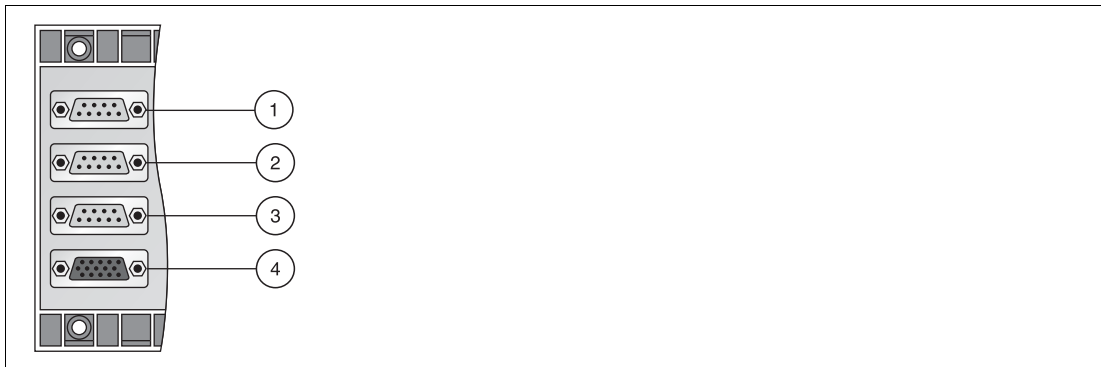
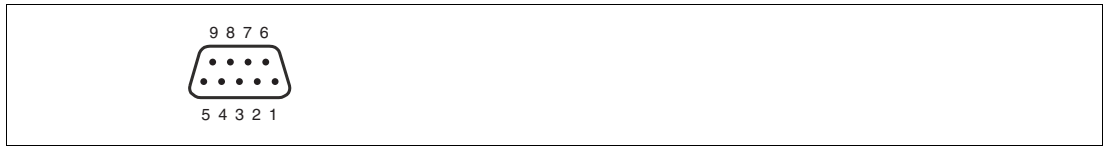


Figure 3.5 Connections on the left-hand side

- 1 **X4:** fieldbus connection
Not present on extension backplane LB9024S
- 2 **X5:** redundant fieldbus connection
Not present on extension backplane LB9024S
- 3 **X6:** service bus connection
Not present on extension backplane LB9024S
- 4 **X7:** extension connection

Pinning on Sub-D Plugs



- Pin 1** Optional shield
- Pin 2** -
- Pin 3** (B) RxD/TxD-P (+) receive/send data P
- Pin 4** Optional control signal P
- Pin 5** GND reference potential
- Pin 6** + 5 V, only at the end of the line
- Pin 7** -
- Pin 8** (A) RxD/TxD-N (-) receive/send data N
- Pin 9** Optional control signal N

When installing, make sure that the transmitting and receiving lines at pin 3 and pin 8 have not been swapped. If the lines have been swapped, the remote I/O station cannot be reached via the fieldbus. If the lines were swapped when looping through, all nodes after this point cannot be reached via the fieldbus.



Activating the Terminator

The fieldbus must have exactly two terminators per segment, one at the start and one at the end. A segment usually starts at the master, while the last remote I/O unit is taken to be the end of the segment.

Insert a terminator into the last remote I/O unit of each bus line. We recommend using sub-D sockets with an integrated, connectible terminator. See chapter 2.6.1



Figure 3.6 Connections on the right-hand side

- 1 **X40**: booster connection
- 2 **S1**: function switch
- 3 **X3**: bus-independent deactivation of the I/O modules
- 4 **X2**: 24 VDC redundant power supply (SELV/PELV)
- 5 **X1**: 24 VDC power supply (SELV/PELV)

X40 Terminal Assignment

Auxiliary energy for 4-channel digital outputs LB6*10* ... LB6*15* can be connected via the booster connection.

- X40.1 = 0 V
- X40.2 = + 24 VDC (SELV/PELV)
- X40.3 = earth

S1 Switch Positions and X3 Terminal Assignment

The S1 switch and X3 terminal control the bus-independent deactivation of the I/O modules.

The bus-independent deactivation of the I/O modules only works for I/O modules equipped with a shutdown input. I/O modules with and without a shutdown input can be installed on the same backplane; however, only the I/O modules that are equipped with a shutdown input are controlled by the bus-independent deactivation.

The backplanes are divided into five areas. Each area monitors different slots on the backplane. If I/O modules equipped with a shutdown input are installed on the backplane, the individual areas can be deactivated using an external switch.



Caution!

Damage to Equipment

Handling the connections improperly can damage the backplane.

- Never supply a control voltage to X3.1 ... X3.5. On backplanes LB9022S and LB9024S, bus-independent deactivation of the I/O modules can be controlled by a volt-free contact only.
- Only operate multiple adjacent backplanes using a common contact to avoid equalizing currents.

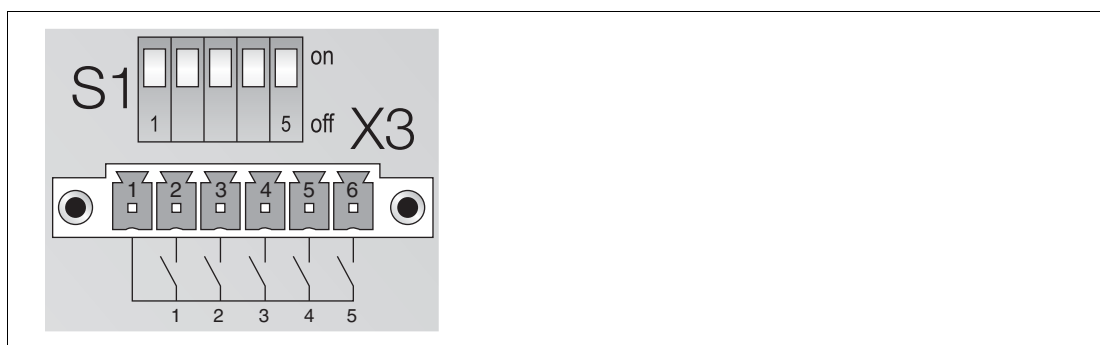


Figure 3.7 X3 terminals and S1 function switches

Area	1	2	3	4	5
LB9022S slots	3 ... 5	6 ... 10	11 ... 15	16 ... 20	21 ... 24
LB9024S slots	25 ... 29	30 ... 34	35 ... 39	40 ... 44	45 ... 48
S1 switch	S1.1	S1.2	S1.3	S1.4	S1.5
X3 contact	X3.1	X3.2	X3.3	X3.4	X3.5

S1.1 ... S1.5	Effect
S1.x = ON	Deactivation of the I/O modules in the associated area is deactivated.
S1.x = OFF	Deactivation in the associated area is controlled by the corresponding X3 contact. If the X3 contact is open (X3.x = OFF), the I/O modules equipped with a shutdown input are deactivated for the corresponding area.

X2 Terminal Assignment

- X2.1 = 0 V
- X2.2 = + 24 VDC (SELV/PELV)
- X2.3 = earth

X1 Terminal Assignment

- X1.1 = 0 V
- X1.2 = + 24 VDC (SELV/PELV)
- X1.3 = earth

3.3.3 LB9035A



Danger!

Risk of explosion

Accessories such as plugs and terminators that do not meet the requirements for use in hazardous areas can cause explosive mixtures to ignite.

Only use accessories approved for use in the respective environment.



Danger!

Risk of Explosion

Connecting and disconnecting from circuits such as terminals, plug-in jumpers or terminators can ignite potentially explosive mixtures.

Connecting and disconnecting from circuits is permitted only when not located in a potentially explosive atmosphere.



Danger!

Risk of Explosion

Actuating the operating elements can ignite potentially explosive mixtures.

Only actuate the operating elements when not located in a potentially explosive atmosphere.

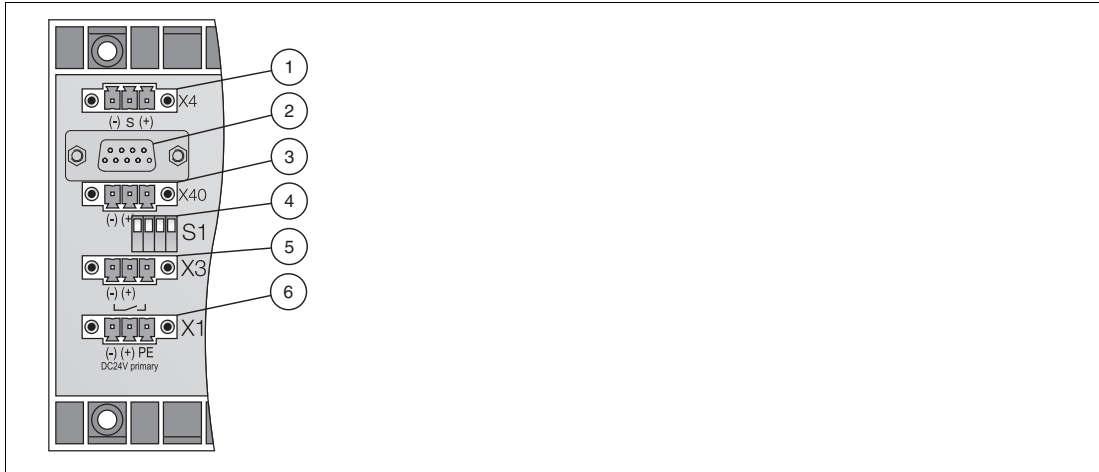


Figure 3.8 Connections

- 1 **X4:** fieldbus connection
- 2 Service bus connection
- 3 **X40:** booster connection
- 4 **S1:** function switch
- 5 **X3:** bus-independent deactivation of the I/O modules
- 6 **X1:** 24 VDC power supply (SELV/PELV)

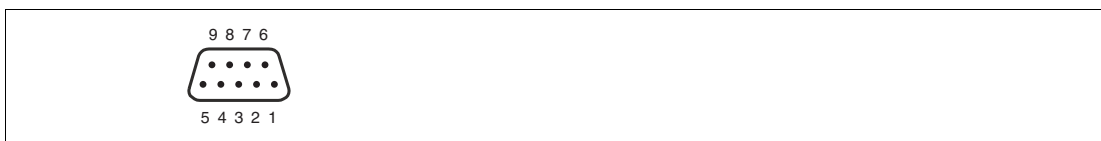
X4 Terminal Assignment

- X4.1 = - FF H1
- X4.2 = shield
- X4.3 = + FF H1

The grounding of the shield depends on the position of switch S1.

S1.3	
ON	The shield is connected directly to PE.
OFF	The shield is connected to PE via capacitive means.

Pinning on Sub-D Plugs



- Pin 1** Optional shield
- Pin 2** -
- Pin 3** (B) RxD/TxD-P (+) receive/send data P
- Pin 4** Optional control signal P
- Pin 5** GND reference potential
- Pin 6** + 5 V, only at the end of the line
- Pin 7** -
- Pin 8** (A) RxD/TxD-N (-) receive/send data N
- Pin 9** Optional control signal N

When installing, make sure that the transmitting and receiving lines at pin 3 and pin 8 have not been swapped. If the lines have been swapped, the remote I/O station cannot be reached via the fieldbus. If the lines were swapped when looping through, all nodes after this point cannot be reached via the fieldbus.

X40 Terminal Assignment

Auxiliary energy for 4-channel digital outputs LB6*10* ... LB6*15* can be connected via the booster connection.

- X40.1 = 0 V
- X40.2 = + 24 VDC (SELV/PELV)
- X40.3 = earth

S1 Switch Positions and X3 Terminal Assignment

The S1 switch and X3 terminal control the bus-independent deactivation of the I/O modules. The terminator on the X4 fieldbus connection can also be activated and deactivated using the S1 switch.

S1.4	
ON	The terminator on the X4 fieldbus connection is activated.
OFF	The terminator on the X4 fieldbus connection is deactivated.

The bus-independent deactivation of the I/O modules only works for I/O modules equipped with a shutdown input. I/O modules with and without a shutdown input can be installed on the same backplane; however, only the I/O modules that are equipped with a shutdown input are controlled by the bus-independent deactivation.

If I/O modules equipped with a shutdown input are installed on the backplane, these modules can be deactivated using an external switch, for example.



Caution!

Damage to Equipment

Handling the connections improperly can damage the backplane.

- Never supply a control voltage to X3.2 when the S1 switch is closed (S1.x = ON).
- Only operate multiple adjacent backplanes using a common control voltage or a common contact to avoid equalizing currents.



Figure 3.9 X3 terminals and S1 function switches

S1.1	S1.2	
ON	ON	Deactivation of the I/O modules is disabled.
OFF	OFF	Deactivation of the I/O modules equipped with a shutdown input is controlled by a control voltage at X3.
ON	OFF	Deactivation of the I/O modules equipped with a shutdown input is controlled by a voltage-free contact at X3.

- X3.1 = 0 V
- X3.2 = 12 VDC ... 24 VDC galvanically isolated control voltage (SELV/PELV), → see Figure 3.4 on page 25, item 1
Control current = $n \times \text{voltage} / 5.6 \text{ K}\Omega$ (where n = number of I/O modules equipped with a shutdown input)
- X3.1 to X3.3 for external, volt-free contact, galvanically isolated from other contacts and potentials, → see Figure 3.4 on page 25, item 2. This separation also applies to other contacts from other backplanes, unless this involves interconnecting the base backplane and the extension backplane, → see Figure 3.4 on page 25, item 3. The status information for the external contact can be read in using the LB1*08* I/O module.

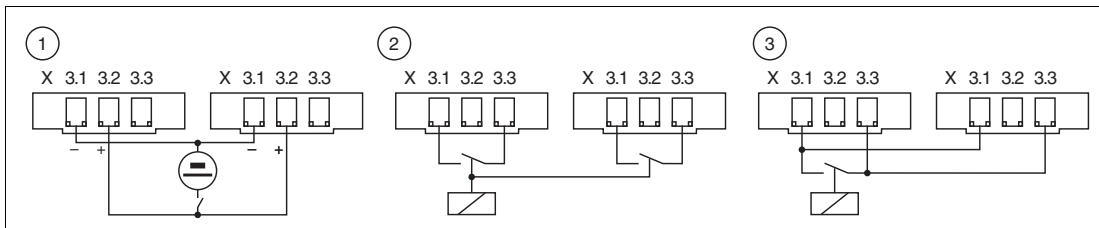


Figure 3.10 Connector X3

- 1 Voltage control for 1 remote I/O station
- 2 Control for 2 backplanes without external voltage
- 3 Base and extension backplane, controlled in common (without external voltage)

X1 Terminal Assignment

- X1.1 = 0 V
- X1.2 = + 24 VDC (SELV/PELV)
- X1.3 = earth

3.4 Inserting and Removing Modules

Fixed slots are reserved on the backplane for com units and power supplies. Com units are equipped with mechanical coding pins on the underside of the enclosure to prevent these modules from being accidentally plugged into the slot of an I/O module.

Slots for I/O modules have equal status, meaning functions can be arranged side by side as required. I/O modules with intrinsically safe circuits and I/O modules with non-intrinsically safe circuits can also be arranged side by side. Please note that a clearance of 50 mm must always be maintained between intrinsically safe and non-intrinsically safe circuits. To ensure this clearance is maintained, fit a separation wall between modules with intrinsically safe circuits and modules with non-intrinsically safe circuits.

Unused slots can be left empty or covered using place-holder modules LB9099 and LB9199A.



Installing I/O Modules

1. Arrange the I/O modules on the backplane from left to right.
2. Push the I/O module into a vacant slot on the backplane.
3. Separate I/O modules with intrinsically safe circuits and I/O modules with non-intrinsically safe circuits using a separation wall. See chapter 3.5
4. Make a note of the types of module used or other identification codes on the label carrier above the I/O modules.



Removing I/O Modules

1. Remove the modules by positioning your thumb and index finger on the top and bottom of the module and pulling.



Figure 3.11 Removing modules

2. If necessary, adjust the information on the label carrier above the I/O modules.



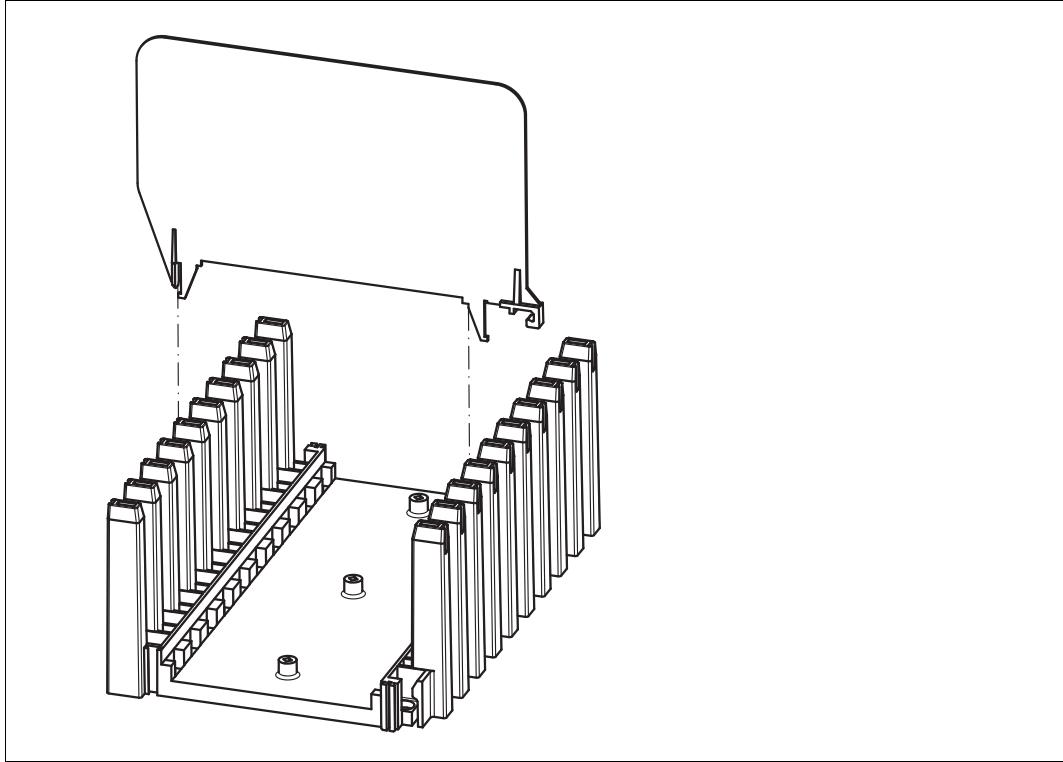
3.5 Installing the Separation Wall

The separation wall is attached to the backplane between I/O modules with intrinsically safe circuits and I/O modules with non-intrinsically safe circuits to ensure a clearance of 50 mm between intrinsically safe circuits and other circuits.

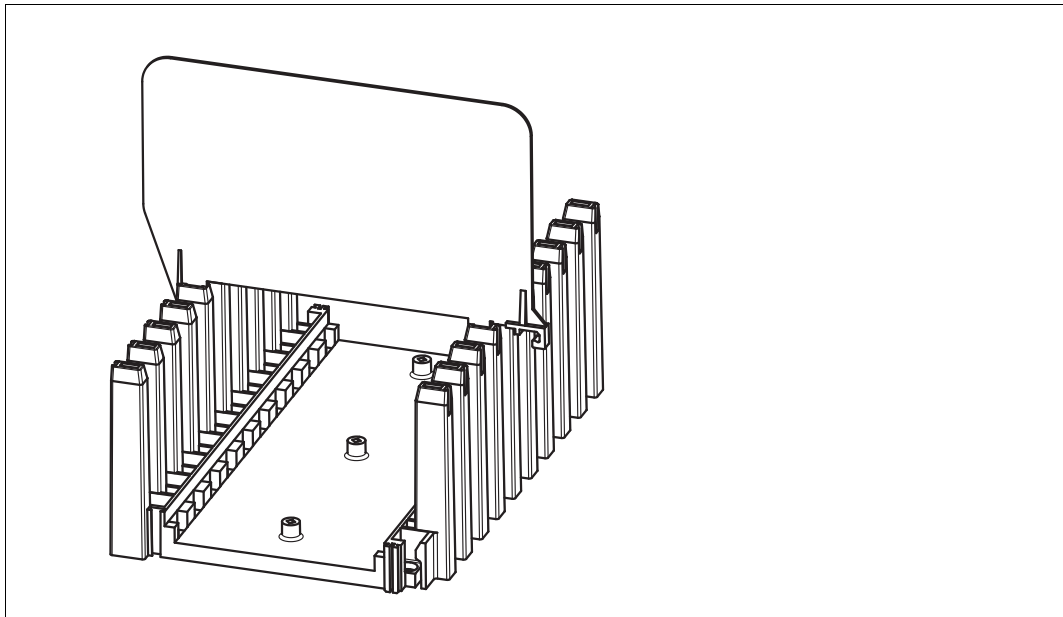


Mounting on a Backplane without a Label Carrier

1. Position the pins on the separation wall over the plastic holders on the backplane.



2. Insert the pins on the separation wall into the plastic holders on the backplane, ensuring the pins snap into place.

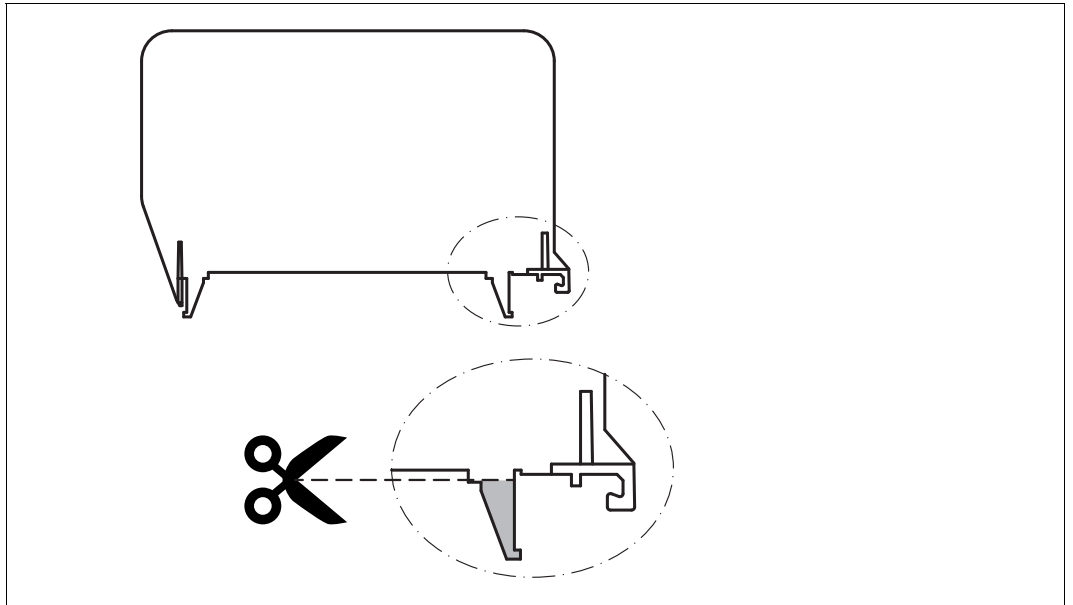


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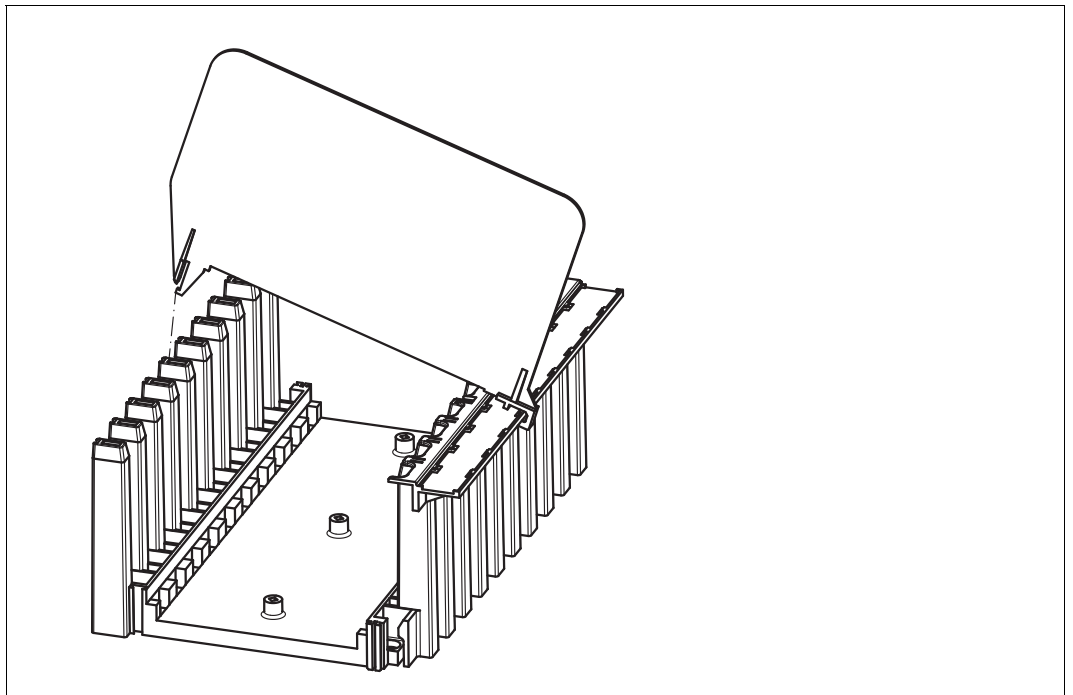


Mounting on a Backplane with a Label Carrier

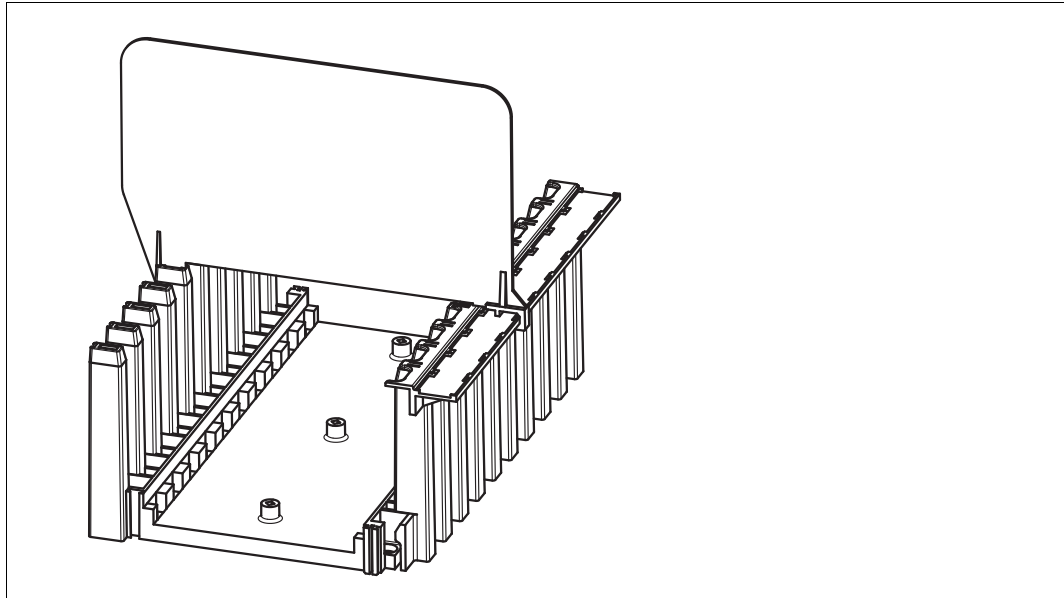
1. Cut off the pin that is located near the catch on the separation wall.



2. Hook the catch into the label carrier.



3. Insert the pin on the separation wall into the plastic holders on the backplane, ensuring the pin snaps into place.



3.6 Field Wiring



Danger!

Risk of explosion

Measuring instruments that do not meet the requirements for use in hazardous areas can cause explosive mixtures to ignite.

Only use accessories and devices that are approved for use in the respective environment.



Caution!

Loss of intrinsic safety

Circuits with the Ex i type of protection that have been operated with non-intrinsically safe circuits must no longer be used as circuits with Ex i type of protection.

Use only Ex i-certified measuring instruments in conjunction with Ex i-certified I/O modules.

Field connections can be made to the I/O modules using screw terminals, front screw terminals, or spring terminals. Use the terminal blocks from the range of accessories. See chapter 2.6.2

Front screw terminals or spring terminals are ideal for performing extensions at a later point or for changing individual field connections, as the plug can remain in the front socket of the I/O module during wiring. These terminals offer a test plug socket for measuring individual current circuits.

The following connection data applies in conjunction with the terminal blocks listed here:
LB9007A, LB9009A, LB9013A ... LB9019A, LB9107A, LB9107P, LB9113A,
LB9115A ... LB9119A, LB9124A ... LB9127A, LB9130A, LB9131A.

Connection data for front screw terminals, screw terminals, and spring terminals	
Rigid conductor cross-section	0.14 mm ² ... 1.5 mm ²
Flexible conductor cross-section	0.14 mm ² ... 1.5 mm ²
Flexible conductor cross-section with wire end ferrule with no plastic sleeve	0.25 mm ² ... 1.5 mm ²
Flexible conductor cross-section with wire end ferrule with plastic sleeve	0.25 mm ² ... 0.5 mm ²

The following connection data applies in conjunction with terminal blocks LB9130A and LB9131A.

Connection data for spring terminals for single-width I/O modules with 2x8 connections	
Rigid conductor cross-section	0.14 mm ² ... 0.5 mm ²
Flexible conductor cross-section	0.14 mm ² ... 0.5 mm ²
Flexible conductor cross-section with wire end ferrule with no plastic sleeve	0.25 mm ² ... 0.5 mm ²
Flexible conductor cross-section with wire end ferrule with plastic sleeve	0.25 mm ² ... 0.5 mm ²



Installing Field Wiring



Danger!

Risk of Explosion

Front connections that are improperly wired can result in dangerous mistakes being made and cause potentially explosive mixtures to ignite.

1. The I/O modules are wired differently depending on the model and function. Wire the terminal blocks to the field devices in accordance with the information in the data sheets for the I/O modules used.
2. Pay attention to the conductor cross sections. We recommend that you do not exceed a conductor cross section of 0.75 mm².
3. Make sure that conductors are insulated all the way up to the terminal.
4. If you use stranded conductors, make sure that these are equipped with wire end ferrules. We recommend using wire end ferrules approved according to DIN 46228-4.
5. Use green terminal blocks/protective covers for non-intrinsically safe circuits and blue terminal blocks/protective covers for intrinsically safe circuits.
6. Maintain a minimum clearance of 50 mm between the intrinsically safe and non-intrinsically safe circuits. Insert a separation wall (see chapter 3.5) or, if necessary, use protective covers (see chapter 2.6.2).
7. Plug the terminals into the front sockets of the corresponding I/O modules and tighten the terminals using the side screws.
8. Fit the cables for intrinsically safe circuits such that they are separate from non-intrinsically safe circuits. Secure the cables of non-intrinsically safe circuits using cable ties.
9. Connect unused cables to terminals or ensure that unused cables are fixed securely and insulated.

3.7 Coding

You can code the front sockets of the I/O modules and terminals so that the terminals and the associated field devices can be assigned to exactly one front socket.

Use the KF-CP coding pins for the following terminal blocks: LB9007A, LB9009A, LB9013A ... LB9019A, LB9107A, LB9107P, LB9113A, LB9115A ... LB9119A, LB9124A ... LB9127A, LB9130A, LB9131A. Use the CP-MC 0.5 coding pins (Phoenix Contact order number 1881435) for the LB9130A and LB9131A terminal blocks.

Coding Connections



Caution!

Danger of incorrect connections

If the coding is not unique, terminals can be accidentally swapped.

Establish a unique coding so that every terminal fits exactly one front socket.

1. To code the front socket of an I/O module, insert one or more coding pins into the corresponding grooves on the front socket.
2. In order to code the terminal to match the front socket, cut off the plastic lugs from the terminal from those points where coding pins are located in the front socket.

Note that the coding in example 1 and example 2 is not unique. The terminal from example 1 could be accidentally connected to the front socket in example 2. In contrast, the coding in example 1 and example 3 is unique.

	Example 1	Example 2	Example 3
Terminal			
Front socket			

3.8 Line Fault Detection

Most I/O modules have a line fault detection function that can recognize a lead breakage or a short circuit.

If digital I/O modules are used, for example with a mechanical contact, an additional resistor circuit must be installed to ensure that the line fault detection function can work correctly. Using the additional resistor circuit, the electronics can distinguish between a closed switch and a short circuit. See chapter 2.6.2

- LB1*03*
If you are using rotational direction detection, connect this input to a resistor circuit. The rotational direction input is ignored for devices without rotational direction detection.
- LB1007*, LB1*08*, LB1*09*
24 V and 5 V inputs can only be used when line fault detection is disabled.

- **LB2***
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 sounders, 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 k Ω 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.

The line fault detection function of the analog I/O modules is based on a current measurement. An additional resistor circuit is not required.

For more information, refer to the software manual for the com unit used.

3.9 Cold Junctions in Thermocouples

The I/O modules LB5*02* and LB5*05* are equipped with an internal cold junction. However, they can be used with an external cold junction. The temperature detected by the external cold junction at the terminal connection is used by the I/O module to compensate for the influences of the ambient temperature.

External cold junctions are available as accessories. See chapter 2.6.2

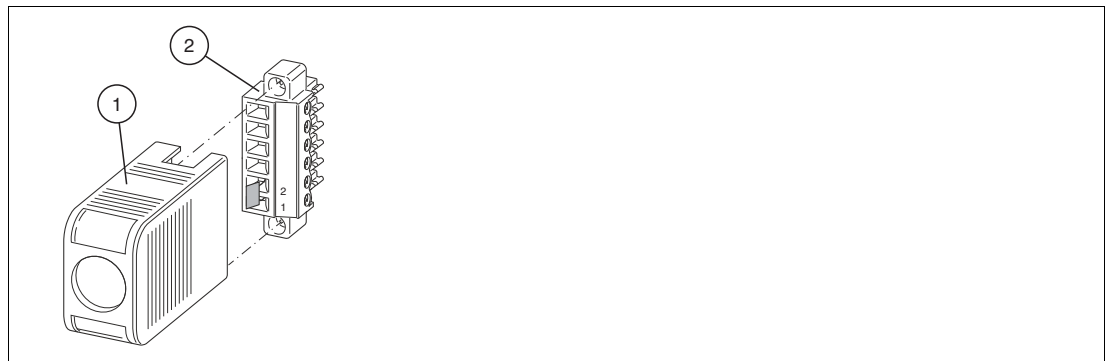


Figure 3.12 External cold junction for thermocouple measurements

1. Protective cover
2. Cold junction consisting of a terminal block and a Pt100 thermocouple on terminal openings 1 and 2

If the cold junction is operated in a 2-wire configuration, the line resistance can be entered into the configuration software to compensate for the line resistance to the external cold junction. For more information, refer to the software manual for the com unit used.

3.10 Line Resistance in Resistance Thermometers

If you operate the LB5*01* and LB5*04* I/O modules in a 2-wire configuration, the line resistance amounts to that of a resistor connected in series to the sensor and affects the measurement result. In order to avoid measurement errors, the line resistance must be measured and compensated for in this configuration. Two options are available here:

Pt100 Short Circuit

1. Short circuit the Pt100 sensor.
2. In the configuration software, set the measuring input of the I/O module to resistance measurement.
For more information, refer to the software manual for the com unit used.
3. Call up the measured value display for the I/O module and make a note of the measured value.
4. In the configuration software, set the measuring input of the I/O module to 2-wire measurement with Pt100 sensor.
5. Enter the measured resistance in the **Line resistance** field. The maximum permissible line resistance is 50 Ω .

Use a Calibrating Resistor

1. Use a calibrating terminal with an integrated calibrating resistor in the sensor supply line.
2. In the configuration software, set the measuring input of the I/O module to 2-wire measurement with Pt100 sensor.
For more information, refer to the software manual for the com unit used.
3. In the configuration software, set the line resistance to 20 Ω .
4. Replace the Pt100 sensor at the measuring point with a 100- Ω measurement resistor.
5. To measure the resistance, call up the measured value display for the corresponding measuring point.
6. Set the displayed value to 0 °C using the calibration potentiometer.
7. Then reconnect the Pt100 sensor.

3.11 Strain Gauge Measurement

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

A constant current of 20 mA is sufficient to power 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

1. Either set the LB4101* 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* temperature input to a millivolt measurement **mV**.
3. Deactivate the cold junction of temperature input LB5*02* by setting the thermostat temperature for the external cold junction to **0 °C**.

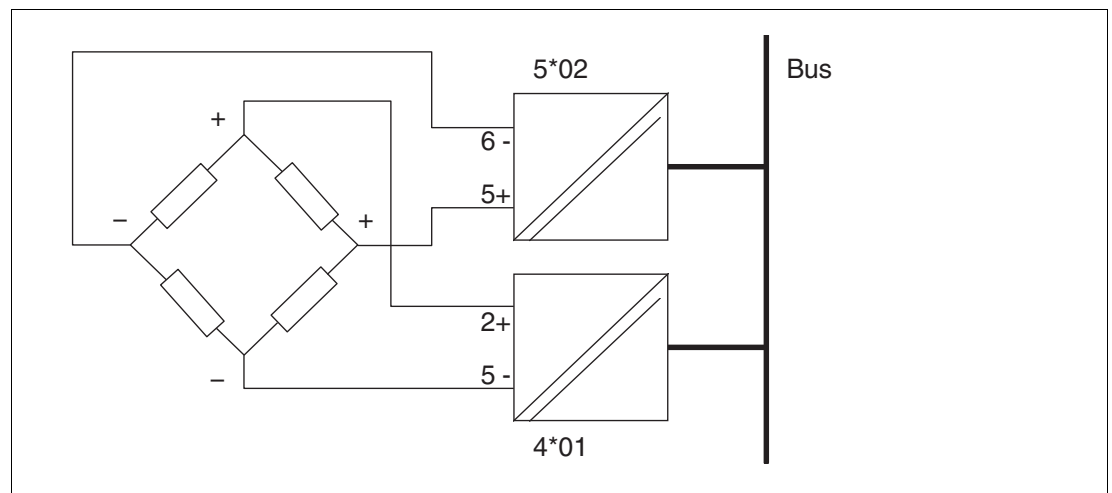


Figure 3.13 Example of a strain gauge bridge



3.12 Redundancy

3.12.1 Basic Principles

Redundancy is used when it is necessary to guarantee operation of a remote I/O station despite one or more components having failed.

To build a redundant system, use backplanes LB9022* and LB9029A and equip these with two com units for com unit redundancy and three power supplies for power supply redundancy. Two power supplies are sufficient to supply the entire backplane. The third power supply is a redundant power supply that can compensate for the failure of another power supply.

It is possible to tell which com unit is active by looking at the operating mode LED. If the operating mode LED is flashing, the com unit is active. If the operating mode LED is not lit, the com unit is passive. For more information about the status LEDs, refer to the data sheet for the relevant com unit in use.

As a general rule, a distinction is made between media redundancy and application redundancy. Com units can be set to media redundancy or application redundancy using the configuration software. For more information, refer to the software manual for the com unit used.



Note!

Note that both com units in a redundant system must have the same firmware.

3.12.2 Media Redundancy

Media redundancy is when the master communicates with a com unit via a voter and a redundant fieldbus cable. The com unit that communicates with the master is active and controls the I/O module on the backplane. The second com unit is passive and reads the data traffic on the backplane.

If the active com unit fails, the passive com unit automatically takes on the configuration of the com unit that was previously active. When there is media redundancy, switching between the com units is independent of the fieldbus cable used.

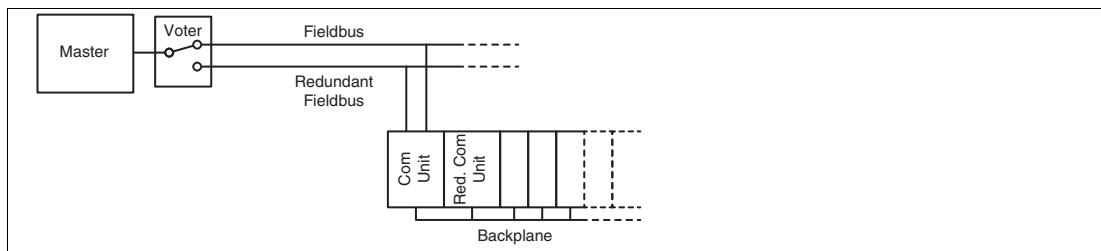


Figure 3.14 Line redundancy

If the master is also redundant, this is known as extended media redundancy.

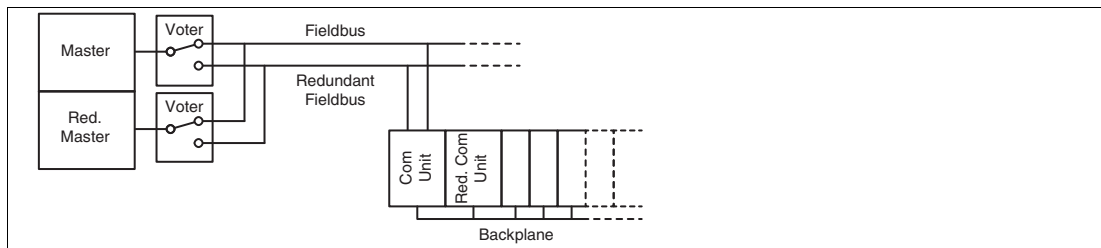


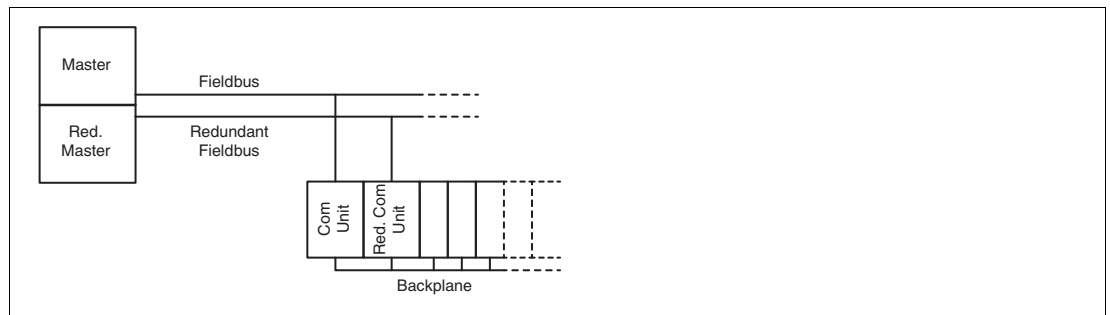
Figure 3.15 Extended media redundancy

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3.12.3 Application Redundancy

In application redundancy, the master has two redundant interfaces to allow it to access both the fieldbus and the redundant fieldbus. Both com units are active on both fieldbuses. However, internally only one com unit is active and controls the I/O modules.

If a fieldbus cable or a com unit fails, a switchover to the redundant fieldbus cable will take place. In the case of application redundancy, the switchover makes the redundant fieldbus cable the active fieldbus cable, and all com units on this fieldbus cable become active com units.



3.13 Fieldbus Connection



Danger!

Risk of explosion

Improperly installed fieldbuses can cause explosive mixtures to ignite.

Observe the wiring specifications set out in IEC/EN 60079-14 for laying lines in a hazardous area.



Danger!

Risk of explosion

Accessories that do not meet the requirements for use in hazardous areas can cause explosive mixtures to ignite.

Only use accessories and devices that are approved for use in the respective environment.

Connection

When possible, use plugs from the range of accessories. See chapter 2.6.1

Cable Lengths

Com units can be configured for various transfer rates. The desired transfer rate and the bus system used dictate the maximum cable length.

For standard applications, the technical data for cable type A in accordance with DIN EN 61158 and DIN EN 61784 applies. The following table relates to standard applications.

Bus system	Transfer rate	Max. cable length
MODBUS	1.2 kbit/s ... 9.6 kbit/s	1200 m
	19.2 kbit/s	1200 m
	38.4 kbit/s	1200 m
	115.2 kbit/s	1000 m
PROFIBUS DP	9.6 kbit/s	1200 m
	19.2 kbit/s	1200 m
	93.75 kbit/s	1200 m
	187.5 kbit/s	1000 m
	500 kbit/s	400 m
	1.5 Mbit/s	200 m
PROFIBUS PA	31.25 kbit/s	1900 m
FOUNDATION fieldbus H1	31.25 kbit/s	1900 m
Service bus	9600 bit/s	1200 m

Repeaters or fiber optic cables such as FOL7250* can be used to extend the cable length.

In accordance with DIN EN 61158 and DIN EN 61784, the following principles apply:

- Linear bus structure without branches, consisting of a cable with terminators
- Length of the spur to the node < 0.3 m
- Total length of all spurs < 6 m
- Data transfer via shielded twisted pair cable
- Terminator resistance 100 Ω ... 130 Ω
- Core cross-section > 0.22 mm², approx. 60 pF/m
- Max. cable length 1200 m, depending on the transfer rate
- Max. 32 active or passive nodes including repeaters
- Max. 3 repeaters between 2 nodes



Example!

The following trip values result at rates below 93.75 kBit/s and with the cables connected in series:

- 0 repeaters
 - Max. cable length: 1200 m
 - 1 master + 31 remote I/O stations, each with 48 I/O modules = 1488 I/O modules
- 1 repeater
 - Max. cable length: 2400 m
 - 1 master + 61 remote I/O stations, each with 48 I/O modules = 2928 I/O modules

Terminators

The fieldbus must have exactly two terminators per segment, one at the start and one at the end. A segment usually starts at the master, while the last remote I/O station is taken to be the end of the segment. A segment also ends or begins at a repeater or a fiber optic cable.

A bus with 3 segments, 1 master, a fiber optic cable transfer path, 4 nodes, and 1 repeater has 6 terminators (T).

Master(T) — Node — (T)Fiber optic cable(T) — Node — (T)Repeater(T) — Node — (T)Node

The terminator depends on the line type, as specified in DIN EN 61158 and DIN EN 61784. A distinction is made between:

- R = 220 Ω for line type A (< 12 MBaud)
- R = 150 Ω for line type B (< 0.5 KBaud). Where possible, line type B should no longer be used.
- R = 120 Ω for service bus

3.14 Potential Equalization and Shielding



Note!

The following subchapters cannot provide the reader with a complete picture of all requirements in terms of grounding, shielding, and lightning protection. More information on this topic can be found in the technical literature and the applicable standards.

3.14.1 Interference

Electromagnetic fields can interfere with the communication path.

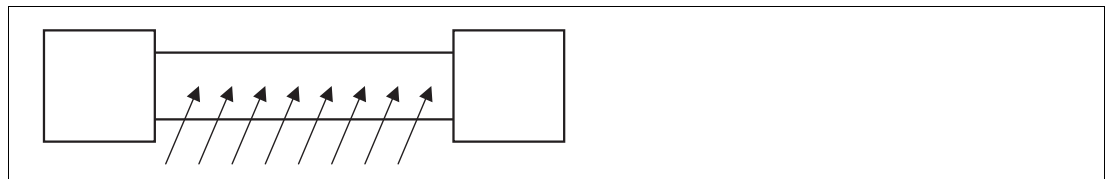


Figure 3.16 Interfering signals caused by induction in parallel conductors

Twisted-pair cables significantly reduce the influence of these interference fields, particularly when compared to cables with parallel strands. The direction of the recorded interference field in a twisted-pair cable reverses over short intervals. This means that the induced interference is practically canceled out, while in parallel strands the interference is active across the entire area.

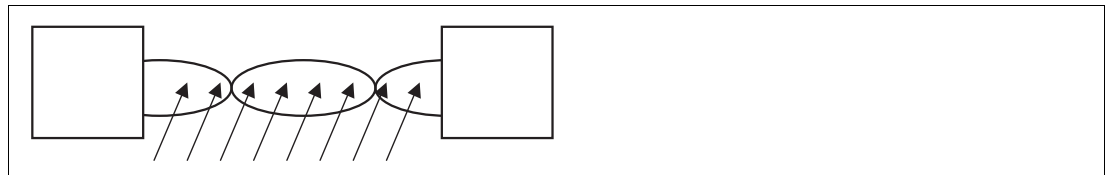


Figure 3.17 Reduced admission of interfering signals in twisted-pair cable



A shielding keeps interfering signals away from the communication path.

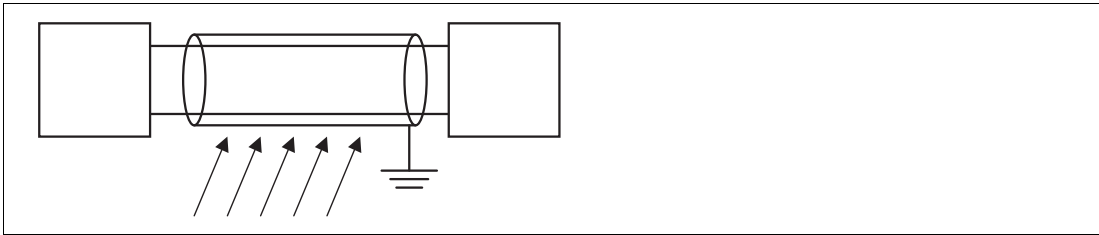


Figure 3.18 Shielding prevents the entry of interference fields

EMC filters are used in many devices to divert any interference to ground. For the sake of symmetry, all lines are provided with suitable capacitance. Capacitively coupled high-frequency interference is effectively canceled out by the symmetrical layout.

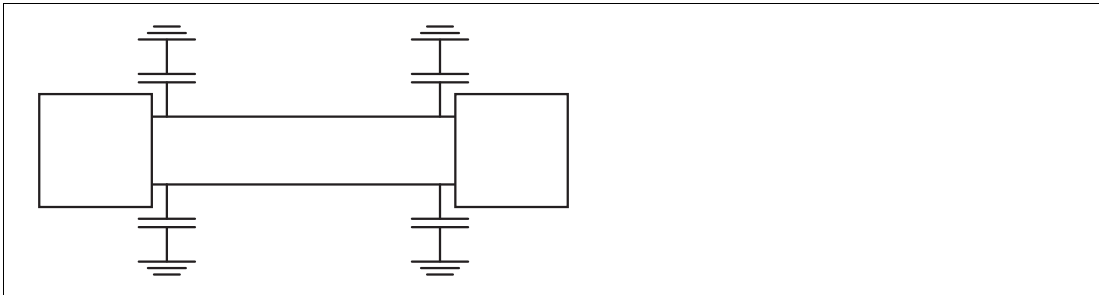


Figure 3.19 EMC filters in signal paths

The same applies to galvanically isolated signals. However, unexpected results may arise in networks created by multichannel systems without isolation. This is because the filter capacitors may even run in parallel, depending on the setup. Isolate the channels to eliminate any interference.

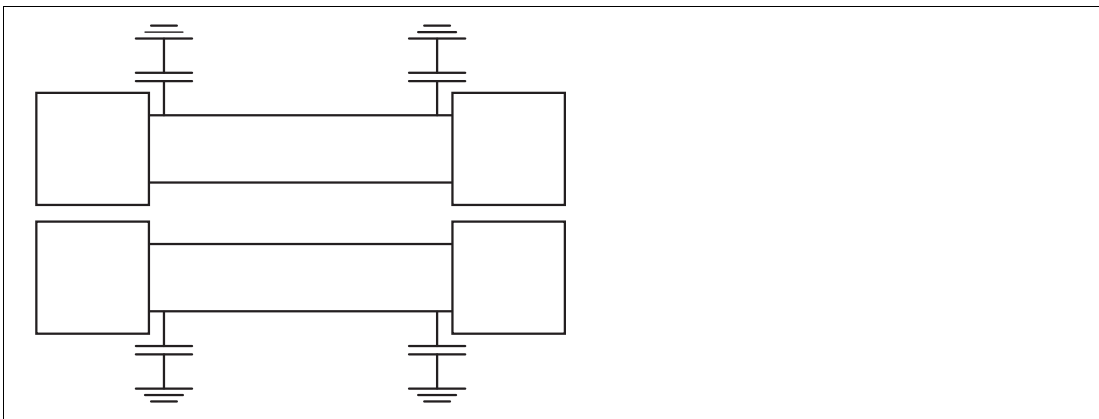


Figure 3.20 EMC filters in a network (simplified diagram)

3.14.2 Wiring



Danger!

Risk of Explosion

Observe the specifications for installation as set out in IEC/EN 60079-14.

Lay the signal leads such that they are separate from the power cables. Please note that AC voltages and current spikes can induce stray voltages in neighboring lines. Thus, shielded cables should be used for EMC-tested devices.

Grounding bars can be laid separately from the shielding (see IEC/EN 60079-14). The shielding is then grounded at one point.

Field Wiring

Depending on the application, the shielding of the wiring must be grounded at one point or at both ends. If possible, avoid grounding at both ends to prevent ground loops and ensure the shielding is not used as a return line.

Sound results can be obtained with grounding at one end of the cable if the cable is laid on a grounded metal cable support. The metal frame in the immediate vicinity of the conductor ensures that only small areas are exposed to the field, so that interference is largely reduced.

Digital inputs are normally controlled by NAMUR proximity switches with a low-impedance signal. In this case, interfering signals have a far lower impact than in circuits containing open switches that do not have an additional resistor circuit. For this reason, do not connect digital inputs to exposed wiring.

The analog signals of resistive sensors or thermocouples are particularly susceptible to interference. Signal converters have built-in filters to reduce this interference. The filters can be switched on if fluctuations in the measuring signal cannot be reduced sufficiently by other means. For more information, refer to the software manual for the com unit used.

Fieldbus Connection

Ground the shielding of the fieldbus cable at both ends. Grounding at one end is sufficient if the fieldbus cable is laid on a grounded metal cable support.



Eliminating Interference

The following measures can improve power.

1. Fit line filters in power supply lines.
Please make sure that supply cables leading to line filters are laid separately from other cables to ensure that any filtered interference is not picked up again.
2. Fit surge protection filters in signal lines.
3. Change to galvanically isolated circuits.

3.15 System Expansion

Adding I/O Modules

By adding an I/O-module, input or output data will be transferred to a slot that was previously empty. To do this, the configuration of the com unit must be adapted. Changes to the configuration of the com unit usually result in the function being interrupted due to a fieldbus restart.

To avoid this, you can activate Hot Configuration in Run (HCiR) in the com unit. If HCiR is active, a new configuration can be transferred to the com unit in the form of a passive data record. In this way, the master still has access to the old configuration in its existing form. As soon as the new configuration in the master matches the new configuration in the com unit, the new configuration in the com unit is activated and the old configuration is deleted. For more information, refer to the software manual for the com unit used.

Alternatively, you can use the Unicom com unit LB8109*. Using the Unicom com unit, you can configure the slots on the backplane in such a way that they can later be used with different I/O modules. For more information, refer to the software manual for Unicom com unit LB8109*.

Extending the Fieldbus

In order to extend the fieldbus cable, the terminator must be removed. In this case, operation can only be maintained using a redundant system.

4 Commissioning

4.1 Electrical Testing of Connections

Make sure that the terminators have been properly fitted to the fieldbus and the service bus.
See chapter 3.13



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 (pin 3) and B (pin 8).
 - ↳ 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 (pin 3) and B (pin 8).
 - ↳ 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 (pin 3) and B (pin 8) 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.



4.2 Configuration

The entire remote I/O station is configured via the com unit. Communication with the com unit can be set up via either the fieldbus or the service bus.



Note!

The LB8107* com unit can be configured via the service bus only.

For more information, refer to the software manual for the com unit used.

4.2.1 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.

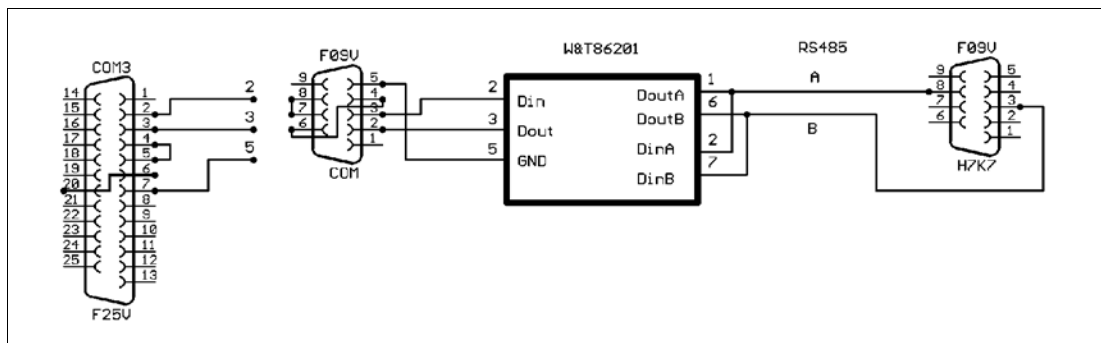


Figure 4.1 Wiring diagram for W&T RS-232-RS-485 interface converter

4.2.2 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).

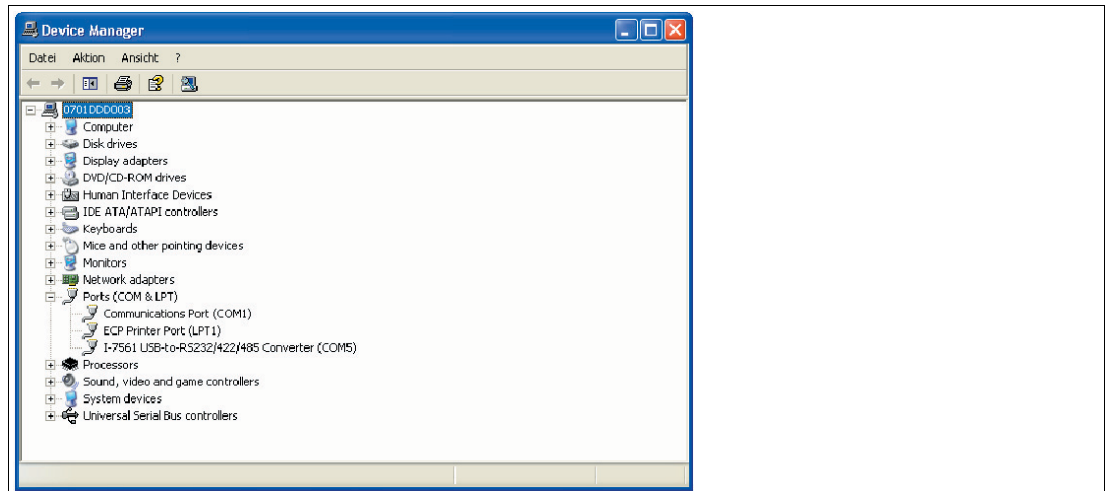


Figure 4.2 USB converter in device manager

4.3 Startup Phase

Do not start to operate all the remote I/O stations simultaneously; instead, connect each remote I/O station to the master in succession.

Ensure that the master read cycle and the com unit watchdog are coordinated with one another. The duration for the transition to substitute values must be longer than the duration of a bus cycle.

For the purposes of fault analysis, we recommend using a bus monitor that is capable of passively monitoring data telegrams on the fieldbus.

Temporary Overload of the Power Supply

To avoid an overload of the power supply in the startup phase as a result of increased startup currents, the number of certain I/O modules on the backplane is limited.

Use:

- A maximum of 11 LB3*, LB4*, and LB7* single-channel I/O modules. Each of these I/O modules consumes 9.09 % of the startup capacity.
- **Or** a maximum of 8 LB3* and LB7* four-channel I/O modules. Each of these I/O modules consumes 12.5 % of the startup capacity.



5 Operation



Danger!

Risk of explosion

If I/O modules are hot swapped, there is a risk of explosion due to sparks forming, since the connections on the backplane are not intrinsically safe.

Before replacing I/O modules, make sure that the atmosphere is not potentially explosive, e.g., by obtaining a hot work permit.

During operation, you can access up-to-date measured values and diagnostic information for the I/O modules via the com unit. For more information, refer to the software manual for the com unit used.

In addition, you can read off basic information about supply and communication from the LEDs on the I/O modules and com units. For more information about the LEDs, refer to the data sheets for the I/O modules and com units used.

6 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.

Communication Errors

Error	Remedy
Communication error on the fieldbus	<ul style="list-style-type: none"> • Check that the cables are connected. • Check that the transmitting and receiving lines are wired correctly and have not been swapped. • Check that the nodes are positioned in linear form and without branches. A star-shaped layout is not permitted. • Check that the terminator has been activated. The fieldbus must have exactly two terminators per segment, one at the start and one at the end. • In the configuration software, check that the selected address is the same as the remote I/O station address. • In the configuration software, check whether the master read cycle and the com unit watchdog are coordinated with one another.
Communication error on the service bus	<ul style="list-style-type: none"> • Check that the cables are connected. • Check that the nodes are positioned in linear form and without branches. A star-shaped layout is not permitted. • Check that the terminator has been activated. The service bus must have exactly two terminators per segment, one at the start and one at the end. • In the configuration software, check that the selected address is the same as the remote I/O station address. • Check that the correct interface is preset in the configuration software.
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 (RS-232 to RS-485 converter or USB to RS-485 converter) with automatic detection of the baud rate and transmission direction.
A new remote I/O station will not work on a bus if other remote I/O stations are already operating on the bus.	<ul style="list-style-type: none"> • Check that the terminators are still on the start and end of the bus after expansion.
The software cannot locate a com unit when establishing the connection	<ul style="list-style-type: none"> • Check that the com unit is plugged in correctly.

Redundancy Faults

Fault	Remedy
Continuous redundancy switchover	<ul style="list-style-type: none"> • Check that the correct type of redundancy is selected (media redundancy or application redundancy). • In the configuration software, check whether the master read cycle and the com unit watchdog are coordinated with one another. • Check that the process control system is set to the correct 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, establish a connection.
I/O 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 one another.

Signal Faults

Fault	Remedy
Faulty signal	<ul style="list-style-type: none"> • Check whether the I/O module is in simulation mode or whether it is working with substitute values. • Check if there is a short circuit or lead breakage within the circuit. • Check that the field devices and sensors are working properly. • Check the communication path to the I/O module. • If necessary, replace 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 using a bus monitor.
The output module switches 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 in the configuration software.
Input module sporadically delivers no measured values	<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.
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.
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.



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