

MANUAL

FB Remote I/O System Hardware



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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
- Mounting 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 additional documentation available online at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This hardware manual
- Software manual for the com units in use
- Instruction manuals for the components in use
- Datasheets for the components in use

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

- EC-type-examination certificate
- EU 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.

Ensure that you are familiar with the system and its components before use. Read the documentation 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 Gb

The FB remote I/O system may be installed and operated in Zone 1 only if it is installed in a surrounding enclosure that complies with equipment protection level Gb.



Note!

Certification Required

The FB remote I/O system must be certified by a notified body before commissioning.

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, bus termination modules, and power supplies, are plugged into the slots on the backplane. The I/O modules, com units, bus termination modules, and power supplies of the FB systems can be replaced during ongoing operation in Zone 1. 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	FB8205*, FB8206*, FB8209*
MODBUS RTU	FB8207*
MODBUS TCP	FB8211*
FOUNDATION fieldbus H1	FB8210*

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 Overview



Figure 2.1 FB remote I/O system components

1. Surrounding Enclosure
2. Backplane with Ex e terminals for power supply and bus cables
3. Power supply
4. Bus termination module
5. Com unit
6. I/O module with intrinsically safe circuits
7. I/O module with Ex e front connector
8. Cable gland for field lines
9. Cable gland for power supply and bus cables

2.4 Backplanes

2.4.1 Function

Backplanes are used to hold com units, bus termination modules, power supplies, and I/O modules. Fixed slots are reserved on the backplane for com units, bus termination modules, 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

The following backplanes can be used as base backplanes or as extension backplanes. Connect the two backplane using backplane connection cable FB9274-300.

FB9262BP10220.0

- Redundant configuration with slots for two com units, two bus termination modules, two power supplies
- Slots for max. 10 single-width or 5 dual-width I/O modules
- For PROFIBUS DP, MODBUS RTU, MODBUS TCP, Ethernet

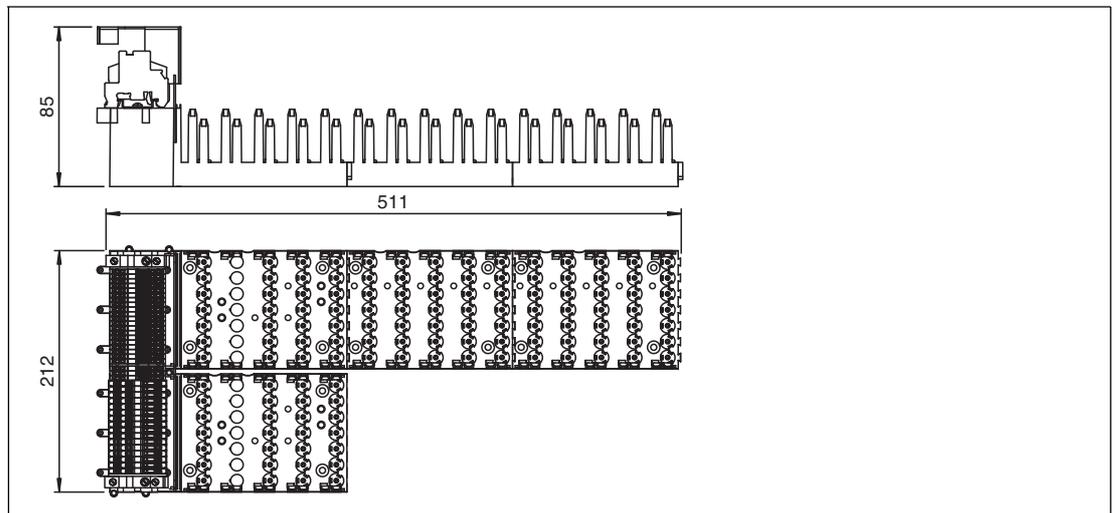


Figure 2.2 FB9262BP10220.0 dimensions

FB9262BP20220.0

- Redundant configuration with slots for two com units, two bus termination modules, two power supplies
- Slots for max. 20 single-width or 10 dual-width I/O modules
- For PROFIBUS DP, MODBUS RTU, MODBUS TCP, Ethernet

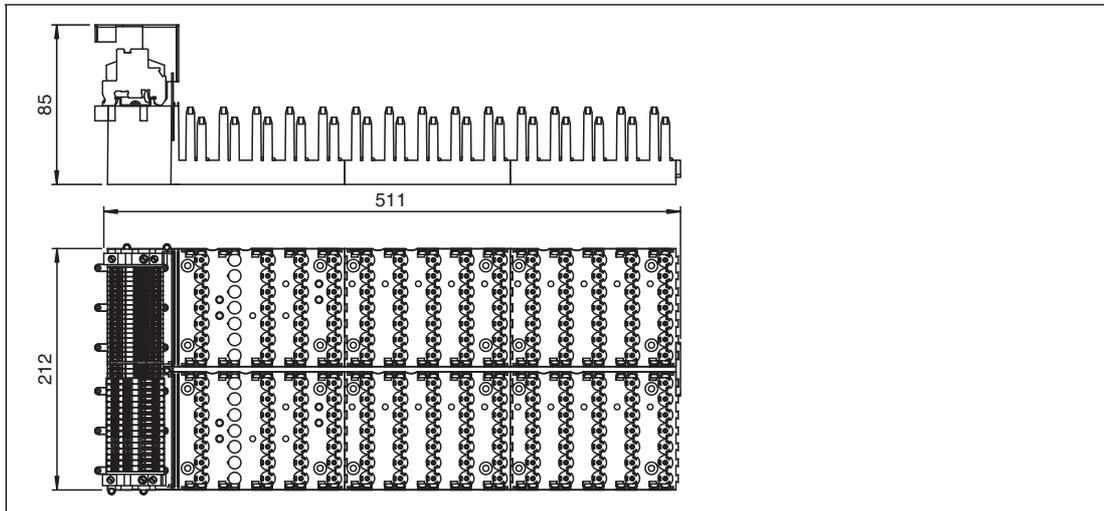


Figure 2.3 FB9262BP20220.0 dimensions

2.4.3 Backplane and Module Compatibility

In principle, FB backplanes are compatible with all FB 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.

FB9262BP*

Use this backplane with the following power supplies only:

- FB9206D
- FB9215B2

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 single-channel I/O modules of type FB3*, FB4*. Each of these I/O modules consumes 9.09 % of the startup capacity.
- **or** a maximum of eight four-channel I/O modules of type FB3*. Each of these I/O modules consumes 12.5 % of the startup capacity.

2.5 I/O Modules, Com Units, Bus Termination Modules, Power Supplies

2.5.1 Function

I/O modules are signal conditioning devices. Field signals from a hazardous area are prepared 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.

Bus termination modules prevent the reflection of signals at the end of the bus line. A bus termination module is required in each final station of a bus line.

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. Bus termination modules are always single-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. On the back of the I/O modules there is a coding pin that prevents an I/O module from being accidentally inserted into a slot that is intended for a com unit or a power supply.

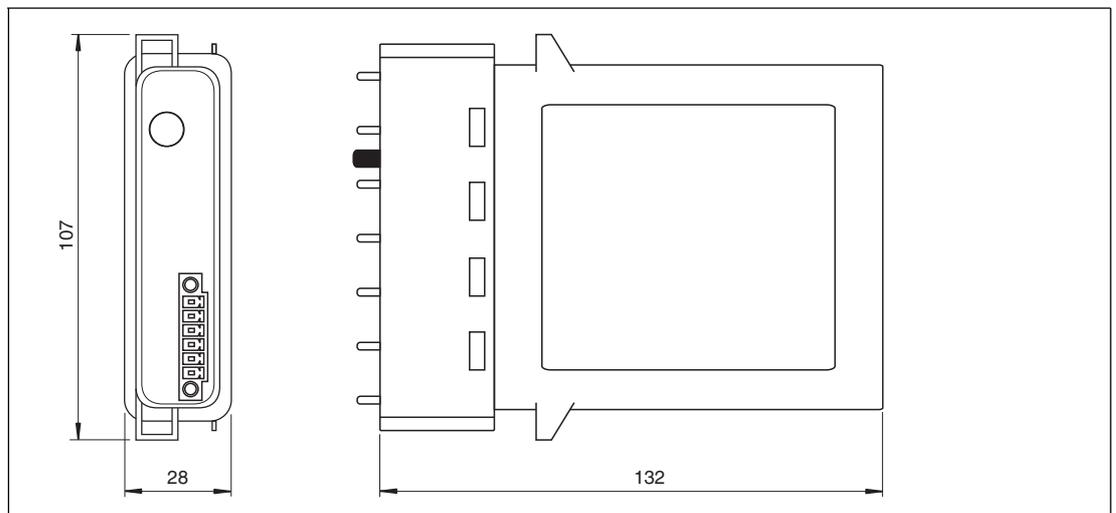


Figure 2.4 Single-width module dimensions

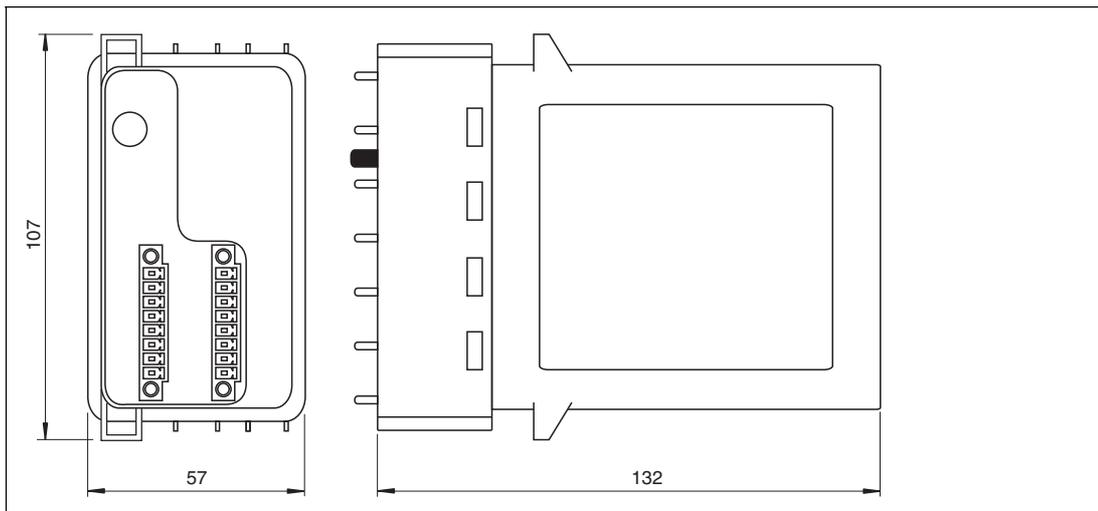


Figure 2.5 Dual-width module dimensions

2.6 Field Units

Field units are enclosure solutions, in which one or more backplanes are preinstalled. The enclosures are either made of glass fiber reinforced polyester or stainless steel and are available in various sizes and versions.

Additional terminal boxes and boxes with grounding bars, which can be provided with a bottom flange, are available for enclosures made of glass fiber reinforced polyester.

More information can be found at www.pepperl-fuchs.com.

2.7 Accessories

2.7.1 Bus Connection

The power supply and the bus cables are wired using the Ex e terminal strip, which is located on the left side of the backplane.

2.7.2 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. Use blue terminal blocks for intrinsically safe circuits. Use black terminal blocks for non-intrinsically safe circuits that comply with type of protection Ex e.

■ Screw Terminals

- Blue: LB9107A, LB9113A, LB9124A, LB9125A

■ Front Screw Terminals

- Blue: LB9117A, LB9118A, LB9119A, LB9127A

■ Spring terminals

- Blue: LB9107P, LB9115A, LB9116A, LB9126A
- Black: LB9109.E.6.1, LB9109.E.8.1, LB9109.E.8.2

Screw Terminals

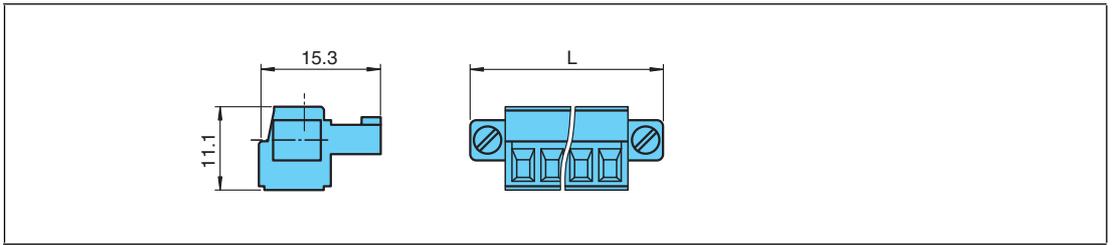


Figure 2.6 Screw terminal dimensions

L = 33.3 mm for 6-pin terminals and 40.9 mm for 8-pin terminals

Front Screw Terminals

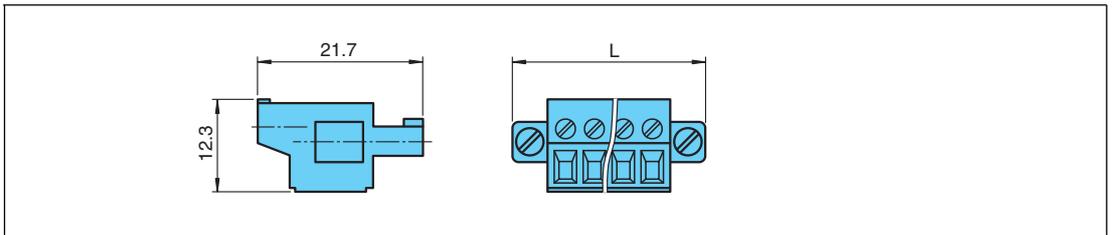


Figure 2.7 Front screw terminal dimensions

L = 33.3 mm for 6-pin terminals and 40.9 mm for 8-pin terminals

Spring Terminals

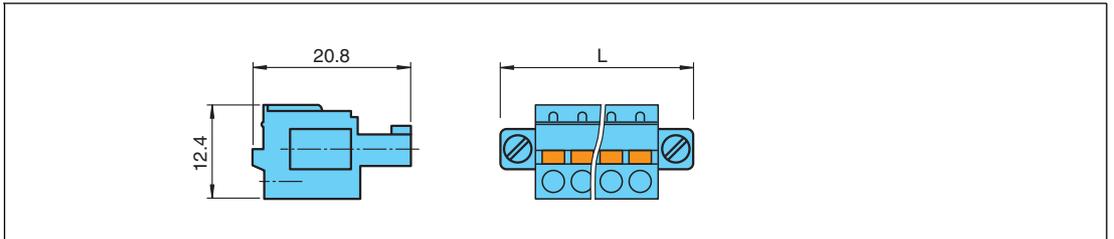


Figure 2.8 Spring terminal dimensions

L = 33.3 mm for 6-pin terminals and 40.9 mm for 8-pin terminals

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 black and blue. Use blue protective covers for intrinsically safe circuits. Use black protective covers for non-intrinsically safe circuits that comply with type of protection Ex e.

■ Protective covers

- Blue: LB9108A, LB9120A
- Black: LB9107.E.6, LB9107.E.8

Protection covers for intrinsically safe circuits

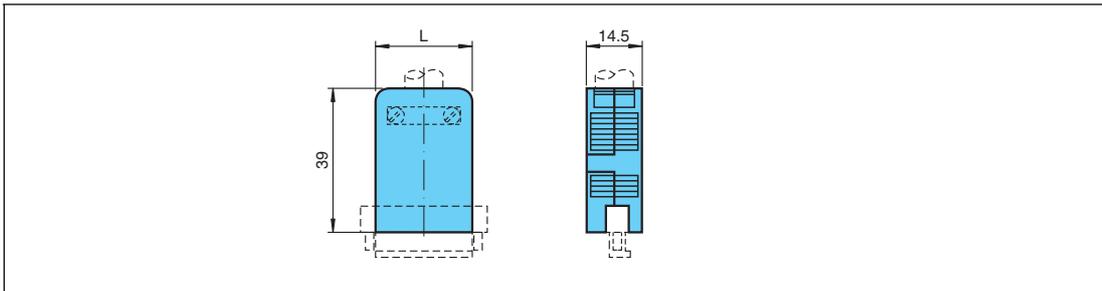


Figure 2.9 Protective cover dimensions

L = 25.25 mm for protective covers for 6-pin terminals and 32.87 mm for protective covers for 8-pin terminals

Protective covers for Ex e modules

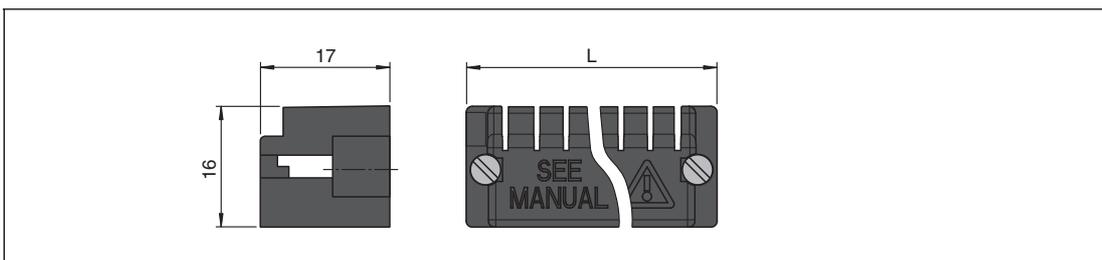


Figure 2.10 Dimensions of protective covers for Ex e modules

L = 33.4 mm for protective covers for 6-pin terminals and 40.8 mm for protective covers for 8-pin terminals

Cold junctions

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

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

Cold Junction

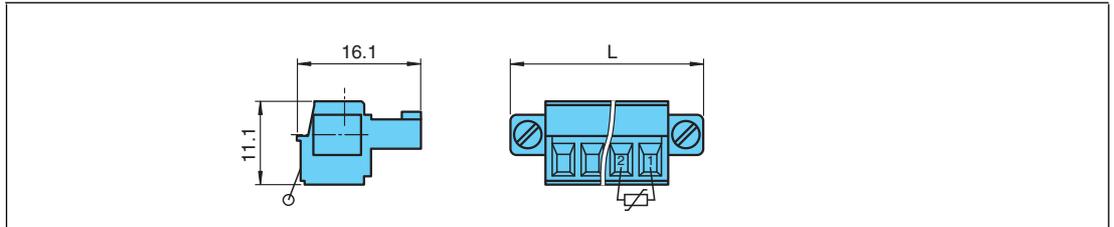


Figure 2.11 Cold junction dimensions

L = 33.3 mm for 6-pin terminals

Cold Junction with a Protective Cover

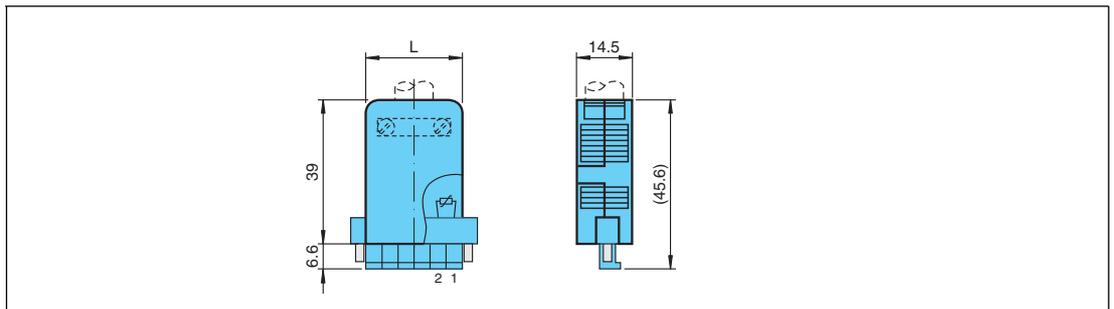


Figure 2.12 Dimensions of a cold junction with a protective cover

L = 33.3 mm for 6-pin terminals



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.

KF-CP

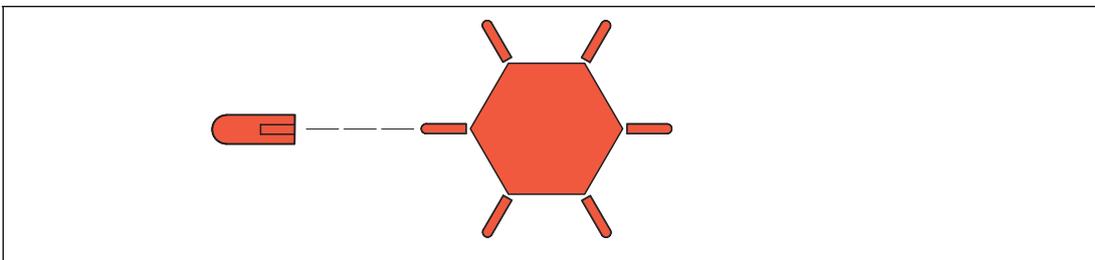


Figure 2.13 KF-CP coding pins

Watchdog Plugs

The watchdog plug is used with digital outputs with a feedback input (FB2201B ... FB2213E). 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

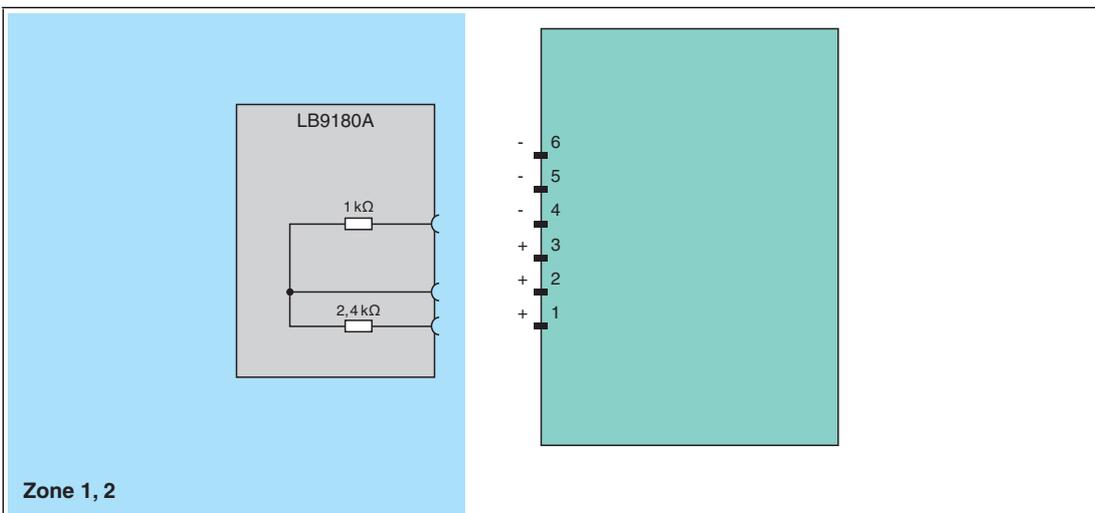


Figure 2.14 Block diagram for the LB9180A

Resistor Network

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

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

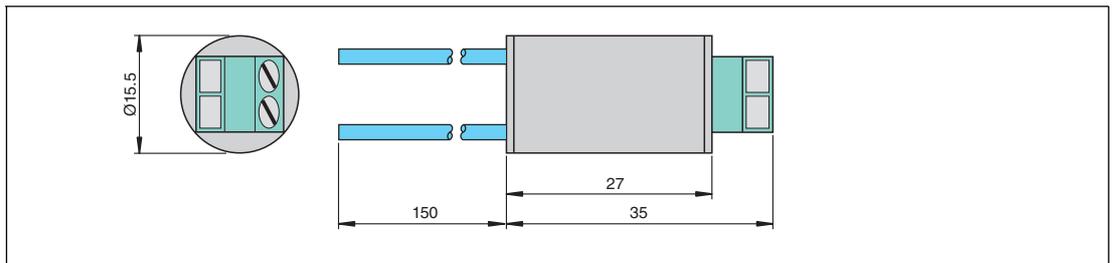


Figure 2.15 Dimensions of the F-NR2-Ex1 resistor network

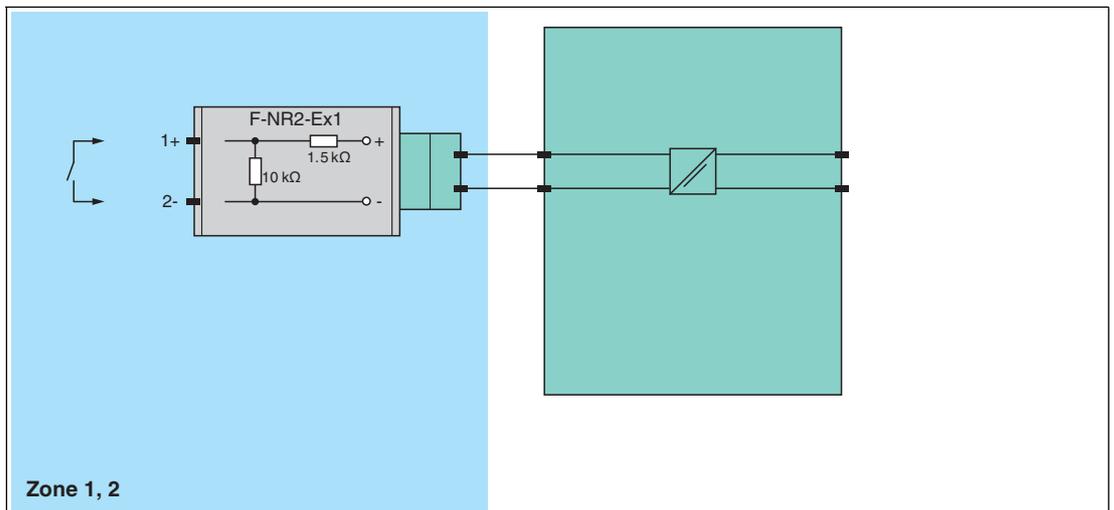


Figure 2.16 Block diagram of the F-NR2-Ex1 resistor network



2.7.3 Connection Cables

Com unit connection cable

The com unit connection cable LB9140A establishes a local connection between two com units. If two com units are used in a redundant system, they must be connected using a com unit connection cable via the front socket to enable internal data exchange. The length of com unit connection cable LB9140A is 1 m.

Com unit FB8211* has 2 front sockets. The socket with contacts 1 ... 8 is used to connect the com unit connection cable. The socket with contacts 9 ... 16 serves as a service bus connection.

Com unit FB8210* is not designed for redundancy mode and therefore has no front socket.

Backplane connection cable

Backplane connection cables FB9271* ... FB9274* establish a local connection between a base backplane and an extension backplane. If a base backplane is extended with an extension backplane with additional I/O modules and power supplies, the backplane connection cable ensures data exchange between the com units on the base backplane and the I/O modules on the extension backplane. The length of backplane connection cables FB9271* ... FB9274* is up to 3 m.

3 Installation

3.1 Surrounding Enclosure



Note!

Requirements for Equipment Protection Level Gb

The FB remote I/O system may be installed and operated in Zone 1 only if it is installed in a surrounding enclosure that complies with equipment protection level Gb.



Note!

Certification Required

The FB remote I/O system must be certified by a notified body before commissioning.

3.2 Mounting the Backplane



Mounting the Backplane

1. Mount the backplane horizontally on a DIN mounting rail.
2. Make sure that the maximum ambient temperature for the components used is not exceeded.

3.3 Connectors

3.3.1 FB9262BP*

The power supply and the bus cables are wired using the Ex e terminal strip, which is located on the left side of the backplane.

Connection data for the Ex e terminal strip	
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

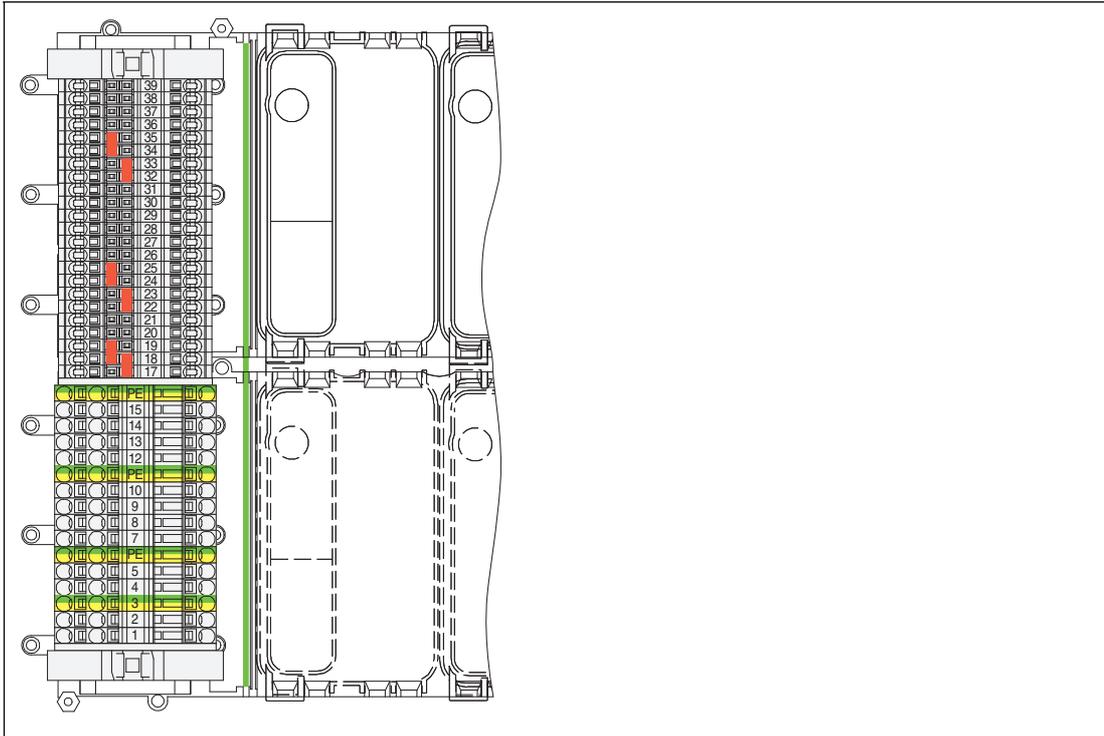


Figure 3.1 Ex e terminal block FB9262BP10220.0, FB9262BP20220.0

Terminal	Plug-in jumpers	Function	
39		Connection between base backplane and extension backplane	
38			
37			
36			
35	x		
34			
33			x
32			
31			
30			
29			
28			
27			
26			
25	x		
24			
23			x
22			
21			
20			

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Terminal	Plug-in jumpers		Function	
19	x		Bus-independent deactivation of the I/O modules	Slots 1 ... 10
18		x		
17				Slots 11 ... 20
PE			Bus connections	Screen
15				PROFIBUS DP, MODBUS RTU: B MODBUS TCP, Ethernet: TX+
14				PROFIBUS DP, MODBUS RTU: A MODBUS TCP, Ethernet: TX-
13				PROFIBUS DP, MODBUS RTU: A (service bus) MODBUS TCP, Ethernet: RX+
12				PROFIBUS DP, MODBUS RTU: B (service bus) MODBUS TCP, Ethernet: RX-
PE			Redundant bus connections	Screen
10				PROFIBUS DP, MODBUS RTU: B MODBUS TCP, Ethernet: TX+
9				PROFIBUS DP, MODBUS RTU: A MODBUS TCP, Ethernet: TX-
8				PROFIBUS DP, MODBUS RTU: A (service bus) MODBUS TCP, Ethernet: RX+
7				PROFIBUS DP, MODBUS RTU: B (service bus) MODBUS TCP, Ethernet: RX-
PE			Power supply	PE
5				L(+)
4				N(-)
PE			Redundant power supply	PE
2				L(+)
1				N(-)

Table 3.1 Terminal designation FB9262BP10220.0, FB9262BP20220.0

Use as base or extension backplane

Backplanes FB9262BP10220.0 and FB9262BP20220.0 can be used as base backplanes or extension backplanes. Remove the following plug-in jumpers from the backplanes, which should be used as extension backplanes.

- 22/23
- 24/25
- 32/33
- 34/35

Connection to the extension backplane

To establish a connection between a base backplane and an extension backplane, connect the following terminals using the backplane connection cable FB9271* ... FB9274*.



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 between base backplane and extension backplane

Base backplane	Extension backplane	Color
39	39	Blue
38	38	Red
37	37	Black
36	36	Violet
31	35	Pink
30	23	Red/blue
29	29	Yellow
28	28	Green
27	27	Brown
26	26	White
21	25	Brown/green
20	33	Yellow/brown
16	16	Gray (screen)

Shutdown input

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 shutdown is performed using an external volt-free contact, which is galvanically isolated from other contacts and potentials. This isolation also applies to other contacts on other backplanes, unless there is an interconnection between a base backplane and an extension backplane. When the contact is open, the I/O modules are shut down by a shutdown input.



Danger!

Risk of Explosion

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

Only use a contact that is approved for use in the respective environment. For installation in Zone 1, use a contact that complies with type of protection Ex e.

- To use the bus-independent shutdown of I/O modules in slots 1 ... 10, replace plug-in jumper 18/19 with an external volt-free contact.
- To use the bus-independent shutdown of I/O modules in slots 11 ... 20, replace plug-in jumper 17/18 with an external volt-free contact.

Power supply connection

The power supply may originate from a central grid. We recommend that you install a mains filter. Then connect the power supply to the appropriate terminals of the basic and extension backplanes.

If you are using a direct current, make sure that the cross-sections of the cables are large enough to keep voltage drops on the supply lines to a minimum. The operating voltage must not fall below 20 V, even if loads are connected (e.g., on valves).

3.4 Maximum Number of I/O Modules



Danger!

Risk of Explosion

Due to excessively high power, the maximum permissible temperature within the enclosure and the maximum permissible surface temperature of the surrounding enclosure may be exceeded.

Perform a heat calculation to determine the maximum number of I/O modules. Do not install additional loads if the maximum permissible number of I/O modules is installed in the surrounding enclosure.

The maximum number of I/O modules that can be installed, taking into account the temperature class, is determined by the permissible power dissipation in the surrounding enclosure. If, in addition to the remote I/O system, other loads are installed, their power consumption may reduce the power available to the remote I/O system.

The power consumption of the I/O modules, com unit, and power supplies can be found in the associated data sheets. For some devices, the data sheet gives the power dissipation in addition to the power consumption. This specifies the power that is converted into heat in the device and is decisive for the calculation of heat in the surrounding enclosure. If the power dissipation is not specified in the data sheet, it can be calculated using the power consumption.

The values in the following tables are maximum values that can be applied if an internal temperature of 60°C is reached at an external temperature of the surrounding enclosure of 40 °C. At an external temperature of 50 °C, the permissible power must be halved.

Permissible power for stainless steel enclosures

Dimensions of the surrounding enclosure (mm) (W x H x D)	Permissible power P _{max} (W) wall mounted	Permissible power P _{max} (W) free standing
350 x 306 x 215	43	54
600 x 400 x 220	75	101
600 x 600 x 220	97	137
700 x 350 x 220	78	105
800 x 800 x 300	176	246
800 x 1000 x 300	206	295

Table 3.2 Permissible power for stainless steel enclosures

Permissible power for plastic enclosures

Dimensions of the surrounding enclosure (mm) (W x H x D)	Permissible power P _{max} (W)
544 x 271 x 210	34
544 x 407 x 210	43
544 x 544 x 210	53

Table 3.3 Permissible power for plastic enclosures

In comparison to analog outputs, digital outputs surrender a large part of their power consumption to loads in the field. It was therefore determined that a maximum of 40 analog channels can be installed in a base unit, and 40 channels in each extension unit. This can be achieved using 10 four-channel I/O modules, which each have a power consumption of 3 W. With a factor of 0.7 (simultaneity factor), this results in a total power consumption of 21 W. The factor was derived from DIN IEC 60364-7-718, VDE 0100-718:2008-05.

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FB2202*

A maximum of 20 I/O modules of type FB2202* are permitted per backplane.

FB621*

I/O modules of type FB621* have a booster connection for additional auxiliary energy. To provide additional auxiliary power in the case of an AC voltage supply, additional Ex e power supplies are required, which must be taken into account in the heat calculation if they are housed in the same surrounding enclosure.

3.5 Inserting and Removing Modules

The connector pins on the modules and the female connectors on the backplane form a flameproof enclosure when plugged together. This enables energized I/O modules without a hot work permit to be inserted or removed, provided that all non-intrinsically safe circuits are fitted with covers or protective covers with degree of protection IP30.



Danger!

Risk of Explosion

Bent or damaged pins on modules can generate a spark, which can cause explosive mixtures to ignite.

Never use modules with bent or damaged connector pins. If the connector pins are bent or damaged, replace the module with an intact module. Never repair modules with bent connector pins by yourself.



Figure 3.2 Bent connector pin



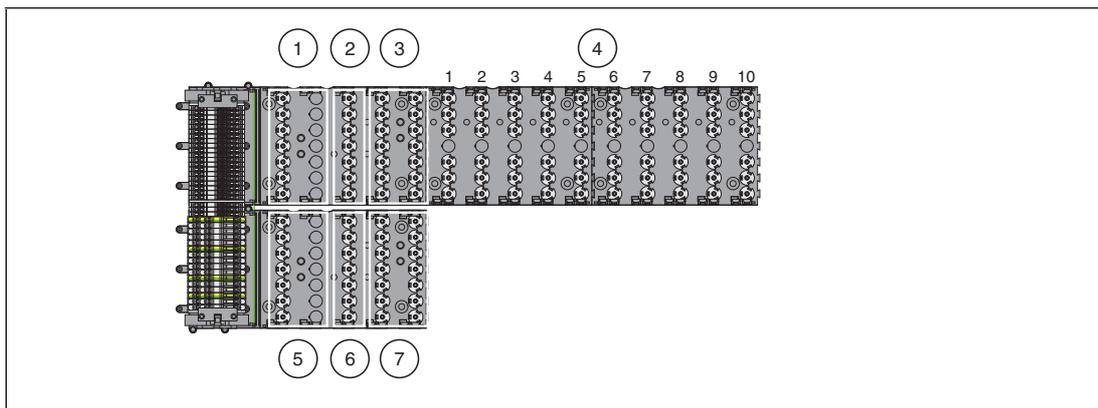
Figure 3.3 Damaged pins with nicks or scratches

Fixed slots are reserved on the backplane for com units, bus termination modules, 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.

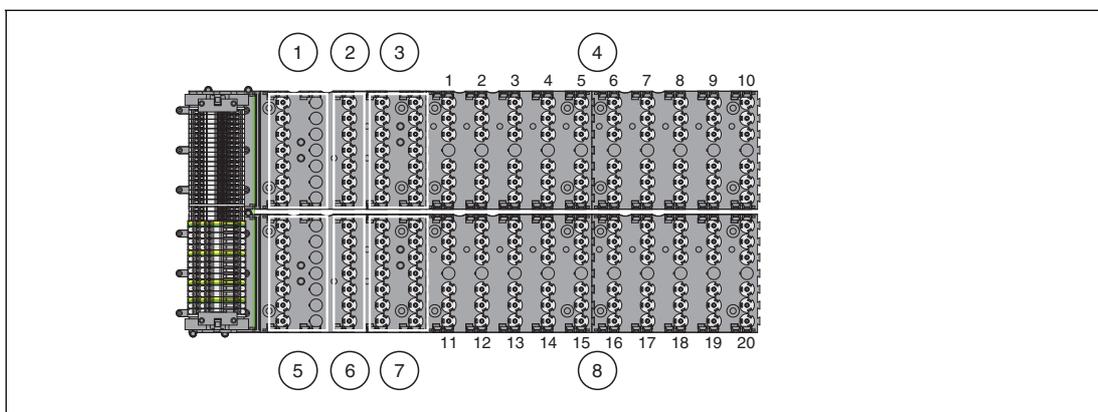
Unused slots can be left empty or fitted with place-holder module FB9299B.

Slots FB9262BP10220.0



1. Power supply
2. Bus termination module
3. Com unit when used as a base backplane
Empty slot when used as an extension backplane
4. Slots for 10 single-width or 5 dual-width I/O modules
5. Redundant power supply
6. Redundant bus termination module
7. Com unit when used as a base backplane
Empty slot when used as an extension backplane

Slots FB9262BP20220.0



1. Power supply
2. Bus termination module
3. Com unit when used as a base backplane
Empty slot when used as an extension backplane
4. Slots for 10 single-width or 5 dual-width I/O modules
5. Redundant power supply
6. Redundant bus termination module
7. Com unit when used as a base backplane
Empty slot when used as an extension backplane
8. Slots for 10 single-width or 5 dual-width I/O modules



Inserting modules



Note!

If you use redundant com units, establish a front connection between the primary com unit and the redundant com unit using com unit connection cable LB9140A before you insert the redundant com unit into the backplane. This ensures that communication between the com units begins immediately after the voltage supply is applied.

1. Write down the module types used or other identification codes using labeling strips, which you can stick between the female connectors of the backplane. The labeling strips should be no thicker than normal paper so that the I/O modules engage properly at all times.

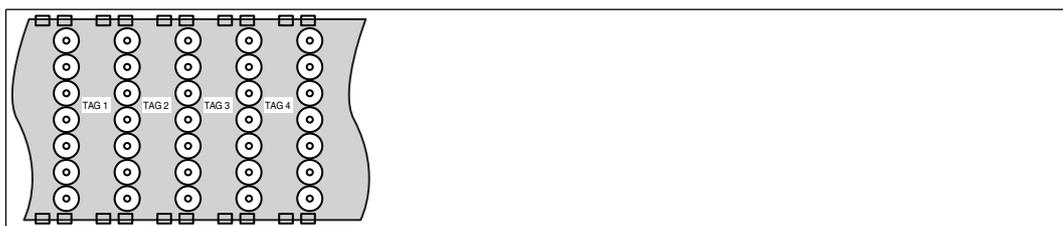


Figure 3.4 Backplane labeling

2. Arrange the modules on the backplane from left to right.
3. Push the I/O module into the slot until all the rear catches have snapped into place. The I/O module must engage twice.

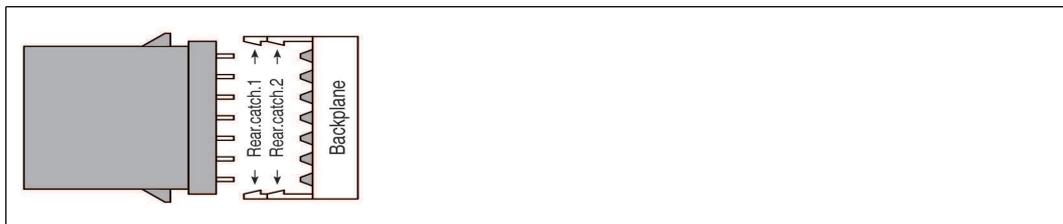


Figure 3.5 Inserting the module

↳ The I/O module is now mounted securely to the backplane.

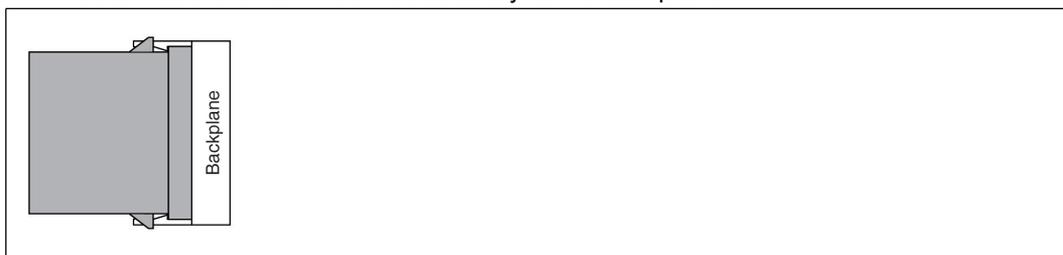


Figure 3.6 Module after insertion in the backplane



Removing modules



Warning!

Risk of Explosion

Forcibly removing modules or using unsuitable tools can damage the module or the backplane, meaning that explosion protection can no longer be guaranteed.

Remove modules only using the corresponding FB removal tool (item number 536628 for single-width modules and item number 536627 for dual-width modules). The FB removal tool requires a two-step removal process.

1. To release the first catch, position the FB removal tool on the right side of the module. Slide the FB removal tool towards the backplane up to the stop.



Figure 3.7 FB removal tool releases the first rear catch

2. Pull out the module a few millimeters together with the FB removal tool until you begin to feel resistance from the second rear catch.

↳ The first rear catch is released and the module no longer has electrical contact with the backplane.

3. Turn the FB removal tool and place it on the left side of the module. Slide the FB removal tool towards the backplane until the second catch is released.



Figure 3.8 FB removal tool releases the second rear catch

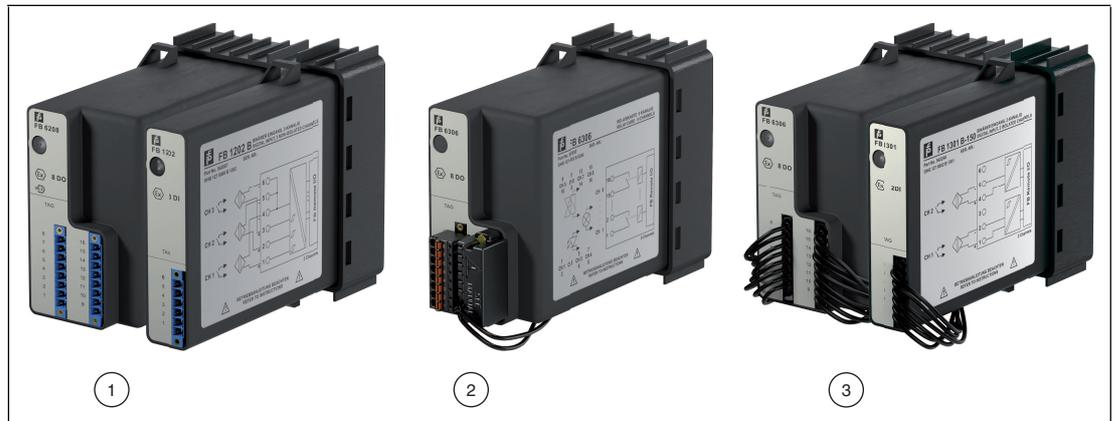
4. Pull the module together with the FB removal tool out of the backplane.

↳ The second rear catch is released and the module is removed from the module slot.

5. If applicable, adjust the information on the labeling strips of the backplane.

3.6 Field Wiring

I/O modules are wired differently depending on the type.



1. Modules with intrinsically safe circuits and front sockets
Field connections can be made to the I/O modules using screw terminals, front screw terminals, or spring terminals.
2. Modules with non-intrinsically safe circuits and front sockets
Field connections can be made to the I/O modules using black spring terminals. The spring terminals must be covered with protective covers for Ex e modules.
3. Modules with non-intrinsically safe circuits and cable tails
I/O modules with a cable tail must be connected to separately approved terminals that comply with type of protection Ex e. These terminals must be equipped with a cover with degree of protection IP30.

Use the terminal blocks and protective covers from the range of accessories. See chapter 2.7.2



Danger!

Risk of Explosion

A spark can be generated by bare, conductive parts such as loose wire ends, which can cause explosive mixtures to ignite.

Stranded conductors without wire end ferrules must not be used. We recommend using wire end ferrules approved according to DIN 46228-4.

If I/O-modules with intrinsically safe circuits and I/O modules with non-intrinsically safe circuits are placed directly next to one another, use wire end ferrules with plastic sleeves.

Please note the following requirements for wires, stranded conductors, and wire end ferrules.

■ Wires

- Insulation stripping: 9 mm
- Core cross-section (conductor): 0.5 mm² ... 1.5 mm²
- External diameter (conductor + insulation): 2 mm ... 3 mm



■ Stranded conductors

- Insulation stripping: 9 mm
- Core cross-section for wire end ferrules with plastic sleeve: 0.5 mm² according to IEC 60228 Class 5 and 6
- Core cross-section for wire end ferrules without plastic sleeve: 0.5 mm ... 1.5 mm² according to IEC 60228 Class 5 and 6

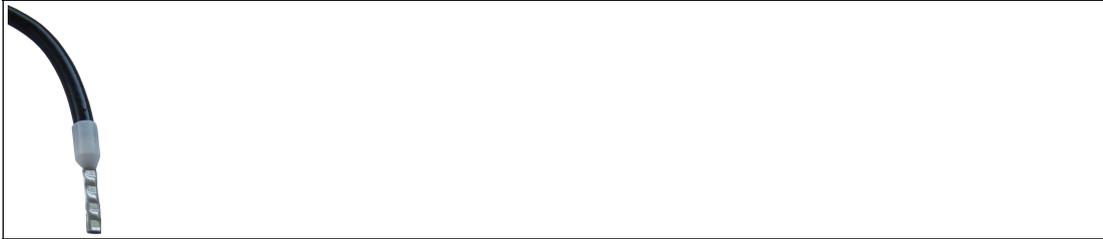


Figure 3.9 Stranded conductor with wire end ferrule



Danger!

Risk of Explosion

Protective covers for Ex e modules with non-intrinsically safe circuits have defined connected loads.

Do not exceed the maximum electrical connected loads: $U_{\max} = 63 \text{ V}$, $I_{\max} = 1 \text{ A}$



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.

3.6.1 I/O modules with front socket

Field connections can be made to the I/O modules using screw terminals, front screw terminals, or spring terminals. Use the terminal blocks and protective covers from the range of accessories. See chapter 2.7.2

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 also offer a test pick-off for measuring individual circuits.

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



Installing field wiring for intrinsically safe circuits



Danger!

Risk of Explosion

Improperly wired front connections can lead to dangerous mix-ups between intrinsically safe and non-intrinsically safe circuits, which can cause explosive mixtures to ignite.

1. The I/O modules are wired differently depending on the type. Wire the terminal blocks to the field devices in accordance with the information in the data sheets for the I/O modules used.
2. Note the permissible core cross-section of the conductor. We recommend that you do not exceed a conductor cross-section of 0.75 mm².
3. If you are using stranded conductors, make sure that these stranded conductors are crimped with wire end ferrules.
4. Make sure that conductors are insulated all the way up to the terminal.
5. Use blue terminal blocks/protective covers only.
6. Make sure that the separation distances to non-intrinsically safe circuits are observed.
7. Unused cables and connection lines must be either connected to terminals or securely fixed and isolated.
8. If necessary, 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. See chapter 3.7
9. Plug the terminals into the front sockets of the corresponding I/O modules and screw the terminals into place using the side screws.
10. Label the connection lines.



Installing field wiring for non-intrinsically safe circuits



Danger!

Risk of Explosion

If intrinsically safe and non-intrinsically safe circuits are present, protective covers may be removed only when the non-intrinsically safe circuits are de-energized and currentless. This can be achieved by disconnecting the I/O module and activating the field circuits using a multifunction terminal (MFT-*).

All unused terminal openings must be covered. If the field wiring is changed and lines are removed, for which lugs have already been broken off from the protective cover, replace the protective cover with a new one.

Non-intrinsically safe circuits must be covered with protective covers for Ex e modules.

1. The I/O modules are wired differently depending on the type. Wire the terminal blocks to the field devices in accordance with the information in the data sheets for the I/O modules used.
2. Note the permissible core cross-section of the conductor. We recommend that you do not exceed a conductor cross-section of 0.75 mm².
3. If you are using stranded conductors, make sure that these stranded conductors are crimped with wire end ferrules.
4. Make sure that conductors are insulated all the way up to the terminal.
5. Use only black terminal blocks of type LB9109.E.6.1, LB9109.E.8.1 and LB9109.E.8.2 and protective covers for Ex e modules of type LB9107.E.6 and LB9107.E.8.



Figure 3.10 Spring terminal with protective cover for Ex e modules

6. Make sure that the separation distances to intrinsically safe circuits are observed.
7. Unused cables and connection lines must be either connected to terminals or securely fixed and isolated.
8. If necessary, 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. See chapter 3.7
9. Plug the terminals into the front sockets of the corresponding I/O modules and screw the terminals into place using the side screws.
10. Break off the lugs of a protective cover for Ex e modules at the points where the field lines lead into the terminal openings. Unused terminal openings must remain covered by the lugs of the protective cover so that no bare, conductive parts are exposed.
11. Place the adapted protective cover for Ex e modules onto the terminal and screw the protective cover into place using the side screws.



Figure 3.11 Terminal with adapted protective cover for Ex e modules

12. Apply the warning marking **Warning - non-intrinsically safe circuits protected by internal cover with degree of protection IP30!** so that it is visible on the surrounding enclosure.

13. Label the connection lines.

3.6.2 I/O modules with cable tail

I/O modules with a cable tail must be connected to separately approved terminals that comply with type of protection Ex e. These terminals must be equipped with a cover with degree of protection IP30. The cover ensures that no bare, conductive parts are exposed.



Figure 3.12 Field wiring of an I/O module with 2 cable tails



Installing field wiring for I/O modules with cable tail



Danger!

Risk of Explosion

If intrinsically safe and non-intrinsically safe circuits are present, covers with degree of protection IP30 may be removed only when the non-intrinsically safe circuits are de-energized and currentless. This can be achieved by disconnecting the I/O module and activating the field circuits using a multifunction terminal (MFT-*).

The terminals for the field wiring must be equipped with a cover with degree of protection IP30.

1. Install the terminals on a separate DIN mounting rail. Arrange the terminals so that the length of the cable tails is sufficient.
2. Refer to the color coding of the connections from the data sheets for the I/O modules used.
3. Make sure that the separation distances to intrinsically safe circuits are observed.
4. Make sure that conductors are insulated all the way up to the terminal.



5. Follow the manufacturer's mounting instructions to install the terminals and the cover.
6. Unused cables and connection lines must be either connected to terminals or securely fixed and isolated.
7. Apply the warning marking **Warning - non-intrinsically safe circuits protected by internal cover with degree of protection IP30!** so that it is visible on the surrounding enclosure.
8. Label the connection lines.

Color coding for single-width I/O modules

Connection	Color
6	Pink
5	Gray
4	Yellow
3	Green
2	Brown
1	White

Color coding for dual-width I/O modules

Left connection	Right connection	Color
8	16	Red
7	15	Blue
6	14	Pink
5	13	Gray
4	12	Yellow
3	11	Green
2	10	Brown
1	9	White

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 coding pins KF-CP.



Coding Connections



Caution!

Danger of incorrect connections

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

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 2.7.2

- FB1*03*

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

- FB1*08*, FB1*09*

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

- FB2*

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 FB5202* and LB5205* are equipped with an internal cold junction. However, they can also 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 2.7.2



Figure 3.13 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 I/O modules FB5201* and FB5204* 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:

Short circuit the Pt100

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 Gage Measurement

I/O modules FB4*01* and FB5202* can be interconnected for strain gage measurements. Use analog output FB4*01* to create a constant current, and the measuring input for temperature input FB5202* 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 Gage Measurement

1. Either set the 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 FB5202* temperature input to a millivolt measurement **mV**.
3. Deactivate the cold junction of temperature input FB5202* by setting the thermostat temperature for the external cold junction to **0 °C**.

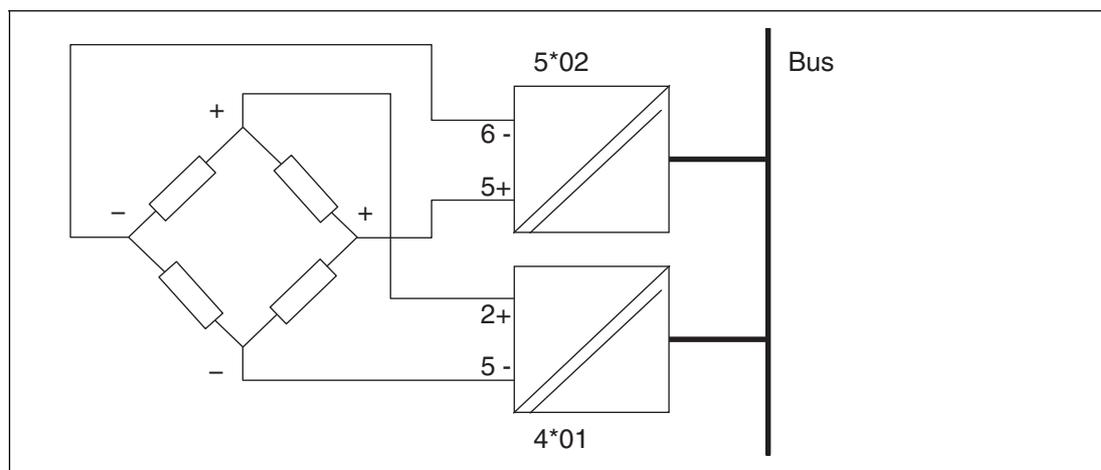


Figure 3.14 Example of a strain gauge bridge

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 set up a redundant system, use backplanes FB9262BP10220.0 and FB9262BP20220.0. These backplanes provide space for redundant com units, redundant bus termination modules, and redundant power supplies.

To ensure that the primary com unit and the redundant com unit use the same data record, both com units must be connected to one another. To do so, connect the com units via the front sockets using com unit connection cable LB9140A. 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.

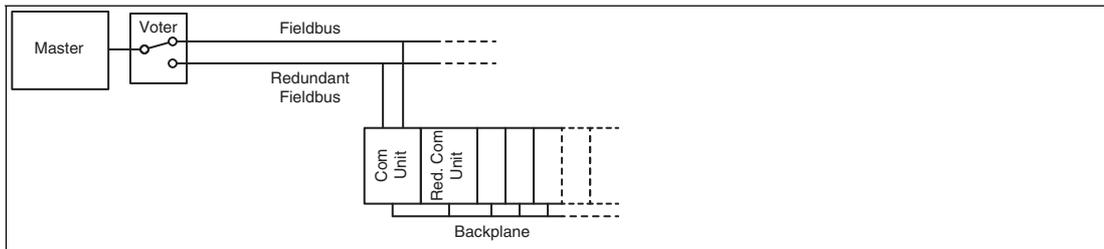


Figure 3.15 Line redundancy

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

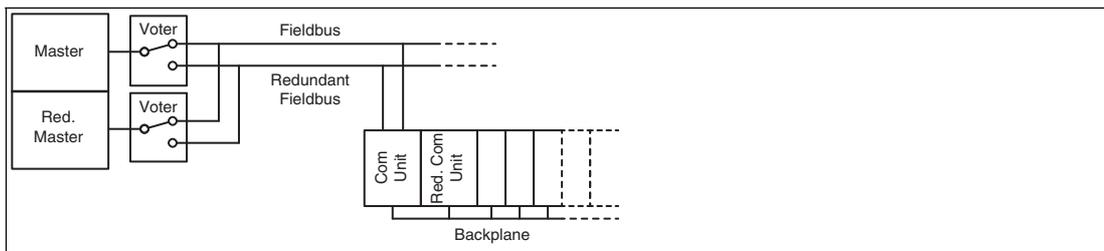
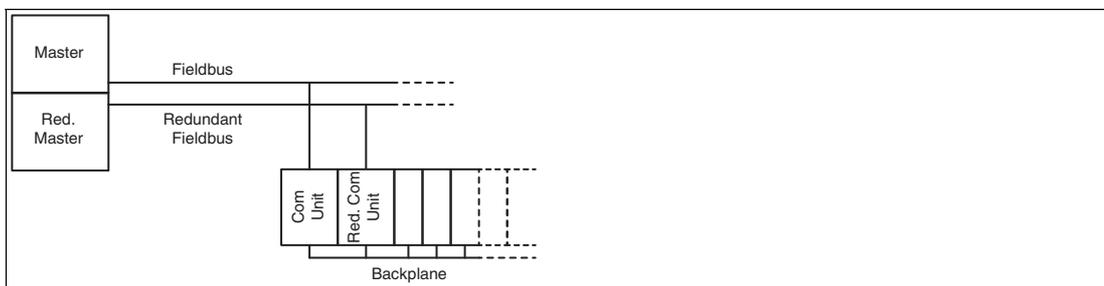


Figure 3.16 Extended media redundancy

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

The connections for the fieldbus and service bus are equipped with double terminals.

Connect the field bus to the appropriate terminals on the base backplane. See chapter 3.3.1

Cable length

Com units can be configured for various transfer rates. The required 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

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 unit is taken to be the end of the segment. A segment also ends or begins at a repeater or a fiber optic cable.

To install a terminator, use the following bus termination modules.

- Terminator for a service bus: FB9293*
- Terminator for a fieldbus: FB9294*
- Terminator for a service bus and a fieldbus: FB9295*

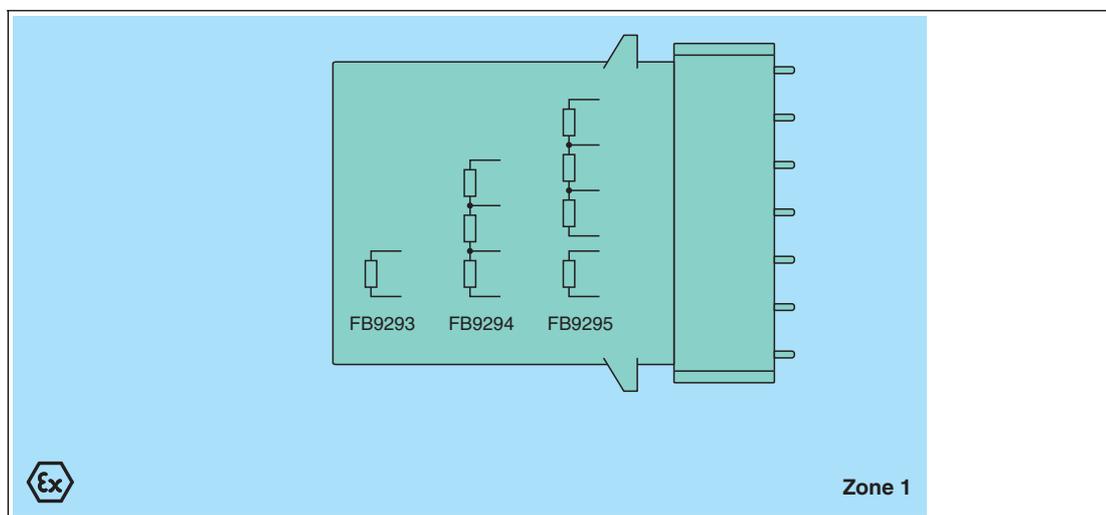


Figure 3.17 Block diagram for FB9293*, FB9294*, FB9295*



Example!

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



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.

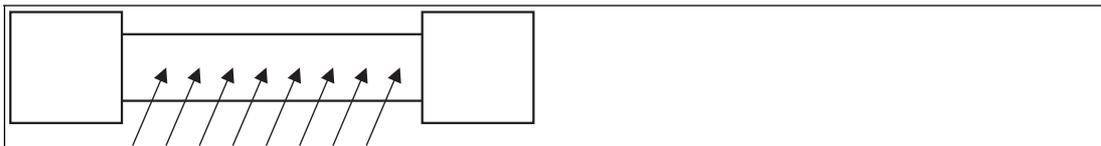


Figure 3.18 Interfering signals caused by induction in parallel conductors

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.

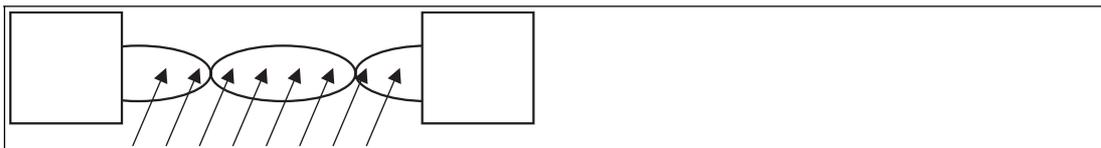


Figure 3.19 Reduced admission of interfering signals in twisted-pair cable

A shielding keeps interfering signals away from the communication path.

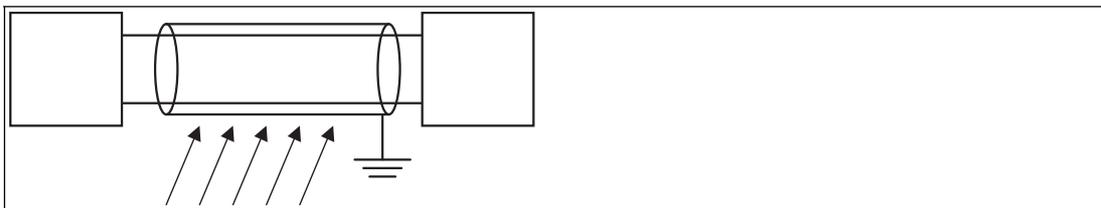


Figure 3.20 Shielding prevents the entry of interference fields

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.

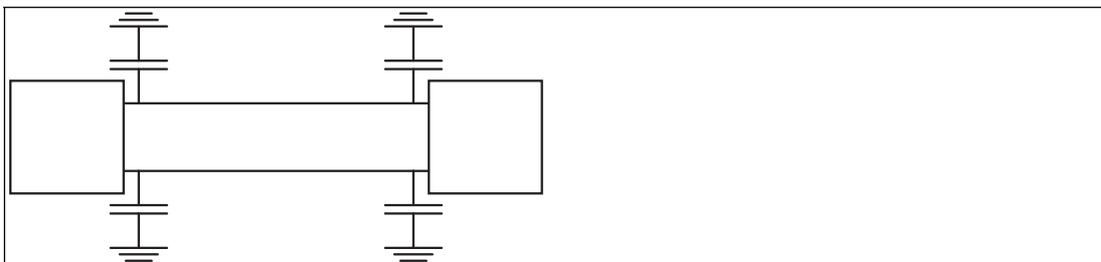


Figure 3.21 EMC filters in signal paths

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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.

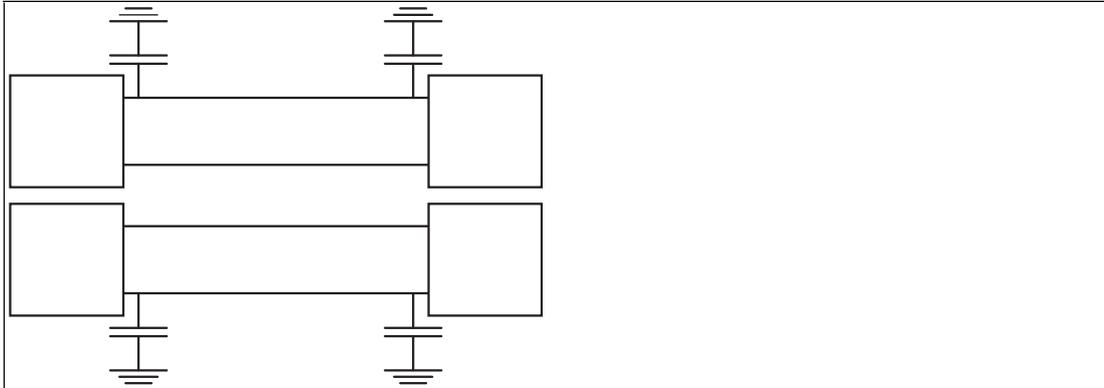


Figure 3.22 EMC filters in a network (simplified diagram)

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 Unicom com unit FB8209*. 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 FB8209*.

Extending the Fieldbus

In order to extend the fieldbus cable, the bus termination module may have to 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 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 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.

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!

Com unit FB8207* can be configured via the service bus only.

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

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 single-channel I/O modules of type FB3*, FB4*. Each of these I/O modules consumes 9.09 % of the startup capacity.
- **or** a maximum of eight four-channel I/O modules of type FB3*. Each of these I/O modules consumes 12.5 % of the startup capacity.



5 Operation

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

Fault	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 beginning 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 beginning 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. ■ Check the settings for the baud rate and transfer 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	Check that the terminators are still on the beginning and end of the bus after expansion.
The software cannot locate a com unit when establishing the connection	Check that the com unit is plugged in correctly.

Fault	Remedy
Communication to the extension backplane is not possible	<ul style="list-style-type: none"> ■ If backplanes FB9262BP10220.0 and FB9262BP20220.0 are used, check if the plug-in jumpers are set correctly. ■ Check that the base backplane and the extension backplane are wired correctly.
Bus-independent deactivation of the I/O modules is not possible	If backplanes FB9262BP10220.0 and FB9262BP20220.0 are used, check if the plug-in jumpers are set correctly.
Multiple I/O modules fail simultaneously	<ul style="list-style-type: none"> ■ Check that the power supply is working properly. ■ Check that the base backplane and the extension backplane are wired 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 whether the com units are connected via the front sockets using com unit connection cable LB9140A. ■ 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 whether the com units are connected via the front sockets using com unit connection cable LB9140A.
I/O modules are continuously changing the data	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.

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Fault	Remedy
Input module sporadically delivers no measured values	Communication with the com unit is interrupted. 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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