KUNBUS
industrial communication

PROFI BUS®

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1 General information

1.1 Disclaimer

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1.2 Notes regarding this user manual

This user manual provides important technical information that can enable you, as a user, to efficient, safe and convenient integration of the Gateways into your applications and systems. It is intended for trained, qualified personnel, whose sound knowledge in the field of electronic circuits and expertise of PROFIBUS is assumed.

As an integral part of the module, the information provided here should be kept and made available to the user.

1.3 Validity

This document describes the application of the KUNBUS Gateways with the product number:

– PR100069, Release 00

1.4 Limitation of Liability

Warranty and liability claims will lapse if:

– the product has been used incorrectly,
– damage is due to non-observance of the operating manual,
– damage is caused by inadequately qualified personnel,
– damage is caused by technical modification to the product (e.g. soldering).

1.5 Customer Service

If you have any questions or suggestions concerning this product, please do not hesitate to contact us:

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support@kunbus.de
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2 Safe use

2.1 User

The Gateway may only be assembled, installed and put into operation by trained, qualified personnel. Before assembly, it is absolutely essential that this documentation has been read carefully and understood. Expertise in the following fields is assumed:

– Electronic circuits,
– Basic knowledge of PROFIBUS,
– work in electrostatic protected areas,
– Locally applicable rules and regulations for occupational safety.

2.2 Symbols

The symbols used have the following meaning:

⚠ DANGER	**Hazard** Observe this information without fail! There is a safety hazard that can lead to serious injuries and death.

⚠ CAUTION	**Caution** There is a safety hazard that can result in minor injuries and material damage.

NOTICE	**Note** There is a safety hazard that can result in material damage.

3 Overview

3.1 Functionality

The KUNBUS Gateway is a protocol converter. It allows communication between networks with different protocols.
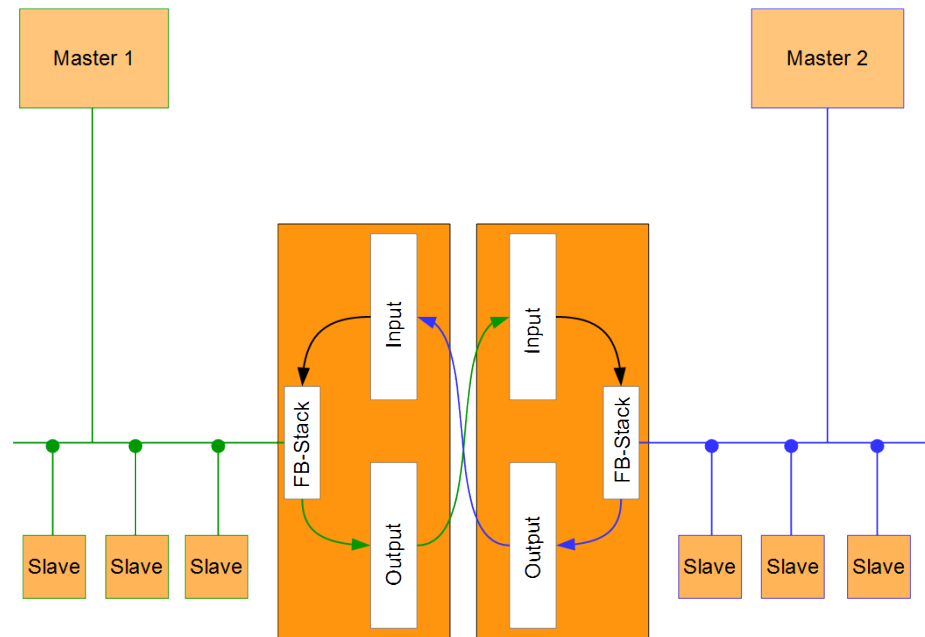
Illustration 1: Functionality

A Gateway consists of 2 gateway components that master one specific protocol each. You can combine these gateway components as you wish. This design offers you a high degree of flexibility, since you can exchange the individual gateway components at any time. The following gateway components are available as slave at present:

– CANopen
– CC-Link
– DeviceNet
– EtherCAT
– EtherNet/IP
– Modbus RTU
– Modbus TCP
– POWERLINK
– PROFIBUS
– PROFINET
– Sercos III

3.2 Control elements

Front view
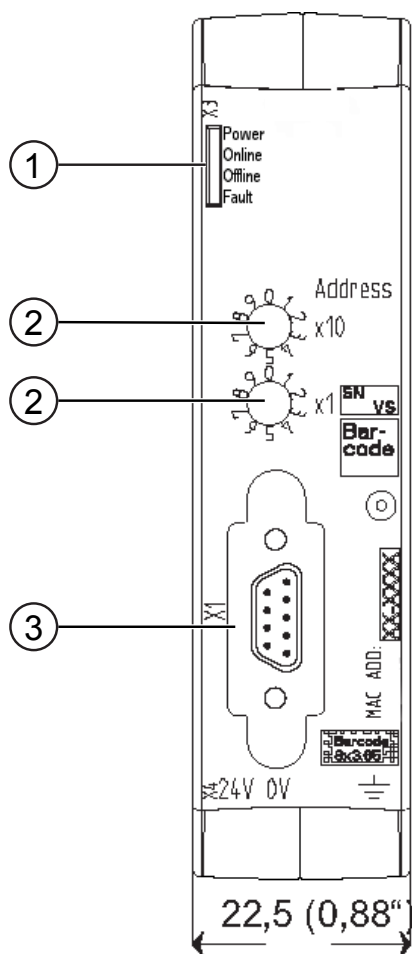
Illustration 2: Front view

1	Status LEDs for signal display.
2	2 rotary coding switches for setting the station address.
3	Fieldbus connection D-Sub-9 socket for the connection to PROFIBUS.

Top

Illustration 3: Top

1	Interconnect Port for interconnecting the gateway components.
2	Locking clamps for securely attaching the gateway component to the DIN rail.

Bottom

Illustration 4: Bottom

1	Mains connection with 24 V power supply
2	Locking clamps for securely attaching the gateway component to the DIN rail.

3.3 Status LEDs

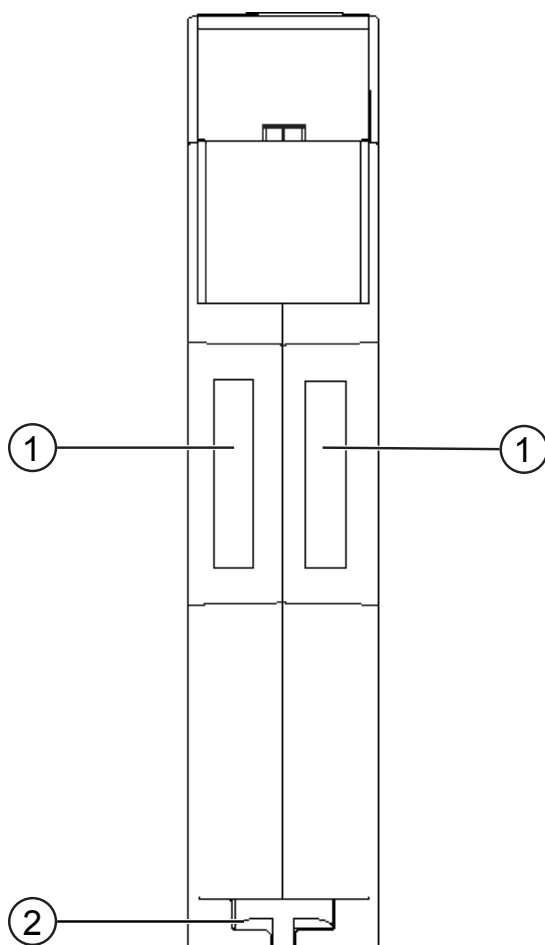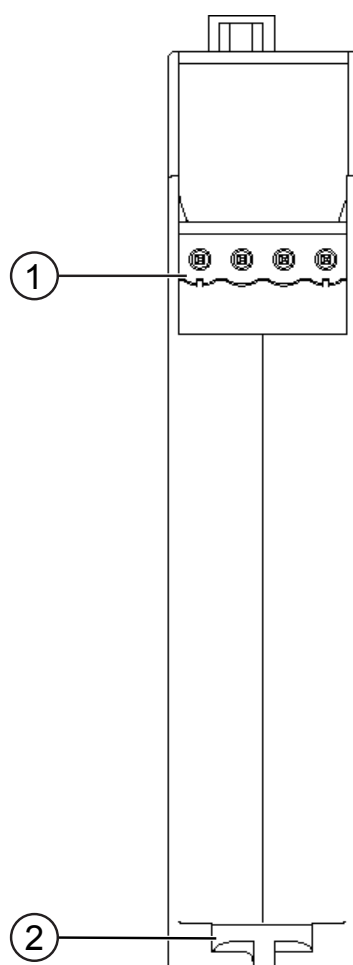The signals of the status LEDs for PROFIBUS have the following meaning:

LED Designation	Signal	Meaning
Power	off	Gateway not running
	flashes, green	Initialisation phase not yet completed
	on, green	Operational
	flashes, red	Correctable error (e.g. second gateway component missing)
	on, red	Serious error/defect in the gateway
Online	on, green	Data is exchanged cyclically
Offline	red	Cyclical data exchange stopped
	red	If the "Fault" LED additionally flashes: Watchdog Timeout
	red, green, flashes alternately	Firmware-Reset is executed
Fault	red	A serious error has occurred. Please contact support.
	red, flashes	If the "Offline" LED additionally lights up red: Watchdog Timeout

4 Installation

4.1 Preparations for interference-free operation

In the following section we have compiled some general information for you, which is important for interference-free operation. If you are already acquainted with this topic, you can skip to the next section. There, you will learn about which conditions are necessary for installing the gateway.

Cable routing

Route your cables separately in cable groups. This will protect your gateway from any unintended electromagnetic interferences.

The following groups should be routed separately:

Group	Line
A	Data and power supply lines for:
	DC voltage below 60 V
	AC voltage below 25 V
B	Data and power supply lines for
	DC voltage between 60 V and 400 V
	AC voltage between 25 and 400 V
C	Power supply lines above 400 V

- You can route cables of the same group together in cable ducts or bundles.
- Cables of group A and B:
  - Route the groups in separate bundles or
  - in cable ducts at a minimum distance of 10 cm from each other.
- Cables of group C
  - Route the groups in separate bundles or
  - in cable ducts at a minimum distance of 50 cm from the other groups.

Shielding

Shield your cables. This will reduce any unintended electromagnetic interferences.

You can find further information on this topic in the specifications for PROFIBUS.

Potential equalization

Potential differences occur when devices are connected to different earths. These potential differences cause malfunctions.

To prevent malfunctions, you have to route an equipotential equalization conductor.

When doing so, bear in mind the following points:

– Select an equipotential equalization conductor with low impedance.
– Select as a reference value for the cross-section of the potential equalization cable:
  – 16 mm^2 for potential equalization cables of up to 200 m in length
  – 25 mm^2 for potential equalization cables of more than 200 m in length
– Use potential equalization cables made from copper or galvanized steel.
– Connect potential equalization cables extensively with the earth rail.
– The smallest surfaces as possible should be sandwiched between potential equalization cables and signal cables.

If the devices of the control system are connected by shielded signal cables that are earthed on both sides, the impedance must be 10% of the shielding impedance.

4.2 Requirements

The Gateway was designed for use in a control cabinet.

✓ The protection class of the control cabinet must be equivalent to at least IP54.

✓ For installation in the control cabinet you need a DIN rail 35 x 7.5 mm (EN50022).

◦ Install the DIN rail horizontally in the control cabinet according to the manufacturers' specifications. When doing so, make sure that the Gateway is at a sufficient distance from other devices.

NOTICE	**Your gateway could get damaged if temperatures are too high.**

➔ Make sure that the ambient temperature in the control cabinet is less than 60 °C.

➔ Keep the ventilation slots unobstructed. These must not be covered by cables etc.

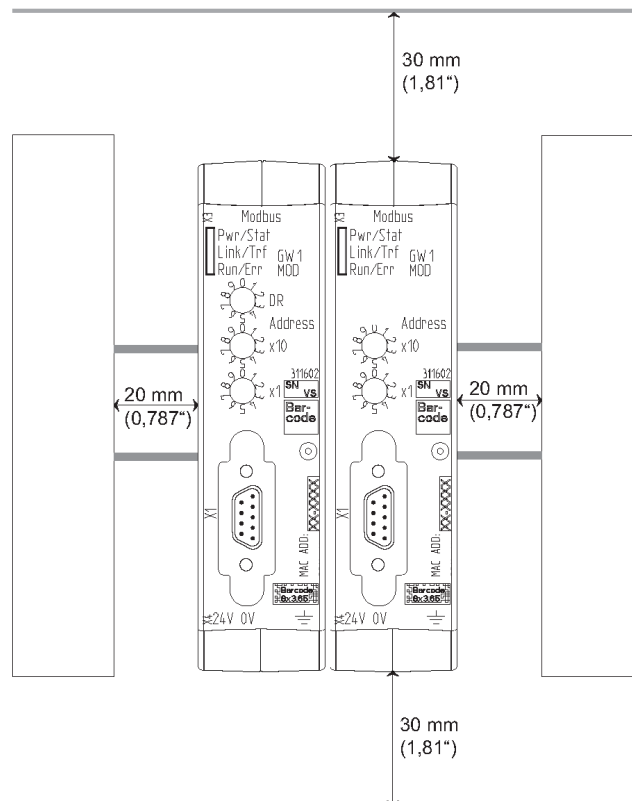➔ Maintain sufficient distance from other devices.

Illustration 5: Distances for installation

◦ Connect each gateway component individually to functional earth. When doing so, make sure that both voltages have the same ground.

⇨ Your control cabinet now meets all requirements for installing the gateway.

4.3 Connecting Gateway Components

In order to attain a fully functional gateway, you have to interconnect both gateway components.

- Connect an interconnect port to each gateway component using the plug-in jumper (product number PR100204).
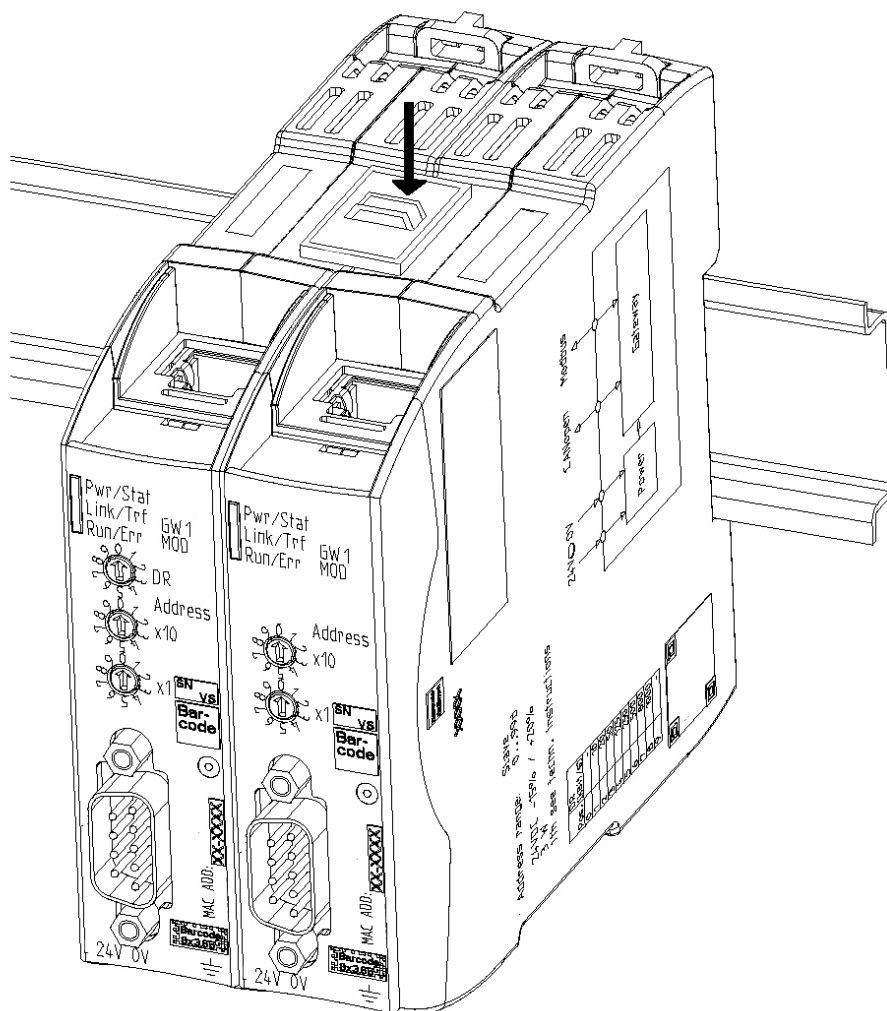
Illustration 6: Connecting Gateway Components

⇨ You can now install the gateway in the control cabinet.

NOTICE	**Only ever interconnect 2 gateway components.**
	If you connect additional components, severe defects could result on all devices.

4.4 Installing Gateway in the Control Cabinet

- Hold the raster element of the gateway on the DIN rail.
- Press down the locking elements towards the gateway.
- Make sure that the gateway is firmly attached to the DIN rail.

4.5 Connecting Power Supply

To connect the gateway component to the power supply, you need a spring-loaded terminal (e.g. Metz-Connect SP995xxVBNC).

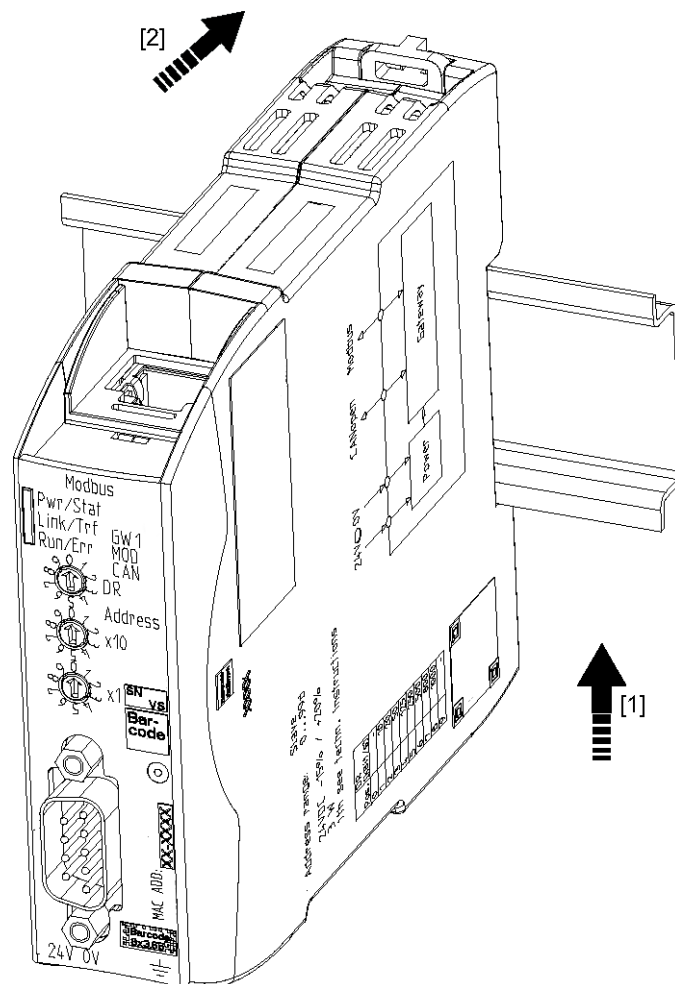You have to connect each gateway component separately to a power supply. Never interconnect functional earth and GND, otherwise the galvanic isolation between gateway GND and fieldbus ground will be removed. Instead, connect the functional earth with low impedance to the potential equalization. You can then dispense with this connection if the shield of the fieldbus cable is connected to the potential equalisation with lower impedance when entering the control cabinet.
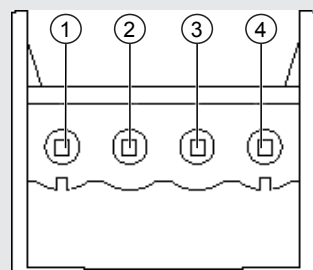
NOTICE	**Use the same power supply for both gateway components.**
	Different power supplies could cause a defect on both module components and malfunctions.
	➔ Ensure in particular that no potential differences occur between the GND pins (2).

Pin Assignment:

Pin	Assignment	
1	24 V for module supply	
2	GND	
3	Do not connect!	
4	Functional earth	

NOTICE	**Do not connect GND to PE**
	This connection could cause unintended malfunctions.

4.6 Connecting Gateway to the Fieldbus

To connect the gateway component to PROFIBUS, you need one D-SUB 9 connector.

The pin assignment complies with the specifications of the PNO.

Pin	Signal	Description
1	-	Not connected
2	M24	Not connected
3	RxD/TxD-P	Received/transmitted data plus, data wire B
4	CNTR-P	Control signal for repeater
5	DGND	Data transmission potential earth (galvanically isolated)
6	VP / +5V	Power supply +5V for bus connection (galvanically isolated)
7	-	Not connected
8	RxD/TxD-N	Received/transmitted data minus, data wire A
9	-	Not connected
Protective collar		Data transmission potential earth
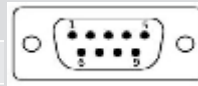
5 Configuration

5.1 Supported Size of the Process Data

The gateway component for PROFIBUS supports process data of a length up to 488 bytes.

NOTICE	**Bear in mind that the maximum length of the process data is always determined by the fieldbus with the shorter data length.**

Example:

CANopen supports 512 bytes

PROFIBUS supports 488 bytes

In conjunction with PROFIBUS/ CANopen this means that 488 bytes are transmitted and updated cyclically.

5.2 Address Assignment

PROFIBUS - Setting Station Address

You can set the station address of the Gateways using these rotary switches.

The address or additional settings are assigned in decimal format. Thus, you have a value range from 00-99 at your disposal. Also see: Table PROFIBUS Settings.

With the two rotary switches you form a two-digit decimal number, in which switch x10 (1) determines the tens digit and switch x1 (2) determines the single digit.
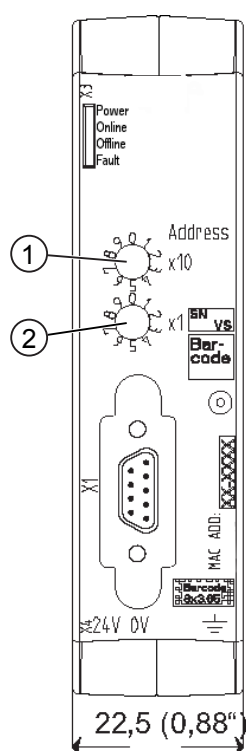

Illustration 7: Coding switch

Example: You want to set the value 39.

Setting for switch 1 = 3

Setting for switch 2 = 9

The settings execute the following actions:

Switch setting	Action
"01" to "98"	Setting Station Address
"00"	Address assignment via SSA telegram
"99"	Firmware Reset, (e.g. to remove address lock by SSA telegram.)

Table 1: PROFIBUS Settings

Info! The new station address is first used when you restart the gateway component.

SSA

The Gateway supports automatic address configuration via the "Set Slave Address" telegram of the PROFIBUS Master.

The PROFIBUS master sends SSA telegrams to the special station address 126. At the same time, a manufacturer identity number is also transmitted in addition to the station address. The manufacturer identity number is specific to a particular product. It can be obtained from the file name of the GSD file of the device. This ensures that only one device with the address 126, which has a particular ID, changes the address.

Address Lock

The Master also defines in this telegram whether the Gateway should no longer accept any further SSA telegrams. The Gateway processes this address lock and saves it permanently. The address is still used even after a restart of the Gateways. To remove the address lock and to change the address, you have to perform a firmware reset. Regardless of this, however, it is possible to change the address at any time using the rotary switch. The setting of the rotary switch always has priority over an address that was set by SSA.

Bitrate

The Gateway supports the following bitrates:

9600 Bit/s
19200 Bit/s
45450 Bit/s
93750 Bit/s
187.5 Kbit/s
500 Kbit/s
1.5 Mbit/s
3 Mbit/s
6 Mbit/s
12 Mbit/s

The Gateway detects the bitrate automatically. You do not have to perform any further settings here.

5.3 Parameterisation

In order to exchange input and output data, the Profibus Protocol Chip must be parameterised by the PROFIBUS Master. Using the device master data (GSD) in the Master you have the option of defining the parameterisation data:

– Watchdog time,
– Affiliation to master,
– Affiliation to group,
– minimum response time Gateways to queries of the master.

The Gateway supports the application commands "Freeze Mode" and "Sync Mode".

The parameter telegram is in accordance with the PROFIBUS standard. User parameters are not allowed.

5.4 PROFIBUS Configuration

To configure the gateway component, you have to perform the appropriate settings with the configuration software of your PROFIBUS Master (class 1).

The PROFIBUS gateway component is created as a so-called "modular DP-V0 Slave". This means that the process data exchanged between the gateways can be structured application-specific on the profibus side.

The gateway component is equipped for this with virtual slots (installation positions). PROFIBUS controllers use these slots to address selected process data. Each slot can contain one module. Within these modules is the process data to be exchanged. Hence, you have the possibility of aggregating associated process data in one slot. This means, for example, that you can poll a compact process mapping of associated states.

If you do not want to use a slot, you can mark it with an empty module. You do not have to perform any further settings on the empty module.

The process data is accessed between the gateway components in separate memory areas for input and output data. The sequence order in which the access takes place depends on the configuration of the modules.

The data of the modules is stored directly in succession in the memory area for the data exchange between gateways (see example further below).

Info! The gateway component does not support any extended diagnosis data.

Byte order:

The bytes are transferred to the controller in Big Endian format.

Module Configuration

A maximum of 64 slots, each with 244 bytes for input and output data, is available for the module configuration. The modules are preset in the GSD and cannot be changed.

The following modules are available for loading the slots:

Module number	Module type	Size [bytes/words]	Access
0	Empty module	0	-
1	Output	1	Byte
2	Output	2	Byte
3	Output	4	Byte
4	Output	8	Byte
5	Output	16	Byte
6	Input	1	Byte
7	Input	2	Byte
8	Input	4	Byte
9	Input	8	Byte
10	Input	16	Byte
11	Input/Output	1	Byte
12	Input/Output	2	Byte
13	Input/Output	4	Byte
14	Input/Output	8	Byte
15	Input/Output	16	Byte
16	Output	1	Word
17	Output	2	Word
18	Output	4	Word
19	Output	8	Word
20	Output	16	Word
21	Input	1	Word
22	Input	2	Word
23	Input	4	Word
24	Input	8	Word
25	Input	16	Word
26	Input/Output	1	Word
27	Input/Output	2	Word
28	Input/Output	4	Word
29	Input/Output	8	Word
30	Input/Output	16	Word

Example of Module Configuration

The following slots are to be configured:

Slot	Module type	Size [bytes/words]	Access	Module number
1	Input	1	Byte	6
2	Input	16	Byte	10
3	Output	16	Byte	5
4	Empty module	0	-	0
5	Input	1	Byte	6
6	Output	8	Byte	4
7	Input	4	Byte	8
8	Input/Output	4	Byte	13
9	Empty module	0	-	0
10	Input/Output	1	Word	26
11	Output	1	Word	16
12	Input	1	Word	21

The following tables provide the memory maps of the example and are thus used for data exchange with other gateways.

Input data

Offset	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x0000	Slot 1	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2
0x0008	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2	Slot 2
0x0010	Slot 2	Slot 5	Slot 7	Slot 7	Slot 7	Slot 7	Slot 8	Slot 8
0x0018	Slot 8	Slot 8	Slot 10 (L)*	Slot 10 (H*)	Slot 12 (L)*	Slot 12 (H*)	-	-

Output data

Offset	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x0000	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3
0x0008	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3	Slot 3
0x0010	Slot 6	Slot 6	Slot 6	Slot 6	Slot 6	Slot 6	Slot 6	Slot 6
0x0018	Slot 8	Slot 8	Slot 8	Slot 8	Slot 10 (L)*	Slot 10 (H)*	Slot 11 (L)*	Slot 11 (H)*

*(L)=Low Byte, (H)=High Byte

6 Technical data

6.1 Technical data

Dimensions	
Width	22.5 mm
Height	96 mm
Depth	110.4 mm
Weight	90 g

Electrical Data	
Power supply	24 V
Power consumption during operation (cyclical data exchange)	100 mA
Status display	LED

Environmental Conditions	
Ambient temperature	0 – 60 °C
Storage temperature	- 25 – 70 °C
Humidity	93 % (at 40 °C)
Condensing	Not allowed
Protection class	
Control cabinet	IP54
Housing	IP20
Terminal area	IP20

Assembly Data	
DIN rail	35 x 7.5 mm
Height	96 mm
Depth	110.4 mm

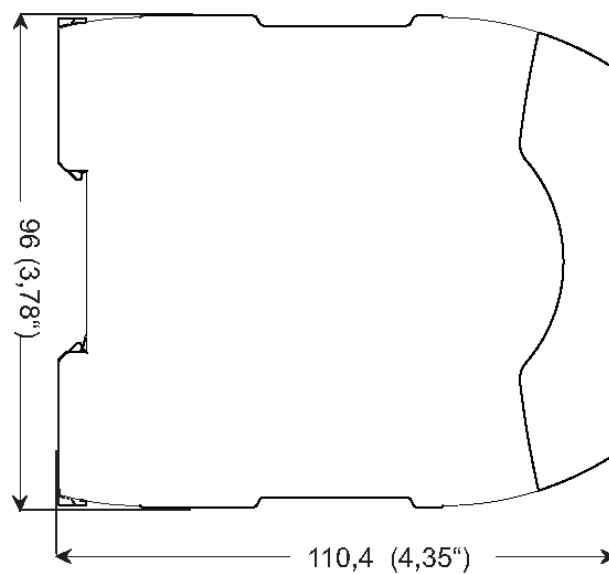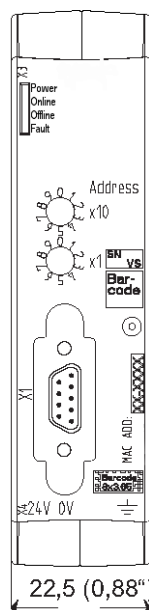| PROFIBUS Interface	
Device Type	Slave
Protocol	DP-V0
Station address	1-98 (decimal)
Maximum data length	
Total	488 byte
Input data	244 byte
Output data	244 byte

Illustration 8: Side dimensions

Illustration 9: Front dimensions

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