KUNBUS
industrial communication

PROFI® NET

Gateway component for PROFINET

Table of Contents

1 General information

1.1 Disclaimer

© 2015 KUNBUS GmbH, Denkendorf (Deutschland)

The contents of this user manual have been prepared by the KUNBUS GmbH with the utmost care. Due to the technical development, the KUNBUS GmbH reserves the right to change or replace the contents of this user manual without prior notice. You can always obtain the latest version of the user manual at our homepage: www.kunbus.de

The KUNBUS GmbH shall be liable exclusively to the extent specified in General Terms and Conditions (www.kunbus.de/agb.html).

The contents published in this user manual are protected by copyright. Any reproduction or use for the in-house requirements of the user is permitted. Reproduction or use for other purposes are not permitted without the express, written consent of the KUNBUS GmbH. Contraventions shall result in compensation for damages.

Trademark protection

- KUNBUS is a registered trademark of the KUNBUS GmbH
- Windows® and Microsoft® are registered trademarks of the Microsoft, Corp.
- Modbus is a registered trademark of the Modbus-IDA Organization.

KUNBUS GmbH
Heerweg 15 c
73770 Denkendorf
Deutschland

www.kunbus.de

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 PROFINET 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:

– PR100074, 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:

KUNBUS GmbH
Heerweg 15 C

+49 (0)711 3409 7077

support@kunbus.de
www.kunbus.de

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 PROFINET,
– 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.
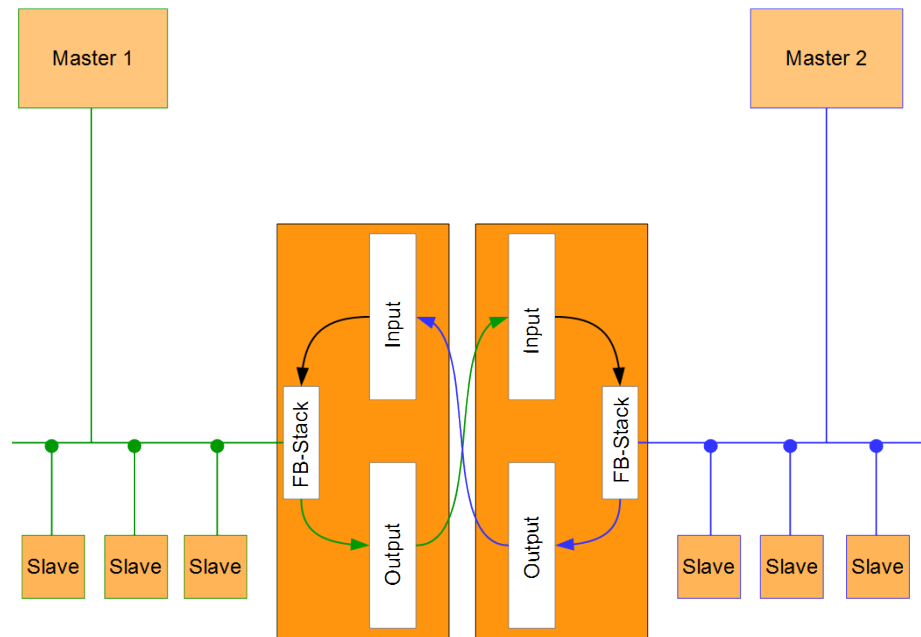
Illustration 1: Functionality

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
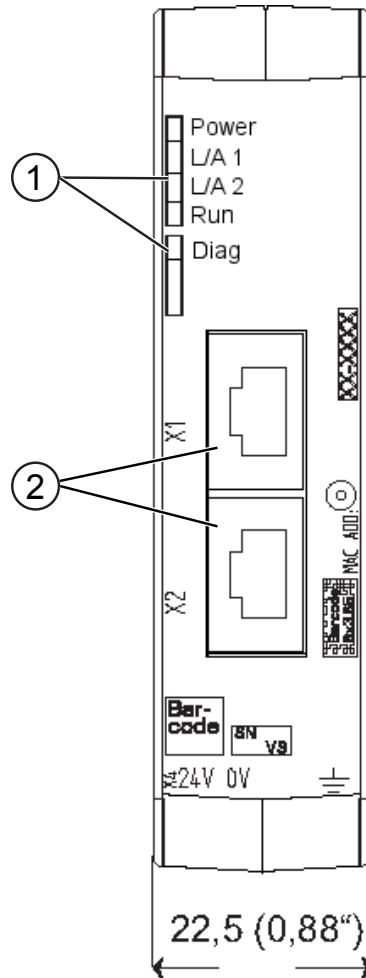
Illustration 2: Front view

1	Status LEDs
2	Fieldbus connection RJ45 socket for the connection to PROFINET.

Top
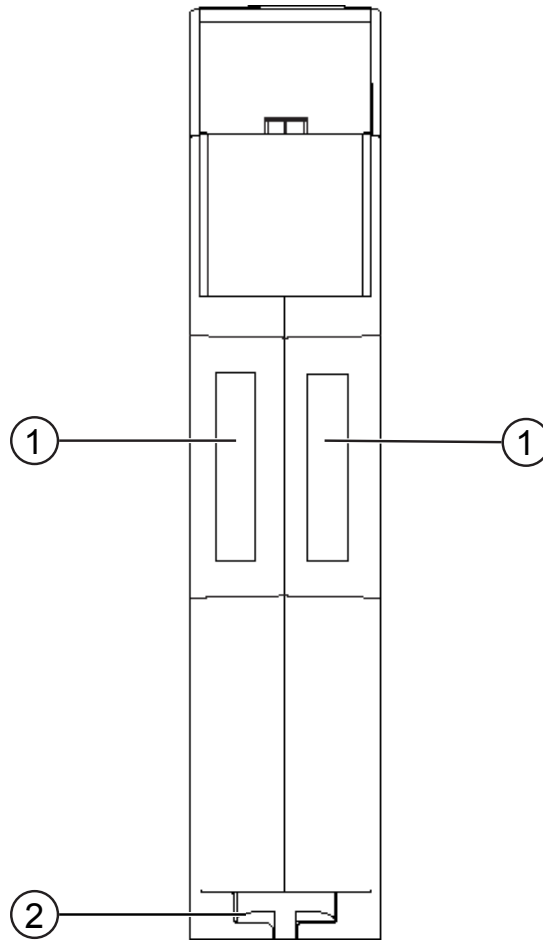
Illustration 3: Top

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 PROFINET have the following meaning:

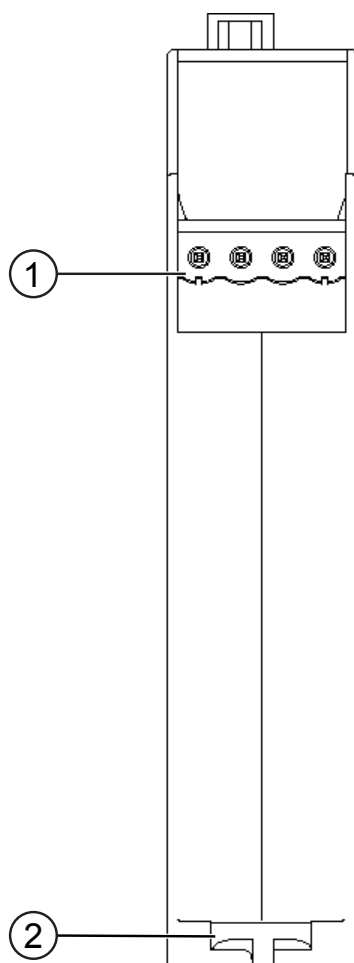| LED Designation	Signal	Meaning
Power	off	Gateway not running
	flashes, green	Initialisation phase not yet completed
	on, green	Operational
	flashes, red	Correctable error (e.g. second gateway component missing)
	on, red	Serious error/defect in the gateway
Link/Traffic Port 1	off	No connection to a network
	on, green	Network cable is connected
	flashes, green	Data packets transmitted or received
Link/Traffic Port 2	off	No connection to a network
	on, green	Network cable is connected
	flashes, green	Data packets transmitted or received
Run	off	No connection to a network
	on, green	Profinet controller is in operating state
	1 flash, green	Profinet controller is connected, but no data processing takes place
	flashes 1 Hz, green	Signaling. Triggered by tool for identification of the gateway component
Diagnosis	off	Everything OK
	on, red	Gateway component reports diagnosis data
	flashes 2 Hz, red	No connection to the controller
		No PROFINET name set in the module
	flashes 1 Hz, green	Signaling. Triggered by tool for identification of the module

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.

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.
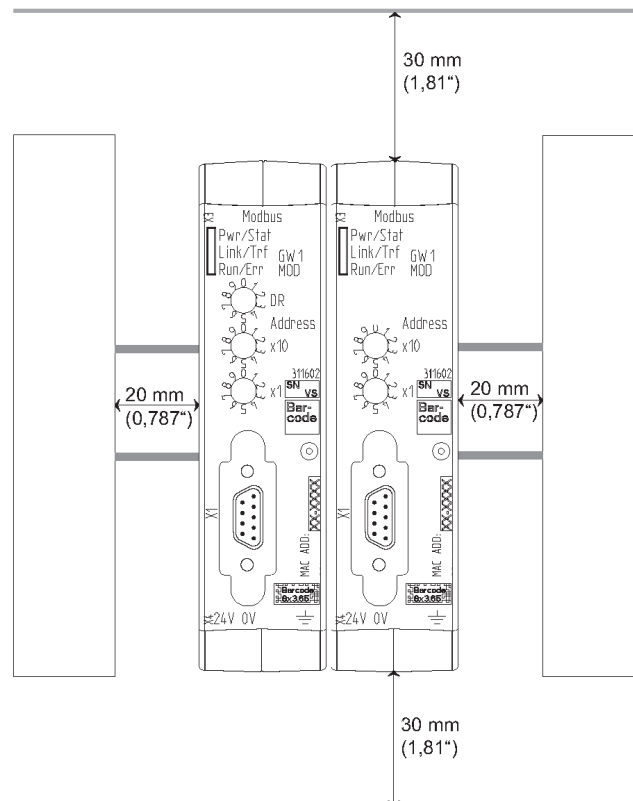
Illustration 5: Distances for installation

◦ 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 provided.
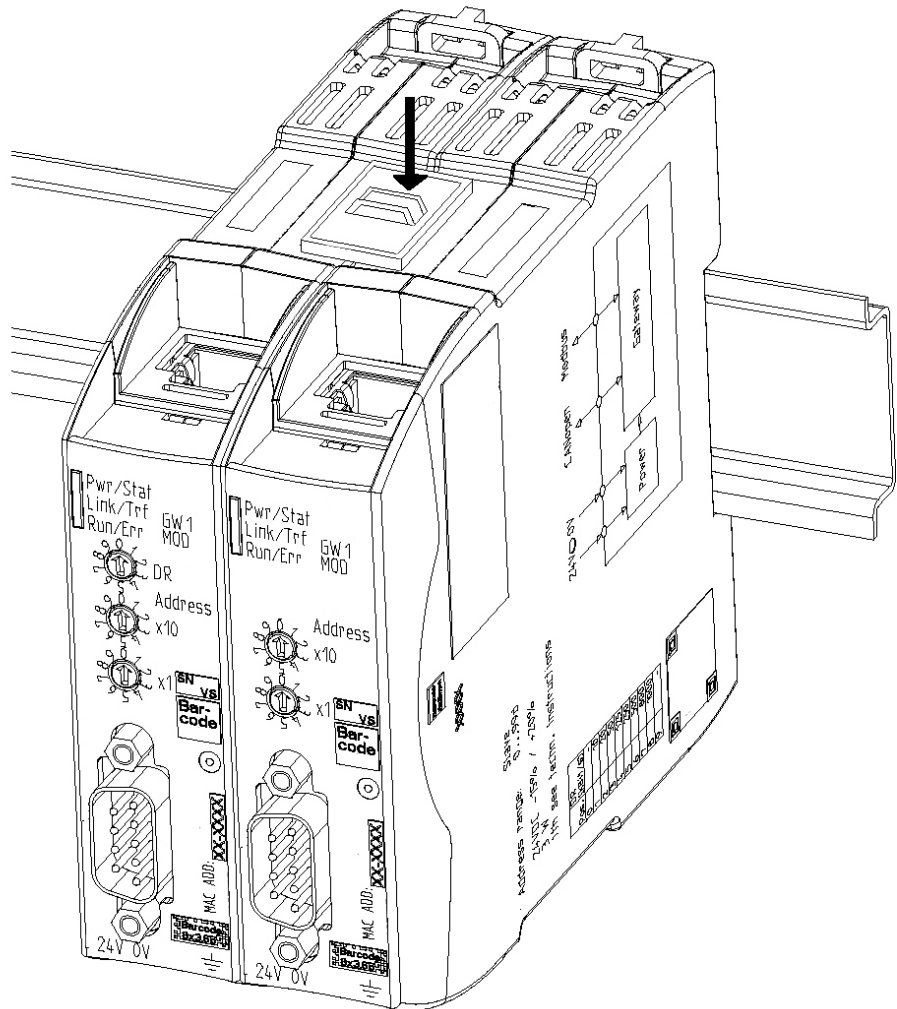
Illustration 6: Connecting Gateway Components

⇨ 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.
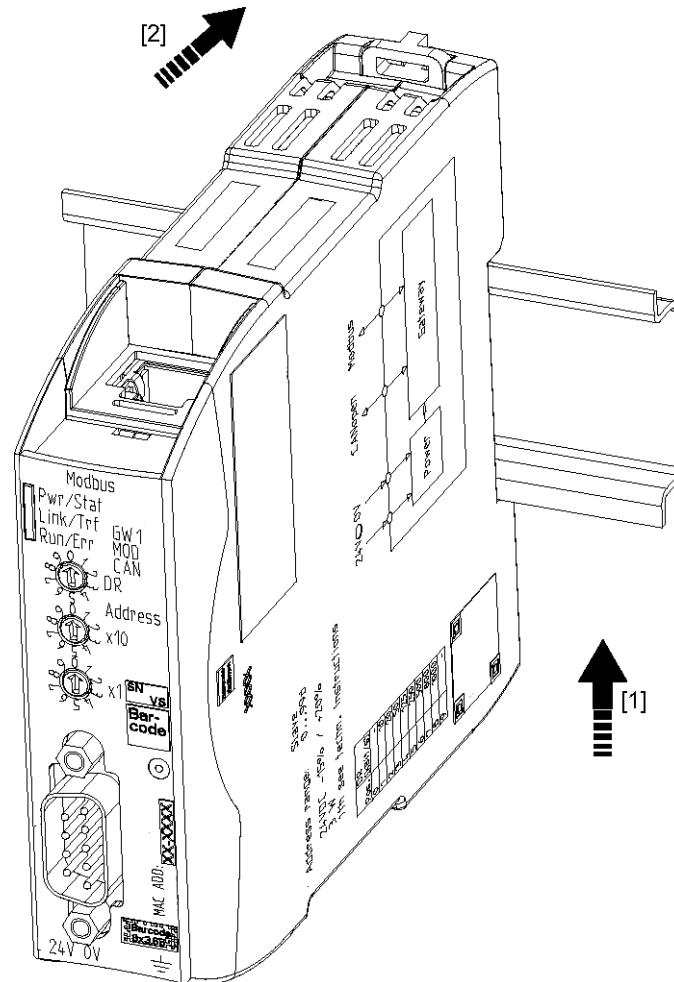
4.5 Connecting Power Supply

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.
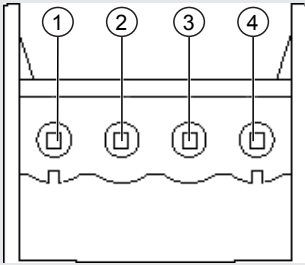
NOTICE	**Use the same power supply for both gateway components.**

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 PROFINET, you need two RJ45 connectors.

The pin assignment complies with the specifications of the PNO.

Pin	Meaning
1	TX+
2	TX-
3	RX+
4	Do not connect!
5	Do not connect!
6	RX-
7	Do not connect!
8	Do not connect!

5 Configuration

5.1 Supported Size of the Process Data

The gateway component for PROFINET supports an input and output area of 512 bytes each:

– The first 320 bytes of each area are intended for the exchange of cyclical process data.

– The remaining 192 bytes can be used for acyclic data exchange (records).

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 Setting Station Name

Since names are easier to handle than complex IP addresses in most cases, you can assign a station name to the gateway component.

You set the station name using the software of your PROFINET controller.

According to the definition RFC 5890, attention must be paid to the name assignment rules in this regard:

– Data should be specified in the Octet string type
– Restriction to a total of 240 characters (letters "a" to "z", numbers "0" to "9", hyphen or dot)
– A name element of the device name must be separated with a dot and can have a maximum of 63 characters.
– No special characters such as umlauts, brackets, underscore, blank etc.
– The hyphen is the only special character allowed.
– The device name must not begin or end with a dot.
– The device name must not begin with numbers.
– The device name must not have the form n.n.n.n (n = 0...999).
– The device name must not begin with the character string "port-xyz-" (x,y,z = 0...9).
– The device name may only begin with "xn-" if the original character string contains values other than "0" to "9" and "a" to "z".
– The field "NameOfStationValue" must not end with 0.

Examples of valid names:

"device -1.machine- 1.plant- 1.vendor"

"mühle1.ölmühle1.plant.com" is coded as " xn–mhle1-kva.xn–lmhle1 -vxa4c.plant.com"

5.3 Exchanging Data cyclically

To configure the gateway component, you have to perform the appropriate settings with the configuration software of your PROFINET -Controller.

The gateway component is equipped with virtual slots (installation positions). PROFINET controllers use these slots to address selected process data. Each slot contains one module. You can assign process data to these modules that are to be exchanged.

Slot	Module	Id	Offset
0	DAP	0x80050000	--
1	Input 16	0x00000005	Output Off 0
2	Input 16	0x00000005	Output Off 16
3	Input 32	0x00000006	Output Off 32
4	Input 32	0x00000006	Output Off 64
5	Input 32	0x00000006	Output Off 96
6	Input 64	0x00000007	Output Off 128
7	Input 64	0x00000007	Output Off 192
8	Input 64	0x00000007	Output Off 256
9	Output 16	0x00000050	Input Off 0
10	Output 16	0x00000050	Input Off 16
11	Output 32	0x00000060	Input Off 32
12	Output 32	0x00000060	Input Off 64
13	Output 32	0x00000060	Input Off 96
14	Output 64	0x00000070	Input Off 128
15	Output 64	0x00000070	Input Off 192
16	Output 64	0x00000070	Input Off 256

Info! The gateway component supports only a submodule with data per module.

In the following tables you will find a detailed overview of all modules.

DAP (Device Access Point)

Description:	DAP
Module ID	0x80050000
Usable in Slot:	0
Total Number of Input Bytes:	0
Total Number of Output Bytes:	0
Number of Submodules	3

Submodule for Record Access

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	0
Number of Output Bytes	0

Submodule that represents the entire Profinet Device

Submodule ID	0x0000000a
Subslot:	0x8000
Number of Input Bytes	0
Number of Output Bytes	0

Submodule that represents Port 1

Submodule ID	0x0000000b
Subslot:	0x8001
Number of Input Bytes	0
Number of Output Bytes	0

Submodule that represents Port 2

Submodule ID	0x0000000c
Subslot:	0x8002
Number of Input Bytes	0
Number of Output Bytes	0

Input 16 Byte

Description:	Input 16 Byte
Module ID	0x00000005
Usable in Slot:	1 – 8
Total Number of Input Bytes:	16
Total Number of Output Bytes:	0
Number of Submodules	1

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	16
Number of Output Bytes	0

Input 32 Byte

Description:	Input 32 Byte
Module ID	0x00000006
Usable in Slot:	1 – 8
Total Number of Input Bytes:	32
Total Number of Output Bytes:	0
Number of Submodules	1

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	32
Number of Output Bytes	0

Input 64 Byte

Description:	Input 64 Byte
Module ID	0x00000007
Usable in Slot:	1 – 8
Total Number of Input Bytes:	64
Total Number of Output Bytes:	0
Number of Submodules	1

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	64
Number of Output Bytes	0

Output 16 Byte

Description:	Output 16 Byte
Module ID	0x00000050
Usable in Slot:	1 – 8
Total Number of Input Bytes:	0
Total Number of Output Bytes:	16
Number of Submodules	1

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	0
Number of Output Bytes	16

Output 32 Byte

Description:	Output 32 Byte
Module ID	0x00000060
Usable in Slot:	1 – 8
Total Number of Input Bytes:	0
Total Number of Output Bytes:	32
Number of Submodules	1

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	0
Number of Output Bytes	32

Output 64 Byte

Description:	Output 64 Byte
Module ID	0x00000070
Usable in Slot:	1 – 8
Total Number of Input Bytes:	0
Total Number of Output Bytes:	64
Number of Submodules	1

Submodule ID	0x00000001
Subslot:	0x0001
Number of Input Bytes	0
Number of Output Bytes	64

5.4 Exchanging Data acyclically (Records)

The gateway component supports records. This access type is useful for all events that do not have to be repeated regularly (e.g. sending parameter data in the start-up phase).

Another benefit of records is due to the fact that you can write continuously ascending areas at once.

Example:. Index 0x1005 writes byte 10 to byte 19 with 10 bytes of data in the output process mapping.

You can use all 512 bytes of the input and output area to read or write records.

NOTICE	**Bear in mind that the first 320 bytes of the input and output area are used for cyclical data transmission.**
	Records that you address with index 0x0000 – 0x00ff or 0x1000 – 0x10ff, can be overwritten by the cyclical data transmission.

Addressing

All records are addressed via API 0, Slot 0, Subslot 1. The data is transferred in Little Endian format. In the case of Big-Endian format, the higher-value bytes are first transmitted and stored at the memory locations with the lowest addresses.

2 bytes are always addressed per index:

Offset 0 + Offset 1 → Record 0

Offset 510 + Offset 511 → Record 255 (0x00ff)

Index 0x0000 – 0x00ff contains the input data sent from the partner gateway component.

Index 0x1000 – 0x10ff contains the output data sent to the partner gateway component.

State of the Partner Gateway

You can read information on the state of the partner gateway component via API 0, Slot 0, Subslot 1, Index 0x2000:

Offset	Length	Element	Comment
0	4	Serial number	
4	2	Module type	KUNBUS internal module type
6	2	Hardware Revision	
8	2	Major Software Version	
10	2	Minor Software Version	
12	4	Subversion Revision	Source Code Version
16	2	Fieldbus Input Length	
18	2	Fieldbus Output Length	
20	1	Bus State	
20	2	Feature descriptor	Supported features of the gateway

5.4.1 I&M Data

Identification & Maintenance Functions

I&M functions are data functions whose sole purpose is to clearly identify the gateway component in the PROFINET.

The gateway component supports I&M functions 0-4. These I&M functions are available in Slot0, Subslot 1. The data from the PROFINET Controller can be read and, if necessary, written via the data index 0xaff0-0xaff4.

I&M 0 data

I&M 0 contains information about the gateway component. It can be read from the PROFINET-Controller with Api0, Slot0, Subslot1, Index 0xaff0 via Record Read.

You will find the following information about the gateway component via the I&M 0 data:

– Vendor ID
– Order ID
– Serial Number
– Hardware Revision
– Software Revision
– Revision Counter
– Profile ID
– Profile specific type
– I&M Version

I&M 1 data

I&M 1 data is stored permanently in the gateway component. It can be read and written from the PROFINET-Controller with Api0, Slot0, Subslot1, Index 0xaff1 via Record Read

I&M 2 data

I&M 2 data is stored permanently in the gateway component. It can be read and written from the PROFINET-Controller with Api0, Slot0, Subslot1, Index 0xaff2 via Record Read

I&M 3 data

I&M 3 data is stored permanently in the gateway component. It can be read and written from the PROFINET-Controller with Api0, Slot0, Subslot1, Index 0xaff3 via Record Read

I&M 4 data

I&M 4 data is stored permanently in the gateway component It can be read and written from the PROFINET-Controller with Api0, Slot0, Subslot1, Index 0xaff4 via Record Read

5.4.2 Diagnosis Alarm

If communication to the partner gateway component is interrupted, the gateway component for PROFIBUS sends a diagnosis alarm to the controller:

– The alarm is sent out from API 0, Slot 0, Subslot 1

– The alarm is sent as channel diagnosis with channel 0x8000

– The alarm has the priority "Maintenance Required",

– Error type is 0x0100 (first user defined error)

  ◦ Check whether the plug-in jumper is connected correctly to both module components.

  ◦ Check whether the partner gateway component is connected to the power supply.

As soon as communication functions again, the PROFINET controller sends a diagnosis telegram to the gateway component.

You can find detailed information about the Diagnosis Alarm in the specifications for PROFINET.

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

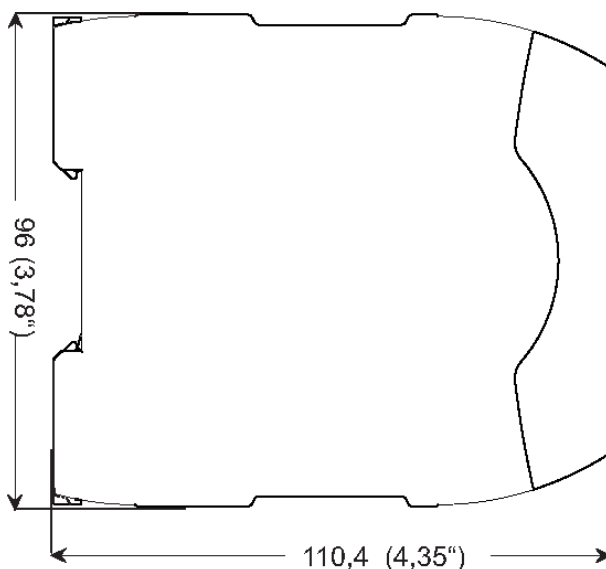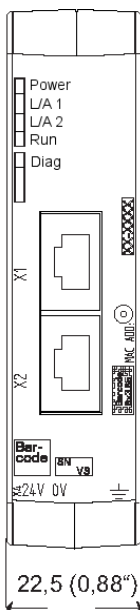| PROFINET Interface	
Device Type	Slave
Protocol	IRT
Maximum data length	
Total	1024 byte
– Input data	– 512 byte
– Cyclical data exchange	– 320 byte
– Acyclic data exchange	– 192 byte
– Output data	– 512 byte
– Cyclical data exchange	– 320 byte
– Acyclic data exchange	– 192 byte
Bitrate	100 MBit

Illustration 7: Side dimensions

Illustration 8: Front dimensions