KUNBUS
industrial communication

Modbus

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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 Modbus TCP 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:

– PR100088, 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
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 Modbus TCP,
– 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.

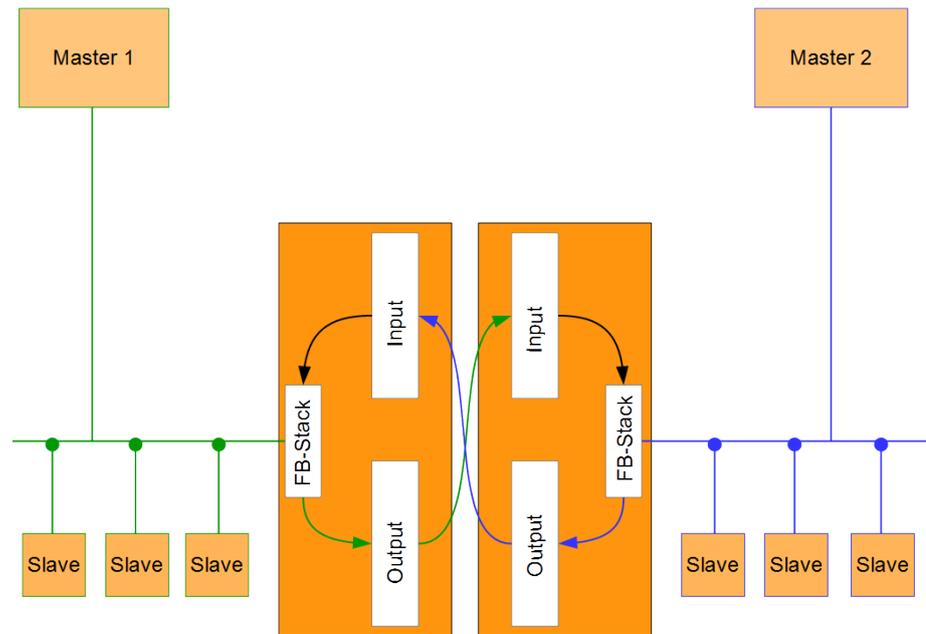| ⚠ CAUTION	**Caution** There is a safety hazard that can result in minor injuries and material damage.

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
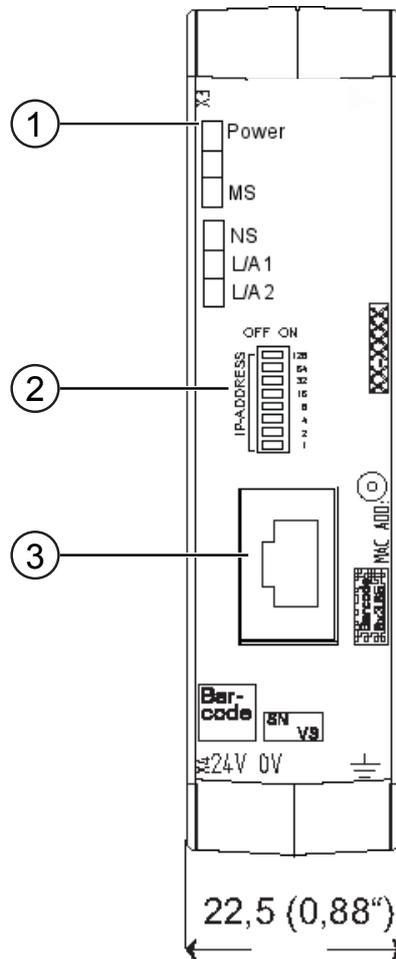
Illustration 2: Front view

1	Status LEDs
2	Coding switch 8-pin DIP switch for setting the IP address.
3	Fieldbus connection RJ45 socket for the connection to the fieldbus (2 sockets in all, s. figure top view)

Top
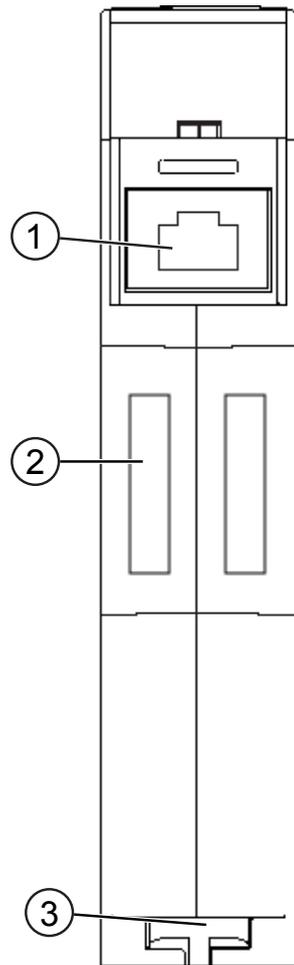
Illustration 3: Top

1	Fieldbus connection RJ45 socket for the connection to the fieldbus (2 sockets in all, s. figure front view).
2	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 Modbus TCP have the following meaning:

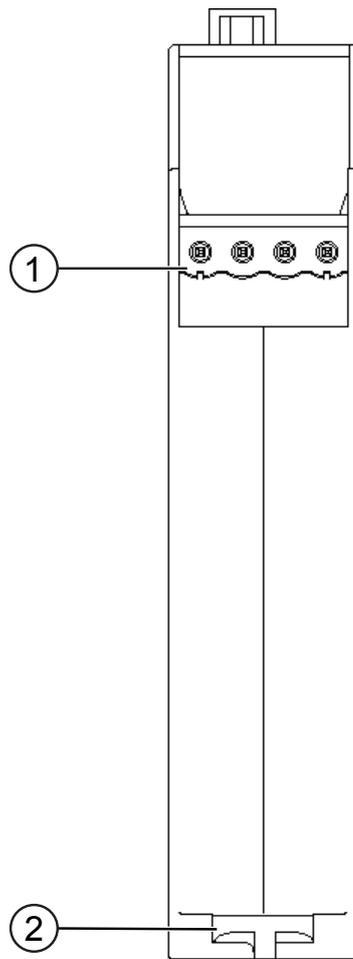| LED Designation	Signal	Meaning
Power	off	Gateway component not running
	flashes, green	Initialisation phase not yet completed
	on, green	Operational
	flashes, red	Correctable error (e.g. second gateway component missing)
	on, red	Serious error/defect in the gateway
MS	off	No power supply
	on, green	Gateway component operational
	flashes, green	Configuration not completed
NS	off	Gateway component is switched off or has no IP address
	flashes, green	IP address set but no CIP connection has been established yet
	on, green	Connection is established
	flashes, red	Connection interrupted (e.g. due to timeout)
	on, red	Set IP address is already being used by another network subscriber
L/A 1 + 2	off	No connection
	green	Connection to another device. No data exchange takes place.
	flashes, green	Connection established. Data exchange takes place.

The signals correspond to the specifications of the IDA. You can find more detailed information at: http://www.modbus.org/

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.

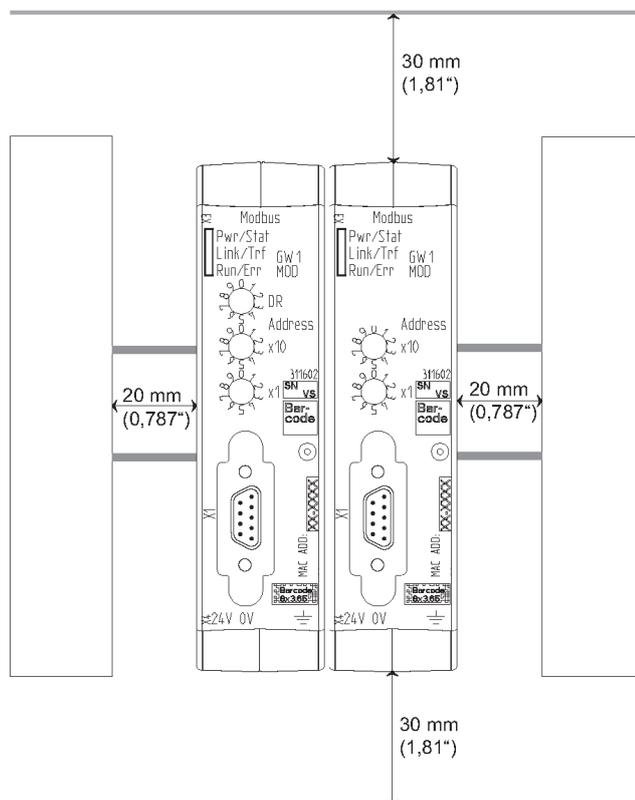➔ Maintain sufficient distance from other devices.

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.
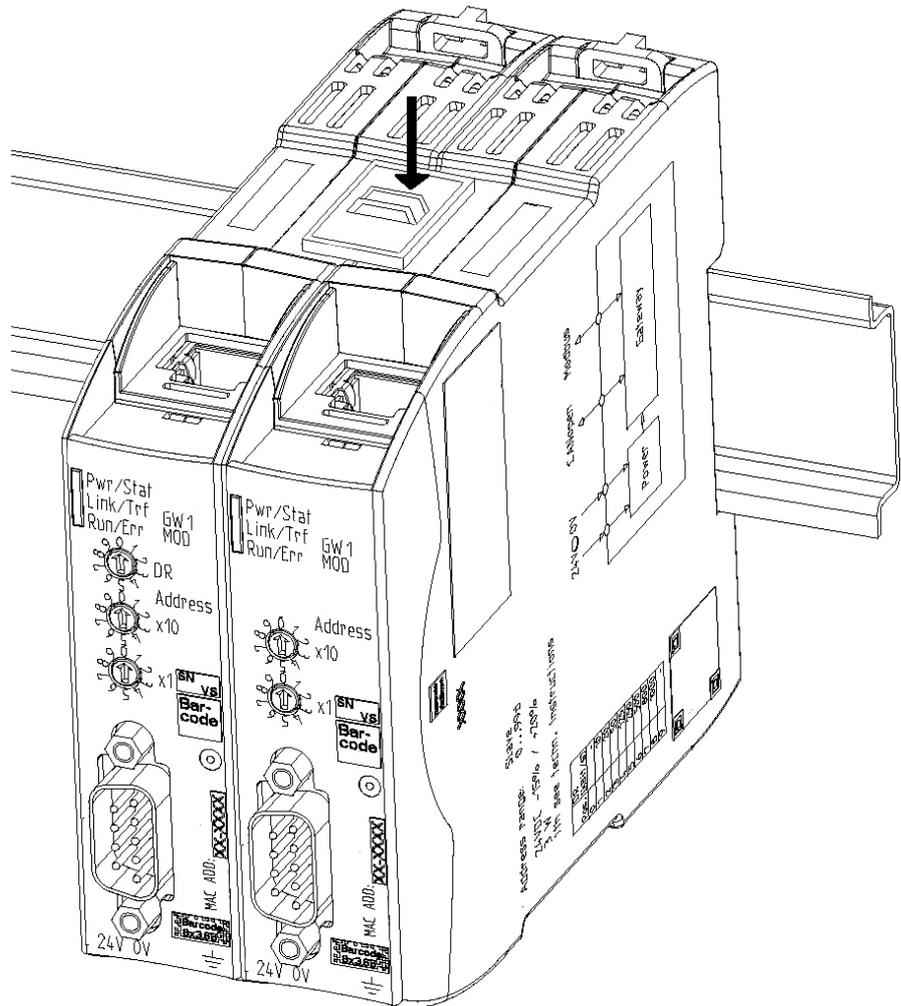
Illustration 6: Connecting Gateway Components

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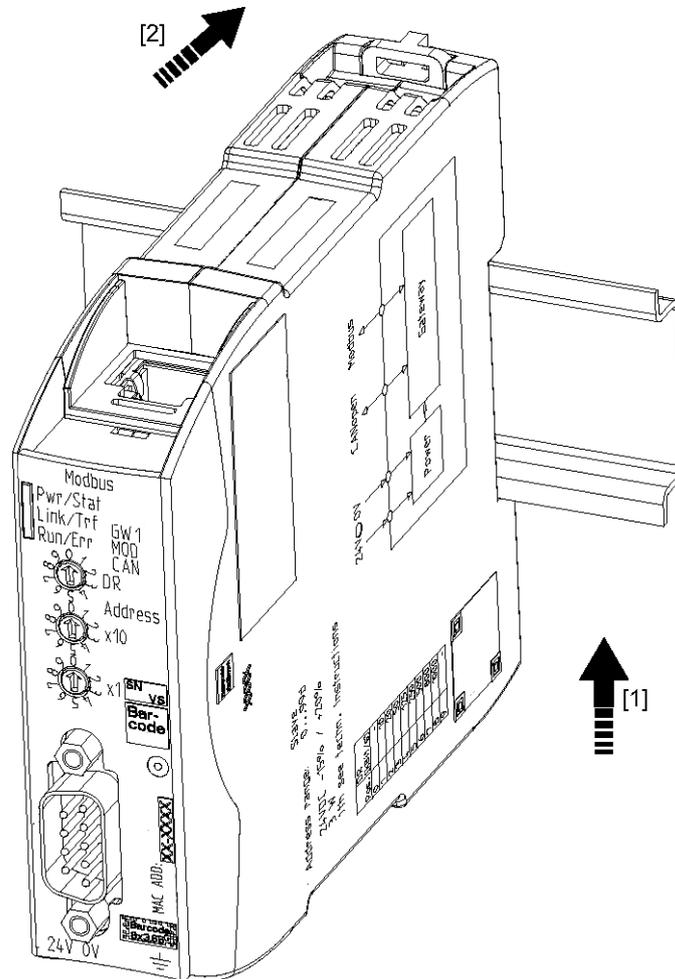
To connect the gateway component to the power supply, you need a spring-loaded terminal (e.g. Metz-Connect SP995xxVBNC).

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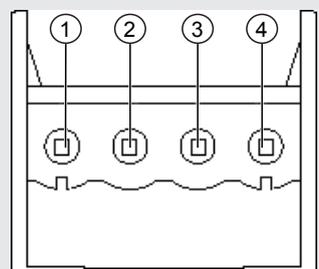
NOTICE	**Do not connect GND to PE**
	This connection could cause unintended malfunctions.

4.6 Connecting Gateway to the Fieldbus

To connect the gateway component to Modbus TCP, you need two RJ45 connectors.

The pin assignment complies with the Ethernet standard.

5 Configuration

5.1 Supported Size of the Process Data

The gateway component for Modbus TCP supports process data of a length up to 480 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

Setting IP Address

With the 8-pin address switch you can set the IP address of the Gateways.

You can set values in binary format between 0-255.

Assigning IP Address manually:

- Set any address between 1-254
  - ⇨ The gateway component uses the address 192.168.0.X with the net mask 255.255.255.0 and gateway 192.168.0.1
- Open the website **http://192.168.0.X**
- Log on:
  Logon data for the initial logon :
  User: Admin
  Password: 1701
- Click on the "Change Configuration" button
- Set the IP address required
- Confirm your entry by pressing the "Apply" button
- Set all address switches to "0"
- Restart the gateway component by switching this off and then on again.
- ⇨ The set IP address is now used.

Receiving IP Address from the DHCP Server

- Set the value "255" (all switches in the direction of the numbers) to activate the DHCP mode.
- ⇨ Assign the IP address automatically from the DHCP server.

Setting IP Address using the Master Software

- Set the value "0" (all switches to "Off")
  - ⇨ The gateway component uses the IP address that was last set using the software.
- You can change this IP address at any time via the EtherNet/IP-protocol or website.
- Restart the gateway component by switching this off and then on again.
- ⇨ The set IP address is now used.

5.3 Configuration of Modbus TCP

Modbus TCP - Addresses and Access Functions

Memory areas

Predefined memory areas are available for addressing the process data. Optionally, you can access the input and output data areas bit by bit (using coils) or word by word.

Register area for word by word access

Address area	Use	Access	Access type	Meaning	
1 - 240	Input Register	Read Only	Holding/Input *	Values that the other gateway component supplies.	
1024 - 1264	Output Register	Read/Write	Holding	Values that are supplied to the other gateway component	
4096	Gateway Status	Read Only	Holding	Displays the connection status to the other gateway component	
				0x01	Initialisation, checking hardware
				0x02	Connection to the other gateway component is checked
				0x03	Other gateway component detected
				0x04	Communication to the other gateway component established.
4097	Fieldbus status of the other gateway component	Read Only	Holding	0x00	Fieldbus not connected. Check all connections
				0x01	Fieldbus connected, no data communication. Check whether an IP address is set
				0x02	Gateway component configured, no data communication
				0x03	Cyclical data exchange

*Input and Holding Register are not differentiated. They can be read using function code 0x004

Register area for bit by bit access

Address area	Use	Access	Access type	Meaning
1 - 3840	Input Bits (Coil)	Read Only	Holding/Input*	Values that the other gateway component supplies.
16385 - 20224	Output Bits (Coil)	Read/Write	Holding	Values that are supplied to the other gateway component

*Input and Holding Register are not differentiated. They can be read using function code 0x004

Functions

You can access the data area of the gateway component using the following functions:

Function code	Use	Description	Max. size per telegram
0x01	Read data bit by bit	read coils	2000 Bit
0x02		read discrete inputs	
0x05	Write data bit by bit	write single coil	1 Bit
0x0f		write multiple coils	1968 Bit
0x03	Read data word by word	read holding registers	125 words
0x04		read input registers	
0x06	Write data word by word	write single register	123 words
0x10		write multiple registers	
0x16		mask write register	
0x17	Read and write data word by word	read/write multiple registers	Read 125 words Write 121 words

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

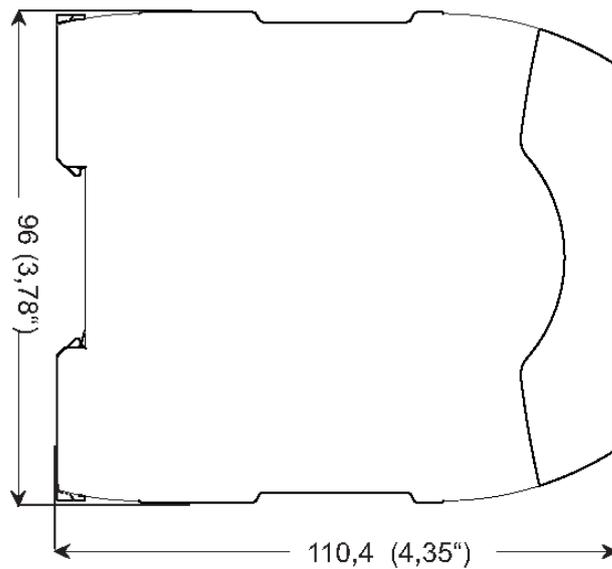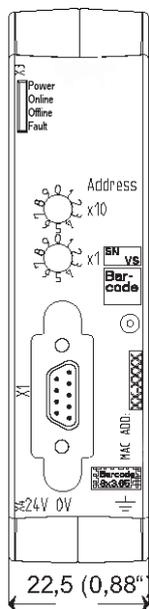| Assembly Data	
DIN rail	35 x 7.5 mm
Height	96 mm
Depth	110.4 mm

Illustration 7: Side dimensions

Illustration 8: Front dimensions