KUNBUS
industrial communication

Gateway component for DMX

Table of Contents

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 integrate the Gateway into your applications and systems efficiently, safely and conveniently. It is intended for trained, qualified personnel, whose sound knowledge in the field of electronic circuits and expertise of DMX 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 Gateway with the product number:

– PR100237, 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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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 DMX,
- work in electrostatic protected areas,
- locally applicable rules and regulations for occupational safety.

2.2 Symbols

The symbols used have the following meaning:

DANGER	**Danger**
	Always observe this information!
	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.
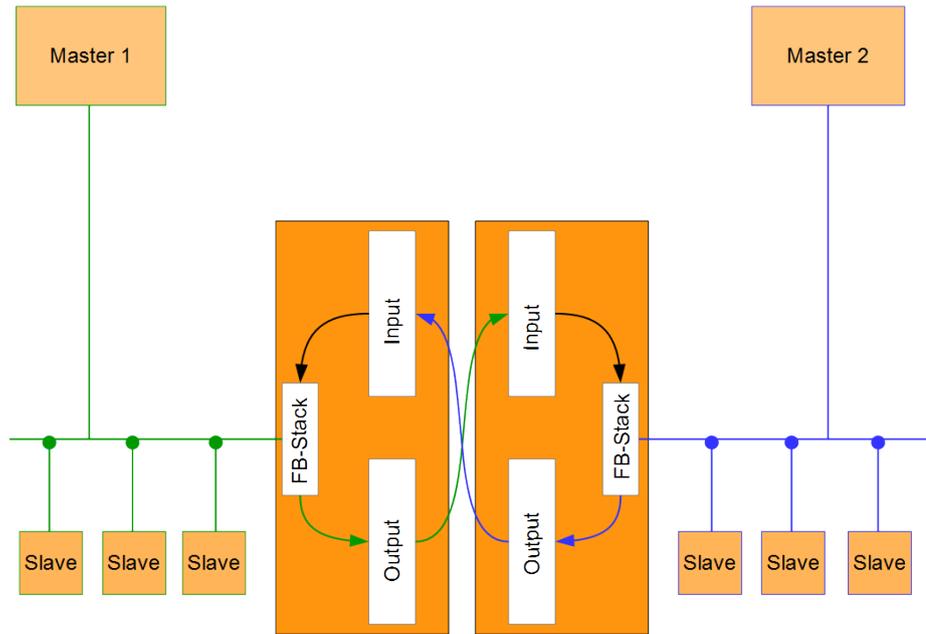
Illustration 1: Functionality as a slave

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 currently available as slaves:

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

The gateway component for DMX can be operated as a master or slave.

In addition, you can combine the gateway components with the RevPi Core.

3.2 Control Elements

Front view
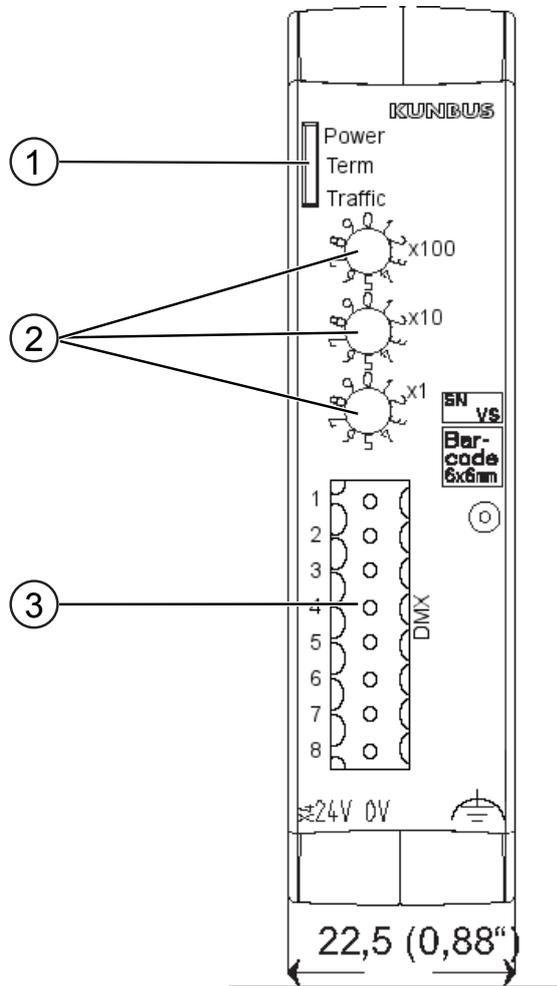
Illustration 2: Front view

1	Status LEDs
2	Rotary coding switch
3	DMX connection

Top
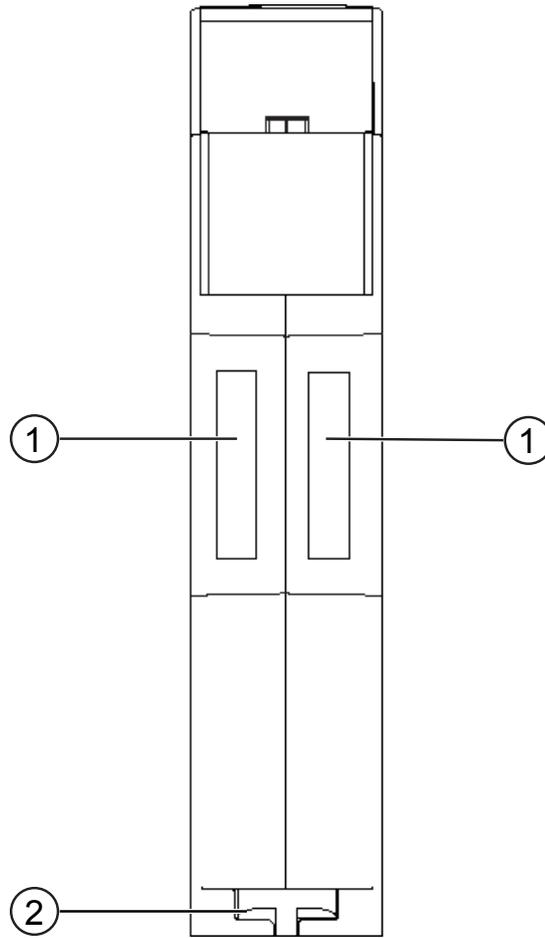
Illustration 3: Top

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

Bottom
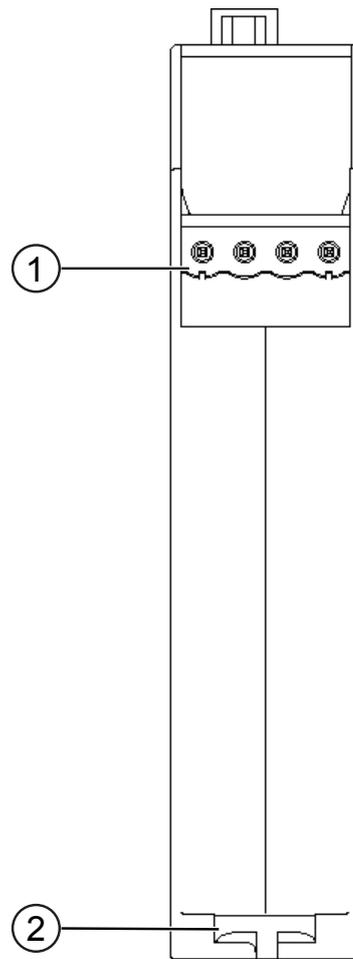
Illustration 4: Bottom

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 DMX have the following meaning:

LED designation	Signal	Meaning
Power	off	Gateway not running
	flashes, green	Initialization phase not yet completed
	on, green	All system components are functioning perfectly
	flashes, red	Correctable error (e.g. second gateway component missing)
	on, red	Serious error/defect in the gateway
Term	on, green	Bus termination not active
	off	Bus termination not active
Traffic	green, flashes	DMX data active (master and slave mode)
	red, on	Slave mode: DMX data inactive

4 Installation

4.1 Preparations for Trouble-free Operation

In the following section we have compiled some general information for you that is important for trouble-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 from each other:

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 the following 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 of copper or galvanized steel.
– Connect potential equalization cables extensively with the earth rail.
– The smallest surfaces 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 be 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.
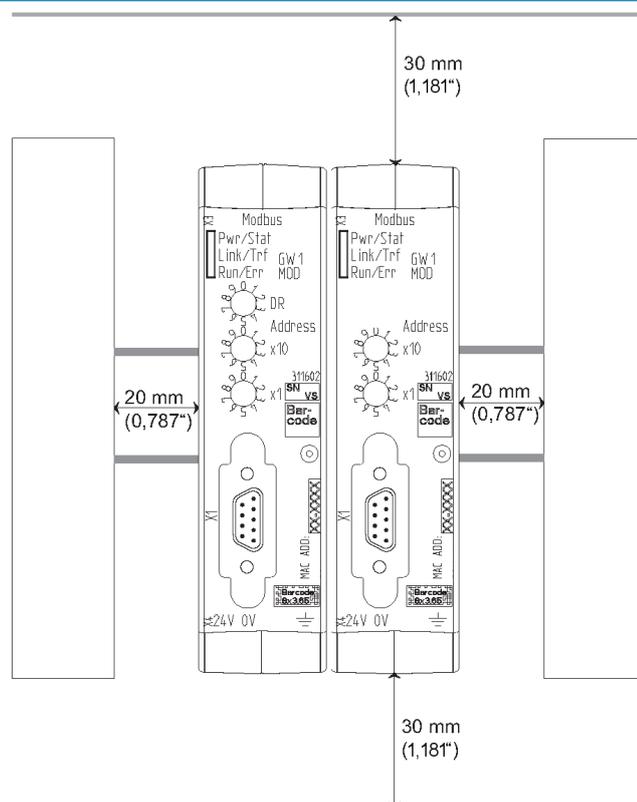
Illustration 5: Distances for installation

◦ Connect each gateway component individually to functional earth. When doing so, make sure that the power supplies of both gateway components 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).
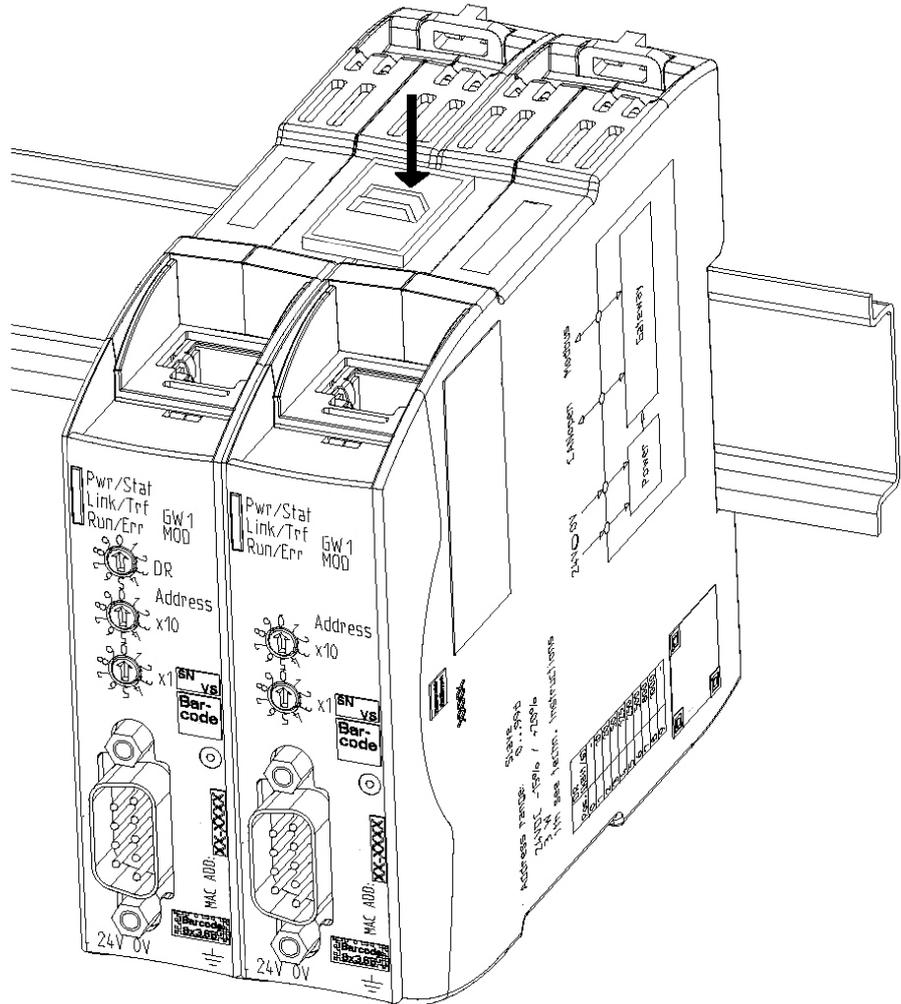
Illustration 6: Connecting gateway components

⇨ 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 a 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.
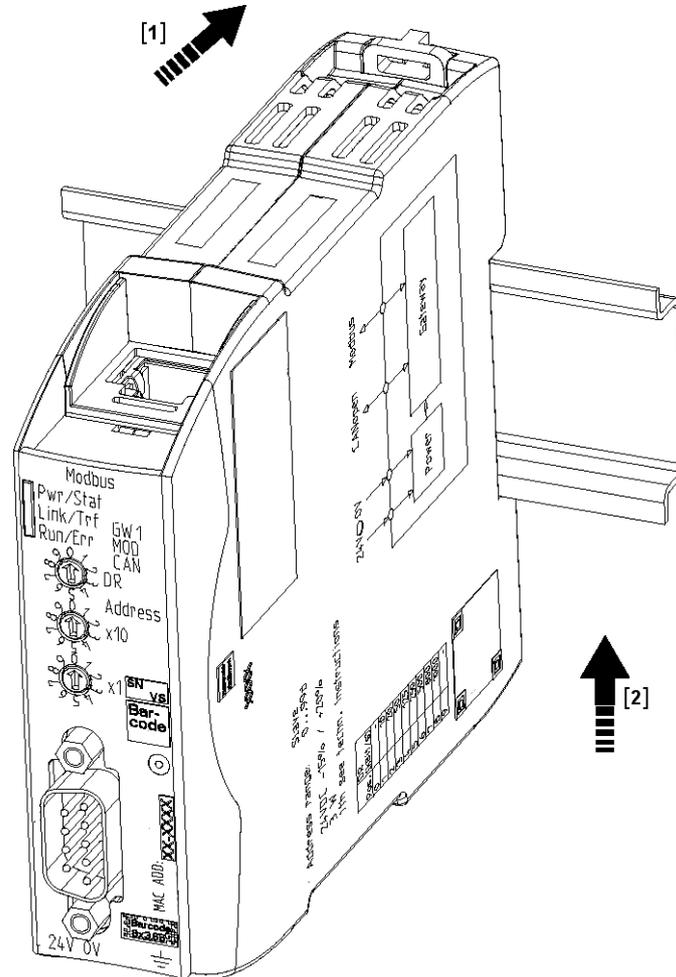
4.5 Connecting a Power Supply

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 equalization with lower impedance when entering the control cabinet.

NOTICE	**Connect each of the two gateway components to the power supply**
	➔ 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	
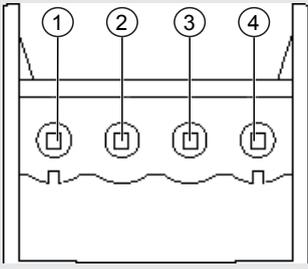
NOTICE	**Do not connect GND to PE**
	This connection could cause unintended malfunctions.

4.6 Connecting a Gateway to the Fieldbus

To connect the gateway component to DMX, you need an adapter.
The table below shows an example connection to a 3-pole XLR plug.

Connection	Function	Pin assignment for XLR plug
1	-	-
2	-	-
3	-	-
4	Earth (screen)	1
5	DMX +	3
6	DMX -	2
7	-	-
8	-	-

5 Configuration

You can operate the gateway component as a master or a slave.

In "Sender" function mode, the gateway component sends data to slaves and performs the function of a bus master (as for a DMX lighting control desk, for example).

In "Receiver" function mode, the gateway component receives data from a bus master and performs the function of an actuator (as for a lighting control, for example).

You have 2 options for configuration of the gateway components:

– Make the setting via the rotary switches
– Making the settings via the partner gateway component

5.1 Supported Size of the Process Data

The gateway component for DMX supports process data up to a length of 512 bytes per direction.

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 244 bytes per direction

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

5.2 Make the setting via the rotary switches

You can set the function mode and the addressing at the rotary switches.
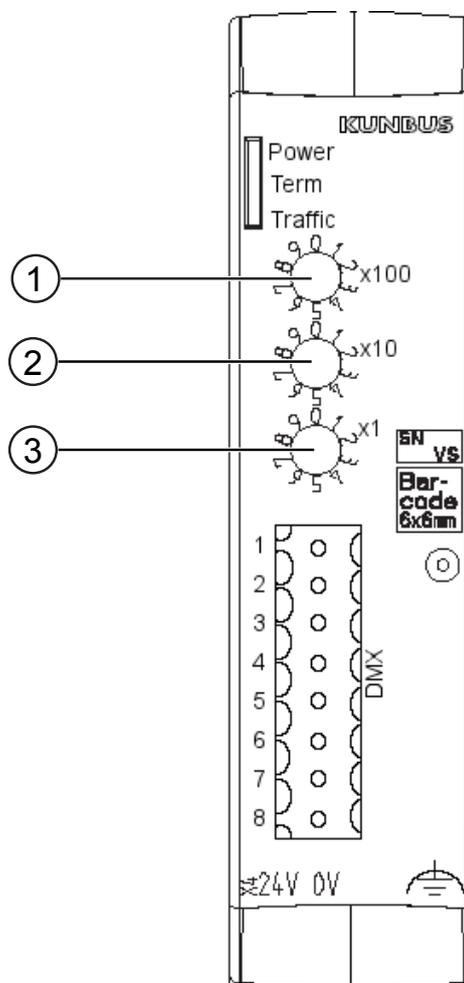
Illustration 7: Rotary switch

With each rotary switch, you can set a decimal from 0-9. These 3 values together allow you to set a value range of 0-999.

– Switch 0x100 (1) determines the hundreds digit
– Switch 0x10 (2) determines the tens digit
– Switch 0x1 (3) determines the ones digit

Example: You want to set the value 234.

Switch setting:

– Switch 1: 2
– Switch 2: 3
– Switch 3: 4

The values are interpreted accordingly in the following table:

Value	Switch setting at the switch			Function mode
	1	2	3	
0	0	0	0	Configuration is via the partner gateway component
1	0	0	1	Receiver mode, bus termination inactive, start address = 1
[…]				
512	5	1	2	Receiver mode, bus termination inactive, start address = 512
513	5	1	3	Sender mode, bus termination active, 512 bytes are transmitted
[…]				
999	9	9	9	Sender mode, bus termination active, 512 bytes are transmitted

Restart the gateway component to activate new settings.

Examples:

Receiver mode, start address 73

To set a DMX receiver with inactive bus termination at start address 73, you must set the switch as follows:

SW_1 = 0

SW_2 = 7

SW_3 = 3

Sender mode

To set a DMX sender with activated bus termination, which transmits 512 channels, you must set the switch as follows:

SW_1 = 5

SW_2 = 1

SW_3 = 3

Partner gateway mode

To configure via a partner gateway, you must set the switch as follows:

SW_1 = 0

SW_2 = 0

SW_3 = 0

5.3 Making the settings via the partner gateway component

You can also make the settings for the DMX gateway component also via a partner gateway component.

In this configuration mode, you as a "sender" can send a maximum 510 bytes, since 2 bytes are required for the configuration.

To make the settings:

- Set the rotary switch of the DMX gateway component to "0, 0, 0"
- Use the master software to configure the individual bits of the first 2 bytes of the DMX data.

They are assigned as follows:

Byte	Bit	Function	Setting options
0	0 (LSB)	Number A 9-Bit value range can be set here. The meaning of this value differs depending on the mode.	**"Sender" function mode** Number of channels to be sent : 1-510 Default value: 510
	1		
	2		
	3		! Since the first two bytes are occupied by the configuration data, a maximum 510 bytes of DMX data can be transmitted in sender mode.
	4		
	5		
	6		
	7		
1	0		**"Receiver" function mode** Receiver address: 1-512 default value: 1
	1 (MSB)		
	2	-	-
	3	-	-
	4	-	-
	5	Zero data determine the behavior with a communication interruption.	0= inactive Last received data are retained 1= active After 1s communication interruption, all data bytes are set to 0
	6	Mode	0= Sender 1= Receiver
	7	Termination	0=Termination active 1= Termination inactive

Termination

The termination resistor prevents reflexions from occurring at the end of the connection that could cause errors in the data communication.

The integrated termination resistor is 120 Ω.

| NOTICE | **Activate the termination resistor only if the module is the first or last subscriber of the connection.** |

Errors in the data communication may occur if the termination resistor is activated while the module is connected at a central position in the network.

Example:

- Mode
    - Sender, Byte 2, do not set Bit 6
- Send data (number)
    - Send 73 channels, channels $73_{10} := 49_{16}$
- Termination
    - Inactive: Byte 2, set Bit 7
- Zero data
    - Inactive: Byte 2, do not set Bit 5

Byte	Bit	Setting
0	0	1
	1	0
	2	0
	3	1
	4	0
	5	0
	6	1
	7	0
1	0	0
	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	1

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 DC
Power consumption during operation (cyclical data exchange)	100 mA
Status display	LED

Environmental conditions	
Ambient temperature	0 – 60 °C
Storage temperature	- 25 – 60 °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

DMX protocol	
Protocol	DMX 512
Communication type	Unidirectional A sender sends the data without receiving feedback. A receiver accepts the data on the bus without feedback.
Baudrate	250 kBaud
Transmission	RS 485
Byte transmission	8N2 (8 data bits, no parity, 2 stop bits)
Special feature	A DMX package starts with 88 us (22 bit lengths) low level (logical 0). This section is called "break".
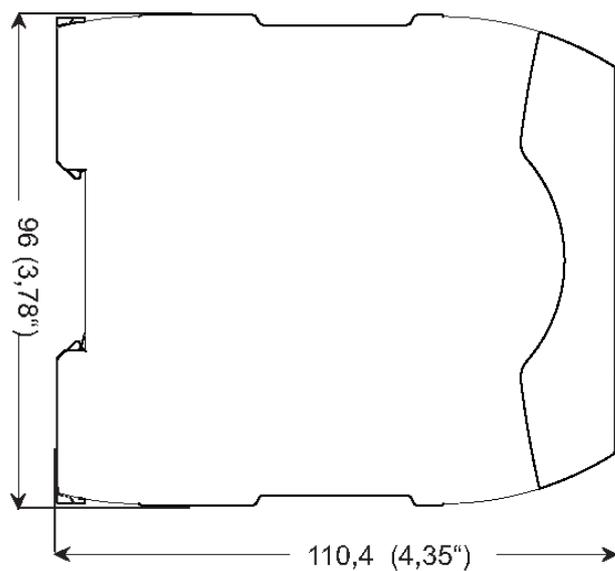
Illustration 8: Side dimensions

96 (3,78")

110,4 (4,35")

22,5 (0,88")
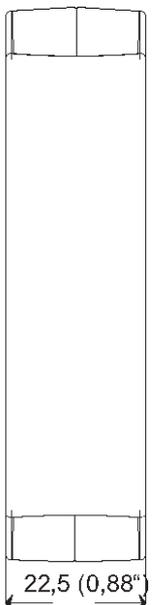
Illustration 9: Front dimensions