

KUNBUS

■ industrial communication

CANopen®



User Manual Gateway component for CANopen

Table of Contents

1	General information	3
1.1	Disclaimer	3
1.2	Notes regarding this user manual.....	4
1.3	Validity	4
1.4	Limitation of Liability	4
1.5	Customer Service	4
2	Safe use	5
2.1	User	5
2.2	Symbols.....	5
3	Overview	6
3.1	Functionality	6
3.2	Control elements	7
3.3	Status LEDs.....	10
4	Installation	11
4.1	Preparations for interference-free operation.....	11
4.2	Requirements	13
4.3	Connecting Gateway Components.....	14
4.4	Installing Gateway in the Control Cabinet	15
4.5	Connecting Power Supply	16
4.6	Connecting Gateway to the Fieldbus.....	17
5	Configuration	18
5.1	Supported Size of the Process Data	18
5.2	Address Assignment.....	19
5.3	CANopen Configuration.....	21
6	Technical data	27
6.1	Technical data	27

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 CANopen 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:

- PR100070, 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 CANopen,
- 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.

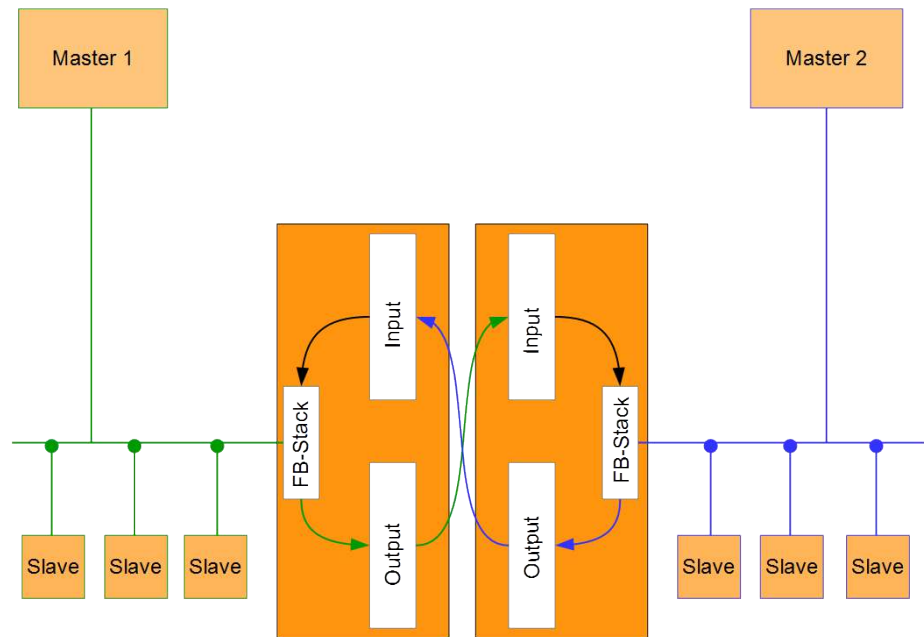


Illustration 1: Functionality

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

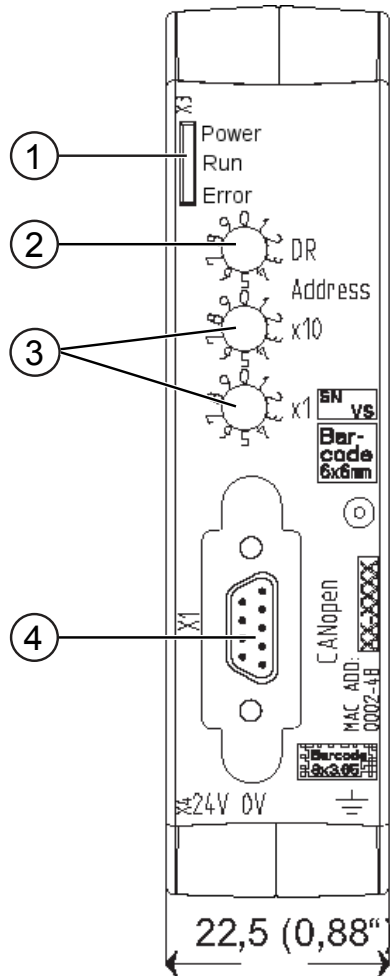


Illustration 2: Front view CANopen

1	Status LEDs
2	Rotary coding switch for setting the bitrate
3	2 Rotary coding switches for setting the node ID
4	Fieldbus connection D-Sub-9 socket for the connection to PROFIBUS.

Top

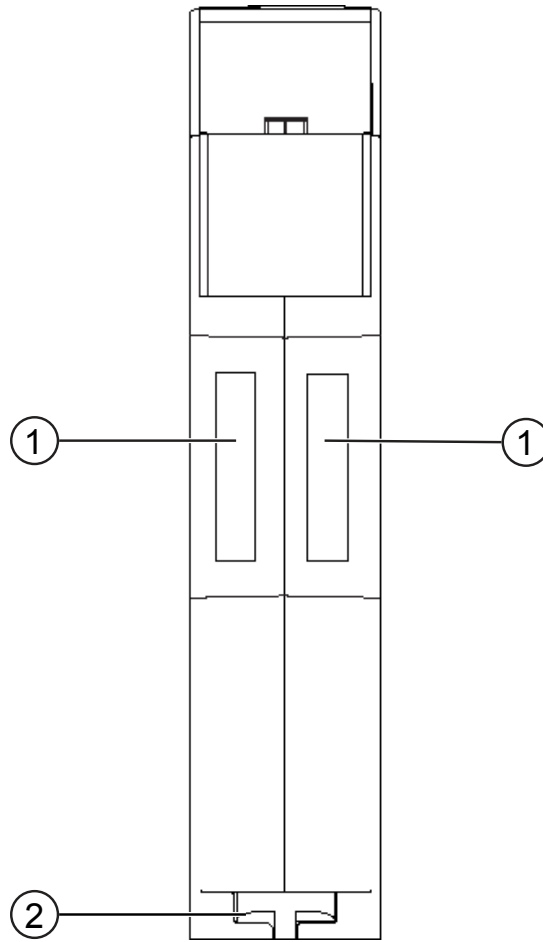


Illustration 3: Top

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

Bottom

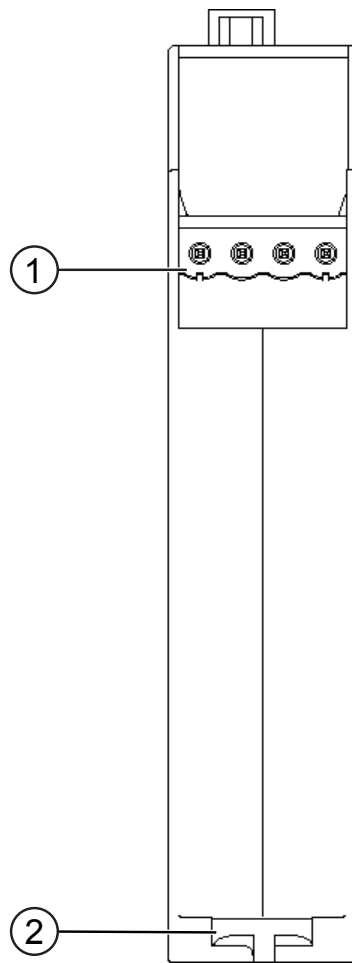


Illustration 4: Bottom

- | | |
|---|--|
| 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 CANopen 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. partner gateway component missing*)
	on, red	Serious error/defect in the gateway
Run LED	off	Gateway component not running
	on, green	CANopen State: Operational
	1 flash, green	CANopen State: Stopped
	flashes, green	CANopen State: Preoperational
	flickers, green	CANopen: Automatic bitrate detection or LSS node setting active
Error LED	off	No Error
	on, red	CAN Controller is in Bus-Off State
	1 flash, red	CAN Controller has reached a Warning Limit
	2 flashes, red	A Node Guard or Heartbeat event has occurred
	flickers, red	CAN Automatic Baudrate Detection active or LSS Node setting active

* If this error occurs, an emergency object with the error code 90XXh is sent. The error code is entered in the object 1003h (pre-defined error field).

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 mm² for potential equalization cables of up to 200 m in length
 - 25 mm² 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.

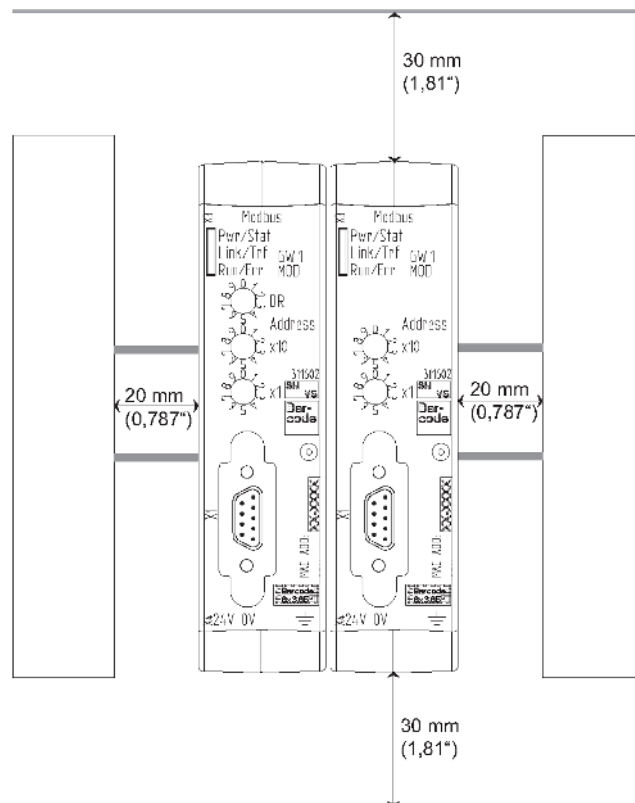
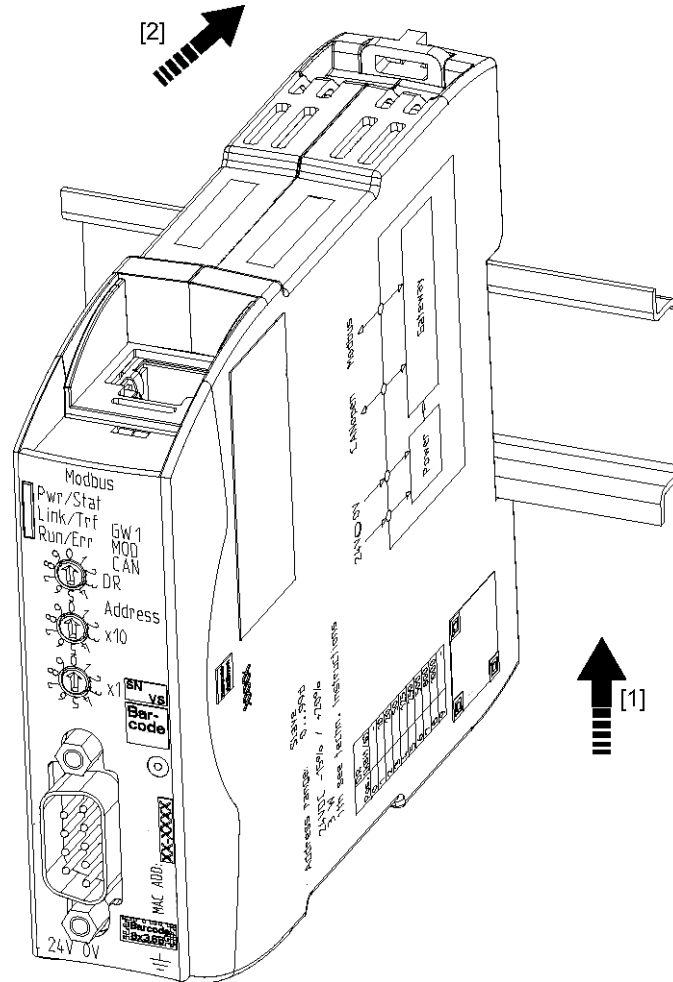


Illustration 5: Distances for installation

- 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.

4.4 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

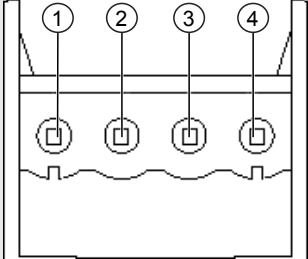
Use the same power supply for both gateway components.

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

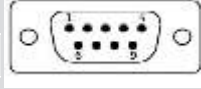
This connection could cause unintended malfunctions.

4.6 Connecting Gateway to the Fieldbus

To connect the gateway component to CANopen, you need one D-SUB9 connector.

The pin assignment complies with the specifications of the CiA.

Pin	Signal	Description
1	-	Do not connect!
2	CAN_L	
3	CAN_GND	Data transmission potential earth (galvanically isolated)
4	-	Do not connect!
5	CAN_SHLD	
6	-	Do not connect!
7	CAN_H	
8	-	Do not connect!
9	-	Do not connect!



5 Configuration

5.1 Supported Size of the Process Data

The gateway component for CANopen supports process data of a length up to 512 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

You have 2 different options for setting the node ID and bitrate for communication with CANopen.

- Using the rotary coding switch
- Using the software of the CANopen Master (LSS)

Setting Node ID and Bitrate using the rotary coding switch

Setting Node ID using the rotary coding switch

You can set the station address of the gateway component using the rotary switches x10 and x1.

The address is assigned in decimal format. Thus, you have a value range from 1-98 at your disposal.

With the two rotary switches you form a two-digit decimal number, in which switch x10 (2) determines the tens digit and switch x1 (3) determines the single digit.

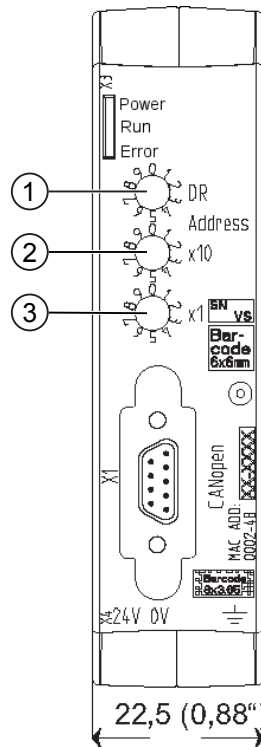


Illustration 7: Coding switch

Example: You want to set the value 39.

Setting for switch x10= 3

Setting for switch x 1 = 9

The settings execute the following actions:

Switch setting	Action
"01" to "98"	Setting the node ID
"00"	Address assignment via LSS telegram
"99"	Firmware Reset

Info! The new node ID is first used when you restart the gateway component.

Setting Bitrate using the Rotary Coding Switch

You can set the bitrate of the gateway component using the rotary switch DR (1).

Values:

0:	Automatic bitrate detection
1	10 Kbit/s
2:	20 Kbit/s
3:	50 Kbit/s
4:	125 Kbit/s
5:	250 Kbit/s
6:	500 Kbit/s
7:	800 Kbit/s
8:	1000 Kbit/s
9	LSS. Bitrate is set by LSS master

Setting Node-ID and Bitrate using the CANopen Master

The gateway component supports LSS. You can set the node ID and/or bitrate using software of your CANopen Master and save it permanently by LSS.

Setting the node ID using LSS

- Set the switch "Node ID x 10" and switch Node ID x 1 to 0
- Assign a node ID for the gateway component in the master software of your CANopen Master.

Setting Bitrate using LSS

- Set the switch "Data Rate Selection" to 9
- Assign a bitrate for the gateway component in the master software of your CANopen Master.

5.3 CANopen Configuration

To configure the gateway component, you have to perform the appropriate settings in the standard objects with the configuration software of your CANopen Master.

You can structure process data exchanged between the gateways application-specifically on the CANopen side using the process data object. For this purpose, CANopen uses mapping objects addressed via index and subindex

The gateway component supports the objects listed below. They comply with the specification DS302 (Version 4.02) of the CiA.

Index	Object Name	Sub-index	Description	Data Type	Access	Comment
1000h	Device Type	00h	Device Type	U32	RO	0000 0000h (No profile)
1001h	Error register	00h	Error register	U8	RO	
1003h	Pre-defined error field	00h	Number of errors	U8	RW	
		01h...08h	Error field	U32	RO	
1005h	COB-ID Sync	00h	COB-ID Sync	U32	RW	Default value is 0000 0080h
1006h	Communication cycle period	00h	Defines the sync interval	U32	RW	Default value is 0000 0000h
1008h	Manufacturer device name	00h	Manufacturer device name	Visible string	RO	"KUNBUS-GW CANopen"
1009h	Manufacturer hardware version	00h	Manufacturer hardware version	Visible string	RO	1.0
100Ah	Manufacturer software version	00h	Manufacturer software version	Visible string	RO	1.0
100Ch	Guard time	00h	Guard time	U16	RW	
100Dh	Life time factor	00h	Life time factor	U8	RW	
1010h	Store Parameters	00h	Largest sub index supported	U8	RO	01h
		01h	Save all parameters	U32	RW	Baud rate and node ID cannot be stored using this command.
1011h	Restore parameters	00h	Largest sub index supported	U8	RO	01h
		01h	Restore all default parameters	U32	RW	
1014h	COB ID EMCY	00h	COB ID EMCY	U32	RO	Default value is 80h + Node ID
1015h	Inhibit Time EMCY	00h	Inhibit Time EMCY	U16	RW	Default value is 0000h
1016h	Consumer Heartbeat Time	00h	Number of entries	U8	RO	01h
		01h	Consumer Heartbeat Time	U32	RW	Node ID + Heartbeat Time. Value must be a multiple of 1ms. Default value is 0000h
1017h	Producer Heartbeat Time	00h	Producer Heartbeat Time	U16	RW	Default value is 0000h
1018h	Identity object	00h	Number of entries	U8	RO	04h
		01h	Vendor ID	U32	RO	000002D5h
		02h	Product Code	U32	RO	71
		03h	Revision Number	U32	RO	00010000h
		04h	Serial Number	U32	RO	

1400h	Receive PDO parameter	00h	Largest sub-index supported	U8	RO	02h
...		01h	COB ID used by PDO	U32	RW	
1407h		02h	Transmission type	U8	RW	
1600h	Receive PDO mapping	00h	No. of mapped application objects in PDO	U8	RW	
...		01h	Mapped object #1	U32	RW	
1607h		02h	Mapped object #2	U32	RW	
		03h	Mapped object #3	U32	RW	
		04h	Mapped object #4	U32	RW	
		05h	Mapped object #5	U32	RW	
		06h	Mapped object #6	U32	RW	
		07h	Mapped object #7	U32	RW	
		08h	Mapped object #8	U32	RW	
1800h	Transmit PDO parameter	00h	Largest sub-index supported	U8	RO	05h
...		01h	COB ID used by PDO	U32	RW	
1807h		02h	Transmission type	U8	RW	
		03h	Inhibit Time EMCY	U16	RW	
		05h	Event Timer (ms)	U16	RW	
1A00h	Transmit PDO mapping	00h	No. of mapped application objects in PDO	U8	RW	
...		01h	Mapped object #1	U32	RW	
1A07h		02h	Mapped object #2	U32	RW	
		03h	Mapped object #3	U32	RW	
		04h	Mapped object #4	U32	RW	
		05h	Mapped object #5	U32	RW	
		06h	Mapped object #6	U32	RW	
		07h	Mapped object #7	U32	RW	
		08h	Mapped object #8	U32	RW	

Table 1: Extract from the specification DS302 (Version 4.02)

Fieldbus Output Data (Direction Master)

With these objects you can read process data that the gateway component sends to the Master. You have 3 possible access types:

- Byte
- Word
- Doubleword

Index	Object Name	Sub-index	Description	Data Type	Access	Remark
2000h	Output Buffer	00h	Number of entries	U8	RO	Access type: Byte
		01h	Output Buffer Byte #0	U8	RO	
		02h	Output Buffer Byte #1			
				
		80h	Output Buffer Byte #127			
2001h	Output Buffer	00h	Number of entries	U8	RO	
		01h	Output Buffer Byte #128	U8	RO	
		02h	Output Buffer Byte #129			
				
		80h	Output Buffer Byte #255			
2002h	Output Buffer	00h	Number of entries	U8	RO	
		01h	Output Buffer Byte #256	U8	RO	
		02h	Output Buffer Byte #257			
				
		80h	Output Buffer Byte #383			
2003h	Output Buffer	00h	Number of entries	U8	RO	
		01h	Output Buffer Byte #384	U8	RO	
		02h	Output Buffer Byte #385			
				
		80h	Output Buffer Byte #511			
2010h	Output Buffer	00h	Number of entries	U8	RO	Access type: Word
		01h	Output Buffer Word #0	U16	RO	
		02h	Output Buffer Word #1			
				
		40h	Output Buffer Word #63			
2011h	Output Buffer	00h	Number of entries	U8	RO	
		01h	Output Buffer Word #64	U16	RO	
		02h	Output Buffer Word #65			
				
		40h	Output Buffer Word #127			
2012h	Output Buffer	00h	Number of entries	U8	RO	Access type: Word
		01h	Output Buffer Word #128	U16	RO	
		02h	Output Buffer Word #129			
				
		40h	Output Buffer Word #191			
2013h	Output Buffer	00h	Number of entries	U8	RO	
		01h	Output Buffer Word #192	U16	RO	
		02h	Output Buffer Word #193			
				
		40h	Output Buffer Word #255			

2020h	Output Buffer	00h	Number of entries	U8	RO	Access type: Doubleword	
		01h	Output Buffer DWord #0	U32	RO		
		02h	Output Buffer DWord #1				
					
		20h	Output Buffer DWord #31				
2021h	Output Buffer	00h	Number of entries	U8	RO		
		01h	Output Buffer DWord #32	U32	RO		
		02h	Output Buffer DWord #33				
					
		20h	Output Buffer DWord #63				
2022h	Output Buffer	00h	Number of entries	U8	RO	Access type: Doubleword	
		01h	Output Buffer DWord #64	U32	RO		
		02h	Output Buffer DWord #65				
					
		20h	Output Buffer DWord #95				
2023h	Output Buffer	00h	Number of entries	U8	RO		
		01h	Output Buffer DWord #96	U32	RO		
		02h	Output Buffer DWord #97				
					
		20h	Output Buffer DWord #127				
2200h	Properties of the partner gateway component	00h	Number of entries	U8	RO		
		01h	Input size	U16	RO		
		02h	Output size	U16	RO		
		03h	Module type	U16	RO		71
		04h	Fieldbus state	U8	RO		s. Table Fieldbus Status

Value	Meaning
0x00	Fieldbus not connected. Check all connections
0x01	Fieldbus connected, no data communication. Check whether a node ID is set
0x02	Gateway component configured, no data communication
0x03	Cyclical data exchange

Table 2: Fieldbus status

Fieldbus Input Data (from the Master)

With these objects you can read process data that the CANopen-Master sends to the gateway component. You have 3 possible access types:

- Byte
- Word
- Doubleword

Index	Object Name	Sub-index	Description	Data Type	Access	Comment
2100h	Input Buffer	00h	Number of entries	U8	RO	Access type: Byte
		01h	Input Buffer Byte #0	U8	RO	
		02h	Input Buffer Byte #1			
				
		80h	Input Buffer Byte #127			
2101h	Input Buffer	00h	Number of entries	U8	RO	
		01h	Input Buffer Byte #128	U8	RO	
		02h	Input Buffer Byte #129			
				
		80h	Input Buffer Byte #255			
2102h	Input Buffer	00h	Number of entries	U8	RO	Access type: Byte
		01h	Input Buffer Byte #256	U8	RO	
		02h	Input Buffer Byte #257			
				
		80h	Input Buffer Byte #383			
2103h	Input Buffer	00h	Number of entries	U8	RO	
		01h	Input Buffer Byte #384	U8	RO	
		02h	Input Buffer Byte #385			
				
		80h	Input Buffer Byte #511			
2110h	Input Buffer	00h	Number of entries	U8	RO	Access type: Word
		01h	Input Buffer Word #0	U16	RO	
		02h	Input Buffer Word #1			
				
		40h	Input Buffer Word #63			
2111h	Input Buffer	00h	Number of entries	U8	RO	
		01h	Input Buffer Word #64	U16	RO	
		02h	Input Buffer Word #65			
				
		40h	Input Buffer Word #127			

2112h	Input Buffer	00h	Number of entries	U8	RO	Access type: Word
		01h	Input Buffer Word #128	U16	RO	
		02h	Input Buffer Word #129			
				
		40h	Input Buffer Word #191			
2113h	Input Buffer	00h	Number of entries	U8	RO	
		01h	Input Buffer Word #192	U16	RO	
		02h	Input Buffer Word #193			
				
		40h	Input Buffer Word #255			
2120h	Input Buffer	00h	Number of entries	U8	RO	Access type: Doubleword
		01h	Input Buffer DWord #0	U32	RO	
		02h	Input Buffer DWord #1			
				
		20h	Input Buffer DWord #31			
2121h	Input Buffer	00h	Number of entries	U8	RO	
		01h	Input Buffer DWord #32	U32	RO	
		02h	Input Buffer DWord #33			
				
		20h	Input Buffer DWord #63			
2122h	Input Buffer	00h	Number of entries	U8	RO	Access type: Doubleword
		01h	Input Buffer DWord #64	U32	RO	
		02h	Input Buffer DWord #65			
				
		20h	Input Buffer DWord #95			
2123h	Input Buffer	00h	Number of entries	U8	RO	
		01h	Input Buffer DWord #96	U32	RO	
		02h	Input Buffer DWord #97			
				
		20h	Input Buffer DWord #127			

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

CANopen Interface	
Device Type	Slave
Station address	1-98 (decimal)
Input data	512 byte
Output data	512 byte

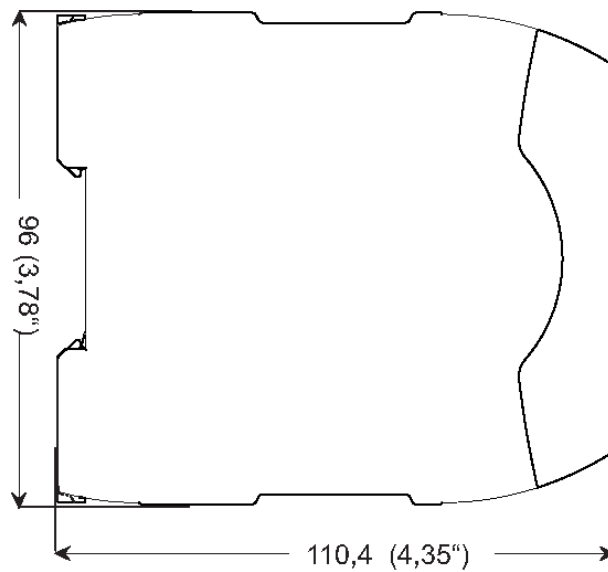


Illustration 8: Side dimensions

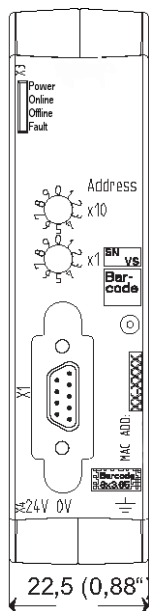


Illustration 9: Front dimensions