![KUNBUS industrial communication]

User Manual
Gateway EtherCAT

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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 will enable you as a user to integrate the Gateways 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 EtherCAT ® is assumed.

As an integral part of the product, 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 Module with the product number:

 – PR100073, release 00

1.4 Limitation of Liability

Warranty and liability claims will lapse, if:

 – the product has been used incorrectly,

– the product is damaged 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.com
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2 Safe Use

2.1 Intended Use

The modular gateway component is part of a gateway that can be combined with another modular gateway component or a RevPi Core/Connect from KUNBUS as required.

The modular gateway component is designed to forward data from a specific protocol to a controller or other gateway component.

No other purpose is intended. If you do not use the device as intended, damage to property and personal injury may result.

2.2 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 EtherCAT,

– work in electrostatic protected areas,

– locally applicable rules and regulations for occupational safety.

2.3 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.

2.4 Important safety instructions

⚠ DANGER

Danger of explosion

The modular Gateway component do not meet the requirements of the ATEX directive. Therefore, they are not suitable for use in potentially explosive environments.

a) Do not use the modular Gateway component in potentially explosive environments.

⚠ CAUTION

Electric shock

Switch off all voltages before assembly/disassembly.

a) Failure to observe this warning may result in personal injury.

⚠ CAUTION

The devices are „open equipment" according to the Standard UL61010-2-201.

To fulfill requirements for safe operation with regard to mechanical stability, flame retardation, stability, and protection against contact, the following alternative types of installation are specified:

a) Installation in a suitable cabinet.

b) Installation in a suitable enclosure.

c) Installation in a suitable equipped, enclosed control room.

NOTICE

Incorrect connection of the power supply

Using an unsuitable power supply can destroy your modules and connected devices.

a) Use a power supply in the approved area for the base modules. The values for this can be found in the technical data of your base module.

2.5 Environmental Conditions

Operate the device only in an environment that corresponds to the operating conditions in order to prevent damage.

Suitable environmental conditions are:

Operating temperature	-20 °C up to +55 °C
Humidity	93% (non-condensing)

NOTICE

This device is designed for indoor use only.

If you use the device outdoors, it may be destroyed.

a) Use the device indoors only.

3 Overview

3.1 Functionality

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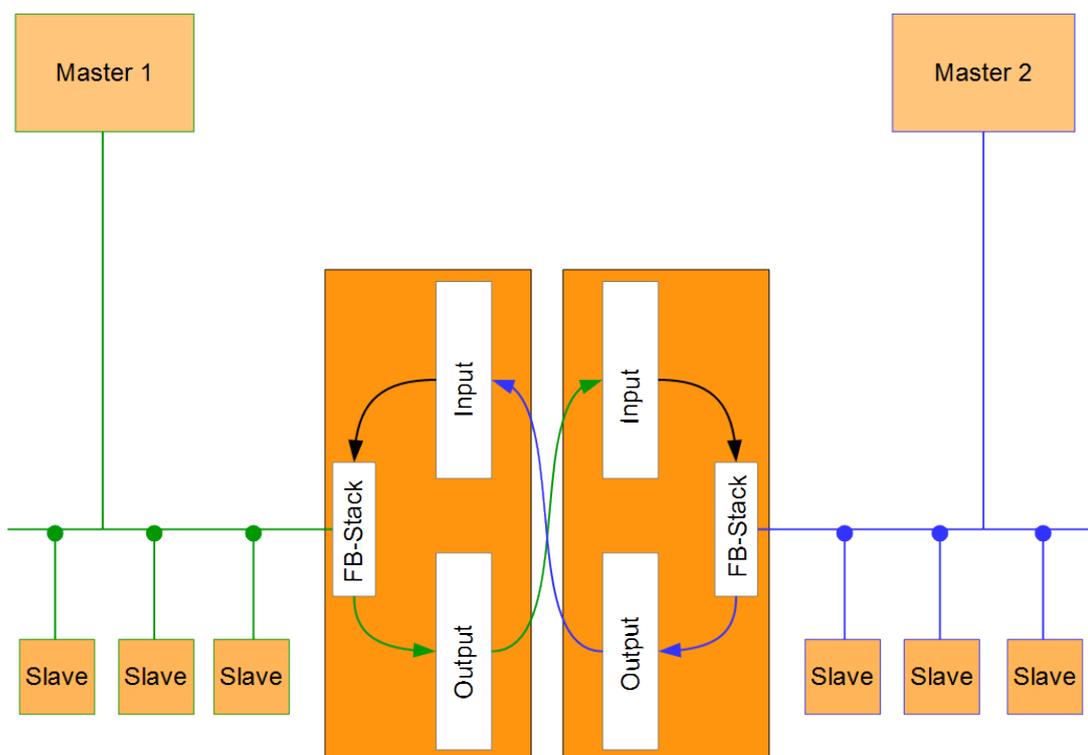
Illustration 1: Functionality as a slave

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 component with the RevPi Core and the RevPi Connect.

3.2 Control Elements

Front view
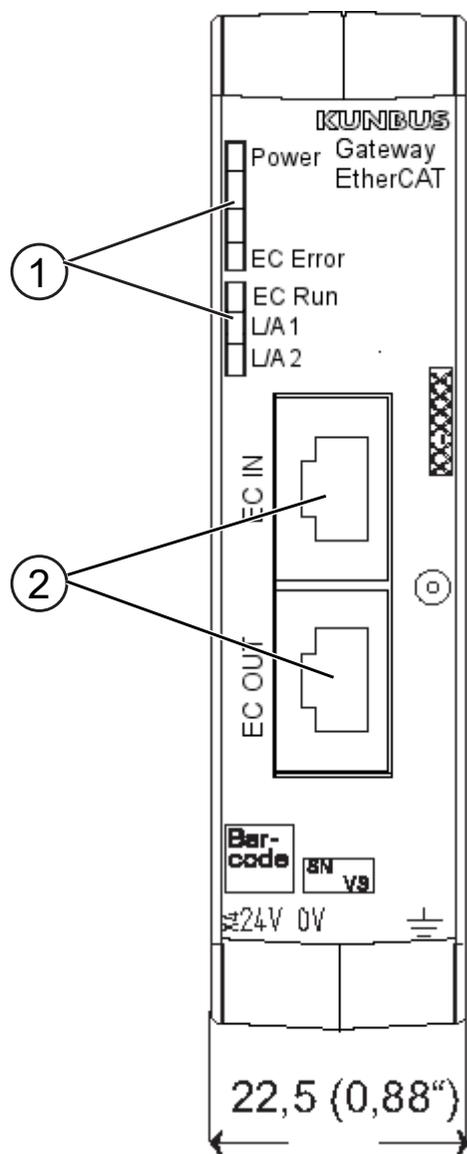
Illustration 2: Front view

1	Status LEDs
2	Fieldbus connection two RJ45 sockets for the connection to EtherCAT

Top
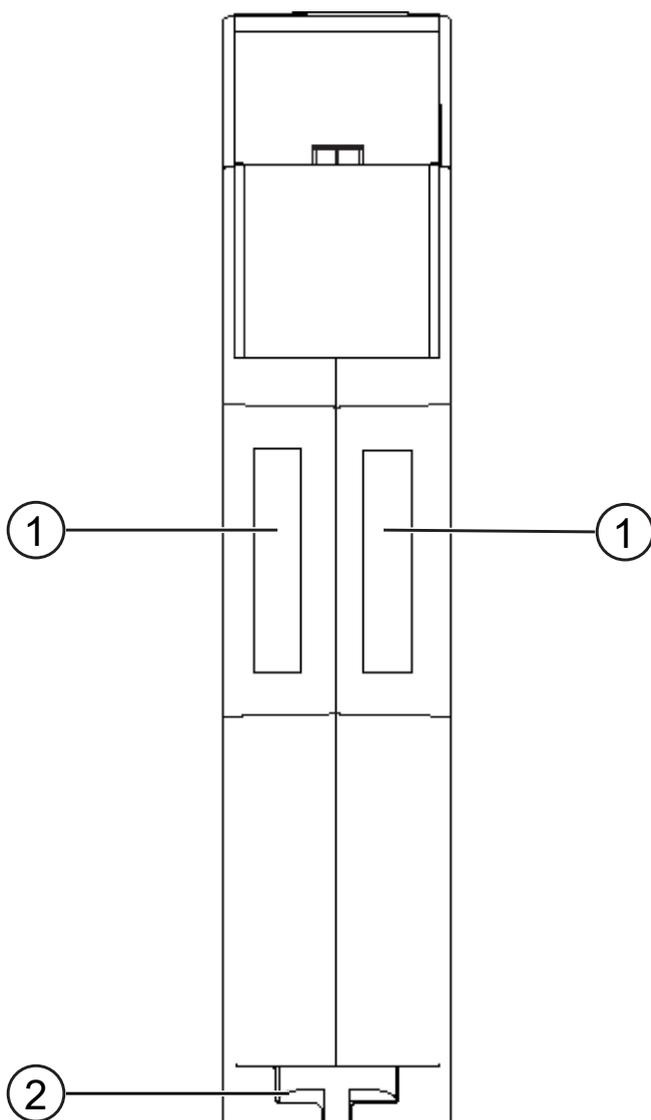
Illustration 3: Top

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

Bottom
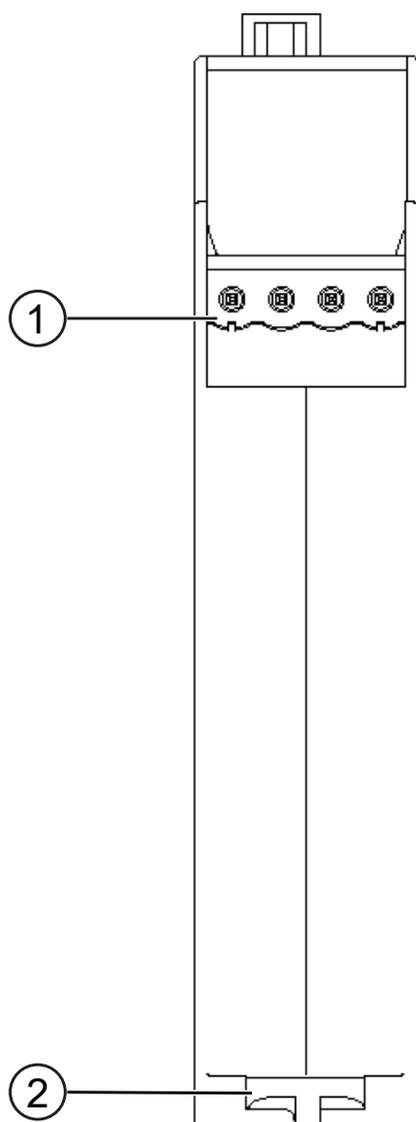
Illustration 4: Bottom

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

3.3 Status LEDs

The gateway component is equipped with 5 status LEDs. The LED Power provides information about the state of the gateway component. The other LEDs provide information about the EtherCAT status.

LED	State	Meaning
Power (green/red)	off	Gateway component not run-ning

	blinks, green	Initialization phase not yet completed
	on, green	All system components are functioning perfectly
	flashes, red	Recoverable error
		Check whether the plug-in jumper is connected correctly to the interconnect port.
	on, red	Serious error/defect in the gateway component
EC ERROR (Red)	off	No Error
	on	Fatal error
	suddenly flashes (200 ms on / 1000 ms off)	As a result of a local error, the gateway component has automatically changed the EtherCat status.
	flashes twice (200 ms on /200 ms off / 200 ms on /1000 ms off)	Time limit exceeded
	flickers (50 ms on / 50 ms off)	An error was detected during the starting process indicating that the status INIT was reached, but a bit error was set in the Alarm Status Register.
	flashes (200 ms on / 200 ms off)	Configuration error
EC RUN (green)	off	EtherCAT State: Init (or gateway component is "off")
	flashes (200 ms on / 200 ms off)	EtherCAT State: Pre-Operational
	suddenly flashes (200 ms on / 1000 ms off)	EtherCAT State: Safe-Operational
	on	EtherCAT State: Operational
L/A 1 (EC IN) (green)	off	No connection
	flickers (50 ms on / 50 ms off)	Connection and data traffic
	on	Connection
L/A 2 (EC OUT) (green)	off	No connection
	flickers (50 ms on / 50 ms off)	Connection and data traffic
	on	Connection

4 Installation

4.1 Preparations for Inteference-free Operation

In the following section we have compiled some general information for you that 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 component.

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 module 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).

a) Install the DIN rail horizontally in the control cabinet according to the manufacturers' specifications. Make sure that the Gateway module has sufficient distance to other devices.

NOTICE

Your gateway could be damaged if temperatures are too high.

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

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

c) Maintain sufficient distance from other devices.
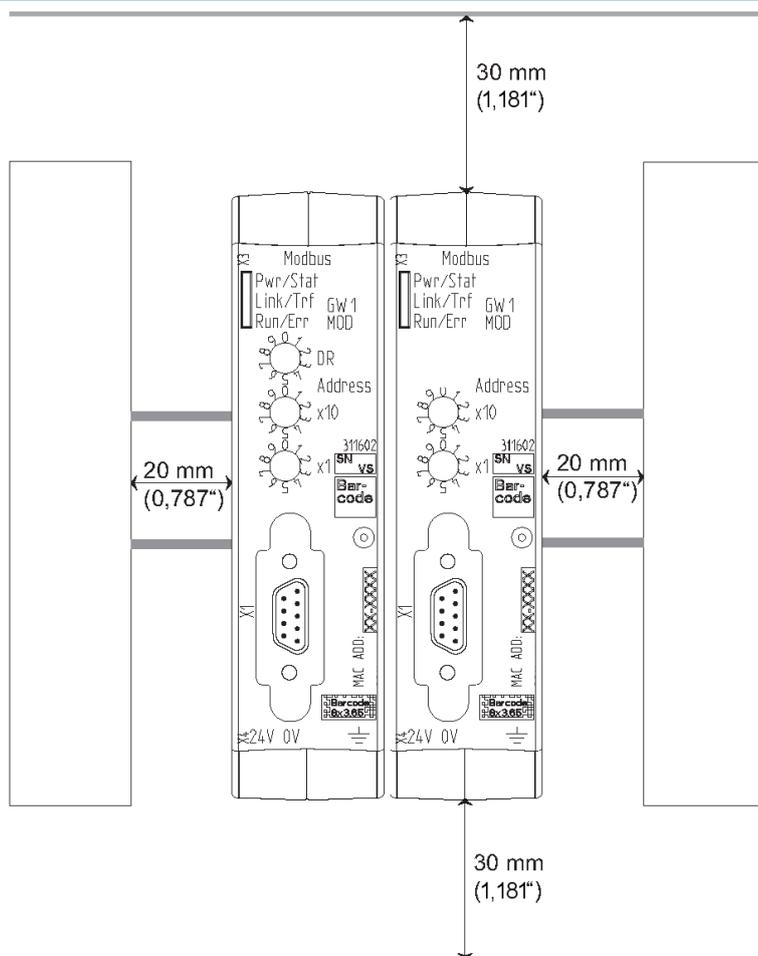
Illustration 5: Distances for installation

b) Connect each gateway component individually to functional earth. Make sure that the power supplies of both gateway components have the same ground.

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

4.3 Connecting Gateway Components

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

a) 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 two gateway components.

If you connect additional components, severe defects could result on all devices.

4.4 Installing a Gateway in the Control Cabinet

a) Hold the grid element of the gateway component against the top-hat rail.

b) Press down the locking elements towards the gateway.

c) Make sure that the gateway is firmly attached to the DIN rail.
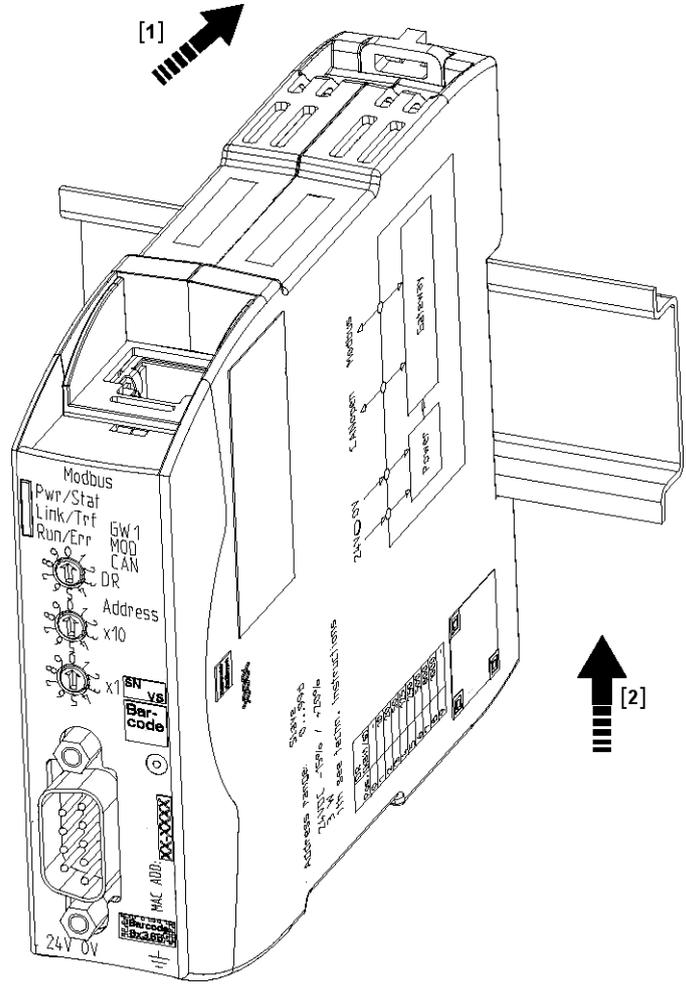
4.5 Connecting a Gateway to the Fieldbus

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

The pin assignment complies with the Ethernet standard.

Pin	Assignment
1	TX+
2	TX-
3	RX+
4	Not assigned.
5	Pin 4 and 5 are interconnected and laid via a filter on PE for better EMC response.
6	RX-
7	Not assigned.
8	Pin 7 and 8 are interconnected and laid via a filter on PE for better EMC response.

4.6 Connecting the Power Supply

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

Lay a separate supply line to the power supply for each gateway component and make sure that the GND are connected to each other at the power supply. Connect FE to PE with low resistance.

NOTICE

Connect the two gateway components to the power supply.

a) 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
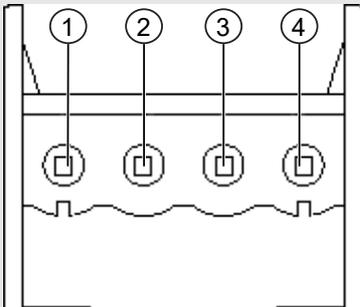
5 Configuration

5.1 Supported Size of Process Data

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

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

Example:

EtherCAT supports 512 bytes

PROFIBUS supports 488 bytes

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

5.2 EtherCAT Configuration

To configure the gateway component, you have to perform the appropriate settings with the configuration software of your EtherCAT Master.

You can use the objects listed below to configure the gateway component.

5.3 Standard Objects

Index	Object Name	Sub-index	Description	Data Type	Access	Remark
1000 h	Device Type	00 h	Device Types	U32	RO	0000 0000h (No profile)
1001 h	Error Register	00 h	Error Register	U8	RO	
1008 h	Manufacturer device name	00 h	Device name	Visible string	RO	"KUNBUS Gateway EtherCAT"
1009 h	Manufacturer hardware version	00 h	Hardware Version	Visible string	RO	"R01"
100Ah	Manufacturer software version	00 h	Software version	Visible string	RO	"majorRevNo". "minorRevNo". "SVNRevNo"
1010 h	Store Parameters	00 h	Number of entries	U8	RO	
		01 h	Store all parameters	U32	RW	Write the value "0x65766173" in this index to save all parameters
1011 h	Restore parameters	00 h	Number of entries	U8	RO	

		01 h	Restore default parameters	U32	RW	Write the value "0x64616f6c" in this index to restore all parameters.
1018 h	Identity object	00 h	Number of entries	U8	RO	04 h
		01 h	Manufacturer Number	U32	RO	
		02 h	Product code	U32	RO	
		03 h	Revision number	U32	RO	
		04 h	Serial number	U32	RO	
1600 h ... 1603 h	Receive PDO mapping	00 h	Number of assigned objects	U8	RW	A mapping can consist of up to 128 assigned objects. It must not be greater than 128 bytes.
		01 h	Assigned object #1	U32	RW	
		02 h	Assigned object #2	U32	RW	
		03 h	Assigned object #3	U32	RW	
		04 h	Assigned object #4	U32	RW	
		05 h	Assigned object #5	U32	RW	
		06 h	Assigned object #6	U32	RW	
		…	…	U32	RW	
		80 h	Assigned object #128	U32	RW	
1A00h ... 1A03h	Transmit PDO mapping	00 h	Number of assigned objects	U8	RW	A mapping can consist of up to 128 assigned objects. It must not be greater than 128 bytes.
		01 h	Assigned object #1	U32	RW	
		02 h	Assigned object #2	U32	RW	
		03 h	Assigned object #3	U32	RW	
		04 h	Assigned object #4	U32	RW	
		05 h	Assigned object #5	U32	RW	
		06 h	Assigned object #6	U32	RW	
		…	…	U32	RW	
		80 h	Assigned object #128	U32	RW	
1C00h	SyncManager Types	00 h	Number of entries	U8	RO	Value: 4
		01 h	Mailbox Out	U8	RW	Value: 0x01
		02 h	Mailbox In	U8	RW	Value: 0x02
		03 h	Outputs	U8	RW	Value: 0x03
		04 h	Inputs	U8	RW	Value: 0x04
1C12h	SyncManager 3 (Rx PDOs)	00 h	Number of entries	U8	RW	Rx PDO transmission
		01 h		U16	RW	
		02 h		U16	RW	
		03 h		U16	RW	
		04 h		U16	RW	
1C13h	SyncManager 4 (Tx PDOs)	00 h	Number of entries	U8	RW	Tx PDO transmission
		01 h		U16	RW	

		02 h		U16	RW	
		03 h		U16	RW	
		04 h		U16	RW	

5.4 EtherCAT In/Outputs

The output data (512 bytes) can be accessed byte-wise, word-wise and double word-wise.

The same data area is accessed here.

Example: 2000h:01h to 2000h:04h maps the same data as 2010h:01h until 2010h:02h and the same data as 2020h:01h

<div style="background:#0096d6;color:white;padding:4px;">

NOTICE
</div>

Gateway component only transfers fieldbus data to the partner gateway component if it is in "Operational" EtherCAT status. Otherwise, "zeros" are transmitted to the partner gateway component.

Fieldbus Output Data (Master Direction)

Index	Object Name	Sub-in-dex	Description	Data type	Access	Access type
2000 h	Output Buffer	00 h	Number of entries	U8	RO	Byte
		01 h	Output Buffer Byte #0	U8	RO	
		02 h	Output Buffer Byte #1			
		...	...			
		80 h	Output Buffer Byte #127			
2001 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Byte #128	U8	RO	
		02 h	Output Buffer Byte #129			
		...	...			
		80 h	Output Buffer Byte #255			
2002 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Byte #256	U8	RO	
		02 h	Output Buffer Byte #257			
		...	...			
		80 h	Output Buffer Byte #383			
2003 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Byte #384	U8	RO	
		02 h	Output Buffer Byte #385			
		...	...			

		80 h	Output Buffer Byte #511			
2010 h	Output Buffer	00 h	Number of entries	U8	RO	Word
		01 h	Output Buffer Word #0	U16	RO	
		02 h	Output Buffer Word #1			
		...	...			
		40 h	Output Buffer Word #63			
2011 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Word #64	U16	RO	
		02 h	Output Buffer Word #65			
		...	...			
		40 h	Output Buffer Word #127			
2012 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Word #128	U16	RO	
		02 h	Output Buffer Word #129			
		...	...			
		40 h	Output Buffer Word #191			
2013 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Word #192	U16	RO	
		02 h	Output Buffer Word #193			
		...	...			
		40 h	Output Buffer Word #255			
2020 h	Output Buffer	00 h	Number of entries	U8	RO	Double word
		01 h	Output Buffer Double Word #0	U32	RO	
		02 h	Output Buffer Double Word #1			
		...	...			
		20 h	Output Buffer Double Word #31			
2021 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Double Word #32	U32	RO	
		02 h	Output Buffer Double Word #33			
		...	...			
		20 h	Output Buffer Double Word #63			
2022 h	Output Buffer	00 h	Number of entries	U8	RO	

Index	Object Name	Sub-index	Description	Data type	Access	Access type
		01 h	Output Buffer Double Word #64	U32	RO	
		02 h	Output Buffer Double Word #65			
		...	...			
		20 h	Output Buffer Double Word #95			
2023 h	Output Buffer	00 h	Number of entries	U8	RO	
		01 h	Output Buffer Double Word #96	U32	RO	
		02 h	Output Buffer Double Word #97			
		...	...			
		20 h	Output Buffer Double Word #127			

Fieldbus input data (from the master)

Index	Object Name	Sub-index	Description	Data type	Access	Access type
2100 h	Input Buffer	00 h	Number of entries	U8	RW	Byte
		01 h	Input Buffer Byte #0	U8	RW	
		02 h	Input Buffer Byte #1			
		...	...			
		80 h	Input Buffer Byte #127			
2101 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Byte #128	U8	RW	
		02 h	Input Buffer Byte #129			
		...	...			
		80 h	Input Buffer Byte #255			
2102 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Byte #256	U8	RW	
		02 h	Input Buffer Byte #257			
		...	...			
		80 h	Input Buffer Byte #383			
2103 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Byte #384	U8	RW	
		02 h	Input Buffer Byte #385			
		...	...			

		80 h	Input Buffer Byte #511			
2110 h	Input Buffer	00 h	Number of entries	U8	RW	Word
		01 h	Input Buffer Word #0	U16	RW	
		02 h	Input Buffer Word #1			
		...	...			
		40 h	Input Buffer Word #63			
2111 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Word #64	U16	RW	
		02 h	Input Buffer Word #65			
		...	...			
		40 h	Input Buffer Word #127			
2112 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Word #128	U16	RW	
		02 h	Input Buffer Word #129			
		...	...			
		40 h	Input Buffer Word #191			
2113 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Word #192	U16	RW	
		02 h	Input Buffer Word #193			
		...	...			
		40 h	Input Buffer Word #255			
2120 h	Input Buffer	00 h	Number of entries	U8	RW	Double word
		01 h	Input Buffer Double Word #0	U32	RW	
		02 h	Input Buffer Double Word #1			
		...	...			
		20 h	Input Buffer Double Word #31			
2121 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Double Word #32	U32	RW	
		02 h	Input Buffer Double Word #33			
		...	...			
		20 h	Input Buffer Double Word #63			
2122 h	Input Buffer	00 h	Number of entries	U8	RW	

		01 h	Input Buffer Double Word #64	U32	RW	
		02 h	Input Buffer Double Word #65			
		...	...			
		20 h	Input Buffer Double Word #95			
2123 h	Input Buffer	00 h	Number of entries	U8	RW	
		01 h	Input Buffer Double Word #96	U32	RW	
		02 h	Input Buffer Double Word #97			
		...	...			
		20 h	Input Buffer Double Word #127			

5.5 Check status

You can poll the status of the other gateway component by SDO entry in the OBD.

Index	Object Name	Sub-index	Description	Data type	Access	Remark	
0x2200	Status of the partner gateway component	00 h	Number of entries	U8	RO		
		01 h	Length of the input data		RO	max. 512 bytes	
		02 h	Length of the output data	U16	RO	max. 512 bytes	
		03 h	Module Type	U16	RO	74 (EtherCAT Gateway Component)	
		04 h	Fieldbus Status	U8	RO	0x00	Fieldbus not connected. Check all connections
						0x01	Fieldbus connected, no data communication.
						0x02	Gateway component configured, no data communication
						0x03	Cyclical data exchange

6 Technical Data

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

Electrical data	
Power supply	24VDC -15%/ +20%; 1.5W
Power consumption during operation (cyclical data exchange)	100 mA
Status display	LED

Environmental Conditions	
Ambient temperature	-30 °C – +55 °C
Storage temperature	-30 °C – +60 °C
Humidity	93% (at 40 °C)
Condensing	Not allowed
Protection class	
Control cabinet	IP54
Housing	IP20
Terminal area	IP20

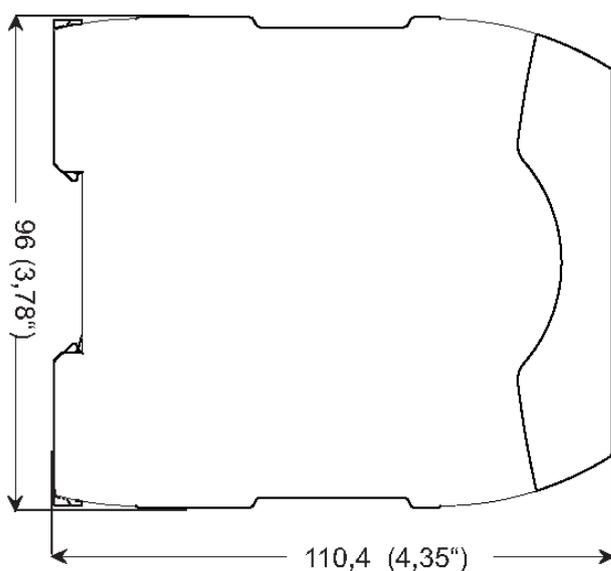| Assembly data	
DIN rail	35 x 7.5 mm
Height	96 mm
Depth	110.4 mm

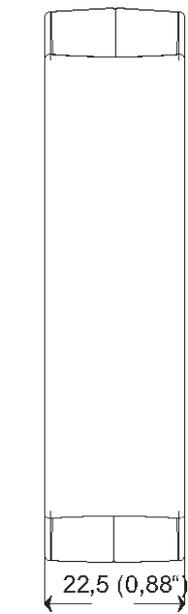*Illustration 7:* Side dimensions

22,5 (0,88")

Illustration 8: Front dimensions

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