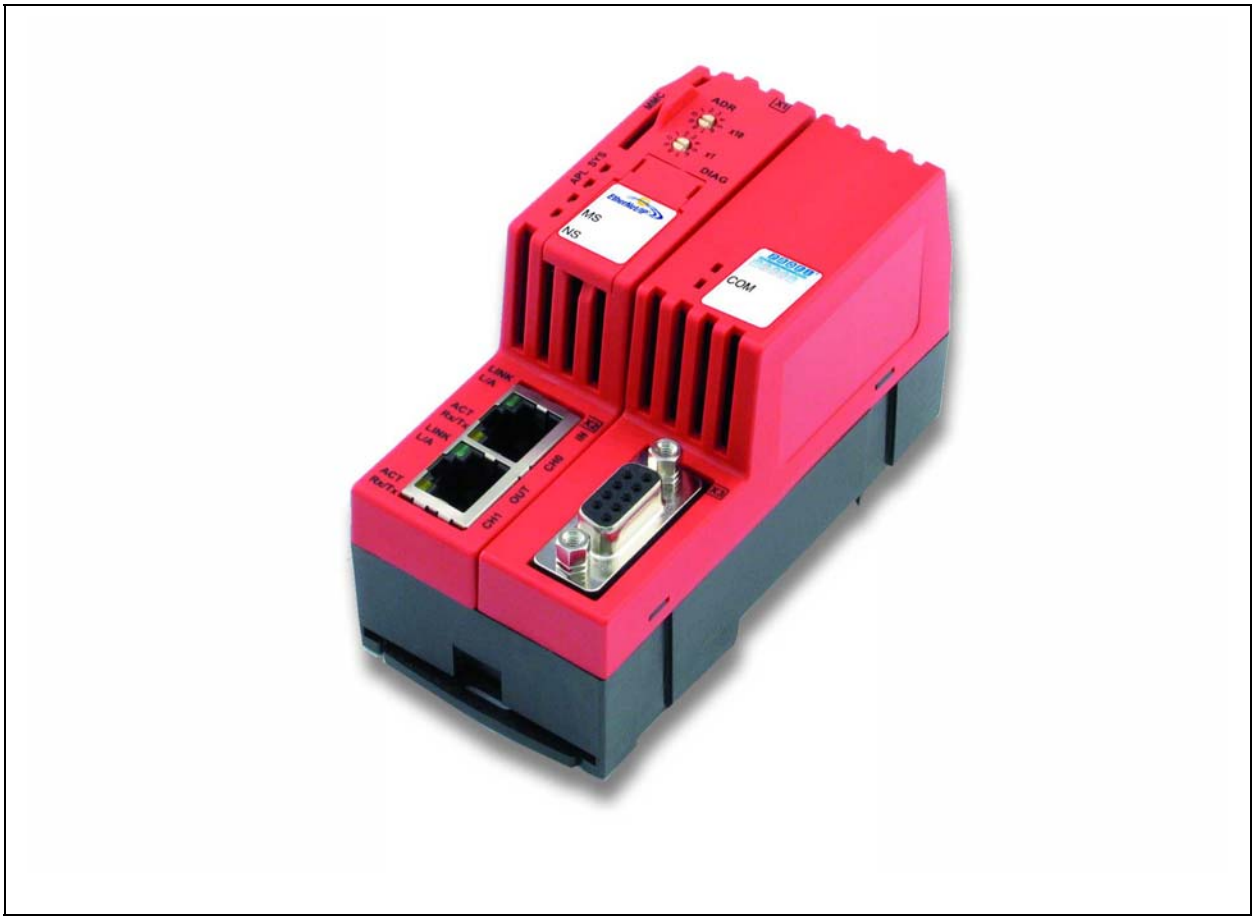
User Manual

netTAP NT 100

Gateway Devices



Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

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Table of Contents

1 Introduction

1.1 About the User Manual

This user manual describes the hardware, installation, commissioning, and operation of the netTAP NT 100 series of gateways.

1.1.1 List of Revisions

Index	Date	Chapter	Revisions
5	2010-02-20	all	Created new and split into two documents.
			The configuration with the SYCON.net software was moved to the operating instruction manual „netGateway“.
			This document describes essentially the hardware.
			Expanded to 20 device types with 122 conversions, new devices with CC-Link.
		6	New chapter „Commissioning / Decommissioning“
6	2010-05-21	1.3	Section Reference to Hardware, Software, Driver and Firmware added
		3.3.2 and 3.3.4	Protcol conversions for 3964R protocol added
		3.5	Update of Configuration Requirements
		4.5.2.4	Important hint in section X2 Ethernet Interface added
		7.1	Section Failure in 10 MBit/s Half Duplex Mode and Workaround added
		8.3.6	Section LED SERCOS III Slave updated
		8.5.4	Section LED 3964R added
		9.2.9	Section SERCOS III Slave updated
		9.4.4	Section Technical Data 3964R added
		10.1.2.1	Section Use of Hubs and Switches added
7	2010-09-09	8.3.2	Text ' for future use’ removed.
		8.3.3	Text ' for future use’ removed.
		10.1.8	Wiring Instructions for RS-422: Bus Requirements corrected.
		10.1.9	Wiring Instructions for RS-485: Bus Requirements corrected.

Table 1: List of Revisions

1.2 Legal Notes

1.2.1 Copyright

1.2.2 Important Notes

The user manual, accompanying texts and the documentation were created for the use of the products by qualified experts, however, errors cannot be ruled out. For this reason, no guarantee can be made and neither juristic responsibility for erroneous information nor any liability can be assumed. Descriptions, accompanying texts and documentation included in the user manual do not present a guarantee nor any information about proper use as stipulated in the contract or a warranted feature. It cannot be ruled out that the user manual, the accompanying texts and the documentation do not correspond exactly to the described features, standards or other data of the delivered product. No warranty or guarantee regarding the correctness or accuracy of the information is assumed.

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for the design, construction, maintenance or operation of nuclear facilities;

in air traffic control systems, air traffic or air traffic communication systems;

in life support systems;

in systems in which failures in the software could lead to personal injury or injuries leading to death.

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Adobe-Acrobat® is a registered trademark of the Adobe Systems Incorporated.

EtherCAT® is a registered trademark of Beckhoff Automation GmbH, Verl, Bundesrepublik Deutschland, formerly Elektro Beckhoff GmbH.

Modbus® is a registered trademark of Schneider Automation

1.2.7 Conventions in this Manual

Operation instructions, a result of an operation step or notes are marked as follows:

Operation Instructions:

➢ <instruction>

Or

1. <instruction>
2. <instruction>

Results:

⇨ <result>

Notes:

Important: <important note>

Note: <note>

<note, were to find further information>

Numbering:

① ... ⓝ reference to the figure used in that section. If the numbers reference to a section outside the current section then a cross reference to that section and figure is indicated.

1.3 Reference to Hardware, Software, Driver and Firmware

Hardware

Device Type	Revision	Port X2	Port X3
NT 100-RE-CC	Revision 1	Ethernet	CC-Link
NT 100-RE-CO	Revision 2	Ethernet	CANopen
NT 100-RE-DP	Revision 2	Ethernet	PROFIBUS-DP
NT 100-RE-DN	Revision 2	Ethernet	DeviceNet
NT 100-RE-RS	Revision 3	Ethernet	Serial
NT 100-DP-CC	Revision 1	PROFIBUS-DP	CC-Link
NT 100-DP-CO	Revision 1	PROFIBUS-DP	CANopen
NT 100-DP-DN	Revision 1	PROFIBUS-DP	DeviceNet
NT 100-DP-DP	Revision 2	PROFIBUS-DP	PROFIBUS-DP
NT 100-DP-RS	Revision 3	PROFIBUS-DP	Serial
NT 100-CO-CC	Revision 1	CANopen	CC-Link
NT 100-CO-CO	Revision 1	CANopen	CANopen
NT 100-CO-DP	Revision 1	CANopen	PROFIBUS-DP
NT 100-CO-DN	Revision 1	CANopen	DeviceNet
NT 100-CO-RS	Revision 2	CANopen	Serial
NT 100-DN-CC	Revision 1	DeviceNet	CC-Link
NT 100-DN-CO	Revision 1	DeviceNet	CANopen
NT 100-DN-DP	Revision 2	DeviceNet	PROFIBUS-DP
NT 100-DN-DN	Revision 2	DeviceNet	DeviceNet
NT 100-DN-RS	Revision 3	DeviceNet	Serial

Table 2: Reference to Hardware

Software

Software	Software Version
SYCONnet netX setup.exe	1.300.x.x

Table 3: Reference to Software

Driver

Driver	Software Version
USB Driver	5.1.2600.2180

Table 4: Reference to Driver

Firmware

Firmware for the protocol conversions: see section *Protocol Conversions* on page 21.

1.4 Contents of the Product DVD

The product DVD for the netTAP NT 100 contains:

Setup program for the configuration and diagnostic program SYCON.net

USB Driver

Documentation

Firmware

Device Description Files (GSD, GSDML, EDS, ...)

1.4.1 Directory Structure of the DVD

All manuals on this DVD are delivered in the Adobe Acrobat® Reader format (PDF).

Directory Name	Description
Adobe Flash Player	Adobe Flash Player installation program
Documentation	Documentation in the Acrobat® Reader Format (PDF)
Driver	USB Driver for NT 100 and NB 100
EDS	Device Description File
Examples	Example files for netSCRIPT
Firmware	Loadable Firmware
fscommand	Files, used for installation
Presentations	Product Presentationen in PowerPoint pps format
Software	Configuration and diagnostic program SYCON.net
Video-Audio Tutorials	Video Tutorial in AVI Format

Table 5: Directory Structure of the DVD

1.4.2 Device Description Files

The directory EDS on the DVD provides device description files for the netTAP NT 100 device.

netTAP NT 100 as	File name
CANopen Slave	NT100_CO_COS.EDS
CC-Link Slave	NT100_CC_CCS_1.csp, NT100_CC_CCS_2.csp, NT100_CC_CCS_3.csp, NT100_CC_CCS_4.csp, NT100_CC_CCS_IO.csp
DeviceNet Slave	NT100_DN_DNS.EDS
EtherCAT Slave	Hilscher NT 100-ECS-XX V2.2.xml
EtherNet/IP Adapter	HILSCHER NT 100-RE EIS V1.1.EDS
PROFIBUS-DP Slave	HIL_0C0E.GSD
PROFINET IO Device	GSDML-V2.1-HILSCHER-NT 100-RE PNS-20100226.xml
SERCOS III Slave	Hilscher NT 100-RE S3S.xml

Table 6: Device description files for netTAP NT 100 on the DVD

The device description files are for the configuration of the used master.

1.4.3 Documentation for netTAP

The following documentation overview gives information, for which items you can find further information in which manual.

Note: Further information: All manuals listed in the overview below can be found in the Documentation directory on the DVD delivered, in the Adobe Acrobat® Reader format (PDF).

Manual	Contents	Document name
User Manual	netTAP NT 100 Installation, Operation and Hardware	netTAP NT 100 - Gateway Devices UM xx EN.pdf (this manual)
User Manual	Software Installation Gateway Solutions	Software Installation - Gateway Solutions UM xx EN.pdf
Operating Instruction Manual	netGateway DTM for netTAP, netBRICK and netLINK Configuration of Gateway and Proxy Devices Configuration of the netTAP NT 100 as EtherCAT Slave, EtherNet/IP Adapter, Open Modbus/TCP, POWERLINK controlled Node, PROFINET IO Device, SERCOS III Slave CANopen Slave, CC-Link Slave, DeviceNet Slave, PROFIBUS-DP Slave, 3964R, ASCII, Modbus RTU Master or Slave respectively netSCRIPT.	netGateway_DTM_en.pdf
Operating Instruction Manual	DTM for EtherCAT Master devices	EtherCAT_Master_DTM_en.pdf
Operating Instruction Manual	Generic DTM for EtherCAT Slave devices	EtherCAT_GenericSlave_DTM_en.pdf
Operating Instruction Manual	DTM for EtherNet/IP Scanner devices	EtherNetIP_Scanner_DTM_en.pdf
Operating Instruction Manual	Generic DTM for EtherNet/IP Adapter devices	EtherNetIP_GenericAdapter_DTM_en.pdf
Operating Instruction Manual	DTM for PROFINET IO Controller devices	PROFINET_IO_Controller_DTM_en.pdf
Operating Instruction Manual	Generic DTM for PROFINET IO Device devices	PROFINET_IO_GenericDevice_DTM_en.pdf
Operating Instruction Manual	DTM for CANopen Master devices	CANopen_Master_netX_DTM_en.pdf
Operating Instruction Manual	Generic DTM for CANopen Slave devices	CANopen_Generic_Slave_DTM_en.pdf
Operating Instruction Manual	DTM for DeviceNet Master devices	DeviceNet_Master_netX_DTM_en.pdf
Operating Instruction Manual	Generic DTM for DeviceNet Slave devices	DeviceNet_Generic_Slave_DTM_en.pdf
Operating Instruction Manual	DTM for PROFIBUS-DP Master devices	PROFIBUS_Master_netX_DTM_en.pdf
Operating Instruction Manual	Generic DTM for PROFIBUS-DP Slave devices	PROFIBUS_Generic_Slave_DTM_en.pdf
User Manual	netSCRIPT Programming Language for serial communication	netSCRIPT Programming Language for Serial Communication UM xx EN.pdf
User Manual	ASCII Handshake Mechanism	ASCII – Handshake Mechanism UM xx EN.pdf
User Manual	3964R Handshake Mechanism	3964R – Handshake Mechanism UM xx EN.pdf

Table 7: Documentation for netTAP NT 100

1.5 Licenses

If the netTAP NT 100 device is used with a firmware with master functionality a master license in the netTAP device must be present.

If the device has a master license can be read out with the software SYCON.net. This is described in the operating instruction manual netGateway_DTM_en.pdf

The master license can be ordered later with SYCON.net and transferred with SYCON.net into the device. (The master license can be ordered with at Hilscher ‘NXLIC-MASTER’ and has part number 8211.000.)

2 Safety

2.1 General Note

The user manual, the accompanying texts and the documentation are written for the use of the products by educated personnel. When using the products, all safety instructions and all valid legal regulations have to be obeyed. Technical knowledge is presumed. The user has to assure that all legal regulations are obeyed.

2.2 Intended Use

Devices secribed in this manual:

are devices for communication and connect two communication networks. The NT 100 devices work as a gateway between these two networks.

netTAP 100 Devices			
NT 100-RE-CC	NT 100-DP-CC	NT 100-CO-CC	NT 100-DN-CC
NT 100-RE-CO	NT 100-DP-CO	NT 100-CO-CO	NT 100-DN-CO
NT 100-RE-DP	NT 100-DP-DN	NT 100-CO-DP	NT 100-DN-DP
NT 100-RE-DN	NT 100-DP-DP	NT 100-CO-DN	NT 100-DN-DN
NT 100-RE-RS	NT 100-DP-RS	NT 100-CO-RS	NT 100-DN-RS

The NT 100 devices are in a compact housing and suitable for DIN rail mounting according to DIN EN 60715.

2.3 Personnel Qualification

The netTAP NT 100 Gateway must only be installed, configured and removed by qualified personnel. Job-specific technical skills for people professionally working with electricity must be present concerning the following topics:

Safety and health at work

Mounting and attaching of electrical equipment

Measurement and Analysis of electrical functions and systems

Evaluation of the safety of electrical systems and equipment

Installing and Configuring IT

2.4 Commitment to read and understand the Manual

Important! Read and understand all instructions in this manual before installation or use of your device to avoid injury.

2.5 References Safety

[1] ANSI Z535.6-2006 American National Standard for Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials

[2] IEC 60950-1, Information technology equipment - Safety - Part 1: General requirements, (IEC 60950-1:2005, modified); GermanEdition EN 60950-1:2006

[3] EN 61340-5-1 and EN 61340-5-2 as well as IEC 61340-5-1 and IEC 61340-5-2

2.6 Labeling of Safety Instructions

The safety instructions are pinpointed particularly. The instructions are highlighted with a specific safety symbol, a warning triangle and a signal word according to the degree of endangerment. Inside the note the danger is exactly named. Instructions to a property damage message do not contain a warning triangle.

Symbol	Sort of Warning or Principle
	Safety symbol for the warning to personal injury
	Warning of danger by electrical current
	Warning of damages by electrostatic discharge

Table 8: Safety Symbols and Sort of Warning or Principle

2.6.1 Signal Words

Signal Word	Meaning
DANGER	Indicates a direct hazard with high risk, which will have as consequence death or grievous bodily harm if it isn't avoided. The use of this signal word shall be restricted to extremely hazard.
WARNING	Indicates a possible hazard with medium risk, which will have as consequence death or (grievous) bodily harm if it isn't avoided.
CAUTION	Indicates a minor hazard with medium risk, which could have as consequence simple battery if it isn't avoided.
Note	Indicates an important note in the manual.

Table 9: Signal Words

2.6.2 Signal Words USA

Signal Word	Meaning
DANGER	Indicates a Hazardous Situation Which, if not Avoided, will Result in Death or Serious Injury.
WARNING	Indicates a Hazardous Situation Which, if not Avoided, could Result in Death or Serious Injury.
CAUTION	Indicates a Hazardous Situation Which, if not Avoided, may Result in Minor or Moderate Injury.
NOTICE	Indicates a Property Damage Message.
Note	Indicates an Important Note in the Manual.

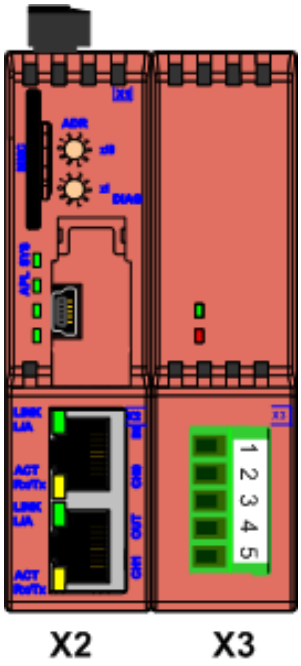
Table 10: Signal Words according to ANSI

3 Description and Requirements

3.1 Description

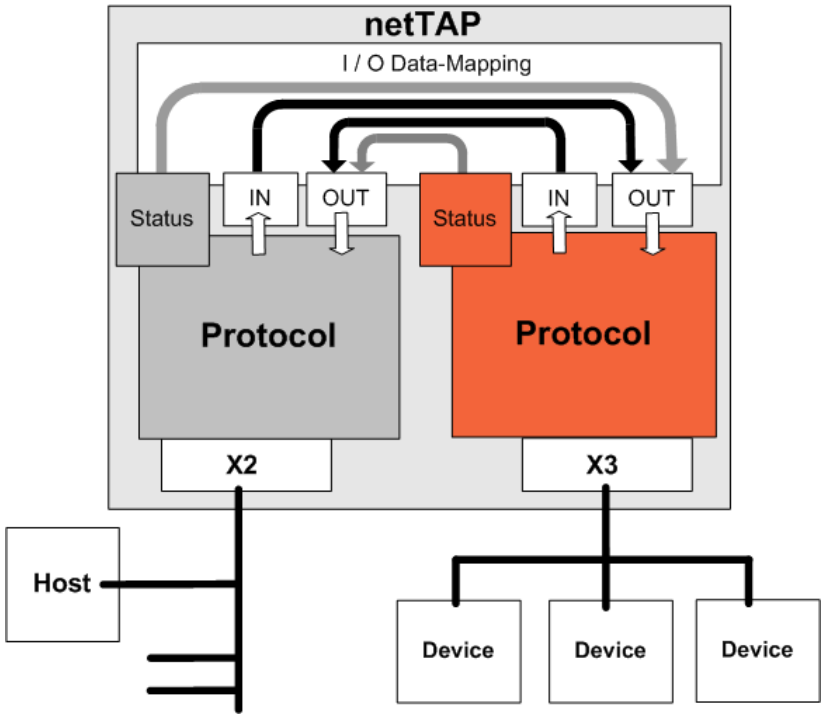
The netTAP NT100 devices described in this manual are communication devices that are connecting two networks to each other. The NT 100 devices are operating as gateway between both networks.

The netTAP 100 is a device with two interface ports. Its principle functionality is illustrated in the figure below. The function of the device is determined by the loaded firmware and the loaded configuration.



Protocol connection

The connection technology depends on the protocol



Block diagram

Figure 1: Function NT 100

The interface X2 may be Ethernet or a fieldbus interface, the interface X3 may be fieldbus or a serial interface. X2 and X3 is located at the front of the device.

Basically it is possible to connect either to port X2 or X3 to a host or to field devices.

The device is configured via the USB interface (under the cover) by a PC and the software SYCON.net. Online diagnosis is possible via the same interface.

The gateway functionality is determined by the loadable firmware. The operation of the configuration tool SYCON.net is described in the documentation netGateway and located in the documents folder of the DVD included in the delivery.

The firmware buffers the cyclic send and receive data of the protocol at port X2 and the protocol of port X3 internally. The configuration tool enables the flexible mapping of the receive data of protocol X2 to send data of the protocol X3 and vice versa.

Status information of the protocol at port X2 can be mapped into the send data of the protocol at port X3 and vice versa.

The firmware of netTAP NT100 as gateway does not support acyclic communications or services of the supported protocols.

3.2 Device Versions and Usage Scenarios

3.2.1 Device Names

The following figure shows a NT 100-RE-DP.

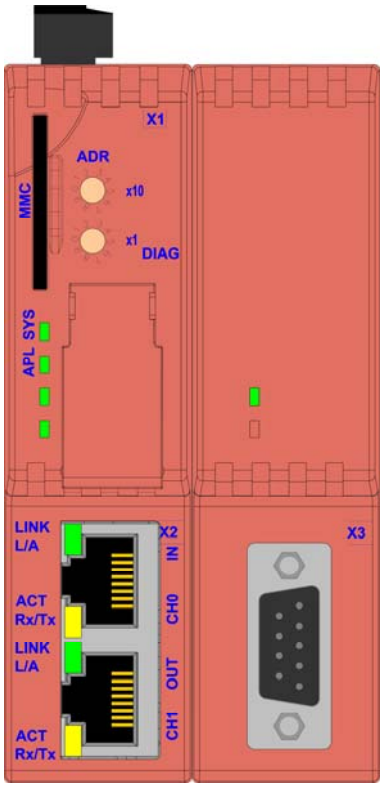
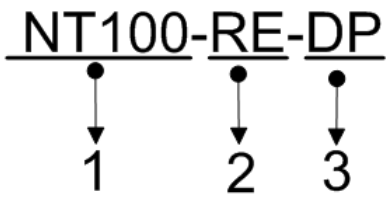


Figure 2: Device Drawing NT 100-RE-DP



The descriptive device name of netTAP devices consists of the following parts

1. Device Type netTAP 100
2. Network on port X2 (left part of device), in the example RE for Real-time Ethernet
3. Network on port X3 (right part of device), in the example DP for PROFIBUS

The following communication systems are currently supported at the primary network X2:

Code	Supported Communication System
RE	Real-time Ethernet (2* RJ45)
DP	PROFIBUS-DP
CO	CANopen
DN	DeviceNet

Table 11: Network on port X2 (Primary Network)

The following communication systems are currently supported at the secondary network X3:

Code	Supported Communication System
DP	PROFIBUS-DP
CC	CC-Link
CO	CANopen
DN	DeviceNet
RS	Serial (Modbus RTU, ASCII respectively serial with netSCRIPT)

Table 12: Network on port X3 (Secondary Network)

3.3 Protocol Conversions

Information about the configuration of the protocol conversion of the device is in the operating instruction manual netGateway_DTM_en.pdf on the DVD in the directory Documentation.

3.3.1 Protocol Conversion 1 - Ethernet to Fieldbus

The netTAP NT 100 connects to Ethernet on port X2 and connects to fieldbus on port X3.

The following devices of the netTAP 100 series support this scenario:

Device Name	Ethernet System (X2)	Fieldbus System (X3)	Firmware File	Firmware Version
NT 100-RE-CC	EtherCAT Master	CC-Link Slave	NTECMCCS.NXF	1.3.x.x
	EtherCAT Slave	CC-Link Slave	NTECSCCS.NXF	1.3.x.x
	EtherNet/IP Scanner / Master	CC-Link Slave	NTEIMCCS.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	CC-Link Slave	NTEISCCS.NXF	1.3.x.x
	Open Modbus/TCP	CC-Link Slave	NTOMBCCS.NXF	1.3.x.x
	POWERLINK Slave	CC-Link Slave	NTPNSCCS.NXF	1.3.x.x
	PROFINET IO Controller	CC-Link Slave	NTPNMCCS.NXF	1.3.x.x
	PROFINET IO Device	CC-Link Slave	NTPNSCCS.NXF	1.3.x.x
	SERCOS III Slave	CC-Link Slave	NTS3SCCS.NXF	1.3.x.x
NT 100-RE-CO	EtherCAT Master	CANopen Slave	NTECMCOS.NXF	1.3.x.x
	EtherCAT Slave	CANopen Master	NTECSCOM.NXF	1.3.x.x
	EtherCAT Slave	CANopen Slave	NTECSCOS.NXF	1.3.x.x
	EtherNet/IP Scanner / Master	CANopen Slave	NTEIMCOS.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	CANopen Master	NTEISCOM.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	CANopen Slave	NTEISCOS.NXF	1.3.x.x
	Open Modbus/TCP	CANopen Master	NTOMBCOM.NXF	1.3.x.x
	Open Modbus/TCP	CANopen Slave	NTOMBCOS.NXF	1.3.x.x
	POWERLINK Slave	CANopen Master	NTPNSCOM.NXF	1.3.x.x
	POWERLINK Slave	CANopen Slave	NTPNSCOS.NXF	1.3.x.x
	PROFINET IO Controller	CANopen Slave	NTPNMCOS.NXF	1.3.x.x
	PROFINET IO Device	CANopen Master	NTPNSCOM.NXF	1.3.x.x
	PROFINET IO Device	CANopen Slave	NTPNSCOS.NXF	1.3.x.x
	SERCOS III Slave	CANopen Master	NTS3SCOM.NXF	1.3.x.x
	SERCOS III Slave	CANopen Slave	NTS3SCOS.NXF	1.3.x.x

Device Name	Ethernet System (X2)	Fieldbus System (X3)	Firmware File	Firmware Version
NT 100-RE-DN	EtherCAT Master	DeviceNet Slave	NTECMDNS.NXF	1.3.x.x
	EtherCAT Slave	DeviceNet Master	NTECSDNM.NXF	1.3.x.x
	EtherCAT Slave	DeviceNet Slave	NTECSDNS.NXF	1.3.x.x
	EtherNet/IP Scanner / Master	DeviceNet Slave	NTEIMDNS.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	DeviceNet Master	NTEISDNM.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	DeviceNet Slave	NTEISDNS.NXF	1.3.x.x
	Open Modbus/TCP	DeviceNet Master	NTOMBDNM.NXF	1.3.x.x
	Open Modbus/TCP	DeviceNet Slave	NTOMBDNS.NXF	1.3.x.x
	POWERLINK Slave	DeviceNet Master	NTPNSDNM.NXF	1.3.x.x
	POWERLINK Slave	DeviceNet Slave	NTPNSDNS.NXF	1.3.x.x
	PROFINET IO Controller	DeviceNet Slave	NTPNMDNS.NXF	1.3.x.x
	PROFINET IO Device	DeviceNet Master	NTPNSDNM.NXF	1.3.x.x
	PROFINET IO Device	DeviceNet Slave	NTPNSDNS.NXF	1.3.x.x
	SERCOS III Slave	DeviceNet Master	NTS3SDNM.NXF	1.3.x.x
	SERCOS III Slave	DeviceNet Slave	NTS3SDNS.NXF	1.3.x.x
NT 100-RE-DP	EtherCAT Master	PROFIBUS-DP Slave	NTECMDPS.NXF	1.3.x.x
	EtherCAT Slave	PROFIBUS-DP Master	NTECSDPM.NXF	1.3.x.x
	EtherCAT Slave	PROFIBUS-DP Slave	NTECSDPS.NXF	1.3.x.x
	EtherNet/IP Scanner / Master	PROFIBUS-DP Slave	NTEIMDPS.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	PROFIBUS-DP Master	NTEISDPM.NXF	1.3.x.x
	EtherNet/IP Adapter / Slave	PROFIBUS-DP Slave	NTEISDPS.NXF	1.3.x.x
	Open Modbus/TCP	PROFIBUS-DP Master	NTOMBDPM.NXF	1.3.x.x
	Open Modbus/TCP	PROFIBUS-DP Slave	NTOMBDPS.NXF	1.3.x.x
	POWERLINK Slave	PROFIBUS-DP Master	NTPNSDPM.NXF	1.3.x.x
	POWERLINK Slave	PROFIBUS-DP Slave	NTPNSDPS.NXF	1.3.x.x
	PROFINET IO Controller	PROFIBUS-DP Slave	NTPNMDPS.NXF	1.3.x.x
	PROFINET IO Device	PROFIBUS-DP Master	NTPNSDPM.NXF	1.3.x.x
	PROFINET IO Device	PROFIBUS-DP Slave	NTPNSDPS.NXF	1.3.x.x
	SERCOS III Slave	PROFIBUS-DP Master	NTS3SDPM.NXF	1.3.x.x
	SERCOS III Slave	PROFIBUS-DP Slave	NTS3SDPS.NXF	1.3.x.x

Table 13: NT 100 for Ethernet to Fieldbus

3.3.2 Protocol Conversion 2 - Ethernet to Serial

The netTAP NT 100 connects to Ethernet on port X2 and connects to serial on port X3.

The following devices of the netTAP 100 series support this scenario:

Device Name	Ethernet System (X2)	Serial protocol on X3	Firmware File	Firmware Version
NT 100-RE-RS	EtherCAT Master	3964R	NTECMNVR.NXF	1.3.x.x
	EtherCAT Master	ASCII	NTECMASC.NXF	1.3.x.x
	EtherCAT Master	Modbus RTU Master/Slave	NTECMMBR.NXF	1.3.x.x
	EtherCAT Master	Seriell mit netSCRIPT	NTECMNSC.NXF	1.3.x.x
	EtherCAT Slave	3964R	NTECSNVR.NXF	1.3.x.x
	EtherCAT Slave	ASCII	NTECSASC.NXF	1.3.x.x
	EtherCAT Slave	Modbus RTU Master/Slave	NTECSMBR.NXF	1.3.x.x
	EtherCAT Slave	Seriell mit netSCRIPT	NTECSNSC.NXF	1.3.x.x
	EtherNet/IP Scanner	3964R	NTEIMNVR.NXF	1.3.x.x
	EtherNet/IP Scanner	ASCII	NTEIMASC.NXF	1.3.x.x
	EtherNet/IP Scanner	Modbus RTU Master/Slave	NTEIMMBR.NXF	1.3.x.x
	EtherNet/IP Scanner	Seriell mit netSCRIPT	NTEIMNSC.NXF	1.3.x.x
	EtherNet/IP Adapter	3964R	NTEISNVR.NXF	1.3.x.x
	EtherNet/IP Adapter	ASCII	NTEISASC.NXF	1.3.x.x
	EtherNet/IP Adapter	Modbus RTU Master/Slave	NTEISMBR.NXF	1.3.x.x
	EtherNet/IP Adapter	Seriell mit netSCRIPT	NTEISNSC.NXF	1.3.x.x
	Open Modbus/TCP	3964R	NTOMBNVR.NXF	1.3.x.x
	Open Modbus/TCP	ASCII	NTOMBASC.NXF	1.3.x.x
	Open Modbus/TCP	Modbus RTU Master/Slave	NTOMBMBR.NXF	1.3.x.x
	Open Modbus/TCP	Seriell mit netSCRIPT	NTOMBNSC.NXF	1.3.x.x
	POWERLINK Slave	3964R	NTPNSNVR.NXF	1.3.x.x
	POWERLINK Slave	ASCII	NTPNSASC.NXF	1.3.x.x
	POWERLINK Slave	Modbus RTU Master/Slave	NTPNSMBR.NXF	1.3.x.x
	POWERLINK Slave	Seriell mit netSCRIPT	NTPNSNSC.NXF	1.3.x.x
	PROFINET IO Controller	3964R	NTPNMNVR.NXF	1.3.x.x
	PROFINET IO Controller	ASCII	NTPNMASC.NXF	1.3.x.x
	PROFINET IO Controller	Modbus RTU Master/Slave	NTPNMMBR.NXF	1.3.x.x
	PROFINET IO Controller	Seriell mit netSCRIPT	NTPNMNSC.NXF	1.3.x.x
	PROFINET IO Device	3964R	NTPNSNVR.NXF	1.3.x.x
	PROFINET IO Device	ASCII	NTPNSASC.NXF	1.3.x.x
	PROFINET IO Device	Modbus RTU Master/Slave	NTPNSMBR.NXF	1.3.x.x
	PROFINET IO Device	Seriell mit netSCRIPT	NTPNSNSC.NXF	1.3.x.x
	SERCOS III Slave	3964R	NTS3SNVR.NXF	1.3.x.x
	SERCOS III Slave	ASCII	NTS3SASC.NXF	1.3.x.x
	SERCOS III Slave	Modbus RTU Master/Slave	NTS3SMBR.NXF	1.3.x.x
	SERCOS III Slave	Seriell mit netSCRIPT	NTS3SNSC.NXF	1.3.x.x

Table 14: NT 100 for Ethernet to Serial

3.3.3 Protocol Conversion 3 - Fieldbus to Fieldbus

The netTAP NT 100 connects to Fieldbus on port X2 and connects to Fieldbus on port X3.

The following devices of the netTAP 100 series support this scenario:

Device Name	Fieldbus System (X2)	Fieldbus System (X3	Firmware File	Firmware Version
NT 100-CO-CC	CANopen Master	CC-Link Slave	NTCOMCCS.NXF	1.3.x.x
	CANopen Slave	CC-Link Slave	NTCOSCCS.NXF	1.3.x.x
NT 100-CO-CO	CANopen Master	CANopen Slave	NTCOMCOS.NXF	1.3.x.x
	CANopen Slave	CANopen Master	NTCOSCOM.NXF	1.3.x.x
	CANopen Slave	CANopen Slave	NTCOSCOS.NXF	1.3.x.x
NT 100-CO-DN	CANopen Master	DeviceNet Slave	NTCOMDNS.NXF	1.3.x.x
	CANopen Slave	DeviceNet Master	NTCOSDNM.NXF	1.3.x.x
	CANopen Slave	DeviceNet Slave	NTCOSDNS.NXF	1.3.x.x
NT 100-CO-DP	CANopen Master	PROFIBUS-DP Slave	NTCOMDPS.NXF	1.3.x.x
	CANopen Slave	PROFIBUS-DP Master	NTCOSDPM.NXF	1.3.x.x
	CANopen Slave	PROFIBUS-DP Slave	NTCOSDPS.NXF	1.3.x.x
NT 100-DP-CC	PROFIBUS-DP Maste	CC-Link Slave	NTDPMCCS.NXF	1.3.x.x
	PROFIBUS-DP Slave	CC-Link Slave	NTDPSCCS.NXF	1.3.x.x
NT 100-DP-CO	PROFIBUS-DP Maste	CANopen Slave	NTDPMCOS.NXF	1.3.x.x
	PROFIBUS-DP Slave	CANopen Master	NTDPSCOM.NXF	1.3.x.x
	PROFIBUS-DP Slave	CANopen Slave	NTDPSCOS.NXF	1.3.x.x
NT 100-DP-DN	PROFIBUS-DP Maste	DeviceNet Slave	NTDPMDNS.NXF	1.3.x.x
	PROFIBUS-DP Slave	DeviceNet Master	NTDPSDNM.NXF	1.3.x.x
	PROFIBUS-DP Slave	DeviceNet Slave	NTDPSDNS.NXF	1.3.x.x
NT 100-DP-DP	PROFIBUS-DP Master	PROFIBUS-DP Slave	NTDPMDPS.NXF	1.3.x.x
	PROFIBUS-DP Slave	PROFIBUS-DP Master	NTDPSDPM.NXF	1.3.x.x
	PROFIBUS-DP Slave	PROFIBUS-DP Slave	NTDPSDPS.NXF	1.3.x.x
NT 100-DN-CC	DeviceNet Master	CC-Link Slave	NTDNMCCS.NXF	1.3.x.x
	DeviceNet Slave	CC-Link Slave	NTDNSCCS.NXF	1.3.x.x
NT 100-DN-CO	DeviceNet Master	CANopen Slave	NTDNMCOS.NXF	1.3.x.x
	DeviceNet Slave	CANopen Master	NTDNSCOM.NXF	1.3.x.x
	DeviceNet Slave	CANopen Slave	NTDNSCOS.NXF	1.3.x.x
NT 100-DN-DN	DeviceNet Master	DeviceNet Slave	NTDNMDNS.NXF	1.3.x.x
	DeviceNet Slave	DeviceNet Master	NTDNSDNM.NXF	1.3.x.x
	DeviceNet Slave	DeviceNet Slave	NTDNSDNS.NXF	1.3.x.x
NT 100-DN-DP	DeviceNet Master	PROFIBUS-DP Slave	NTDNMDPS.NXF	1.3.x.x
	DeviceNet Slave	PROFIBUS-DP Master	NTDNSDPM.NXF	1.3.x.x
	DeviceNet Slave	PROFIBUS-DP Slave	NTDNDPS.NXF	1.3.x.x

Table 15: NT 100 for Fieldbus to Fieldbus

3.3.4 Protocol Conversion 4 - Fieldbus to Serial

The netTAP NT 100 connects to Fieldbus on port X2 and connects to serial on port X3.

The following devices of the netTAP 100 series support this scenario:

Device Name	Fieldbus System (X2)	Serial (X3)	Firmware File	Firmware Version
NT 100-CO-RS	CANopen Master	3964R	NTCOMNVR.NXF	1.3.x.x
	CANopen Master	ASCII	NTCOMASC.NXF	1.3.x.x
	CANopen Master	Modbus RTU Master/Slave	NTCOMMBR.NXF	1.3.x.x
	CANopen Master	Seriell mit netSCRIPT	NTCOMNSC.NXF	1.3.x.x
	CANopen Slave	3964R	NTCOSNVR.NXF	1.3.x.x
	CANopen Slave	ASCII	NTCOSASC.NXF	1.3.x.x
	CANopen Slave	Modbus RTU Master/Slave	NTCOSMBR.NXF	1.3.x.x
	CANopen Slave	Seriell mit netSCRIPT	NTCOSNSC.NXF	1.3.x.x
NT 100-DP-RS	PROFIBUS-DP Master	3964R	NTDPMNVR.NXF	1.3.x.x
	PROFIBUS-DP Master	ASCII	NTDPMASC.NXF	1.3.x.x
	PROFIBUS-DP Master	Modbus RTU Master/Slave	NTDPMMBR.NXF	1.3.x.x
	PROFIBUS-DP Master	Seriell mit netSCRIPT	NTDPMNSC.NXF	1.3.x.x
	PROFIBUS-DP Slave	3964R	NTDPSNVR.NXF	1.3.x.x
	PROFIBUS-DP Slave	ASCII	NTDPSASC.NXF	1.3.x.x
	PROFIBUS-DP Slave	Modbus RTU Master/Slave	NTDPSMBR.NXF	1.3.x.x
	PROFIBUS-DP Slave	Seriell mit netSCRIPT	NTDPSNSC.NXF	1.3.x.x
NT 100-DN-RS	DeviceNet Master	3964R	NTDNMNVR.NXF	1.3.x.x
	DeviceNet Master	ASCII	NTDNMASC.NXF	1.3.x.x
	DeviceNet Master	Modbus RTU Master/Slave	NTDNMMBR.NXF	1.3.x.x
	DeviceNet Master	Seriell mit netSCRIPT	NTDNMNSC.NXF	1.3.x.x
	DeviceNet Slave	3964R	NTDNSNVR.NXF	1.3.x.x
	DeviceNet Slave	ASCII	NTDNSASC.NXF	1.3.x.x
	DeviceNet Slave	Modbus RTU Master/Slave	NTDNSMBR.NXF	1.3.x.x
	DeviceNet Slave	Seriell mit netSCRIPT	NTDNSNSC.NXF	1.3.x.x

Table 16: NT 100 for Fieldbus to Serial

3.4 System Requirements

For correct application of the netTAP NT 100, the gateway device must be mounted on a DIN-rail according to DIN EN 60715.

A suitable power supply is required. The voltage to be applied must be in the allowed range 24 V ± 6 V DC. The power supply must be able to deliver at least a current of 100 mA at 24 V.

Power supply is possible via pins 1 (GND) and 2 (24V) of the netTAP NT 100 power supply connector located on the upper side of the device.

CAUTION!

Device Destruction!

- The voltage must not exceed 30 V significantly, otherwise the device may be destroyed or damaged.

NOTICE

Device Destruction!

- The voltage must not exceed 30 V significantly, otherwise the device may be destroyed or damaged.

In order to avoid damage caused by overheating or freezing, it is necessary that the temperature of the device does not exceed the limits of the allowed temperature range.

The following preconditions must additionally be met in order to operate the Gateway device successfully:

1. The Gateway device must have been provided with the correctly suiting firmware.
2. The Gateway device must have been configured correctly using the SYCON.net system configurator.

3.5 Configuration Requirements

The configuration software SYCON.net must be installed on a PC. The requirements for the PC are:

PC with 1 GHz processor or higher

Windows® 2000 and Windows® XP

Internet Explorer 5.5 or higher

Free disk space: min. 400 MByte

DVD ROM drive

RAM: min. 512 MByte, recommended 1024 MByte

Graphic resolution: min. 1024 x 768 pixel

Keyboard and Mouse

USB

Note: If the project file is saved and opened again or it is used on another PC, the system requirements need to match. Particularly the DTMs need to be installed on the used PC.

4 Device Drawings and Connections

4.1 Dimensioned Drawing

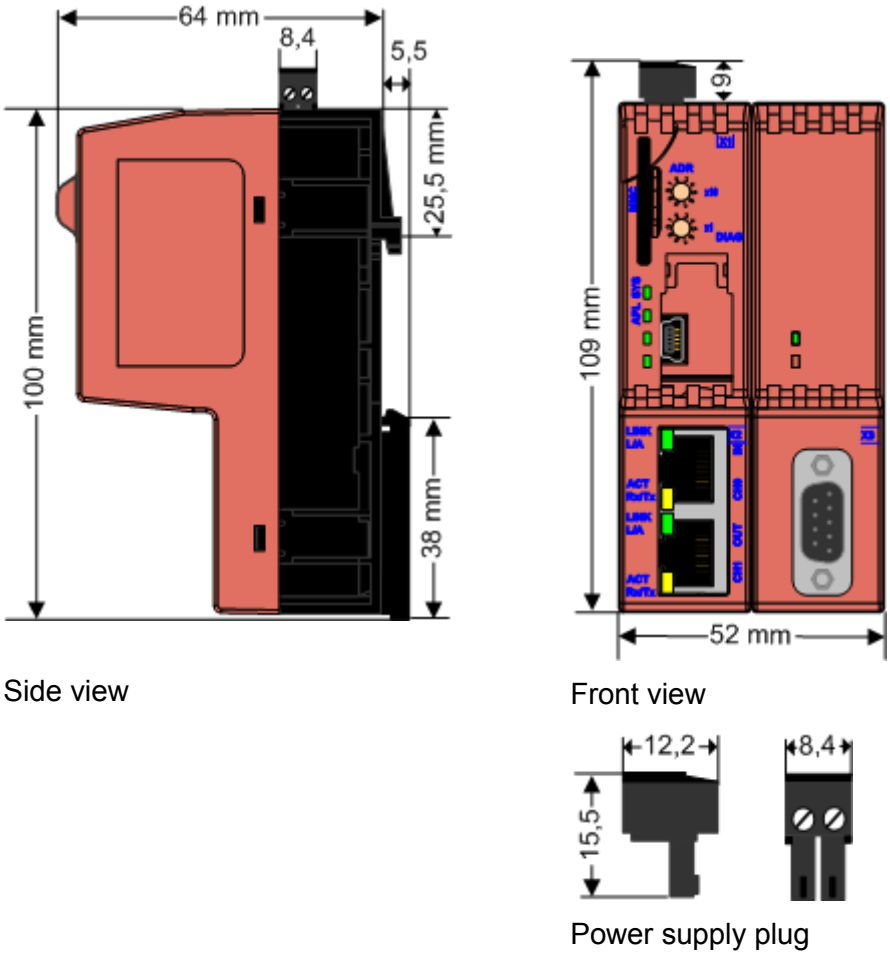


Figure 3: Dimensioned Drawing

Please take care of the device's headroom. There is enough space necessary to allow the connection of the connectors and wires since they are all tending upwards.

The power supply plug is included in delivery. As spare part: the plug can be obtained from RIA CONNECT GmbH in 78176 Blumberg with part number 31369102-001792.

4.2 LEDs and Control Elements

4.2.1 LEDs and Control Elements of the upper half of the Device

LEDs and control elements of the upper half of the device are independent of the device type and the bus connections of the lower half of the device.

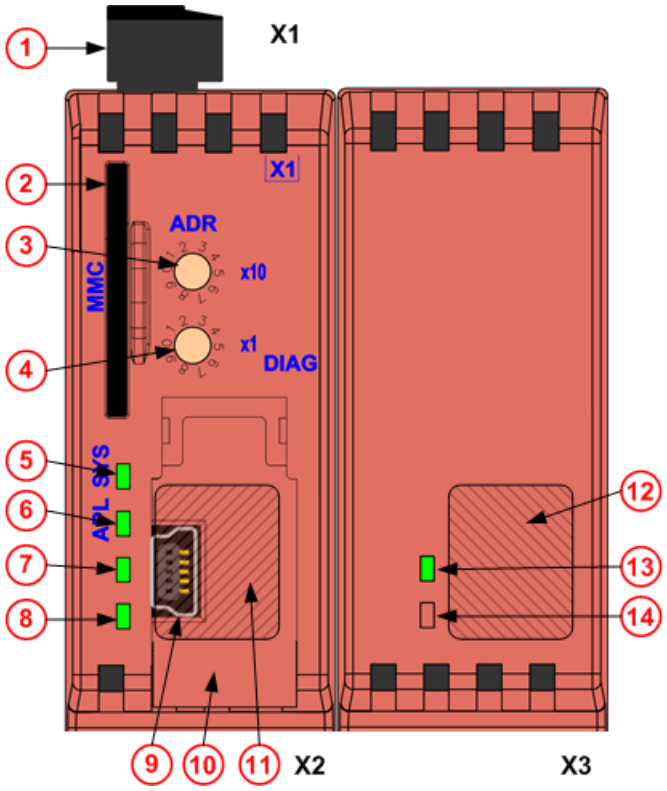


Figure 4: LEDs and Control Elements of the upper half of the Device

1. Connector X1 for power supply
2. Slot for MMC card (part number 1719.001)
3. Rotary address switch, factor 10
4. Rotary address switch, factor 1
5. SYS LED
6. APL LED
7. LED, depends on protocol at X2
8. LED, depends on protocol at X2
9. Mini-USB diagnostic interface below the cover
10. Cover for diagnostic interface
11. Position for protocol depending label for the protocol at X2 on the cover
12. Position for protocol depending label for the protocol at X3
13. LED, depends on protocol at X3
14. LED, depends on protocol at X3

4.2.2 LEDs of the lower half of the Device

The lower part of the device has no control elements. Only the device type NT 100-RE-XX (Real-time Ethernet) has LEDs on the left (X2). The meaning depends on the used protocol.

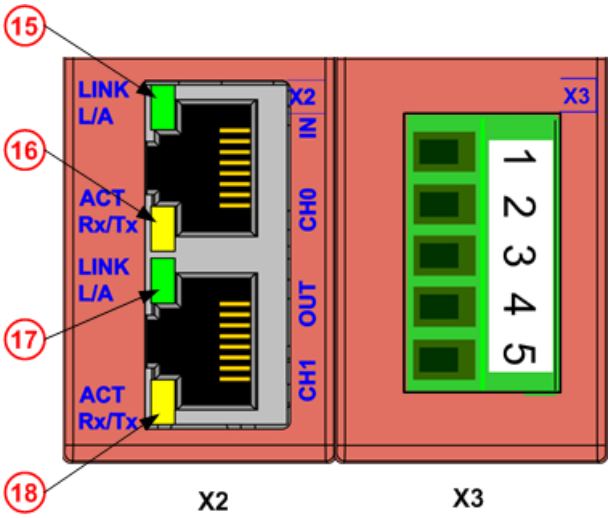


Figure 5: LEDs of the lower half of the Device

15 LED, green, LINK at channel 0 at X2

16 LED, yellow, ACT (activity) at channel 0 at X2

17 LED, green, LINK at channel 1 at X2.

18 LED, yellow, ACT (activity) at channel 1 at X2

4.3 Device Drawings of the left Part (with Connector X2)

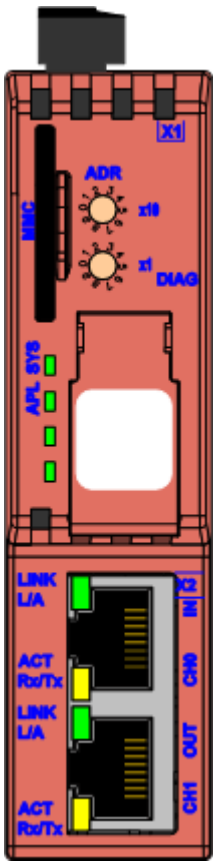
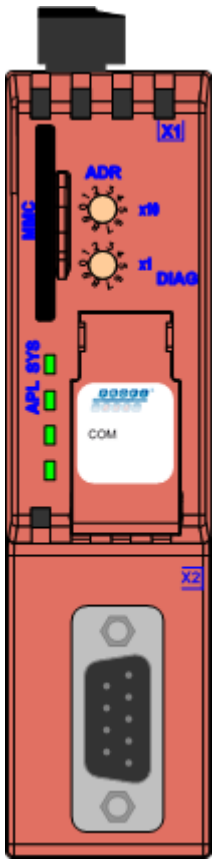
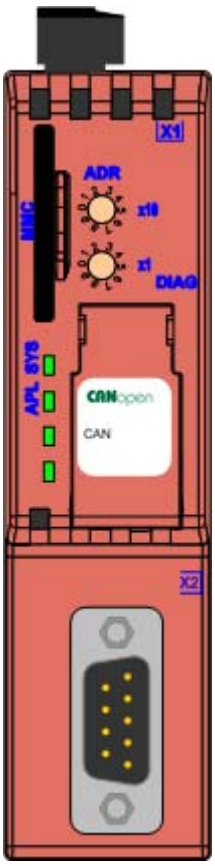
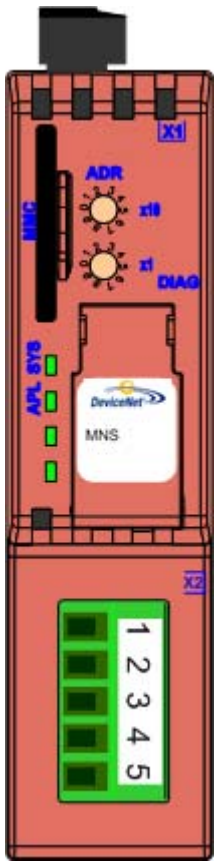
NT 100-RE-XX	NT 100-DP-XX	NT 100-CO-XX	NT 100-DN-XX
			
X2 2*RJ45 socket	X2 Dsub female 9-pin	X2 Dsub male 9-pin	X2 COMBICON 5-pin
These parts are parts of the following device types:			
NT100-RE-DP NT100-RE-CO NT100-RE-DN NT100-RE-RS NT100-RE-CC	NT100-DP-DP NT100-DP-CO NT100-DP-DN NT100-DP-RS NT100-DP-CC	NT100-CO-DP NT100-CO-CO NT100-CO-DN NT100-CO-RS NT100-CO-CC	NT100-DN-DP NT100-DN-CO NT100-DN-DN NT100-DN-RS NT100-DN-CC

Figure 6: Device Drawings – Left Part (X2)

LED label for Real-time Ethernet (NT 100-RE-XX):

PROFINET IO	EtherCAT	EtherNet/IP	SERCOS III	Open Modbus/TCP	POWERLINK
SF BF	RUN ERR	MS NS	STA ERR	RUN ERR	BS BE

The labels are part of delivery. Please stick the corresponding label on your device.

4.4 Device Drawings of the left Part (with Connector X3)

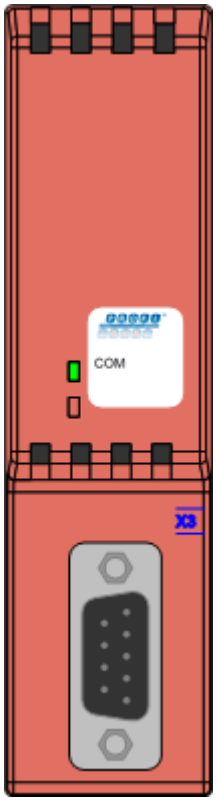
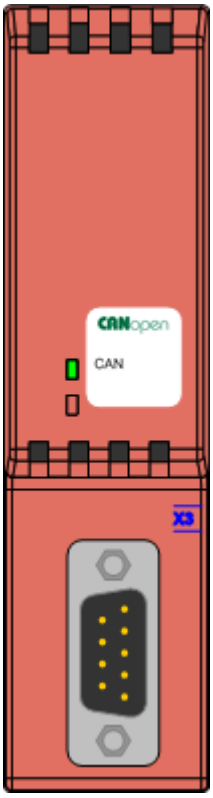
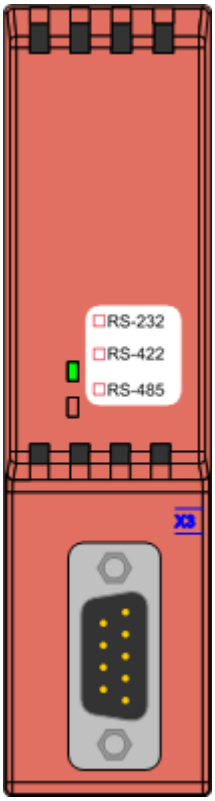
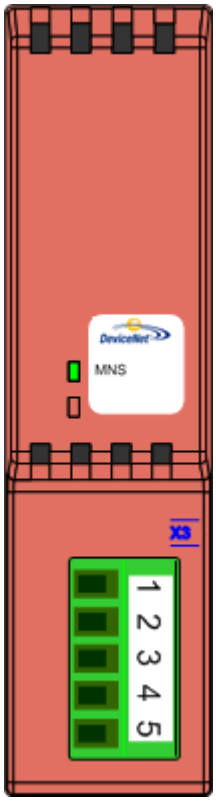
NT 100-XX-DP	NT 100-XX-CO	NT 100-XX-RS	NT 100-XX-DN	NT 100-XX-CC
				
X3 Dsub female 9-pin	X3 Dsub male 9-pin	X3 Dsub male 9-pin	X3 COMBICON 5-pin	X3 COMBICON 5-pin
These parts are parts of the following device types:				
NT100-RE-DP NT100-DP-DP NT100-CO-DP NT100-DN-DP	NT100-RE-CO NT100-DP-CO NT100-CO-CO NT100-DN-CO	NT100-RE-RS NT100-DP-RS NT100-CO-RS NT100-DN-RS	NT100-RE-DN NT100-DP-DN NT100-CO-DN NT100-DN-DN	NT100-RE-CC NT100-DP-CC NT100-CO-CC NT100-DN-CC

Figure 7: Device Drawings – Left Part (X3)

4.5 Connections

4.5.1 X1 Power Supply

The power supply of the netTAP 100 gateway has to be connected to the power connector X1. The power supply voltage must be in the range between 18 V and 30 V DC. The plug is included in delivery.

Power supply line pin assignment

Power supply line	Pin	Signal	Description
 Mini Combicon	1	0 V / GND	Ground of power supply
	2	24 V	+24 V power supply

Table 17: Power supply line pin assignment

4.5.2 X2/X3 Front Connection

Depending on the device type, the netTAP has on of the following front connections

- X2/X3 PROFIBUS Interface
- X2/X3 CANopen Interface
- X2/X3 DeviceNet Interface
- X2 Ethernet Interface
- X3 CC-Link Interface
- X3 Serial Interface – RS-232 / RS-422 / RS-485

4.5.2.1 X2/X3 PROFIBUS Interface

The PROFIBUS interface X2/X3 is a RS-485 interface according to PROFIBUS standard EN 50170. The interface is for NT 100-XX-DP devices on the left (X2) and for NT 100-DP-XX on the right (X3) half of the housing.

RS-485 Profibus pin assignment

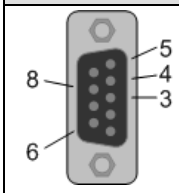
PROFIBUS	Pin	Signal	Description
 9-pole sub-D socket, female	3	Rx/Tx +	Receive- / Transmit data positive
	4	CNTR-P	Control signal for repeater (direction control)
	5	ISO GND	Data ground
	6	VP	Power supply positive
	8	Rx/Tx -	Receive- / Transmit data negative

Table 18: PROFIBUS RS-485 pin assignment

A pull up resistor of 100 kΩ is connected device internally at “Rx / Tx +“.

A pull down resistor of 100 kΩ is connected device internally at “Rx / Tx -“.

Please note the wiring instructions in section *PROFIBUS* on page 96.

4.5.2.2 X2/X3 CANopen Interface

The CANopen interface X2/X3 is according to ISO 11898 according to the CANopen CiA DS 102 standard.

CANopen pin assignment

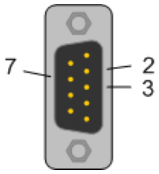
CANopen	Pin	Signal	Description
 9-pole sub-D male.	2	CAN L	CANbus L bus line
	3	ISO GND	CAN ground
	7	CAN H	CAN bus H bus line

Table 19: CANopen pin assignment

Please note the wiring instructions in section *CANopen* on page 98.

4.5.2.3 X2/X3 DeviceNet Interface

The pin assignment of the DeviceNet interface X2/X3 is according to the DeviceNet standard.

DeviceNet pin assignment

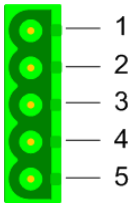
DeviceNet	Pin	Signal	Description
 COMBICON Socket,female	1	ISO GND	Common ground DeviceNet-power supply.
	2	CAN L	CAN Low signal
	3	Drain	Shield
	4	CAN H	CAN High signal
	5	V+	+24 V DeviceNet-power supply

Table 20: DeviceNet pin assignment

Please note the wiring instructions in section *DeviceNet* on page 99.

4.5.2.4 X2 Ethernet Interface

Important! When using Ethernet TCP/UDP/IP, EtherNet/IP or Modbus TCP at 10 MBit/s use only switches or 10/100 MBit/s dual-speed hubs and ensure that the network operates at 100 MBit/s and in full-duplex mode.

Refer to section *Failure in 10 MBit/s Half Duplex Mode and Workaround* on page 48.

For Ethernet interface RJ45 sockets are used and twisted pair cables of category 5 (CAT5) or higher, which are 4 pairs of twisted pairs. The maximum baudrate is 100 MBit/s (CAT5).

Note: The device supports the Auto Crossover function. Due to this fact RX and TX can be switched. The following figure shows the RJ45 standard pinning.

Ethernet on RJ45 pin assignment

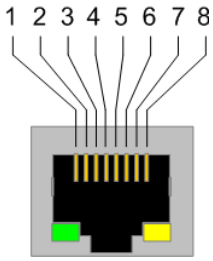
Ethernet	Pin	Signal	Description
 RJ45 socket, female	1	TX+	Transmit data positive
	2	TX–	Transmit data negative
	3	RX+	Receive data positive
	4	Term 1	Connected and terminated to PE via RC combination*
	5	Term 1	
	6	RX–	Receive data negative
	7	Term 2	Connected and terminated to PE via RC combination*
	8	Term 2	
			* Bob Smith Termination

Table 21: Ethernet RJ45 pin assignment

4.5.2.5 X3 CC-Link Interface

CC-Link pin assignment

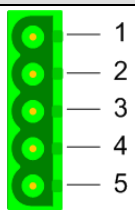
CC-Link	Pin	Signal	Description
 Socket,female	1	DA	Data positive
	2	DB	Data negative
	3	DG	Data ground
	4	SLD	Shield, internally connected to common ground
	5	FG	Field ground, internally connected to common ground

Table 22: CC-Link pin assignment

Please note the wiring instructions in section *CC-Link* on page 101.

4.5.2.6 X3 Serial Interface – RS-232 / RS-422 / RS-485

The serial interface at X3 can be used with RS-232, RS-422 or RS-485.. This must be set by the software configuration.

RS-232 pin assignment

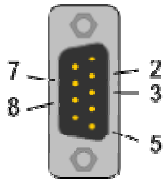
RS-232	Pin	Signal	Description
 9-pole sub-D socket, male	2	RxD	Receive data
	3	TxD	Transmit data
	5	GND	Reference potential
	7	RTS	Request to send
	8	CTS	Clear to send
	Shield	PE	Metal shell on PE

Table 23: RS-232 pin assignment

RS-422 pin assignment

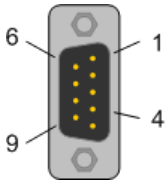
RS-422	Pin	Signal	Description
 9-pole sub-D socket, male	1	RxD-	Receive data negative
	4	TxD+	Transmit data positive
	6	RxD+	Receive data positive
	9	TxD-	Transmit data negative
	Shield	PE	Metal shell on PE

Table 24: RS-422 pin assignment

RS-485 pin assignment

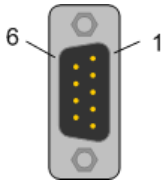
RS-485	Pin	Signal	Description
 9-pole sub-D socket, male	1	RxD / TxD -	Receive data / Transmit data negative
	6	RxD / TxD +	Receive data / Transmit data positive
	Shield	PE	Metal shell on PE

Table 25: RS-485 pin assignment

4.5.2.7 Termination for RS-422 and RS-485

On the back of the NT 100-XX-RS devices is a sliding switch (S3) for activation or deactivation of the termination.

Switch S3		Meaning
 Switch in position **On** (up).	Switch up **On**	Termination switched on with 220 Ohm termination resistor for RS-422 between RxD + and RxD - respectively for RS-485 between RxD/TxD + and RxD/TxD - and 390 Ohm pull up/pull down resistor
	Switch down **Off**	Termination switched off

Table 26: Sliding Switch for Termination of RS-422 respectively RS-485 on NT 100-XX-RS Devices

The following figure shows the termination in the device for RS-485:

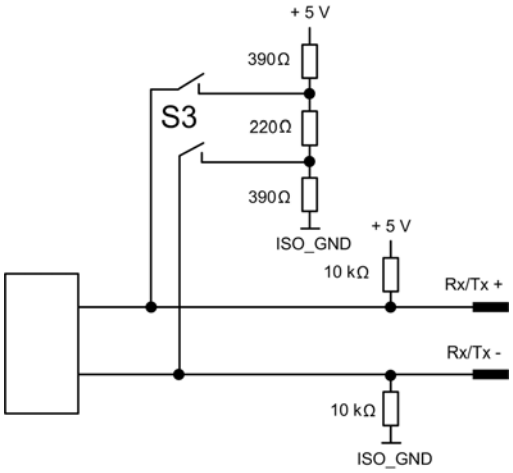


Figure 8: RS-485 Termination

For RS-422 the termination shown above is only at the RxD signals.

4.5.3 Diagnostic Interface (Mini-B USB)

The USB interface is for configuration and diagnostic purposes.

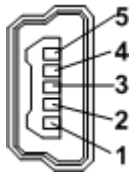
USB Socket	Pin	Signal	Description
	1	USB_EXT	Power supply USB Bus (+5 V, from externally)
	2	D-	Data -
	3	D+	Data +
	4	ID	
	5	GND	Ground

Table 27: Pin Assignment Mini-B USB Connector (5-pin)

4.6 Schematic Diagram - Galvanic Isolation

The following schematic diagram illustrates the internal connection between the different connectors. This gives you the chance to properly install the device in accordance with the potential equalization concept of your plant.

Note: The PE connection (potential equalization) of the device is done via the DIN rail.

4.6.1 Isolation in case of NT 100-RE-XX Devices

Coupling for the device types:

NT 100-RE-CC, NT 100-RE-CO, NT 100-RE-DP, NT 100-RE-DN, NT 100-RE-RS

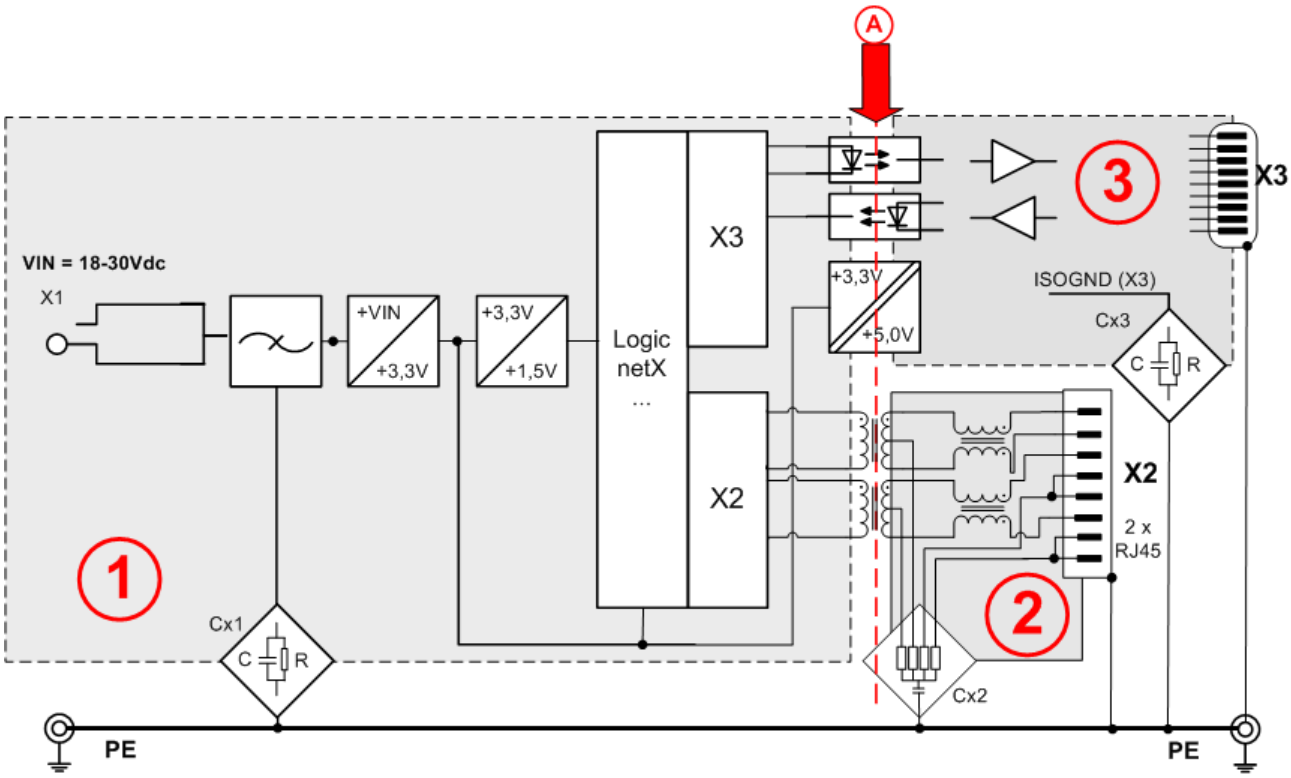


Figure 9: Galvanic Isolation NT 100-RE-XX Devices

The device has three galvanically isolated areas. The isolation to the bus connection is indicated by an arrow (A).

(1) System area, galvanically coupled with the power supply connection X1

(2) Ethernet connecting area, 2 * RJ45. The figure above shows only one RJ45 socket. The second RJ45 socket is built up identically and connected to the logic at netX X2.

(3) Fieldbus connecting area with DSub male / female or Combicon-connector.

The following table shows the characteristics of the galvanic isolation of the different areas and coupling against potential equalization.

Area Connection	Protocol	galv. Isolation	Coupling	Coupling against PE potential	Functional earthing to-PE
① X1	-	no	Cx1 ①	4 * 10 nF 500V	
			HF ①	Cf = 10 nF, Lf = 47 µH	
② X2	Ethernet	inductive	Cx2 ②	4 * 75 Ω, 1 nF 2000 V	Directly via the metal connection of RJ 45 sockets
③ X3	CC-Link	inductive	Cx3 ③	3,3 nF 63 V	directly
	CANopen	optically	Cx3 ③	1 MΩ // 15 nF 1000V	directly
	Profibus DP	inductive	Cx3 ③	1 MΩ // 2,2 nF 1000 V	directly
	DeviceNet	optically	Cx3 ③	1 MΩ // 15 nF 1000V	1 MΩ // 15 nF 1000V
	RS-232/422/485	optically	Cx3 ③	1 MΩ // 15 nF 1000V // 10 nF 500 V	directly

Table 28: Coupling RE Devices

4.6.2 Isolation in case of NT 100-DP-XX /CO-XX /DN-XX Devices

Coupling for the device types:

NT 100-DP-CC NT 100-DP-CO NT 100-DP-DN NT 100-DP-DP NT 100-DP-RS

NT 100-CO-CC NT 100-CO-CO NT 100-CO-DP NT 100-CO-DN NT 100-CO-RS

NT 100-DN-CC, NT 100-DN-CO NT 100-DN-DP NT 100-DN-DN NT 100-DN-RS

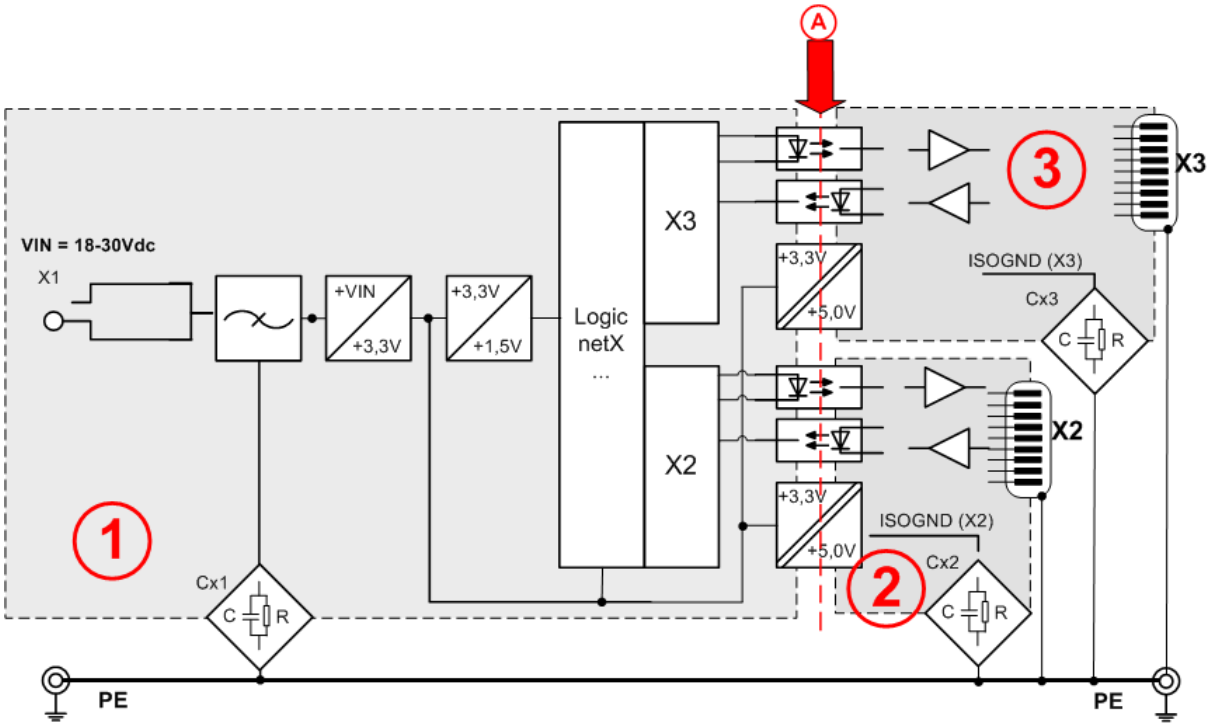


Figure 10: Galvanic Isolation NT 100-DP-XX/CO-XX/DN-XX Devices

The device has three galvanically isolated areas. The isolation to the bus connection is indicated by an arrow Ⓐ.

① System area, galvanically coupled with the power supply connection X1

② X3 fieldbus connecting area with DSub male / female or Combicon-connector.

③ X3 fieldbus connecting area with DSub male / female or Combicon-connector.

The following table shows the characteristics of the galvanic isolation of the different areas and coupling against potential equalization.

Area Connection	Protocol	galv. Isolation	Coupling	Coupling against PE potential	Functional earthing to-PE
① **X1**	-	no	Cx1 ①	4 * 10nF 500V	
			HF ①	Cf = 10 nF, Lf = 47 µH	
② **X2**	Profibus DP	inductive	Cx2 ②	1 MΩ // 2,2 nF 1000 V	directly
	CANopen	optically	Cx2 ②	1 MΩ // 15 nF 1000V	directly
	Profibus DP	inductive	Cx2 ②	1 MΩ // 2,2 nF 1000 V	directly
	DeviceNet	optically	Cx2 ②	1 MΩ // 15 nF 1000V	1 MΩ // 15 nF 1000V
③ **X3**	CC-Link	inductive	Cx3 ③	3,3 nF 63 V	directly
	CANopen	optically	Cx3 ③	1 MΩ // 15 nF 1000V	directly
	Profibus DP	inductive	Cx3 ③	1 MΩ // 2,2 nF 1000 V	directly
	DeviceNet	optically	Cx3 ③	1 MΩ // 15 nF 1000V	1 MΩ // 15 nF 1000V
	RS-232/422/485	optically	Cx3 ③	1 MΩ // 15 nF 1000V // 10 nF 500 V	directly

Table 1: Coupling NT 100-DP-XX/CO-XX/DN-XX Devices

5 NT 100 Mounting and Dismounting

5.1 Mounting Instructions

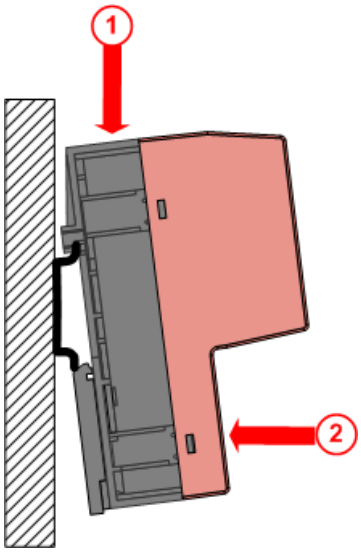
The devices can be mounted side-by-side without any gap. On the top side, the devices should have a minimum distance of 20 mm to the next device.

The air ventilation slots of the device must not be covered by any objects.

	**Note:** Please pay attention to the grounding concept and shielding concept of the plant. The concept shout prevent that a compensating current flows via signal and power supply lines between the used devices. Otherwise a device destruction is possible.

5.2 DIN Top Hat Rail Mounting of the NT 100

Mount the top hat rail according to DIN EN 60715 for the netTAP device horizontally at the intended location. The DIN top hat rail has to be connected with the potential equalization conductor (PE).



Push the device (as illustrated at the left) onto the top hat rail from above (1).

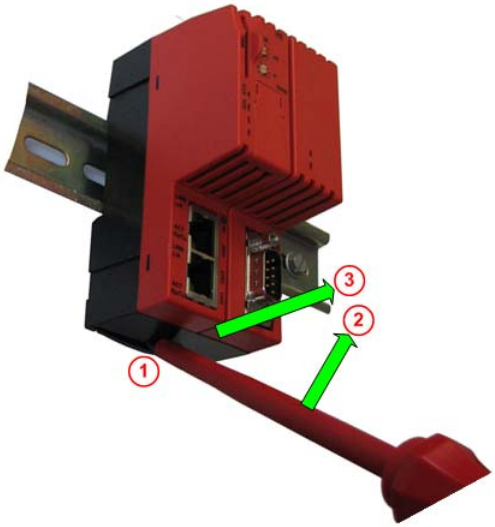
Then press the device against the mounting surface, according to arrow (2).

Figure 11: Mounting the netTAP NT 100 device onto the DIN top hat rail

Afterwards connect the 24 V supply voltage to the device. Grounding is done via a grounding contact located at the backside of the device connecting it electrically to the DIN top hat rail.

5.3 Removing the NT 100 from the DIN Top Hat Rail

In order to remove the netTAP from the DIN Top Hat Rail, first remove the power supply cable and all data cables from the device.



To release the device from the DIN Top Hat Rail, use a screw driver, which you put at the clip ① in the center of the device. By pressing the screw driver in direction of arrow ② the lock at the DIN top hat rail is released. You can then easily pull the device off the DIN top hat rail in direction of arrow ③.

Figure 12: Removing the NT 100 device from the DIN Top Hat Rail

6 Commissioning / Decommissioning

6.1 Load Firmware and Configuration

The device delivered without loaded firmware and configuration.

It is necessary that a firmware and configuration is loaded into the device for commissioning.

6.1.1 Download Configuration Files from the PC

1. The configuration can be created and saved offline with or without real device on a standard PC with the software SYCON.net. The configuration can be downloaded into the device in two steps afterwards
2. The selected firmware and configuration has to be transferred in two steps via a USB connection into the device.

   The configuration is stored in the device in a non-volatile flash memory. Once set the data will be available after each power cycle.

   These steps are described in the operating instruction manual netGateway.

So it is possible to transfer the configuration into the device before or after mounting the device at its place of use.

6.1.2 Transfer Configuration Files from MMC card

1. The configuration can be created and saved offline with or without real device on a standard PC with the software SYCON.net. The configuration can be saved on the PC.
2. The configuration files have to be transferred via a USB connection into the device.
3. Transfer with the software SYCON.net the firmware and configuration files from the non-volatile flash memory of the netTAP onto a MMC card. These steps are described in the operating instruction manual netGateway.
4. Remove the MMC card from the netTAP100 device.
5. Insert the MMC card with the stored firmware and the configuration files into the MMC slot of the device. The device continues its operation with the firmware and configuration, which is stored in the device in the non-volatile flash memory.
6. Remove power supply from the netTAP NT 100 device
7. After return of power the files from the MMC card are copied into the non-volatile flash memory of the device (this operation takes a moment) and then the device starts with it.
8. Remove the MMC card from the device to have a faster start of the device for the next return of power. Because of that the copy operation at the next return of power is not done.

It is possible to load the same configuration from one MMC card into several devices without using a PC.

A MMC card can be obtained/ordered from Hilscher. The part number is 1719.001.

6.2 Start-up Behavior

The start-up behavior of the device depends on the fact, whether at the time of return of power supply an MMC card is inserted in the device or not.

6.2.1 Start-up without MMC Card

After return of power supply the configuration data are loaded from the flash memory circuit into the RAM of the netX100 processor which is subsequently started. Depending on the amount of stored configuration data this can last for some seconds (approx. 4 s).

6.2.2 Start-up with MMC Card

Important: Two parameter are displayed in SYCON.net software for the start behavior in case of repowering the device and MMC card present in the slot of the device. Only the **Start-up Options** parameter **Restore automatically** with setting “Every start” has to be used!

The **Start-up Options** parameter **Restore automatically** with the setting “**If different**“ is not supported by the netTAP firmware and results in the situation that no files from the MMC card are transferred into the device. However it is possible to copy the files from MMC card to the device with SYCON.net software (manually).

The following description refers to the parameter start behavior “Every Start“ of the MMC card.

1. Remove power supply from the netTAP NT 100 device
2. Insert MMC card with until it snaps in
3. Supply 24 V operation voltage to the device

➪ The SYS LED indicates a quick alternating between green and yellow for approx. 8 s. During this time the MMC card can be removed from the device to prevent the data transfer.

Afterwards the files were transferred from the MMC card into the non-volatile flash memory of the device. This operation takes (typically) up to 1 minute. With large configuration files (especially netSCRIPT files) this time can be exceeded. During this operation the SYS LED is yellow

➪ After the copy operation the device starts with the new configuration

It is possible to load the same configuration from one MMC card into several devices without using a PC.

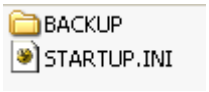
6.2.3 Reset Device to Factory Settings

Using an MMC card and the basic firmware stored there, the netTAP NT 100 device can be set back to factory settings.

In order to do so, copy from the directory of the DVD

```
Firmware\NT 100 Factory Settings\MMC Images
```

the file `STARTUP.INI` and the directory `BACKUP` (including all subdirectories) into the root directory of an empty MMC card.



Proceed as follows:

1. Remove power supply from the netTAP NT 100 device
2. Insert MMC card with basic firmware until it snaps in.
3. Supply 24 V operation voltage to the device

- The device loads the firmware while the SYS-LED indicates the following states: Quick alternating between green and yellow (for approx. 8 s), then solid yellow (for approx. 10 s), then switched off for a short time and finally solid green.
- Afterwards the device is reset to factory settings.

Subsequently the device needs to be configured by the software SYCON.net by a PC. The configuration steps are described in document netGateway.

6.3 Put the Device out of Operation

Note: In order to avoid personal and material damage do not remove this device from a production line without having ensured a secure operation of the production line during and after the removal of the device.

Disconnect the communication cables from the device.

Disconnect the plug for power supply.

Remove the device as described in section „Removing the NT 100 from the DIN Top Hat Rail“ on page 43 from the DIN rail.

7 Troubleshooting

Two methods for troubleshooting exist:

The visual analysis of the LED conditions of the device

The analysis via the USB port along with the configuration tool SYCON.net.

The following overview describes the error conditions that may be detected by a visual check of the LEDs.

LED state	Remedy
No LED is on	The device is not powered or the device has a malfunction and needs replacement
LED ⑤ flashes yellow/green at 1 Hz	After a power cycle the device has not found a valid firmware and remains in bootloader mode. The device has to be recovered and set back to factory setting. Follow the chapter Reset Device to Factory Settings on page 46.
LED ⑤ on yellow	The device has a malfunction and needs replacement.
LED ⑤ on green, LED ⑥ on red flashing or red on.	The device is well initialized. Further analysis is possible with the LED ⑥ APL. Follow the chapter „The APL LED“ on page 50.
LED ⑥ flashing green	The communication via port X2 or/and port X3 is not in data exchange mode. See chapter „The APL LED“ on page 50.

Table 29: NT 100 Troubleshooting

The device is operational just in case the illustrated error conditions do not met. Further protocol specific error diagnostics via the LEDs is possible by reading on the chapter “LED”.

In deep diagnostics is possible at any time via the USB diagnostic port of the device and a PC with the software SYCON.net.

In case of trouble you should make sure that you have downloaded a correct signal mapping to the device via SYCON.net

For some protocols it is necessary to synchronize data via a handshake between the gateway and the superordinated PLC. Please make sure that the handshake mechanism is kept.

7.1 Failure in 10 MBit/s Half Duplex Mode and Workaround

Affected Hardware

Hardware with the communications controller netX 50, netX 100 or netX 500; netX/Internal PHYs.

When can this Failure occur?

When using standard Ethernet communication with 10 MBit/s half duplex mode, the PHY gets stuck in case of network collisions. Then no further network communication is possible. Only device power cycling allows Ethernet communication again.

This problem can only occur with Ethernet TCP/UDP IP, EtherNet/IP or Modbus TCP protocols when using hubs at 10 MBit/s. The issue described above is not applicable for protocols which use 100 MBit/s or full duplex mode.

Solution / Workaround:

Do not use 10 MBit/s-only hubs. Use either switches or 10/100 MBit/s Dual Speed hubs, to make sure the netX Ethernet ports are connected with 100 MBit/s or in full duplex mode.

This erratum is fixed with all components of the ‘Y’ charge (9 digit charge number shows ‘Y’ at position 5 (nnnnYnnnn).

Reference

“Summary of 10BT problemon EthernetPHY”,
RenesasElectronics Europe, April 27, 2010

8 LED

The position of the LEDs is shown in the device drawings in section *LEDs and Control Elements* from page 29. The number in the column LED is the position number in the device drawing.

8.1 The SYS LED

This LED indicates important operating states (without configuration of the device).

LED	Color	State	Meaning
SYS Number in the device drawing ⑤	**Duo LED yellow/green**		
	(green)	On	Operating System running. further diagnostic see APL LED.
	(yellow)	static	Firmware and configuration files are loaded. The duration of this state depends from the size of the firmware and configuration files. This can take one minute and longer. Remains the LED with yellow permanently, then a hardware failure is possible.
	(yellow / green)	Flashing yellow/green 1 Hz	**Error state!** Boot loader active. No STARTUP.INI files was found. No communication via USB with SYCON.net is possible. A MMC card with the files for factory setting on it is necessary to make the device operational. Ho to create an appropriate MMC card see section *"Reset Device to Factory Settings"* on page 46.
	(yellow / green)	Flashing yellow/green 16 Hz	Waiting period (appr. 8 sec, adjustable) before copying the firmware and configuration files from the MMC card into the Flash memory.
	(off)	Off	Power supply for the device is missing or hardware failure.

Table 30: System LED

8.2 The APL LED

This LED indicates the communication state for X2 and X3 as well as the configuration state.

LED	Color	State	Meaning
APL number in the device drawing ⑥	**Duo LED green/read**		
	 (green)	On	The communication on X2 and X3 is in cyclic data exchange and the gateway function is executed
	 (green)	Blinking with 2 s off, 0,5 s on	netTAP is initialized, but the communication on X2 is not in cyclic data exchange.
	 (green)	Blinking with 2 s off, 0,5 s on, 0,5 s off, 0,5 s on,	netTAP is initialized, but the communication on X3 is not in cyclic data exchange.
	 (red)	Blinking with 2 s off, 0,5 s on	netTAP is initialized, but the configuration for the communication protocol on X2 is missing or has an error
	 (red)	Blinking with 2 s off, 0,5 s on, 0,5 s off, 0,5 s on,	netTAP is initialized, but the configuration for the communication protocol on X3 is missing or has an error
	 (red)	On	netTAP has detected an error during the initialization: Missing configuration, error in configuration or internal error

Table 2: LED APL

8.3 LED Real Time Ethernet Systems

8.3.1 LED EtherCAT Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherCAT Slave protocol is loaded to the device.

LED	Color	State	Meaning
RUN Number in the device drawing: ⑦	**Duo LED red/green**		
	-	Off	**INIT:** The device is in state INIT
	(green)	Blinking	**PRE-OPERATIONAL:** The device is in state PRE-OPERATIONAL
	(green)	Single Flash	**SAFE-OPERATIONAL:** The device is in state SAFE-OPERATIONAL
	(green)	On	**OPERATIONAL:** The device is in state OPERATIONAL
ERR Number in the device drawing: ⑧	**Duo LED red/green**		
	-	Off	**No error:** The EtherCAT communication of the device is in working condition
	(red)	Blinking	**Invalid Configuration:** General Configuration Error (Example: State change commanded by master is impossible due to register or object settings.)
	(red)	Single Flash	**Unsolicited State Change:** Slave device application has changed the EtherCAT state autonomously: Parameter "Change" in the AL status register is set to 0x01:change/error (Example: Synchronization Error, device enters Safe-Operational automatically.)
	(red)	Double Flash	**Application Watchdog Timeout:** An application watchdog timeout has occurred. (Example: Sync Manager Watchdog timeout)
	(red)	On	**PDI Watchdog Timeout:** A PDI Watchdog timeout has occurred (Example: Application controller is not responding any more)
	-	Off	**Not powered, no IP address:** If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
L/A IN/ RJ45 Ch0 ⑮ **L/A OUT/** RJ45 Ch1 ⑰	**LED green**		
	(green)	On	A link is established
	(green)	Flashing	The device sends/receives Ethernet frames
	-	Off	No link established
RJ45 Ch0 ⑯ RJ45 Ch1 ⑰	**LED yellow**		
	(yellow)	-	-

Table 31: LEDs EtherCAT Slave

LED State Definition for EtherCAT Slave for the LEDs RUN ⑦ and ERR LED ⑧

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 32: LED State Definition for EtherCAT Slave for the RUN and ERR LEDs

8.3.2 LED EtherNet/IP Scanner (Master)

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherNet/IP Scanner (Master) protocol is loaded to the device.

LED	Color	State	Meaning
MS Number in the device drawing: ⑦	**Duo LED red/green**		
	(green)	On	**Device operational:** If the device is operating correctly, the module status indicator shall be steady green.
	(green)	Flashing	**Standby:** If the device has not been configured, the module status indicator shall be flashing green.
	(red)	On	**Major fault:** If the device has detected a non-recoverable major fault, the module status indicator shall be steady red.
	(red)	Flashing	**Minor fault*:** If the device has detected a recoverable minor fault, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor fault. (*for future use)
	(red/green)	Flashing	**Self-test:** While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	-	Off	**No power:** If no power is supplied to the device, the module status indicator shall be steady off.
NS Number in the device drawing: ⑧	**Duo LED red/green**		
	(green)	On	**Connected:** If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	(green)	Flashing	**No connections:** If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	(red)	On	**Duplicate IP*:** If the device has detected that its IP address is already in use, the network status indicator shall be steady red. (*For future use)
	(red)	Flashing	**Connection timeout:** If one or more of the connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	(red/green)	Flashing	**Self-test:** While the device is performing its power up testing, the network status indicator shall be flashing green/red.
	-	Off	**Not powered, no IP address:** If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
LINK/RJ45 Ch0 & Ch1 ⑮ & ⑰	**LED green**		
	(green)	On	A connection to the Ethernet exists
	-	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1 ⑯ & ⑱	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 33: LEDs EtherNet/IP Scanner (Master)

8.3.3 LED EtherNet/IP Adapter (Slave)

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherNet/IP Adapter (Slave) protocol is loaded to the device.

LED	Color	State	Meaning
MS Number in the device drawing: 7	**Duo LED red/green**		
	(green)	On	**Device operational:** If the device is operating correctly, the module status indicator shall be steady green.
	(green)	Flashing	**Standby:** If the device has not been configured, the module status indicator shall be flashing green.
	(red)	On	**Major fault:** If the device has detected a non-recoverable major fault, the module status indicator shall be steady red.
	(red)	Flashing	**Minor fault:** If the device has detected a recoverable minor fault, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor fault.
	(red/green)	Flashing	**Self-test:** While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	-	Off	**No power:** If no power is supplied to the device, the module status indicator shall be steady off.
NS Number in the device drawing: 8	**Duo LED red/green**		
	(green)	On	**Connected:** If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	(green)	Flashing	**No connections:** If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	(red)	On	**Duplicate IP:** If the device has detected that its IP address is already in use, the network status indicator shall be steady red.
	(red)	Flashing	**Connection timeout:** If one or more of the connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	(red/green)	Flashing	**Self-test:** While the device is performing its power up testing, the network status indicator shall be flashing green/red.
	-	Off	**Not powered, no IP address:** If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
LINK/RJ45 Ch0 & Ch1 15 & 17	**LED green**		
	(green)	On	A connection to the Ethernet exists
	-	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1 16 & 18	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 34: LEDs EtherNet/IP Adapter (Slave)

8.3.4 LED Open Modbus/TCP

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the Open Modbus/TCP protocol is loaded to the device.

LED	Color	State	Meaning
RUN Number in the device drawing: 7	**Duo LED red/green**		
	-	Off	**Not Ready** OMB task is not ready
	(green)	Flashing cyclic with 1Hz	**Ready, not configured yet** OMB task is ready and not configured yet
	(green)	Flashing cyclic with 5Hz	**Waiting for Communication:** OMB task is configured
	(green)	On	**Connected:** OMB task has communication – at least one TCP connection is established
ERR Number in the device drawing: 8 1	**Duo LED red/green**		
	-	Off	No communication error
	(red)	Flashing cyclic with 2Hz (On/Off Ratio = 25 %)	System error
	(red)	On	Communication error active
LINK/RJ45 Ch0 & Ch1 15 & 17	**LED green**		
	(green)	On	A connection to the Ethernet exists
	-	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1 16 & 18	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 35: LEDs Open Modbus/TCP

8.3.5 LED PROFINET IO-RT-Device

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the PROFINET IO-RT-Device protocol is loaded to the device.

LED	Color	State	Meaning
SF Number in the device drawing: ⑦	**Duo LED red/green**		
	(red)	On	Watchdog timeout; channel, generic or extended diagnosis present; system error
	(red)	Flashing cyclic at 2 Hz (for 3 sec.)	DCP signal service is initiated via the bus
	-	Off	No error
BF Number in the device drawing: ⑧	**Duo LED red/green**		
	(red)	On	No configuration; or low speed physical link; or no physical link
	(red)	Flashing cyclic at 2 Hz	No data exchange
	-	Off	No error
LINK/RJ45 Ch0 & Ch1 ⑮ & ⑰	**LED green**		
	(green)	On	A connection to the Ethernet exists
	-	Off	The device has no connection to the Ethernet
RX/TX/RJ45 Ch0 & Ch1 ⑯ & ⑱	**LED yellow**		
	(yellow)	Flashing	The device sends/receives Ethernet frames

Table 36: LEDs PROFINET IO-RT-Device

8.3.6 LED SERCOS III Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the SERCOS III Slave protocol is loaded to the device.

LED	Color	State	Meaning
S3 (STA) Name in the device drawing: **COM 0** ⑦	**Duo LED red/green/orange** (orange = red/green simultaneously)		
	(green)	On	**CP4:** Communication phase 4, Normal operation, no error
	(green)	Flashing (4 Hz)	**Loopback**: The network state has changed from „fast-forward“ to „loopback“.
	(red/ green)	Flashing (4 Hz), *The LED flashes at least for 2 seconds from red to green.*	**Communication Error**: Depends on IDN S-0-1003 (for details refer to `SERCOS III Slave Protocol API.pdf` on the product CD). Shows how long the Master may in the communication phases CP3 and CP4 not received Master SYNC telegrams.
	(red)	On	**SIII C1D**: Error detectd according to Sercos III Cass 1 Diagnosis.
	(orange)	On	**CP0 … CP3**: Communication phase 0 to Communication phase 3
	(orange)	Flashing (4 Hz)	**Identification**: Bit 15 in the Slave device control that indicates remote address allocation or configuration errors between Master and Slaves (for details refer to `SERCOS III Slave Protocol API.pdf` on the product CD).
	-	Off	No SERCOS III Communication
Name in the device drawing: **COM 1** ⑧	**Duo LED red/green**		
	-	-	This LED is not used.
L/A/RJ45 Ch0 & Ch1 ⑮ & ⑰	**LED green**		
	(green)	On	Link: A connection to the Ethernet exists
	(green)	Flashing	Activity: The device sends/receives Ethernet frames
	-	Off	The device has no connection to the Ethernet
RJ45 Ch0 & Ch1 ⑯ & ⑱	**LED yellow**		

Table 37: LEDs SERCOS III Slave

LED State Definition for SERCOS III Slave for the S3 LED (STA-LED)

⑦

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Flashing (4 Hz)	The indicator turns on and off with a frequency of 4 Hz: on for appr. 125 ms, followed by off for appr. 125 ms.

Table 38: LED State Definition for SERCOS III Slave for the S3 LED (STA LED)

8.4 LED Fieldbus Systems

8.4.1 LED PROFIBUS-DP Master

The subsequent table describes the meaning of the LED of the device when the firmware of the PROFIBUS-DP Master protocol is loaded to the device.

LED	Color	State	Meaning
Communication LED			
COM ⑦ with protocol at X2, ⑬ with protocol at X3	**Duo LED red/green**		
	(green)	Flashing acyclic	No configuration or stack error
	(green)	Flashing cyclic	Profibus is configured, but bus communication is not yet released from the application
	(green)	On	Communication to all Slaves is established
	(red)	Flashing cyclic	Communication to at least one Slave is disconnected
	(red)	On	Communication to one/all Slaves is disconnected

Table 39: LEDs PROFIBUS DP Master

8.4.2 LED PROFIBUS-DP Slave

The subsequent table describes the meaning of the LED for the device when the firmware of the PROFIBUS-DP Slave protocol is loaded to the device.

LED	Color	State	Meaning
Communication LED			
COM ⑦ with protocol at X2, ⑬ with protocol at X3	**Duo LED red/green**		
	 (green)	On	RUN, cyclic communication
	 (red)	Flashing cyclic	STOP, no communication, connection error
	 (red)	Flashing acyclic	not configured

Table 40: LEDs PROFIBUS DP Slave

8.4.3 LED CANopen Master

The subsequent table describes the meaning of the LEDs for the device when the firmware of the CANopen Master protocol is loaded to the device.

LED	Color	State	Meaning
Communication LED			
CAN ⑦ with protocol at X2, ⑬ with protocol at X3	**Duo LED red/green**		
	-	Off	The device is executing a reset
	(green)	Single flash	**STOPPED:** The Device is in STOPPED state
	(green)	Blinking	**PREOPERATIONAL:** The Device is in the PREOPERATIONAL state
	(green)	On	**OPERATIONAL:** The Device is in the OPERATIONAL state
	(red)	Single flash	**Warning Limit reached:** At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames).
	(red)	Double flash	**Error Control Event:** A guard event (NMT Slave or NMT-master) or a heartbeat event (Heartbeat consumer) has occurred.
	(red)	On	**Bus Off:** The CAN controller is bus off

Table 41: LEDs CANopen Master – 1 Communication LED (current Hardware Revision)

LED State Definition for CANopen Master for the CAN LED ⑦ with protocol at X2 respectively ⑬ with protocol at X3

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 42: LED State Definition for CANopen Master for the CAN LED

8.4.4 LED CANopen Slave

The subsequent table describes the meaning of the LEDs for the device when the firmware of the CANopen Slave protocol is loaded to the device.

LED	Color	State	Meaning
CIFX Devices with 1 Communication LED (current Hardware Revision)			
CAN ⑦ with protocol at X2, ⑬ with protocol at X3	**Duo LED red/green**		
	-	Off	The device is executing a reset
	(green)	Single flash	**STOPPED:** The Device is in STOPPED state
	(green)	Blinking	**PREOPERATIONAL:** The Device is in the PREOPERATIONAL state
	(green)	On	**OPERATIONAL:** The Device is in the OPERATIONAL state
	-	Off	**No Error:** The Device is in working condition
	(red)	Single flash	**Warning Limit reached:** At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames).
	(red)	Double flash	**Error Control Event:** A guard event (NMT Slave or NMT-master) or a heartbeat event (Heartbeat consumer) has occurred.
	(red)	On	**Bus Off:** The CAN controller is bus off

Table 43: LEDs CANopen Slave

LED State Definition for CANopen Slave for the CAN LED ⑦ with protocol at X2 respectively ⑬ with protocol at X3

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 44: LED State Definition for CANopen Slave for the CAN LED

8.4.5 LED DeviceNet Master

The subsequent table describes the meaning of the LEDs for the fieldbus device when the firmware of the DeviceNet Master protocol is loaded to the device.

LED	Color	State	Meaning
MNS ⑦ with protocol at X2, ⑬ with protocol at X3	**Duo LED red/green**		
	 (green)	On	Device is online and has one or more connections in the established state.
	 (green)	Flashing	Device is online and has no connection in the established state.
	 (red)	On	Critical connection failure; device has detected a network error: duplicate MAC-ID or sever error in CAN network (CAN-bus off).
	 (red)	Flashing	Connection timeout.
	 (red/green)	Flashing	Communication faulted.
	-	Off	After start of the device and during duplicate MAC-ID check.

Table 45: LEDs DeviceNet Master

8.4.6 LED DeviceNet Slave

The subsequent table describes the meaning of the LEDs for the fieldbus device when the firmware of the DeviceNet Slave protocol is loaded to the device.

LED	Color	State	Meaning
MNS ⑦ with protocol at X2, ⑬ with protocol at X3	**Duo LED red/green**		
	(green)	On	Device is online and has one or more connections in the established state.
	(green)	Flashing	Device is online and has no connection in the established state.
	(red)	On	Critical connection failure; device has detected a network error: duplicate MAC-ID or sever error in CAN network (CAN-bus off).
	(red)	Flashing	Connection timeout.
	(red/green)	Flashing	Communication faulted.
	-	Off	After start of the device and during duplicate MAC-ID check.

Table 46: LEDs DeviceNet Slave

8.4.7 LED CC-Link Slave

The subsequent table describes the meaning of the LEDs for the fieldbus device when the firmware of the CC-Link Slave protocol is loaded to the device.

LED	Color	State	Meaning
L RUN **L ERR** 13 with protocol at X3	**Duo LED red/green**		
	-	Off	1. Before participating in the network 2. Unable to detect carrier 3. Timeout 4. Resetting hardware
	(green)	Blinking	-
	(green)	On	Receive both refresh and polling signals or just the refresh signal normally, after participating in the network.
	-	Off	1. Normal communication 2. Resetting hardware
	(red)	Blinking	The switch setting has been changed from the setting at the reset cancellation (blinks for 0.4 sec.).
	(red)	On	1. CRC error 2. Address parameter error (0, 65 or greater is set including the number of occupied stations) 3. Baud rate switch setting error during cancellation of reset (5 or greater)

Table 47: LEDs CC-Link Slave

8.5 LEDs Serial

8.5.1 LED Modbus RTU

The subsequent table describes the meaning of the LEDs for the Modbus RTU protocol.

LED	Color	State	Meaning
COM (13)	**Duo LED red/green**		
	(green)	On	The device has a valid configuration for Modbus RTU and is ready for Modbus communication respectively sends/receives Modbus RTU telegrams
	(red)	On	Communication error: The device works as **Modbus RTU Master:** - the slave device answered with a error (Modbus Exception), e. g. functioncode not supported, access to invalid register addresses or coil addresses - receive error detected, e. g. parity error or checksum error - timeout (slave device does not answer) The device works as **Modbus RTU Slave:** - the Modbus RTU Master device uses an invalid function-code - the Modbus RTU Master device has accessed an invalid register addresses or coil addresses - receive error detected, e. g. parity error or checksum error - timeout (application does not answer or answers with error) The error display is set back with the next error free Modbus telegram sequence
	-	Off	During initialisation or invalid Modbus RTU configuration or missing power supply

Table 48: LED Modbus RTU Protocol

8.5.2 LED ASCII

The subsequent table describes the meaning of the LEDs for the ASCII protocol.

LED	Color	State	Meaning
COM ⑬	**Duo LED red/green**		
	(green)	Flashing cyclic with 1 Hz	The device sends/receive data
	(green)	On	The device is ready for serial communication
	(red)	Flashing cyclic with 5 Hz	The device is configured and is in the state stop
	(red)	Flashing cyclic with 1 Hz	The device is not configured
	-	Off	During initialisation or missing power supply

Table 49: LED ASCII Protocol

8.5.3 LED Serial with netSCRIPT

The subsequent tables describe the meaning of the LEDs using 'serial with netSCRIPT'.

The meaning of the LED is determined by the device firmware, when the script is not executed. The meaning of the LED is determined by the script, when the script is executed.

Script is not executed

The device firmware does the following steps after the download of the netSCRIPT file into the device:

1. The script file is searched and loaded

2. The script file was loaded successfully. The device firmware now switches the COM LED off.

3. The script file is executed. The script now has the control of the COM LED.

LED	Color	State	Meaning
COM (13)	**Duo LED red/green**		
	(red)	On	netSCRIPT file is searched and loaded
	(green)	On (for appr. 0,5 s)	netSCRIPT file was loaded successfully
	(red)	Single Flash The indicator shows one short flash (200 ms) followed by a long off phase (1000 ms).	No script file loaded Script error occurred, which lead to a stop of the script execution The execution of the script was stopped by the debugger
	-	Off	Script running. The control of the LED states (after the startup sequence) is done with the netSCRIPT functions "setRunLed()" and "setErrorLed()" by the programmer

Table 50: LED serial with netSCRIPT – Script is not executed

Script is executed

LED	Color	State	Meaning
COM (13)	**Duo LED red/green**		
	(green)	Controlled by the script	The meaning is defined by the use of the netSCRIPT function "setRunLed()" in the script
	(red)	Controlled by the script	The meaning is defined by the use of the netSCRIPT function "setErrorLed()" in the script
	-	Off	The meaning is defined by the use of the netSCRIPT function "setRunLed()" and "setErroLed()" in the script

Table 51: LED serial with netSCRIPT – Script is executed

8.5.4 LED 3964R

The subsequent table describes the meaning of the LEDs for the 3964R protocol.

LED	Color	State	Meaning
COM ⑬	**Duo LED red/green**		
	(green)	Flashing cyclic with 10 Hz	The device sends/receive data
	(green)	On	The device is ready for serial communication
	(red)	On	Communication error: - receive error detected, e. g. parity error or checksum error - timeout (remote device does not answer) The error display is set back with the next error free 3964R telegram sequence
	(red)	Flashing cyclic with 5 Hz	The device is configured and is in the state stop
	(red)	Flashing cyclic with 1 Hz	The device is not configured
	-	Off	During initialisation or missing power supply

Table 52: LED 3964R Protocol

9 Technical Data

9.1 Technical Data netTAP 100 Gateway

9.1.1 NT 100

NT 100	Parameter	Value
Communication controller	Type	netX 100
Memory	RAM	8 MB SDRAM
	FLASH	4 MB serial Flash
	MMC card (optional)	max. 2 GByte SDHC- or SDXC- card type must not be used.
	netSCRIPT and Variables	appr. 1 MByte
Diagnostic Interface	Socket	Mini-USB, 5-pin
Display	LED Display	SYS System Status APL Application Status COM Communication Status LINK Link ACT Activity
Power supply	Voltage	24 V ± 6 V DC with reverse voltage protection
	Current at 24 V (typically)	130 mA
	Power Consumption	3.2 W
	Connector	Mini-COMBICON, 2-pin
	Power supply	Device shall be supplied by an isolated voltage source
Environmental conditions	Temperature range	0 … + 60 °C
	Humidity	No condensation permitted
	Environment	Device must be used in a pollution degree 2 environment
Device	Dimensions (L x W x H)	100 x 52 x 70 mm (without connector)
	Weight	appr. 150 g
	Mounting	on DIN rail EN 60715
	Protection Class	IP 20
	RoHS	Yes
CE Sign	CE Sign	Yes
	Emission	CISPR 11 Class A
	Immunity	EN 61131-2:2003
Configuration	Software	SYCON.net

Table 53: Technical Data NT 100 (Part 1)

NT 100	Parameter	Value
Ethernet Interface for the device types: NT 100-RE-CC, NT 100-RE-CO, NT 100-RE-DN, NT 100-RE-DP, NT 100-RE-RS.	Transmission rate	100 MBit/s 10 MBit/s (depending on loaded firmware)
	Interface Type	100 BASE-TX, isolated 10 BASE-TX (depending on loaded firmware), isolated
	Half duplex/Full duplex	supported (at 100 MBit/s)
	Auto-Negotiation	supported (depending on loaded firmware)
	Auto-Crossover	supported
	Connector	2 * RJ45
PROFIBUS Interface for the device types: NT 100-xx-DP, NT 100-RE-DP, NT 100-CO-DP NT 100-DN-DP, NT 100-DP-DP, NT 100-DP-CC, NT 100-DP-CO, NT 100-DP- DN, NT 100-DP-RS.	Transmission rate	9,6 kBit/s, 19,2 kBit/s, 31,25 kBit/s, 45,45 kBit/s, 93,75 kBit/s, 187,5 kBit/s, 500 kBit/s, 1,5 MBit/s, 3 MBit/s, 6 MBit/s, 12 MBit/s
	Interface Type	RS 485, optically isolated
	Connector	SubD female, 9-pin
CANopen Interface for the device type: NT 100-RE-CO, NT 100-DN-CO, NT 100-DP-CO, NT 100-CO-CO, NT 100-CO-CC, NT 100-CO-DP, NT 100-CO-DN, NT 100-CO-RS.	Transmission rate	10 kBit/s, 20 kBit/s, 50 kBit/s, 100 kBit/s, 125 kBit/s, 250 kBit/s, 500 kBit/s, 800 kBit/s, 1 MBit/s
	Interface Type	ISO 11898, optically isolated
	Connector	SubD male, 9-pin
DeviceNet Interface for the device type: NT 100-RE-DN, NT 100-DP-DN, NT 100-CO-DN, NT 100-DN-DN NT 100-DN-CO, NT 100-DN-CC, NT 100-DN-DP, NT 100-NN-RS.	Transmission rate	125 kBit/s, 250 kBit/s, 500 kBit/s
	Interface Type	ISO 11898, optically isolated
	Connector	COMBICON, 5-pin

Table 54: Technical Data NT 100 (Part 2)

NT 100	Parameter	Value
CC-Link Interface Version 1 and 2 for the device type: NT 100-RE-CC NT 100-DP-CC, NT 100-CO-CC, NT 100-DN-CC,	Transmission rate	156 kBit/s 625 kBit/s 2500 kBit/s 5 MBit/s 10 MBit/s
	Interface Type	RS-485, galvanically isolated
	Connector	COMBICON, 5-pin
Serial Interface for the device type: NT 100-RE-RS, NT 100-CO-RS, NT 100-DN-RS, NT 100-DP-RS.	Interface Type	RS-232, RS422, RS-485, optically isolated
	Transmission rate ASCII	300 Bit/s 600 Bit/s 1200 Bit/s 2400 Bit/s 4800 Bit/s 9600 Bit/s 19200 Bit/s 38400 Bit/s 57600 Bit/s 115200 Bit/s
	Transmission rate Modbus RTU	4800 Bit/s 9600 Bit/s 19200 Bit/s 38400 Bit/s 57600 Bit/s 115200 Bit/s
	Transmission rate netSCRIPT	Continuously between 6 ... 1000000 Bit/s adjustable

Table 3: Technical Data NT 100 (Part 3)

9.2 Technical Data of Real-Time Ethernet Communication Protocols

9.2.1 EtherCAT Master

Parameter	Description
Maximum number of EtherCAT slaves	Maximum 200 Slaves
Maximum number of cyclic input data	5760 bytes
Maximum number of cyclic output data	5760 bytes
Minimum bus cycle time	1 ms (fix)
Topology	Line
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Configuration File (ethercat.xml)	Maximum 1 MByte
Limitations	CoE-Upload, CoE-Download for user data transfer not supported The size of the bus configuration file is limited by the size of the RAM Disk (1 Megabyte) Only Ethernet Port 0 of the device is used for communication All CoE Uploads, Downloads and information services must fit in one TLR-Packet. Fragmentation is not supported Support of Distributed clocks (Slave synchronisation) is always activated The bus cycle time is fixed to a value of 1000 µs The watchdog time is fixed to a value of 20 ms
Reference to firmware/stack version	V2.3.x.x

Table 55: Technical Data EtherCAT Master Protocol

9.2.2 EtherCAT Slave

Parameter	Description
Maximum number of cyclic input data	200 bytes
Maximum number of cyclic output data	200 bytes
Type	Complex Slave
FMMUs	3 (netX 100/netX 500)
SYNC Manager	4 (netX 100/500)
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Limitation	Acyclic communication not supported LRW is not supported
Reference to firmware/stack version	V2.3.x.x

Table 56: Technical Data EtherCAT Slave Protocol

9.2.3 EtherNet/IP Scanner (Master)

Parameter	Description
Maximum number of EtherNet/IP connections	64 connections for implicit
Maximum number of total cyclic input data	5760 bytes
Maximum number of total cyclic output data	5760 bytes
Maximum number of cyclic input data	504 bytes per slave per telegram
Maximum number of cyclic output data	504 bytes per slave per telegram
IO Connection type	Cyclic, minimum 1 ms (depending on used number of connections and used number of input and output data)
UCMM, Class 3	Supported
Predefined standard objects	Identity Object Message Route Object Assembly Object Connection Manager Ethernet Link Object TCP/IP Object
DHCP	Supported
BOOTP	Supported
Baud rates	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Integrated switch	Supported
Limitations	No acyclic user data communication CIP Sync Services are not implemented TAGs are not supported ACD (Address Conflict Detection) not supported DLR not supported (ring topology)
Reference to firmware/stack version	V2.1.x.x

Table 57: Technical Data EtherNet/IP Scanner (Master) Protocol

9.2.4 EtherNet/IP Adapter (Slave)

Parameter	Description
Maximum number of input data	504 bytes
Maximum number of output data	504 bytes
IO Connection	1 explicit owner, up to 2 listen only
IO Connection type	Cyclic, minimum 1 ms
UCMM	Supported
Predefined standard objects	Identity Object Message Route Object Assembly Object Connection Manager Ethernet Link Object TCP/IP Object
DHCP	Supported
BOOTP	Supported
Baud rates	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Integrated switch	Supported
Limitations	No acyclic user data communication CIP Sync Services are not implemented TAGs are not supported ACD (Address Conflict Detection) not supported DLR not supported (ring topology)
Reference to firmware/stack version	V2.1.x.x

Table 58: Technical Data EtherNet/IP Adapter (Slave) Protocol

9.2.5 Open Modbus/TCP

Parameter	Description
Maximum number of input data	2880 Registers
Maximum number of output data	2880 Registers
Acyclic communication	Read/Write Register: - Max. 125 Registers per Read Telegram (FC 3, 4, 23), - Max. 121 Registers per Write Telegram (FC 23), - Max. 123 Registers per Write Telegram (FC 16) Read/Write Coil: - Max. 2000 Coils per Read Telegram (FC 1, 2), - Max. 1968 Coils per Write Telegram (FC 15)
Modbus Function Codes	1, 2, 3, 4, 5, 6, 7, 15, 16, 23 (Function code 23 in server mode only)
Mode	Client or Server
Baud rates	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Reference to firmware/stack version	V2.2.x.x

Table 59: Technical Data Open Modbus/TCP Protocol

9.2.6 POWERLINK Controlled Node (Slave)

Parameter	Description
Maximum number of cyclic input data	1490 bytes
Maximum number of cyclic output data	1490 bytes
Baud rate	100 MBit/s, half-duplex
Data transport layer	Ethernet II, IEEE 802.3
Ethernet Powerlink version	V 2
Limitation	No acyclic communication No slave to slave communication
Reference to firmware/stack version	V2.1.x.x

Table 60: Technical Data POWERLINK Controlled Node (Slave) Protocol

9.2.7 PROFINET IO-RT-Controller

Parameter	Description
Maximum number of PROFINET IO Devices	128
Maximum number of total cyclic input data	5760 bytes
Maximum number of total cyclic output data	5760 bytes
Maximum number of cyclic input data	1024 bytes per device (= IOCR data length)
Maximum number of cyclic output data	1024 bytes per device (= IOCR data length)
Supported Protocols	RTC – Real Time Cyclic Protocol, Class 1 RTA – Real Time Acyclic Protocol DCP – Discovery and configuration Protocol CL-RPC – Connectionless Remote Procedure Call
Context management by CL-RPC	Supported
Minimum cycle time	1 ms Different IO-Devices can be configured with different cycle times
Baud rate	100 MBit/s Full-Duplex mode
Data transport layer	Ethernet II, IEEE 802.3
Configuration File	Maximum 1 MByte
Limitations	Read/Write Record not supported No Alarm processing RT over UDP not supported Multicast communication not supported DHCP is not supported Only one IOCR per IO Device NameOfStation of IO Controller CANNOT be set using the DCP SET NameOfStation service but only at start-up while configuring the IO Controller SNMP not supported LLDP not supported The buffer for IO-Device diagnosis data will be overwritten in case of multiple diagnostic events. Only one (the last) event is stored at the same time. If a single event produces more than 200 bytes of diagnosis data, only the first 200 bytes will be taken care of. The usable (minimum) cycle time depends on the number of used IO Devices, the number of used input and output data. The cycle-time, the number of configured IO Devices and the amount of IO data depend on each other. For example it is not possible due to performance reasons to have 128 IO Devices communication with cycle-time 1ms. The size of the bus configuration file is limited by the size of the RAM Disk (1 MByte)
Reference to firmware/stack version	V2.2.x.x

Table 61: Technical Data PROFINET IO RT Controller

9.2.8 PROFINET IO-RT-Device

Parameter	Description
Maximum number of cyclic input data	1024 bytes
Maximum number of cyclic output data	1024 bytes
Maximum number of all submodules	100
Maximum slot address	300
Maximum subslot address	100 (Physical device (PDev) submodules are allowed at slot 0, subslot addresses 0x8000 – 0x8064)
Supported protocols	RTC – Real Time Cyclic Protocol, Class 1 RTA – Real Time Acyclic Protocol DCP – Discovery and configuration Protocol CL-RPC – Connectionless Remote Procedure Call LLDP – Link Layer Discovery Protocol SNMP – Simple Network Management Protocol
Used Protocols (subset)	UDP, IP, ARP, ICMP (Ping)
Topology recognition	LLDP, SNMP V1, MIB2, physical device
VLAN- and priority tagging	Supported
Context Management by CL-RPC	Supported
Minimum cycle time	1ms IO-Device can be configured with different cycle times
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Limitations	Acyclic communication not supported RT over UDP not supported IRT not supported Multicast communication not supported Only one device instance is supported DHCP is not supported
Reference to firmware/stack version	V2.1.40.x

Table 62: Technical Data PROFINET IO RT Device Protocol

9.2.9 SERCOS III Slave

Parameter	Description
Maximum number of cyclic input data (Tx) of all slaves	200 bytes (including Connection Control)
Maximum number of cyclic output data (Rx) of all slaves	200 bytes (including Connection Control)
Maximum number of slave devices	8
Maximum number of applicable SERCOS addresses	512 (1 … 511)
Minimum cycle time	250 µs
Topology	Line and ring
Communication phases	NRT, CP0, CP1, CP2, CP3, CP4
Baud rate	100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
Supported SERCOS III version	Communication Specification Version 1.1.2
Supported SERCOS Communication Profiles	SCP_FixCFG Version 1.1.1 SCP_VarCFG Version 1.1.1 SCP_VarCFG Version 1.1.3
Supported FSP profiles	FSP_IO
SCP_NRT support	No (planned)
Identification LED feature supported	yes
Storage location of object dictionary	mixed mode
Limitations	Max. 2 connections: 1 for consumer and 1 for producer No acyclic user data transfer Modifications of the Service-Channel Object Dictionary are volatile after reset (if resides on device) Hot plug is not supported yet Cross communication not supported yet NRT Channel is not supported yet, only forwarding The Ethernet Interface is not supported yet.
Reference to firmware/stack version	V3.0.x.x

Table 63: Technical Data SERCOS III Slave Protocol

9.3 Technical Data Fieldbus Protocols

9.3.1 CANopen Master

Parameter	Description
Maximum number of CANopen nodes	126
Maximum number of cyclic input data	3584 bytes
Maximum number of cyclic output data	3584 bytes
Maximum number of receive PDOs	512
Maximum number of transmit PDOs	512
Exchange of process data	Via PDO transfer: - synchronized, - remotely requested and - event driven (change of date)
Functions	Emergency message (consumer) Node guarding / life guarding, heartbeat PDO mapping NMT Master SYNC protocol (producer) Simple boot-up process, reading object 1000H for identification
Baud rates	10 kBits/s, 20 kBits/s, 50 kBits/s, 100 kBits/s, 125 kBits/s, 250 kBits/s, 500 kBits/s, 800 kBits/s, 1 MBits/s
Data transport layer	CAN Frames
CAN Frame type	11 Bit
Limitations	SDO-Upload/Download for user data transfer not supported
Reference to firmware/stack version	V2.2.x.x

Table 64: Technical Data CANopen Master Protocol

9.3.2 CANopen Slave

Parameter	Description
Maximum number of cyclic input data	512 bytes
Maximum number of cyclic output data	512 bytes
Maximum number of receive PDOs	64
Maximum number of transmit PDOs	64
Exchange of process data	Via PDO transfer - synchronized, - remotely requested and - event driven (change of date)
Functions	Node guarding / life guarding, heartbeat PDO mapping NMT Slave SYNC protocol (consumer)
Baud rates	10 kBits/s, 20 kBits/s, 50 kBits/s, 100 kBits/s, 125 kBits/s, 250 kBits/s, 500 kBits/s, 800 kBits/s, 1 MBits/s
Data transport layer	CAN Frames
CAN Frame type	11 Bit
Limitations	SDO-Upload/Download for user data transfer not supported Emergency message (producer) not supported
Reference to firmware/stack version	V2.2.x.x

Table 65: Technical Data CANopen Slave Protocol

9.3.3 CC-Link Slave

Parameter	Description
Firmware works according to CC-Link Version 2.0:	
Station Types	Remote Device Station (up to 4 occupied stations)
Maximum input data	368 bytes
Maximum output data	368 bytes
Input data remote device station	112 bytes (RY) and 256 bytes (RWw)
Output data remote device station	112 bytes (RX) and 256 bytes (RWr)
Extension cycles	1, 2, 4, 8
Baud rates	156 kBit/s, 625 kBit/s, 2500 kBit/s, 5 MBit/s, 10 MBit/s
Limitation	Intelligent Device Station not supported
Firmware works according to CC-Link Version 1.11:	
Station Types	Remote I/O station, Remote device station' (up to 4 occupied stations)
Maximum input data	48 bytes
Maximum output data	48 bytes
Input data remote I/O station	4 bytes (RY)
Output data remote I/O station	4 bytes (RX)
Input data remote device station	4 bytes (RY) and 8 bytes (RWw) per occupied station
Output data remote device station	4 bytes (RX) and 8 bytes (RWr) per occupied station
Baud rates	156 kBit/s, 625 kBit/s, 2500 kBit/s, 5 MBit/s, 10 MBit/s
Firmware	
Reference to firmware/stack version	V2.2.x.x

Table 66: Technical Data CC-Link-Slave Protocol

9.3.4 DeviceNet Master

Parameter	Description
Maximum number of DeviceNet slaves	63
Maximum number of total cyclic input data	3584 bytes
Maximum number of total cyclic output data	3584 bytes
Maximum number of cyclic input data	255 bytes/connection
Maximum number of cyclic output data	255 bytes/connection
Maximum configuration data	1000 bytes/slave
Baud rates	125 kBits/s, 250 kBit/s, 500 kBit/s Auto baudrate detection is not supported
Data transport layer	CAN frames
Connections	Bit Strobe Change of State Cyclic Poll Explicit Peer-to-Peer Messaging
Fragmentation	Explicit and I/O
UCMM	Supported
Objects	Identity Object (Class Code 0x01) Message Router Object (Class Code 0x02) DeviceNet Object (Class Code 0x03) Connection Object (Class Code 0x05) Acknowledge Handler Object (Class Code 0x06)
Baud rates	125 kBits/s, 250 kBit/s, 500 kBit/s Auto baudrate detection is not supported
Data transport layer	CAN frames
Limitations	Acyclic communication (Explicit Messaging) for user data transfer not supported
Reference to firmware/stack version	V2.1.x.x

Table 67: Technical Data DeviceNet Master Protocol

9.3.5 DeviceNet Slave

Parameter	Description
Maximum number of cyclic input data	255 bytes
Maximum number of cyclic output data	255 bytes
Connections	Poll Change-of-state Cyclic Bit-strobe
Fragmentation	Explicit and I/O
UCMM	Not supported
Baud rates	125 kBits/s, 250 kBit/s, 500 kBit/s Auto baudrate detection is not supported
Data transport layer	CAN frames
Limitations	Acyclic communication (Explicit Messaging) for user data transfer not supported
Reference to firmware/stack version	V2.1.x.x

Table 68: Technical Data DeviceNet Slave Protocol

9.3.6 PROFIBUS-DP Master

Parameter	Description
Maximum number of PROFIBUS-DP slaves	125
Maximum number of total cyclic input data	3584 bytes
Maximum number of total cyclic output data	3584 bytes
Maximum number of cyclic input data	244 bytes/slave
Maximum number of cyclic output data	244 bytes/slave
Configuration data	Max. 244 bytes per slave
Parameterization data per slave	7 bytes/slave standard parameters Max. 237 bytes/slave application specific parameters
Baud rate	9,6 kBits/s, 19,2 kBits/s, 31,25 kBits/s, 45,45 kBits/s 93,75 kBits/s, 187,5 kBits/s, 500 kBits/s, 1, 5 MBits/s, 3 MBits/s, 6 MBits/s, 12 MBit/s Auto baudrate detection is not supported
Data transport layer	PROFIBUS FDL
Limitations	DP V1 services class 1 and 2 are not supported DP V2 services are not implemented
Reference to firmware/stack version	V2.2.x.x

Table 69: Technical Data PROFIBUS-DP Master Protocol

9.3.7 PROFIBUS-DP Slave

Parameter	Description
Maximum number of cyclic input data	244 bytes
Maximum number of cyclic output data	244 bytes
Maximum number of modules	24
Baud rate	9,6 kBits/s, 19,2 kBits/s, 31,25 kBits/s, 45,45 kBits/s 93,75 kBits/s, 187,5 kBits/s, 500 kBits/s, 1, 5 MBits/s, 3 MBits/s, 6 MBits/s, 12 MBit/s Auto baudrate detection is supported
Data transport layer	PROFIBUS FDL
Limitations	DP V1 services class 1 and 2 are not supported SSCY1S – Slave to slave communication state machine not implemented Data exchange broadcast not implemented I&M0 with fixed settings only
Reference to firmware/stack version	V2.2.x.x

Table 70: Technical Data PROFIBUS-DP Slave Protocol

9.4 Technical Data Serial Protocols

9.4.1 ASCII

Parameter	Description and Value Range
Maximum telegram length	1024 bytes
Data bits	7, 8 bits
Stop bits	1, 2 bit(s)
Parity	None, even, odd
Baud rate	300 bit/s, 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s
Duplex	Half-duplex
Flow control	None
Indicator for end of received telegram	On receipt of a fixed number of characters On receipt of termination character(s) Elapse of character delay time
Timing parameter	Response timeout Receive watchdog time Send cycle time Character delay time
Number of send buffers	1
Number of receive buffers	1
Number of transmission retries	1
Maximum number of structure elements of a send telegram	10
Maximum number of structure elements of a receive telegram	10
Structure elements	Start character(s), Device address, Object index or start address, Command identifier, Data area with length information, Data area with termination character(s), End character(s), Checksum, Character(s) without meaning (fix length)
Checksum methods	CRC8, CRC16, CRC32, Exor

Table 71: Technical Data ASCII Protocol

9.4.2 Modbus RTU Master/Slave

Parameter	Description and Value Range
Maximum number of input data	2880 Registers
Maximum number of output data	2880 Registers
Acyclic communication	Read/Write Register, Maximum 125 Registers per Read Telegram (FC 3, 4), Maximum 123 Registers per Write Telegram (FC 16), Maximum 118 Registers per Write Telegram (FC 23), Maximum 118 Registers per Read Telegram (FC 23) Read/Write Coil, Maximum 2000 Coils per Read Telegram (FC 1, 2), Maximum 1968 Coils per Write Telegram (FC 15)
Function Codes Modbus Master	1, 2, 3, 4, 5, 6, 15, 16
Function Codes Modbus Slave	1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 23
Mode	Modbus Master or Modbus Slave
Baud rates	1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s
Data bits	8 bits
Stop bits	1, 2 bit(s)
Parity	None, even, odd
Limitations	Broadcast not supported
Reference to firmware/stack version	V1.1.x.x

Table 72: Technical Data Modbus RTU Protocol

9.4.3 netSCRIPT (Serial)

Parameter	Description and Value Range
Data bits	1 … 8 bits
Inversion of data bits	Adjustable
Stop bits	1 … 65535 bit(s), polarity is adjustable
Start bit	1, polarity is adjustable
Parity	none, even, odd, constant value
Baudrate	6 … 1.000.000 Bit/s
Flow control RS-232	None or RTS/CTS handshake Polarity of RTS signal adjustable
Timing Parameter	Response timeout, programmable in script, Character delay time (adjustable) (resolution 10 ns) Receive watchdog time and Send cycle time, programmable in script (resolution script cycle time)
Number of transmission retries	1, retries programmable in script
Maximum number of structure elements of a send telegram	Programmable in script
Maximum number of structure elements of a receive telegram	Programmable in script
Structure elements	Start character(s), Device address, Object index or start address, Command identifier, Data area with length information, Data area with termination character(s), Endcharacter(s), Checksum, Character(s) without meaning All listed and further structure elements are programmable in script
Checksum methods	CRC algorithm configurable (width, polynom, initial value, bit direction of input bytes and result value) XOR and sum function possible
Parameter FIFO Mode	
Maximum telegram length	Only limited by the script processing speed and by the data transfer spped
Duplex	Full-duplex for RS-232, RS-422 Half-duplex for RS-485
End indicator of received telegram	Programmable in script
Number of send buffers	1, with 256 characters
Number of receive buffers	1, with 256 characters
Parameter Block Mode	
Maximum telegram length	1024 bytes
Duplex	Half-duplex
End indicator of received telegram	Free definable end indicator with up to 64 bit and bit by bit AND mask
Number of send and receive buffers	15 … 240 (15 buffers with 1024 character buffer size, 240 buffers with 1 character buffer size)
Trailer bytes	0 … 255 bytes
Firmware	
Reference to stack version	1.2.x.x

Table 73: Technical Data netSCRIPT Serial

9.4.4 3964R

Parameter	Description and Value Range
Maximum Telegram Length	5736 bytes
Data Bits	7, 8 bits
Stop Bits	1, 2 bit(s)
Parity	None, even, odd
Baud Rate	300 bit/s, 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s
Duplex	Half-duplex
Priority	Adjustable: High or low Priority
Timing Parameter	Acknowledge Timeout Character Delay Time
Number of Send Buffers	1
Number of Receive Buffers	Ring Buffer with 30 buffers (FIFO)
Number of Transmission Retries	Adjustable
Checksum Method	BCC

Table 74: Technical Data 3964R Protocol

10 Appendix

10.1 Wiring Instructions

Please note the wiring instructions for the corresponding protocol specifications, otherwise a perfect function of the device is not guaranteed.

Use shielded cables, where the shield at both end should be connect extensively with the potential equalization. Cables for communication should be layed/placed as far away as possible from cables transferring energy, to avoid EMC influence caused by switching operation from cables transferring energy.

10.1.1 Assembly of D-Sub Connectors

The design of the bus cabling is an essential factor for the proper function of communication. Therefore, special attention should be paid to the cable connections with its connectors. Particularly, ensure good shield connection.

The shield must be connected as follows

1. Dismantle the cable.
2. Pull back the shielding from the cable sheathing.
3. Reduce the shielding that later it is covered by the nozzle.
4. Push a nozzle or shrinking tube over the cable sheathing that at the cable end a zone of 5 to 8 mm remains free.
5. Connect the wire ends with the connector
6. Then push the cable in the plug to the bare braided shield under the strain relief.
7. Fix the strain relief with screws.

The cable connection should look like shown below:

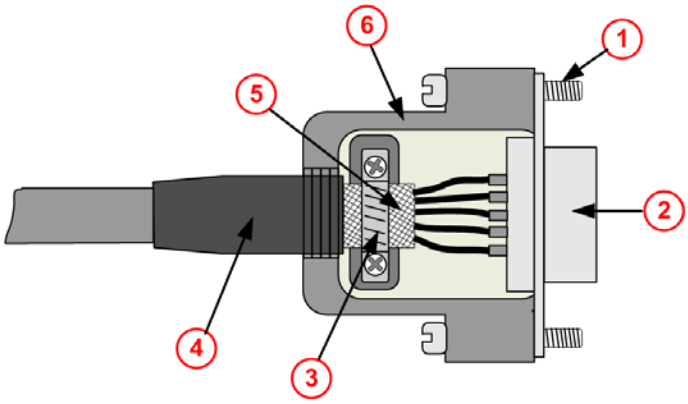


Figure 13: D-Sub Cable Assemblies

1. Fixing screw UNC.
2. Metallic plug collar
3. Strain relief for connecting the shielding with the connector housing
4. Shrinking tube or nozzle to cover the shielding and for bend protection
5. Cable shielding pulled back over the cable sheathing
6. Metallic or metallized connector housing

10.1.2 Ethernet

10.1.2.1 Use of Hubs and Switches

For the corresponding communication systems, the use of hubs and/or switches is either forbidden or allowed. The following table shows the acceptable use of hubs and switches by each communication system:

Communication System	Hub	Switch
EtherCAT	forbidden	only allowed between EtherCAT Master and first EtherCAT Slave (100 MBit/s, Full Duplex)
EtherNet/IP	allowed	allowed (10 MBit/s/100 MBit/s, Full or Half Duplex, Auto-Negotiation)
Open Modbus/TCP	allowed	allowed (10 MBit/s/100 MBit/s, Full or Half Duplex, Auto-Negotiation)
POWELINK	allowed	forbidden
PROFINET IO RT	forbidden	Only allowed, if the switch supports ‚Priority Tagging' and LLDP (100 MBit/s, Full Duplex)
SERCOS III	forbidden	forbidden

Table 75: Use of Hubs and Switches

NOTICE!

Failure of the Network Communication

- Do not operate hardware with the communication controllers netX 50, netX100 or netX 500 with the protocols Ethernet TCP/UDP/IP, EtherNet/IP or Modbus TCP at 10 MBit/s in half-duplex mode, otherwise failure of the network communication can occure.
- Use only switches or 10/100 MBit/s dual-speed hubs and ensure that the network operates at 100 MBit/s and in full-duplex mode.

NOTICE

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- Use only switches or 10/100 MBit/s dual-speed hubs and ensure that the network operates at 100 MBit/s and in full-duplex mode.

For further information refer to section *Failure in 10 MBit/s Half Duplex Mode and Workaround* on page 48.

10.1.3 PROFIBUS

Please ensure that termination resistors are available at both ends of the cable. If special PROFIBUS connectors are being used, these resistors are often found inside the connector and must be switched on. For baud rates above 1.5 MBaud use only special connectors, which also include additional inductance.

It is not permitted to have T-stubs on PROFIBUS high baud rates. Use only a special cable which is approved for PROFIBUS-DP. Make a solid connection from the cable shield to ground at every device and make sure that there is no potential difference between the grounds at the devices.

If the Hilscher device is linked with only one other device on the bus, they must be at the ends of the bus line. The reason is that these devices must deliver the power supply for the termination resistors. Otherwise the Master can be connected at any desired position.

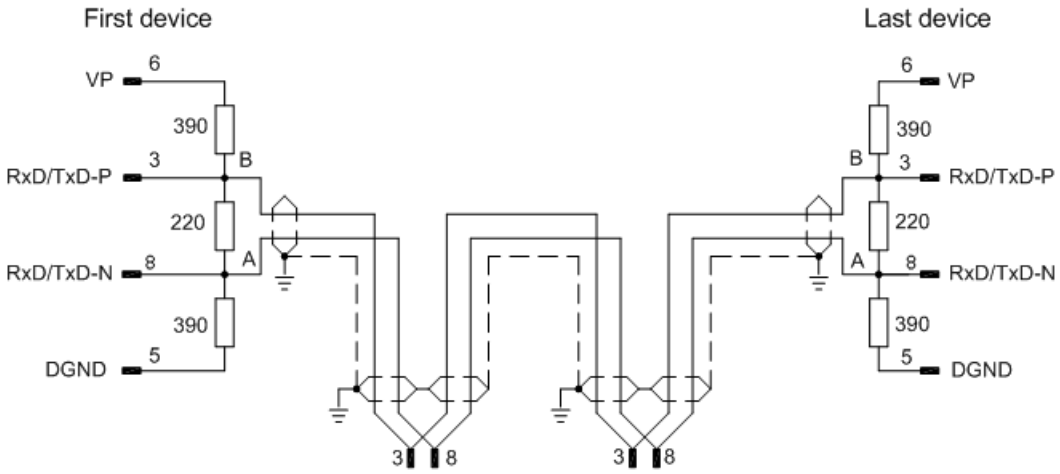

Figure 14: PROFIBUS-DP-Network

Up to 32 PROFIBUS devices can be connected to one bus segment. If several bus segments are linked to each other with repeaters, there can be up to 127 devices on the network.

Only PROFIBUS certified cable, preferably the cable type A, should be used.

The maximum length of a bus segment depends on the baudrate used, see the following table.

Baud rate in kBit/s	Max. distance in m
9,6	1.200
19,2	1.200
93,75	1.200
187,5	1.000
500	400
1.500	200
3.000	100
6.000	100
12.000	100

Table 76: PROFIBUS Segment Length in Dependence of the Baud Rate

The following table contains the most important electrical dsata concerning PROFIBUS certified cable:

Parameter	Value
Impedance	135…165 Ω
Capacity	< 30 pF/m
Loop resistance	110 Ω/km
Wire gauge	0,64 mm

Table 77: Characteristics of PROFIBUS certified Cable

10.1.4 CANopen

Please use only CAN certified cable with the following characteristics:

Parameter	Value
Impedance	120 Ω ± 12 Ω
Capacity	< 50 pF/m

Table 78: Characteristics of CAN certified Cable

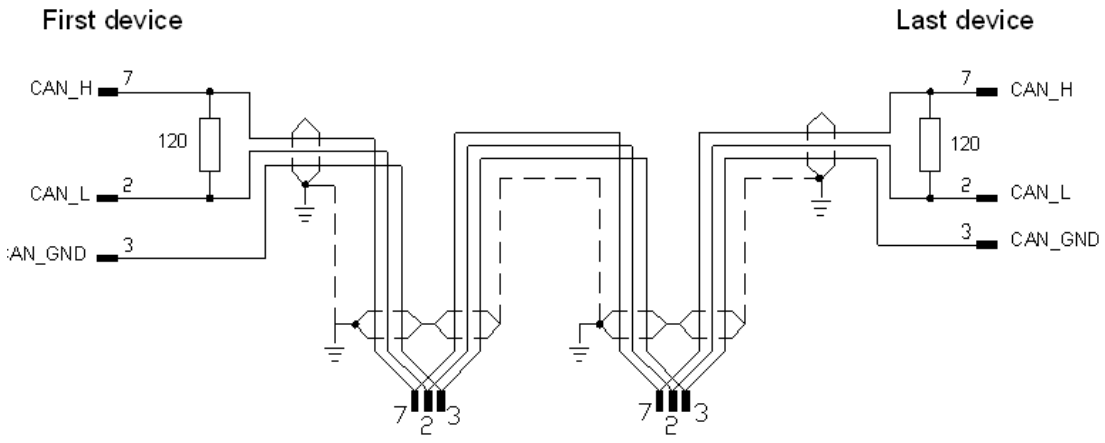

Figure 15: Termination CAN Network

At the ends of the network there must be two resistors of 120 Ω to terminate the cable. It is allowed to use repeaters to increase the number of nodes, which may be connected, or to increase the maximum cable length.

The CAN segment length in dependence of the Baud rate or corresponding Loop Resistance and Wire Gauge is given in the following table:

CANopen cables are listed in the following table:

Baud rate in kBit/s s	Max. distance	Loop Resistance	Wire Gauge
10	1000 m	<26 Ω/km	0,75...0,80 mm2
20	1000 m	<26 Ω/km	0,75...0,80 mm2
50	1000 m	<26 Ω/km	0,75...0,80 mm2
125	500 m	<40 Ω/km	0,50...0,60 mm2
250	250 m	<40 Ω/km	0,50...0,60 mm2
500	100 m	<60 Ω/km	0,34...0,60 mm2
800	50 m	<60 Ω/km	0,34...0,60 mm2
1.000	40 m	70 Ω/km	0,25...0,34 mm2

Table 79: CAN Segment Length in dependence of the Baud rate or corresponding Loop Resistance and Wire Gauge

10.1.5 DeviceNet

Up to 64 DeviceNet devices can be linked together over the bus. The maximum length of the bus cable depends on the used baud rate and the used cable type. Only special proved DeviceNet cable should be used.

The maximum length of the DeviceNet cable depends from the baud rate and from the chosen cable type. In the following table, these are listed in the following table:

Baudrate in kbit/s	Maximum length of cable (thick cable)	Maximum length of cable (thick cable)
125	500 m	100 m
250	250 m	100 m
500	100 m	100 m

Table 80: Maximum length in dependence from the baud rate for DeviceNet cables.

The data line cables must match the following conditions:

Data line cable*		Impedance	Capacity	Loop Resis-tance	Wire Gauge (Diameter)
Thick		120 Ohm	<39,4 pf/m	<22,6 Ohm/km	2 * 1.1 mm
Thin		120 Ohm	<39,4 pf/m	<91,8 Ohm/km	2 * 0,6 mm

Table 81 Characteristics of DeviceNet Data Line Cable

The power supply cables must match the following conditions:

Power supply ca-ble*		Loop Resis-tance	Wire Gauge (Diameter)
Thick		<11,8 Ohm/km	2 * 1.4 mm
Thin		<57,4 Ohm/km	2 * 0,7 mm

Table 82: Characteristics of DeviceNet Power Supply Cable

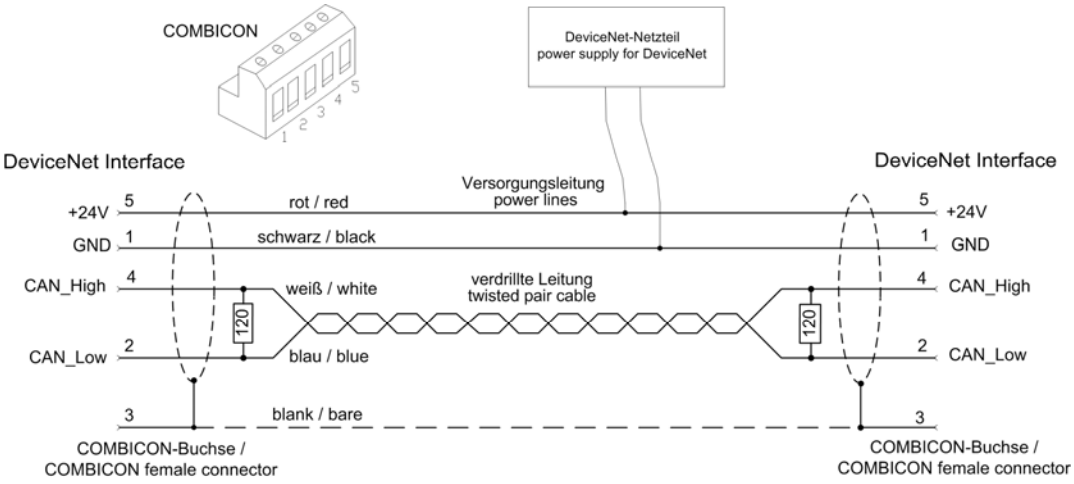

Figure 16: DeviceNet Network

Please ensure that termination resistors with 120 Ohm are available at both ends of the cable.

Further devices can be connected via T-stubs to the bus cable. The maximum length of all T-stubs is 6 m. The whole length of the bus cable and all T-stubs does not exceed the maximum length listed in the following table. There are two different types of cables. If both cables types are used within the same network, the maximum length is:

Max. distance	Baud rate in kBits/s
Lthick + 5 x Lthin <= 500 m	at 125 kBaud
Lthick + 2,5 x Lthin <= 250 m	at 250 kBaud
Lthick + Lthin <= 100 m	at 500 kBaud

Table 83: DeviceNet Segment Length in dependence of the Baud rate

The DeviceNet cable contains the data line cables and the power supply cables.

10.1.6 CC-Link

Use only a special cable which is approved for CC-Link. CC-Link specifies several shielded three-core Twisted Pair cables. It is recommended to use only one type of cable for an installation. Please ensure that termination resistors are available at both ends of the cable. The value of the termination resistor depends on the used type of cable and can be 100, 110 and 130 Ω, respectively.

The following illustration displays the basic network structure.

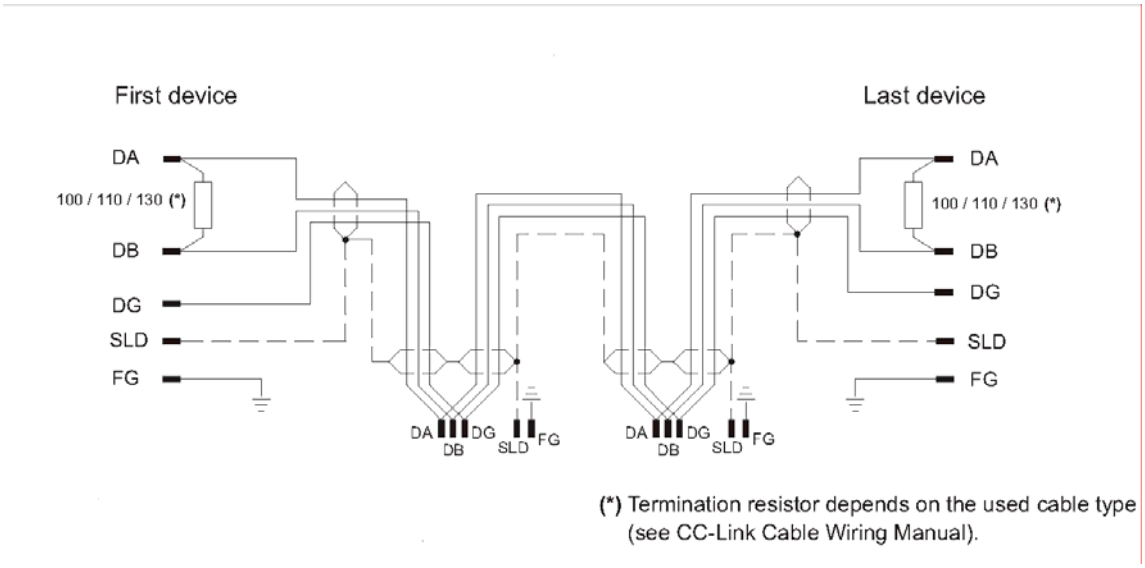

Figure 17: CC-Link Network

(*) The termination resistor depends on the used cable type (see CC-Link Cable Wiring Manual).

The maximum length of one bus segment depends on the used baud rate. The structure of the network can be built up without or with branches. The details listed here are taken from the "CC link Cable Wiring manual" from July 2004. Also further details are contained there. The document is ready for download on http://www.cc-link.org.

Note: For CC-Link V2.00 the cable specification V1.10 has not been changed.

Only trunk line, without branches:

Baud rate	max. Length cable V1.00	max. Length cable V1.10 and cable V1.00 with high capacity	max. length high flexible V1.10 (Type 50%)
156 kbps	1200 m	1200 m	600 m
625 kbps	600 m	900 m	450 m
2,5 Mbps	200 m	400 m	200 m
5 Mbps	150 m	160 m	80 m
10 Mbps	100 m	100 m	50 m

Table 84: Maximum length

Note: Further cable types are available with which however only lower maximum lengths can be reached.

Trunk line with branch lines:

baud rate	156 kbps	625 kbps
max. length trunk line	500 m	100 m
max. number of devices in branch line	6	6
max. cable length of branch line	8 m	8 m
max. length of all branch lines	200 m	50 m

Table 85: Maximum length

Further devices can be connected via T-branches to the bus cable only at the baud rates 156 kbps and 625 kbps. The maximum length of all T-stubs is limited to 8 m. The whole length of the bus cable and all T-branches does not exceed the maximum length listed in the following table.

Minimum Distance:

Between two devices a minimum distance is to be kept.

Distance between CC-Link devices	CC-Link cable V1.00	CC-Link cable V1.10
Remote device to next remote device	0.3 m or more	0.2 m or more
Remote device to next Master and/or intelligent device	1 m or more	0.2 m or more

Table 86: Minimum distance between two devices

10.1.7 RS-232

The RS232 interface (EIA-232) is a point-to-point connection of two communication devices. Only shielded cables have to be used. No termination resistors are required.

Take care of the pin assignment at the communication partner. This decides, whether you need a so called null modem cable with crossed pin assignments.

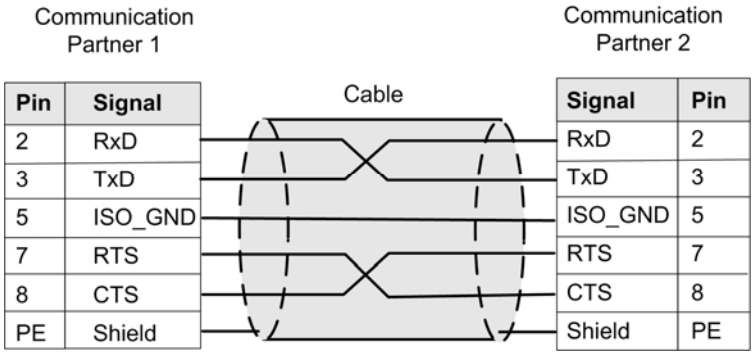

Figure 18: RS-232 Null-Modem Cable Connection

The pin assignment are for a DSub connector.

The signals RTS and CTS are not present on all devices.

Conductor length and transmission rates

In the EIA-232 norm a maximum cable capacitance of 2500 pF is allowed for a RS232 connection.

Cables of such capacitance may have the following lengths depending on the baud rate

max. baud rate	max. length
19.200	15 m
57.600	5 m
115.200	<2 m

Higher length can be achieved with cables of extraordinarily low capacitance.

10.1.8 RS-422

The lines of this industry bus interface are operated in push-pull action, four lines are required which can be controlled in half duplex or full duplex mode. This interface has been designed for one master and at maximum 10 slaves. Using repeaters, using even more slaves is possible.

Cable lengths of up to 1.2 km (at low baud rates) and data transmission rates of up to 10 MBit/s (at maximally 12 m length of line) are possible.

The following illustration shows wiring for RS422:

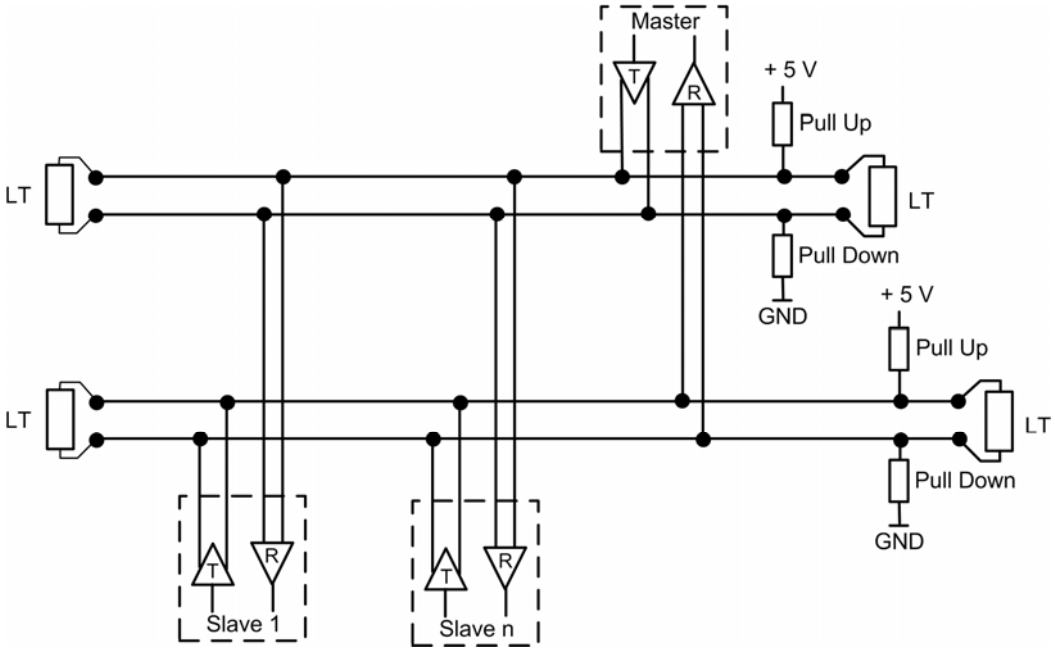

Figure 19: RS422 Wiring

Bus Requirements:

The bus cable must be a shielded 4.wire twisted pair cable. Each pair of wires has to be used for exactly one data transmission direction. The shield should be connected at both ends to the potential equalization system.

On each end, the bus requires a termination resistor (LT) of 90 Ω to 150 Ω between the lines. This value depends on the characteristic wave impedance of the cable.

The pull-up and pull-down resistors should have a resistance of 390 Ω up to 650 Ω.

Cable Requirements:

The workmanship of bus cabling is an important factor of the reliable operation and also for the electromagnetic compatibility and emission. It is mandatory to use shielded twisted-pair cables. The shield of the cable must consist of a copper wire mesh.

Parameter	Value
Characteristic wave impedance	150 Ω ± 15 Ω
Capacitance	< 30 pF/m
Loop resistance	110 Ω/km
Wire gauge	0,64 mm

Table 87: Electric Requirements to RS-422 Cables

The following lengths of lines can be achieved:

Max. overall length of line	Max. Baud rate	Max. length of a single branch line
120 m	1 MBit/s	0,3 m
600 m	500 kBit/s	0,6 m
1200 m	100 kBit/s	1,5 m

Table 88: RS422 Conductor Length and Transmission Rates

10.1.9 RS-485

The lines of this industry bus interface are operated in push-pull action, only two lines are required which can be controlled in half duplex or full duplex mode. The advantage of the 2-wire technology mainly consists in the multi-master capability. In principle, each participant is able to exchange data with any other participant. However, synchronous send attempts of two or more participants must be prevented by the applied protocol. The RS485 interface allows the connection of up to 32 transmitters and receivers using a protocol. (With repeaters even more participants are possible.)

Nowadays, RS-485 supports cable lengths of up to 1.2 km and data transmission rates of up to 1 MBit/s. Concerning this topic, see *Table 90: RS-485 Cable* Lengths on page 107

The following illustration shows wiring for RS-485:

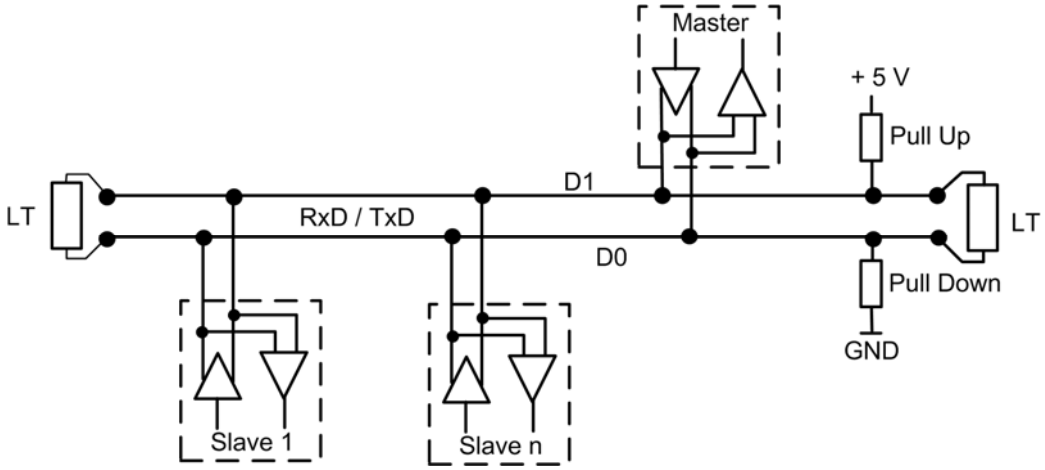

Figure 20: RS-485 Wiring

Bus requirements:

The bus cable must be a shielded twisted pair cable where the shield should be connected at both ends with large contact areas to the potential equalization system.

On each end, the bus requires a termination resistor (LT) between the lines D1 und D0 of approximately the amount of the characteristic wave impedance of the cable, which usually amounts to a value between 120 Ω and 220 Ω.

The pull-up and pull-down resistors should have a value of 390 Ω up to 650 Ω.

Cable **requirements:**

The workmanship of bus cabling is an important factor of the reliable operation and also for the electromagnetic compatibility and emission. It is mandatory to use shielded twisted-pair cables. The shield of the cable must consist of a copper wire mesh.

Parameter	Value
Characteristic wave impedance	150 Ω ± 15 Ω
Capacitance	< 30 pF/m
Loop resistance	110 Ω/km
Wire gauge	0,64 mm

Table 89: Electric Requirements to RS-485 Cables

The following lengths of lines can be achieved:

Max. overall length of line	Max. Baud rate	Max. length of a single branch line
120 m	1 MBit/s	0,3 m
600 m	500 kBit/s	0,6 m
1200 m	100 kBit/s	1,5 m

Table 90: RS-485 Cable Lengths

11 Lists

11.1 List of Figures

11.2 List of Tables

12 Glossary

10-Base T

Standard for communication on Ethernet over twisted pair lines with RJ45 connectors and a baud rate of 10 MBit/s (according to the IEEE 802.3 specification).

100-Base TX

Standard for communication on Ethernet over unshielded twisted pair lines with RJ45 connectors and a baud rate of 100 MBit/s according to the IEEE 802. specification

Auto-Crossover

Auto-Crossover is a feature of an interface: An interface with Auto-Crossover capability will automatically detect and correct if the data lines have been exchanged vice versa.

Auto-Negotiation

Auto-Negotiation is a feature of an interface: An interface with Auto- Negotiation will automatically determine a set of correct communication parameters.

Baud rate

Data transmission speed of a communication channel or interface.

Boot loader

Program loading the firmware into the memory of a device in order to be executed.

DDF

Device Description File.

Device Description File

A file containing configuration information about a device being a part of a network that can be read out by masters for system configuration. Device Description Files use various formats which depend on the communication system. Often these formats are based on XML such as EDS files or files. Contains configuration information

EDS file

A special kind of Device Description File used by EtherNet/IP.

EtherCAT

A communication system for industrial Ethernet designed and developed by Beckhoff Automation GmbH.

EtherNet/IP

A communication system for industrial Ethernet designed and developed by Rockwell. It partly uses the CIP (Common Industrial Protocol).

Ethernet Powerlink

A communication system for industrial Ethernet designed and developed by B&R. It partly uses CANopen technologies.

Gateway

A device interfacing between two different communication standards.

GND

Reference potential

ISO GND

Isolated reference potential, isolated from other device areas.

Open Modbus/TCP

A communication system for Industrial Ethernet designed and developed by Schneider Automation and maintained by the Modbus-IDA organization based on the Modbus protocols for serial communication.

PE

Potential equalization line, Potential equalization line of the process plant.

PROFINET

A communication system for Industrial Ethernet designed and developed by PROFIBUS International. It uses some mechanisms similar to those of the PROFIBUS field bus.

Real-Time Ethernet

Real-Time Ethernet (also denominated as *Industrial Ethernet*) is an extension of the Ethernet networking technology for industrial purposes with very good Real-Time features and performance. There is a variety of different Real-Time Ethernet systems on the market which are incompatible with each other. The most important systems of these are

- EtherCAT
- EtherNet/IP
- Ethernet Powerlink
- Open Modbus/TCP
- PROFINET
- SERCOS III

SERCOS III

A communication system for industrial Ethernet designed and developed by Bosch-Rexroth and supported by SERCOS International.

13 Contacts

Headquarters

Germany
Hilscher Gesellschaft für
Systemautomation mbH
Rheinstrasse 15
65795 Hattersheim
Phone: +49 (0) 6190 9907-0
Fax: +49 (0) 6190 9907-50
E-Mail: info@hilscher.com

Support
Phone: +49 (0) 6190 9907-99
E-Mail: de.support@hilscher.com

Subsidiaries

China
Hilscher Systemautomation (Shanghai) Co. Ltd.
200010 Shanghai
Phone: +86 (0) 21-6355-5161
E-Mail: info@hilscher.cn

Support
Phone: +86 (0) 21-6355-5161
E-Mail: cn.support@hilscher.com

France
Hilscher France S.a.r.l.
69500 Bron
Phone: +33 (0) 4 72 37 98 40
E-Mail: info@hilscher.fr

Support
Phone: +33 (0) 4 72 37 98 40
E-Mail: fr.support@hilscher.com

India
Hilscher India Pvt. Ltd.
New Delhi - 110 025
Phone: +91 11 40515640
E-Mail: info@hilscher.in

Italy
Hilscher Italia srl
20090 Vimodrone (MI)
Phone: +39 02 25007068
E-Mail: info@hilscher.it

Support
Phone: +39 02 25007068
E-Mail: it.support@hilscher.com

Japan
Hilscher Japan KK
Tokyo, 160-0022
Phone: +81 (0) 3-5362-0521
E-Mail: info@hilscher.jp

Support
Phone: +81 (0) 3-5362-0521
E-Mail: jp.support@hilscher.com

Korea
Hilscher Korea Inc.
Suwon, 443-810
Phone: +82-31-204-6190
E-Mail: info@hilscher.kr

Switzerland
Hilscher Swiss GmbH
4500 Solothurn
Phone: +41 (0) 32 623 6633
E-Mail: info@hilscher.ch

Support
Phone: +49 (0) 6190 9907-99
E-Mail: ch.support@hilscher.com

USA
Hilscher North America, Inc.
Lisle, IL 60532
Phone: +1 630-505-5301
E-Mail: info@hilscher.us

Support
Phone: +1 630-505-5301
E-Mail: us.support@hilscher.com