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 device family.

### 1.1.1 List of revisions

| Revision | Date | Change |
|---|---|---|
| 19 | 2021-03-01 | Firmware version 2.0 |
| | | Device NT 100-RE-EN removed. |
| | | Section *LEDs* [ page 59] updated. |
| | | Section *Technical data* [ page 88] updated. |
| 20 | 2021-03-30 | Section Technical Data *PROFINET IO-Device* [ page 98]: MRP Client added. |

*Table 1: List of revisions*

### 1.1.2 Conventions in this manual

Notes, instructions, results of operating steps and positions in figures are marked as follows:

**Notes**

**Important:**
<important note you must follow to avoid malfunction>

**Note:**
<general note>

<note where to find further information>

**Instructions**

1. Operation purpose
2. Operation purpose
   ➢ Instruction

**Results**

Intermediate result

Final result

### Safety messages

The labeling of safety messages is explained in the chapter Safety.

The *positions* ①, ②, ③... or ⓐ, ⓑ, ⓒ... or Ⓐ, Ⓑ, Ⓒ... refer 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.

## 1.2 Reference to device, software, driver and firmware

| Device type | Part number | from revision | Port X2 | Port X3 |
|---|---|---|---|---|
| NT 100-RE-CC | 1712.140 | Revision 2 | Ethernet | CC-Link |
| NT 100-RE-CO | 1712.160 | Revision 4 | Ethernet | CANopen |
| NT 100-RE-DP | 1712.180 | Revision 4 | Ethernet | PROFIBUS DP |
| NT 100-RE-DN | 1712.170 | Revision 4 | Ethernet | DeviceNet |
| NT 100-RE-RS | 1712.100 | Revision 4 | Ethernet | Serial |
| NT 100-DP-CC | 1718.140 | Revision 4 | PROFIBUS DP | CC-Link |
| NT 100-DP-CO | 1718.160 | Revision 4 | PROFIBUS DP | CANopen |
| NT 100-DP-DN | 1718.170 | Revision 4 | PROFIBUS DP | DeviceNet |
| NT 100-DP-DP | 1718.180 | Revision 4 | PROFIBUS DP | PROFIBUS DP |
| NT 100-DP-RS | 1718.100 | Revision 4 | PROFIBUS DP | Serial |
| NT 100-CO-CC | 1716.140 | Revision 4 | CANopen | CC-Link |
| NT 100-CO-CO | 1716.160 | Revision 3 | CANopen | CANopen |
| NT 100-CO-DP | 1716.180 | Revision 1 | CANopen | PROFIBUS DP |
| NT 100-CO-DN | 1716.170 | Revision 3 | CANopen | DeviceNet |
| NT 100-CO-RS | 1716.100 | Revision 3 | CANopen | Serial |
| NT 100-DN-CC | 1717.140 | Revision 4 | DeviceNet | CC-Link |
| NT 100-DN-CO | 1717.160 | Revision 3 | DeviceNet | CANopen |
| NT 100-DN-DP | 1717.180 | Revision 4 | DeviceNet | PROFIBUS DP |
| NT 100-DN-DN | 1717.170 | Revision 3 | DeviceNet | DeviceNet |
| NT 100-DN-RS | 1717.100 | Revision 4 | DeviceNet | Serial |

*Table 2: Reference to device*

| Software | Software version |
|---|---|
| SYCON.net setup.exe | 1.0500.201127.35275 and later |

*Table 3: Reference to software*

| Driver | Driver version |
|---|---|
| USB driver | USB driver of Windows® |

*Table 4: Reference to driver*

Firmware for the protocol conversions, see section *Protocol conversions* [▷ page 21].

## 1.3 Contents of the product DVD

The product DVD for the netTAP NT 100 contains:

- Setup program for the configuration and diagnosis program SYCON.net
- USB driver
- Documentation
- Firmware
- Device description files (EDS, GSD, GSDML, ...)
- Tools

### 1.3.1 Directory structure of the DVD

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

| Directory | Description |
|---|---|
| Documentation | Documentation in the Acrobat® Reader Format (PDF) |
| Driver_&_Toolkit | Device driver<br>Driver toolkit |
| Firmware_EDS_Examples_Webpages | Loadable firmware for netTAP NT 100<br>Device description files (EDS) |
| Software_&_Tools | SYCON.net |

*Table 5: Directory structure of the Gateway Solutions DVD*

## 1.3.2 Device description files

The directory `Firmware,_EDS,_Examples,_Webpages\Firmware_&_EDS\netTAP 100\DeviceDescription` contains device description files for netTAP NT 100.

| NT 100 | File name |
|---|---|
| CANopen Slave | NT100_CO_COS.eds |
| CC-Link Slave | 0x0352_NT100-CC_2.11_en.cspproj<br>0x0352_NT100-CCS_2.11_en.cspp<br>nt100-cc-ccs_1.csp (for one Remote Device Station),<br>nt100-cc-ccs_2.csp (for two Remote Device Stations),<br>nt100-cc-ccs_3.csp (for three Remote Device Stations),<br>nt100-cc-ccs_4.csp (for four Remote Device Stations),<br>nt100-cc-ccs_io_1.csp (for one Remote IO Station) |
| DeviceNet Slave | NT100_DN_DNS.EDS |
| EtherCAT Slave | Hilscher NT 100 RE ECS V4.6.xml |
| EtherNet/IP Adapter | HILSCHER NT 100-RE EIS V1.1.EDS |
| POWERLINK Controlled Node | 00000044_NT100PLS-64O_64I.xdd<br>00000044_NT100PLS-512O_512I.xdd |
| PROFIBUS DP Slave | HIL_0C0E.GSD |
| PROFINET IO Device | GSDML-V2.35-HILSCHER-NT 100-RE PNS-YYYMMDD.xml |
| Sercos Slave | SDDML#v3.0#Hilscher#NT_100_RE-FIXCFG_FSPIO#YYYY-MM-DD.xml with default settings only.<br>**Note:** Use the SDDML export function in SYCON.net to create a suitable SDDML file. |

*Table 6: Device description files for netTAP NT 100*

The device description files are used in the configuration software of the master.

### 1.3.3 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).

**Basic documentation for netTAP NT 100**

You always need the following documents:

| Manual | Contents | Document name |
|---|---|---|
| User Manual | netTAP NT 100<br>Installation, Operation and Hardware | netTAP NT 100 - Gateway Devices UM xx EN.pdf<br>(this manual) |
| User Manual | Software Installation<br>Gateway Solutions | Software Installation - Gateway Solutions UM xx EN.pdf |
| Operating Instruction Manual | Configuration of Gateway and Proxy Devices<br>netTAP, netBRICK and netLINK<br>Step by step description of the configuration of the netTAP NT 100.<br>Configuration of the netTAP NT 100 as<br>EtherCAT Slave,<br>EtherNet/IP Adapter,<br>Open Modbus/TCP,<br>POWERLINK Controlled Node,<br>PROFINET IO-Device,<br>Sercos Slave<br>CANopen Slave,<br>CC-Link Slave,<br>DeviceNet Slave,<br>PROFIBUS DP Slave,<br>3964R,<br>ASCII,<br>Modbus RTU Master or Slave respectively<br>netSCRIPT. | Configuration of Gateway and Proxy Devices OI xx EN.pdf |

*Table 7: Basic documentation for netTAP NT 100*

### netTAP NT 100 with EtherCAT Master

You need the following additional documents, if you use the protocol EtherCAT Master on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | DTM for EtherCAT Master devices | EtherCAT Master DTM OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM for EtherCAT Slave devices | EtherCAT Generic Slave DTM OI xx EN.pdf |

*Table 8: Additional Documentation for netTAP NT 100 with EtherCAT Master*

### netTAP NT 100 with EtherNet/IP Scanner

You need the following additional documents, if you use the protocol EtherNet/IP Scanner on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | DTM for EtherNet/IP Scanner devices | EtherNetIP Scanner DTM OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM from EDS File EtherNet/IP Adapter Devices | EtherNetIP Generic Adapter DTM EDS OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM for EtherNet/IP Adapter devices | EtherNetIP Generic Adapter DTM OI xx EN.pdf |

*Table 9: Additional Documentation for netTAP NT 100 with EtherNet/IP Scanner*

### netTAP NT 100 with PROFINET IO-Controller

You need the following additional documents, if you use the protocol PROFINET IO-Controller on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | DTM for PROFINET IO-Controller devices | PROFINET IO Controller DTM OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM for PROFINET IO-Device devices | PROFINET IO Generic Device DTM IO xx EN.pdf |

*Table 10: Additional Documentation for netTAP NT 100 with PROFINET IO-Controller*

### netTAP NT 100 with Sercos Master

You need the following additional documents, if you use the protocol Sercos Master on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | | |
| Operating Instruction Manual | | |

*Table 11: Additional Documentation for netTAP NT 100 with sercos Master*

### netTAP NT 100 with CANopen Master

You need the following additional documents, if you use the protocol CANopen Master on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | DTM for CANopen Master devices | CANopen Master DTM OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM for CANopen Slave devices | CANopen Generic Slave DTM OI xx EN.pdf |

*Table 12: Additional Documentation for netTAP NT 100 with CANopen Master*

### netTAP NT 100 with DeviceNet Master

You need the following additional documents, if you use the protocol DeviceNet Master on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | DTM for DeviceNet Master devices | DeviceNet Master DTM OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM for DeviceNet Slave devices | DeviceNet Generic Slave DTM OI xx EN.pdf |

*Table 13: Additional Documentation for netTAP NT 100 with DeviceNet Master*

### netTAP NT 100 with PROFIBUS DP Master

You need the following additional documents, if you use the protocol PROFIBUS DP Master on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | DTM for PROFIBUS DP Master devices | PROFIBUS DP Master DTM OI xx EN.pdf |
| Operating Instruction Manual | Generic DTM for PROFIBUS DP Slave devices | PROFIBUS DP Generic Slave DTM OI xx EN.pdf |

*Table 14: Additional Documentation for netTAP NT 100 with PROFIBUS DP Master*

### netTAP NT 100 with netSCRIPT

You need the following additional documents, if you use the protocol netSCRIPT on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Operating Instruction Manual | netSCRIPT<br>Programming Language for serial communication | netSCRIPT Programming Language for Serial Communication UM xx EN.pdf |

*Table 15: Additional Documentation for netTAP NT 100 with netSCRIPT*

### netTAP NT 100 with ASCII

You need the following additional documents, if you use the protocol ASCII on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Application Note | ASCII Data Flow Control | ASCII Data Flow Control AN xx EN.pdf |

*Table 16: Additional Documentation for netTAP NT 100 with ASCII*

### netTAP NT 100 with 3964R

You need the following additional documents, if you use the protocol 3964R on the gateway device:

| Manual | Contents | Document name |
|---|---|---|
| Application Note | 3964R Data Flow Control | 3964R Data Flow Control AN xx EN.pdf |

*Table 17: Additional Documentation for netTAP NT 100 with 3964R*

# 2 Safety

## 2.1 General note about safety

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

| NT 100-RE-XX | NT 100-DP-XX | NT 100-CO-XX | NT 100-DN-XX |
|---|---|---|---|
| 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 |

*Table 18: netTAP devices: NT 100*

The netTAP 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 systems

## 2.4 References safety

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 re-quirements, (IEC 60950-1:2005, modified); German Edition 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

## 2.5 Safety instructions to avoid personal injury

To ensure your own personal safety and to avoid personal injury, you necessarily must read, understand and follow the following safety instructions and all safety messages in this manual about danger causing personal injury, before you install and operate your netTAP NT 100 device.

**Danger of unsafe system operation**

To prevent harm of persons, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

## 2.6 Safety instructions to avoid property damage

To avoid property damage respectively device destruction of the netTAP NT 100 device, you necessarily must read, understand and follow the following safety instructions and all safety messages in this manual about danger causing property damage, before you install and operate your netTAP NT 100 device.

### 2.6.1 Power disconnect during firmware or configuration download

If during the process of downloading a firmware or configuration

- the power supply to the device is interrupted, or
- the power supply to a PC with the software application is interrupted, or
- a reset to the device is done,

this may lead to the following consequences:

Loss of device parameters, firmware corruption

- The firmware download or the configuration download is interrupted and remains incomplete.
- The firmware or the configuration database will be corrupted and device parameters will be lost.
- Device damage may occur as the device cannot be rebooted.

Whether these consequences occur depends on when the power disconnect occurs during the download.

➢ During configuration download process, do not interrupt the power supply to the PC or to the device, and do not perform a reset!

Otherwise you might be forced to send in your device for repair.

**Power drop during write and delete accesses in the file system**

The FAT file system in the netX firmware is subject to certain limitations in its operation. Write and delete accesses in the file system (firmware update, configuration download etc.) can demage the FAT (File Allocation Table) if the accesses cannot be completed if the power drops. Without a proper FAT, a firmware may not be found and cannot be started.

Make sure that the power supply to the device is not interrupted during write and delete accesses in the file system (firmware update, configuration download, etc.).

### 2.6.2 Device destruction by exceeding allowed supply voltage

Adhere for all netTAP NT 100 device described in this manual the instruction hereafter:

The netTAP NT 100 may only be operated with the specified supply voltage. Make sure that the limits of the allowed range for the supply voltage are not exceeded. A supply voltage above the upper limit can cause severe damage to the netTAP NT 100! A supply voltage below the lower limit can cause malfunction in the netTAP NT 100. The allowed range for the supply voltage is defined by the tolerances specified in this manual.

The data on the mandatory supply voltage for the netTAP NT 100 device is documented in section *Requirements for operation* [page 26]. There the required and permitted supply voltage for the netTAP NT 100 device is provided inclusively the permitted tolerance range.

### 2.6.3 Exceeding the maximum number of allowed write/delete accesses

This device uses a serial Flash chip for storing remanent data, such as firmware, configuration, etc. This chip allows a maximum of 100 000 write/delete accesses which is sufficient for a standard device operation. Writing/deleting the chip excessively (e.g. in order to change configuration or name of station) will exceed the maximum number of allowed write/delete accesses and, thus, result in damage to the device. If, e.g., the configuration is changed every hour, the maximum number will be reached after 11.5 years. If, e.g., it is changed every minute, the maximum number will already be reached after approx. 69 days.

Avoid exceeding the maximum number of allowed write/delete accesses by excessive writing.

### 2.6.4 Danger of unsafe system operation

To prevent property damage, do not remove this device under runtime conditions before you can not guarantee further a safe and secure operation of the plant.

## 2.7 Labeling of safety messages

| 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 |

*Table 19: Signal words*

# 3 Description and requirements

## 3.1 Brief description

The netTAP NT 100 devices described in this manual are communication devices and connect two communication networks. The netTAP devices act as a gateway between the two networks.

The netTAP NT 100 is a device with two interfaces (communication channels) whose operating principle is shown in the following figure.

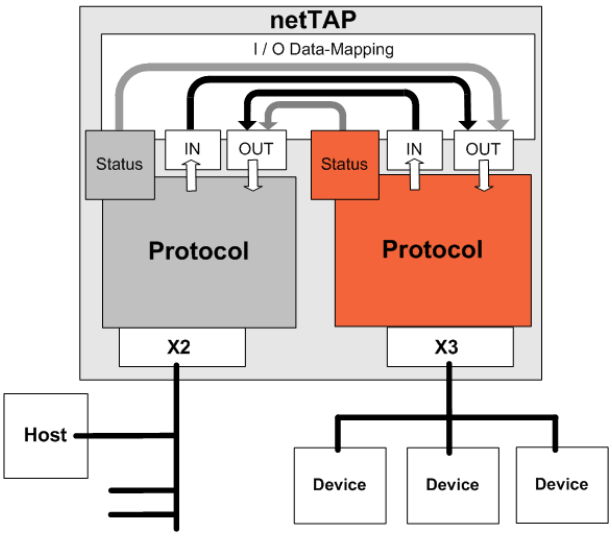



*Figure 1: netTAP operating principle*

The function of the device is determined by a loadable firmware and configuration.

Interface X2 is an Ethernet or a fieldbus interface, interface X3 is a fieldbus, an Ethernet or a serial interface. Connections X2 and X3 are accessible from the front of the device. In principle, hosts or field devices can be connected to X2 and X3.

Under the protective cover of the netTAP device, there is a USB interface for device configuration and diagnosis by a PC.

The netTAP devices are configured with the configuration and diagnosis program SYCON.net. The loadable firmware determines the gateway function. The operation of the configuration software SYCON.net is described in the Operating Instruction Manual *Configuration of Gateway and Proxy Devices*. You will find this manual in the document directory of the product DVD.

The firmware holds the cyclic send and receive data of the protocol on port X2 and the data of the protocol on port X3 in an internal memory of the device. Using the configuration software, the receive data of the protocol on port X2 can be mapped to the transmit data of the protocol on ports X3 and the receive data of the protocol on port X3 can be mapped to the transmit data of the protocol on ports X2.

Status information of the protocol on port X2 can be mapped to the transmit data of the protocol on port X3 and vice versa.

The firmware of the netTAP NT 100 with gateway function does not support the mapping of acyclic services/messages.

## 3.2 Device type name

The following figure shows an NT 100 RE-DP.

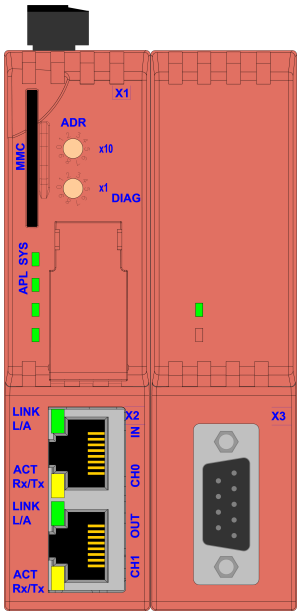



*Figure 2: Device name NT 100-RE-DP*

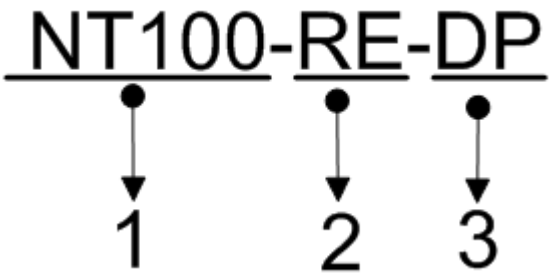



*Figure 3: Device name (example)*

The device description consists of the following parts:

1. Device type netTAP 100
2. Network to port X2 (left part of the device). In the example, RE stands for Real-Time Ethernet
3. Network to port X3 (right part of the device). In the example, DP stands for PROFIBUS

The following networks are supported (primary network on port X2):

| Name | Network |
|---|---|
| CO | CANopen |
| DN | DeviceNet |
| DP | PROFIBUS DP |
| RE | Real-Time Ethernet (2* RJ45) |

*Table 20: Network on port X2 (primary network)*

The following networks are supported (secondary network on connector X3):

| Name | Network |
|---|---|
| CC | CC-Link |
| CO | CANopen |
| DN | DeviceNet |
| DP | PROFIBUS DP |
| RS | Serial (Modbus RTU, ASCII, 3964R or serial with netSCRIPT) |

*Table 21: Network on port X3 (secondary network)*

# 3.3 Protocol conversions

## 3.3.1 Protocol conversion 1: Ethernet to Fieldbus

The netTAP device connects Ethernet (connector X2) and Fieldbus (connectorX3). The following devices support that:

| NT 100 device type | Protocol to X2 | Protocol to X3 | Firmware file | Firmware version |
|---|---|---|---|---|
| NT 100-RE-CC | EtherCAT Master | CC-Link Slave | NTECMCCS.NXF | 2.0 |
| | EtherCAT Slave | CC-Link Slave | NTECSCCS.NXF | |
| | EtherNet/IP Scanner | CC-Link Slave | NTEIMCCS.NXF | |
| | EtherNet/IP Adapter | CC-Link Slave | NTEISCCS.NXF | |
| | Open Modbus/TCP | CC-Link Slave | NTOMBCCS.NXF | |
| | POWERLINK Controlled Node | CC-Link Slave | NTPLSCCS.NXF | |
| | PROFINET IO-Controller | CC-Link Slave | NTPNMCCS.NXF | |
| | PROFINET IO-Device | CC-Link Slave | NTPNSCCS.NXF | |
| | Sercos Master | CC-Link Slave | NTS3MCCS.NXF | |
| | Sercos Slave | CC-Link Slave | NTS3SCCS.NXF | |
| NT 100-RE-CO | EtherCAT Master | CANopen Slave | NTECMCOS.NXF | 2.0 |
| | EtherCAT Slave | CANopen Master | NTECSCOM.NXF | |
| | EtherCAT Slave | CANopen Slave | NTECSCOS.NXF | |
| | EtherNet/IP Scanner | CANopen Slave | NTEIMCOS.NXF | |
| | EtherNet/IP Adapter | CANopen Master | NTEISCOM.NXF | |
| | EtherNet/IP Adapter | CANopen Slave | NTEISCOS.NXF | |
| | Open Modbus/TCP | CANopen Master | NTOMBCOM.NXF | |
| | Open Modbus/TCP | CANopen Slave | NTOMBCOS.NXF | |
| | POWERLINK Controlled Node | CANopen Master | NTPLSCOM.NXF | |
| | POWERLINK Controlled Node | CANopen Slave | NTPLSCOS.NXF | |
| | PROFINET IO-Controller | CANopen Slave | NTPNMCOS.NXF | |
| | PROFINET IO-Device | CANopen Master | NTPNSCOM.NXF | |
| | PROFINET IO-Device | CANopen Slave | NTPNSCOS.NXF | |
| | Sercos Master | CANopen Slave | NTS3MCOS.NXF | |
| | Sercos Slave | CANopen Master | NTS3SCOM.NXF | |
| | Sercos Slave | CANopen Slave | NTS3SCOS.NXF | |
| NT 100-RE-DN | EtherCAT Master | DeviceNet Slave | NTECMDNS.NXF | 2.0 |
| | EtherCAT Slave | DeviceNet Master | NTECSDNM.NXF | |
| | EtherCAT Slave | DeviceNet Slave | NTECSDNS.NXF | |
| | EtherNet/IP Scanner | DeviceNet Slave | NTEIMDNS.NXF | |
| | EtherNet/IP Adapter | DeviceNet Master | NTEISDNM.NXF | |
| | EtherNet/IP Adapter | DeviceNet Slave | NTEISDNS.NXF | |
| | Open Modbus/TCP | DeviceNet Master | NTOMBDNM.NXF | |
| | Open Modbus/TCP | DeviceNet Slave | NTOMBDNS.NXF | |
| | POWERLINK Controlled Node | DeviceNet Master | NTPLSDNM.NXF | |
| | POWERLINK Controlled Node | DeviceNet Slave | NTPLSDNS.NXF | |
| | PROFINET IO-Controller | DeviceNet Slave | NTPNMDNS.NXF | |
| | PROFINET IO-Device | DeviceNet Master | NTPNSDNM.NXF | |
| | PROFINET IO-Device | DeviceNet Slave | NTPNSDNS.NXF | |
| | Sercos Master | DeviceNet Slave | NTS3MDNS.NXF | |
| | Sercos Slave | DeviceNet Master | NTS3SDNM.NXF | |
| | Sercos Slave | DeviceNet Slave | NTS3SDNS.NXF | |

| NT 100 device type | Protocol to X2 | Protocol to X3 | Firmware file | Firmware version |
|---|---|---|---|---|
| NT 100-RE-DP | EtherCAT Master | PROFIBUS DP Slave | NTECMDPS.NXF | 2.0 |
| | EtherCAT Slave | PROFIBUS DP Master | NTECSDPM.NXF | |
| | EtherCAT Slave | PROFIBUS DP Slave | NTECSDPS.NXF | |
| | EtherNet/IP Scanner | PROFIBUS DP Slave | NTEIMDPS.NXF | |
| | EtherNet/IP Adapter | PROFIBUS DP Master | NTEISDPM.NXF | |
| | EtherNet/IP Adapter | PROFIBUS DP Slave | NTEISDPS.NXF | |
| | Open Modbus/TCP | PROFIBUS DP Master | NTOMBDPM.NXF | |
| | Open Modbus/TCP | PROFIBUS DP Slave | NTOMBDPS.NXF | |
| | POWERLINK Controlled Node | PROFIBUS DP Master | NTPLSDPM.NXF | |
| | POWERLINK Controlled Node | PROFIBUS DP Slave | NTPLSDPS.NXF | |
| | PROFINET IO-Controller | PROFIBUS DP Slave | NTPNMDPS.NXF | |
| | PROFINET IO-Device | PROFIBUS DP Master | NTPNSDPM.NXF | |
| | PROFINET IO-Device | PROFIBUS DP Slave | NTPNSDPS.NXF | |
| | Sercos Master | PROFIBUS DP Slave | NTS3MDPS.NXF | |
| | Sercos Slave | PROFIBUS DP Master | NTS3SDPM.NXF | |
| | Sercos Slave | PROFIBUS DP Slave | NTS3SDPS.NXF | |

*Table 22: NT 100 for the conversion "Ethernet to Fieldbus"*

### 3.3.2 Protocol conversion 2: Ethernet to Serial

The netTAP device connects Ethernet (connector X2) and Serial (connectorX3). The following devices support that:

| NT 100 device type | Protocol to X2 | Protocol to X3 | Firmware file | Firmware version |
|---|---|---|---|---|
| NT 100-RE-RS | EtherCAT Master | 3946R | NTECMNVR.NXF | 2.0 |
| | EtherCAT Master | ASCII | NTECMASC.NXF | |
| | EtherCAT Master | Modbus RTU Master/Slave | NTECMMBR.NXF | |
| | EtherCAT Master | Serial with netSCRIPT | NTECMNSC.NXF | |
| | EtherCAT Slave | 3946R | NTECSNVR.NXF | |
| | EtherCAT Slave | ASCII | NTECSASC.NXF | |
| | EtherCAT Slave | Modbus RTU Master/Slave | NTECSMBR.NXF | |
| | EtherCAT Slave | Serial with netSCRIPT | NTECSNSC.NXF | |
| | EtherNet/IP Scanner | 3946R | NTEIMNVR.NXF | |
| | EtherNet/IP Scanner | ASCII | NTEIMASC.NXF | |
| | EtherNet/IP Scanner | Modbus RTU Master/Slave | NTEIMMBR.NXF | |
| | EtherNet/IP Scanner | Serial with netSCRIPT | NTEIMNSC.NXF | |
| | EtherNet/IP Adapter | 3946R | NTEISNVR.NXF | |
| | EtherNet/IP Adapter | ASCII | NTEISASC.NXF | |
| | EtherNet/IP Adapter | Modbus RTU Master/Slave | NTEISMBR.NXF | |
| | EtherNet/IP Adapter | Serial with netSCRIPT | NTEISNSC.NXF | |
| | Open Modbus/TCP | 3946R | NTOMBNVR.NXF | |
| | Open Modbus/TCP | ASCII | NTOMBASC.NXF | |
| | Open Modbus/TCP | Modbus RTU Master/Slave | NTOMBMBR.NXF | |
| | Open Modbus/TCP | Serial with netSCRIPT | NTOMBNSC.NXF | |
| | POWERLINK Controlled Node | 3946R | NTPLSNVR.NXF | |
| | POWERLINK Controlled Node | ASCII | NTPLSASC.NXF | |
| | POWERLINK Controlled Node | Modbus RTU Master/Slave | NTPLSMBR.NXF | |
| | POWERLINK Controlled Node | Serial with netSCRIPT | NTPLSNSC.NXF | |
| | PROFINET IO-Controller | 3946R | NTPNMNVR.NXF | |
| | PROFINET IO-Controller | ASCII | NTPNMASC.NXF | |
| | PROFINET IO-Controller | Modbus RTU Master/Slave | NTPNMMBR.NXF | |
| | PROFINET IO-Controller | Serial with netSCRIPT | NTPNMNSC.NXF | |
| | PROFINET IO-Device | 3946R | NTPNSNVR.NXF | |
| | PROFINET IO-Device | ASCII | NTPNSASC.NXF | |
| | PROFINET IO-Device | Modbus RTU Master/Slave | NTPNSMBR.NXF | |
| | PROFINET IO-Device | Serial with netSCRIPT | NTPNSNSC.NXF | |
| | Sercos Master | 3946R | NTS3MNVR.NXF | |
| | Sercos Master | ASCII | NTS3MASC.NXF | |
| | Sercos Master | Modbus RTU Master/Slave | NTS3MMBR.NXF | |
| | Sercos Master | Serial with netSCRIPT | NTS3MNSC.NXF | |
| | Sercos Slave | 3946R | NTS3SNVR.NXF | |
| | Sercos Slave | ASCII | NTS3SASC.NXF | |
| | Sercos Slave | Modbus RTU Master/Slave | NTS3SMBR.NXF | |
| | Sercos Slave | Serial with netSCRIPT | NTS3SNSC.NXF | |

*Table 23: NT 100 for the conversion "Ethernet to Serial"*

### 3.3.3 Protocol conversion 3: Fieldbus to Fieldbus

The netTAP device connects Fieldbus (connector X2) and Fieldbus (connectorX3). The following devices support that:

| NT 100 device type | Protocol to X2 | Protocol to X3 | Firmware file | Firmware version |
|---|---|---|---|---|
| NT 100-CO-CC | CANopen Master | CC-Link Slave | NTCOMCCS.NXF | 2.0 |
| | CANopen Slave | CC-Link Slave | NTCOSCCS.NXF | |
| NT 100-CO-CO | CANopen Master | CANopen Slave | NTCOMCOS.NXF | |
| | CANopen Slave | CANopen Master | NTCOSCOM.NXF | |
| | CANopen Slave | CANopen Slave | NTCOSCOS.NXF | |
| NT 100-CO-DN | CANopen Master | DeviceNet Slave | NTCOMDNS.NXF | |
| | CANopen Slave | DeviceNet Master | NTCOSDNM.NXF | |
| | CANopen Slave | DeviceNet Slave | NTCOSDNS.NXF | |
| NT 100-CO-DP | CANopen Master | PROFIBUS DP Slave | NTCOMDPS.NXF | |
| | CANopen Slave | PROFIBUS DP Master | NTCOSDPM.NXF | |
| | CANopen Slave | PROFIBUS DP Slave | NTCOSDPS.NXF | |
| NT 100-DP-CC | PROFIBUS DP Master | CC-Link Slave | NTDPMCCS.NXF | 2.0 |
| | PROFIBUS DP Slave | CC-Link Slave | NTDPSCCS.NXF | |
| NT 100-DP-CO | PROFIBUS DP Master | CANopen Slave | NTDPMCOS.NXF | |
| | PROFIBUS DP Slave | CANopen Master | NTDPSCOM.NXF | |
| | PROFIBUS DP Slave | CANopen Slave | NTDPSCOS.NXF | |
| NT 100-DP-DN | PROFIBUS DP Master | DeviceNet Slave | NTDPMDNS.NXF | |
| | PROFIBUS DP Slave | DeviceNet Master | NTDPSDNM.NXF | |
| | PROFIBUS DP Slave | DeviceNet Slave | NTDPSDNS.NXF | |
| NT 100-DP-DP | PROFIBUS DP Master | PROFIBUS DP Slave | NTDPMDPS.NXF | |
| | PROFIBUS DP Slave | PROFIBUS DP Master | NTDPSDPM.NXF | |
| | PROFIBUS DP Slave | PROFIBUS DP Slave | NTDPSDPS.NXF | |
| NT 100-DN-CC | DeviceNet Master | CC-Link Slave | NTDNMCCS.NXF | 2.0 |
| | DeviceNet Slave | CC-Link Slave | NTDNSCCS.NXF | |
| NT 100-DN-CO | DeviceNet Master | CANopen Slave | NTDNMCOS.NXF | |
| | DeviceNet Slave | CANopen Master | NTDNSCOM.NXF | |
| | DeviceNet Slave | CANopen Slave | NTDNSCOS.NXF | |
| NT 100-DN-DN | DeviceNet Master | DeviceNet Slave | NTDNMDNS.NXF | |
| | DeviceNet Slave | DeviceNet Master | NTDNSDNM.NXF | |
| | DeviceNet Slave | DeviceNet Slave | NTDNSDNS.NXF | |
| NT 100-DN-DP | DeviceNet Master | PROFIBUS DP Slave | NTDNMDPS.NXF | |
| | DeviceNet Slave | PROFIBUS DP Master | NTDNSDPM.NXF | |
| | DeviceNet Slave | PROFIBUS DP Slave | NTDNSDPS.NXF | |

*Table 24: NT 100 for the conversion "Fieldbus to Fieldbus"*

### 3.3.4 Protocol conversion 4: Fieldbus to Serial

The netTAP device connects Fieldbus (connector X2) and Serial (connectorX3). The following devices support that:

| NT 100 device type | Protocol to X2 | Protocol to X3 | Firmware file | Firmware version |
|---|---|---|---|---|
| NT 100-CO-RS | CANopen Master | 3946R | NTCOMNVR.NXF | 2.0 |
| | CANopen Master | ASCII | NTCOMASC.NXF | |
| | CANopen Master | Modbus RTU Master/Slave | NTCOMMBR.NXF | |
| | CANopen Master | Serial with netSCRIPT | NTCOMNSC.NXF | |
| | CANopen Slave | 3946R | NTCOSNVR.NXF | |
| | CANopen Slave | ASCII | NTCOSASC.NXF | |
| | CANopen Slave | Modbus RTU Master/Slave | NTCOSMBR.NXF | |
| | CANopen Slave | Serial with netSCRIPT | NTCOSNSC.NXF | |
| NT 100-DP-RS | PROFIBUS DP Master | 3946R | NTDPMNVR.NXF | 2.0 |
| | PROFIBUS DP Master | ASCII | NTDPMASC.NXF | |
| | PROFIBUS DP Master | Modbus RTU Master/Slave | NTDPMMBR.NXF | |
| | PROFIBUS DP Master | Serial with netSCRIPT | NTDPMNSC.NXF | |
| | PROFIBUS DP Slave | Modbus RTU Master/Slave | NTDPSMBR.NXF | |
| | PROFIBUS DP Slave | 3946R | NTDPSNVR.NXF | |
| | PROFIBUS DP Slave | ASCII | NTDPSASC.NXF | |
| | PROFIBUS DP Slave | Serial with netSCRIPT | NTDPSNSC.NXF | |
| NT 100-DN-RS | DeviceNet Master | 3946R | NTDNMNVR.NXF | 2.0 |
| | DeviceNet Master | ASCII | NTDNMASC.NXF | |
| | DeviceNet Master | Modbus RTU Master/Slave | NTDNMMBR.NXF | |
| | DeviceNet Master | Serial with netSCRIPT | NTDNMNSC.NXF | |
| | DeviceNet Slave | 3946R | NTDNSNVR.NXF | |
| | DeviceNet Slave | ASCII | NTDNSASC.NXF | |
| | DeviceNet Slave | Modbus RTU Master/Slave | NTDNSMBR.NXF | |
| | DeviceNet Slave | Serial with netSCRIPT | NTDNSNSC.NXF | |

*Table 25: NT 100 for the conversion "Fieldbus to Serial"*

# 3.4 Requirements

## 3.4.1 Requirements for operation

Mount the netTAP device on a DIN rail.

An external power supply is required. The voltage must be within the permissible range of 24 V DC ± 6 V DC. The power supply must provide at least 130 mA (at 24 V).

Power is supplied via connector X1.

**NOTICE**

**Device damage**

The supply voltage must not exceed 30 V, otherwise damage to the device is possible.

The permissible temperature range must be observed for operation.

For a correct operation of the netTAP, the following additional requirements must be met:

1. A suitable firmware must have been loaded into the device.
2. The netTAP must have been configured with SYCON.net without errors.

### 3.4.2 Configuration software requirements

- PC with 1 GHz processor or higher
- Windows® 7 (32-bit and 64-bit) SP1,
  Windows® 8 (32-bit and 64-bit),
  Windows® 8.1 (32-bit and 64-bit),
  Windows® 10 (32-bit and 64-bit)
- Administrator rights are required for installation
- Internet Explorer 5.5 or higher
- RAM: At least 512 MB, recommended 1024 MB
- Free hard disk space: Approx. 400 MB
- Resolution: At least 1024 x 768 pixels
- Keyboard and mouse
- USB
- Restriction: Touch screen is not supported

**Note:**

If the project file is used on another PC,

- ➢ this PC must also meet the system requirements listed above,
- ➢ the device description files of the devices used in the project must be imported into the configuration software SYCON.net on the new PC, and
- ➢ the DTMs of the devices used in the project must also be installed on this additional PC.

## 3.5 Licenses

For using a firmware with master functionality, the netTAP device must have a master license . To read out and display whether the device has a master license, use the software SYCON.net.

**Note:**
To read out whether the device has a master license, a firmware must be loaded in the device. The base firmware is not sufficient for this purpose. The operating instruction manual *Gateway and Proxy Device Configuration OI xx EN.pdf* describes how to load a firmware into the device and how to read out whether the device contains a master license.

The master license can be ordered subsequently and transferred into the device using the software SYCON.net. Use SYCON.net to read the necessary ordering data from the device and to prepare the order.

The order name of the master license is: NXLIC-MASTER, part number: 8211.000

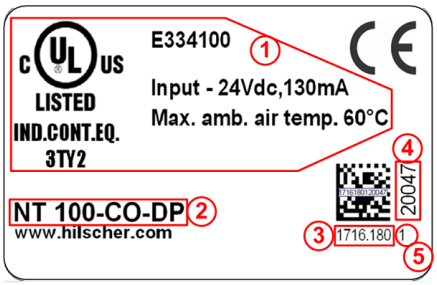
# 4 Device drawings and connectors

## 4.1 Dimensional drawings

Provide sufficient headroom to allow the removal of the power supply connector from above.

The power supply plug is included within the delivery. As a spare part, the plug can be ordered from RIA connect GmbH in 78176 Blumberg; part number: 31369102-001792.

## 4.2 Device label




(1) UL certification data, see http://www.ul.com
(2) Device type name
(3) Part number
(4) Serial number
(5) Hardware revision

*Table 26: Device label*

# 4.3 LEDs and control elements

## 4.3.1 LEDs and control elements of the upper half of the device

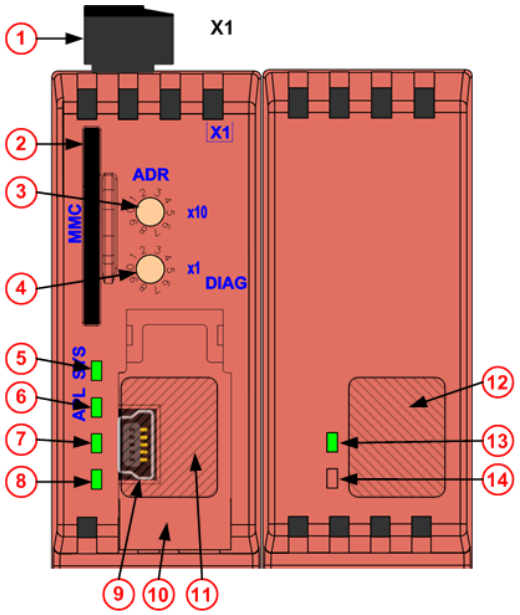



*Figure 4: LEDs and control elements (upper half of the device)*

| Pos. | Description | |
|---|---|---|
| (1) | Connector X1, power supply | |
| (2) | Slot for SD/MMC memory card (article number of SD card: 1719.003) | |
| (3) | Address switch, factor 10. | From SYCON.net version 1.351, the address switches can be activated and from firmware version 1.5 they can be used for PROFIBUS DP slave, DeviceNet slave, CANopen slave, and CC-Link slave. SYCON.net serves to configure whether the address switches are active for X2 or X3 . Section *Value range of the address switches* [ page 31] describes the value range for each protocol. |
| (4) | Address switch, factor 1. | |
| (5) | SYS LED | |
| (6) | APL LED | |
| (7) | LED, meaning depends on the protocol at X2. | |
| (8) | LED, meaning depends on the protocol at X2. | |
| (9) | Mini-USB connector under the cover flap | |
| (10) | Cover flap for mini-USB connector | |
| (11) | Position for protocol-dependent label for the protocol at connector X2 on the cover flap of the USB connector. | |
| (12) | Position for protocol-dependent label for the protocol at connector X3. | |
| (13) | LED, meaning depends on the protocol at X3. | |
| (14) | LED, meaning depends on the protocol at X3. | |

*Table 27: LEDs and control elements (upper half of the device)*

#### 4.3.1.1 Value range of the address switches

The following tables for PROFIBUS DP slave, DeviceNet slave, CANopen slave and CC-Link slave specify the value range of the address switches.

| Protocol | Valid range of values |
|---|---|
| PROFIBUS DP Slave | 0 … 99 (station address) |
| DeviceNet Slave | 0 … 63 (MAC ID) |
| CANopen Slave | 0 … 99 (node address) |

*Table 28: Value range of the address switches*

| Protocol | Valid range of values | Number of stations | |
|---|---|---|---|
| CC-Link Slave | 1 … 64 | 1 | The number of stations depends on the configuration. |
| | 1 … 63 | 2 | |
| | 1 … 62 | 3 | |
| | 1 … 61 | 4 | |

*Table 29: Value range of the address switches (CC-Link slave)*

### 4.3.2 LEDs of the lower half of the device

The lower half of the device has no control elements. Device type NT 100-RE-XX (real-time Ethernet) has LEDs at connector X2 on the left side. The meaning of the LEDs depends on the protocol.

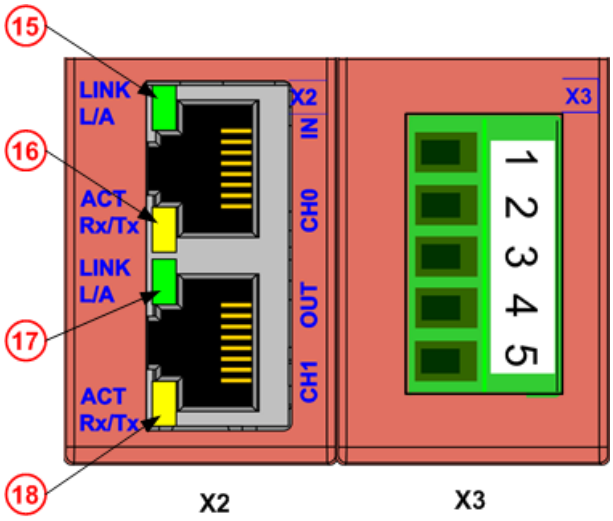



*Figure 5: LEDs (lower half of the device)*

| Pos. | Description |
|---|---|
| (15) | LINK LED (link) / L/A LED (link and activity) on channel 0 at X2, green. |
| (16) | ACT LED (activity) / Rx/Tx LED (activity) on channel 0 at X2, yellow. |
| (17) | LINK LED (link) / L/A LED (link and activity) on channel 1 at X2, green. |
| (18) | ACT LED (activity) / Rx/Tx LED (activity) on channel 1 at X2, yellow. |

*Table 30: LEDs (lower half of the device)*

## 4.4 Device drawings: Left side (connector X2)

The figures in the following table show the left side of a netTAP device with connector X2.

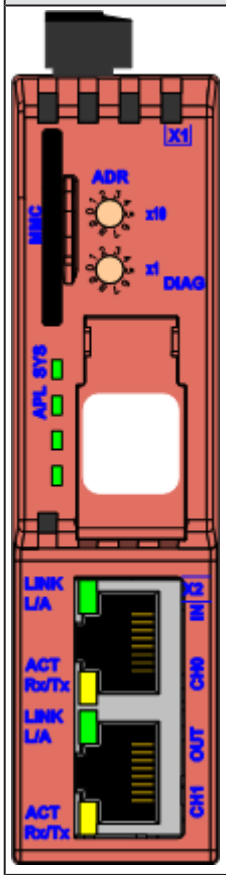
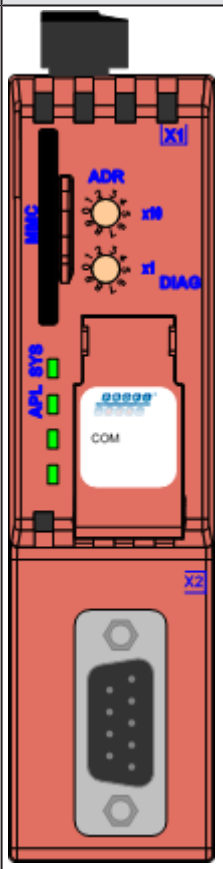
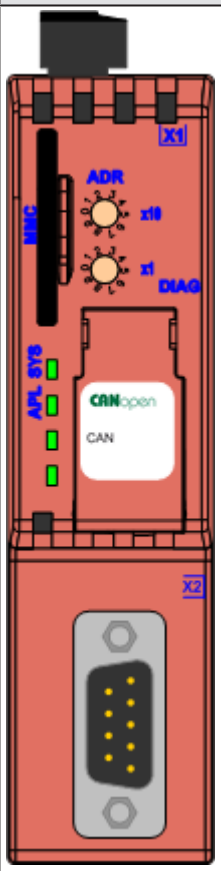
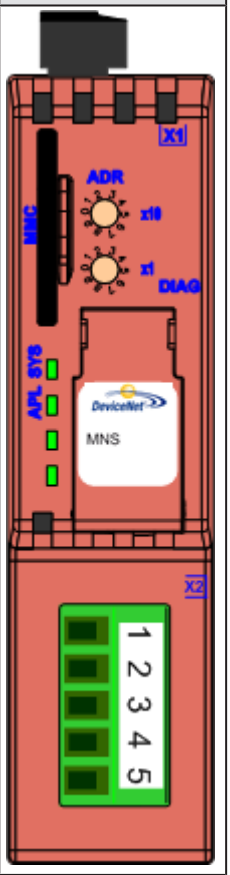
| NT 100-RE-XX | NT 100-DP-XX | NT 100-CO-XX | NT 100-DN-XX |
|---|---|---|---|
|  |  |  |  |
| X2 2*RJ45 socket | X2 D-Sub socket, 9-pin | X2 D-Sub plug, 9-pin | Mini-COMBICON, 5-pin |
| Included in device: | | | |
| NT100-RE-DP<br>NT100-RE-CO<br>NT100-RE-DN<br>NT100-RE-RS<br>NT100-RE-CC | NT100-DP-DP<br>NT100-DP-CO<br>NT100-DP-DN<br>NT100-DP-RS<br>NT100-DP-CC | NT100-CO-DP<br>NT100-CO-CO<br>NT100-CO-DN<br>NT100-CO-RS<br>NT100-CO-CC | NT100-DN-DP<br>NT100-DN-CO<br>NT100-DN-DN<br>NT100-DN-RS<br>NT100-DN-CC |

*Table 31: Device drawings (left side, X2)*

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

| PROFINET | EtherCAT | EtherNet/IP | Sercos | Open Modbus | POWERLINK |
|---|---|---|---|---|---|
| SF<br>BF | RUN<br>ERR | MS<br>NS | STA<br>ERR | RUN<br>ERR | BS<br>BE |

*Table 32: LED label (Real-Time Ethernet)*

The LED stickers are included within the delivery. Apply the LED sticker according to the firmware loaded.

## 4.5 Device drawings: Right side (connector X3)

The figures in the following table show the right side of a netTAP device with connector X3.

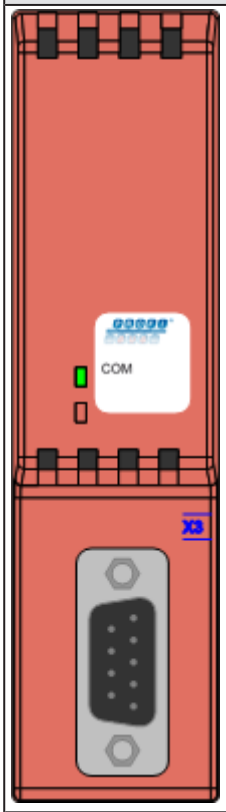
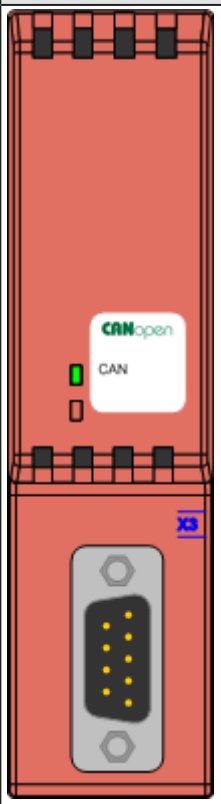
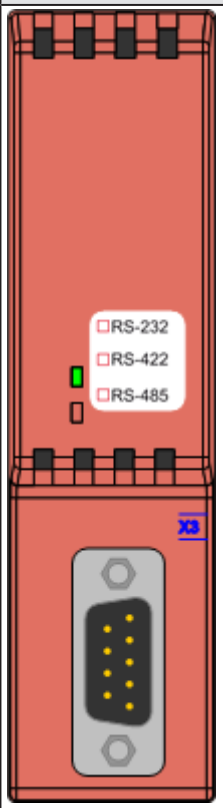
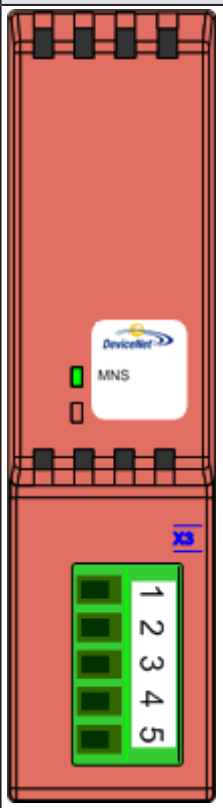
| NT 100-XX-DP | NT 100-XX-CO | NT 100-XX-RS | NT 100-XX-DN | NT 100-XX-CC |
|---|---|---|---|---|
|  |  |  |  |  |
| X3: D-Sub socket, 9-pin | X3: D-Sub plug, 9-pin | X3: D-Sub plug, 9-pin | X3: COMBICON , 5-pin | X3: COMBICON , 5-pin |
| Included in device: | | | | |
| NT100-RE-DP<br>NT100-DP-DP<br>NT100-CO-DP<br>NT100-DN-DP | NT100-RE-CO<br>NT100-DP-CO<br>NT100-CO-CO<br>NT100-DN-CO | NT100-RE-RS<br>NT100-DP-RS<br>NT100-CO-RS<br>NT100-DN-RS | NT100-RE-DN<br>NT100-DP-DN<br>NT100-CO-DN<br>NT100-DN-DN | NT100-RE-CC<br>NT100-DP-CC<br>NT100-CO-CC<br>NT100-DN-CC |

*Table 33: Device drawings (right side, X3)*

# 4.6 Connectors and interfaces

## 4.6.1 X1 power supply

The netTAP devices are supplied via connector X1. The supply voltage must be between 18 V and 30 V DC. The plug is included within the delivery.

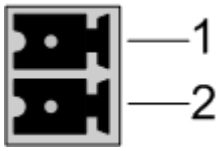
| Power supply | Pin | Signal | Description |
|---|---|---|---|
|  Mini Combicon | 1 | 0 V / GND | GND of the power supply,<br>4 * 10 nF against PE |
| | 2 | +24 V DC | +24 V DC power supply |

*Table 34: Power supply*

## 4.6.2 X2/X3 Front connectors

### 4.6.2.1 X2/X3 PROFIBUS interface

The PROFIBUS (X2/X3) is designed as an RS-485 interface according to the PROFIBUS standard EN 50170.

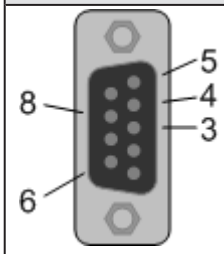
| PROFIBUS | Pin | Signal | Description |
|---|---|---|---|
|  D-Sub socket, 9-pin | 3 | Rx/Tx+ | Receive/send data, positive |
| | 4 | CNTR-P | Control signal for repeater (direction control) |
| | 5 | ISO_GND | Data reference potential |
| | 6 | VP | Voltage for terminating resistor 5 V, max. current: 100 mA |
| | 8 | Rx/Tx | Receive/transmit data, negative |
| | Shield | PE | Metal shell |

*Table 35: PROFIBUS interface (RS-485)*

Inside the device, a pull-up resistor of 100 kΩ is connected to "Rx/Tx+".

Inside the device, a pull-down resistor of 100 kΩ is connected to "Rx/Tx-".

### 4.6.2.2 X2/X3 CANopen interface

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

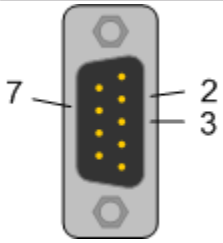
| CANopen | Pin | Signal | Description |
|---|---|---|---|
|  D-Sub plug, 9-pin | 2 | CAN L | CAN_L bus line |
| | 3 | ISO_GND | CAN reference potential |
| | 7 | CAN H | CAN_H bus line |
| | 1, 4, 5, 6, 8, 9 | - | **Important note and strongly recommended:** Leave these pins unconnected! Otherwise there is a high risk of a device damage. |
| | Shield | PE | Metal shell on PE |

*Table 36: CANopen interface (ISO 11898)*

### 4.6.2.3 X2/X3 DeviceNet interface

The DeviceNet interface X2/X3 is designed according to the DeviceNet standard.

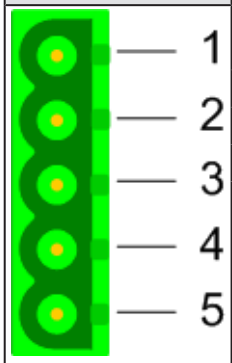
| DeviceNet | Pin | Signal | Description |
|---|---|---|---|
|  COMBICON socket | 1 | ISO GND | DeviceNet reference potential, 15 nF against PE |
| | 2 | CAN L | CAN Low signal |
| | 3 | Drain | Shield, 15 nF against PE |
| | 4 | CAN H | CAN High signal |
| | 5 | V+ | +24 V DeviceNet power supply |

*Table 37: DeviceNet interface*

### 4.6.2.4 X2 Ethernet interface

For the Ethernet interface, use RJ45 plug and a twisted pair cable of category 5 (CAT5), or higher, which consists of 4 pairs of twisted wires with a max. baud rate of 100 MBit/s (CAT5).

**Note:**
The device supports the Auto Crossover function and can therefore switch RX and TX. The following figure shows the RJ45 standard pin assignment.

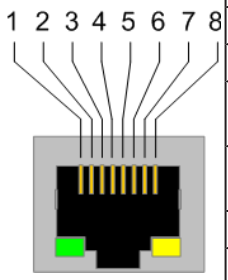
| Ethernet | Pin | Signal | Description |
|---|---|---|---|
|  RJ-45 socket | 1 | TX+ | Transmit data positive |
| | 2 | TX– | Transmit data negative |
| | 3 | RX+ | Receive data positive |
| | 4 | - | Connected and terminated to PE via RC combination* |
| | 5 | - | Connected and terminated to PE via RC combination* |
| | 6 | RX– | Receive data negative |
| | 7 | - | Connected and terminated to PE via RC combination* |
| | 8 | - | Connected and terminated to PE via RC combination* |
| | - | PE | Metal shell on PE |
| | - | - | * Bob Smith Termination |

*Table 38: RJ45 Ethernet interface*

### 4.6.2.5 X3 CC-Link interface

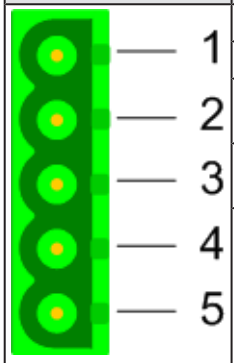
| CC-Link | Pin | Signal | Description |
|---|---|---|---|
|  COMBICON socket | 1 | DA | Data positive |
| | 2 | DB | Data negative |
| | 3 | DG | Data ground, on ISO_GND, 3.3 nF against PE |
| | 4 | SLD | Shield, pin 4 and 5 are internally connected |
| | 5 | FG | Field ground, pin 4 und 5 are internally connected to PE |

*Table 39: CC-Link interface*

### 4.6.2.6 X3 Serial interface – RS-232 / RS-422 / RS-485

The configuration of the serial interface determines whether X3 is an RS-232, RS-422 or RS-485 interface.

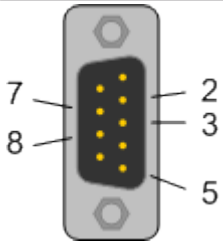
| RS-232 | Pin | Signal | Description |
|---|---|---|---|
|  D-Sub plug, 9-pin | 2 | RxD | Receive data |
| | 3 | TxD | Transmit data |
| | 5 | ISO_GND | Reference potential |
| | 7 | RTS | Request to send |
| | 8 | CTS | Clear to send |
| | Shield | PE | Metal shell on PE |

*Table 40: RS-232 interface*

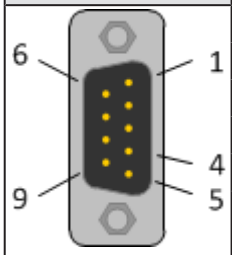
| RS-422 | Pin | Signal | Description |
|---|---|---|---|
|  D-Sub plug, 9-pin | 1 | RxD - | Receive data negative |
| | 4 | TxD + | Send data positive |
| | 5 | ISO_GND | Reference potential |
| | 6 | RxD + | Receive data positive |
| | 9 | TxD - | Send data negative |
| | Shield | PE | Metal shell on PE |

*Table 41: RS-422 interface*

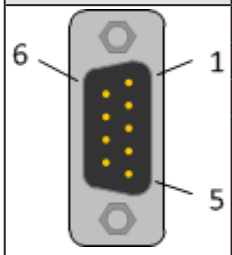
| RS-485 | Pin | Signal | Description |
|---|---|---|---|
|  D-Sub plug, 9-pin | 1 | RxD/TxD- | Receive/transmit data, negative |
| | 5 | ISO_GND | Reference potential |
| | 6 | RxD/TxD+ | Receive/send data, positive |
| | Shield | PE | Metal shell on PE |

*Table 42: RS-485 interface*

### 4.6.2.7 Termination for RS-422 and RS-485

The sliding switch (S3) on the backside of NT 100-XX-RS devices serves to activate or deactivate the termination.

| Switch S3 | | Description |
|---|---|---|
|  Switch in position On (up). | Switch up: **On** | Termination switched on with 220 Ohm termination resistor<br>for RS-422 between RxD+ and RxD- or<br>for RS-485 between RxD/TxD+ and RxD/TxD-<br>and 390 Ohm pull-up/pulldown resistor. |
| | Switch down: **Off** | Termination switched off. |

*Table 43: Termination for RS-422 and RS-485*

The following figure shows the RS-485 termination of the device.

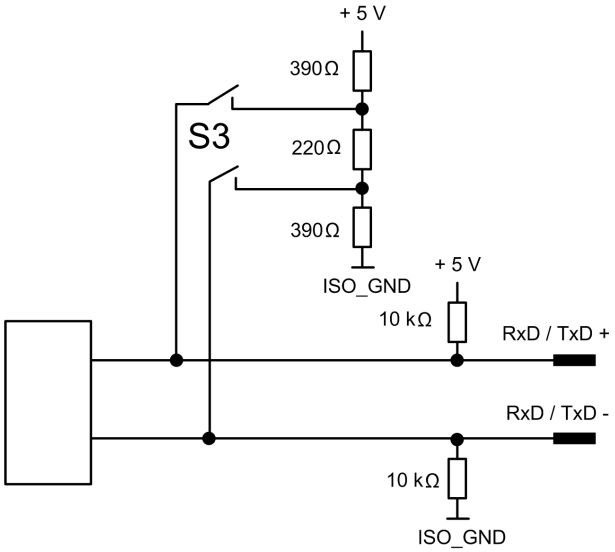



*Figure 6: RS-485 termination*

With the RS-422 interface, the termination shown above exists only at the RxD lines.

## 4.6.3 Diagnostic interface (Mini-B USB)

The USB interface serves configuration and diagnostic purposes.

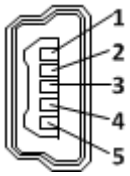
| USB | Pin | Signal | Description |
|---|---|---|---|
|  Mini-B USB 5-ping | 1 | n.c. | - |
| | 2 | D- | Data- |
| | 3 | D+ | Data+ |
| | 4 | ID | - |
| | 5 | GND | Reference potential |
| | Shield | PE | Metal shell on PE |

*Table 44: USB interface (Mini-B)*

## 4.7 Schematic diagrams - Galvanic Isolation

The following schematic diagrams show the connection between the different connectors of the device and enable you to properly integrate the device in accordance with the potential equalization and shielding concept of your plant.

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

### 4.7.1 Galvanic isolation in case of NT 100-RE-XX devices

The following figure is valid for the devices NT 100-RE-CC, NT 100-RE-CO, NT 100-RE-DP, NT 100-RE-DN, and NT 100-RE-RS.

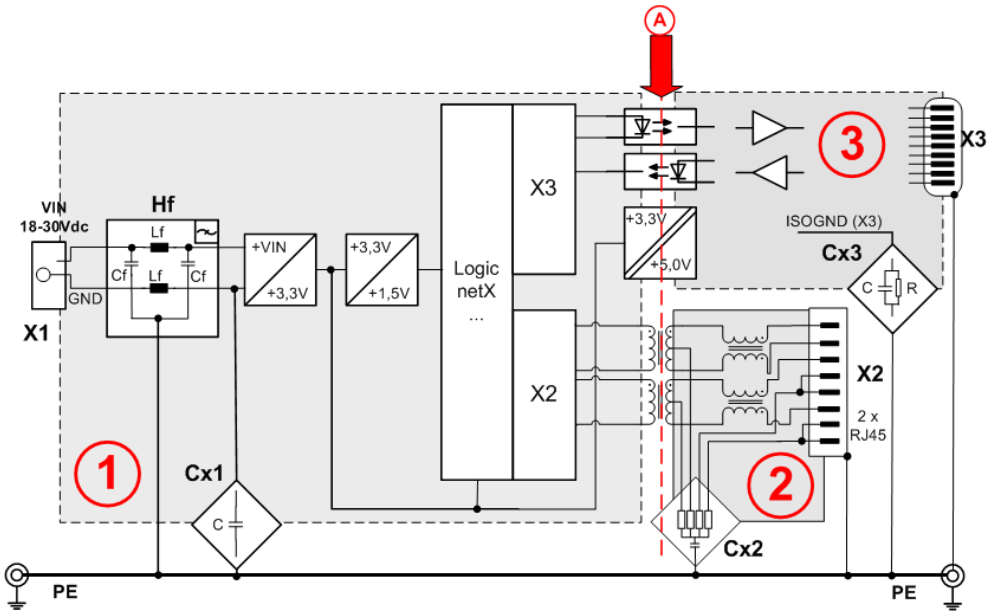



*Figure 7: Galvanic isolation in case of NT 100-RE-XX devices*

The device has three galvanically isolated areas. Arrow (A) shows the isolation to the connectors X2 and X3.

| Area | Description |
|---|---|
| (1) | System area, galvanically coupled with power supply connector X1. |
| (2) | Ethernet connecting area X2: 2 * RJ45.<br>The figure shows only one RJ45 socket. The second RJ45 socket is built up identically and connected to the logic (area X2). |
| (3) | Fieldbus connecting area X3: D-Sub-plug/socket or COMBICON connector. |

*Table 45: Areas*

The following table shows the data of the galvanic isolation and coupling against PE.

| Pos. | Connector | Galvanic isolation | Coupling against PE | Shield connection against PE |
|---|---|---|---|---|
| X1 (1) | - | no | Cx1: 4 * 10 nF 500 V<br>HF: Cf = 10 nF, Lf = 47 µH | - |
| X2 (2) | Ethernet | inductive | Cx2: 4 * 75 Ω, 1 nF 2000 V | directly via the metal connection of RJ-45 sockets |
| X3 (3) | CC-Link | inductive | Cx3: 3.3 nF 63 V | directly |
| | CANopen | optical | Cx3: 1 MΩ parallel to 15 nF 1000 V | directly |
| | PROFIBUS DP | inductive | Cx3: 1 MΩ parallel to 2.2 nF 1000 V | directly |
| | DeviceNet | optical | Cx3: 1 MΩ parallel to 15 nF 1000 V | 1 MΩ parallel to 15 nF 1000 V |
| | RS-232/422/485 | optical | Cx3: 1 MΩ parallel to 15 nF 1000V parallel to 10 nF 500 V | directly |

*Table 46: Coupling of NT 100-RE-XX devices*

## 4.7.2 Galvanic isolation in case of NT 100-DP-XX, NT 100-CO-XX, and NT 100-DN-XX devices

The following figure is valid for the devices

- 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.,

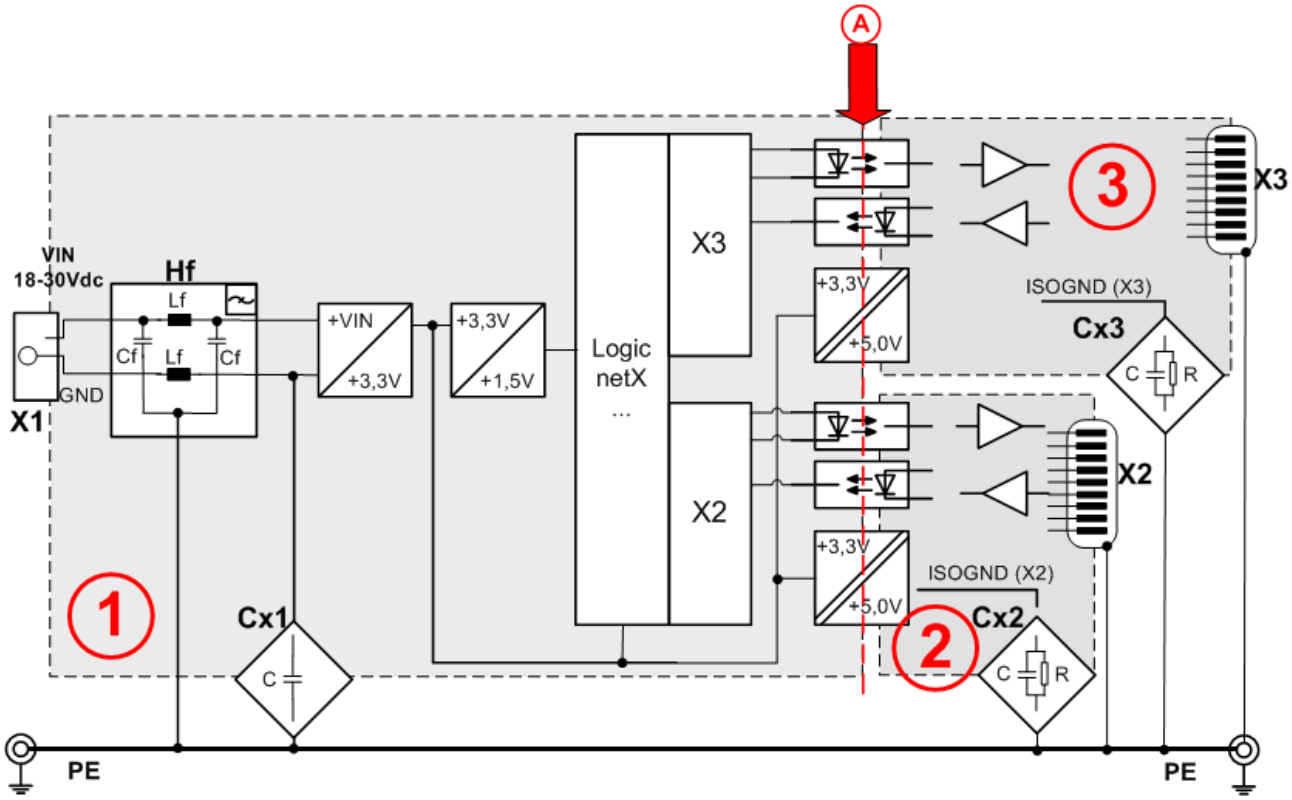



*Figure 8: Galvanic isolation NT 100-DP-XX / NT 100-CO-XX / NT 100-DN-XX devices*

The device has three galvanically isolated areas. Arrow (A) shows the isolation to the connectors X2 and X3.

| Area | Description |
|---|---|
| (1) | System area, galvanically coupled with power supply connector X1. |
| (2) | Fieldbus connecting area X2: D-Sub-plug/socket or COMBICON connector. |
| (3) | Fieldbus connecting area X3: D-Sub-plug/socket or COMBICON connector. |

*Table 47: Areas*

The following table shows the data of the galvanic isolation and coupling against PE.

| Pos. | Connector | Galvanic isolation | Coupling against PE | Shield connection against PE |
|---|---|---|---|---|
| X1 (1) | - | no | Cx1: 4 * 10 nF 500 V<br>HF: Cf = 10 nF, Lf = 47 µH | - |
| X2 (2) | CANopen | optical | Cx2: 1 MΩ parallel to 15 nF 1000 V | directly |
| | DeviceNet | optical | Cx2: 1 MΩ parallel to 15 nF 1000 V | 1 MΩ parallel to 15 nF 1000 V |
| | PROFIBUS DP | inductive | Cx2: 1 MΩ parallel to 2.2 nF 1000 V | directly |
| X3 (3) | CC-Link | inductive | Cx3: 3.3 nF 63 V | directly |
| | CANopen | optical | Cx3: 1 MΩ parallel to 15 nF 1000 V | directly |
| | DeviceNet | optical | Cx3: 1 MΩ parallel to 15 nF 1000 V | 1 MΩ parallel to 15 nF 1000 V |
| | PROFIBUS DP | inductive | Cx3: 1 MΩ parallel to 2.2 nF 1000 V | directly |
| | RS-232/422/485 | optical | Cx3: 1 MΩ parallel to 15 nF 1000V parallel to 10 nF 500 V | directly |

*Table 48: Galvanic isolation NT 100-DP-XX / NT 100-CO-XX / NT 100-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.

**NOTICE**

.

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).

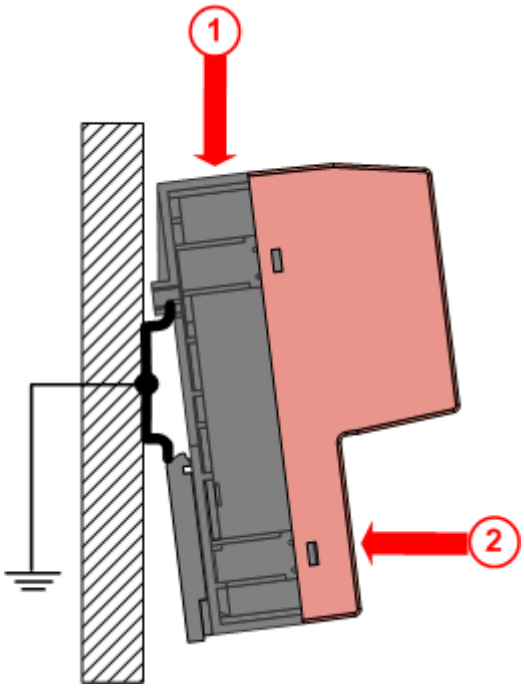



*Figure 9: Mounting the NT 100*

- Push the device onto the top hat rail from above (1).
- Then press the device against the mounting surface, according to arrow (2).
- 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 Dismounting the NT 100 from the DIN top hat rail

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

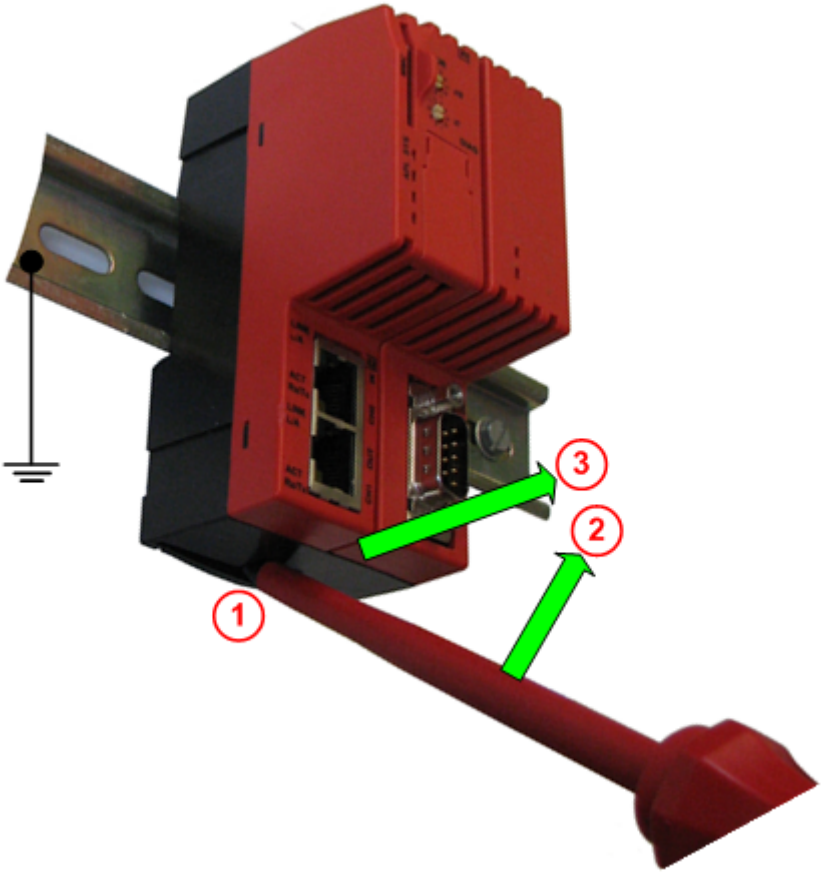



*Figure 10: Dismounting the NT 100 device from the DIN top hat rail*

- 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.
- Slightly press 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).

# 6 Installing the driver

For installing the USB driver, use the installation programm `Gateways_setup.exe` on the Gateway Solution DVD in the main directory. The programm checks whether the USB driver is installed or not.

At first, install the USB driver before you connect a netTAP device to the USB port of the PC for the first time.

# 7 Commissioning

## 7.1 Load firmware and configuration

The device is delivered without loaded firmware and without configuration. For commissioning it is necessary to load using the configuration software SYCON.net a firmware and a configuration into the device.

### 7.1.1 Download configuration files with the PC

Proceed as follows:

1. Create and save the configuration on a standard PC using the configuration software SYCON.net.
2. First, download the firmware via a USB connection into the device. The firmware has to be downloaded only once.
3. Afterwards, download the configuration via the USB connection into the device. Download the configuration again after each change.

The firmware and configuration is stored in a non-volatile memory in the device and will be available after each power on.

A step by step description is in the operating instruction manual Configuration of Gateway and Proxy Devices.

### 7.1.2 Transfer configuration using a memory card

#### 7.1.2.1 Prerequisite for memory cards

**Prerequisites**

1. A memory card with a maximum capacity of 2 GByte can be used.
2. The memory card has to be formatted in FAT format. The FAT12/16/32 formats are supported. The exFAT format is not supported.
3. Memory cards of the type MMC or SD card can be used. Additional prerequisites apply to use any SD card, which are described below.

**Prerequisites to use any SD card**

Any SD cards can only be used if **both** of the following prerequisites are fulfilled:

1. Firmware version 1.5.10.0 or higher has to be used in the device.
2. The following devices can be used with any MMC and SD card for saving and recovering the device:
   – NT 100-RE-XX with serial number 24906 and higher,
   – NT 100-DP-XX with serial number 21473 and higher,
   – NT 100-DN-XX with serial number 20283 and higher as well as
   – NT 100-CO-XX with serial number 20148 and higher.

Only the SD card which can be ordered from Hilscher (part number 1719.003) can be used reliable with devices that have a lower serial number.

#### 7.1.2.2 Steps to transfer configuration files from memory card

Using a memory card makes it possible to load the same configuration (and firmware) into several devices without using a PC. At first a PC and software SYCON.net is necessary to prepare the memory card.

1. Create and save the configuration on a standard PC using the software SYCON.net.
2. Transfer the configuration from the PC via a USB connection into the device.
3. Insert an empty but formatted memory card into the memory card slot of the netTAP device until it snaps in.
4. Use SYCON.net to copy the firmware and configuration inside the netTAP device to the memory card.
5. Remove the memory card from the device.
6. Insert this memory card into the memory card slot (labeled MMC) of the new device. This device continues its operation with the firmware and configuration, which is stored in the device in the non-volatile Flash memory.
7. Remove the power supply from the device.
8. Reconnect the power supply. After return of power the files from the memory card are copied into the non-volatile Flash memory of the device (this operation takes a moment) and then the device starts with it.
9. Remove the memory card from the device to have a faster start of the device for the next power on, because the copy operation is not done.

## 7.2 Start-up behavior

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

### 7.2.1 Start-up without memory card

After return of power supply the configuration data are loaded into the device internal memory. Depending on the amount of stored configuration da-ta this can last for some seconds (approx. 4 s).

### 7.2.2 Start-up with memory card

This section describes the take-over of the configuration data from memory card.

**Important:**

Two parameters are displayed in SYCON.net software for the start behavior in case of repowering the device and memory 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 memory card are transferred into the device. However it is possible to copy the files from memory card to the device with SYCON.net software (manually).

The following description refers to the parameter start behavior **Every Start** of the memory card.

- ➢ Remove power supply from the netTAP NT 100 device.
- ➢ Insert memory card with until it snaps in.
- ➢ 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 memory card can be removed from the device to prevent the data transfer.
- ↬ Afterwards the files were transferred from the memory 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 memory card into several devices without using a PC.

### 7.2.3 Reset device to factory settings with memory card

Using a memory card that has the basic firmware stored on it, the netTAP NT 100 device can be set back to factory settings.

**Create a memory card**

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

```
Supplements & Examples\Device Recovery\netTAP 100 Factory Settings
\Recovery via Memory Card\
```

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

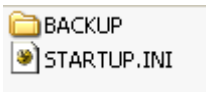



*Figure 11: Files for farctory settings*

**Proceed as follows**

- ➢ Insert the memory card with basic firmware until it snaps in.
- ➢ Insert the memory card with basic firmware until it snaps in.
- ➢ 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 using a PC. The configuration steps are described in document Configuration of Gateway and Proxy Devices.

### 7.2.4 Boot-up behaviour on invalid firmware

If after the power up cycle the LED SYS (Pos. (5) in section *LEDs and control elements* [▷ page 30] ) yellow / green with approx. 1 Hz, the firmware of the device is invalid or has been destroyed. In this case there is no further access possible with the configuration tool SYCON.net. The device has fallen back into boot loader mode.

The device has to be recovered to the factory default settings.

#### 7.2.4.1 Recover to factory default settings via USB

The following devices are recoverable via USB:

- NT 100-RE-XX serial number 20888 and above.
- NT 100-DP-XX serial number 20397 and above.
- NT 100-DN-XX serial number 20145 and above.
- NT 100-CO-XX serial number 20060 and above.

Devices with serial numbers below cannot be updated via USB and are remaining recoverable with memory card only. See section *Gerät mit Speicherkarte auf Werkseinstellung zurücksetzen* [page 49] .

In case there is no further communication possible via and the configuration tool SYCON.net because a firmware download has failed for example, then a special recovery procedure can bring back the device back to life.

In this special state the LED SYS (Pos. (5) in section *LEDs and control elements* [page 30] ) yellow / green with approx. 1 Hz.

In case a NT 100 device is connected in this very special state to the USB port of a PC, windows will ask for a new USB driver, even if you have already installed it before. Please follow the instructions in the section *Installation des USB-Treibers für den “Hilscher netX boot monitor“* [page 51] .

Just in the case that no driver installation is requested (cause the device has been previously connected in this state before already) please follow the in-structions in the section *Firmware Laden* [page 54] .

### 7.2.4.2 USB driver installation in boot loader mode as „Hilscher netX boot monitor“

**Note:**
The following section only need to be done in case of an error, if the firm-ware download into the devices was not completed without error. (Loss of power or line interruption during the firmware download).

After establishing the USB cable connection and powering the device, windows will ask you for the USB driver with the following window:

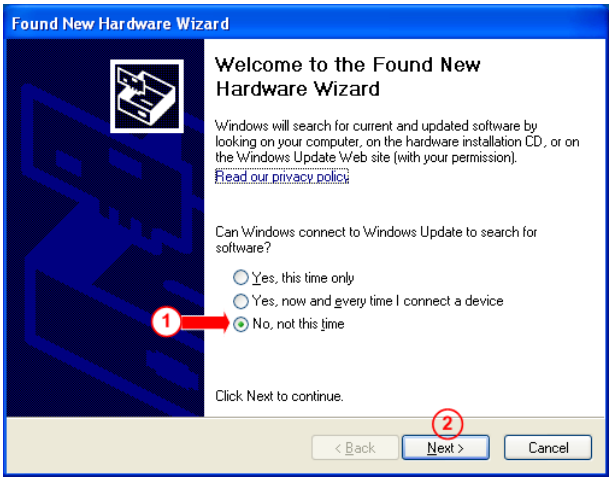



*Figure 12: USB installation - Step 1*

- ➢ Insert the DVD included in the delivery into the DVD drive of your PC.
- ➢ Select **No, not this time** (1) . Afterwards click **Next** (2) .
- ➢ The following window will be opened.

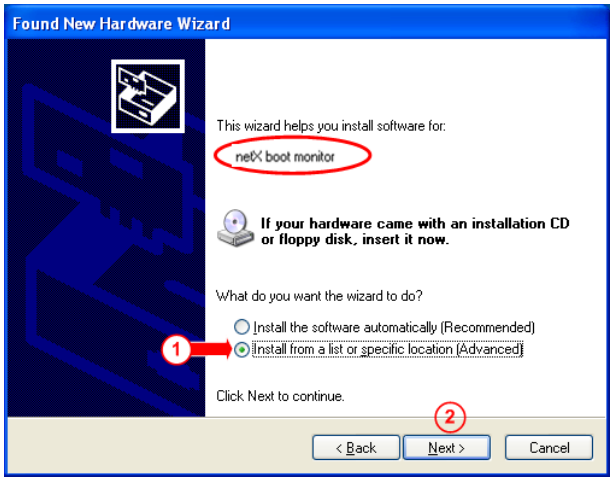



*Figure 13: USB installation - Step 2*

- ➢ Select **Install from a list or specific location** (1) and then click **Next** (2) .

The following window will be opened.

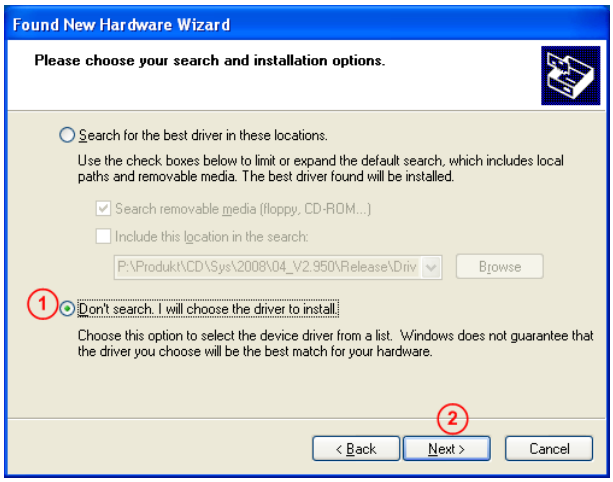



*Figure 14: USB installation - Step 3*

➢ Select **Don’t search** (1) and then click **Next** (2) .

The following window will be opened.

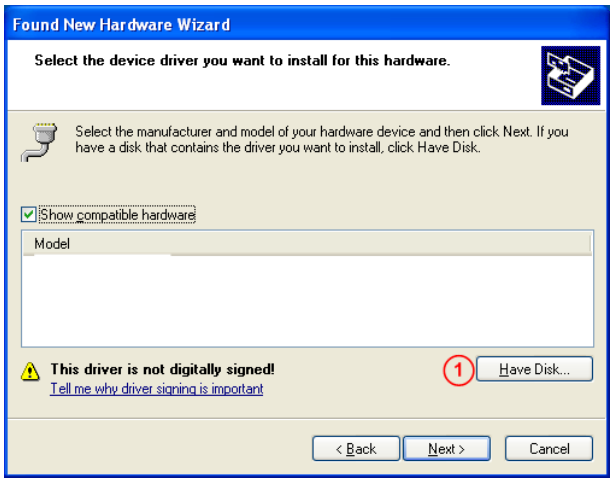



*Figure 15: USB installation - Step 4*

➢ Select **Have Disk** (1) .

The following window will be opened.

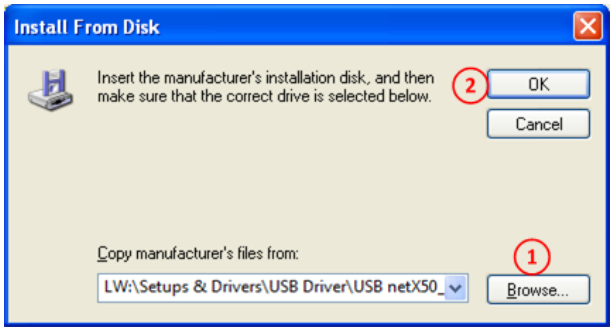



*Figure 16: USB installation - Step 5*

➢ Select **Browse** (1) .

➢ In the opening file explorer move to the DVD folder `Setups & Drivers\USB Driver\USB netX50_51_52 and netX100`
and select the file `netX_usb_cdc.inf`.

➢ After returning to this window, click **OK** (2) .

↬ You will return back to the following window.

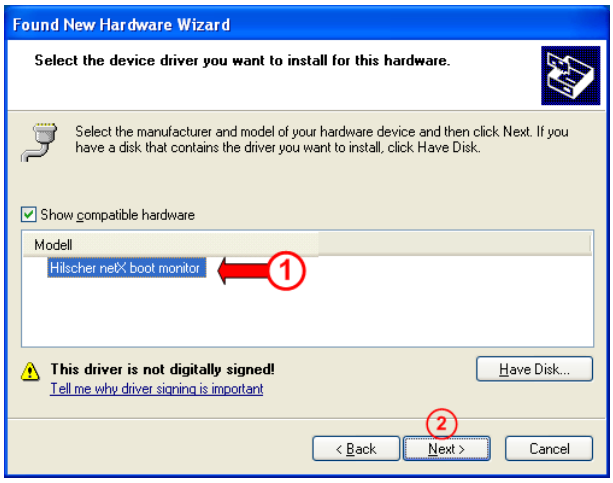



*Figure 17: USB installation - Step 6*

➢ Select **Hilscher netX boot monitor** (1) (even if there are other entries shown, please select this one) and click **Next** (2) .

↬ The following window will be opened.

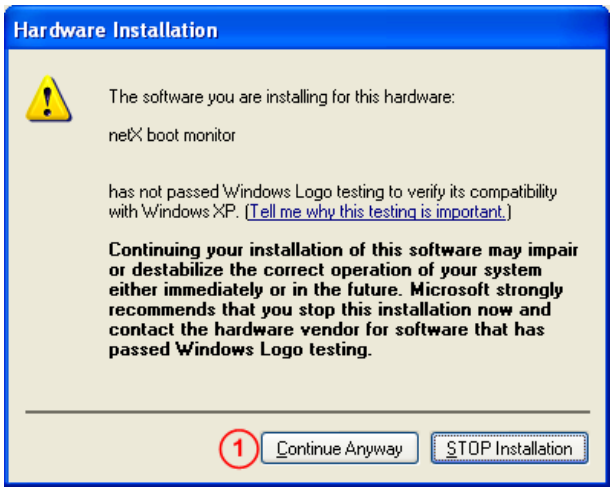



*Figure 18: USB Installation Schritt 7*

➢ Click **Continue Anyway** (1).

➢ Wait until the driver has been installed.

➢ Continue with section *Firmware Laden* [page 54].

### 7.2.4.3 Loading firmware

- Start directly from the DVD `Supplements & Examples\Device Recovery\netTAP 100 Factory Settings\Recovery via USB \comproX.exe .`
- Alternatively, copy all files from `Supplements & Examples\Device Recovery\netTAP 100 Factory Settings\Recovery via USB` onto your PC and then start `comproX.exe`.
- The following window will be opened.

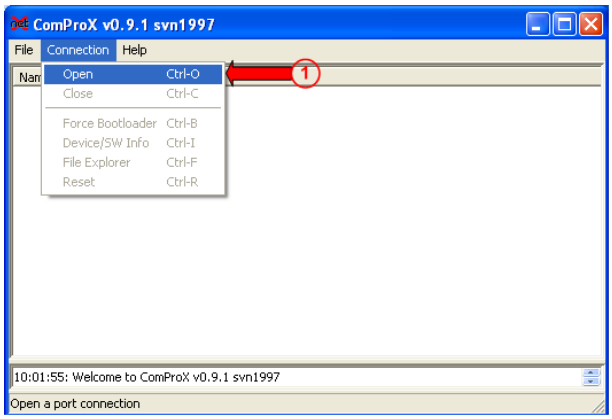



*Figure 19: ComProX Start*

- Select the drop down menu **Connection > Open** (1).
- The following window will be opened.

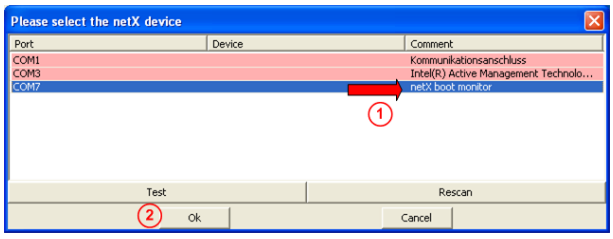



*Figure 20: ComProX select connection*

- Click **netX boot monitor** (1) and confirm with **OK** (2).
- You are forwarded to the program's start screen.

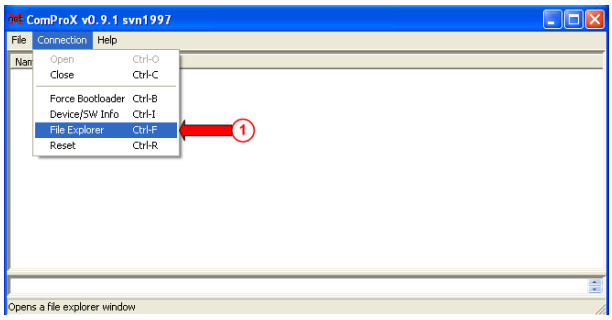



*Figure 21: ComProX File Explorer*

➢ Select now from the drop down menu **Connection > File Explorer** (1).

➧ The following additional windows will be opened.

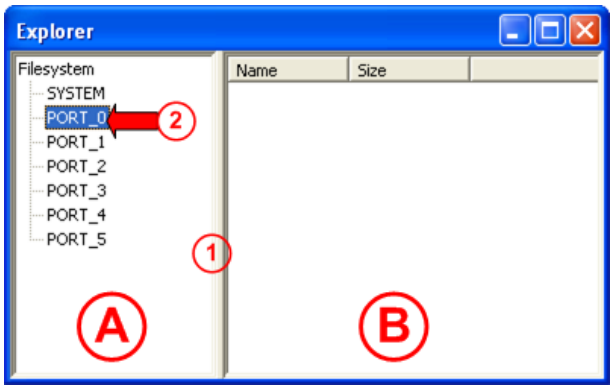



*Figure 22: ComProX File Explorer, NT 100 file structure*

➢ In order to see the file system of the device in the window area (A) move the dividing line (1) slightly to the right.

➢ Select in the window area (A) the entry **PORT_0** (2). Then do a right mouse click afterwards in the window area (B) .

➧ The following dialog menu will be opened.

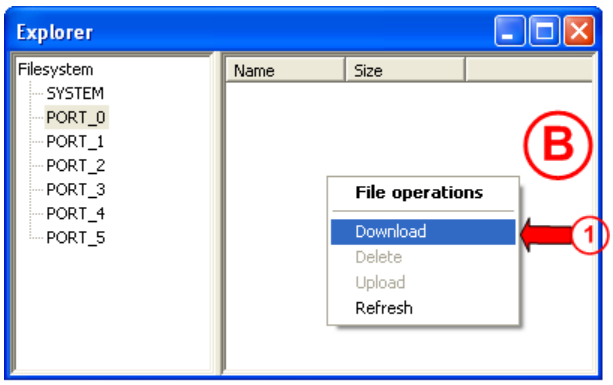



*Figure 23: ComProX File Explorer, file menu 1*

➢ Select **Download** (1) .

➧ The standard file explorer of your windows will be opened.

➢ Move on the DVD to folder
`Supplements & Examples\Device Recovery\netTAP 100 Factory Settings\Recovery via USB`
file `NTBASEFW.NXF`. Click **Open**.

➧ Loading the firmware may take some seconds.

➢ Right mouse click into the window area (B).

The following dialog menu will be opened.

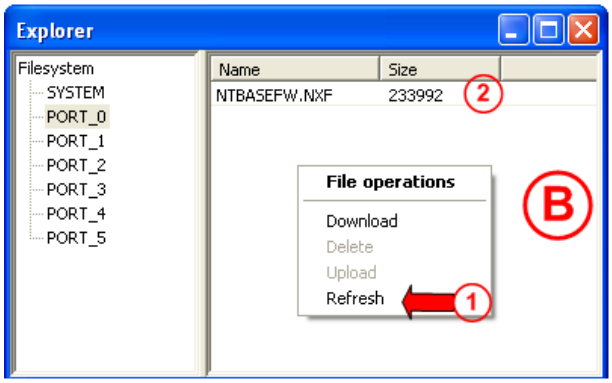



*Figure 24: ComProX File Explorer, file menu 2*

- Select **Refresh** (1) .
- In case the download was successful ComProX will show the downloaded firmware as shown at (2).
- Close the window above and close the main window of ComProX.
- Remove the power from your device and perform a power cycle.
- The device will be restarted and the firmware will be started. Now the LED SYS (Pos. (5) in section *LEDs and control elements* [page 30] ) will be on green and the LED APL (Pos. (6) ) blinks red.

The reset to factory settings has successfully been executed. Now you can access to the device again with the configuration tool SYCON.net via the USB port. From there you can now download the firmware of your choice.

# 8 Troubleshooting

## 8.1 Troubleshooting tips

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.

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30]. The number in the LED state column shows the position of the LED in the device drawing.

| LED status | Remedy |
|---|---|
| No LED is on | The device is not powered or the device has a malfunction and needs replacement. |
| SYS LED (5) blinks yellow/green with 1 Hz | After a power cycle the device has not found a valid firmware and remains in boot loader mode. The device has to be recovered and set back to factory setting. Follwo section "Gerät mit Speicherkarte auf Werkseinstellung zurücksetzen" !!!. |
| SYS LED (5) on yellow | The device has a malfunction and needs replacement. |
| SYS LED (5) on green, APL LED (6) on red blinking or on red. | The device is well initialized. Further analysis is possible with the APL LED (6). See section APL !!!. |
| APL LED (6) blinks green | The communication via port X2 or/and port X3 is not in data exchange mode. See section LED APL auf Seite 67 !!!. |

*Table 49: 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 *LEDs* [page 59].

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.

## 8.2 Failure in 10 MBit/s half-duplex mode and workaround

Only older devices of device type NT 100-RE-xx are affected, which have a serial number below 20356.

Device type NT 100-RE-EN is not affected.

**Affected hardware**

Hardware with the communication 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 problem on EthernetPHY”,

RenesasElectronics Europe, April 27, 2010

# 9 LEDs

## 9.1 SYS

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

| LED | Color | State | Description |
|---|---|---|---|
| SYS<br>Number in the device drawing (5) | Duo LED yellow/green | | |
| | (green) | On | Device is initialized. Further diagnosis, see APL LED. |
| | (yellow) | On | 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.<br>Remains the LED yellow permanently, then a hardware failure is possible. |
| | (yellow) | Blinking | The device does not work. In the connected USB cable, Pin 4 has a connection to ground.<br>• Remove the USB cable from the device. Disconnect the power supply from the device.<br>• Reconnect the power supply to the device. After some seconds reconnect the USB cable to the device.<br>• The device is working. |
| | (yellow/ green) | Blinking yellow/ green<br>1 Hz | Error: Boot loader is active.<br>STARTUP.INI file is missing. No communication via USB with SYCON.net is possible. A memory card with the files for factory setting on it is necessary to make the device operational.<br>To prepare a memory card, see section *Reset device to factory settings with memory card* [page 49]. |
| | (yellow/ green) | Blinking yellow/ green<br>16 Hz | Waiting period (appr. 8 sec, adjustable) before copying the firmware and configuration files from the memory card into the Flash memory. |
| | (off) | Off | Power supply for the device is missing or hardware failure. |

*Table 50: LED states System LED*

To determine the position of the SYS LED use the device drawings in section *LEDs and control elements* [page 30].

## 9.2 APL

The following table describes the APL LED.

| LED | Color | State | Meaning |
|---|---|---|---|
| **APL** | **Duo LED red/green** | | |
| | (green) | On | The communication at X2 and X3 is in cyclic data exchange and the gateway function is performed. |
| | (green) | Blinking (1 Hz, 1 x, 2 s off) | The device is initialized, but the communication at X2 is not in cyclic data exchange. |
| | (green) | Blinking (1 Hz, 2 x, 2 s off) | The device is initialized, but the communication at X3 is not in cyclic data exchange. |
| | (red) | Blinking (1 Hz, 1 x, 2 s off) | The device is initialized, but the configuration for the communication protocol at X2 is missing or the communication contains an error. |
| | (red) | Blinking (1 Hz, 2 x, 2 s aus) | The device is initialized, but the configuration for the communication protocol at X3 is missing or the communication contains an error. |
| | (red) | On | The device has detected an error during the initialization: Missing configuration, error in configuration or internal error. |
| | (gray) | Off | The device is not in operation. |

*Table 51: APL LED states*

| LED state | Definition |
|---|---|
| Blinking (1 Hz, 1 x, 2 s off) | The indicator blinks 1 x (500 ms) followed by a long “off“ phase (2,000 ms). |
| Blinking (1 Hz, 2 x, 2 s off) | The indicator blinks 2 x (each 500 ms), separated by a short off phase (500 ms). The sequence is finished by a long off phase (2,000 ms). |

*Table 52: APL LED state definitions*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [page 30].

# 9.3 LEDs Real-Time Ethernet systems

## 9.3.1 LEDs EtherCAT Master

The following table describes the LEDs for EtherCAT Master.

| LED | Color | State | Description |
|---|---|---|---|
| **RUN** | **Duo LED red/green** | | |
| | (off) | Off | **INIT:** The device is in INIT state. |
| | (green) | Blinking (2.5 Hz) | **PRE-OPERATIONAL:** The device is in PRE-OPERATIONAL state. |
| | (green) | Flickering (10 Hz) | The device is not configured. |
| | (green) | Single flash | **SAFE-OPERATIONAL:** The device is in SAFE-OPERATIONAL state. |
| | (green) | On | **OPERATIONAL:**The device is in the OPERATIONAL state. |
| **ERR** | **Duo LED red/green** | | |
| | (off) | Off | Master has no errors |
| | (red) | Single flash | Bus Sync error threshold |
| | (red) | Double flash | Internal Stop of the bus cycle |
| | (red) | Triple Flash | DPM watchdog has expired. |
| | (red) | Quadruple Flash | No Master license present in the device. |
| | (red) | Blinking (2.5 Hz) | Error in the configuration database. |
| | (red) | Single Flickering | Channel Init was executed at the Master.<br>Transient state that may not be visible. |
| | (red) | Double Flickering | Slave is missing<br>Unconfigured slave<br>No matching mandatory slave list<br>No bus connected |
| | (red) | Flickering (10 Hz) | Boot-up was stopped due to an error. |
| **LINK** | **LED green** | | |
| | (green) | On | **Link:** The device is linked to the Ethernet, but does not send/ receive Ethernet frames. |
| | (green) | Flickering (load dependent) | **Activity:** The device is linked to the Ethernet and sends/receives Ethernet frames. |
| | (off) | Off | The device has no link to the Ethernet. |
| **ACT** | **LED yellow** | | |
| | (off) | Off | This LED is not used. |

*Table 53: LED states for the EtherCAT Master (V4) protocol*

| LED state | Definition |
|---|---|
| Single flash | The LED shows one short flash (200 ms) followed by a long “Off“ phase (1,000 ms). |
| Double flash | The LED 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). |
| Triple Flash | The LED shows a sequence of three 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). |
| Quadruple Flash | The LED shows a sequence of four 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). |
| Blinking (2.5 Hz) | The LED turns on and off with a frequency of 2.5 Hz: “On” for 200 ms, followed by “Off” for 200 ms. |
| Single Flickering | The LED is switched on and off once:<br>"On" for 50 ms, followed by "Off" for 500 ms. |
| Double Flickering | The LED is switched on and off and on once:<br>"On" / "Off" / "On" each for approximately 50 ms, followed by "Off" for 500 ms. |
| Flickering (10 Hz) | The LED turns on and off with a frequency of 10 Hz: “On” for 50 ms, followed by “Off” for 50 ms. |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 54: LED state definitions for the EtherCAT Master (V4) protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▷ page 30].

## 9.3.2 LEDs EtherCAT Slave

The following table describes the LEDs for EtherCAT Slave.

| LED | Color | State | Description |
|---|---|---|---|
| **RUN** | **Duo LED red/green** | | |
| | (off) | Off | **INIT:** The device is in INIT state. |
| | (green) | Blinking (2.5 Hz) | **PRE-OPERATIONAL:** The device is in PRE-OPERATIONAL state. |
| | (green) | Single flash | **SAFE-OPERATIONAL:** The device is in SAFE-OPERATIONAL state. |
| | (green) | On | **OPERATIONAL:** The device is in the OPERATIONAL state. |
| **ERR** | **Duo LED red/green** | | |
| | (off) | Off | **No error:** The EtherCAT communication of the device is in working condition. |
| | (red) | Blinking (2.5 Hz) | **Invalid configuration:** General Configuration Error<br>Possible reason: State change commanded by master is impossible due to register or object settings. |
| | (red) | Single flash | **Local error:** Slave device application has changed the EtherCAT state autonomously.<br>Possible reason 1: A host watchdog timeout has occurred.<br>Possible reason 2: Synchronization Error, device enters Safe-Operational automatically. |
| | (red) | Double flash | **Application watchdog timeout:** An application watchdog timeout has occurred. Possible reason: Sync Manager Watchdog timeout. |
| **L/A IN**, **L/A OUT** | **LED green** | | |
| | (green) | On | **Link:** The device is linked to the Ethernet, but does not send/ receive Ethernet frames. |
| | (green) | Flickering (load dependent) | **Activity:** The device is linked to the Ethernet and sends/receives Ethernet frames. |
| | (off) | Off | The device has no link to the Ethernet. |
| | **LED yellow** | | |
| | (off) | Off | This LED is not used. |

*Table 55: LED states for the EtherCAT Slave protocol*

| LED state | Definition |
|---|---|
| Blinking (2.5 Hz) | The LED turns on and off with a frequency of 2.5 Hz: “On” for 200 ms, followed by “Off” for 200 ms. |
| Single flash | The LED shows one short flash (200 ms) followed by a long “Off“ phase (1,000 ms). |
| Double flash | The LED 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). |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 56: LED state definitions for the EtherCAT Slave protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▷ page 30].

### 9.3.3 LEDs EtherNet/IP Scanner

The following table describes the LEDs for EtherNet/IP Scanner.

| LED | Color | State | Description |
|---|---|---|---|
| **MS** (module status) | **Duo LED red/green** | | |
| | (green) | On | **Device operational:** The device is operating correctly. |
| | (green) | Flashing (1 Hz) | **Standby:** The device has not been configured. |
| | (green/red/ green) | Flashing green/red/ green | **Self-test**: The device performs a self-test after power-on. The following sequence is displayed during the self-test:<br>• NS-LED off.<br>• MS LED turns green for approximately 250 ms, turns red for approximately 250 ms, and again turns green (and holds that state until the power-up test has completed).<br>• NS LED turns green for approximately 250 ms, turns red for approximately 250 ms, and then turns off (and holds that state until the power-up test has completed). |
| | (red) | Flashing (1 Hz) | **Major recoverable fault:** The device has detected a major recoverable fault. E.g., an incorrect or inconsistent configuration can be considered a major recoverable fault. |
| | (red) | On | **Major unrecoverable fault:** The device has detected a major unrecoverable fault. |
| | (off) | (Off) | **No power:** The device is powered off. |
| **NS** (Network status) | **Duo LED red/green** | | |
| | (green) | On | **Connected:** An IP address is configured, at least one CIP connection (any transport class) is established, and an Exclusive Owner connection has not timed out. |
| | (green) | Flashing (1 Hz) | **No connections:** An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out. |
| | (green/red/off) | Flashing green/red/off | **Self-test:** The device performs a self-test after power-on. Refer to the description of the MS LED in the self-test status. |
| | (red) | Flashing (1 Hz) | **Connection timeout:** An IP address is configured, and an Exclusive Owner connection for which this device is the target has timed out.<br>The NS LED returns to steady green only when all timed out Exclusive Owner connections are reestablished. |
| | (red) | On | **Duplicate IP:** The device has detected that its IP address is already in use. |
| | (off) | Off | **Not powered, no IP address:** The device does not have an IP address (or is powered off). |
| **LINK** | **LED green** | | |
| | (green) | On | The device is linked to the Ethernet. |
| | (off) | Off | The device has no link to the Ethernet. |
| **ACT** | **LED yellow** | | |
| | (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames. |
| | (off) | Off | The device does not send/receive Ethernet frames. |

*Table 57: LED states for the EtherNet/IP Scanner protocol*

| LED state | Definition |
|---|---|
| Flashing (1 Hz) | The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |
| Flashing fast green/red/ green | The MS LED or NS LED turns on green "On" for 250 ms, then red "On" for 250 ms, then green "On" (until the test is completed). |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity |

*Table 58: LED state definitions for the EtherNet/IP Scanner protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30].

## 9.3.4 LEDs EtherNet/IP Adapter

The following table describes the LEDs for EtherNet/IP Adapter.

| LED | Color | State | Description |
|---|---|---|---|
| **MS** (module status) | **Duo LED red/green** | | |
| | (green) | On | **Device operational:** The device is operating correctly. |
| | (green) | Flashing (1 Hz) | **Standby:** The device has not been configured. |
| | (green/red/ green) | Flashing fast green/red/ green | **Self-test**: The device performs a self-test after power-on. The following sequence is displayed during the self-test:<br>• NS-LED off.<br>• MS LED turns green for approximately 250 ms, turns red for approximately 250 ms, and again turns green (and holds that state until the power-up test has completed).<br>• NS LED turns green for approximately 250 ms, turns red for approximately 250 ms, and then turns off (and holds that state until the power-up test has completed). |
| | (red) | Flashing (1 Hz) | **Major recoverable fault:** The device has detected a major recoverable fault. E.g., an incorrect or inconsistent configuration can be considered a major recoverable fault. |
| | (red) | On | **Major unrecoverable fault:** The device has detected a major unrecoverable fault. |
| | (off) | Off | **No power:** The device is powered off. |
| **NS** (Network status) | **Duo-LED red/green** | | |
| | (green) | On | **Connected:** An IP address is configured, at least one CIP connection (any transport class) is established, and an Exclusive Owner connection has not timed out. |
| | (green) | Flashing (1 Hz) | **No connections:** An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out. |
| | (green/red/off) | Flashing fast green/red/off | **Self-test:** The device performs a self-test after power-on. Refer to the description of the MS LED in the self-test status. |
| | (red) | Flashing (1 Hz) | **Connection timeout:** An IP address is configured, and an Exclusive Owner connection for which this device is the target has timed out.<br>The NS LED returns to steady green only when all timed out Exclusive Owner connections are reestablished. |
| | (red) | On | **Duplicate IP:** The device has detected that its IP address is already in use. |
| | (off) | (Off) | **Not powered, no IP address:** The device does not have an IP address (or is powered off). |
| **LINK** | **LED green** | | |
| | (green) | On | The device is linked to the Ethernet. |
| | (off) | Off | The device has no link to the Ethernet. |
| **ACT** | **LED yellow** | | |
| | (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames. |
| | (off) | Off | The device does not send/receive Ethernet frames. |

*Table 59: LED states for the EtherNet/IP Adapter protocol*

| LED state | Definition |
|---|---|
| Flashing (1 Hz) | The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |
| Flashing fast green/red/ green | The MS LED or NS LED turns on green "On" for 250 ms, then red "On" for 250 ms, then green "On" (until the test is completed). |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity |

*Table 60: LED state definitions for the EtherNet/IP Adapter protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▷ page 30].

### 9.3.5 LEDs Open Modbus/TCP

The following table describes the LEDs for Open Modbus/TCP.

| LED | Color | State | Description |
|---|---|---|---|
| **RUN** | **Duo LED red/green** | | |
| | ● (green) | On | **Connected:** OMB task has communication. At least one TCP connection is established. |
| | ✺ (green) | Flashing (1 Hz) | **Ready, not configured yet:** OMB task is ready and not yet configured. |
| | ✺ (green) | Flashing (5 Hz) | **Waiting for Communication:** OMB task is configured. |
| | ● (off) | Off | **Not Ready:** OMB task is not ready. |
| **ERR** | **Duo LED red/green** | | |
| | ● (off) | Off | No communication error |
| | ✺ (red) | Flashing (2 Hz, 25% on) | System error |
| | ● (red) | On | Communication error active |
| **LINK** | **LED green** | | |
| | ● (green) | On | The device is linked to the Ethernet. |
| | ● (off) | Off | The device has no link to the Ethernet. |
| **ACT** | **LED yellow** | | |
| | ✺ (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames. |
| | ● (off) | Off | The device does not send/receive Ethernet frames. |

*Table 61: LED states for the OpenModbusTCP protocol*

| LED state | Definition |
|---|---|
| Flashing (1 Hz) | The LED turns on and off with a frequency of 1 Hz: "On" for 500 ms, followed by "Off" for 500 ms. |
| Flashing (2 Hz, 25% on) | The LED turns on and off with a frequency of 2 Hz: “On” for 125 ms, followed by “Off” for 375 ms. |
| Blinking (5 Hz) | The LED turns on and off with a frequency of 5 Hz: “On” for 100 ms, followed by “Off” for 100 ms. |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 62: LED state definitions for the OpenModbusTCP protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▸ page 30].

### 9.3.6 LEDs POWERLINK Controlled Node

The following table describes the LEDs for POWERLINK Controlled Node.

| LED | Color | State | Description |
|---|---|---|---|
| **BS** (Bus status) | **Duo LED red/green** | | |
| | (green) | On | Slave is in **'Operational'** state. |
| | (green) | Triple flash | Slave is in **'ReadyToOperate'** state. |
| | (green) | Double flash | Slave is in **'Pre-Operational 2'** state. |
| | (green) | Single flash | Slave is in **'Pre-Operational 1'** state. |
| | (green) | Flickering (10 Hz) | Slave is in **'Basic Ethernet'** state |
| | (green) | Blinking (2.5 Hz) | Slave is in **'Stopped'** state. |
| | (off) | Off | Slave initializing |
| **BE** (Bus Error) | **Duo LED red/green** | | |
| | (off) | Off | Slave has no error |
| | (red) | On | Slave has detected an error |
| **L/A** | **LED green** | | |
| | (green) | On | **Link:** The device is linked to the Ethernet, but does not send/ receive Ethernet frames. |
| | (green) | Flickering (load dependent) | **Activity:** The device is linked to the Ethernet and sends/receives Ethernet frames. |
| | (off) | Off | The device has no link to the Ethernet. |
| | **LED yellow** | | |
| | (off) | Off | This LED is not used. |

*Table 63: LED states for the POWERLINK Controlled Node protocol*

| LED state | Definition |
|---|---|
| Triple flash | The LED shows a sequence of three 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). |
| Double flash | The LED 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). |
| Single flash | The LED shows one short flash (200 ms) followed by a long "Off" phase (1,000 ms). |
| Flickering (10 Hz) | The LED turns on and off with a frequency of 10 Hz: "On" for 50 ms, followed by "Off" for 50 ms. The red LED and the green LED are switched on alternately. |
| Blinking (2.5 Hz) | The LED turns on and off phase with a frequency of 2,5 Hz: "On" for 200 ms followed by "Off" for 200 ms. The red LED and the green LED are switched on alternately. |
| Flickering (load dependant) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 64: LED state definitions for the POWERLINK Controlled Node protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30].

### 9.3.7 LEDs PROFINET IO-Controller

The following table describes the LEDs for PROFINET IO-Controller.

| SYS | SF | BF | Description |
|---|---|---|---|
| System status | System Failure | Bus Failure | LED name<br>name |
| Yellow/green | Red/green | Red/green | Colours of the Duo LEDs SYS, SF or BF |
| **Firmware and Configuration** | | | |
| Off | Off | Off | Power supply for the device is missing or hardware defect. |
| On, yellow | Off | Off | No second stage bootloader found in Flash memory. |
| Flashing, green/ yellow, cyclic | Off | Off | No firmware file found in Flash file system. |
| On, green | On, red | Off | PROFINET IO Controller is not configured. |
| On, green | Off | On, red | No Ethernet port has a link. E. g., no cable connected to any of the Ethernet ports. |
| On, green | Off | Flashing, red, 2 Hz | PROFINET IO Controller is not online (Bus is switched to Off). |
| **PROFINET communication** | | | |
| On, green | Off<br>or<br>On, red | Flashing, red, 1Hz | Not all configured devices are in data exchange. |
| On, green | On, red | - | One IO Device connected to the PROFINET IO Controller reports a problem. |
| On, green | Off | Off | All devices are in data exchange and no problem has been reported by any device. |
| **PROFINET IO Controller operation** | | | |
| On, green | Flashing, red, 1 Hz, 3 s | Off | A PROFINET DCP Set Signal has been received. |
| On, green | Flashing, red, 2 Hz | Flashing, red, 2 Hz | The PROFINET IO Controller has detected an address conflict. Another device in the network is using the same Name of Station or IP address as the PROFINET IO Controller.<br>Or watchdog error |
| On, green | On, red | On, red | No valid Master license |

*Table 65: PROFINET IO Controller, SYS, COM0 and COM1 LEDs states*

| LED | Color | State | Description |
|---|---|---|---|
| **LINK** | **LED green** | | |
| | (green) | On | The device is linked to the Ethernet. |
| | (off) | Off | The device has no link to the Ethernet. |
| **RX/TX** | **LED yellow** | | |
| | (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames. |
| | (off) | Off | The device does not send/receive Ethernet frames. |

*Table 66: PROFINET IO Controller, Ethernet LEDs states*

| LED state | Definition |
|---|---|
| Flashing (1 Hz, 3 s) | The LED turns on and off for 3 seconds with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |
| Flashing (1 Hz) | The LED turns on and off with a frequency of 1 Hz: "On" for 500 ms, followed by "Off" for 500 ms. |
| Flashing (2 Hz) | The LED turns on and off with a frequency of 2 Hz: “On” for 250 ms, followed by “Off” for 250 ms. |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 67: PROFINET IO Controller, LEDs states definitions*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30].

### 9.3.8 LEDs PROFINET IO-Device

The following table describes the LEDs for PROFINET IO-Device.

| LED | Color | State | Description |
|---|---|---|---|
| **SF** (System Failure) | **Duo LED red/green** | | |
| | (off) | Off | No error |
| | (red) | Flashing (1 Hz, 3 s) | DCP signal service is initiated via the bus. |
| | (red) | On | Watchdog timeout; channel, generic or extended diagnosis present; system error |
| **BF** (Bus Failure) | **Duo LED red/green** | | |
| | (off) | Off | No error |
| | (red) | Flashing (2 Hz) | No data exchange |
| | (red) | On | No configuration;<br>or low speed physical link; or no physical link |
| **LINK** | **LED green** | | |
| | (green) | On | The device is linked to the Ethernet. |
| | (off) | Off | The device has no link to the Ethernet. |
| **RX/TX** | **LED yellow** | | |
| | (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames. |
| | (off) | Off | The device does not send/receive Ethernet frames. |

*Table 68: LED states for the PROFINET IO-Device protocol*

| LED state | Definition |
|---|---|
| Flashing (1 Hz, 3 s) | The LED turns on and off for 3 seconds with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |
| Flashing (2 Hz) | The LED turns on and off with a frequency of 2 Hz: “On” for 250 ms, followed by “Off” for 250 ms. |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 69: LED state definitions for the PROFINET IO-Device protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30].

### 9.3.9 LEDs Sercos Master

The following table describes the LEDs for Sercos Master.

| LED | Color | State | Description |
|---|---|---|---|
| **STA** | **Duo LED red/green** | | |
| | (green) | On | **CP4:** Communication phase **4** |
| | (green) | Triple Flash | **CP3: Communication phase 3** |
| | (green) | Double flash | **CP2: Communication phase 2** |
| | (green) | Single flash | **CP1: Communication phase 1** |
| | (green) | Blinking (2.5 Hz) | **CP0: Communication phase 0** |
| | (green) | Flickering (10 Hz) | **Master is not configured and is in NRT.** After a status change this isn't indicated again |
| | (off) | Off | **NRT:** Non Real-Time Mode |
| **ERR** | **Duo LED red/green** | | |
| | (red) | Single flash | Bus Sync error threshold |
| | (red) | Double flash | Internal Stop of the bus cycle |
| | (red) | Triple Flash | DPM watchdog has expired. |
| | (red) | Quadruple Flash | No Master license present in the device. |
| | (red) | Blinking (2.5 Hz) | Error in the configuration database. |
| | (red) | Single Flickering | Channel Init was executed at the Master.<br>Transient state that may not visible at all. |
| | (red) | Double Flickering | Slave is missing.<br>Unconfigured slave<br>No matching mandatory slave list<br>No bus connected<br>Duplicate Sercos address<br>Invalid Sercos address |
| | (red) | Flickering (10 Hz) | Boot-up was stopped due to an error. |
| | (off) | Off | No error |
| **L/A** | **LED green** | | |
| | (green) | On | **Link:** The device is linked to the Ethernet, but does not send/ receive Ethernet frames. |
| | (green) | Flickering (load dependent) | **Activity:** The device is linked to the Ethernet and sends/receives Ethernet frames. |
| | (off) | Off | The device has no link to the Ethernet. |
| | **LED yellow** | | |
| | (off) | Off | This LED is not used. |

*Table 70: LED states for the Sercos Master protocol*

| LED state | Definition |
|---|---|
| Single flash | The LED shows one short flash (200 ms) followed by a long “Off“ phase (1,000 ms). |
| Double flash | The LED 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). |
| Triple flash | The LED shows a sequence of three 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). |
| Quadruple flash | The LED shows a sequence of four 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). |
| Blinking (2.5 Hz) | The LED turns on and off with a frequency of 2.5 Hz: “On” for 200 ms, followed by “Off” for 200 ms. |
| Single Flickering | The LED is switched on and off once: "On" for 50 ms, followed by "Off" for 500 ms. |
| Double Flickering | The LED is switched on and off and on once: "On" / "Off" / "On" each for approximately 50 ms, followed by "Off" for 500 ms. |
| Flickering (10 Hz) | The LED turns on and off with a frequency of 10 Hz: “On” for 50 ms, followed by “Off” for 50 ms. |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 71: LED state definitions for the Sercos Master protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▷ page 30].

## 9.3.10 LEDs Sercos Slave

The following table describes the LEDs for Sercos Slave.

| LED | Color | State | Description |
|---|---|---|---|
| **S** | **Duo-LED red/green** (orange = red/green simultaneously) | | |
| | (green) | On | **CP4:** Communication phase **4:** Normal operation, no error |
| | (green) | Flashing (2 Hz) | **Loopback:** The network state has changed from „fast-forward“ to „loopback“. |
| | (green/ orange) | Flashing (1 x green/3s) | **CP3: Communication phase 3** |
| | | (2 x green/3s) | **CP2: Communication phase 2** |
| | | (1 x green/3s) | **CP1: Communication phase 1** |
| | (orange) | On | **CP2: Communication phase 0** |
| | (orange/ green) | Flashing (2 Hz) | **HP0:** Hot-plug mode |
| | | (1 x orange/3s) | **HP1:** Hot-plug mode |
| | | (2 x orange/3s) | **HP2:** Hot-plug mode |
| | (orange) | Flashing (2 Hz) | **Identification:**<br>Invoked by (C-DEV.Bit15 in the Device Control)<br>Or<br>SIP Identification Request |
| | (green/red) | Flashing (2 Hz, min. 2s) | **MST losses ≥ (S-0-1003/2):** The communication warning (S-DEV.Bit 15) is present in the device status. |
| | (red/orange) | Flashing (2 Hz) | **Application error (C1D):** See GDP & FSP Status codes class error. |
| | (red) | Flashing (2 Hz) | **Watchdog error:** Application is not running. |
| | (red) | On | **Communication Error (C1D):** Error detected according to Sercos third generation Class 1 Diagnosis, see SCP Status codes class error. |
| | (off) | Off | **NRT-Mode:** (Non Real-Time Mode) No Sercos Communication |
| | **Duo LED red/green** | | |
| | (off) | Off | This LED is not used. |
| **L/A** | **LED green** | | |
| | (green) | On | **Link:** The device is linked to the Ethernet, but does not send/ receive Ethernet frames. |
| | (green) | Flickering (load dependent) | **Activity:** The device is linked to the Ethernet and sends/ receives Ethernet frames. |
| | (off) | Off | The device has no link to the Ethernet. |
| | **LED yellow** | | |
| | (off) | Off | This LED is not used. |

*Table 72: LED states for the Sercos Slave protocol*

| LED state | Definition |
|---|---|
| Flashing (2 Hz) | The LED turns on and off with a frequency of 2 Hz: *one color*: "On" for appr. 250 ms, followed by "Off" for appr. 250 ms.<br>*two colors*: First color for appr. 250 ms, followed by the second color for appr. 250 ms. |
| Flashing (1 x green/3s) | Flashing green for 250 ms, then orange on for 2 second and 750 ms. |
| Flashing (2 x green/3s) | Flashing green / orange / green, each for 250 ms, then orange on for 2 seconds and 250 ms. |
| Flashing (3 x green/3s) | Flashing green / orange / green / orange / green, each for 250 ms, then orange on for 1 second and 750 ms. |
| Flashing (1 x orange /3s) | Flashing orange for 250 ms, then green on for 2 second an 750 ms. |
| Flashing (2 x orange /3s) | Flashing orange / green / orange, each for 250 ms, then green on for 2 seconds and 250 ms. |
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 73: LED state definitions for the Sercos Slave protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▷ page 30].

# 9.4 LEDs Fieldbus systems

## 9.4.1 LED CANopen Master

The following table describes the LEDs for CANopen Master.

| LED | Color | State | Description |
|---|---|---|---|
| **CAN** | **Duo LED red/green** | | |
| | ● (green) | On | **OPERATIONAL:** The device is in the OPERATIONAL state. |
| | ✺ (green) | Blinking (2.5 Hz) | **PREOPERATIONAL:** The device is in the PREOPERATIONAL state. |
| | ✺ (green) | Single flash | **STOPPED:** The device is in STOPPED 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 in bus OFF state. |
| | ● (off) | Off | **RESET:** The device is executing a reset or the device has no configuration. |

*Table 74: LED states for the CANopen Master protocol*

| LED states | Definition |
|---|---|
| Blinking (2.5 Hz) | The LED turns on and off with a frequency of 2.5 Hz: “On” for 200 ms, followed by “Off” for 200 ms. |
| Single flash | The LED shows one short flash (200 ms) followed by a long “Off“ phase (1,000 ms). |
| Double flash | The LED 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 75: LED state definitions for the CANopen Master protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [▸ page 30].

## 9.4.2 LED CANopen Slave

The following table describes the LED for CANopen Slave.

| LED | Color | State | Description |
|---|---|---|---|
| **CAN** | **Duo LED red/green** | | |
| | (green) | On | **OPERATIONAL:** The device is in the OPERATIONAL state. |
| | (green) | Blinking (2.5 Hz) | **PREOPERATIONAL:**The device is in the PREOPERATIONAL state. |
| | (green) | Single flash | **STOPPED:** The device is in STOPPED state. |
| | (red/green) | Flickering (10 Hz) | **Auto baud rate detection active:** The Device is in the auto baud rate detection mode. |
| | (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 in bus OFF state. |
| | (off) | Off | **RESET:** The device is executing a reset or the device has no configuration. |

*Table 76: States of the CAN LED for the CANopen Slave protocol*

| LED state | Definition |
|---|---|
| Flickering (10 Hz) | The LED turns on and off with a frequency of 10 Hz: “On” for 50 ms, followed by “Off” for 50 ms. |
| Blinking (2.5 Hz) | The LED turns on and off with a frequency of 2.5 Hz: “On” for 200 ms, followed by “Off” for 200 ms. |
| Single flash | The LED shows one short flash (200 ms) followed by a long “Off“ phase (1,000 ms). |
| Double flash | The LED 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). The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

*Table 77: LED state definitions for the CANopen Slave protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30].

### 9.4.3 LED CC-Link Slave

The following table describes the LEDs for CC-Link Slave.

| LED | Color | State | Description |
|---|---|---|---|
| **L RUN** | **LED green** | | |
| | (green) | On | After participating in the network, the device receives both refresh and polling signals or just the refresh signal normally. |
| | (off) | Off | 1. Before participating in the network<br>2. Unable to detect carrier<br>3. Timeout<br>4. Resetting hardware |
| **L ERR** | **LED red** | | |
| | (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<br>2. Address parameter error (0.65 or greater is set including the number of occupied stations)<br>3. Baud rate switch setting error during cancellation of reset (5 or greater) |
| | (off) | Off | 1. Normal communication<br>2. Resetting hardware |

*Table 78: LED states for the CC-Link Slave protocol*

To determine the position of the LEDs use the device drawings in section *LEDs and control elements* [page 30].

### 9.4.4 LED DeviceNet Master

The following table describes the LED for DeviceNet Master.

| LED | Color | State | Description |
|---|---|---|---|
| **MNS** | **Duo LED red/green** | | |
| | ● (green) | On | **Device operational AND on-line, connected**<br>Device is online and has established all connections with all Slaves. |
| | ✺ (green) | Flashing (1 Hz) | **Device operational AND on-line**<br>Device is online and has established no connection in the established state.<br>- Configuration missing, incomplete or incorrect. |
| | ✺ ✺ ● (green/red/off) | Flashing green/red/off | **Self-test:** The device performs a self-test after power-on. The MNS LED turns green for approximately 250 ms, then turns red for approximately 250 ms, then turns off. |
| | ✺ (red) | Flashing (1 Hz) | **Minor fault and/or connection time-out**<br>Device is online and has established one or more connections in the established state. It has data exchange with at least one of the configured slaves.<br>Minor or recoverable fault: No data exchange with one of the configured Slaves. One or more Slaves are not connected.<br>Connection timeout.<br>No network power present. |
| | ● (red) | On | **Critical fault or critical link failure**<br>Critical connection failure; device has detected a network error: duplicateMAC-ID or severe error in CAN network (CAN-bus off). |
| | ● (off) | Off | **Device is not powered**<br>- The device may not be powered.<br>**Device is not on-line and/or no network power**<br>- The device has not yet completed the Dup_MAC_ID test.<br>- The device is powered, but the network power is missing. |

*Table 79: LED states for the DeviceNet Master protocol*

| LED state | Definition |
|---|---|
| Flashing (1 Hz) | The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |
| Flashing green/red/off | The LED turns on green "On" for 250 ms, then red "On" for 250 ms, then "Off". |

*Table 80: LED state definitions for the DeviceNet Master protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [▸ page 30].

## 9.4.5 LED DeviceNet Slave

The following table describes the LED for DeviceNet Slave.

| LED | Color | State | Description |
|---|---|---|---|
| **MNS** | **Duo LED red/green** | | |
| | (green) | On | **Device operational AND on-line, connected**<br>Device is online and has established all connections with all Slaves. |
| | (green) | Flashing (1 Hz) | **Device operational AND on-line**<br>Device is online and has established no connection in the established state.<br>- Configuration missing, incomplete or incorrect. |
| | (green/red/off) | Flashing green/red/off | **Self-test:** The device performs a self-test after power-on. The MNS LED turns green for approximately 250 ms, then turns red for approximately 250 ms, then turns off. |
| | (red) | Flashing (1 Hz) | **Minor fault and/or connection time-out**<br>Device has no connection to the Master.<br>Minor or recoverable fault: No data exchange with the Master.<br>Connection timeout.<br>No network power present. |
| | (red) | On | **Critical fault or critical link failure**<br>Critical connection failure; device has detected a network error: duplicate MAC-ID or severe error in CAN network (CAN-bus off). |
| | (off) | Off | **Device is not powered**<br>- The device may not be powered.<br>**Device is not on-line and/or no network power**<br>- The device has not yet completed the Dup_MAC_ID test.<br>- The device is powered, but the network power is missing. |

*Table 81: LED states for the DeviceNet Slave protocol*

| LED state | Definition |
|---|---|
| Flashing (1 Hz) | The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |
| Flashing green/red/off | The LED turns on green "On" for 250 ms, then red "On" for 250 ms, then "Off". |

*Table 82: LED state definitions for the DeviceNet Slave protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [page 30].

## 9.4.6 LED PROFIBUS DP Master

The following table describes the LED for PROFIBUS DP Master.

| LED | Color | State | Description |
|---|---|---|---|
| **COM** | **Duo LED red/green** | | |
| | (green) | On | Communication to all Slaves is established. |
| | (green) | Blinking (5 Hz) | PROFIBUS is configured, but the bus communication is not yet released from the application. |
| | (green) | Flashing, acyclic | No configuration or faulty configuration |
| | (red) | Blinking (5 Hz) | Communication to at least one Slave is disconnected. |
| | (red) | On | Communication to all Slaves is disconnected or another serious error has occurred.<br>Redundant Mode: The active Master was not found. |
| | (off) | Off | Device is not switched on or supply voltage is missing. |

*Table 83: LED states for the PROFIBUS DP Master protocol*

| LEDs states | Definition |
|---|---|
| Blinking (5 Hz) | The LED turns on and off with a frequency of 5 Hz: “On” for 100 ms, followed by “Off” for 100 ms. |
| Flashing, acyclic | The LED turns on and off in irregular intervals. |

*Table 84: LED state definitions for the PROFIBUS DP Master protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [page 30].

## 9.4.7 LED PROFIBUS DP Slave

The following table describes the LED for PROFIBUS DP Slave.

| LED | Color | State | Description |
|---|---|---|---|
| **COM** | **Duo LED red/green** | | |
| | (green) | On | RUN, cyclic communication |
| | (green) | Flashing, cyclic (2 Hz) | Master is in CLEAR state. |
| | (red) | Flashing, acyclic (1 Hz) | The device is not configured. |
| | (red) | Flashing, cyclic (2 Hz) | STOP, no communication, connection error |
| | (red) | On | Wrong configuration at PROFIBUS DP Slave. |
| | (off) | Off | Device is not switched on or supply voltage is missing. |

*Table 85: LED states for the PROFIBUS DP Master protocol*

| LED states | Definition |
|---|---|
| Flashing, acyclic (1 Hz) | The LED turns on and off in irregular intervals, with a frequency of 1 Hz: “On” for 750 ms, followed by “Off” for 250 ms. |
| Flashing, cyclic (2 Hz) | The LED turns on and off with a frequency of 2 Hz: “On” for 250 ms, followed by “Off” for 250 ms. |

*Table 86: LED state definitions for the PROFIBUS DP Slave protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [page 30].

# 9.5 LEDs Serial

## 9.5.1 LED Modbus RTU

The following table describes the LED for Modbus RTU.

| LED | Color | State | Description |
|---|---|---|---|
| **COM** | **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:**<br>The device works as **Modbus RTU Master**:<br>- The Slave device answered with an error (Modbus Exception), e. g. function code not supported, access to invalid register addresses or coil addresses.<br>- Receive error detected, e. g. parity error or checksum error<br>- timeout (Slave device does not answer).<br>The device works as **Modbus RTU Slave**:<br>- The Modbus RTU Master device uses an invalid function code.<br>- The Modbus RTU Master device has accessed to invalid register addresses or coil addresses.<br>- Receive error detected, e. g. parity error or checksum error.<br>- Timeout (application does not answer or answers with error).<br>The error display is set back with the next error free Modbus telegram sequence. |
| | ● (off) | Off | During initialization or invalid Modbus RTU configuration or missing power supply. |

*Table 87: LED states for the Modbus/RTU Master protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [▷ page 30].

## 9.5.2 LED ASCII

The following table describes the LED for ASCII.

| LED | Color | State | Description |
|---|---|---|---|
| **COM** | **Duo LED red/green** | | |
| | (green) | Blinking (5 Hz) | The device sends/receives data. |
| | (green) | On | The device is ready for serial communication. |
| | (red) | Blinking (5 Hz) | The device is configured and is in stop state. |
| | (red) | Blinking (1 Hz) | The device is not configured. |
| | (off) | Off | During initialization or missing power supply. |

*Table 88: LED states for the ASCII protocol*

| LED state | Definition |
|---|---|
| Blinking (5 Hz) | The LED turns on and off with a frequency of 5 Hz: “On” for 100 ms, followed by “Off” for 100 ms. |
| Blinking (1 Hz) | The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |

*Table 89: LED state definitions for the ASCII protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [page 30].

### 9.5.3 LED Serial with netSCRIPT

The following table describes the LED for netSCRIPT serial.

The meaning of the COM LED is determined by the device firmware, when the script is not executed. The meaning of the COM 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 | Description |
|---|---|---|---|
| **COM** | **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 | No script file loaded<br>Script error occurred, which lead to a stop of the script execution.<br>The execution of the script was stopped with the debugger. If the red LED will change in this state, then the green LED keeps its last state, that e. g. is green or off. |
| | ● (off) | Off | Script running<br>The control of the LED states (after the startup sequence) is done with the netSCRIPT functions **"setRunLed()"** and **"setErrorLed()"** by the programmer |

*Table 90: LED states for 'Serial with netSCRIPT' – Script is not executed*

| LED state | Definition |
|---|---|
| Single flash | The LED shows one short flash (200 ms) followed by a long "off" phase (1,000 ms). |

*Table 91: LED state definitions for the netSCRIPT protocol*

#### Script is executed

| LED | Color | State | Meaning |
|---|---|---|---|
| **COM** | **Duo LED red/green** | | |
| | ● (red)<br>✹ (red) | Controlled by the script | The meaning is defined by the use of the netSCRIPT function **"setRunLed()"** in the script. |
| | ● (green)<br>✹ (green) | Controlled by the script | The meaning is defined by the use of the netSCRIPT function **"setErrorLed()"** in the script. |
| | ● (off) | Off | The meaning is defined by the use of the netSCRIPT function **"setRunLed()"** and **"setErroLed()"** in the script. |

*Table 92: LED states for 'Serial with netSCRIPT' – Script is executed*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [▸ page 30].

### 9.5.4 LED 3964R

The following table describes the LED for 3964R.

| LED | Color | State | Description |
|---|---|---|---|
| **COM** | **Duo LED red/green** | | |
| | (green) | Flickering (10 Hz) | The device sends/receives data. |
| | (green) | On | The device is ready for serial communication. |
| | (red) | Blinking (5 Hz) | The device is configured and is in stop state. |
| | (red) | Blinking (1 Hz) | The device is not configured. |
| | (red) | On | Communication error:<br>- Receive error detected, e. g. parity error or checksum error.<br>- Timeout (remote device does not answer). The error display is set back with the next error free 3964R telegram sequence.<br>The error display is set back with the next error free 3964R telegram sequence. |
| | (off) | Off | During initialization or missing power supply. |

*Table 93: LED states for the 3964R protocol*

| LED state | Definition |
|---|---|
| Flickering (10 Hz) | The LED turns on and off with a frequency of 10 Hz: “On” for 50 ms, followed by “Off” for 50 ms. |
| Blinking (5 Hz) | The LED turns on and off with a frequency of 5 Hz: “On” for 100 ms, followed by “Off” for 100 ms. |
| Blinking (1 Hz) | The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms. |

*Table 94: LED state definitions for the 3964R protocol*

To determine the position of the LED use the device drawings in section *LEDs and control elements* [page 30].

# 10 Technical data

## 10.1 Technical data netTAP NT 100 Gateway

| NT 100 | Parameter | Value |
|---|---|---|
| Communication controller | Type | netX 100 |
| Memory | RAM | 8 MB SDRAM |
| | FLASH | 4 MB serial Flash |
| | Memory card (optional) | Type: MMC or SD card<br>Storage capacity: Max. 2 GByte<br>**Important:** Comply with the requirements on using the memory card: Type, max. storage capacity, and format. The memory card must be formatted with FAT. The formats FAT12/16/32 are supported. The exFAT format is not supported. |
| | netSCRIPT and variable | approx. 1 MByte |
| Diagnostic interface | Socket | Mini-USB, 5-pin |
| Display | LED display | SYS System status<br>APL Application status<br>COM Communication status<br>LINK link<br>ACT Activity |
| Power supply | Voltage | 24 V ± 6 V DC, with reverse voltage protection |
| | Current consumption at 24 V (typical) | 130 mA |
| | Power consumption | 3.2 W |
| | Connector | Mini-COMBICON, 2-pin |
| | Power supply | For UL-compliant use:<br>The device must be powered from an isolated voltage source |
| Ambient conditions | Ambient temperature (operation) | 0 °C … + 60 °C |
| | Ambient temperature (storage) | 40 °C … +85 °C |
| | Relative humidity | 10% … 95% relative humidity, no condensation allowed |
| | Environment | For UL-compliant use:<br>The use of the device is limited to an environment of pollution degree 2 |
| Device | Dimensions (L x W x H) | 100 mm x 52 mm x 70 mm (without connector) |
| | Weight | approx. 150 g |
| | Mounting | On DIN rail, DIN EN 60715 |
| | Protection class | IP 20 |
| | RoHS | Yes |
| CE mark | CE mark | Yes |
| | Emission | CISPR 11 Class A. |
| | Immunity | EN 61131-2:2003 |
| UL | UL-listed: UL 508 | UL file no. E334100 |
| Configuration | Software | SYCON.net |

*Table 95: Technical data NT 100 (part 1)*

| NT 100 | Parameter | Value |
|---|---|---|
| Ethernet interface of the device types:<br>NT 100-RE-CC<br>NT 100-RE-CO<br>NT 100-RE-DN<br>NT 100-RE-DP<br>NT 100-RE-RS | Transmission rate | 100 MBit/s<br>10 MBit/s (depending on the firmware loaded) |
| | Interface type | 100 BASE-TX, isolated<br>10 BASE-TX (depending on the firmware loaded), isolated |
| | Half duplex / full duplex | supported (at 100 MBit/s) |
| | Auto-Negotiation | supported (depending on the firmware loaded) |
| | Auto-Crossover | supported |
| | Connector | 2 * RJ45 |
| PROFIBUS interface of the device types:<br>NT 100-RE-DP<br>NT 100-CO-DP<br>NT 100-DN-DP<br>NT 100-DP-DP<br>NT 100-DP-CC<br>NT 100-DP-CO<br>NT 100-DP-DN<br>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, potential-free |
| | Connector | D-Sub socket, 9-pin |
| CANopen interface of the device types:<br>NT 100-RE-CO<br>NT 100-DN-CO<br>NT 100-DP-CO<br>NT 100-CO-CO<br>NT 100-CO-CC<br>NT 100-CO-DP<br>NT 100-CO-DN<br>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, potential-free |
| | Connector | D-Sub connector, 9-pin |
| DeviceNet interface of the device types:<br>NT 100-RE-DN<br>NT 100-DP-DN<br>NT 100-CO-DN<br>NT 100-DN-DN<br>NT 100-DN-CO<br>NT 100-DN-CC<br>NT 100-DN-DP<br>NT 100-DN-RS | Transmission rate | 125 kBit/s, 250 kBit/s, 500 kBit/s |
| | Interface type | ISO 11898, potential-free |
| | Connector | COMBICON, 5-pin |

*Table 96: Technical data NT 100 (part 2)*

| NT 100 | Parameter | Value |
|---|---|---|
| CC-Link interface (version 1 and 2) of the device types:<br>NT 100-RE-CC<br>NT 100-DP-CC<br>NT 100-CO-CC<br>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, potential-free |
| | Connector | COMBICON, 5-pin |
| Serial interface of the device types:<br>NT 100-RE-RS<br>NT 100-CO-RS<br>NT 100-DN-RS<br>NT 100-DP-RS | Interface type | RS-232, RS-422, RS-485, potential-free |
| | Transfer rate with 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 with Modbus RTU | 4800 Bit/s, 9600 Bit/s, 19200 Bit/s, 38400 Bit/s, 57600 Bit/s, 115200 Bit/s |
| | Transfer rate with netSCRIPT | Adjustable in range<br>RS-232: 6 **...** 460000 Bit/s<br>RS-422: 6 **...** 1000000 Bit/s<br>RS-485: 6 **...** 1000000 Bit/s |

*Table 97: Technical data NT 100 (part 3)*

# 10.2 Technical data of Real-Time Ethernet protocols

## 10.2.1 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 |
| Restrictions | CoE upload, CoE download for user data transfer not supported<br>The size of the bus configuration file is limited by the size of the RAM Disk (1 MByte)<br>Only Ethernet Port 0 of the device is used for communication<br>All CoE Uploads, Downloads and information services must fit in one TLR-Packet. Fragmentation is not supported Fragmentation is is not supported<br>Support of Distributed clocks (Slave synchronisation) is always activated<br>The bus cycle time is fixed to a value of 1000 µs<br>The watchdog time is fixed to a value of 20 ms |
| Reference to firmware/stack version | V2.0/V4.4 |

*Table 98: Technical data EtherCAT Master*

### 10.2.2 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/netX 500) |
| Baud rate | 100 MBit/s |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Restrictions | Acyclic communication not supported<br>LRW is not supported |
| Reference to firmware/stack version | V2.0/V4.7 |

*Table 99: Techncal data EtherCAT Slave*

### 10.2.3 EtherNet/IP Scanner

| Parameter | Description |
|---|---|
| Maximum number of connections | 64 connections for implicit |
| Maximum number of total cyclic input data | 5712 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,<br>Message Router Object,<br>Assembly Object,<br>Connection Manager Object,<br>Ethernet Link Object,<br>TCP/IP Object |
| Topology | Tree, line, ring |
| DLR (Device Level Ring) | Beacon based ’Ring Node’ |
| ACD (Address Conflict Detection) | Supported |
| DHCP | Supported |
| BOOTP | Supported |
| Baud rate | 10 and 100 MBit/s |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Integrated switch | Supported |
| Restrictions | No acyclic user data communication<br>CIP Sync Services are not implemented<br>TAGs are not supported |
| Reference to firmware/stack version | V2.0/V2.10 |

*Table 100: Technical data EtherNet/IP Scanner*

### 10.2.4 EtherNet/IP Adapter

| Parameter | Description |
|---|---|
| Maximum number of input data | 504 bytes |
| Maximum number of output data | 504 bytes |
| IO Connection (implicit) | 1 exclusive owner, up to 2 listen only |
| IO Connection type | Cyclic, minimum 1 ms |
| UCMM | Supported |
| Predefined standard objects | Identity Object,<br>Message Router Object,<br>Assembly Object,<br>Connection Manager Object,<br>Ethernet Link Object,<br>TCP/IP Object |
| Topology | Tree, line, ring |
| DLR (Device Level Ring) | Beacon based ’Ring Node’ |
| ACD (Address Conflict Detection) | Supported |
| DHCP | Supported |
| BOOTP | Supported |
| Baud rate | 10 and 100 MBit/s |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Integrated switch | Supported |
| Restrictions | No acyclic user data communication<br>CIP Sync Services are not implemented<br>TAGs are not supported |
| Reference to firmware/stack version | V2.0/V2.13 |

*Table 101: Technical data EtherNet/IP Adapter*

### 10.2.5 Open Modbus/TCP

| Parameter | Description |
|---|---|
| Maximum number of input data | 2880 registers |
| Maximum number of output data | 2880 registers |
| Maximum number of connections | 16 |
| Acyclic communication | Read/write register:<br>• Max. 125 registers per read telegram (FC 3, 4, 23),<br>• Max. 121 registers per write telegram (FC 23),<br>• Max. 123 registers per write telegram (FC 16)<br>Read/write coil:<br>• Max. 2000 coils per read telegram (FC 1, 2),<br>• Max. 1968 coils per write telegram (FC 15) |
| Modbus function codes | 1, 2, 3, 4, 5, 6, 7, 15, 16, 23 (funktion code 23 in server mode only) |
| Protocol mode | Client or server |
| Baud rate | 10 and 100 MBit/s |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Reference to firmware/stack version | V2.0/V2.6 |

*Table 102: Technical data Open Modbus/TCP*

### 10.2.6 POWERLINK Controlled Node

| 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 |
| Restriction | No acyclic user data communication<br>No slave to slave communication |
| Reference to firmware/stack version | V2.0/V3.4 |

*Table 103: POWERLINK Controlled Node*

### 10.2.7 PROFINET IO-Controller

| Parameter | Description |
|---|---|
| Maximum number PROFINET IO-Devices | 128 |
| Maximum number of total cyclic input data | 5712 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<br>RTA – Real Time Acyclic Protocol<br>DCP – Discovery and configuration Protocol<br>CL-RPC – Connectionless Remote Procedure Call |
| Context-Management by CL-RPC | Supported |
| Minimum cycle time | 1 ms<br>Different IO-Devices can be configured with different cycle times |
| Baud rate | 100 MBit/s<br>Full-duplex |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Configuration file | Maximum 1 MByte |

| Parameter | Description |
|---|---|
| Restrictions | Read/Write Record not supported<br>No alarm processing<br>RT over UDP not supported<br>Multicast communication not supported<br>DHCP is not supported<br>Only one IOCR per IO Device<br>NameOfStation of IO-Controller cannot be set using the DCP SET NameOfStation service but only at start-up while configuring the IO-Controller<br>SNMP is not supported<br>LLDP is not supported<br>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.<br>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.<br>The size of the bus configuration file is limited by the size of the RAM Disk (1 MByte)<br>Only one API (API = 0) is supported.<br>The IO-Device feature “FastStartUp” can not be used.<br>WriteMultiple-Record service is not supported. |
| Reference to firmware/stack version | V2.0/V3.3 |

*Table 104: Technical data PROFINET IO-Controller*

### 10.2.8 PROFINET IO-Device

| Parameter | Description |
|---|---|
| Maximum number of cyclic input data | 1024 bytes |
| Maximum number of cyclic output data | 1024 bytes |
| Supported protocols | RTC – Real Time Cyclic Protocol, Class 1 and 2 (unsynchronized)<br>RTA – Real Time Acyclic Protocol<br>DCP – Discovery and configuration Protocol<br>CL-RPC – Connectionless Remote Procedure Call<br>LLDP – Link Layer Discovery Protocol<br>SNMP – Simple Network Management Protocol |
| Used rotocols (subset) | UDP, IP, ARP, ICMP (Ping) |
| Topology recognition | LLDP, SNMP V1, MIB2, physical device |
| Media redundancy | MRP Client |
| VLAN- und priority-tagging | Yes |
| Context-Management by CL-RPC | Supported |
| Minimum cycle time | 1 ms for RTC1 and RTC2 |
| Baud rate | 100 MBit/s |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Restrictions | No acyclic user data communication<br>RT over UDP not supported<br>Multicast communication not supported<br>DHCP is not supported<br>RT Class 2 synchronized (IRT “flex”) is not supported<br>RT Class 3 synchronized not supported<br>FastStartUp is not supported.<br>Access to the submodule granular status bytes (IOCS) is not supported.<br>The amount of configured IO-data influences the minimum cycle time that can be reached<br>Supervisor-AR is not supported, Supervisor-DA-AR is supported<br>Only 1 Input CR and 1 Output CR are supported<br>Multiple WriteRequests are not supported |
| Reference to firmware/stack version | V2.0/V4.4 |

*Table 105: Technical data PROFINET IO-Device*

## 10.2.9 Sercos Master

| Parameter | Description |
|---|---|
| Maximum number of cyclic input data | 5760 bytes (including Connection Control per Connection) |
| Maximum number of cyclic output data | 5760 bytes (including Connection Control per Connection) |
| Maximum number of configured slave devices | 511 |
| Minimum cycle time | 250 µs |
| Acyclic communication | Service channel: Read/Write/Commands (for configuration only) |
| Functions | Bus scan |
| Communication phases | NRT, CP0, CP1, CP2, CP3, CP4 |
| Topology | Line and double ring |
| Redundancy | Supported |
| Baud rate | 100 MBit/s, full-duplex |
| Data transport layer | Ethernet II, IEEE 802.3 |
| Auto crossover | Supported |
| Supported Sercos version | Communication Specification Version 1.1.1/1.1.2 |
| Restrictions | No acyclic user data communication<br>NRT channel not supported<br>Hot-Plug not supported<br>Cross Communication not supported<br>Ring healing (needed for redundancy) is only available if the Master has a configuration |
| Reference to firmware/stack version | V2.0/V2.1 |

*Table 106: Technical data Sercos Master*

## 10.2.10 Sercos Slave

| Parameter | Description |
|---|---|
| Maximum number of cyclic input data (Tx) | 128 bytes (including Connection Control and IO Status) |
| Maximum number of cyclic output data (Rx) | 128 bytes (including Connection Control and IO Control) |
| Maximum number of slave devices | 1 |
| Sercos addresses | 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 version | Sercos in the third generation<br>Communication Specification Version 1.1.2 |
| Supported sercos Communication Profiles | SCP_FixCFG Version 1.1.1<br>SCP_VarCFG Version 1.1.1<br>SCP_VarCFG Version 1.1.3 |
| Supported FSP profiles | FSP_IO |
| SCP_NRTPC support | Yes |
| S/IP support | Yes |
| Identification LED feature supported | Yes |
| Restrictions | Max. 2 connections:<br>1 for consumer and 1 for producer<br>No acyclic user data communication<br>Modifications of the Service-Channel Object Dictionary will be volatile after reset, if it resides on device<br>Hot-Plug not supported<br>Cross Communication not supported<br>NRT Channel only forwarding and S/IP |
| Reference to firmware/stack version | V2.0/V3.5 |

*Table 107: Technical data Sercos Slave*

# 10.3 Technical data of field bus protocols

## 10.3.1 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<br>• synchronized,<br>• remotely requested, and<br>• event driven (change of date) |
| Functions | Emergency Message (Consumer)<br>Node Guarding / Life Guarding, Heartbeat<br>PDO Mapping<br>NMT Master<br>SYNC protocol (Producer)<br>Simple boot-up process, reading object 1000H for identification |
| Baud rate | 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 for CANopen | 11 bit |
| Restrictions | CoE upload, CoE download for user data transfer not supported |
| Reference to firmware/stack version | V2.0/V2.14 |

*Table 108: Technical data CANopen Master*

### 10.3.2 CANopen Slave

| Parameter | Description |
|---|---|
| Maximum number of cyclic input data | 512 bytes<br>Objects 2200, 2201, 2202, 2203 each with up to 128 bytes |
| Maximum number of cyclic output data | 512 bytes<br>Objects 2000, 2001, 2002, 2003 each with up to 128 bytes |
| Maximum number of receive PDOs | 64 |
| Maximum number of transmit PDOs | 64 |
| Exchange of process data | Via PDO transfer<br>• synchronized,<br>• remotely requested, and<br>• event driven (change of date, event timer) |
| Functions | Node Guarding / Life Guarding, Heartbeat<br>PDO Mapping<br>NMT Slave<br>SYNC protocol (Consumer)<br>SDO upload/download (server, for configuration)<br>Emergency Message (Producer) |
| Baud rate | 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<br>Automatic baud rate detection is supported. |
| Data transport layer | CAN frames |
| CAN frame type for CANopen | 11 bit |
| Restrictions | Timestamp (Producer/Consumer) not supported on application level. |
| Reference to firmware/stack version | V2.0/V3.7 |

*Table 109: Technical data CANopen Slave*

#### Configuration of the node address

The CANopen node address can be configured by SYCON.net or by address switches. The address switches can be activated with SYCON.net version 1.351 (or higher) and can be used with firmware version 1.5 (or higher).

### 10.3.3 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 number of cyclic input data | 368 bytes |
| Maximum number of cyclic output data | 368 bytes |
| Input data remote device station | 112 bytes (RY) and 256 ytes (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 |
| Restriction | Intelligent Device Station not supported |
| Firmware works according to CC-Link Version 1.11 | |
| Station types | Remote I/O station,<br>Remote device station' (up to 4 occupied stations) |
| Maximum number of cyclic input data | 48 bytes |
| Maximum number of cyclic 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 | V2.0/V2.12 |

*Table 110: Technical data CC-Link Slave*

#### Configuration of the station number

The CC-Link station number can be configured by SYCON.net or by address switches. The address switches can be activated with SYCON.net version 1.351 (or higher) and can be used with firmware version 1.5 (or higher).

### 10.3.4 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 |
| Connections | Bit Strobe<br>Change of State<br>Cyclic<br>Poll<br>Explicit Peer-to-Peer Messaging |
| Functions | Quick Connect |
| Fragmentation | Explicit and I/O |
| UCMM | Supported |
| Objects | Identity Object (Class Code 0x01)<br>Message Router Object (Class Code 0x02)<br>DeviceNet Object (Class Code 0x03)<br>Connection Object (Class Code 0x05)<br>Acknowledge Handler Object (Class Code 0x06) |
| Baud rate | 125 kBits/s, 250 kBit/s, 500 kBit/s<br>Automatic baud rate detection is not supported. |
| Data transport layer | CAN frames |
| Restrictions | User data transfer through the gateway only via IO connections |
| Reference to firmware/stack version | V2.0/V2.4 |

*Table 111: Technical data DeviceNet Master*

### 10.3.5 DeviceNet Slave

| Parameter | Description |
|---|---|
| Maximum number of cyclic input data | 255 bytes |
| Maximum number of cyclic output data | 255 bytes |
| Connections | Poll<br>Change of State<br>Cyclic<br>Bit Strobe |
| Fragmentation | Explicit and I/O |
| UCMM | Not supported |
| Baud rate | 125 kBits/s, 250 kBit/s, 500 kBit/s<br>Automatic baud rate detection is not supported. |
| Data transport layer | CAN frames |
| Restrictions | Access to Application Object only via IO connection |
| Reference to firmware/stack version | V2.0/V2.5 |

*Table 112: Technical data DeviceNet Slave*

#### Configuration of the MAC ID

The DeviceNet MAC ID can be configured by SYCON.net or by address switches. The address switches can be activated with SYCON.net version 1.351 (or higher) and can be used with firmware version 1.5 (or higher).

### 10.3.6 PROFIBUS DP Master

| Parameter | Description |
|---|---|
| Maximum number of PROFIBUS DP Slaves | 125 |
| Maximum number of total cyclic input data | 5712 bytes |
| Maximum number of total cyclic output data | 5760 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<br>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<br>Automatic baud rate detection is not supported. |
| Data transport layer | PROFIBUS FDL |
| Restrictions | DP V1 services class 1 and 2 are not supported<br>DP V2 services are not supported |
| Reference to firmware/stack version | V2.0/V2.9 |

*Table 113: Technical data PROFIBUS DP Master*

### 10.3.7 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 | Max. 4 input modules and max. 4 output modules, max. 24 modules when using manual setting |
| 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<br>Automatic baud rate detection is supported. |
| Data transport layer | PROFIBUS FDL |
| Restrictions | DP V1 services class 1 and 2 to transfer user data are not supported<br>SSCY1S – Slave to slave communication state machine not implemented<br>Data exchange broadcast not implemented<br>I&M0 with fixed settings only |
| Reference to firmware/stack version | V2.0/V2.10 |

*Table 114: Technical data PROFIBUS DP Slave*

#### Configuration of the station address

The PROFIBUS station address can be configured by SYCON.net or by address switches. The address switches can be activated with SYCON.net version 1.351 (or higher) and can be used with firmware version 1.5 (or higher).

# 10.4 Technical data of serial protocols

## 10.4.1 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<br>On receipt of termination character(s)<br>Elapse of character delay time |
| Timing parameter | Acknowledge timeout<br>Receive watchdog time<br>Send cycle time<br>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)<br>Device address<br>Object index or start address<br>Command identifier<br>Data area with length information<br>Data area with termination character(s)<br>End character(s)<br>Checksum<br>Character(s) without meaning (fix length) |
| Checksum methods | CRC8, CRC16, CRC32, Exor |
| Reference to firmware/stack version | V2.0/V1.1 |

*Table 115: Technical data ASCII*

### 10.4.2 Modbus RTU Master/Slave

| Parameter | Description, value range |
|---|---|
| Maximum number of input data | 2880 registers |
| Maximum number of output data | 2880 registers |
| Acyclic communication | Read/write register<br>• Maximum 125 registers per read telegram (FC 3, 4)<br>• Maximum 123 registers per write telegram (FC 16)<br>• Maximum 118 registers per write telegram (FC 23)<br>• Maximum 118 registers per read telegram (FC 23)<br>Read/write coil<br>• Maximum 2000 coils per read telegram (FC 1, 2),<br>• 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 |
| Modbus address | 1 ... 247 |
| Baud rate | 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 |
| Restrictions | Broadcast not supported |
| Reference to firmware/stack version | V2.0/V1.5 |

*Table 116: Technical data Modbus RTU Master/Slave*

### 10.4.3 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 |
| Baud rate | Depends on the used hardware interface. See technical data of the device. |
| Flow control RS-232 | None or RTS/CTS handshake,<br>Polarity of RTS signal adjustable |
| Timing parameter | Response timeout, programmable in script,<br>Character delay time (adjustable) (resolution 10 ns)<br>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)<br>Device address<br>Object index or start address<br>Command identifier<br>Data area with length information<br>Data area with termination character(s)<br>End character(s)<br>Checksum<br>Character(s) without meaning<br>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)<br>XOR and sum function possible |
| Parameter FIFO Mode | |
| Maximum telegram length | Only limited by the script processing speed and by the data transfer sped |
| Duplex | Full-duplex for RS-232, RS-422<br>Half-duplex for RS-485 |
| Indicator for end 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 |
| Indicator for end of received telegram | Free definable end indicator with up to 64 bit and bit by bit AND mask |

| Parameter | Description and value range |
|---|---|
| Number of send/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 firmware/stack version | V2.0/V1.4 |

*Table 117: Technical data of serial protocols*

### 10.4.4 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<br>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 |
| Reference to firmware/stack version | V2.0/V1.0 |

*Table 118: Technical data 3964*

# 11 Wiring instructions

Observe the wiring instructions for the corresponding networks to guarantee a correct function of the device. Always use shielded cables whose shield has a large-scale connection to the potential equalization at both ends. Lay the communication lines as far away as possible from the power lines to avoid EMC influence caused by switching operations in the power lines.

## 11.1 Assembly of D-Sub connectors

The design of the bus cabling is essential for the proper function of communication. Special attention should therefore be paid to the cable connections with its connectors and a good shield connection.

Connect the shield as follows:

- ➢ Dismantle the cable.
- ➢ Pull back the shielding from the cable sheathing.
- ➢ Reduce the shielding so that later it is covered by the nozzle.
- ➢ Push a nozzle or shrinking tube over the cable sheathing so that a zone of 5 to 8 mm remains free at the cable end.
- ➢ Connect the wire ends with the connector.
- ➢ Push the cable in the plug to the bare braided shield under the strain relief.
- ➢ Tighten the screws of the strain relief.
- ⇨ The figure shows how the cable connection should look like:

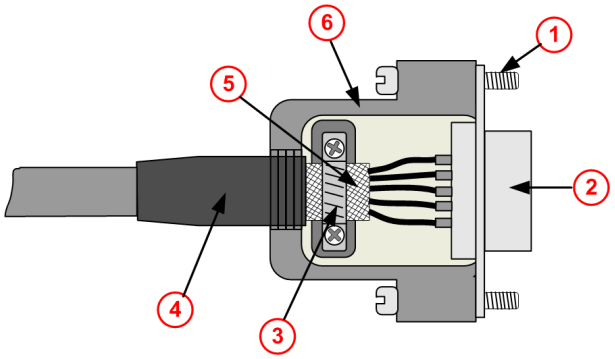



*Figure 25: D-Sub cable assemblies*

| Pos. | Description |
|---|---|
| (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 as bend protection. |
| (5) | Cable shielding pulled back over the cable sheathing. |
| (6) | Metallic or metallized connector housing |

*Table 119: D-Sub cable assemblies*

## 11.2 Ethernet

### 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 | Allowed between EtherCAT Master and first EtherCAT Slave only (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) |
| POWERLINK | Allowed | Forbidden |
| PROFINET IO | Forbidden | Allowed only, if the switch supports ‚Priority Tagging' and LLDP (100 MBit/s, full-duplex) |
| Sercos | Forbidden | Forbidden |

*Table 120: Use of hubs and switches*

When using old NT 100-RE-XX devices, then follow::

**Important:**

Failure of the network communication

- Do not operate devices 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 occurr.
- 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* [page 58].

## 11.3 PROFIBUS

Make sure that there are termination resistors at both ends of the cable. If special PROFIBUS connectors are used, these resistors are often inside the connector and only need to be switched on.

For baud rates above 1.5 MBit/s, use only PROFIBUS connectors that also include additional inductance.

At these high baud rates, branch lines are not allowed. Use only a special cable that is approved for PROFIBUS. With every device provide a large-scale connection from cable shield to ground and make sure that there is no potential difference between these points.

If you link the netTAP device with only one other device, both devices must be connected at the ends of the cable so that the termination resistors are supplied with voltage. Otherwise the Master can be connected at any other point.

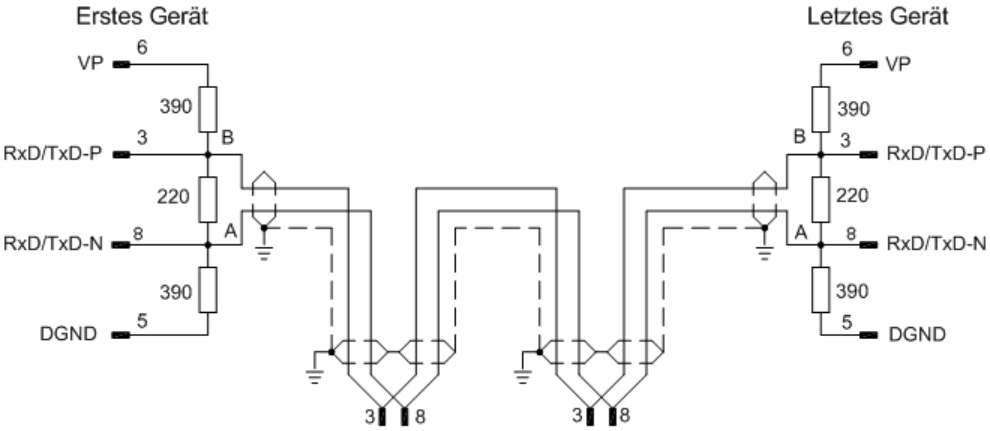



*Figure 26: PROFIBUS cable and termination*

You can link up to 32 DeviceNet devices in one bus segment. If several bus segments with repeaters are linked, max. 127 devices can be connected to the network.

The max. length of a bus segment depends on the baud rate used. Use only a special cable that is approved for PROFIBUS; preferably type A.

The max. cabl length depends on the baud rate und is indicated in the following table.

| Baud rate | Max. cable length |
|---|---|
| 9.6 kbit/s | 1200 m |
| 19.2 kbit/s | 1200 m |
| 93.75 kbit/s | 1200 m |
| 187.5 kbit/s | 1000 m |
| 500 kbit/s | 400 m |
| 1.5 Mbit/s | 200 m |
| 3 Mbit/s | 100 m |
| 6 Mbit/s | 100 m |
| 12 Mbit/s | 100 m |

*Table 121: Max. cable length and baud rate for PROFIBUS*

The following table contains the most important electrical data for a PROFIBUS cable:

| Parameter | Value |
|---|---|
| Impedance | 150 Ω ± 15 Ω |
| Capacity | < 30 pF/m |
| Loop resistance | < 110 Ω/km |
| Wire diameter | 0.64 mm |

*Table 122: Electrical requirements: PROFIBUS cable*

## 11.4 CANopen

Use only a special cable that is approved for CAN with the followingcharacteristics:

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

*Table 123: Electrical requirements: CANopen cable*

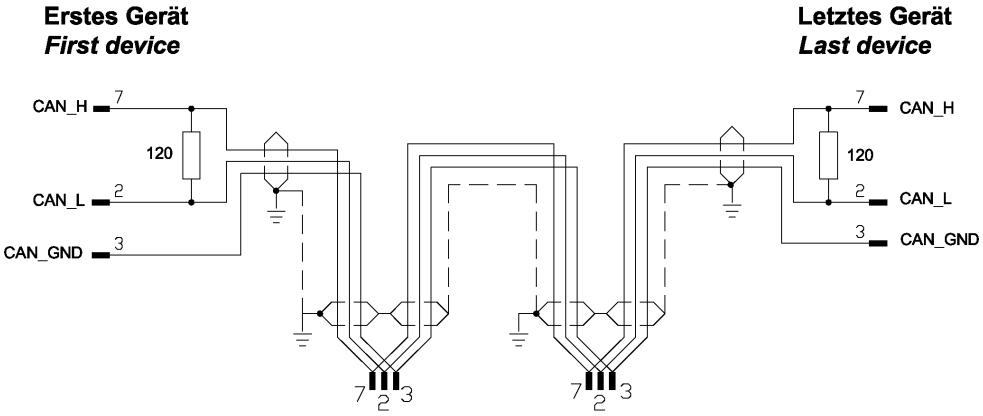



*Figure 27: CANopen cable and termination*

Termination resistors of 120 Ω must be installed at the ends of the network. Repeaters may be used to increase the number of connected nodes or the max. cable length.

The following table indicates the max. length for CANopen cables depending on baud rate, loop resistance, and the required wire cross section:

| Baud rate | Max. length | Loop resistance | Wire cross section |
|---|---|---|---|
| 10 kBit/s | 1000 m | < 26 Ω/km | 0.75 ... 0.80 mm² |
| 20 kBit/s | 1000 m | < 26 Ω/km | 0.75 ... 0.80 mm² |
| 50 kBit/s | 1000 m | < 26 Ω/km | 0.75 ... 0.80 mm² |
| 125 kBit/s | 500 m | < 40 Ω/km | 0.50 ... 0.60 mm² |
| 250 kBit/s | 250 m | < 40 Ω/km | 0.50 ... 0.60 mm² |
| 500 kBit/s | 100 m | < 60 Ω/km | 0.34 ... 0.60 mm² |
| 800 kBit/s | 50 m | < 60 Ω/km | 0.34 ... 0.60 mm² |
| 1 MBit/s | 30 m | < 70 Ω/km | 0.25 ... 0.34 mm² |

*Table 124: Max. cable length and baud rate for CANopen*

## 11.5 DeviceNet

You can link up to 64 DeviceNet devices together via the bus. The max. length of the cable depends on the baud rate and cable type. Use only a special cable that is approved for DeviceNet. The following table indicates the respective values.

| Baud rate | Max. length of cable (thick cable) | Max. length of cable (thin cable) |
|---|---|---|
| 125 kbit/s | 500 m | 100 m |
| 250 kbit/s | 250 m | 100 m |
| 500 kbit/s | 100 m | 100 m |

*Table 125: Max. cable length and baud rate for DeviceNet*

The data transmission lines must meet the following requirements:

| Parameter | Value (thick cable) | Value (thin cable) |
|---|---|---|
| Impedance | 120 Ω | 120 Ω |
| Capacity | < 39.4 pF/m | < 39.4 pF/m |
| Loop resistance | < 22.6 Ω/km | < 91.8 Ω/km |
| Wire diameter | 2*1.1 mm | 2*0.6 mm |

*Table 126: Electrical requirements on DeviceNet data lines*

The power supply cables must meet the following requirements:

| Parameter | Value (thick cable) | Value (thin cable) |
|---|---|---|
| Loop resistance | < 11.8 Ω/km | < 57.4 Ω/km |
| Wire diameter | 2*1.4 mm | 2*0.7 mm |

*Table 127: Electrical requirements on DeviceNet power supply cables*

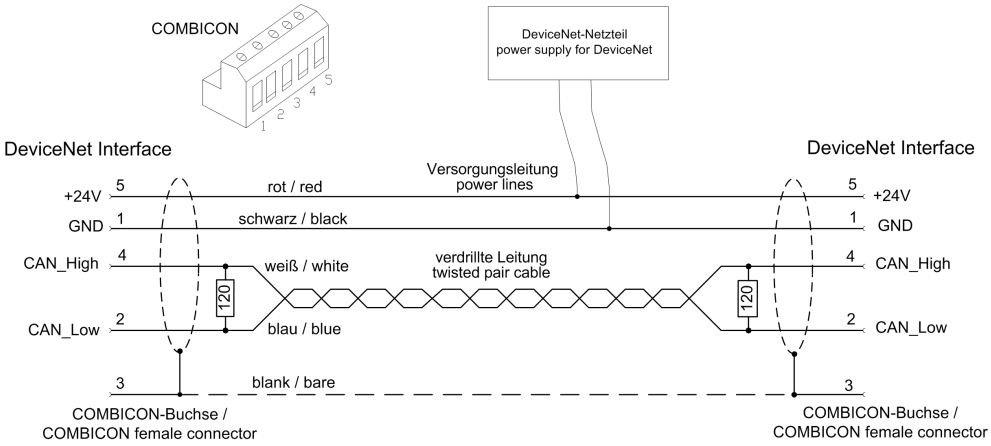



*Figure 28: DeviceNet cable and termination*

Make sure that there are termination resistors of 120 Ohm at both ends of the cable.

Via branch lines, further devices can be connected to the cable. The max. length of a branch line is 6 m. The entire length of the cable and all branch lines must not exceed the max. length listed in the following table.

Two different cable types exist. If both cables types are used within the same network, the max. length is calculated as follows:

| Baud rate | Formula |
|---|---|
| 125 kbit/s | $L_{thick}$ + 5 * $L_{thin}$ <= 500 m |
| 250 kbit/s | $L_{thick}$ + 2.5 * $L_{thin}$ <= 250 m |
| 500 kbit/s | $L_{thick}$ + $L_{thin}$ <= 100 m |

*Table 128: Formula for calculating the max. cable length for DeviceNet (thick and thin cable)*

## 11.6 CC-Link

Use only a special cable that is approved for CC-Link. CC-Link specifies several shielded three-core Twisted Pair cables. We recommend using only one type of cable for an installation. Make sure that there are termination resistors at both ends of the cable. The value of the termination resistor depends on the cable type used and can be 100, 110 or 130 Ohm.

The following figure shows the general structure of the cable:

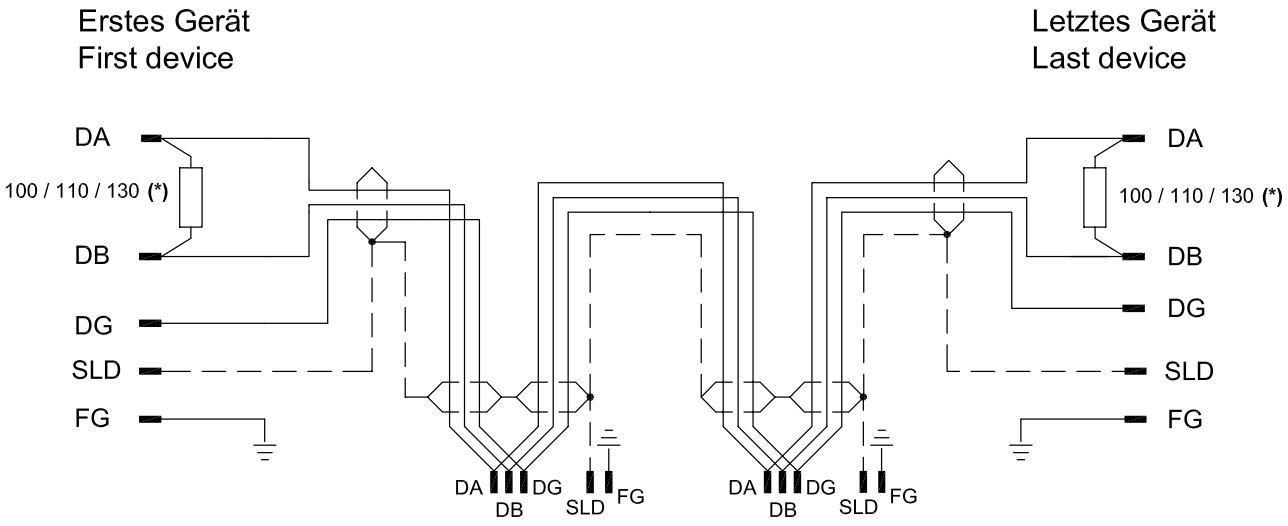



*Figure 29: CC-Link cable*

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

The max. length of a bus segment depends on the baud rate used. The network structure can be built using a cable with or without branches. The "CC link Cable Wiring manual", July 2004, contains all details listed here. The manual contains further information and is available for download under CC0407-06-D on http://www.cc-link.org.

Cable specification V1.10 has not been changed for CC-Link V2.00.

Depending on the baud rate, the different cable types allow the following cable lengths:

### Only trunk line without branch lines

| Baud rate | max. length, cable V1.00 | max. length, cables V1.10 and V1.00 with high capacity | max. length, highly 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 129: Max. length*

Further cable types are available, but with these cable types only shorter max. lengths are possible.

### 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 130: Max. length*

Only at the baud rates 156 kbps and 625 kbps can further devices be connected to the bus cable via branch lines. The max. length of a branch line is 8 m. The entire length of the bus cable and all branch lines must not exceed the max. length listed in the following table.

### Min. cable length

| 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 or intelligent device | 1 m or more | 0.2 m or more |

*Table 131: Min. distance between two devices*

### CC-Link cable housing

A CC-Link cable housing is included within the delivery of a netTAP NT 100-XX-CC gateway device. The cable housing is from Phoenix Contact, number 1803895, designation KGG-MSTB 2,5/5.

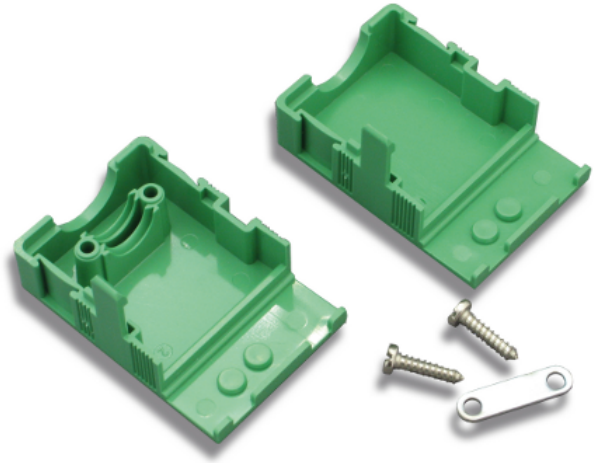


*Figure 30: CC-Link cable housing – separate components*

Use the delivered cable housing. The cable housing serves to protect the CC-Link communication line against EMC disturbances which might come in via the screws of the COMBICON connector.

### Assembly

- ➢ Place the Combicon connector with the screwed-down CC-Link cable into the lower part of the cable housing.
- ➢ Tighten the two screws to attach the strain relief of the CC-Link cable to the cable housing.
- ➢ Place the upper part of the cable housing onto the lower part to close the cable housing.

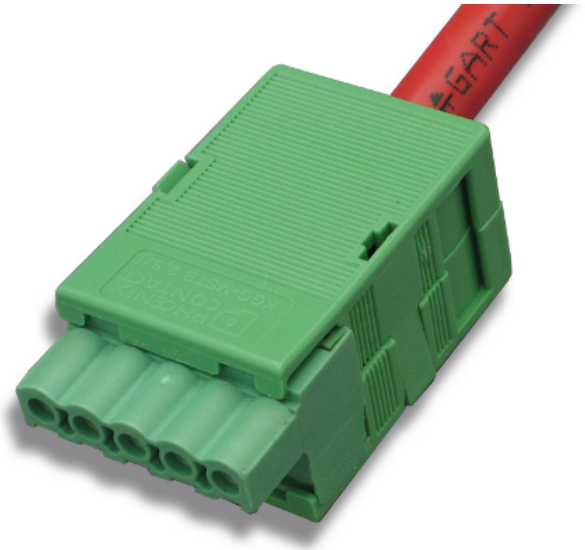


*Figure 31: Mounted CC-Link cable housing*

# 11.7 RS-232

The RS-232 interface (EIA-232) is a point-to-point connection of two communication devices. Use shielded cables. Termination resistors are not required.

Pay attention to the pin assignment of both communication partners. That decides on whether you need a so-called null modem cable with crossed pin assignments.

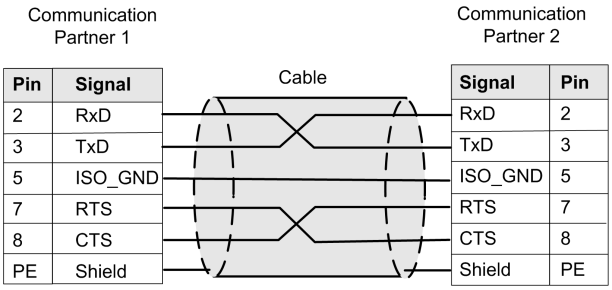



*Figure 32: RS-232 null modem cable connection*

The indications apply to a 9-pin D-Sub connector. Not all devices have RTS and CTS signals.

### Cable lengths and transmission rates

The EIA-232 specification allows a max. cable capacity for an RS-232 connection of max. 2500 pF and enables the following cable lengths depending on the baud rate:

| Max. baud | Max. length |
|---|---|
| 19200 | 15 m |
| 57600 | 5 m |
| 115200 | < 2 m |

*Table 132: Max. cable length and baud rate with RS-232*

Cables of a lower capacity allow even higher lengths.

# 11.8 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 max. 10 slaves. Using repeaters allows even more slaves.

Cable lengths of up to 1.2 km (at low baud rates) and data transmission rates of up to 10 MBit/s (at a max. cable length of 12 m) are possible. The max. useable transmission rate depends on the technical data of the devices used.

The following figure shows an RS-422 wiring.

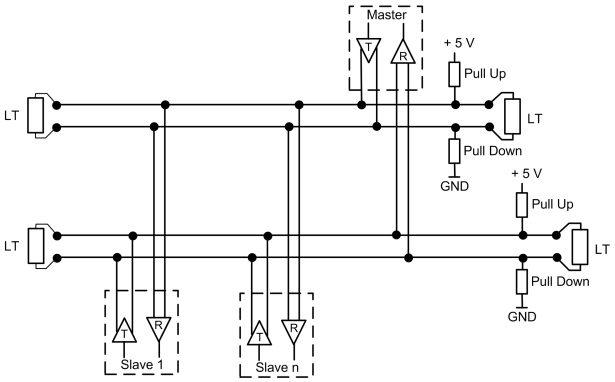



*Figure 33: RS-422 cable*

### 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 to the potential equalization system at both ends.

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 to 650 Ω.

### Cable requirements

The design of the bus cabling is essential for the reliable operation and electromagnetic compatibility (EMC). Always use shielded twisted pair cables. The shield of the cable must consist of a copper wire mesh.

| Parameter | Value |
|---|---|
| Impedance | 150 Ω ± 15 Ω |
| Capacity | < 30 pF/m |
| Loop resistance | 110 Ω/km |
| Wire diameter | 0.64 mm |

*Table 133: Electrical requirements: RS-422 cable*

The following line lengths are possible:

| Max. cable length | Baud rate | Max. branch line length |
|---|---|---|
| 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 134: RS-422 cable lengths*

## 11.9 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 major advantage of the 2-wire technology is its multi-master capability. In principle, each participant is able to exchange data with any other participant. However, the applied protocol must prevent two or more participants from sending at the same time. Using a protocol, the RS-485 interface allows the connection of up to 32 transmitters and receivers. With repeaters even more participants are possible.

RS-485 supports cable lengths of up to 1.2 km and data transmission rates of up to 1 MBit/s. The max. useable transmission rate depends on the technical data of the devices used.

The following figure shows an RS-485 wiring.

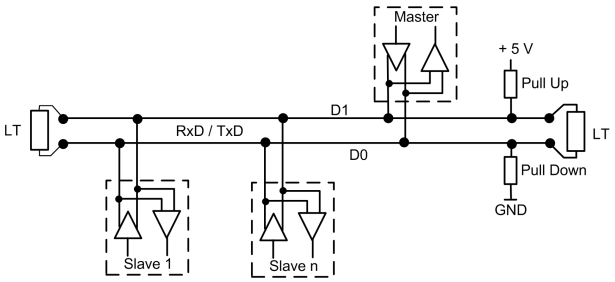



*Figure 34: RS-485 cable*

### Bus requirements

The bus cable must be a shielded twisted pair cable. The shield should have a large-scale connection to the potential equalization system at both ends.

On each end, between the lines D1 und D0, the bus requires a termination resistor (LT) whose value range corresponds to that of the wave impedance of the cable. Generally, the value of the termination resistor ranges between 120 Ω and 220 Ω.

The value of the pull-up and pull-down resistors ranges between 390 Ω and 650 Ω.

### Cable requirements

The design of the bus cabling is essential for the reliable operation and electromagnetic compatibility (EMC). Always use shielded twisted pair cables. The shield of the cable must consist of a copper wire mesh.

| Parameter | Value |
|---|---|
| Impedance | 150 Ω ± 15 Ω |
| Capacity | < 30 pF/m |
| Loop resistance | 110 Ω/km |
| Wire diameter | 0.64 mm |

*Table 135: Electrical requirements: RS-485 cable*

The following line lengths are possible:

| Max. cable length | Baud rate | Max. branch line length |
|---|---|---|
| 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 136: RS-485 cable lengths*

# 12 Appendix

## 12.1 Legal notes

**Copyright**



**Important notes**

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