Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Network Clock Device

Model 8030NTS/NCD

For DIN Rail Installation
(DIN EN 60715 TH35)

ENGLISH

Version: 04.01 – 17.06.2021

	SET	IMAGE (8030)	FIRMWARE (8024)
Valid for	Version: **04.xx**	Version: **04.xx**	Version: **02.xx**

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Version Numbers (Firmware / Description)

THE TERM **SET** DEFINES THE FIXED RELATIONSHIP BETWEEN THE IMAGE VERSION AND THE ASSOCIATED H8 FIRMWARE VERSION.

THE FIRST TWO DIGITS OF THE TECHNICAL DESCRIPTION VERSION NUMBER, THE **SET** VERSION AND THE IMAGE VERSION **MUST BE THE SAME**! THEY DESIGNATE THE SHARED FUNCTIONAL IDENTITY BETWEEN DEVICE, SOFTWARE AND TECHNICAL DESCRIPTION.

THE VERSION NUMBER OF THE IMAGE AND THE H8 SOFTWARE CAN BE READ IN THE WEBGUI OF THE NETWORK CLOCK DEVICE 8030NTS/NCD.

THE TWO DIGITS AFTER THE DOT IN THE VERSION NUMBER DESIGNATES CORRECTIONS TO THE FIRMWARE AND/OR DESCRIPTION WHICH HAVE NO EFFECT ON FUNCTIONALITY.

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Symbols and Characters

Operational Reliability

Disregard may cause damages to persons or material.

Functionality

Disregard may impact function of system/device.

Information

Notes and Information.

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Safety regulations

The safety regulations and observance of the technical data serve to ensure trouble-free operation of the device and protection of persons and material. It is therefore of utmost importance to observe and compliance with these regulations.

If these are not complied with, then no claims may be made under the terms of the warranty. No liability will be assumed for any ensuing damage.

Safety of the device

This device has been manufactured in accordance with the latest technological standards and approved safety regulations

The device should only be put into operation by trained and qualified staff. Care must be taken that all cable connections are laid and fixed in position correctly. The device should only be operated with the voltage supply indicated on the identification label.

The device should only be operated by qualified staff or employees who have received specific instruction.

If a device must be opened for repair, this should only be carried out by employees with appropriate qualifications or by ***hopf*** Elektronik GmbH.

Before a device is opened or a fuse is changed all power supplies must be disconnected.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labelled accordingly.

The safety may be impaired when the device does not operate properly or if it is obviously damaged.

CE-Conformity

CE

This device fulfils the requirements of the EU directive 2014/30/EU "Electromagnetic Compatibility" and 2014/35/EU "Low Voltage Equipment".

Therefore the device bears the CE identification marking
(CE = Communautés Européennes = European communities)

The CE indicates to the controlling bodies that the product complies with the requirements of the EU directive - especially with regard to protection of health and safety for the operator and the user - and may be released for sale within the common markets.

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1 Network Clock Device 8030NTS/NCD

The Network Clock Device 8030NTS/NCD consists of a Network Time Client 8030NTC and a Network Time Server 8030NTS/M. Module 8030NTC acts as time source for the appliance, module 8030NTS/M as NTP Stratum 1 Time Server or as PTP Grandmaster.

Module 8030NTC supports the following network protocols as synchronization source:

- NTP (incl. SNTP)
- IEEE 1588 Precision Time Protocol (PTP) (**Activation key required**)

The Time Server supports the following synchronization protocols:

- NTP (incl. SNTP)
- Daytime
- Time
- SINEC H1 time datagram (**Activation Key necessary**)
- IEEE 1588 Precision Time Protocol (PTP) (**Activation Key necessary**)

The Network Clock Device 8030NTS/NCD is integrated into a compact DIN Rail housing and is characterized by its easy and simple operation, although it offers a **broad range of functions**. Some of the practice-oriented functionalities are:

- **Complete parameterisation via protected WebGUI access**
  All required settings for operation can be executed via a password proteded WebGUI.

- **Automatic switch-over of summer/winter time** (initial setting required)
  After initial commissioning there is no user intervention for a correct summer/winter time changeover for the following years required.

- **Automatic handling of the leap second**
  If a leap second is going to be announced via the synchronization source of Network Clock Device 8030NTS/NCD, the leap second will automatically be inserted into the time information.

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A superior security is guaranteed via available coding procedures such as symmetric keys, autokey and access restrictions and deactivation of non-used protocols.

Diffferent **Managemenet and Monitoring Functions** are availabe **as options** (e.g. SNMP, SNMP-Traps, E-mail notification, Syslog-messages including MIB II and private Enterprise MIB).

A few other basic functions of the Network Clock Device 8030NTS/NCD:

- Operates as **NTP Server with Stratum 1** or as **PTP Grandmaster**
- Easy operation via **WebGUI**
- **Status LEDs** on the front panel
- Completely **maintance-free** system

Software supplied:

- ***hmc*** (***hopf*** Management Console) Software

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Overview of the functions of the Network Clock Device 8030NTS/NCD:

Ethernet Interface

- Auto negotiate
- 10 Mbps half-/full duplex
- 100 Mbps half-/full duplex
- 1 Gbps full duplex

Time Protocols

- RFC-5905 NTPv4 Server
  - NTP Broadcast Mode
  - NTP Multicast Mode
  - NTP Client for additional NTP Servers (redundancy)
  - SNTP Server
  - NTP Symmetric Key Encryption
  - NTP Autokey Encryption
  - NTP Access Restrictions
- SINEC H1 time datagram **(Activation Key necessary)**
- RFC-867 DAYTIME Server
- RFC-868 TIME Server
- Precision Time Protocol (PTP) according to IEEE Std 1588™-2008 **(Activation Key necessary)**
  - IEEE Standard Profile for Use of IEEE 1588™ Precision Time Protocol in Power System Applications (Power Profile) according to IEEE Std C37.238™-2011

Network Configuration (Activation Key necessary)

- Routing
- Bonding (NIC Teaming) Link aggregation according to IEEE 802.1ad
- VLAN support according to IEEE 802.1q
- PRP (Parallel Redundancy Protocol) according to IEC62439-3

System management (Activation Key necessary)

- E-mail notification
- Syslog messages to external syslog server
- SNMPv2c/v3, SNMP Traps (MIB II, Private Enterprise MIB)

Configuration Channel

- HTTP/HTTPS WebGUI (browser-based)
- Telnet
- SSH
- External LAN configuration tool (***hmc*** - **Network-Configuration-Assistant**)

Additional Freatures

- Firmware Update via TCP/IP
- Fail-safe
- Watchdog circuit
- Customized security banner
- NTP local time support

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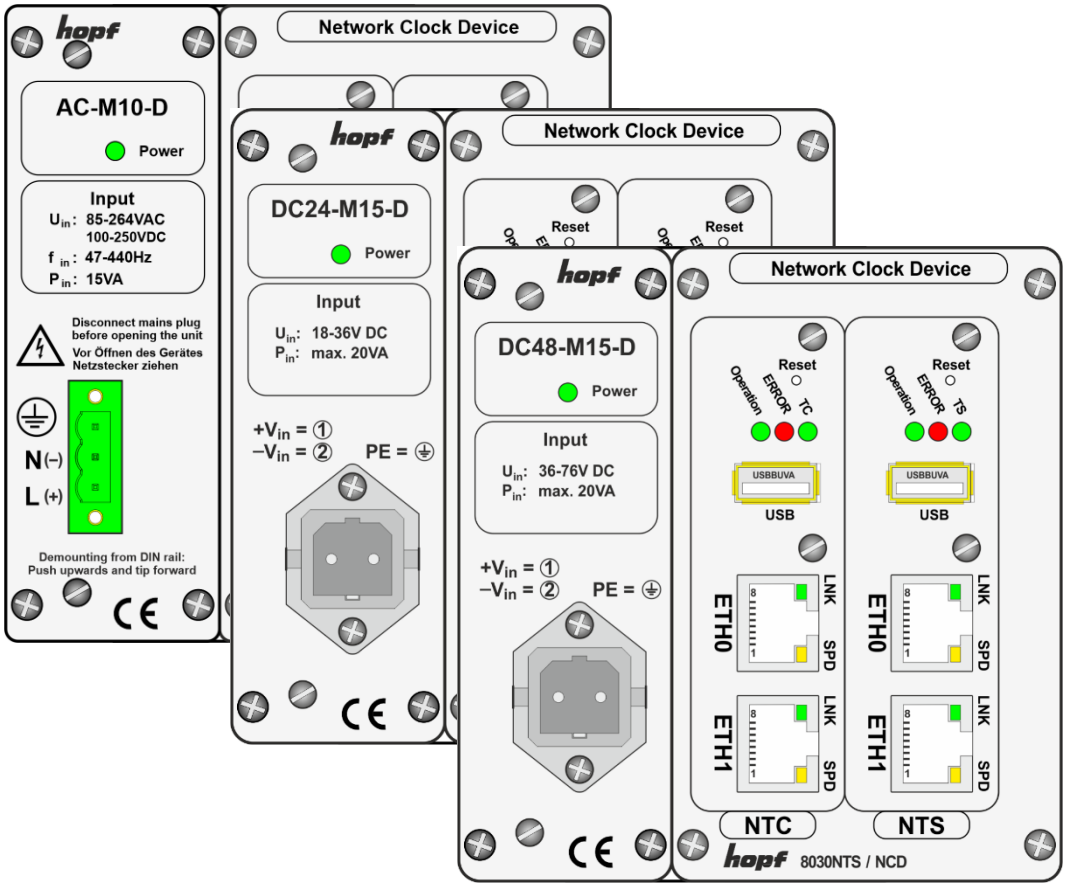
2 System Structure

Views of the Network Clock Device 8030NTS/NCD with AC and DC power supply.



2.1 Housing

The Network Clock Device 8030NTS/NCD is built into a closed aluminium profile housing for horizontal DIN Rail mounting according to DIN EN 60715 TH35.

2.2 Power Supply

Currently the following types of power supplies are available:

- AC/DC wide range power supply 85-264VAC / 100-250VDC

  Type: AC-M10-D
- DC power supply 18-36VDC (nominal voltage 24VDC)

  Type: DC24-M15-D
- DC power supply 36-76VDC (nominal voltage 48VDC)

  Type: DC48-M15-D

2.3 Functional Overview of the Front Panel Elements

You can find more information about the front panel elements of modules 8030NTC and 8030NTS/M in the individual module-manuals.

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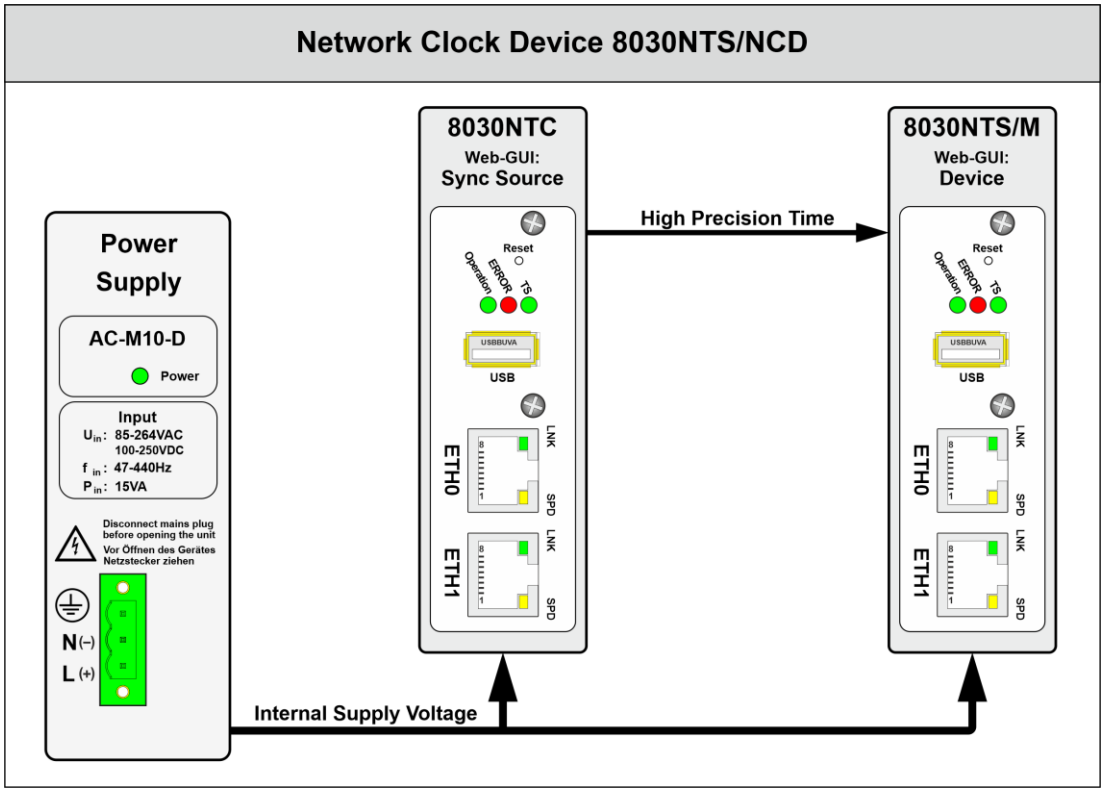
3 Function Principle

This chapter describes the function principle of the Network Clock Device 8030NTS/NCD and the internal relations between the different functional groups.

3.1 Block Diagram



- **Internal Supply Voltage**
  The individual functional components are supplied with the required operating voltage via the implemented power supply unit.
- **Time Information**
  The Module 8030NTC provides the time information and the according synchronization status to Module 8030NTS/M. This time and status information is used for synchronization of the NTP service and if applicable other signal generations and network protocols running on 8030NTS/M.

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3.2 Function 8030NTC

The Module 8030NTC acts as a network time client. A complete LINUX operating system is running on this Module providing all functions such as NTP, WebGUI etc.

By means of selected network time protocols (NTP or PTP) the module-internal crystal is going to be adjusted. Thus, a highly precise time base for module 8030NTS/M – and if necessary further signal generators – will be generated.

3.3 Function 8030NTS/M

The Module 8030NTS/M acts as a network time server. A complete LINUX operating system is running on this Module providing all functions such as NTP, WebGUI etc.

Module 8030NTS/M will be adjusted based on the time information delivered by module 8030NTC and provides this time information to all other activated network time services.

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4 System Behaviour

This chapter describes the behaviour of the system in special operational phases and conditions.

4.1 Boot Phase

The boot process of the Network Clock Device 8030NTS/NCD starts after turning on the system or a reset.

During the boot process the Modules 8030NTC and 8030NTS/M boots its operation system and is therefore not available via LAN.

The end of the boot process is reached when the LED test of the operation LEDs in the front panel has finished. The boot process lasts approx. 1-1.5 minutes.

4.2 Adjustment Process

During boot process the activated synchronization service (NTP or PTP) will automatically be started on module 8030NTC. After starting the synchronization service module 8030NTC requires approx. 5 – 10 minutes to be adjusted.

After adjusting the synchronization service of module 8030NTC, the module provides a valid sync status for module 8030NTS/M, whereby module 8030NTS/M synchronizes based on this time information of module 8030NTC. This process can last approx. 5 – 10 minutes too.

After synchronizing module 8030NTS/M will be available as network time server.

4.3 Firmware Update

Modules 8030NTC and 8030NTS/M can be updated mutually independent.

Detailed information can be found in the module specific technical manuals of the modules 8030NTC and 8030NTS/M.

4.4 Activation of Functions (Activation Key)

There are individual, mutually independent activation keys available for module 8030NTC and 8030NTS/M depending on the serial number of the module where the functionality is intended to be activated.

Detailed information can be found in the module specific technical manuals of the modules 8030NTC and 8030NTS/M.

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5 Installation

The installation of the Network Clock Device 8030NTS/NCD is described below.

5.1 Installation/Dismounting of the DIN Rail Housing

The Network Clock Device 8030NTS/NCD can be mounted on all rails in accordance with DIN EN 60715 TH35 and is designed for horizontal mounting.

Dimensions

The dimensions of the housing can be found in ***Chapter 11.4 Dimensions – DIN Rail Housing***.

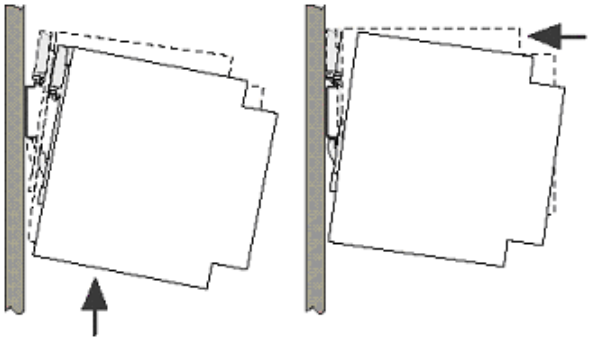
- **Network Clock Device 8030NTS/NCD** – **Housing: TYPE 2**

In order to guarantee an adequate convection, we recommend the following minimum distance from other modules:

- 5.0 cm in vertical direction and
- 1.0 cm in horizontal direction.

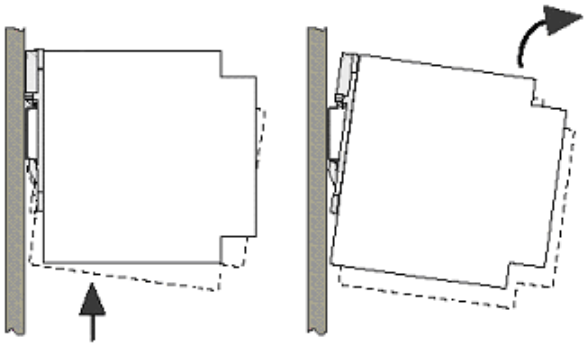
5.1.1 Mounting

Place the module's rail guide bar against the lower edge of the rail, push the module upwards, and clip to the back.



5.1.2 Dismounting

Push the module upwards and then tip forward to remove from the rail.



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5.2 Protective Earth Conductor (Grounding)

Grounding of the Network Clock Device 8030NTS/NCD is achieved via the PE line of the power supply wiring.

5.3 Power Connection

Depending on the version of the appliance an AC or DC power feeding is available.

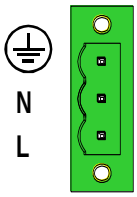
5.3.1 AC Power Supply

The standard AC power supply unit of the Network Clock Device 8030NTS/NCD is described hereunder. However, the connection data on the nameplate of the respective device are always applicable.

Pay attention to the following when connecting the power supply:

- Correct voltage type (AC or DC),
- Voltage amount

The power cable is connected via a 3pole pluggable screw terminal with housing.



Connecting the incorrect voltage can damage the Network Clock Device 8030NTS/NCD.

5.3.1.1 Safety and Warning Instructions

Please read these instructions thoroughly to facilitate safe operation of the device and to use all of its functions!

Warning: Never work on live equipment! Danger to life!

The Network Clock Device 8030NTS/NCD is a built-in device. Installation and commissioning may only be carried out by suitable specialist personnel. In doing so the respective country-specific regulations (e.g. VDE, DIN) must be observed.

In particular, before commissioning please ensure that

- The power connection has been installed correctly and there is guaranteed protection against electric shock!
- The ground wire is connected!
- All power cables are correctly fused and sized!
- All output lines are sized in accordance with the max. output current of the device or are specially fused!
- Sufficient convection is guaranteed!

The device contains components carrying life-threatening voltage and a high amount of stored energy!

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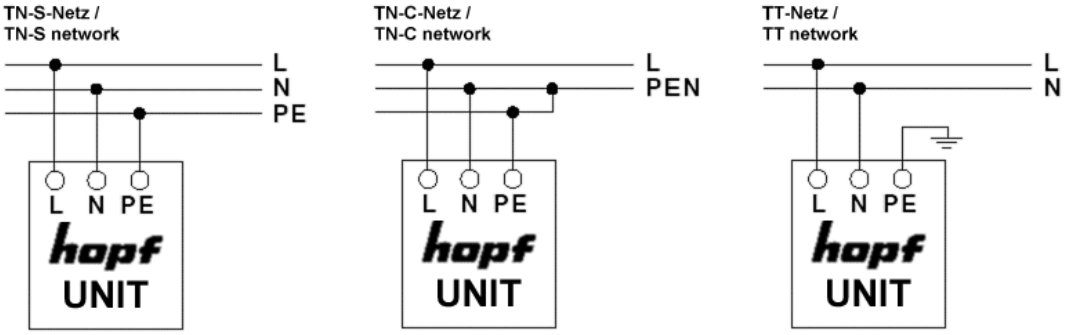
5.3.1.2 Connection to various Power Networks



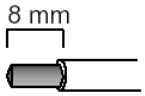
5.3.1.3 Power Cable Connection

The power cable is connected via a 3-pole pluggable screw terminal. The following cable cross-sections can be connected to the input plug:

	Fixed [mm²]	Flexible [mm²]	AWG	Starting moment [Nm]
L, N, ⏚	0.2-2.5	0.2-2.5	24-12	0.5 – 0.6

For a reliable and secure contact:

Strip the insulation by 8 mm!



The connector must always be mounted using the housing and strain relief fitting provided.

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5.3.1.4 Voltage Input / Fuse Protection

The 85-264VAC connection is made via the pluggable screw terminal L, N and ⏚.

Primary Side Fuse Protection

The device must be installed in accordance with the provisions of EN 60950. There must be a suitable isolating device external to the power supply capable of switching the device off.

The primary side line protection, for example, is suitable for this purpose.

Further equipment protection is not required because the device is fused internally.

Recommended External Fuse

When connecting the Network Clock Device 8030NTS/NCD a suitable fuse protection of the power supply needs to be observed.

Accordingly, the performance data should be taken from the nameplate of the device. Currently the standard versions of the Network Clock Device 8030NTS/NCD are supplied with power supplies with power consumption between 6 and 15VA.

Regarding DC applications a suitable fuse must be connected.

If the internal fuse trips it is highly likely that the device is faulty. In this case the equipment should be checked at the factory!

5.3.1.5 Power Supply Specifications

All specifications regarding the AC power supply can be found in ***Chapter 11.3 Power Supplies***.

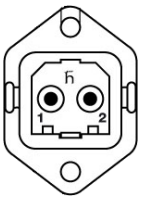
5.3.1.6 Power LED

The green Power LED allows a functional evaluation directly on site at the control cabinet.

LED lights	Normal power supply operation
LED off	No power supply is available or the device is faulty.

5.3.2 DC Power Supply

Make sure that the external voltage source is switched off. When connecting the power supply, ensure that the polarity and ground connection are correct!



- The power supply cable is connected to the Network Clock Device 8030NTS/NCD by means of a 2-pole plug connector with additional ground connection and interlock:

  $+V_{in}$: Positive pole (contact 1)
  $-V_{in}$: Negative pole (contact 2)
  PE: Ground

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Connecting the incorrect voltage can damage the Network Clock Device 8030NTS/NCD.

Grounding:
The negative pole (-Vin) and the ground (PE) are connected together as standard on the system side.

5.3.2.1 Power Supply Unit Specifications

All specifications regarding the DC power supply can be found in ***Chapter 11.3 Power Supplies***.

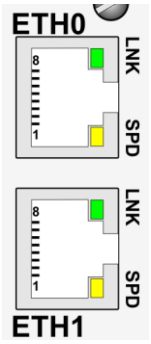
5.3.2.2 Fuse Protection

When connecting the Network Clock Device 8030NTS/NCD a suitable fuse protection of the power supply needs to be observed.

Accordingly, the performance data should be taken from the nameplate of the device. Currently the standard versions of the Network Clock Device 8030NTS/NCD are supplied with power supplies with power consumption of max. 20VA.

If the internal fuse (device fuse) blows, it is most probable that the device is defective. In this case the device needs to be checked in the facatory!

5.4 Connection LAN Interface ETH0/ETH1 of Modules 8030NTC and 8030NTS/M



LNK LED (Green)	Description
Off	10 MBit Ethernet detected
On	100 MBit / 1 GBit Ethernet detected

SPD LED (Yellow)	Description
Off	No LAN connection to a network
On	LAN connection available
Flashes	Network activity at ETH0 (transmission / reception)

Pin No.	Assignment
1	TX_DA+
2	TX_DA-
3	RX_DB+
4	BI_DC+
5	BI_DC-
6	RX_DB-
7	BI_DD+
8	BI_DD-

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6 Commissioning

For putting Network Clock Device 8030NTS/NCD into operation the application must be supplied with voltage first. After that modules 8030NTC and 8030NTS/M can be configured.

Please have a look at the individual module-manuals how to put both applications into operation.

6.1 Establish the Network Connection via Web Browser

Ensure that the network parameters of the Network Clock Device 8030NTS/NCD are configured in accordance with the local network before connecting the device to the network.

Connecting a network to an incorrectly configured Network Clock Device 8030NTS/NCD (e.g. duplicate IP address) may cause interference on the network.

Each of the two Modules of the Network Clock Device 8030NTS/NCD is supplied with:

ETH0 with static IPv4 address

IPv4 address:	192.168.0.1
IPv4 network mask:	255.255.255.0
Gateway:	not set

ETH1 with DHCP

In case it is not known whether the Network Clock Device 8030NTS/NCD with a Factory Default setting causes problems in the network, the basis network parameterization should be executed via a "Peer to Peer" network connection.

Request the required network parameters from your network administrator if those are unknown.

The network connection is made via a LAN cable and RJ45 plug (recommended cable type: CAT5 or better).

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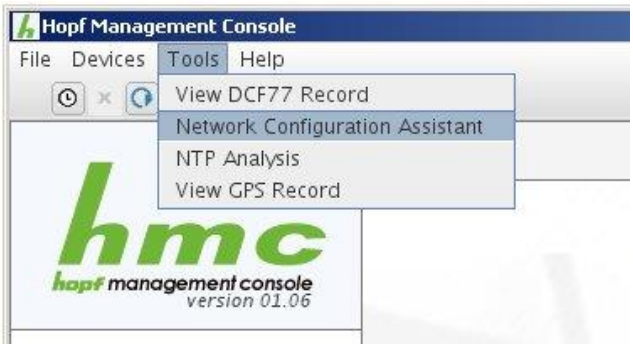
6.2 Network Configuration for ETH0 via LAN through *hmc*

After connecting the system to the power supply and creating the physical network connection to the LAN interface of the modules from the Network Clock Device 8030NTS/NCD, the modules can be searched for on the network via the ***hmc*** (***hopf*** **Management Console**). Then the base LAN parameters (IP address, netmask and gateway or DHCP) may be adjusted in order to allow accessibility for other systems on the network.

The SEARCH Function of the ***hmc*** - **Network Configuration Assistant** **requires** for location and recognition of the desired Network Clock Device 8030NTS/NCD the ***hmc***-computer **in the same SUB Net**.

The base LAN parameters can be set via the ***hmc*** integrated **Network Configuration Assistant**.



After a successful start of the ***hmc*** **Network Configuration Assistant** and completed search of the ***hopf*** LAN devices, the configuration of the base LAN parameters can be done.

The Module 8030NTC of the Network Clock Device 8030NTS/NCD is stated as **8030NTC** in the **Device List.**

The Module 8030NTS/M of the Network Clock Device 8030NTS/NCD is stated as **8030NTS/M** in the **Device List.**

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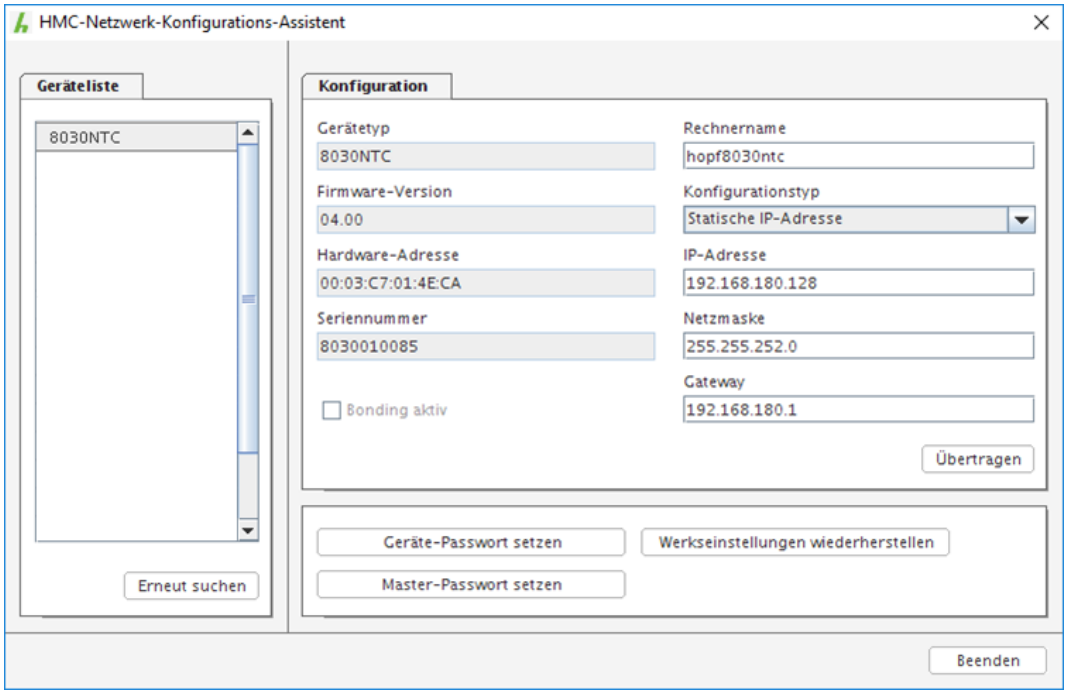
The determination of different devices (or other products variants) is made via **Hardware Address** (MAC Address).



For an extended configuration of the Time Server 8030NTS/NCD through a browser via WebGUI the following base parameters are required:

- **Host Name** ⇨ e.g. hopf8030nts
- **Network Configuration Type** ⇨ e.g. Static IP Address or DHCP
- **IP Address** ⇨ e.g. 192.168.100.149
- **Netmask** ⇨ e.g. 255.255.255.0
- **Gateway** ⇨ e.g. 192.168.100.1

The **hostname must** meet the following conditions:

- The hostname may only contain the characters 'A'-'Z', '0'-'9', '-' and '.' . There should be no distinction between upper-and lower-case letters.
- The character '.' may only appear as a separator between labels in domain names.
- The sign '-' must not appear as first or last character of a label.

The network parameters being assigned should be pre-determined with the network administrator in order to avoid problems on the network (e.g. duplicate IP address).

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7 HTTP/HTTPS WebGUI – Web Browser Configuration Interface

Detailed information can be found in the module specific technical manuals of the modules 8030NTC and 8030NTS/M.

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8 SSH and Telnet Basic Configuration

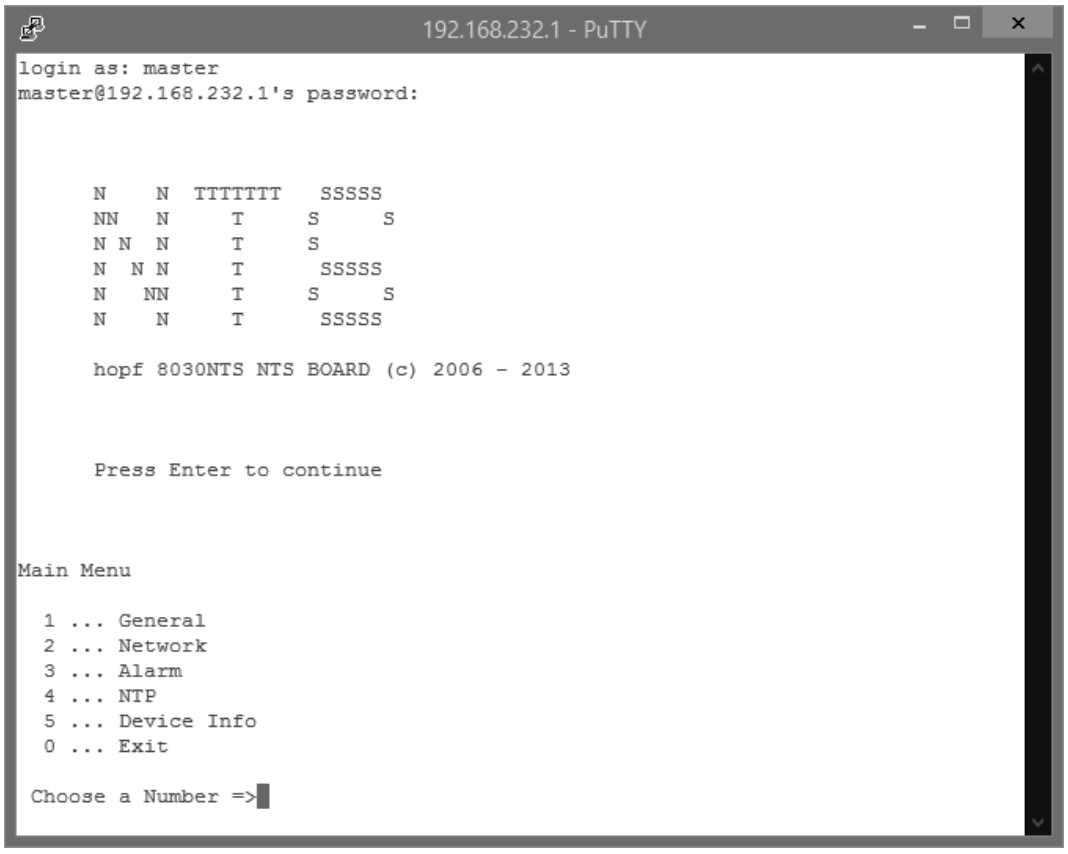
Only basic configuration is possible via SSH or Telnet. The complete configuration of the Network Clock Device 8030NTS/NCD takes place exclusively via the WebGUI.

It is just as easy to use SSH (Port 22) or Telnet (Port 23) as the WebGUI. Both protocols use the same user interface and menu structure.

The user names and passwords are the same as on the WebGUI and are kept in alignment.

SSH does not allow blank passwords for safety reasons.

The corresponding protocols should be enabled for the use of Telnet or SSH.



The navigation through the menu takes place by entering the respective number associated with the menu option (as can be seen in the above image).

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9 Fault Analysis / Troubleshooting

This chapter explains different error patterns and the process to contact the ***hopf*** support team.

9.1 Error Patterns

This chapter describes various error patterns which enable the customer to make a preliminary problem analysis. In addition they also provide assistance in describing the error when contacting the ***hopf*** support.

If possible, for each problem the entire status in the tab **GENERAL** page "**Module Errors**" via WebGUI should always be checked.

9.1.1 Complete Failure

Description

- The Status LEDs on the front panel are off

Cause / Problem Solution

- Device is switched off
- Voltage supply failure
- Power supply defective

9.2 Support by Company *hopf*

Should the system show any other failure description than listed in ***Chapter 9.1 Error Patterns***, please contact the support of company ***hopf*** Elektronik GmbH by providing an exact failure description and the following information:

If possible, for each problem the **Configuration File** in the tab **DEVICE** should be downloaded from the device and be sent to the ***hopf*** support.

- With the file **System Configuration** or if not possible with the serial number of the System
- When does the error occur: During commissioning or operation
- Exact error description

Please write to the following E-mail address with the above information:

support@hopf.com

Providing a detailed error description and above listed information avoid the need for additional clarification and leads to a faster processing by the support team.

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10 Maintenance

The Network Clock Device 8030NTS/NCD is generally maintenance-free. The following points should be observed if a cleaning of the system might be necessary.

10.1 General Guidelines for Cleaning

The following **must not** be used to clean the Network Clock Device 8030NTS/NCD:

- Fluids
- Cleaning agents containing solvents
- Cleaning agents containing acids
- Abrasive media

The use of such cleaning agents or media could damage the Network Clock Device 8030NTS/NCD.

Do not use a wet cloth to clean the Network Clock Device 8030NTS/NCD.

There is the danger of an electric shock.

To clean the Network Clock Device 8030NTS/NCD use a cloth that is:

- Antistatic
- Soft
- Non-fabric
- Damp

10.2 Cleaning the Housing

Make sure that connections or cables are not loosened while cleaning the housing of the Network Clock Device 8030NTS/NCD. There is the danger of damage and functionality loss.

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11 Technical Data

The company ***hopf*** reserves the right to hardware and software alterations at any time.

11.1 General – 8030NTS/NCD

General Data	
Installation position:	On horizontal 35mm rail in accordance with DIN EN 60715 TH35
Protection type of the housing:	IP30
Protection class:	I, with PE connection
Housing design:	Aluminium, closed
Housing dimensions:	*See **Chapter 11.4 Dimensions – DIN Rail Housing***
Weight:	Approx. 0.8kg

Ambient Conditions		
Temperature range:	Operation:	0°C to +50°C
	Storage:	-20°C to +75°C
Humidtiy:		max. 95%, non condensing

CE Conformity
EMV Directive 2004/108/EC
EN 55022 : 2006 + A1 : 2007
EN 61000-3-2 : 2006 + A2 : 2009, EN 61000-3-3 : 2008
EN 55024 : 1998+A1 : 2001+A2 : 2003
Low Voltage Directive 2006/95/EC
EN 60950-1 : 2006

MTBF	
MTBF	> 250,000h

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11.2 Technical Data of the modules

In the individual module-manuals you can find all relevant technical data of both modules of the Network Clock Device 8030NTS/NCD.

11.3 Power Supplies

AC Wide-Range Power Supplies

Internal Power Supply (Only wide input range)	***hopf*** Type: **AC-M05-D**	***hopf*** Type: **AC-M10-D**
Input Data		
Input voltage range	85-264VAC 100-250VDC	85-264VAC 100-250VDC
Frequency	47-440Hz 0 Hz	47-440Hz 0 Hz
Current consumption (at nominal values)	approx. 0.15A (100VAC) 0.10A (200VAC)	approx. 0.30A (100VAC) 0.20A (200VAC)
Inrush current	typ. 15A (I_O = 100%) 100VAC typ. 30A (I_O = 100%) 200VAC	typ. 15A (I_O = 100%) 100VAC typ. 30A (I_O = 100%) 200VAC
Hold-up time at nominal laod	> 20msec. (> 100VAC)	> 20msec. (> 100VAC)
Start-up time after connected mains voltage	< 1 sec.	< 1 sec.
Transient overvoltage protection	Overvoltage protection III (EN 60664-1)	Overvoltage protection III (EN 60664-1)
Protection supply, internal	400 mA slow blow (device protection)	400 mA slow blow (device protection)
Recommended back-up fuse (AC)	Circuit breaker 6A, 10A charakteristics B (EN 60898)	Circuit breaker 6A, 10A charakteristics B (EN 60898)
Leakage current against PE	< 0.5mA (60Hz, according to EN 60950)	< 0.5mA (60Hz, according to EN 60950)
Input isolation voltage / PE	2000VAC, 1 minute, leakage current = 10mA, 500VDC, 50MOhm min. (at room temperature)	2000VAC, 1 minute, leakage current = 10mA, 500VDC, 50MOhm min. (at room temperature)

Output Data (only internal)		
Internal nominal output voltage	5VDC	5VDC
Nominl output current I_N 0° C ... +55° C	1A (U_{OUT} = 5VDC)	2A (U_{OUT} = 5VDC)
Efficiency	> 77%	> 74%
Function Display (Power LED)	LED green	LED green

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DC Power Supplies

Internal Power Supply	*hopf* Type: **DC24-M15-D**	*hopf* Type: **DC48-M15-D**
Input Data		
Input voltage range	18-36VDC	36-76VDC
Current consumption (at nominal values)	approx. 0.69A	Approx. 0.35A
Start-up time after connected mains voltage	< 200msec.	< 200msec.
Protection supply internal (Device protection)	2A fast blow	1A fast blow
Input isolation voltage Input / Output	1,500VDC 1 minute, 500VDC 50MΩ min. (20°C ±15°C)	1,500VDC 1 minute, 500VDC 50MΩ min. (20°C ±15°C)
Output Data (only internal)		
Internal nominal output voltage	5VDC	5VDC
Nominl output current I_N 0° C ... +55° C	3A (U_{OUT} = 5VDC)	3A (U_{OUT} = 5VDC)
Efficiency	> 90%	> 90%
Function Display (Power LED)	LED green	LED green

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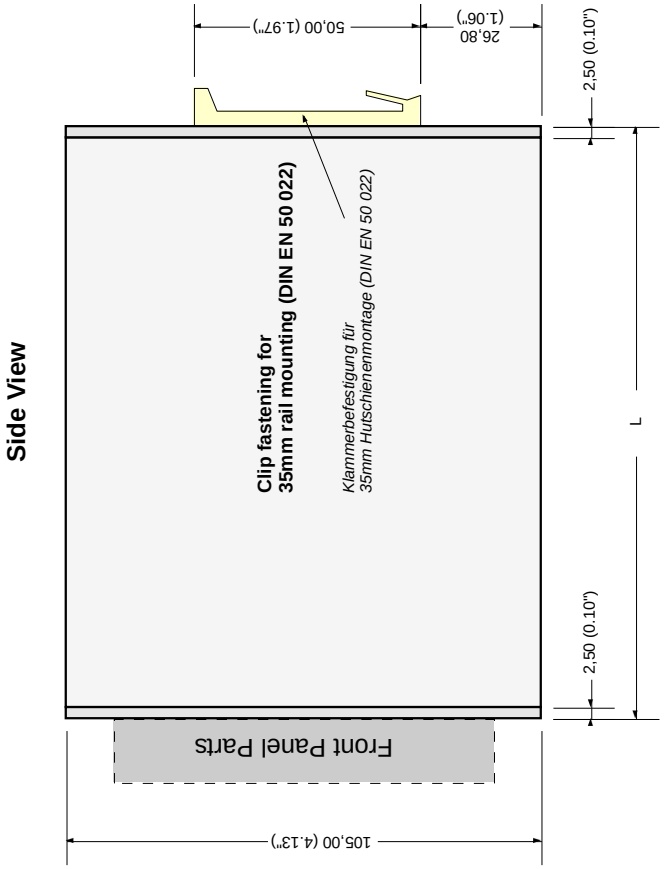
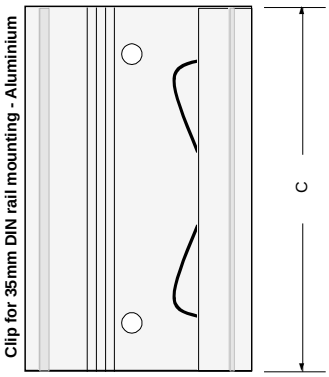
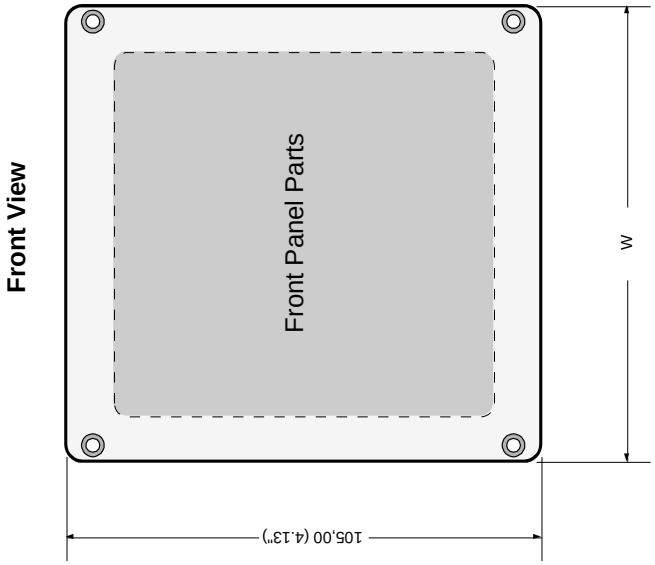
11.4 Dimensions – DIN Rail Housing





Material: Aluminium

All dimensions in mm (inch)



TYPE	(L)ength	(W)idth	(C)lip
1	130 (5.12")	64,5 (2.54")	40,0 (1.57")
2	130 (5.12")	100,0 (3.94")	80,0 (3.15")
3	130 (5.12")	135,0 (5.31")	80,0 (3.15")
4	175 (6.89")	64,5 (2.54")	40,0 (1.57")
5	175 (6.89")	100,0 (3.94")	80,0 (3.15")
6	175 (6.89")	135,0 (5.31")	80,0 (3.15")

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12 Factory Defaults of Time Server 8030NTS/NCD

The factory settings of the two modules of the Network Clock Device 8030NTS/NCD can be found in the respective module description.

13 Glossary and Abbreviations

13.1 NTP-specific Terminology

Stability	The average frequency stability of the clock system.
Accuracy	Specifies the accuracy in comparison to other clocks.
Precision of a clock	Specifies how precisely the stability and accuracy of a clock system can be maintained.
Offset	This value represents the time difference between two clocks. It is the offset by which the local time would have to be adjusted in order to keep it congruent with the reference clock.
Clock skew	The frequency difference between two clocks (first derivative of offset over time).
Drift	Real clocks vary in frequency difference (second derivative of offset over time). This variation is known as drift.
Roundtrip delay	Roundtrip delay of an NTP message to the reference and back.
Dispersion	Represents the maximum error of the local clock relative to the reference clock.
Jitter	The estimated time error of the system clock measured as the average exponential value of the time offset.

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13.2 Abbreviations

D, DST	Daylight Saving Time
ETH0	Ethernet Interface 0
ETH1	Ethernet Interface 1
FW	Firmware
GPS	Global Positioning System
HW	Hardware
IF	Interface
IP	Internet Protocol
LAN	Local Area Network
LED	Light Emitting Diode
NTP	Network Time Protocol
NE	Network Element
OEM	Original Equipment Manufacturer
OS	Operating System
PTP	Precision Time Protocol
PRP	Parallel Redundancy Protocol
RFC	Request for Comments
SNMP	Simple Network Management Protocol (handled by more than 60 RFCs)
SNTP	Simple Network Time Protocol
S, STD	Standard Time
TCP	Transmission Control Protocol http://de.wikipedia.org/wiki/User_Datagram_Protocol
ToD	Time of Day
UDP	User Datagram Protocol http://de.wikipedia.org/wiki/User_Datagram_Protocol
UTC	Universal Time Coordinated
VLAN	Virtual Local Area Network
WAN	Wide Area Network
msec	millisecond (10^{-3} seconds)
µsec	microsecond (10^{-6} seconds)
ppm	parts per million (10^{-6})

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13.3 Definitions

An explanation of the terms used in this document.

13.3.1 DHCP (Dynamic Host Configuration Protocol)

DHCP makes it possible to integrate a new computer into an existing network with no additional configuration. It is only necessary to set the automatic reference of the IP address on the client. Without DHCP, relatively complex settings need to be made. Beside the IP address, further parameters such as network mask, gateway and DNS server have to be entered. A DHCP server can assign these parameters automatically by DHCP when starting a new computer (DHCP client).

DHCP is an extension of the BOOTP protocol. A valid IP address is allocated automatically if a DHCP server is available on the network and DHCP is enabled.

See RFC 2131 Dynamic Host Configuration Protocol for further information.

13.3.2 NTP (Network Time Protocol)

Network Time Protocol (NTP) is a standard for the synchronization of clocks in computer systems via packet-based communication networks. Although it is processed mainly over UDP, it can also be transported by other layer 4 protocols such as TCP. It was specially developed to facilitate reliable timing via networks with variable packet runtime.

NTP uses the Marzullo algorithm (devised by Keith Marzullo of the San Diego University in his dissertation) with a UTC timescale and supports leap seconds from Version 4.0. NTP. It is one of the oldest TCP/IP protocols still in use. It was developed by David Mills of the University of Delaware and published in 1985. The protocol and UNIX implementation continue to be developed under his direction. Version 4 is the up to date version of the protocol. This uses UDP Port 123.

NTPv4 can maintain the local time of a system to an accuracy of some 10 milliseconds via the public Internet. Accuracies of 500 microseconds and better are possible under ideal conditions on local networks.

With a sufficiently stable, local clock generator (oven-stabilised quartz, rubidium oscillator, etc.) and using the kernel PLL (see above), the phase error between reference clock generator and local clock can be reduced to something of the order of a few hundred microseconds. NTP automatically compensates for the drift of the local clock.

NTP can be installed over firewalls and offers a range of security functions.

See RFC 5905 for further information.

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13.3.3 SNMP (Simple Network Management Protocol)

Simple Network Management Protocol (SNMP) is a network protocol which was developed by the IETF in order to be able to monitor and control network elements from a central station. This protocol regulates the communication between the monitored devices and the monitoring station. SNMP describes the composition of the data packets which can be transmitted and the communication procedure. SNMP was designed in such a way that can be provided by SNMP include:

- Monitoring of network components
- Remote control and configuration of network components
- Fault detection and notification

Due to its simplicity, SNMP has become the standard which is supported by most management programmes. SNMP Versions 1 and 2c hardly offer any safety mechanisms. The safety mechanisms have been significantly expanded in the current Version 3.

Using description files, so-called MIB's (Management Information Base), the management programmes are able to represent the hierarchical structure of the data of any SNMP agent and to request data from them. In addition to the MIB's defined in the RFC's, every software and hardware manufacturer can define his own so-called private MIB's which reflect the special characteristics of his product.

13.3.4 TCP/IP (Transmission Control Protocol / Internet Protocol)

TCP and IP are generally used concurrently and thus the term TCP/IP has become established as the standard for both protocols.

IP is based on network layer 3 (layer 3) in the OSI Layer Model whereas TCP is based on layer 4, the transport layer. In other words, the expression TCP/IP signifies network communication in which the TCP transport mechanism is used to distribute or deliver data over IP networks. As a simple example: Web browsers use TCP/IP to communicate with web servers.

13.3.5 PTP (Precision Time Protocol)

The Precision Time Protocol (PTP) is a standard for synchronising clocks in computer networks. Unlike NTP it focuses on a higher accuracy and local networks.

In a network with several PTP-devices, every PTP-device executes the Best Master Clock-algorithm, to determine which PTP-device has the highest accuracy. That PTP-device serves as reference clock and is called Grandmaster Clock.

The Grandmaster Clock sends SYNC messages periodically to distribute the actual time to the slaves. The slaves periodically send Delay Request- or Path Delay Request-messages to the Grandmaster Clock. The Grandmaster Clock replies to those messages with a Delay Respond or Path Delay Respond message. The PTP-devices take sending and reception timestamps of those messages and attach those timestamps to the messages. These timestamps allow the slave to calculate the network delay and the exact actual time. For calculating the network delay the slave assumes, that the network delay in both directions is the same.

The PTP-devices use either Ethernet or UDP for their network communication. UDP uses the Ports 319 and 320.

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13.4 Accuracy & NTP Basic Principles

NTP is based on the Internet protocol. Transmission delays and errors as well as the loss of data packets can lead to unpredictable accuracy data and time synchronization effects.

NTP protocol neither defines nor guarantees the accuracy or correctness of the time server.

Thus the QoS (Quality of Service) used for direct synchronization with GPS or serial interface does not apply to synchronization via NTP.

In simplified terms, accuracies of between 1msec and 1sec can be expected, depending on the accuracies of the servers used.

The accuracy of IP-based time synchronization is depending on the following criteria:

- Characteristics and accuracy of the time server / time signal used
- Characteristics of the sub-network
- Characteristics and quality of the synchronization client
- The algorithm used

NTP has a variety of algorithms to equalise the possible characteristics of IP networks. Algorithms also exist to equalise the offset between reference time source and the local clock.

However, under some circumstances it is not possible to provide an algorithmic solution.

For example:

1. Time servers which do not deliver any correct time cannot be detected at all. The only option available to NTP is to mark these time servers as FALSETICKERS in comparison to other time servers and to disregard them. However, this means that if only 2 time servers are configured, NTP has no way of determining the correctness of the individual times and clearly identifying which time is incorrect.
2. Asymmetries in the transmission between NTP servers and NTP clients can neither be measured nor calculated by NTP. NTP works on the assumption that the transmission path to the NTP server is exactly as long as the return path. The NTP algorithm can only filter out changes on a statistical basis. The use of several servers makes it possible for the combining algorithm to pick up and filter out any such errors. However, there is no possibility of filtering if this asymmetry is present on all or most of the NTP servers (faulty routing etc).
3. It goes without saying that the accuracy of the synchronised time cannot be better than the accuracy resolution of the local clock on the NTP server and NTP client.

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With reference to the above mentioned error circumstances, the delivered **time offset** of the NTP should be considered to be at best the most favourable case and in no way to be a value that takes account of all possible errors.

In order to resolve this problem, NTP delivers the maximum possible error in relation to the offset. This value is designated as the synchronization distance ("**LAMBDA**") and is the sum of the **Root Dispersion** and half of the **Root Delay** of all NTP servers used. This value describes the worst possible case and thus the maximum error that can be expected.

Finally, please note that the user of the Time Server is responsible for the network conditions between the Time Server and the NTP clients.

As an example, we mention the case where a network has a delay of 500msec and an accuracy shift (asynchronization.) of 50msec occurs. The synchronised clients will therefore NEVER achieve accuracy values of one millisecond or even microseconds!

The accuracy value in the GENERAL tab of the WebGUI is designed to help the user to estimate the accuracy.

14 List of RFCs

- NTPv4 - Protocol and Algorithms Specification (RFC 5905)
- NTPv4 - Autokey Specification (RFC 5906)
- PPS API (RFC 2783)
- DHCP (RFC 2131)
- Time Protocol (RFC 868)
- Daytime Protocol (RFC 867)
- HTTP (RFC 2616)
- HTTPS (RFC 2818)
- SSH-2 (RFC 4250-4256, 4335, 4344, 4345, 4419, 4432, 4716, 5656)
- TELNET (RFC 854-861)
- SNMPv2 (RFC 1213, RFC1901-1908)
- SNMPv3 (RFC 3410-3418)
- SYSLOG (RFC 5424)
- SMTP (RFC 5321)

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15 List of Open Source Packages Used

The ***hopf*** Network Clock Device 8030NTS/NCD includes various software packages which are subject to other license conditions. In case the use of such a software package might violate the licence conditions ***hopf*** will ensure immediately after written notice that the licence conditions are met again.

If the underlying licence conditions relating to a specific software package require availibility of the source code the package is provided electronically (email, download etc.) on request.

Detailed information can be found in the module specific technical manuals of the modules 8030NTC and 8030NTS/M.

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