Industriefunkuhren

hopf
Elektronik GmbH

Technical Manual

Network Clock Device

Model 8030HEPTA/NCD

ENGLISH

Version: 04.01 - 24.02.2020

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

Version number (Firmware / Manual)

THE FIRST TWO DIGITS OF THE VERSION NUMBER OF THE TECHNICAL MANUAL AND THE FIRST TWO DIGITS OF THE FIRMWARE VERSION MUST **COMPLY WITH EACH OTHER**. THEY INDICATE THE FUNCTIONAL CORRELATION BETWEEN DEVICE AND TECHNICAL MANUAL.

THE DIGITS AFTER THE POINT IN THE VERSION NUMBER INDICATE CORRECTIONS IN THE FIRMWARE / MANUAL THAT ARE OF NO SIGNIFICANCE FOR THE FUNCTION.

Downloading Technical Manuals

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Homepage: http://www.hopf.com

E-mail: info@hopf.com

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.

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

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.

Contents   Page

1   Network Clock Device 8030HEPTA/NCD

The Network Clock Device 8030HEPTA/NCD consists of a Network Time Client 8030NTC and a Network Time Server 8030NTS/M. Module 8030NTC acts as time source for the application, module 8030NTS/M as **NTP Stratum 1 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**)

Module 8030NTS/M can output the following network protocols:

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

Front Side
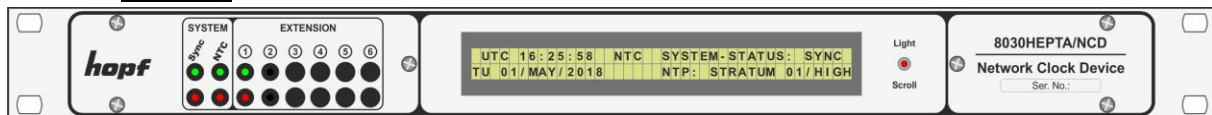
Rear Side

The Network Clock Device 8030HEPTA/NCD is integrated into a 1U/84HP 19" rack and characterized by its easy and simple operation. Some of these practice-oriented functionalities are e.g.:

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

- **LCD-Display and Status-LEDs in the front panel**
  The LCD-Display and the Status-LEDs make rapidly and easily substantial information for commissioning, on the operating status and for support matters available if a problem occurs, even without WebGUI access.

- **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**
  In case of announcing a leap second via the sync source of Network Clock Device 8030NTS/NCD, this leap second will automatically be inserted.

- **Customized extensions possible**
  The new designed housing concept allows customized system extensions for additional signal outputs (processed ex-works) easily and fast.

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

Different **Management and Monitoring Functions** are available __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 8030HEPTA/NCD:

- Operates as **NTP Server with Stratum 1** or as **PTP Grandmaster**
- Easy operation via **WebGUI**
- **LCD-Display (2x40) and Status LEDs on the front panel**
- Completely **maintenance-free** system
- Maintenance-free, buffered **backup clock** for at least three days

Software supplied:

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

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

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

Time Protocols
- RFC-5905 NTPv4 Server
    - o NTP Broadcast Mode
    - o NTP Multicast Mode
    - o NTP Client for additional NTP Servers (redundancy)
    - o SNTP Server
    - o NTP Symmetric Key Encryption
    - o NTP Autokey Encryption
    - o 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)**
    - o 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 Features
- Firmware Update via TCP/IP
- Fail-safe
- Watchdog circuit
- Customizable security banner
- NTP local time support

2   System Structure

The Network Clock Device 8030HEPTA/NCD consists of the following:

- 1/1 19" module rack 1U/84HP (Slim Line)

- System front panel with LCD-Display (2x40), pushbutton and status LEDs

System front view:
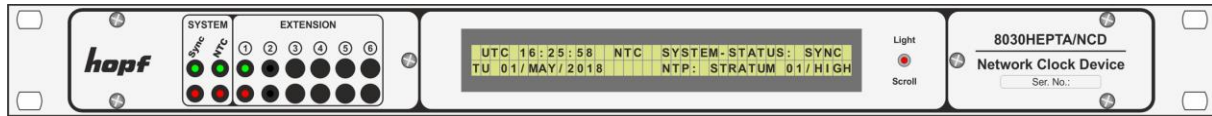
- Wide-ranging power supply unit from 100-240V AC / 20VA (Standard) or 40VA (47-63Hz). Other input voltages available

- Voltage feed with power switch with connections in accordance with IEC/EN60320/C14 including EMI line filter

- Connection for protection earth (PE) cables up to 16mm²

- Module 8030NTC

- Module 8030NTS/M

- Space for up to 8 additional output modules depending on system structure

System rear side:

The new designed housing concept allows customized system extensions for additional signal outputs (processed ex-works) easily and fast.

2.1 19 inch Rack 1U/84HP (Slim Line)
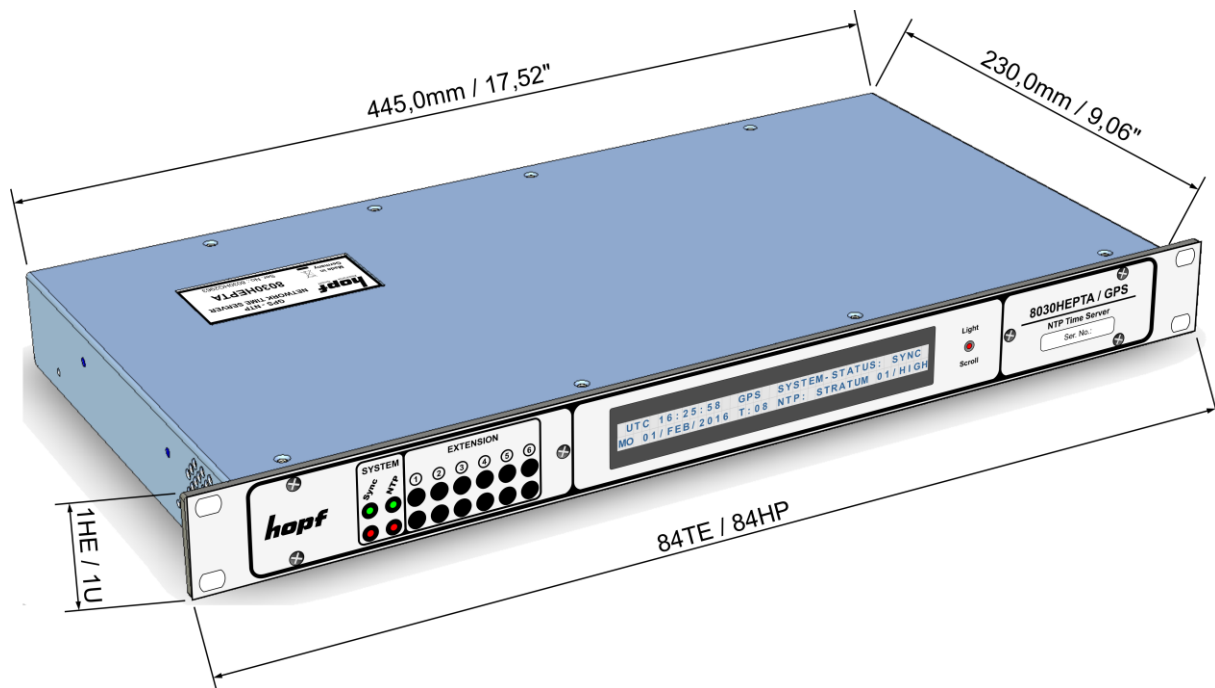
2.2 Functional Overview of the Front Panel Elements

This chapter describes the individual function elements of the front and rear panel.

2.2.1 LCD-Display with Pushbutton
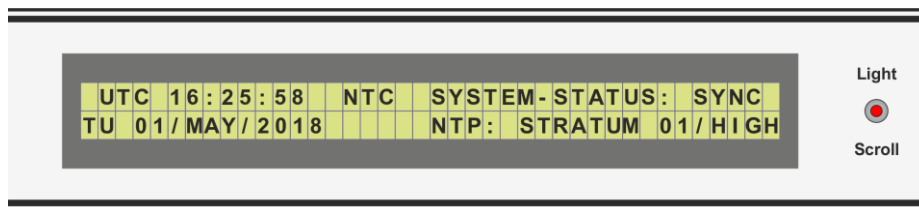
The background illumination of the LCD-Display is activated or rather controlled by the pushbutton Light/Scroll.

The 2x40 LCD-Display enables reading out the time and further essential information for the commissioning, the operation status, and for support even without WebGUI access.

The operation and function of the pushbutton and the display are described in *Chapter 7 LCD-Display with Pushbutton – Function*.

2.2.2 Status-LEDs – System (& Extension)

The Status LEDs on the front panel indicate the current synchronization and operation status of the Network Clock Device 8030HEPTA/NCD. Meanings of the LEDs are the following:
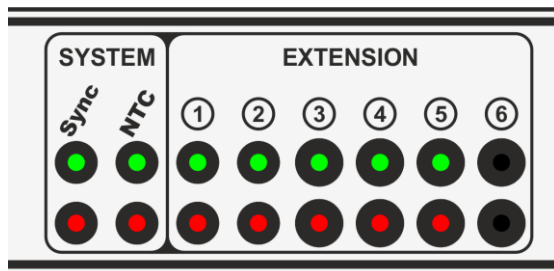
ℹ During the boot process, all LEDs are flashing in a test sequence.

System - Sync			
Status LEDs			
Green	**Red**	**Sync-Status**	**Status Code**
ON	Off	**Sync** (radio-synchronous) with quartz regulation	**SYNC**
Flashes	Off	**Sync** (radio-synchronous) - SyncOFF timer running	**SYOF**
ON	Flashes	**Sync** (radio-synchronous) - simulation mode	**SYSI**
Flashes	Flashes	**Quarz** - SyncON timer running	**QUON**
ON	ON	**Quarz** - time was set via synchronization source	**QUEX**
Flashes	ON	**Quarz** - time set manually or after reset	**QUSE**
Off	ON	**No valid time**	**INVA**
Off	Off	No operating voltage / faulty	---

System - NTC				
Status LEDs		**NTP-Status**		
Green	**Red**	**NTP Service**	**STRATUM**	**ACCURACY**
Off	On	Not Active	---	Low
Flashes 1Hz 50%	On	Active	16	Low
Flashes 1Hz 10%	Off	Active	1-15	Low
Flashes 1Hz 50%	Off	Active	1-15	Medium
On	Off	Active	1-15	High

2.2.3 Functional Elements Rear Side

The rear side parts of modules 8030NTC and 8030NTS/M can be found in the individual module manuals.

2.2.4 Extension Modules 1 - 6 (Option)

All installed system extensions deviating from the standard system 8030HEPTA/NCD including the pertinent Status LEDs are documented and described in a device-specific supplementary instruction.

3   Function Principle

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

3.1   Block Diagram
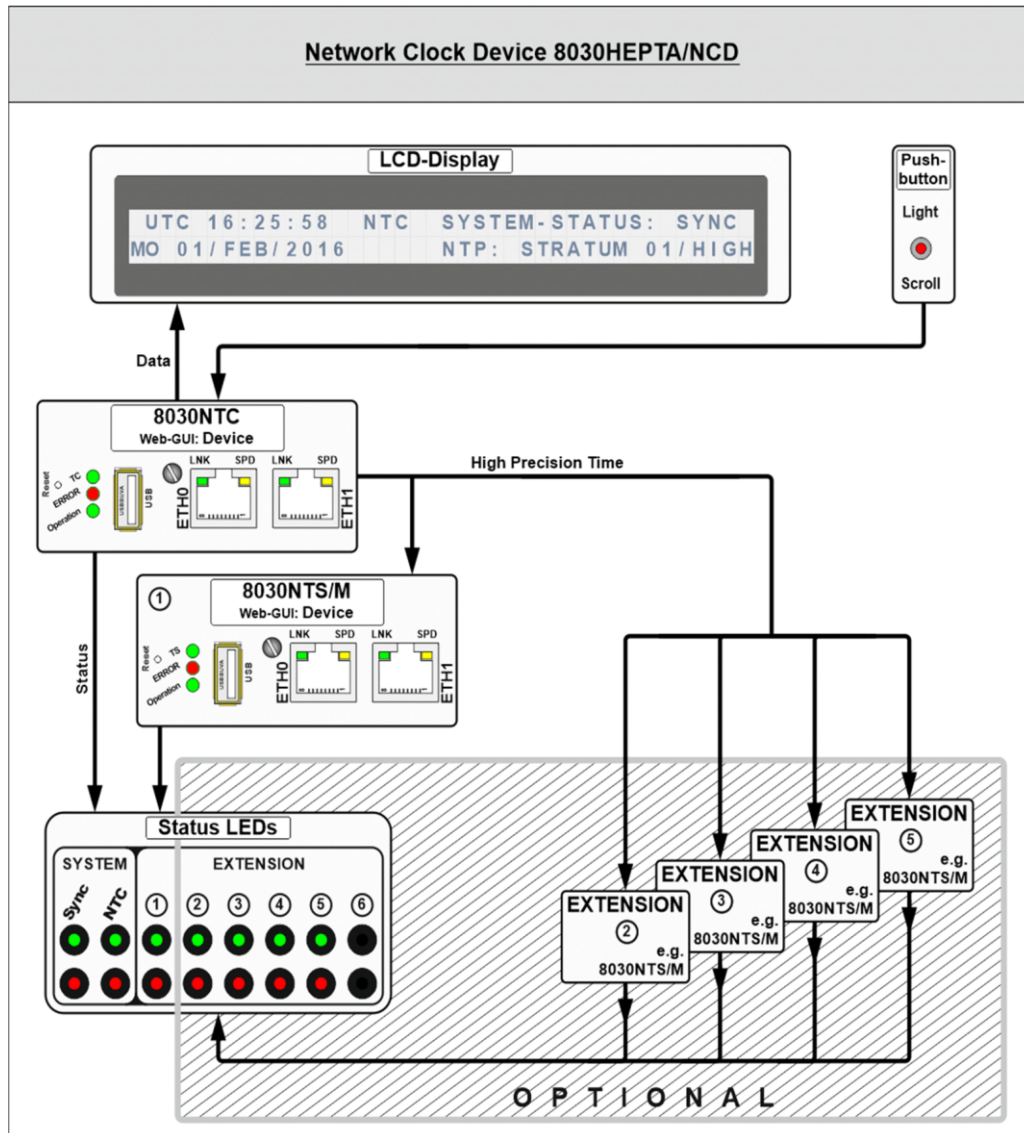
- **Time Information**

  Module 8030NTC provides the time information as well as the particular synchronization status to Module 8030NTS/M. With this time and status information the NTP service running on Module 8030NTS/M and if necessary further signal generations and network protocols are going to be synchronized.

3.2 Function 8030NTC

Module 8030NTC is the "heart" of Network Clock Device 8030HEPTA/NCD. The complete LINUX operating system which provides all functions (e.g. NTP, Web-GUI etc.) runs on this module. By means of the chosen network time protocol (NTP or PTP) the module-internal crystal will be adjusted, thus a highly-precise time base for Module 8030NTS/M and, if necessary, further signal generations created.

3.3 Function 8030NTS/M

Module 8030NTS/M acts as network time server. A complete LINUX operating system which provides all functions (e.g. NTP, Web-GUI etc.) runs on this module. Module 8030NTS/M will be adjusted by the time information provided by Module 8030NTC and provides this time information to all activated network time services.

3.4 LCD-Display with Pushbutton

System settings cannot be changed via the pushbutton nor the display. The display allows the readout of important system and operation parameters directly at the device, even without WebGUI access.

Update of the data in both the display and the WebGUI is subject to specific refreshing cycles. The display indicates if the refreshing cycle is not completed yet.

3.5 System EXTENSION 1 - 8 (Option)

Network Clock Device 8030HEPTA/NCD can be expanded with additional modules ex works. Therefore four extension slots are available.

Each extension slot can either be equipped with one NTP time server module 8030NTS/M (each with two GigaBit LAN interfaces) or max. two output modules.

Additionally implemented NTP time server modules 8030NTS/M are mutually independent and are going to be parameterized via their WebGUI. The operating status of each module 8030NTS/M will be displayed via 2 status LEDs on the front panel which are assigned to the particular module 8030NTS/M via the related EXTENSION number. If the application is exclusively equipped with modules 8030NTS/M, max. 4 mutually independent modules 8030NTS/M can be implemented.

Output modules issue signals of the internal signal generators of module 8030NTC via various electrical levels or via fiber optic. Parameterization of the particular signal generator can be done via WebGUI of module 8030NTC. Status of the output modules will not be monitored via status LEDs on the front panel. If the clock system is exclusively equipped with output modules, max. 8 output modules can be implemented.

System front view:
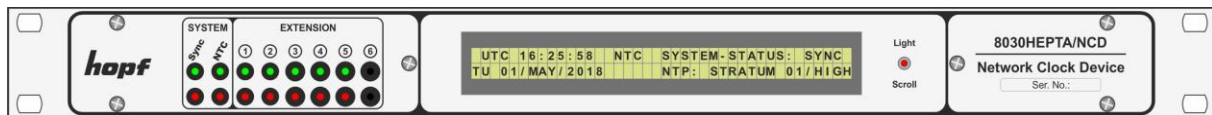

System rear side / plug-in side:
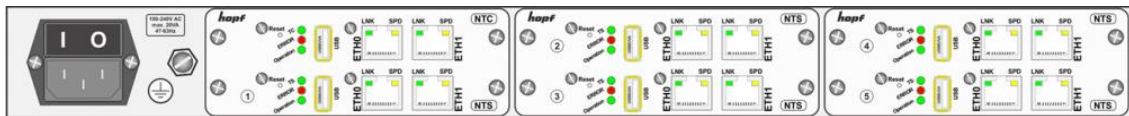
All installed system extensions deviating from the standard system Network Clock Device 8030HEPTA/NCD including the pertinent Status LEDs are documented and described in a device-specific supplementary instruction.

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 8030HEPTA/NCD starts after turning on the system or a reset.

This phase can be recognized by the LCD-Display and activated LED test of the Status LEDs in the front panel.

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

The end of the boot process is reached when the LCD-Display changes to the standard picture and the LED test of the Status-LEDs in the front panel has been finished.

> **i** Boot phase takes approx. 35 seconds by using static IP-addresses for ETH0 and ETH1. Boot phase can be extended, depending on the network configuration in use (e.g. DHCP).

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 the module requires approx. 5-10 minutes to be adjusted.

After the synchronization service of Module 8030NTC is adjusted, Module 8030NTC provides a valid sync status to Module 8030NTS/M, whereby Module 8030NTS/M will be synchronized based on the time information of Module 8030NTC. This requires approx. 5-10 minutes.

After that Module 8030NTS/M will be available as network time server.

4.3 Firmware-Update

Both modules 8030NTC and 8030NTS/M can mutually be updated.

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.

5   Installation

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

5.1   Network Clock Device 8030HEPTA/NCD in 1U Housing

5.1.1   Installation of the 19 Inch Rack

The System is assembled in a 1U/84HP 19" housing for control cabinet installation (measurement see **Chapter 2.1 19 inch Rack 1U/84HP (Slim Line)**).

The following steps are to be carried out:

- Place the rack in the control panel and fix to the mounting brackets on the front side of the rack using 4 screws.

> The side ventilation apertures on the right and left hand sides must not be covered. Otherwise ventilation will not be effective and lack of convection and / or thermal coupling with surrounding equipment may give rise to an excessive equipment operating temperature.

- Ensure that there is sufficient space between the back of the rack and the control panel to allow connection and data lines with the system

5.1.2   Earthing

The Network Clock Device 8030HEPTA/NCD is usually earthed via the PE cable of the power supply.

An additional earth cable for surge protection purposes can be connected by means of the earth screw located on the rear side of the System housing.

5.1.3   AC Power Supply

The Systems' standard AC power supply unit is described here. However, the connection data on the nameplate of the respective unit is always applicable.

Attention should be paid to the following when connecting the power supply:

- Correct voltage type (AC or DC)
- Voltage level

The power feed is via an input connector with EMI filter compliant with IEC/EN 60320-1/C14

- Check that the mains power switch is in position " **0** " (= off).
- Plug the input connector into the System's mains power inlet.
- Connect the input connector to the mains power supply and switch the line circuit breaker on.

> The Network Clock Device 8030HEPTA/NCD can be damaged if incorrect voltage is connected.

5.1.3.1 Safety and Warning Instructions

Please read these instructions fully in order to guarantee safe operation of the equipment and to be able to use all the functions.

> **Caution:** Never work on an open unit when voltage is applied!
> Danger to life!

The Network Clock Device 8030HEPTA/NCD is an installation device. Installation and commissioning may only be carried out by suitably qualified specialist personnel. In doing so the respective country-specific specifications must be observed (e.g. VDE, DIN).

Before commissioning ensure that:

- The power supply has been connected correctly and electrical shock protection is in place
- The earth wire is connected
- All supply cables are correctly sized and fused
- All output cables are suitably sized or specially fused for the max. output current of the equipment
- Sufficient convection is guaranteed

The equipment contains life-threatening components and a high level of stored energy.

5.1.3.2 Power Supply Unit Specifications

All AC power supply specifications are described in ***Chapter 12 Technical Data***.

5.1.3.3 Fusing

Pay attention to the correct fusing of the power supply when connecting the Network Clock Device 8030HEPTA/NCD.

The corresponding performance data can be taken from the equipment nameplate. The Network Clock Device 8030HEPTA/NCD is currently fitted with a power supply unit with a power consumption of max. 20VA (Standard) or 40VA (47-63Hz).

> If the internal fuse (device protection) trips it is highly probable that the equipment is faulty. In this case the device should be checked in the factory.

5.1.4 DC Power Supply (Option)

Ensure that the external power supply is switched off. When connecting the supply cable make sure that the polarity is correct and the equipment is earthed.
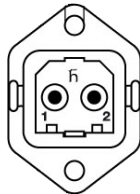
- The cable of the power supply is connected using a 2-pole plug connector with additional earth connection and inter-locked with the Network Clock Device 8030HEPTA/NCD:

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

The Network Clock Device 8030HEPTA/NCD can be damaged if incorrect voltage is connected.

Earthing:
By default the minus pole (-Vin) and earthing (PE) are connected system-sided.

5.1.4.1 Power Supply Unit Specifications

All DC power supply specifications are described in *Chapter 12 Technical Data*.

5.1.4.2 Fusing

Pay attention to the correct fusing of the power supply when connecting the Network Clock Device 8030HEPTA/NCD.

The corresponding performance data can be taken from the equipment nameplate. The Network Clock Device 8030HEPTA/NCD is currently fitted with a power supply unit with a power consumption of max. 20VA (Standard) or 40VA (47-63Hz).

If the internal fuse (device protection) trips it is highly probable that the equipment is faulty. In this case the device should be checked in the factory.

5.1.4.3 Reverse Voltage Protection

The version of Network Clock Device 8030HEPTA/NCD with DC supply has reverse voltage protection. This protection prevents damage to the equipment due to an incorrectly connected DC power supply.

Protection is effected by means of a self-resetting fuse. In the case of reverse polarity, it is necessary to switch the equipment off for approx. 20 seconds after this fuse has tripped. The power supply can then be connected with the correct polarity.

5.2 Connection LAN Interface ETH0/ETH1
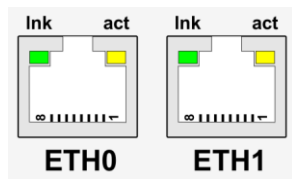
LNK LED (Green)	Description
Off	10 MBit Ethernet detected
On	100 MBit / 1 GBit Ethernet detected

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-

6 Commissioning

For putting Network Clock Device 8030HEPTA/NCD into operation the application need to be supplied with voltage; then both modules 8030NTC and 8030NTS/M need to be configured.

For further information for putting the modules into operation please have a look at the individual module-manuals.

6.1 Switching the Operating Voltage on
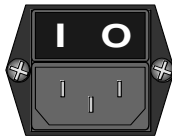
AC power supply:	
	Put the mains power switch into position " **I** " (on). The Network Clock Device 8030HEPTA/NCD starts running with the boot process indicated in the display (see **_Chapter 6.2 LCD-Display after Switch On / Reset (Boot_ Phase)_**_)._
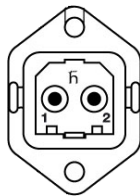
DC power supply:	
	Switch on external power supply source. The Network Clock Device 8030HEPTA/NCD starts running with the boot process indicated in the display (see **_Chapter 6.2 LCD-Display after Switch On / Reset (Boot_ Phase)_**_)._

6.2 LCD-Display after Switch On / Reset (Boot Phase)

In the 2x40digit LCD-Display the following start-up picture appears for the boot phase after switching on or a reset:

```
    hopf 8030HEPTA/NTC :  Booting...
    Status-LEDs (Front):  LED-Test active
```

6.3 Establish the Network Connection via Web Browser

> ⚠ Ensure that the network parameters of the Network Clock Device 8030HEPTA/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 8030HEPTA/NCD (e.g. duplicate IP address) may cause interference on the network.

> ⚠ Each of the two Modules of the Network Clock Device 8030HEPTA/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 8030HEPTA/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.

> ℹ 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: CAT5e or better).

6.4 Network Configuration for ETH0 via LAN through *hmc* software

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 8030HEPTA/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 of the Network Clock Device 8030HEPTA/NCD 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**.
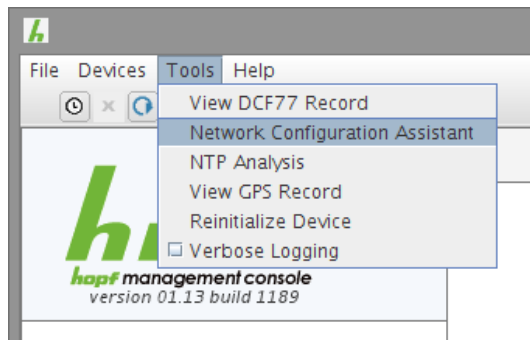
After a successful start of the **hmc Network Configuration Assistant** and completed search of the **hopf** LAN devices, the configuration of the base LAN parameters can be done.

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

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

If several devices with the same name are listed in the Device List, they can be distinguished by the **Hardware Address** (MAC address)

> **i** The factory set MAC address for the Network Clock Device 8030HEPTA/NCD can also be read out via the LCD-Display.
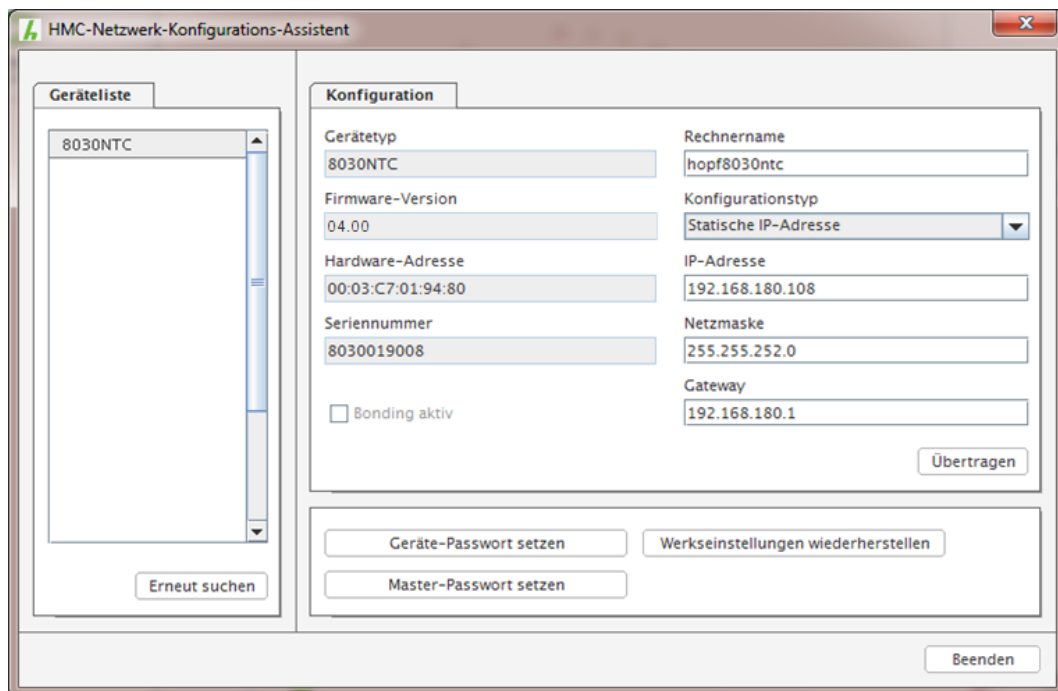
For an extended configuration of the Network Clock Device 8030HEPTA/NCD through a browser via WebGUI the following base parameters are required:

- **Host Name** ⇨ e.g. hopf8030
- **Network Configuration Type** ⇨ e.g. Static IP Address or DHCP
- **IP Address** ⇨ e.g. 192.168.0.20
- **Netmask** ⇨ e.g. 255.255.224.0
- **Gateway** ⇨ e.g. 192.168.224.1

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).

7 LCD-Display with Pushbutton – Function

System settings cannot be changed via the pushbutton nor the display. The display allows the readout of important system and operation parameters directly at the device, even without WebGUI access.

The data indicated in the display are applicable to updating-cycles such as the WebGUI. An on-going process is indicated via the display.

When the display has been activated by pressing a key, the backlight turns off after approx. 4 minutes without pressing any further key and the display switches to the standard image.

Switching on the System

In the 2x40digit LCD-Display the following start-up picture appears for the boot phase after switching on or a reset:

```
    h o p f   8 0 3 0 H E P T A / N T C :   B o o t i n g . . .
    S t a t u s - L E D s   ( F r o n t ) :   L E D - T e s t   a c t i v e
```

7.1 Pushbutton Function (Light / Scroll)

The pushbutton has 3 functions right now:

1. Activation of the backlight (if not already been activated).

2. Switching to the next displayed image

3. If the pushbutton is pressed longer than 5 seconds, it is switched between UTC and local in the standard display image when the key is released. This switching over is failsafe stored.

7.2 Standard Display Image

This chapter describes the different elements and functions of the standard display image.

7.2.1 Standard Display Image without valid Time

After the start-up screen, the following picture appears in the display during the first start-up or after a de-energized state

The following picture (with incrementing second) is displayed during the first start-up or after a de-energized state at the start screen:

```
 U T C   0 0 : 0 0 : 3 8     N T C     S Y S T E M - S T A T U S :   I N V A
M O   0 1 / J A N / 0 0 0 0   T : 0 0   N T P :   S T R A T U M   - - / L O W
```

```
 U T C   0 0 : 0 0 : 3 8     N T C     S Y S T E M - S T A T U S :   I N V A
M O   0 1 / J A N / 0 0 0 0           P T P :             0 n s
```

> **!** After a power failure less than 3 days the display starts with the internal backup clock information if a time information exists.

> **i** If the Sync Source ERROR "RTC error" is enabled after switching on without valid time, this can be corrected by releasing a Reset of the Sync Source.

7.2.2 Standard Display Image with valid Time

Example image for the standard display after a system start with valid backup information or after manual input of the time information via the WebGUI:

```
U T C   1 6 : 2 5 : 5 8     N T C     S Y S T E M - S T A T U S :   Q U S E
T U   1 2 / J A N / 2 0 1 6         N T P :     S T R A T U M   1 6 / L O W
```

```
U T C   1 6 : 2 5 : 5 8     N T C     S Y S T E M - S T A T U S :   Q U S E
T U   1 2 / J A N / 2 0 1 6         P T P :             1 1 0 n s
```

Time Information:

LOC 10:25:19 /D	Display with the setting: **local time**. • D for summertime (Daylight-Saving Time) • S for standard time (wintertime)
UTC 08:25:19	Display with the setting: **UTC time**.
MO - TU - WE - TH - **FR - SA - SU**	Display with the **Weekday** in abbreviations: complies with **MONDAY – SUNDAY**
12/JAN/2016	Display of date: **Day / Abbr. of Month / Year**

> **i** It can be switched between UTC and local time as time basis for the display by using the button.
> Therefore the pushbutton must be pressed for 5 seconds.

System-Status:

SYNC	Time synchronized + Quartz regulation started/running
SYOF	Time synchronized + SyncOFF running
SYSI	Time synchronized as simulation mode (without actual GPS reception)
QUON	Quartz/Crystal time + SyncON running
QUEX	Quartz/Crystal time (in freewheel after synchronization failure ⇨ Board was already synchronized)
QUSE	Quartz/Crystal time after reset or manual setting
INVA	Invalid time

NTP-Status:

The current Stratum and accuracy value of the NTP service is shown here.

PTP-Status:

Hereby the current time deviation to the PTP grandmaster will be displayed.

7.2.3   Standard Display with Additional Information

In the standard display further systemically significant information/conditions are displayed as soon as they occur.

```
UTC  16:25:58   NTC    SYSTEM-STATUS:
TU  12/JAN/2016        8030HEPTA Update
```

Active additional information automatically leads to the activation of the backlight.

Supplementary information is indicated alternating to the standard content of the display. Such additional information include following details/conditions:

1. Announcement active (see **Chapter 7.6 Announcements (Summertime / Leap Second)**)

2. An Image-Update of Module 8030HEPTA/NCD is active

3. A H8-Update of the Sync Source is active

7.3   GENERAL ERROR

Should a failure occur within the system not ensuring a defined and safe operation of the Time Server 8030HEPTA/NCD anymore this is indicated via the LCD-Display.

If there is an active GENERAL ERROR, the backlight is activated.

If such an error occurs it is recommended to disconnect the system from power for 30 seconds and then turn it on and put it into operation again. If the failure occurs again after this process, the system needs to be sent for repair or rather contact the **hopf** Support with the appropriate failure report (see **Chapter 10.2 Support by Company hopf**).

Example:

```
GENERAL-ERROR: NO DATA FROM SYNC-SOURCE
Turn OFF/ON power may solve the problem
```

7.4   LAN Parameter

The 3 display pictures of the LAN parameter indicate essential information on the active LAN interface ETH0 / ETH1 and in PRP- resp. Bonding-Mode.

In the display picture the currently valid values of the IPv4 address, netmask and gateway are shown and whether the values are statically assigned via the WebGUI or via DHCP.

Example for ETH0:

ETH0: STATIC IP: 192.168.000.001/NM: 24	
Link: Up GW: 000.000.000.000	

Example for ETH1:

ETH1: DHCP IP: 000.000.000.000/NM: 00	
Link: Down GW: 000.000.000.000	

Example for PRP / Bonding:

PRP : STATIC IP: 192.168.000.001/NM: 24	
Link: Up GW: 000.000.000.000	

For the non-active interface mode the following pictures are displayed:

Example for ETH0:

ETH0: Bonding or PRP is active	
Link: Up	

Example for ETH1:

ETH1: Bonding or PRP is active	
Link: Down	

Example for PRP / Bonding:

Bonding and PRP is not active	

7.5 Local Time Parameter

Provided a local time via the input of difference time to UTC and/or switching points for the summertime is parameterized, these values can be read in the display.

Example:

```
Time-Zone       S->D  02:00 SU 27/03/2016
Offset:+01:00   D->S  03:00 SU 30/10/2016
```

The difference time to UTC was set to +1h in the above example. Based on the general parameters for the summer-/wintertime changeover set in the WebGUI, the following switching points are calculated for the current year (2016) by the system:

- Start of summertime (S => D) on Sunday, 27 March 2016 at 2.00 o'clock
- End of summertime (D => S) on Sunday, 30 October 2016 at 3.00 o'clock

Without valid time (System-Status INVA) the real values for the ST/WT changeover cannot be calculated.

```
            Missing Data
            Missing Data
```

Should the ST/WT changeover be disabled, it is shown in the display as follows:

```
Time-Zone       S->D changeover disabled
Offset:+01:00   D->S changeover disabled
```

Should the difference time and/or ST/WT changeover not be initially set by the user (in this case at least one Sync Source ERROR is active), the following picture is displayed:

```
Time-Zone Offset and/or DST Changeover
        not initially set by USER
```

7.6 Announcements (Summertime / Leap Second)

In this picture the availability of an announcement for a summer-/wintertime changeover (DST-Announcement) or for inserting a leap second (Leap Second Announcement) is indicated.

> **i** Should an announcement be available, this is signalized in the standard image.

Example:

```
      DST-Announcement:      ACTIVE
Leapsecond-Announcement:  Not active
```

In the above picture a summer-/wintertime changeover is processed on the next hour change.

7.7   System-Info

In the pictures with the system info, the uptime of the system, program versions and the serial numbers of the components are indicated.

In the display picture SYS-Info 01 the uptime and the image version of the Module 8030HEPTA are stated.

Example:

```
S Y S - I n f o :   U p t i m e : 0 0 0 1 - D a y / 0 2 - H o u r / 5 3 - M i n
    0 1 / 0 3      I m a g e : 0 4 . 0 0 P    D a t e : 0 8 . 0 1 . 2 0 1 8
```

In the display image SYS-Info 02 the serial number and the H8 processor version of the Module 8030HEPTA are shown in the first line, whereas in the second line the serial number of the Sync Source and its H8 processor version are stated.

Example:

```
S Y S - I n f o :   8 0 3 0 - 0 1 0 1 3 3   P 0 1 . 0 0   - 0 2 . 0 8 . 2 0 1 6
    0 2 / 0 3
```

The display image SYS-Info 03 indicate device information exclusively required by the *hopf* Support.

Example:

```
S Y S - I n f o :   0 1 1 5 1 1 B 4 0 0 1 8 9 9 9 9 9 9 9 9 9 A 0 0 0 1 0 8 0 6
    0 3 / 0 3      1 3 0 0 0 0 0 0 0 1 3 8 3 F 0 0 0 8 0 2 1 0 1 3 0 0 0 2
```

8   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.

9 SSH and Telnet Basic Configuration

> Only basic configuration is possible via SSH or Telnet. The complete configuration of the Network Clock Device 8030HEPTA/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.
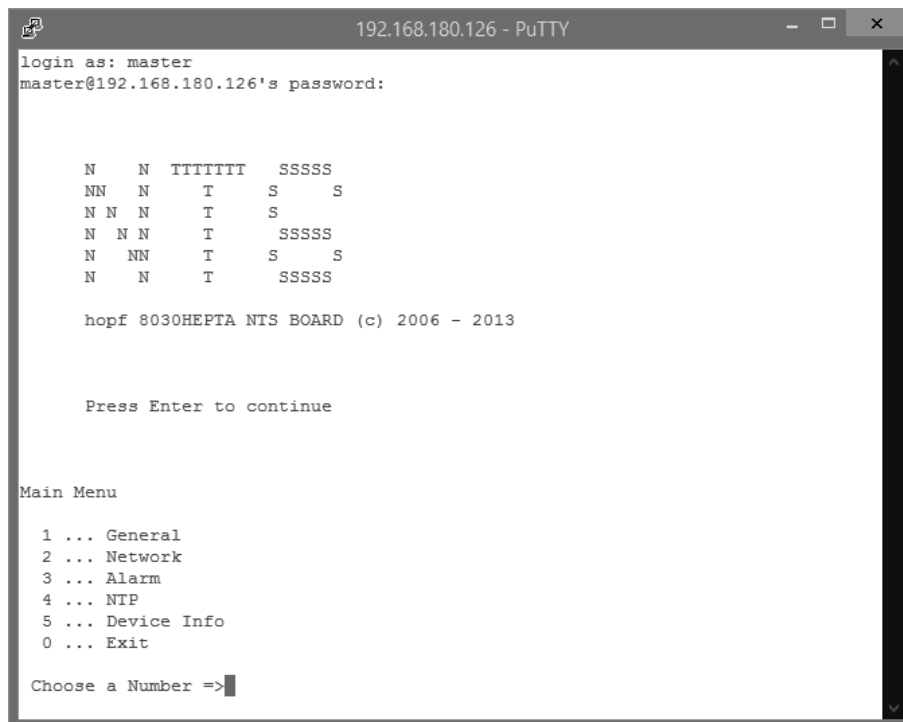
The user names and passwords are the same as on the WebGUI and are kept in alignment.

> SSH does not allow blank passwords for safety reasons.

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

```
192.168.180.126 - PuTTY

login as: master
master@192.168.180.126's password:


     N    N  TTTTTTT   SSSSS
     NN   N     T     S     S
     N N  N     T     S
     N  N N     T      SSSSS
     N   NN     T     S     S
     N    N     T      SSSSS


     hopf 8030HEPTA NTS BOARD (c) 2006 - 2013



     Press Enter to continue



Main Menu

  1 ... General
  2 ... Network
  3 ... Alarm
  4 ... NTP
  5 ... Device Info
  0 ... Exit

Choose a Number =>
```

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).

10 Fault Analysis / Troubleshooting

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

10.1 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.

> **i** If possible, for each problem the entire status in the tab **GENERAL** via WebGUI should always be checked.

10.1.1 Complete Failure

Description

- The Status LEDs on the rear panel are off

Cause / Problem Solution

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

10.2 Support by Company *hopf*

Should the system show any other failures than listed in *Chapter 10.1 Error Patterns*, please contact the support of company *hopf* Elektronik GmbH by providing an exact failure description and the following information:

> **i** If possible, for each problem the **Configuration File** in the tab **DEVICE** should be downloaded from both modules 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.

11   Maintenance

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

11.1   General Guidelines for Cleaning

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

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

There is the danger of an electric shock.

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

- Antistatic

- Soft

- Non-fabric

- Damp

11.2   Cleaning the Housing

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

11.3   Cleaning the Display and Front Panel

Minimum pressure should be exerted when cleaning the display and push button. Excessive pressure may cause mechanical damage.

12 Technical Data

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

12.1 General – 8030HEPTA/NCD

General Data – System 8030HEPTA/NCD	
Housing design:	Sheet steel / Aluminium, closed
Housing dimensions:	See *Chapter 2.1 19 inch Rack 1U/84HP (Slim Line)*
Protection type of the housing:	IP20
Protection class:	I, with PE connection. Additional earth screw for cables up to 16mm^2
Cooling:	Passive, ventilation slots left / right
Weight:	Approx. 3kg

AC Power Supply (with wide input range)	Power supply capacity 20VA (Standard)	Power supply capacity 40VA
Nominal input voltage:	100-240V AC / 47-63Hz Connection via input connector compliant with IEC/EN 60320-1/C14 with EMI line filter and switch	
Input voltage range:	85-264V AC	
Frequency:	47-63Hz	
Current consumption (at nominal values):	about 0.37A (120V AC) 0.23A (230V AC)	about 0.80A (120V AC) 0.40A (230V AC)
Starting current:	Typ. 15A (I_O = 100%) 120V AC Typ. 30A (I_O = 100%) 230V AC	
Mains failure bridging at nominal load:	> 20msec. (> 100V AC)	
Turn-on time after application of mains voltage:	< 500msec.	
Transient overvoltage protection:	Overvoltage category II (EN 60664-1)	
Input fuse - internal:	2A (equipment protection)	
Recommended pre-fuse:	Line protection switch 6A, 10A characteristic B (EN 60898)	
PE leakage current:	< 0.75mA (60Hz, compliant with EN 60950)	
Insulation voltage input / PE:	2000V AC, 1 minute, residual current = 10mA, 500V DC, 50MΩ at least (at room temperature)	
Output Data (internal only)		
Internal nominal output voltage:	5V DC	
Nominal output current I_N 0°C .. +55°C:	3A (U_{OUT} = 5V DC)	6A (U_{OUT} = 5V DC)
Efficiency:	> 74% (at 230V AC and nominal values)	> 75% (at 230V AC and nominal values)

DC Power Supply (Option)	Power supply capacity 20VA (Standard) / 40VA - Option		
Nominal input voltage:	24V DC	48V DC	110/220V DC
Input voltage range:	18-36V DC	36-76V DC	100-250V DC
Current consumption (at nominal values):	**20VA power supply:**	**20VA power supply:**	**20VA power supply:**
	0.69A	0.35A	0.40A
	40VA power supply:	**40VA power supply:**	**40VA power supply:**
	1.36A	0.68A	0.40A
Turn-on time after application of mains voltage:	< 200msec.	< 200msec.	< 500msec.
Input fuse - internal (equipment protection):	**20VA power supply:**	**20VA power supply:**	**20VA power supply:**
	2A fast-acting	1A fast-acting	2A
	40VA power supply:	**40VA power supply:**	**40VA power supply:**
	4A fast-acting	2A fast-acting	2A
Insulation voltage input / output:	1.500V DC 1 minute, 500V DC 50MΩ at least (20°C ±15°C)	1.500V DC 1 minute, 500V DC 50MΩ at least (20°C ±15°C)	2000V AC, 1 Minute, residual current = 10mA, 500V DC, 50MΩ at least (at room temp.)
Output Data (internal only)			
Internal nominal output voltage:	5V DC	5V DC	5V DC
Nominal output current I_N 0°C ... +55°C	**20VA power supply:**	**20VA power supply:**	**20VA power supply:**
	3A (U_{OUT} = 5V DC)	3A (U_{OUT} = 5V DC)	3A (U_{OUT} = 5V DC)
	40VA power supply:	**40VA power supply:**	**40VA power supply:**
	6A (U_{OUT} = 5V DC)	6A (U_{OUT} = 5V DC)	6A (U_{OUT} = 5V DC)
Efficiency:	> 90%	> 90%	> 74%

Ambient Conditions		
Temperature range:	Operation:	0°C to +55°C
	Storage:	-20°C to +75°C
Humidity:		max. 95%, non condensing

CE Conformity
EMV Directive 2014/30/EU
EN 55022 : 2010 / AC : 2011
EN 61000-3-2 : 2006 / A2 : 2009, EN 61000-3-3 : 2013
EN 55024 : 2010
Low Voltage Directive 2014/35/EU
EN 60950-1 : 2006 / AC : 2011

MTBF	
MTBF	> 200,000h

13 Factory Defaults of Time Server 8030HEPTA/NCD

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

14 Glossary and Abbreviations

14.1 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.

14.2 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})

14.3   Definitions

An explanation of the terms used in this document.

14.3.1 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.

> **i**   See RFC 2131 Dynamic Host Configuration Protocol for further information.

14.3.2 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.

> **i**   See RFC 5905 for further information.

14.3.3 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 every network-compatible device can be integrated into the monitoring. Functions of the network management which 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.

14.3.4 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.

14.3.5 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.

14.4 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.

> ℹ 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 <u>any</u> 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.

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 (asynchronous) 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.

15   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)
- SNMPv2c (RFC 1213, RFC1901-1908)
- SNMPv3 (RFC 3410)
- SYSLOG (RFC 5424)
- SMTP (RFC 5321)

16   List of Open Source Packages Used

The *hopf* Network Clock Device 8030HEPTA/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 8030HEPTA and 8030NTS/M.