

Industriefunkuhren



Technical Manual

NTP Time Server Module with LAN Interface

Model 8029NTS/M

ENGLISH

Version: 03.00 – 11.02.2013

SET	IMAGE (8029)	FIRMWARE (8029)
Valid for	Version: 03.xx	Version: 01.xx

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 TIME SERVER 8029NTS/M (SEE **CHAPTER 7.3.5.1 DEVICE INFORMATION** AND **CHAPTER 7.3.5.2 HARDWARE INFORMATION**).

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.



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 2004/108/EC "Electromagnetic Compatibility" and 2006/95/EC "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 NTP Time Server Module 8029NTS/M

Module 8029NTS/M is a compact NTP Time Server for the integration in clock systems or rather in signal converters. Based on the fed time information the module turns into a high-accurate **NTP Stratum 1** Time Server for the worldwide used time protocol **NTP (Network Time Protocol)**. This Time Server Module is used for the synchronization of computers and industrial networks.

The NTP Time Server module supports the following network synchronization protocols:

- NTP (incl. SNTP)
- Daytime
- Time
- SINEC H1 time datagram (**Activation Key necessary**)

Its operation is guaranteed by just supplying the Module 8029NTS/M with power and providing appropriate time information for the internal synchronization. Both are usually carried out in the basis system the Module 8029NTS/M is integrated in. However the module can also be used in an independent signal converter.



The Module 8029NTS/M requires approx. 2-3 minutes for a successful and module's internal time synchronization, depending on the fed synchronization signal. As the module has no internal back-up clock and in order to receive an internal time for the time generation, it is required to synchronize the module after a reset or a power failure again.

The respective NTP status of the module is indicated via three LEDs in the front panel. This allows an easy identification of the current operation status or any fault.

Due to its compact size, the Time Server 8029NTS/M is easy to integrate and 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 protected WebGUI also giving an overview of the status of the Time Server 8029NTS/M.
- **Automatic handling of the leap second**
Insertion of a leap second in UTC time is automatically recognised and executed by the Time Server 8029NTS/M.

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).

Currently the Time Server 8029NTS/M offers following unlockable functions:

- **Alarming**
After activation **SNMP, Syslog and E-mail notification** are available in order to monitor the system condition. Furthermore, a MIB II and private Enterprise MIB are provided allowing realization of management functions.
- **Routing**
This function allows entering routes in the Time Server 8029NTS/M for special network requirements.
- **SINEC H1 time datagram**
This function allows parameterization of the SINEC H1 time datagram and output via the LAN interface.

A few other basic functions of the Time Server 8029NTS/M:

- The Time Server 8029NTS/M operates as **NTP Server with Stratum 1**
- Easy operation via **WebGUI**
- **NTP Status LEDs** on the front panel
- Completely **maintenance-free** system

Software supplied:

- **hmc** Remote Software for the operating systems:
 - Microsoft® Windows® NT/2000/XP/VISTA/7 (32/64 Bit)
 - Microsoft® Windows® Server 2003/2008 (32/64 Bit)
 - Linux® (32/64 Bit)
 - Oracle® Solaris SPARC/x86
 - IBM AIX® (ab Version 5.2)
 - HP-UX 11i (RS232 support only for PA-RISC architecture)

Overview of the functions of the network Time Server 8029NTS/M:

Ethernet Interface

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

Time Protocols

- 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
- PPS Time Source
- SINEC H1 time datagram **(Activation Key necessary)**
- RFC-867 DAYTIME Server
- RFC-868 TIME Server

Network Protocols

- HTTP/ HTTPS
- DHCP
- Telnet
- SSH
- SNMPv2c, SNMP Traps (MIB II, Private Enterprise MIB) **(Activation Key necessary)**
- NTP (including SNTP)
- SINEC H1 time datagram **(Activation Key necessary)**

Configuration Channel

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

Additionally Features

- E-mail notification **(Activation Key necessary)**
- Syslog messages to external syslog server **(Activation Key necessary)**
- Routing **(Activation Key necessary)**
- Update via TCP/IP
- Failsafe
- Watchdog circuit
- System management
- Customized security banner

2 Module Description

The NTP Time Server Module 8029NTS/M is a complete multi-processor embedded-linux system.

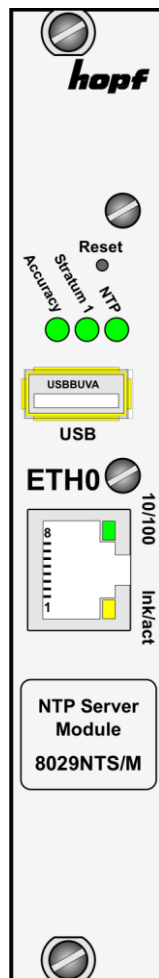
Usually the module is integrated as a NTP Time Server extension in **hopf** clock systems at the factory.

The module is supplied with power, the necessary time information for its synchronisation with the system time and with the system reset, if any, via an internal plug-in connection.

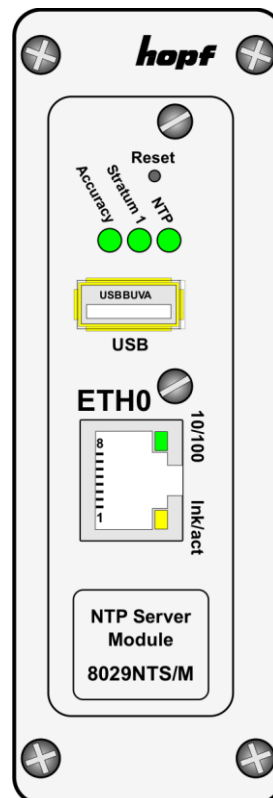
2.1 Installation Variants (Examples)

The module can be equipped with panels for the integration in different housings and system variants.

**Module 8029NTS/M
for the integration
in 19" systems
with 3U/4HP panels**



**Module 8029NTS/M
with front panel
for the integration in
DIN Rail housings (example)**



2.2 Installation and Removal of the Module

The module is supplied with power, the necessary time information for its synchronisation with the system time and with the system reset, if any, via an internal plug-in connection.

For service and repair purposes the module can be removed from the device.



The module does not support HOT-PLUG

In case an installation or removal of the module should be necessary the device in which the module is integrated in must be disconnected from power.

2.3 Functional Overview of the Front Panel Elements

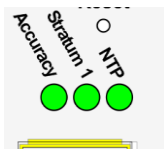
This chapter describes the individual front panel elements and their functions.

2.3.1 Reset-(Default) Button



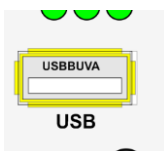
The Reset-(Default) Button is accessible with a thin objective through the small drilling in the front panel next to the "Reset" inscription" (see **chapter 4.3 Reset-(Default) Button**).

2.3.2 NTP Status LEDs (NTP/Stratum/Accuracy)



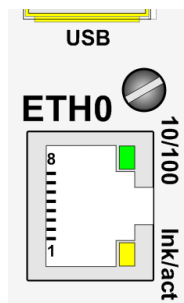
NTP-LED (Green)	NTP service of the Time Server 8029NTS/M
On	Standard , running
Off	Not running
Stratum1-LED (Green)	The NTP service of the Time Server 8029NTS/M works with:
On	Stratum 1
Flashes	Stratum 2-15
Off	Stratum 16 (no synchronization of NTP Clients)
Accuracy-LED (Green)	The NTP service of the Time Server 8029NTS/M works with accuracy of:
On	high
Flashes	medium
Off	low

2.3.3 USB-Port



On specific problems the USB connection can be used for a system recovery after consulting the **hopf** Support.

2.3.4 LAN Interface ETH0



10/100-LED (Green)	Description
Off	10 MBit Ethernet detected
On	100 MBit Ethernet detected

Ink/act-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+
2	Tx-
3	Rx+
4	Not in use
5	Not in use
6	Rx-
7	Not in use
8	Not in use

2.3.4.1 MAC-Address for ETH0

Each LAN interface is clearly identifiable on the Ethernet via a unique MAC Address (hardware address).

The MAC address given for the LAN interface ETH0 can be read in WebGUI of the appropriate board or be determined via the **hmc Network Configuration Assisant**. The MAC address is uniquely assigned for each LAN interface by the company **hopf** Elektronik GmbH.



The factory set MAC address for the Time Server 8029NTS/M is stated on a sticker directly placed on the module.



hopf Elektronik GmbH MAC addresses begin with **00:03:C7**:xx:xx:xx.

3 Function Principle

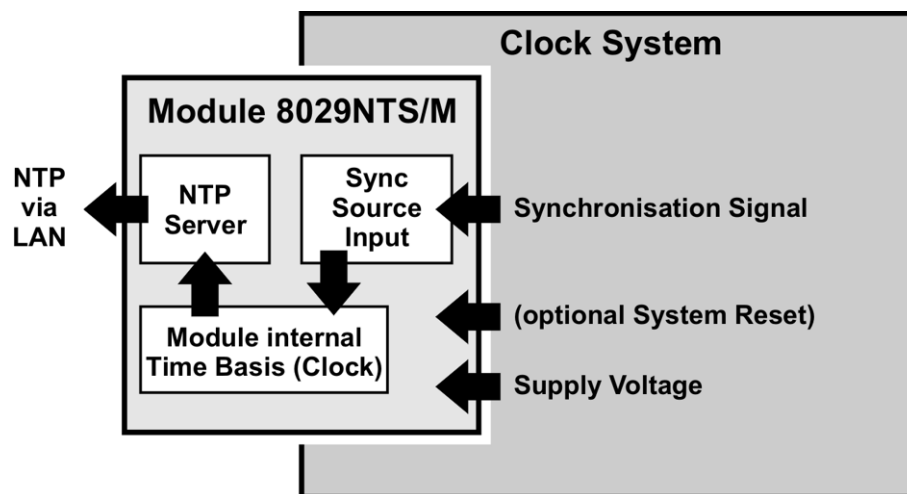
This chapter describes the functional principle of the Time Server 8029NTS/M and the internal relations between the individual function groups.

The Time Server Modul 8029NTS/M is a multi-processor system.

The structure allows the following mode of operation:

The module receives evaluable time information within the complete system (clock system). The time basis of the module is synchronized with high precision onto this time information.

Based on this internal time information standardized time information is supplied to the NTP service enabling the module to operate as a high-precises Stratum 1 – NTP Time Server.



In this module Sync Source describes the time information provided to the module as well as the module- internal evaluation up to the successful synchronization of its internal time basis.

External Synchronization Signal (Sync Source Input)

Usually the status of the respective Sync Source is supplied in the synchronization signal as well.

Synchronisation of the Module (Clock)

Based on the system-internal provided synchronization signal and the status information contained therein the module is self-synchronized.

This synchronization status is indicated in the Web-GUI

(GENERAL - SYNC SOURCE STATUS).

NTP Adjustment

Based on the time information synchronized in the module the NTP service is supplied and controlled with standardized time information.

The status of the NTP service (time, date, stratum and accuracy) is indicated in the WebGUI **(GENERAL – NTP TIME STATUS).**

Modul Status

All information of the module required for an optimum operating state are recorded and evaluated centrally **(GENERAL – MODULE OVERVIEW).**

This concept allows the use of different synchronization signals to provide the module with time information. The format supplied to the module needs to be parameterized in the WebGUI of the module.

Although the fed synchronization signal might fail the module can continuously and independently synchronize the NTP service based on the internal time information. A differential setting of this behaviour can be parameterized in the WebGUI.

The module offers a variety of further settings in order to adopt the behaviour of the Time Server to the respective requirements.

4 Module Behaviour

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

4.1 Boot Phase

The boot process of the Time Server 8029NTS/M starts after turning on the system or a reset.

During the boot process the Module 8029NTS/M boots its LINUX operation system and is therefore not available via LAN.

The end of the boot process is reached when the green NTP LED is shining and thereby indicates that the NTP service on Module 8029NTS/M has been started and enabled. The boot process lasts approx. 1-1.5 minutes.

4.2 NTP Adjustment Process (NTP/Stratum/Accuracy)

NTP is a regulation process. After start of the NTP services, automatically processed during booting, the Time Server 8029NTS/M requires approximately 5-10 minutes after synchronization of the Sync Source until NTP is set to the high accuracy of the Sync Source and reaches the optimized operation condition of **STRATUM = 1** and **ACCURACY = High**.

The decisive factors here are accuracy of the Sync Source (Accuracy) and the appropriate synchronization condition of the Sync Source.

4.3 Reset-(Default) Button

The Time Server 8029NTS/M can be reset by the Reset-(Default) Button behind the front panel of the board. The Reset-(Default) Button is accessible with a thin objective through the small drilling in the front panel.

The button triggers different functions depending on how long it is pressed:

Duration	Function
< 1 sec.	No action
1 - 9 sec.	After releasing a hardware reset is triggered in the module
10 - 19 sec.	After releasing a CUSTOM DEFAULT followed by a REBOOT is triggered after approx. 10 seconds.
>= 20 sec.	After releasing a FACTORY DEFAULT followed by a REBOOT is triggered after approx. 10 seconds



If the user saves **no** CUSTOM DEFAULT via the WebGUI, a FACTORY DEFAULT is triggered instead.

4.4 Firmware Update

The Time Server 8029NTS/M is a multi processor system. For this reason a firmware update always consists of a so called Software SET including up to two (2) program releases defined by the SET version needed to be loaded into the board.

Module 8029NTS/M:

1x Image Update

1x H8 Update



An update is a critical process.
The device should not be turned off during the update and the network connection to the device not be interrupted.



All programs of a SET needed to be uploaded to ensure a defined operation condition.



The program releases assigned to a SET version may be taken from the release notes of the software SETs of the Time Sever 8029NTS/M.

The general process of a software update of Module 8029NTS/M is described below:

H8 Update

1. Log in as Master in WebGUI of the board.
2. Select in the **Device** tab the menu item **H8 Firmware Update**.
3. Select the file with the file extension **.mot for Module 8029NTS/M** via the selection window.
4. The selected file is shown in the selection window.
5. The update process is started with the button **Upload now**.
6. In WebGUI the successful file transfer to the Module is indicated.
7. Now the update of the board automatically starts after a few seconds.
8. After successful update the board automatically reboots.
9. After approx. 2 minutes the H8 update process is finished and the board is again accessible via WebGUI.

Image Update

10. Log in as Master in WebGUI of the board.
11. Select in **Device** tab the menu item **Image Update**.
12. Select the file with the file **.img** via the selection window.
13. The selected file is shown in the selection window.
14. The update process is started with the button **Upload now**.
15. In WebGUI the successful file transfer and writing to the Module is indicated.
16. In WebGUI the successful update is indicated after 2-3 minutes with the request to release a reboot of the board.
17. After activation and successful reboot of the board the image update process is finished.

4.5 Activation of Functions by Activation Keys

Currently the Time Server 8029NTS/M offers three functions that require an "Activation Key".

These functions are only available after entering a valid activation key related to the serial number of the Module 8029NTS/M (not the serial number of the overall system).

The activation of such function(s) can be done by default and also later by the user if required.



The input and display is done in the tab "Device" under the menu item "Product Activation".

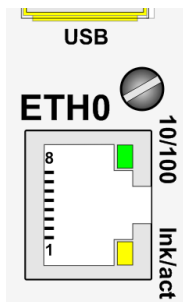
These functions are:

- **Alarming**
After activation the functions **SNMP, Syslog and Email notification** are available in order to monitor the system condition. Furthermore a MIB II and private enterprise MIB are provided with which management functions can be realized.
- **Routing**
This function allows entering routes in the the Time Server 8029NTS/M for spezial network requirements.
- **SINEC H1 time datagram**
This function allows paramerization of the SINEC H1 datagram and output via the LAN interface.



The settins for activation keys (e.g. an entered activation key) are neither modified nor influenced by the functions FACTORY DEFAULTS and CUSTOM DEFAULTS.

5 Connection LAN Interface ETH0



10/100-LED (Green)	Description
Off	10 MBit Ethernet detected
On	100 MBit Ethernet detected

Ink/act-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+
2	Tx-
3	Rx+
4	Not in use
5	Not in use
6	Rx-
7	Not in use
8	Not in use

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

6 Commissioning

This chapter describes commissioning of the Time Server 8029NTS/M.

6.1 General Procedure

Overview of the general commissioning procedure:

- Finish the installation process completely
- Switch on the device
- Wait until the booting phase is finished (Duration approx. 2 min. – finished when the green NTP LED is lit on)
- Using the SEARCH Function of the **hmc - Network Configuration Assistant** in order to access the Time Server 8029NTS/M and set the basis LAN parameters (e.g. DHCP). Afterwards connect to the WebGUI of the Time Server 8029NTS/M via Web browser

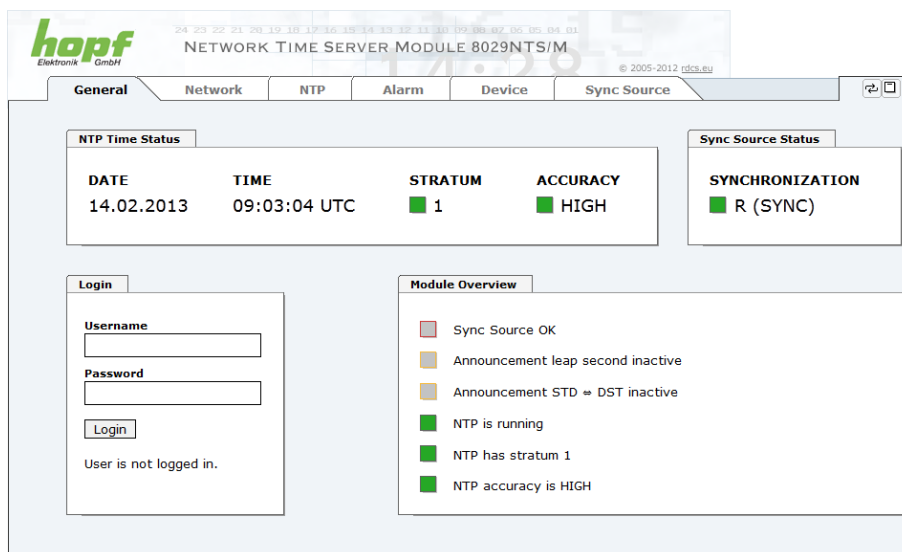
OR

connect directly with the factory default IP-address (192.168.0.1) to the WebGUI of the Time Server 8029NTS/M via Web browser

- Log in as "**master**"
- Change default passwords for "**master**" and "**device**" In the **DEVICE** tab
- Set all required LAN parameters (e.g. entry of DNS server) in **NETWORK** tab if necessary
- Check current settings in **NTP** tab and modify according to individual needs as necessary
- Verify respectively Parametrize following values of the Sync Source in **SYNC SOURCE** tab:
 - Used Sync Source
 - Set the local difference time to UTC

For modules, integrated in clock systems in the factory, these settings were already performed by the **hopf** company.

- Check for **Sync Source Error** in tab **SYNC SOURCE**
- Parametrize optional functions e.g. SNMP or SINEC H1 time datagram
- If all base settings are carried out correctly and the set Sync Source supplies the time information with the appropriate accuracy, the **GENERAL** tab should look like this after approx. 30 min. (usually considerably faster):



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24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03

NETWORK TIME SERVER MODULE 8029NTS/M

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General Network NTP Alarm Device Sync Source

NTP Time Status

DATE	TIME	STRATUM	ACCURACY
14.02.2013	09:03:04 UTC	1	HIGH

Sync Source Status

SYNCHRONIZATION

R (SYNC)

Login

Username

Password

Login

User is not logged in.

Module Overview

- Sync Source OK
- Announcement leap second inactive
- Announcement STD to DST inactive
- NTP is running
- NTP has stratum 1
- NTP accuracy is HIGH

6.2 Switching on the Operating Voltage

The Time Server 8029NTS/M has no own switch for the power supply. The Time Server 8029NTS/M is activated by switching on the device in which it is integrated in.

6.3 Establish the Network Connection via Web Browser



Ensure that the network parameters of the Time Server 8029NTS/M are configured in accordance with the local network before connecting the device to the network.



Connecting a network to an incorrectly configured Time Server 8029NTS/M (e.g. duplicate IP address) may cause interference on the network.



The Time Server 8029NTS/M is supplied with a static IP-address (equivalent to the factory default setting).

IP-address:	192.168.0.1
Network mask:	255.255.255.0
Gateway:	not set



In case it is not known whether the Time Server 8029NTS/M 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).

6.4 Network Configuration for ETH0 via LAN through *hmc*

After connecting the system to the power supply and creating the physical network connection to LAN interface of the Time Server 8029NTS/M, the device 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 Time Server 8029NTS/M for other systems on the network.



The SEACH Function of the ***hmc*** - **Network Configuration Assistant** requires for location and recognition of the wished Time Server 8029NTS/M the ***hmc***-computer in the same SUB Net.

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



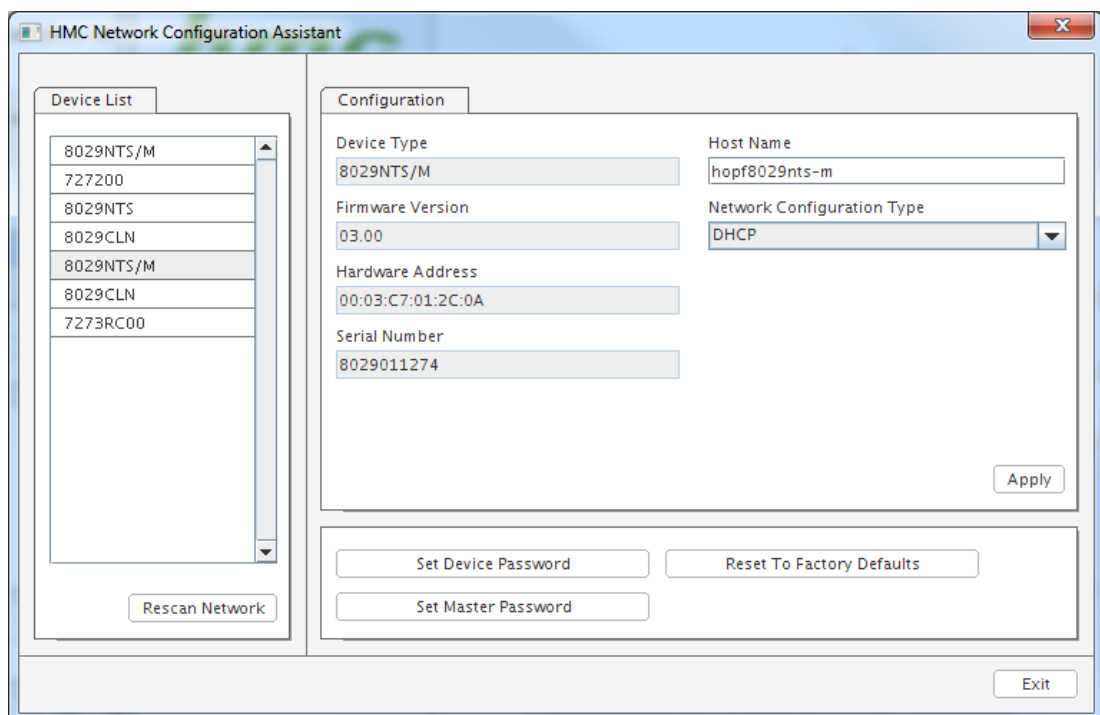
After a successful start of the **hmc Network Configuration Assistant** and completed search of the **hopf** LAN devices, the configuration of the base LAN parameters can be done.

The Time Server 8029NTS/M is stated as **8029NTS/M** in the **Device List**.

The determination of different Time Server 8029NTS/M (or other products variants) is made via **Hardware Address** (MAC Address).



The factory set MAC address for the Time Server 8029NTS/M is stated on a sticker laterally positioned on the exterior of the housing of the device.



For an extended configuration of the Time Server 8029NTS/M through a browser via WebGUI the following base parameters are required:

- **Host Name** ⇒ e.g. hopf8029nts-m
- **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).

IP Address (IPv4)

An IP address is a 32 bit value divided into four 8 bit numbers. The standard presentation is 4 decimal numbers (in the range 0...255) separated from each other by dots (dotted quad notation).

Example: 192.002.001.123

The IP address consists of a leading network ID followed by the host ID. Four common network classes were defined in order to cover different requirements. Depending on the network class, the last one, two or three bytes define the host while the rest define the network (network ID) in each case.

In the following text the "x" stands for the host part of the IP address.

Class A Networks

IP addresses 001.xxx.xxx.xxx to 127.xxx.xxx.xxx

There is a maximum of 127 different networks in this class. This allows the possibility to connect a very high number of devices (max. 16.777.216)

Example: 100.000.000.001, (Network 100, Host 000.000.001)

Class B Networks

IP addresses 128.000.xxx.xxx to 191.255.xxx.xxx

Each of these networks can consist of up to 65534 devices.

Example: 172.001.003.002 (Network 172.001, Host 003.002)

Class C Networks

IP addresses 192.000.000.xx to 223.255.255.xxx

These network addresses are the most commonly used. Up to 254 devices can be connected.

Class D Networks

The addresses from 224.xxx.xxx.xxx - 239.xxx.xxx.xxx are used as multicast addresses.

Class E Networks

The addresses from 240.xxx.xxx.xxx - 254.xxx.xxx.xxx are designated as "Class E" and are reserved.

Gateway Address

The gateway or router address is required in order to be able to communicate with other network segments. The standard gateway must be set to the router address which connects these segments. This address must be within the local network.

After entering the above mentioned LAN parameters, they needed to be transferred to the Time Server 8029NTS/M via the **Apply** button. Afterwards the entry of the **Device Password** is requested:



The Time Server 8029NTS/M is supplied with the default device password **<device>** on delivery. After entry click on the **OK** button to confirm.

The LAN parameters thus set are directly adopted (without reboot) by the Time Server 8029NTS/M and are immediately active.

7 HTTP/HTTPS WebGUI – Web Browser Configuration Interface



For the correct display and function of the WebGUI, JavaScript and Cookies must be enabled in the browser.



The correct function & display of the WebGUI were verified on Windows XP and Windows7 using the browsers MS InternetExplorer 8 and Mozilla Firefox, version 6.0.2 and 14.0.1

7.1 Quick Configuration

This chapter gives a brief description of the basic operation of the WebGUI installed on the module.

7.1.1 Requirements

- Ready-for-operation **hopf** NTP Time Server 8029NTS/M
- PC with installed web browser (e.g. Internet Explorer) in the sub-network of Time Server 8029NTS/M

7.1.2 Configuration Steps

- Create the connection to the Time Server with a web browser
- Login as a '**master**' user (default password <master> is set by delivery)
- Switch to "Network" tab if available and enter the DNS Server (required for NTP and the alarm messages depending of network)
- Save the configuration
- Switch to "Device" tab and restart Network Time Server via "Reboot Device"
- NTP Service is now available with the standard settings
- NTP specified settings can be done in the "NTP" tab
- Alarm messages via Syslog/SNMP/Email can be configured in "Alarm" tab – only if this function is enabled by an activation key



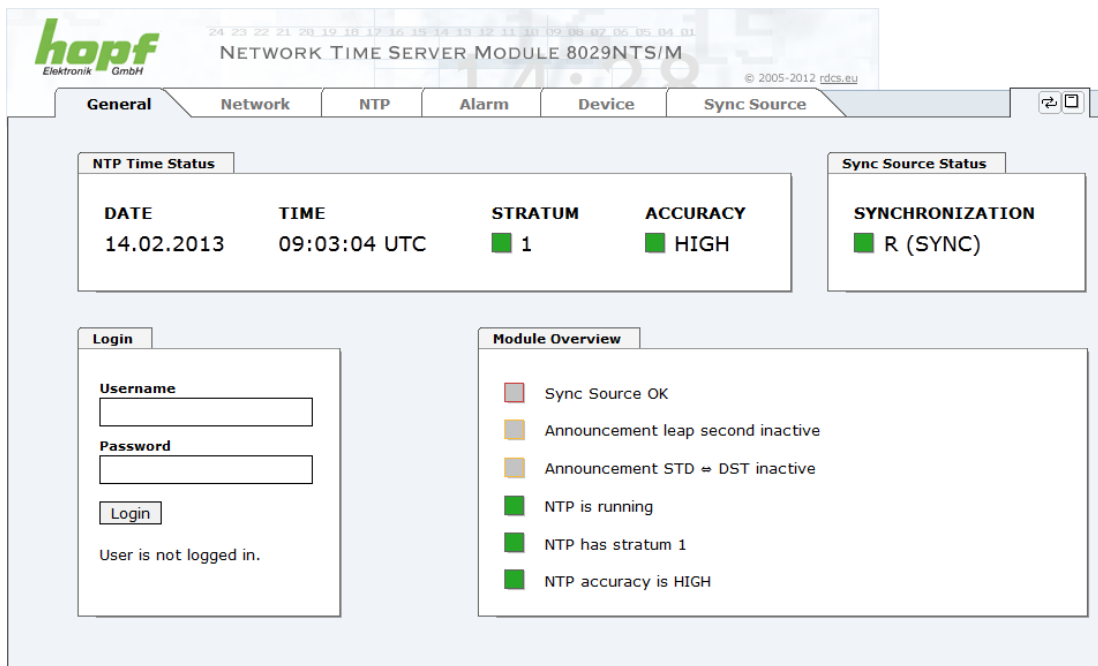
The following detailed explanatory information should be read if anything is unclear while executing the configuration steps.

7.2 General – Introduction

The Time Server 8029NTS/M should be accessible to a web browser if it has been set up correctly. Enter the IP address - as set up in the Time Server 8029NTS/M earlier - or the DNS name on the address line <http://xxx.xxx.xxx.xxx> and the following screen should appear.



The complete configuration can only be completed via the modules WebGUI!



The screenshot shows the WebGUI interface for the hopf Network Time Server Module 8029NTS/M. The interface has a top navigation bar with tabs: General, Network, NTP, Alarm, Device, and Sync Source. The main content area is divided into several sections:

- NTP Time Status:** A table showing the current time and status.

DATE	TIME	STRATUM	ACCURACY
14.02.2013	09:03:04 UTC	1	HIGH
- Sync Source Status:** A box showing the synchronization status.

SYNCHRONIZATION
R (SYNC)
- Login:** A section with input fields for Username and Password, a Login button, and a message: "User is not logged in."
- Module Overview:** A list of status indicators:
 - Sync Source OK
 - Announcement leap second inactive
 - Announcement STD \Rightarrow DST inactive
 - NTP is running
 - NTP has stratum 1
 - NTP accuracy is HIGH



The WebGUI was developed for multi-user read access but not for multi-user write access. It is the responsibility of the user to pay attention to this issue.

7.2.1 LOGIN and LOGOUT as User

All of the modules data can be read without being logged on as a special user. However, the configuration and modification of settings and data can only be carried out by an authorised user! Two types of user are defined:

- **"master"** user (default password on delivery: **<master>**)
- **"device"** user (default password on delivery: **<device>**)

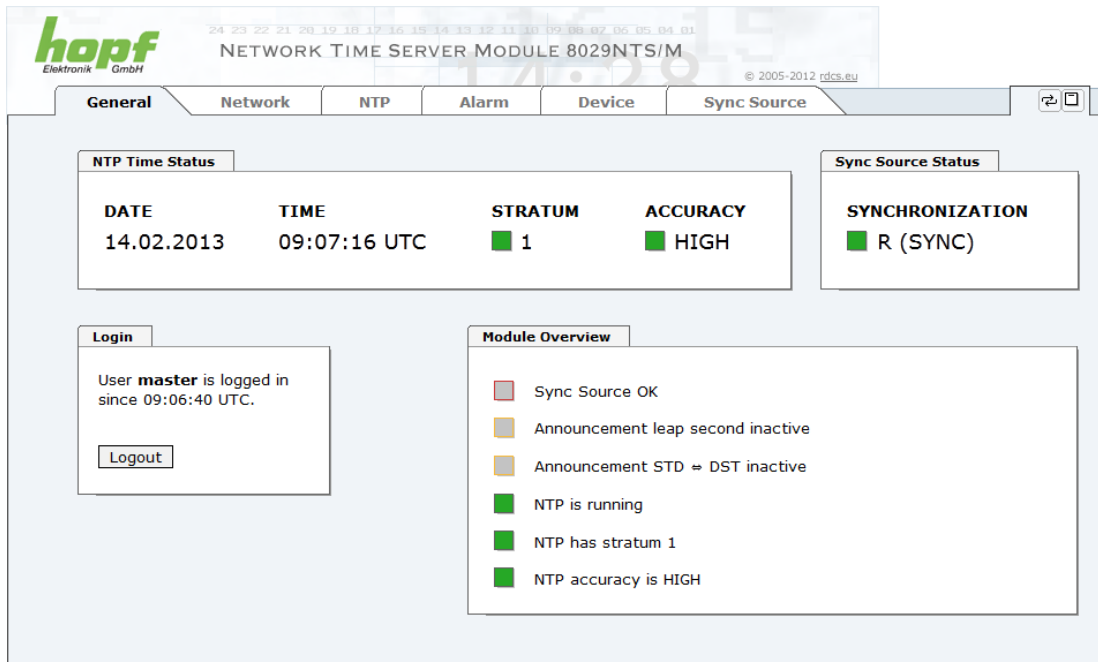


Differentiation is made between **upper and lower case** characters in the password. Alphanumeric characters and the following symbols can be used: **[] () * - _ ! \$ % & / = ?**



The password should be changed after the first login for security reasons.

The following screen should be visible after logging in as a "master" user:



Click on the **Logout** button to log out.



The WebGUI is equipped with a session management. If the user does not conduct a logout, the logout is automatically made after 10 minutes of inactivity (idle time).

After successful login, depending on the access level (device or master user), changes can be made to the configuration and saved.

Users logged in as “**master**” have all access rights to the Time Server 8029NTS/M.

Users logged in as “**device**” do **not** have access to:

- Trigger reboot
- Trigger factory defaults
- Carry out image update
- Carry out H8 firmware update
- Upload certificate
- Change master password
- Download configuration files

7.2.2 Navigation via the Web Interface

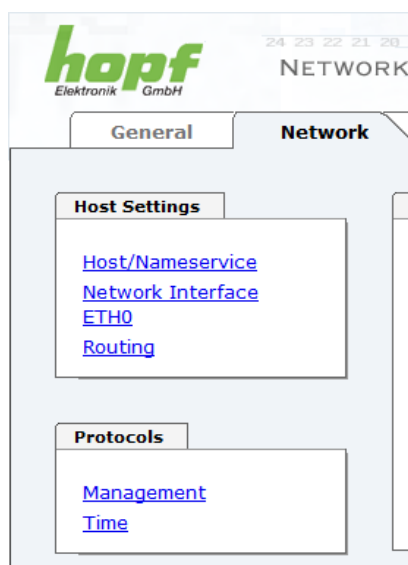
The WebGUI is divided into functional tabs. Click on one of these tabs to navigate through the board. The selected tab is identified by a darker background colour, see the following image (General in this case).



User login is not required in order to navigate through the board configuration options.



JavaScript and Cookies should be enabled in the browser in order to guarantee the correct operation of the web interface.



All the links within the tabs on the left hand side lead to corresponding detailed display or setting options.

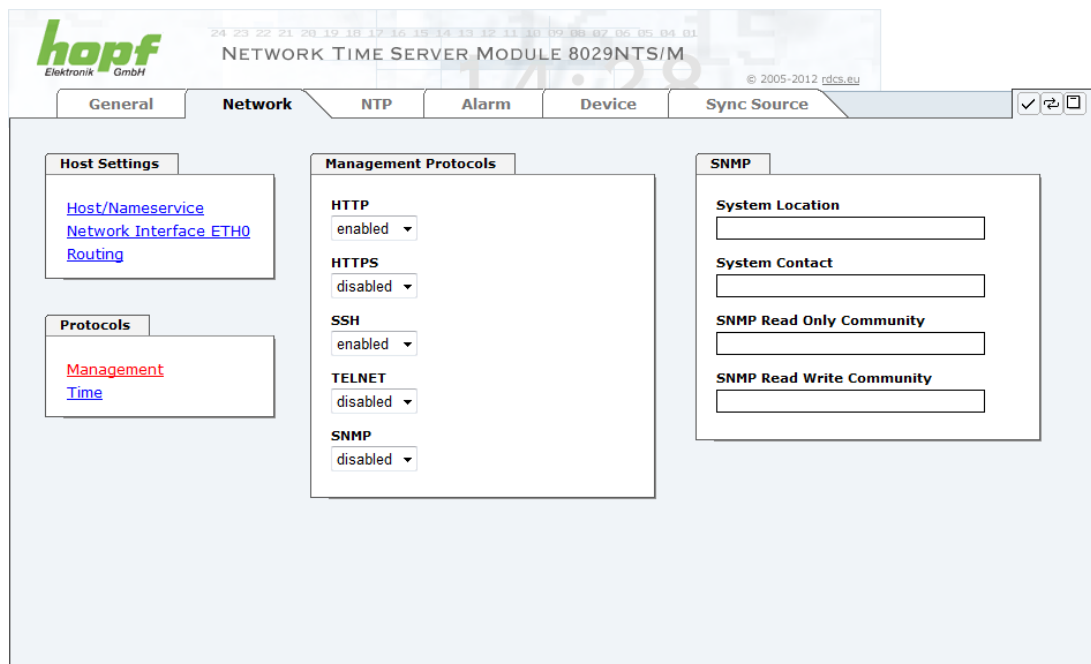
7.2.3 Enter or Changing Data

It is necessary to be logged on as one of the users described above in order to enter or change data.

All changeable data, are saved in Module 8029NTS/M. For these data the value saving is divided into two steps.

For a permanent saving the modified value **MUST** first be accepted with **Apply** from the module and then be stored with **Save**. Otherwise the modifications get lost after a reboot of the module or switching the system off.

Only in the tab Sync Source the values are failsafe stored or rather adopted with **Apply**.



After an entry with **Apply** is made, the configured field is marked with a star ' * '. This means that a value has been entered or changed but not yet been stored in the flash memory.



Meaning of the symbols from left to right:

No.	Symbol	Description
1	Apply	Acceptance of changes and entered data
2	Reload	Restoring the saved data
3	Save	Fail-save storage of the data in the flash configuration

If the data should only be tested it is sufficient to accept the changes with **Apply**.



Changing Network Parameters

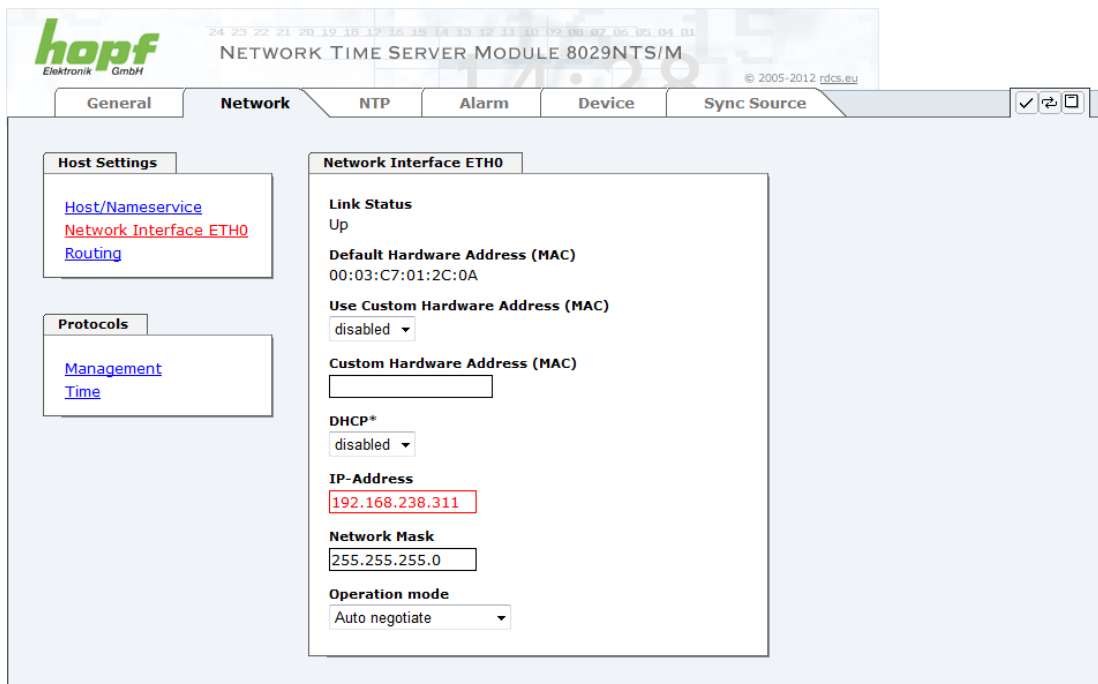
Modifications of the network parameters (e.g. IP address) are immediately effective clicking on **Apply** to confirm.
However, the modifications are not permanently saved yet. This requires to access the WebGUI with the new network parameters again and to save the data with **Save** permanently.



For adopting changes and entering values only the respective buttons in the WebGUI can be used.

7.2.4 Plausibility Check during Input

A plausibility check is generally carried out during input.



The screenshot shows the 'Network Interface ETH0' configuration page. The 'IP-Address' field is highlighted with a red border, indicating an invalid value. The other fields are as follows:

- Link Status: Up
- Default Hardware Address (MAC): 00:03:C7:01:2C:0A
- Use Custom Hardware Address (MAC): disabled
- Custom Hardware Address (MAC):
- DHCP*: disabled
- IP-Address: 192.168.238.311 (highlighted with a red border)
- Network Mask: 255.255.255.0
- Operation mode: Auto negotiate

As illustrated in the above image, an invalid value (e.g. text where a number should be entered, IP address not within the range etc.) is identified by a red border when an attempt is made to accept these settings. It should be noted here that this is only a semantic check and not to test whether an entered IP address can be used on the own network or in the configuration! As long as an error message is displayed it is not possible to save the configuration in the flash memory.



The error check only verifies semantics and the validity of ranges. It is **NOT** a **logic or network check** for entered data.

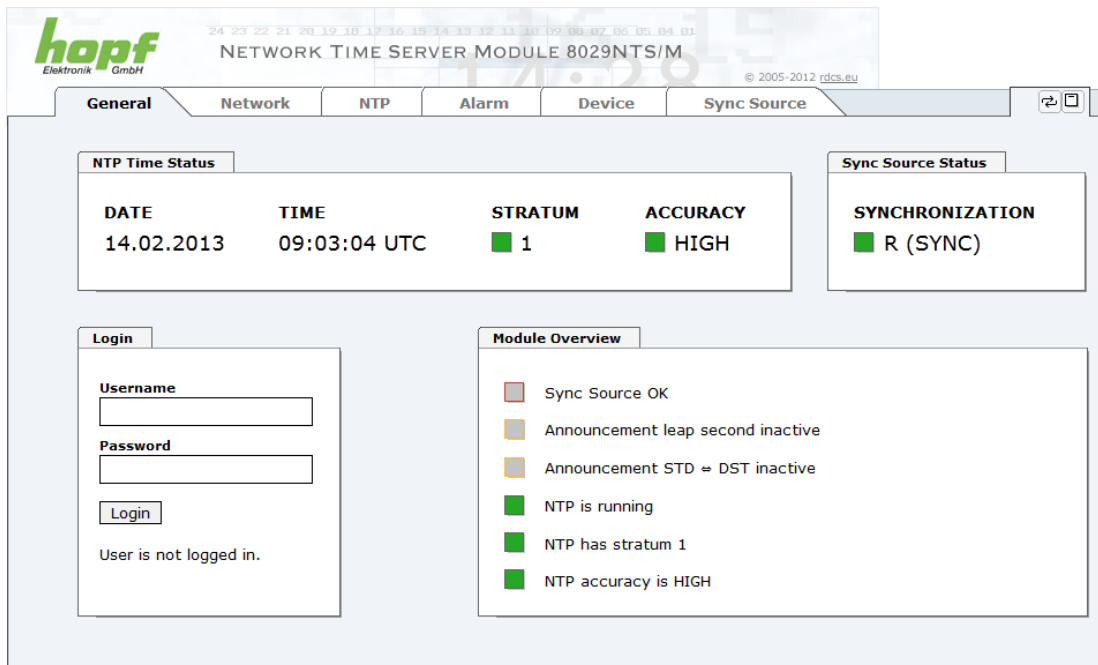
7.3 Description of the Tabs

The WebGUI is divided into the following tabs:

- General
- Network
- NTP
- Alarm
- Device
- Sync Source

7.3.1 GENERAL Tab

This is the first tab displayed when using the web interface.



The screenshot shows the web interface for the hopf Network Time Server Module 8029NTS/M. The interface has a top navigation bar with tabs: General, Network, NTP, Alarm, Device, and Sync Source. The 'General' tab is selected. Below the navigation bar, there are two main sections: 'NTP Time Status' and 'Sync Source Status'. The 'NTP Time Status' section displays the following information:

DATE	TIME	STRATUM	ACCURACY
14.02.2013	09:03:04 UTC	1	HIGH

The 'Sync Source Status' section displays the following information:

SYNCHRONIZATION
R (SYNC)

Below these sections, there is a 'Login' section with fields for 'Username' and 'Password', a 'Login' button, and a message 'User is not logged in.' To the right of the login section is a 'Module Overview' section with a list of status indicators:

- Sync Source OK
- Announcement leap second inactive
- Announcement STD \Rightarrow DST inactive
- NTP is running
- NTP has stratum 1
- NTP accuracy is HIGH

NTP Time Status

This area shows basic information about the current time and date of the Time Server 8029NTS/M. The time **always** corresponds to UTC. The reason for this is that NTP always works with UTC and not with local time.

Stratum displays the actual NTP stratum value of the Time Server 8029NTS/M with the value range from 1-16.

The **ACCURACY** field (accuracy of NTP) can contain the values LOW - MEDIUM - HIGH. The meaning of these values is explained in **Chapter 13.5 Accuracy & NTP Basic Principles**.

Sync Source Status

Display of the actual internal synchronization status of the module's internal time basis achieved by the adjusted and fed Sync Source:

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

Login

The login box is described in **Chapter 7.2.1 LOGIN and LOGOUT as User**.

Module Overview

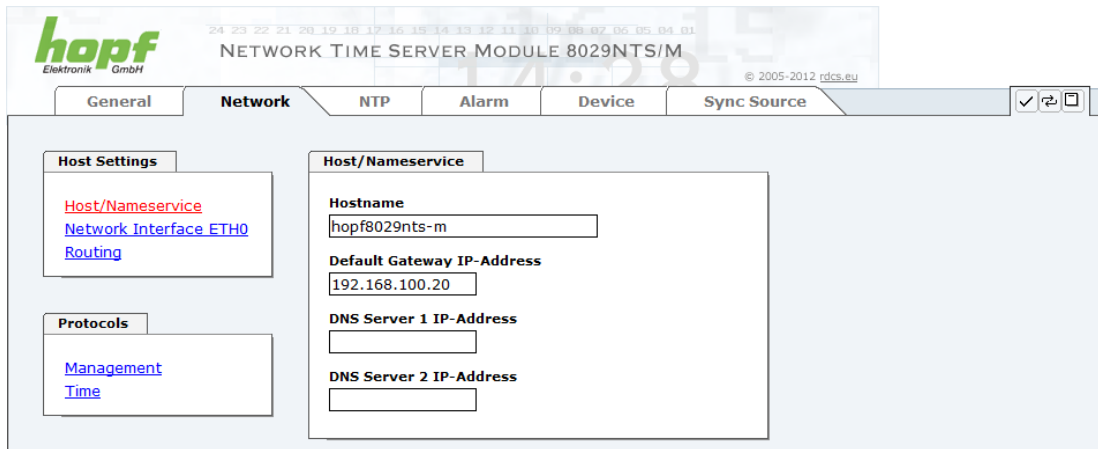
This table gives a direct overview of the Time Server's 8028NTS/M current operating states.

WebGUI	Description
Sync Source OK	When active (RED) there is a failure in the field of the Sync Source or its evaluation. For details please go to SYNC SOURCE tab – Sync Source Errors .
Announcement leap second inactive	When active (ORANGE) there is an announcement for a leap-second.
Announcement STD ⇔ DST inactive	When active (ORANGE) there is an announcement for a summer / winter time change-over.
NTP is running	The NTP process on Module 8029NTS/M is running
NTP has stratum 1	Shows the appropriate stratum the NTP process works with.
NTP Accuracy is High	Shows the appropriate accuracy the NTP process works with.

The display fields LEAP SECOND and STD ⇔ DST announce a corresponding event to the next hour (insertion of a leap-second or rather switchover of summer/winter time).

7.3.2 NETWORK Tab

All the links within the tab on the left hand side lead to corresponding detailed setting options.



The screenshot shows the 'NETWORK' tab selected in the top navigation bar. The left sidebar contains links for 'Host Settings' (with sub-links for Host/Nameservice, Network Interface ETH0, and Routing) and 'Protocols' (with sub-links for Management and Time). The main content area is titled 'Host/Nameservice' and contains the following fields:

- Hostname:** hopf8029nts-m
- Default Gateway IP-Address:** 192.168.100.20
- DNS Server 1 IP-Address:** (empty field)
- DNS Server 2 IP-Address:** (empty field)



Changing Network Parameters

Modifications of the network parameters (e.g. IP address) are immediately effective clicking on **Apply** to confirm. However, the modifications are not permanently saved yet. This requires to access the WebGUI with the new network parameters again and to save the data with **Save** permanently.

7.3.2.1 Host/Nameservice

Setting for the clear network detection.

7.3.2.1.1 Hostname

The standard setting for the Hostname is "**hopf8029nts-m**". This name should also be adapted to the respective network infrastructure.

If in doubt, simply leave the standard value in place or ask your network administrator.



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.



For a correct operation a hostname is required. The field for the hostname must not be left blank.

7.3.2.1.2 Default Gateway

Contact your network administrator for details of the standard gateway if not known. If no standard gateway is available (special case), enter 0.0.0.0 in the input field or leave the field blank.

7.3.2.1.3 DNS Server 1 & 2

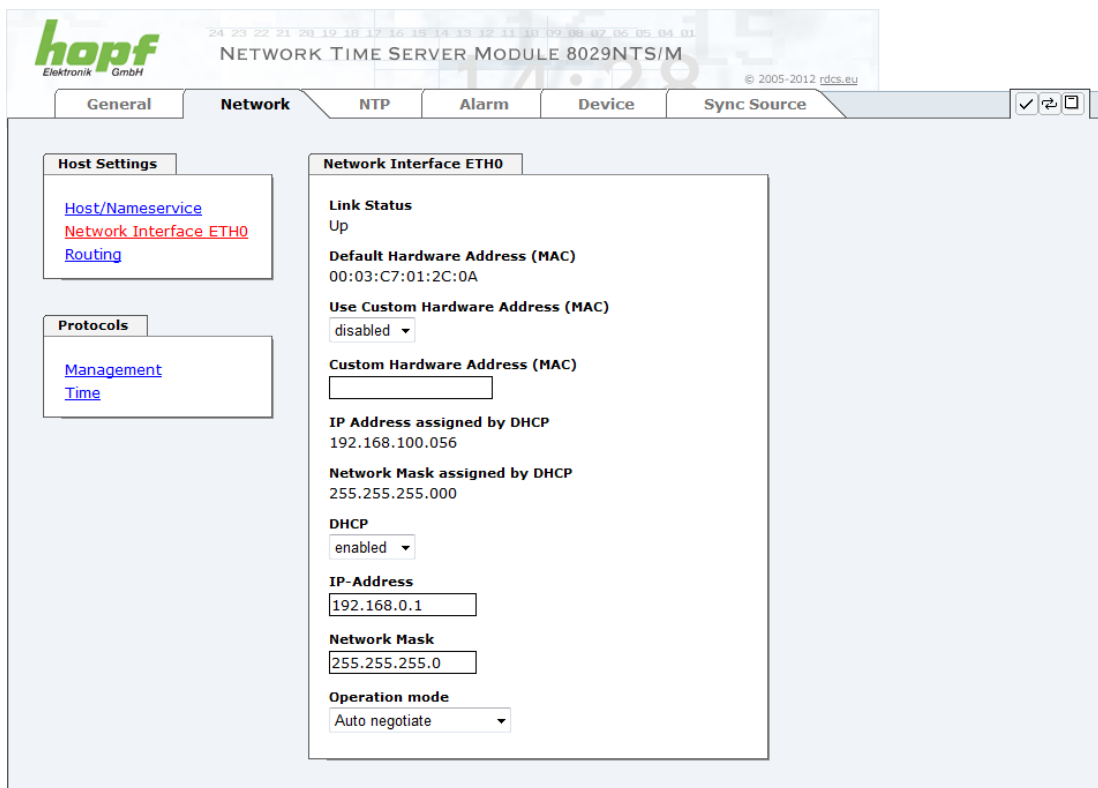
The IP address of the DNS server should be entered if you wish to use complete hostnames (hostname.domainname) or work with reverse lookup.

Contact your network administrator for details of the DNS server if not known.

If no DNS server is available (special case), enter 0.0.0.0 in the input field or leave the field blank.

7.3.2.2 Network Interface ETH0

Configuration of the Ethernet interface ETH0 of the Time Server 8029NTS/M.



7.3.2.2.1 Default Hardware Address (MAC)

The factory default MAC address can only be read and cannot be changed by the user. It is assigned once only by **hopf** Elektronik GmbH for each Ethernet interface.

For further information about the MAC address refer to **chapter 2.3.4.1 MAC-Address for ETH0** for the Time Server 8029NTS/M.



hopf Elektronik GmbH MAC addresses begin with **00:03:C7:xx:xx:xx**.

7.3.2.2.2 Customer Hardware Address (MAC)

The MAC address assigned from **hopf** can be changed to any user-defined MAC address. The board identifies itself with the user-defined MAC address to the network. The default hardware address shown in WebGUI remains unchanged.



Double assignment of MAC addresses on the Ethernet referring to customers MAC addresses should be avoided. If the MAC address is not known, please contact your network administrator.

The use of customers MAC address needs to be activated by the function **Use Custom Hardware Address (MAC)** with **enable**.

The customers MAC address has to be entered in hexadecimal form with a colon to separate as described in the below example, e.g. **00:03:c7:55:55:02**



The MAC address assigned by **hopf** can be activated at any time by disabling this function.



There are no MAC multicast addresses allowed!

7.3.2.2.3 DHCP

If DHCP is to be used, activate this with **enabled**.

7.3.2.2.4 IP Address

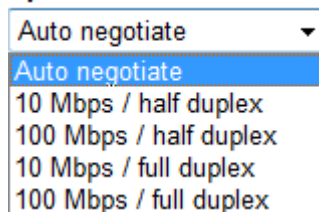
If DHCP is not used, the IP address needed to be entered here. Contact your network administrator for details of the used IP address if not known.

7.3.2.2.5 Network Mask

If DHCP is not used, the network mask needed to be entered here. Contact your network administrator for details of the used network mask if not known.

7.3.2.2.6 Operation Mode

Operation mode



The network device usually adjusts the data stream and duplex mode to the device to which it is connected (e.g. HUB, SWITCH) automatically. If the network device requires a certain speed or duplex mode, this can be configured via the web interface. The value should only be changed in special cases. The automatic setting is normally used.

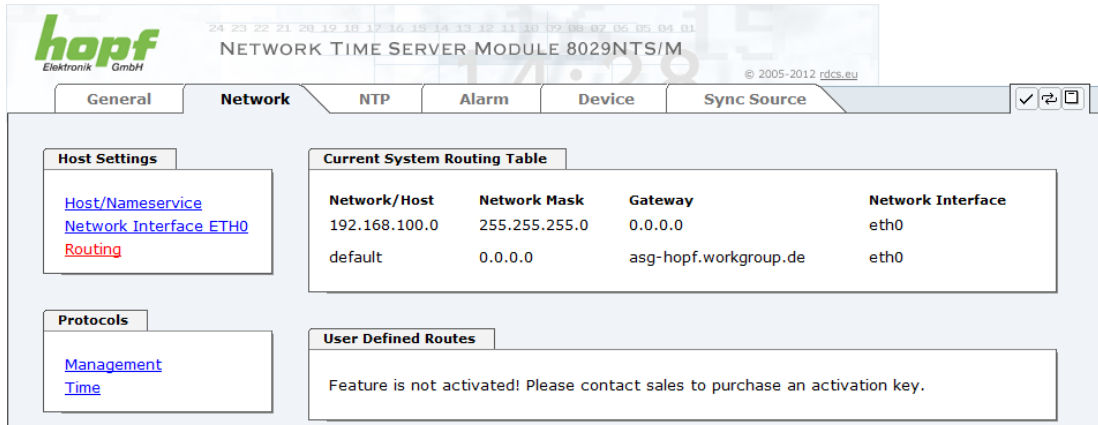


In individual cases an enabled "Auto negotiate" might lead to problems between the network components and the adjustment process fails.

In such cases it is recommended to set the network speed of the Time Server 8029NTS/M **and** the connected network components manually to the same value.

7.3.2.3 Routing (Activation Key necessary)

A route must be configured if the module is not only be used in the local sub-network.



The screenshot shows the 'Network' tab in the Hopf WebGUI. The 'Host Settings' section includes links for 'Host/Nameservice', 'Network Interface ETH0', and 'Routing' (highlighted in red). The 'Current System Routing Table' shows two entries:

Network/Host	Network Mask	Gateway	Network Interface
192.168.100.0	255.255.255.0	0.0.0.0	eth0
default	0.0.0.0	asg-hopf.workgroup.de	eth0

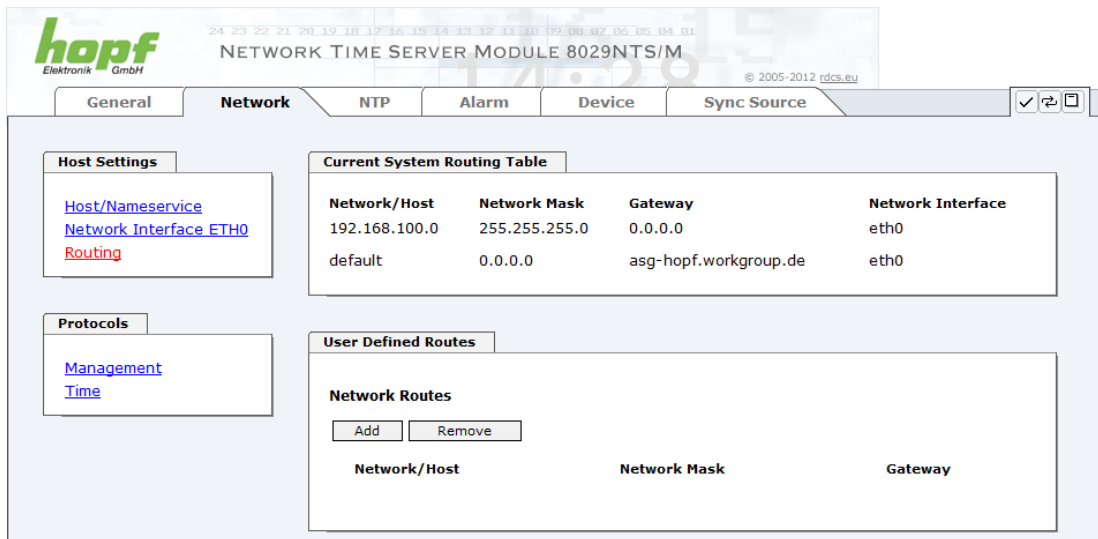
The 'User Defined Routes' section displays a message: 'Feature is not activated! Please contact sales to purchase an activation key.'

The gateway / gateway host need to be in the local sub-network range of the module in order to use the routes.



The parameterization of this feature is a critical process as an incorrect configuration may lead to considerable problems on the network!

WebGUI with Routing activated



The screenshot shows the 'Network' tab in the Hopf WebGUI. The 'Host Settings' section includes links for 'Host/Nameservice', 'Network Interface ETH0', and 'Routing' (highlighted in red). The 'Current System Routing Table' shows two entries:

Network/Host	Network Mask	Gateway	Network Interface
192.168.100.0	255.255.255.0	0.0.0.0	eth0
default	0.0.0.0	asg-hopf.workgroup.de	eth0

The 'User Defined Routes' section is now active and shows a table for 'Network Routes' with columns for 'Network/Host', 'Network Mask', and 'Gateway'. There are 'Add' and 'Remove' buttons above the table.

The image above shows every configured route of the base system routing table as well as the user's defined routes.



The module cannot be used as a router!

7.3.2.4 Management (Management-Protocols – HTTP, SNMP etc.)

Protocols that are not required should be disabled for security reasons. A correctly configured module is always accessible via the web interface.

Changes to the availability of a protocol (enable/disable) take effect immediately.



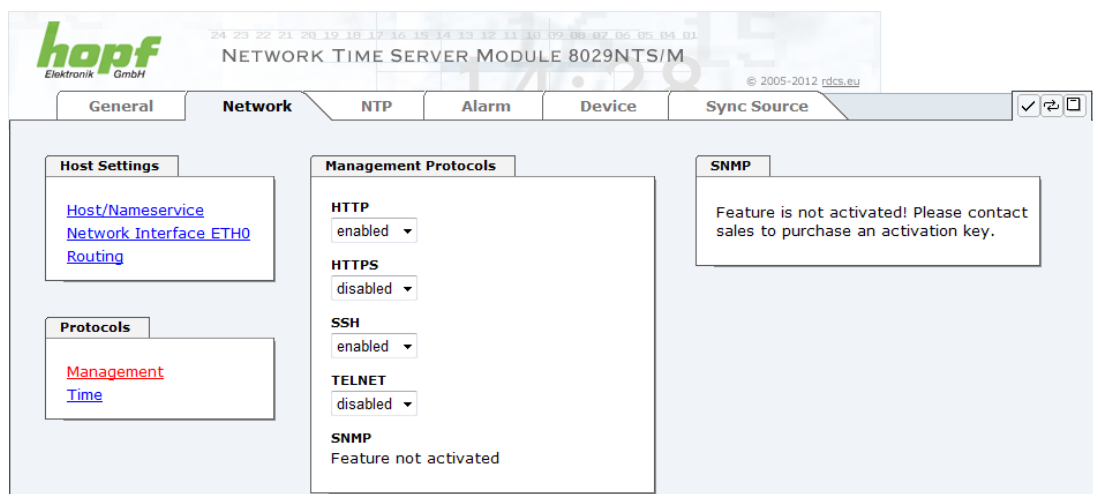
For SNMP functionality an activation key is necessary.



If by mistake all protocol channels become "disabled", the SSH channel is automatically "enabled" after the attempt to save.

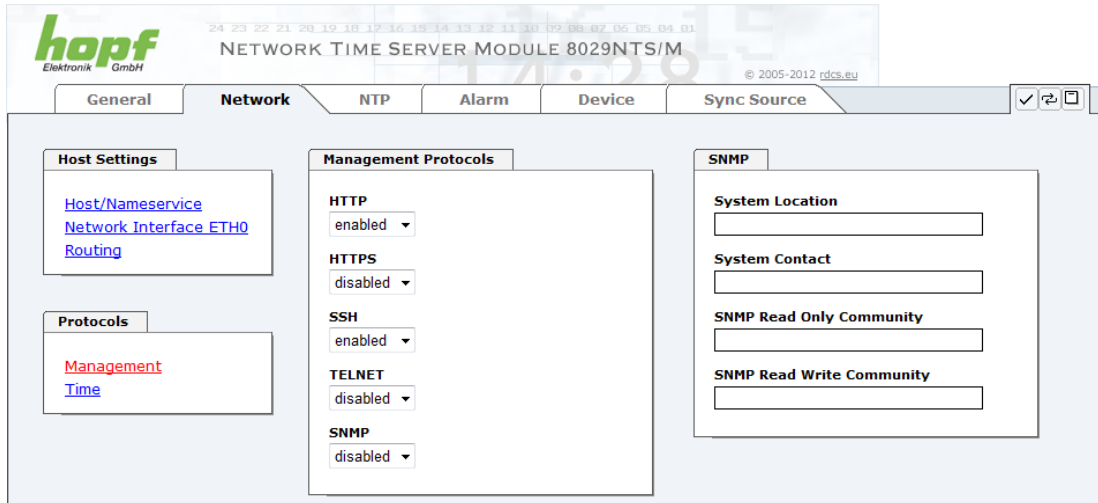


After a Factory Default the HTTP and SSH channels are "enabled".



These service settings are valid globally! Services with "disabled" status are not externally accessible and are not made externally available by the module!

WebGUI with Alarming activated

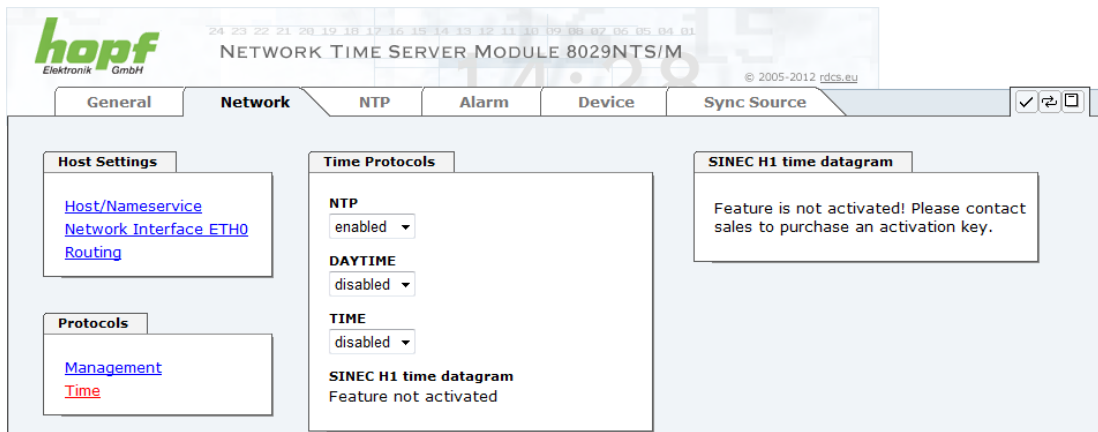


Using SNMP and SNMP- traps the protocol SNMP should be enabled.

All fields must be filled in for a correct operation of SNMP. Contact your network administrator for details of data not known.

7.3.2.5 Time

Activation and configuration of different synchronization protocols




All protocols can be enabled at the same time.

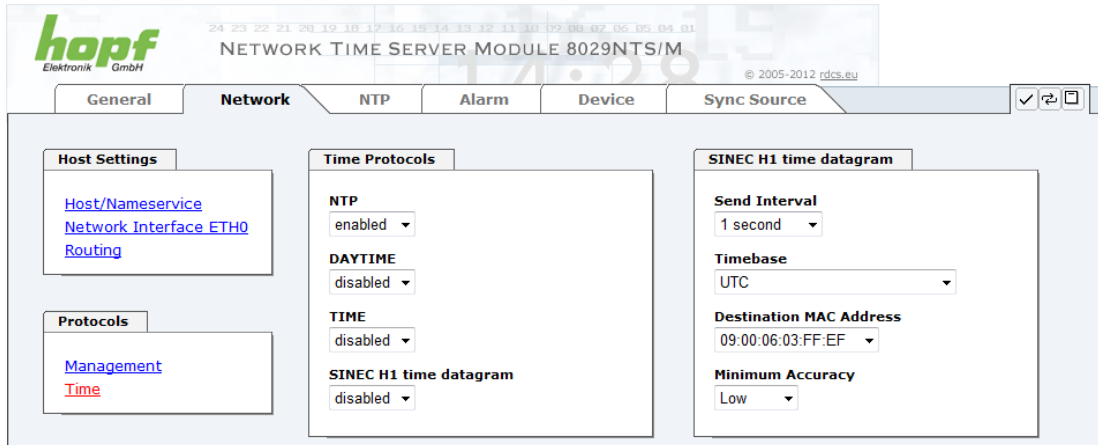
7.3.2.5.1 Synchronization Protocols (Time Protocols – NTP, SNTP etc.)

Needed time protocols can be enabled here.

- NTP (incl. SNTP)
- DAYTIME
- TIME
- SINEC H1 time datagram (Activation key necessary)

7.3.2.5.2 SINEC H1 time datagram (Activation Key necessary)

Configuration of the SINEC H1 time datagram



Broadcast transmission intervals of the SINEC H1 time datagram (Send Interval):

- every second
- every 10 second
- every 60 second

Timebase see also *Chapter 13.2.1 Time-specific expressions:*

- Local time
- UTC
- Standard time
- Standard time with daylight / standard time status

Destination MAC Address:

- 09:00:06:03:FF:EF
- 09:00:06:01:FF:EF
- FF:FF:FF:FF:FF:FF

Synchronization Status based on Starting Transmission (Minimum Accuracy)

This setting defines at which internal accuracy status the SINEC H1 time datagram should be transmitted (see **Chapter 13.5 Accuracy & NTP Basic Principles** and **Chapter 11 Technical Data**):

- LOW
- MEDIUM
- HIGH



The setting Minimum Accuracy = LOW may lead to the output of non-synchronised (thus possibly wrong) time information.

7.3.3 NTP Tab

This tab shows information and adjustment possibilities of the NTP services of the Time Server 8029NTS/M. The NTP service is the significant main service of the Time Server 8029NTS/M.

If you are not familiar with the subject of NTP you can find a short description in the Glossary. More details are also available at <http://www.ntp.org/>.

NTP functionality is provided by an NTP-Demon running on the embedded Linux of the Time Server 8029NTS/M.

Depending on the receiving conditions and under unfavourable circumstances it may take several hours until long-term accuracy is obtained (normally 5-10 minutes). During this time the NTP algorithm adjusts the internal accuracy parameters.



The NTP time protocol must be enabled in order to use NTP (see **Chapter 7.3.2.5 Time**)



After all changes relating to NTP a restart of the NTP service must be performed (see **Chapter 7.3.3.6 (Restart NTP)**).



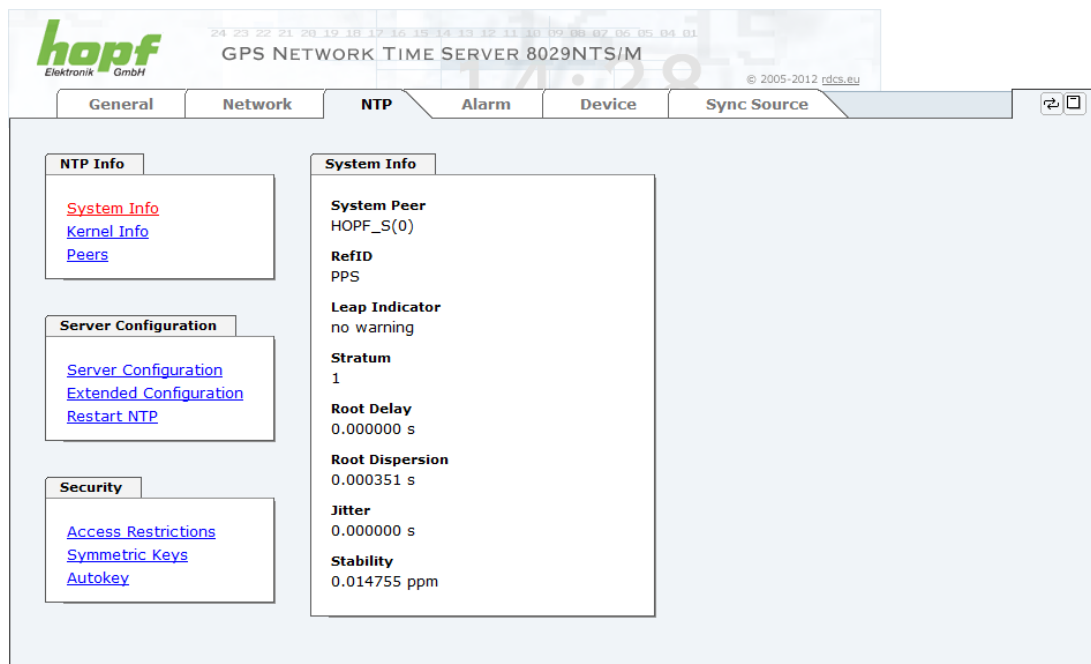
Via the NTP protocol SNTP Clients can also be synchronized. In contrast to NTP in SNTP Clients delay times are not evaluated on the network. For this reason the accuracy reached in SNTP Clients is lower than in NTP Clients.

7.3.3.1 System Info

In the window "System Info" the current NTP values of the NTP service running on the embedded Linux of the Time Server 8029NTS/M are indicated. In addition to the NTP calculated values for root delay, root dispersion, jitter, and stability the stratum value of the Time Server 8029NTS/M, the status to the leap second, and the current system peer are also found here.

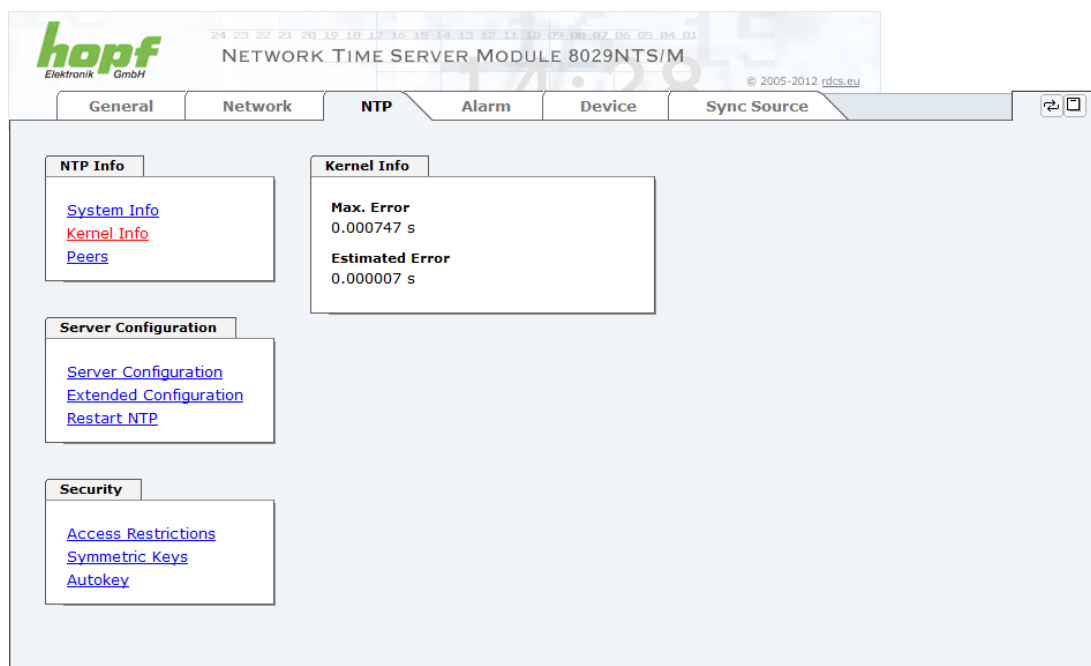
The NTP version used adjusts the leap second correctly.

The Time Server 8029NTS/M works as NTP Server with stratum 1 and belongs to the best available class of NTP server, as it has a reference clock with direct access.



7.3.3.2 Kernel Info

The "Kernel Info" overview shows the current error values of the internal embedded Linux clock. Both values are internally updated every second.



This screenshot shows a maximum kernel clock error of 0.747 msec (milliseconds). The estimated error value is 7 μ s (microseconds).

The values indicated here are based on the calculation of the NTP service and have no significance for the accuracy of the adjusted and fed Sync.

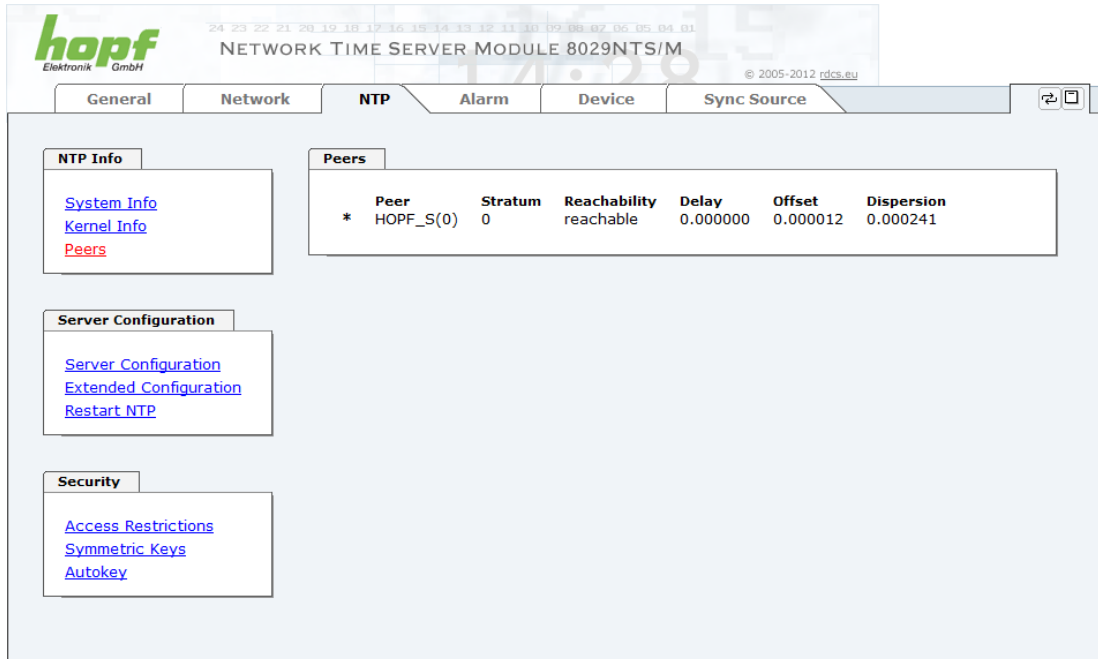
7.3.3.3 Peers

The "Peers summary" is used to track the performance of the configured NTP server/driver and the NTP algorithm itself.

The information displayed is identical with the information available via NTPQ or NTPDC programmes.

Each NTP server/driver that has been set up in the NTP server configuration is displayed in the peer information.

The connection status is displayed in the reachability column (not reachable, bad, medium, and reachable).



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NETWORK TIME SERVER MODULE 8029NTS/M

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General Network **NTP** Alarm Device Sync Source

NTP Info

[System Info](#)
[Kernel Info](#)
[Peers](#)

Peers

Peer	Stratum	Reachability	Delay	Offset	Dispersion
* HOPF_S(0)	0	reachable	0.000000	0.000012	0.000241

Server Configuration

[Server Configuration](#)
[Extended Configuration](#)
[Restart NTP](#)

Security

[Access Restrictions](#)
[Symmetric Keys](#)
[Autokey](#)

Three lines can be seen in the above image. The first line displays the **hopf - refclock ntp driver** that gets the time information directly from the Sync Source.

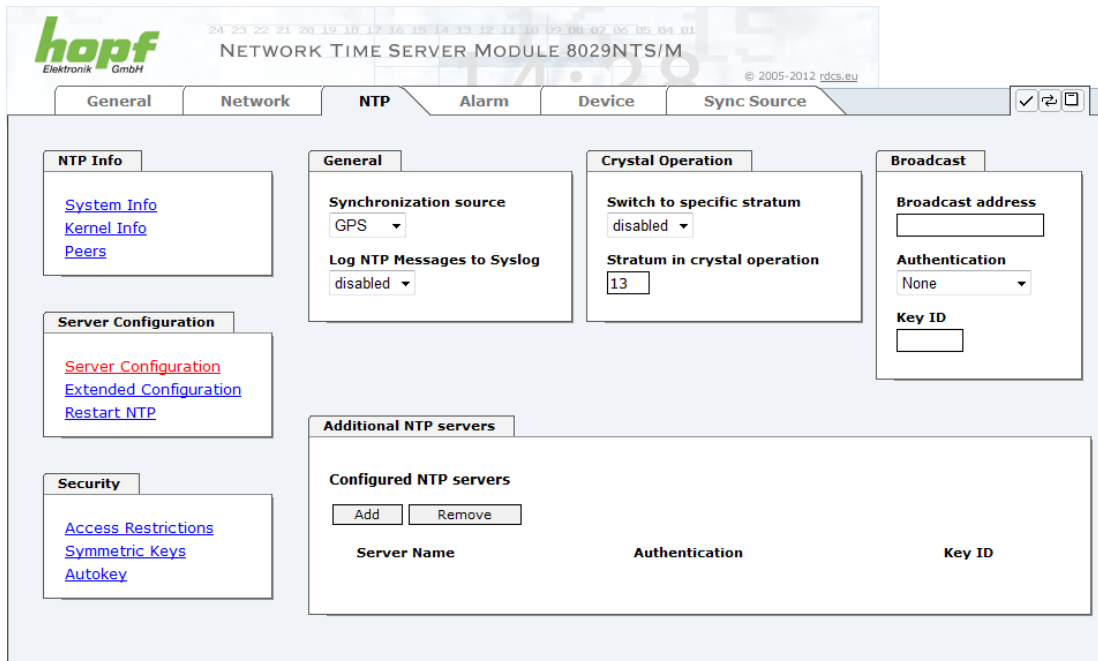
The second and third line display external NTP server that can be additionally added to the internal **hopf - refclock ntp driver** in the menu server configuration.

A short explanation and definition of the displayed values can be found in **Chapter 13.5 Accuracy & NTP Basic Principles**.

The character in the first column on the left presents the current status of the NTP association in the NTP selection algorithm. A list and description of possible characters can be found in the Glossary (see **Chapter 13.2 Tally Codes (NTP-specific)**).

7.3.3.4 Server Configuration

The basic settings for NTP base functionality are displayed selecting the "Server Configuration" link.



The NTP-hopf-refclock driver is already configured as standard (127.127.38.0 in the "Peers Summary") and is not explicitly displayed here.

7.3.3.4.1 Synchronization Source (General / Synchronization source)

As "Synchronization source" either GPS or DCF77, depending on the appropriate Sync Source, has to be selected. This is required in order to align the NTP algorithm for the calculation of the accuracy with the synchronization source.



Based on the selection of GPS, even though GPS is not the source of the Sync Source (different product option) the value **HIGH** for **Accuracy** may never be reached.

7.3.3.4.2 NTP Syslog Messages (General / Log NTP Messages to Syslog)

This option enables or disables Syslog messages which are generated from the NTP service.

This value has no effect if Syslog is not configured in the ALARM tab (see **Chapter 7.3.4.1 Syslog Configuration**).

7.3.3.4.3 Crystal Operation

Crystal Operation / Switch to Specific Stratum

If the Sync Source connected to the module supplies an inadequate or no time information required for the time synchronization of the Module the NTP service of the Time Server 8029NTS/M usually behaves in the way that the receipt of time information is stopped from the Sync Source and the stratum value reset to 16 (defined as invalid in NTP).



NTP Clients do not accept time information from a NTP Time Server with stratum 16 (invalid). Briefly, as long as the Time Server 8029NTS/M indicates the stratum value 16, NTP Clients are not synchronized.

This behaviour of NTP during crystal operation of the Sync Source can be changed. Therefore the function "*Switch to specific stratum*" should be enabled by setting the value to "*enabled*" and the so-called downgrading stratum (= stratum value of the Time Server 8029NTS/M during crystal operation of the Sync Source).

For the synchronization of NTP Clients during crystal operation of the Sync Source or for testing the system without connected synchronization source, in the setting "*enabled*" any stratum value between 1 and 15 can be set.

Crystal Operation / Stratum in Crystal Operation

The value defined here (range 1-15) designates the transmitted fallback NTP stratum level of the module in "*Quartz*" synchronization status. Stratum 1 should be configured if downgrading is not desired in status "*Quartz*".



The NTP service **MUST** also be restarted (see **Chapter 7.3.3.6 Restart NTP**).



Using the option "*Switch to specific stratum*" the NTP Clients are synchronized with time information indicated in the general menu of the WebGUI of the Sync Source during crystal operating. Whether this time information (e.g. through drift) is imprecise or the time is manually set (wrong) cannot be detected by the NTP Client!



In case the value 1 is used for "*Stratum in crystal operation*", the NTP Client cannot not verify whether the Time Server 8029NTS/M is synchronised or runs in crystal operation. Should a differentiation be wished between synchronized and crystal operation the downgrading stratum needs to be set to a value between 2 and 15.

The value is only adjustable if the "*Switch to specific stratum*" function is enabled.

7.3.3.4.4 Broadcast / Broadcast Address

This section is used to configure the Time Server 8029NTS/M as a broadcast or multicast server.

The broadcast mode in NTPv3 and NTPv4 is limited to clients on the same sub-network and Ethernets which support broadcast technology.

This technology does not generally extend beyond the first hop (network node - such as router or gateway).

The broadcast mode is provided for configurations which are designed to facilitate one or more servers and as many clients as possible in a sub-network. The server continuously generates broadcast messages at defined intervals, corresponding to 16 seconds (minpoll 4) for Time Server 8029NTS/M. Care should be taken to ensure that the correct broadcast address is used for the sub-network, usually xxx.xxx.xxx.255 (e.g. 192.168.1.255). If the broadcast address is not known, this can be requested from the network administrator.

This section can also be used to configure the Time Server 8029NTS/M as a multicast server. The configuration of a multicast server is similar to that of a broadcast server. However, a multicast group address (class D) is used instead of the broadcast address.

An explanation of multicast technology goes beyond the scope of this document.

In principle, a host or router sends a message to an IPv4 multicast group address and expects all hosts and routers to receive this message. In doing so, there is no limit to the number of senders and receivers and a sender may also be a receiver and vice-versa. The IANA has assigned the multicast group address IPv4 224.0.0.1 to the NTP, however this should only be used if the multicast range can be safely limited in order to protect neighbouring networks. As a basic principle, administratively manageable IPv4 group addresses should be used as described in RFC-2365 or GLOP group addresses as described in RFC-2770.

7.3.3.4.5 Broadcast / Authentication / Key ID

Broadcast packets can be protected by authentication for security reasons.

If a security method is selected here, this must be configured **additionally** in the security settings of the NTP tab. A key must be defined if the Symmetric Key is selected.

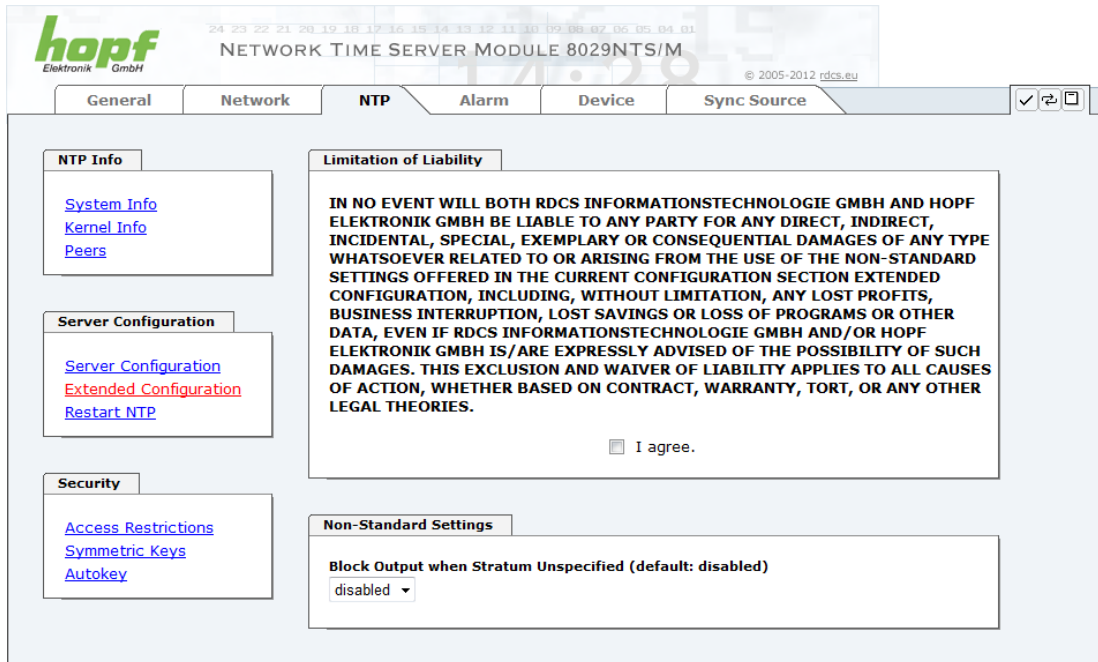
7.3.3.4.6 Additional NTP SERVERS

Adding further NTP servers provides the opportunity to implement a security system for the time service. However, this affects the accuracy and stability of the Time Server 8029NTS/M.

Detailed information on this subject can be found in the NTP documentation (<http://www.ntp.org/>).

7.3.3.5 Extended NTP Configuration

NTP is a standard for synchronising clocks in computer systems via packet-based communication networks. For special applications a NON standard setting can be configured.



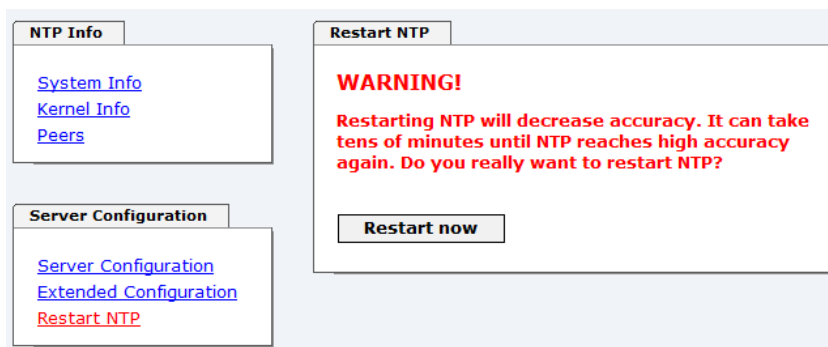
For activation of this special NTP setting, the customer's approval shown in the WebGUI needed to be declared by checking the field "I agree".

7.3.3.5.1 Suppression of unspecified NTP Outputs

Unspecified NTP outputs that e.g. are generated by NTP at a restart are suppressed when this function is enabled.

7.3.3.6 Restart NTP

The following screen appears after clicking on the Restart NTP option:



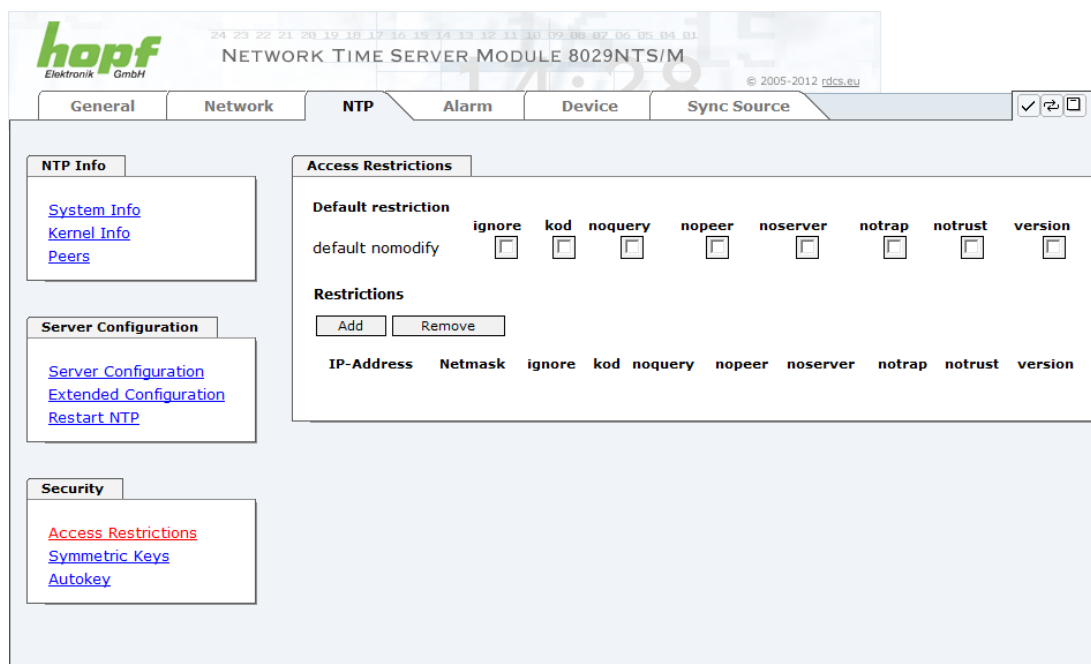
Restarting NTP services is the only possibility of making NTP changes effective without having to restart the entire Time Server 8029NTS/M. As can be seen from the warning message, the currently reachable stability and accuracy get lost caused by this restart.



After a restart of the NTP service it takes up to 10 minutes until the NTP service on the Time Server 8029NTS/M is completely adjusted.

7.3.3.7 Configuring the NTP Access Restrictions

One of the extended configuration options for NTP is the "Access Restrictions" (NTP access restrictions).



Restrictions are used in order to control access to the System's NTP service and these are regrettably the most misunderstood options of the NTP configuration.

If you are not familiar with these options, a detailed explanation can be found at <http://www.ntp.org/>.



IP addresses should be used when configuring the restrictions – no Hostnames!

The following steps show how restrictions can be configured - should these not be required it is sufficient to retain the standard settings.

The standard restrictions tell the NTP service how to handle packets of hosts (including remote time servers) and sub-network which otherwise have no special restrictions.

The NTP configuration can simplify the selection of the correct standard restrictions while making the required security available.

Before beginning the configuration the points **7.3.3.7.1** to **7.3.3.7.4** must be checked by the user:

7.3.3.7.1 NAT or Firewall

Are incoming connections to the NTP Service blocked by NAT or a Stateful Inspection Firewall?	
No	Proceed to Chapter 7.3.3.7.2 Blocking Unauthorised Access
Yes	No restrictions are required in this case. Proceed further to Chapter 7.3.3.7.4 Internal Client Protection / Local Network Threat Level

7.3.3.7.2 Blocking Unauthorised Access

Is it really necessary to block all connections from unauthorised hosts if the NTP Service is openly accessible?	
No	Proceed to Chapter 7.3.3.7.3 Allowing Client Requests
Yes	<p>In this case the following restrictions are to be used:</p> <p>ignore in the default restrictions <input checked="" type="checkbox"/></p> <p>If a standard restriction is selected in this area, exceptions can be declared in separate lines for each authorised server, client or sub-network. See Chapter 7.3.3.7.5 Addition of Exceptions to Standard</p>

7.3.3.7.3 Allowing Client Requests

Are clients to be allowed to see the server status information when they receive the time information from the NTP service (even if this is information about the module, operating system and NTPD version)?	
No	<p>In this case select from the following standard restrictions: See Chapter 7.3.3.7.6 Access Control Options</p> <p>kod <input checked="" type="checkbox"/></p> <p>notrap <input checked="" type="checkbox"/></p> <p>nopeer <input checked="" type="checkbox"/></p> <p>noquery. <input checked="" type="checkbox"/></p>
Yes	<p>In this case select from the following standard restrictions: See Chapter 7.3.3.7.6 Access Control Options:</p> <p>kod <input checked="" type="checkbox"/></p> <p>notrap <input checked="" type="checkbox"/></p> <p>nopeer <input checked="" type="checkbox"/></p> <p>If a standard restriction is selected in this area, exceptions can be declared in separate lines for each authorised server, client or sub-network. See Chapter 7.3.3.7.5 Addition of Exceptions to Standard .</p>

7.3.3.7.4 Internal Client Protection / Local Network Threat Level

How much protection from internal network clients is required?	
Yes	<p>The following restrictions can be enabled if greater security settings than the installed authentication are required in order to protect the NTP service from the clients see Chapter 7.3.3.7.6 Access Control Options.</p> <p>kod <input checked="" type="checkbox"/></p> <p>notrap <input checked="" type="checkbox"/></p> <p>nopeer <input checked="" type="checkbox"/></p>

7.3.3.7.5 Addition of Exceptions to Standard Restrictions

After the standard restrictions have been set once, certain exceptions may be necessary for special hosts/sub-networks in order to allow remote time servers and client hosts/sub-networks to contact the NTP service.

These standard restrictions are to be added in the form of restriction lines.

Access Restrictions

Default restriction

ignore

kod

noquery

nopeer

noserver

notrap

notrust

version

default nomodify

☒

☒

☒

☒

☒

☒

☐

☐

Restrictions

Add

Remove

IP-Address	Netmask	ignore	kod	noquery	nopeer	noserver	notrap	notrust	version
<input type="checkbox"/> 192.168.233.199	255.255.224.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



An unrestricted access of the Time Server 8029NTS/M to its own NTP service is always allowed, irrespective of whether standard restrictions are ignored or not. This is necessary in order to be able to display NTP data on the web interface.

Add restriction exception: (for each remote time server)

Restrictions: Press **ADD**

Enter the IP address of the remote time server.

Enable restrictions: e.g.

notrap / nopeer / noquery ☒

Allow **unrestricted access** to a special host (e.g. System administrator's workstation):

Restrictions: Press **ADD**

IP address 192.168.1.101

Do not enable any restrictions

Allow a **sub-network** to receive time server and query server statistics:

Restrictions: Press **ADD**

IP address 192.168.1.0

Network mask 255.255.255.0

notrap / nopeer ☒

7.3.3.7.6 Access Control Options

The official documentation concerning the current implementation of the restriction instructions can be found on the “Access Control Options” page at <http://www.ntp.org/>.

Numerous access control options are used. The most important of these are described in detail here.

nomodify – "Do not allow this host/sub-network to modify the NTPD settings unless it has the correct key."



Default Settings:

Always active. Can't be modified by the user.

As standard, NTP requires authentication with a symmetric key in order to carry out modifications with NTPDC. If a symmetric key is not configured for the NTP service, or if this is kept in a safe place, it is not necessary to use the nomodify option unless the authentication procedure appears to be unsafe.

noserver – "Do not transmit time to this host/sub-network."

This option is used if a host/sub-network is only allowed access to the NTP service in order to monitor or remotely configure the service.

notrust – "Ignore all NTP packets which are not encrypted."

This option tells the NTP service that all NTP packets which are not encrypted should be ignored (it should be noted that this is a change from ntp-4.1.x). The notrust option **MUST** NOT be used unless NTP Crypto (e.g. symmetric key or Autokey) has been correctly configured on both sides of the NTP connection (e.g. NTP service and remote time server, NTP service and client).

noquery – "Do not allow this host/sub-network to request the NTP service status."

The ntpd status request function, provided by ntpd/ntpd, declassifies certain information over the running ntpd Base System (e.g. operating system version, ntpd version) which under certain circumstances ought not to be made known to others. It must be decided whether it is more important to hide this information or to give clients the possibility of seeing synchronization information over ntpd.

ignore – "In this case ALL packets are refused, including ntpq and ntpdc requests".

kod – "A kiss-o'-death (KoD) packet is transmitted if this option is enabled in the case of an access error."

KoD packets are limited. They cannot be transmitted more frequently than once per second. Any KoD packet which occurs within one second from the last packet is removed.

notrap – "Denies support for the mode 6 control message trap service in order to synchronise hosts."

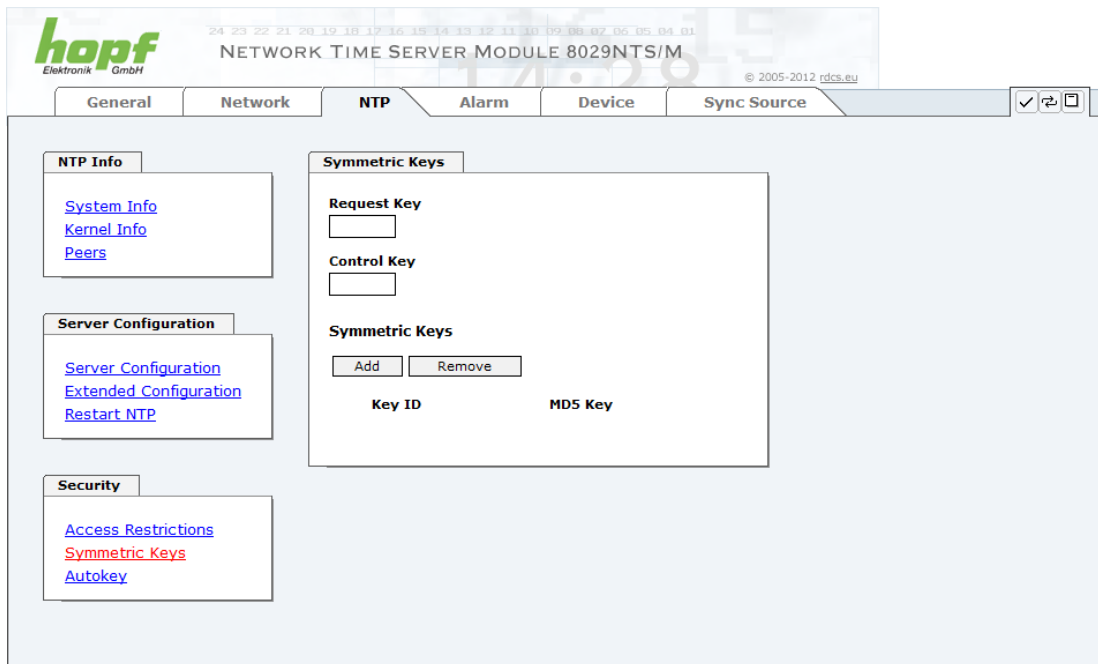
The trap service is a sub-system of the ntpq control message protocols. This service logs remote events in programmes.

version – "Denies packets which do not correspond to the current NTP version."



Changes in data do not take effect immediately after clicking on the “Apply” symbol. The NTP service **MUST** also be restarted (see **Chapter 7.3.3.6 Restart NTP**).

7.3.3.8 Symmetric Key



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24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03

NETWORK TIME SERVER MODULE 8029NTS/M

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General Network **NTP** Alarm Device Sync Source

NTP Info

[System Info](#)
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Server Configuration

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Security

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[Autokey](#)

Symmetric Keys

Request Key

Control Key

Symmetric Keys

Key ID	MDS Key
--------	---------

7.3.3.8.1 Why Authentication?

Most NTP users do not require authentication as the protocol contains several filters (for bad time).

Despite this, however, the use of authentication is common. There are certain reasons for this:

- Time should only be used from safe sources
- An attacker broadcasts false time signals
- An attacker poses as another time server

7.3.3.8.2 How is Authentication used in the NTP Service?

Client and server can execute an authentication whereby a code word is used on the client side and a restriction on the server side.

NTP uses keys to implement the authentication. These keys are used when data are exchanged between two machines.

In principle both sides must know this key. The key can generally be found in the `"*/etc/ntp.keys"` directory. It is unencrypted and hidden from public view. This means that the key has to be distributed on a safe route to all communication partners. The key can be downloaded for distribution under "Downloads / Configuration Files" on the DEVICE tab. It is necessary to be logged in as "Master" in order to access this.

The keyword key of a client's `ntp.conf` determines the key that is used to communicate with the designated server (e.g. the Time Server 8029NTS/M). The key must be reliable if time is to be synchronised. Authentication causes a delay. This delay is automatically taken into account and adjusted in the current versions.

7.3.3.8.3 How is a key created?

A key is a sequence of up to 31 ASCII characters. Some characters with special significance cannot be used (alphanumeric characters and the following symbols can be used: [] () * - _ ! \$ % & / = ?).

A new line can be inserted by pressing the **ADD** key. The key which is stored in the key file is entered on this line. The key ID is used to identify the key and is in the range from 1 – 65534. This means that 65534 different keys can be defined.

Duplicate key ID's are not allowed. Having now explained the principles of keys, it should be possible to use a key in practically the same way as a password.

The value of the request key field is used as the password for the ntpdc tool while the value of the control key field is used as the password for the ntpq tool.

More information is available at <http://www.ntp.org/>.

7.3.3.8.4 How does authentication work?

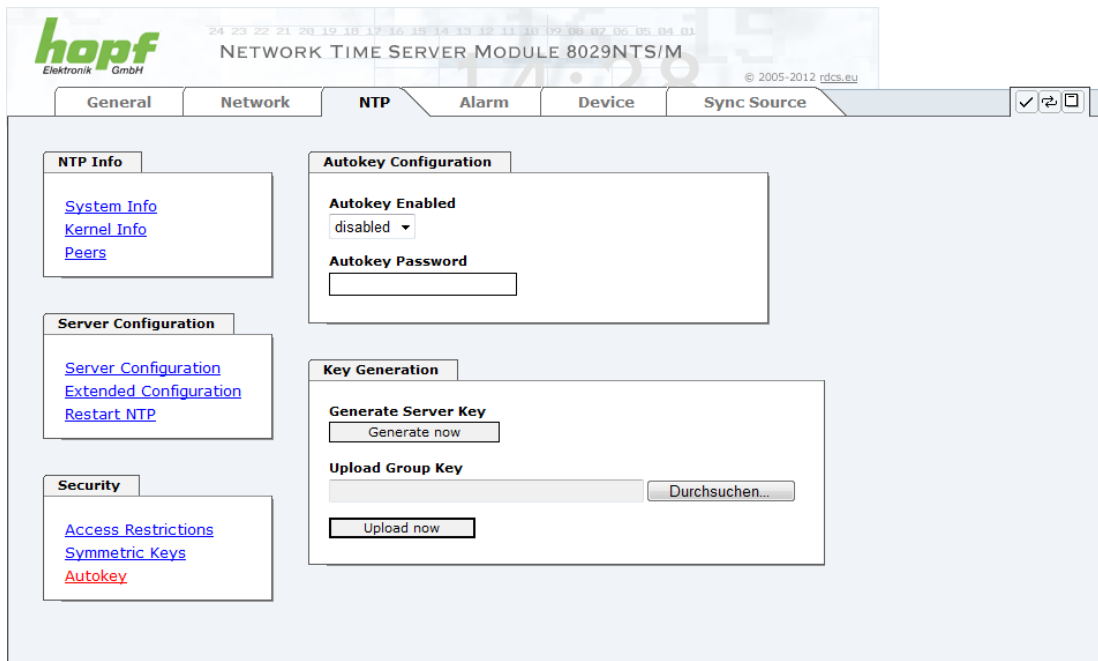
The basic authentication is a digital signature and no data encryption (if there are any differences between the two). The data packet and the key are used to create a non-reversible number which is attached to the packet.

The receiver (which has the same key) carries out the same calculation and compares the results. Authentication has been successful if the results agree.

7.3.3.9 Autokey

NTPv4 offers a new Autokey scheme based on **public key cryptography**.

As a basic principle, **public key cryptography** is safer than **symmetric key cryptography** as protection is based on a private value which is generated by each host and is never visible.



In order to enable Autokey v2 authentication, the “Autokey Enabled” option must be set to “enabled” and a password specified (may not be blank).

A new server key and certificate can be generated by pressing the "Generate now" button.



Generate now

This should be carried out regularly as these keys are only valid for one year.

If the Time Server 8029NTS/M is to form part of an NTP trust group, a group key can be defined and uploaded with the "Upload now" button.

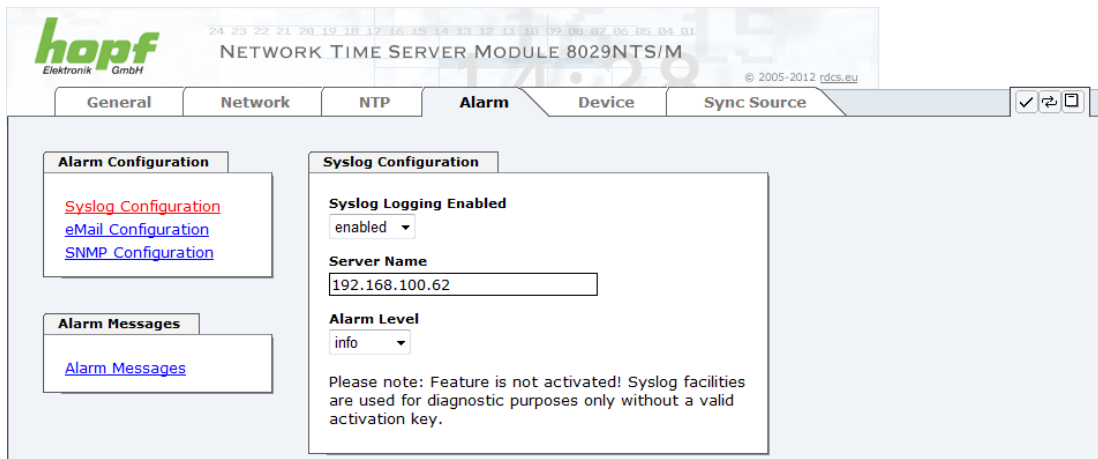
Detailed information about the NTP Autokey scheme can be found in the NTP documentation (<http://www.ntp.org/>).



Changes in data do not take effect immediately after clicking on the "Apply" symbol. The NTP service **MUST** also be restarted (see **Chapter 7.3.3.6 Restart NTP**).

7.3.4 ALARM Tab (Activation Key necessary)

All the links within the tab on the left hand side lead to corresponding detailed setting options.



The screenshot shows the web interface for the hopf Network Time Server Module 8029NTS/M. The top navigation bar includes tabs for General, Network, NTP, Alarm (selected), Device, and Sync Source. The main content area is divided into two sections: Alarm Configuration and Syslog Configuration.

Alarm Configuration:

- Links: [Syslog Configuration](#), [eMail Configuration](#), [SNMP Configuration](#)
- Alarm Messages:** [Alarm Messages](#)

Syslog Configuration:

- Syslog Logging Enabled:** enabled (dropdown)
- Server Name:** 192.168.100.62 (text input)
- Alarm Level:** info (dropdown)
- Note:** Please note: Feature is not activated! Syslog facilities are used for diagnostic purposes only without a valid activation key.

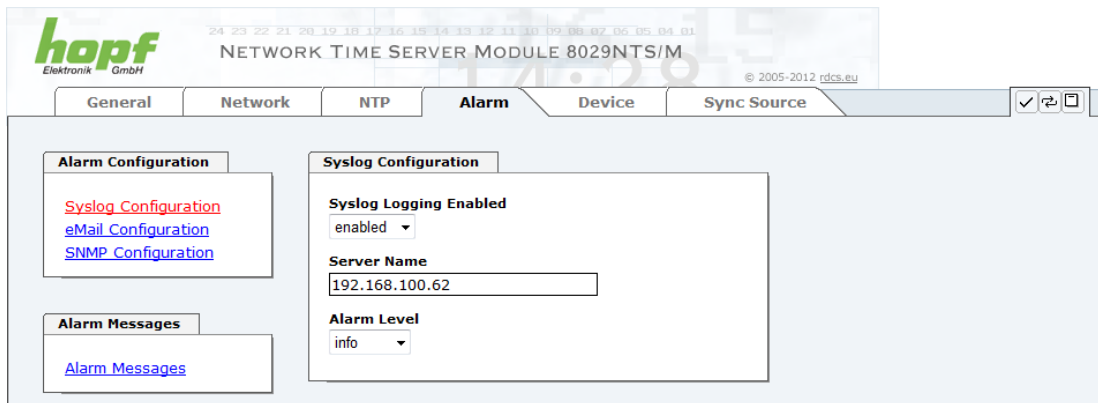
7.3.4.1 Syslog Configuration

It is necessary to enter the name or IP address of a Syslog server in order to store every configured alarm situation which occurs on the module in a Linux/Unix Syslog. If everything is configured correctly and enabled (depending on the Syslog level), every message is transmitted to the Syslog server and stored in the Syslog file there.

Syslog uses Port 514.

Co-logging in the system itself is not possible as therefore the internal memory is not of sufficient size.

It should be noted that the standard Linux/Unix Syslog mechanism is used for this functionality. This is not the same as the Windows System Event mechanism!



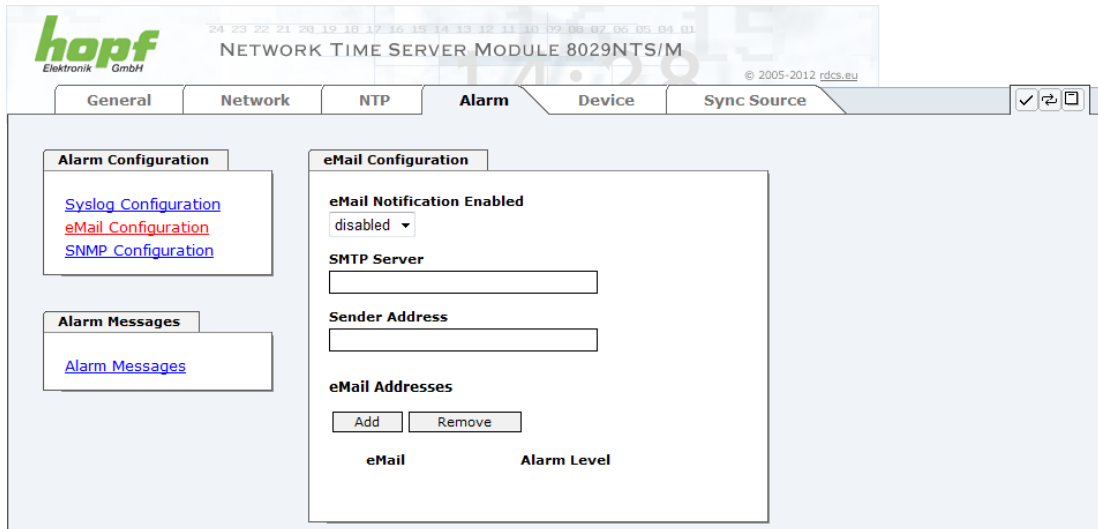
The screenshot shows the 'Alarm' configuration tab in the Hopf WebGUI. The 'Syslog Configuration' section is active, showing 'Syslog Logging Enabled' as 'enabled', 'Server Name' as '192.168.100.62', and 'Alarm Level' as 'info'. On the left, there are links for 'Syslog Configuration', 'eMail Configuration', and 'SNMP Configuration' under the 'Alarm Configuration' tab, and a link for 'Alarm Messages' under the 'Alarm Messages' tab. The top navigation bar includes 'General', 'Network', 'NTP', 'Alarm', 'Device', and 'Sync Source'.

The alarm level designates the priority level of the messages to be transmitted and the level from which transmission should take place (see **Chapter 7.3.4.4 Alarm Messages**).

Alarm Level	Transmitted Messages
none	no messages
info	info / warning / error / alarm
warning	warning / error / alarm
error	error / alarm
alarm	alarm

The NTP service implemented in the system can transmit its own Syslog messages (see **Chapter 7.3.3.4.2 NTP Syslog Messages (General / Log NTP Messages to Syslog)**).

7.3.4.2 E-mail Configuration



The screenshot shows the web interface for the hopf Network Time Server Module 8029NTS/M. The 'Alarm' tab is selected, and the 'eMail Configuration' sub-tab is active. The interface includes a sidebar with links to 'Syslog Configuration', 'eMail Configuration', and 'SNMP Configuration'. The main content area contains the 'eMail Configuration' form, which has fields for 'eMail Notification Enabled' (a dropdown menu currently showing 'disabled'), 'SMTP Server', 'Sender Address', and a table for 'eMail Addresses' with 'Add' and 'Remove' buttons.

E-mail notification is one of the important features of this device which offers technical personnel the opportunity to monitor and/or control the IT environment.

It is possible to configure various, independent E-mail addresses which each have different alarm levels.

Depending on the configured level, an E-mail is sent after an error has occurred on the respective receiver.

A valid E-mail server (SMTP server) must be entered for the purpose of correct configuration.

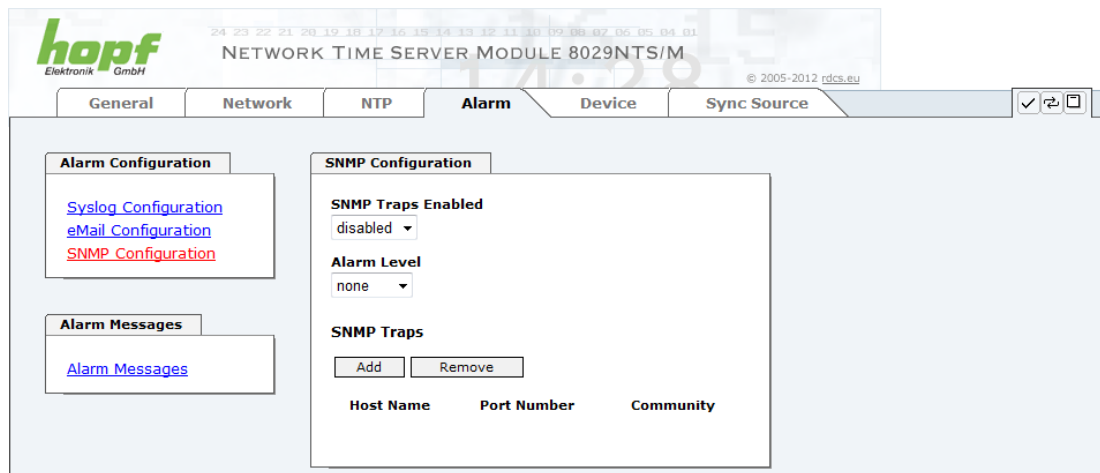
Some E-mail servers only accept messages if the sender address entered is valid (spam protection). This can be inserted in the "Sender Address" field.

The Alarm Level designates the priority level of the messages to be sent and determines from which level the message should be sent (see **Chapter 7.3.4.4 Alarm Messages**).

Alarm Level	Transmitted Messages
none	no messages
info	info / warning / error / alarm
warning	warning / error / alarm
error	error / alarm
alarm	alarm

7.3.4.3 SNMP Configuration / TRAP Configuration

It is possible to use an SNMP agent (with MIB) or to configure SNMP traps in order to monitor the module over SNMP.



SNMP traps are sent to the configured hosts over the network. It should be noted that these are based on UDP and therefore it is not certain that they will reach the configured host!

Several hosts can be configured. However, all have the same alarm level.

The private **hopf** enterprise MIB is also available over the web (see **Chapter 7.3.5.12 Downloading Configuration Files / SNMP MIB**).

The Alarm Level designates the priority level of the messages to be sent and determines from which level the message should be sent (see **Chapter 7.3.4.4 Alarm Messages**).

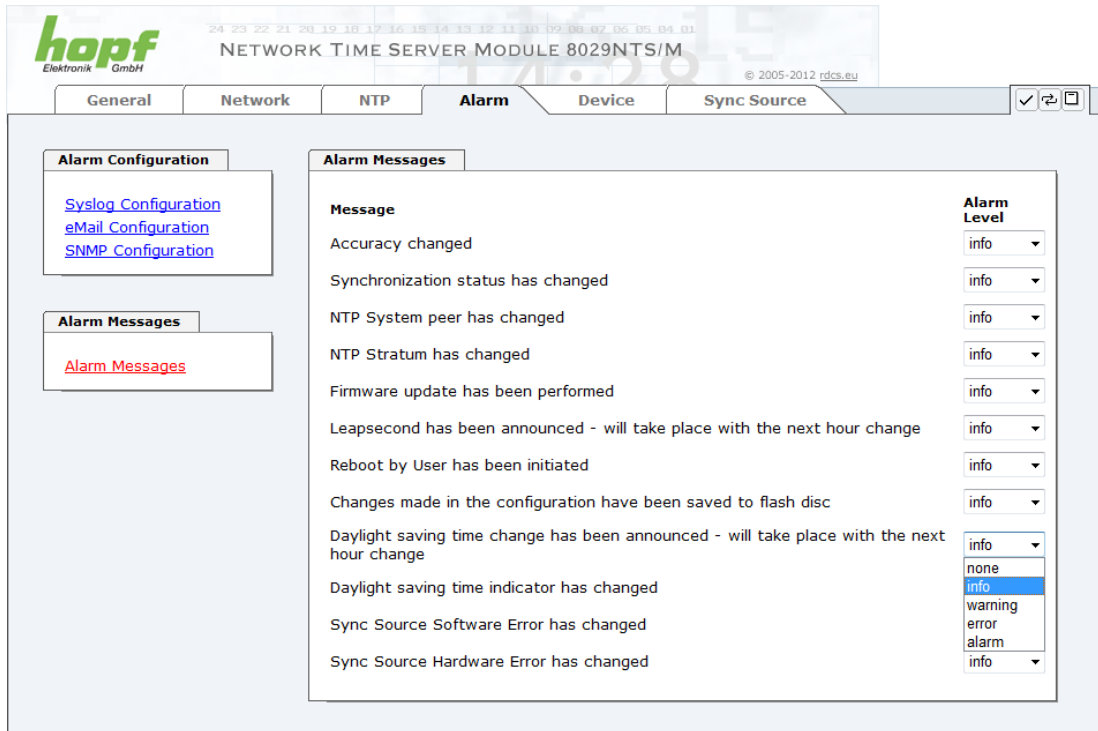
Alarm Level	Transmitted Messages
none	no messages
info	info / warning / error / alarm
warning	warning / error / alarm
error	error / alarm
alarm	alarm



The SNMP protocol must be enabled in order to use SNMP (see **Chapter 7.3.2.4 Management (Management-Protocols – HTTP, SNMP)**).

7.3.4.4 Alarm Messages

Every message shown in the image can be configured with the displayed alarm levels. Selection of the level NONE means that this message is completely ignored.



The screenshot shows the web interface for the Hopf Network Time Server Module 8029NTS/M. The top navigation bar includes tabs for General, Network, NTP, Alarm (selected), Device, and Sync Source. The main content area is divided into two sections: Alarm Configuration and Alarm Messages. The Alarm Messages section contains a table with the following messages and their configured alarm levels:

Message	Alarm Level
Accuracy changed	info
Synchronization status has changed	info
NTP System peer has changed	info
NTP Stratum has changed	info
Firmware update has been performed	info
Leapsecond has been announced - will take place with the next hour change	info
Reboot by User has been initiated	info
Changes made in the configuration have been saved to flash disc	info
Daylight saving time change has been announced - will take place with the next hour change	info
Daylight saving time indicator has changed	info
Sync Source Software Error has changed	info
Sync Source Hardware Error has changed	info

The 'Alarm Level' dropdown menu is open, showing options: info, none, info, warning, error, alarm, info. The 'info' option is selected.

Depending on the messages, their configured levels and notifications levels of the E-mails, a corresponding action is carried out if an event occurs.



Modified settings are failsafe stored after **Apply** and **Save** only.

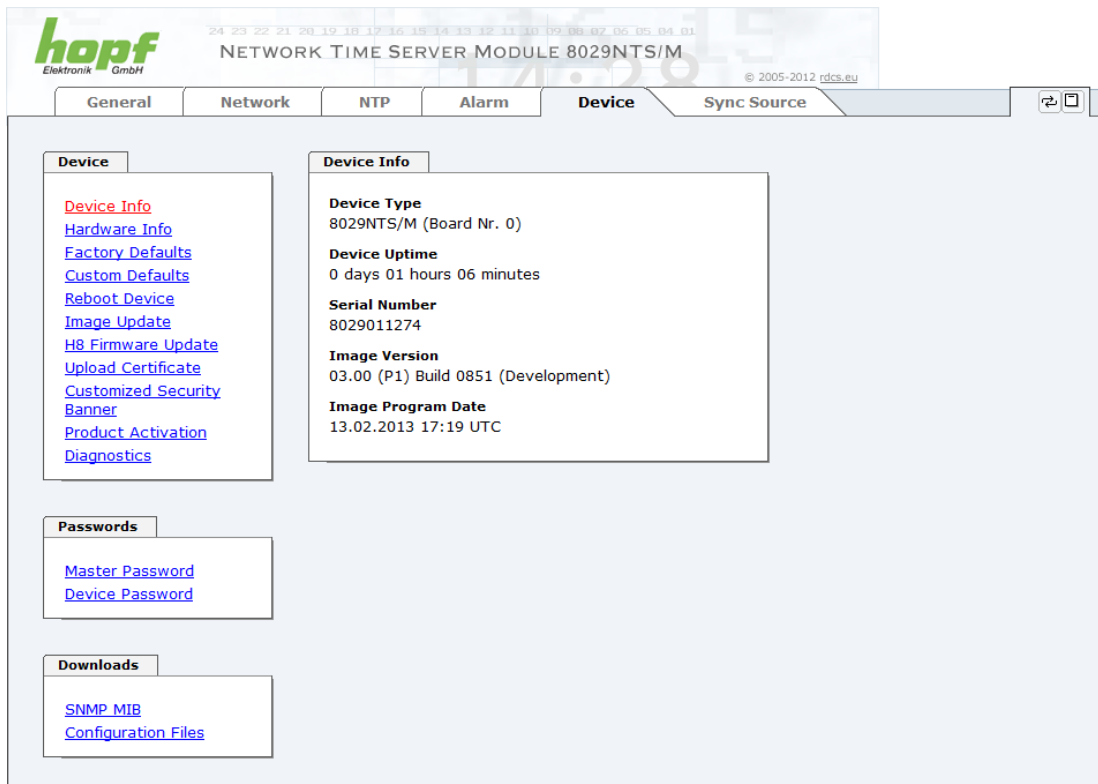
7.3.5 DEVICE Tab

All the links within the tab on the left hand side lead to corresponding detailed setting options.

This tab provides the basic information about the hardware of Module 8029NTS/M as well as software/firmware. Password administration and the update services for the module are also made accessible via this website. The complete download zone is also a component of this site.

7.3.5.1 Device Information

All information is available exclusively in write-protected and read-only form. Details on the board type, serial number and current software versions are provided to the user for service and enquiry purposes.



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NETWORK TIME SERVER MODULE 8029NTS/M
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General Network NTP Alarm **Device** Sync Source

Device

[Device Info](#)
[Hardware Info](#)
[Factory Defaults](#)
[Custom Defaults](#)
[Reboot Device](#)
[Image Update](#)
[H8 Firmware Update](#)
[Upload Certificate](#)
[Customized Security](#)
[Banner](#)
[Product Activation](#)
[Diagnostics](#)

Device Info

Device Type
8029NTS/M (Board Nr. 0)

Device Uptime
0 days 01 hours 06 minutes

Serial Number
8029011274

Image Version
03.00 (P1) Build 0851 (Development)

Image Program Date
13.02.2013 17:19 UTC

Passwords

[Master Password](#)
[Device Password](#)

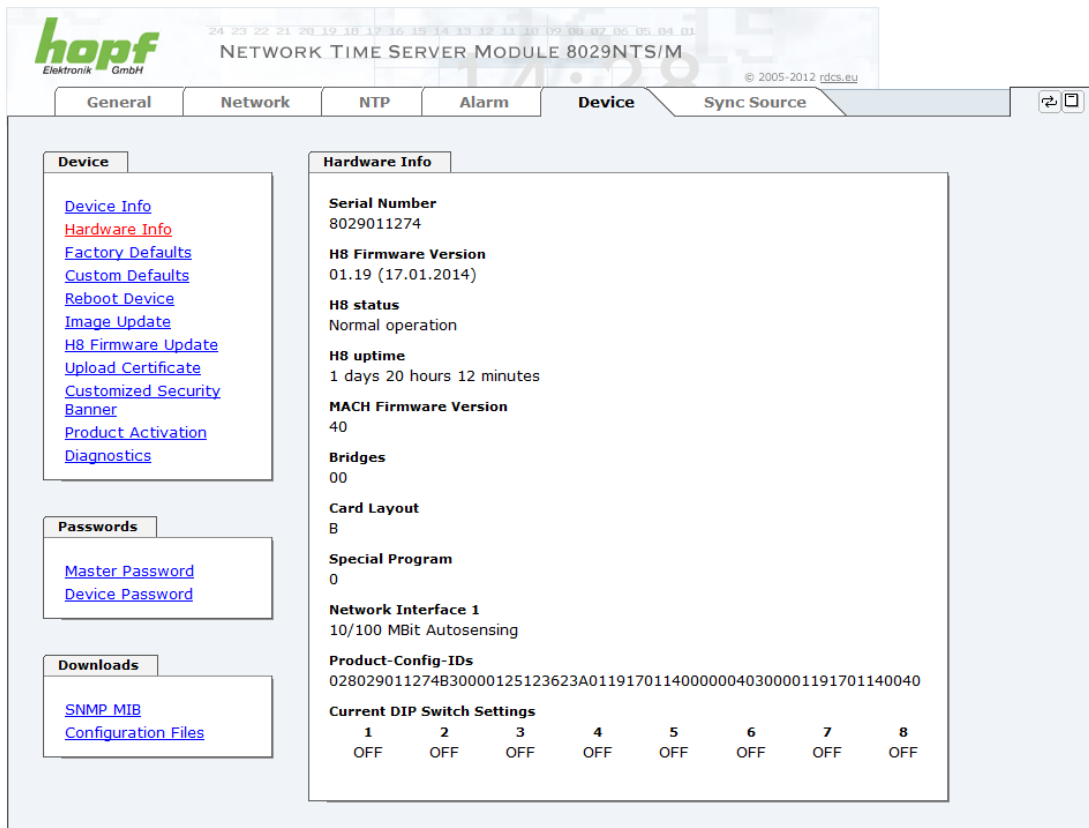
Downloads

[SNMP MIB](#)
[Configuration Files](#)

7.3.5.2 Hardware Information

Read-only access is provided here in the same way as for device information.

The user requires this information in the case of service requests, e.g. MACH version, hardware status etc.



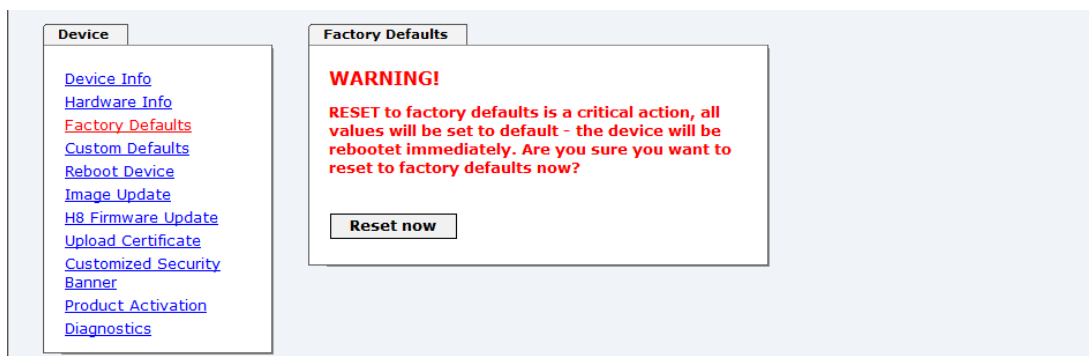
The screenshot shows the 'Hardware Info' tab selected under the 'Device' menu. The page displays various hardware and firmware details for the 8029NTS/M module.

Current DIP Switch Settings							
1	2	3	4	5	6	7	8
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The display "Current DIP Switch Settings" is not applicable for this device.

7.3.5.3 Restoring the Factory Defaults Settings

In some cases it may be necessary or wished to reset all settings of module 8029NTS/M to factory settings (factory defaults).



The screenshot shows the 'Factory Defaults' tab selected under the 'Device' menu. A prominent red warning message is displayed, cautioning that resetting to factory defaults is a critical action and will reboot the device.

WARNING!

RESET to factory defaults is a critical action, all values will be set to default - the device will be rebooted immediately. Are you sure you want to reset to factory defaults now?

Reset now

This function serves to reset all values in the flash memory to their factory default values. This also includes passwords (see **Chapter 12 Factory Defaults of Time Server 8029NTS/M**).

Please log in as a "Master" user in accordance with the description in **Chapter 7.2.1 LOGIN and LOGOUT as User**

Pressing the "**Reset now**" button releases setting of the factory default values.

Once this procedure has been triggered there is NO possibility of restoring the deleted configuration.

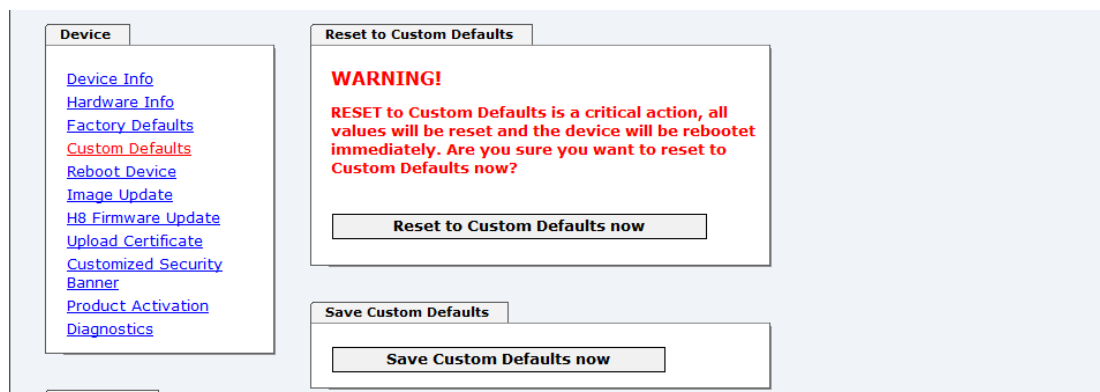


A **Factory Default** requires a complete check and optionally a new configuration of the Module 8029NTS. In particular the default MASTER and DEVICE passwords should be reset.

7.3.5.4 Restoring saved Customer Settings (Custom Defaults)

This function allows to save a current configuration as CUSTOM DEFAULTS.

The current configuration is saved. It is irrelevant whether the configuration has already been saved with "**SAVE to FLASH**" or just activated by "**Apply**".



In order to activate a CUSTOM DEFAULTS a configuration has to be saved initially.

Saving is only processed via the button "**Save Custom Defaults now**". A successful saving is confirmed with a text message underneath the button.



If the user saves no CUSTOM DEFAULT via the WebGUI, a FACTORY DEFAULT via the Reset-(Default) button is triggered instead.

With this function the saved configuration is written back into the flash memory.



The settings for activation keys (e.g. an entered activation key) are neither deleted nor restored by the CUSTOM DEFAULTS.

7.3.5.5 Restarting the Module (Reboot Device)



The restart concerns the Module 8029NTS/M only but **not** the Sync Source.

The screenshot shows the Hopf web interface. On the left, under the 'Device' tab, there is a list of links: Device Info, Hardware Info, Factory Defaults, Custom Defaults, Reboot Device (highlighted in red), Image Update, H8 Firmware Update, Upload Certificate, Customized Security Banner, Product Activation, and Diagnostics. On the right, the 'Reboot Device' dialog is open, displaying a red 'WARNING!' message: 'REBOOT is a critical action, all unsaved changes will be lost. Are you sure you want to reboot the device now?'. At the bottom of the dialog is a 'Reboot now' button.



All settings **not** saved with "Save" are lost on reboot (see **Chapter 7.2.3 Enter or Changing Data**).

Moreover the **NTP service** implemented in the system is restarted. This leads to a renewed alignment phase with the loss of the stability and accuracy reached up to this point.

Log in is carried out as "Master" user in accordance with the description in **Chapter 7.2.1 LOGIN and LOGOUT as User**.

Press the "**Reboot now**" button and wait until the restart has been performed.

7.3.5.6 Image Update & H8 Firmware Update

Patches and error recovery are provided for the individual modules by means of updates.

Both the embedded image and the H8 firmware can only be downloaded to the Board via the web interface (login as "Master" user required). See also **Chapter 4.4 Firmware Update**.



The following points should be noted regarding updates:

- Only experienced users or trained technical personnel should carry out an update after checking all necessary preconditions.
- Important: **Faulty updates** or **update attempts** may under certain circumstances require the Board to be returned to the factory for rectification at the owner's expense.
- Check that the update on hand is suitable for your Board. If in doubt please consult the support of the **hopf** company.
- In order to guarantee a correct update, the "**New version of saved site**" function must be set to "**On each access to the site**" in the Internet browser used.
- During the update procedure, the device **must not be switched off** and **settings must not be saved to the flash memory!**
- Updates are always executed as software set. I.e. H8 firmware update + image update. Unless specifically defined otherwise in the SET, it is absolutely essential to complete the H8 firmware update first, followed by the image update.
- For the Update please pay attention to the points in **Chapter 4.4 Firmware Update**.

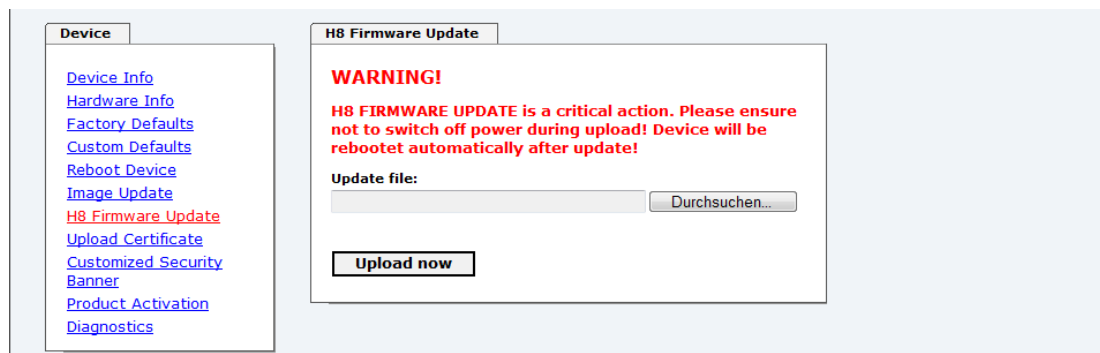
In order to carry out an update, enter the name and the folder in which the update / firmware image is located in the text field or open the file selection dialogue by pressing the "Browse" button.

Correct firmware and image designations are (e.g.):

H8-8029NTS-M_v0100_128.mot for the **H8 firmware**
(update takes approx. 1-1.5 minutes)

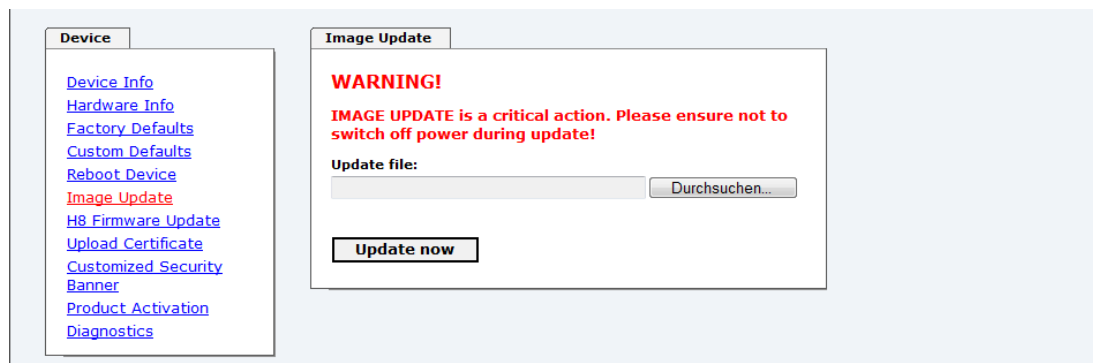
upgrade_8029gen_v0300.img for the **embedded image**
(update takes approx. 2-3 minutes)

The update process is started by pressing the "**Update now**" button. The update is installed if the transfer and checksum test are successful. A success page is displayed and shows the number of bytes that have been transferred and installed.



A restart of the Board with the new Firmware is done automatically after the H8-Firmware update.

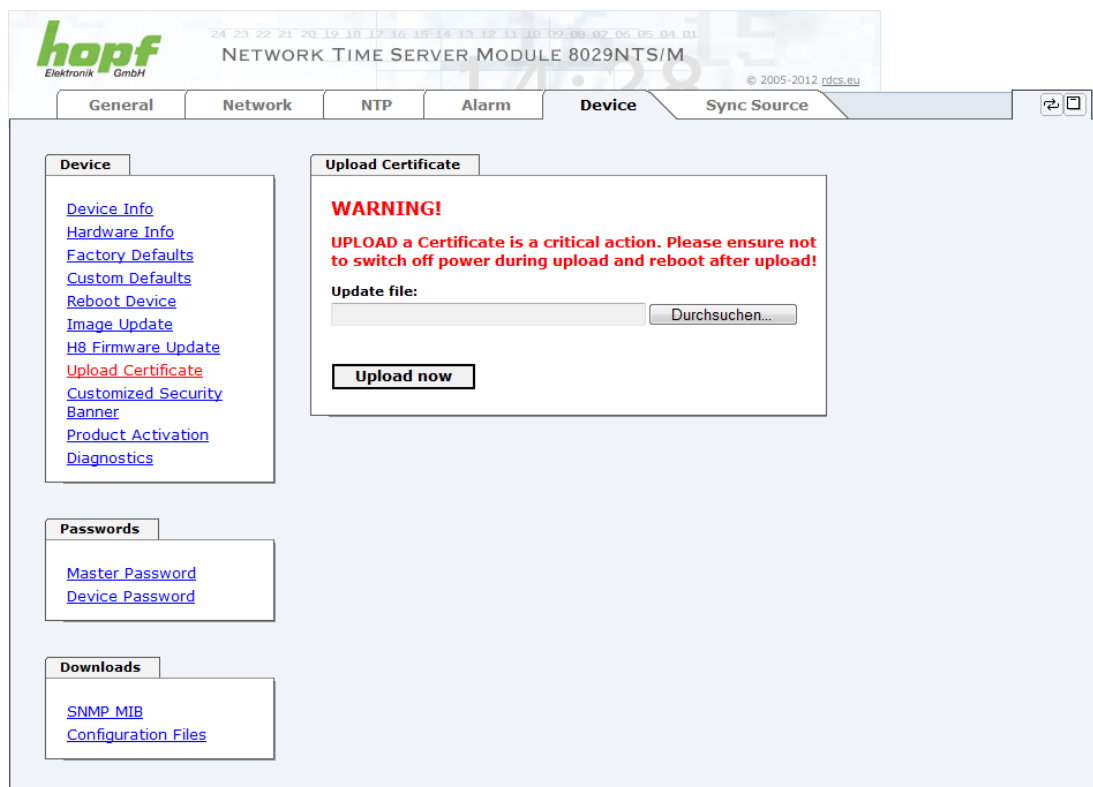
The procedure for the **Image update** differs only in how the module is restarted.



After the image-update the WebGUI displays a window to confirm the restart (reboot) of the board.

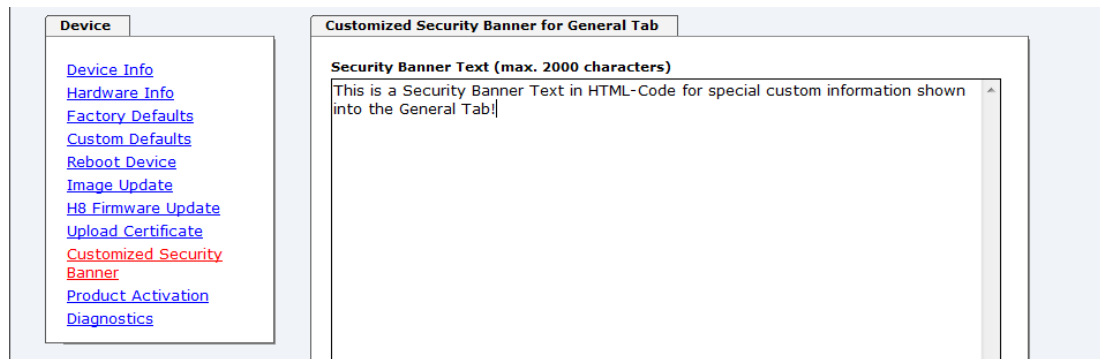
7.3.5.7 Upload of User SSL-Server-Certificate (Upload Certificate)

This offers the possibility to encrypt the https connections to the module with a user-provided SSL server certificate.

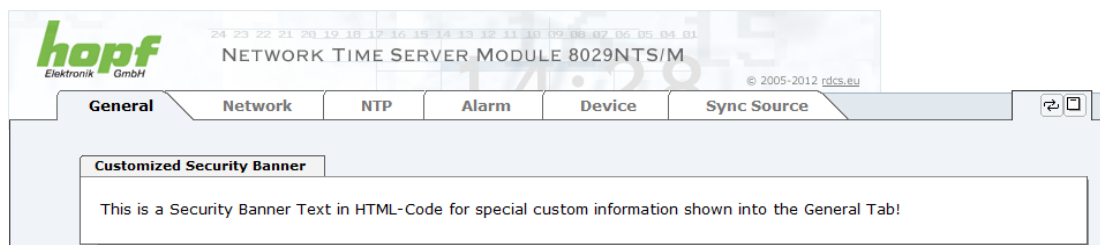


7.3.5.8 Customized Security Banner

Special security information displayed in the General tab can be entered here by the user.



The security information can be written as 'unformatted' text as well as in HTML format. There are 2000 characters available to write failsafe into the Time Server 8029NTS/M.



After a successful storage the "Customized Security Banner" with the saved security information is displayed in the General-Tab.

To delete the "Customized Security Banner" the inserted text must be deleted and saved again.

7.3.5.9 Product Activation by means of Activation Keys

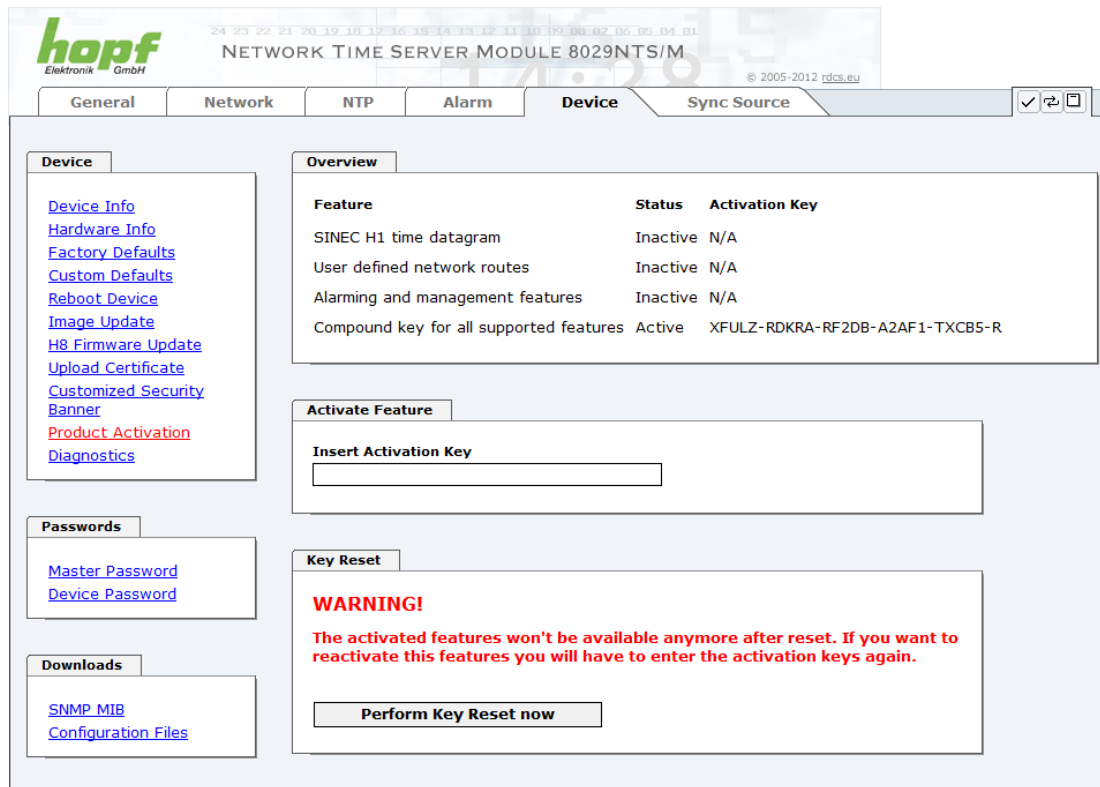
For the activation of optional functions, e.g. "alarming" or "SINEC H1 time datagram", a special activation key is required for which an order with the **hopf** Elektronik GmbH can be placed. Each activation key is related to a special board with an appropriate serial number and cannot be used for several boards.



For a subsequent order of an activation key the serial number of the Module 8029NTS/M needs to be provided. The serial number can be found under the tab DEVICE – Device info (serial number 8029...).



The settings for activation keys (e.g. an entered activation key) are neither deleted nor restored via the functions FACTORY DEFAULTS and CUSTOM DEFAULTS.



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General Network NTP Alarm **Device** Sync Source

Device

[Device Info](#)
[Hardware Info](#)
[Factory Defaults](#)
[Custom Defaults](#)
[Reboot Device](#)
[Image Update](#)
[H8 Firmware Update](#)
[Upload Certificate](#)
[Customized Security Banner](#)
[Product Activation](#)
[Diagnostics](#)

Overview

Feature	Status	Activation Key
SINEC H1 time datagram	Inactive	N/A
User defined network routes	Inactive	N/A
Alarming and management features	Inactive	N/A
Compound key for all supported features	Active	XFULZ-RDKRA-RF2DB-A2AF1-TXCB5-R

Activate Feature

Insert Activation Key

Key Reset

WARNING!
 The activated features won't be available anymore after reset. If you want to reactivate this features you will have to enter the activation keys again.

Perform Key Reset now

Passwords

[Master Password](#)
[Device Password](#)

Downloads

[SNMP MIB](#)
[Configuration Files](#)

Overview

Full listing of all optional functions with the current activation status and stored activation key

Activate Feature

Input field to enter a new activation key. After entering the feature is activated by pressing the ☒ Apply button.

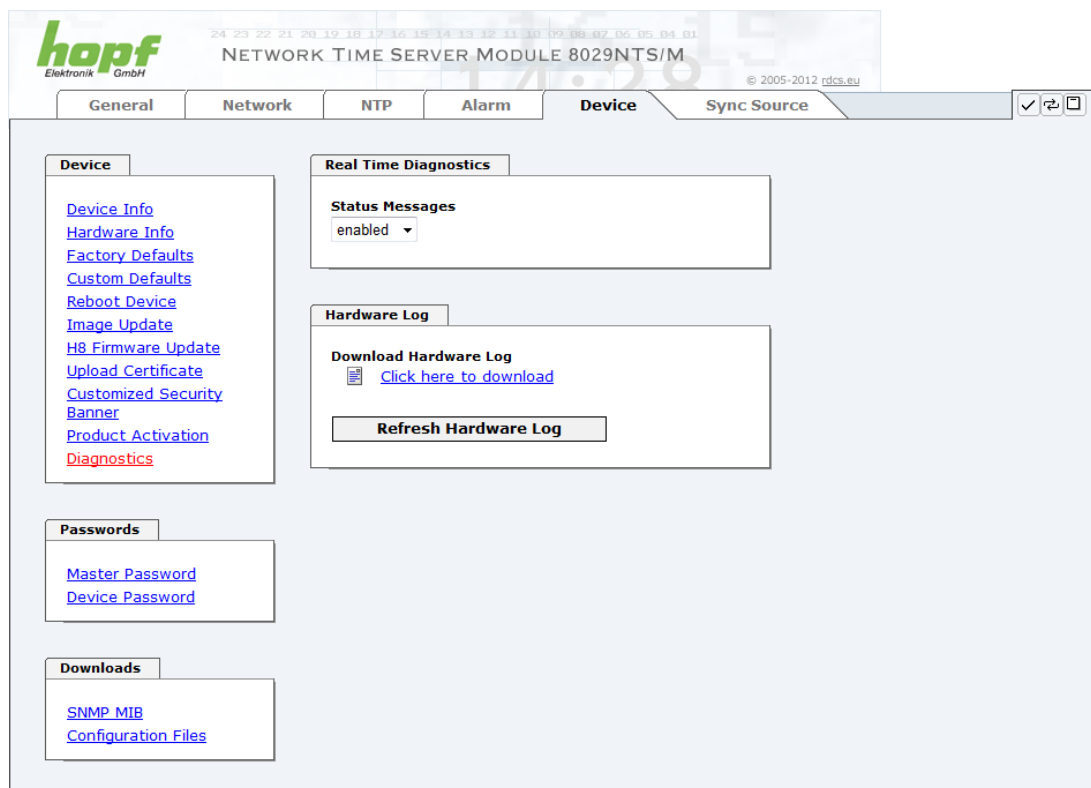
If the activation was successful the new feature is listed in the overview with status “Active” and can be used immediately.

Key Reset

Clears all activation keys and sets all optional features to status “Inactive”. All other non-optimal features are still available after performing the key reset. If an optional feature is enabled again, the last stored configuration for this feature is restored.

7.3.5.10 Diagnostics Function

It "status messages" is enabled the output is processed as SYSLOG message. This function should only be used/enabled in case a problem arises and after consulting the **hopf** support.



The screenshot shows the hopf web interface for the NETWORK TIME SERVER MODULE 8029NTS/M. The top navigation bar includes tabs for General, Network, NTP, Alarm, Device, and Sync Source. The 'Device' tab is selected. On the left, a sidebar menu lists various device management options, with 'Diagnostics' highlighted in red. The main content area is divided into two sections: 'Real Time Diagnostics' and 'Hardware Log'. In the 'Real Time Diagnostics' section, the 'Status Messages' dropdown is set to 'enabled'. The 'Hardware Log' section includes a 'Download Hardware Log' button with a link 'Click here to download' and a 'Refresh Hardware Log' button.

7.3.5.11 Passwords (Master/Device)

Differentiation is made between upper and lower case characters in passwords. In principle, all alphanumeric characters and the following symbols are allowed in passwords:

[] () * - _ ! \$ % & / = ?

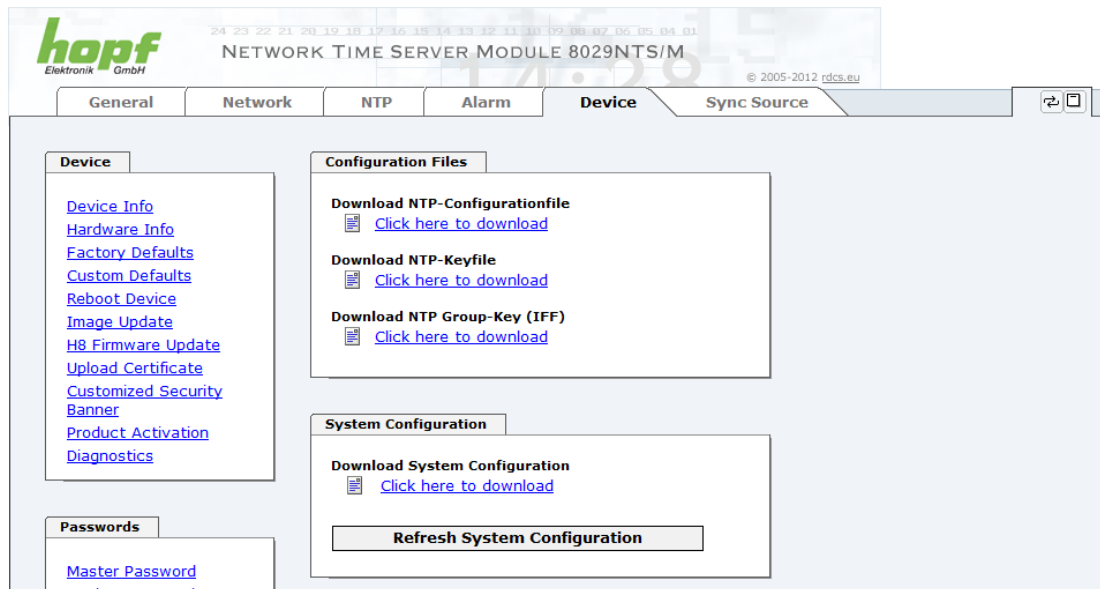
(See also **Chapter 7.2.1 LOGIN and LOGOUT as User**)



The screenshot shows the 'Change Device Password' page in the hopf web interface. The left sidebar menu is the same as in the previous screenshot, with 'Diagnostics' highlighted. The main content area has a 'Change Device Password' tab. It contains three input fields: 'Current password', 'New password (min. 6 characters)', and 'Confirm new password'.

7.3.5.12 Downloading Configuration Files / SNMP MIB

In order to be able to download certain configuration files via the web interface, it is necessary to be logged on as a "master" user.



The loaded file **System Configuration** from the module is only used for support purposes and cannot be reloaded for adjusting the settings in the Time Server 8029NTS/M.



For the download of the file **System Configuration** the following process is mandatory:

1. Pressing the button **SAVE**
2. Pressing the button **Refresh System Configuration**
3. Perform the download of the file

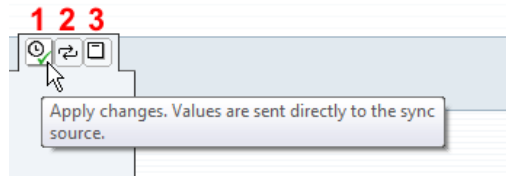
The "private **hopf** enterprise MIB" is also available via the WebGUI in this area.



7.3.6 SYNC SOURCE Tab

The complete display and parameterization of the synchronization of the module by the respectively fed Sync Source takes place in this tab.

The modified values in the tab SYNC SOURCE are directly adopted by pressing the button 1 and failsafe stored. This behaviour is indicated on the modified display of the Apply button. The buttons 2 and 3 are without function in the tab SYNC SOURCE and are not required.

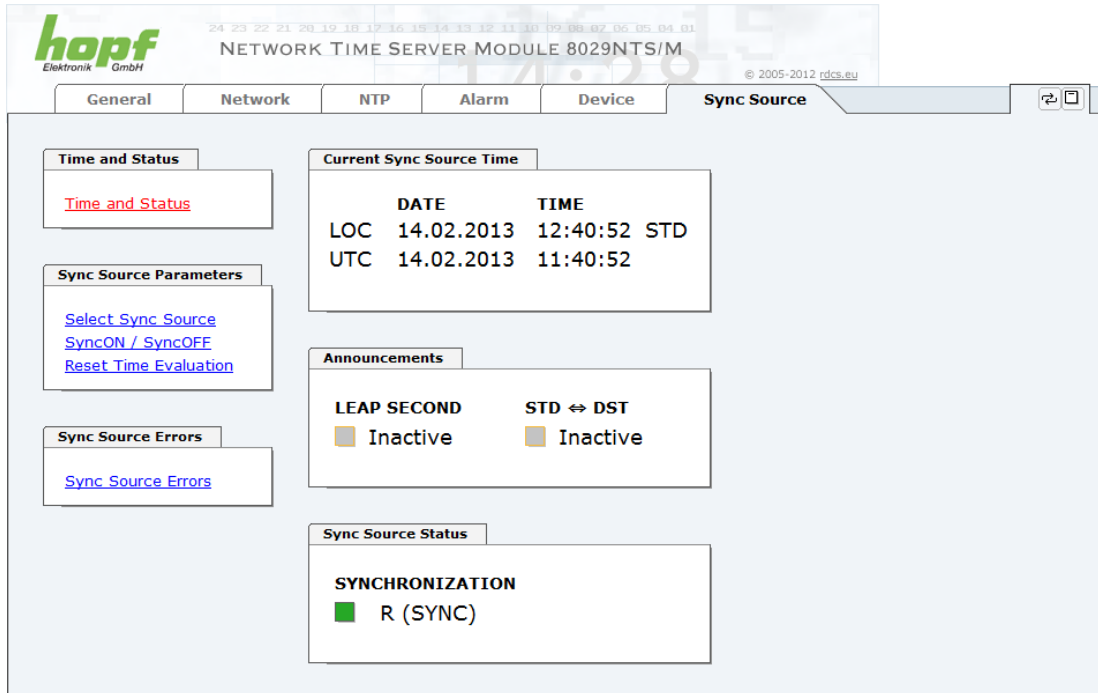


After the data transfer it can take up to 30 seconds until the modified data are modul-internally reapplied for the WebGUI indication.



Generally it is recommended to activate the function **Reset Time Evaluation** after performing modifications of the Sync Source settings (e.g. using the module in a stand-alone converter). This ensures that the modul-internal time information is really provided by the reset Sync Source.

7.3.6.1 Time and Status



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General Network NTP Alarm Device **Sync Source**

Time and Status
[Time and Status](#)

Current Sync Source Time

	DATE	TIME
LOC	14.02.2013	12:40:52 STD
UTC	14.02.2013	11:40:52

Sync Source Parameters
[Select Sync Source](#)
[SyncON / SyncOFF](#)
[Reset Time Evaluation](#)

Announcements

LEAP SECOND	STD ⇌ DST
<input type="checkbox"/> Inactive	<input type="checkbox"/> Inactive

Sync Source Errors
[Sync Source Errors](#)

Sync Source Status

SYNCHRONIZATION
☒ R (SYNC)

Current Sync Source Time

This area indicates the current time and date of the Sync Source. Both the local and UTC time are displayed.



In theory, depending on the synchronization status of the Sync Source, the time displayed here can differ from the NTP time since two independent time systems are involved.

Announcements

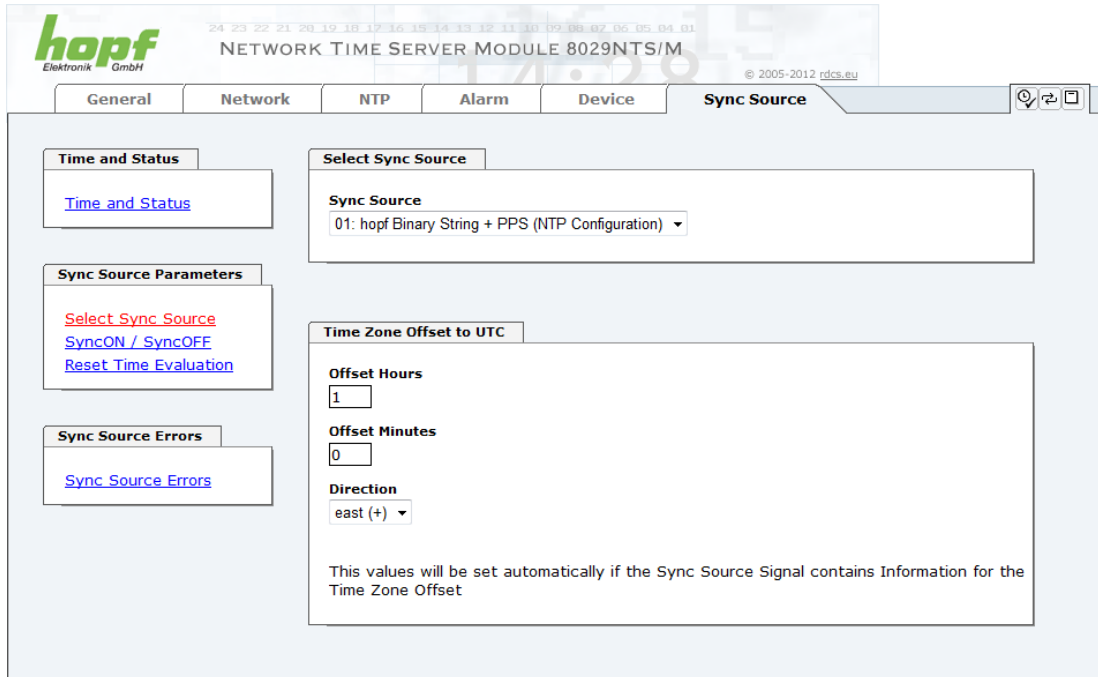
The display fields LEAP SECOND and STD ⇌ DST announce a corresponding event to the next hour (insertion of a leap-second or rather switch-over of summer/winter time).

Sync Source Status

Display of the actual status of synchronization of the Sync Source with these possible values:

SYNC	Time synchronized + Quartz regulation started/running
SYOF	Time synchronized + SyncOFF running
YSI	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

7.3.6.2 Select Sync Source Time



The Module 8029NTS/M can be synchronized by different time information. Using these modules in **hopf** basis systems the necessary settings are performed by default.

Using the module in converter units the settings may be required by the customer.

This selection determines what kind of time information should be evaluated by the module.

Currently **hopf** specific time formats as well as the DCF77 pulse (1Hz) with local time are available for the synchronization.

01: hopf Binary string with PPS (NTP configuration)
02: hopf System-BUS 6000 with PPS
03: hopf System-BUS 7001 with PPS
04: hopf Master/Slave-String – Transmission cycle: Every minute
05: hopf Master/Slave-String – Transmission cycle: Every second
06: hopf Master/Slave-String with PPS – Transmission cycle: Every min.
07: hopf Master/Slave-String with PPS – Transmission cycle: Every sec.
08: DCF77 Pulse (1Hz) – Local time (MEZ)



There is no synchronization of the Module and also no generation of the signal for the output in case of an incorrect setting.

7.3.6.2.1 Difference Time (Time Zone Offset to UTC)

The input of the difference time (Time Zone Offset to UTC) by the user is only necessary for Sync Source time information that donot include the current difference time.

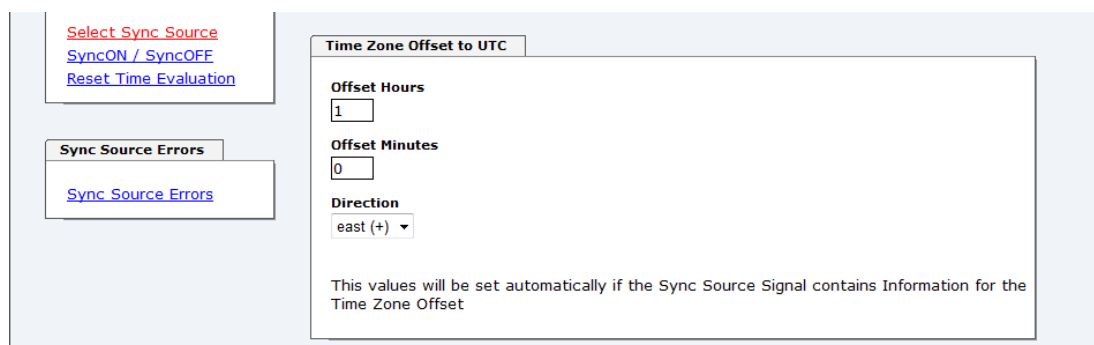
It is currently required for the synchronization by DCF77 pulse with local time.



The difference time to be entered **always** relates to **UTC to local time stadnard time (winter time)** although commissioning ort he input of difference time takes place during summer time.



If the respectively set Sync Source supplies the current difference time with its time information the user's entered values are automatically overwritten with the information of the Sync Source after a successful synchronization.



- **Offset Hours** Time Zone Offset input of the full hour (0-13)
- **Offset Minutes** Time Zone Offset input of minutes (0-59)

Example:

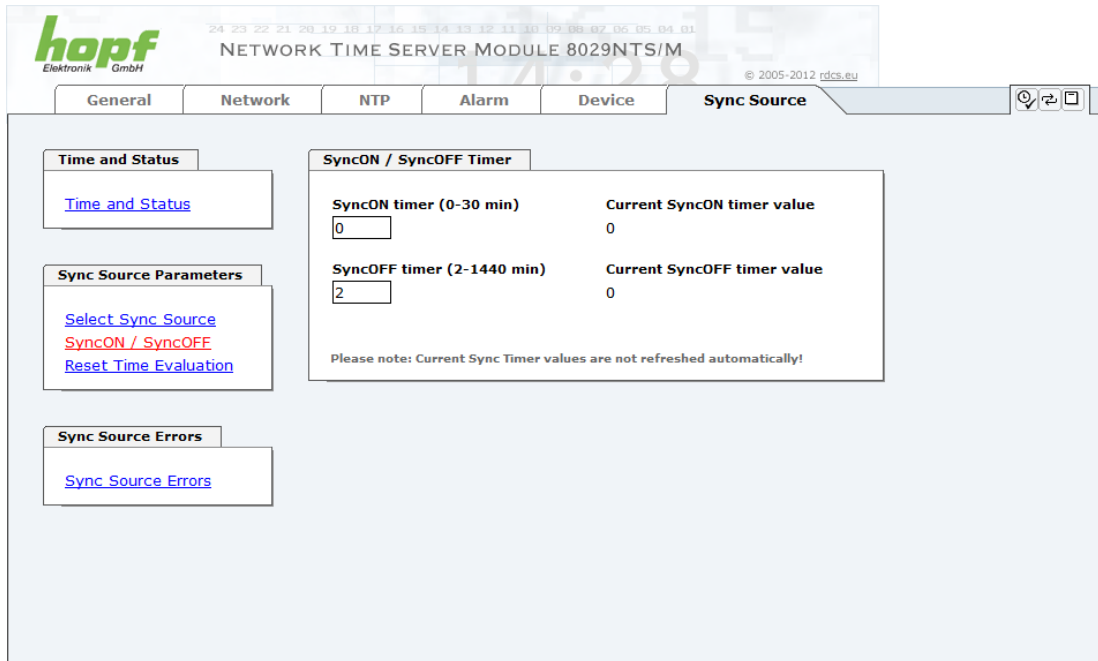
Time Offset for Germany	⇒ East, 1 hour and 0 minutes (+ 01:00)
Time Offset for Peru	⇒ West, 5 hours and 0 minutes (- 05:00)

Direction relating to Prime Meridian – Direction of the Difference Ttime

Entering the direction the local time deviates from world time:

- 'East' corresponds to east,
- 'West' corresponds to west of the Prime-Meridian (Greenwich)

7.3.6.3 SyncON / SyncOFF Timer



SyncON Timer

The SyncON timer is used to delay the sync-status “SYNC” by the set time although the module is already synchronous.

This function is enabled when adjustment processes should be terminated as defined before the sync status is “SYNC”.

This function is not required for this module and should always be set to 0.

SyncOFF Timer

This value is used to provide reception failure bypassing resulting from the Sync Source. This timer shall allow an error-message free operation even if there are temporary problems with the Sync Source.

In the event of a reception failure of the Sync Source, the re-synchronization of the Sync Source to **quartz** status is delayed by the set value. The module continues to run in synchronization status on the internally regulated, highly accurate quartz base during this period.

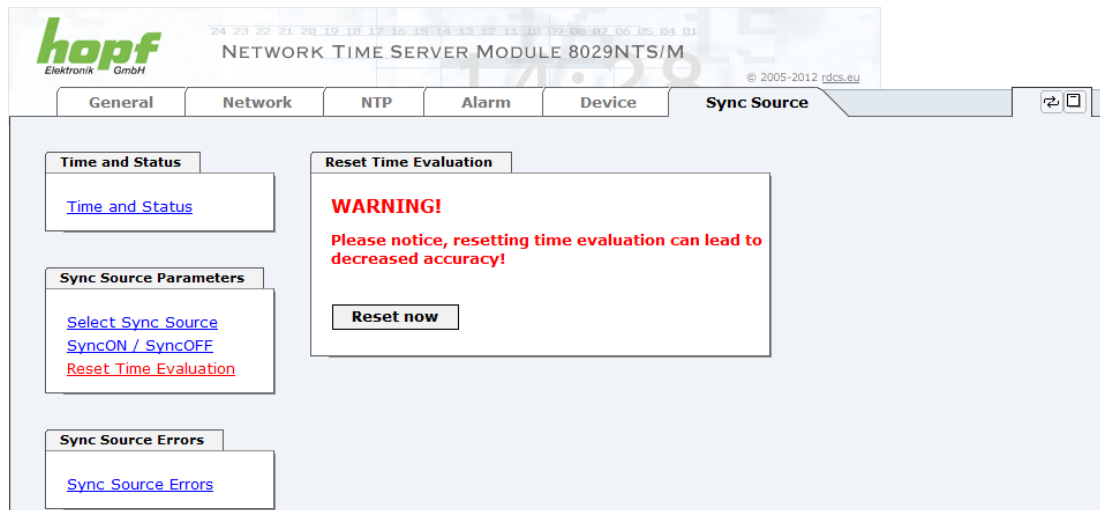
This timer is of special significance when certain system outputs are linked to a specific system status.

The Timer can be set from 2min. to 1440min.

Current Timer values

In case of an active Timer the appropriate value of the timer is displayed here.

7.3.6.4 Reset Time Evaluation



This function "Reset Time Evaluation" allows a setting back of the total internal evaluation of the module fed time information including any announcements for the summer/winter time switchover or rather insertion of a lump second.



The NTP service has its own and independent time. After processing this function, hence the NTP service receives time information unless the module-internal time basis has successfully been re-synchronized.

7.3.6.5 Sync Source Errors

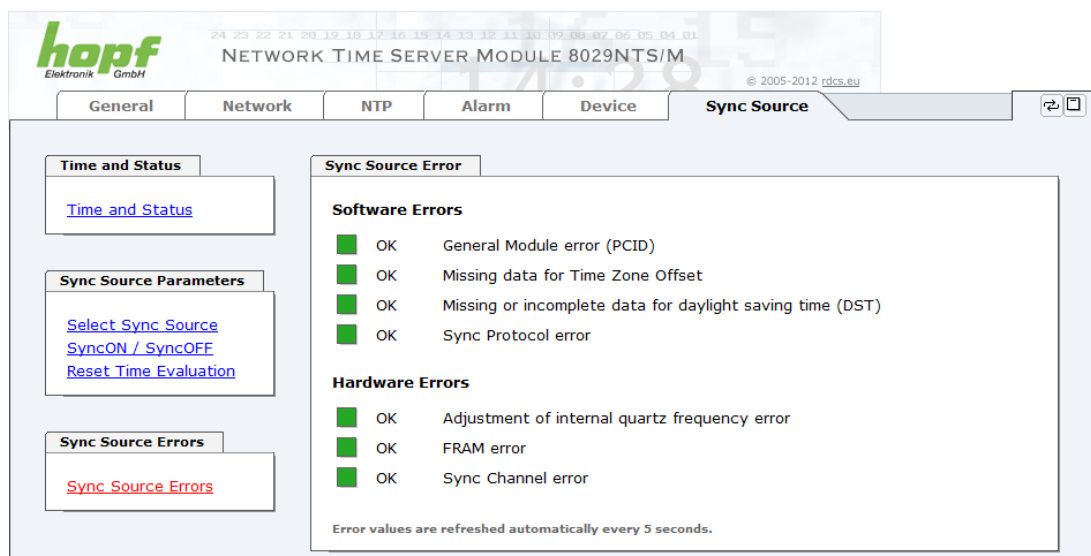
This tab indicates the current failure status of the Sync Source or rather the components involved in the evaluation of the signals of the Sync Source.



Sync Source describes in this module the supplied time information to the module as well as the modul-internal evaluation up to the successful synchronization of the modul-internal time basis.



If collected error messages are displayed in the tab GENERAL (Sync Source Error) there is at least one error.



The screenshot shows the web interface for the Hopf Network Time Server Module 8029NTS/M. The top navigation bar includes tabs for General, Network, NTP, Alarm, Device, and Sync Source. The Sync Source tab is active, displaying a sidebar with links for Time and Status, Sync Source Parameters, and Sync Source Errors. The main content area is titled 'Sync Source Error' and contains two sections: 'Software Errors' and 'Hardware Errors'. Both sections list error types with green 'OK' status indicators. The software errors include General Module error (PCID), Missing data for Time Zone Offset, Missing or incomplete data for daylight saving time (DST), and Sync Protocol error. The hardware errors include Adjustment of internal quartz frequency error, FRAM error, and Sync Channel error. A note at the bottom states: 'Error values are refreshed automatically every 5 seconds.'



This page is updated automatically every 5 seconds.

Overview Software Errors

- **General Module error (PCID)**
If this error occurs even after a Power reset, the device is damaged.
- **Missing data for Time Zone Offset**
Difference time (Time Zone Offset) shall be, where necessary, initially set by the user.
- **Missing or incomplete data for daylight saving time (DST)**
The switchover times for summer/winter time shall be, where necessary, initially set / disabled by the user.
- **Sync Protocol error**
The protocol being read or rather the time information of the Sync Source can neither be evaluated nor used.

Overview Hardware Errors

- **Adjustment of internal quartz frequency error**
Problems with the internal quartz regulation of the Module 8029NTS/M have been occurred. So the specified accuracy of the Sync Source cannot be guaranteed anymore.
- **FRAM error**
If this error occurs even after a voltage reset, the support team of company **hopf** needs to be contacted for further actions.
- **Sync Channel error**
No signal is detected on the module-internal inputs for the the time information.

7.3.6.5.1 Sync Protocol error

The protocol being read or rather the time information of the Sync Source can neither be evaluated nor used.

By default the "Sync Protocol error " is always set after a system reset. After start of the module the failure is set or rather be cancelled according to the received Sync Source protocol. This error is separately operated for each time format of the respective Sync Source. All used time protocols of the respective Sync Source may cause the setting of this failure.

Below the behaviour of the quality counter and the single formats of the Sync Source are described:



The respective quality counter evaluates the protocol of the time information received **every second** according to the following scheme:

Value range of the quality counter: 0-60

Quality counter +1 ⇒ all verifications are POSITIVE

Quality counter -5 ⇒ at least one verification is NEGATIVE

After a system reset:

Initial value of the quality counter = 0

Value of the quality counter = 0-30 ⇒ **Error "Sync Protocol error"**

If the quality counter has been >30 one time during operation:

Quality counter = 0 ⇒ **Error "Sync Protocol error"**

Quality counter ≠ 0 ⇒ **No error**

Sync Source with Output of SERIAL STRING and PPS

Serial String (Interval = every second or minute)

The internal string is controlled once per second or minute for:

- Plausibility of the strings structure
- Plausibility of the time information

If all the criteria of the string are met, the quality counter is raised;
at least one not met criteria leads to a count down of the counter.



The protocols per minute **do not use a quality counter**. Here the error can be set or cancelled every minute depending on the result of the verification.

PPS (Interval = every second)

The PPS is controlled once per second for:

- The reception cycle is within 1000msec ±10msec
- Max. deviation of the pulse width ±40msec
- Pulse width max. 800msec

If all the criteria of the string are met, the quality counter is raised;
at least one not met criteria leads to a count down of the counter.

Sync Source with Output of SERIAL STRING

Serial String (Interval = every second or minute)

The internal serial string is controlled once per second for:

- Plausibility of the strings structure
- Plausibility of the time information

If all the criteria of the string are met, the quality counter is raised;
at least one not met criteria leads to a count down of the counter.



Protocols per minute **do not use a quality counter**. Here the error can be set or cancelled every minute depending on the result of the verification.

Sync Source with Output of DCF77 Pulse

DCF77 pulse (Interval = every minute)

The DCF77 time telegram is controlled once per minute for:

- Plausibility of the strings structure
- Plausibility of the time information
- Plausibility of pulse length
 - DCF77 pulse low = 100msec. ± 20 msec.
 - DCF77 pulse high = 200msec. ± 20 msec.



Protocols per minute **do not use a quality counter**. Here the error can be set or cancelled very minute depending on the result of the verification.

7.3.6.5.2 Sync Channel error

On the input of the adjusted Sync Source no signal nor activity is detected.

By default the error "Sync Channel" is **not** set after a System reset. After system start the error is set or rather be cancelled according to the activity on the signal input. This error is separately operated for each signal input. All used signal inputs of the respective Sync Source may cause the setting of a failure independently.

Based on no activity on a used signal input, the error "Sync Channel" is set at the end of the signal input - **Time OUT**. Each detected activity on this signal input sets the signal inputl - TimeOUT and thus resets the error.

Sync Source	Signal Input	Signal Input - TimeOUT
Serial String with PPS	Serial String	181 seconds
	PPS	61 seconds
Serial String	Serial String	181 seconds
DCF77 pulse	DCF77 Pulse	25 seconds

8 SSH and Telnet Basic Configuration



Only basic configuration is possible via SSH or Telnet. The complete configuration of the Time Server 8029NTS/M 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.

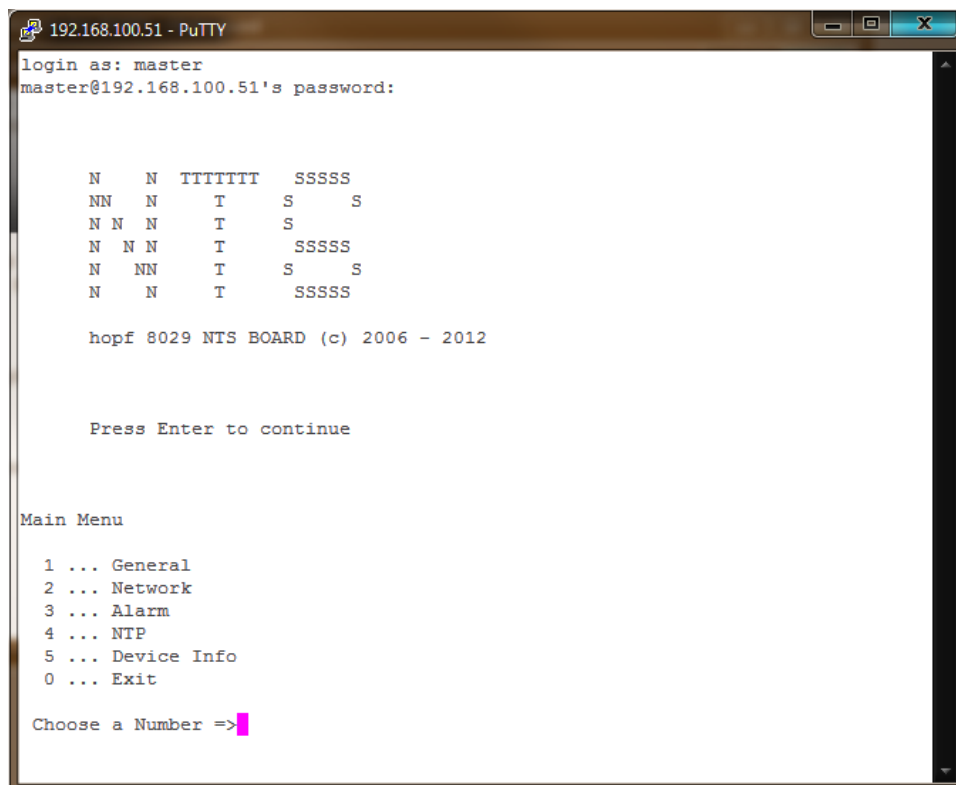
The user names and passwords are the same as on the WebGUI and are kept in alignment (see **Chapter 7.3.5.11 Passwords (Master/Device)**).



SSH does not allow blank passwords for safety reasons.



The corresponding protocols should be enabled for the use of Telnet or SSH (see **Chapter 7.3.2.4 Management (Management-Protocols – HTTP, SNMP)**).



```

192.168.100.51 - PuTTY
login as: master
master@192.168.100.51's password:

  N  N  TTTTTT  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

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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).

9 Support from the **hopf** Company

Should the System show an undefined operating state or other error conditions arise, please contact the Support at **hopf** Elektronik GmbH with an exact description of the fault and the following information:

- If a WebGUI access is possible, download the according configuration files in the tab "DEVICE" and e-mail those to **hopf**
- If an access to the device is not possible please note the serial number of the system
- Occurrence of the error: 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 description of the error and the information listed above avoids the need for additional clarification and leads to faster processing by our Support team.

10 Maintenance

The Time Server 8029NTS/M is generally maintenance-free.

11 Technical Data



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

General	
Operation	via WebGUI
Installation Position	any position
Protection Type of Module	IP00
Dimensions of Module	Multi-layer board 80mm x 60mm
Power Supply	5V DC \pm 5% (via internal plug-in connectors)
Power Consumption	Type 230mA / max. 300mA
MTBF	> 1,250,000h
Weight	Approx. 0.1kg

Temperature Range	
Operation	0°C to +50°C
Storage	-20°C to +75°C
Humidity	max. 90%, non condensing

LAN	
Network Connection	Via a LAN cable with RJ45 connector, male (recommended cable type CAT5 or better)
Network Interface ETH0	10/100 Base-T
Ethernet Compatibility	Version 2.0 / IEEE 802.3
Isolation Voltage (Network- to system side)	1500 Vrms

CE compliant to EMC Directive 89/336/EC and Low Voltage Directive 73/23/EC		
Safety / Low Voltage Directive	DIN EN 60950-1:2001 + A11 + Corrigendum	
EN 61000-6-4		
EMC (Electromagnetic Compatibility) / Interference Immunity	EN 610000-4-2 /-3/-4/-5/-6/-11	
EN 61000-6-2	EN 61000-3-2 /-3	
Radio Interference Voltage EN 55022	EN 55022 Klasse B	
Radio Interference Emission EN 55022	EN 55022 Klasse B	

GPS-System - Accuracy		
Lambda < 15ms	Stability < 0.2ppm	HIGH
Lambda < 15ms	Stability >= 0.2ppm and <= 2ppm, Offset < 1ms	HIGH
Lambda < 15ms	Stability > 2ppm or Offset >= 1ms	MEDIUM
DCF77-System - Accuracy		
Lambda < 15ms	Stability < 0.6ppm	HIGH
Lambda < 15ms	Stability >= 0.6ppm and <= 2ppm, Offset < 2ms	HIGH
Lambda < 15ms	Stability > 2ppm or Offset >= 2ms	MEDIUM

Time Protocols

- 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
- PPS Time Source
- RFC-867 DAYTIME Server
- RFC-868 TIME Server
- SINEC H1 time datagram (Activation key required)

TCP/IP Network Protocols

- HTTP/ HTTPS
- DHCP
- Telnet
- SSH
- SNMP (Activation Key required)
- NTP (incl. SNTP)
- SINEC H1 time datagram (Activation key required)

Configuration Channels

- HTTP/HTTPS-WebGUI (Browser Based)
- Telnet
- SSH
- **hmc** Network Configuration Assistant

12 Factory Defaults of Time Server 8029NTS/M

This chapter lists the factory default values of the individual components integrated in the Time Server 8029NTS/M.

The default delivery status of the Time Server 8029NTS/M meets the factory default values when using GPS synchronization sources. In case of synchronization of the module by DCF77 based time information the function "**NTP / General / Sync Source**" is factory-set to "**DCF77**" on delivery.



Using the board in DCF77 systems (different product variant) the setting for **NTP / General / Sync Source** needs to be re-configured to "**DCF77**" after a factory default.

NTP Server Configuration	Setting	WebGUI
Sync Source	DCF77	DCF77

12.1.1 Network

Host/Name Service	Setting	WebGUI
Hostname	hopf8029nts-m	hopf8029nts-m
Default Gateway	Blank	---
DNS 1	Blank	---
DNS 2	Blank	---
Network Interface ETH0	Setting	WebGUI
Use Custom Hardware Address (MAC)	Disabled	Disabled
Custom Hardware Address (MAC)	Blank	---
DHCP	Disabled	Disabled
IP	192.168.0.1	192.168.0.1
Netmask	255.255.255.0	255.255.255.0
Operation mode	Auto negotiate	Auto negotiate
Routing	Setting	WebGUI
User Defined Routes	Blank	---
Management	Setting	WebGUI
HTTP	Enabled	Enabled
HTTPS	Disabled	Disabled
SSH	Enabled	Enabled
TELNET	Disabled	Disabled
SNMP	Disabled	Disabled
System Location	Blank	---
System Contact	Blank	---
Read Community	Blank	---
Read/Write Community	Blank	---
Time	Setting	WebGUI
NTP	Enabled	Enabled
DAYTIME	Disabled	Disabled
TIME	Disabled	Disabled
SINEC H1 time datagram	Setting	WebGUI
Send Interval	Every second	1 second
Timebase	UTC	UTC
Destination MAC Address	09:00:06:03:FF:EF	09:00:06:03:FF:EF
Minimum Accuracy	LOW	LOW

12.1.2 NTP

NTP Server Configuration	Setting	WebGUI
Sync Source	GPS	GPS
NTP to Syslog	Disabled	Disabled
Switch to specific stratum	Disabled	Disabled
Stratum in crystal operation	Blank	---
Broadcast address	Blank	---
Authentication	Disabled	None
Key ID	Blank	---
Additional NTP Servers	Blank	---
NTP Extended Configuration	Setting	WebGUI
Limitation of Liability	Blank	---
Block Output when Stratum Unspecified	Disabled	Disabled
NTP Access Restrictions	Setting	WebGUI
Access Restrictions		Default nomodify
NTP Symmetric Keys	Setting	WebGUI
Request Key	Blank	---
Control Key	Blank	---
Symmetric Keys	Blank	---
NTP Autokey	Setting	WebGUI
Autokey	Disabled	Disabled
Password	Blank	---

12.1.3 ALARM

Syslog Configuration	Setting	WebGUI
Syslog	Disabled	Disabled
Server Name	Blank	---
Alarm Level	Disabled	None
E-mail Configuration	Setting	WebGUI
E-mail Notifications	Disabled	Disabled
SMTP Server	Blank	---
Sender Address	Blank	---
E-mail Addresses	Blank	---
SNMP Traps Configuration	Setting	WebGUI
SNMP Traps	Disabled	Disabled
Alarm Level	Disabled	None
SNMP Trap Receivers	Blank	---
Alarm Messages	Setting	WebGUI
Alarms	All disabled	All none

12.1.4 DEVICE

User Passwords	Settings	WebGUI
Master Password	master	---
Device Password	device	---
Diagnostic	Settings	WebGUI
Real Time Diagnostics	Disabled	Disabled
Product Activation	Settings	WebGUI
Activate Feature	No changes	No changes

12.1.5 Sync Source

All Sync Source settings shall not be affected by a factory- and custom-default.

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.

13.2 Tally Codes (NTP-specific)

space	reject	Rejected peer – either the peer is not reachable or its synchronization distance is too great.
x	false tick	The peer was picked out by the NTP intersection algorithm as a false time supplier.
.	excess	The peer was picked out by the NTP sort algorithm as a weak time supplier on the basis of synchronization distance (concerns the first 10 peers).
-	outlier	The peer was picked out by the NTP clustering algorithm as an outlier.
+	candidate	The peer was selected as a candidate for the NTP combining algorithm.
#	selected	The peer is of good quality but not among the first six peers selected by the sort algorithm on the basis of synchronization distance.
*	sys.peer	The peer was selected as a system peer. Its characteristics are transferred to the Base System.
o	pps.peer	The peer was selected as a system peer. Its characteristics are transferred to the Base System. The current synchronization is derived from a PPS (pulse-per-second) signal either indirectly via PPS reference clock driver or directly via kernel interface.

13.2.1 Time-specific expressions

UTC	UTC Time (Universal Time Coordinated) was depending on the Greenwich Mean Time (GMT) definition of the zero meridian. While GMT follows astrological calculations, UTC is based on the stability and accuracy of the Caesium standard. The leap second was defined in order to cover this deviation.
Time Zone	The globe was originally divided into 24 longitudinal segments or time zones. Today, however, there are a number of time zones which in part apply specifically to certain individual countries only. In relation to the time zones, consideration was given to the fact that local daylight and sunlight coincide at different times in the individual time zones. The zero meridian runs through the British city of Greenwich.
Time Offset	This is the difference between UTC and the valid standard time of the current time zone. The Time Offset will be commit from the local time zone.
Local Standard Time (winter time)	Standard Time = UTC + Time Offset The time offset is defined by the local time zone and the local political regulations.
Daylight Saving Time (summer time)	Offset of Daylight Saving Time = + 1h Daylight Saving Time was introduced to reduce the energy requirement in some countries. In this case one hour is added to the standard time during the summer months.
Local Time	Local Time = Standard Time if exists with summer / winter time changeover
Leap Second	A leap second is a second which is added to the official time (UTC) in order to synchronise this with Greenwich Mean Time when required. Leap seconds are defined internationally by the International Earth Rotation and Reference Systems Service (IERS) .

13.3 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
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
WAN	Wide Area Network
msec	millisecond (10^{-3} seconds)
µsec	microsecond (10^{-6} seconds)
ppm	parts per million (10^{-6})

13.4 Definitions

An explanation of the terms used in this document.

13.4.1 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.

13.4.2 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.

13.4.3 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.

13.4.4 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.

13.5 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.

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)
- SNMP (RFC 1213, RFC1901-1908)
- SYSLOG (RFC 5424)
- SMTP (RFC 5321)

15 List of Open Source Packages Used

Third Party Software

The **hopf** Time Server 8029NTS/M includes a numerous of software packages subject to other license conditions. In case the use of such a software package might violate the licence conditions immediately after written notice it is ensured that the underlying licence conditions are met again.

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

The following table includes all used software packages with the applicable underlying software license conditions:

Package name	Version	License	License details	Patches
boa	0.94.14rc21	GPL	v1+	No
busybox	1.18.5	GPL	v2	No
eeprog	0.7.6	GPL	v2+	No
ethtool	2.6.39	GPL	v2	No
i2c-tools	3.0.3	GPL	v2	No
libatomic_ops	1.2	GPL	v2	No
libdaemon	0.14	LGPL	v2.1	No
libelf	0.8.12	LGPL	v2	No
libevent	1.4.12	3-clause BSD	http://libevent.org/LICENSE.txt	No
libgcrypt	1.5.0	GPL	v2	No
libgpg-error	1.8	GPL	v2	No
libsysfs	2.1.0	LGPL	v2.1	No
libupnp	1.6.6	BSD	http://pupnp.sourceforge.net/LICENSE	No
libusb	1.0.8	LGPL	v2	No
linux	2.6.38.8	GPL	v2	No
ltrace	0.5.3	GPL	v2	No
lzo	2.05	GPL	v2	No
mii-diag	2.11	GPL		No
mini_httpd	1.19		Copyright © 1999,2000 by Jef Poskanzer <jef@mail.acme.com>. All rights reserved. Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. THIS SOFTWARE IS PROVIDED BY THE AUTHOR	No

Package name	Version	License	License details	Patches
			<p>AND CONTRIBUTORS ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.</p>	
mtt	1.4.6	GPL	v2	No
ncurses	5.7	Permissive free software licence	<p>Copyright (c) 1998-2004,2006 Free Software Foundation, Inc.</p> <p>Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:</p> <p>The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.</p> <p>THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE ABOVE COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.</p> <p>Except as contained in this notice, the name(s) of the above copyright holders shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization.</p>	No
net-snmp	5.6.1	BSD (more)	http://net-snmp.sourceforge.net/about/license.html	No
ntp	4.2.6p3	NTP	<p>Copyright (c) University of Delaware 1992-2011</p> <p>Permission to use, copy, modify, and distribute this software and its documentation for any purpose with or without fee is hereby granted, provided</p>	Yes (6)

Package name	Version	License	License details	Patches
			that the above copyright notice appears in all copies and that both the copyright notice and this permission notice appear in supporting documentation, and that the name University of Delaware not be used in advertising or Publicity pertaining to distribution of the software without specific, written prior permission. The University of Delaware makes no representations about the suitability of this software for any purpose. It is provided "as is" without express or implied warranty.	
openssh	5.8p2	BSD		No
openssl	1.0.0d	Dual	http://www.openssl.org/source/license.html	No
readline	6.2	GPL	v3	No
setserial	2.17	GPL		No
strace	4.5.20	BSD		No
sudo	1.7.6p2	ISC-style	http://www.sudo.ws/sudo/license.html	No
uboot	2010.06	GPL	v2	No
uboot-tools	2011.03	GPL	v2	Yes (1)
uClibc	0.9.32	LGPL	v2.1	No
usbutils	003	GPL	v2	No
util-linux	2.19.1	GPL	v2	No
which	2.20	GPL	v3	No
zlib	1.2.5	Permissive free software licence	http://www.gzip.org/zlib/zlib_license.html	No