Industrie**funkuhren**

hopf
Elektronik GmbH

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Technical Manual

LAN Board

Model 7270

ENGLISH

Version: 06.02 – 29.05.2006

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Valid for Devices 7270 with FIRMWARE   Version: **06.xx**

Version number (Firmware / Description)

THE FIRST TWO DIGITS OF THE VERSION NUMBER OF THE TECHNICAL DESCRIPTION AND THE FIRST TWO DIGITS OF THE FIRMWARE VERSION MUST **COMPLY WITH EACH OTHER**.

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

Downloading Technical Descriptions

All current descriptions of our products are available free of charge via our homepage on the Internet.

Homepage: http://www.hopf.com

E-Mail: info@hopf.com

Symbols and Characters

Operational Reliability

Disregard may cause damages to persons or material.

Functionality

Disregard may impact function of system/device.

Information

Notes and Information.

Safety regulations

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

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

Safety of the device

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

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

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

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

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

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

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

CE-Conformity

This device fulfils the requirements of the EU directive 89/336/EWG "Electromagnetic compatibility" and 73/23/EWG "Low voltage equipment".

Therefore the device bears the CE identification marking (CE=Communauté Européenne)

CE = Communautes Europeénnes = European communities

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

Contents   Page

1 General information

The 7270 LAN board is a **N**etwork **T**ime **S**erver (*abbr.* NTS) for *hopf* GPS and DCF77 19" or. ½ 19" (3HE) racks - System 7001, 6842 and 6855.

It can be used for synchronizing the PC or SPS networks with the accurate time and can be installed at any point in the network.

The 7270 LAN board is available with network interface 10 Base-T or 10/100 Base-T.

The board supports the world wide used time protocol NTP as well as the special industrial Ethernet protocol SINEC H1.

The configuration of the 7270 LAN board is via the keypad of the *hopf* System 7001, 6842 or 6855. A remote control configuration of the network setting of the 7270 LAN board via Ethernet with Telnet is possible as well as remote control via SNMP.

2 Hardware

2.1 Front panel components
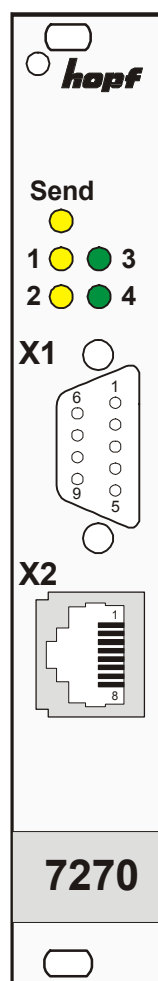
LEDs (the significance of the LED is dealt with in section 4)
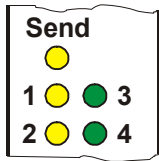
Send	*yellow*	indicates the status of the bus communication	
1	*yellow*	indicates the synchronization status of the time telegram for Ethernet protocols	
2	*yellow*	indicates the presence of the time telegram for Ethernet protocols	
3	*green*	LAN Interface Diagnosis LED in combination with LED1 and LED2	
4	*green*	indicates connection to the network	

X1 (9-pole SUB-D connector)
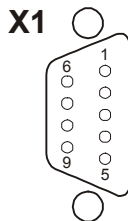
Pin no.	Allocation
1	Minute pulse of defined length (potential free)
2	Receiving cable RxD1 (RS232)
3	Transmission cable TxD1 (RS232)
4	free
5	GND
6	+12 V DC, max. 50mA (isolated to GND1)
7	reserved
8	reserved
9	GND1 (potential free) for minute pulse

X2 (RJ-45 bush, with shield, 10/100 Base-T connector)
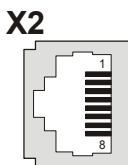
Pin no.	Allocation	
1	positive transmission line	**Tx+**
2	negative transmission line	**Tx-**
3	positive receiving line	**Rx+**
6	negative receiving line	**Rx-**
4, 5, 7, 8	unassigned	

2.2 Settings of DIP switch

Bauelemente Positionsbild der 7270 LAN Karte
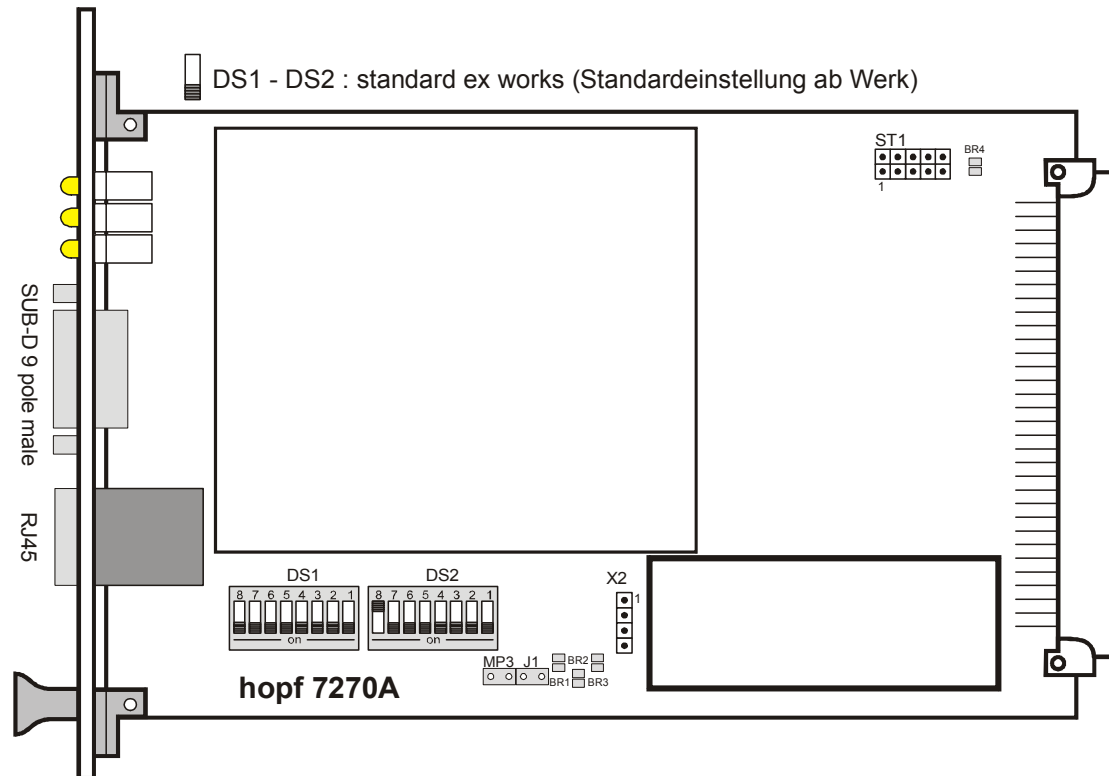
DIP switch block (**DS1**)

No.:	Status	Function
8	**on / off**	Activate/deactivate LAN configuration of the system
7	**on / off**	for 7001 / 68xx system bus specification
6, 5	**on / off**	configuration of the length of the minute pulse (in msec)
4...1	**on / off**	board identification (1 ... 8)

DIP switch block 2 (**DS2**)

No:	Status	Function
8	**on / off**	reserved for *hopf* Elektronik, the setting must not be changed!
7	**on / off**	unassigned
6	**on / off**	unassigned
5	**on / off**	unassigned
4	**on / off**	unassigned
3	**on / off**	unassigned
2	**on / off**	unassigned
1	**on / off**	Output of NTP time stamp including "Stratum 1" in mode radio and quartz.

Additional connectors, jumpers and bridges

	Function
ST1	*hopf* Elektronik service connector
X2	*hopf* Elektronik diagnosis connector
J1	*hopf* Elektronik service jumper
MP3	Operating voltage measuring points (5V DC)

2.3 Technical data

General	Euro board 160 x 100 mm (4HP) for 19" or ½ 19" (3U) racks
Voltage supply Internal system voltage	5V DC $\pm$ 5%
Current (norm. / max.) with 10 Base-T Interface with 10/100 Base-T interface	1,5VA / 2VA 3,6VA / 4VA
Minute pulse ext. 12V DC voltage isolation	potential isolated, as current generator 12V DC / min. 20mA, max. 100 mA 12V DC, max. 100mA, potential isolated min. 1000V DC
Temperature range	0 to 50° C 0 to 70° C by restricted free wheeling characteristics
MTBF	> 285,000 h
Network interface	10 Base-T or 10/100 Base-T
Ethernet compatibility Protocols supported	Version 2.0 / IEEE 802.3 UDP, TCP, SNMP, ICMP, Telnet

3 Setting of the 7270 LAN board

The configuration of the 7270 LAN board with the required network parameters, such as IP address, gateway address, network mask and a general control byte, is via the keypad of systems 6855, 6842, 7001GPS or DCF77.

The corresponding descriptions of the above-mentioned base systems is presupposed for configuration. The following explanation deals with the input of the values found in the menu item **"SET"** or **"SETZEN"**. In the illustrations the format of the English illustration is used.

> **!** After setting all the LAN specific items in the corresponding menu, this must be left after last using the `ENT` key by pressing `BR`. Only then the information is transmitted to the appropriate LAN board.

3.1 Input functions 6842/6855

A maximum of two 7270 LAN boards can be used in this system.

3.1.1 IP address

The IP address is entered via the following selection picture:

SET LAN 1   or   **SET LAN 2**
ADR.   Y/N   **ADR.   Y/N**

After entering `Y` the following will appear in the display:

LAN 1 >

Now the IP address can be entered in four groups of three decimal figures from 0 to 255. This must be made in three digits (e.g. : 9 ⇨ 009). After three figures have been entered a point (.) will automatically appear. The last group will be limited by a left arrow (**<**). The input must be completed with key `ENT`.

A completed entry appears, for example, as follows:

LAN 1 >192.168
        017.001<

The example also repeats the pre-set IP address **192.168.017.001** as the ex-works setting.

> **!** In 6842/6855 systems with two LAN boards the parameters for each board must be entered and transmitted separately.

3.1.2 Input of gateway address

The gateway address is entered via the following selection of commands:

SET LAN 1   or   **SET LAN 2**
GATEWAY ADR. Y/N   **GATEWAY ADR. Y/N**

After entering `Y` the following will appear in the display:

LAN 1 >

The gateway address can only be entered in the same form as the IP address.

The last group will be limited by a left arrow (**<**). Input must be completed with key `ENT` .

3.1.3 Input of network mask

The network mask is entered via the following selection of commands:

SET LAN 1   or   **SET LAN 2**
NET-MASK Y/N   **NET-MASK Y/N**

After entering `Y` the following will appear in the display:

NET-MASK LAN 1   or   **NET-MASK LAN 2**
           >   **>**

The network mask can be entered in the range from **0-31**. The last group will be limited by a left arrow (**<**). Input must be completed with key `ENT` .

3.1.4 Input of control byte

Various settings can be made with the control byte.

The control byte is entered via the following selection of commands:

SET LAN 1   or   **SET LAN 2**
CNTRL.-BYTE Y/N   **CNTRL.-BYTE Y/N**

After entering `Y` the following will appear in the display:

BIT 7654 3210

–

Only a **"0"** or a **"1"** can be entered in the second line for the individual bits.

e.g.: **BIT 7654 3210**
      0000 0010

Input must be completed with key `ENT` .

The description of the individual functions in the control byte can be found in section 3.3.

3.2 Input functions of System 7001

Up to eight 7270 LAN boards can be configured with the system 7001GPS/DCF77. Input and display functions are called up with the menu item **LAN = 6**.The start display appears:

SELECT   LAN-BOARD NR.   1- 8   INPUT   --> _ <--

A figure between **1-8** must be entered.

3.2.1 Input IP address

When the board number is entered (board identification) the display changes to the   **SET** menu for the IP address.

BOARD --> 1 <-- IP-ADR. > 192.168.017.001 <
NEW INPUT WITH "Y"   > _

In the upper line the board identification appears as entered with the IP address which is currently set. In order to enter a new address the input (**Y**)es is required.

Now the IP address is entered in four groups of three decimal figures from 0 to 255, each with a point (**.**) to separate the groups of figures or three decimal figures. Input is in three digits (e.g.: 9 ⇨ 009). After the three figures have been entered a point (**.**) must set.

The IP address must be entered as follows, e.g.:

BOARD --> 1 <-- IP-ADR. > 192.168.017.001 <
NEW INPUT WITH "Y"   > 192.168.017.001 <

After the last group of figures there is a left arrow (**<**). Input is completed with key ` ENT ` . The new address is shown in the upper line. If there is an error during input, the menu is left and an error message will be shown.

> ⚠ If any other figure or letter is used except ` Y ` and ` BR ` the menu items continue in sequence for the board set.

3.2.2 Input of gateway address

The next menu item to be shown is editing the gateway or router address.

BOARD --> 1 <-- GW-ADR. > 191.124.010.001 <
NEW INPUT WITH "Y"   > _

The gateway address can now be entered in the same way as the IP address in section 3.2.1.

3.2.3 Input of network mask

If any other figure or letter is entered except ⌷ Y ⌷ and ⌷ BR ⌷ the menu items continue in sequence for the board set. Editing of the network mask then appears as the next menu item. To calculate the network mask the number of bits for the host part is entered. The range is from **0-31**. The following appears in the display:

BOARD --> 1 <-- NET MASC   > 16 <
NEW INPUT WITH "Y"   >_

The input is completed by pressing ⌷ ENT ⌷ . The new network mask appears in the upper line. When an input error is made the menu item is left and an error message will be shown.

3.2.4 Input of control bytes

Various settings can be made with the control byte.

The control byte is entered via the following selection of commands:

BOARD --> 1 <-- CNTR-BYTE > 00000010 <
NEW INPUT WITH "Y"   >_

After entering ⌷ Y ⌷ a **"0"** or a **"1"** for the individual bits can be entered in the second line. The input is completed with key ⌷ ENT ⌷ . The new control byte appears in the upper line. When an input error is made, the menu item is left and an error message will be shown.

3.3 Control byte

Various functions can be activated via the control byte, e.g. time basis, NTP protocol, SINEC H1 protocol with corresponding parameter.

The bits indicate the following:

Bit 7 =   **0** standard setting (Must not be changed!)
Bit 6 =   **0** output of **NTP** protocol
               1 output of **SINEC H1** protocol
Bit 5/4 = Configuration of the required SINEC H1 MAC address
               or Broadcast address

Bit 5	Bit 4		
0	0	MAC address 1	09 00 06 03 FF EF
0	1	MAC address 2	09 00 06 01 FF EF
1	0	Broadcast adr.	FF FF FF FF FF FF

When **"NTP Protocol"** is set the bits are irrelevant.

Bit 3/2 =   Configuration of the required transmission intervals for SINEC H1 protocol

Bit3	Bit2	
0	0	1 sec.
0	1	10 sec.
1	0	60 sec.
1	1	60 sec.

The bits are irrelevant with the setting **"NTP Protocol".**

Bit 1/0 =   Time basis for NTP and SINEC H1 Protocol

Bit1	Bit0	
0	0	Local time with any switchover times
0	1	Local standard time (CET)
1	0	UTC
1	1	Local standard time (CET) with details of summer and winter time in the time status

3.4   System bus setting

With switch **7** in the DIP switch block (**DS1**) a selection can be made between the bus of system 7001 and the bus of the boards (systems) 6855 / 6842. These settings should only be made by qualified staff.

DIP switch block 1 (**DS1**)

No.: 7	
on	Bus 7001
off	Bus 6855 / 6842

3.5   Setting the board identification

Two 7270 LAN boards can be addressed by the systems 6855, 6842 and eight 7270 LAN boards can be addressed by the system 7001GPS/DCF77. The board identification is set in DIP switch block (**DS1**) with the switches 1-4. These settings should only be made by qualified staff.

DIP switch block 1 (**DS1**)

no.: 4	no.: 3	no.: 2	no.: 1	Board no.:
on	on	on	on	**1**
on	on	on	off	**2**
on	on	off	on	**3**
on	on	off	off	**4**
on	off	on	on	**5**
on	off	on	off	**6**
on	off	off	on	**7**
on	off	off	off	**8**

3.6 Minute pulse

A potential free minute pulse of 12V DC is distributed on a 9-pole SUB-D connector. The length of the pulse can be adjusted in 4 steps. The pulse lengths are set via the DIP switch block (**DS1**) as follows:

N0.: 6	No.: 5	Pulse length
on	on	10 msec
on	off	100 msec
off	on	500 msec
off	off	1000 msec

The output is an "open emitter" with a current limiter to 20 mA. The external pull down load must be in a range of 120 to 600 Ohm.

> ⚠ A resistor greater the 600 Ohm will increase the rise/fall time of the pulse.

3.7 Remote configuration of the network parameters via Telnet

The network parameters of the 7270 LAN board can also be configured via Ethernet with a *Telnet*- compatible programme via *TCP Port 9999*. The setting of the time basis for the corresponding output protocol NTP or SINEC H1 is only possible via a system keypad.

To use the configuration via Telnet the configuration via the system keypad of the radio-controlled clock should not be used. This is activated with **switch no.: 8** in the position **OFF** DIP switch block 2 (**DS2**).

> ⚠ With remote configuration the information which appears in the system display of the radio-controlled clock is not updated.

3.8 Remote monitoring via SNMP (read modus)

For further information regarding the set-up of applications with remote monitoring via SNMP please contact *hopf* Elektronik GmbH.

3.9 NTP

The 7270 LAN board is a network time server (**N**etwork **T**ime **S**erver, NTS). This supports **NTP versions 1, 2, 3 und 4.**

The 7270 LAN board provides comprehensive support for SNTP (Simple NTP).

3.10 NTP Time Stamp Output dependent on System Status

When activating this mode with DIP switch **DS2 switch 1**, NTP synchronization takes place via stratum 1 independent of the radio ("**r**", "**R**") or quartz ("**C**") system status; the base system only needs to have a valid time. Radio synchronization of the base system is not required in this setting. This means that if the system only has a manually input time available, NTP is synchronized in the same way as when it is synchronous.

DS2 DIP1	NTP synchronization under system status	System Status	Output 7270 NTP	NTP Reception Status
on	Radio-controlled operation **"R"** (default setting)	Not valid "**-**"	No time / Stratum 0	Stratum 16
		Quartz operation "C"	**No time / Stratum 0**	**Stratum 16**
		Radio reception "**r, R**"	System time / Stratum 1	Stratum 1
off	Radio-controlled operation **"R"** Quartz operation **"C"** (The radio status for NTP is simulated)	Not valid "**-**"	No time/ Stratum 0	Stratum 16
		Quartz operation "C"	**System time / Stratum 1**	**Stratum 1**
		Radio reception "**r, R**"	System time / Stratum 1	Stratum 1

> ⚠ NTP servers that are synchronized with the board 7270 are not able to identify whether the radio status is simulated or not. In this way, time deviations arising in this mode due to drift in the quartz operation (independent clock) or manual setting of the time/date (even incorrect but plausible time/date) are accepted by the server.
>
> In this simulation mode, a **time leap with radio synchronous status** occurs on a manual time/date entry and subsequent synchronization.

3.11 SINEC H1 Output dependent on System Status

As soon as the base system has a valid time, SINEC H1 is synchronized from the board 7270 with stratum 1. At the same time, SINEC H1 is also synchronized in the system status **"quartz"**. This means that even if only a manually input time is available to the system, for example, SINEC H1 is synchronized in the same way as if the system were synchronous.

4   LED Status and Error Codes

There are 5 LEDs for status or error messages on the front panel.

4.1   Send LED

SEND LED	Description
Flashing	Normal case. Access to the internal bus is displayed.
	The board 7270 is correctly connected to the system 7001.
Permanently off	Error on another board. No further bus access is possible.
Permanently lit	Error on the board 7270

4.2   Network Status LEDs 1-4

LED 1	LED 2	LED 3	Function
Lit	Off	Off	**Synchronization** of LAN possible with board 7270.
Off	Flashing	Off	**No synchronization** of LAN possible with board 7270 e.g.: - system 7001 not synchronised, - or board 7270 is not implemented, it becomes no time information from system 7001.

LED 4	Function
Lit	Network connection is **correctly** via RJ45
Off	Network connection is **incorrect** via RJ45

LED 1-4	Function
al off ⇨ al lit ⇨ initial flashing	**RESET**-behaviour of board 7270 with on it following initialising. (duration about 5 second)
different flashing of al LEDs	**Error behaviour** (continuous)

5   Glossary

Network IP address

An IP address is a 32 bit value which is divided into four 8 bit numbers. The standard way of presenting this is by 4 decimal numbers (in the range 0...255) separated by dots (dotted quad notation).

Example: 192.002.001.123

The IP address is made up of a network ID followed by a host ID. In order to cover a variety of needs, four common network classes have been defined. Depending on the network class, the last one, two or three bytes define the host whilst the remaining bytes define the network (network ID).

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

Class A Networks

IP address 001.xxx.xxx.xxx to 127.xxx.xxx.xxx

There is a maximum of 127 different networks in this class. This makes it possible 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 address 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 address 192.000.000.xxx to 223.255.255.xxx

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

Class D Networks

Addresses from 224.xxx.xxx.xxx to 239.xxx.xxx.xxx are used as multicast addresses.

Class E Networks

Addresses from 240.xxx.xxx.xxx to 254.xxx.xxx.xxx are identified as "Class E" and are reserved.

Exceptions

- No address is permitted which sets the 4 highest valued bits at 1-1-1-1.
  (240.xxx.xxx.xxx - 254.xxx.xxx.xxx). These addresses are classified as *Class E* and are reserved.
- The host address where all the bits are set at "0" is used to address the network as a whole (e.g. with routing entries)
- The host part address where all bits are set at "1" is the broadcast address. This means that every station is being addressed.
- Network and broadcast addresses may not be used as host addresses.
  - e.g. 192.168.0.0   indicates the whole network
    192.168.0.255   indicates the broadcast address

Broadcast address

The IP address is used for addressing all hosts in a network. As a rule this address corresponds to the network ID and the value 255 for each part of the host part of the IP address (e.g. 149.202.255.255 stands for all hosts in class B networks 149.202.0.0).

Gateway address

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

Network mask

The network mask is used to sub-divide IP addresses external to network classes A, B and C. By entering the network mask it is possible to specify how many bits of the IP address are used as the network part and how many as the host part, for example:

Standard Class A	8 Bit Network	24 Bit Host Part	Network Mask: 255.000.000.000
Standard Class B	16 Bit Network	16 Bit Host Part	Network Mask: 255.255.000.000
Standard Class C	24 Bit Network	8 Bit Host Part	Network Mask: 255.255.255.000

The number of host part bits is entered in order to calculate the network mask:

Network Mask	Host Bits
255.255.255.252	2
255.255.255.248	3
255.255.255.240	4
255.255.255.224	5
255.255.255.192	6
255.255.255.128	7
255.255.255.000	8
255.255.254.000	9
255.255.252.000	10
255.255.248.000	11
.	.
.	.
255.128.000.000	23
255.000.000.000	24

Example:

Network mask required: 255.255.255.128

Value to be entered for "Number of Bits for Host Part": 7

MAC address

Media **A**ccess **C**ontrol address is a non-changeable 8 Byte hardware address of a network board.

SINEC H1

Special Ethernet time protocol for industrial applications

NTP

Network **T**ime **P**rotocol, a network time protocol for synchronizing networks.

SNTP

Simple **N**etwork **T**ime **P**rotocol