Technical Information

Operating Instructions

LANTIME / SHSPZF

ETX BGT

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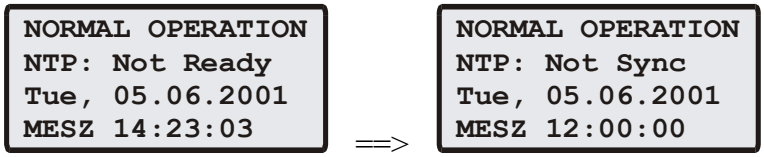
Table of Contents

Quick Start

- Approximately 30 seconds after power up the lower display line shows "NTP: not sync" instead of "NTP: not ready".

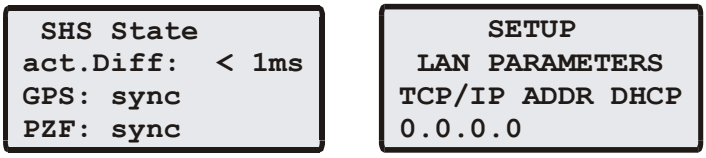


- When the LANTIME/SHS is switched on the SHS STATE menu is displayed because the two receivers (GPS and PZF) are usually not synchronized yet. After the configured time limit is reached the LANTIME/SHS goes to normal operation. The following notes should be taken into consideration:

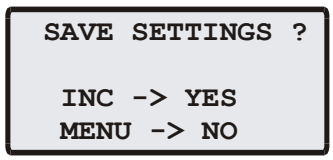
- The GPS antenna/converter unit must be installed in a location from which as much of the sky as possible can be seen (see "Mounting the GPS antenna")

- The PZF antenna must be positioned to maximize the correlation value greater then 60 %. Also the distance to DCF77 transmitter must be configured

- The time limit (the max. accepted time difference between GPS and PZF) has to be set to the needed accuracy (default 10 ms)



- Enter TCP/IP address, netmask and default gateway:
  - Press Menu four times to enter the LAN PARAMETERS setup menu
  - Press CLR/ACK to see the TCP/IP address first
  - Press CLR/ACK once again to be able to enter the IPv4 TCP/IP address
  - With NEXT the respective digit is to select while INC is used to set the value
  - To take over the changes it is necessary to press CLR/ACK again
  - A wildcard '*' is displayed to confirm the changes
  - Pressing NEXT, netmask and the default gateway can be entered
  - Pressing MENU following by INC causes the changes to become active



NOTE: All settings are related to the first Ethernet connection (ETH0).

After this all further settings can be done via network interface, either by using a WEB browser or a Telnet Session.

Default user: **root**
Default password: **timeserver**

NTP-Timeserver LANTIME/SHS

Secure Hybrid System with Strongly Verificated Reference Time

Meinberg LANTIME devices are Stratum-1 time servers which provide a high-accuracy reference time to TCP/IP networks via the Network Time Protocol (NTP). The main difference between the LANTIME models is the primary time source from which a device derives its reference time. Primary time source options include external radio clocks, built-in DCF77, GPS, or IRIG receivers, and even a hybrid combination of a DCF77 and a GPS receiver.

The LANTIME/SHS/BGT (Secure Hybrid System, 19" modular case) has a built-in hybrid radio clock which derives its reference time from both the satellite based Global Positioning System (GPS) and long wave receiver PZF5xx. During normal operation the hybrid radio clock passes the highly accurate reference time on to the built-in NTP time server which makes the reference time available to the network.

In order to prevent the NTP server from spreading a faulty reference time in the network, the hybrid receiver includes two independent standard radio clocks. Both the satellite receiver GPS167 and the long wave receiver PZF5xx have their own signals and high quality crystal oscillators which let the radio clocks provide accurate time even if their primary time transmitters cannot be received for a few days.

The two radio clocks derive their time telegrams and high accuracy pulse-per-second (PPS) signals from two independent primary time sources. The time telegrams and the PPS signals output by the clocks are compared against each other. If either the difference between the time telegrams or the difference between the PPS signals exceeds a configurable limit of some milliseconds, or if one of the receivers stops generating a time telegram, then the hybrid radio clock stops passing any timing information to the NTP server. So the NTP server can only spread a very strongly verificated reference time.

The radio clock modules are assembled in a 19" modular case (3UE) which also includes a single board computer, and a power supply unit. Configurable settings can be modified via menus on the 4 line LC display and the four buttons in the front panel. A failure output can be used to generate an alarm signal if any malfunction is detected.

The single board computer runs a Linux system which is loaded from flash disk into RAM at power-up. Aside from NTP, the Linux operating system supports additional network protocols like HTTP(S), SSH, FTP, or telnet, which allows remote configuration or monitoring across the network, e.g. using a common web browser. Remote access from the network can also be disabled for security reasons.

Changes in the radio clocks' receiver status, errors conditions, and other events generate error messages which can be logged on either the local Linux system, or on another SYSLOG server in the network. Additionally, those messages can be sent to a management console by SNMP traps or automatic e-mails.

If it is necessary to provide redundancy against hardware failure then it is also possible to install several LANTIME NTP servers in the same network.

LANTIME/SHS: Modes Of Operation

Normal mode of operation: Both the radio clocks are synchronized to their primary time sources, the difference between the independent reference times is below the configured limit. The NTP server receives the time information including the status "synchronized", so it acts as Stratum-1 server and makes the reference time available to the network.

One of the radio clocks falls out of sync e.g. due to an antenna failure or other reception problems. The clock changes its status to "not synchronized" and continues counting time based on its built-in high-accuracy crystal oscillator. Depending on the configuation, it takes some days up to several weeks until the difference between the time signals exceeds the limit. Since one of the radio clocks is still synchronized, the timing information is passed to the NTP server with status "synchronized" until the limit is exceeded.

Both the radio clocks are not synchronized to their primary time sources although at least one of them **has been synchronized before**. As long as the time difference doesn't exceed the limit, the time information is passed to the NTP server, but the status included is set to "not synchronized". The NTP server keeps accepting the time information for a given trust time, after the trust time it discards the time information.

Both the radio clocks are not synchronized to their primary time sources and **have not been synchronized after the last power-up**. The hybrid clock does not pass any time information to the NTP server until at least one of the independent radio clocks is synchronized and the time difference between the clocks is below the configured limit.

The radio clocks output **time information with a difference which exceeds the configured limit**, or one of the radio clocks **does not output any time information at all**. One of the following circumstances can be the reason why:

An intended external fake

Failure or malfunction of one of the primary time transmitters

Failure or malfunction of one of the radio clocks

Persistent reception problems

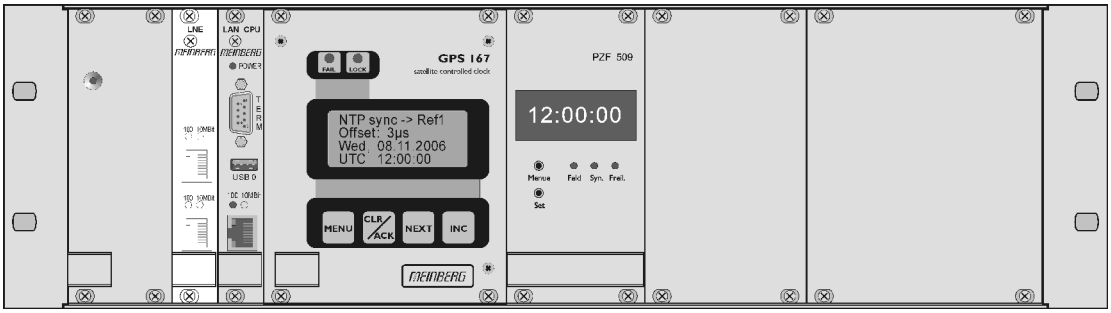
In all the cases listed above the **plausibility checks on the timing information fail**, so the hybrid radio clock stops passing any timing information on to the NTP server. The NTP server's stratum changes to a worse value to let the clients know that the server's reference time source fails. The hybrid radio clock continues supplying time to the NTP server after all error conditions have been removed and the **error has been acknowledged** by an operator.

If one or more additional LANTIME NTP servers are available on the network then clients which have been configured to use all of them will automatically discard the LANTIME with the bad stratum and synchronize to another NTP server which is operating correctly at a better stratum. If no redundant LANTIME is available, however, the clients will continue to synchronize to the LANTIME with worse stratum. This way it is guaranteed that all the client devices on the network operate using the same system time.

All changes of the reception status of one of the radio clocks, and also failure of the hybrid clock's plausibility check are logged by the local Linux system and optionally reported across the network. If the hybrid receiver passes the status "not synchronized" to the NTP server, or it has disabled time information output at all, then the alarm signal output of the LANTIME/SHS is activated.

The Modular System LANTIME

LANTIME is a set of equipment composed of a satellite controlled clock GPS167, a long wave receiver PZF5xx, a single-board computer SBC GEODE 266 MHz with integrated network card, and a power supply unit T60B, all installed in a metal desktop case and ready to operate. The interfaces provided by LANTIME are accessible via connectors in the rear panel of the case. Details of the components are described below.



Front View LANTIME/SHS

The implemented NTPD distributes the reference time from the SHS receiver cyclic in the network. Information on the NTPD is monitored on the LC display or can be inquired via the network.

The installation of LANTIME is very easy for the system/network administrator. The network address, the netmask and the default gateway have to be configured from the front panel of LANTIME. The network address or the equivalent name of LANTIME has to be shown to all NTP clients in the TCP/IP network.

As well as NTP the Linux system also supports a number of further network protocols: HTTP(S), FTP, SSH and Telnet. Because of this remote configuration or status requests can come from any WEB browser. This access via the network can be deactivated. Changes in the receiver status, errors or other important events are logged either on the local Linux system or on an external SYSLOG-Server. In addition messages can be sent to a data center via SNMP traps or automatically generated e-mails where they can be recorded. Furthermore all alarm messages can be displayed by the large display VP100/20/NET that is accessed via network connection. In order to avoid a service interruption several LANTIME NTP servers can be installed in the same network to obtain redundancy.

Supported Network Services

The following network services are provided via RJ45 10/100Base-T Ethernet (Auto sensing):

- NTP v2, v3, v4
  - NTP broadcast mode
  - NTP multicast
  - NTP symmetric keys
  - NTP Autokey
- Simple Network Time Protocol (SNTP)
- TIME
- SNMP v1,2,3 with extended SNMP-Agent and SNMP-Traps for NTP and reference clock status
- DHCP Client
- NFS
- TELNET
- FTP
- HTTP
- HTTPS with Openssl2
- SSH2 Secure Shell Login
- Alarm messages via e-mail
- IPv6
  - 3 global IPv6 addresses configurable
  - Autoconf Feature to be disabled
  - supported network services: NTP, HTTP, HTTPS, SNMP, SSH
- Windows „net time“ via NETBIOS
- Winpopup (Window Mail)

Additional Features and Options

- external NTP timeserver
- free configuration of NTP: thereby MD5 authentication and access control via address & mask restriction
- extended menu guidance for configuration and monitoring via Telnet, SSH or serial terminal interface
- optional up to 3 RJ45/10/100 Mbit Ethernet interfaces
- extended HTTP statistic support with long-term graphic and access statistic to NTP
- alarm messages can be displayed on external large display VP100/20/NET
- USB memory stick slot for extended functionality: software update, transfer of secure certificates, log files and configurations, keypad locking

User Interface

- terminal connection via serial interface, status LED
- Web browser interface with graphical statistic of the one-day cycle offsets
- Telnet or Secure Shell Login for password protected operation of the Linux operating system
- FTP access for updating the operating system and downloading log files
- Simple Network Management Protocol for automatically SNMP-Traps in case of alarm
- SYSLOG messages can be passed to different computers
- configurable e-mail notification
- Simulation of a synchronous radio clock in order to operate without antenna

Options

- up to two further Ethernet RJ45 connectors
- Frequency and pulse outputs via BNC connectors (e.g. 10 MHz, 2.048 MHz, PPS)
- higher free running accuracy with optional oscillators (OCXO)
- IRIG-B outputs
- ANZ14/NET or VP100/20/NET as display connected via network

Why to use a Network Timeserver

A network timeserver should be used if accurate time is essential for undisturbed operation. It is possible to synchronize computers in a network using Public Domain Time servers over the Internet, but there are good reasons not to use them:

- The possibility to send notification via e-mail or SNMP-Trap to an administrator in the event of any synchronisation failure.
- The computers in the network do not have a reliable internet connection.
- The computers in the network cannot rely on the availability of external timeservers. Most operators of these timeservers do not guarantee continuous availability nor the accuracy of their service.
- NTP is able to compensate for the propagation delay of the network packets only in case of “usual” internet traffic. However, if unforeseen occurrences cause badly fluctuating propagation times, it is possible that the time synchronisation is disturbed. Reasons for this may be: hacker attacks, numerous upcoming new viruses etc.
- An own timeserver cannot be easily compromised by external sources.

Network Time Protocol (NTP)

NTP is a common method for synchronization of hardware clocks in local und global networks. The basic concept, version 1 [Mills88], was published in 1988 as RFC (Request For Comments). Experiences made from the practical use in Internet was followed by version 2 [Mills89]. The software package NTP is an implementation of the actual version 3 [Mills90], based on the specification RFC-1305 from1990 (directory doc/NOTES). Permission to use, copy, modify and distribute this software for any purpose and without fee is hereby granted (read File COPYRIGHT).

NTP's way of operation is basically different from that of most other protocols. NTP does not synchronize all connected clocks, it forms a hierarchy of timeservers and clients. A level in this hierarchy is called a *stratum*, and Stratum-1 is the highest level. Timeservers of this level synchronize themselves by a reference time source, such as a radio controlled clock, GPS-receiver or modem time distribution. Stratum-1-Servers distribute their time to several clients in the network which are called Stratum-2.

A high precision synchronization is feasible because of the several time references. Every computer synchronizes itself by up to three valued time sources. NTP enables the comparison of the hardware times and the adjustment of the own clock. A time precision of 128 ms, often better than 50 ms, is possible.

NTP Target

The software package NTP was tested on different UNIX systems. Many UNIX systems have pre-installed a NTP client. Only some configurations have to be made (/etc/ntp.conf - see NTP Client Installation). NTP clients as freeware or shareware are also available for the most other operating systems like Windows XP/2000/NT/95/98/3x, OS2 or MAC. The following WEB site is recommended to get the latest version of NTP: "http://www.eecis.udel.edu/~ntp/". More information you can find on our web page at "http://www.meinberg.de/english/sw/ntp.htm".

NTP-Client Installation

The following example shows the installation of a NTP client under UNIX. First make sure that there is no NTP installed on your computer because many UNIX operating systems include NTP already.

The shipped source code of the NTP daemon has to be compiled on the target system. Using the enclosed script file configures the compilation of the NTP daemon and all tools.

```
configure
```

All necessary information from the system will be collected and the corresponding make files will be generated in the subdirectories.

After that the NTP daemon and all needed utilities will be generated. Therefore type:

```
make
```

While compiling the NTP daemon several warnings may appear. These warnings are mostly unimportant. In case of problems during the compilation read the system dependent notes in the subdirectory ‘html’.

Afterwards the generated programs and tools have to be moved in the corresponding directories. Therefore type:

```
make install
```

The time adjustment can occur in different ways. Either the system time can be set once by using the tool "ntpdate lantime" or the NTPD daemon is started. In the first case it is recommended to set the time automatically with "cron" or once when booting the system. The second case is described below.

First a file named /etc/ntp.conf has to be generated with an editor. Adapting the file to Meinberg LANTIME it should contain the following:

```
# Example for /etc/ntp.conf for Meinberg LANTIME
server 127.127.1.0              # local clock
server 172.16.3.35              # TCPIP address of LANTIME
# optional: Driftfile
# driftfile /etc/ntp.drift
# optional: activate all messages in syslogfile
# logconfig =all
```

The NTP daemon is started with "ntpd" or, using "rc.local", while booting the system. Status messages during operation are saved in /var/adm/messages and / var/adm/syslog (corresponding to the syslog configuration).

e.g.: tail /var/log/messages
shows the last lines from the file "messages"

The status messages can also be redirected in a log file by using the following option:

ntpd -llogfile

The command "ntpq" in the directory "ntpq" requests the actual status of the NTP daemon (see also doc/ntpq.8).

e.g.: ntpq/ntpq

An interpreter appears; Type "?" for a list of all available commands. The command "peer" is used to list all active reference clocks:

remote	refid	st	t	when	poll	reach	delay	offset	jitter
LOCAL(0)	LOCAL(0)	3	l	36	64	3	0.00	0.000	7885
lantime	.GPS.	0	l	36	64	1	0.00	60.1	15875

with the following meaning:

- remote: list of all valid time servers (ntp.conf)
- refid: reference number
- st: actual stratum value (hierarchy level)
- when: last request (seconds)
- poll: period of requesting the time server (seconds)
- reach: octal notation of the successful requests, shifted left
- delay: delay of the network transmission (milliseconds)
- offset: difference between system time and reference time (milliseconds)
- jitter: variance of the offsets (milliseconds)

Repeatedly "peer" commands lets the user observe the accuracy of the NTP daemon. Every 64 seconds (value of -poll) a new time string is red in from the radio clock. The NTP daemon needs approx. 3...5 minutes for initialisation. This is indicated by a wildcard (*) on the left side of the remote name.

The NTP daemon terminates itself if the system time differs from the UTC time by more than 1024 seconds. This often happens when the time zone is not correctly set (see also system manual "zic" or "man zic").

GPS satellite controlled clock

A Meinberg GPS167 satellite controlled radio clock is used as a reference time base. The satellite receiver clock GPS167 has been designed to provide extremely precise time to its user. The clock has been developed for applications where conventional radio controlled clocks can not meet the growing requirements in precision. High precision available 24 hours a day around the whole world is the main feature of the new system which receives its information from the satellites of the Global Positioning System.

The Global Positioning System (GPS) is a satellite-based radio-positioning, navigation, and time-transfer system. It was installed by the United States Department of Defence and provides two levels of accuracy: The Standard Positioning Service (SPS) and the Precise Positioning Service (PPS). While PPS is encrypted and only available for authorized (military) users, SPS has been made available to the general public.

GPS is based on accurately measuring the propagation time of signals transmitted from satellites to the user's receiver. A nominal constellation of 21 satellites together with 3 active spares in six orbital planes 20000 km over ground provides a minimum of four satellites to be in view 24 hours a day at every point of the globe. Four satellites need to be received simultaneously if both receiver position (x, y, z) and receiver clock offset from GPS system time must be computed. All the satellites are monitored by control stations which determine the exact orbit parameters as well as the clock offset of the satellites' on-board atomic clocks. These parameters are uploaded to the satellites and become part of a navigation message which is retransmitted by the satellites in order to pass that information to the user's receiver.

The high precision orbit parameters of a satellite are called ephemeris parameters whereas a reduced precision subset of the ephemeris parameters is called a satellite's almanac. While ephemeris parameters must be evaluated to compute the receiver's position and clock offset, almanac parameters are used to check which satellites are in view from a given receiver position at a given time. Each satellite transmits its own set of ephemeris parameters and almanac parameters of all existing satellites.

GPS167 Features

The hardware of GPS167 is a 100 mm x 160 mm microprocessor board. The front panel integrates a 2 x 40 character LC display, two LED indicators and 5 push buttons. The receiver is connected to the antenna/converter unit by a 50 Ω coaxial cable (refer to "Mounting the Antenna"). Feeding the antenna/converter occurs DC insulated via the antenna cable. Optionally an antenna splitter for up to four receivers connected to one antenna is available.

The navigation message coming in from the satellites is decoded by GPS167´s microprocessor in order to track the GPS system time with an accuracy of better than 500 ns or 250 nsec (OCXO). Compensation of the RF signal's propagation delay is done by automatic determination of the receiver's position on the globe. A correction value computed from the satellites´ navigation messages increases the accuracy of the board's TCXO or OCXO to 10^{-9} and automatically compensates the oscillators aging. The last recent value is restored from the battery buffered memory at power-up.

Time Zone and Daylight Saving

GPS system time differs from the universal time scale (UTC) by the number of leap seconds which have been inserted into the UTC time scale after GPS had been initiated in 1980. The current number of leap seconds is part of the navigation message supplied by the satellites, so GPS167´s internal real time is based on UTC. Conversion to local time including handling of daylight saving year by year can be done by the receiver's microprocessor if the corresponding parameters are set up by the GPS Monitor (included Windows software).

Internally LANTIME always runs on UTC based time. NTP calculates this UTC time from the GPS receivers local time. The time zone of LANTIME is fixed to UTC. However, the time monitored on the LC display is the GPS receiver's local time.

Mounting the GPS Antenna

The GPS satellites are not stationary but circle round the globe in a period of about 12 hours. They can only be received if no building is in the line-of-sight from the antenna to the satellite, so the antenna/converter unit must be installed in a location from which as much of the sky as possible can be seen. The best reception is given when the antenna has a free view of 8° angular elevation above the horizon. If this is not possible the antenna should be installed with a mostly free view to the equator because of the satellite courses which are located between latitudes of 55° North and 55° South. If this is not possible problems occur especially when at least four satellites for positioning have to be found.

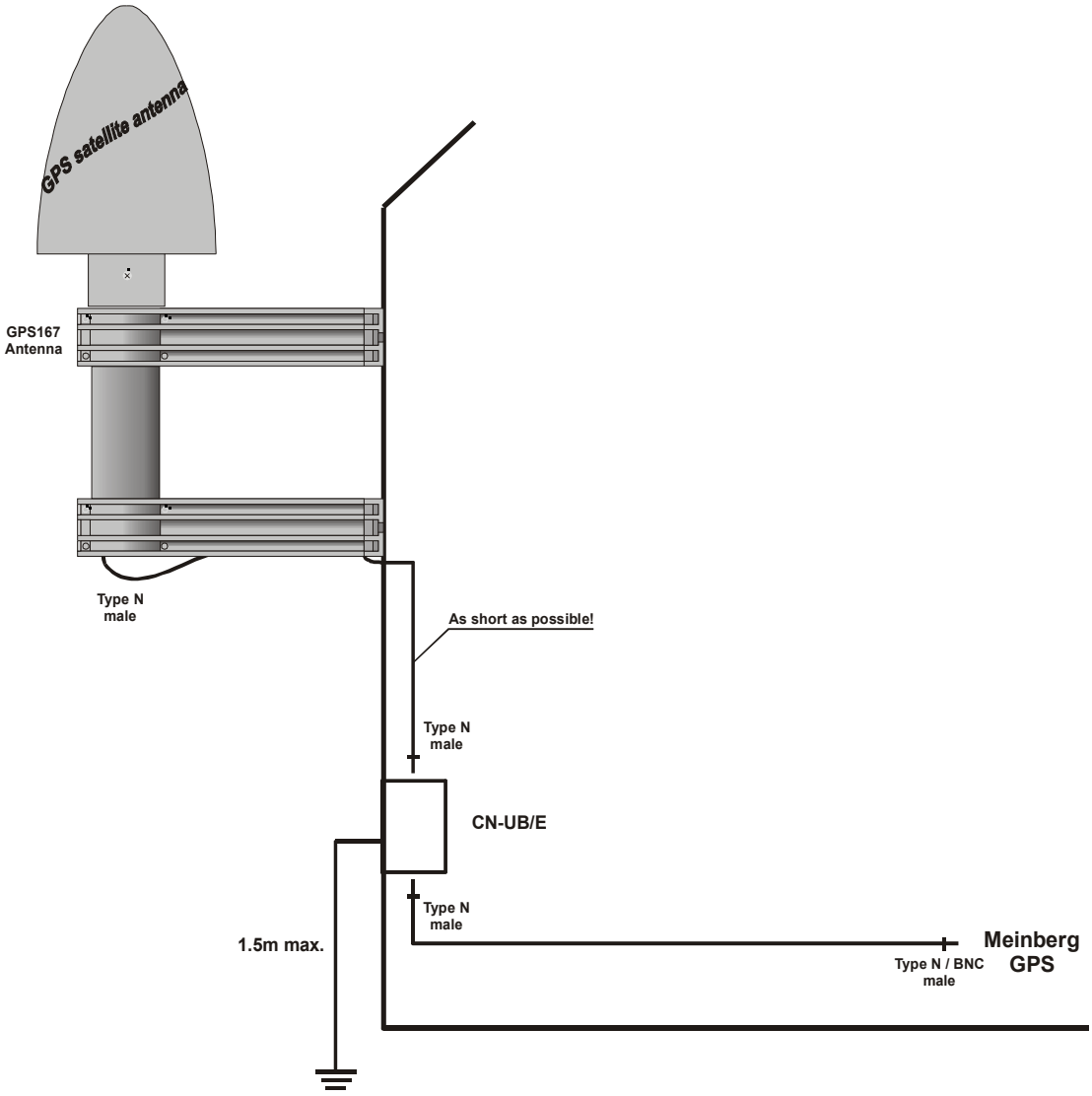
The antenna/converter unit can be mounted on a pole with a diameter up to 60 mm or on a wall. A 50 cm plastic tube, two holders for wall-mounting and clamps for pole-mounting are added to every GPS167. A standard coaxial cable with 50 Ω impedance should be used to connect the antenna/converter unit to the receiver. The maximum length of cable between antenna and receiver depends on the attenuation factor of the used coaxial cable.

Example:

Type of cable	diameter Ø [mm]	Attenuation at 100MHz [dB]/100m	max. lenght [m]
RG58/CU	5mm	15.9	300 [1]
RG213	10.5mm	6.9	700 [1]
1)This specifications are made for antenna/converter units produced after January, 2005			
The values are typically ones; the exact ones are to find out from the data sheet of the used cable.			

Up to four GPS167 receivers can be run with one antenna/converter unit by using the optional antenna splitter. The total length of one antenna line between antenna, splitter and receiver must not be longer than the max. length shown in the table above. The position of the splitter in the antenna line does not matter. When installing the high voltage protector CN-UB/E (CN-UB-280DC) be aware to set it directly after reaching indoor. The CN-UB/E is not for outdoor usage.

Assembly with CN-UB/E



Antenna Short-Circuit

In case of an antenna line short-circuit the following message appears in the display:

```
ANTENNA
SHORT-CIRCUIT
DISCONNECT POWER
!!!
```

If this message appears the clock has to be disconnected from the mains and the defect eliminated. After that the clock can be powered-up again. The antenna supply voltage must be in a range of 18.5 V_{DC} (no load) and 17 V_{DC} (connected GPS antenna).

General information DCF77 PZF

The German long wave transmitter DCF77 started continuous operation in 1970. The introduction of time codes in 1973 build the basic for developing modern radio remote clocks.

The carrier frequency of 77.5 kHz is amplitude modulated with time marks each second. The BCD-coding of the time telegram is done by shifting the amplitude to 25% for a period of 0.1s for a logical '0' and for 0.2s for a logical '1'. The receiver reconstructs the time frame by demodulating this DCF-signal. Because the AM-signal is normally superimposed by interfering signals, filtering of the received signal is required. The resulting bandwidth-limiting causes a skew of the demodulated time marks which is in the range of 10 ms. Variations of the trigger level of the demodulator make the accuracy of the time marks worse by additional +/-3 ms. Because this precision is not sufficient for lots of applications, the PTB (Physical and Technical Institute of Germany) began to spread time information by using the correlation technique.

The DCF-transmitter is modulated with a pseudo-random phase noise in addition to the AM. The pseudo-random sequence (PZF) contains 512 bits which are transmitted by phase modulation between the AM-time marks. The bit sequence is build of the same number of logical '0' and logical '1' to get a symmetrical PZF to keep the average phase of the carrier constant. The length of one bit is 120 DCF-clocks, corresponding to 1,55 ms. The carrier of 77.5 kHz is modulated with a phase deviation of +/-10° per bit. The bit sequence is transmitted each second, it starts 200ms after the beginning of an AM second mark and ends shortly before the next one.

Compared to an AM DCF77-receiver, the input filter of a correlation receiver can be dimensioned wide-bandwidth. The incoming signal is correlated with a reconstructed receiver-PZF. This correlation analysis allows the generation of time marks which have a skew of only some microseconds. In addition, the interference immunity is increased by this method because interference signals are suppressed by averaging the incoming signal. By sending the original or the complemented bit sequence, the BCD-coded time information is transmitted.

The absolute accuracy of the generated time frame depends on the quality of the receiver and the distance to the transmitter, but also on the conditions of transmission. Therefore the absolute precision of the time frame is better in summer and at day than in winter and at night. The reason for this phenomenon is a difference in the portion of the sky wave which superimposes the ground wave. To check the accuracy of the time frame, the comparison of two systems with compensated propagation delay is meaningful.

Features of PZF5xx

The PZF5xx is a high precision receive module for the DCF77-signal build in euro card size (100 mm x 160 mm).

The micro controller of the system correlates its receiver-PZF with the incoming pseudorandom sequence and decodes the time information of the DCF-telegram simultaneously. The controller handles input and output functions of the PZF5xx and synchronizes the internal real-time clock.

By evaluating the pseudorandom phase noise, the PZF5xx is able to generate time frames with thousand times the accuracy of standard AM-time code receivers. The precise regulation of the main oscillator (TCXO, OCXO optional for higher accuracy) of the radio clock is possible therefore. So, the PZF5xx can be used as a standard frequency generator besides the application as a time code receiver. Six fixed and one settable TTL-level standard frequencies are available at the rear VG-connector. The synthesizer frequency exists as an open drain output and a sine wave signal also.

The PZF5xx delivers TTL-low and TTL-high active pulses per minute and per second further. To distribute information concerning date, time and status, two independent serial interfaces (RS232) are used which are configurable in a setup menu.

Like mentioned before, the PZF5xx includes a battery-backed real-time clock which runs crystal-precise if the main power supply fails.

Important system parameters are stored in a battery-backed (RAM of the RTC) or non-volatile (EEPROM) memory.

If an update of system software becomes necessary, the new firmware can be loaded via serial interface (COM0) without removing the PZF5xx for inserting a new EPROM.

Antenna

The PZF5xx operates with a ferrite antenna which is damped to match the bandwidth needed for the correlation reception.

Assembly of antenna

The antenna has to be mounted as exactly as possible. Turning it out of the main receive direction will result in less accurate time frames. The antenna must be placed in longitudinal direction to the DCF-transmitter (Frankfurt). The nearness to microcomputers should be avoided and the antenna should be installed with a minimum distance of 30cm to all metal objects, if possible. A distance of several meters to TV- or computer monitors must be kept.

After switching the PZF5xx to the menu 'PZF STATE', the adjustment of the antenna can be executed. The displayed value is proportional to the received field strength.

The best method of mounting the antenna is to look for the minimum field strength and turn the antenna by 90° to maximum then. A high field strength on its own is no guarantee for good conditions of reception, because interfering signals within the bandwidth of the receiver also have an effect on the displayed value.

The maximum interference immunity can be found by looking at the autocorrelation coefficient (in percent) in the menu 'PZF-STAT'. The displayed value should be close to 75 % for best reception.

Powering Up the System

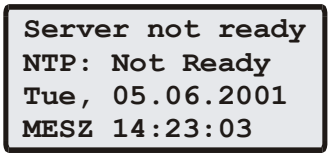
When the LANTIME/SHS is switched on the SHS STATE menu is displayed because the two receivers (GPS and PZF) are usually not synchronized yet. After the configured time limit is reached the LANTIME/SHS goes to normal operation. The following notes should be taken into consideration:

- the GPS antenna/converter unit must be installed in a location from which as much of the sky as possible can be seen (see "Mounting the GPS antenna")
- the PZF antenna must be positioned to optimise the correlation better than 60 %
- the distance to the German long wave transmitter have to be configured
- the time limit (the max. accepted time difference between GPS and PZF) has to be set to the needed accuracy (default 10 ms)

Some menues can be called not before the single board computer has booted. Because of this the state menues for the PZF and the setup for the LAN parameters can not be edited until the bootphase has finished (approx. 1 minute).

Booting the GPS receiver

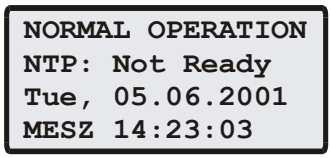
If both the antenna and the power supply have been connected the system is ready to operate. About 10 seconds after power-up the receiver's oscillator has warmed up and operates with the required accuracy. If the receiver finds valid almanac and ephemeris data in its battery buffered memory and the receiver's position has not changed significantly since its last operation the receiver can find out which satellites are in view now. Only a single satellite needs to be received to synchronize and generate output pulses, so synchronization can be achieved maximally one minute after power-up.



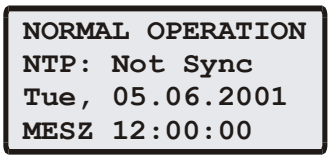
If the receiver position has changed by some hundred kilometres since last operation, the satellites´ real elevation and Doppler might not match those values expected by the receiver thus forcing the receiver to start scanning for satellites. This mode is called **Warm Boot** because the receiver can obtain ID numbers of existing satellites from the valid almanac. When the receiver has found four satellites in view it can update its new position and switch to **Normal Operation**. If the almanac has been lost because the battery had been disconnected the receiver has to scan for a satellite and read in the current almanacs. This mode is called **Cold Boot**. It takes 12 minutes until the new almanac is complete and the system switches to Warm Boot mode scanning for other satellites.

Booting the Single Board Computer

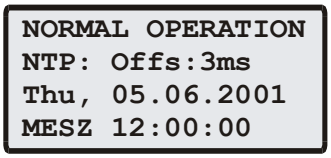
The LINUX operating system is loaded from a packed file on the flash disk of the single board computer to a RAM disk. All files of the flash disk are stored in the RAM disk after booting. Because of that it is guaranteed that the file system is in a defined condition after restart. This boot process takes approx. one minute. During this time the following message appears on the display:



Once per second the GPS compares the GPS time with the PZF5xx time. Both the pulses per second and the serial time strings are compared. If the calculated deviation exceeds the configured time limit or one of the receiver stops generating time strings or pulses, the hybridsystem stops sending time information to the NTP server. Once the hybridsystem sent a time string, the NTP daemon is started with the corresponding parameters. After that the NTPD starts synchronisation with the references. The references are usually the RTC of the single board computer, the serial time string and the pulse per second (PPS) from the hybridsystem. If the NTPD is started but not synchronous with the hybridsystem yet, the following message is displayed:



For the synchronisation of the NTPD with the GPS it is necessary that the GPS receiver is synchronous with the GPS time (LOCK LED is turned on). Also the time difference between the GPS und PZF receiver must be less then the time limit error. In this case the following message is monitored on the display:



The second line shows the user that the NTPD is synchronized with the GPS with an offset of -3 ms. Because of the internal time of the NTP which is adjusted by a software PLL (phase locked loop) it takes a certain time to optimise this offset. The NTPD tries to keep the offset below ±128 ms; if the offset becomes too large the system time is set with the GPS time. Typically values for the offset are +-5 ms after the NTPD has already synchronized. If NTPD is not synchronised and GPS receiver is then, the green LOCK-LED is blinking.

Configuration User Interface

There are several ways to configure the LANTIME parameters:

Command Line Interface (CLI) via TELNET
Command Line Interface via SSH
Command Line Interface via serial interface terminal (BGT versions only)
HTTP Interface
Secure HTTP Interface (HTTPS)
Front panel LCD Interface
SNMP Management

To put LANTIME into operation for the first time an IP address is entered via the front panel keys and LC display (refer to: DHCP IPv4 or AUTOCONF IPv6). LANTIME variants without LC display have to be given the IP address via the serial interface in the front panel, running a terminal software e.g. on a laptop. If once the IPv4 address, netmask and IPv4 GATEWAY are configured, or the network interface is initialised by IPv6 SCOPE-LINK, the LANTIME is accessible from any computer in the network (remote).

To set up a TELNET connection the following commands are entered:

telnet 198.168.10.10 // LANTIME IP address
user: root
password: timeserver

With “setup” the configuration program is started.

To set up a SSH connection the following commands are entered:

ssh root@198.168.10.10 // LANTIME IP address
password: timeserver

With “setup” the configuration program is started.

To set up a HTTP connection the following address is to enter in a web browser:

http://198.168.10.10 // LANTIME IP address
password: timeserver

To set up a Secure HTTP (HTTPS) connection the following address is entered in a web browser:

https://198.168.10.10 // LANTIME IP address
password: timeserver

The Front Panel Layout

GPS FAIL LED

The FAIL LED is turned on whenever the TIME_SYN output is low (receiver is not synchronized).

GPS LOCK LED

The LOCK LED is turned on when after power-up the receiver has acquired at least four satellites and has computed its position. In normal operation the receiver position is updated continuously as long as at least four satellites can be received. The LOCK LED is **blinking** when the GPS has locked and the NTP is not synchronized. If a time limit error occurs both LEDs FAIL and LOCK are blinking.

LC Display

The 4 x 16 character LC display is used to show the receiver's status and let the user edit parameters. The keys described below let the user select the desired menu. The next chapter lists all available menus in detail. A quick reference of the available menus and submenus can be found at the end of this document.

MENU Key

This key lets the user step through several display menus showing specific data.

CLR/ACK Key

This key has to be used when parameters are to be modified. When this key is pressed the parameters that have been edited are saved in the battery buffered memory. If the menu is left without pressing CLR/ACK all changes are discarded.

NEXT Key

When editing parameters (LCD cursor is visible) this key moves the cursor to the next digit with respect to the next parameter to be edited. If the current menu just displays data (cursor not visible) pressing this key switches to a submenu (if available).

INC Key

When editing parameters this key increments the digit or letter at the cursor position.

Configuration via LC Display

On first installation of LANTIME the network parameters can only be configured by the front panels push buttons and the LC display. Press MENU until the SETUP menus appear on the display. The first setup menu are the LAN PARAMETERS. Pressing NEXT further setup menus appear. Pressing CLR/ACK the LAN PARAMETERS menu is entered. The submenu TCP/IP ADDRESS appears. Pressing NEXT the following submenus can be chosen: NET MASK, DEFAULT GATEWAY, IPv6 address, HOSTNAME, DOMAINNAME, NAMESERVER and REMOTE CONNECT. CLR/ACK lets the user enter the corresponding submenu to make changes with NEXT and INC. Pressing CLR/ACK after changing parameters acknowledges the changes. Leaving the menu with MENU all changes are discarded and the setup menu is displayed again. All changed settings of the LAN PARAMETER's sub menu come into affect not before MENU is pressed once again and the changes are confirmed.

The unique 32 bit TCP/IP address must be set by the network administrator. The net mask will be defined by the network. It is probable that you will need to set up the default gateway also.

The correct connection to the LANTIME can be reviewed from any other workstation in the network with the program PING.

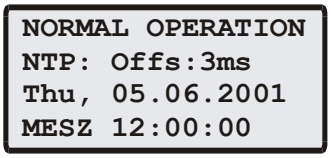
REMOTE CONNECT lets the user enable or disable all connections via network (e.g. TELNET, FTP or HTTP). If changes occur via HTTP interface or setup program the message "REMOTE CONNECT: partial enabled" may appear. The NTP protocol will restart after any change.

NOTE: Any HTTP, HTTPS, SSH or TELNET connection to the LANTIME is possible only if REMOTE CONNECT is enabled!

The menus in Detail

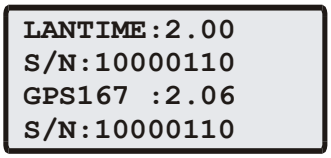
Root Menu

The root menu is shown when the receiver has completed initialisation after power-up. The left side of the first line of the display shows the receiver's mode of operation as described above. The text "NORMAL OPERATION" might be replaced by "COLD BOOT", "WARM BOOT" or "UPDATE ALMANAC". If the antenna is disconnected or not working properly, the text "ANTENNA FAULTY" is displayed instead.

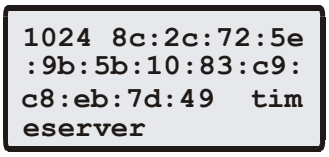


On the right side of the display the current date, the name of the time zone (as defined in the setup menu) and local time are monitored. If the "IGNORE LOCK" option is enabled an "*" will be shown behind the time.

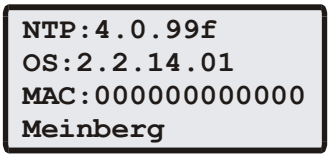
If the NEXT key is pressed from the root menu a submenu is displayed showing the receiver's software revision of the LANTIME software and the GPS167 flash software:



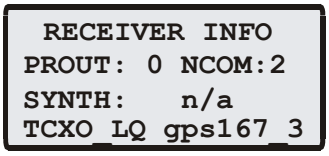
If the NEXT key is pressed twice from the root menu a submenu is displayed showing the NTP software version, the operating system version and the MAC address of the integrated net card.



Pressing NEXT the third time the fingerprint of the SSH key is displayed:

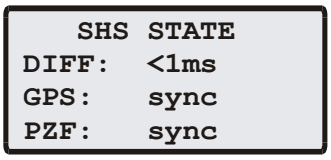


Pressing NEXT the fourth time the receiver info is displayed:



Menu SHS State

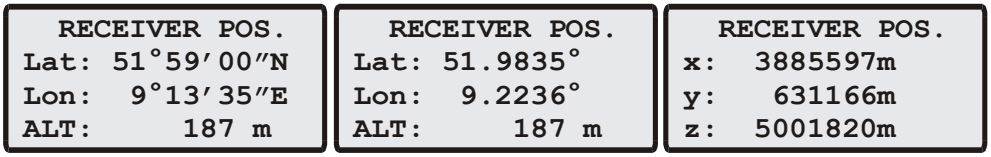
The SHS state is displayed automatically whenever a time limit error occurs, i.e. the deviation between GPS time and PZF time is larger than the configured limit. After powering-up the LANTIME this menu is displayed as long as the time deviation is larger than the time limit. After the deviation becomes smaller than the time limit, the main menu is displayed automatically. However, if a time limit error occurs during the normal operation (not after powering-up) the error must be acknowledged to change back to the normal operation by pressing the CLR/ACK key in the SHS state menu. It is also possible to acknowledge the error by a modification via the HTTP interface. An acknowledgement is essential even if the time limit error has settled itself! Generating time strings again starts not before the acknowledgement took place.



Note: As long as both of the two LEDs FAIL and LOCK blink simultaneously, a time limit error took place and no time string is sent to the NTP.

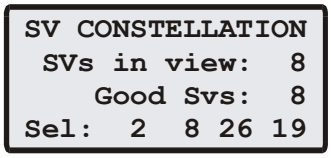
Menu RECEIVER POS.

This menu shows the current receiver position. The NEXT key lets the user select one of three formats. The default format is geographic latitude, longitude and altitude with latitude and longitude displayed in degrees, minutes and seconds. The next format is geographic too, with latitude and longitude displayed in degrees with fractions of degrees. The third format displays the receiver position in earth centred, earth fixed coordinates (ECEF coordinates). The three formats are shown below:

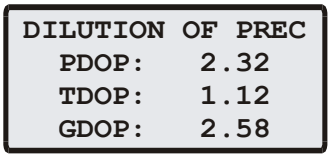


Menu SV CONSTELLATION

The SV constellation menu gives an overview of the current satellites (SVs) in view. The second line of the display shows the number of satellites with an elevation of 5° or more (In view), the number of satellites that can be used for navigation (Good) and the selected set of satellites which are used to update the receiver position (Sel).

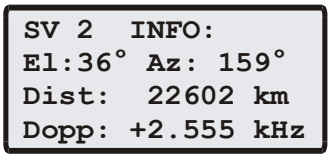


The precision of the computed receiver position and time is affected by the geometric constellation of the four satellites being used. A set of values called dilutions of precision (DOP) can be computed from the geometric constellation. Those values can be displayed in a submenu of the SV constellation menu. PDOP is the position dilution of precision, TDOP is the time dilution of precision, and GDOP, computed from the others above, is the general dilution of precision. Lower DOP values mean more precision.



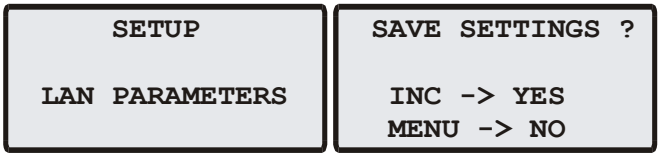
Menu SV POSITION

This menu gives information on the currently selected satellite (SV). The satellite's ID number, its elevation, azimuth and distance from the receiver position reflect the satellite's position in the sky whereas the Doppler shows whether the satellite is coming up from the horizon (Doppler positive) or going down to the horizon (Doppler negative). All satellites in view can be monitored by using the NEXT key.



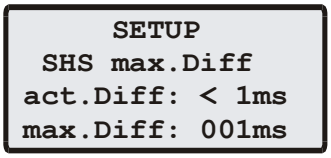
Menu SETUP

From this menu, several topics can be selected which let the user edit parameters or force special modes of operation. A specific topic can be selected using the NEXT key. Depending on the current topic, pressing the CLR/ACK key either enters edit mode with the selected set of parameters or switches to the selected mode of operation (after the user has acknowledged his decision). Once edit mode has been entered, the NEXT key lets the cursor move to the digit or letter to be edited whereas the INC key increments the digit or letter under the cursor. If changes have been made, the CLR/ACK key must be pressed. If all changes have been made in one setup submenu you have to press the MENU key. After that you will be asked to save the settings. Press INC to change and save the last changes. Otherwise all changes are discarded when the user presses the MENU key in order to return to the SETUP display.



SETUP SHS Time Limit

In this menu the maximum time limit is to be configured. If the deviation between GPS time and PZF time exceeds the configured time limit, the hybridsystem stops generating time strings. The time limit can be set between 1 ms and 400 ms.



SETUP LAN PARAMETERS

In this submenu the network parameters are configured. These parameters have to be adapted to the existing network when the LANTIME is installed the first time. The following parameters can be set: **TCP/IP ADDRESS, NETMASK, DEFAULT GATEWAY, IPv6 ADDRESS HOSTNAME, DOMAINNAME, NAMESERVER, SYSLOG SERVER, SNMP MANAGER, REMOTE CONNECT, RESET FACTORY SETTINGS und NET LINK MODE**. All settings are applied to the first Ethernet interface only. All further Ethernet interfaces have to be configured via HTTP or CLI interface. With the submenu REMOTE CONNECT you can enable or disable all network connections via TELNET, FTP or HTTP. When the network parameters have been changed the configuration file is updated and the NTPD is restarted.

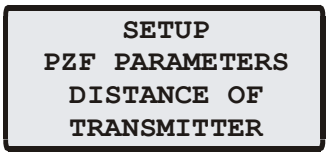
With the submenu **RESET FACTORY SETTINGS** the following parameters will be set to the default values:

All configuration parameters of the timeserver are saved on the Flash Disk in the file / mnt/flash/global_configuration. It is recommended not to modify this file manually but to use the configuration interface (HTTP, CLI or SNMP). If this file does not exist, an empty file is generated. The default configuration file is part of the attachment.

The parameters for speed and mode of the net card can be changed with the menu item NET LINK MODE. There are 5 modes available: Autosensing, 10 MBit/Half-Duplex, 100 MBit/Half-Duplex, 10 MBit/Full-Duplex, 100 MBit/Full-Duplex. Default setting is Autosensing.

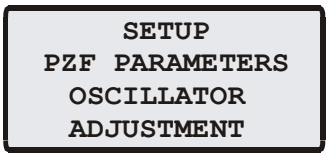
SETUP PZF PARAMETERS

In this submenu the PZF specific parameters can be edited. The distance to the transmitter is entered in the menu "DISTANCE OF TRANSMITTER" for compensating the propagation delay of the received pseudo-random code. This setting should be done as exact as possible because the absolute precision of the time frame is influenced by this value.



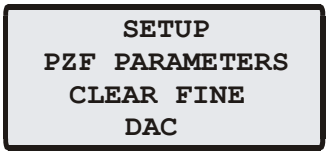
The basic model of the PZF509 includes a voltage controlled temperature compensated oszillator (VCTCXO). Its nominal frequency of 10MHz is adjusted by using two digital-to-analog converters (DACs). One of them is responsible for the coarse tuning and the other one for the fine adjustment of the oscillator.

The value for the coarse-DAC is settable in the menu "OSCILL. AJUST" in the range of 0 to 4095. If the edited value exceeds 4095 the maximum value is stored. This menu only lets the user modify the coarse-DAC (CAL). The fine-DAC (FINE) is displayed but not to edit. It can be cleared in the next menu.



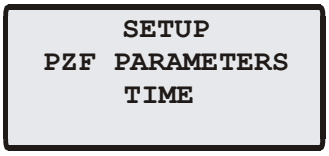
This value should only be changed by specialized personnel of company Meinberg and not by the user!

Using the menu "CLR FINE DAC" the DAC is set to its mid-scale value and the difference to its last value is added to the coarse DAC proportional.



This process is released automatically if the value of the fine DAC exceeds its limits (0...4095). Therefore the setting of the value to mid-scale by hand is reserved for service purposes only!

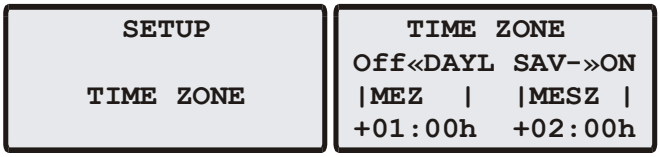
The menu "TIME" lets the user edit the time of the PZF509 in hours, minutes, seconds and set the daylight saving (MESZ) active or not. The LANTIME itself always runs on UTC based time. This UTC-time is displayed on the LCD.



The menu "TIME" lets the user edit the date and the day of week of the PZF509 radio clock.

SETUP TIME ZONE

This menu lets the user enter the names of the local time zone with daylight saving disabled and enabled, together with the zones´ time offsets from UTC. The left part of the display shows the zone and offset if daylight saving is off whereas the right part shows name and offset if daylight saving is on. These parameters are used to convert UTC to local time, e.g. MEZ = UTC + 1h and MESZ = UTC + 2h for central Europe. The range of date daylight saving comes in effect can be entered using the next two topics of the setup menu.

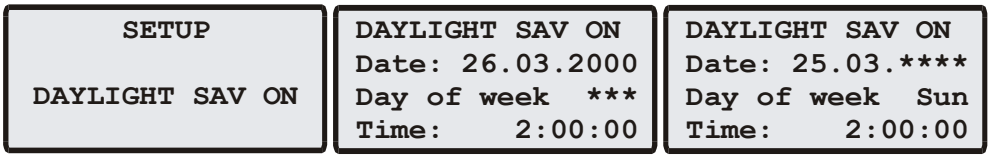


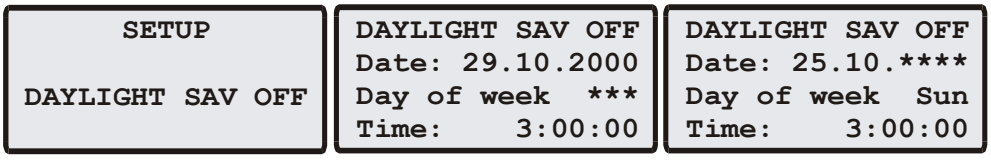
SETUP DAYLIGHT SAV ON/OFF

These two topics let the user enter the range of date for daylight saving to be in effect. Concerning parameter input both topics are handled identically, so they are described together in this chapter. Beginning and ending of daylight saving may either be defined by exact dates for a single year or using an algorithm which allows the receiver to re-compute the effective dates year by year. The figures below show how to enter parameters in both cases. If the number of the year is displayed as wildcards (´*´), a day-of-week must be specified. Then, starting from the configured date, daylight saving changes the first day which matches the configured day-of-week. In the figure below March 25, 1996 is a Saturday, so the next Sunday is March 31, 1996.

All changeover rules for the daylight saving like "the first/the second/the second to last/the last Sunday/Monday etc. in the x-th month," can be described by the used format "first specified day-of-week after a defined date".

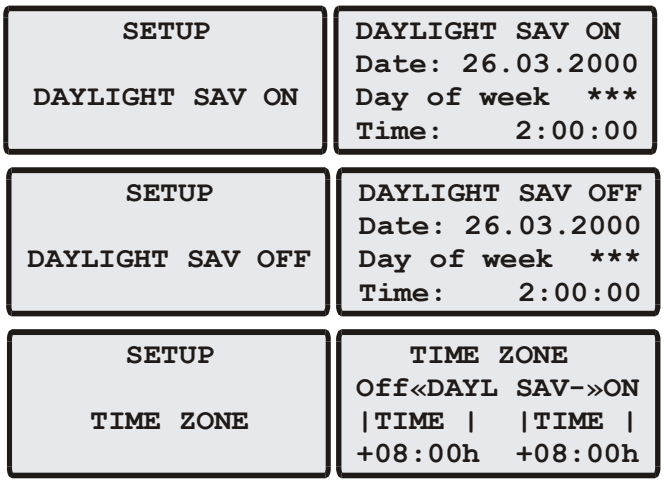
If the number of the year is not displayed as wildcards the complete date exactly determines the day daylight saving has to change (March 31, 1996 in the figures below), so the day-of-week does not need to be specified and therefore is displayed as wildcards.





If no changeover in daylight saving is wanted, identical dates and times must be entered in both of the submenus. In addition identical offsets for DAYLIGHT SAV

ON/OFF should be configured in the submenu TIMEZONE. After this a restart should be done.



SETUP SERIAL PORT

This menu lets the user configure the baud rate and the framing of the serial RS232 port to one of the following values:

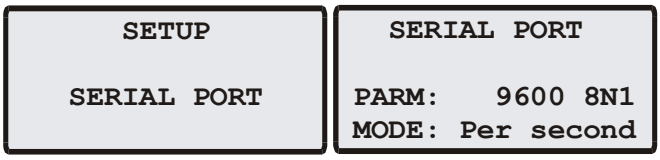
Baud Rate:	300 to 19200
Framing:	7E2, 8N1, 8E1, 8O1

COM provides a time string once per second or once per minute.

Default:	COM: 19200 baud, 8N1, once per second

The following modes are possible:

Per Second:	Time string will be send to next change of second
Per Minute:	Time string will be send to next change of minute
On Request:	Time string will be send if an '?' will be send to this port

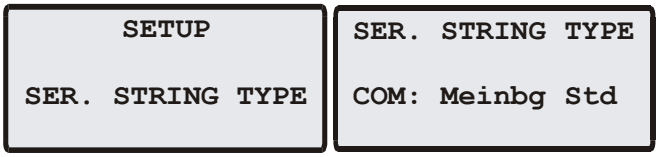


SETUP SERIAL STRING TYPE

This topic is used to select one of several different types of serial time strings or the capture string for each serial port.

The following time strings can be selected:

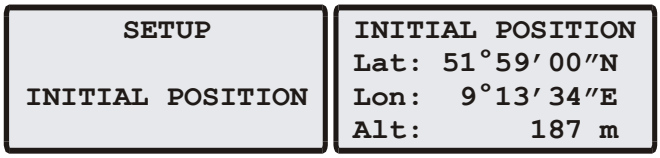
- Meinberg Standard String
- GPS167 Capture String
- SAT String
- UNI-Erlangen String
- NMEA String (RMC)
- SPA String
- Computime String



Refer to chapter **Time Strings** for details.

SETUP INITIAL POSITION

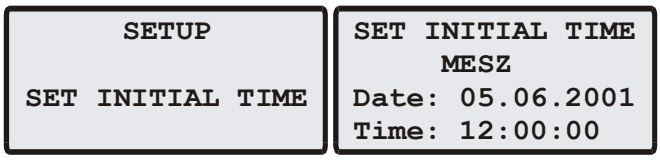
When the receiver is primarily installed at a new location far away from the last position saved in the receiver's memory the satellites in view and their Doppler will differ so much from those expected due to the wrong position that GPS167 has to scan for satellites in Warm Boot mode. Making the new approximately known position available to the receiver can avoid Warm Boot and speed up installation.



SETUP INITIAL TIME

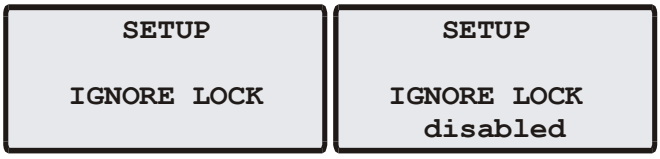
If the receiver's on-board real time clock keeps a wrong time the receiver is unable to compute the satellites´ correct elevation angles and Doppler. This submenu enables the user to change the receiver's system time for initialisation. After the receiver has locked, its real time clock will be adjusted using the information from the satellites.

When the antenna is disconnected it is possible to set the LANTIME with any time. Note that the NTP will not synchronize to a GPS losing its reception or if the deviation to the system time is larger than 1024 seconds. In this case the menu IGNORE LOCK has to be active. After setting the clock manually the system should be restarted (REBOOT).



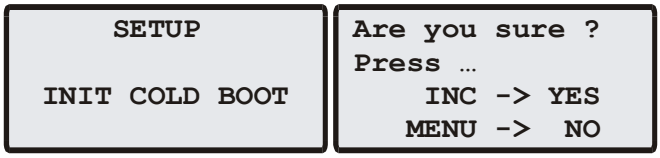
IGNORE LOCK

Enabling this menu lets the user run the LANTIME without antenna. Normally the NTPD loses synchronisation with the GPS when the antenna is disconnected or the GPS did not receive enough satellites (red FAIL LED is turned on). When IGNORE LOCK is enabled the status information from the GPS is fixed to SYNC. So it is possible to set the NTPD with any other time entered by the SETUP INITIAL TIME menu. Usually this menu should be disabled. If this option is enabled an "*" will be shown behind the time string in the root menu.



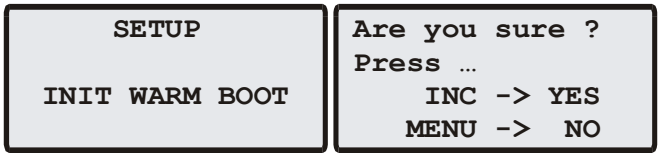
INITIATE COLD BOOT

This menu lets the user initialise all GPS data's, i.e. all saved satellite data's will be cleared. The user has to acknowledge this menu again before the initialisation starts. The system starts operating in the COLD BOOT mode and seeks for a satellite to read its actual parameters.



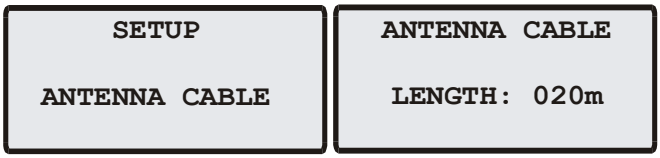
INITIATE WARM BOOT

This menu lets the user force the receiver into the Boot Mode. This may be necessary when the satellite data in the memory are too old or the receiver position has changed by some hundred kilometres since last operation. Synchronisation time may be reduced significantly. If there is valid satellite data in the memory the system starts in the WARM BOOT mode, otherwise the system changes into COLD BOOT to read new data's.



ANTENNA CABLE

This menu asks the user to enter the length of the antenna cable. The received time frame is delayed by approx. 5 ns per meter antenna cable. The receiver is able to compensate this delay if the exact cable length is given. The default value is 20 m. The maximum value that can be entered is 500 m (only with low loss cable).



Resetting Factory Defaults of the GPS

If both, the NEXT key and the INC key on the front panel, are pressed while the system is powered up the battery buffered memory is cleared and user definable parameters are reset to factory defaults. The key should be held until the root menu is displayed on LCD. Due to the fact that the satellites parameters have been cleared, the system comes up in COLD BOOT mode. The network and NTP parameters will not be changed.

Front panel PZF509

Pilot lamps

The 'Feld'-LED is switched on if a DCF-signal with at least minimum field strength needed for the correlation receiption is detected at the input of the receiver.

The 'Syn.'-LED indicates that the autocorrelation coefficient decreases beyond 52% and correct receiption is not possible therefore. This happens if a strong interferer within the bandwidth of the receiver is present or the transmitter is switched of.

If the 'Freil.'-LED is on, it was not possible to synchronize the internal realtime clock to DCF-time. This condition occures for at most two minutes after switching on the PZF509, because two DCF-telegrams are checked for plausibility before the data is taken over. Short disturbance of receiption can cause this state too.

Display

The eight digit alphanumeric display shows important information concerning status and time. The setting of system parameters is also done with the help of the display.

Control keys

It is possible to change the displayed information (time, date or status information) by two keys. The 'Menu'-key selects one of several menus. After presing the 'Set'-button the belonging information appears on the display. Furthermore, the keys are used to set user-specific parameters in several submenus.

PZF Menu items

The type of DCF-clock and the software revision are displayed first after power-up. The following information are readable before the PZF509 switches to time-display automatically:

PZF REC.

REV:x.xx

The handling of any queries will be simplified if the software revision is given by the user.

The following menus are available then:

TIME: The current time is displayed.

DATE: The actual date appears on the display.

DAY o.W.: The day of week will be displayed.

PZF STAT: Information about the decoding of the pseudo-random sequence are available in this menu. The following texts may be displayed:

GSYNC: The pseudo-random sequence is read into the internal RAM for one second and the system tries to achieve a coarse synchronisation. This procedure starts after power-up or worse reception for more than ten seconds.

K: xx%: If the coarse synchronisation was successful, the receiver enters the state of fine-correlation. The system tries to lock the received PZF as exact as possible to generate a precise time frame. The display shows the correlation coefficient at the end of each second, which can be in the range of 52 % to 77 %. A high value for the coefficient should be achieved by choosing a suitable position for the antenna.

The essential part of the tracking is completed five seconds after the appearance of 'K:xx%' and the generation of pulses per minute and per second starts. Tracking steps of three microseconds are possible each second until the internal real time clock is synchronized (two minutes max.). Afterwards, corrections of the time frame are executed per minute only. The direction of these steps is displayed by the characters '>' or '<' behind the digits of the correlation coefficient.

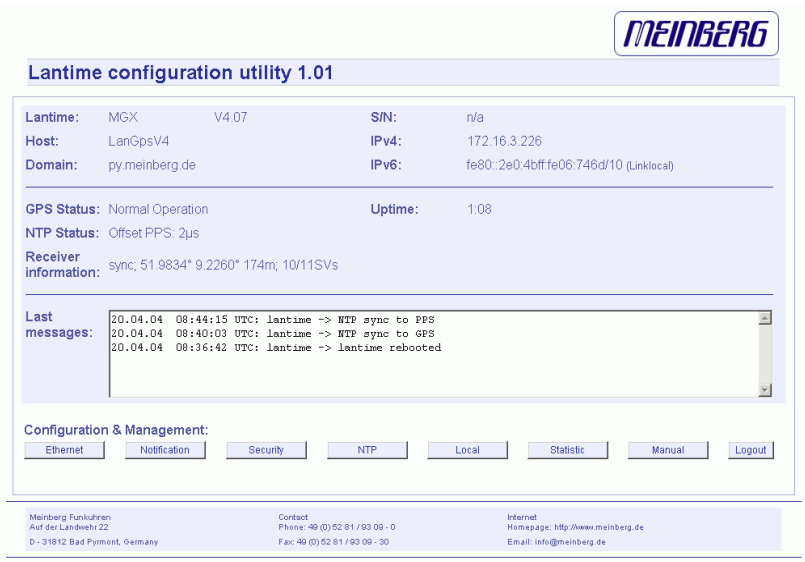
FIELD: The digitised value of the field strength is displayed in this menu. There is a logarithmic relation between this value and the field strength. This menu is useful for mounting the antenna, like described in chapter 'Assembly of antenna.

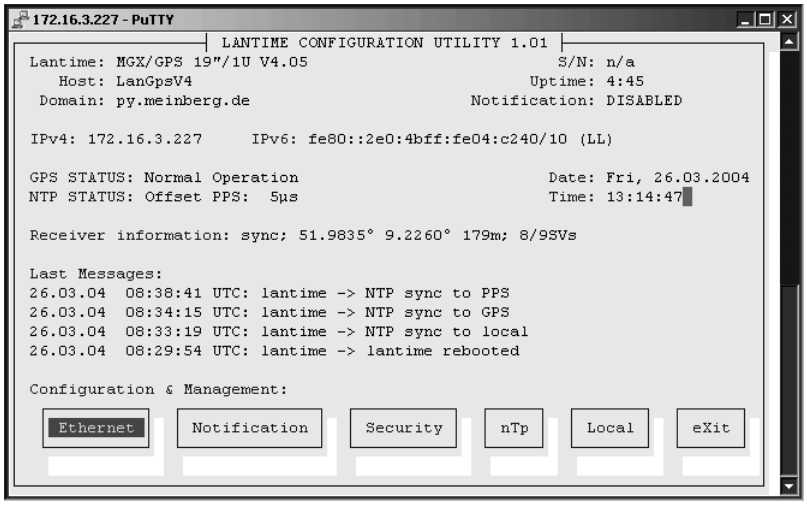
The LANTIME configuration interfaces

The LANTIME offers three different options for configuration and status management: Web interface, Command Line Interface Setup and SNMP. In order to use the SNMP features of your LANTIME, you need special software like management systems or SNMP clients. In order to use the web interface, all you need is a web browser (LANTIME supports a broad range of browsers).

In addition to the SNMP and web interface, you can also manage your LANTIME configuration via a command line interface (CLI), which can be used via a TELNET or SSH connection. A setup tool can be started after login, just type “setup” and press ENTER at the prompt.

There are only a few differences between the web interface and the CLI, most options are accessible from both interfaces (the CLI has no statistical functions).





The above screenshots show the web interface and the Command Line Interface setup tool. The CLI setup tool cannot be used by more than one user at a time, the web interface can be used by more than one user in parallel, but the two or more running sessions may influence each other. We explicitly do not recommend the parallel usage of the configuration interfaces.

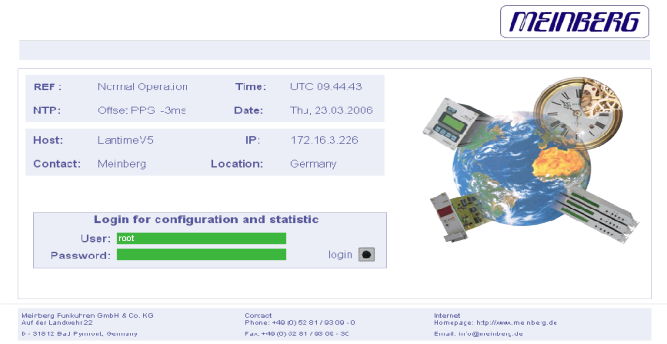
The web interface

Connect to the web interface by entering the following address into the address field of your web browser:

http://198.168.10.10

(You need to replace 198.168.10.10 with the IP address of your LANTIME). If you want to use an encrypted connection, replace the http:// with https:// in the above address. You may be prompted to accept the SSL certificate of your LANTIME the first time you are connecting to the system via HTTPS.

In both HTTP and HTTPS mode, you will see the following login screen:



On this start page you see a short status display, which corresponds with the LC display on the front panel of the LANTIME unit. The upper line shows the operation mode of the GPS receiver. As well as “SHS: NORMAL OPERATION” you may also read “SHS: COLD BOOT”, “SHS: WARM BOOT” or “SHS: UPDATE ALMANACH”. If the connection to the antenna is broken, a “SHS: ANTENNA FAULTY” will appear.

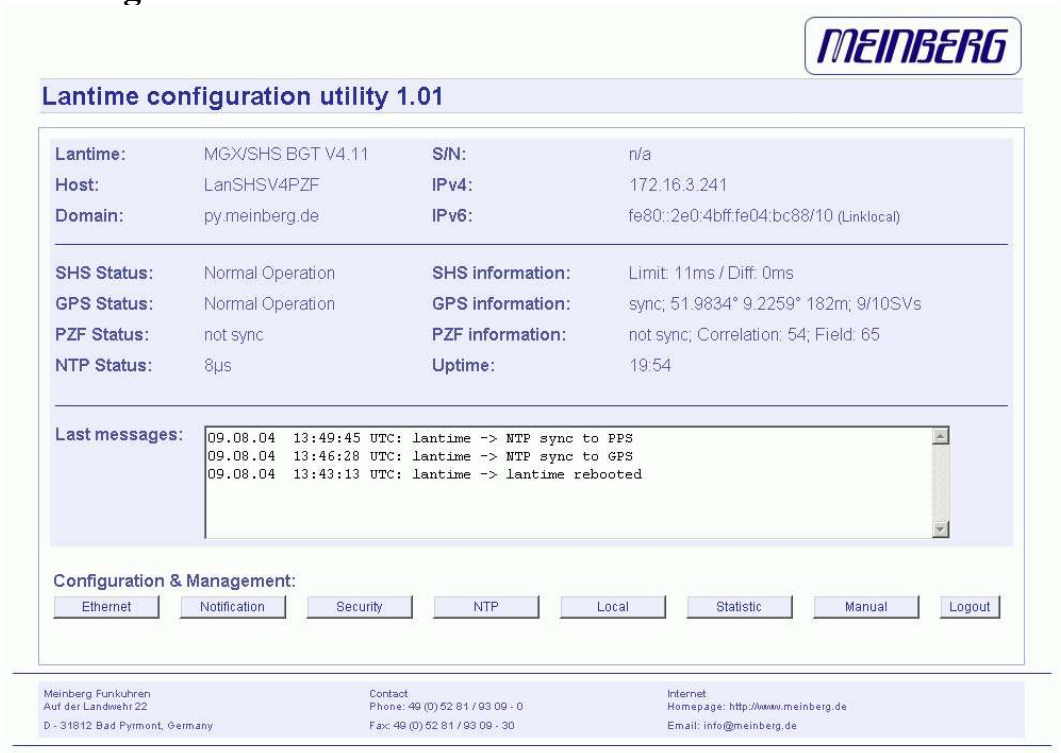
In the upper right corner of the LC display the time and time zone can be found, below that you will find the date and weekday.

On the second line the systems reports the NTP status. During the initial synchronisation process a “NTP: not sync” indicates that the NTP system is not synchronised, this can also appear if the GPS looses synchronisation and the NTP switches back to its “LOCAL CLOCK” time source .

The GPS clock is connected to the LANTIME system internally by using a serial connection and additionally by using the second pulse. There are therefore 2 reference clocks used by NTPD, the GPS and PPS time source. You will find the two time sources in the status information of the NTPD. After the NTP is synchronised, the Display shows “NTP: Offset GPS: x” or “NTP: Offset PPS: x” where “x” is the actual offset to the GPS or PPS time source.

This page will be reloaded every 30 seconds in order to reflect the current status of the unit. Please bear this in mind when you try to login and enter your password. If you do not press ENTER or the Login button within 30 seconds, the user and the password field is cleared and you have to start over again.

Configuration: Main Menu



After entering the right password, the main menu page shows up. This page contains an overview of the most important configuration and status parameters for the system.

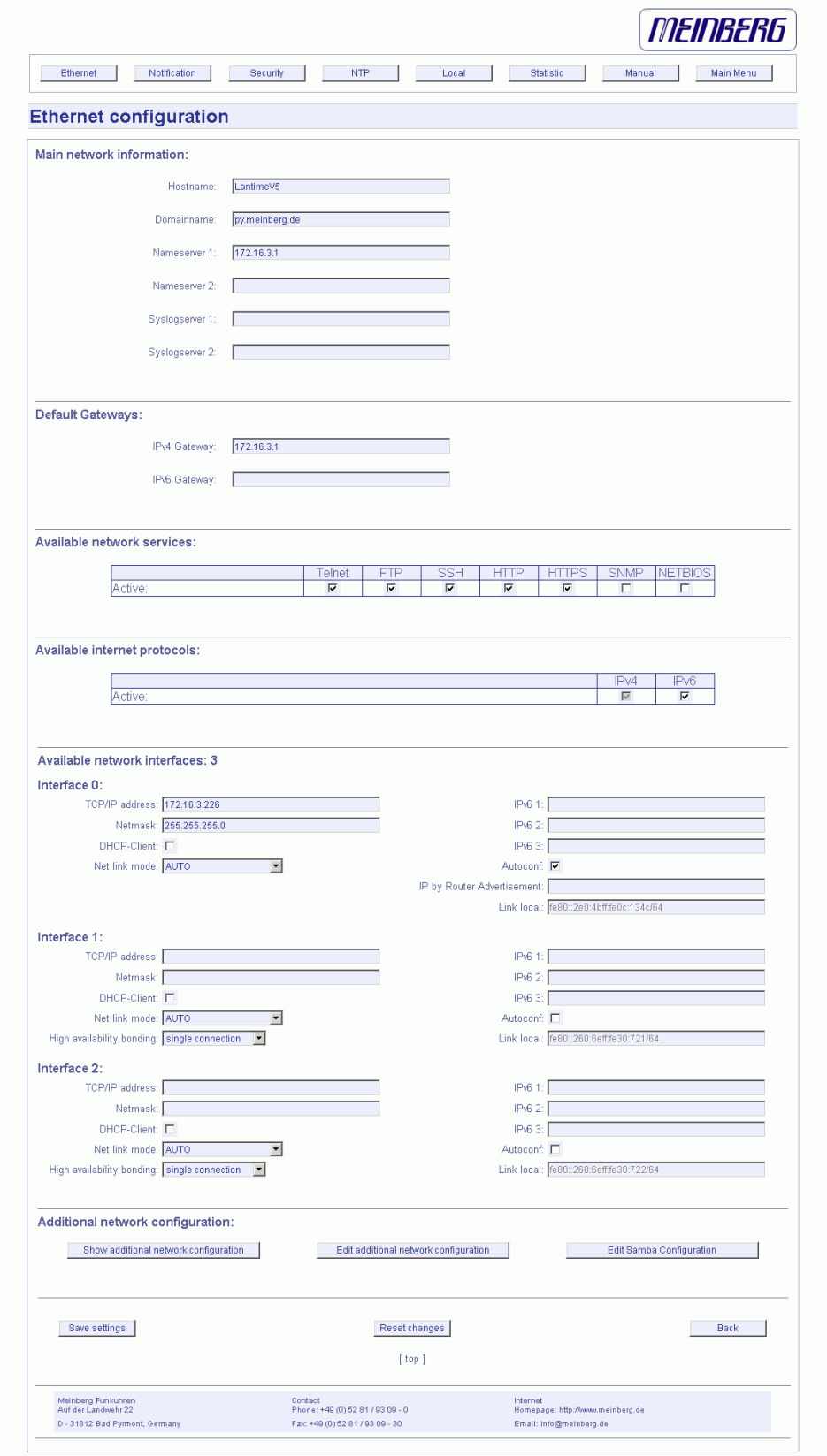
The start page gives a short overview of the most important configuration parameters and the runtime statistics of the unit. In the upper left corner you can read which LANTIME model and which version of the LANTIME software you are using. This LANTIME software version is a head version number describing the base system and important subsystems. Below the version you will find the actual hostname and domain of your LANTIME unit, the IPv4 and IPv6 network address of the first network interface and on the right side the serial number, the uptime of the system (time since last boot) and the notification status.

In the second section the actual status of the GPS reference clock and the NTP subsystem is shown, additional information about the GPS receiver are also found here. This includes the number of satellites in view and the number of good satellites in view.

The third section shows the last messages of the system, with a timestamp added. The newest messages are on top of the list. This is the content of the file / var/log/messages, which is created after every start of the system (and is lost after a power off or reboot).

By using the buttons in the lower part of the screen, you can reach a number of configuration pages, which are described below.

Configuration: Ethernet



In the network configuration all parameters related to the network interfaces can be changed. In the first section you can change the hostname and domain name. You can also specify two nameserver and two SYSLOG server. In the nameserver and syslog server fields you may enter an IPv4 or IPv6 address (the syslog servers can be specified as a hostname, too).

All information written to the LANTIME SYSLOG (/var/log/messages) can be forwarded to one or two remote SYSLOG servers. The SYSLOG daemon of this remote SYSLOG needs to be configured to allow remote systems to create entries. A Linux SYSLOD can be told to do so by using the command “syslogd –r” when starting the daemon.

If you enter nothing in the SYSLOG server fields or specify 0.0.0.0 as the SYSLOG servers addresses, the remote SYSLOG service is not used on your LANTIME.

Please be aware of the fact that all SYSLOG entries of the timeserver are stored in / var/log/messages and will be deleted when you power off or reboot the timeserver. A daily CRON job is checking for the size of the LANTIME SYSLOG and deletes it automatically, if the log size is exceeding a certain limit.

By specifying one or two remote SYSLOG servers, you can preserve the SYSLOG information even when you need to reboot or switch off the LANTIME.

In the second section the possible network protocols and access methods can be configured. You can enable/disable TELNET, FTP, SSH, HTTP, HTTPS, SNMP and NETBIOS by checking/unchecking the appropriate check boxes. After you saved your settings with the “Save” button, all these subsystems are stopped and eventually restarted (only if they are enabled, of course).

The third section allows you to select the IP protocol version 6. In this version the IPv4 protocol is mandatory and cannot be disabled, but as a workaround a standalone IPv6 mode can be achieved by entering an IPv4 address “0.0.0.0” and disabling the DHCP client option for every network interface of your LANTIME. By doing so, you ensure that the timeserver cannot be reached with IPv4. Please note that TELNET, FTP and NETBIOS cannot be used over IPv6 in this version. It is no problem to use IPv4 and IPv6 in a mixed mode environment on your LANTIME.

Network interface specific configuration

The interface specific parameters can be found in the Interface section. If your LANTIME is equipped with only one network interface, you will find only one sub section (Interface 0). Otherwise you see a sub section for each installed Ethernet port.

Here, the parameters for the network port can be changed. In the upper section of the page you can enter the IPv4 parameters, the lower part gives you access to the IPv6 parameters of the interface.

IPv4 addresses and DHCP

IPv4 addresses are built of 32 bits, which are grouped in four octets, each containing 8 bits. You can specify an IP address in this mask by entering four decimal numbers, separated by a point ".".

Example: 192.168.10.2

Additionally you can specify the IPv4 netmask and your default gateway address.

Please contact your network administrator, who can provide you with the settings suitable for your specific network.

If there is a DHCP (Dynamic Host Configuration Protocol) server available in your network, the LANTIME system can obtain its IPv4 settings automatically from this server. If you want to use this feature (again, you should ask your network administrator whether this is applicable in your network), you can change the DHCP Client parameter to "ENABLED". In order to activate the DHCP client functionality, you can also enter the IP address "000.000.000.000" in the LCD menu by using the front panel buttons of the LANTIME. Using DHCP is the default factory setting.

The MAC address of your timeserver can be read in the LCD menu by pressing the NEXT button on the front panel twice. This value is often needed by the network administrator when setting up the DHCP parameters for your LANTIME at the DHCP server.

If the DHCP client has been activated, the automatically obtained parameters are shown in the appropriate fields (IPv4 address, netmask, gateway).

IPv6 addresses and autoconf

You can specify up to three IPv6 addresses for your LANTIME timeserver. Additionally you can switch off the IPv6 autoconf feature. IPv6 addresses are 128 bits in length and written as a chain of 16bit numbers in hexadecimal notation, separated with colons. A sequence of zeros can be substituted with "::" once.

```
Examples:
  "::"  is the address, which simply consists of zeros
  "::1" is the address, which only consists of zeros and a 1 as the
last bit. This is the so-called host local address of IPv6 and is
the equivalent to 127.0.0.1 in the IPv4 world
  "fe80::0211:22FF:FE33:4455"
       is a typical so-called link local address, because it uses
the “fe80” prefix.
In URLs the colon interferes with the port section, therefore IPv6-
IP-addresses are written in brackets in an URL.
 ("http://[1080::8:800:200C:417A]:80/" ; the last “:80” simply sets
the port to 80, the default http port)
```

If you enabled the IPv6 protocol, the LANTIME always gets a link local address in the format “fe80:: …”, which is based upon the MAC address of the interface. If a IPv6 router advertiser is available in your network and if you enabled the IPv6 autoconf feature, your LANTIME will be set up with up to three link global addresses automatically.

The last parameter in this sub section is “Netlink mode”. This controls the port speed and duplex mode of the selected Ethernet port. Under normal circumstances, you should leave the default setting (“autosensing”) untouched, until your network administrator tells you to change it.

High Availability Bonding

The standard moniker for this technology is IEEE 802.3ad, although it is known by the common names of trunking, port trunking, teaming and link aggregation. The conventional use of bonding under Linux is an implementation of this link aggregation.

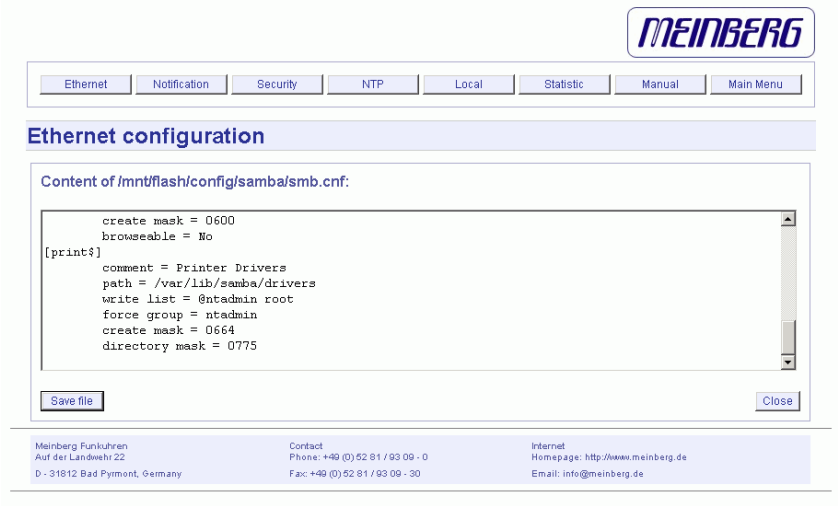
A separate use of the same driver allows the kernel to present a single logical interface for two physical links to two separate switches. Only one link is used at any given time. By using media independent interface signal failure to detect when a switch or link becomes unusable, the kernel can, transparently to user space and application layer services, fail to the backup physical connection. Though not common, the failure of switches, network interfaces, and cables can cause outages. As a component of high availability planning, these bonding techniques can help reduce the number of single points of failure.

At this menu point it is possible to add each Ethernet port to a bonding group. At least two physical Ethernet ports must be linked to one bonding group to activate this feature. The first Ethernet Port in one bonding group provides the IP-Address and the net mask of this new virtual device.

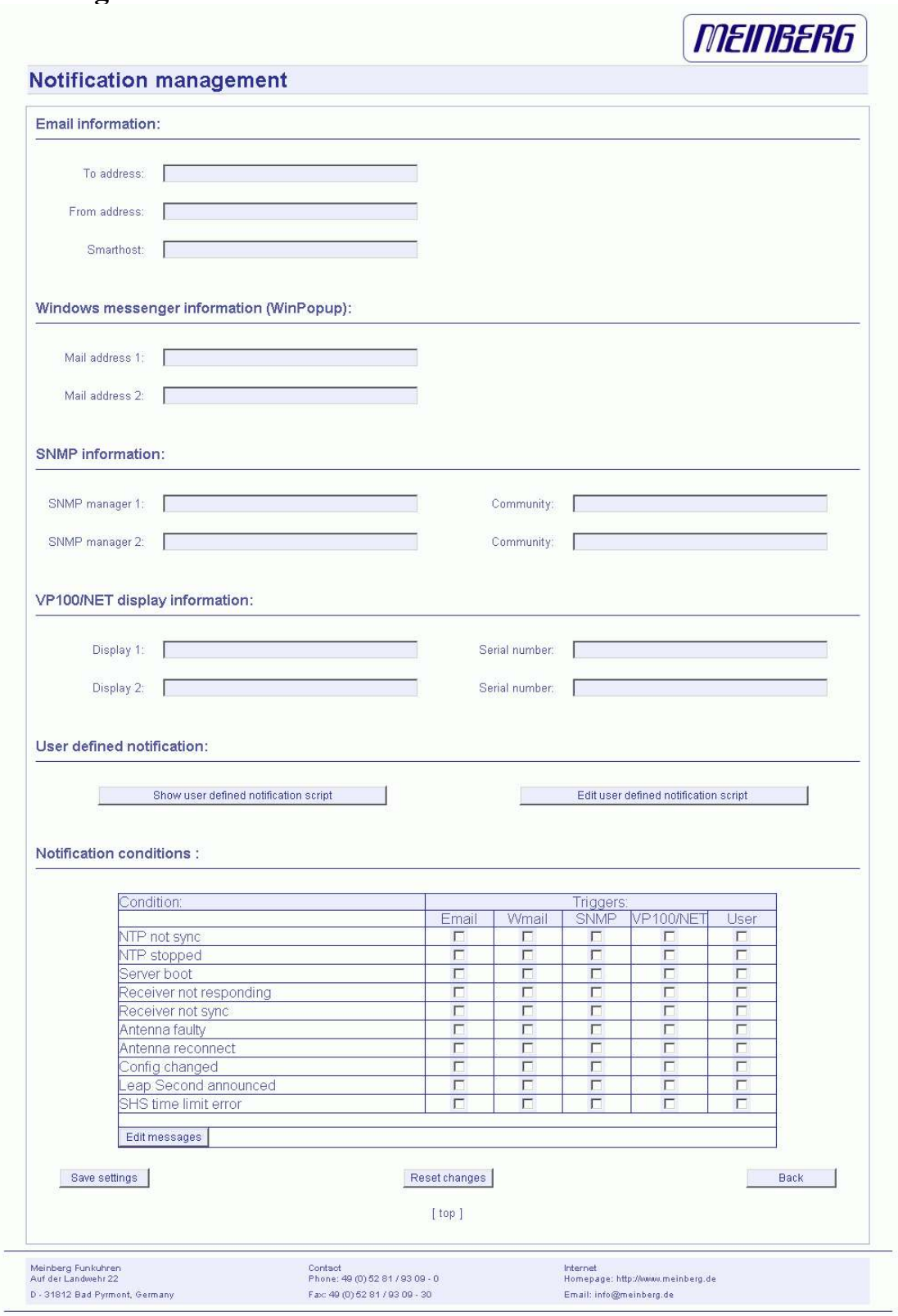
Additional Network Configuration

You can configure additional network parameter like special network routes or alias definitions. For this you will edit a script file which will be activated every time after the network configuration will run.

Also the Samba Configuration from „/etc/samba/smb.conf“ can be edited:



Configuration: Notification



Alarm events

On this page you can set up different notification types for a number of events. This is an important feature because of the nature of a timeserver: running unobserved in the background. If an error or problem occurs, the timeserver is able to notify an administrator by using a number of different notification types.

The LANTIME timeserver offers four different ways of informing the administrator or a responsible person about nine different events: EMAIL sends an e-mail message to a specified e-mail account, SNMP-TRAP sends a SNMP trap to one or two SNMP trap receivers, WINDOWS POPUP MESSAGE sends a winpopup message to one or two different computers and DISPLAY shows the alarm message on a wall mount display model VP100/NET, which is an optional accessory you can obtain for your LANTIME.

Here is a table of supported events:

"NTP not sync"	NTP is not synchronised to a reference time source
"NTP stopped"	NTP has been stopped (mostly when very large time offsets occur)
"Server boot"	System has been restarted
"Receiver not responding"	No contact to the internal GPS receiver
"Receiver not sync"	Internal GPS clock is not synchronised to GPS time
"Antenna faulty"	GPS antenna disconnected
"Antenna reconnect"	GPS antenna reconnected
"Config changed"	Configuration was changed by a user
„Leap second announced“	A leap second has been announced
“TIME LIMIT ERROR”	SHS detected time difference

Every event can use a combination of those four notification types, of course you can disable notification for an event (by just disabling all notification types for this event). The configuration of the four notification types can be changed in the upper section of the page, you can control which notification is used for which event in the lower part of the page.

E-mail messages

You can specify the e-mail address which is used as the senders address of the notification e-mail (From: address), the e-mail address of the receiver (To: address) and a SMTP smarthost, that is a mail server forwarding your mail to the receiver’s mail server. If your LANTIME system is connected to the internet, it can deliver those e-mails itself by directly connecting to the receivers mail server.

These settings cannot be altered with the LC display buttons of the front panel. Please note the following:

- The LANTIME hostname and domain name should be known to the SMTP smarthost
- A valid nameserver entry is needed
- The domain part of the “From:” address has to be valid

Windows Popup Messages

Most Microsoft Windows operating systems provide you with a local notification tool. You can send messages via the special Windows protocol in your local network. It is not necessary to enable the NETBIOS protocol of the LANTIME in order to use this notification. On the Windows client side it is necessary to activate the “Microsoft Client for Windows” in the network configuration.

You can enter the Windows computer name of up to two Windows PCs in the appropriate fields. Every message contains a time stamp and a plain text message:

SNMP-TRAP messages

Up to two SNMP trap receiver hosts can be configured in this subsection, you may use IPv4 or IPv6 addresses or specify a hostname. Additionally you have to enter a valid SNMP community string for your trap receiving community. These can be unrelated to the SNMP community strings used for status monitoring and configuration access (see SNMP configuration on the “Security” page).

VP100/NET wall mount display

The VP100/NET wall display is an optional accessory for the LANTIME timeserver, it has an own integrated Ethernet port (10/100 Mbit) and a SNTP client. The time for the display can be received from any NTP server using the SNTP protocol (like your LANTIME), additionally the display is capable of showing text messages, which are sent by using a special utility. The LANTIME can send an alarm message to one or two VP100/NET displays over the network, whenever an event occurs for which you selected the display notification type. If this happens, a scrolling alarm message is shown three times on the display.

Just enter the display’s IP address and its serial number (this is used for authorisation), which can be found by pressing the SET button on the back of the display four times. The serial number consists of 8 characters, representing four bytes in hexadecimal notation.

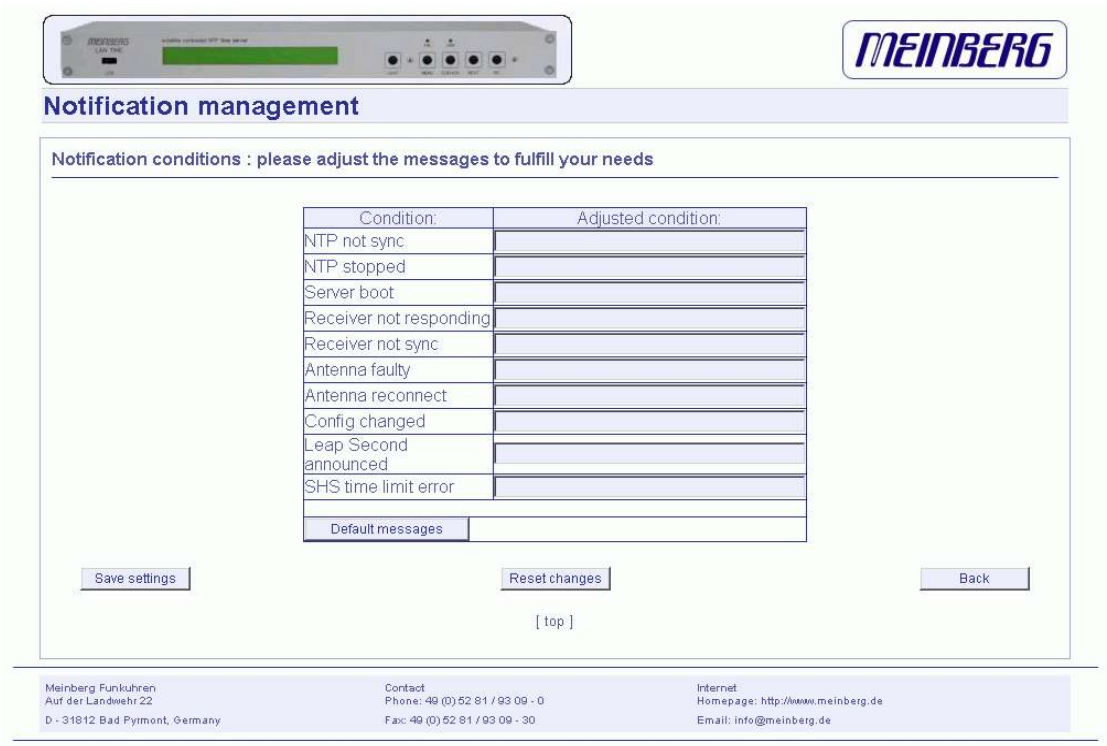
If you want to use the display for other purposes, you can send text messages to it by using our command line tool *send2display*, which can be found on the LANTIME. This allows you to use the display by CRON jobs or your own shell scripts etc. If you run the tool without parameters, a short usage screen is shown, explaining all parameters it may understand. See appendix for a printout of this usage screen.

User defined Alarm scripts

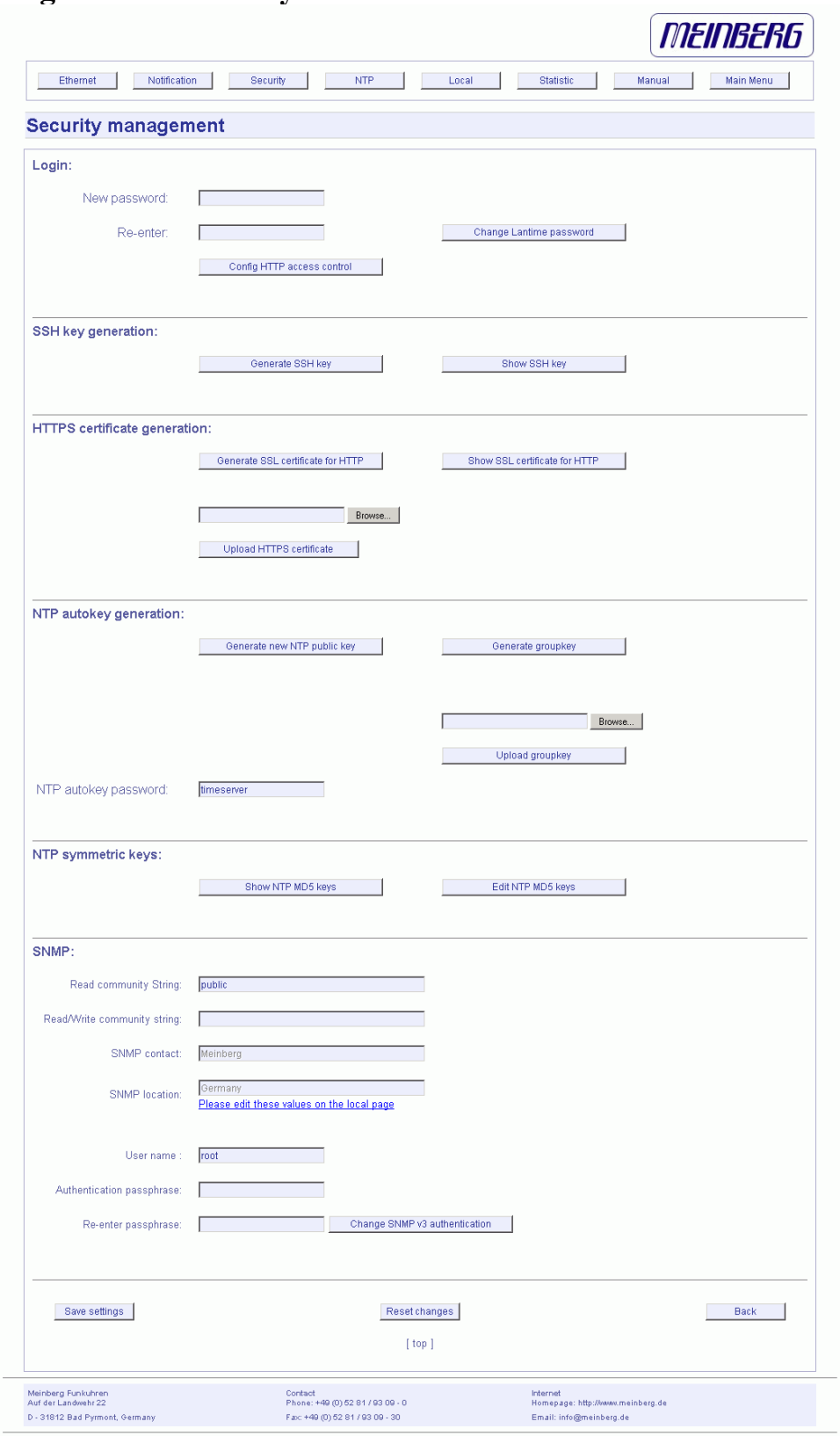
You can define your own alarm script for every event by using the “Edit user defined notification script”. This script will be called automatically if one of the selected events occurs. This user alarm script will be stored on the Flash-Disk at “/mnt/flash/user_defined_notification”. This script will be called with index and the alarm message as text. The index value of the test message is 0.

Alarm messages

You can change the alarm message text for every event by using the „Edit Messages“ button, the messages are stored in a file /mnt/flash/notification_messages on the flash disk of your timeserver.



Configuration: Security



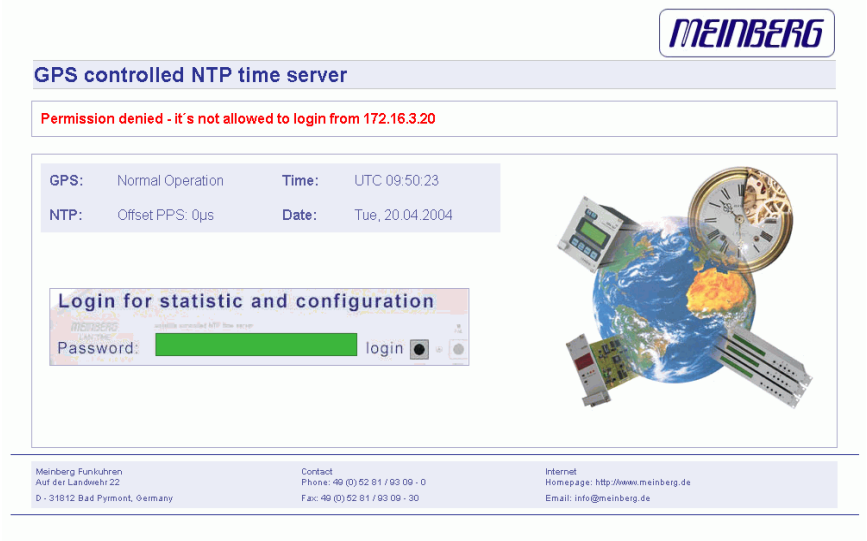
Password

On the ““Security““ page you can manage all security relevant parameters for your timeserver. In the first section “Login” the administration password can be changed, which is used for SSH, TELNET, FTP, HTTP and HTTPS access. The password is stored encrypted on the internal flash disk and can only be reset to the default value “timeserver” by a “factory reset”, changing all settings back to the factory defaults. Please refer to the LCD configuration section in this manual.

HTTP Access Control

With this function you can restrict the access to the web interface and allow only a few hosts to login. Only the hosts you entered in the list are able to login to the HTTP/HTTPS server of your LANTIME.

If a non-allowed host tries to login, the following message appears:



SSH Secure Shell Login

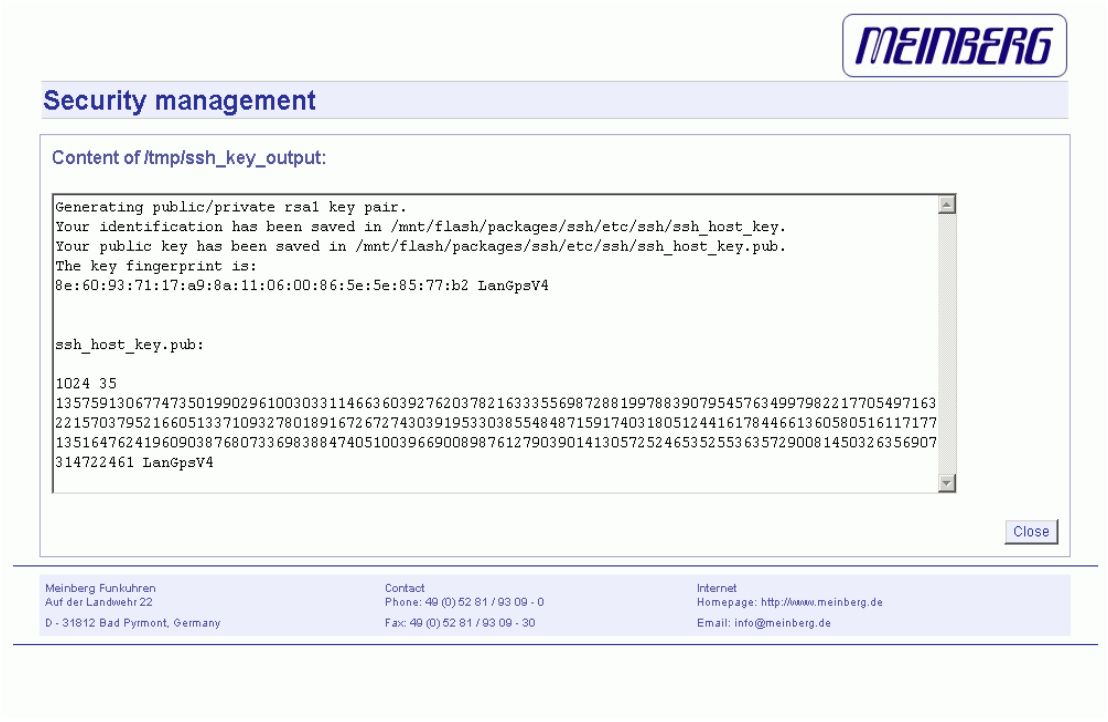
The SSH provides you with a secure shell access to your timeserver. The connection is encrypted, so no readable passwords are transmitted over your network. The actual LANTIME version supports SSH1 and SSH2 over IPv4 and IPv6. In order to use this feature, you have to enable the SSHD subsystem and a security key has to be generated on the timeserver by using the “Generate SSH key” button. Afterwards, a SSH client can connect to the timeserver and opens a secure shell:

ssh root @ 192.168.16.111

The first time you connect to a SSH server with an unknown certificate, you have to accept the certificate, afterwards you are prompted for your password (which is configured in the first section of this page).

If you generate a new SSH key, you can copy and paste it into your SSH client configuration afterwards in order to allow you to login without being prompted for a password. We strongly recommend to use SSH for shell access, TELNET is a very insecure protocol (transmitting passwords in plain text over your network).

If you enabled SSH, your LANTIME automatically is able to use secure file transfer with SCP or SFTP protocol. The usage of FTP as a file transfer protocol is as insecure as using TELNET for shell access.

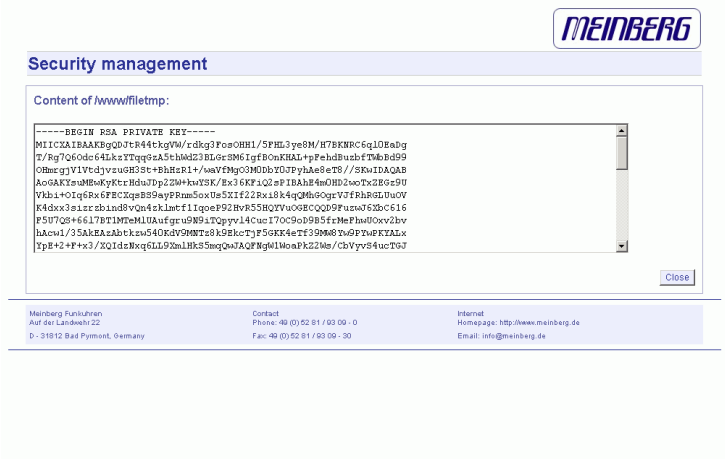


Generate SSL Certificate for HTTPS

HTTPS is the standard for encrypted transmission of data between web browser and web server. It relies on X.509 certificates and asymmetric crypto procedures. The timeserver uses these certificates to authenticate itself to the client (web browser). The first time a web browser connects to the HTTPS web server of your LANTIME, you are asked to accept the certificate of the web server. To make sure that you are talking to your known timeserver, check the certificate and accept it, if it matches the one stored on the LANTIME. All further connections are comparing the certificate with this one, which is saved in your web browser configuration. Afterwards you are prompted to verify the certificate only when it changed.

By using the button ““Generate SSL certificate for HTTP““ you can create a new certificate. Please enter your organisation, name, mail address and the location in the upcoming form and press “Generate SSL certificate” to finally generate it.

After the successful generation of the certificate, it is shown to you:



It is also possible to upload your own HTTPS certification. If you upload a non valid certification HTTPS will not work.

NTP keys and certificates

The fourth and fifth section of the “Security“ page allow you to create the needed crypto keys and certificates for secure NTP operation (please see NTP authentication below).

The function “Generate new NTP public key“ is creating a new self-signed certificate for the timeserver, which is automatically marked as “trusted“.

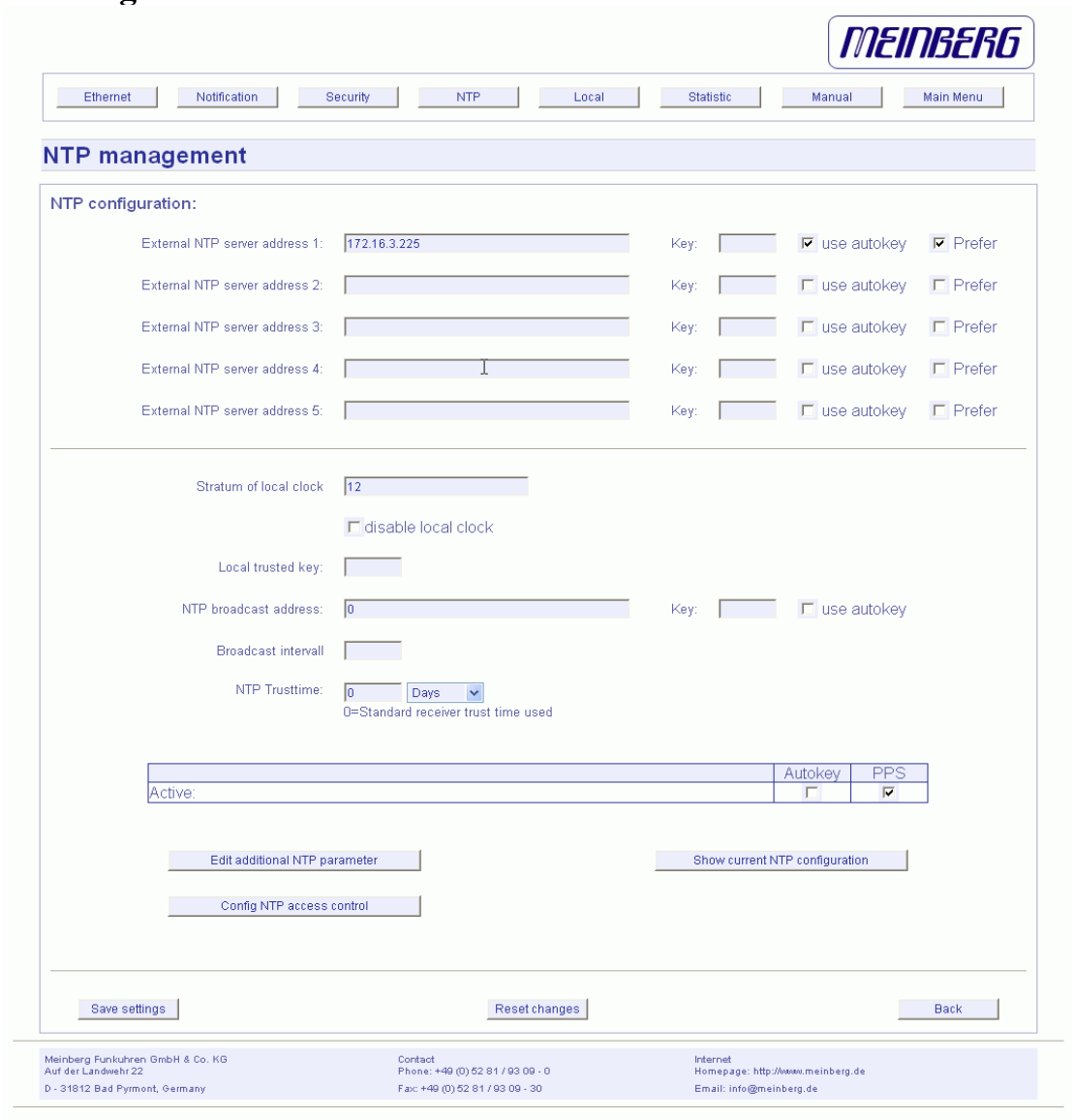
Important note: This certificate is depending on the hostname of your LANTIME, it is mandatory to re-create the certificate after changing the hostname. The certificates are build with the internal command “ntp-keygen -T” (ntp-keygen is part of the installed NTP suite). Your LANTIME is using the /etc/ntp/ directory for storing its private and public keys (this is called the “keysdir”). Please refer to the chapter “NTP Autokey” for further information (below).

The two options “Show NTP MD5 key“ and “Edit NTP MD5 keys“ allow you to manage the symmetric keys used by NTP. More about that can be found in the chapter about symmetric keys (below).

SNMP Parameter

In the last Section all parameters for SNMP can be configured. More information you can find later in this manual.

Configuration: NTP



The NTP configuration page is used to set up the additional NTP parameters needed for a more specific configuration of the NTP subsystem.

The default configuration of the timeserver consists of a local clock, which represents the hardware clock of your LANTIME system and the GPS reference clock. The local clock is only chosen as the NTP time reference after the GPS clock lost its synchronisation. The stratum level of this local clock is set to 12, this ensures that clients recognise the switchover to the local clock and are able to eventually take further actions. The local clock can be disabled if the timeserver should not answer any more when the reference clock is out of order.

Because the reference clock is internally connected to the LANTIME system by using a serial connection, the accuracy using this way of synchronisation is around 1 ms. The high accuracy of the LANTIME timeserver (around 10 microseconds) is available by using the ATOM driver of the NTP subsystem, which is directly

interpreting the PPS (pulse per second) of the GPS reference clock. The default configuration looks like this:

```
#  ***  lantime  ***
# NTP.CONF for GPS167 with UNI ERLANGEN

server  127.127.1.0                 # local clock
fudge   127.127.1.0 stratum 12      # local stratum

server  127.127.8.0 mode 135 prefer  # GPS167 UNI Erlangen PPS
fudge   127.127.8.0 time1 0.0042     # relative to PPS
server  127.127.22.0                 # ATOM (PPS)
fudge   127.127.22.0 flag3 1         # enable PPS API
enable stats
statsdir /var/log/
statistics loopstats
driftfile /etc/ntp.drift

# Edit /mnt/flash/ntpconf.add to add additional NTP parameters
```

By using the NTP configuration page, a number of additional parameters can be added to this default ntp.conf. In the upper section up to five external NTP servers can be set up to provide a high grade of redundancy for the internal reference clock. For each of these external NTP servers the AUTOKEY or symmetric key feature of NTP can be used to ensure the authentic of these time sources. The “Prefer“ flag can be set for each external server. The internal refclock has set this flag by default. The “Prefer“ flag is usefull if one of the refclocks are not available or out of sync.

The field “Stratum of local clock” is used to change the stratum level of the local clock (see above), default is 12.

The “Local trusted key“ field holds a list of all trusted symmetric keys (comma or space separated), which have to be accepted by the NTPD of your LANTIME.

If you want to use your LANTIME timeserver to send NTP broadcast packets to your network, you have to enter a valid broadcast address in “NTP broadcast address”. If you want to use IPv6 multicast mode, you have to enter a valid IPv6 multicast address in this field. Please note that NTP Version 4, which is used by the LANTIME timeserver, only permits authenticated broadcast mode. Therefore you have to set up the AUTOKEY feature or a symmetric key if you use a NTPv4 client and want to broadcast / multicast your time. A sample configuration of the NTP client for broadcast with symmetric keys looks like:

```
broadcastclient yes
broadcastdelay 0.05    # depends on your network
keys /etc/ntp/keys
trustedkey 6 15
requestkey 15
controlkey 15
```

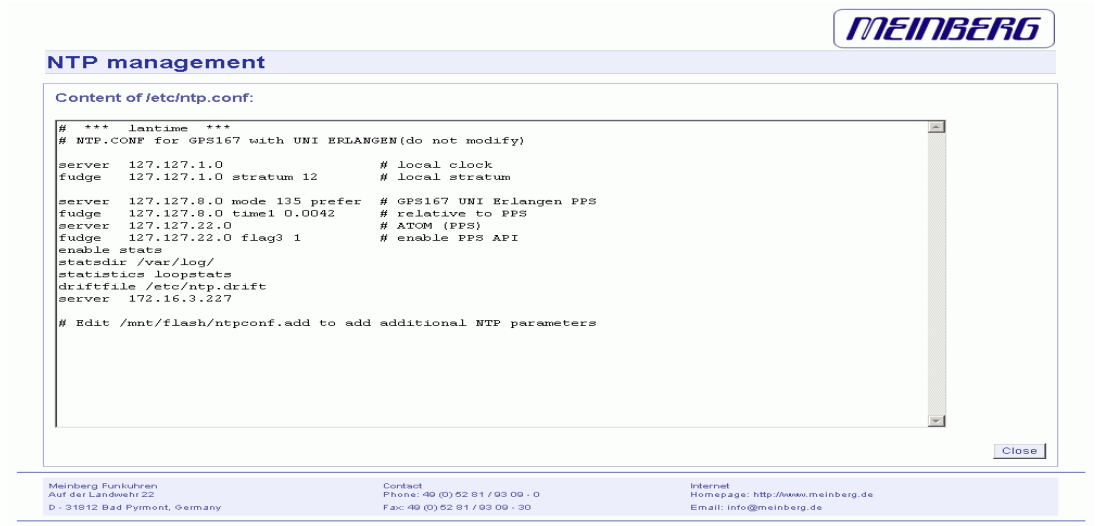
In the next section you can enable the AUTOKEY feature for your LANTIME timeserver and the PPS mode (which is enabled in default settings), see above for a description.

The NTP Trusttime will specify the time how long the NTP will trust the reference time if this is not synchronized (free running). This time will be set in seconds or minutes or hours. The value 0 will be select the default value for the specific reference clock. The default values are:

Lantime/GPS : 96 h
Lantime/PZF : 0,5 h
Lantime/RDT: 0,5 h
Lantime/NDT: 96 h

After each restart and after any change of configuration a new /etc/ntp.conf file is generated by the LANTIME software. Any changes you made to this file are lost. In order to use your custom ntp.conf (your LANTIME is using a standard version of the NTP software suite, therefore all configuration parameters of the NTP software are fully supported), you have to edit the file /mnt/flash/ntpconf.add, which is automatically appended to the /etc/ntp.conf file generated at boot time or when reloading configuration after a change. You can edit this file by using the button "Edit additional NTP parameter".

By choosing „Show current NTP configuration", you can review the actual state of the /etc/ntp.conf file. The file cannot be changed on this page, see above for a description why editing this file is not reasonable.



NTP Authentication

NTP version 2 and version 3 support an authentication method using symmetric keys. If a packet is sent by the NTPD while using this authentication mode, every packet is provided with a 32 bit key ID and a cryptographic 64/128 bit checksum of the packet. This checksum is built with MD5 or DES, both algorithms offer a sufficient protection against manipulation of data.

Please note that the distribution of DES in the United States of America and Canada is subject to restrictions, while MD5 is not affected by that. With any of these algorithms the receiving NTP clients validate the checksum. Both parties (server and client) need to have the same crypto key with the same key ID.

In the authentication mode a party is marked "untrusted" and not suitable for synchronisation, whenever unauthorised packets or authorised packets with a wrong key are used. Please note that a server may recognise a lot of keys but uses only a few of them. This allows a timeserver to serve a client, who is demanding an authenticated time information, without "trusting" the client.

Some additional parameters are used to specify the key IDs used for validating the authentic of each partner. The configuration file /etc/ntp.conf of a server using this authentication mode may look like this:

```
# peer configuration for 128.100.100.7
# (expected to operate at stratum 2)
# fully authenticated this time
peer 128.100.49.105 key 22  # suzuki.ccie.utoronto.ca
peer 128.8.10.1 key 4       # umd1.umd.edu
peer 192.35.82.50 key 6         # lilben.tn.cornell.edu
keys /mnt/flash/ntp.keys        # path for key file
trustedkey 1 2 14 15        # define trusted keys
requestkey 15                   # key (mode 6) for accessing server variables
controlkey 15                   # key (mode 7) for accessing server variables
```

The "keys" parameter indicates the location of the file, in which all symmetric keys are stored. The "trustedkey" line identifies all key IDs, which have to be considered "trusted" or "uncompromised". All other keys defined in the keyfile are considered "compromised". This allows to re-use already owned keys by just adding their respective key ID to the "trustedkey" parameter. If a key needs to be "switched off", it can be removed from this line without actually removing it from the system. This ensures an easy way to re-activate it later without actually transferring the key again.

The line „requestkey 15" declares the key ID for mode-6 control messages (as described in RFC-1305), which are used by the ntpq utility for example. The "controlkey" parameter is specifying the key used for mode-7 private control messages, for example used by the ntpdc utility. These keys protect the ntpd variables against unauthorised modification.

The ntp.keys file mentioned above holds a list of all keys and their respective ID known by the server. This file should not be world-readable (only root should be able to look into this) and it may look like this:

```
# ntp keys file (ntp.keys)
1         N    29233E0461ECD6AE    # des key in NTP format
2         M    RIrop8KPPvQvYotM    # md5 key as an ASCII random string
14        M    sundial             # md5 key as an ASCII string
15        A    sundial             # des key as an ASCII string
# the following 3 keys are identical
10        A    SeCReT
10        N    d3e54352e5548080
10        S    a7cb86a4cba80101
```

The first column holds the key ID (used in the ntp.conf file), the second column defines the format of the key, which is following in column three. There are four different key formats: “A” means DES key with up to eight 7-bit ASCII characters, where each character is standing for a key octet (this is used by Unix passwords, too). “S” is a DES key written in hexadecimal notation, where the lowest bit (LSB) of each octet is used as the odd parity bit. If the key format is specified as “N”, it also consists of a hexadecimal string, but in NTP standard format by using the highest bit (HSB) of each octet used as the odd parity bit. A key defined as “M” is a MD5 key with up to 31 ASCII characters. The Lantime supports MD5 authentication only.

Please be aware of the following restrictions: No “#”, “\t” (tab), “\n” (newline) and “\0” (null) are allowed in a DES or MD5 ASCII key. The key ID 0 is reserved for special purposes and should not appear in the keys file.

NTP AUTOKEY

NTP Version 4 supports symmetric keys and additionally provides the so-called AUTOKEY feature. The authentic of received time at the NTP clients is sufficiently ensured by the symmetric key technique. In order to achieve a higher security, e.g. against so-called replay attacks, it is important to change the used crypto keys from time to time.

In networks with a lot of clients, this can lead to a logistic problem, because the server key has to be changed on every single client. To help the administrator to reduce this work (or even eliminate it completely), the NTP developers invented the AUTOKEY feature, which works with a combination of group keys and public keys. All NTP clients are able to verify the authentic of the time they received from the NTP servers of their own AUTOKEY group by using this AUTOKEY technique.

The AUTOKEY features works by creating so-called secure groups, in which NTP servers and clients are combined. There are three different kinds of members in such a group:

a) Trusted Host

One or more trusted NTP servers. In order to become a “trusted” server, a NTP server must own a self-signed certificate marked as “trusted”. It is good practice to operate the trusted hosts of a secure group at the lowest stratum level (of this group).

b) Host

One ore more NTP servers, which do not own a „trusted“ certificate, but only a self-signed certificate without this “trusted” mark.

c) Client

One ore more NTP client systems, which in contrast to the above mentioned servers do not provide accurate time to other systems in the secure group. They only receive time.

All members of this group (trusted hosts, hosts and clients) have to have the same group key. This group key is generated by a so-called trusted authority (TA) and has to be deployed manually to all members of the group by secure means (e.g. with the UNIX SCP command). The role of a TA can be fulfilled by one of the trusted hosts of the group, but an external TA can be used, too.

The used public keys can be periodically re-created (there are menu functions for this available in the web interface and also in the CLI setup program, see “Generate new NTP public key” in section “NTP Autokey” of the “Security Management” page) and then distributed automatically to all members of the secure group. The group key remains unchanged, therefore the manual update process for crypto keys for the secure group is eliminated.

A LANTIME can be a trusted authority / trusted host combination and also a “non-trusted” host in such a secure group.

To configure the LANTIME as a TA / trusted host, enable the AUTOKEY feature and initialise the group key via the HTTPS web interface (“Generate groupkey”) or CLI setup program. In order to create such a group key, a crypto password has to be used in order to encrypt / decrypt the certificate. This crypto password is shared between all group members and can be entered in the web interface and CLI setup program, too. After generating the group key, you have to distribute it to all members of your secure group (and setup these systems to use AUTOKEY, too). In the ntp.conf file of all group members you have to add the following lines (or change them, if they are already included):

```
crypto pw cryptosecret
keysdir /etc/ntp/
```

In the above example “cryptosecret“ is the crypto password, that has been used to create the group key and the public key. Please note that the crypto password is included as a plain text password in the ntp.conf, therefore this file should not be world-readable (only root should have read access to it).

On the clients, the server entries must be altered to enable the AUTOKEY feature for the connections to the NTP servers of the group. This looks like:

```
server time.meinberg.de autokey version 4
server time2.meinberg.de
```

You find the server time.meinberg.de which is using the AUTOKEY feature, while time2.meinberg.de is used without any authentic checks.

If you want to setup the LANTIME server as a trusted host, but need to use a different trusted authority, please create your own group key with this TA and include it with the web interface of your LANTIME (on page “Security Management” see section “NTP autokey” , function “Upload groupkey”).

If you want to setup the LANTIME as a “non-trusted” NTP server, you have to upload the group key of your secure group (“Security Management” / “NTP autokey” / “Upload groupkey”) and create your own, self-signed certificate (without marking it as “trusted”). Because every certificate which is creating by using the web interface and/or CLI setup is marked “trusted”, you have to execute the tool “ntp-keygen” manually on your LANTIME by using shell access (via SSH).

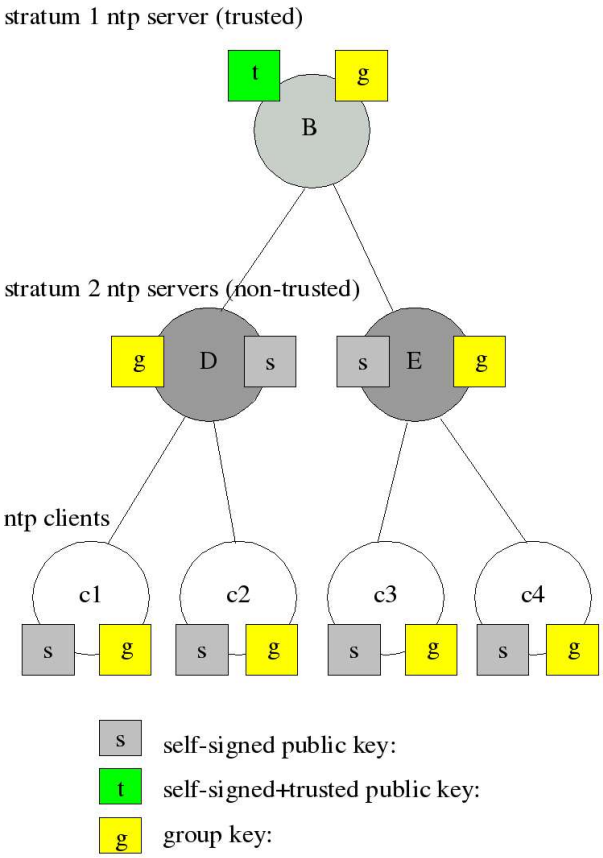
```
LantimeGpsV4:/etc/ntp # ntp-keygen -q cryptosecret
```

Here, too, “cryptosecret“ is the crypto password used in the ntp.conf entry. Then you have to copy the new ntpkeys to the flash disk with:

```
cp    /etc/ntp/ntpkey_*   /mnt/flash/config/ntp/uploaded_groupkeys
```

A detailed description about ntp-keygen can be found on the NTP website (http://www.ntp.org).

Example:



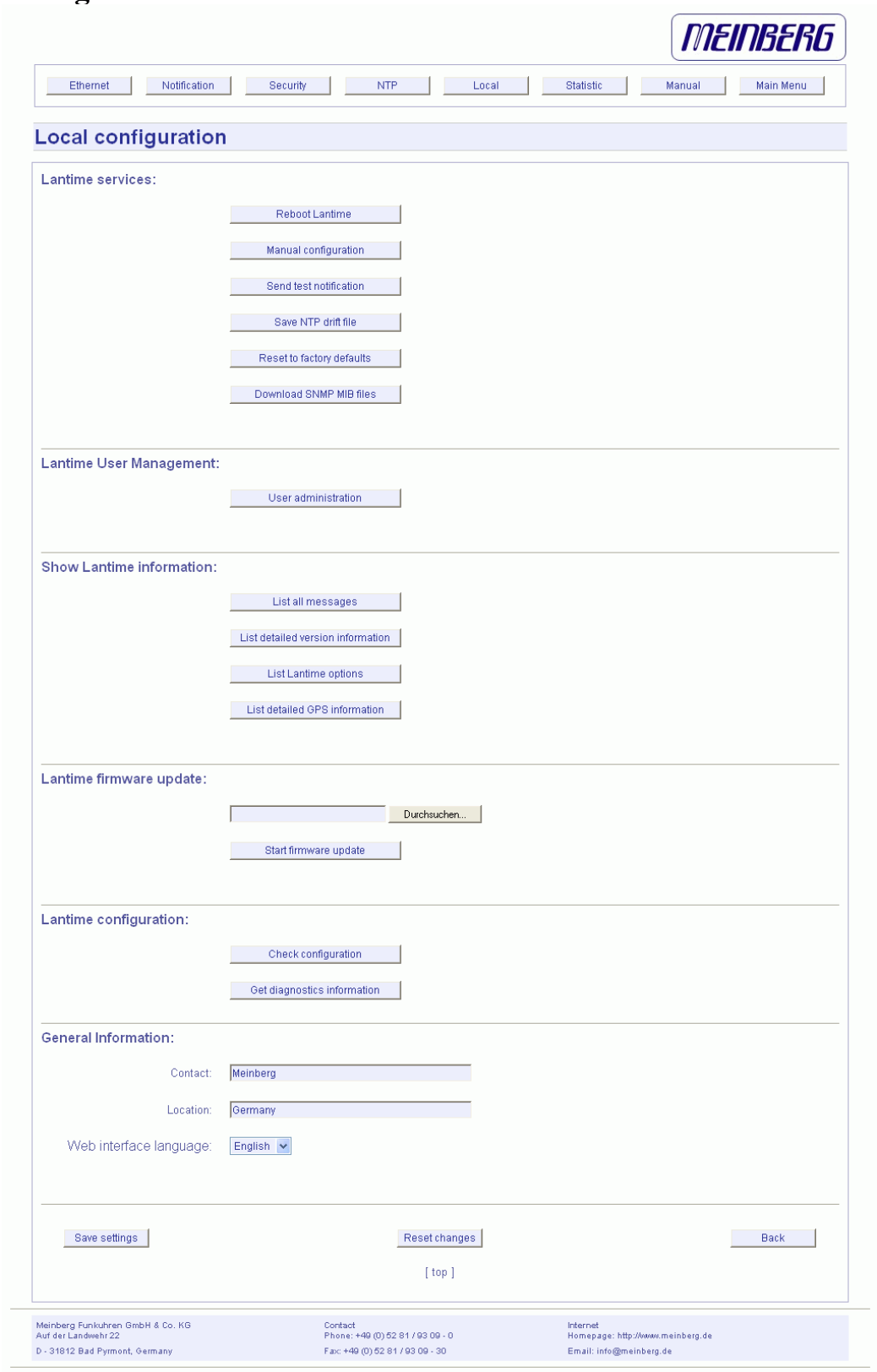
This autokey group is formed by one Stratum-1-server (B), two Stratum-2-servers (D and E) and a number of clients (in the diagram there are 4 clients shown, c1 – c4). B is the trusted host, he holds the group key and a self-signed certificate marked as "trusted".

D and E are NTP servers, which are "non-trusted" hosts of the group, they hold the group key and a self-signed certificate which lacks the "trusted" mark. The clients also hold the group key and a self-signed certificate.

In order to distribute new public keys to the whole group, the administrator only has to generate a new "t" key, which will be distributed automatically to the two hosts D and E. Because these two servers can now present a unbroken chain of certificates to a trusted host, they can be considered "trusted" by the clients as well.

More about the technical background and detailed processes of the AUTOKEY technique can be found at the official NTP website (http://www.ntp.org).

Configuration: Local



Administrative functions

In the first section there are several functions which may be used by the administrator. The button “Reboot Lantime” is restarting the system, the built-in reference clock is not affected by this, only the included computer system is rebooted, which may take up to 30 seconds.

With “Manual configuration“ you are able to change the main configuration by editing the configuration file by hand. After editing, press the “Save file” button to preserve your changes, afterwards you are asked if your changes should be activated by reloading the configuration (this results in reloading several subsystems like NTPD, HTTPD etc.).

The function “Send test notification“ is generating a test alarm message and sends it using all configured notify possibilities (e-mail, WMail, SNMP-Traps, wall mount display).

You can use the function “Save NTP drift file“ to copy the file /etc/ntp.drift to the internal flash disc of your LANTIME. NTP is using this file to have the parameters for compensation of the incorrectness of the system clock available directly after a restart. This results in a faster synchronisation process of the NTPD subsystem after a system restart. You should use this function only, if the NTPD has been synchronized to the internal reference clock for more than one day. This is done here at Meinberg directly before shipping the LANTIME unit to our customers, so you do not need to use this function during normal operation. It may be applicable after a software update.

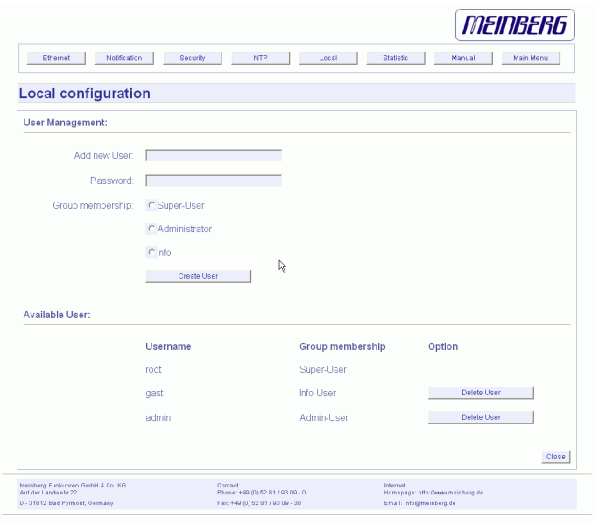
The function “Reset to factory defaults“ is setting all configuration parameters back to default values. The regular file /mnt/flash/global_configuration will be replaced with the file /mnt/flash/factory.conf, but first a copy of the configuration is saved under /mnt/flash/global_configuration.old for backup reasons. The default password “timeserver” is replacing the actual password, too. After using this function, all certificates should be recreated because of the change of the unit’s hostname.

Please be aware of the fact that the default configuration is not activated instantly. If you want to avoid setting up the IP address of your unit by locally configuring it on site with the buttons of the front panel (meaning physical presence of someone directly at the location of the LANTIME), you have to configure the network parameters of your LANTIME immediately after using the “reset to factory defaults” button. So, please proceed directly to the Ethernet page and check/change the IP address and the possible access subsystems (HTTP for example) of the LANTIME. The first usage of “Save settings” will load the configuration from flash into memory and activate it.

The point “Download SNMP MIB files“ can be used to download all Meinberg specific SNMP MIB files to your workstation. They can be distributed to all SNMP management clients afterwards.

User Management

For administration different users can be set up. 3 group memberships can be assigned to each user: the Super-User has all properties for administration. The group membership Administrator can change all parameters via the command line interface (CLI) configuartion tool and the WEB interface. The group Administrator cannot use any Linux command in a Telnet, SSH or Terminal session. If the Administrator will login, the setup program will be started directly. After termination of the Setup program this user will be logout automatically. The group membership “Info“ has the same properties like the Administrator but cannot change any parameter.



The menu “User Management“ allows you to set up different users with a password and the group membership. To change the properties of an user you have to delete the old user and set up a new one. The user “root“ cannot be deleted and has always the membership of Super-User. The password of the user “root“ can be set on the security page.

Administrative Information

The button “List all messages“ displays the SYSLOG of the LANTIME completely. In this log all subsystems create their entries, even the OS (upper case) kernel. The SYSLOG file /var/log/messages is only stored in the system’s ram disk, therefore it is lost after a power off or restart. If you configured an external SYSLOG server, all LANTIME syslog entries will be duplicated on this remote system and can be saved permanently this way.

Mar 15 13:35:17 LanGpsV4 ntpd[12948]: ntpd 4.2.0@1.1161-r Fri Mar 5 15:58:48 CET 2004 (3)
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: signal_no_reset: signal 13 had flags 4000000
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: precision = 3.000 usec
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: kernel time sync status 2040
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: frequency initialized 45.212 PPM from /etc/ntp.drift
Mar 15 13:38:36 LanGpsV4 lantime[417]: NTP sync to GPS
Mar 15 13:38:36 LanGpsV4 lantime[417]: NTP restart
Mar 15 13:45:36 LanGpsV4 proftpd[14061]: connect from 172.16.3.2 (172.16.3.2)
Mar 15 14:01:11 LanGpsV4 login[15711]: invalid password for `root' on `ttyp1' from `172.16.3.45'
Mar 15 14:01:17 LanGpsV4 login[15711]: root login on `ttyp1' from `172.16.3.45'

With “List detailed version information“ a number of version numbers (including LANTIME software, operating system and NTPD) are shown in a textbox.

The function “List LANTIME Options“ shows the hardware options installed in your LANTIME.This file contains hardware specific information which will be setup once only by the manufacturer.

Using the button “List detailed SHS information“ gives you the possibility to check detailed SHS status information. The first parameter indicates the time and date of the last update of the shown parameters. Next you find the GPS receiver status and the NTP status, followed by the GPS position data. The position uses the Latitude / Longitude / Altitude format. Latitude and Longitude are shown in degrees, minutes and seconds, Altitude is shown in meters above sea level.

The satellite section shows the numbers of satellites in view and the number of usable satellites (“good SV”). Additionally, the selected set of the four used satellites can be read.

The accuracy of the calculated receiver position and time deviation is dependent on the constellation of the four selected satellites. Using the position of the receiver and the satellites, a number of values can be calculated, which allow a rating of the selected constellation. These values are called “Dilutions of Precision (DOP)”.

PDOP is the abbreviation for “Position Dilution of Precision”, TDOP means “Time Dilution of Precision” and GDOP stands for “General Dilution of Precision”. Lower values are indicating better accuracy.

The next section “Satellite Info“ shows information about all the satellites, which are in view momentarily. The satellite ID, elevation, Azimuth and distance to the receiver reveal the position of the satellite in the sky. The Doppler shows whether the satellite is ascending (positive values) or descending (negative value).

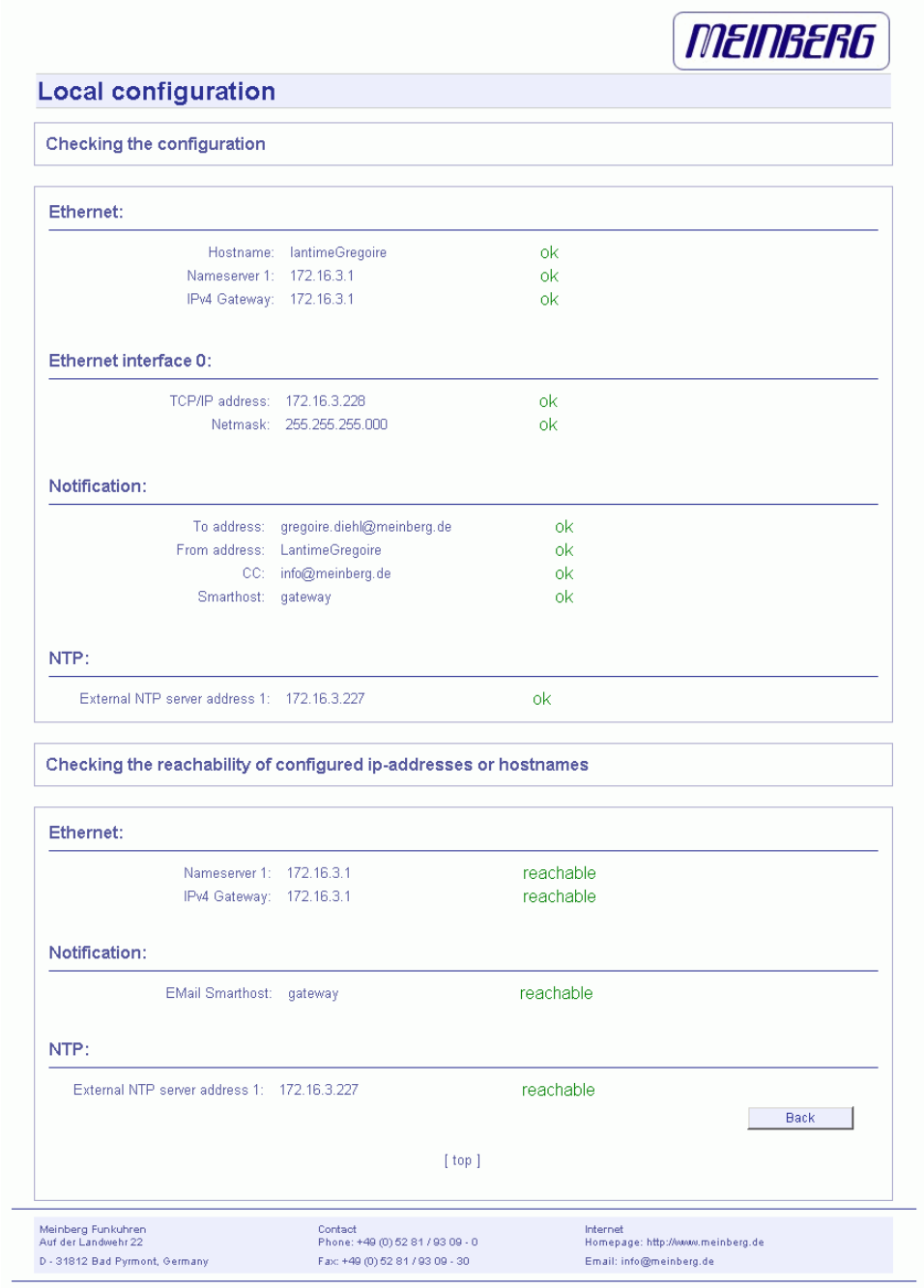
Software Update

If you need to update the software of your LANTIME, you need a special file from Meinberg, which can be uploaded to the LANTIME by first choosing the file on your local computer with the “Browse” button and then press “Start firmware update”.

The chosen file will be uploaded to the LANTIME, afterwards you are prompted to confirm the start of the update process. The scope of the update only depends on the chosen file.

Automatic configuration check

All parameters of the LANTIME can be checked for plausibility and all configured servers (e.g. SYSLOG servers, nameservers) are tested for reachability. All red coloured values should be reviewed by the administrator. Because all configured hostnames / IP addresses of the servers are processed during the reachabilitytests, the whole check process may take a while.



Get Diagnostics Information

The diagnostics information is a set of configuration parameters and files stored in a packed text file. With the help of these informations the technical support from Meinberg can reproduce the current state of your Lantime. It takes some time to collect all information from the Lantime. Do not press the button again while this process is running - some web browsers will cancel the job if you press the button twice. After that you can download the packed file “config.zip“ to your local computer. If you have any questions or problems with your Lantime please send this file “config.zip“ as an attachment of an e-mail to Meinberg support and describe your problem.

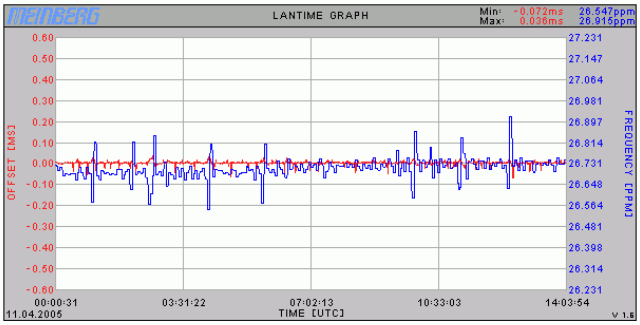
Web interface language

With the selector box “Web interface language” you can change the displayed language of the WEB interface.

Configuration: Statistics

Statistic

Statistic information:



Available logfiles: loopstats [Generate statistic]

merge loopstats

Lantime information:

S/N: n/a
GPS167 :4.13 S/N:10060740
NTP Version: 4.2.0a@1.1320-o Mon Feb 7 12:39:58 UTC 2005 (1)
Kernel Version: 2.4.20-NANO
Filesystem Version: n/a
ETHERNET HWaddr 00:E0:4B:06:B3:03
Uptime: 248 h
Mem free: 4392 kB
Disk free: 18723 kb

NTP access information:

remote address	port	local address	count	m	ver	code	avglen	first
127.0.0.1	2225	127.0.0.1	1597854	7	2	0	0	0
172.16.3.41	123	172.16.3.228	12624	3	4	0	64	10
172.16.3.13	123	172.16.3.228	2865	3	4	0	64	19
172.16.3.5	123	172.16.3.228	1793	3	4	0	1020	200
172.16.3.227	123	172.16.3.228	887	4	4	0	1024	322
172.16.3.48	123	172.16.3.228	363	3	4	0	979	595

Output of "ntpq -p":

remote	refid	st	t	when	poll	reach	delay	offset	jitter
LOCAL(0)	LOCAL(0)	12	l	25	64	377	0.000	0.000	0.004
+GENERIC(0)	.GPS.	0	l	56	64	377	0.000	0.000	0.004
oPPS(0)	.PPS.	0	l	52	64	377	0.000	-0.003	0.004
172.16.3.227	.INIT.	16	u	323	1024	0	0.000	0.000	4000.00

Output of "ntpq -c 'cv assID'":

assID=22365 status=0003 clk_okay, last_clk_fault,
device="Meinberg GPS16x receiver",
timecode="\x0211.04.05; 1; 14:04:46; +00:00; ; 51.9827N 9.2258E 180m\x03",
poll=13852, noreply=0, badformat=0, baddata=0, fudgetime1=4.400,
stratum=0, refid=GPS, flags=4,
refclock_ppstime="c605027d.ffffabbd Mon, Apr 11 2005 14:04:45.999",
refclock_time="c605027e.00000000 Mon, Apr 11 2005 14:04:46.000",
refclock_status="UTC DISPLAY; TIME CODE; PPS; POSITION; (LEAP INDICATION; PPS SIGNAL; POSITION)",
refclock_format="Meinberg GPS Extended",
refclock_states="*NOMINAL: 10d+08:09:24 (100.00%); FAULT: 00:00:03 (0.00%); running time: 10d+08:09:27"

[Back]

[top]

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Statistical Information

In the first section a graphical diagram shows the running synchronisation process. NTP is storing this statistical information in so-called “loopstats” files, which are used here to draw the curves. The red line is describing the offset between the internal reference clock (GPS) and the system clock. The blue line shows the frequency errors of the system time (in PPM, parts per million). In the upper right corner of the diagram you will find the measurement range of the red and blue curve. The last 24 hours are shown initially, but you are able to select the last 10 days (or fewer days, depending on the system uptime) or switch to a “merge loopstats” diagram, which shows all available days in one diagram (with a maximum of 10 days). All time data is using UTC.

The next sections shows version information for a number of subsystems, including the OS kernel version, NTPD version and the GPS firmware revision of the internal reference clock. Additionally, the MAC address of the first Ethernet interface can be found here. The “Mem free” value is indicating the free memory available to the system, the Disk free value is related to the ram disk of the LANTIME. Both system memory and ram disk have a total capacity of 32 MB (each). The Uptime parameter displays the time since the last boot process of the unit.

In the next section all NTP clients accessing the NTP server are listed. This list is maintained internally by NTPD, clients who did not access the NTPD for a longer period are automatically removed. This section can grow very long in large networks. There are no further information found about the parameters “code, avglen and first. The name resolution of the IP address in the first colume will take too much time; so its disabled.

After that a list of all actually refclocks of the internal NTP server will be shown.

remote	refid	st	t	when	poll	reach	delay	offset	jitter
LOCAL(0)	LOCAL(0)	3	l	36	64	3	0.00	0.000	7885
lantime	.GPS.	0	l	36	64	1	0.00	60.1	15875

with the following meaning:

- remote: list of all valid time servers (ntp.conf)
- refid: reference number
- st: actual stratum value (hierarchy level)
- when: last request (seconds)
- poll: period of requesting the time server (seconds)
- reach: octal notation of the successful requests, shifted left
- delay: delay of the network transmission (milliseconds)
- offset: difference between system time and reference time (milliseconds)
- jitter: variance of the offsets (milliseconds)

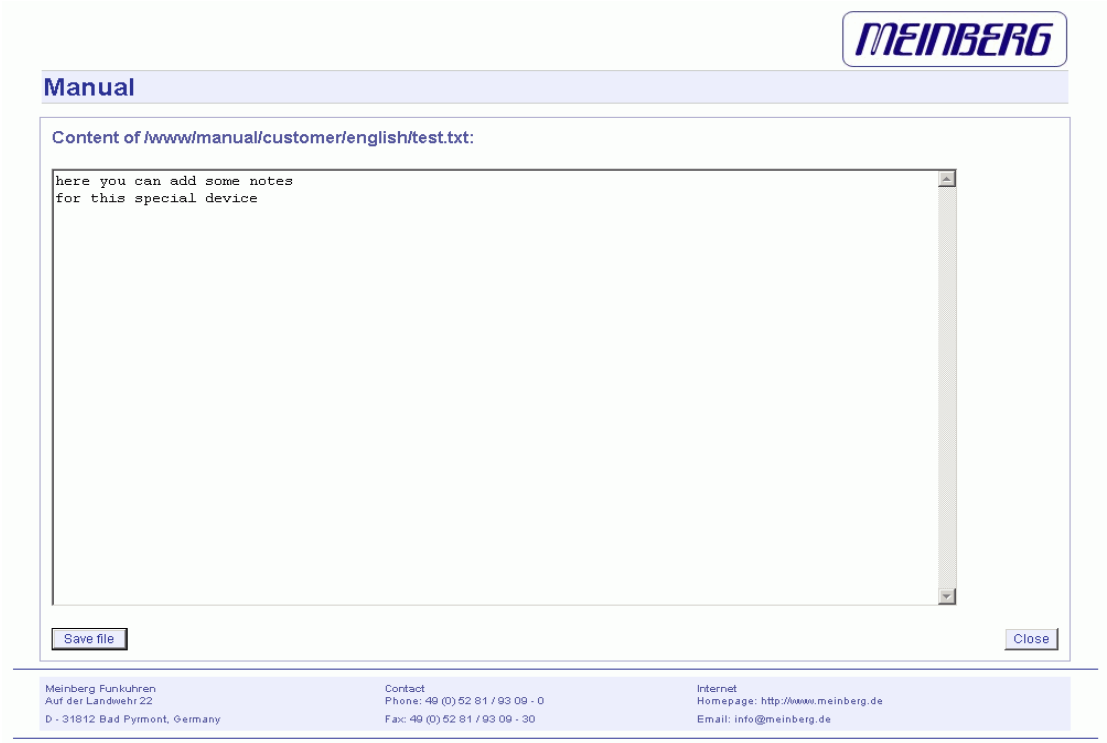
The last section will show some NTP specific informations about the refclock.

Configuration: Manual

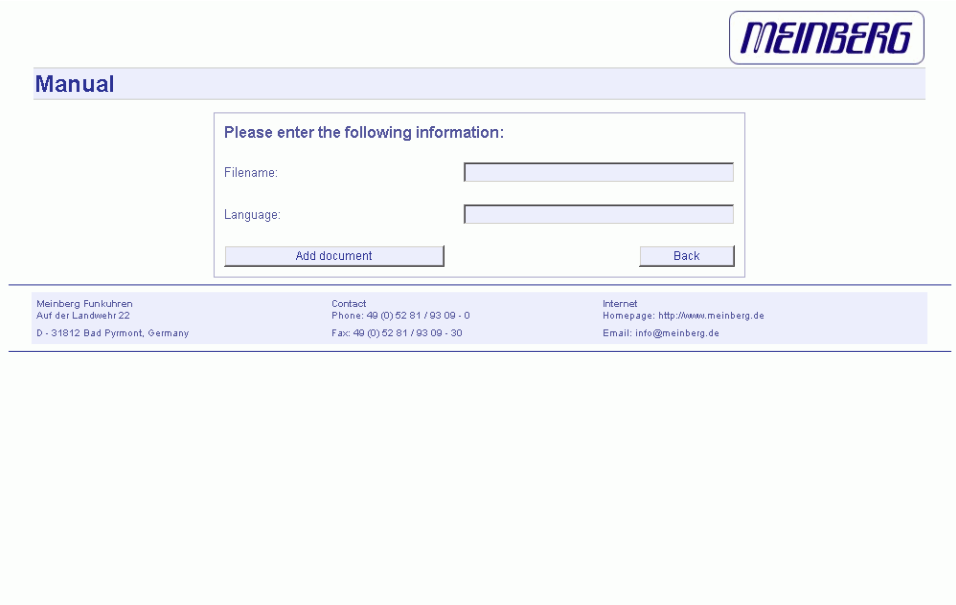
This page gives you access to the documents stored on your LANTIME, especially the manuals and your own notes. The two lists include filename, language, file type, date and size of the documents/notes.

The LANTIME documents can be downloaded from here in order to read / print them on your workstation.

The customer notes are a way of storing small pieces of information on your LANTIME, for example if you want to keep track of configuration changes and want to comment them, you can create a note called “config_changes” and show or edit it from here. If you want to get rid of one of your notes, you are able to delete it by choosing the appropriate button.

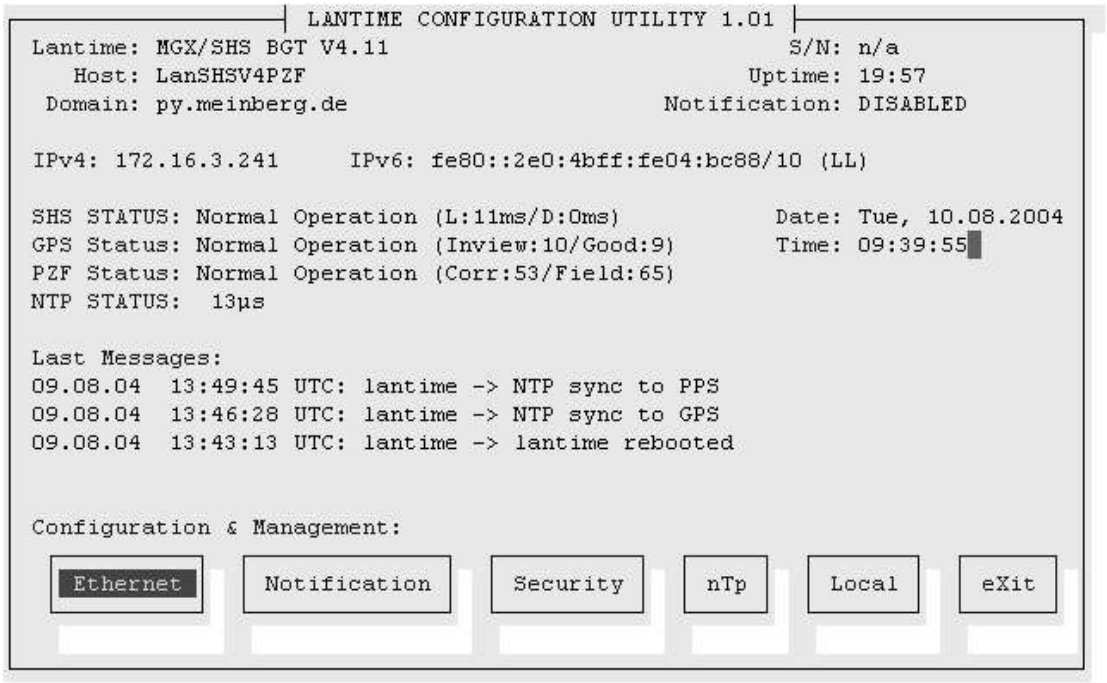


If you want to add a note (you can maintain more than one note on your LANTIME), after choosing the button “add note” you have to enter a filename (without a directory path, all notes are stored in a fixed directory on the flash disk of your LANTIME) and the language of your note first. After you confirmed these parameters with “Add document”, you are able to edit the text of your new note.



The Command Line Interface

The command line interface (CLI) can be used within a TELNET or SSH session. After login, just enter “setup” to start the CLI setup tool.



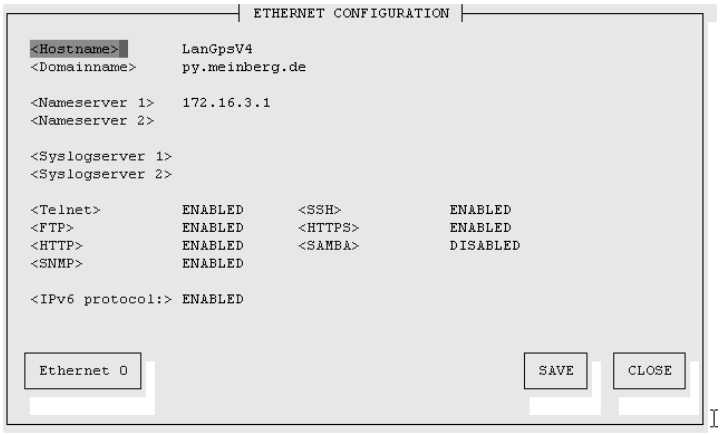
The start page gives a short overview of the most important configuration parameters and the runtime statistics of the unit. In the upper left corner you can read which LANTIME type and version of the LANTIME software you are using. This LANTIME software version is a head version number describing the base system and important subsystem. Below the version you will find the actual hostname and domain of your LANTIME unit, the IPv4 and IPv6 network address of the first network interface and on the right side the serial number, the uptime of the system (time since last boot) and the notification status is reported.

In the second section the actual status of the GPS reference clock and the NTP subsystem is shown, additional information about the GPS receiver can also be found here. This includes the number of satellites in view and the number of good satellites in view.

The third section shows the last messages of the system, each with a timestamp added. The newest messages are placed at the top of the list. This reflects the content of the file /var/log/messages, which is created after every start of the system (and is lost after a power off or reboot, see “Syslog server” to learn how to save the entries of your SYSLOG).

By using the buttons in the lower part of the screen, you can reach a number of configuration pages, that are described below.

CLI Ethernet



In the network configuration all parameters related to the network interfaces can be changed. In the first section you can change the hostname and domain name. You can also specify two nameservers and two SYSLOG servers. In the nameserver and SYSLOG server fields you may enter an IPv4 or IPv6 address (the SYSLOG servers can be specified as a hostname, too).

All information which is written to the LANTIME SYSLOG (/var/log/messages) can be forwarded to one or two remote SYSLOG servers. The SYSLOG daemon of this remote SYSLOG needs to be configured to allow remote systems to create entries. A Linux SYSLOGD can be told to do so by using the command “syslogd –r” for starting the daemon.

If you enter nothing in the SYSLOG server fields or specify 0.0.0.0 as the SYSLOG server's addresses, the remote SYSLOG service is not started on your LANTIME.

Please be aware of the fact that all SYSLOG entries of the timeserver are stored in / var/log/messages and will be deleted when you power off or reboot the timeserver. A daily CRON job is checking for the size of the LANTIME SYSLOG and deletes them automatically, if their size is exceeding a limit.

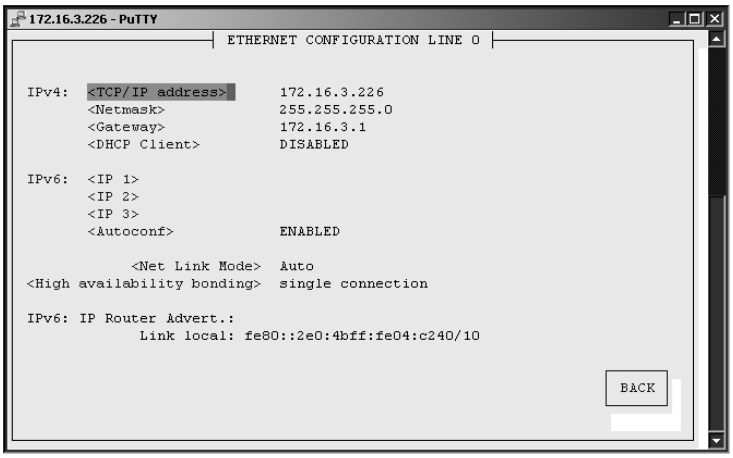
By specifying one or two remote SYSLOG servers, you can preserve the SYSLOG information even when you have to reboot or switch off the LANTIME.

In the second section the possible network protocols and access methods can be configured. You can enable/disable TELNET, FTP, SSH, HTTP, HTTPS, SNMP and NETBIOS by checking/unchecking the appropriate check box. After you saved your settings with the “Save” button, all of these subsystems are stopped and restarted (if they are enabled).

The third section allows you to select the IP protocol 6. In this version the IPv4 protocol is mandatory and cannot be disabled, but a standalone IPv6 mode can be reached by entering an IPv4 address “0.0.0.0” and disabling the DHCP client option for every network interface of your LANTIME. By doing so, you ensure that the timeserver cannot be reached with IPv4. Please note that TELNET, FTP and

NETBIOS cannot be used over IPv6 in this version. IPv4 and IPv6 can be used together on one LANTIME.

To manage the interface specific parameters, you can enter the Ethernet Configuration Line page by using one of the ETHERNET buttons. If your LANTIME is equipped with only one network interface, you will find only one button (ETHERNET 0). Otherwise you see one button for each installed Ethernet port.



Here, the parameters for the network port can be changed. In the upper section of the page you can enter the IPv4 parameters, the lower part gives you access to the IPv6 parameters of the interface.

IPv4 addresses are built of 32 bits, which are grouped in four octets, each containing 8 bits. You can specify an IP address in this mask by entering four decimal numbers, separated by a point ".".

Example: 192.168.10.2

Additionally you can specify the IPv4 Netmask and your default gateway address.

Please contact your network administrator, who will provide you with the settings suitable for your specific network.

If you are running a DHCP (Dynamic Host Configuration Protocol) server in your network, the LANTIME system can obtain its IPv4 settings automatically from this server. If you want to use this feature (you should also ask your network administrator if this is applicable in your network), you can change the DHCP Client parameter to "ENABLED". In order to activate the DHCP client functionality, you can also enter the IP address "000.000.000.000" in the LCD menu by using the front panel buttons of the LANTIME. This is the default setting.

The MAC address of your timeserver can be read in the LCD menu by pressing the NEXT button on the front panel twice. This value is often used by the network administrator when setting up the DHCP parameters for your LANTIME at the DHCP server.

If the DHCP client has been activated, the automatically obtained parameters are shown in the appropriate fields (IPv4 address, netmask, gateway).

You can specify up to three IPv6 addresses for your LANTIME timeserver. Additionally you can switch off the IPv6 AUTOCONF feature. IPv6 addresses are 128 bits in length and written as a chain of 16 bit numbers in hexadecimal notation, separated with colons. A sequence of zeros can be substituted with "::" once.

Examples:
"::" is the address, which simply consists of zeros
"::1" is the address, which only consists of zeros and a 1 as the last bit. This is the so-called host local address of IPv6 and is the equivalent to 127.0.0.1 in the IPv4 world
"fe80::0211:22FF:FE33:4455"
is a typical so-called link local address, because it uses the "fe80" prefix.
In URLs the colon interferes with the port section, therefore IPv6-IP-addresses are written in brackets in an URL.
("http://[1080::8:800:200C:417A]:80/" ; the last ":80" simply sets the port to 80, the default http port)

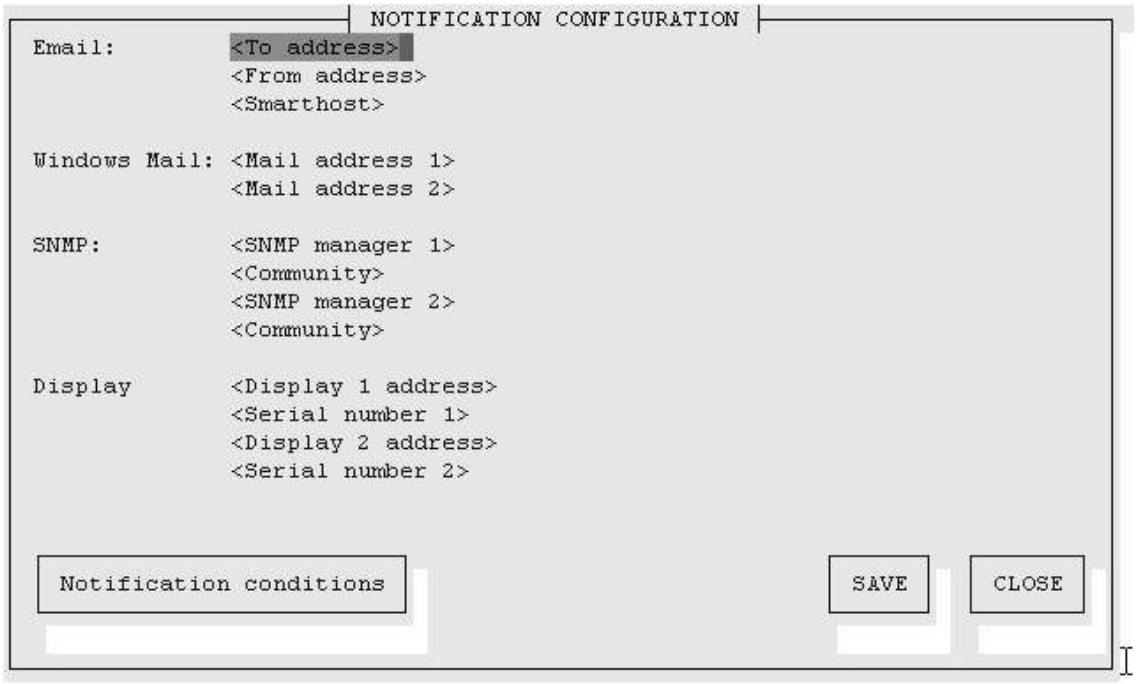
If you enabled the IPv6 protocol, the LANTIME always gets a link local address in the format "fe80:: …", which is based upon the MAC address of the interface. If a IPv6 router advertiser is available in your network and if you enabled the IPv6 AUTOCONF feature, your LANTIME will be set up with up to three link global addresses automatically.

The next parameter in this sub section is "Netlink mode". This controls the port speed and duplex mode of the selected Ethernet port. Under normal circumstances, you should leave the default setting ("autosensing") untouched, until your network administrator tells you to change it.

High Availability Bonding is the last parameter in this section. The standard moniker for this technology is IEEE 802.3ad, although it is known by the common names of trunking, port trunking, teaming and link aggregation. The conventional use of bonding under Linux is an implementation of this link aggregation. A separate use of the same driver allows the kernel to present a single logical interface for two physical links to two separate switches. Only one link is used at any given time. By using media independent interface signal failure to detect when a switch or link becomes unusable, the kernel can, transparently to userspace and application layer services, fail to the backup physical connection. Though not common, the failure of switches, network interfaces, and cables can cause outages. As a component of high availability planning, these bonding techniques can help reduce the number of single points of failure.

At this menu point it is possible to add each Ethernet port to a bonding group. At least two physical Ethernet ports must be linked to one bonding group to activate this feature. The first Ethernet Port in one bonding group provides the IP Address and the net mask of this new virtual device.

CLI Notification



Alarm events

On this page you can set up different notification types for a number of events. This is an important feature because of the nature of a timeserver: running in the background. If an error or problem occurs, the timeserver is able to notify an administrator by using a number of different notification types.

The LANTIME timeserver offers four different ways of informing the administrator or a responsible person about nine different events: EMAIL send an e-mail message to a specified e-mail account, SNMP-TRAP sends a SNMP trap to one or two SNMP trap receivers, WINDOWS POPUP MESSAGE sends a Winpopup message to one or two different computers and DISPLAY shows the alarm message on a wall mount display model VP100/NET, that is an optional accessory you can obtain from us.

Here is a table of all events:

"NTP not sync"	NTP is not synchronised to a reference time source
"NTP stopped"	NTP has been stopped (mostly when very large time offsets occur)
"Server boot"	System has been restarted
"Receiver not responding"	No contact to the internal GPS receiver
"Receiver not sync"	Internal GPS clock is not synchronised to GPS time
"Antenna faulty"	GPS antenna disconnected
"Antenna reconnect"	GPS antenna reconnected
"Config changed"	Configuration was changed by a user
„Leap second announced“	A leap second has been announced
“TIME LIMIT ERROR”	SHS detected time difference

Every event can use a combination of those four notification types, of course you can disable notification for events by disabling all notification types. The configuration of the four notification types can be changed in the upper section of the page, you can control which notification is used for which event by using the button “notification conditions” in the lower part of the page.

E-mail messages

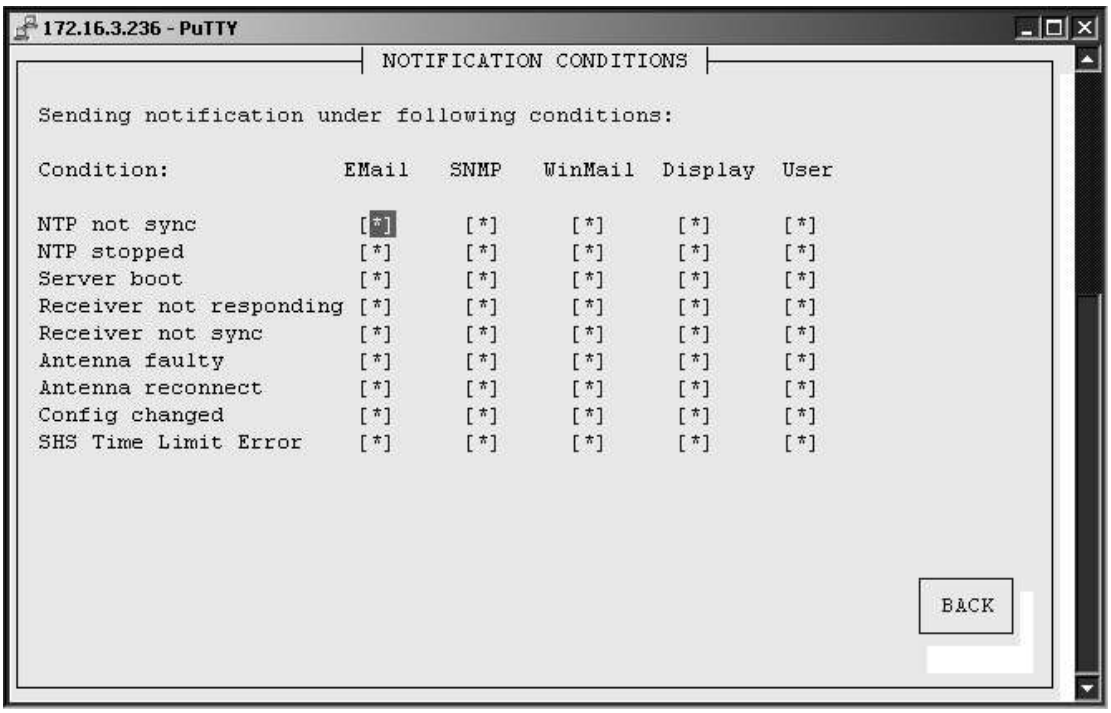
You can specify the e-mail address which is used as the senders address of the notification e-mail (From: address), the e-mail address of the receiver (To: address) and a SMTP smarthost, that is a mail server who is forwarding your mail to the receiver. If your LANTIME system is connected to the internet, it can deliver those e-mails itself.

These settings cannot be altered with the LC display buttons of the front panel. Please note the following:

- The LANTIME hostname and domain name should be known to the SMTP smarthost

- A valid nameserver entry is needed

- The domain part of the From: address has to be valid



Windows Popup Messages

Most Microsoft Windows operating systems provide you with a local notification tool. You can send messages via the special Windows protocol in your local network. It is not necessary to enable the NETBIOS protocol of the LANTIME in order to use this notification. On the Windows client side it is necessary to activate the "Microsoft Client for Windows" in the network configuration.

You can enter the Windows computer name of up to two Windows PCs in the appropriate fields. Every message contains a time stamp and a plain text message:

SNMP-TRAP messages

Up to two SNMP trap receiver hosts can be configured in this subsection, you may use IPv4 or IPv6 addresses or specify a hostname. Additionally you have to enter a valid SNMP community string for your trap receiving community. These are mostly independent from the SNMP community strings used for status monitoring and configuration (see SNMP configuration on the "Security" page).

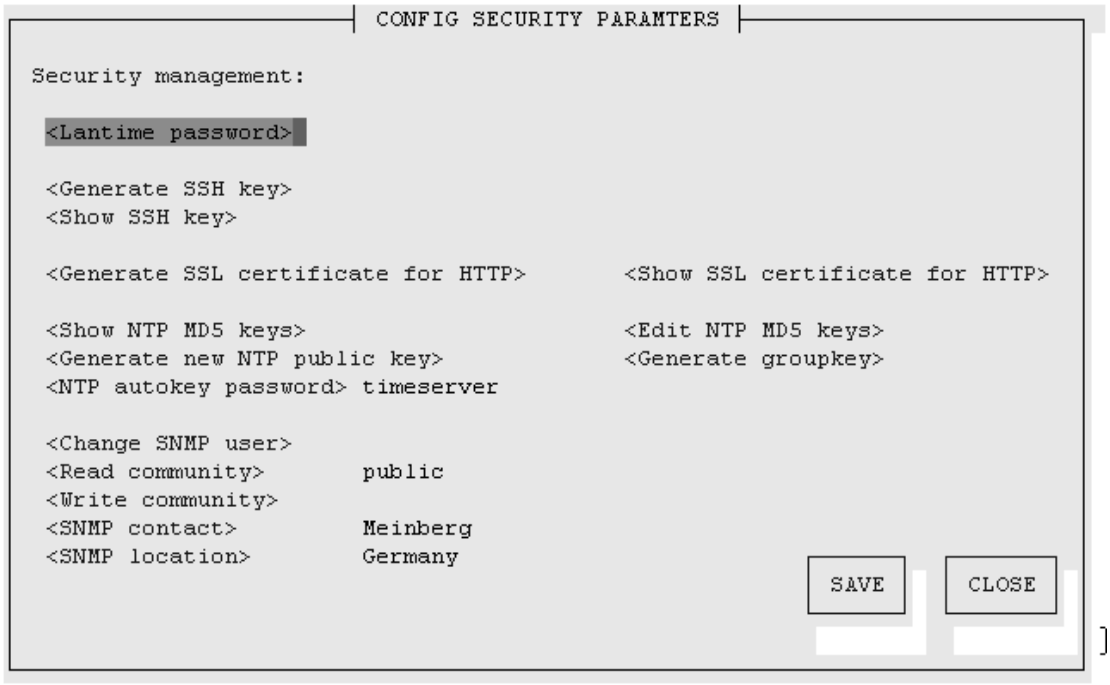
VP100/NET wall mount display

The VP100/NET wall display is an optional accessory for the LANTIME timeserver, it has an own integrated Ethernet port (10/100 Mbit) and a SNTP client. The time of the display can be received from any NTP server using the SNTP protocol, additionally the display is able to show text messages, which are sent by using special software. The LANTIME can send an alarm message to one or two VP100/NET displays over the network, whenever an event occurs, for which you selected the display notification type. An alarm message is shown three times as a scrolling message.

Just enter the display's IP address and its serial number (this is used for authorization), which can be found by pressing the red SET button on the back of the display four times. The serial number consists of 8 characters, representing four bytes in hexadecimal notation.

If you want to use the display for other purposes, you can send text messages to it by using our command line tool *send2display*, which can be found on the LANTIME. This allows you to use the display by CRON jobs or your own shell scripts etc. If you run the tool without parameters, a short usage screen is shown, explaining all parameters it may understand. See appendix for a printout of this usage screen.

CLI Security



Password

On the “Security“ page you can manage all security relevant parameters for your timeserver. In the first section “Login” the administration password can be changed, which is used for SSH, TELNET, FTP, HTTP and HTTPS access. The password is stored encrypted on the internal flash disk and can only be reset to the default value “timeserver” by a “factory reset”, changing all settings back to the factory defaults. Please refer to the LCD configuration section in this manual.

SSH Secure Shell Login

The SSH provides you with a secure shell access to your timeserver. The connection is encrypted, so no readable passwords are transmitted over your network. The actual LANTIME version supports SSH1 and SSH2 over IPv4 and IPv6. In order to use this feature, you have to enable the SSHD subsystem and a security key has to be generated on the timeserver by using the “Generate SSH key” button. Afterwards, a SSH client can connect to the timeserver and opens a secure shell:

ssh root @ 192.168.16.111

The first time you connect to a SSH server with an unknown certificate, you have to accept the certificate, afterwards you are prompted for your password (which is configured in the first section of this page).

If you generate a new SSH key, you can copy and paste it into your SSH client configuration afterwards in order to allow you to login without being prompted for a password. We strongly recommend to use SSH for shell access, TELNET is a very insecure protocol (transmitting passwords in plain text over your network).

If you enabled SSH, your LANTIME automatically is able to use secure file transfer with SCP or SFTP protocol. The usage of FTP as a file transfer protocol is as insecure as using TELNET for shell access.

Generate SSL Certificate for HTTPS

HTTPS is the standard for encrypted transmission of data between web browser and web server. It relies on X.509 certificates and asymmetric crypto procedures. The timeserver uses these certificates to authenticate itself to the client (web browser). The first time a web browser connects to the HTTPS web server of your LANTIME, you are asked to accept the certificate of the web server. To make sure that you are talking to your known timeserver, check the certificate and accept it, if it matches the one stored on the LANTIME. All further connections are comparing the certificate with this one, which is saved in your web browser configuration. Afterwards you are prompted to verify the certificate only when it changed.

By using the button “Generate SSL certificate for HTTP" you can create a new certificate. Please enter your organisation, name, mail address and the location in the upcoming form and press “Generate SSL certificate” to finally generate it.

NTP keys and certificates

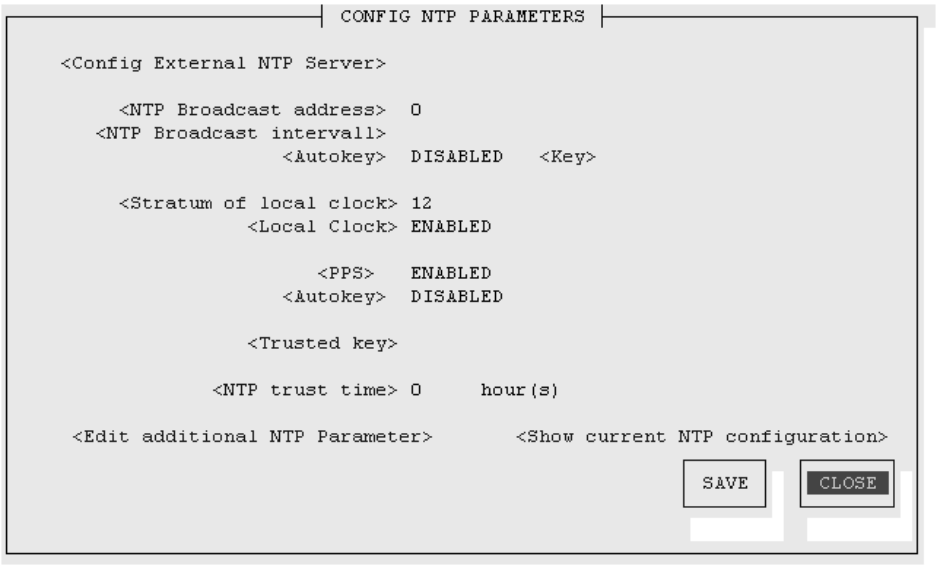
The fourth and fifth section of the “Security” page allow you to create the needed crypto keys and certificates for secure NTP operation (please see NTP authentication below).

The function “Generate new NTP public key“ is creating a new self-signed certificate for the timeserver, which is automatically marked as “trusted“.

Important note: This certificate is depending on the hostname of your LANTIME, it is mandatory to recreate the certificate after changing the hostname. The certificates are build with the internal command “ntp-keygen -T” (ntp-keygen is part of the installed NTP suite). Your LANTIME is using the /etc/ntp/ directory for storing its private and public keys (this is called the “keysdir”). Please refer to the chapter “NTP Autokey” for further information (below).

The two options “Show NTP MD5 key“ and “Edit NTP MD5 keys“ allow you to manage the symmetric keys used by NTP. More about that can be found in the chapter about symmetric keys (below).

CLI NTP Parameter



The NTP configuration page is used to set up the additional NTP parameters needed for a more specific configuration of the NTP subsystem.

The default configuration of the timeserver consists of a local clock, which represents the hardware clock of your LANTIME system and the GPS reference clock. The local clock is only chosen as the NTP time reference after the GPS clock lost its synchronisation. The stratum level of this local clock is set to 12, this ensures that clients recognise the switchover to the local clock and are able to eventually take further actions. The local clock can be disabled.

Because the GPS reference clock is internally connected to the LANTIME system by using a serial connection, the accuracy using this way of synchronisation is around 1 ms. The high accuracy of the LANTIME timeserver (around 10 microseconds) is available by using the ATOM driver of the NTP subsystem, which is directly interpreting the PPS (pulse per second) of the GPS reference clock. The default configuration looks like this:

```
#  ***  lantime  ***
# NTP.CONF for GPS167 with UNI ERLANGEN

server  127.127.1.0                  # local clock
fudge   127.127.1.0 stratum 12       # local stratum

server  127.127.8.0 mode 135 prefer  # GPS167 UNI Erlangen PPS
fudge   127.127.8.0 time1 0.0042     # relative to PPS
server  127.127.22.0                 # ATOM (PPS)
fudge   127.127.22.0 flag3 1         # enable PPS API
enable stats
statsdir /var/log/
statistics loopstats
driftfile /etc/ntp.drift

# Edit /mnt/flash/ntpconf.add to add additional NTP parameters
```

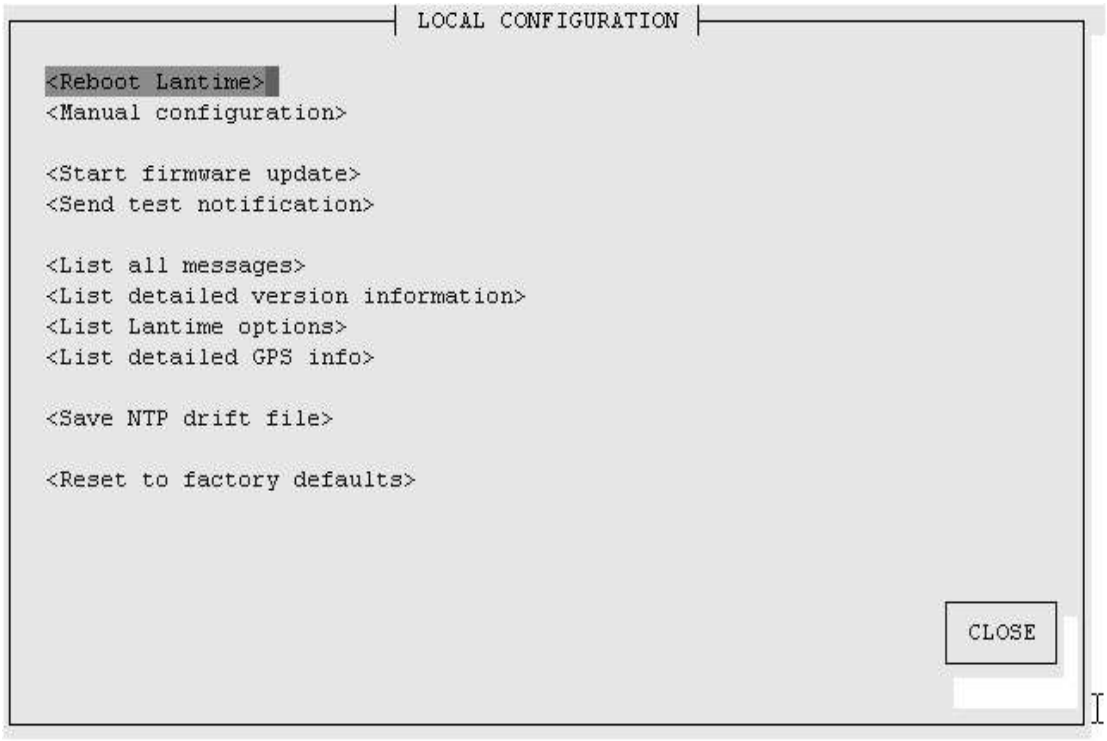
CLI NTP Authentication

Please see the corresponding chapter in the web interface description.

CLI NTP Autokey

Please see the corresponding chapter in the web interface description.

CLI Local



Administrative functions

In the first section there are several functions which may be used by the administrator. The button “Reboot LANTIME” is restarting the system, the built-in reference clock is not affected by this, only the included computer system is rebooted, which may take up to 30 seconds.

With “Manual configuration“ you are able to change the main configuration by editing the configuration file by hand. After editing, press the “Save file” button to preserve your changes, afterwards you are asked if your changes should be activated by reloading the configuration (this results in reloading several subsystems like NTPD, HTTPD etc.).

The function “Send test notification“ is generating a test alarm message and sends it using all configured notify possibilities (e-mail, WMail, SNMP-Traps, wall mount display).

You can use the function “Save NTP drift file“ to copy the file /etc/ntp.drift to the internal flash disc of your LANTIME. NTP is using this file to have the parameters for compensation of the incorrectness of the system clock available directly after a restart. This results in a faster synchronisation process of the NTPD subsystem after a system restart. You should use this function only, if the NTPD has been synchronized to the internal reference clock for more than one day. This is done here at Meinberg directly before shipping the LANTIME unit to our customers, so you do not need to use this function during normal operation. It may be applicable after a software update.

The function “Reset to factory defaults“ is setting all configuration parameters back to default values. The regular file /mnt/flash/global_configuration will be replaced with the file /mnt/flash/factory.conf, but first a copy of the configuration is saved under /mnt/flash/global_configuration.old for backup reasons. The default password “timeserver” is replacing the actual password, too. After using this function, all certificates should be recreated because of the change of the unit’s hostname.

Please be aware of the fact that the default configuration is not activated instantly. If you want to avoid setting up the IP address of your unit by locally configuring it on site with the buttons of the front panel (meaning physical presence of someone directly at the location of the LANTIME), you have to configure the network parameters of your LANTIME immediately after using the “reset to factory defaults” button. So, please proceed directly to the Ethernet page and check/change the IP address and the possible access subsystems (HTTP for example) of the LANTIME. The first usage of “Save settings” will load the configuration from flash into memory and activate it.

User Management

For administration different users can be set up. 3 group memberships can be assigned to each user: the Super-User has all properties for administration. The group membership Administrator can change all parameters via the command line interface (CLI) configuartion tool and the WEB interface. The group Administrator cannot use any Linux command in a Telnet, SSH or Terminal session. If the Administrator will login, the setup program will be started directly. After termination of the Setup program this user will be logout automatically. The group membership “Info“ has the same properties like the Administrator but cannot change any parameter.

The menu “User Management“ allows you to set up different users with a password and the group membership. To change the properties of an user you have to delete the old user and set up a new one. The user “root“ cannot be deleted and has always the membership of Super-User. The password of the user “root“ can be set on the security page.

Administrative information

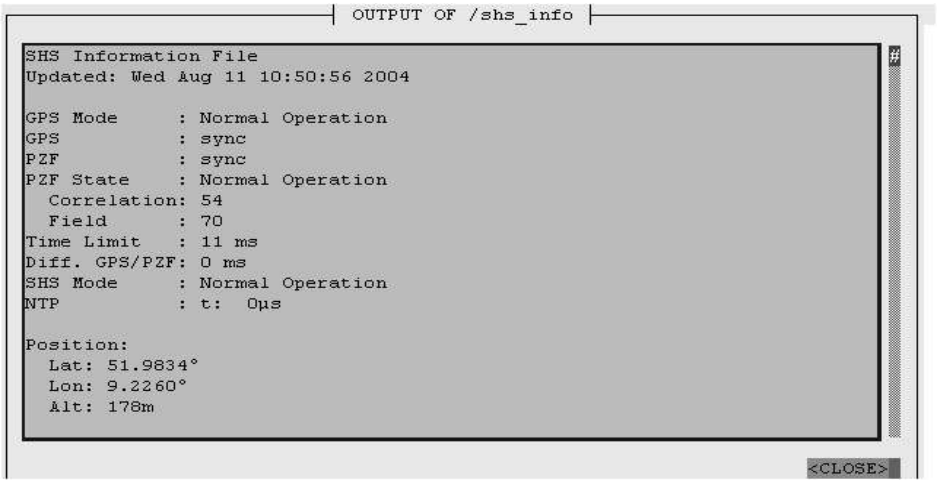
The button “List all messages“ displays the SYSLOG of the LANTIME completely. In this log all subsystems create their entries, even the OS kernel. The SYSLOG file /var/log/messages is only stored in the system’s ram disk, therefore it is lost after a power off or restart. If you configured an external SYSLOG server, all LANTIME SYSLOG entries will be duplicated on this remote system and can be saved permanently this way.

```
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: ntpd 4.2.0@1.1161-r Fri Mar 5 15:58:48 CET
2004 (3)
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: signal_no_reset: signal 13 had flags 4000000
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: precision = 3.000 usec
Mar 15 13:35:17 LanGpsV4 ntpd[12948]: kernel time sync status 2040
```

Mar 15 13:35:17 LanGpsV4 ntpd[12948]: frequency initialized 45.212 PPM from /etc/ntp.drift
Mar 15 13:38:36 LanGpsV4 lantime[417]: NTP sync to GPS
Mar 15 13:38:36 LanGpsV4 lantime[417]: NTP restart
Mar 15 13:45:36 LanGpsV4 proftpd[14061]: connect from 172.16.3.2 (172.16.3.2)
Mar 15 14:01:11 LanGpsV4 login[15711]: invalid password for `root' on `ttyp1' from `172.16.3.45'
Mar 15 14:01:17 LanGpsV4 login[15711]: root login on `ttyp1' from `172.16.3.45'

With “List detailed version information“ a number of version numbers (including LANTIME software, operating system and NTPD) are shown in a textbox.

The function “List LANTIME Options“ shows the hardware options installed in your LANTIME.



Using the button “List detailed SHS information“ gives you the possibility to check detailed GPS status information. The first parameter indicates the time and date of the last update of the shown parameters. Next you find the GPS receiver status and the NTP status, followed by the GPS position data. The position uses the Latitude / Longitude / Altitude format. Latitude and Longitude are shown in degrees, minutes and seconds, Altitude is shown in meters above sea level.

The satellite section shows the numbers of satellites in view and the number of usable satellites (“good SV”). Additionally, the selected set of the four used satellites can be read.

The accuracy of the calculated receiver position and time deviation is dependent on the constellation of the four selected satellites. Using the position of the receiver and the satellites, a number of values can be calculated, which allow a rating of the selected constellation. These values are called “Dilutions of Precision (DOP)”.

PDOP is the abbreviation for “Position Dilution of Precision”, TDOP means “Time Dilution of Precision” and GDOP stands for “General Dilution of Precision”. Lower values are indicating better accuracy.

The next section “Satellite Info“ shows information about all the satellites, which are in view momentarily. The satellite ID, elevation, Azimuth and distance to the receiver reveal the position of the satellite in the sky. The Doppler shows whether the satellite is ascending (positive values) or descending (negative value).

Software Update

If you need to update the software of your LANTIME, you need a special file update.tgz from Meinberg, which has to be uploaded to the LANTIME by using ftp, SCP or SFTP to the root dir (/update.tgz), after the file transfer is complete, press “Start firmware update”.

Afterwards you are prompted to confirm the start of the update process. The scope of the update only depends on the chosen file.

SNMP Support

The Simple Network Management Protocol (SNMP) has been created to achieve a standard for the management of different networks and the components of networks. SNMP is operating on the application layer and uses different transport protocols (like TCP/IP and UDP), so it is network hardware independent. The SNMP design consists of two types of parties, the agent and the manager. SNMP is a client-server architecture, where the agent represents the server and the manager represents the client. The LANTIME has an integrated SNMP agent, who is designed especially to handle SNMP requests for LANTIME specific status information (including status variables for the internal reference clock). The LANTIME SNMP agent is also capable of handling SET requests in order to manage the LANTIME configuration via SNMP, if your SNMP management software is also supporting this feature. The elements (objects / variables) are organised in data structures called Management Information Base (MIB). The LANTIME includes the standard NET-SNMP MIB and is based on SNMPv1 (RFC 1155, 1157), SNMPv2 (RFC 1901-1908) and SNMPv3. The following SNMP version is installed on the timeserver:

Net-SNMP Version:	5.0.8
Network transport support:	Callback Unix TCP UDP TCPIPv6 UDPIPv6
SNMPv3 Security Modules:	usm
Agent MIB code:	mibII, ucd_snmp, snmpv3mibs, notification, target, agent_mibs, agentx agent_mibs, utilities, meinberg, mibII/ipv6
Authentication support:	MD5 SHA1
Encryption support:	DES

By using the special Meinberg SNMP-agent all important status variables can be read with SNMP conformant client software. Where applicable, a variable is implemented as string and numeric value, for example allowing SNMP client software to use the information for drawing diagrams or monitor threshold levels.

When using the NET-SNMP suite, you can read all status information your LANTIME offers via SNMP by using the snmpwalk command:

```
snmpwalk –v2c –c public timeserver enterprises.5597
```

```
...mbgLtNtp.mbgLtNtpCurrentState.0 = 1 : no good refclock (->local)
...mbgLtNtp.mbgLtNtpCurrentStateVal.0 = 1
...mbgLtNtp.mbgLtNtpStratum.0 = 12
...mbgLtNtp.mbgLtNtpActiveRefclockId.0 = 1
...mbgLtNtp.mbgLtNtpActiveRefclockName.0 = LOCAL(0)
...mbgLtNtp.mbgLtNtpActiveRefclockOffset.0 = 0.000 ms
...mbgLtNtp.mbgLtNtpActiveRefclockOffsetVal.0 = 0
...mbgLtNtp.mbgLtNtpNumberOfRefclocks.0 = 3
...mbgLtNtp.mbgLtNtpAuthKeyId.0 = 0
...mbgLtNtp.mbgLtNtpVersion.0 = 4.2.0@1.1161-r Fri Mar  5 15:58:56 CET 2004 (3)

...mbgLtRefclock.mbgLtRefClockType.0 = Clock Type: GPS167 1HE
...mbgLtRefclock.mbgLtRefClockTypeVal.0 = 1
...mbgLtRefclock.mbgLtRefClockMode.0 = Clock Mode: Normal Operation

...mbgLtRefclock.mbgLtRefClockModeVal.0 = 1
...mbgLtRefclock.mbgLtRefGpsState.0 = GPS State: sync
...mbgLtRefclock.mbgLtRefGpsStateVal.0 = 1
...mbgLtRefclock.mbgLtRefGpsPosition.0 = GPS Position: 51.9834° 9.2259° 181m
...mbgLtRefclock.mbgLtRefGpsSatellites.0 = GPS Satellites: 06/06
...mbgLtRefclock.mbgLtRefGpsSatellitesGood.0 = 6
...mbgLtRefclock.mbgLtRefGpsSatellitesInView.0 = 6
...mbgLtRefclock.mbgLtRefPzfState.0 = PZF State: N/A
...mbgLtRefclock.mbgLtRefPzfStateVal.0 = 0
...mbgLtRefclock.mbgLtRefPzfKorrelation.0 = 0
...mbgLtRefclock.mbgLtRefPzfField.0 = 0
```

Please note that you only see the object names (like "mbgLtRefclock.mbgLtRefPzfField") if you installed the Meinberg MIB files on your client workstation first (please see the web interface or CLI setup tool chapters to find out how to do this).

By using the standard MIB, no NTP get requests are allowed. Only the standard system and network parameters can be accessed (e.g. using the NET-SNMP command "snmpget").

Only by using the Meinberg MIB the change of configuration parameters is possible (the command "snmpset" is used to alter a variable, for example).

Configuration over SNMP

The LANTIME timeserver can be configured via several user interfaces. Besides the possibility to setup its parameters with the web interface (HTTP and/or HTTPS) and the direct shell access via Telnet or SSH, a SNMP based configuration interface is available.

In order to use the SNMP configuration features of the timeserver, you need to fulfil the following requirements (the system has to be reachable over the network, of course):

a) SNMP has to be activated in the timeservers setup by setting up a RWCOMMUNITY

b) In the SNMP configuration the read-write-access needs to be activated

c) The timeserver-specific MIB files must be present on the clients, they have to be included in the SNMP setup of the client software

a) and b) can be achieved by using the web interface or the shell access, please see the appropriate chapters in this manual. The mentioned MIB files can be found directly on the timeserver located at /usr/local/share/snmp/mibs. All files with names starting with “MBG-SNMP-“ have to be copied onto the SNMP clients by using the timeservers ftp access (for example). You may also use the web interface, on the page “Local“ you will find a button “Download MIB files“. You will get a tar-archive if you are using the download button, which you have to unpack first. Afterwards, copy all MIB files to the MIB directory on your client(s) and configure your SNMP client software to use them.

Examples for the usage of the SNMP configuration features

The following examples are using the software net-snmp, a SNMP open source project. You will find detailed information at www.net-snmp.org!

To browse the configuration branch of the timeserver-MIB, you could use the following command on a UNIX system with net-snmp SNMP tools installed:

```
root@testhost:/# snmpwalk -v2c -c public timeserver.meinberg.de mbgLtCfg

MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfghostname.0 = STRING: LantimeSNMPTest
MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfgDomainname.0 = STRING: py.meinberg.de
MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfgNameserver1.0 = STRING: 172.16.3.1
MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfgNameserver2.0 = STRING:
MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfgSyslogserver1.0 = STRING:
MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfgSyslogserver2.0 = STRING:
[...]
```

To alter a parameter, with net-snmp you would use the snmpset command:

```
root@testhost:/# snmpset -v2c -r 0 -t 10 -c rwsecret timeserver.meinberg.de
mbgLtCfghostname.0 string „helloworld“


MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfghostname.0 = STRING: helloworld

root@testhost:/#
```

Please note that your SNMP request has to be sent with a sufficient timeout (in the above snmpset example this was achieved by using the “-t 10“ option, choosing a timeout of 10 seconds), because after each parameter change, the timeserver reloads its configuration, which takes a few seconds. The request is acknowledged by the SNMP agent afterwards.

To change a group of parameters without reloading the configuration after each parameter, you have to send all parameter changes in one single request. You can do this with the net-snmp snmpset command by specifiying multiple parameters in one command line:

```
root@testhost:/# snmpset -v2c -r 0 -t 10 -c rwsecret timeserver.meinberg.de
mbgLtCfghostname.0 string „helloworld“ mbgLtCfgDomainname.0 string
„internal.meinberg.de“


MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfghostname.0 = STRING: helloworld
MBG-SNMP-LANTIME-CFG-MIB::mbgLtCfgDomainname.0 = STRING: internal.meinberg.de

root@testhost:/#
```

The available SNMP variables are described in detail in the “SNMP configuration reference“ part of this manual. Additionally, it is recommended to also read the mentioned MIB files.

Further configuration possibilities

Because the timeserver uses a standard version of the net-snmp SNMP daemon (with extended features covering the timeserver-specific functions), all configuration parameters of the SNMPD can be used. The configuration file of the SNMP daemon is located at /usr/local/share/snmp after boot time, the filename is snmpd.conf.

During the boot sequence, this file is created dynamically by using a template file and appending the SNMP parameters stored in the timeserver setup.

If you need to customize the configuration of the timeservers SNMPD (for setting up detailed access control rights for example), you may edit /mnt/flash/packages/snmp/etc/snmpd_conf.default (which is the mentioned template file). Please note that some lines are appended to this file (as described above), before it is used as /usr/local/share/snmp/snmpd.conf by the snmpd process.

Send special timeserver commands with SNMP

The timeserver is capable of receiving special commands by SNMP in order to reboot the unit or reload its configuration after you manually changed it. A special SNMP variable is reserved for this (mbgLtCmdExecute) and has to be set to a special integer value for each command. The following commands are available:

Reboot(1)

Setting the mbgLtCmdExecute variable to value 1 will reboot the timeserver after a short waiting period of approximately 3-5 seconds.

FirmwareUpdate(2)

This command installs a previously uploaded (with FTP for example) firmware version.

ReloadConfig(3)

The parameters of the timeserver configuration (stored in /mnt/flash/global_configuration) are re-read and afterwards a number of subsystems (e.g. NTPD, HTTPD/HTTPSD, SMBD) will be restarted in order to use those eventually changed settings. Please note that the SNMPD will not be restarted by this command (you have to use reboot instead or restart it manually by killing the process and starting it again in the shell).

GenerateSSHKey(4)

A new SSH key will be generated.

GenerateHTTPSKey(5)

A new HTTPS key will be generated.

ResetFactoryDefaults(6)

The configuration of the timeserver is reset to factory defaults, afterwards an automatic ReloadConfig is executed in order to use these default settings.

GenerateNewNTPAutokeyCert(7)

A new key is generated, it can be used with the NTP AUTOKEY feature.

SendTestNotification(8)

A test message is sent by using all notification methods the timeserver has a configuration for (e.g. mail, winpopup, SYSLOG etc.).

A few examples:

(we are again using the snmpset command which comes with the net-snmp tools).

```
root@testhost:/# snmpset -v2c -r 0 -t 10 -c rwsecret timeserver.meinberg.de
mbgLtCmdExecute.0 int 1

MBG-SNMP-LANTIME-CMD-MIB::mbgLtCmdExecute.0 = INTEGER: Reboot(1)
root@testhost:/#
```

The command shown above is forcing the timeserver to reboot. Instead of using the integer value, you may also enter the command name, as it is defined in the MIB file MBG-SNMP-LANTIME-CMD.txt (and in the command list above).

If you want the timeserver to reload it's configuration file (which you previously uploaded via FTP probably), you would enter this command:

```
root@testhost:/# snmpset -v2c -r 0 -t 10 -c rwsecret timeserver.meinberg.de
mbgLtCmdExecute.0 int ReloadConfig

MBG-SNMP-LANTIME-CMD-MIB::mbgLtCmdExecute.0 = INTEGER: ReloadConfig(3)
root@testhost:/#
```

Please pay attention to the options “-r 0“ (meaning “no retries“) and “-t 10“ (meaning “timeout of 10 secs“) in the above examples. These options avoid multiple executions of the desired command, additionally they give your snmpset command enough time to wait for an acknowledgement from the timeservers snmp agent.

Configuration of the timeserver with SNMP: Reference

The MIB of the timeserver includes the following parts:

SNMP Object	Name	Description
enterprises.5597	mbgSNMP	Root node of the Meinberg-MIB
mbgSNMP.3	mbgLantime	Root node of the LANTIME MIB
mbgLantime.1	mbgLtNtp	LANTIME NTP status variables
mbgLantime.2	mbgLtRefclock	LANTIME reference time source status variables
mbgLantime.3	mbgLtTraps	LANTIME SNMP traps
mbgLantime.4	mbgLtCfg	LANTIME configuration variables
mbgLantime.5	mbgLtCmd	LANTIME control commands

Further detailed information can be found in the Meinberg MIB files.

Reference of LANTIME SNMP configuration variables:

SNMP branch	***Variable***	***Data type***	***Description***
mbgLtCfgNetwork	mbgLtCfghostname	string	The hostname of the timeserver
	mbgLtCfgDomainname	string	The Domainname of the timeserver
	mbgLtCfgNameserver1	string (IPv4 or IPv6-address)	IP-address of first nameserver
	mbgLtCfgNameserver2	string (IPv4 or IPv6-address)	IP-address of second nameserver
	mbgLtCfgSyslogserver1	string (IPv4 or IPv6-address or hostname)	IP-address or hostname of first syslog-server
	mbgLtCfgSyslogserver2	string (IPv4 or IPv6-address or hostname)	IP-address or hostname of second syslog-server
	mbgLtCfgTelnetAccess	integer (0 = disabled, 1 = enabled)	Telnet access activated?
	mbgLtCfgFTPAccess	integer (0 = disabled, 1 = enabled)	FTP-access activated?
	mbgLtCfgHTTPAccess	integer (0 = disabled, 1 = enabled)	Webinterface activated?
	mbgLtCfgHTTPSAccess	integer (0 = disabled, 1 = enabled)	Encrypted webinterface activated?
	mbgLtCfgSNMPAccess	integer (0 = disabled, 1 = enabled)	SNMP-daemon activated?
	mbgLtCfgSambaAccess	integer (0 = disabled, 1 = enabled)	LANManager-access activated?
	mbgLtCfgIPv6Access	integer (0 = disabled, 1 = enabled)	IPv6-protocol enabled?
	mbgLtCfgSSHAccess	integer (0 = disabled, 1 = enabled)	SSH-access activated?
mbgLtCfgNTP	mbgLtCfgNtpServer1IP	string (IPv4 or IPv6-address or hostname)	First external NTP-server
	mbgLtCfgNtpServer1KEY	integer	Link to the key which should be used for the first NTP-server
	mbgLtCfgNtpServer2IP	string (IPv4 or IPv6-address or hostname)	Second external NTP-server
	mbgLtCfgNtpServer2KEY	integer	Link to the key which should be used for the second NTP-server
	mbgLtCfgNtpServer3IP	string (IPv4 or IPv6-address or hostname)	Third external NTP-server

SNMP branch	*Variable*	*Data type*	*Description*
	mbgLtCfgNtpServer3KEY	integer	Link to the key which should be used for the third NTP-server
	mbgLtCfgStratumLocalClock	integer(0..15)	Stratum-value of the internal system clock of the timeserver
	mbgLtCfgNTPTrustedKey	integer	Link to the key which should be used for the internal reference time source
	mbgLtCfgNTPBroadcastIP	string (IPv4 or IPv6-address)	IP-address, which has to be used for NTP-broadcasts (or multicasts)
	mbgLtCfgNTPBroadcastKey	integer	Link to the key which should be used for outgoing NTP-broadcasts
	mbgLtCfgNTPBroadcastAutokey	integer (0 = disabled, 1 = enabled)	Use autokey for NTP broadcasts?
	mbgLtCfgAutokeyFeature	integer (0 = disabled, 1 = enabled)	Use autokey feature of the NTP server?
	mbgLtCfgAtomPPS	integer (0 = disabled, 1 = enabled)	Atom PPS (pulse per second) activated?
mbgLtCfgEMail	mbgLtCfgEMailTo	string (Liste von EMail-addressn)	One or more (semicolon separated) email address(es). which should receive warnings and alarm notifications from the timeserver
	mbgLtCfgEMailFrom	string (EMail-address)	The EMail-address which is used as the senders address for email notifcations
	mbgLtCfgEMailSmarthost	string (IPv4 or IPv6-address or hostname)	The SMTP-host, which is used for sending mails
mbgLtCfgSNMP	mbgLtCfgSNMPTrapReceiver1	string (IPv4 or IPv6-address or hostname)	First host, which receives notifications sent as SMTP-traps
	mbgLtCfgSNMPTrapReceiver1Community	string	The SNMP community used when sending SNMP-Traps to the first host
	mbgLtCfgSNMPTrapReceiver2	string (IPv4 or IPv6-address or hostname)	Second host, which receives notifications sent as SMTP-traps
	mbgLtCfgSNMPTrapReceiver2Community	string	The SNMP community used when sending SNMP-Traps to the second host
	mbgLtCfgSNMPROCommunity	string	The SNMP community, which has read-only access and therefore can be used to only monitor status variables or configuration values (SNMP V2c)
	mbgLtCfgSNMPRWCommunity	string	The SNMP community, which has read-write access and there for can be used to monitor status variables and get/set configuration values (SNMP V2c)
	mbgLtCfgSNMPContact	string	Contact information (e.g. name of a contact person) of the timeserver
	mbgLtCfgSNMPLocation	string	Location (e.g. building/room number) of the timeserver
mbgLtCfgWinpopup	mbgLtCfgWMailAddress1	string	First receiver of notifications sent as windows popup messages
	mbgLtCfgWMailAddress2	string	Second receiver of notifications sent as windows popup messages
mbgLtCfgWalldisplay	mbgLtCfgVP100Display1IP	string (IPv4 or IPv6-address or hostname)	hostname or IP-address of the first wallmount display used for showing notifications
	mbgLtCfgVP100Display1SN	string (Hexstring)	The serial number of the first wall mount display used for showing notifications (can be found in the setup menu of the display)
	mbgLtCfgVP100Display2IP	string (IPv4 or IPv6-address or hostname)	hostname or IP-address of the second wall mount display used for showing notifications
	mbgLtCfgVP100Display2SN	string (Hexstring)	The serial number of the first wall mount display used for showing notifications (can be found in the setup menu of the display)

SNMP branch	*Variable*	*Data type*	*Description*
mbgLtCfgNotify	mbgLtCfgNotifyNTPNotSync	string(combination)	Exactly one, none or a combination of the following notification types: email=sending an email wmail=sending a winpopup-message snmp=sending a SNMP-trap, disp=showing on wall mount display, syslog=sending a syslog-entry for the event „NTP not synchronized“
	mbgLtCfgNotifyNTPStopped	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „NTP Daemon stopped“
	mbgLtCfgNotifyServerBoot	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „Timeserver reboot“
	mbgLtCfgNotifyRefclockNotResponding	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „Refclock not ready“
	mbgLtCfgNotifyRefclockNotSync	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „Refclock not synchron“
	mbgLtCfgNotifyAntennaFaulty	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „GPS antenna not connected or dammaged“
	mbgLtCfgNotifyAntennaReconnect	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „GPS antenna reconnected“
	mbgLtCfgNotifyConfigChanged	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „Configuration changed“
	mbgLtCfgNotifyLeapSecondAnnounced	string (combination)	(see mbgLtCfgNotifyNTPNotSync) for the event „Leap second announced“
mbgLtCfgEthernet	mbgLtCfgEthernetIf0IPv4IP	string (IPv4 IP-address)	IPv4-address of first network interface of the timeserver
	mbgLtCfgEthernetIf0IPv4Netmask	string (IPv4 Netzmaske)	IPv4-netmask of first network interface of the timeserver
	mbgLtCfgEthernetIf0IPv4Gateway	string (IPv4 IP-address)	IPv4-address of the default gateway of the timeservers first network interface
	mbgLtCfgEthernetIf0DHCPClient	integer (0 = disabled, 1 = enabled)	Configure the first network interface of the timeserver with DHCP?
	mbgLtCfgEthernetIf0IPv6IP1	string (IPv6 IP-address)	First IPv6-IP-address of the timeservers first network interface
	mbgLtCfgEthernetIf0IPv6IP2	string (IPv6 IP-address)	Second IPv6-IP-address of the timeservers first network interface
	mbgLtCfgEthernetIf0IPv6IP3	string (IPv6 IP-address)	Third IPv6-IP-address of the timeservers first network interface
	mbgLtCfgEthernetIf0IPv6Autoconf	integer (0 = disabled, 1 = enabled)	Activate autoconf for the IPv6 - configuration of the timeservers first network interface?
	mbgLtCfgEthernetIf0NetlinkMode	integer (0..4)	Configuration of the network-speed and duplex settings of the timeservers first network interface 0 = autosensing, 1 = 10Mbit/s half duplex, 2= 10Mbit/s full duplex, 3=100Mbit/s half duplex, 4=100Mbit/s full duplex

For all additional Ethernet interfaces of the timeserver, “If0“ only has to be replaced with “Ifx“, where “x“ is substituted by the number of the desired Ethernet interface. Example: The IPv4-address of the timeservers third Ethernet interface can be set with mbgLtCfgEthernetIf2IPv4IP!

SNMP Traps

If configured, the LANTIME is sending SNMP traps, which can be received by up to 2 SNMP management systems. These traps can be received by using the NET-SNMP suite tool “snmptrapd”, you can start it on a UNIX system with “snmptrapd –p” (-p is for output to stdout, -s would use the syslog for output). The corresponding MIB files can be found on the LANTIME at /usr/local/share/snmp/mibs/ , all Meinberg specific MIB files are named “MBG-SNMP.…”. These MIB files can be downloaded by using the web interface (see “Local” page, “Download MIB files” button), after unpacking the archive file you can import the MIB files into your management system.

The following SNMP-traps are available:

"NTP not sync"	NTP not synchronised to refclock
"NTP stopped"	NTP stopped
"Server boot"	System has rebooted
"Receiver not responding"	no answer from GPS
"Receiver not sync"	GPS receiver not synchronised
"Antenna faulty"	GPS antenna not connected
"Antenna reconnect"	GPS antenna reconnected
"Config changed"	System parameter changed by user
„Leap second announced“	Leap second announced

See the ”Notification“ page at the web interface and Command Line Interface description to learn how to configure the SNMP trap receivers.

SNMP Trap Reference

All traps can be found under the mbgLtTraps section in the Meinberg MIB. A special trap exists for every notification event the timeserver knows. Please note that the traps are only sent if you configured the notification type “SNMP trap” for the event, otherwise no trap is generated. All traps have a string parameter included, which contains the plain text event message for the appropriate event (you are able to change the default text messages, see web interface and/or CLI setup section to find out how to do this).

Here is a list of all traps the timeserver knows:

mbgLtTrapNTPNotSync (mbgLtTraps.1): Whenever the NTP daemon (ntpd) looses sync, it will generate this trap and send it to the configured SNMP trap receivers.

mbgLtTrapNTPStopped (mbgLtTraps.2): This trap is sent when the NTP daemon stopped, manually or because of an error condition.

mbgLtTrapServerBoot (mbgLtTraps.3): After finishing the boot process, this trap is generated.

mbgLtTrapReceiverNotResponding (mbgLtTraps.4): Trap to be sent when the internal receiver of the timeserver is not responding.

mbgLtTrapReceiverNotSync (mbgLtTraps.5): If the internal receiver looses sync, the SNMP trap receivers will receive this trap.

mbgLtTrapAntennaFaulty (mbgLtTraps.6): This trap will be sent whenever the timeserver recognises a broken connection to the antenna of the receiver.

mbgLtTrapAntennaReconnect (mbgLtTraps.7): After the connection to the antenna has been re-established, this trap is sent.

mbgLtTrapConfigChanged (mbgLtTraps 8): After reloading its configuration, the timeserver generates this trap.

mbgLtTrapLeapSecondAnnounced (mbgLtTraps 9): If a leap second has been announced by the internal GPS receiver, this trap will be sent.

mbgLtTrapTestNotification (mbgLtTraps 99): This trap is sent whenever you are requesting a test notification; it is only used for testing the connection between the timeserver and your SNMP trap receivers.

<u>Attachment:</u> Technical Information

Skilled/Service-Personnel only: Replacing the Lithium Battery

The life time of the lithium battery on the board is at least 10 years. If the need arises to replace the battery, the following should be noted:

ATTENTION!

There is a Danger of explosion if the lithium battery is replaced incorrectly. Only identical batteries or batteries recommended by the manufacturer must be used for replacement. The waste battery has to be disposed as proposed by the manufacturer of the battery.

Technical Specifications LANTIME BGT

HOUSING:	Metal 19"Modular chassis, Schroff EUROPAC lab HF Front panel: 3U/84HP (128 mm high / 426 mm wide)
PROTECTION RATING:	IP20
PHYSICAL DIMENSIONS:	483 mm wide x 132 mm high x 260 mm deep

Safety instructions for building-in equipment

This building-in equipment has been designed and tested in accordance with the requirements of Standard IEC 950 "Safety of Information Technology Equipment, including Electrical Business Equipment".

During installation of the building-in equipment in an end application (i.e. rack) additional requirements in accordance with Standard IEC 950 have to be taken into account.

- The building-in equipment is a class 1 - equipment and must be connected to an earthed outlet (TN Power System).
- The building-in equipment has been evaluated for use in office environment (pollution degree 2) and may be only used in this environment. For use in rooms with a higher pollution degree more stringent requirements are applicable.
- The building-in equipment may not be opened.
- Protection against fire must be assured in the end application.
- The ventilation opening may not be covered.
- The equipment/building-in equipment was evaluated for use in a maximum ambient temperature of 40 °C.
- For safe operation the building-in equipment must be protected by max 16 A fuse in the power installation system.
- Disconnection of the equipment from mains is done by pulling the mains plug.

CE-Label

CE

EN 60950

Safety of Information Technology Equipment,
including Electrical Business Equipment

Electromagnetic compatibility

EN50081-1

Electromagnetic compatibility (EMC). Generic emission standard. Part 1: Residential, commercial and light industry

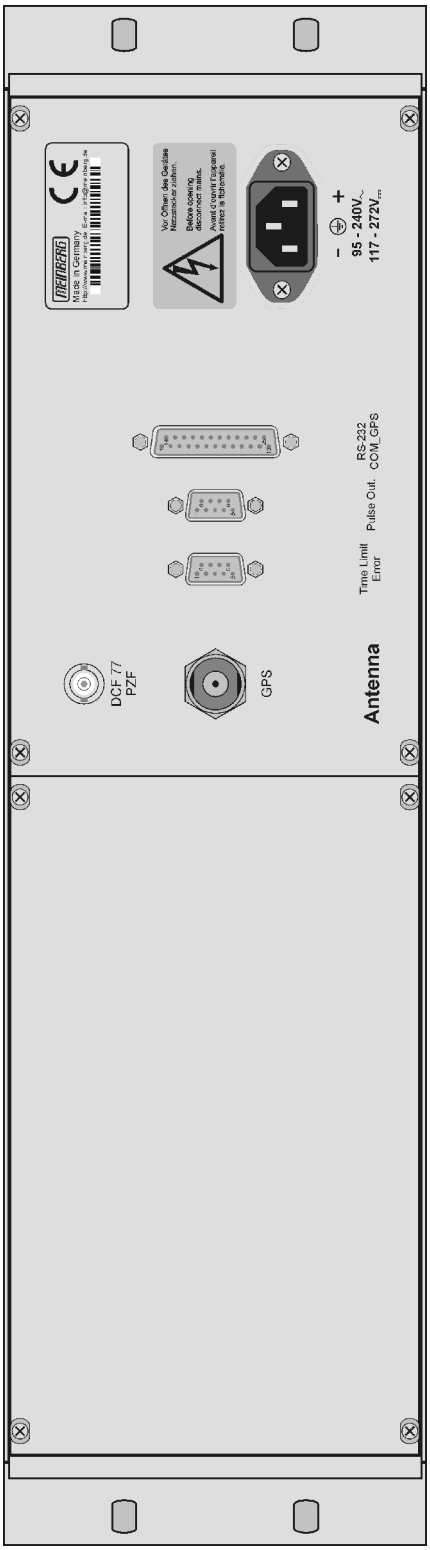
EN50082-2

Electromagnetic compatibility (EMC). Generic immunity standard. Part 2: Industrial environment

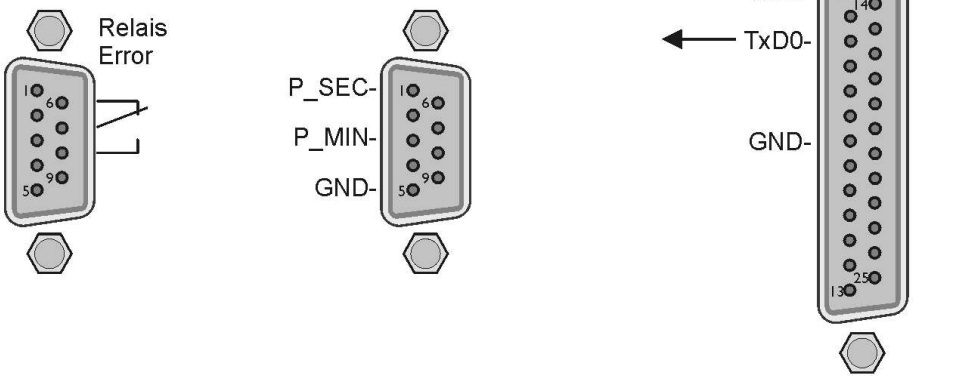
Rear- / Front Panel Connectors

Name	Type	Signal	Cable
Front panel			
TERM	9 pin SUB-D	RS-232	shielded data line
Network	RJ-45	Ethernet	shielded data line
Rear panel			
COM_GPS	25 pin SUB-D	RS-232	shielded data line
Pulse Output	9 pin SUB-D	TTL via 50 Ω	shielded line
Time Limit Error	9 pin SUB-D	Relay, make contact	
Antenna GPS	Coax type N	35.4 MHz / 10 Mhz	shielded coaxial line
Antenna PZF	BNC		shielded coaxial line
Power supply	power cord receptable EN60320 – C13	95-240 V AC ±10 % 117-272 V DC ±10 %	power supply cord

Rear View LANTIME



SUB-D Connector Assignments



Time Limit Error

Pulse Out

RS-232 COM_GPS

Technical Specifications GPS167

RECEIVER:	6 channel C/A code receiver with external antenna/converter unit
ANTENNA:	Antenna/converter unit with remote power supply refer to chapter "Technical Specifications GPS167 Antenna"
ANTENNA INPUT:	Antenna circuit dc-insulated; dielectric strength: 1000 V Length of cable: refer to chapter "Mounting the Antenna"
LC DISPLAY:	1HE: 2 x 40 character, menu selectable by push buttons and light BGT: 4 x 16 Zeichen, menu selectable by push buttons
TIME TO SYN-CHRONIZATION:	One minute with known receiver position and valid almanac 12 minutes if invalid battery buffered memory
PULSE OUTPUTS:	Change of second (P_SEC, TTL level) Change of minute (P_MIN, TTL level)
ACCURACY OF PULSES:	Better than ±250 nsec after synchronization and 20 minutes of operation Better than ±2 µsec during the first 20 minutes of operation
FREQUENCY OUTPUTS:	10 MHz (TTL level)
SERIAL PORTS:	3 asynchronous serial ports (RS-232)
	COM0: fixed, internal used COM1: fixed, internal used COM2+3: configurable, sending Standard Meinberg Time String (once per second or per minute)
POWER REQUIREMENTS:	5 V ± 5 %, @ 700 mA
PHYSICAL DIMENSION:	Eurocard, 100 mm x 160 mm
REAR EDGE CONNECTOR:	According to DIN 41612, type C 64, rows a+c (male)
RF CONNECTOR:	Coaxial SMB connector (male)
AMBIENT TEMPERATURE:	0 ... 50 °C
HUMIDITY:	85 % max.

Accuracy of frequency TCXO quartz (standard)

Accuracy of time and frequency outputs of Meinberg GPS-receivers with different oscillator options

	TCXO HQ	OCXO LQ	OCXO MQ	OCXO HQ	OCXO DHQ	Rubidium
short term stability (t = 1 sec)	$2 * 10^{-9}$	$1 * 10^{-9}$	$2 * 10^{-10}$	$5 * 10^{-12}$	$2 * 10^{-12}$	$2 * 10^{-11}$
accuracy of PPS (pulse per second)	< +/- 250 nsec < +/- 500 nsec (GPS163)	< +/- 250 nsec	< +/- 100 nsec	< +/- 100 nsec	< +/- 100 nsec	< +/- 100 nsec
phase noise	1 Hz -60 dBc/Hz 10 Hz -90 dBc/Hz 100 Hz -120 dBc/Hz 1 kHz -130 dBc/Hz	1 Hz -60 dBc/Hz 10 Hz -90 dBc/Hz 100 Hz -120 dBc/Hz 1 kHz -130 dBc/Hz	1 Hz -75 dBc/Hz 10 Hz -110 dBc/Hz 100 Hz -130 dBc/Hz 1 kHz -140 dBc/Hz	1 Hz -100 dBc/Hz 10 Hz -130 dBc/Hz 100 Hz -145 dBc/Hz 1 kHz -155 dBc/Hz	1 Hz -100 dBc/Hz 10 Hz -125 dBc/Hz 100 Hz -140 dBc/Hz 1 kHz -150 dBc/Hz	1 Hz -75 dBc/Hz 10 Hz -89 dBc/Hz 100 Hz -128 dBc/Hz 1 kHz -140 dBc/Hz
accuracy free run, one day	$+/- 1 * 10^{-7}$ +/- 1 Hz (Note 1)	$+/- 2 * 10^{-8}$ +/- 0,2 Hz (Note 1)	$+/- 1,5 * 10^{-9}$ +/- 15 mHz (Note 1)	$+/- 5 * 10^{-10}$ +/- 5 mHz (Note 1)	$+/- 1 * 10^{-10}$ +/- 1 mHz (Note 1)	$+/- 2 * 10^{-11}$ +/- 0,2 mHz (Note 1)
accuracy free run, one year	$+/- 1 * 10^{-6}$ +/- 10 Hz (Note 1)	$+/- 4 * 10^{-7}$ +/- 4 Hz (Note 1)	$+/- 1 * 10^{-7}$ +/- 1 Hz (Note 1)	$+/- 5 * 10^{-8}$ +/- 0,5 Hz (Note 1)	$+/- 1 * 10^{-8}$ +/- 0,1 Hz (Note 1)	$+/- 5 * 10^{-10}$ +/- 5 mHz (Note 1)
accuracy GPS-synchronous averaged 24 h	$+/- 1 * 10^{-11}$	$+/- 1 * 10^{-11}$	$+/- 5 * 10^{-12}$	$+/- 1 * 10^{-12}$	$+/- 1 * 10^{-12}$	$+/- 1 * 10^{-12}$
accuracy of time free run, one day	+/- 8,6 msec	+/- 1,8 msec	+/- 130µsec	+/- 44 µsec	+/- 10 µsec	+/- 1,8 µsec
accuracy of time free run, one year	+/- 32 sec	+/- 13 sec	+/- 3,5 sec	+/- 1,6 sec	+/- 300 msec	+/- 16 msec
temperature dependant drift, free run	$+/- 1 * 10^{-6}$ (-20...70°C)	$+/- 2 * 10^{-7}$ (0...60°C)	$+/- 5 * 10^{-8}$ (-20...70°C)	$+/- 1 * 10^{-8}$ (5...70°C)	$+/- 2 * 10^{-10}$ (5...70°C)	$+/- 6 * 10^{-10}$ (-25...70°C)
power supply @25°C steady state warm up	5V / 20mA N/A	5V / 160mA or 12V / 70mA 5V / 380mA or 12V / 160mA	5V / 90mA 5V / 330mA	12V / 125mA 12V / 295mA	12V / 250mA 12V / 700mA	24V / 540mA N/A
suitable for clock type	GPS161 GPS163 GPS167 (SV) GPS16xPCI GPS16xPC	GPS161 GPS167 (SV) GPS16xPCI (5V only) GPS16xPC (5V only)	GPS161 GPS167 (SV)	GPS161 GPS167 (SV)		GPS167 (SV)

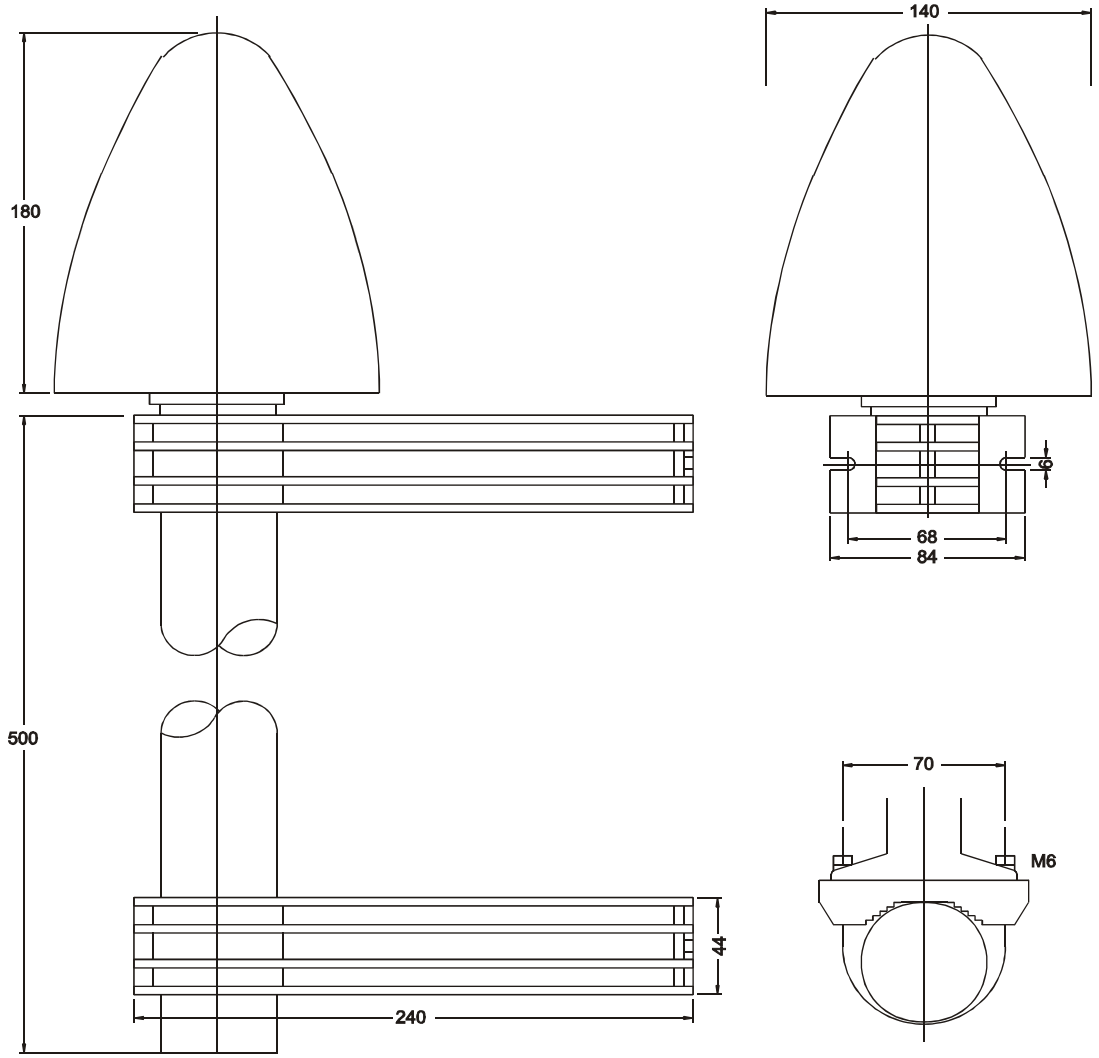
Note 1:
The accuracy in Hertz is based on the standard frequency of 10 MHz. For example: Accuracy of TCXO (free run one day) is +/- 1 * 10 E-7 * 10 MHz = +/- 1 Hz

The given values for the accuracy of frequency and time (not short term accuracy) are only valid for a constant ambient temperature !
A minimum time of 24 hours of GPS-synchronicity is required before free run starts.

Technical Specifications GPS167 Antenna

ANTENNA:	Dielectric patch antenna, 25 x 25 mm	
	Receive frequency:	1575.42 MHz
	Bandwidth:	9 MHz
CONVERTER:	Local oscillator to converter frequency:	10 MHz
	First IF frequency:	35.4 MHz
POWER REQUIREMENTS:	12 V ... 18 V, @ 100 mA (provided via antenna cable)	
CONNECTOR:	Coax type N, female	
AMBIENT TEMPERATURE:	-40 ... +65 °C	
HOUSING:	ABS plastic case for outdoor installation (IP56)	

PHYSICAL DIMENSION:



Signal Description GPS167

Name	Pin	Function
GND	32a+c	Ground
VCC in (+5 V)	1a+c	+5 V supply
VCC in (+12 V)	2a+c	+12 V supply
P_SEC out	6c	Pulse when second changes, TTL level, active high, length 200 msec
P_MIN out	8c	Pulse when minute changes, TTL level, active high, length 200 msec
DCF_MARK out	17c	DCF77 compatible second marks, TTL level, active high, length 100/200 msec
100 kHz out	10a	100 kHz frequency output, TTL-level
1 MHz out	11a	1 MHz frequency output, TTL- level
10 MHz out	12a	10 MHz frequency output, TTL- level
F_SYNTH	21c	Synthesizer output, TTL- level
F_SYNTH_OD	22c	Synthesizer output, Open Drain, max sink current to GND: 150 mA
F_SYNTH_SIN	23c	Synthesizer output, sine-wave 1.5 V eff.
TIME_SYN	19c	TTL output, HIGH level if synchronization has been achieved, LOW level after reset or in case of serious errors (e.g. antenna faulty)
CAPx	27c, 28c	Time capture inputs (TTL), capture on falling slope
COMx TxD out		COMx RS-232 transmit data output
COMx RxD in		COMx RS-232 receive data input
/RESET in/out	9c	RESET signal, Open Drain pulled up to +5 V
SDA, SCL, SCL_EN (reserved)		Internal serial control bus, for extension boards reserved, do not connect

Rear Connector Pin Assignments GPS167

	a	c
1	VCC in (+5V)	VCC in (+5V)
2	VCC in (+12V)	VCC in (+12V)
3	VDD in (TCXO/OCXO)	VDD in (TCXO/OCXO)
4	(reserved, FreqAdjust out)	
5		
6		P_SEC out
7		
8	(reserved, 10 MHz in)	P_MIN out
9		/RESET in/out
10	100 kHz out	ProgPulse0 out
11	1 MHz out	ProgPulse1 out
12	10 MHz out	ProgPulse2 out
13		SCL
14		SCL_EN
15	COM2 RxD in	SDA
16	COM2 TxD out	(reserved, P3.2)
17	COM3 RxD in	DCF_MARK out
18	COM3 TxD out	(reserved, Vref/TxD2 TTL)
19	GND	TIME_SYN out
20	GND	(reserved, P2.3)
21	GND	F_SYNTH out
22	GND	F_SYNTH_OD out
23	GND	F_SYNTH_SIN out
24	GND	COM1 TxD out
25	GND	
26	GND	COM0 TxD out
27	GND	CAP1 in
28	GND	CAP0 in
29	GND	COM1 RxD in
30	GND	COM0 RxD in
31	GND	GND
32	GND	GND

DIN 41612 connector, Typ C 64, row a + c

Technical specifications PZF5xx

RECEIVER:	Preamplifier with two post-connected receiver channels for best aquisition and tracking of the DCF-signals.
CONTROL OF RECEPTION:	The DCF-signal is checked for minimum field strength by microprocessor. The result is indicated by LED. In addition, the value of the digitized field strength is displayed in menu 'FIELD'.
BATTERY-BACKUP:	In case of power failure an internal realtime clock runs crystal-precise. Important parameters are stored in the system-RAM. Life time of lithium battery: 10 years minimum Option: capacitance-backup for about 150 hours
INTERFACES:	Two independant asynchronous serial ports (internal RS232)
PULSE OUTPUTS:	Active-high and active-low pulses per minute and per second, TTL-level, pulse duration 200 ms
ACCURACY OF PULSES:	Time delay of two systems PZF5xx with a maximum distance of 50 km: typ. 20 µs, max. 50 µs Time shifting of successive pulses: max. 1.5 µs
PROPAGATION-TIME COMPENSATION:	The signal delay is compensated if the distance of the receiver to the transmitter is given.
STANDARD FREQUENCIES:	10 MHz are synchronized to DCF by a digital PLL. Accuracy in synchronized state: +/- $5 \cdot 10^{-9}$ (short term stability) Accuracy in unsynchronized state: $1 \cdot 10^{-8}$ for one hour 77.5 kHz, 155 kHz und 310 kHz derived from receiver-PLL Accuracy in synchronous state: +/- $5 \cdot 10^{-7}$ (short term stability)
TERMINAL CONNECTION:	Blade-connector strip VG64, DIN 41612 Sub-miniatur coaxial HF-connector (SMB internal)
BOARD DIMENSIONS:	Eurocard size 100 mm x 160 mm, Epoxy 1,5 mm Front panel 12TE (61 mm)
ANTENNA:	Ferrite antenna in plastic housing

HUMIDITY:	Relativ humidity 85 % max.
TEMPERATURE	
RANGE:	0° - 60 ° Celsius
POWER SUPPLY:	+ 5 V, approx. 330 mA

Signal description PZF5xx

Name	Pin	Function
GND	32a+c	Reference potential
VCC in (+5 V)	1a+c	+5 V power supply
VDD in (+12 V)	2a+c	+12 V power supply, reserved
DCF_MARK out	4c	DCF77 Emulation, TTL level, active high pulse duration: 100 ms or 200 ms
P_SEC out	6c	Pulse per second, TTL-level, active high
/P_SEC out	6a	Pulse per second, TTL-level, active low
P_MIN out	8c	Pulse per minute, TTL-level, active high
/P_MIN out	8a	Pulse per minute, TTL-level, active low
77,5 kHz out	10c	77.5 kHz frequency output, TTL-level
155 kHz out	11c	155 kHz frequency output, TTL-level
310 kHz out	12c	310 kHz frequency output, TTL-level
100 kHz out	10a	100 kHz frequency output, TTL-level
1 MHz out	11a	1 MHz frequency output, TTL-level
10 MHz out	12a	10 MHz frequency output, TTL-level
F_SYNTH out	21c	Synthesizer frequency, TTL-level
F_SYNTH_OD out	22c	Synthesizer frequency, open-drain
F_SYNTH_SIN out	23c	Synthesizer frequency, sinewave
COM0 TxD out	26c	COM0 RS-232 output
COM0 RxD in	30c	COM0 RS-232 input
COM1 TxD out	24c	COM1 RS-232 output
COM1 RxD in	29c	COM1 RS-232 input
/BOOT in	4a	Input for activating the bootstrap-loader
TIME_SYN out	19c	Status output, TTL-level, high if synchronous
/RESET in/out	9c	RESET-pin, reserved for expansions Do not connect
SDA, SCL, SCL_EN		Serial bus for expansions, do not connect
Reserved		Reserved for future expansions, do not connect

Rear Connector Pin Assignments PZF5xx

	a	c
1	VCC in (+5V)	VCC in (+5V)
2	VDD in (+12V)	VDD in (+12V)
3		
4	/BOOT in	DCF_MARK out
5		reserved
6	/P_SEC out	P_SEC out
7		
8	/P_MIN out	P_MIN out
9		/RESET in/out
10	100 kHz out	77,5 kHz out
11	1 MHz out	155 kHz out
12	10 MHz out	310 kHz out
13		SCL
14		SCL_EN
15		SDA
16		
17		reserved
18		
19		TIME_SYN out
20		
21		F_SYNTH out
22		F_SYNTH_OD out
23		F_SYNTH_SIN out
24		COM1 TxD out
25		
26		COM0 TxD out
27		reserved
28		reserved
29		COM1 RxD in
30		COM0 RxD in
31		
32	GND	GND

DIN 41612 connector, Typ C 64, row a + c

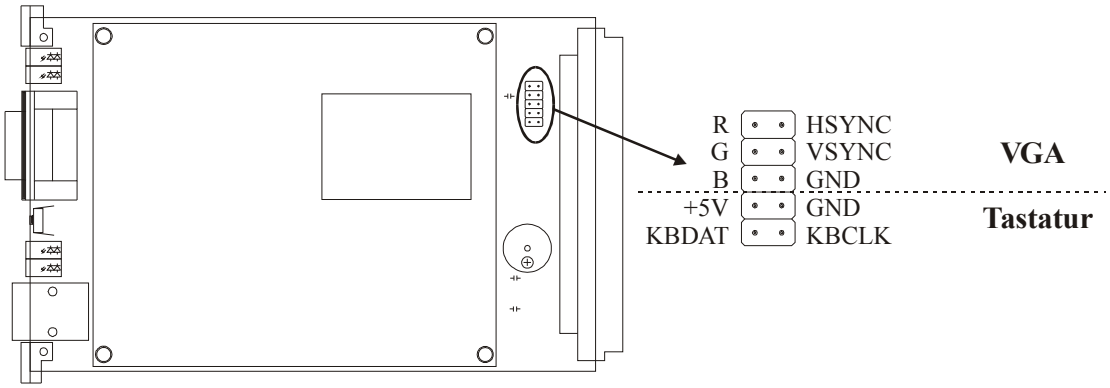
Technical Specifications LAN CPU

PROCESSOR:	Geode^{TM} GX1 with 266 MHz
MAIN MEMORY:	32 MB (to 64 MB upgradeable)
CACHE-MEMORY:	16 KB 2nd Level Cache
FLASHDISK:	8 MB (until max. 72 MB)
NETWORK CONNECTOR:	10/100 MBIT with RJ45-Jack DAVICOM DM9102AEthernet NIC Controller
SERIAL - INTERFACE:	Four serial RS232-Ports 16550 compatible to FIFO - RS232 9-pol. DSUB-male connector - three RS232 male connector according to DIN 41612, type C 96 (only TxD, RxD, DCD)
PARALLEL INTERFACE :	One LPT-Port male connector type C 96
IDE-BUS:	Primary IDE-Bus male connector type C 96
VGA-CONNECTION:	10-pol pin contact strip
KEYBOARD CONNECTION:	10-pol pin contact strip
STATE LEDs:	- power supply - 'Connect', 'Activity' and 'Speed' of the network connection
POWER REQUIREMENTS:	5 V ± 5 %, @ 1 A
FRONTPANEL:	3 HE / 4 TE (128 mm high x 20,3 mm wide)
CONNECTOR:	According to DIN 41612, type C 96, rows a+b+c (male) DSUB-plug (9-pol) RJ45-jack
AMBIENT TEMPERATURE:	0 ... 50 °C
HUMIDITY:	85 % max.

Rear Connector Pin Assignments LAN CPU

	c	b	a	
1	VCC in (+5V)	VCC in (+5V)	VCC in (+5V)	
2	VCC in (+5V)	VCC in (+5V)	VCC in (+5V)	
3	GND	GND	GND	
4	PPS in	/AFD out	/STB out	
5	/ERR in	/SLIN out	/INIT out	
6	D5 in/out	D6 in/out	D7 in/out	LPT1
7	D2 in/out	D3 in/out	D4 in/out	
8	/ACK in	D0 in/out	D1 in/out	
9	/SLCT in	PE in	/BUSY in	
10	GND	GND	GND	
11	GND	GND	GND	
12	DIAG_S in/out	/CS1 out	/CS3 out	
13	A0 out	A1 out	A2 out	
14	RDY in	/AK out	INTRQ in	
15	DRQ in	/IOW out	/IOR out	
16	D15 in/out	D0 in/out	D14 in/out	Primary IDE
17	D1 in/out	D13 in/out	D2 in/out	
18	D12 in/out	D3 in/out	D11 in/out	
19	D4 in/out	D10 in/out	D5 in/out	
20		D9 in/out	D7 in/out	
21	D6 in/out	D8 in/out	/HDRST out	
22	GND	GND	GND	
23	Rx+ in	Tx- out	Tx+ out	
24	Rx- in	LED LINK out	LED ACTIVITY out	Ethernet
25		LED SPEED 100M out	LED SPEED10M out	
26	GND	GND	GND	
27	RxD4 in	TxD4 out	DCD4 in	
28	RxD3 in	TxD3 out	DCD3 in	RS232
29	RxD2 in	TxD2 out		
30	RxD1 in	TxD1 out	DCD1 in	
31	GND	GND	GND	
32	GND	GND	GND	

VGA, Keyboard Connector Pin Assignments

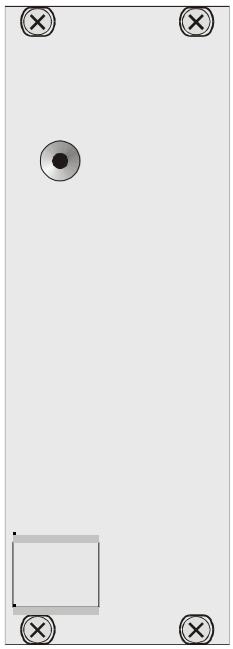


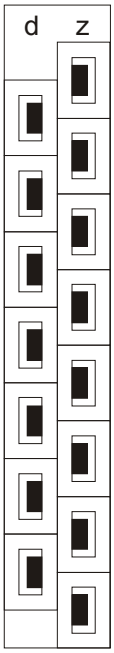
Technical Specifications Power Supply Unit PULS AP 336-505

INPUT VOLTAGE:	105 ... 300 V DC, max. 0.7 A 85 ... 265 V AC, 47... 63 Hz, max. 1.5 A
FUSE:	Electronic
OUTPUT VOLTAGES:	Vout1: 5.15 V / 2 A Vout2: +12 V / 1 A Vout3: -12 V / 1 A Minimum load of the 5 V output when control accuracy of the 12V outputs should be smaller than 4 %: 100 mA
TOTAL SAVE LOAD:	Max. 35 Watt
TYPE OF CONNECTOR:	Male connector according to DIN 41612, type H15, pre-mating protective contact
MOUNTING FRAME:	19" module 3U / 9HP (128 mm high x 45 mm wide), according to DIN 41494, part 5

EMC-conform to EN 60950

Front Panel and Rear Connector Pin Assignments





4	+Vout 1
6	+Vout 1
8	GND 1
10	GND 1
12	NC
14	NC
16	Pfl
18	Vout 2
20	GND 2/3
22	Vout 3
24	GND 2/3
26	NC
28	N (GNDin)
30	L (Vin)
32	PE

Time Strings

Format of the Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

<STX>D:*dd.mm.yy*;T:*w*;U:*hh.mm.ss*;*uvxy*<ETX>

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

<STX> Start-Of-Text (ASCII code 02h)
sending with one bit occuracy at change of second

dd.mm.yy the current date:

dd	day of month	(01..31)
mm	month	(01..12)
yy	year of the century	(00..99)
w	the day of the week	(1..7, 1 = Monday)

hh.mm.ss the current time:

hh	hours	(00..23)
mm	minutes	(00..59)
ss	seconds	(00..59, or 60 while leap second)

uv clock status characters:

u: '#' clock has not synchronized after reset
' ' (space, 20h) clock has synchronized after reset

v: different for DCF77 or GPS receivers:

'*' DCF77 clock currently runs on XTAL
GPS receiver has not checked its position

' ' (space, 20h) DCF77 clock is sync'd with transmitter
GPS receiver has determined its position

x time zone indicator:

'U'	UTC	Universal Time Coordinated, formerly GMT
' '	MEZ	European Standard Time, daylight saving disabled
'S'	MESZ	European Summertime, daylight saving enabled

y announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:

'!' announcement of start or end of daylight saving time
'A' announcement of leap second insertion
' ' (space, 20h) nothing announced

<ETX> End-Of-Text (ASCII code 03h)

Format of the GPS167 Capture String

The Meinberg GPS167 Capture String is a sequence of 31 ASCII characters terminated by a CR/LF (Carriage Return/Line Feed) combination. The format is:

CH*x_tt.mm.jj_hh:mm:ss.fffffff*<CR><LF>

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

x	0 or 1 corresponding on the number of the capture input		
_	ASCII space 20h		
dd.mm.yy	the capture date:		
	dd	day of month	(01..31)
	mm	month	(01..12)
	yy	year of the century	(00..99)
hh:mm:ss.fffffff	the capture time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	fffffff	fractions of second, 7 digits	
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

Format of the SAT-Time String

The SAT-Time String is a sequence of 29 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

<STX>*dd.mm.yy*/*w*/*hh:mm:ss*xxxxuv<ETX>

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

<STX>	Start-Of-Text (ASCII code 02h) sending with one bit occuracy at change of second		
dd.mm.yy	the current date:		
	dd	day of month	(01..31)
	mm	month	(01..12)
	yy	year of the century	(00..99)
	w	the day of the week	(1..7, 1 = Monday)
hh:mm:ss	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
xxxx	time zone indicator:		
	'UTC'	Universal Time Coordinated, formerly GMT	
	'MEZ'	European Standard Time, daylight saving disabled	
	'MESZ'	European Summertime, daylight saving enabled	
u	clock status characters:		
	'#'	clock has not synchronized after reset	
	' '	(space, 20h) clock has synchronized after reset	
v	announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:		
	'!'	announcement of start or end of daylight saving time	
	' '	(space, 20h) nothing announced	
<CR>	Carriage-return (ASCII code 0Dh)		
<LF>	Line-feed (ASCII code 0Ah)		
<ETX>	End-Of-Text (ASCII code 03h)		

Format of the Uni Erlangen String (NTP)

The time string Uni Erlangen (NTP) of a **GPS-clock** is a sequence of 66 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

<STX>tt.mm.jj; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.llle hhhh*m*<ETX>

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

<STX> Start-Of-Text (ASCII code 02h)
sending with one bit occuracy at change of second

dd.mm.yy the current date:

dd	day of month	(01..31)
mm	month	(01..12)
yy	year of the century	(00..99)
w	the day of the week	(1..7, 1 = Monday)

hh.mm.ss the current time:

hh	hours	(00..23)
mm	minutes	(00..59)
ss	seconds	(00..59, or 60 while leap second)

v sign of the offset of local time zone related to UTC

oo:oo offset of local time zone related to UTC in hours and minutes

ac clock status characters:

a: '#' clock has not synchronized after reset
' ' (space, 20h) clock has synchronized after reset

c: '*' GPS receiver has not checked its position
' ' (space, 20h) GPS receiver has determined its position

d time zone indicator:

'S'	MESZ	European Summertime, daylight saving enabled
' '	MEZ	European Standard Time, daylight saving disabled

f announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:

'!' announcement of start or end of daylight saving time
' ' (space, 20h) nothing announced

g announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:

'A' announcement of leap second insertion
' ' (space, 20h) nothing announced

i	leap second insertion ‘L’ leap second is actually inserted (active only in 60th sec.) ‘ ‘ (space, 20h) no leap second is inserted
bbb.bbbb	latitude of receiver position in degrees leading signs are replaced by a space character (20h)
n	latitude, the following characters are possible: ‘N’ north of equator ‘S’ south d. equator
lll.llll	longitude of receiver position in degrees leading signs are replaced by a space character (20h)
e	longitude, the following characters are possible: ‘E’ east of Greenwich ‘W’ west of Greenwich
hhhh	altitude above sea level in meters leading signs are replaced by a space character (20h)
<ETX>	End-Of-Text (ASCII-Code 03h)

Format of the NMEA 0183 String (RMC)

The NMEA String is a sequence of 65 ASCII characters starting with the '$' character and ending with the characters CR (carriage return) and LF (line-feed). The format is:

$GPRMC,*hhmmss.ss*,*A*,*bbbb.bb*,*n*,*lllll.ll*,*e*,0.0,0.0,*ddmmyy*,0.0,*ahh<CR><LF>**

The letters printed in *italics* are replaced by ASCII numbers or letters whereas the other characters are part of the time string. The groups of characters as defined below:

$	start character (ASCII-Code 24h) sending with one bit occuracy at change of second		
hhmmss.ss	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	ss	fractions of seconds	(1/10 ; 1/100)
A	Status	(A = time data valid) (V = time data not valid)	
bbbb.bb	latitude of receiver position in degrees leading signs are replaced by a space character (20h)		
n	latitude, the following characters are possible:		
	'N'	north of equator	
	'S'	south d. equator	
lllll.ll	longitude of receiver position in degrees leading signs are replaced by a space character (20h)		
e	longitude, the following characters are possible:		
	'E'	east of Greenwich	
	'W'	west of Greenwich	
ddmmyy	the current date:		
	dd	day of month	(01..31)
	mm	month	(01..12)
	yy	year of the century	(00..99)
a	magnetic variation		
hh	checksum (EXOR over all characters except '$' and '*')		
<CR>	carriage-return; ASCII-Code 0Dh		
<LF>	line-feed; ASCII-Code 0Ah		

Format of the ABB SPA Time String

The ABB SPA Time String is a sequence of 32 ASCII characters starting with the characters ">900WD" and ending with the <CR> (Carriage Return) character. The format is:

>900WD:*yy-mm-tt_hh.mm;ss.fff*:*cc*<CR>

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

yy-mm-tt	the current date:		
	yy	year of the century	(00..99)
	mm	month	(01..12)
	dd	day of month	(01..31)
_	Space (ASCII code 20h)		
hh.mm;ss.fff	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	fff	milliseconds	(000..999)
cc	Check sum. EXCLUSIVE-OR result of the previous characters, displayed as a HEX byte (2 ASCII characters 0..9 or A..F)		
<CR>	Carriage Return (ASCII code 0Dh)		

Format of the COMPUTIME Time String

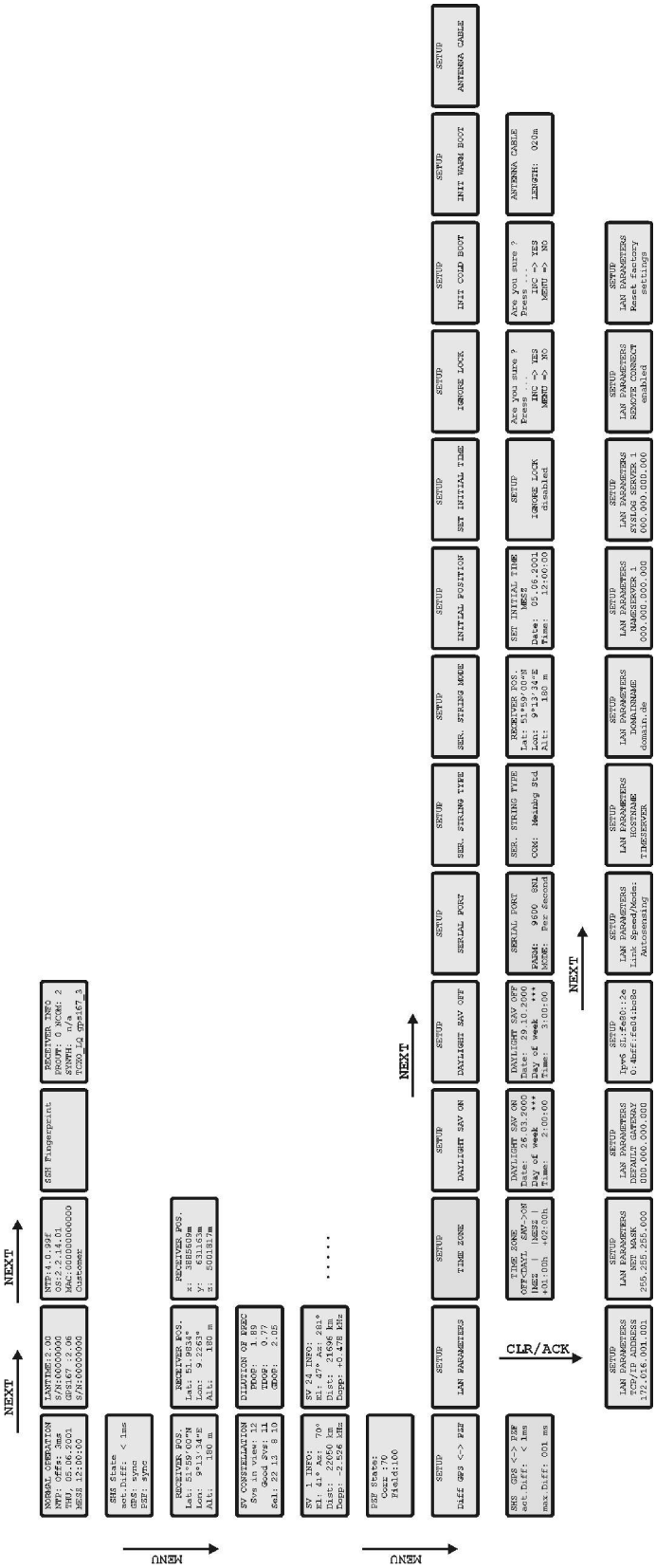
The COMPUTIME Time String is a sequence of 24 ASCII characters starting with the characters “T" and ending with the <LF> (Line-Feed, ASCII-Code 0Ah) character. The format is:

T*:jj:mm:tt:ww:hh:mm:ss<CR><LF>*

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

T	Start character sending with one bit occuracy at change of second		
jj:mm:tt	the current date:		
	jj	year of the century	(00..99)
	mm	month	(01..12)
	tt	day of month	(01..31)
	ww	day of week	(01..07, 01 = monday)
hh:mm:ss	the current time:		
	hh	hours (00..23)	
	mm	minutes (00..59)	
	ss	seconds (00..59, oder 60 wenn Schaltsekunde)	
<CR>	Carriage-Return (ASCII-Code 0Dh)		
<LF>	Line-Feed, (ASCII-Code 0Ah)		

Menu Quick Reference



Declaration of Conformity

Hersteller / Manufacturer

Meinberg Funkuhren GmbH & Co. KG
Auf der Landwehr 22
D-31812 Bad Pyrmont

erklärt in alleiniger Verantwortung, dass das Produkt,
declares under its sole responsibility, that the product

Produktbezeichnung / Product Name: **NTP Timeserver**

Modell / Typ / Model Designation: **LANTIME/SHS**

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt.
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EN55022, 5/99, Class B	Grenzwerte und Messverfahren für Funkstörungen von informationstechnischen Einrichtungen Limits and methods of measurement of radio interference characteristics of information technology equipment
EN55024, 5/99	Grenzwerte und Messverfahren für Störfestigkeit von informationstechnischen Einrichtungen Limits and methods of measurement of Immunity characteristics of information technology equipment
EN 61000-3-2, 3/96	Elektromagnetische Verträglichkeit (EMV) Grenzwerte für Oberschwingungsströme EMC limits for harmonic current emissions
EN 61000-3-3, 3/96	Elektromagnetische Verträglichkeit (EMV) Grenzwerte für Spannungsschwankungen und Flicker in Niederspannungsnetzen Limitation of voltage fluctuation and flicker in low-voltage supply systems
EN 60950/96	Sicherheit von Einrichtungen der Informationstechnik Safety of information technology equipment

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following the provisions of Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility.

Bad Pyrmont, den 08.05.2002

Manual VP100/NET Display configuration

send2display Version 0.1

usage:

send2display -h hostname -s serialnumber [options]

Valid options are:

-h, --host H	Uses H as the hostname of the display unit
-s, --serialnumber S	Uses S as the serialnumber of the display (e.g. 03A00C7F)
-c, --clear M	Clear message M (0-31)
-b, --beep	Beeper sound while showing the message
-a, --clearall	Clear all messages of the display
-m, --message M	Create/change message M (0-31, default = 0)
-e, --executions E	Sets number of consecutive executions to E (1-9, default = 1)
-q, --quiet	Quiet mode (no program output to stdout/stderr)
-v, --verbose	Verbose mode (output of debugging info on stdout)
-?, --help	Show help message

Defining messages

==========

a) Static or flashing text:

You can define a maximum of 9 lines for a message.

Start with -(x) "text", where (x) represents the line number.

-1, --line1 "text"	Set text for line 1
-2, --line2 "text"	Set text for line 2

...

You can set the duration and mode for each line separately. Specifiy the following options directly after the text-definition of a line:

-f, --noflash	Change line mode to static (default is flashing)
-d, --duration X	Set the duration of the line to x seconds (default is 3 seconds)

b) Scrolling text:

You can define a maximum of 241 characters per scrolling message. If you want the message to "softly" end, simply add some spaces to the end of your text (attention: text and spaces must be no more than 241 chars in length).

-t, --scrolltext "text"	Set scrolltext

If you want the message (any type) to appear periodically, you can set the time interval with:

-D, --periodday D	Display message every D days
-H, --periodhour H	Display message every H hours
-M, --periodminute M	Display message every M minutes

(You can combine these options. Default is: message is displayed only once)

Possible error codes: 1=parameter error, 2=no ACK from display, 3=network error

Examples:

send2display -h 172.16.3.251 -s 0a03007f -m1 -e2 -1"Hello World" -d5 -2"what a nice day" -d3
(shows two lines of text (2 times), 1st line is shown for 5 seconds and 2nd line for 3 seconds)
send2display -h 172.16.3.251 -s 0a03007f -m1 -e1 -1"Oops" -H2 -M30
(shows one line of text every 2 hours and 30 minutes, a sound (beep) can be heared while
the message is displayed)
send2display -h 172.16.3.251 -s 0a03007f -c1
(deletes the message 1, so no more beeps every 2:30 hrs ...)
send2display -h 172.16.3.251 -s 0a03007f -t"Hello world..." -e3
(shows a scrolling message with soft end, repeating it 3 times

Global Configuration File

This file contains all global parameters of the LANTIME. You can find this file on the write protected flash disk at /mnt/flash/global_configuration:

```
#----------------------
#  Configuration File
#
#----------------------

# Configuration File Section
Configuration File Version Number   :4.05
Configuration File Last Change      :Mon Mar 15 07:44:21 2004

# Network Parameter Section
Hostname                          [ASCII,50]:LanGpsV4
Domainname                        [ASCII,50]:py.meinberg.de
IPv4 GATEWAY      .....                [IP]:0
IPv6 GATEWAY      .....                [IP]:0
Nameserver 1                           [IP]:
Nameserver 2                           [IP]:
Syslogserver 1                    [ASCII,50]:
Syslogserver 2                    [ASCII,50]:
Telnet Port active                    [BOOL]:1
FTP Port active                       [BOOL]:1
SSH active                            [BOOL]:1
HTTP  active                          [BOOL]:1
HTTPS active                          [BOOL]:1
SNMP  active                          [BOOL]:1
SAMBA active                          [BOOL]:0
IPv6  active                          [BOOL]:1

# NTP Section
External NTP Server 1 IP          [ASCII,50]:
External NTP Server 1 KEY              [NUM]:
External NTP Server 1 AUTOKEY         [BOOL]:
External NTP Server 2 IP          [ASCII,50]:
External NTP Server 2 KEY              [NUM]:
External NTP Server 2 AUTOKEY         [BOOL]:
External NTP Server 3 IP          [ASCII,50]:
External NTP Server 3 KEY              [NUM]:
External NTP Server 3 AUTOKEY         [BOOL]:
NTP Stratum Local Clock         [NUM,0..15]:12
NTP Trusted Key                        [NUM]:
NTP AUTOKEY feature active            [BOOL]:0
NTP ATOM PPS active                   [BOOL]:1
NTP Broadcast TCPIP                     [IP]:0
NTP Broadcast KEY                      [NUM]:0
NTP Broadcast AUTOKEY                 [BOOL]:
NTP Trust Time.......                 [BOOL]:0

# EMail Section
EMail To Address                  [ASCII,50]:
EMail From Address                [ASCII,50]:
EMail Smarthost                   [ASCII,50]:

# SNMP Section
SNMP Trap Receiver Address 1      [ASCII,50]:
SNMP Trap Receiver Community 1    [ASCII,50]:
SNMP Trap Receiver Address 2      [ASCII,50]:
SNMP Trap Receiver Community 2    [ASCII,50]:
SNMP V3 User Name                 [ASCII,50]:root
SNMP Read Community String        [ASCII,50]:public
SNMP Write Community String       [ASCII,50]:
SNMP Contact String               [ASCII,50]:Meinberg
```

```
SNMP Location String            [ASCII,50]:Germany
# Windows Messages Section
WMail Address 1                 [ASCII,50]:
WMail Address 2                 [ASCII,50]:

# VP100 Display Section
VP100 Display Address 1         [ASCII,50]:
VP100 Display Sernum  1         [ASCII,50]:
VP100 Display Address 2         [ASCII,50]:
VP100 Display Sernum  2         [ASCII,50]:

# Notification Section
Notification on NTP_not_sync        [CASE]:
Notification on NTP_stopped         [CASE]:
Notification on Server_boot         [CASE]:
Notification on Refclock_not_respon.[CASE]:
Notification on Refclock_not_sync   [CASE]:
Notification on Antenna_faulty      [CASE]:
Notification on Antenna_reconnect   [CASE]:
Notification on Config_changed      [CASE]:
Notification on Leap second announ. [CASE]:

# Ethernet Parameter Section
ETH0 IPv4 TCPIP address               [IP]:0
ETH0 IPv4 NETMASK                     [IP]:0
ETH0 DHCP CLIENT                    [BOOL]:1
ETH0 IPv6 TCPIP address 1             [IP]:
ETH0 IPv6 TCPIP address 2             [IP]:
ETH0 IPv6 TCPIP address 3             [IP]:
ETH0 IPv6 Autoconf                  [BOOL]:1
ETH0 Net Link Mode                [NUM,0:4]:
ETH0 Bonding Group                [NUM,0:4]:
```

Global Option File

This file contains all global options for special hardware configuration of the LANTIME. Do not modify this file. You can find this file on the write protected flash disk at /mnt/flash/global_options:

```
#GLOBAL OPTIONS

NUMBER ETHERNET INTERFACES: 1
SYSTEM LAYOUT: 0
SYSTEM ADV LAYOUT: 0
SYSTEM LANGUAGE: 0
SYSTEM PARAMETER: server
SYSTEM DESIGN: 0
```

Third party software

The LANTIME network timeserver is running a number of software products created and/or maintained by open source projects. A lot of people contributed to this and we explicitly want to thank everyone involved for her/his great work.

The used open source software comes with its own license which we want to mention below. If one of the licenses for a third party software product is violated, we will as soon as possible apply any changes needed in order to conform with the corresponding license after we acknowledged about that violation.

If a license for one of the software products states that we have to provide you with a copy of the source code or other material, we will gladly send it to you on data media via normal post or by e-mail upon request. Alternatively we can provide you with a link to a download location in the internet, allowing you to download the most actual version. Please note that we have to charge you for any incurred expenses if you choose to receive the source code on data media.

Operating System GNU/Linux

The distribution of the GNU/Linux operating system is covered by the GNU General Public License (GPL), which we included below.

More information about GNU/Linux can be found on the GNU website (www.gnu.org) and on the website of GNU/Linux (www.linux.org).

Our version of the Linux kernel has been optimized for the time server application by applying the so-called PPSkit-patch from Ulrich Windl.

Samba

The Samba software suite is a collection of programs, which implement the Server Message Block (SMB) protocol for UNIX systems. By using Samba your Lantime is capable of sending Windows popup messages and serves request for network time by clients using the NET TIME command.

The distribution of Samba is covered – like GNU/Linux – by the GNU General Public License, see below.

The website of the Samba project (or a mirror) can be reached at www.samba.org!

Network Time Protocol Version 4 (NTP)

The NTP project, lead by David L. Mills, can be reached in the internet at www.ntp.org. There you will find a wealthy collection of documentation and information covering all aspects of the application of NTP for time synchronization purposes. The distribution and usage of the NTP software is allowed, as long as the following notice is included in our documentation:

```
*********************************************************************
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*                                                                   *
*********************************************************************
```

mini_httpd

For our web based configuration tool (HTTP and HTTPS) we use mini_httpd from ACME Labs. The distribution and usage of this program is free provided as long as the following notice appears in the documentation:

```
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```

Find out more regarding mini_httpd at the ACME Labs homepage (www.acme.com).

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END OF TERMS AND CONDITIONS

Timecode (option)

Abstract

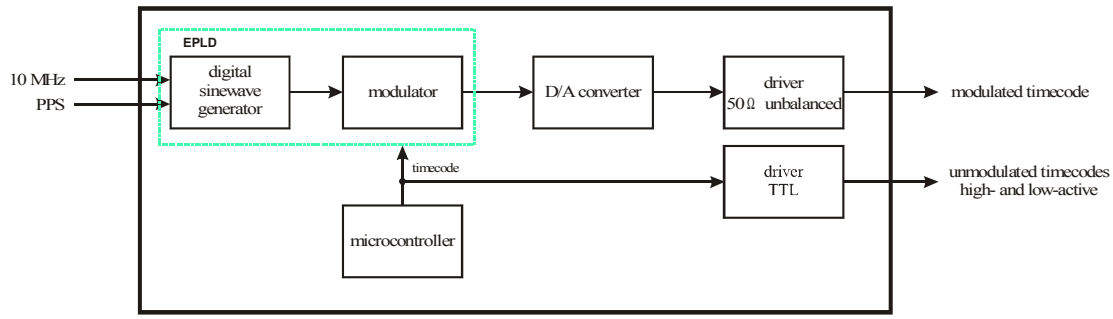
The transmission of coded timing signals began to take on widespread importance in the early 1950´s. Especially the US missile and space programs were the forces behind the development of these time codes, which were used for the correlation of data. The definition of time code formats was completely arbitrary and left to the individual ideas of each design engineer. Hundreds of different time codes were formed, some of which were standardized by the "Inter Range Instrumentation Group" (IRIG) in the early 60´s.

Except these "IRIG Time Codes", other formats like NASA36, XR3 or 2137 are still in use. The board GPS167-TC however generates the IRIG-B, AFNOR NFS 87-500 code as well as IEEE1344 code which is an IRIG-B123 coded extended by information for time zone, leap second and date. Other formats may be available on request.

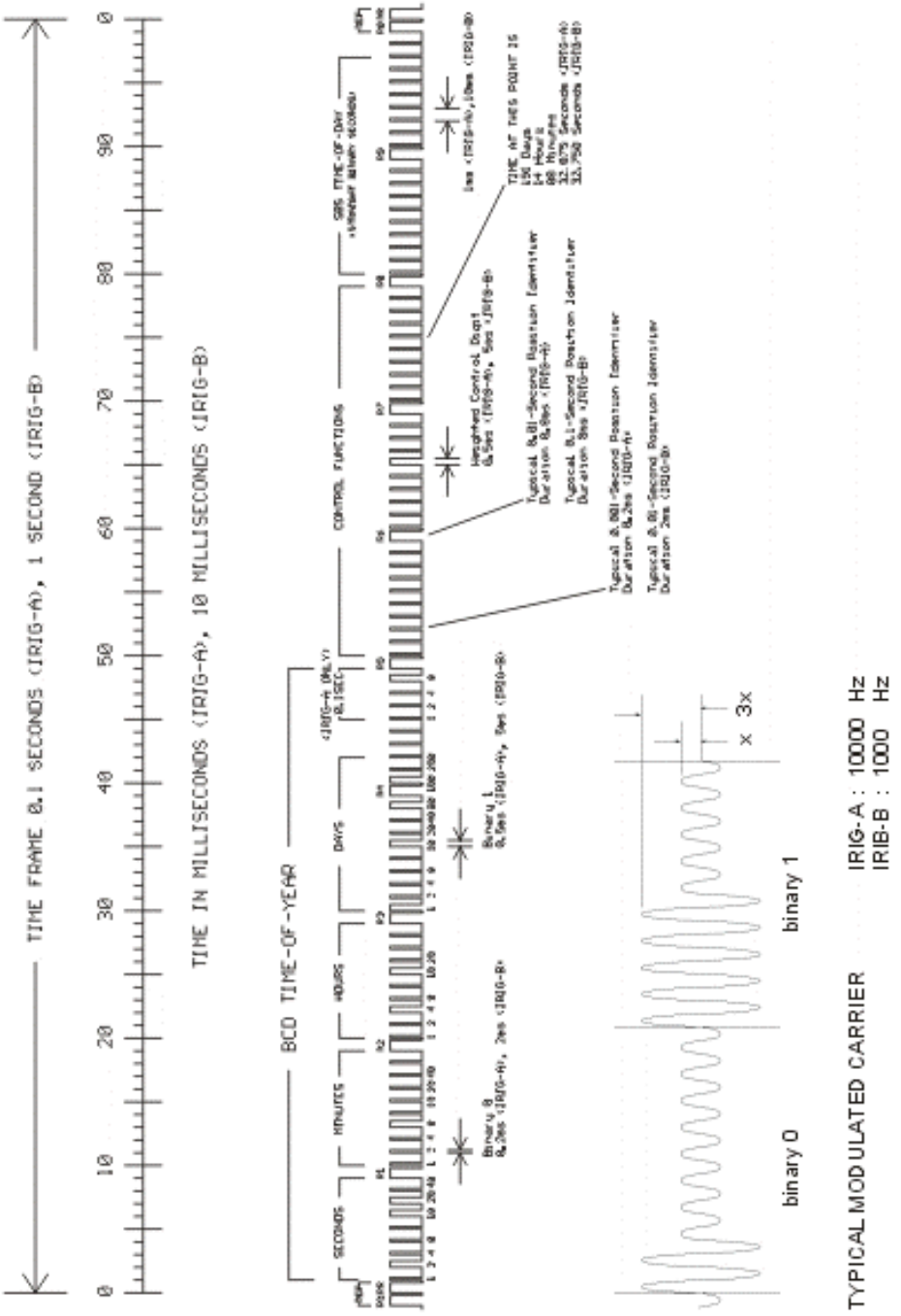
Principle of Operation

The Board GPS167-TC has been designed for the generation of IRIG, AFNOR and IEEE1344 standard time codes. Apart from the digitally generated amplitude-modulated code, GPS167-TC also provides the unmodulated DC-Level shift code. The modulated sine wave carrier and the board´s internal time pattern are derived from the radio clock´s disciplined oscillator.

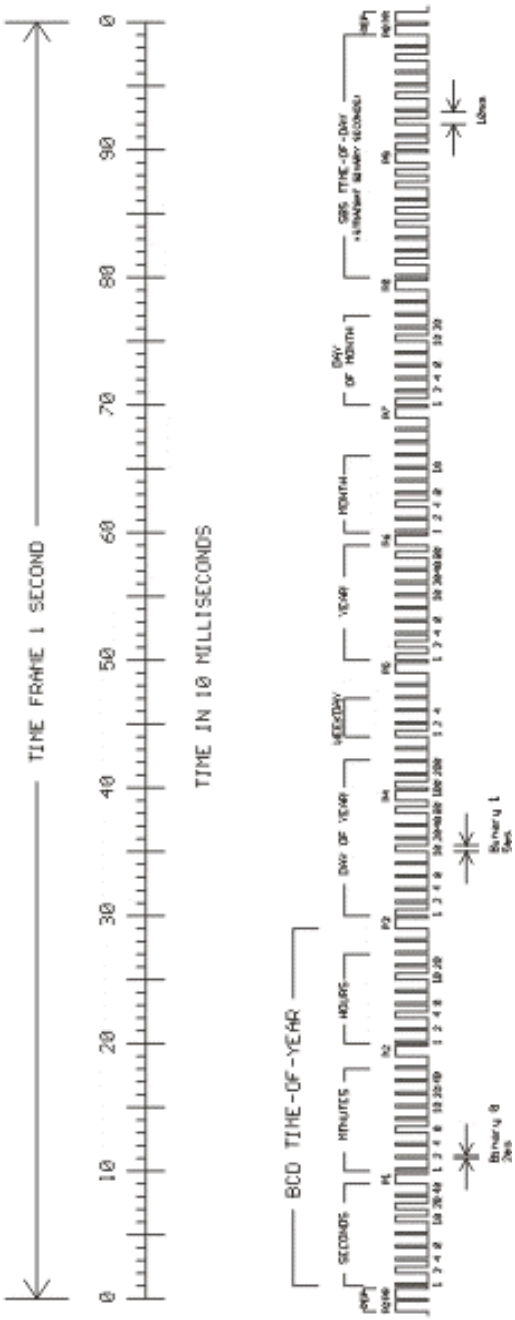
Block Diagram Timecode



IRIG Standard Format



AFNOR Standard Format



Assignment of CF Segment in IEEE1344 Code

Bit No.	Designation	Description
49	Position Identifier P5	
50	Year BCD encoded 1	low nibble of BCD encoded year
51	Year BCD encoded 2	
52	Year BCD encoded 4	
53	Year BCD encoded 8	
54	empty, always zero	
55	Year BCD encoded 10	high nibble of BCD encoded year
56	Year BCD encoded 20	
57	Year BCD encoded 40	
58	Year BCD encoded 80	
59	Position Identifier P6	
60	LSP - Leap Second Pending	set up to 59s before LS insertion
61	LS - Leap Second	0 = add leap second, 1 = delete leap second [1.)]
62	DSP - Daylight Saving Pending	set up to 59s before daylight saving changeover
63	DST - Daylight Saving Time	set during daylight saving time
64	Timezone Offset Sign	sign of TZ offset 0 = '+', 1 = '-'
65	TZ Offset binary encoded 1	Offset from IRIG time to UTC time. Encoded IRIG time plus TZ Offset equals UTC at all times !
66	TZ Offset binary encoded 2	
67	TZ Offset binary encoded 4	
68	TZ Offset binary encoded 8	
69	Position Identifier P7	
70	TZ Offset 0.5 hour	set if additional half hour offset
71	TFOM Time figure of merit	time figure of merit represents approximated clock error. [2.)] 0x00 = clock locked 0x0F = clock failed
72	TFOM Time figure of merit	
73	TFOM Time figure of merit	
74	TFOM Time figure of merit	
75	PARITY	parity on all preceding bits incl. IRIG-B time

[1.)] current firmware does not support leap deletion of leap seconds

[2.)] TFOM is cleared, when clock is synchronized first after power up. *see chapter Selection of generated timecode*

Generated Time Codes

Besides the amplitude modulated sine wave signal, the board also provides unmodulated DC-Level Shift TTL output in parallel. Thus six time codes are available.

a)	B002:	100 pps, PWM DC signal, no carrier BCD time-of-year
b)	B122:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year
c)	B003:	100 pps, PWM DC signal, no carrier BCD time-of-year, SBS time-of-day
d)	B123:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, SBS time-of-day
e)	AFNOR:	Code according to NFS-87500, 100 pps, AM-Sine wave signal, 1kHz carrier frequency, BCD time-of-year, complete date, SBS time-of-day, Signal level according to NFS-87500
f)	IEEE1344:	Code according to IEEE1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time-of-year, SBS time-of-day, IEEE1344 extensions for date, timezone, daylight-saving and leap second in control functions (CF) segment. *also see table 'Assignment of CF segment in IEEE1344 mode'*

Selection of Generated Time Code

The time code to be generated can be selected by Menu Setup IRIG-settings or the GPS Monitorprogram. DC-Level Shift Codes (PWM-signal) B00x and modulated sine wave carrier B12x are always generated simultaneously. Both signals are provided at the VG64-Connector, i.e. if code B132 is selected also code B002 is available. This applies for the codes AFNOR NFS 87-500 and IEEE1344 as well.

The TFOM field in IEEE1344 code is set dependent on the 'already sync'ed' character ('#') which is sent in the serial time telegram. This character is set, whenever the preconnected clock was not able to synchronize after power up reset. The 'time figure of merit' (TFOM) field is set as follows.

Clock synchronized once after power up: TFOM = 0000
Clock <u>not</u> synchronized after power up: TFOM = 1111

For testing purposes the output of TFOM in IEEE1344 mode can be disabled. The segment is set to all zeros then.

Outputs

The module GPS167-TC provides modulated and unmodulated (DC-Level Shift) outputs. The format of the timecodes is illustrated in the diagramms "IRIG-" and "AFNOR standard-format".

AM - Sine Wave Output

The amplitude-modulated carrier is available at the VG-connector pin 14a. The carrier frequency depends on the code and has a value of 1 kHz (IRIG-B). The signal amplitude is 3 V_{pp} (MARK) and 1 V_{pp} (SPACE) into 50 Ω. The encoding is made by the number of MARK-amplitudes during ten carrier waves. The following agreements are valid:

a) binary "0": 2 MARK-amplitudes, 8 SPACE-amplitudes
b) binary "1": 5 MARK-amplitudes, 5 SPACE-amplitudes
c) position-identifier: 8 MARK-amplitudes, 2 SPACE-amplitudes

PWM DC Output

The pulse width modulated DC signals shown in the diagramms "IRIG" and "AFNOR standard format" are coexistent to the modulated output and is available at the VG connector pin 13a with TTL level.

Technical Data

OUTPUTS: Unbalanced AM-sine wave-signal:
3 V_{PP} (MARK) / 1 V_{PP} (SPACE) into 50 Ω
PWM signal: TTL, high and low active

USB Stick

Via front panel Lantime supports a USB connector to plug in a USB Memory Stick. This USB stick can be used for different tasks in combination with the Lantime:

- Transfer configuration parameters between different Lantimes
- Keypad locking for secure using the keypad of the LCD
- Transfer of log files
- Transfer for full or incremental Software Updates
- Upload and download of secure certificates (SSL, SSH) and password

When connecting the USB stick to the Lantime the LC Display will change automatically to the SETUP menu with the submenu „USB MEMORYSTICK“ and the type of stick will be displayed:

```
SETUP:        USB MEMORYSTICK
USB: 0  USB DRIVE
```

If the Lantime found a special menu and file structure on the USB stick you will get the new submenus by pressing the NEXT button. All these submenus will be defined on the stick:

```
SETUP:        USB MEMORYSTICK
 copy configuration to memory stick
```

Menu Structure

The submenus with the corresponding commands are declared in special files on the USB stick. These files will be loaded and interpreted by the Lantime. So it is possible to build up your own configuration. The following diretory and file structure have to be placed on the USB stick:

```
/Lantime/
        Menu/
                menu_1
                script_for_menu_1
                menu_2
                script_for_menu_2
```

Menu Configuration Files

Every submenu will be defined by a spezial formated text file. The name of this file has to be started with „menu_“. This file is an ASCII file which can be created by a standard text editor with the following format:

```
# Comment

Menu-Name: get configuration from USB Stick
Menu-Type: default
Menu-Script: get_config_from_usb_stick
Menu-Pre-Cmd:
Menu-Post-Cmd:
```

With the key name „Menu-Name:“ the text in the LC display will be defined. The „Menu-Type:“ will be always „default“ (not supported yet). The „Menu-Script“ will define the real name of the script file which will be started if the submenu will be activated with the CLR/ACK button. The following message will be displayed on the LCD:

```
copy configuration to memory stick
  INC -> YES         MENU -> NO
```

With the key names „Menu-Pre-Cmd:“ and „Menu-Post-Cmd:“ some special internal commands can be activated before or after starting the script file. The following commands are possible:

RELOAD_CONFIG:	reload configuration file of the Lantime
REBOOT:	reboot the operating system on Lantime

When connecting the USB stick to Lantime the filesystem of the USB stick will be mounted to „/mnt/usb_storage“. This interface can be used to configure the menu and script files.

Menu Script Files

The name of the script file which will be activated when pressing the CLR/ACK button on a submenu will be defined in the Menu configuration file. The script files consists of commands using in a Telnet session (like „cp“ or „rm“). The following example will copy the Lantime configuration file from the USB stick to the internal flash of the Lantime.

```
mount -o remount, rw /mnt/flash
cp /mnt/flash/global_configuration /mnt/flash/global_configuration.old
cp /mnt/usb_storage/my_config  /mnt/flash/global_configuration
mount -o remount, ro /mnt/flash
```

Be aware that the internal flash of the Lantime is read only mounted. If you want to copy files to the internal flash of the Lantime the internal flash have to be remounted for writing (use the command: „mount -o remount, rw /mnt/flash“).

Keypad locking

The USB stick can be used for locking the buttons of the Lantime LC display. Activating this feature the user cannot use the buttons without connecting the USB stick to Lantime. The access authorisation has been realized with a password file on the USB stick “/mnt/usb_storage/Lantime/keypad_lock“. This password file will be compared with “/mnt/flash/keypad_lock“. So it is possible to manage different Lantime with one USB stick.

The keypad locking will be activated with a submenu from the USB stick:

```
SETUP:       USB MEMORYSTICK
 prepare front panel keypad locking
```

When activating this submenu the file “/mnt/usb_storage/Lantime/keypad_lock“ will be copied to the internal flash. When de-activating the keypad locking this file will be removed from the internal flash.

```
SETUP:       USB MEMORYSTICK
 remove front panel keypad locking
```

Reference

[Mills88] Mills, D. L., "Network Time Protocol (Version 1) - specification and implementation", DARPA Networking Group Report RFC-1059, University of Delaware, July 1988

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[Mills90] Mills, D. L., "Network Time Protocol (Version 3) - specification, implementation and analysis", Electrical Engineering Department Report 90-6-1, University of Delaware, June 1989

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