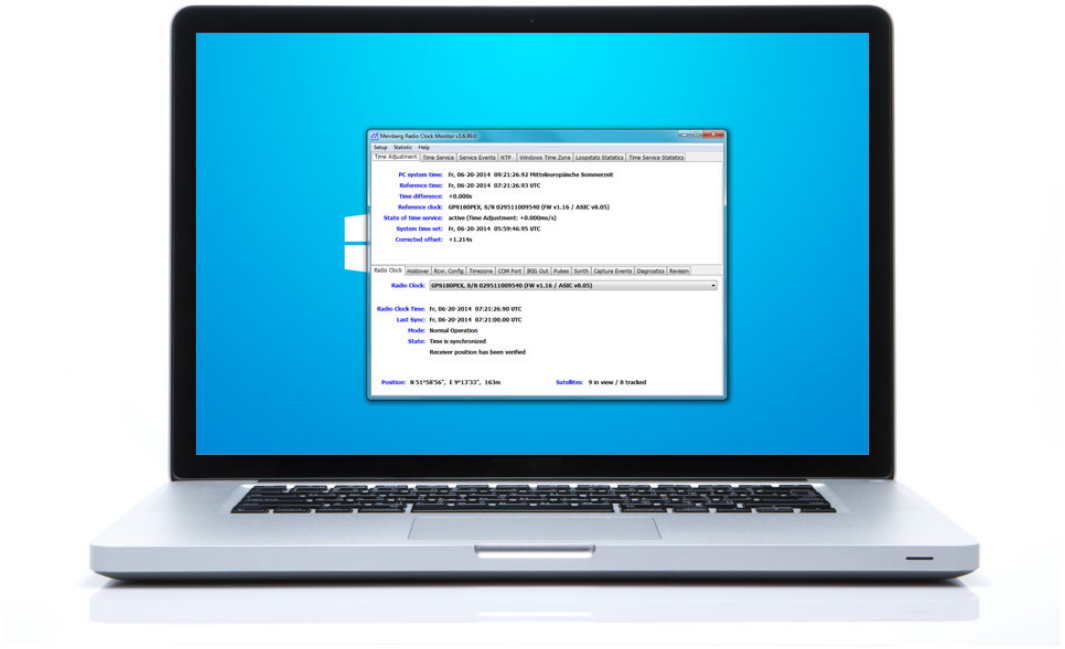

MANUAL

MBGMON-WX

Meinberg Monitoring Software

10th July 2014

Meinberg Radio Clocks GmbH & Co. KG

Table of Contents

1 Impressum

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2 Overview

This document describes the features of the Meinberg driver software package MBGMON-WX for Windows. The package can be used under Windows NT and all newer versions, the package can not be used under Windows 95, Windows 98, and Windows ME.

The driver package can be used with any Meinberg plug-in board with PCI or ISA bus, or with an external device which is connected to one of the computer's serial RS-232 ports and transmits the Meinberg standard time string once per second. Additionally all Meinberg USB devices and systems with a corresponding network interface can be used.

The Meinberg Time Adjustment Service MbgAdjTm reads a reference time from the installed device and keeps the Windows system time synchronized to that reference time. If the required time adjustment is below a configurable limit then the system time is slewed smoothly, without time steps, and therefore unnoticeably for other applications. The service runs in the background and can thus also operate if no user is logged on.

The monitor program MbgMon can be used to configure and check the status of the time adjustment service. Additionally it can be used to review or modify configurable parameters of an installed plug-in board or external device which is connected by network or serial interface.

3 Install

3.1 Installing The Driver Software

If a new PCI or USB device is installed under a modern operating system with Plug-And-Play support (e.g Windows 2000 and newer) then the driver software should be installed before the device, in order to let the operating system's device manager recognize the new device correctly. If a device with ISA bus is installed, or installation is done under Windows NT (which does not provide Plug-And-Play support) then the card should be installed before the driver software in order to let the installation program be able to detect and the card.

Download DKWIN driver for Meinberg Clocks
`http://www.meinbergglobal.com/english/sw/#win`

If an external device is installed which is connected to one of the PC's serial ports then it doesn't matter at all whether the driver software or the device is installed first.

If an existing driver package shall be updated to a newer version then the newer version can simply be installed over the existing version. If no program except the time adjustment service (e.g. the monitor program, or third party applications) are accessing the device during installation then usually there's not even a reboot required. The driver package is shipped as a self-extracting archive which unpacks itself when executed and then starts the setup program. The setup program asks for an installation directory. By default the program is installed in Meinberg/MbgMon below the default program directory. During installation the time service MBGADJTM.EXE and some Meinberg DLLs are copied to the Windows system directory.

Download MBGMON-WX (Installer and Documentation)
`http://www.meinberg.de/download/utils/windows/mbgmon-wx.zip`

After the software has been installed the radio clock device can be installed:
- *Installing a Plug-In Device*
- *Installing an External Device*

After installation has been completed the monitor program MbgMon should be run in order to review the configuration. The tab labelled Time Service can be used to control the way the time service works. In the normal case those settings don't need to be modified. The tabs in the lower part of the monitor program window can be used to check status and configuration of the radio clock.

Finally you should start the time adjustment service (Menu Setup | Start Time Service) to have the Windows system time synchronized.

3.2 Installing an Internal Radio Clock

First please note the hints on Installing the Driver Software.

Shut down the PC and install the Meinberg plug-in board in a free slot. After reboot a plug-and-play operating system (i.e. Windows 2000 and newer) will detect a new PCI card and the "New Hardware" wizard will appear to install a driver for the new device. Point the installer to the subdirectory driver/pnp where the *MEINBERG.INF* file is located.

ISA cards can not be detected automatically so you have to run the "Add Hardware" wizard manually to install the new device (see readme.txt for details).

Under Windows NT the driver should be installed after the plug-in board has been installed. The driver detects PCI cards automatically. If you install an ISA card then the appropriate checkbox must be marked and the card's port base address has to be entered during installation.

Finally you should start the time adjustment service (Menu Setup | Start Time Service) to have the Windows system time synchronized.

3.3 Installing an External Radio Clock

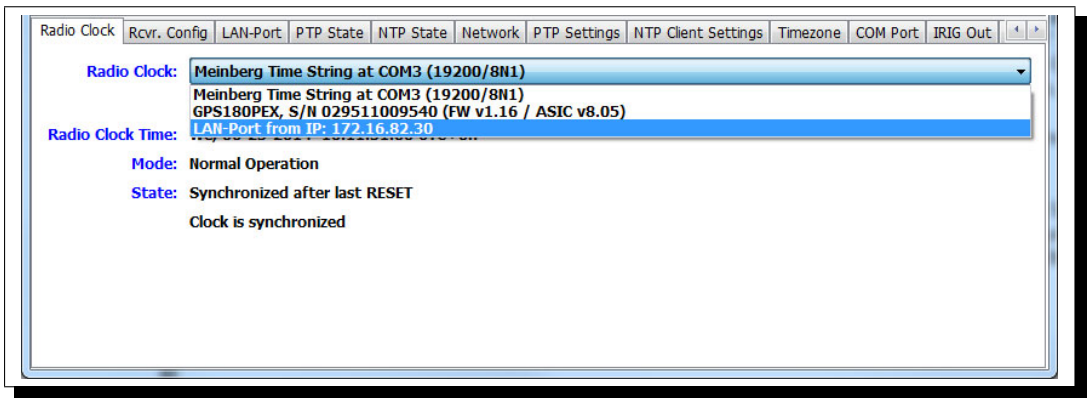
Be sure an external device is connected to one of the computer's COM ports which transmits the Meinberg Standard time string once per second.

After the driver software package has been installed, start the monitor program MbgMon. Check the pull down menu "Radio Clock" on the tab sheet "Radio clock" if "Meinberg time string at COM ..." is selected. The COM Port tab sheet can be used to configure the serial port the external device is connected to. Finally you should start the time adjustment service (Menu Setup | Start Time Service) to have the Windows system time synchronized.

If an USB device is used, install the driver software first, then plug-in the device. Afterwards the "New Hardware" wizard will appear to install a driver for the new device. Point the installer to the subdirectory *driver/pnp* where the *MEINBERG.INF* file is located.

3.4 Configuration of an external Clock over the Network

Devices, which are equipped with a network interface (LAN-XPORT) can be configured using the MBGMON-WX software. These configuration settings can be done in the lower area of the window. In the drop-down menu "Radio Clock" the corresponding port can be selected. If no network interface is available, you can open the tab sheet "LAN-Port" and with the button "Search" all available network devices will be listed here (see chapter 6.8.5).



4 The Time Adjustment Service MbgAdjTm

The Meinberg time adjustment service for Windows is used to adjust the Windows system time according to a reference time provided by a Meinberg radio clock. This function has been implemented as a Windows service which runs in the background even if no user is logged in. The service status can be checked using the monitor program MbgMon, which also provides the tab "Time Service" which can be used to configure the way the service works.

The Windows system clock is internally based on UTC (Universal Time, Coordinated; formerly called GMT, Greenwich Mean Time) which is world-wide the same and does not account for any daylight saving. Thus it enables the system to order events by time, even if they occur on computers located in different time zones.

However, users normally prefer to see the time according to their time zone, so Windows lets the user select his time zone and before the time is presented to the user the operating system converts it to local time depending on the user's configuration. So conversion to local time, and switching to and from daylight saving, depends on the time zone configured for the operating system and thus is to be handled by the operating system.

After the service has been started it normally waits until the reference time source claims to be synchronized before it starts to adjust the Windows system time. This behaviour can be changed using the service configuration parameter Ignore sync after reset.

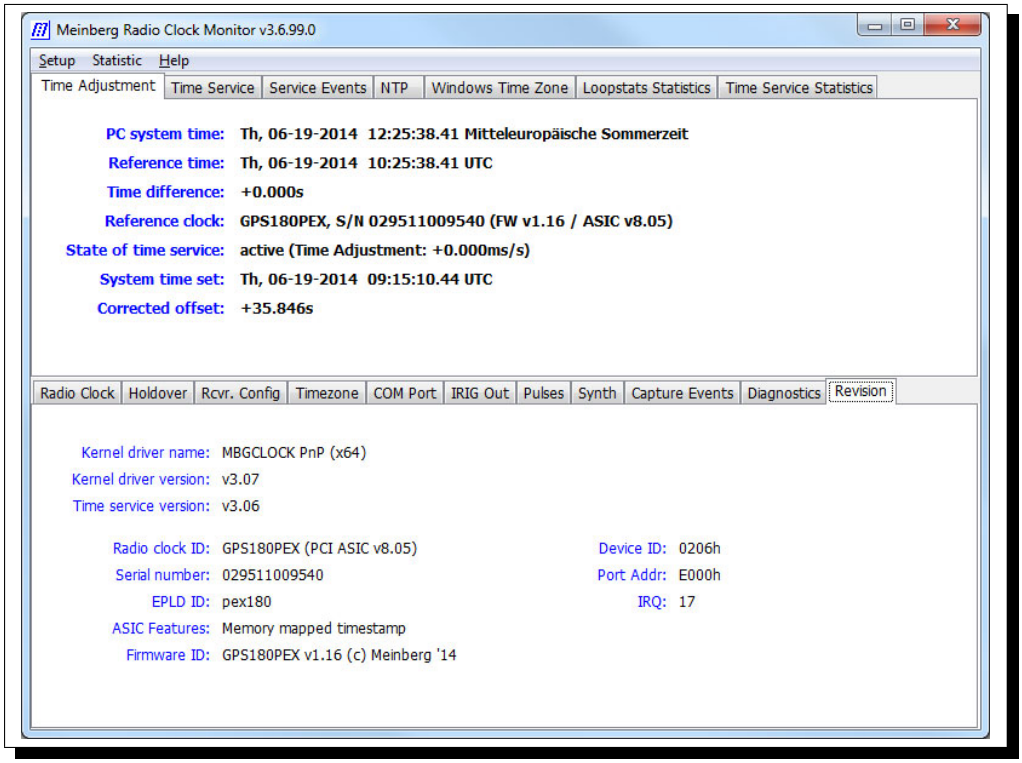
The time adjustment service controls the Windows UTC time, not the local time. The service reads the reference time from a radio clock, converts it to UTC, and calculates the difference to the Windows UTC time. If the time difference exceeds a limit called sync radius then the Windows system time is stepped, otherwise the time difference is corrected by accelerating the system clock or slowing it down until the difference of times is minimized. The advantage of this approach is that the system time normally increases monotonically, without steps, and corrections are made unnotifiably for other applications

Events like starting/stopping the service or status changes of the reference time source are logged in the Windows application event log.

The accuracy of the time adjustment depends on the type of the reference clock. With GPS, GLONASS and IRIG receivers an accuracy of better than 1ms is possible, with DCF77 receivers the accuracy is better than 10ms.

5 The Monitor Program MBGMON-WX

This monitor program is used to control the status of the reference clock, the PC's system time and the status of the time adjustment service. Once the driver and the service have been installed properly and the service has been started, the monitor program can be terminated since the system time is adjusted by the time service which runs in the background.

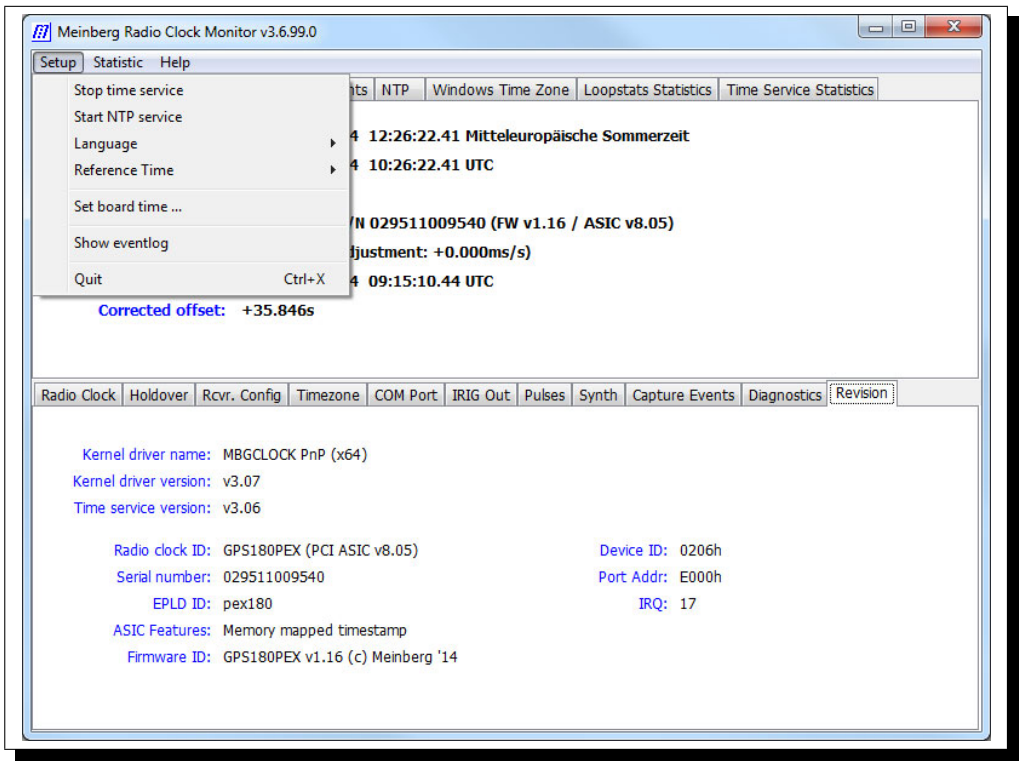


Note: If the any configurable parameter shall be modified then the program must be run from an account which has administrator rights. Without administrator rights the configuration can be reviewed, but not modified. In this case the associated controls are grayed out.

The different features of the program are explained in the following chapters:

- Menu "Setup"
- Status and Configuration of the Time Adjustment Service
- Status and Configuration of the Radio Clock Device

5.1 The Menu Setup

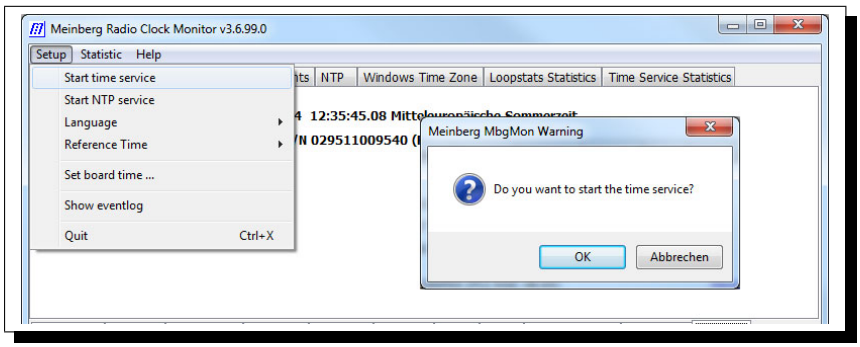


This menu lets the user modify some basic settings of the service program and change language used by the monitor program. The service can be started or stopped, and the reference time source can be selected, if several sources are available. If the NTP package is also installed then the NTP service can be started or stopped using this menu. If supported by the reference time device then this menu can also be used to set the reference time manually, which may be required for testing purposes.

Menu items which can not be used are displayed grayed out:

- Start/Stop time service
- Start/Stop NTP service
- Language
- Reference Time
- Set Board Time
- Show eventlog

5.2 Setup | Start/Stop Time Service



This menu can be used to start or stop the Meinberg time adjustment service. If the service is currently active then it can be stopped, and vice-versa. The service start mode is changed accordingly, so the service is only started automatically when the computer is rebooted if it is currently started.

The tab "Time Adjustment" can be used to monitor the service status.

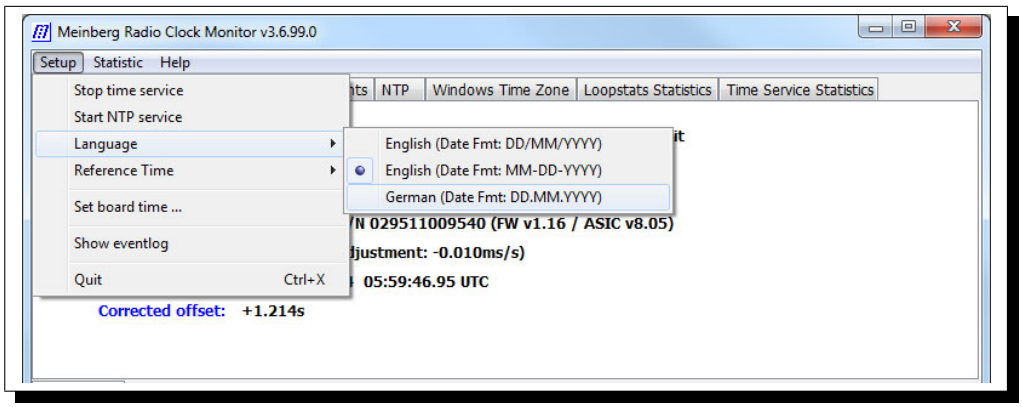
5.3 Setup | Start/Stop NTP Service

This menu can be used to start or stop the NTP service. If the service is currently active then it can be stopped, and vice-versa. The service start mode is changed accordingly, so the service is only started automatically when the computer is rebooted if it is currently started.

The NTP service can be used to distribute the disciplined Windows system time on the network. If the NTP package is not installed then this menu item is grayed out.

Additional information about NTP can be found on the Meinberg NTP Info Page on the internet:
`http://www.meinbergglobal.com/english/info/ntp.htm`

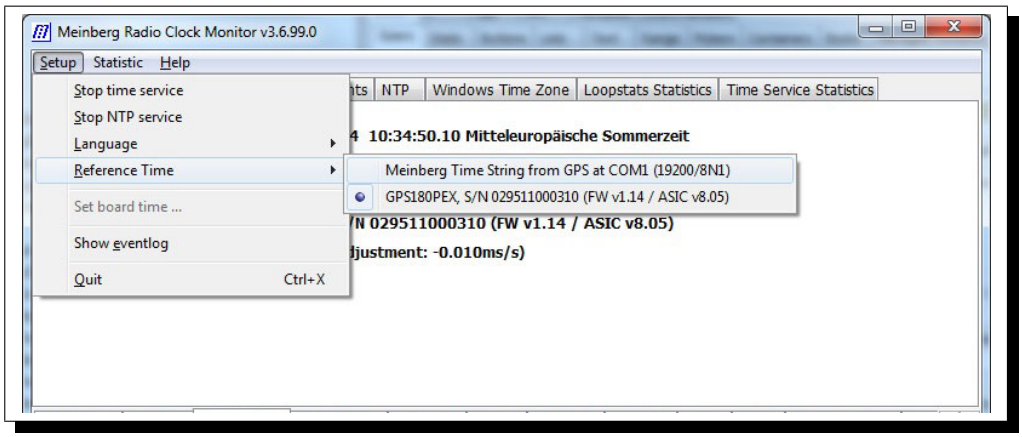
5.4 Setup | Language



This menu item can be used to select the display language of the monitor program. The selected language is saved and used again when the monitor program starts the next time

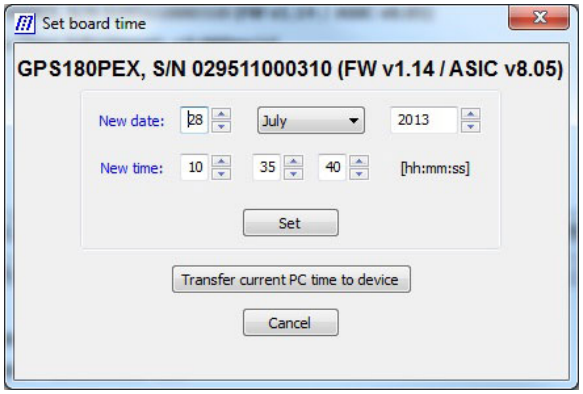
Two different time and date display formats can by selected for English language.

5.5 Setup | Reference Time



If several reference time sources are available, e.g. several plug-in boards and an external device, then this menu item can be used to select which of them is to be used by the time adjustment service to discipline the system time.

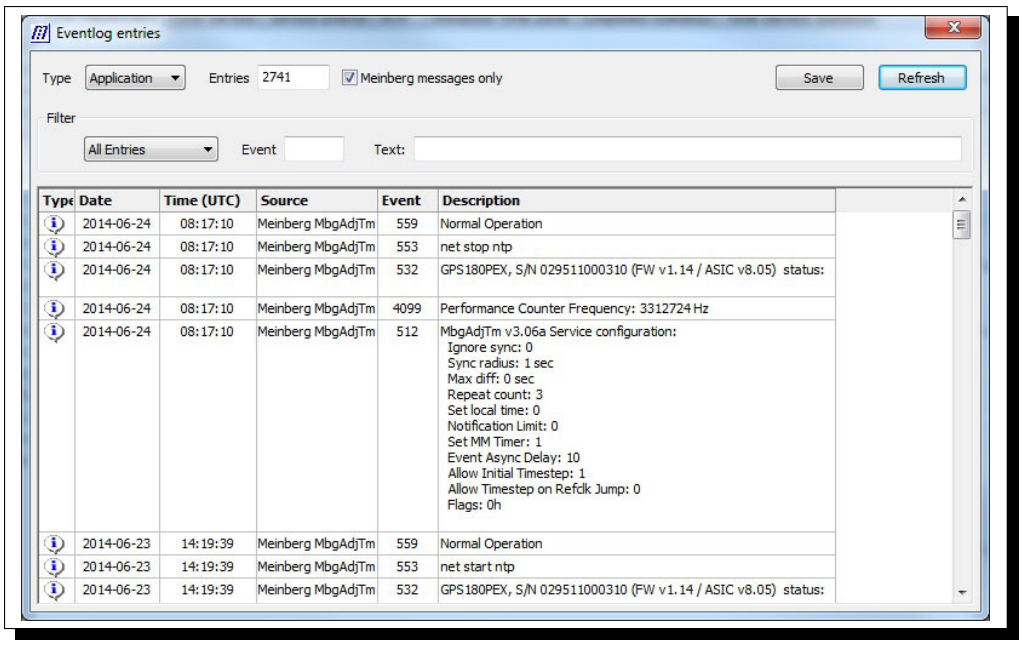
5.6 Setup | Set Board Time



This menu item can be used to set the time of a reference time source device manually, if this is supported by the device. This can be useful for testing purposes. A dialog is displayed where the new date and time can be entered.

Alternatively, the current PC time is transmitted to the reference clock. Please note that the achievable accuracy with which the system time can be transferred depends on the used reference clock.

5.7 Setup | Show Event Log



This menu item displays the Windows Event Log and protocol files in .evt format. Messages that are originated from Meinberg applications can be filtered out easily.

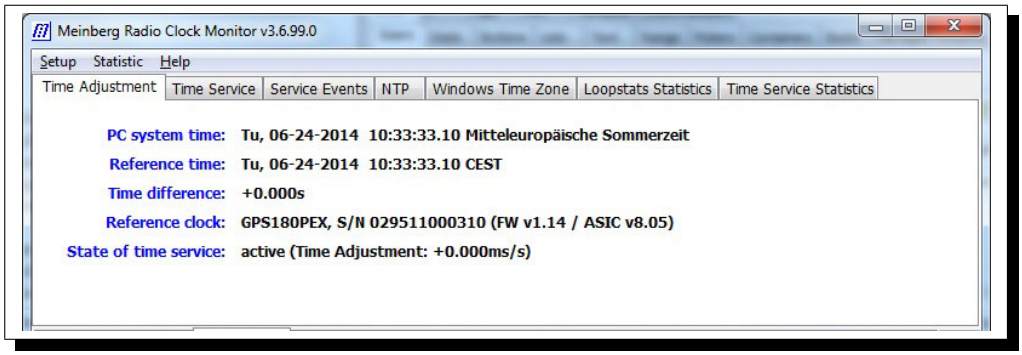
6 Status and Configuration of the Time Adjustment Service

The following chapters refer to the upper half of the MbgMon window which can be used to monitor the status of the time adjustment service and configure the way the time adjustment service behaves.

The exact appearance and the number of the active tabs may vary depending on the system configuration and the installed software packages:

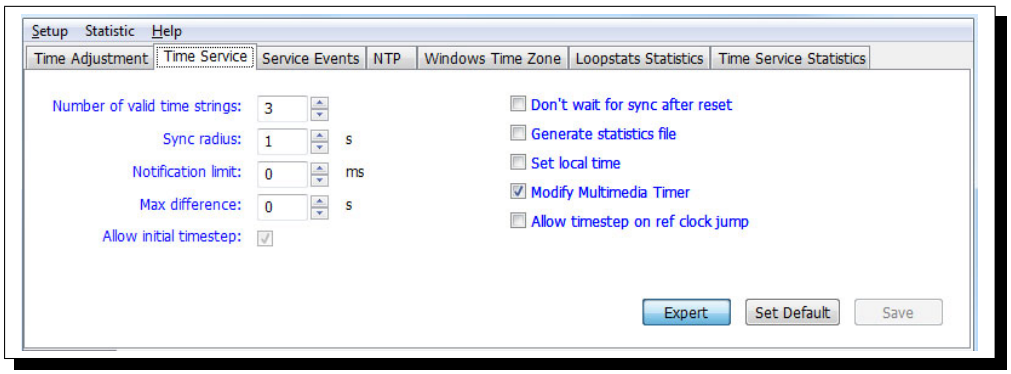
- Time Adjustment Status
- Time Service Configuration
- Time Service Events
- WindowsTimezone
- NTP Service
- Loopstats Statistics
- Time Service Statistics

6.1 The Tab Sheet Time Adjustment



The result of the last time comparison is displayed here, including time and offset of the last correction. The parameter "Reference Clock" indicates which reference clock is used for the time adjustment. The parameter "Time Adjustment" provides information about the correction value used to slew the system clock.

6.2 The Tab Sheet Time Service



On this page the time adjustment service can be configured. The button "Set Default" resets all parameters of the time service to their default settings. Changes come into effect when the "Save" button is clicked.

A detailed description of the configuration parameters can be found on the following pages:

- Number of valid time strings
- Sync Radius
- Notification Limit
- Max difference
- Ignore sync after reset
- Generate statistics file

Expert Modus:

- Set local time
- Modify Multimedia Timer
- Allow timestep on ref clock jump

6.2.1 Number of valid time strings

Whenever the time adjustment service reads the reference time from a radio clock, transmission errors may occur (mainly if an external radio clock is connected via interface cable) which let the service read a faulty time.

The service compares system time to the reference time to check whether an adjustment of system time is necessary or not. However, the adjustment will be applied only if a number of consecutive comparisons configured here indicate adjustment is needed. This value is set to 3 by default.

6.2.2 Sync Radius

The time adjustment service calculates the difference between system time and the reference time read from a radio clock. If the absolute difference is less than the difference defined by this parameter the system time is adjusted to the reference time by slowing down or speeding up the Windows system clock, so the system time is adjusted monotonically without any discontinuity.

However, a large difference would imply a long time until the adjustment would be completed, so if the absolute difference exceeds this value system time will be set immediately in spite of the resulting discontinuity. This value is set to 1s by default.

6.2.3 Maximum Difference

This parameter defines a maximum difference of time that may be adjusted by the time adjustment service. If a large difference between system time and reference time is detected on a running system there could either be some defect, or the administrator has modified system time.

In either case the service may not be allowed to adjust system time, so it stops itself. The administrator must care to correct the settings and restart the service. If this parameter is set to 0 then this feature is disabled. This value is set to 0 by default.

6.2.4 Notification Limit

If a value is entered in this field then a notification log entry is generated every time the difference between the system time and the reference time crosses this limit.

6.2.5 Ignore Sync after Reset

By default, the time adjustment service waits until the radio clock has synchronized at least once after power-up before the computer's system time will be adjusted. The corresponding status flag is provided by the plug-in radio clocks and is also part of the serial time string.

However, in a noisy electrical environment it may take a long time until the clock can properly decode proper the time marks. On the other hand, the time that is kept inside the radio clock is often much more accurate than the time provided by the computer's built-in real time clock, so the administrator can check this box to let the service ignore the flag mentioned above and adjust the computer's system time immediately. By default this option is not enabled.

6.2.6 Generate Statistics File

If this checkbox is marked then the service generates another log file for statistic purposes under the following path: "SystemDrive/mbgstats.log". If an internal satellite receiver is used then the number of satellites in view and the number of good satellites are recorded in this text file. A new entry is added whenever one of thoose values changes.

If an internal DCF77 clock is used then the signal strength is recorded. A new entry is added whenever the signal strength changes significantly. By default this option is not enabled.

6.2.7 Set Local Time

The Windows system clock is internally based on UTC (Universal Time, Coordinated; formerly called GMT, Greenwich Mean Time) which is world-wide the same and does not account for any daylight saving. Thus it enables the system to order events by time, even if they occur on computers located in different time zones.

The time presented to the users is derived from that UTC time depending on the configured Windows time zone settings. Depending on those settings, the operating system also switches to and from daylight saving time according to the configuration. Normally the driver software also converts the reference time to UTC which is then used to discipline the computer's UTC time. The computer's local time is then derived from the disciplined UTC time, as described above.

Some broken time configuration may require that the Windows local time is directly adjusted to the local time from the reference clock, so this option can be checked in order to let the time adjustment service behave this way.

However, **Meinberg explicitely discourages from setting this option** since it may cause the Windows UTC time to step back and forth in the background, which is not obvious at the first glance and may yield unpredictable results, especially with regard to database applications. By default this option is not enabled.

6.2.8 Modify Multimedia Timer

The windows multimedia timer is normally used by multimedia applications which set the timer to highest resolution in order to allow for seamless playback of music, videos, and animated images. Unfortunately, for other applications the system time seems to step by up to more than 100 milliseconds when the first multimedia application starts. The time seems to step back after the last multimedia application has terminated.

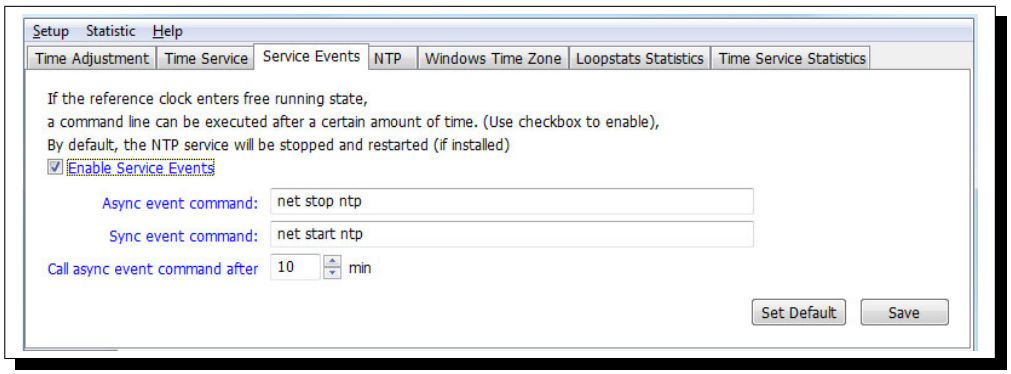
If this option is checked the the time adjustment service sets the multimedia timer to highest resolution as long as the service is active, so there are no morte time steps when multimedia applications are started or stopped. By default this option is enabled.

6.2.9 Allow time step on ref clock jump

The time adjustment service checks permanently if the reference clock sends consistent consecutive time stamps one after each other. If a hardware failure occurs then the reference clock might deliver a faulty time stamp although the status pretends that the card is synchronized. The service recognizes this time step automatically and stops the adjustment.

In special test environments a big time step of the reference clock might be ok, especially in cases where the reference clock has been set manually. If this option is enabled the security checks of the time stamps are suppressed. By default this option is disabled.

6.3 The Tab Sheet Service Events

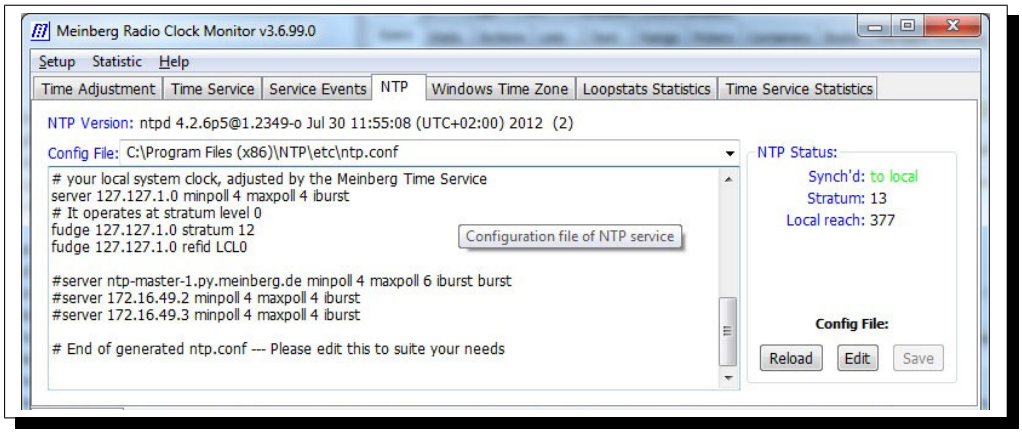


This page allows the configuration of the time services´ reaction on certain events. One event occurs when the reference time source enters the "free running" state. Another event occurs when the source re-enters the sync state. Two command lines can be assigned to one event respectively. A batch file or an executable can also be assigned to an event.

The main purpose of this feature is to control the running state of the NTP service if installed. So the calls "net stop ntp" and "net start ntp" are the default values. In contrast to Unix operating systems the NTP service has no chance of checking the state of a reference clock because it cannot access the reference clock directly. This feature prevents the NTP service of sending out a possibly wrong time into the network.

Under difficult reception conditions, there is a possibility of temporary loss of synchronization. But because of the holdover capability of reference clock when running on a crystal oscillator, the time remains very accurate for some time. That's why a delayed execution of the command line is possible. The delay is set to 10 minutes by default.

6.4 The Tab Sheet NTP



Note: This page is displayed only if the NTP time service is also installed.

On this page, the most important state messages of the NTP Service are displayed.
The Service can act as a
- Client,
- Server, or
- Peer.

The NTP Service can be started or stopped using the menu Setup | start / stop NTP service

- As client the NTP service queries its reference time from one or more other servers.
- As server it makes its own time available as reference time for other clients.
- As peer it compares its system time to other peers until all the peers finally agree about the "true" time to synchronize to.

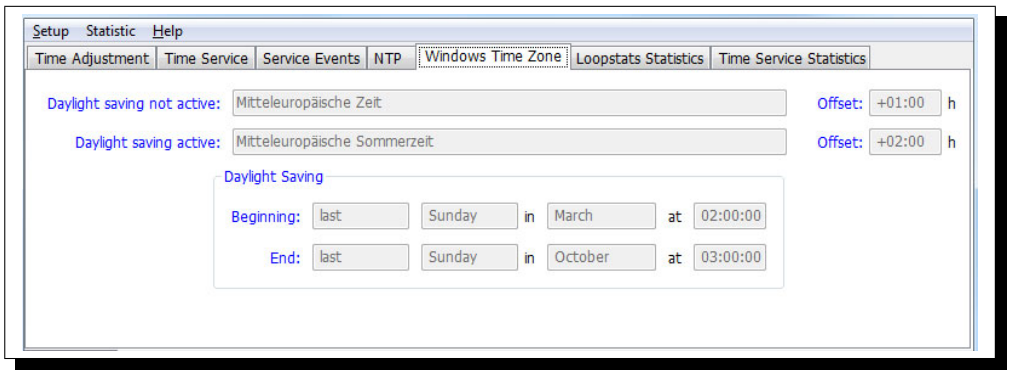
These features can be used to set up a hierarchical time synchronization structure. The hierarchical levels of the time synchronization structure are called stratum levels. A smaller stratum number means a higher level in the hierarchy structure. On top of the hierarchy there is the daemon which has the most accurate time and therefore the smallest stratum number. By default, a daemon's stratum level is always one level below the level of its reference time source. The top level daemon often uses a radio clock as reference time source. By default, radio clocks have a stratum number of 0, so a daemon that uses that radio clock as reference time will be a stratum 1 time server, which has the highest priority level in the NTP hierarchy.

In large networks it is a good practice to install one ore more stratum 1 time servers which make a reference time available to several server computers in each department. Thus the servers in the departments become stratum 2 time servers which can be used as reference time source for workstations and other network devices of the department. The reach Value shows if a reference time source could be reached at the last polling intervals, i.e. data could be read from the reference time source, and the reference time source was synchronized. The value must be interpreted as an 8 bit shift register whose content is displayed as octal values. If the NTP daemon has just started, the value is 0. Each time a query was successful a "1" is shifted in from the right, so after the daemon has been started the sequence of reach numbers 0, 1, 3, 7, 17, 37, 77, 177, 377. The maximum value 377 means that the eight last queries were completed successfully.

The NTP daemon must have reached a reference time source several times (reach not 0) before it selects a preferred time source and puts an asterisk in the first column. Finally the ntp.conf file is displayed and can be edited.

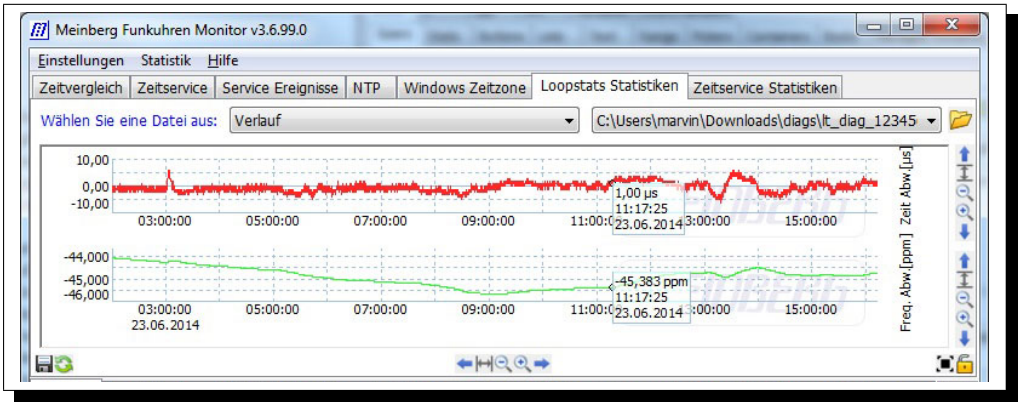
Detailed Information about NTP and its configuration options can be found on our
NTP Info Page on the Internet:
http://www.meinbergglobal.com/english/info/ntp.htm

6.5 The Tab Sheet Windows Time Zone



Unfortunately there's no easy way under Windows to check when the operating system switches to and from daylight saving time according to the configured time zone. This tab page can be used to check and verify the selected settings. However, this program does not support any modification of those settings.

6.6 The Tab Sheet Loopstats-Statistics

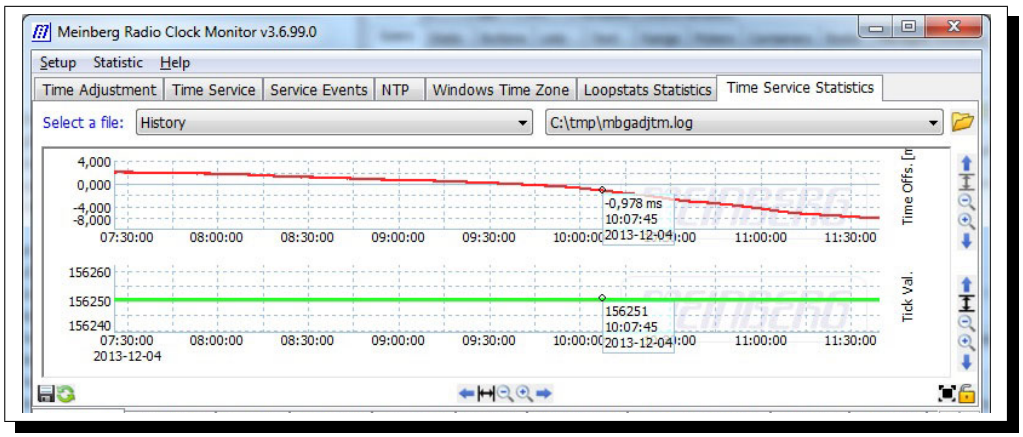


On this site, you will see two graphs, if you choce a valid loopstats file before. The Loopstats is a statistics file with numeric offsets between the reference time and internal system time. This file is generated during synchronisation and comprises the date, time, time offsets and the frequency of the system.

The numeric value at the Tab Sheet Time Service (time difference) shows only the current offset between the reference time and the system time. This is not very significant and you don´t know the characteristics of the offset from the whole synchronisation. Now you can generate a statistic file (see generate statistics file) and shows it graphical in this tab sheet. The upper graph describes the time offset between the reference time and the internal system time in seconds. The lower displays the oscillation of the frequency in PPM (part per minute) during the synchronisation. The units will scale automatically, but you can scale it manually. If you want to change the scaling, use the buttons around the graphics or the mouse wheel (in addition with Strg for horizontal scrolling).

You can save the graphs by using the save button in the left lower corner. Refresh the graph with the button next to it. If you want to lock the vertical zooming, click the button in the right lower corner. There is also a button to scale the graph automatically.

6.7 The Tab Sheet Time Service Statistics



On this site, you will see two graphs if you chose a valid time service statistic file before. It is a statistics file with numeric offsets between the reference time and internal system time. This file is generated during synchronisation if Meinberg Time Service is active.

The numeric value behind the time service status at the Tab Sheet "Time Adjustment" (behind the Time Service status) shows only the current offset between the reference time and the system time. This is not very significant and you don't know the characteristics of the offset from the whole synchronisation. Now you can generate a statistic file (see: generate statistics file) and draws it graphical in this tab sheet. The upper graph describes the time offset between the reference time and the internal system time in seconds. The lower graph displays the tick value of the frequency in PPM (part per minute) during the synchronisation. The units will scale automatically, but you can scale it manually. If you want to change the scaling, use the buttons around the graphics or the mouse wheel (in addition with Strg for horizontal scrolling).

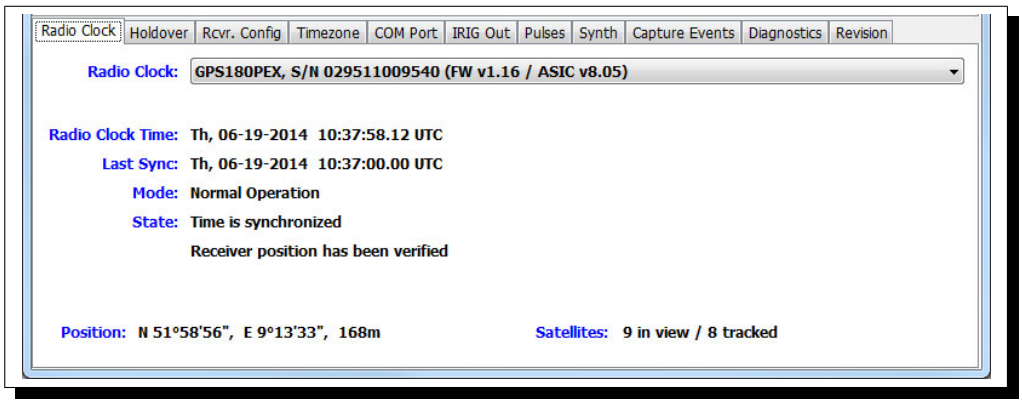
You can save the graphs by using the save button in the left lower corner. Refresh the graph with the button next to it. If you want to lock the vertical zooming, click the button in the right lower corner. There is also a button to scale the graph automatically.

6.8 Status and Configuration of the Radio Clock Device

The following chapters refer to the lower half of the MbgMon window which can be used to monitor the status of the radio clock device and modify the configuration of plug-in devices. The exact appearance and the number of the active tabs vary depending on the type of the device used as reference time source. Only those tabs are displayed which can be used for the selected device:

- Radio Clock
- Holdover / Antenna
- Receiver Configuration
- Lan Port
- PC COM Port
- Network
- PTP Status
- PTP Settings
- NTP Status
- NTP Client Settings
- Time Zone
- COM Port for Plug-In Boards
- IRIG In
- IRIG Out
- Pulses
- Synth
- Capture Events
- Event-Log
- Holdover
- Diagnostics
- Revision

6.8.1 The Tab Sheet Radio Clock



The pull down menu "Radio Clock" selects a reference time source to check its status and modify its configuration using the remaining tabs of the register. Any of the installed plug-in cards can be selected, plus one external device connected via one of the computer's serial ports.

The reference time source selected here does not affect the device which has been selected as reference time source for the time adjustment service (see also Setup | Reference Time).

Last Sync: The radio clock's last synchronization time.

Status messages:
If reference clock device operates properly then some messages similar to those below should be displayed:

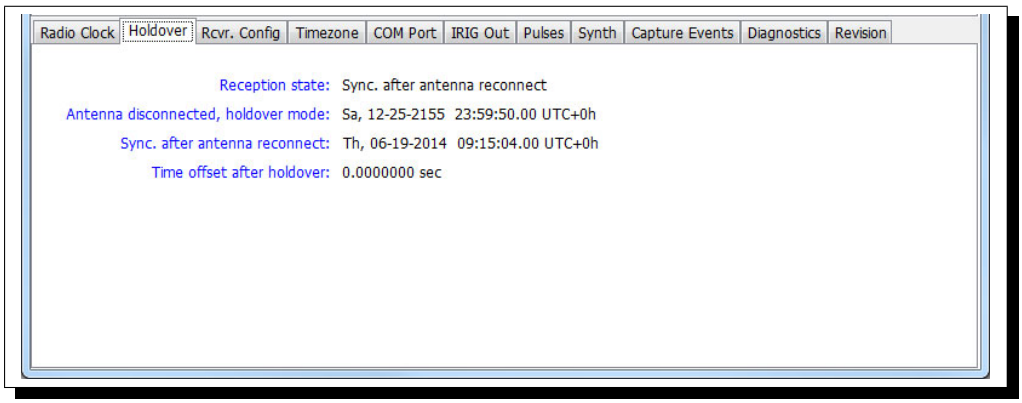
GPS:
Normal Operation
Time is synchronized
Receiver position has been verified

DCF77/IRIG:
Normal Operation
Synchronized after last Reset
Clock is synchronized

You can find a detailed description of possible error messages here:

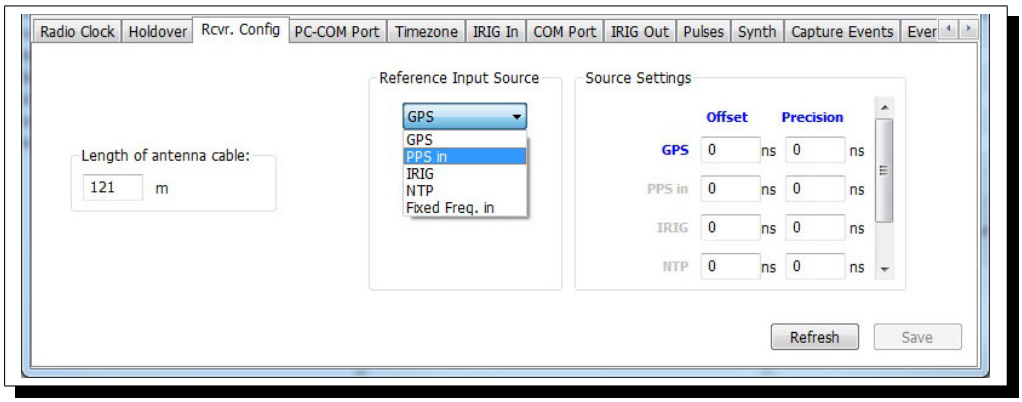
Modulation Display (Mod.):	If a plug-in DCF77 radio clock is installed properly this field reflects the second markers decoded from the received long wave signal
Modulation Signal On /Off:	If the note symbol is enabled, the modulation signal from DCF77 is made audible.
Signal Bar:	The length of the signal bar corresponds to the strength of an incoming DCF77 or IRIG signal. If the signal strength is too low then the status info "Antenna faulty" is displayed. In this case the antenna's location and orientation should be checked.

6.8.2 The Tab Sheet Holdover



This page is only displayed for satellite receivers. It shows the state of the GPS antenna, i.e. whether it is currently connected, at which time it has been disconnected and reconnected, and the time offset observed when the antenna was reconnected.

6.8.3 The Tab Sheet Receiver Config



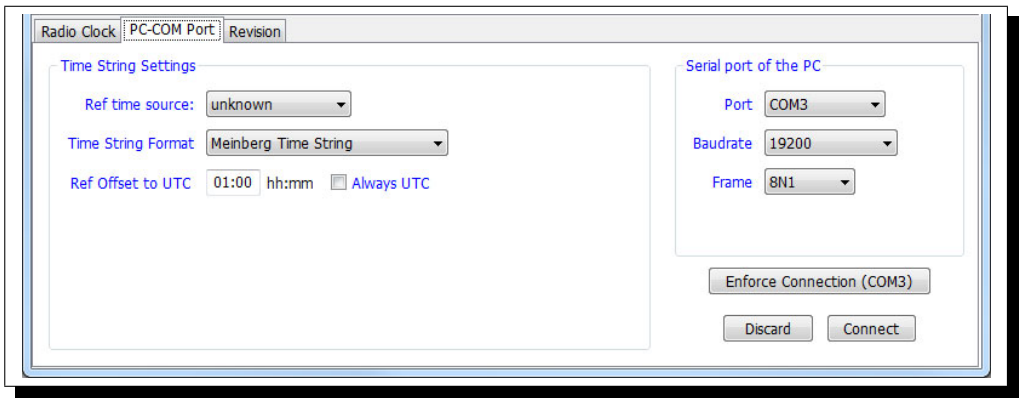
The tab sheet receiver configuration is used to set the following parameters:

GPS: Antenna cable length (m)
The configure of the GPS antenna cable length is required to let the GPS receiver be able to compensate the cable delay.

PZF (DCF77)
WWVB, MSF ... Distance to transmitter (km)

MRS System (N2X) Reference time, priority, offset and accuracy

6.8.4 The Tab Sheet PC COM Port

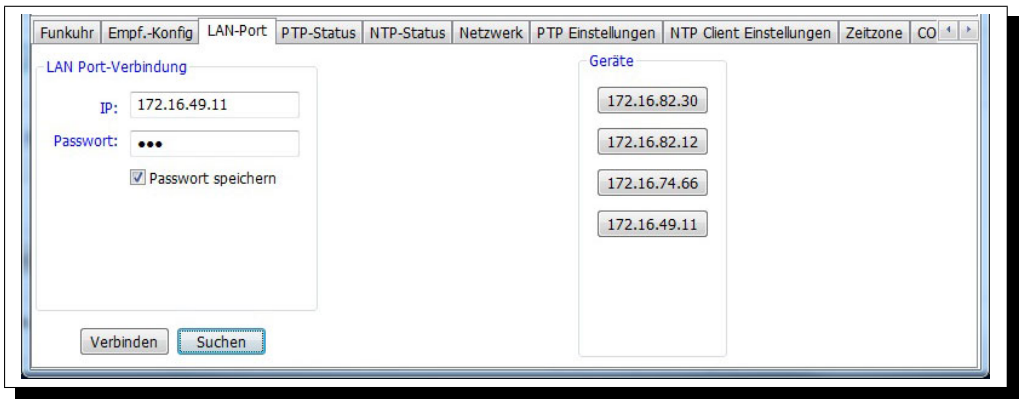


This page is only displayed if an external reference time source is configured which is connected via one of the computer's serial ports. The pull down box labeled "Port" is used to select the PC's COM port to which the external device has been connected. The tab also lets you select the transmission speed (baud rate) and framing which have to be configured according to the settings of the external device. The correct Ref Time Source (DCF77, GPS, or IRIG) should be configured in order to have the correct status info messages displayed on the "Radio Clock" tab.

Under "Telegram Type" you can select the format of the serial time string, which must also be configured according to the settings at the external device. By default the Meinberg Standard time string is used. However, some other formats can also be configured. Also check the time zone settings of the radio clock. If local time is selected on the external clock, then the reference offset must be configured so that the time service is able to calculate the correct time difference. If the external device sends a local time instead of UTC then the UTC time offset must also be configured accordingly in order to allow for a correct operation of the time adjustment service. The valid range for this parameter is -12:00 to 12:00 hours.

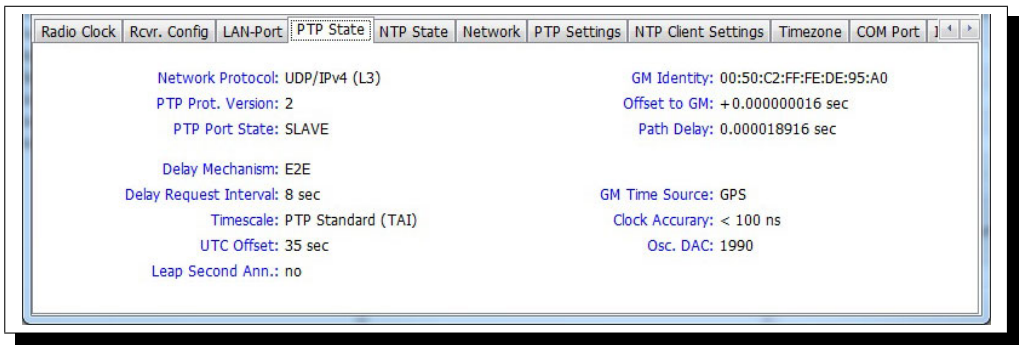
For details of the configuration of the external device please refer to the external clock's operating instructions.

6.8.5 The Tab Sheet Lan Port



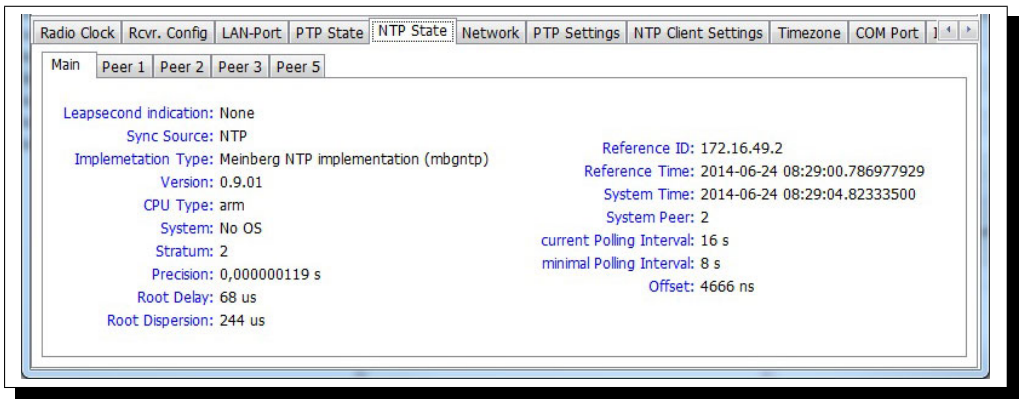
To set up a network connection, the IP address and the password must be entered in this section so that the program can access the corresponding lan port.With pressing the "Connect" button the network connection can be established. With pressing the "Search" button, all available devices on the network can be listed.

6.8.6 The Tab Sheet PTP Status



This page is only displayed if the reference clock has PTP (Precision Time Protocol) support. On this page the current status of the PTP port is displayed. After startup, the port state changes from "INITIALIZING" to "LISTENING" if the network interface is configured correctly. Afterwards the PTP slot card waits for incoming messages from a grandmaster clock in the network. As soon as valid PTP grandmaster messages have arrived the port state should change to "UNCALIBRATED" and then to "SLAVE" finally. Whenever the PTP port enters "SLAVE" mode and a valid path delay has been measured then the PTP card declares itself as "synchronized".

6.8.7 The Tab Sheet NTP Status



The NTP Status tab is divided into the following sections:

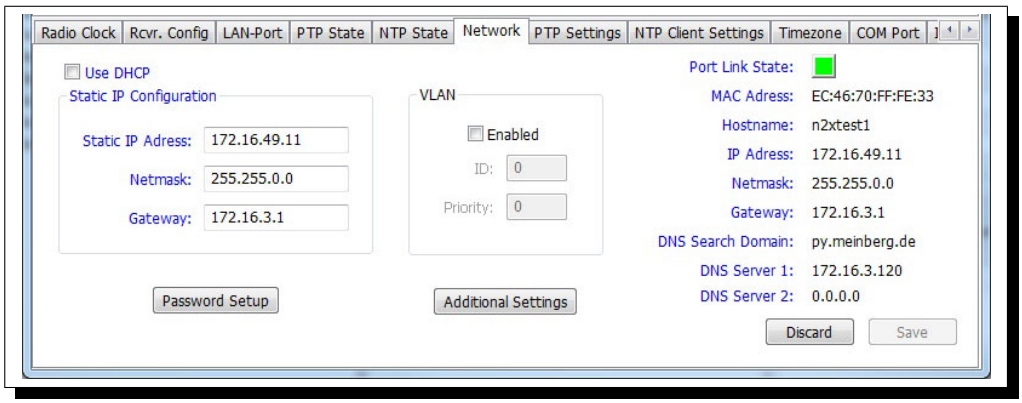
Main - the following information about the NTP status can be read here:

- Schaltsekundenankündigung
- Synchronisationsquelle
- Implementationsart
- Version
- CPU Typ
- Betriebssystem
- Stratum
- Genauigkeit
- Root Delay
- Root Dispersion
- Referenz ID
- Referenzzeit
- Systemzeit
- System Peer
- Anfrageintervall
- Abweichung

Peer_1 bis Peer_n - depending on the number of used and registered NTP server (maximum 7 are possible)

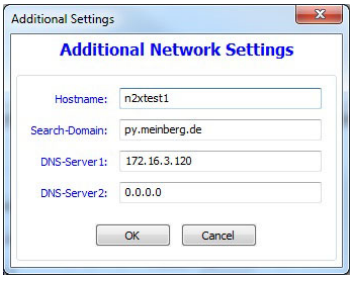
- Peer Status
- Schaltsekundenankündigung
- Ausgewählter Status
- Reach Status
- Quelladresse
- Zieladresse (z.B. SyncBox/N2X)
- Stratum
- Genauigkeit
- Root Delay
- Root Dispersion
- Referenz ID
- Referenzzeit
- Aktuelle Peer-Zeit
- Reach
- Unreach
- Host Modus
- Peer Modus
- Host Poll Interv.
- Peer Poll Interv.

6.8.8 The Tab Sheet Network



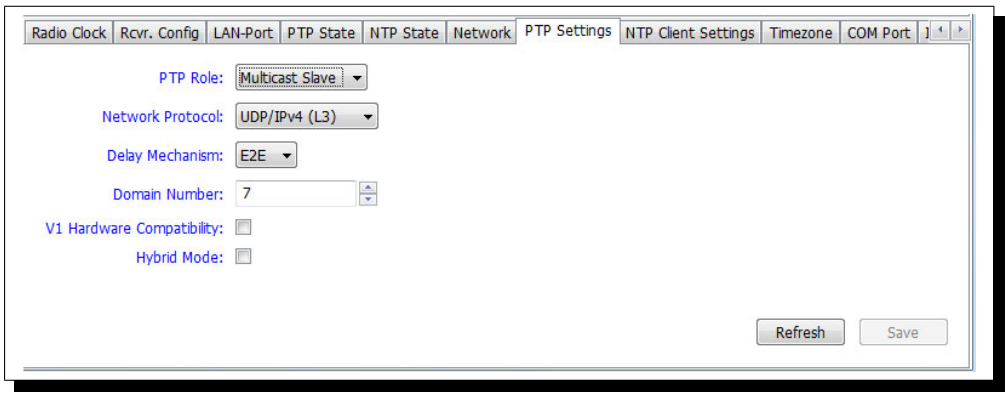
This page is only displayed if the reference clock provides a network port. On this page it can be decided if the IP address of the network port should be set via DHCP or via a static IP address. The MAC address of the network interface chip and the IP address that is currently configured are displayed.

Additionally extended network settings
can made within the menu
"Additional Network Settings":
- Hostname
- Search-Domain
- DNS-Server 1
- DNS-Server 2



With the pop-up menu "Password Settings" the user can enter or change a password for the network port.

6.8.9 The Tab Sheet PTP Settings



This page is only displayed if the reference clock has PTP (Precision Time Protocol) support. On this page some parameters of the IEEE 1588 (PTP V2) standard can be configured.

Domain Number:
A PTP domain consists of one or more PTP devices communicating with each other as defined by the protocol. The domain is identified by an integer, in the range of 0 to 255.

Network Protocol:
This parameter defines the transport protocol for the PTP communication.

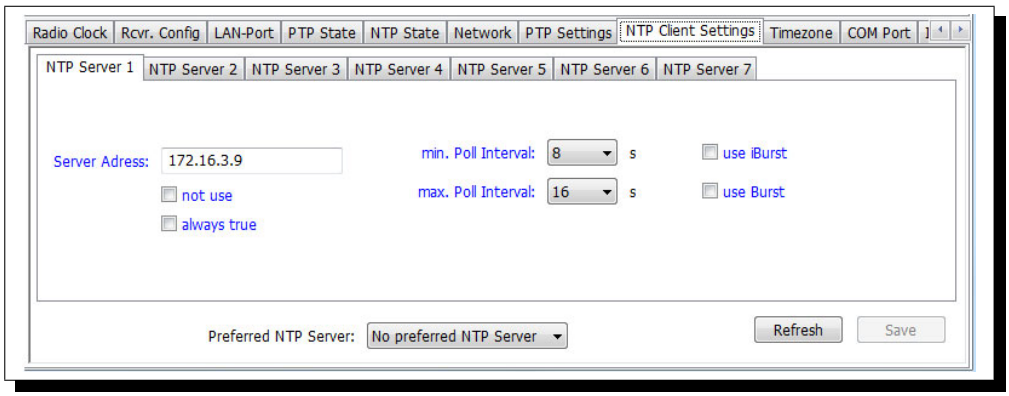
V1 Hardware Compatibility:
Some PTP Version 1 implementations of hardware assist time stamping check the length of the incoming packet before qualifying the timestamp and require the UDP payload of the PTP event messages to be at least 124 octets in length. Nodes using such hardware shall set bit 0 equal to "1" in all PTP event messages transmitted from the node.

Delay Mechanism:
The delay mechanism specifies the propagation delay measuring mechanism used by the PTP port for the computation of the "mean path delay".

E2E – End-to-end:
The "Delay Request-Response" mechanism is used between Master and Slave

P2P – Peer to Peer:
The "Peer delay" mechanism is used to measure the port-to-port propagation time to measure the link delay between two ports.

6.8.10 The Tab Sheet NTP Client Settings



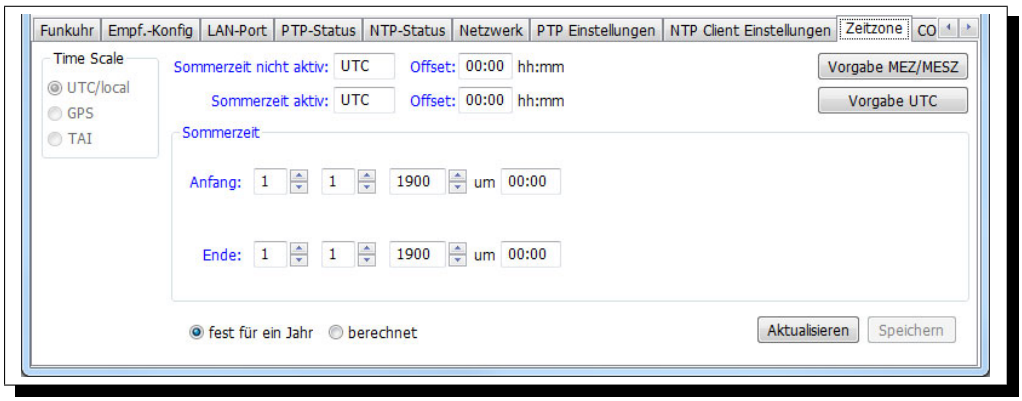
In this section up to seven external NTP servers can be set up to provide a high grade of redundancy for the used reference clock. For each of these external NTP servers the following parameters are configurable:

- Server Address - the IP of the NTP Server
- not use
- always true
- min. / max. Polling Interval
- use iBurst
- use Burst

If "iburst" is activated, the initial synchronisation speeds up because the ntpd queries more NTP packets than usual from servers with this designation, so the NTP Daemon is able to collect the necessary data to make the evaluation more quickly.

The "iburst" option is recommended, and sends a burst of packets only if it cannot obtain a connection with the first attempt. The "burst" option always does this, even on the first attempt, and should never be used without explicit permission and may result in blacklisting.

6.8.11 The Tab Sheet Time Zone



This tab is only displayed if the selected plug-in board supports an on-board time zone configuration. The board's time zone configuration affects only the time displayed in the monitor program, and the time output e.g. via a card's serial port or IRIG output. Synchronization of the Windows time is not affected because the time adjustment service always converts the card's on-board time to UTC before it is used to adjust the Windows UTC time.

Some of the plug-in board only allow for a selection of a preconfigured time zone from a given set:

CET/CEST	Central European Time or Summer Time, as broadcasted by DCF77
always CET	always CET, daylight saving suppressed
UTC	always UTC
EET/EEST	East European Time or Summer Time, CET/CEST+1h

Other boards allow for the configuration of an individual time zone, inclusive of automatic switching to and from daylight saving:

The upper fields show the time zone settings: name of standard time and its offset from UTC, and name of daylight time and its offset from UTC. The offset values are computed from the following formula: Local time = UTC + offset.

For Germany this algorithm is: Daylight saving starts on the last Sunday of March at 2 o'clock CET and ends at the last Sunday of October at 3 o'clock CEST. Alternatively, the exact dates of beginning and end of daylight saving can be entered for one year. However, this method is not recommended.

Some of the plug-in cards (mainly newer versions of our GPS receivers) support the switching of the internal time scale. The possible settings are:

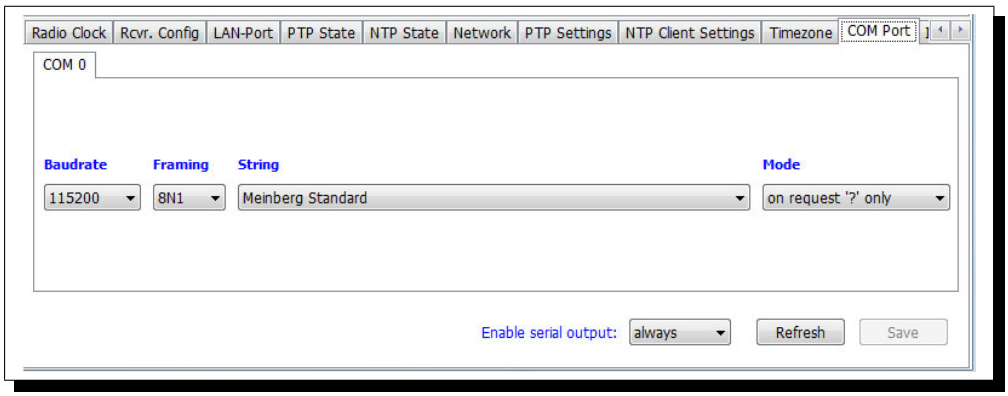
UTC/local: This is the standard setting for most of the applications. The internal time scale is based on the official UTC time which can be converted to a local time by adding an offset. If a leap second is announced then this "extra" second will be inserted at the announced time. That's why the UTC time is not monotonically increasing.

GPS: This setting configures the internal time scale to the GPS system time, as sent by the GPS satellites. The GPS time was started on 06/01/1980 synchronous to UTC but does not account for leap seconds since this date. That's why in January 2009 the GPS time was 15 seconds ahead to the UTC time. The GPS time is monotonically increasing.

TAI: "Temps Atomique International". International atomic time scale. This time scale does not care about leap seconds as well as the GPS time and was started in 1958. In January 2009 the TAI time was 34 seconds ahead of the UTC time. The TAI time is monotonically increasing

NOTE: The time scales "GPS" and "TAI" are used for special purposes only! Please note that the time service will immediately follow a change in this setting and the system time of the PC will be synchronized according to the selected time scale.

6.8.12 The Tab Sheet COM Port for Plug-In Boards



This tab is displayed only if a plug-in board is selected which supports one or more serial interfaces. Note that these serial ports are controlled by the radio clock device, not by the operating system. Besides the serial transmission parameters it's possible for some cards to control when the serial output is enabled: either immediately after power-up (always), or after the device has synchronized.

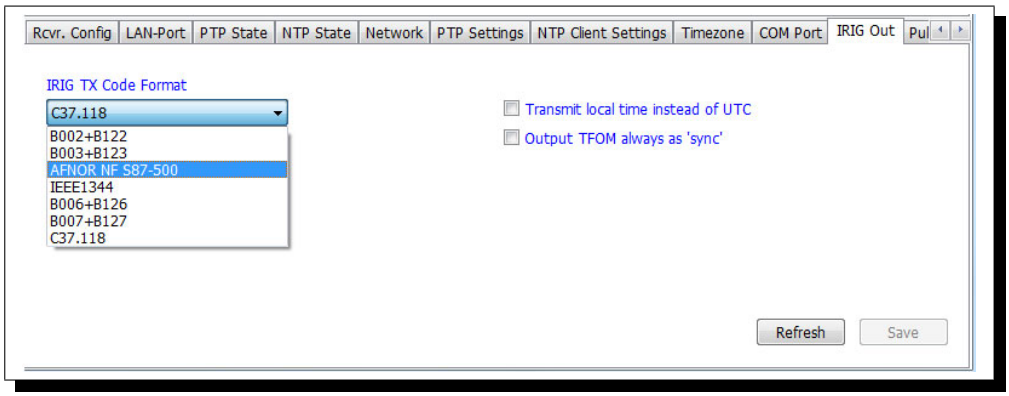
6.8.13 The Tab Sheet IRIG In

This tab sheet is displayed only if the selected device provides an IRIG input. At the first time installation of the IRIG board the correct parameters have to be configured. Otherwise the plug-in board will always return a status "unsynchronized" which will prevent the time adjustment service from adjusting the Windows system time. IRIG signals are generated using different framings or codes. Additionally, the time transferred using the IRIG signal may be UTC or some local time which has an offset from UTC. The parameters configured here must be set up according to the settings of the IRIG generator which provides the signal.

More detailed information about IRIG signals can be found on the Meinberg IRIG Info Page on the internet.

The selection field "IRIG Receiver Format" is used to configure the required IRIG code frame. The parameter "IRIG Time Offset to UTC" must contain the number of hours between the IRIG time and UTC, i.e. if the IRIG time is UTC + 1 hour then the parameter should read "1". If the IRIG generator sends UTC without offset, the correct value is "00:00". This parameter must be in the range –12:00 hours through 12:00 hours. If the checkbox labelled "Send serial UTC" is checked then the time string sent via the IRIG receiver board's serial output will always be converted to UTC time, depending on the configured time offset. If the checkbox is not checked then the time string will contain exactly the same time as decoded from the IRIG signal.

6.8.14 The Tab Sheet IRIG Out

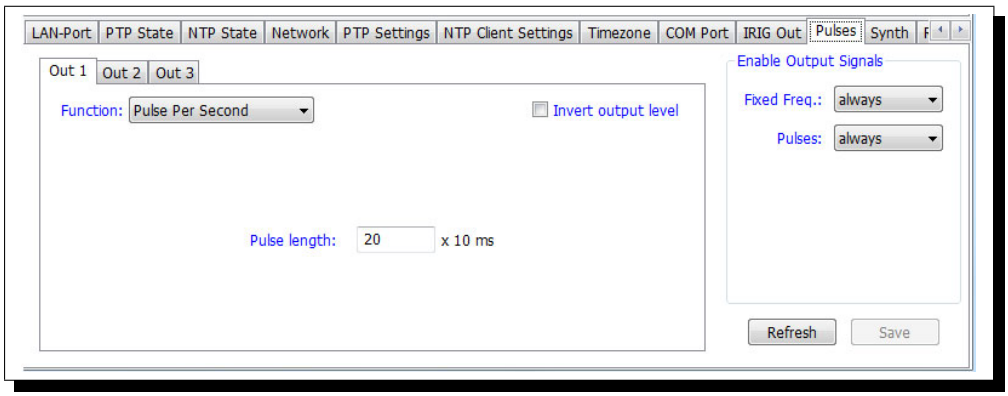


This tab sheet is displayed only if the selected plug-in board provides an IRIG output. The selection field "IRIG TX Code Format" is used to configure the desired IRIG code frame.

Detailed information about IRIG signals can be found on the Meinberg IRIG Info Page on the internet.

If the checkbox labelled "Transmit local time instead of UTC" is checked then the time code sent via the IRIG output represents the local time according to the card's time zone settings, otherwise the time code contains always UTC time. Since most IRIG codes are unable to carry information on the UTC offset, or daylight saving status, UTC time should be transmitted, if possible. If the checkbox "Output TFOM always as sync" is marked then the TFOM (Time Figure Of Merit) flag in the transmitted IRIG code will always indicate that the IRIG source is in a "synced" state, even though it may not be synchronized to an input signal. This checkbox is only enabled if the selected IRIG format supports the TFOM flag.

6.8.15 The Tab Sheet Pulses

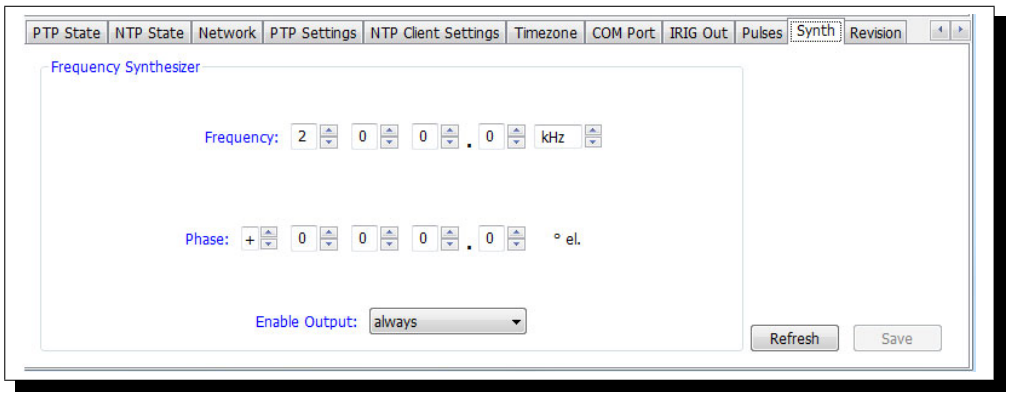


This tab sheet is displayed only if the selected plug-in board provides frequency or pulse outputs. The field "Enable Output Signals" can be used to configure whether those outputs shall be enabled always, or only after the card has been synchronized. If the card provides programmable output pulses then another field is available which can be used to configure those outputs. The available functions depend on the features of the installed card.

The following signals and parameters can be set (as far as these options are available on the receiver):

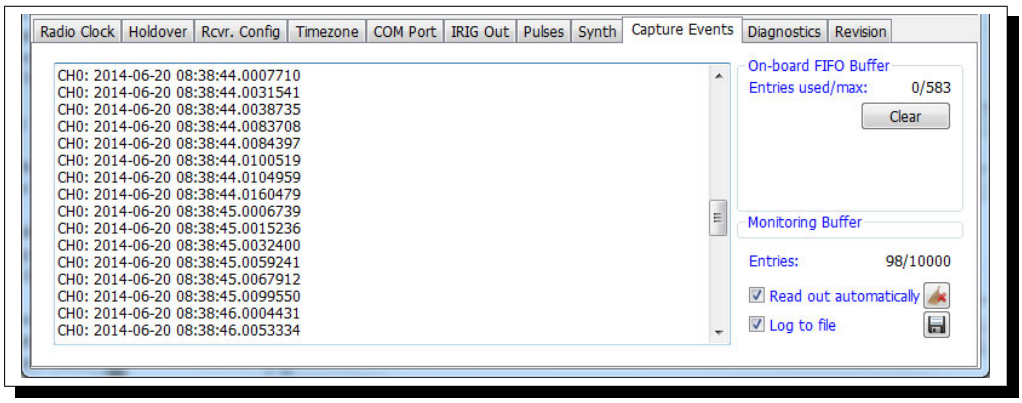
- Timer (3 switching-times On - Off)
- Single Shot (pulse length and start time)
- Cyclic Pulse (pulse length and cycle time)
- Pulse Per Second (pulse length)
- Pulse Per Minute (pulse length)
- Pulse Per Hour (pulse length)
- DCF77 Marks (timeout)
- Time Sync
- DCLS Time Code
- 10 MHz Frequency
- Synthesizer Frequency
- Time Slots per Minute (Number and security buffer)

6.8.16 The Tab Sheet Synth



This tab sheet is displayed only if the selected plug-in board provides a programmable synthesizer output. Besides the frequency and phase settings it's also possible to configure whether the synthesizer is enabled always, or only after the card has been synchronized. Additionally, the tab sheet displays the current synthesizer status.

6.8.17 The Tab Sheet Capture Events

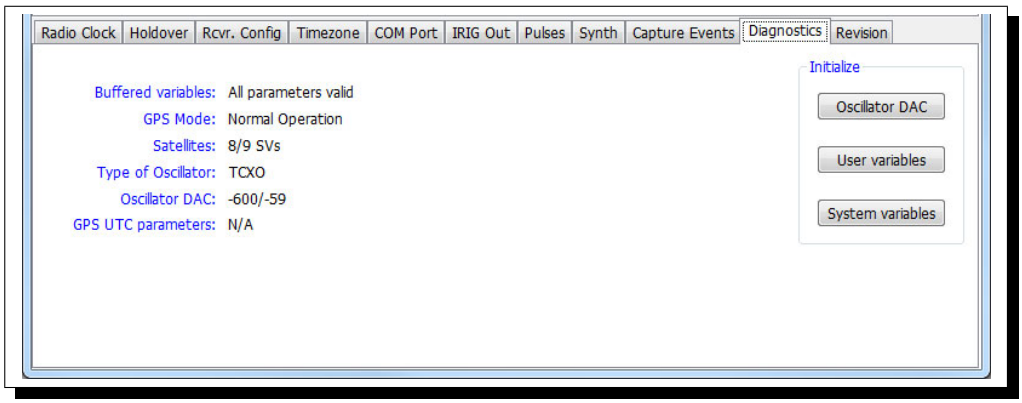


This tab sheet is displayed only if the selected plug-in board provides time capture inputs. Time capture events are usually stored in a FIFO buffer on the plug-in board. This tab sheet can be used to check the number of entries in the buffer, retrieve and display the entries from the buffer, and save them to a file.

6.8.18 The Tab Sheet Event-Log

This tab sheet is displayed only if the selected plug-in board provides event-logs. Event-Log events are usually stored in a FIFO buffer on the plug-in board. This tab sheet can be used to check the number of entries in the buffer, retrieve and display the entries from the buffer.

6.8.19 The Tab Sheet Diagnostics



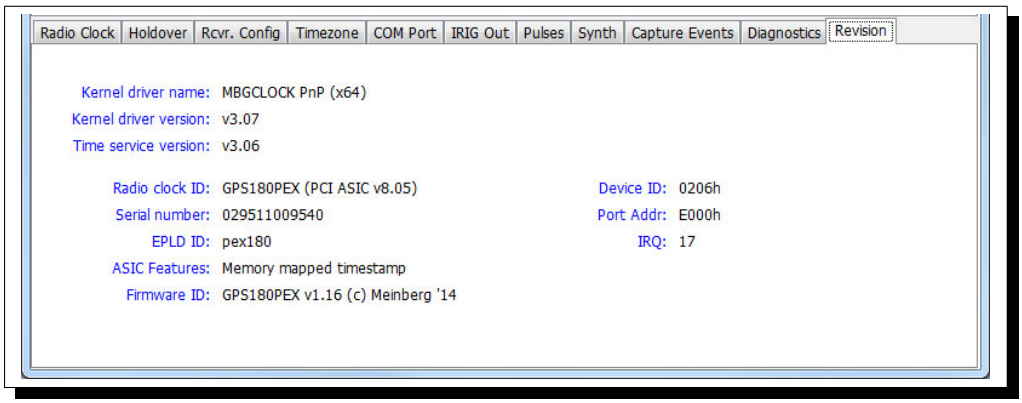
On this page the user can check extended status information of the receiver and do several initializations. Displayed status information includes if all buffered variables are valid or not, the mode of operation, the number of good satellites out of the number of satellites which are currently in view, and the two adjustment values for the on-board oscillator control. The field "Initialize" provides several buttons to initialize certain variables. This buttons should only be used by people who know what they are doing.

Oscillator DAC:
During normal operation a fine tuned oscillator DAC is continuously adjusted to discipline the oscillator frequency. If the button "Oscillator DAC" is clicked then the value of the fine tuned oscillator DAC is reset to 0 and its previous value is used to update another DAC which does the raw oscillator control.

User vars:
If the button "User vars" is clicked then all user specific parameters like time zone, serial port parameters etc. are reset to default values.

System vars:
If the button" System vars" is clicked the all GPS parameters saved on the board are cleared. The GPS receiver then switches to "Cold Boot" mode in order to recollect all actual data from the satellites.

6.8.20 The Tab Sheet Revision



Revision of a GPS180PEX - PCIe Computer Clock

This page displays the revision information of some components of the driver package, plus some more details of the selected device including Firmware and ASIC revisions and the port and IRQ resources assigned to the device.

7 Specifications / Trouble Shooting

7.1 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 accuracy 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 (depending on clock type):

u:	'#'	GPS: clock is running free (without exact synchr.)
		PZF: time frame not synchronized
		DCF77: clock has not synchronized after reset
	' '	(space, 20h)
		GPS: clock is synchronous (base accuracy is reached)
		PZF: time frame is synchronized
		DCF77: clock has synchronized after reset
v:	'*'	GPS: receiver has not checked its position
		PZF/DCF77: clock currently runs on XTAL
	' '	(space, 20h)
		GPS: receiver has determined its position
		PZF/DCF77: clock is syncronized with transmitter

x time zone indicator:

'U'	UTC	Universal Time Coordinated, formerly GMT
' '	CET	European Standard Time, daylight saving disabled
	'S'	(CEST) European Summertime, daylight saving enabled

y anouncement 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

7.2 General Information DCF77

The radio remote clocks made by Meinberg receive the signal from the long wave transmitter DCF77. This long wave transmitter installed in Mainflingen near Frankfurt/Germany transmits the reference time of the Federal Republic of Germany. This time reference is either the Central European Time (Mitteleuropäische Zeit, MEZ) or the Central European Summer Time (Mitteleuropäische Sommerzeit, MESZ). The transmitter is controlled by the atomic clock plant at the Federal Physical Technical Institute (PTB) in Braunschweig/Germany and transmits the current time of day, date of month and day of week in coded second pulses. Once every minute the complete time information is available.

At the beginning of every second the amplitude of the high precision 77.5 kHz carrier frequency is lowered by 75% for a period of 0.1 or 0.2 sec. The length of these time marks represent a binary coding scheme using the short time mark for logical zeroes and the long time mark for logical ones. The information on the current date and time as well as some parity and status bits can be decoded from the time marks of the 15th up to the 58th second every minute. The absence of any time mark at the 59th second of a minute signals that a new minute will begin with the next time mark.

In order to increase the accuracy of the demodulated time marks, the carrier of DCF77 is additionally modulated with a pseudo-random phase noise. The pseudo-random sequence has a length of 512 bits which are transmitted in the time interval between the AM marks. Due to the pseudo-random characteristics of the sequence, the mean deviation of the carrier phase is still zero. The phase modulated carrier can be received with a larger bandwidth. Correlation algorithms known from satellite techniques let PZF receivers determine the correct time with an accuracy of some microseconds which is much superior to the accuracy achieved by standard AM receivers.

Information about these radio clocks you can find on our homepage.

7.3 General Information GPS

Our satellite receiver clock has been designed to provide extremely precise time to its user. The clock has been developed for applications where conventional radio controlled clocks can't 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 Defense 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 24 satellites together with several 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.

GPS system time differs from the universal time scale UTC (Universal Time Coordinated) by the number of leap seconds which have been inserted into the UTC time scale after GPS has been initiated in 1980. The current number of leap seconds is part of the navigation message supplied by the satellites, so the receiver'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 user because this information is not part of the satellites navigation message.

7.4 General Information IEEE 1588 (PTP)

PTP/IEEE1588 is a time synchronization protocol that offers sub-microsecond accuracy over a standard Ethernet connection.

This level of accuracy can be reached by adding a so-called hardware time stamping unit to the network ports that are used for PTP time synchronization. The time stamping unit captures the exact time when a PTP synchronization packet is sent or received. These time stamps are taken into account in order to compensate transfer delays introduced by the Ethernet network.

In PTP networks there is only one active source of time, the so-called Grandmaster Clock. If two or more Grandmaster Clocks exist in one network, an algorithm defined in the standard is used to find out which one is the „best“ source of time. This „Best Master Clock“ algorithm has to be implemented on every PTP/IEEE1588 compliant system and therefore all clients („Slave Clocks“) will select the same Grandmaster. The other, not selected Grandmaster Clocks will „step back“ and enter passive mode, meaning that they do not send out synchronization packets as long as that is done by the selected master.

The installed network infrastructure components play a big role in a PTP network and directly influence the level of accuracy that can be reached on the clients.

Asymmetric network connections degrade the accuracy. Therefore classic layer 2 and 3 Ethernet switches with their store and forward technology are not suitable for PTP/IEEE1588 networks and should be avoided. Simple Ethernet hubs, at least the ones with fixed pass-through times, are no problem. In large networks special switches with built-in PTP/IEEE1588 functionality help to maintain a good level of accuracy even over several subnets and longer distances. These components act as so-called "Boundary Clocks", they compensate their internal packet processing times by using time stamping units on each port. They synchronize to the Grandmaster Clock and in turn act as a Grandmaster to the other subnets they are connected to.

7.5 Trouble Shooting

Bad/no reception:
When using a DCF77 receiver it is important to position the antenna in an optimal way. The following method is recommended to align the antenna.

Start the monitor program, check the selected DCF77 radio clock and watch the field strength indicator. First the antenna should be turned slowly until the minimum field strength is found. Finally the antenna must be turned by 90° from this position to obtain maximum signal. More important is in fact the modulation signal. It should blink exactly once per second and must not have any jitter effects.

The antenna/converter unit must be installed in a location from which as much of the sky as possible can be seen.

State of the Radio Clock:

Normal Operation:
GPS: The receiver has computed its position and acquired the correct time. The satellites in view are displayed as well as the used satellites
DCF: The radio clock is synchronous to DCF77

Antenna Faulty:
GPS: The antenna is not installed properly
DCF: The field strength is not sufficient or the antenna is not connected

Free Running:
DCF: The radio clock is running on Xtal oscillator

Warm-Boot:
Valid satellite data (Almanach) is in the memory but the position has to be calculated new.
Time to synchronization: max. 7min.

Cold-Boot:
The GPS receiver seeks for a satellite to reed it's actual almanach and calculates the position.
Time to synchronization: max. 12min.

Received no Time String:
External radio clock: The serial COM port of the PC is ready but does not receive any valid time string. Check the COM port-Settings of the PC. May be the serial cable must be crossed. Test the connection with an ordinary terminal program, e.g. Hyper terminal.

Error opening COM Port:
Windows is unable to open the COM port, maybe because any other program has the COM port already in use. Check the port access

Reference Time not valid:
The valid time is kept in the buffered on-board RTC. Therefore, after power-down, the clock comes back with the actual time. However, if the buffer capacitor or the back-up battery is low, the RTC loses data and the clock comes back with an invalid time. In this case the clock has to be synchronized first.

If an IRIG receiver card is used and the "Reference Time not valid" message is displayed, then the UTC offset of the IRIG signal and the board time might have not been set initially. The current year and the UTC offset are not transmitted in most of the IRIG codes, so these values have to be set manually when using the card for the first time.

Synchronized after last RESET:
GPS: The GPS receiver has determined its position and the oscillator is adjusted to the GPS system time.
DCF: The clock has already synchronized once after the last reset.

Not synchronized after last RESET:
GPS: The GPS receiver has not determined it's position yet and the oscillator is not adjusted to the GPS system time.
DCF: The clock has not been synchronized after the last reset.

Found Antenna Signal:
The radio clock receives a valid antenna signal.

Looking for Antenna Signal:
The radio clock can not receive a valid antenna signal, the antenna is disconnected or the field strength is too low.

Begin Daylight Saving announced:
Announcement of start of the daylight saving time
Begin of the announcement: one hour before the changeover

End Daylight Saving announced:
Announcement of end of the daylight saving time
Begin of the announcement: one hour before the changeover

Leap Second Announced:
Announcement of leap second insertion
Begin of the announcement: one hour before the changeover