

Technical Information  
Operating Instructions  
**GPS161xHS**

## **Impressum**

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## Content of the USB stick

Besides this manual, the provided USB stick includes a setup program for the monitor software GPSMON32. This utility can be used to configure Meinberg GPS receivers via their serial ports and display status information of the module.

The software is executable under the following operating systems:

- Windows Server 2003
- Windows XP
- Windows 2000
- Windows NT
- Windows ME
- Windows 9x

If the USB stick is lost, the setup program can be downloaded for free at:

<http://www.meinberg.de/english/sw/#gpsmon>

## General information



**At first, only the standard modules with one serial RS-232 interface are described on the following pages. Details of additional output signals realized for the present module can be found in chapter „Options“.**

Differing from the standard module the following options are possible:

- oscillator with higher quality
- second independent interface (RS-232, RS-485 or fiber optic)
- pulse per second PPS (TTL into 50  $\Omega$  and/or fiber optic)
- 10 MHz standard frequency (TTL into 50  $\Omega$  and/or sine 0.5 Vrms into 50  $\Omega$ )

The Meinberg satellite receiver clocks of the GPS164xHS series are available with different power supplies:

	19...72VDC	100...240VAC	100...240VDC
GPS161DHS	X		
GPS161AHS		X	
GPS161DAHS		X	X

The differences are described in the relevant chapters, the name GPS161xHS is used whenever common features of all types of clocks are specified.

## **The GPS system**

The satellite receiver clock GPS161xHS has been designed to provide an extremely precise time reference for the generation of serial time telegrams.

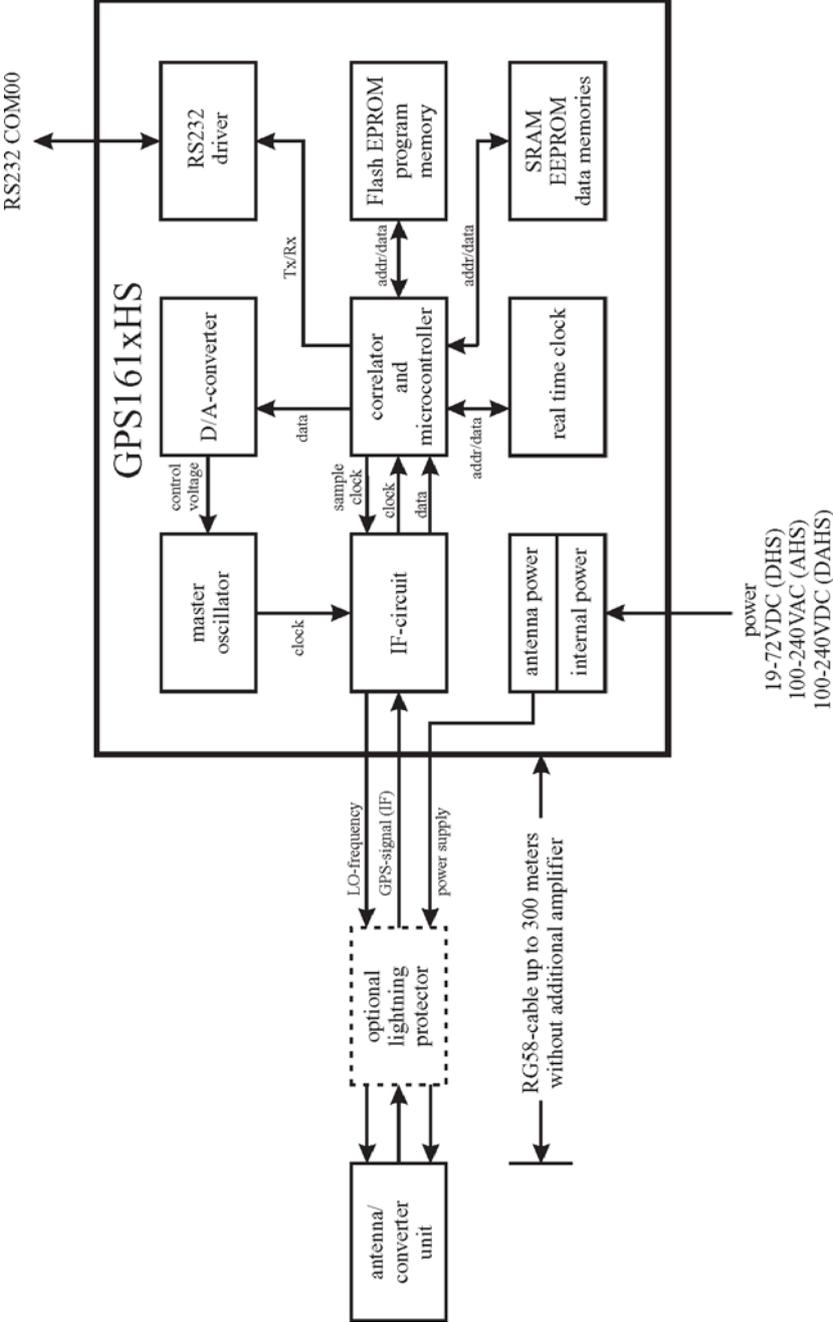
The clock was developed for applications where conventional radio controlled clocks can't meet the growing requirements in precision. High precision available 24 hours a day around the whole world is the main feature of the system which receives its information from the satellites of the Global Positioning 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 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.

# Block diagram GPS161xHS



## **GPS161xHS features**

The satellite controlled clock GPS161xHS is designed for mounting on a DIN rail. The front panel integrates two LED indicators, a hidden push button, a DSUB- and a BNC-connector. The receiver is connected to the antenna/converter unit by a 50  $\Omega$ -coaxial cable with length up to 300 m. It is possible to connect up to four receivers to one antenna by using an optional antenna diplexer.

The navigation message coming from the satellites is decoded by GPS161xHS's microprocessor in order to track the GPS system time with an accuracy of better than  $\pm 1 \mu\text{sec}$ . Compensation of the RF signal's propagation delay is done by automatical 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 master oscillator (TCXO) to  $\pm 5 \cdot 10^{-9}$  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 has been initiated in 1980. The current number of leap seconds is part of the navigation message supplied by the satellites, so GPS161xHS'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 with the help of the software GPSMON32 (included Windows software).

## **Asynchronous serial port**

An asynchronous serial interface (RS-232) called COM0 is available to the user. In the default mode of operation, the serial output is disabled until the receiver has synchronized after power-up. However, the system can be configured to enable this output immediately after power-up. Transmission speed, framing and the kind of the time string can be configured. The serial port is sending a time string either once per second, once per minute or on request with ASCII '?' only. The format of the output strings is ASCII, see the technical specifications for details. The corresponding parameters can be set up by GPSMON32 (included Windows software) using serial port COM0.

## Installation

### Power supply

The variants of the module GPS161xHS are designed for following power supply options:

GPS161DHS	:	19...72 VDC (DC-insulation 1.5 kVDC)
GPS161AHS	:	100...240 VAC, 47...63 Hz
GPS161DAHS	:	100...240 VDC 100...240 VAC, 47...63 Hz

The voltage feed of the DC variants is done via terminal blocks in the frontpanel of the clock and should have low resistance to minimize spurious emission (EMI). The AC models include a fuse which is available at the front panel.

To avoid potential differences between the signal ground of GPS164xHS and a post-connected unit installed on different DIN rails, the signal ground of the clock is insulated from the case.

**The case must be grounded by using the rear contact.**

### Mounting the 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 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 even this is not possible problems occur especially when at least four satellites for positioning have to be found.

The unit can be mounted using a pole with a diameter up to 60 mm. A standard coaxial cable with 50 Ω impedance (e.g. RG58C) should be used to connect the antenna/converter unit to the receiver. Cable thinner than RG58 should be avoided due to its higher DC resistance and RF attenuation. When using the optional antenna diplexer the total length of one antenna line between antenna, diplexer and receiver must not be longer than 300 m. If a cable with less attenuation is used its length may be increased accordingly (e.g. 600 m with RG213).



**If the antenna cable was cabled by the user: before powering up the system, make sure that there is no short-circuit between the inner and outer conductor of the antenna cable, because this could cause a fault of GPS161xHS.**

## Powering up the system

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 TCXO 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 kilometers 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.

## **The front panel layout**

### **FAIL LED**

The FAIL LED is turned on whenever the receiver is not synchronous to the GPS-system.

### **LOCK LED**

The LOCK LED is turned on if the receiver has acquired at least four satellites and has computed its position after power-up. In normal operation the receiver position is updated continuously as long as at least four satellites can be received. When the receivers position is known and steady only, a single satellite needs to be received for synchronization.

### **BSL Key**

Whenever the on-board software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory using the serial port COM0. There is no need to open the metal case and insert a new EPROM.

If the BSL key behind the front panel is pressed during operation, a bootstrap-loader is activated and waits for instructions from the serial port COM0. The new firmware can be sent to GPS161xHS from any standard PC with serial interface. A loader program will be shipped together with the file containing the image of the new firmware.

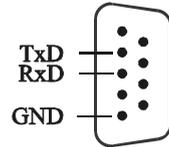
The contents of the program memory will not be modified until the loader program has sent the command to erase the flash memory. So, if the BSL key is pressed unintentionally, the firmware will not be changed accidentally. After the next power-up, the system will be ready to operate again.

### **BNC connector GPS Ant**

The antenna/converter unit is connected to the receiver circuit of the GPS161xHS through this connector.

## Assignment of the DSUB connector

The serial port COM0 is accessible via a nine-pole female DSUB connector in the frontpanel. This RS-232 interface can be connected to a computer by using a standard modem cable. TxD describes the sending, RxD the receiving line of GPS161xHS.



RS232 COM0

## 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!

**Danger of explosion in case of inadequate replacement of the lithium battery. Only identical batteries or batteries recommended by the manufacturer must be used for replacement. The waste battery must be disposed as proposed by the manufacturer of the battery.**

## CE label



This device conforms to the directive 89/336/EEC approximation of the laws of the Member States of the European Community relating to electromagnetic compatibility.

## Technical specifications GPS161xHS

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 of antenna"
ANTENNA INPUT:	Antenna circuit dc-insulated; dielectric strength: 1000V <sub>DC</sub> Length of cable: refer to chapter "Mounting the antenna"
TIME TO SYNCHRONIZATION:	One minute with known receiver position and valid almanac 12 minutes if invalid battery buffered memory
BATTERY BACKUP:	Storage of important GPS-system data in the internal RAM backed-up by lithium battery lifetime of battery 10 years min.
SERIAL PORT:	One asynchronous serial port COM0 (RS-232) Baud Rate: 300 up to 19200 Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1  time string selectable: 'Standard Meinberg', 'Meinberg GPS', 'SAT', 'ABB-SPA', 'Uni Erlangen (NTP)', 'NMEA (RMC)', 'Computime'  default settings: 19200 Bd, 8N1 'standard Meinberg' time string per second mode of operation 'if sync'
STATUS INDICATION:	Receiver status: Lock: the receiver was able to compute its position after power-up Fail: the receiver is asynchronous to the GPS-system

POWER

REQUIREMENTS: **GPS161DHS**

19...72 VDC

DC-isolation 1.5 kVDC

**GPS161AHS**

100...240 VAC, 47...63 Hz

fuse: 500 mA

**GPS161DAHS**

100...240 VDC

100...240 VAC, 47...63 Hz

fuse: 500 mA

DIMENSION: 105 mm x 85 mm x 104 mm (H x W x D)

CONNECTORS: Coaxial BNC connector for antenna/converter unit  
female nine-pole SUB-MIN-D-connector for RS232  
power cord receptacle for AC-line (AHS)  
3-pole screw terminal (DHS/DAHS)

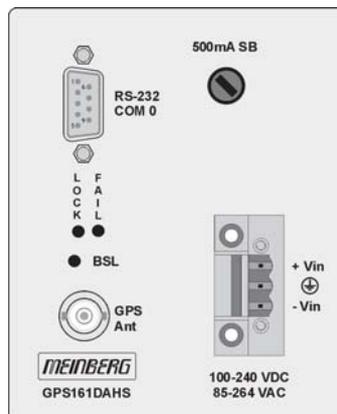
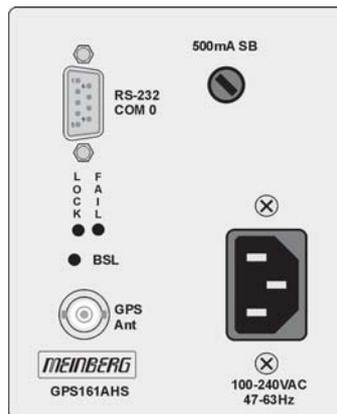
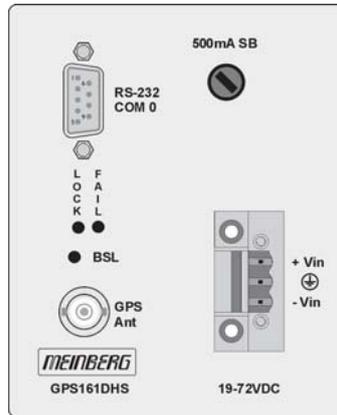
AMBIENT

TEMPERATURE: 0 ... 50°C

HUMIDITY: 85% max.

## Front views

The following illustrations are showing the front views of the standard models of the GPS161xHS series:



## Technical specifications of antenna

ANTENNA: dielectrical patch antenna, 25 x 25mm  
receive frequency: 1575.42 MHz  
bandwidth: 9 MHz

CONVERTER: local oscillator to converter frequency: 10 MHz  
first IF frequency: 35.4 MHz

### POWER

REQUIREMENTS: 12V ... 18V, @ 100mA (provided via antenna cable)

CONNECTOR: coax type N, female

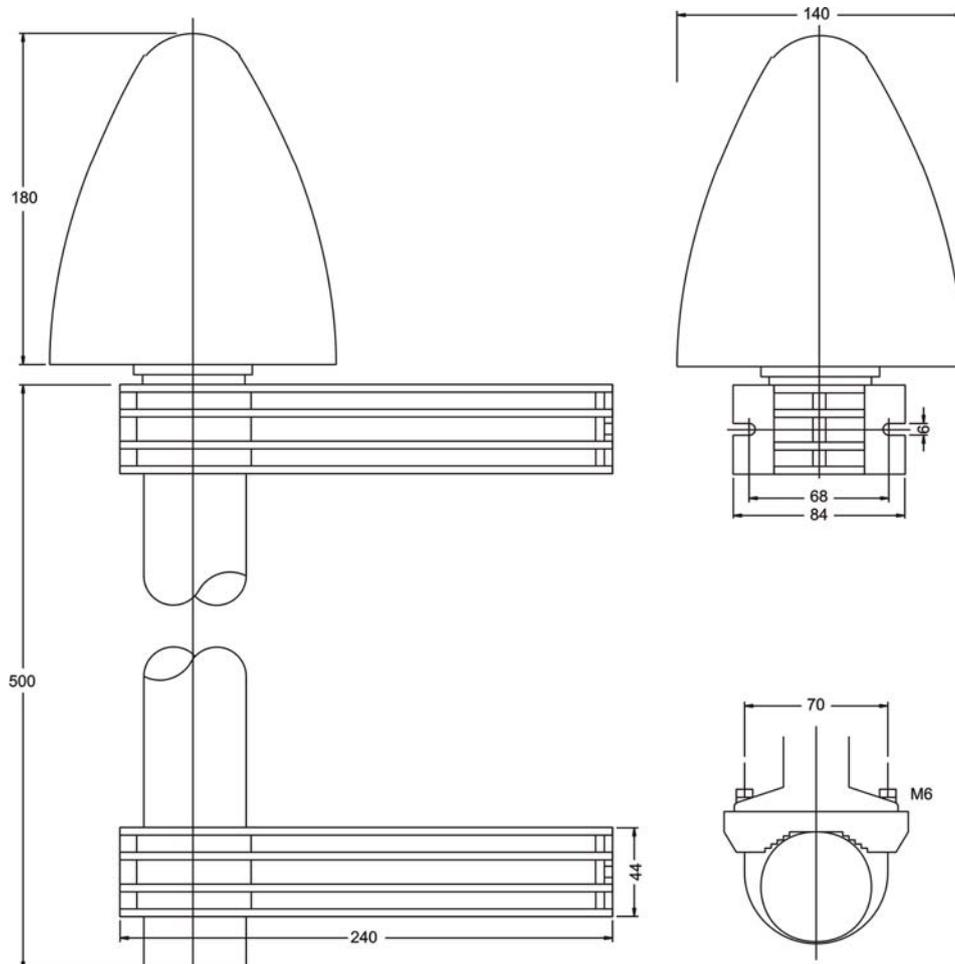
### AMBIENT

TEMPERATURE: -25 ... +65°C

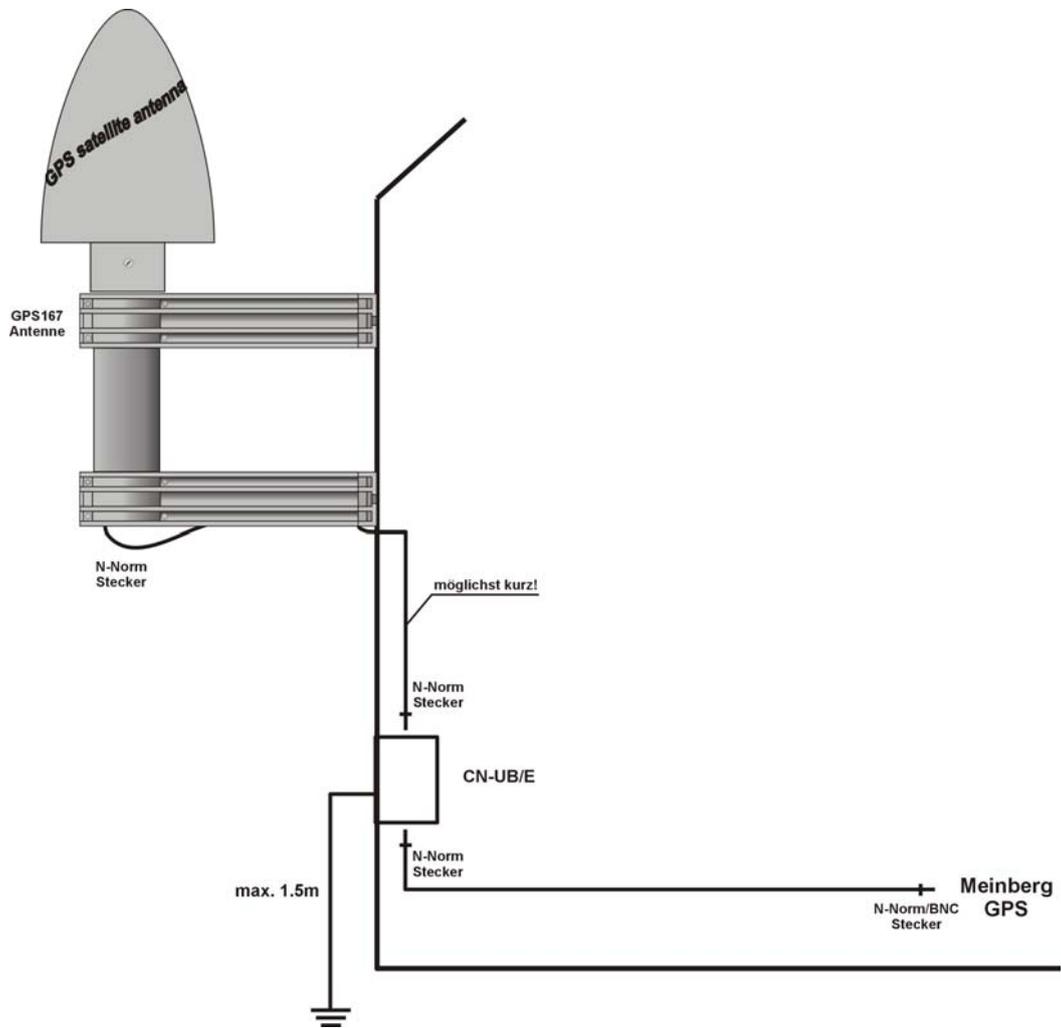
HOUSING: ABS plastic case for outdoor installation (IP56)

### PHYSICAL

#### DIMENSION:



# Assembly with CN-UB/E (CN-UB-280DC)



## 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)

*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 Meinberg GPS Time String

The Meinberg Standard Time String is a sequence of 36 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. Contrary to the Meinberg Standard Telegram the Meinberg GPS Timestring carries no local timezone or UTC but the direct GPS time without conversion into UTC.

The format is:

**<STX>D:*tt.mm.jj*;T:*w*;U:*hh.mm.ss*;uvGy;*lll*<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)
<i>dd.mm.yy</i>	the current date: <i>dd</i> day of month (01..31) <i>mm</i> month (01..12) <i>yy</i> year of the century (00..99)
<i>w</i>	the day of the week (1..7, 1 = Monday)
<i>hh.mm.ss</i>	the current time: <i>hh</i> hours (00..23) <i>mm</i> minutes (00..59) <i>ss</i> seconds (00..59, or 60 while leap second)
<i>uv</i>	clock status characters (depending on clock type): <i>u</i> : ‘#’ GPS: clock is running free (without exact synchr.) ‘ ‘ (space, 20h) GPS: clock is synchronous (base accuracy is reached) <i>v</i> : ‘*’ GPS: receiver has not checked its position ‘ ‘ (space, 20h) GPS: receiver has determined its position
G	time zone indicator 'GPS-Time'
<i>y</i>	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>lll</i>	Number of leap seconds between UTC and GPS-Time ( UTC = GPS-Time + number of leap seconds )
<ETX>	End-Of-Text (ASCII code 03h)

## 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>*tt.mm.jj/w/hh.mm.ss*MEzzxy<CR><LF><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)

*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)

*zz* time zone indicator:

'Z' MEZ European Standard Time, daylight saving disabled

'SZ' MESZ European Summertime, daylight saving enabled

*x* clock status characters:

'\*' 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

*y* 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 NMEA (RMC) string

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,llll.ll,e,0.0,0.0,ddmmyy,0.0,a\*hh*<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)
<i>hhmmss.ss</i>	the current time: <i>hh</i> hours (00..23) <i>mm</i> minutes (00..59) <i>ss</i> seconds (00..59, or 60 while leap second) <i>ss</i> fractions of seconds (1/10 ; 1/100)
A	Status (A = time data valid) (V = time data not valid)
<i>bbbb.bb</i>	latitude of receiver position in degrees leading signs are replaced by a space character (20h)
<i>n</i>	latitude, the following characters are possible: 'N' north of equator 'S' south d. equator
<i>llll.ll</i>	longitude of receiver position in degrees leading signs are replaced by a space character (20h)
<i>e</i>	longitude, the following characters are possible: 'E' east of Greenwich 'W' west of Greenwich
<i>ddmmyy</i>	the current date: <i>dd</i> day of month (01..31) <i>mm</i> month (01..12) <i>yy</i> year of the century (00..99)
<i>a</i>	magnetic variation
<i>hh</i>	checksum (EXOR over all characters except '\$' and '*')
<CR>	carriage-return; ASCII-Code 0Dh
<LF>	line-feed; ASCII-Code 0Ah

## Format of the ABB-SPA timestring

The ABB SPA timestring 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:

<i>yy-mm-tt</i>	the current date:	
<i>yy</i>	year of the century	(00..99)
<i>mm</i>	month	(01..12)
<i>dd</i>	day of month	(01..31)
–	Space (ASCII code 20h)	
<i>hh.mm;ss.fff</i>	the current time:	
<i>hh</i>	hours	(00..23)
<i>mm</i>	minutes	(00..59)
<i>ss</i>	seconds	(00..59, or 60 while leap second)
<i>fff</i>	milliseconds	(000..999)
<i>cc</i>	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 T character and ending with the LF (line feed, ASCII Code 0Ah) character. The format is:

**T:*yy:mm:dd: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

*yy:mm:dd*    the current date:

*yy*    year of the century    (00..99)

*mm*    month                    (01..12)

*dd*    day of month                (01..31)

*ww*            the day of the week            (01..07, 01 = monday)

*hh:mm:ss*    the current time:

*hh*    hours                        (00..23)

*mm*    minutes                      (00..59)

*ss*    seconds                      (00..59, or 60 while leap second)

<CR>        Carriage-return (ASCII code 0Dh)

<LF>        Line-feed (ASCII code 0Ah)

## Format of the time string Uni Erlangen (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 ll.lllle hhhhm<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:

<i>&lt;STX&gt;</i>	Start-Of-Text (ASCII code 02h)
<i>dd.mm.yy</i>	the current date: <i>dd</i> day of month (01..31) <i>mm</i> month (01..12) <i>yy</i> year of the century (00..99)
<i>w</i>	the day of the week (1..7, 1 = Monday)
<i>hh.mm.ss</i>	the current time: <i>hh</i> hours (00..23) <i>mm</i> minutes (00..59) <i>ss</i> seconds (00..59, or 60 while leap second)
<i>v</i>	sign of the offset of local timezone related to UTC
<i>oo:oo</i>	offset of local timezone related to UTC in hours and minutes
<i>ac</i>	clock status characters: <i>a</i> : ‘#’ clock has not synchronized after reset ‘ ‘ (space, 20h) clock has synchronized after reset  <i>c</i> : ‘*’ GPS receiver has not checked its position ‘ ‘ (space, 20h) GPS receiver has determined its position
<i>d</i>	time zone indicator: ‘S’ MESZ European Summertime, daylight saving enabled ‘ ‘ MEZ European Standard Time, daylight saving disabled
<i>f</i>	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
<i>g</i>	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 of equator

*lll.lll* 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

*hhh* altitude above sea level in meters  
    leading signs are replaced by a space character (20h)

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

## Options

### Oscillator

The standard oscillator of GPS161xHS is a TCXO (Temperature Compensated Xtal Oscillator). The module can be equipped with oscillators of higher quality (OCXO, Oven Controlled Xtal Oscillator) listed in the table below:

	TCXO	OCXO LQ	OCXO MQ	OCXO HQ
short term stability $\tau = 1$ sec	$2 * 10^{-9}$	$1 * 10^{-9}$	$2 * 10^{-10}$	$1 * 10^{-11}$
accuracy free run one day	$\pm 1 * 10^{-7}$ $\pm 1$ Hz (Note 1)	$\pm 2 * 10^{-8}$ $\pm 0.2$ Hz (Note 1)	$\pm 1,5 * 10^{-9}$ $\pm 15$ mHz (Note 1)	$\pm 5 * 10^{-10}$ $\pm 5$ mHz (Note 1)
accuracy free run one year	$\pm 1 * 10^{-6}$ $\pm 10$ Hz (Note 1)	$\pm 4 * 10^{-7}$ $\pm 4$ Hz (Note 1)	$\pm 1 * 10^{-7}$ $\pm 1$ Hz (Note 1)	$\pm 5 * 10^{-8}$ $\pm 0.5$ Hz (Note 1)
accuracy GPS- synchronous averaged 24 h	$\pm 1 * 10^{-11}$	$\pm 1 * 10^{-11}$	$\pm 5 * 10^{-12}$	$\pm 1 * 10^{-12}$
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 -95 dBc/Hz 10 Hz -125 dBc/Hz 100 Hz -145 dBc/Hz 1 kHz -155 dBc/Hz
power supply at 25°C steady state warm up	+5V / 20 mA N/A	+5V / 160 mA +5V / 380 mA	+5V / 300 mA +5V / 700 mA	+5V / 300 mA +5V / 700 mA
temperature dependant drift free run	$\pm 1 * 10^{-6}$ (-20...70°C)	$\pm 2 * 10^{-7}$ (0...60°C)	$\pm 5 * 10^{-8}$ (-20...70°C)	$\pm 1 * 10^{-8}$ (5...70°C)

**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  $\pm 1 * 10^{-7} * 10$  MHz =  $\pm 1$  Hz

### Additional interface

A second independant serial interface (COM1) with the following transmission parameters is available:

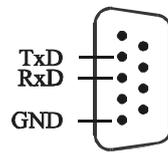
- baud rate: 300 bis 19200
- data format: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1
- telegram settable: 'Standard Meinberg', 'Meinberg GPS', 'SAT', 'ABB-SPA', 'Uni Erlangen (NTP)', 'NMEA (RMC)', 'Comuptime'

It can be realized as an electrical (RS-232 or RS-485) or optical interface. Technical data of an optical intetrface:

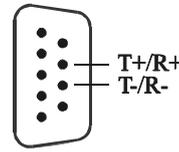
- optical power: typ. 15 $\mu$ W
- optical receive power: min. 3 $\mu$ W
- optical connector: ST-connector for GI 50/125 $\mu$ m or GI 62,5/125 $\mu$ m gradient fiber

## Assignment of the DSUB connector (COM1)

Depending on the chosen option, the connector for the interface COM1 can be assigned as follows:



COM1  
RS-232



COM1  
RS-485

## Pulse per second

The module GPS161xHS can generate a pulse per second (PPS) as an electrical (TTL into 50  $\Omega$  via BNC-connector) or optical signal with the following features:

- accuracy of pulse after synchronization and 20 minutes of operation:

TCXO (standard)/OCXO LQ	:	better than $\pm 250$ nsec
OCXO MQ/OCXO HQ	:	better than $\pm 100$ nsec
- pulse duration 1 msec
- leading edge synchronous to UTC-second

characteristics of an optical output:

- optical power: typ. 15  $\mu$ W
- optical connector: ST-connector for GI 50/125  $\mu$ m or GI 62,5/125  $\mu$ m gradient fiber

## Standard frequency

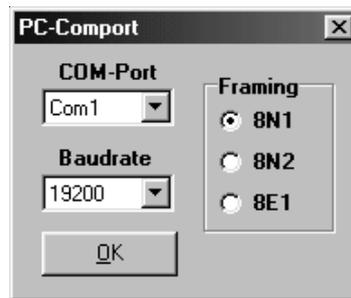
As an option, a standard frequency of 10 MHz is available via a BNC-connector that is derived from the GPS-synchronized master oscillator of the system directly. The following outputs are available:

- TTL into 50  $\Omega$
- sine 0.5 Vrms into 50  $\Omega$
- accuracy see table „*Oscillator*“

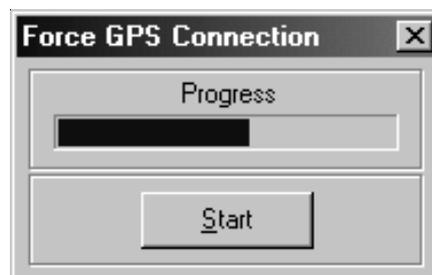
## The program GPSMON32

The program GPSMON32 can be used to monitor and program all essential functions of Meinberg GPS-Receiver. The Software is executable under Win9x/2k/NT. To install GPSMON32 just run Setup.exe from the included diskette and follow the instructions of the setup program.

To obtain a connection between your PC and the GPS-receiver, connect the receivers COM0 port to a free serial port of your PC. The PCs comport used by the program GPSMON32 can be selected in submenu '**PC-Comport**' in menu '**Connection**'.



Also transfer rate and framing used by the program are selected in this menu. Communication between the clock and the PC comes about, only if the GPS serial port is configured in the same way as the PCs comport. You can enforce an access, if the GPS serial port is not configured with appropriate parameters for communication. Select the menu item '**Enforce Connection**' in menu '**Connection**' and click '**Start**' in the appearing window. Some firmware versions of GPS167 do not support this way of setting up a connection. If '**Enforce Connection**' doesn't succeed apparently, please change the serial port parameter of GPS COM0 manually to the PCs parameters.



## Online Help

The online help can be started by clicking the menu item 'Help' in menu Help. In every program window a direct access to a related help topic can be obtained by pressing F1. The help language can be selected by clicking the menu items Deutsch/English in the Help Menu.

