MANUAL

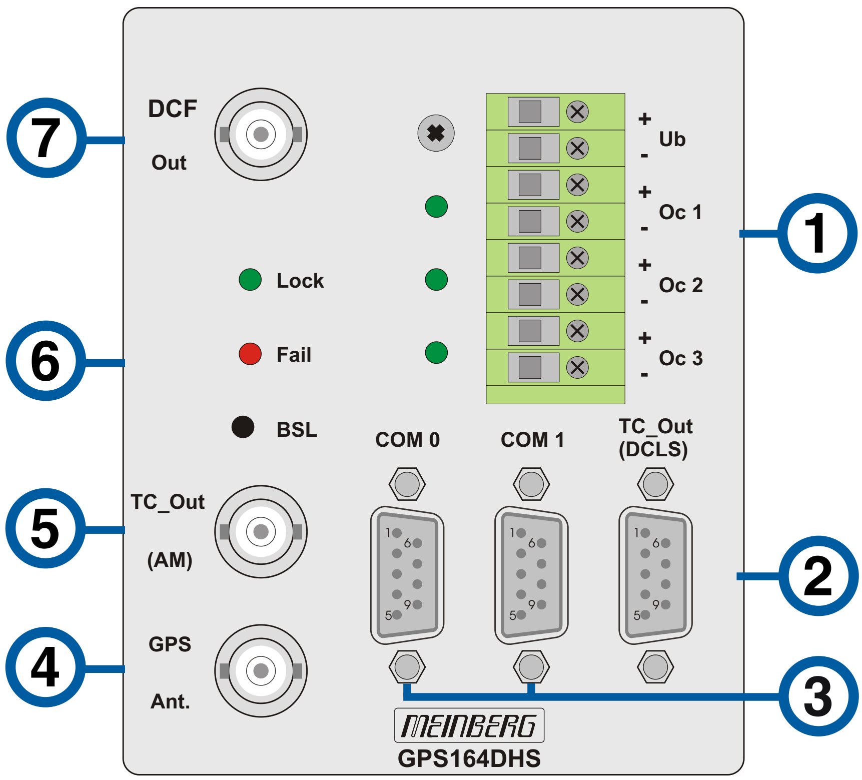
GPS164XHS

DIN Rail GPS Receiver

7th December 2015

Meinberg Radio Clocks GmbH & Co. KG

Front view (Frontansicht) GPS164XHS



DEUTSCH

1. Spannungsversorgung (siehe technische Daten)
   Optokoppler Ausgänge 8pol. Schraub-/Klemmleiste
2. Time Code DCLS Ausgang, 9pol. D-SUB
3. Serielle Schnittstellen COM 0 - COM 1, 9pol. D-SUB
4. GPS Antenne, BNC
5. Time Code AM Ausgang, BNC
6. Status LEDs / BSL (Boot Strap Loader)
7. DCF Ausgang, BNC

ENGLISH

1. Power supply connector (see chapter technical specifications)
   Optocoupler outputs 8pin. Screwterminal
2. Time Code DCLS output, 9pin. D-SUB
3. Serial ports COM 0 - COM 1, 9pin. D-SUB
4. GPS Antenna, BNC
5. Time Code AM outputs, BNC
6. Status LEDs / BSL (Boot Strap Loader)
7. DCF output, BNC

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1 Imprint

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Date: 2015-12-07

2 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 to display status information of the module.

The software is executable under the following operating systems:

- Windows 8
- Windows 7
- Windows VISTA
- Windows Server 2003
- Windows XP
- Windows 2000
- Windows NT
- Windows ME
- Windows 9x

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

3 General information about GPS164

The Meinberg satellite receiver clocks of the GPS164xHS series are available with several options. This manual describes the following models:

	19...72 VDC	100...240 VAC	100...240 VDC	optocoupler outputs	PhotoMOS relay outputs
GPS164DHS	x			x	
GPS164AHS		x		x	
GPS164DAHS		x	x	x	
GPS164/AQ/DHS	x				x
GPS164/AQ/AHS					x
GPS164/AQ/DAHS		x	x		x

The vaiants differ in power supply and the type of DC-isolation of the programmable pulse outputs. The differences are described in the relevant chapters, the name GPS164xHS is used whenever common features of all types of clocks are specified.

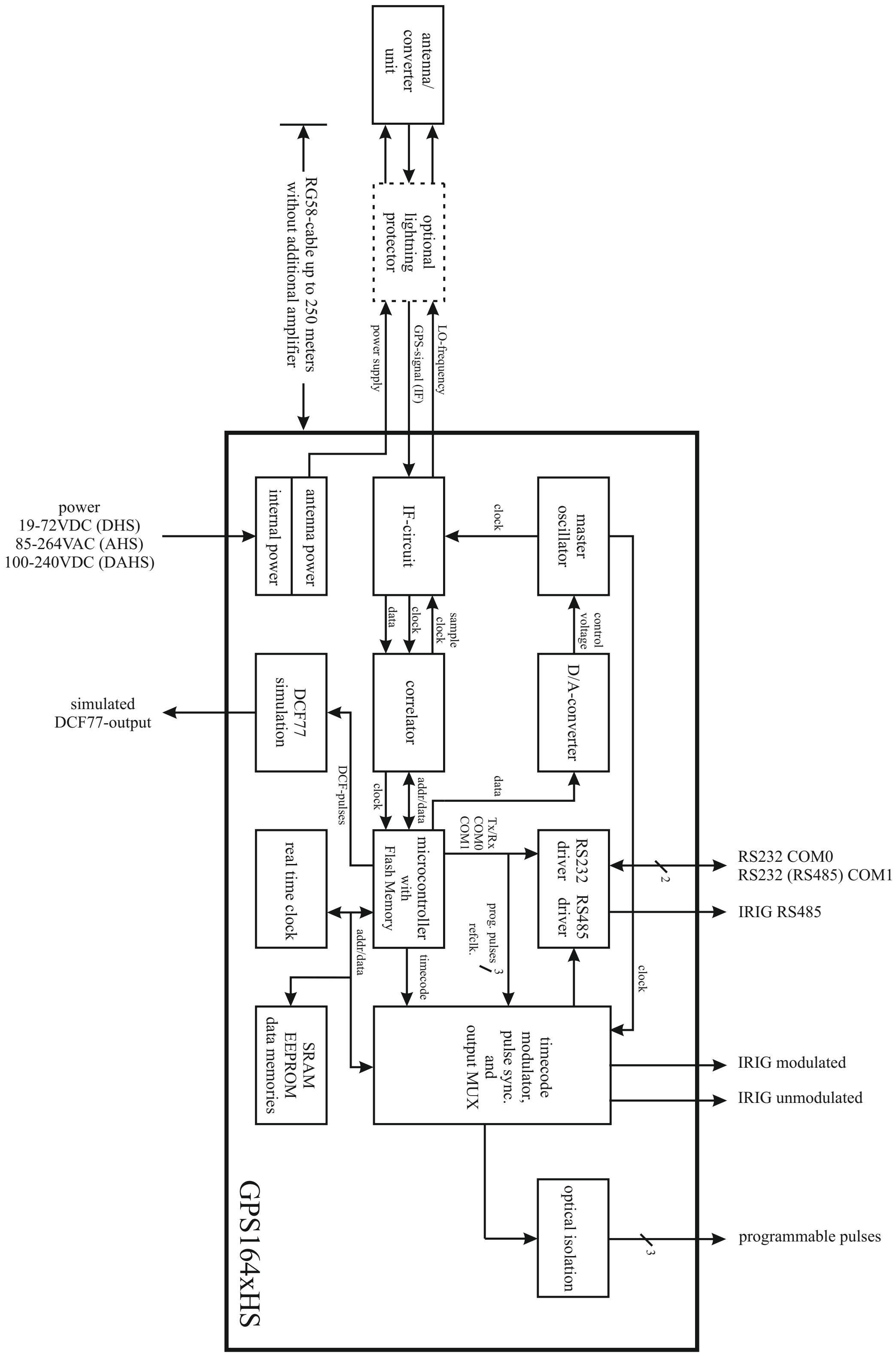
The satellite receiver clock GPS164xHS has been designed to provide an extremly precise time reference for the generation of programmable pulses. High precision available 24 hours a day around the whole world is the main feature of the new system which receives it's information from the satellites of 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 Departement 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 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.

4 Block diagram GPS164xhs



5 GPS164 Features

The GPS164 is designed for mounting on a DIN rail. The front panel integrates five LED indicators, a hidden push button, an eight-pole terminal block, three DSUB and three BNC-connectors. The receiver is connected to the antenna/converter unit by a 50 Ohm coaxial cable with length up to 300 m (when using RG58 cable). It is possible to connect up to four receivers to one antenna by using an optional antenna diplexer. Additional outputs are described below

The navigation message coming from the satellites is decoded by GPS164xHS's microprocessor in order to track the GPS system time with an accuracy of better than +/-250 nsec. 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 TCXO to +/-5x10-9 and automatically compensates the oscillators aging. The last recent value is restored from the battery memory at power-up.

5.1 Time Zone and Daylight Saving

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 GPS170SV´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. As standard the switchover times are set to the values of the European Union (Central Europe). The Manual „GPSMON32" describes how parameter setting for other locations is done. It is possible to deactivate the automatic switching to/from daylight saving.

5.2 Pulse outputs

The pulse generator of the satellite controlled clock GPS164xHS containes three independant channels and is able to generate a multitude of differeent pulses, which are configured with the software GPSMON32. The active state of each channel is invertible, the pulse duration settable between 10 msec and 10sec in steps of 10 msec. In the default mode of operation the pulse outputs are disabled unti the the receiver has synchronized after power-up. The pulse outputs are electrically insulated by optocouplers (GPS164xHS) or PhotoMOS relays (GPS164/AQ/xHS) and are available at the terminal block.
The following modes can be configured for each channel independently:

Timer mode: Three on- and off-times per day per channel programmable

Cyclic mode: Generation of peropdically repeated pulses.
A cycle time of two seconds would generate a pulse at
0:00:00, 0:00:02, 0:00:04 etc.

DCF77-Simulation mode: The corresponding output simulates the DCF77 time telegram.
The time marks are representing the local time as configured by the user.

DCF77-M59 Generates a modified DCF77 telegram with a 50ms pulse inserted in the 59th second gap.

Single Shot Mode: A single pulse of programmable length is generated once a day at a programmable point of time

Per Sec.
Per Min.
Per Hr. modes: Pulses each second, minute or hour

Status: One of three status messages can be emitted:

'position OK':	The output is switched on if the receiver was able to compute its position
'time sync':	The output is switched on if the internal timing is synchronous to the GPS-system
'all sync':	Logical AND of the above status messages. The output is active if position is calculated AND the timing is synchronized

Time code The un-modulated IRIG or AFNOR signal of the built in time code generator is made available at the respective output.

Time String The time string of the serial port COM1 is made available at the respective output.

Idle-mode: The output is inactive.

5.3 Asynchronous Serial Ports

Two asynchronous serial interface (RS-232) called COM0 and COM1 are available to the user. In the default mode of operation, the serial outputs are disabeled until the receiver has synchonized after power up. However, the system can be configured to enable those outputs immediately after power-up. Transmission speeds, framings and the kind of the time string can be configured separately. The serial ports are 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.

5.4 Time code outputs

5.4.1 Introduction

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

http://www.meinberg.de/english/info/irig.htm

Except these time codes other formats, like NASA36, XR3 or 2137, are still in use. The module GPS164TDHS however generates IRIG-B or AFNOR NFS500 only.

Selection of the generated time code is done by using the monitor program GPSMON32.

5.4.2 Generated Time Codes

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

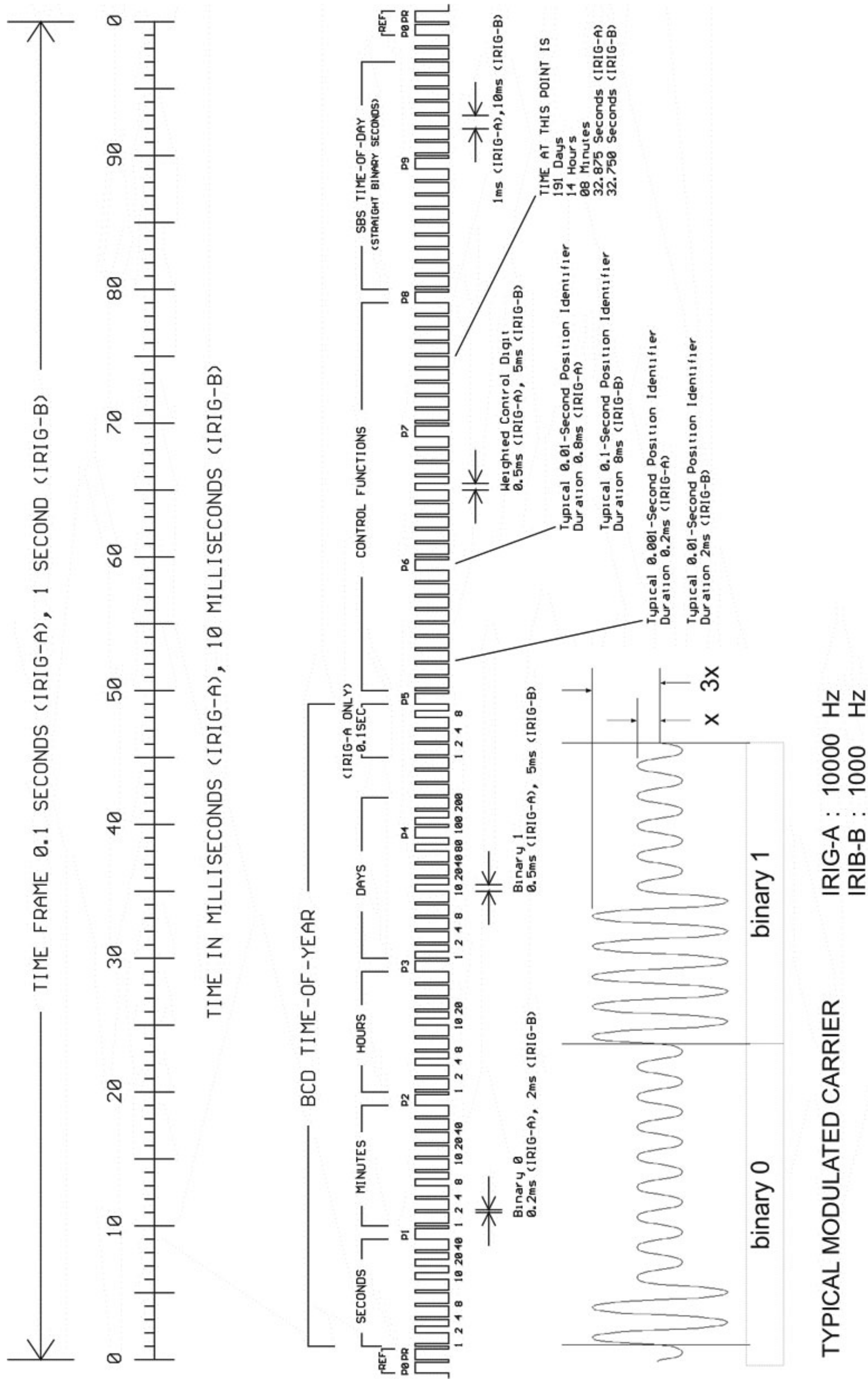
a)	B002:	100 pps, DCLS signal, no carrier BCD time-of-year
b)	B122:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year
c)	B003:	100 pps, DCLS signal, no carrier BCD time-of-year, SBS time-of-day
d)	B123:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, SBS time-of-day
e)	B006:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year
f)	B126:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year
g)	B007:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year, SBS time-of-day
h)	B127:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year, SBS time-of-day
i)	AFNOR:	Code according to NFS-87500, 100 pps, wave signal, 1kHz carrier frequency, BCD time-of-year, complete date, SBS time-of-day, Signal level according to NFS-87500
j)	IEEE1344:	Code according to IEEE1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time-of-year, SBS time-of-day, IEEE1344 extensions for date, timezone, daylight saving and leap second in control functions (CF) segment. (also see table 'Assignment of CF segment in IEEE1344 mode')
k)	C37.118	Like IEEE1344 - with turned sign bit for UTC-Offset

5.4.3 Code generation

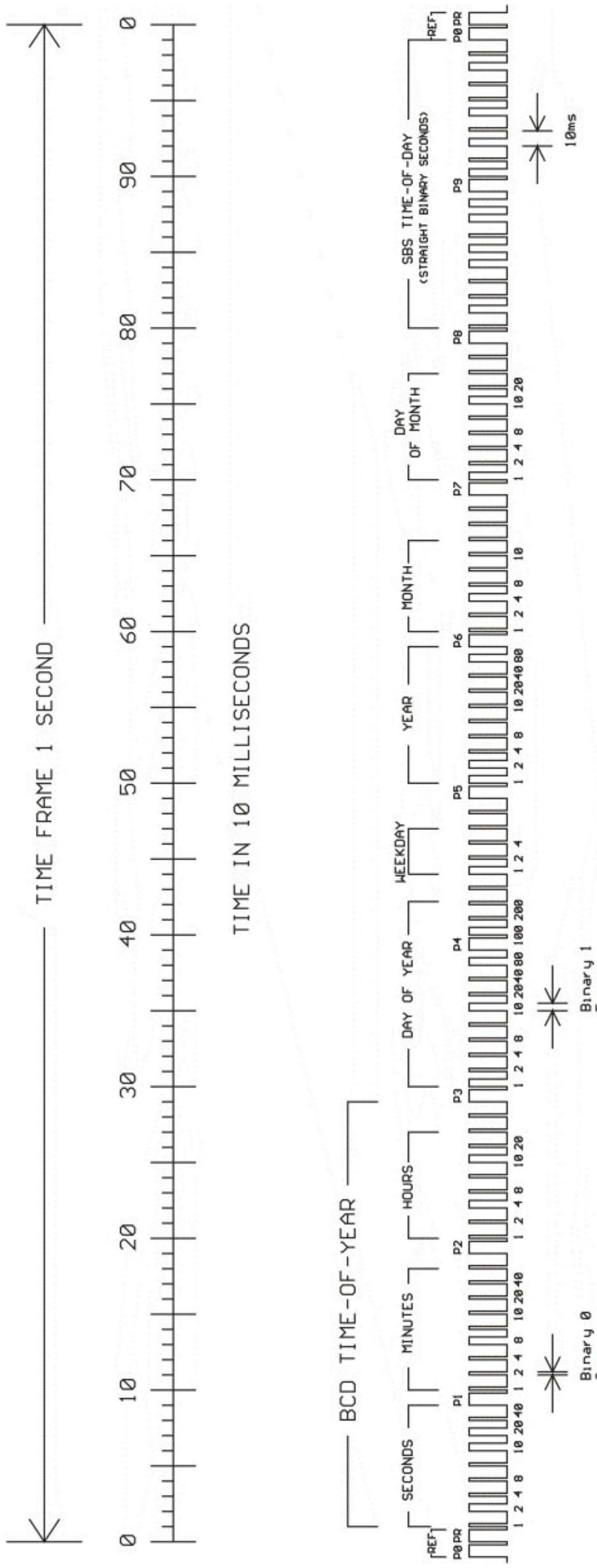
In the default mode of operation the IRIG/AFNOR timecode outputs are disabled until the GPS-receiver has been synchronized after power-up. Due to that the generation of the IRIG-code only starts after synchronization.

If the code must be available immediately after power-up, the software GPSMON32 can be used to enable the time code output without synchronization of the GPS-receiver by setting the enable flag 'pulses' to 'always'. In this mode of operation the IRIG-code is not locked to UTC-second until synchronization.

5.4.4 IRIG Standard Format



5.4.5 AFNOR Standard Format



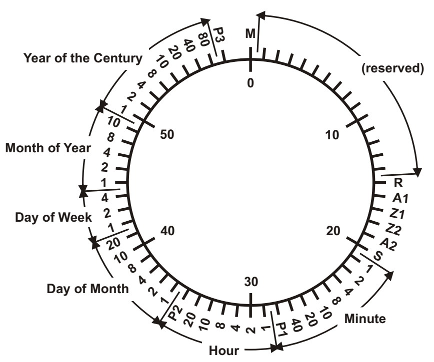
5.4.6 Assignment of CF Segment in IEEE1344 Code

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

1.) current firmware does not support leap deletion of leap seconds
2.) TFOM is cleared, when clock is synchronized first after power up. see chapter Selection of generated timecode

5.4.7 DCF77 Emulation

The GPS164 satellite controlled clock generates TTL level time marks (active HIGH) which are compatible with the time marks spread by the German long wave transmitter DCF77. This long wave transmitter installed in Mainflingen near Frankfurt/Germany transmits the reference time of the Federal Republic of Germany: time of day, date of month and day of week in BCD coded second pulses. Once every minute the complete time information is transmitted. However, GPS164 generates time marks representing its local time as configured by the user, including announcement of changes in daylight saving and announcement of leap seconds. The coding sheme is given below:



M	Start of Minute (0.1 s)	
R	RF Transmission via secondary antenna	
A1	Announcement of a change in daylight saving	
Z1, Z2	Time zone identification	
	Z1, Z2 = 0, 1:	Daylight saving disabled
	Z1, Z2 = 1, 0:	Daylight saving enabled
A2	Announcement of a leap second	
S	Start of time code information	
P1, P2, P3	Even parity bits	

Time marks start at the beginning of new second. If a binary "0" is to be transmitted, the length of the corresponding time mark is 100 msec, if a binary "1" is transmitted, the time mark has a length of 200 msec. 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. The DCF emulation output is enabled immediately after power-up.

6 Installation

6.1 Skilled/Service-Personnel only: Replacing the Lithium Battery

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

ATTENTION!
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.

6.2 Power supply

The variants of the module GPS180xHS are designed for following power supply options:

GPS1xxDHS:	19...72 VDC (DC-insulation 1.5 kVDC)
GPS1xxAHS:	100...240 VAC, 47...63 Hz
GPS1xxDAHS:	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 front contact.

6.3 Mounting the GPS Antenna

The GPS satellites are not stationary, but circle round the globe with 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/downconverter unit must be installed in a location that has as clear a view of the sky as possible. The best reception is achieved when the antenna has a free view of 8° angular elevation above the horizon. If this is not possible, the antenna should be installed with the clearest free view to the equator, because the satellite orbits are located between latitudes 55° North and 55° South. If this is not possible, you may experience difficulty receiving the four satellites necessary to complete the receiver's position solution.

The antenna/converter unit can be mounted on a wall, or on a pole up to 60 mm in diameter. A 50 cm plastic tube, two wall-mount brackets, and clamps for pole mounting are included. A standard RG58 coaxial cable should be used to connect the antenna/downconverter unit to the receiver. The maximum length of cable between antenna and receiver depends on the attenuation factor of the coaxial cable.

Up to four GPS164 receivers can be run with one antenna/downconverter unit by using an optional antenna splitter. The total length of an antenna line from antenna to receiver must not be longer than the max. length shown in the table below. The position of the splitter in the antenna line does not matter.

The optional delivered MBG S-PRO protection kit can also be used for outdoor installation (degree of protection: IP55).

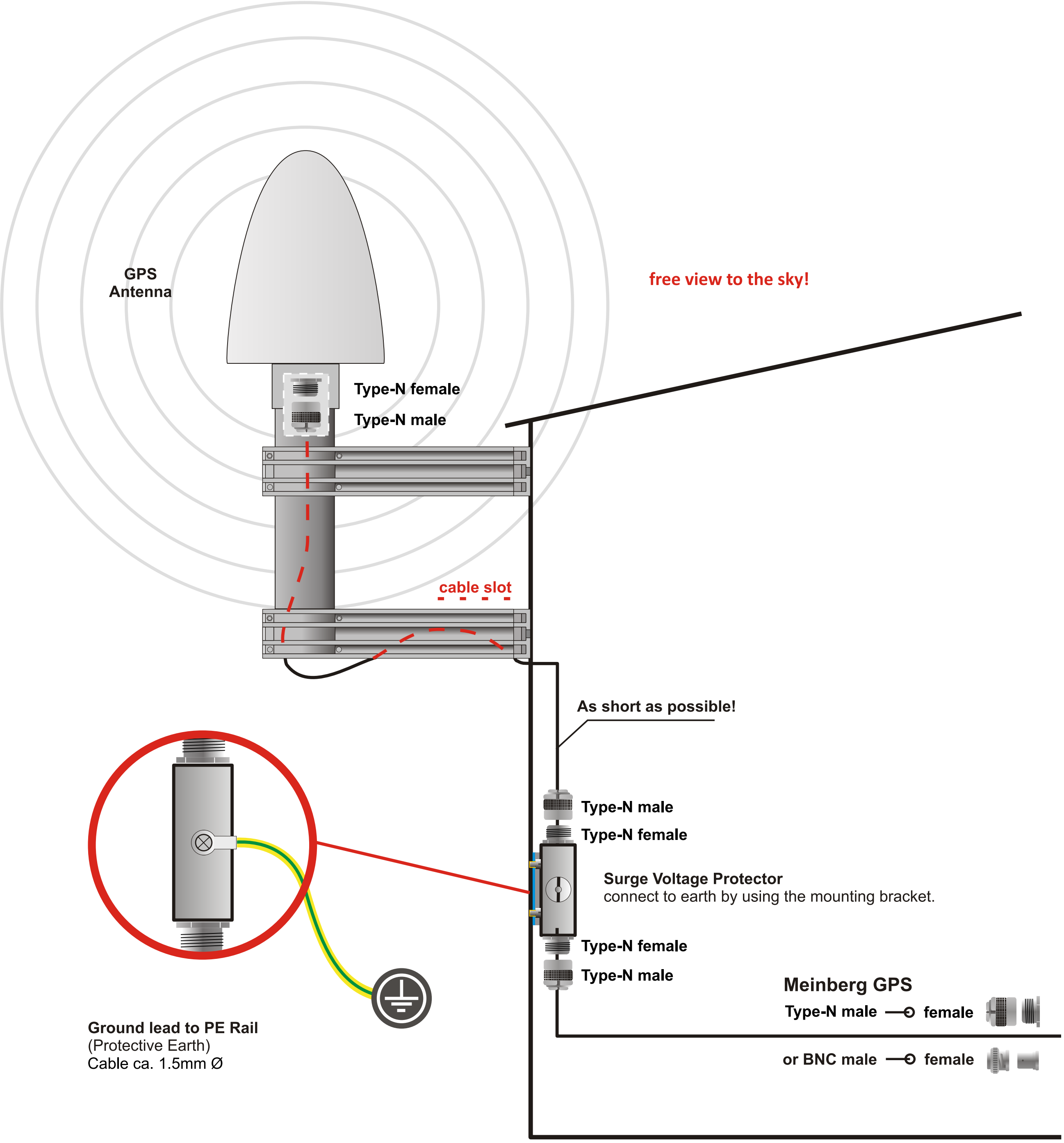
6.3.1 Example:

Type of cable	diameter Ø [mm]	Attenuation at 100MHz [dB]/100m	max lenght. [m]
RG58/CU	5mm	17	300 (1)
RG213	10.5mm	7	700 (1)

(1)This specifications are made for antenna/converter units produced after January, 2005
The values are typically ones; the exact ones are to find out from the data sheet of the used cable

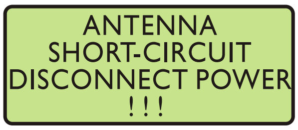
6.3.2 Antenna Assembly with Surge Voltage Protection

Optional a surge voltage protector for coaxial lines is available. The shield has to be connected to earth as short as possible by using the included mounting bracket. Normally you connect the antenna converter directly with the antenna cable to the system.



6.3.3 Antenna Short-Circuit

(systems with front display only)
In case of an antenna line short-circuit the following message appears in the display:



If this message appears the clock has to be disconnected from the mains and the defect eliminated. After that the clock can be powered-up again. The antenna supply voltage must be $15V_{DC}$.

6.4 Powering Up the System

If both the antenna and the power supply have been connected the system is ready to operate. About 10 seconds to 3 minutes after power-up the receiver 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 to 10 minutes after power-up. After 20 minutes of operation the OCXO is full adjusted and the generated frequencies are within the spezified tolerances.

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.

In the default mode of operation, neither pulse and synthesizer outputs nor the serial ports will be enabled after power-up until synchronization has been achieved. However, it is possible to configure some or all of those outputs to be enabled immediately after power-up. If the system starts up in a new environment (e. g. receiver position has changed or new power supply) it can take some minutes until the OCXO´s output frequency has been adjusted. Up to that time accuracy of frequency drops to 10^{-8} reducing the accuracy of pulses to +-3 μs.

7 The Front Panel Layout

7.1 FAIL LED

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

7.2 LOCK LED

The LOCK LED is turned on when 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 static, a single satellite is sufficient for synchronization.

7.3 OCx LEDs

The LEDs OC1, OC2 and OC3 are indicating the status of the corresponding pulse output. A burning LED symbolizes the active-state of an optocoupler.

7.4 BSL Key (hidden)

Whenever the on-board software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory via 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 while the system is powered up, a bootstrap-loader is activated and waits for instructions from the serial port COM0. The new firmware can be sent to the GPS164 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 while the system is powered up, the firmware will not be changed accidentially. After the next power-up, the system will be ready to operate again.

7.5 BNC connector DCF Out

The insulated AM-modulated carrier frequency is available using this connector.

7.6 Connectors TC_Out (AM/DCLS)

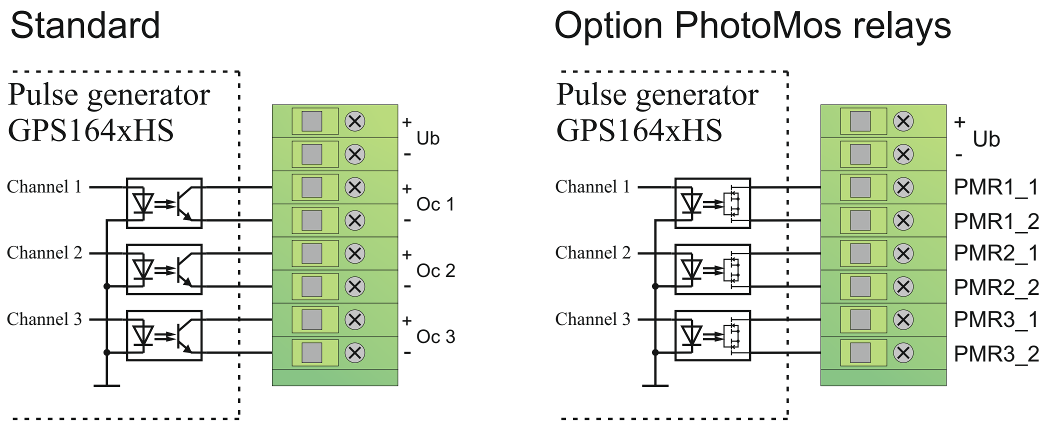
The modulated IRIG or AFNOR timecode signal is output at BNC connector TC_Out (AM), the un-modulatedtime code signal is available at Sub-D Connector TC_Out (DCLS)

7.7 BNC connector GPS Ant

The antenna/converter unit is connected to the receiver circuit of the GPS164 through this connector.

7.8 Assignment of the terminal block

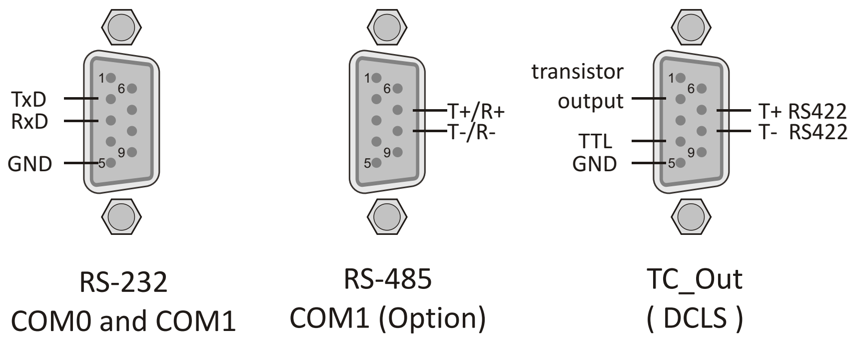
The pulse outputs are accessible through the terminal block in the front panel. In addition, the power supply of variants GPS164DHS and GPS164/AQ/DHS is connected using two poles of this terminal block. The marking besides the terminal has the following meaning:



+Ub	positive potential of power supply (GPS164(/AQ/)DHS only)
-Ub	reference potential of power supply (nur GPS164(/AQ/)DHS)
+OCx	collector of optocoupler
-OCx	collector of optocoupler
PMRx_1	contact 1 of PhotoMOS relay
PMRx_2	contact 2 of PhotoMOS relay

7.9 Assignment of the DSUB connectors

The serial ports COM0 and COM1 as well as the unmodulated IRIG/AFNOR time code signals are accessible via nine-pole DSUB connectors in the frontpanel. These RS-232 interfaces can be connected to a computer by using a standard modem cable. TxD describes the sending, RxD the receiving line of the GPS164xHS.



8 Technical Specifications GPS164 Railmount

8.1 Safety instructions for building-in equipment

This built-in type has been designed and tested in accordance with the requirements of of the IEC60950-1 standard „Safety of Information Technology Equipment, including Electrical Business Equipment".

- If the device is is assembled into another appliance (i.e. rack) additional requirements in accordance with IEC60950-1 standard have to be taken into account.
- The built-in type has been developed for use in office environment (pollution degree 2) and only be used in this environment. For use in rooms with a higher pollution degree more stringent requirements are applicable.
- The equipment/built-in type has been evaluated for use in a maximum ambient temperature of 50°C.
- The ventilation opening may not be covered.
- The built-in type is a class 1 equipment and must be connected to an grounded outlet (TN Power System) located close to the device and easily accessible.
- For safe operation the built-in type must be protected by max 16A fuse in the power installation system.
- Protection against fire must be assured in the end application.
- Disconnection of the equipment from mains is done by pulling all mains plugs.
- The built-in type may be opened only by qualified personell.

8.2 Technical data GPS164

HOUSING:	Chassis for mounting on DIN rail 125 mm x 115 mm x 105 mm (W x H x D)
POWERSUPPLY:	19...72 VDC (galvanic isolation 1.5 kVDC) 100-240 VAC or 100-240 VDC
AMBIENT TEMPERATURE:	0...50 °C
HUMIDITY:	85 %
ENCLOSURE TYPE:	IP20

8.3 Oscillator specifications

Verfügbare Oszillatoren für Meinberg GPS Empfänger und NTP Zeitserver:
OCXO, TCXO, Rubidium

	TCXO	OCXO LQ	OCXO SQ	OCXO MQ	OCXO HQ	OCXO DHQ	Rubidium (only available for 3U models)
Kurzzeitstabilität (τ = 1 sec)	$2 \cdot 10^{-9}$	$1 \cdot 10^{-9}$	$5 \cdot 10^{-10}$	$2 \cdot 10^{-10}$	$5 \cdot 10^{-12}$	$2 \cdot 10^{-12}$	$2 \cdot 10^{-11}$
Genauigkeit des PPS (Sekundenimpuls)	< ±100 ns	< ±100 ns	< ±50 ns	< ±50 ns	< ±50 ns	< ±50 ns	< ±50 ns
Phasenrauschen	1Hz -60dBc/Hz 10Hz -90dBc/Hz 100Hz -120dBc/Hz 1kHz -130dBc/Hz	1Hz -60dBc/Hz 10Hz -90dBc/Hz 100Hz -120dBc/Hz 1kHz -130dBc/Hz	1Hz -70dBc/Hz 10Hz -105dBc/Hz 100Hz -125dBc/Hz 1kHz -140dBc/Hz	1Hz -75dBc/Hz 10Hz -110dBc/Hz 100Hz -130dBc/Hz 1kHz -140dBc/Hz	1Hz < -85dBc/Hz 10Hz < -115dBc/Hz 100Hz < -130dBc/Hz 1kHz < -140dBc/Hz	1Hz < -80dBc/Hz 10Hz < -110dBc/Hz 100Hz < -125dBc/Hz 1kHz < -135dBc/Hz	1Hz -75dBc/Hz 10Hz -89dBc/Hz 100Hz -128dBc/Hz 1kHz -140dBc/Hz
Genauigkeit freilaufend, ein Tag	$\pm 1 \cdot 10^{-7}$ ±1Hz (1)	$\pm 2 \cdot 10^{-8}$ ±0.2Hz (1)	$\pm 5 \cdot 10^{-9}$ ±50mHz (1)	$\pm 1.5 \cdot 10^{-9}$ ±15mHz (1)	$\pm 5 \cdot 10^{-10}$ ±5mHz (1)	$\pm 1 \cdot 10^{-10}$ ±1mHz (1)	$\pm 2 \cdot 10^{-11}$ ±0.2mHz (1)
Genauigkeit freilaufend, 1 Jahr	$\pm 1 \cdot 10^{-6}$ ±10Hz (1)	$\pm 4 \cdot 10^{-7}$ ±4Hz (1)	$\pm 2 \cdot 10^{-7}$ ±2Hz (1)	$\pm 1 \cdot 10^{-7}$ ±1Hz (1)	$\pm 5 \cdot 10^{-8}$ ±0.5Hz (1)	$\pm 1 \cdot 10^{-8}$ ±0.1Hz (1)	$\pm 5 \cdot 10^{-10}$ ±5mHz (1)
Genauigkeit GPS-synchron, 24h gemittelt	$\pm 1 \cdot 10^{-11}$	$\pm 1 \cdot 10^{-11}$	$\pm 1 \cdot 10^{-11}$	$\pm 5 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$
Genauigkeit der Zeit freilaufend, 1 Tag	± 4.3 ms	± 865 µs	± 220 µs	± 65 µs	± 22 µs	± 4.5 µs	± 1.1 µs
Genauigkeit der Zeit freilaufend, 1 Jahr	± 16 s	± 6.3 s	± 4.7 s	± 1.6 s	± 788 ms	± 158 ms	± 8 ms
Temperaturdrift freilaufend	$\pm 1 \cdot 10^{-6}$ (-20...70°C)	$\pm 2 \cdot 10^{-7}$ (0...60°C)	$\pm 1 \cdot 10^{-7}$ (-10...70°C)	$\pm 5 \cdot 10^{-8}$ (-20...70°C)	$\pm 1 \cdot 10^{-8}$ (5...70°C)	$\pm 2 \cdot 10^{-10}$ (5...70°C)	$\pm 6 \cdot 10^{-10}$ (-25...70°C)

Hinweis 1:
Die Genauigkeit in Hertz basiert auf der Normalfrequenz von 10MHz.

Zum Beispiel: Genauigkeit des TCXO (freilaufend, ein Tag) ist $\pm 1 \cdot 10^{-7} \cdot 10MHz = \pm 1$ HZ

Die angegebenen Werte für die Zeit und Frequenzgenauigkeit (nicht Kurzzeitstabilität) sind nur für eine konstante Umgebungstemperatur gültig!
Es sind mindestens 24 Stunden GPS-Synchronizität vor Freilauf erforderlich.

8.4 Skilled/Service-Personnel only: Replacing the Lithium Battery

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

ATTENTION!

There is a Danger of explosion if the lithium battery is replaced incorrectly. Only identical batteries or batteries recommended by the manufacturer must be used for replacement.

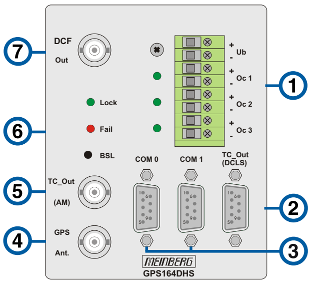
The waste battery has to be disposed as proposed by the manufacturer of the battery.

8.5 Front Panel Connectors GPS164

Name	Type	Signal	Cable
COM X	9pin. D-SUB	RS232	shielded data line
Optoc. Out	8pin. Screwterminal		
DCF Out	BNC	77.5kHz	shielded coaxial line
Time Code			
AM Out	BNC	3Vpp into 50 Ohm	shielded coaxial line
DCLS Out	9pin. D-SUB	RS422	shielded coaxial line
Antenna	BNC		shielded coaxial line
Power supply	over 8pin. Screw terminal (standard model) over 5pin DFK (DHS with power supply) power coord rec. (AHS with power supply)		

8.6 Front views

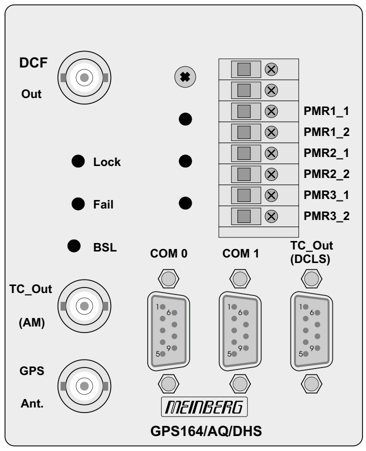
The following figures are showing the front panels of the variants of the module GPS164xHS

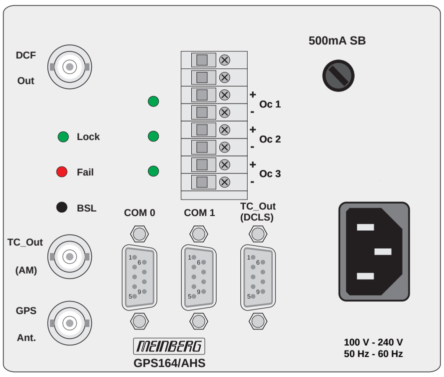


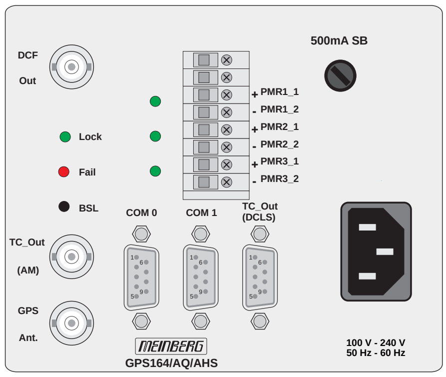
DEUTSCH
1. Spannungsversorgung (siehe technische Daten)
   Optokoppler Ausgänge 8pol. Schraub-/Klemmleiste
2. Time Code DCLS Ausgang, 9pol. D-SUB
3. Serielle Schnittstellen COM 0 - COM 1, 9pol. D-SUB
4. GPS Antenne, BNC
5. Time Code AM Ausgang, BNC
6. Status LEDs / BSL (Boot Strap Loader)
7. DCF Ausgang, BNC

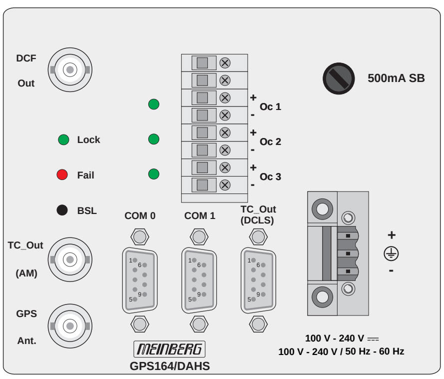
ENGLISH
1. Power supply connector (see chapter technical specifications)
   Optocoupler outputs 8pin. Screwterminal
2. Time Code DCLS output, 9pin. D-SUB
3. Serial ports COM 0 - COM 1, 9pin. D-SUB
4. GPS Antenna, BNC
5. Time Code AM outputs, BNC
6. Status LEDs / BSL (Boot Strap Loader)
7. DCF output, BNC

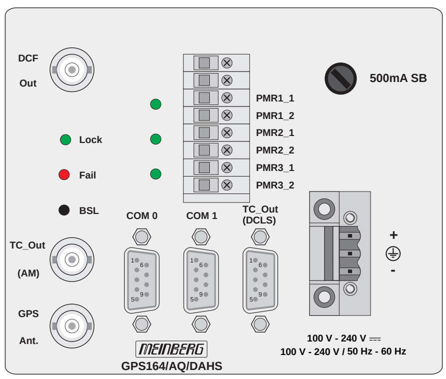
Option PhotoMOS relays











9 Technical Specifications GPS receiver

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 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 pulse configuration and important GPS-system data in the internal RAM, backed-up by lithium battery lifetime of battery 10 years min.
PULSE OUTPUTS:	three programmable outputs **GPS164DHS, GPS164AHS, GPS164DAHS** DC-insulated by optocouplers U_{CEmax} = 55 V, I_{Cmax} = 50 mA, P_{tot} = 150 mW, V_{iso} = 5000 V pulse delay: t_{on} e.g. 20 μsec (I_C = 10 mA) t_{off} e.g. 3 μsec (I_C = 10mA) **GPS164/AQ/DHS, GPS164/AQ/AHS, GPS164/AQ/DAHS** DC-insulated by PhotoMOS relays U_{max} = 400 V, I_{max} = 150 mA, P_{tot} = 360 mW, V_{iso} = 1500 V pulse delay: t_{on} e.g. 0,18 msec (I_{load} = 150 mA) t_{off} e.g. 0,07 msec (I_{load} = 150mA) default settings: all pulse outputs inactive mode of operation: 'if sync'
ACCURACY OF PULSES:	better than +-250nsec after synchronization and 20 minutes of operation better than +-3 μsec during the first 20 minutes of operation
SERIAL PORTS:	2 independant asynchronous serial ports **COM0** (RS-232) Baud Rate: 300 up to 19200 Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1 **COM1** (RS-232, optional RS-485) Baud Rate: 300 up to 19200 Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1 time string selectable for COM0 and COM1 'standard Meinberg', 'SAT', 'Uni Erlangen (NTP)', 'NMEA-183' (RMC), and 'Computime' default settings: COM0: 19200, 8N1 COM1: 9600, 8N1

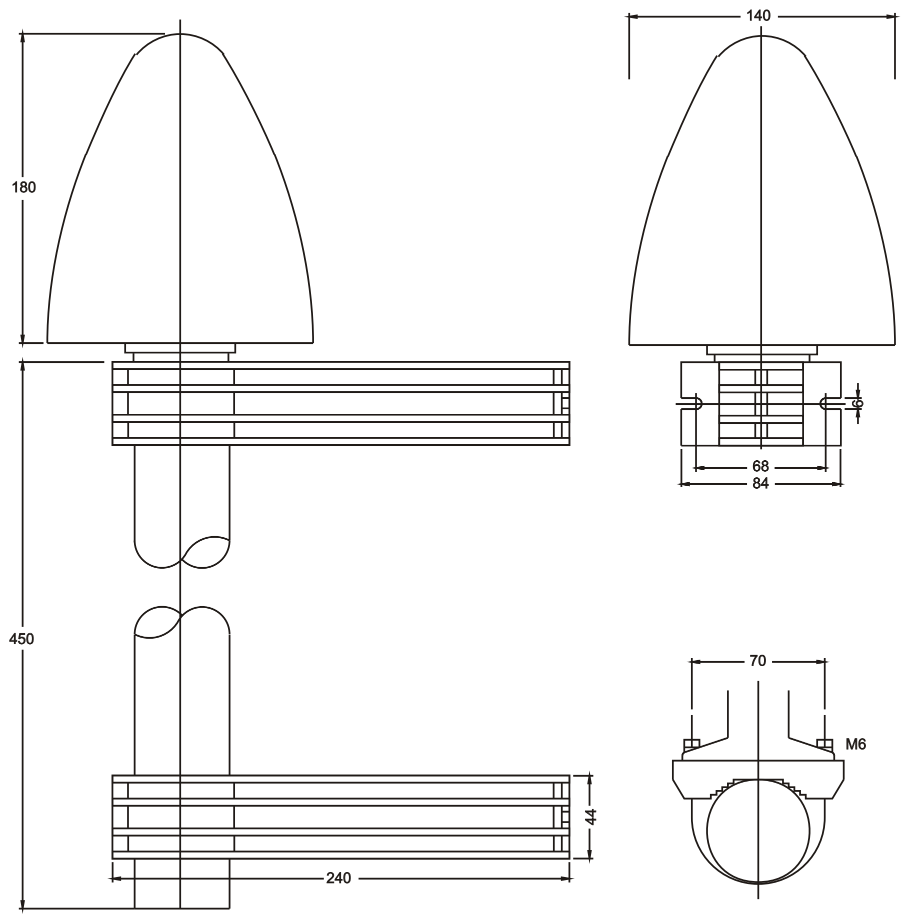
		'standard Meinberg' for COM0 and COM1 time string per second mode of operation 'if sync'
TIME CODE OUTPUTS:	modulated via BNC-connector:	
	IRIG:	$3V_{PP}$ (MARK), $1V_{PP}$ (SPACE) into 50Ω
	AFNOR:	$2.17V_{SS}$ (MARK), $0.688V_{SS}$ (SPACE) into 50Ω
	modulated via DSUB-connector: Field effect transistor with internal pull-up (470 Ω) to +5V	
	Data of transistor: Uds_{max} = 100 V, Id_{max} = 150 mA, P_{max} = 250 mW TTL into 50Ω RS422	
DCF77 EMULATION:	AM-modulated 77.5 kHz carrier frequency usable as replacement for a DCF77 antenna output level approximately -55 dBm (unmodulated)	
STATUS INDICATION:	receiver status:	
	Lock:	the reciever was able to compute its position after power-up
	Fail:	the receiver is asynchronous to the GPS-system
	status of the pulse outputs: a burning LED indicates the active state of the corresponding optocoupler/PhotoMOS relay	
POWER REQUIREMENTS:	**GPS164DHS, GPS164/AQ/DHS** 19...72 VDC DC-isolation 1.5 kVDC	
	GPS164AHS, GPS164/AQ/AHS 100...240 VAC, 47...63 Hz fuse: 500 mA	
	GPS164DAHS, GPS164/AQ/DAHS 100...240 VDC 100...240 VAC, 47...63 Hz fuse: 500 mA	
DIMENSION:	GPS164DHS, GPS164/AQ/DHS 105 mm x 85 mm x 104 mm (height x width x depth)	
	GPS164AHS, GPS164/AQ/AHS, GPS164DAHS,GPS164/AQ/DAHS 105 mm x 125.5 mm x 104 mm (height x width x depth)	
CONNECTORS:	coaxial BNC connectors for antenna/converter unit, AMmodulated DCF77 output and modulated time code output eight-pole terminal block for connection of: - pulse outputs - power supply (GPS164DHS and GPS164/AQ/DHS only)	
	GPS164AHS and GPS164/AQ/AHS only: power cord receptacle for AC-line	

	GPS164DAHS and GPS164/AQ/DAHS only: three-pole terminal block for connection of power supply
AMBIENT TEMPERATURE:	0 ... 50°C
HUMIDITY:	85% max.

9.1 Technical Specifications GPS Antenna

Antenna:	dielectrical patch antenna,	25 x 25 mm
	receive frequency:	1575.42 MHz
Bandwith:	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:	N-Type, female	
Ambient Temperature:	-40 ... +65°C	
Housing:	ABS plastic case for	
	outdoor installation (IP66)	

Physical Dimension:



9.2 Time Strings

9.2.1 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

9.2.2 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*;*uv*G*y*;*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)		
tt.mm.jj	the current date:		
	tt	day of month	(01..31)
	mm	month	(01..12)
	jj	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 is running free (without exact synchr.)
		' '	(space, 20h) clock is synchronous (base accuracy is reached)
	v:	'*'	receiver has not checked its position
		' '	(space, 20h) receiver has determined its position
G	time zone indicator 'GPS-Time'		
y	anouncement of discontinuity of time, enabled during last hour before discontinuity comes in effect:		
	'A'	announcement of leap second insertion	
	' '	(space, 20h) nothing announced	
lll	number of leap seconds between UTC and GPS-Time (UTC = GPS-Time + number of leap seconds)		
<ETX>	End-Of-Text, (ASCII Code 03h)		

9.2.3 Format of the Meinberg Capture String

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

CH*x*_ *tt.mm.jj*_ *hh:mm:ss.fffffff* <CR><LF>

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

x	0 or 1 corresponding on the number of the capture input
_	ASCII space 20h

dd.mm.yy the capture date:

dd	day of month	(01..31)
mm	month	(01..12)
yy	year of the century	(00..99)

hh:mm:ss.fffffff the capture time:

hh	hours	(00..23)
mm	minutes	(00..59)
ss	seconds	(00..59, or 60 while leap second)
fffffff	fractions of second, 7 digits	

<CR> Carriage Return, ASCII Code 0Dh

<LF> Line Feed, ASCII Code 0Ah

9.2.4 Format of the SAT Time String

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

<STX>*dd.mm.yy/w/hh:mm:ssxxxxuv*<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)
xxxx	time zone indicator:		
	‘UTC‘	Universal Time Coordinated, formerly GMT	
	‘CET‘	European Standard Time, daylight saving disabled	
	‘CEST’	European Summertime, daylight saving enabled	
u	clock status characters:		
	‘#’	clock has not synchronized after reset	
	‘ ‘	(space, 20h) clock has synchronized after reset	
v	anouncement 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		

9.2.5 Format of the Uni Erlangen String (NTP)

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

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

<STX> Start-Of-Text, ASCII Code 02h
sending with one bit occuracy at change of second

dd.mm.yy the current date:

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

hh.mm.ss the current time:

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

v sign of the offset of local timezone related to UTC

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

ac clock status characters:

a:	‘#’	clock has not synchronized after reset
	‘ ‘	(space, 20h) clock has synchronized after reset
c:	‘*’	GPS receiver has not checked its position
	‘ ‘	(space, 20h) GPS receiver has determined its position

d time zone indicator:

‘S’	CEST	European Summertime, daylight saving enabled
‘ ‘	CET	European Standard Time, daylight saving disabled

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

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

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

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

i leap second insertion

‘L’	leap second is actually inserted (active only in 60th sec.)
‘ ‘	(space, 20h) no leap second is inserted

bbb.bbbb latitude of receiver position in degrees
leading signs are replaced by a space character (20h)

n latitude, the following characters are possible:

‘N’	north of equator

	'S'	south d. equator
lll.llll	longitude of receiver position in degrees leading signs are replaced by a space character (20h)	
e	longitude, the following characters are possible: 'E' east of Greenwich 'W' west of Greenwich	
hhhh	altitude above WGS84 ellipsoid in meters leading signs are replaced by a space character (20h)	
<ETX>	End-Of-Text, ASCII Code 03h	

9.2.6 Format of the NMEA 0183 String (RMC)

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

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

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

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

9.2.7 Format of the NMEA 0183 String (GGA)

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

$GPGGA,*hhmmss.ss,bbbb.bbbbb,n,lllll.ll,e,A,vv,hhh.h,aaa.a,M,ggg.g,M,,0*cs*<CR><LF>

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

$	Start character, ASCII Code 24h sending with one bit accuracy at change of second
hhmmss.ss	the current time: hh hours (00..23) mm minutes (00..59) ss seconds (00..59, or 60 while leap second) ss fractions of seconds (1/10 ; 1/100)
A	Status (A = time data valid) (V = time data not valid)
bbbb.bbbbb	latitude of receiver position in degrees leading signs are replaced by a space character (20h)
n	latitude, the following characters are possible: 'N' north of equator 'S' south d. equator
lllll.lllll	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
A	Position fix (1 = yes, 0 = no)
vv	Satellites used (0..12)
hhh.h	HDOP (Horizontal Dilution of Precision)
aaa.h	Mean Sea Level altitude (MSL = altitude of WGS84 - Geoid Separation)
M	Units, meters (fixed value)
ggg.g	Geoid Separation (altitude of WGS84 - MSL)
M	Units, meters (fixed value)
cs	checksum (EXOR over all characters except '$' and '*')
<CR>	Carriage Return, ASCII Code 0Dh
<LF>	Line Feed, ASCII Code 0Ah

9.2.8 Format of the NMEA 0183 String (ZDA)

The NMEA String is a sequence of 38 ASCII characters starting with the **'$GPZDA'** character and ending with the characters **CR** (carriage return) and LF (line-feed). The format is:

$GPZDA,*hhmmss.ss,dd,mm,yyyy,HH,II*cs*<CR><LF>
ZDA - Time and Date: UTC, day, month, year and local timezone.

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

$	Start character, ASCII Code 24h sending with one bit accuracy at change of second		
hhmmss.ss	the current UTC time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59 or 60 while leap second)
HH,II	the local timezone (offset to UTC):		
	HH	hours	(00..+-13)
	II	minutes	(00..59)
dd,mm,yy	the current date:		
	dd	day of month	(01..31)
	mm	month	(01..12)
	yyyy	year	(0000..9999)
cs	checksum (EXOR over all characters except '$' and '*')		
<CR>	Carriage Return, ASCII Code 0Dh		
<LF>	Line Feed, ASCII Code 0Ah		

9.2.9 Format of the ABB SPA Time String

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

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

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

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

9.2.10 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 sending with one bit accuracy at change of second		
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		

9.2.11 Format of the RACAL standard Time String

The RACAL standard Time String is a sequence of 16 ASCII characters terminated by a X (58h) character and ending with the CR (Carriage Return, ASCII Code 0Dh) character. The format is:

<X><G><U>*yymmddhhmmss*<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:

<X>	Control character sending with one bit accuracy at change of second		code 58h
<G>	Control character		code 47h
<U>	Control character		code 55h
yymmdd	the current date:		
	yy	year of the century	(00..99)
	mm	month	(01..12)
	dd	day of month	(01..31)
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		
Interface parameters:	7 Databits, 1 Stopbit, odd. Parity, 9600 Bd		

9.2.12 Format of the SYSPLEX-1 Time String

The SYSPLEX1 time string is a sequence of 16 ASCII characters starting with the SOH (Start of Header) ASCII controll character and ending with the LF (line feed, ASCII Code 0Ah) character. The format is:

<SOH>ddd:hh:mm:ssq<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:

<SOH>	Start of Header (ASCII control character) sending with one bit accuracy at change of second		
ddd	day of year		(001..366)
hh:mm:ss	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	q	Quality indicator	(space) Time Sync (GPS lock) (?) no Time Sync (GPS fail)
<CR>	Carriage-return (ASCII code 0Dh)		
<LF>	Line-Feed (ASCII code 0Ah)		

9.2.13 Format of the ION Time String

The ION time string is a sequence of 16 ASCII characters starting with the SOH (Start of Header) ASCII controll character and ending with the LF (line feed, ASCII Code 0Ah) character. The format is:

<SOH>ddd:hh:mm:ssq<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:

<SOH>	Start of Header (ASCII control character) sending with one bit accuracy at change of second		
ddd	day of year		(001..366)
hh:mm:ss	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	q	Quality indicator	(space) Time Sync (GPS lock) (?) no Time Sync (GPS fail)
<CR>	Carriage-return (ASCII code 0Dh)		
<LF>	Line-Feed (ASCII code 0Ah)		

10 The program GPSMON32

The program GPSMON32 can be used to monitor and programm all essential functions of Meinberg GPS-Receivers. The Software is executable under Windows 7, Windows Vista, Win9X, Win2000, WinXP and WinNT. To install GPSMON32 just run **setup.exe** from the included USB flash drive and follow the instructions of the setup program.

Program and clock can communicate either via serial link or via TCP/IP connection if the clock is prepared for (XPT board). The mode to be used can be selected in menu *"Connection -> Settings"* by the checkboxes serial and network.

10.1 Serial Connection

To obtain a connection between you 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 apperaring window. Some firmware versions of the GPS receiver 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.

10.2 Network Connection

(only clocks with Ethernet access!)

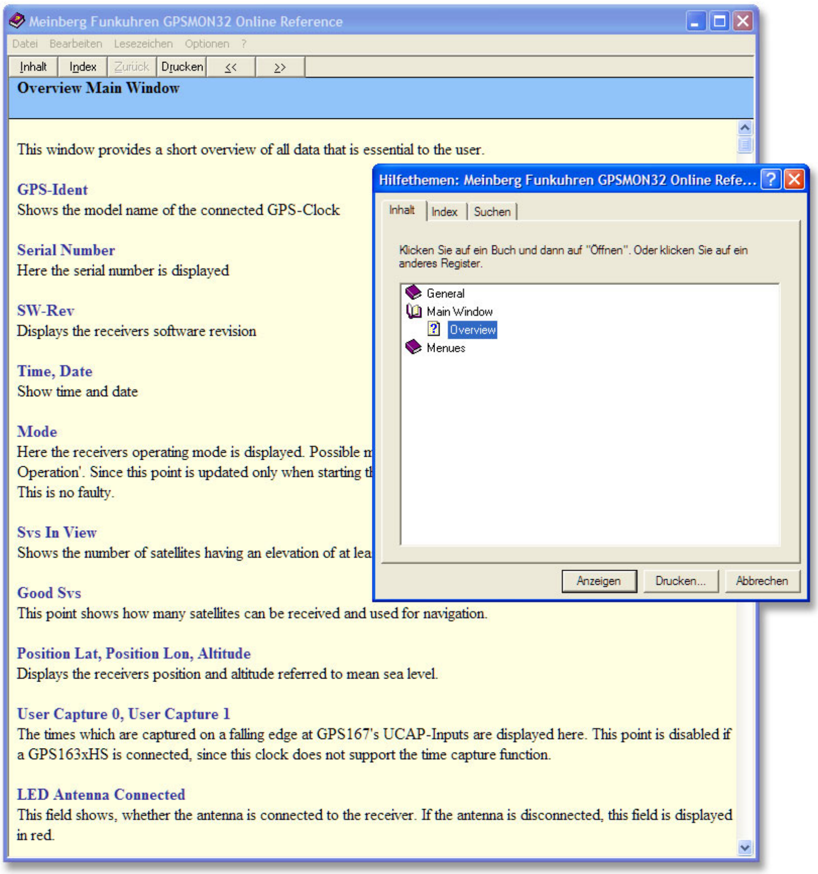
Settings needed for a network connection can be done in menu "Connection->Settings".
To set up a network connection from clock program GPSMON32, the mode "network" must be selected in the field "mode". Further the TCP/IP-Address must be entered in field "IP-Address". If the IP-Address is unknown, the user can let the program search for available clocks in the local network by clicking the "Find" button. A new connection can be set up by clicking to one of the displayed addresses.

Access to radioclocks by network is always protected by a Password.

The online help function of GPSMON32 provides detailed information on setting up a TCP/IP connection.

10.3 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 German/English in the Help Menu



11 Declaration of Conformity

Konformitätserklärung

Doc ID: GPS164XHS-2015-12-07

Hersteller *Manufacturer*	Meinberg Funkuhren GmbH & Co. KG Lange Wand 9, D-31812 Bad Pyrmont

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

Produktbezeichnung *Product Designation*	**GPS164XHS**

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards

EN55022:2010, Class B	Limits and methods of measurement of radio interference characteristics of information technology equipment
EN55024:2010	Limits and methods of measurement of Immunity characteristics of information technology equipment
EN 61000-3-2:2006 (+A1:2009 +A2:2009)	Electromagnetic Compatibility (EMC) Limits for harmonic current emissions
EN 61000-3-3:2008 (+A1:2001 +A2:2005)	Electromagnetic Compatibility (EMC) Limitation of voltage fluctuation and flicker in low-voltage supply systems
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

gemäß den Richtlinien 2014/30/EU (Elektromagnetische Verträglichkeit), 2014/35/EU (Niederspannungsrichtlinie), 2011/65/EU (Beschränkung der Verwendung bestimmter gefährlicher Stoffe) und 93/68/EWG (CE Kennzeichnung) sowie deren Ergänzungen.
following the provisions of the directives 2014/30/EU (electromagnetic compatibility), 2014/35/EU (low voltage directive), 2011/65/EU (restriction of the use of certain hazardous substances) and 93/68/EEC (CE marking) and its amendments.

Bad Pyrmont, 2015-12-07

Günter Meinberg
Managing Director

GPS164_DHS_QSG_181110