MEINBERG

MANUAL

GPS180XHS

Railmount GPS Receiver

23rd March 2012

Meinberg Radio Clocks GmbH & Co. KG

Table of Contents

1 Impressum

Meinberg Radio Clocks GmbH & Co. KG
Lange Wand 9, 31812 Bad Pyrmont - Germany

Phone: + 49 (0) 52 81 / 93 09 - 0
Fax: + 49 (0) 52 81 / 93 09 - 30

Internet: http://www.meinberg.de
Mail: info@meinberg.de

Date: 2011-06-21

2 Content of the USB stick

Besides this manual, the provides 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 7
- Windows VISTA
- Windows Server 2003
- Windows XP
- Windows 2000
- Windows NT
- Windows ME
- Windows 9x

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

3 General information about GPS180XHS

At first, only the standard modules with one serial RS-232 interface are descibed on the following pages. Details of tadditional 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 quiality
- second independant interface (RS-232, RS-485 or fiber optic)
- pulse per second PPS (TTL into 50 Ohm and/or fiber optic)
- 10 MHz standard frequency (TTL into 50 Ohm and/or sine 0.5 Vrms into 50 Ohm)

The Meinberg satellite receiver clocks of the GPS180XHS series are available with different power supplies:

	19..72VDC	100..240VAC	100..240VDC
GPS180DHS	X		
GPS180AHS		X	
GPS180DAHS		X	X

The differences are described in the relevant chapters, the name GPS180XHS is used whenever common features of all types of clocks are specified.

4 General Information GPS

The satellite receiver clock GPS180 has been designed to provide extremly 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 this 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 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 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.

5 Block diagram GPS180XHS
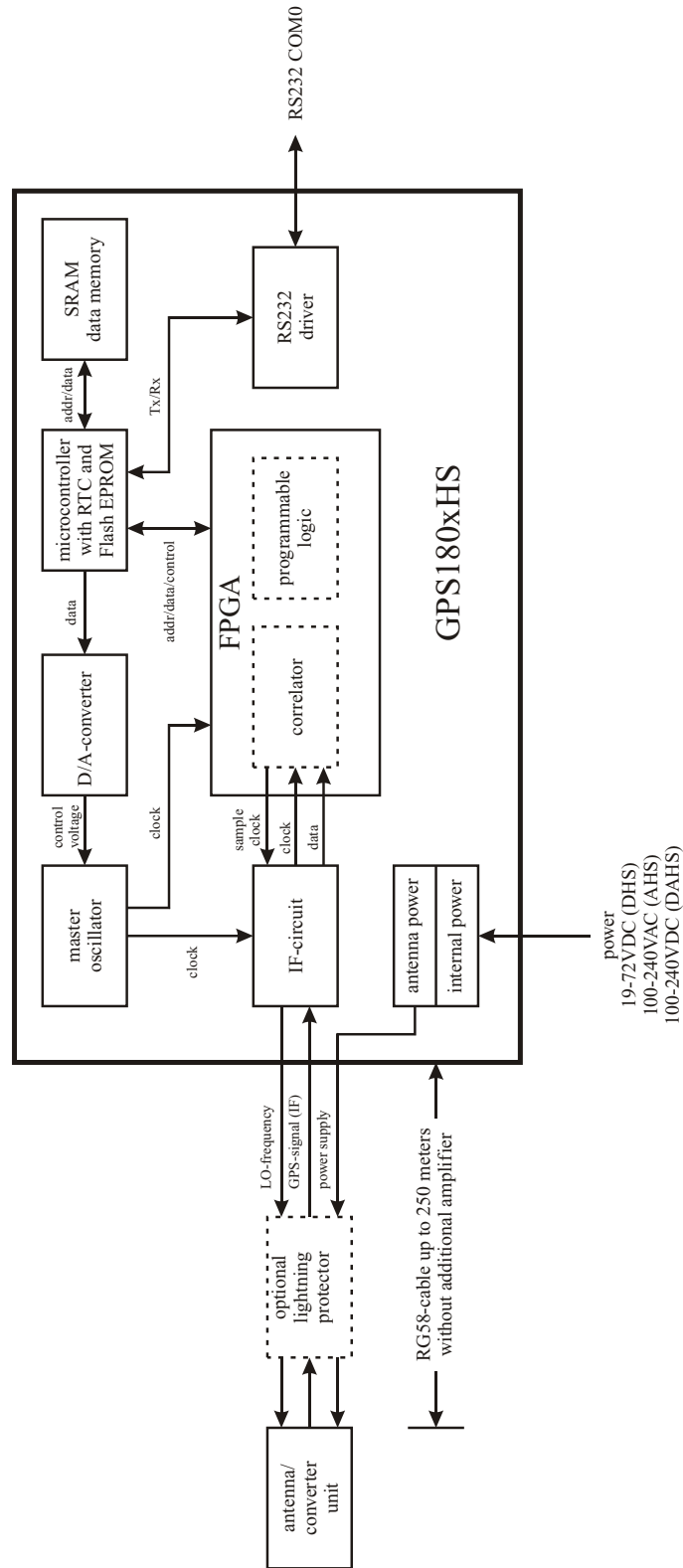
6 GPS180 Features

The satellite controlled clock GPS180xHS 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 Ohm-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 GPS180xHS´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 master oscillator (TCXO) to +- 5.10-9 and automatically compensates the oscillators aging. The last recent value is restored from the battery buffered memory at power-up.

6.1 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 since GPS was initiated in 1980. The current number of leap seconds is part of the navigation message supplied by the satellites, so the internal real time of the GPS180 is based on UTC time scale. Conversion to local time and annual daylight saving time can be done by the receiver's microprocessor if the corresponding parameters are set up by the user.

6.2 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 reveicer 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 secound, once per minute or on request with ASCII "?" only. The format of the output strings is ASCII, see the technical specifications for detail. The corresponding parameters can be set up by GPSMON32 (included Windows software) using serial port COM0.

7 Installation

7.1 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.

7.2 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.

7.3 Mounting the GPS Antenna

The GPS satellites are not stationary but circle round the globe in a period of about 12 hours. They can only be received if no building is in the line-of-sight from the antenna to the satellite, so the antenna/converter unit must be installed in a location from which as much of the sky as possible can be seen. The best reception is given when the antenna has a free view of 8° angular elevation above 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 occure especially when at least four sattelites for positioning have to be found.

The antenna/converter unit can be mounted on a pole with a diameter up to 60 mm or at a wall. A 45 cm plastic tube, two holders for wall-mounting and clamps for pole-mounting are added to every GPS180. A standard coaxial cable with 50 ohm impedance should be used to connect the antenna/converter unit to the receiver. The maximum lenght of cable between antenna and receiver depends on the attenuation factor of the used coaxial cable.

Up to four GPS180 receivers can be run with one antenna/converter unit by using the optional antenna diplexer. The total length of one antenna line between antenna, diplexer and receiver must not be longer than the max. lenght shown in the table above. The position of the diplexer in the antenna line does not matter.

High voltage protectors must be installed directly after reaching the indoors. The optional delivered protection kit is not for outdoor usage.

Note:
If the antenna cable was assembled 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 GPS180.

7.3.1 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

7.3.2 Antenna Short-Circuit 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.

GPS Antenna

GPS satellite antenna

free view to the sky!

N-Norm female
N-Norm male

cable slot

As short as possible!

N-Norm male
N-Norm female

Surge Voltage Protector
connect to earth by using the mounting bracket.

N-Norm female
N-Norm male

Meinberg GPS
N-Norm male ━━◯ female

or BNC male ━━◯ female

Ground lead to PE Rail
(Protective Earth)
Cable / 16mm^2 - fastened
with cable shoe
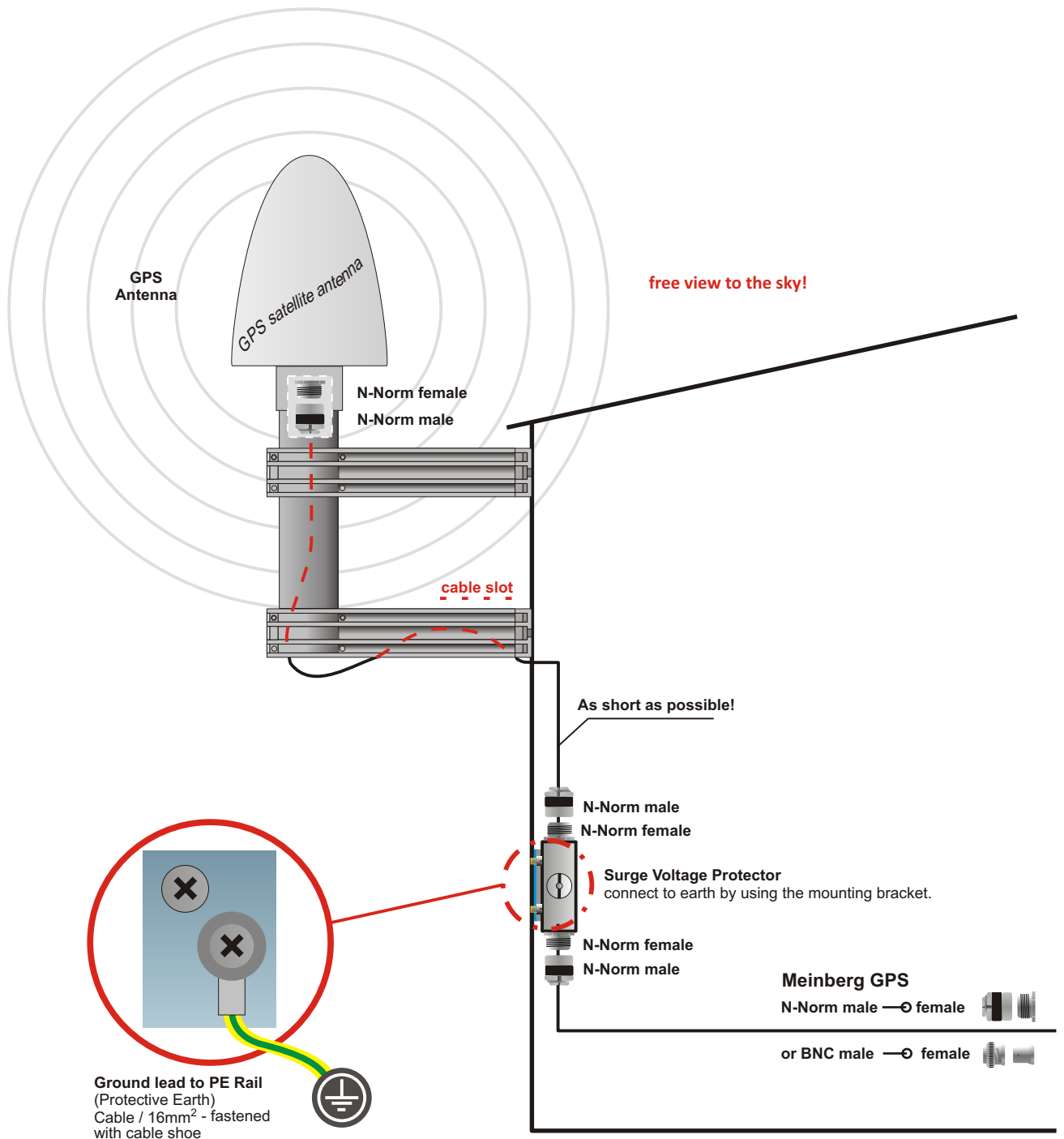
7.4 Powering Up the System

If both the antenna and the power supply have been connected the system is ready to operate. About 10 seconds after power-up the receiver´s until 3 minutes 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 until 10 minutes. 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 $+$-5μs.

8 The Front Panel Layout

8.1 FAIL LED

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

8.2 LOCK LED

The LOCK LED is turned on when after power-up the receiver has acquired at least four satellites and has computed its position 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.

8.3 SUB-D Connector Assignments

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 coumputer by using a standard modem cable. TxD describes the sending, RxD the receiving line of GPS180xHS

RS-232
COM0
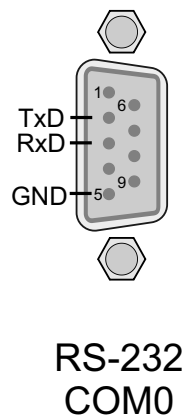
8.4 Front views

The following illustrations are showing the front views of the standard models of the GPS180XHS series with PPS and 10MHz output option:

GPS180DHS

GPS180AHS

GPS180DAHS
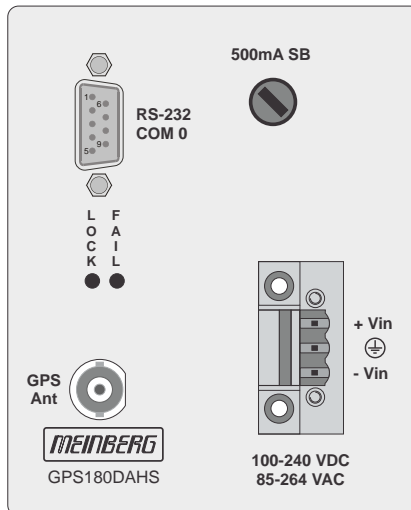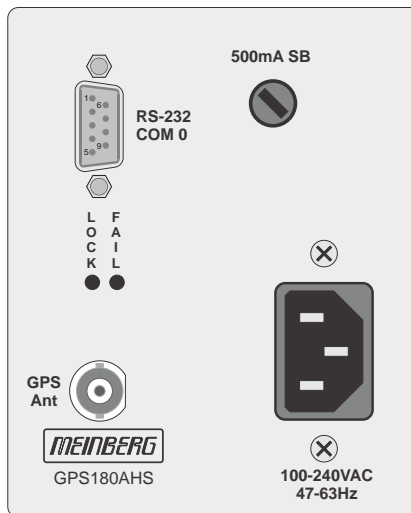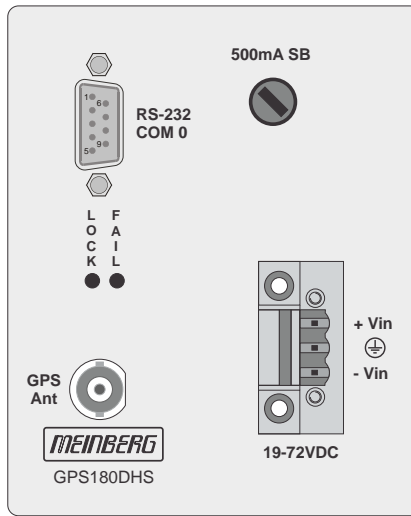
9 Technical Specifications GPS180XHS

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 GPS Antenna"

ANTENNA
INPUT: Antenna circuit dc-insulated; dielectric strength: 1000 V
                       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 asychronous serial port
                       COM0 (RS-232)
                       Baud Rate: 300 up to 19200
                       Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1

                       time sting selectable:
                       'Standard Meinberg', 'Meinberg GPS', 'SAT', 'ABB-SPA','RACAL',
                       'Uni Erlangen (NTP)', 'NMEA (RMC,GGA,ZDA)', 'Computime','ION'

                       default settings: 19200 Bd, 8N1
                                            'standard Meinberg'
                                            time sting per second
                                            mode of operation 'if sync'

STATUS
INDICATION: Receiver status:
                       Lock: the reveiver was able to coute its position
                                            after power-up

                       Fail: the receiver is asynchronous to the GPS-system

POWER
REQUIREMENTS: **GPS180DHS:**   19...72 VDC
                                            DC-isolation 1.5 kVDC

                       GPS180AHS: 100...240 VAC, 47...63 Hz
                                            fuse: 500 mA

                       GPS180DAHS: 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 mine-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.

9.1 Technical Specifications GPS Antenna

ANTENNA: dielectric 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

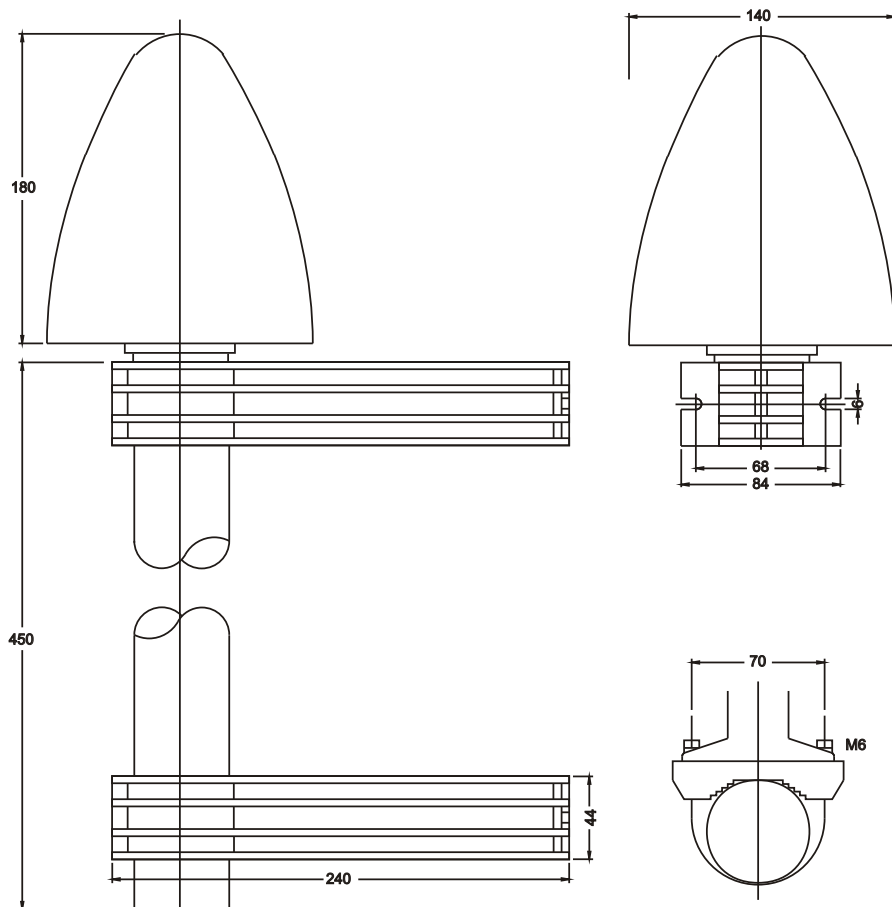POWER
REQUIREMENTS: 12V ... 18V, @ 100mA
                            (provided via antenna cable)

CONNECTOR: N-Type, female

AMBIENT
TEMPERATURE: -40 ... +65°C

HOUSING: ABS plastic case for
                            outdoor installation (IP66)

Physical Dimension:

9.2 Time Strings

The Time Strings are depent on the Software

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 occuracy at change of second
dd.mm.yy   the current date:
               dd   day of month   (01..31)
               mm   month   (01..12)
               yy   year of
               the century   (00..99)

w   the day of
               the week   (1..7, 1 = Monday)

hh.mm.ss   the current time:
               hh   hours   (00..23)
               mm   minutes   (00..59)
               ss   seconds   (00..59, or 60 while leap second)
uv   clock status characters (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
               ' '   MEZ   European Standard Time, daylight saving disabled
               'S'   MESZ 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;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)

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 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:

$$\mathbf{<STX>}\mathit{dd.mm.yy/w/hh:mm:ssxxxxuv}\mathbf{<ETX>}$$

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

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

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

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

xxxx   time zone indicator:
            'UTC'   Universal Time Coordinated, formerly GMT
            'MEZ'   European Standard Time, daylight saving disabled
            'MESZ'   European Summertime, daylight saving enabled

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

v   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

9.2.4 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:

<p align="center"><STX><i>tt.mm.jj; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm</i><ETX></p>

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'	MESZ	European Summertime, daylight saving enabled
	' '	MEZ	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

9.2.5 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 occuracy at change of second	

hhmmss.ss	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	ss	fractions	
		of seconds	(1/10 ; 1/100)

A	Status	(A = time data valid)
		(V = time data not valid)

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

n	latitude, the following characters are possible:	
	'N'	north of equator
	'S'	south d. equator

lllll.ll	longitude of receiver position in degrees
	leading signs are replaced by a space character (20h)

e	longitude, the following characters are possible:	
	'E'	east of Greenwich
	'W'	west of Greenwich

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

a	magnetic variation

hh	checksum (EXOR over all characters except '$' and '*')

<CR>	Carriage Return, ASCII Code 0Dh

<LF>	Line Feed, ASCII Code 0Ah

9.2.6 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 occuracy at change of second
hhmmss.ss	the current time: hh hours (00..23) mm minutes (00..59) ss seconds (00..59, or 60 while leap second) ss fractions of seconds (1/10 ; 1/100)
A	Status (A = time data valid) (V = time data not valid)
bbbb.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

9.2.7 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,ll*__*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 occuracy 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,ll	the local timezone (offset to UTC):	
	HH hours	(00..+-13)
	ll 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	

9.2.8 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

9.2.9 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 occuracy 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

9.2.10 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

9.2.11 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 character and ending with the LF (line feed, ASCII Code 0Ah) character. The format is:

<p align="center"><SOH>ddd:hh:mm:ssq <CR><LF></p>

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 Options

10.1 Additional interface

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

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

It can be realized as an electrical RS-232 (COM1), RS485 (COM3) or optical interface (COM2).

Technical data of an optical interface:
- optical power: typ 15 μW
- optical receive power: min 3. μW
- optical connector: ST-Connector for GI 50 / 125μm gradient fiber

10.1.1 Assignment of the DSUB connector (COM1)

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

COM1
RS-232

COM3
RS-485

10.2 Pulse Per Second

The module GPS180XHS can generate a pulse per second (PPS) as an electrical
(TTL into 50 Ω 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 +-250 nsec
  OCXO MQ/OCXO HQ: better than +-100 nsec

- pulse duration 200 msec
- leading edge synchronous to UTC-second

Characteristics of an optical output:
- optical power: typ. 15μW
- optical connector: ST-connector for GI 50/125μm or
 GI 62,5/125μm gradient fiber

10.3 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 Ω
- sine 0.5 Vrms into 50 Ω
- accuracy see table „Oscillator"

GPS180DHS with PPS and 10MHz output BNC connector
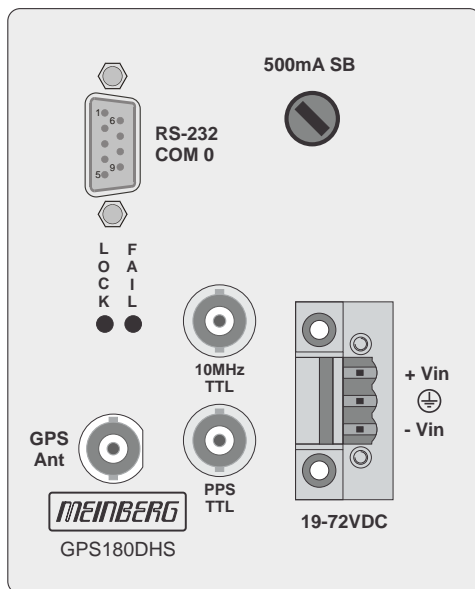
10.4 Oscillator specifications

Oscillators available for Meinberg GPS Receivers/Time Servers: OCXO, TCXO, Rubidium

	TCXO	OCXO LQ	OCXO MQ	OCXO HQ	OCXO DHQ	Rubidium (only available for 3U models)
short term stability (τ = 1 sec)	$2 \cdot 10^{-9}$	$1 \cdot 10^{-9}$	$2 \cdot 10^{-10}$	$5 \cdot 10^{-12}$	$2 \cdot 10^{-12}$	$2 \cdot 10^{-11}$
accuracy of PPS (pulse per sec)	$< \pm 250$ ns	$< \pm 250$ ns	$< \pm 100$ ns	$< \pm 100$ ns	$< \pm 100$ ns	$< \pm 100$ ns
phase noise	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 -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
accuracy free run, one day	$\pm 1 \cdot 10^{-7}$ ±1Hz (Note1)	$\pm 2 \cdot 10^{-8}$ ±0.2Hz (Note1)	$\pm 1.5 \cdot 10^{-9}$ ±15mHz (Note1)	$\pm 5 \cdot 10^{-10}$ ±5mHz (Note1)	$\pm 1 \cdot 10^{-10}$ ±1mHz (Note1)	$\pm 2 \cdot 10^{-11}$ ±0.2mHz (Note1)
accuracy, free run, 1 year	$\pm 1 \cdot 10^{-6}$ ±10Hz (Note1)	$\pm 4 \cdot 10^{-7}$ ±4Hz (Note1)	$\pm 1 \cdot 10^{-7}$ ±1Hz (Note1)	$\pm 5 \cdot 10^{-8}$ ±0.5Hz (Note1)	$\pm 1 \cdot 10^{-8}$ ±0.1Hz (Note1)	$\pm 5 \cdot 10^{-10}$ ±5mHz (Note1)
accuracy GPS-synchronous, average 24h	$\pm 1 \cdot 10^{-11}$	$\pm 1 \cdot 10^{-11}$	$\pm 5 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$
accuracy of time free run, 1 day	± 4.3 ms	± 865 µs	± 65 µs	± 22 µs	± 4.5 µs	± 1.1 µs
accuracy of time free run, 1 year	± 16 s	± 6.3 s	± 1.6 s	± 788 ms	± 158 ms	± 8 ms
temperature dependant drift free run	$\pm 1 \cdot 10^{-6}$ (-20...70°C)	$\pm 2 \cdot 10^{-7}$ (0...60°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)

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 $\pm 1 \cdot 10^{-7} \cdot 10$MHz = ± 1 HZ

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

Konformitätserklärung

Declaration of Conformity

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 Name	**Satellitenfunkuhr**
Modell / Typ Model Designation	**GPS180DAHS**

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

EN55022:2008-05, Class A

Grenzwerte und Meßverfahren für Funkstörungen von informationstechnischen Einrichtungen
Limits and methods of measurement of radio interference characteristics of information technology equipment

EN55024:2003-10

Grenzwerte und Meßverfahren für Störfestigkeit von informationstechnischen Einrichtungen
Limits and methods of measurement of Immunity characteristics of information technology equipment

EN 61000-3-2:2006

Elektromagnetische Verträglichkeit (EMV)
Grenzwerte für Oberschwingungsströme
EMC limits for harmonic current emissions

EN 61000-3-3:1995
(+A1:2001 +A2:2005)

Elektromagnetische Verträglichkeit (EMV)
Grenzwerte für Spannungsschwankungen und Flicker in Niederspannungsnetzen
Limitation of voltage fluctuation and flicker in low-voltage supply systems

gemäß den Richtlinien 2004/108/EG (Elektromagnetische Verträglichkeit), 2006/95/EG (Niederspannungsrichtlinie) und 93/68/EWG (CE Kennzeichnung) sowie deren Ergänzungen.
following the provisions of the directives 2004/108/EC (electromagnetic compatibility), 2006/95/EC (low voltage directive) and 93/68/EEC (CE marking) and its amendments.

Bad Pyrmont, den 22.06.2011

Günter Meinberg
Managing Director