The Synchronization Experts.

MANUAL

GPS165DAHS

DIN Rail GPS Receiver

May 8, 2024

Meinberg Funkuhren GmbH & Co. KG

Table of Contents

1 Imprint

Meinberg Funkuhren 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 - 230

Website: https://www.meinbergglobal.com
Email: info@meinberg.de

Date: May 8, 2024

2 Copyright and Liability Exclusion

At the time of writing of this document, reasonable effort was made to carefully review links to third-party websites to ensure that they were compliant with the laws of the Federal Republic of Germany and relevant to the subject matter of the document. Meinberg accepts no liability for the content of websites not created or maintained by Meinberg, and does not warrant that the content of such external websites is suitable or correct for any given purpose.

While Meinberg makes every effort to ensure that this document is complete, suitable for purpose, and free of material errors or omissions, and periodically reviews its library of manuals to reflect developments and changing standards, Meinberg does not warrant that this specific document is up-to-date, comprehensive, or free of errors. Updated manuals are provided at **www.meinbergglobal.com** and **www.meinbergsupport.com**.

You may also write to **techsupport@meinberg.de** to request an updated version at any time or provide feedback on errors or suggested improvements, which we are grateful to receive.

Meinberg reserves the right to make changes of any type to this document at any time as is necessary for the purpose of improving its products and services and ensuring compliance with applicable standards, laws & regulations.

3 Presentation Conventions in this Manual

3.1 Conventions for the Presentation of Critical Safety Warnings

Warnings are indicated with the following warning boxes, using the following signal words, colors, and symbols:

Caution!

This signal word indicates a hazard with a **low risk level**. Such a notice refers to a procedure or other action that may result in **minor injury** if not observed or if improperly performed.

Warning!

This signal word indicates a hazard with a **medium risk level**. Such a notice refers to a procedure or other action that may result in **serious injury** or even **death** if not observed or if improperly performed.

Danger!

This signal word indicates a hazard with a **high risk level**. Such a notice refers to a procedure or other action that will very likely result in **serious injury** or even **death** if not observed or if improperly performed.

3.2 Secondary Symbols Used in Safety Warnings

Some warning boxes may feature a secondary symbol that emphasizes the defining nature of a hazard or risk.

The presence of an "electrical hazard" symbol is indicative of a risk of electric shock or lightning strike.

The presence of a "fall hazard" symbol is indicative of a risk of falling when performing work at height.

This "laser hazard" symbol is indicative of a risk relating to laser radiation.

3.3 Conventions for the Presentation of Other Important Information

Beyond the above safety-related warning boxes, the following warning and information boxes are also used to indicate risks of product damage, data loss, and information security breaches, and also to provide general information for the sake of clarity, convenience, and optimum operation:

Important!

Warnings of risks of product damage, data loss, and also information security risks are indicated with this type of warning box.

Information:

Additional information that may be relevant for improving efficiency or avoiding confusion or misunderstandings is provided in this form.

3.4 Generally Applicable Symbols

The following symbols and pictograms are also used in a broader context in this manual and on the product.

The presence of the "ESD" symbol is indicative of a risk of product damage caused by electrostatic discharge.

Direct Current (DC) *(symbol definition IEC 60417-5031)*

Alternating Current (AC) *(symbol definition IEC 60417-5032)*

Grounding Terminal *(symbol definition IEC 60417-5017)*

Protective Earth Connection *(symbol definition IEC 60417-5019)*

Disconnect All Power Connectors *(symbol definition IEC 60417-6172)*

4 Important Safety Information

The safety information provided in this chapter as well as specific safety warnings provided at relevant points in this manual must be observed during every installation, set-up, and operation procedure of the device, as well as its removal from service.

Any safety warnings affixed to the device itself must also be observed.

Any failure to observe this safety information, these safety warnings, and other safety-critical operating instructions in the product documentation, or any other improper usage of the device may result in unpredictable behavior from the product, and may result in injury or death.

Depending on your specific device configuration and installed options, some safety information may not be applicable to your device.

Meinberg accepts no responsibility for injury or death arising from a failure to observe the safety information, warnings, and safety-critical instructions provided in the product documentation.

It is the responsibility of the operator to ensure that the product is safely and properly used.

Should you require additional assistance or advice on safety-related matters for your product, Meinberg's Technical Support team will be happy to assist you at any time. Simply send a mail to **techsupport@meinberg.de**.

4.1 Appropriate Usage

The device must only be used appropriately in accordance with the specifications of the product documentation! Appropriate usage is defined exclusively by this manual as well as any other relevant documentation provided directly by Meinberg.

Appropriate usage includes in particular compliance with specified limits! The device's operating parameters must never exceed or fall below these limits!

4.2 Product Documentation

The information in this manual is intended for readers with an appropriate degree of safety awareness.

The following are deemed to possess such an appropriate degree of safety awareness:

- **skilled personnel** with a familiarity with relevant national safety standards and regulations,
- **instructed personnel** having received suitable instruction from skilled personnel on relevant national safety standards and regulations

Read the product manual carefully and completely before you set the product up for use.

If any of the safety information in the product documentation is unclear for you, do **not** continue with the set-up or operation of the device!

Safety standards and regulations change on a regular basis and Meinberg updates the corresponding safety information and warnings to reflect these changes. It is therefore recommended to regularly visit the Meinberg website at **https://www.meinbergglobal.com** or the Meinberg Customer Portal at **https://meinberg.support** to download up-to-date manuals.

Please keep all product documentation, including this manual, in a safe place in a digital or printed format to ensure that it is always easily accessible.

Meinberg's Technical Support team is also always available at **techsupport@meinberg.de** if you require additional assistance or advice on safety aspects of your system.

4.3 Safety during Installation

This rack-mounted device has been designed and tested in accordance with the requirements of the standard IEC 62368-1 (*Audio/Video, Information and Communication Technology Equipment—Part 1: Safety Requirements*). Where the rack-mounted device is to be installed in a larger unit (such as an electrical enclosure), additional requirements in the IEC 62368-1 standard may apply that must be observed and complied with. General requirements regarding the safety of electrical equipment (such as IEC, VDE, DIN, ANSI) and applicable national standards must be observed in particular.

The device has been developed for use in industrial or commercial environments and may only be used in such environments. In environments at risk of high environmental conductivity ("high pollution degree" according to IEC 60664-1), additional measures such as installation of the device in an air-conditioned electrical enclosure may be necessary.

If the unit has been brought into the usage area from a cold environment, condensation may develop; in this case, wait until the unit has adjusted to the temperature and is completely dry before setting it up.

When unpacking & setting up the equipment, and before operating it, be sure to read the information on installing the hardware and the specifications of the device. These include in particular dimensions, electrical characteristics, and necessary environmental conditions.

Fire safety standards must be upheld with the device in its installed state—never block or obstruct ventilation openings and/or the intakes or openings of active cooling solutions.

The device with the highest mass should be installed at the lowest position in the rack in order to position the center of gravity of the rack as a whole as low as possible and minimize the risk of the rack tipping over. Further devices should be installed from the bottom, working your way up.

The device must be protected against mechanical & physical stresses such as vibration or shock.

Never drill holes into the device to mount it! If you are experiencing difficulties with rack installation, contact Meinberg's Technical Support team for assistance!

Inspect the device housing before installation. The device housing must be free of any damage when it is installed.

4.4 Grounding the Device

In order to ensure that the device can be operated safely and to meet the requirements of IEC 62368-1, the device must be correctly connected to the protective earth conductor via the protective earth terminal.

If an external grounding terminal is provided on the chassis, it must be connected to the grounding busbar for safety reasons before connecting the power supply. This ensures that any possible leakage current on the chassis is safely discharged to earth.

The screw, washer, and toothed lock washer necessary for mounting the grounding cable are provided on the grounding terminal of the chassis. A grounding cable is not included with the device.

Please ensure that your grounding cable has a thickness of 1.5 mm^2 or greater, that you use a suitable grounding terminal or lug, and that the connection is properly crimped!

4.5 Electrical Safety

This Meinberg product is operated at a hazardous voltage.

This system may only be set up and connected by skilled personnel, or by instructed personnel who have received appropriate technical & safety training from skilled personnel.

Custom cables may only be assembled by a qualified electrician.

Never work on cables carrying a live current!

Never use cables or connectors that are visibly damaged or known to be defective! Faulty, defective, or improperly connected shielding, connectors, or cables present a risk of injury or death due to electric shock and may also constitute a fire hazard!

Before operating the device, check that all cables are in good order. Ensure in particular that the cables are undamaged (for example, kinks), that they are not wound too tightly around corners, and that no objects are placed on the cables.

Cables must be laid in such a way that they do not present a tripping hazard.

The power supply should be connected using a short, low-inductance cable. Avoid the use of power strips or extension cables if possible. If the use of such a device is unavoidable, ensure that it is expressly rated for the rated currents of all connected devices.

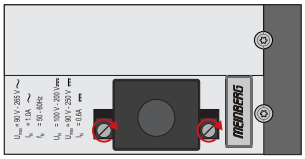
Never connect or disconnect power, data, or signal cables during a thunderstorm! Doing so presents a risk of injury or death, as cables and connectors may conduct very high voltages in the event of a lightning strike!

Device cables must be connected or disconnected in the order specified in the user documentation for the device. Connect all cables only while the device is de-energized before you connect the power supply.

Always pull cable connectors out at **both** ends before performing work on connectors! Improperly connecting or disconnecting this Meinberg system may result in electric shock, possibly resulting in injury or death!

When pulling out a connector, **never** pull on the cable itself! Pulling on the cable may cause the plug to become detached from the connector or cause damage to the connector itself. This presents a risk of direct contact with energized components.

5-Pin MSTB Connector



3-Pin MSTB Connector

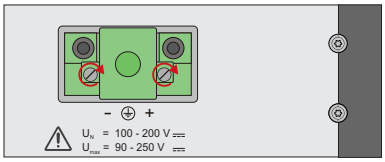


Illustration: Lock screws on an MSTB plug connector; in this case on a LANTIME M320

Ensure that all plug connections are secure. In particular, when using plug connectors with lock screws, ensure that the lock screws are securely tightened. This is especially important for power supply connectors where 3-pin or 5-pin MSTB connectors with lock screws are used (see illustration).

Before the device is connected to the power supply, the device housing must be grounded by connecting a grounding cable to the grounding terminal of the device.

When installing the device in an electrical enclosure, it must be ensured that adequate clearance is provided, minimum creepage distances to adjacent conductors are maintained, and that there is no risk of short circuits.

Protect the device from the ingress of objects or liquids!

If the device malfunctions or requires servicing (for example, due to damage to the housing, power supply cable, or the ingress of liquids or objects), the power supply may be cut off. In this case, the device must be isolated immediately and physically from all power supplies! The following procedure must be followed in order to correctly and reliably isolate the device:

- Pull the power supply plug from the power source.
- Loosen the locking screws of the MSTB power supply plug on the device and pull it out of the device.
- Contact the person responsible for your electrical infrastructure.
- If your device is connected to one or more uninterruptible power supplies (UPS), the direct power supply connection between the device and the UPS solution must be first be disconnected.

4.5.1 Special Information for Devices with AC Power Supply

This device is a Protection Class 1 device and may only be connected to a grounded outlet (TN system).

For safe operation, the installation must be protected by a fuse rated for currents not exceeding 20 A and equipped with a residual-current circuit breaker in accordance with applicable national standards.

The appliance must only ever be disconnected from the mains power supply via the mains socket and not from the appliance itself.

Make sure that the power connector on the appliance or the mains socket is readily accessible for the user so that the mains cable can be pulled out of the socket in an emergency.

Non-compliant cabling or improperly grounded sockets are an electrical hazard!

Only connect the appliance to a grounded shockproof outlet using a safety-tested mains cable designed for use in the country of operation.

4.5.2 Special Information for Devices with DC Power Supply

In accordance with IEC 62368-1, it must be possible to disconnect the appliance from the supply voltage from a point other than the appliance itself (e.g., from the primary circuit breaker).

The power supply plug may only be fitted or dismantled while the appliance is isolated from the power supply (e.g., disconnected via the primary circuit breaker).

Power supply cables must have adequate fuse protection and have an adequate wire gauge size (1 mm^2 – 2.5 mm^2 / 17 AWG – 13 AWG)

The power supply of the device must have a suitable on-demand disconnection mechanism (i.e., a switch). This disconnection mechanism must be readily accessible in the vicinity of the appliance and marked accordingly as a disconnection mechanism for the appliance.

4.6 Safety when Maintaining and Cleaning the Device

Only use a soft, dry cloth to clean the device.

Never use liquids such as detergents or solvents to clean the device! The ingress of liquids into the device housing may cause short circuits in the electronic circuitry, which in turn can cause a fire or electric shock!

Neither the device nor its individual components may be opened. The device or its components may only be repaired by the manufacturer or by authorized personnel. Improperly performed repairs can put the user at significant risk!

In particular, **never** open a power supply unit or module, as hazardous voltages may be present within the power supply device even after it is isolated from the upstream voltage. If a power supply unit or module is no longer functional (for example due to a defect), it can be returned to Meinberg for repair.

Some components of the device may become very hot during operation. Do not touch these surfaces!

If maintenance work is to be performed on the device and the device housing is still hot, switch off the device beforehand and allow it to cool.

4.7 Battery Safety

The integrated CR2032 lithium battery has a service life of at least ten years.

Should it be necessary to replace the battery, please note the following:

- The battery may only be replaced by the same type or a comparable type recommended by the manufacturer.
- The battery may only be replaced by the manufacturer or authorized personnel.
- The battery must not be exposed to air pressure levels outside of the limits specified by the manufacturer.

Improper handling of the battery may result in the battery exploding or in leakages of flammable or corrosive liquids or gases.

- **Never** short-circuit the battery!
- **Never** attempt to recharge the battery!
- **Never** throw the battery in a fire or dispose of it in an oven!
- **Never** dispose of the battery in a mechanical shredder!

5 Important Product Information

5.1 CE Marking

This product bears the CE mark as is required to introduce the product into the EU Single Market.

The use of this mark is a declaration that the product is compliant with all requirements of the EU directives effective and applicable as at the time of manufacture of the product.

These directives are listed in the EU Declaration of Conformity, appended to this manual as Chapter **14**.

5.2 UKCA Marking

This product bears the British UKCA mark as is required to introduce the product into the United Kingdom (excluding Northern Ireland, where the CE marking remains valid).

The use of this mark is a declaration that the product is in conformity with all requirements of the UK statutory instruments applicable and effective as at the time of manufacture of the product.

These statutory instruments are listed in the UK Declaration of Conformity, appended to this manual as Chapter **15**.

5.3 Ensuring the Optimum Operation of Your Device

- Ensure that ventilation slots are not obscured or blocked by dust, or else heat may build up inside the device. While the system is designed to shut down safely and automatically in the event of temperature limits being exceeded, the risk of malfunctions and product damage following overheating cannot be entirely eliminated.
- The device is only deemed to be appropriately used and EMC limits (electromagnetic compatibility) are only deemed to be complied with while the device housing is fully assembled in order to ensure that requirements pertaining to cooling, fire safety, electrical shielding and (electro)magnetic shielding are upheld.

5.4 Maintenance and Modifications

Important!

Before performing any maintenance work on or authorized modification to your Meinberg system, we recommend making a backup of any stored configuration data (e.g., to a USB flash drive from the Web Interface).

5.4.1 Replacing the Battery

Your device's clock module is fitted with a lithium battery (type CR2032) that is used to locally storage almanac data and sustain operation of the real-time clock (RTC) in the reference clock.

This battery has a life of at least ten years. However, if the device exhibits the following unexpected behaviors, the voltage of the battery may have dropped below 3 V, and the battery will need to be replaced:

- The reference clock has the wrong date or wrong time when the system is started.
- The reference clock repeatedly starts in Cold Boot mode (i.e., upon starting, the system has no ephemeris data saved whatsoever, resulting in the synchronization process taking a very long time due to the need to rediscover all of the visible satellites).
- Some configuration options relating to the reference clock are lost every time the system is restarted.

In this case, you should not replace the battery on your own. Please contact the Meinberg Technical Support team, who will provide you with precise guidance on how to perform the replacement.

5.4.2 Replacing the Fuse

Danger!

This equipment is operated at a hazardous voltage.

Danger of death from electric shock!

- The device must be disconnected from the mains! This is done using the physical power switch.
- Once the power switch is OFF, release the lock screws of the power connector (if applicable) and detach the connector.

Meinberg recommends keeping a spare fuse to hand at all times to ensure that a triggering of the integrated fuse does not disrupt the operation of your system for any longer than absolutely necessary. Ensure that it is of the proper type, and that it has the appropriate current and voltage ratings and blow curve. The rated voltage and current values are marked on the device itself next to the fuse compartment.

Fuses are marked with standardized designations in accordance with IEC 60127 to provide information about their specifications. For example, if a fuse is marked *T 2.5 A H 250 V*, it has the following meaning:

- *T*: The blow curve type, in this case *timelag*
- *2.5 A*: The current rating, in this case *2.5 Ampere*
- *H*: The breaking capacity, in this case *high*
- *250 V*: The voltage rating, in this case *250 Volt*

Ensure that the new fuse meets the following requirements and satisifies the specifications printed on the device itself:

Current Type	Labeling Standard	Cooling Material	Blow Curve Type	Dimensions
AC	IEC 60127-compliant	With/without	T (Timelag)	5 x 20 mm
DC	IEC 60127-compliant	With	T (Timelag)	5 x 20 mm

Replacement Process

1. Cut the power supply to the device before disconnecting all signal, antenna, error relay, and serial interface connections from the device. Check that the device is actually de-energized and ensure that it cannot be switched back on!
2. Remove the fuse bracket from the fuse compartment by rotating it anticlockwise using a slotted screwdriver. Replace the fuse and insert the fuse bracket with the new fuse into the fuse compartment. Push it in with the screwdriver and rotate it clockwise until the fuse bracket is securely seated again.
3. Reconnect all cables in the reverse order to how they were disconnected. The power can now be switched back on if appropriate.

5.5 Disposal

Disposal of Packaging Materials

The packaging materials that we use are fully recyclable:

Material	Use for	Disposal
Polystyrene	Packaging frame/filling material	Recycling Depot
PE-LD (Low-density polyethylene)	Accessories packaging, bubble wrap	Recycling Depot
Cardboard	Shipping packaging, accessories	Paper Recycling

For information on the proper disposal of packaging materials in your specific country, please inquire with your local waste disposal company or authority.

Disposal of the Device

This product falls under the labeling obligations of the Waste Electrical and Electronic Equipment Directive 2012/19/EU ("*WEEE Directive*") and thus bears this WEEE symbol. The presence of this symbol indicates that this electronic product may only be disposed of in accordance with the following provisions.

Important!

Do not dispose of the product or batteries via the household waste. Inquire with your local waste disposal company or authority on how to best dispose of the product or battery if necessary.

This product is considered to be a "**B2B**" product for the purposes of the WEEE Directive and is also classified as "**IT and Telecommunications Equipment**" in accordance with Annex I of the Directive.

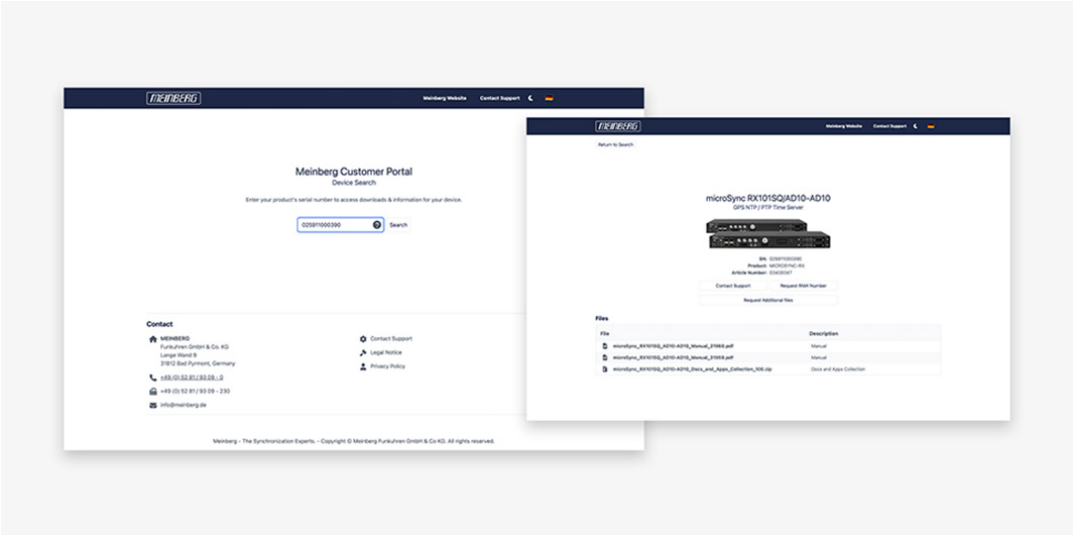
It can be returned to Meinberg for disposal. Any transportation expenses for returning this product (at end-of-life) must be covered by the end user, while Meinberg will bear the costs for the waste disposal itself. If you wish for Meinberg to handle disposal for you, please get in touch with us. Otherwise, please use the return and collection systems provided within your country to ensure that your device is disposed of in a compliant fashion to protect the environment and conserve valuable resources.

Disposal of Batteries

Please consult your local waste disposal regulations for information on the correct disposal of batteries as hazardous waste.

6 Meinberg Customer Portal - Software and Documentation

End users of Meinberg products are provided with technical support, full documentation and software downloads through our Support Centre - all in one place: https://meinberg.support



No Registration required
There's no need to register; simply enter your product's serial number at https://www.meinberg.support and you'll have everything you need to get your Meinberg system up and running—or perhaps back up and running, as the case may be—with up-to-date installation and reference manuals, downloads for drivers, remote monitoring, configuration tools, and SNMP MIB files, direct links to contact Meinberg's Technical Support team, and the ability to easily request additional files.

The Meinberg Customer Portal vastly simplifies how you access support, software, and documentation, and ensures that you always have the latest versions of downloadable tools and manuals at your disposal.

The installation program for the monitor software "Meinberg Device Manager".
With the help of this programme, Meinberg receivers can be configured via the serial interface and status information of the module can be displayed.

The Meinberg Device Manager software is executable under the following operating systems:

Windows
- Windows 10
- Windows 8.1
- Windows 8
- Windows 7

Linux
- Ubuntu
- Mint Linux
- Debian
- SUSE Linux
- CentOS

The installation programme can also be downloaded at any time via an internet connection:
https://www.meinbergglobal.com/english/sw/mbg-devman.htm

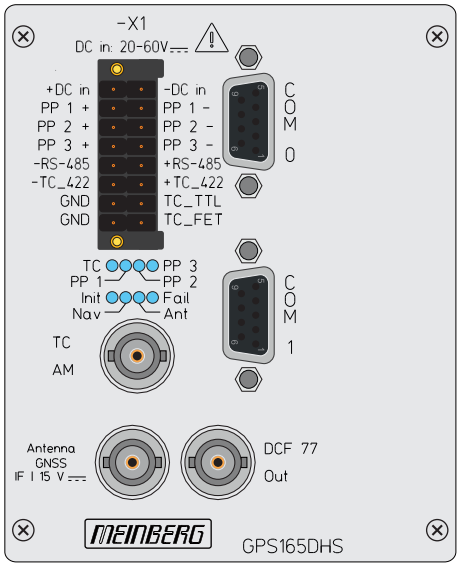
A detailed documentation in PDF format can be found here:
https://www.meinbergglobal.com/download/docs/manuals/english/meinberg-device-manager.pdf

7 General information about GPS165XHS

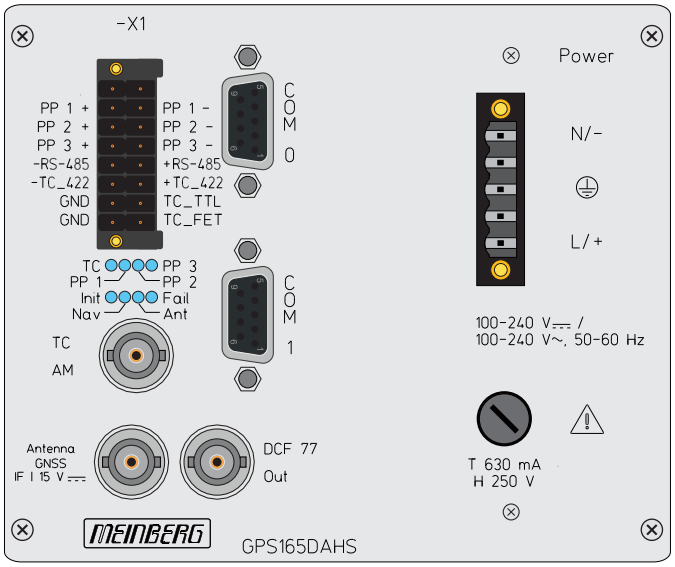
The Meinberg satellite receiver clocks of the GPS165xHS series are available with several options. This manual describes the following models:

	20-60 V DC	100-240 V AC	100-240 V DC	Optocoupler outputs	PhotoMos relay outputs
GPS165DHS	x			x	
GPS165DAHS		x	x	x	
GPS165/MOS/DHS	x				x
GPS165/MOS/DAHS		x	x		x

GPS165DHS



GPS165DAHS



The variants 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 GPS165xHS is used whenever common features of all types of clocks are specified.

The satellite receiver clock GPS165xHS 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.

8 GPS Features

The GPS is designed for mounting on a DIN rail. The front panel integrates eight LED indicators, an terminal block, two 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 GPS's microprocessor in order to track the GPS system time with an accuracy of better than +- 100nsec. 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 $\pm 5 \times 10^{-9}$ and automatically compensates the oscillators aging. The last recent value is restored from the battery memory at power-up.

8.1 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 describes how parameter setting for other locations is done. It is possible to deactivate the automatic switching to/from daylight saving.

8.2 Pulse outputs

The pulse generator of the satellite controlled clock GPS containes three independant channels and is able to generate a multitude of different pulses, which are configured with the software "Meinberg Device Manager". 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. However, you can configure the assembly group to enable the ports immediately after switching on. The pulse outputs are electrically insulated by optocouplers or PhotoMOS relays and are available at the -X1-Interface (DMC-Connector).

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.

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.

Idle-mode: The output is inactive.

Synthesizer: Frequency output 0 Hz to 10 MHz

8.3 Asynchronous Serial Ports

One RS-485 serial interface and two asynchronous serial interfaces (RS-232) are available to the user. By default, automatic transmission of a time string via the serial ports is disabled until the receiver has synchronized. However, it is possible to change the device configuration so that serial time strings are always transmitted 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 the program "Meinberg Device Manager" using serial port COM 0.

8.4 Time code outputs

8.4.1 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 however generates IRIG-B or AFNOR NFS500 only.

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

8.4.2 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

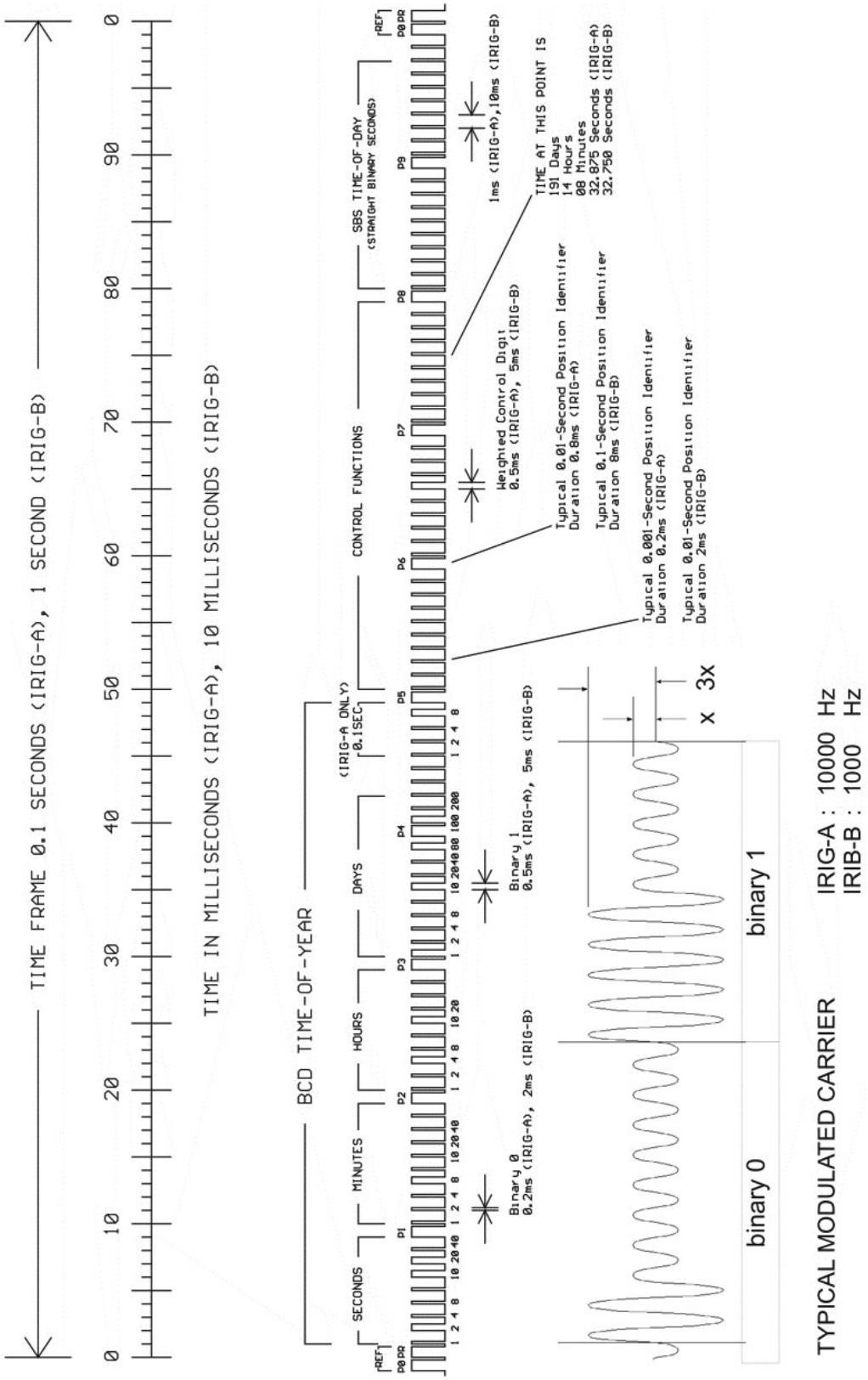
j) IEEE1344: Code according to IEEE1344-1995, 100 pps, AM sine wave signal,
1kHz carrier frequency, BCD time-of-year, SBS time-of-day,
IEEE1344 extensions for date, timezone, daylight saving and
leap second in control functions (CF) segment.
(also see table 'Assignment of CF segment in IEEE1344 mode')

k) C37.118 Like IEEE1344 - with turned sign bit for UTC-Offset

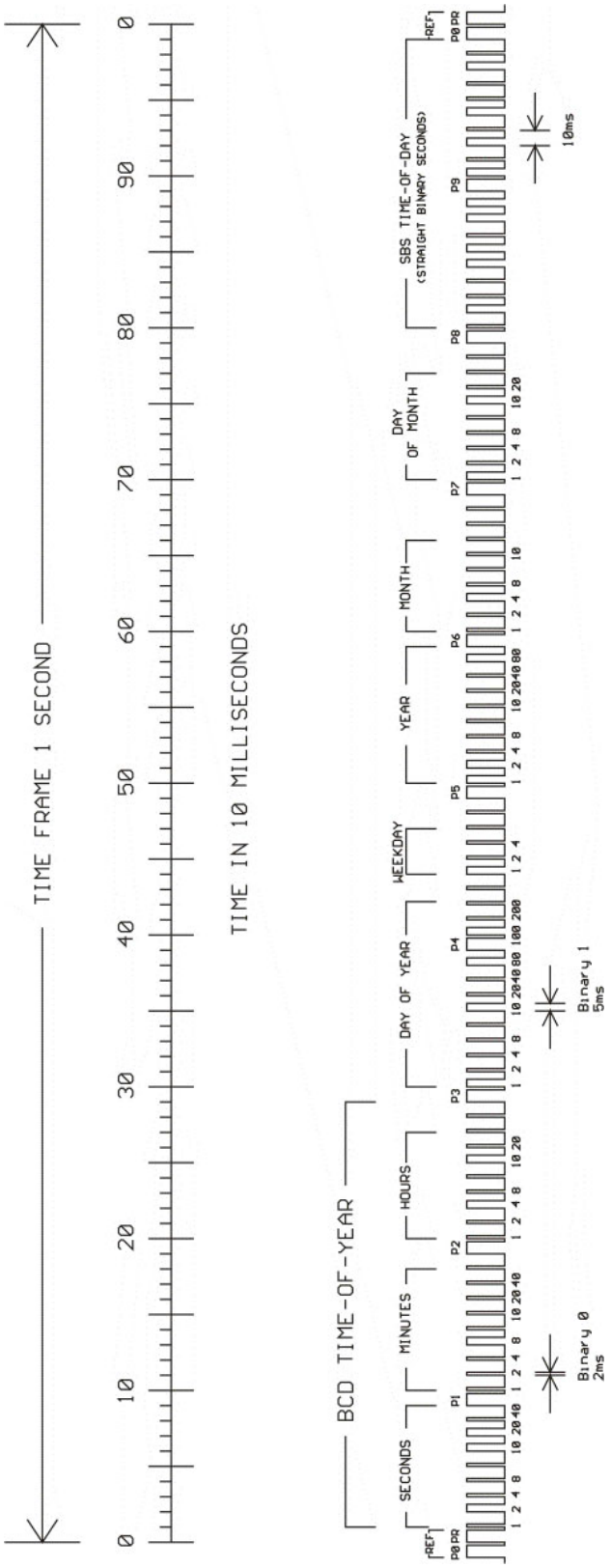
8.4.3 Time Code Generation

By default, time code signals are not output until the GPS165/DAHS is synchronized. However, if the time code signal needs to be output immediately after a reset regardless of the GNSS synchronization state, the "Pulses" enable flag can be set to "Always" in the Meinberg Device Manager software. In this case, the generated time code cannot be considered to be locked to the official UTC second until the GNSS is synchronized.

8.4.4 Time Code Format According to IRIG Standard



8.4.5 Time Code Format According to AFNOR Standard



8.4.6 Structure of CF Segment in IEEE1344 Code

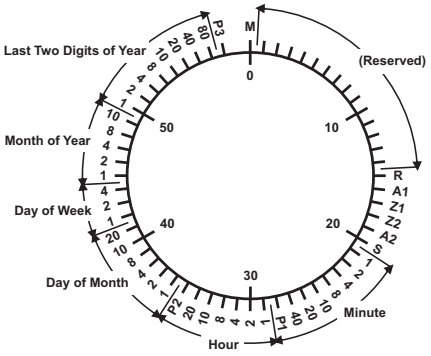
Bit No.	Designation	Description
49	Position Identifier P5	
50	Year BCD encoded 1	
51	Year BCD encoded 2	Low nibble of BCD-encoded year
52	Year BCD encoded 4	
53	Year BCD encoded 8	
54	empty, always zero	
55	Year BCD encoded 10	
56	Year BCD encoded 20	High nibble of BCD-encoded year
57	Year BCD encoded 40	
58	Year BCD encoded 80	
59	Position Identifier P6	
60	LSP - Leap Second Pending	Set until 59s before LS insertion
61	LS - Leap Second	0 = Add leap second, 1 = Remove leap second 1.)
62	DSP - Daylight Saving Pending	Set until 59s before Daylight Saving Time 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 between IRIG time and 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	TFOM represents approximate clock error 2.)
73	TFOM Time figure of merit	0x00 = Clock synchronized, 0x0F = Clock in free-run mode
74	TFOM Time figure of merit	
75	PARITY	Parity of all preceding bits

1.) Current firmware only supports insertion of leap seconds!
2.) TFOM is set to 0 if clock has been able to synchronize since power up. The firmware does not support other codes.

For more information, please refer to the time code specifications.

8.5 DCF77 Emulation

The 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, the 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 Time	
Z1, Z2	Time Zone Identification	
	Z1, Z2 = 0, 1:	Daylight Saving Time Disabled
	Z1, Z2 = 1, 0:	Daylight Saving Time 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. The time stamps can be provided via pulses outputs. Furthermore, the DCF77 signal is available via a BNC connector as an amplitude-modulated 77.5 kHz carrier. This output can be used for radio clocks as a replacement for a DCF77 antenna.

9 Installation

9.1 Technical data GPS165/DAHS Chassis

The variants of the module GPS165/DAHS are designed for following housing dimensions of DIN-railmount:

Housing:	GPS165DHS: 85 mm x 105 mm x 104 mm	(B x H x T)
	GPS165DAHS: 125.5 mm x 105 mm x 104 mm	(B x H x T)
	GPS165DAHSx 165.5 mm x 105 mm x 104 mm	(B x H x T)
Ambient Temperature:	0...50 °C	
Storage Temperature:	-20...70 °C	
Humidity:	85 %	
Protecting Rate:	IP20	

9.2 Power supply

The variants of the module GPS165/DAHS are designed for following power supply options:

GPS165DHS:	20-60 V DC (DC-insulation 1.5 kV DC)
GPS165DAHS:	100-240 V DC 100-240 V AC, 50-60 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).

To avoid potential differences between the signal ground of GPS165/DAHS and a post-connected unit installed on different DIN rails, the signal ground of the clock is insulated from the case.

The case must be grounded by using the rear contact.

9.3 Installing a GPS Antenna

The following chapters explain how to select a suitable location for your antenna, how to fit the antenna, and how to implement effective anti-surge protection for your antenna installation.

9.3.1 Selecting the Antenna Location

There are essentially two ways a compatible Meinberg GPS Antenna (such as a GPSANTv2) can be installed using the accessories included:

1. Mounted on a pole

2. Mounted on a wall

To avoid difficulties with synchronization of your Meinberg time server, select a location that allows for an unobstructed view of the sky (Fig. 1) so as to ensure that enough satellites can be found.

To ensure that your antenna has the best 360° view possible, Meinberg recommends mounting the antenna on a roof on a suitable metal pole (see Fig. 1, antenna on right). If this is not possible, the antenna may be mounted on the wall of a building, but must be high enough above the edge of the roof (see Fig. 1, antenna on left).

This prevents the line of sight between the antenna and the satellites from being partially or fully obstructed and limits the impact of GNSS signal reflections from other surfaces such as house walls.

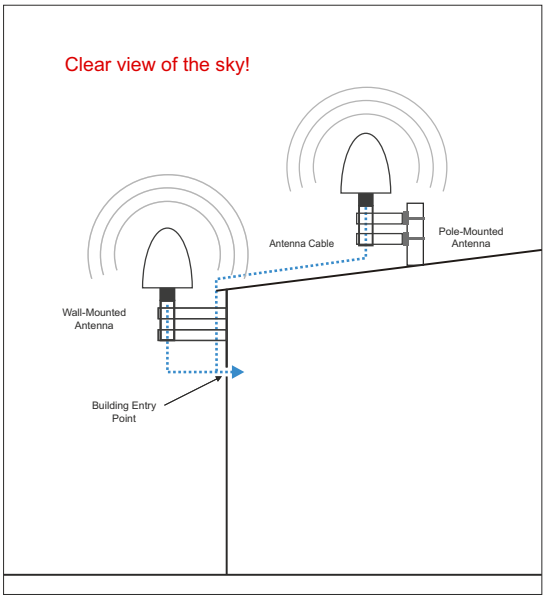


Fig. 1: Ideal Positioning

If there is a solid obstacle (a building or part of a building) in the line of sight between the antenna and each of the satellites (see Fig. 2), it is likely that the satellite signals will be partially or fully obstructed or reflected signals will cause interference, causing problems with signal reception.

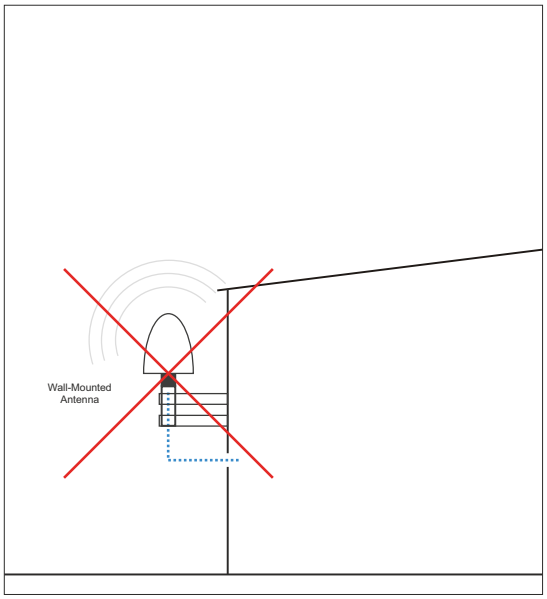


Fig. 2: Poor positioning of a wall-mounted antenna

There must also be no conductive objects, overhead power lines, or other electrical lighting or power circuits within the signal cone of the antenna (approx. 98 degrees), as these can cause interference in the already weak signals transmitted in the frequency band of the satellites.

Other Installation Criteria for Optimum Operation:

- Vertical installation of antenna (see Fig. 1)
- At least 50 cm (1.5 ft) distance to other antennas
- A clear view towards the equator
- A clear view between the 55th north and 55th south parallels (satellite orbits).

Information:

Problems may arise with the synchronization of your Meinberg time server if these conditions are not met, as four satellites must be located to calculate the exact position.

9.3.2 Installation of the Antenna

Please read the following safety information carefully before installing the antenna and ensure that it is observed during the installation.

Danger!

Do not mount the antenna without an effective fall arrester!

Danger of death from falling!

- Ensure that you work safely when installing antennas!
- Never work at height without a suitable and effective fall arrester!

Danger!

Do not work on the antenna installation during thunderstorms!

Danger of death from electric shock!

- Do not carry out any work on the antenna installation or the antenna cable if there is a risk of lightning strike.
- Do not perform any work on the antenna installation if it is not possible to maintain the prescribed safety distance from exposed power lines or electrical substations.

Mount the Meinberg GPS Antenna (as shown in Fig. 3) at a distance of at least 50 cm to other antennas using the mounting kit provided, either onto a vertical pole of no more than 60 mm diameter or directly onto a wall.

Item	Description	QTY
1	Antenna	1
2	M8 grounding stud	1
3	safety washer	1
4	M8 hex nut	1
5	Antenna pole	1
6	M4 hex nut	8
7	M4 x 12 phillips-head screw	8
8	threaded U-bolt (pole diameter max. 60 mm)	2
9	M6 spacer	4
10	M6 hex nut	4
11	pole clamp halves	4
12	pole bracket	2

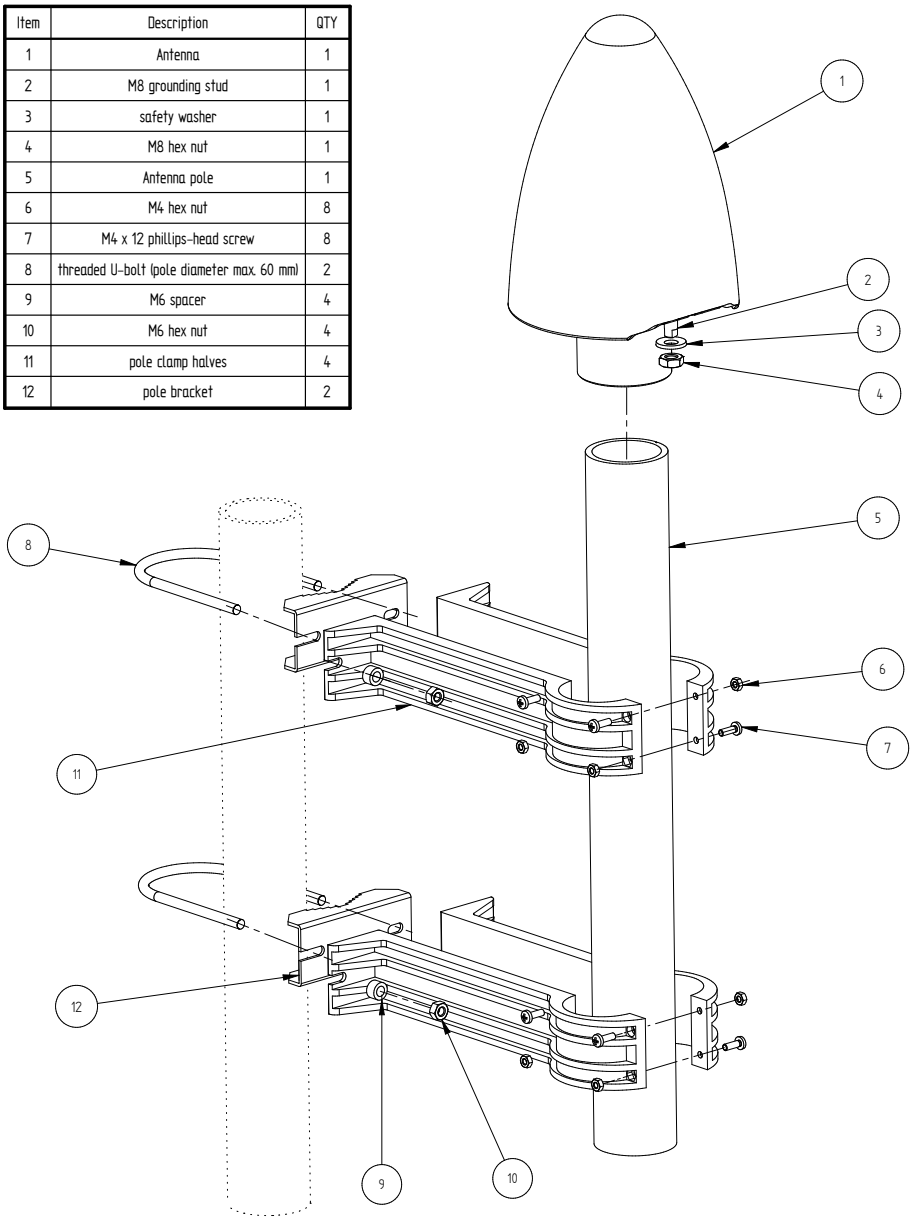


Fig. 3: Mounting a Meinberg GPS Antenna onto a Pole

Fig. 3 illustrates the mounting of a Meinberg GPS Antenna on a pole by way of example. When mounting the antenna on a wall, the four wall plugs and M6x45 screws should be used to mount the two halves of the pole clamp (Fig. 3, Pos. 12) using the provided screw slits.

The next chapter explains how the antenna cable should be laid.

9.3.3 Antenna Cable

Selecting the Appropriate Cable

Meinberg provides suitable cable types with its antennas and these are ordered together with the antenna to match the length you need from your antenna to your Meinberg reference clock. The route to be covered for your antenna installation should be determined and the appropriate cable type selected accordingly before confirming your order.

Important!

Please avoid using a mixture of different cable types for your antenna installation. This should be taken into consideration in particular when purchasing additional cable, for example to extend an existing cable installation.

The cable is shipped with both ends fitted with the appropriate connectors as standard, although the cable can also be shipped without any pre-fitted connectors if so requested.

The table below shows the specifications of the supported cable types for the transmission of the 35 MHz intermediate frequency:

Cable Type	RG58C/U	RG213	H2010 (Ultraflex)
Signal Propagation Time at 35 Mhz (ns/100 m)*	503	509	387
Attenutation at 35 MHz (dB/100 m)	8.48	3.46	2.29
DC Resistance (Ohm/100 m)	5.3	1.0	1.24
Cable Diameter (mm)	5	10.3	10.2
Max. Cable Length (m)	300	700	1100

Table: Specifications of Cable Types Recommended by Meinberg

** The propagation times are specified on the basis of 100 m cable; these values can be used as a reference to calculate the propagation time of any other arbitrary length of cable.*

Laying the Antenna Cable

When laying the antenna cable, ensure that the specified maximum cable length is not exceeded. This length will depend on the selected cable type and its attenuation factor. If the specified maximum length is exceeded, correct transmission of the synchronization data and thus proper synchronization of the reference clock can no longer be guaranteed.

Lay the coaxial cable from the antenna to the point of entry into the building as shown in Figures 5 and 6 in the chapter "**Surge Protection and Grounding**". Like any other metallic object in the antenna installation (antenna and pole), the antenna cable must be integrated into the grounding infrastructure of the building and also connected to the other metallic objects.

Caution!

When laying the antenna cable, ensure that sufficient distance is maintained from live cables (such as high-voltage power lines), as these can cause severe interference and compromise the quality of the antenna signal significantly. Surges in power lines (caused, for example, by lightning strike) can generate induced voltages in a nearby antenna cable and damage your system.

Further Points to Consider when Laying Antenna Cable:

- The minimum bend radius of the cable must be observed.[1]
- Any kinking, crushing, or other damage to the external insulation must be avoided.
- Any damage or contamination of the coaxial connectors must be avoided.

[1] *The bend radius is the radius at which a cable can be bent without sustaining damage (including kinks).*

Compensating for Signal Propagation Time

The propagation of the signal from the antenna to the receiver (reference clock) can incur a certain delay. This delay can be compensated for with Meinberg Device Manager Software.

The signal propagation time can be compensated for by entering the length of the antenna cable under "**Settings** → **Clock**".

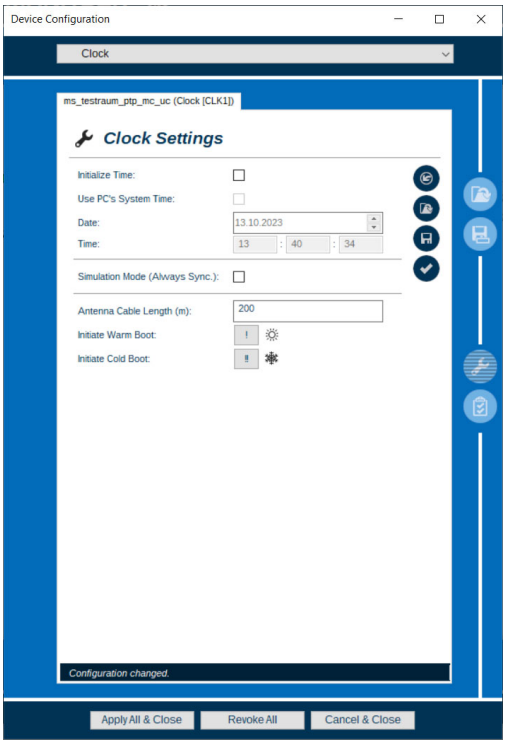


Illustration: "Clock" menu in Meinberg Device Manager

The next chapter "**Surge Protection and Grounding**" explains how to implement effective surge protection for an antenna installation.

9.3.4 Surge Protection and Grounding

The greatest risk to an antenna installation and the electronic devices connected to it is exposure to lightning strikes. An indirect lightning strike in the vicinity of the antenna or coaxial cable can induce significant surge voltages in the coaxial cable. This induced surge voltage can then be passed to the antenna and to the building interior, which can damage or even destroy both your antenna and your Meinberg system.

This is why antennas and antenna cables must always be integrated into a building's equipotential bonding infrastructure (Fig. 4, Item 5) as part of an effective lightning protection strategy to ensure that voltages induced by lightning strikes directly on or indirectly near the antenna are redirected safely to ground.

Warning!

Surge protection and lightning protection systems may only be installed by persons with suitable electrical installation expertise.

Meinberg GPSANTv2

Meinberg's new-generation "GPSANTv2" antenna features integrated surge protection in accordance with IEC 61000-4-5 Level 4 to reliably shield the antenna against surge voltages. The antenna also has a grounding terminal to allow it to be connected as directly as possible to a bonding conductor using a grounding cable. Please refer to the standards regarding antenna installations (e.g., DIN EN 60728-11) for more information.

However, in order to preserve the safety of the building and to protect your Meinberg system, Meinberg recomends the use of the MBG-S-PRO surge protector, which is addressed in more detail later in this chapter.

Surge Protection

VDE 0185-305 (IEC 62305) (relating to buildings with lightning protection systems) and VDE 0855-1 (IEC 60728-11) (addressing bonding strategies and the grounding of antenna installations in buildings with no external lightning protection system) are the lightning protection standards applicable to antenna installations on a building. Antennas must generally be integrated into a building's lightning protection system or bonding infrastructure.

If the antenna represents the highest point of a building or pole, the lightning protection strategy should incorporate a safe zone (e.g., formed by a lightning rod) positioned above the antenna. This increases the likelihood of lightning being 'caught' by the lightning rod, allowing surge currents to be safely passed from the lightning rod along a grounding conductor to ground.

Electrical Bonding

Electrical bonding is the connection of all metallic, electrically conductive elements of the antenna installation in order to limit the risk of dangerous voltages for people and connected devices.

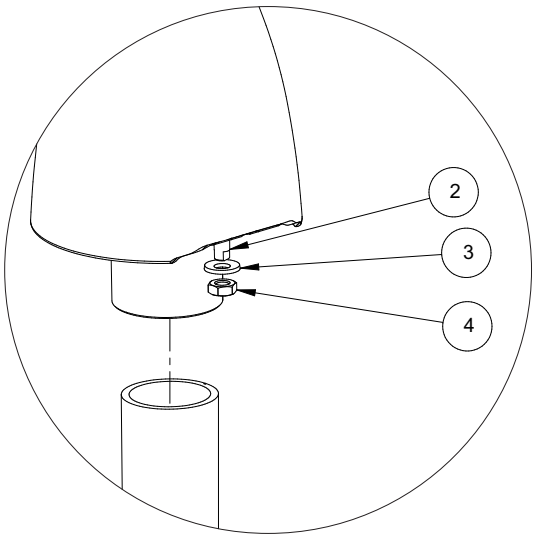
To this end, the following elements should be connected and integrated into a bonding system:

- the antenna cable shielding using cable shield bonding connectors*
- the core conductor of the antenna cable using surge protection devices
- antennas, antenna poles
- ground electrodes (e.g., foundation electrode)

*Minimum IP rating IP X4 when using bonding connectors outdoors.

Connecting the Grounding Terminal of the Antenna

As mentioned previously, the antenna must be connected to a grounding busbar using a grounding cable (not included). A grounding cable must be assembled for this purpose; the recommended conductor thickness is 4 mm^2 – 6 mm^2 and a ring terminal fitting the M8 (0.315 inch) grounding bolt must be used.



Grounding Cable Installation Procedure:

1. Remove the nut (Pos. 4) and the safety washer (Pos. 3).
2. Place the ring terminal onto the grounding bolt (Pos. 2).
3. First place the safety washer (Pos. 3) onto the grounding bolt (Pos. 2), then screw the M8 nut (Pos. 4) onto the thread of the grounding bolt.
4. Tighten the nut (Pos. 4) with a max. torque of 6 Nm.

Once the antenna has been correctly installed with the grounding cable, connect the grounding cable to the bonding bar (see Fig. 5 and 6).

The drawings below illustrate how a Meinberg GPS Antenna can be installed in accordance with the above conditions on a pole (e.g., antenna pole) or building roof.

Antenna Installation without Insulated Lightning Rod System

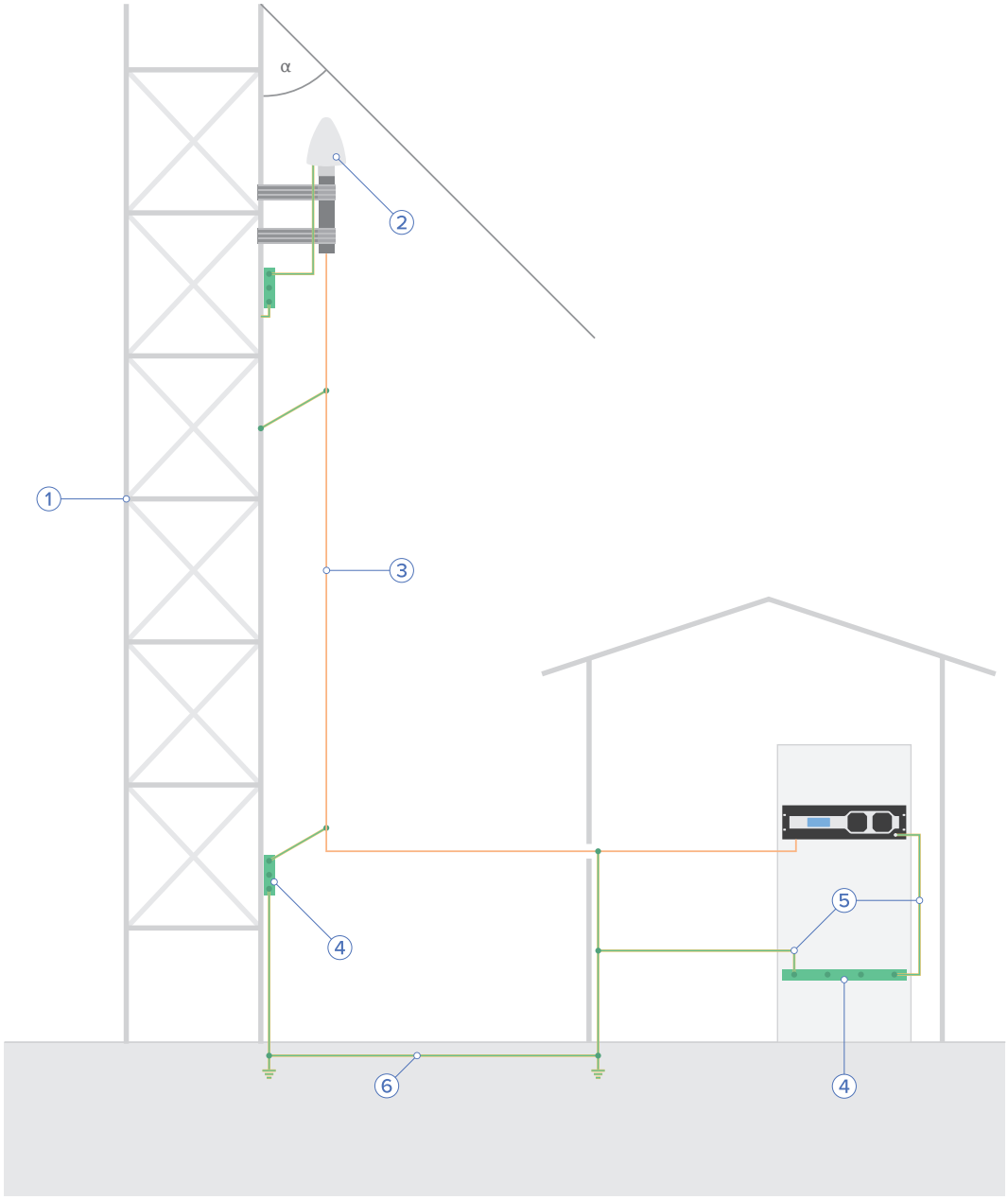


Fig. 5: Installation on a Pole

1 Antenna Pole
2 Meinberg GPS Antenna
3 Antenna Cable
4 Bonding Bar
5 Bonding Conductor
6 Foundation Electrode
α Safety Zone

Antenna Installation with Insulated Lightning Rod System

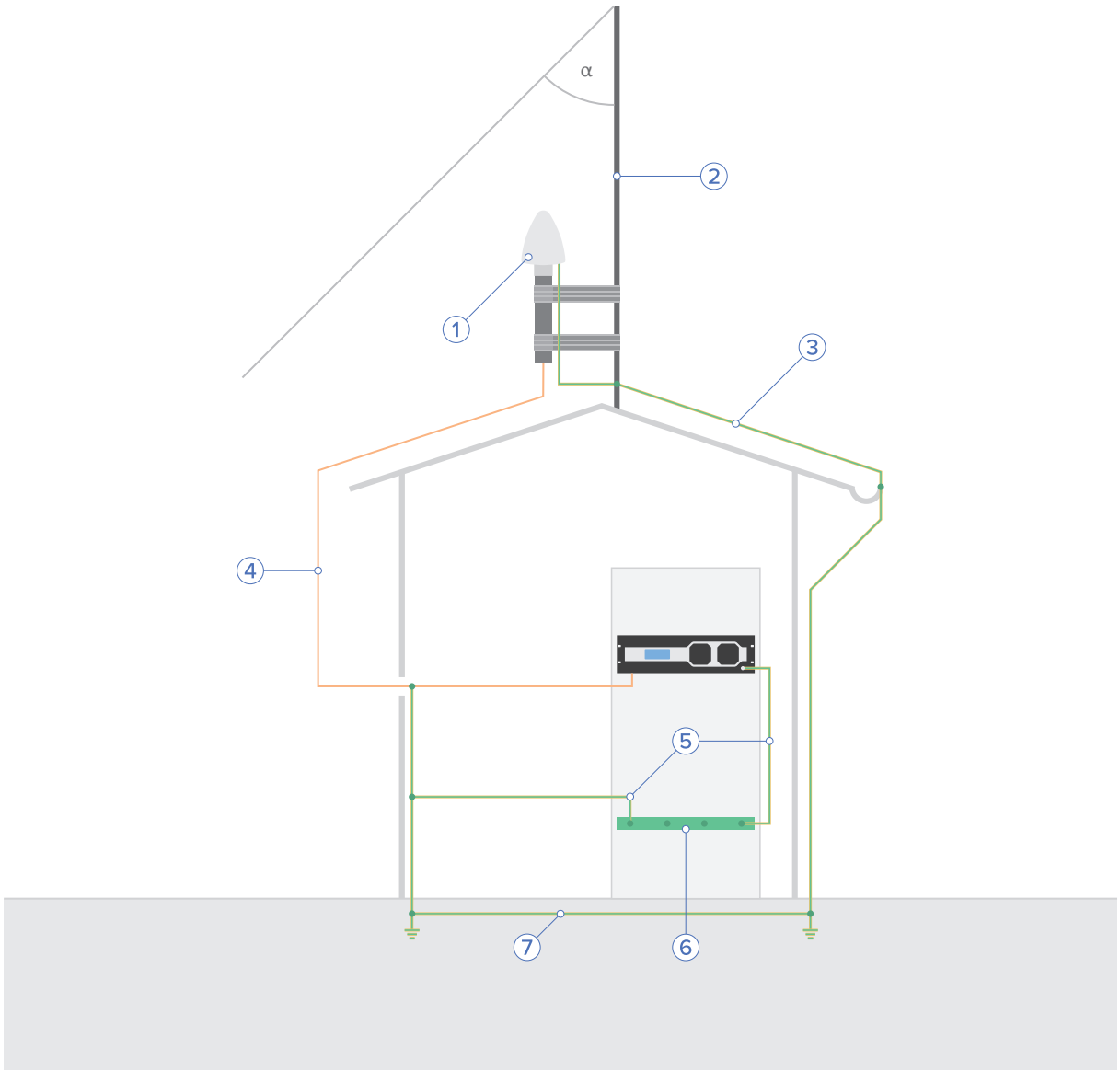


Fig. 6: Roof Installation

1 Meinberg GPS Antenna
2 Lightning Rod
3 Lightning Rod Conductor
4 Antenna Cable
5 Bonding Conductor
6 Bonding Bar
7 Foundation Electrode
α. Safety Zone

Optional MBG S-PRO Surge Protector

Information:

The surge protector and suitable coaxial cable are not included as standard with a Meinberg GPS Antenna, but can be ordered as an optional accessory.

Construction

The MBG-S-PRO is a surge protector (Phoenix CN-UB-280DC-BB) for coaxial connections. It is patched directly into the antenna line and consists of a replaceable gas discharge tube that redirects the energy from the cable shielding to the ground potential when ignited.

Installation Conditions

To protect the building from possible surge voltages, the MBG-S-PRO is installed at the point of entry of the antenna cable into the building. The MBG-S-PRO must be shielded against water spray and water jets, either by means of a suitable enclosure (IP65) or a protected location.

Ideal Installation Conditions:

- Installation at the point where the antenna cable passes through the building wall
- Ground conductor cable from surge protector to grounding busbar as short as possible

Installation and Connection

This surge protector has no dedicated input or output polarity and therefore has no preferred installation orientation. It features Type-N female connectors at both ends.

Installation

1.
Fit the surge protector to the supplied mounting bracket as shown in the illustration.

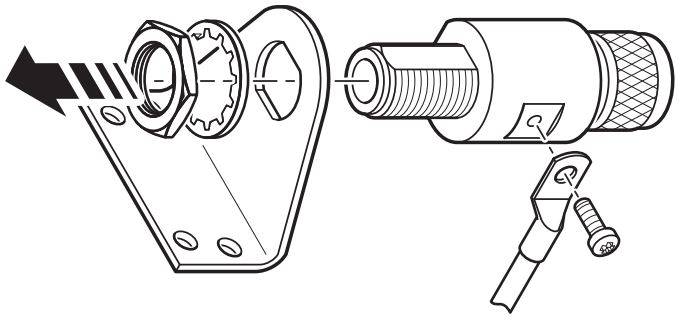


Fig. 7: Installation of the Surge Protector

2.
Connect the MBG-S-PRO to a grounding busbar using a ground conductor cable that is as short as possible. It is also important for the ground terminal of the surge protector to be connected to the same bonding bar as the connected Meinberg system in order to prevent destructive potential differences.

3.
Connect the coaxial cable from the antenna to one of the surge protector connectors, then connect the other surge protector connector to the coaxial cable leading to the Meinberg reference clock.

Caution!

For safety reasons, the antenna cable must not exceed a certain length if there are no other devices such as a power distributor between the surge protector and the downstream electronic device with integrated surge protection at the mains connector level.

Please refer to the document "**Technical Specifications: MBG-S-PRO Surge Protector**" in the appendix as well as the manufacturer's data sheet for detailed installation instructions and technical specifications for the surge protector.

Data Sheet (Download):
https://www.meinbergglobal.com/download/docs/shortinfo/german/cn-ub-280dc-bb_pc.pdf

9.4 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.

10 The Front Panel Layout

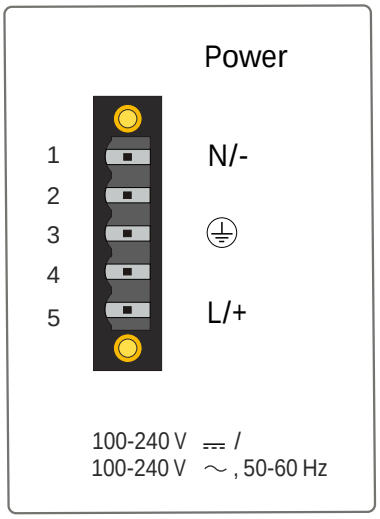
10.1 Front Panel Connectors GPS165/DAHS

Name	Type	Signal	Cable
COM 0, COM 1	9pin. D-SUB	RS-232	shielded data line
COM 2	16pin. Terminal	RS-485	data line
Optoc. Out	16pin. Terminal		
DCF Out	BNC female	77.5 kHz	shielded coaxial line
Time Code			
AM Out	BNC female	3 V_{pp} into 50 Ohm	shielded coaxial line
DCLS Out	16pin.Terminal	RS-422, TTL	data line
Antenna	BNC female		shielded coaxial line
Power supply	over 16pin. Terminal (DHS) over 5pin Screwterminal (DAHS)		

10.2 AC/DC Power Supply Connector

Connection Type: 5pin DFK

Pin Assignment:
1: N/-
2: not connected
3: PE (Protective Earth)
4: not connected
5: L/+



Input Parameter

Nominal Voltage Range:	U_N	=	100-240 V~ 100-240 V ⎓
Max. Voltage Range:	U_{max}	=	85-264 V~ 90-264 V ⎓
Nominal Current:	I_N	=	0.15 A
Nominal Frequency Range:	f_N	=	50-60 Hz
Max. Frequency Range:	f_{max}	=	47-63 Hz
Inrush Current:	I_P	=	50 A @ 230 V AC

Output Parameter

Max. Power:	P_{max}	=	15 W
Max. Heat Emission:	E_{therm}	=	54.00 kJ/h (51.19 BTU/h)

Danger!

This equipment is operated at a hazardous voltage.

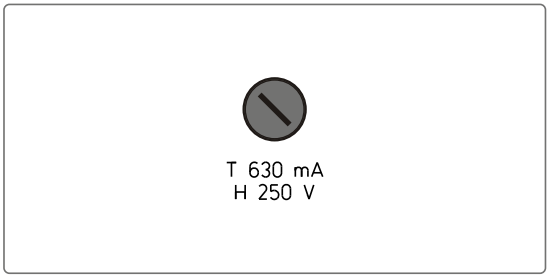
Danger of death from electric shock!

- This device must be connected by qualified personnel (electricians) only.
- Never handle exposed terminals or plugs while the power is on.
- All connectors must provide protection against contact with live parts in the form of a suitable plug body!

- Note: Always ensure that wiring is safe!
- Important: The device must be grounded by means of a connection with a correctly installed protective earth conductor (PE).

10.3 Fuse

The fuse protects against overload or short circuits and thus prevents damage to the installed power supply. The fuse is accessible from the front panel and can be replaced.



Technical Specification

Rated Voltage:	250 V
Shutter delay:	slow blow
Rated Current:	630 mA

Danger!

Danger of death due to electrical shock!

This equipment is operated at a hazardous voltage.

- The device must be disconnected from the mains! This is done using the physical power switch. Once the power switch is OFF, release the lock screws of the power supply connector and detach the connector.
- Disconnect all signal cables from the device, including antenna, fault message relay contact cables, and serial interfaces.
- Please note the information in the chapter "Important Safety Information -> Replacing the Fuse"

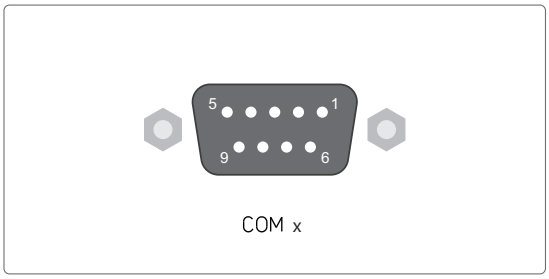
10.4 Assignment of the DSUB connectors

The serial ports COM 0 and COM 1 are accessible via 9pin 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 GPS165/DAHS.

Connector: D-SUB female 9pin

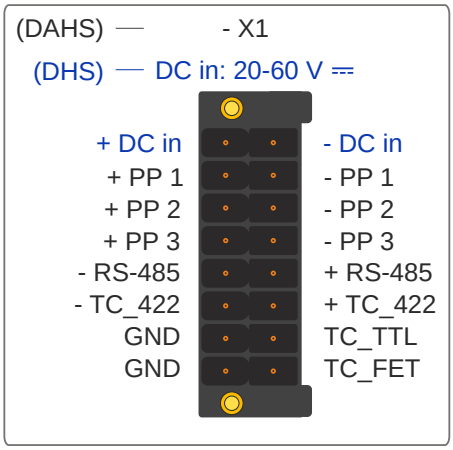
Cable: shielded data line

Assignment:
Pin 2: TxD (transmit)
Pin 3: RxD (receive)
Pin 5: GND (ground)

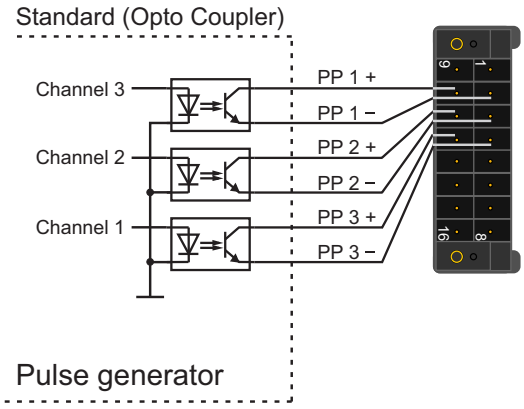


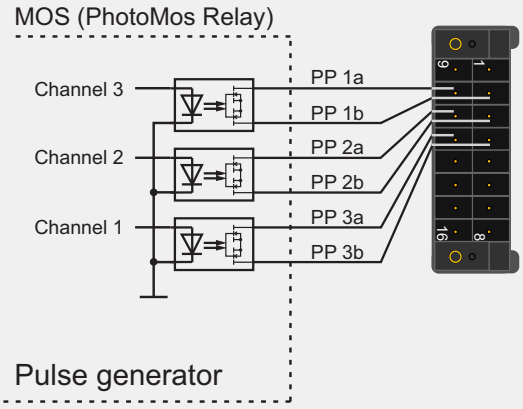
10.5 Assignment of the terminal block

The pulse outputs are accessible through the terminal block in the front panel. In addition, the power supply of variants GPS165DHS and GPS165/AQ/DHS is connected using two poles of this terminal block. The marking besides the terminal has the following meaning:



+	DC in	positive potential of power supply (GPS165(/MOS/)DHS only)
-	DC in	reference potential of power supply (GPS165(/MOS/)DHS only)
+	PP x	Programmable Pulse (positiv)
-	PP x	Programmable Pulse (negativ)
+	RS-485	Serial Time string (positiv)
-	RS-485	Serial Time string (negativ)
+	TC_422	Time Code (DCLS) with RS-422 level (positiv)
-	TC_422	Time Code (DCLS) with RS-422 level (negativ)
	TC_TTL	Time Code (DCLS), TTL into 50 Ω
	TC_FET	Time Code (DCLS), field-effect transistor (470 Ω to +5V)
	GND	Ground

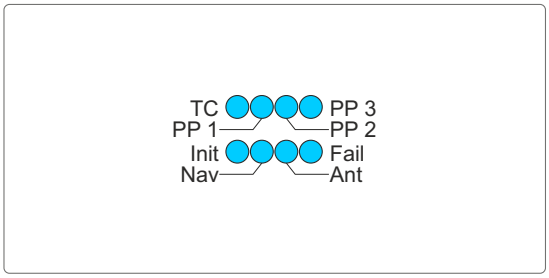




10.6 Status LEDs DMC Connector

LED Indicators

TC:	green blinking: time code signal
PP 1:	off: no signal configured green blinking: prog pulse signal
PP 2:	off: no signal configured green blinking: prog pulse signal
PP 3:	off: no signal configured green blinking: prog pulse signal
Init:	blue: while the receiver passes through the initialization phase green: the oscillator has warmed up
Nav.	green: positioning successfully
Ant:	red: antenna faulty or not connected
Fail:	red: time has not synchronized



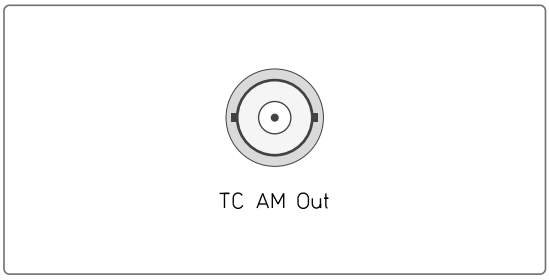
10.7 Time Code AM Output

Carrier frequency: 1 kHz (IRIG-B)

Signal outputs: Unbalanced sine wave-signal:
3 V_{pp} (MARK)
1 V_{pp} (SPACE) into 50 Ohm

Connector: BNC, female

Cable: shielded coax line



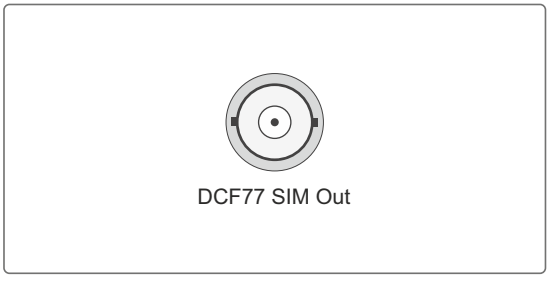
10.8 DCF77 Simulated Output (-62 dBm)

Output signal: 77.5 kHz frequency

Signal level: -62 dBm

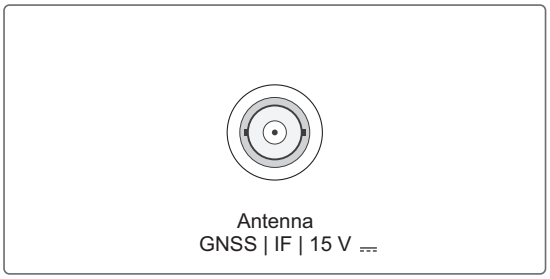
Connection type: BNC, female

Cable: shielded coax line



10.9 Antenna Input: GPS Reference Clock

Receiver Type:	12-Channel GPS Receiver
Signal Support:	GPS: L1 C/A (1575.42 MHz)
Mixing Frequency: (Reference Clock to Antenna)	10 MHz [1]
Intermediate Frequency: (Antenna to Reference Clock)	35.4 MHz [1]
	1) These frequencies are transferred via the antenna cable
Power Supply Voltage of Antenna:	15 V (via antenna cable)
Power Consumption of Antenna:	100 mA (via antenna cable)
Connector Type:	BNC, Female
Cable Type:	Coaxial Cable, Shielded
Cable Length:	Max. 300 m (RG58) Max. 700 m (RG213) Max. 1100 m (H2010 Ultraflex)



Danger!

Do not work on the antenna installation during thunderstorms!

Danger of death from electric shock!

- **Do not** carry out any work on the antenna installation or the antenna cable if there is a risk of lightning strike.
- **Do not** perform any work on the antenna installation if it is not possible to maintain the prescribed safety distance from exposed power lines or electrical substations.

11 Technical Specifications GPS Receiver

Receiver: 12 channel C/A code receiver

Antenna: GPS Antenna with remote power supply
refer to chapter "Technical specifications of 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 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

GPS165DHS, GPS165DAHS
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 = 10 mA)

GPS165/MOS/DHS, GPS165/MOS/DAHS
DC-insulated by PhotoMOS relays
U_{max} = 250 V AC/DC peak, 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} = 150 mA)

default settings: all pulse outputs inactive
mode of operation: 'if sync'

Accuracy of Pulses: better than +-100nsec after synchronization and 20 minutes of operation
better than +-3 μsec during the first 20 minutes of operation

Serial Ports: 3 independant asynchronous serial ports

COM0 (RS-232)
Baud Rate: 300 up to 19200
Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1, 801

COM1 (RS-232)
Baud Rate: 300 up to 19200
Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1, 801

COM2 (RS-485)
Baud Rate: 300 up to 19200
Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1, 801

time string selectable for COM0, COM1 and COM2
possible stringtypes in chapter: Time Stings

default settings: COM0: 19200, 8N1
COM1, COM2: 9600, 8N1
'standard Meinberg'
time string per second
mode of operation 'if sync'

Time Code Outputs:

modulated via BNC-connector:
3 V_{pp} (MARK), 1 V_{pp} (SPACE) into 50Ω

unmodulated via 16-pin terminal:
Field effect transistor with internal pull-up (1 kΩ) to +5 V

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)

Power Requirements:

GPS165DHS
20-60 V DC
DC-isolation 1.5 kV DC

GPS165DAHS
100-240 V DC
100-240 V AC, 50-60 Hz
fuse: 630 mA

Dimension:

GPS165/DHS
105 mm x 85 mm x 104 mm (height x width x depth)

GPS165/DAHS
105 mm x 125.5 mm x 104 mm (height x width x depth)

GPS165/DAHSx
105 mm x 165.5 mm x 104 mm (height x width x depth)

Connectors:

coaxial BNC connectors for antenna/converter unit, AM modulated DCF77 output and modulated time code output
16-pole terminal block for connection of:
- pulse outputs
- power supply (GPS165DHS and GPS165/MOS/DHS only)

DAHS, MOS/DAHS: 5pol. Screwterminal

Ambient Temperature:

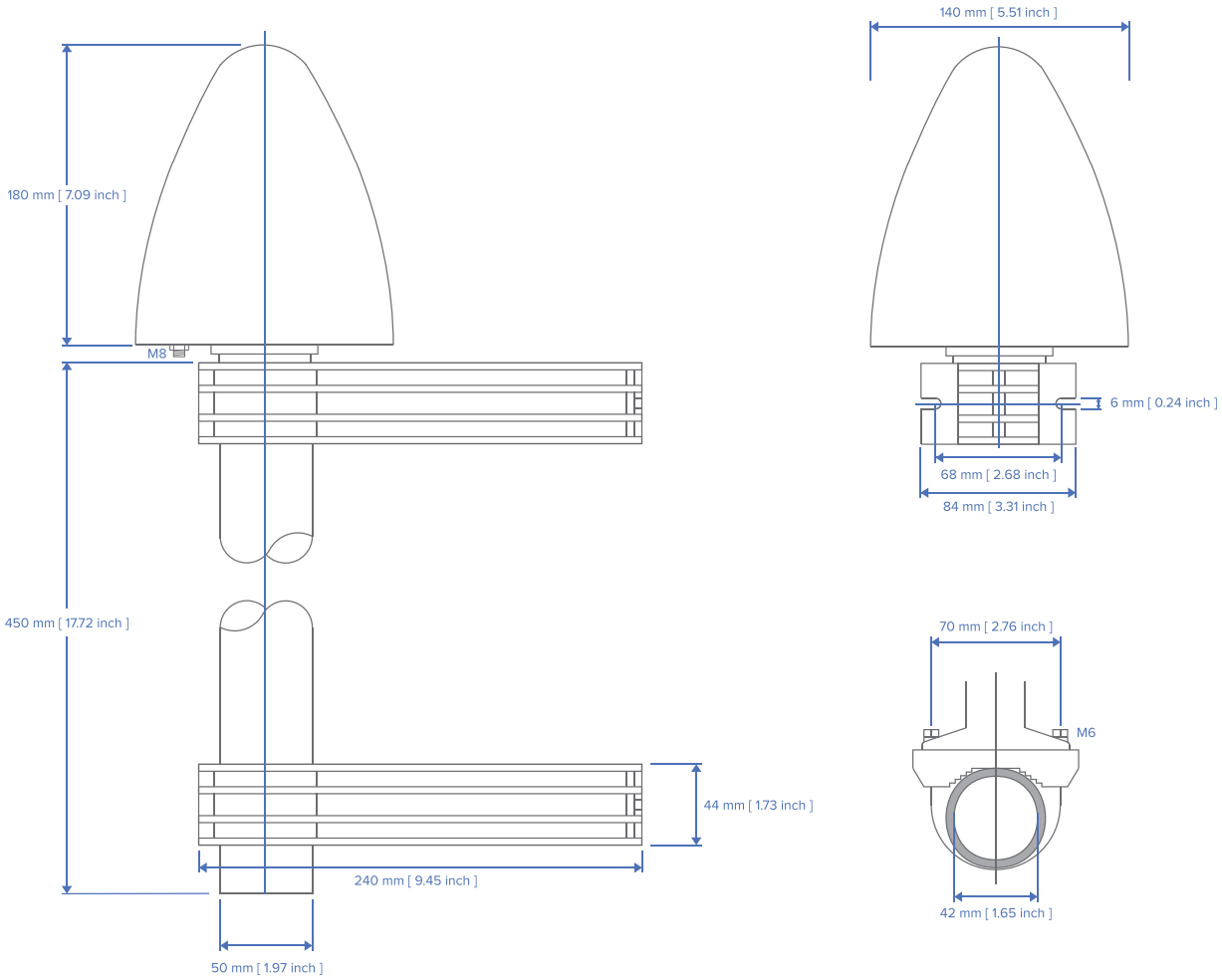
0 ... 50°C

Humidity:

85% max.

11.1 Technical Specifications: GPSANTv2 Antenna

Physical Dimensions:



Specifications

Power Supply:	15 V, approx. 100 mA (provided via antenna cable)
Reception Frequency:	1575.42 MHz (GPS L1/Galileo E1 Band)
Bandwidth:	9 MHz
Frequencies:	Mixing Frequency: 10 MHz Intermediate Frequency: 35.4 MHz
Element Gain:	Typically 5.0 dBic at zenith
Polarization:	Right-Hand Circular Polarization
Axial Ratio:	$\leq$ 3 dB at zenith
Nominal Impedance:	50 Ω
VSWR:	$\leq$ 1.5 : 1
Conversion Gain:	56 dB $\pm$ 3 dB
Out-of-Band Rejection:	$\geq$ 70 dB @ 1555 MHz $\geq$ 55 dB @ 1595 MHz
Noise Figure:	Typically 1.8 dB, maximum 3 dB at +25 °C
Surge Protection:	Level 4 (per IEC 61000-4-5) Test Voltage: 4000 V Max. Peak Voltage @ 2 Ω: 2000 A
ESD Protection:	Level 4 (per IEC 61000-4-2) Contact Discharge: 8 kV Air Discharge: 15 kV
Connector Type:	Type-N, Female
Housing Material:	ABS Plastic Case for Outdoor Installation
IP Rating:	IP65
Temperature Range:	–60 °C to +80 °C (–76 °F to 176 °F)
Weight:	1.4 kg (3.53 lbs), including mounting kit

11.2 Technical Specifications: MBG-S-PRO Surge Protector

The MBG-S-PRO is a surge protector (Phoenix CN-UB-280DC-BB) for coaxial connections. It is patched directly into the antenna line and consists of a replaceable gas discharge tube that redirects the energy from the cable shielding to the ground potential when ignited. Connect the MBG-S-PRO using a ground conductor cable that is as short as possible.

The MBG S-PRO has no dedicated input/output polarity and no preferred installation orientation.

Phoenix CN-UB-280DC-BB

Features:

- Excellent RF Performance
- Multiple Strike Capability
- 20 kA Surge Protection
- Bidirectional Protection

Contents of Package:	Surge Protector with Mounting Bracket and Accessories
Product Type:	Surge Protector for Transmission and Receiver Devices
Construction Type:	In-Line Breaker
Connector Types:	Type-N, Female/Type-N, Female

The original product page of the supplier (see link) of the CN-UB-280DC-BB surge protector provides detailed specifications, as well as a variety of product-specific documents under the link below:

Data Sheet (Download):
https://www.meinbergglobal.com/download/docs/shortinfo/german/cn-ub-280dc-bb_pc.pdf

11.3 Connection Data DFMC-connector

Conductor cross section solid min.	0.2 mm^2
Conductor cross section solid max.	1.5 mm^2
Conductor cross section flexibel min.	0.2 mm^2
Conductor cross section flexibel max.	1.5 mm^2
Conductor cross section flexible, with ferrule, without plastic sleeve min.	0.25 mm^2
Conductor cross section flexible, with ferrule, without plastic sleeve max.	1.5 mm^2
Conductor cross section flexible, with ferrule, with plastic sleeve min.	0.25 mm^2
Conductor cross section flexible with ferrule, with plastic sleeve max.	0.75 mm^2
Conductor cross section AWG min.	24
Conductor cross section AWG max.	16
AWG according to UL/CUL min.	16
AWG according to UL/CUL max.	24

Specifications for ferrules

Ferrules without insulating collar, according to DIN 46228-1	Cross-section: 0.25 mm^2; length: 5 mm ... 7 mm
	Cross-section: 0.34 mm^2; length: 7 mm
	Cross-section: 0.5 mm^2; length: 8 mm ... 10 mm
	Cross-section: 0.75 mm^2; length: 8 mm ... 10 mm
	Cross-section: 1 mm^2; length: 8 mm ... 10 mm
	Cross-section: 1.5 mm^2; length: 10 mm
Ferrules with insulating collar, according to DIN 46228-4	Cross-section: 0.14 mm^2; length: 8 mm
	Cross-section: 0.25 mm^2; length: 8 mm ... 10 mm
	Cross-section: 0.34 mm^2; length: 8 mm ... 10 mm
	Cross-section: 0.5 mm^2; length: 8 mm ... 10 mm
	Cross-section: 0,75 mrn^2; length: 8 mm ... 10 mm

11.4 Oscillator specifications

Oscillators available for Meinberg Reference Clocks / Time Servers:
TCXO, OCXO LQ /SQ/HQ/DHQ

	TCXO	OCXO LQ	OCXO SQ	OCXO HQ	OCXO DHQ
short term stability (τ = 1 sec)	$2 \cdot 10^{-9}$	$1 \cdot 10^{-9}$	$2 \cdot 10^{-10}$	$5 \cdot 10^{-12}$	$2 \cdot 10^{-12}$
accuracy of PPS (pulse per sec)	< ±250 ns	< ±250 ns	< ±100 ns	< ±100 ns	< ±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
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)
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)
accuracy GPS-synchronous, average 24h	$\pm 1 \cdot 10^{-11}$	$\pm 1 \cdot 10^{-11}$	$\pm 5 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-12}$
accuracy of time free run, 1 day	± 4.3 ms	± 865 µs	± 65 µs	± 10 µs	± 4.5 µs
accuracy of time free run, 1 year	± 16 s	± 6.3 s	± 1.6 s	± 788 ms	± 158 ms
temperature dependant drift free run	$\pm 1 \cdot 10^{-6}$ (-20...70°C)	$\pm 2 \cdot 10^{-7}$ (0...60°C)	$\pm 1 \cdot 10^{-7}$ (-10...70°C)	$\pm 1 \cdot 10^{-8}$ (5...70°C)	$\pm 2 \cdot 10^{-10}$ (5...70°C)

Note 1: The accuracy in Hertz is based on the standard frequency of 10 MHz.

For example: Accuracy of TCXO (free run one day) is $\pm 1 \cdot 10^{-7} \cdot 10$ 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.

11.5 Time Strings

11.5.1 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 as follows:

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

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

<STX>	Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second		
dd.mm.yy	The 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 time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
uv	Clock status characters (depending on clock type):		
	u:	'#'	GPS: Clock is in free-run mode (no exact synchronization) PZF: Time frame not synchronized DCF77: Clock has not synchronized since last reset
		' '	(space, 20h) GPS: Clock is synchronized (base accuracy is reached) PZF: Time frame is synchronized DCF77: Clock has synchronized since last reset
	v:	'*'	GPS: Receiver has not checked its position PZF/DCF77: Clock currently running off XTAL
		' '	(space, 20h) GPS: Receiver has determined its position PZF/DCF77: Clock is synchronized 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	Announcement of clock jump during last hour before jump enters 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		

11.5.2 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 as follows:

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

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

<STX> Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second

dd.mm.yy The 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 = Monday, ~~1~~7 = Sunday)

hh:mm:ss The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during 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 since last reset
' '	(Space, 20h) Clock has synchronized since last reset

v Announcement of clock jump during last hour before jump enters 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

11.5.3 NMEA 0183 String (RMC)

The NMEA 0183 RMC String is a sequence of 65 ASCII characters starting with the string '$GPRMC' and ending with the characters <CR> (Carriage Return) and <LF> (Line Feed). The format is as follows:

$GPRMC,*hhmmss.ff*,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-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

$	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second		
GP	Talker ID, in this case "GP" for GPS		
RMC	Message type ID, in this case "RMC"		
hhmmss.ss	The time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
	ff	Fractions of Seconds	(1/10 ; 1/100)
A	Status (A = Time Data Valid, V = Time Data not Valid)		
bbbb.bb	Geographical latitude of receiver position in degrees Leading characters padded by space characters (ASCII code 20h)		
n	Latitudinal hemisphere, with the following characters possible:		
	"N"	North of Equator	
	"S"	South of Equator	
lllll.ll	Geographical longitude of receiver position in degrees Leading characters padded by space characters (ASCII code 20h)		
e	Longitudinal hemisphere, with following characters possible:		
	"E"	East of Greenwich Meridian	
	"W"	West of Greenwich Meridian	
0.0,0.0	Speed over the ground in knots and track angle in degrees. With a Meinberg GPS clock, these values are always 0.0, With GNS clocks, the values are calculated by the receiver for mobile applications		
ddmmyy	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yy	Year of the Century	(00–99)
a	Magnetic Variation E/W		
hh	Checksum (XOR of all characters except "$" and "*")		
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

11.5.4 NMEA 0183 String (GGA)

The NMEA 0193 GGA String is a sequence of characters starting with the string "$GPGGA" and ending with the characters <CR> (Carriage Return) and <LF> (Line Feed). The format is as follows:

$GPGGA,*hhmmss.ff*,*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-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

$	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second
GP	Talker ID, in this case "GP" for GPS
GGA	Message type ID, in this case "GGA"
hhmmss.ss	The time: *hh* Hours (00–23) *mm* Minutes (00–59) *ss* Seconds (00–59, or 60 while leap second) *ff* Fractions of Seconds (1/10 ; 1/100)
bbbb.bbbbb	Geographical latitude of receiver position in degrees Leading characters padded by space characters (ASCII code 20h)
n	Latitudinal hemisphere, with the following characters possible: "N" North of Equator "S" South of Equator
lllll.llllll	Geographical longitude of receiver position in degrees Leading characters padded by space characters (20h)
e	Longitudinal hemisphere, with following characters possible: "E" East of Greenwich Meridian "W" West of Greenwich Meridian
A	Position fixed (1 = yes, 0 = no)
vv	Number of satellites used (0–12)
hhh.h	HDOP (Horizontal Dilution of Precision)
aaa.h	Mean Sea Level Altitude (MSL Altitude = WGS84 Altitude - Geoid Separation)
M	Meters (unit as fixed value)
ggg.g	Geoid Separation (WGS84 Altitude - MSL Altitude)
M	Meters (unit as fixed value)
cs	Checksum (XOR of all characters except "$" and "*")
<CR>	Carriage Return, ASCII code 0Dh
<LF>	Line Feed, ASCII code 0Ah

11.5.5 NMEA 0183 String (ZDA)

The NMEA 0183 ZDA String is a sequence of 38 ASCII characters starting with the string "$GPZDA" 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 time zone.

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

$	Start character, ASCII Code 24h sent with one-bit accuracy at change of second		
hhmmss.ss	UTC time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
HH,II	The local time zone (offset to UTC):		
	HH	Hours	(00–±13)
	II	Minutes	(00–59)
dd,mm,yy	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yyyy	Year	(0000–9999)
cs	Checksum (XOR of all characters except "$" and "*")		
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

11.5.6 Uni Erlangen String (NTP)

The Uni Erlangen String (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 as follows:

<STX>*dd.mm.yy; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm*<ETX>

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

<STX> Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of Century	(00–99)

w Day of the week (1–7, 1 = Monday)

hh.mm.ss The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)

v -/+ sign of the offset of local timezone relative to UTC

oo:oo Offset of local time zone relative to UTC in hours and minutes

ac Clock status characters:

a:	'#'	Clock has not synchronized since reset
	' '	(Space, 20h) Clock has synchronized since 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 Time enabled
' '	CET	European Standard Time, Daylight Saving Time disabled

f Announcement of clock jump during last hour before jump enters effect:

'!'	Announcement of start or end of Daylight Saving Time
' '	(Space, 20h) nothing announced

g Announcement of clock jump during last hour before jump enters effect:

'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

i Leap second insertion

'L'	Leap second is currently to be inserted (only active in 60th second)
' '	(Space, 20h) No leap second to be inserted

bbb.bbbb Geographical latitude of receiver position in degrees
Leading characters padded by Space characters (20h)

`n` Latitudinal hemisphere, with the following characters possible:
- 'N' North of Equator
- 'S' South of Equator

`lll.llll` Geographical longitude of receiver position in degrees
Leading characters padded by Space characters (20h)

`e` Longitudinal hemisphere, with the following characters possible:
- 'E' East of Greenwich Meridian
- 'W' West of Greenwich Meridian

`hhhh` Altitude above WGS84 ellipsoid in meters
Leading characters padded by Space characters (20h)

`<ETX>` End-of-Text, ASCII code 03h

11.5.7 Computime Time String

The Computime time string is a sequence of 24 ASCII characters, starting with the character T and terminated with the character <LF> (Line Feed, ASCII code 0Ah). The format is as follows:

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 unalterable parts of the time string. The groups of characters as defined below:

T — Start character
Sent with 1-bit accuracy at the start of the second.

yy:mm:dd — The current date:

yy	Year without century	(00–99)
mm	Month	(01–12)
dd	Day of the month	(01–31)
ww	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 during leap second)

<CR> — Carriage Return (ASCII code 0Dh)

<LF> — Line Feed (ASCII code 0Ah)

11.5.8 SYSPLEX-1 Time String

The SYSPLEX-1 time string is a sequence of 16 ASCII characters starting with the <SOH> (Start-of-Header) ASCII control character and terminated with the <LF> (Line Feed, ASCII code 0Ah) character.

Important!

To ensure that the time string can be correctly output and displayed through any given terminal program, a singular "C" (not include quotation marks) must be input.

The format is:

<SOH>*ttt*:*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:

<SOH>	Start-of-Header, ASCII code 01h sent with one-bit accuracy at the change of each second		
ddd	Day of Year	(001–366)	
hh:mm:ss	Current time:		
	hh Hours	(00–23)	
	mm Minutes	(00–59)	
	ss Seconds	(00–59, or 60 during leap second)	
	q Quality Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
		"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)		
<LF>	Line Feed (ASCII code 0Ah)		

11.5.9 Format of the 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:***jj-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:

jj-mm-tt	the current date:		
	jj	year of the century	(00..99)
	mm	month	(01..12)
	tt	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	Checksum. 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

11.5.10 RACAL Standard Time String

The RACAL Standard Time String is a sequence of 16 ASCII characters started by a X character and terminated by the <CR> (Carriage Return, ASCII code 0Dh) character. The format is as follows:

XGU*yymmddhhmmss*<CR>

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

X	Start character, ASCII code 58h Sent with one-bit accuracy at the change of each second		
G	Control character, ASCII code 47h		
U	Control character, ASCII code 55h		
yymmdd	Current date:		
	yy	Year of Century	(00–99)
	mm	Month	(01–12)
	dd	Day of Month	(01–31)
hh:mm:ss	Current time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
<CR>	Carriage Return, ASCII code 0Dh		

11.5.11 Meinberg GPS Time String

The Meinberg GPS 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. Unlike the Meinberg Standard Time String, the Meinberg GPS Time String does not carry any local time zone or UTC data; it simply carries the direct GPS time without any conversion into UTC. The format is as follows:

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

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

<STX> Start-of-Text, ASCII code 02h

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of the Century	(00–99)

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

hh.mm.ss the current time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 while leap second)

uv Clock status characters:

u:	'#'	Clock is in free-run mode (no exact synchronization)
	' '	(Space, 20h) Clock is synchronized (base accuracy is achieved)
v:	'*'	Receiver has not checked its position
	' '	(Space, 20h) Receiver has determined its position

G 'GPS time' time zone indicator

y Announcement of clock jump during last hour before jump enters effect:
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

11.5.12 ION Time String

The ION time string is a sequence of 16 ASCII characters starting with the <SOH> (Start of Header, ASCII code 01h) ASCII control character and ending with the <LF> (Line Feed, ASCII code 0Ah) character. The format is as follows:

<SOH>*ddd:hh:mm:ssq*<CR><LF>

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

<SOH>	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
ddd	Day of Year		(001–366)	
hh:mm:ss	Current time:			
	hh	Hours	(00–23)	
	mm	Minutes	(00–59)	
	ss	Seconds	(00–59, or 60 while leap second)	
	q	Quality Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
			"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)			
<LF>	Line Feed (ASCII code 0Ah)			

11.5.13 ION Blanked Time String

The ION Blanked time string is a sequence of 16 ASCII characters starting with the <SOH> (Start of Header, ASCII code 01h) ASCII control character and ending with the <LF> (Line Feed, ASCII code 0Ah) character. The format is as follows:

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

Important!

The blanking interval of is 2 minutes and 30 seconds long and is added every 5 minutes.

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

<SOH>	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
ddd	Day of Year		(001–366)	
hh:mm:ss	Current time:			
	hh	Hours	(00–23)	
	mm	Minutes	(00–59)	
	ss	Seconds	(00–59, or 60 while leap second)	
	q	Quality Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
			"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)			
<LF>	Line Feed (ASCII code 0Ah)			

11.5.14 IRIG-J Timecode

The IRIG-J timecode consists of a string of ASCII characters sent in "701" format, i.e.,:

- 1 Start Bit
- 7 Data Bits
- 1 Parity Bit (odd)
- 1 Stop Bit

The on-time marker of the string is the leading edge of the start bit. The timecode consists of 15 characters, sent once per second at a baud rate of 300 or greater. The format is as follows:

<SOH>*DDD:HH:MM:SS*<CR><LF>

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

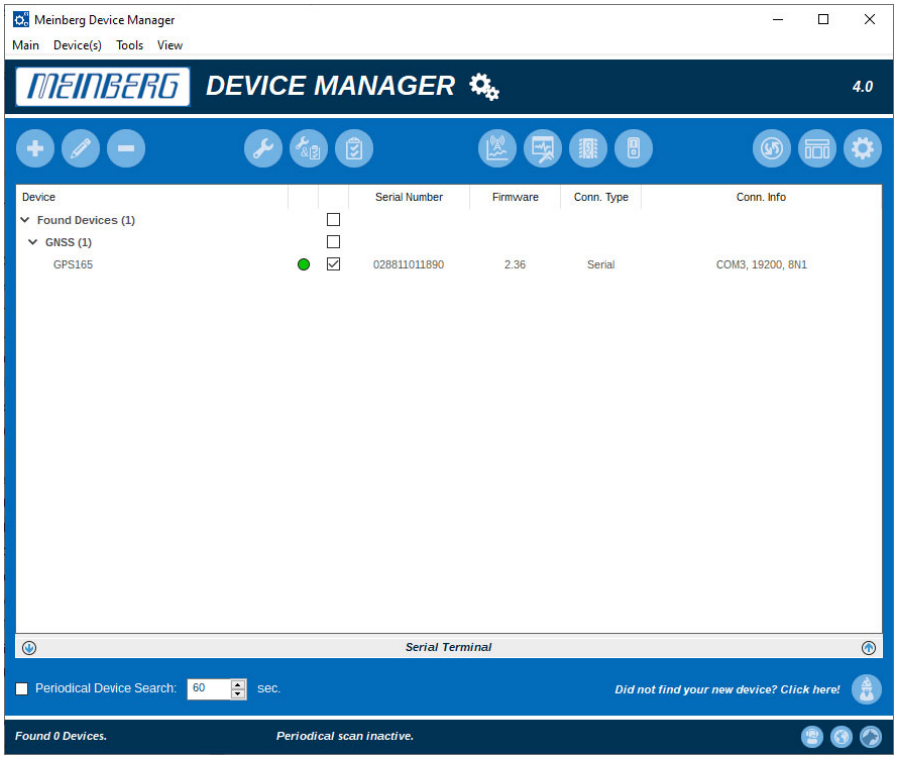
<SOH>	"Start of Header" (ASCII code 01h)
DDD	Day of the year (ordinal date, 1–366)
HH, MM, SS	Time of the start bit, specified in hours (HH), minutes (MM), seconds (SS)
<CR>	"Carriage Return" (ASCII code 0Dh)
<LF>	"Line Feed" (ASCII code 0Ah)

12 Meinberg Device Manager

The program serves the configuration of Meinberg Radio Clocks. The software can be run on the operating systems Windows 7 or higher.

Documentation:
https://www.meinbergglobal.com/download/docs/manuals/english/meinberg-device-manager.pdf

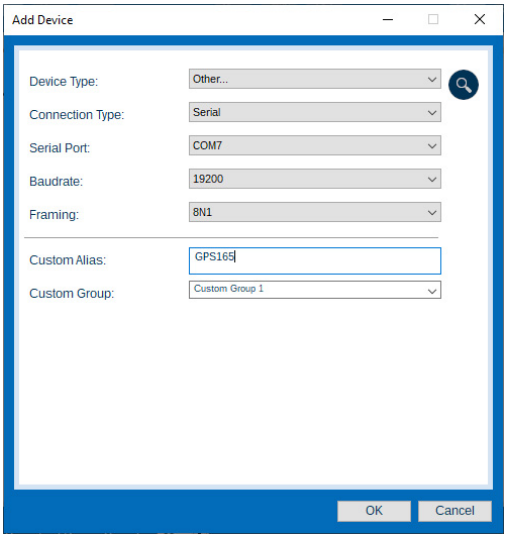
Download:
https://www.meinbergglobal.com/english/sw/mbg-devman.htm



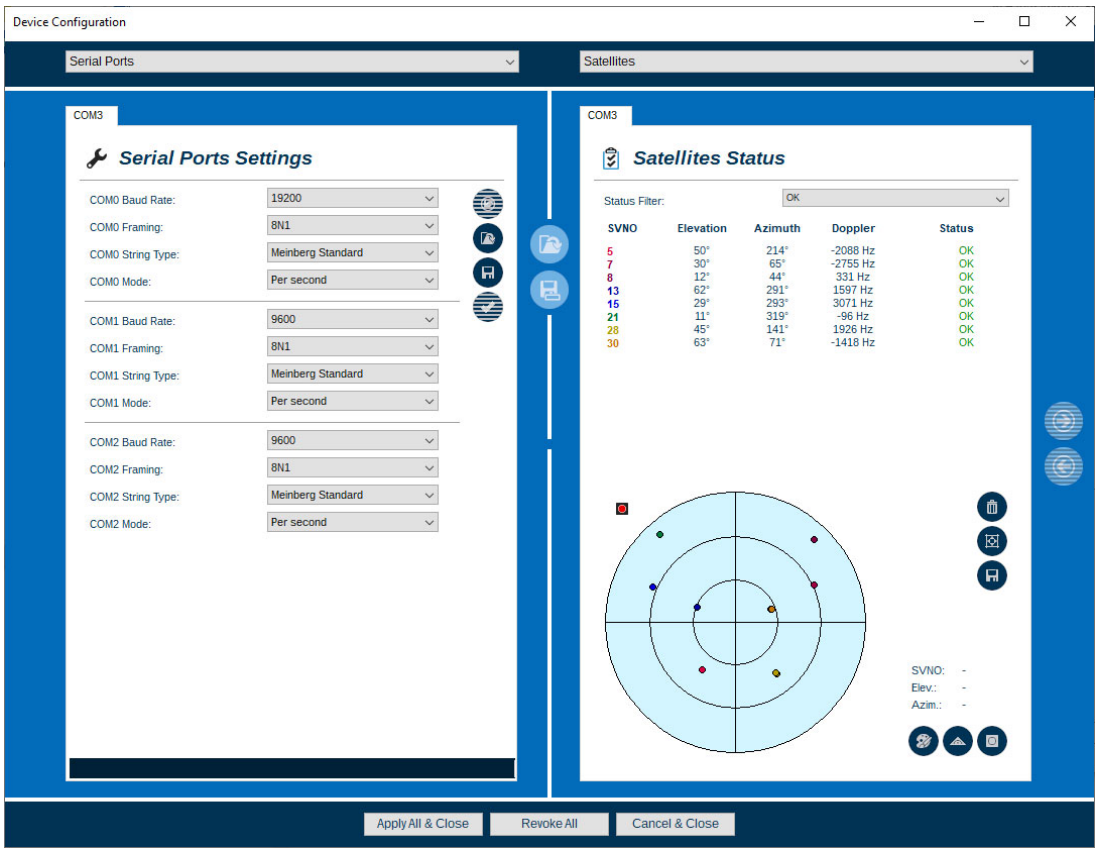
A connection between the system and the program can be produced by serial port. The configurations are described in the "Meinberg Device Manager" documentation.

Connection

The PC should have generated an automatic connection to the clock, select the tab "Search Device". Alternatively, you can use the button "Add Device" to generate a connection to the clock by using the same configure (Port / Baud / Framing).



Configuration



With "Configure Device" various configurations can be carried out on the system. Please note that any changes you make in the settings must always be confirmed with the "Apply Configuration" button. Use the "Restore Configuration" button to reset all settings back to their default values. For more information, please refer to the Meinberg Device Manager manual.

13 RoHS Conformity

Conformity with EU Directive 2011/65/EU (RoHS)

We hereby declare that this product is compliant with the European Union Directive 2011/65/EU and its delegated directive 2015/863/EU "Restrictions of Hazardous Substances in Electrical and Electronic Equipment" and that no impermissible substances are present in our products pursuant to these Directives.

We warrant that our electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), polybrominated diphenyl ethers (PBDEs), bis(2-ethylhexyl)phthalat (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), or diisobutyl phthalate (DIBP) above the legal limits.

14 Declaration of Conformity for Operation in the European Union

EU-Konformitätserklärung

Doc ID: GPS165DAHS-May 8, 2024

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*	**GPS165DAHS**

auf das sich diese Erklärung bezieht, mit den folgenden Normen und Richtlinien übereinstimmt:
to which this declaration relates is in conformity with the following standards and provisions of the directives:

RED – Richtlinie *RED Directive* 2014/53/EU	ETSI EN 303 413 V1.2.1 (2021-04)
EMV – Richtlinie *EMC Directive* 2014/30/EU	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-19 V2.2.1 (2022-09) DIN EN IEC 61000-6-2:2019 DIN EN IEC 61000-6-3:2021 DIN EN 55032:2015/AC:2016/A11:2020/A1:2020 DIN EN 55035:2017/A11:2020
Niederspannungsrichtlinie *Low Voltage Directive* 2014/35/EU	DIN EN IEC 62368-1:2020/A11:2020
RoHS – Richtlinie *RoHS Directive* 2011/65/EU + 2015/863/EU	DIN EN IEC 63000:2018

Bad Pyrmont, den May 8, 2024

Aron Meinberg
Quality Management

MEINBERG
Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9
31812 Bad Pyrmont

15 Declaration of Conformity for Operation in the United Kingdom

UK Declaration of Conformity

Doc ID: GPS165DAHS-May 8, 2024

Manufacturer	Meinberg Funkuhren GmbH & Co. KG Lange Wand 9 31812 Bad Pyrmont Germany

declares that the product

Product Designation	**GPS165DAHS**

to which this declaration relates, is in conformity with the following standards and provisions of the following regulations under British law:

Radio Equipment Regulations 2017 (as amended) *SI 2017/1206*	ETSI EN 303 413 V1.2.1 (2021-04)
Electromagnetic Compatibility Regulations 2016 (as amended) *SI 2016/1091*	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-19 V2.2.1 (2022-09) EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55032:2015/AC:2016/A11:2020/A1:2020 EN 55035:2017/A11:2020
Electrical Equipment (Safety) Regulations 2016 (as amended) *SI 2016/1101*	EN IEC 62368-1:2020/A11:2020
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (as amended) *SI 2012/3032*	EN IEC 63000:2018

Bad Pyrmont, Germany, dated May 8, 2024

Aron Meinberg
Quality Management

MEINBERG
Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9
31812 Bad Pyrmont

GPS165_DAHS_QSG_080524