The Synchronization Experts.

SETUP GUIDE

GNMANTv2

GNSS Multi Band Antenna
for Meinberg GNSS Clocks

Meinberg Funkuhren GmbH & Co. KG

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1 Imprint and Legal Information

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3 Copyright and Liability Exclusion

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4 Presentation Conventions in this Manual

4.1 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.

4.2 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.

4.3 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.

4.4 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)*

5 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 and operation procedure of the antenna, as well as its removal from service.

Any safety warnings affixed to the product 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 product may result in unpredictable behavior from the product, and may result in injury or death.

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.

5.1 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!

5.2 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 Meinberg product.

5.3 Safety during Installation

If the antenna is to be installed at height, only use equipment that has been tested and is suitable for reaching the location.

Always ensure that suitable personal protective equipment is worn when working at height!

Ensure that you work safely when installing antennas!

Never work at height without a suitable and effective fall arrester!

Never mount, connect, disconnect, or dismantle an antenna while 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.

5.4 Electrical Safety

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.

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.

Ensure that all plug connections are secure.

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:

5.4.1 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.

5.4.2 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.

6 Important Product Information

6.1 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 12.

6.2 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 13.

6.3 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 packaging	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 via the household waste. Inquire with your local waste disposal company or authority on how to best dispose of the product 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.

7 Introduction of the GNMANTv2 Antenna

Meinberg's GNMANTv2 is a multi-GNSS, multi-band antenna that is engineered and manufactured entirely by Meinberg from the ground up to ensure optimum performance for timing & synchronization applications.

The GNMANTv2 provides dual-band reception with excellent reception of all GNSS constellations (GPS, GLONASS, Galileo, BeiDou), encompassing almost all GNSS services in these systems. Additionally, the antenna supports reception of augmentation systems, including SBAS, EGNOS, Fugro AtomiChron, and QZSS.

The GNMANTv2 also features a dedicated narrowband frontend filter for effective rejection of out-of-band signals and a very low-noise preamp, allowing for maximum signal quality with minimal interference. Integrated surge protection helps to protect the antenna from damage from surge voltages and indirect lightning strikes.

Housed in an injection-molded ABS IP65 plastic case with Meinberg's distinctive waterproof "mushroom" design and specified for operating conditions from -70 °C to +85 °C, the GNMANTv2's construction helps it to withstand the rigors of outdoor use in even the most challenging weather conditions.

This manual provides all the information you need to help you to install and set up your GNMANTv2 for use as quickly and easily as possible, encompassing two key steps: → "Planning the Installation of the Antenna" and → "Assembly and Fixture of the Antenna".

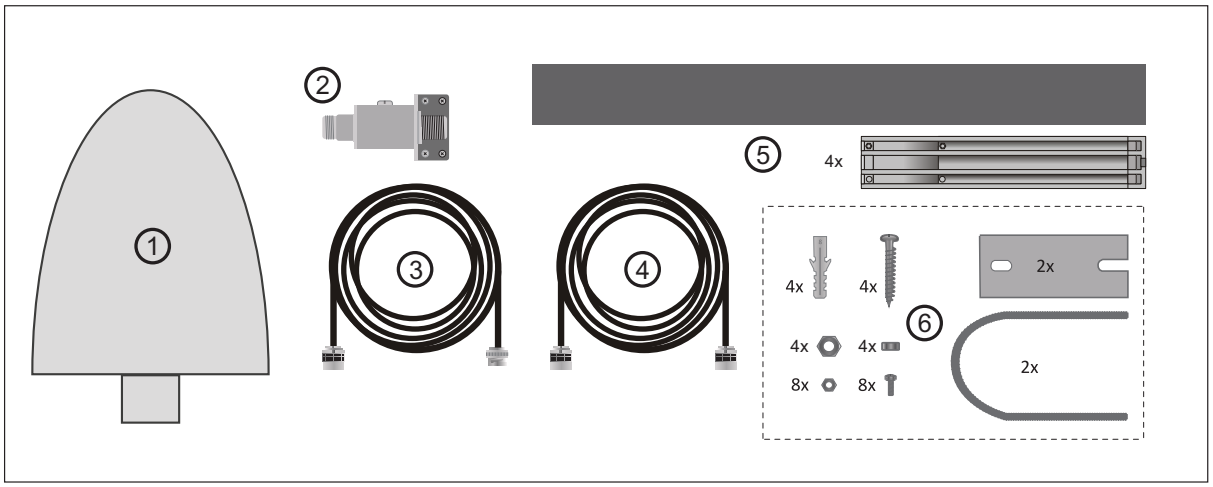
Of course, if you need any additional assistance with setting up your GNMANTv2 at any point, please do not hesitate to contact Meinberg's Technical Support Team, who will be happy to help:

Phone: +49 (0) 5281 9309-888

Email: techsupport@meinberg.de

8 Before You Start

8.1 Contents of Delivery



A delivery of a Meinberg GNMANTv2 antenna includes the following:

1 GNMANTv2 Antenna
2. MBG S-PRO Surge Protector (optional)
3. RG58C/U Antenna Cable (optional)
4. Coaxial Cable for Surge Protector (optional)
5. Tube Mount and Clips for Meinberg GNMANTv2 Antenna
6. Mounting Kit for Meinberg GNMANTv2 Antenna

Unpack the GNMANTv2-Antenna and all accessories carefully and check the contents of the delivery against the enclosed packing list to ensure that no parts are missing. If any of the listed items are missing, please contact our Sales Department at *sales@meinberg.de*

Check that the product has not been damaged in transit. If the product is damaged or fails to operate upon installation, please contact Meinberg immediately. Only the recipient (the person or company receiving the system) may file claims or complaints against the forwarder for damage caused in transit.

Meinberg recommends that you keep the original packaging materials in case the product needs to be shipped or transported again at a later date.

9 Installation of the Antenna

9.1 The Importance of Good Antenna Positioning

This chapter aims to provide some basic technical background as to the factors that influence good GNSS antenna positioning.

Basics of GNSS Reception for Time Servers

A GNSS antenna captures signals from satellites visible in the sky (referred to as *live-sky signals*). These signals are transmitted by constellations of satellites (also known as *space vehicles* or SVs) in a medium Earth orbit of generally between 20,000 and 30,000 km above sea level.

GNSS antennas used by Meinberg time servers are directional antennas designed to be installed vertically in order to receive live-sky signals within their *signal cone*, which is a reception field spreading out from the antenna up to the sky.

In the case of the GNSS Multi-Band Antenna, this signal cone is approximately 120° relative to the zenith (straight up) to ensure that the antenna can capture a strong a signal as possible even at the horizontal extremes (90° from the zenith). This signal cone can be disrupted by solid objects or other radio signals in its path.

There is a certain margin of error involved in calculating a position based on the distance between an antenna and the satellites visible within the signal cone. Because of this margin of error (known as *dilution of precision*), the position calculated between two measurements can vary even though the antenna and receiver are physically in exactly the same place. Dilution of precision can be influenced by factors outside of the influence of the receiver, such as ionospheric interference, but some factors can be affected by well-considered antenna positioning that maximizes the visible sky while minimizing potential sources of interference.

Impact of GNSS Lock Count on Clock Accuracy

An antenna used for a Meinberg time server requires a lock on the live-sky signals from at least four satellites within the antenna's (ideally undisrupted) signal cone for the receiver to properly, accurately, and consistently determine its position, which it does by generating a *navigation solution*. The more satellites that are visible, the more options the receiver has to generate a *strong solution*, in which the satellites are far apart and the dilution of precision is lower, resulting in a more accurate position fix. This improves the stablility of the position that is measured from solution to solution.

The specified accuracy of synchronized Meinberg time servers assume clear-sky conditions for GNSS receivers, such that any obstructions antithetical to clear-sky conditions may reduce clock accuracy accordingly.

It is therefore important for an antenna to have as much direct exposure to the sky as possible, as this increases the chances of more live-sky signals being correctly detected and improves the quality of the position detection. Obstructions such as buildings or trees reduce or eliminate the chance of live-sky signals being correctly received from that direction, limit the strength of the navigation solution, and can also produce *multipath interference* (see below).

In locations between the 55th parallels, a clear view to the northern and/or southern horizons is especially important in increasing the number of GNSS satellites visible at any given time, because the *ground tracks* of the GPS and Galileo satellite orbits converge with greater frequency around the 55th parallels and the equator of the Earth.

In locations **north** of the **55th north parallel** (e.g., much of Canada, Scandinavia, Greenland, Alaska) GNSS

reception is less reliable, as the further north the receiver is located, the less likely GNSS reception at the zenith becomes. As such, a clear view to the north is *less* beneficial and a clear, unobstructed view to the south becomes *more* important.

Conversely, in locations **south** of the **55th south parallel** (principally Antarctica, but also small parts of Brazil, Chile, and Argentina), GNSS reception at the zenith becomes more problematic the further south the receiver is located. As such, a clear view to the **south** is *less* beneficial here, while a clear, unobstructed view to the **north** becomes *more* important.

Radio-Frequency Interference

GNSS signals are conventionally very weak—typically as low as –120 to –130 dBm at ground level. For a common point of reference, the signal strength of a 2.4 GHz wi-fi router at the extremes of its range must be –80 dBm to maintain a stable connection.

With this in mind, radio-frequency interference plays a significant role in GNSS signal reception and must therefore factor into your choice of installation location. Even minor electromagnetic and other radio-frequency interference from other antennas, overhead power lines, and electrical equipment such as HVAC units and cameras can introduce errors, as can a general proximity to metallic surfaces.

Further information on RF emissions from other devices may be obtainable from the documentation of those devices, but as a general rule, a distance of 50 cm from other GNSS antennas, at least 10 m from camera systems (regardless of radio or cable transmission) or HVAC units, and at least 30 m from transmission antennas should be maintained.

Multipath Interference

To enable GNSS antennas to receive sky signals reliably even at horizon level, the signal cone of an antenna typically encompasses the ground to a certain degree. This can be problematic in that GNSS signals can be 'reflected' from terrestrial surfaces such as the ground (as well as other buildings or other vertical surfaces) and are essentially an 'echo' of an otherwise directly received GNSS signal. These signals are referred to as 'multipath interference' and can significantly disrupt a Meinberg time server's ability not only to determine its position but also acquire the time from the GNSS signal.

The mitigation of multipath interference relies first and foremost on the directional antenna being mounted vertically, so that the center of the signal cone is directed towards the zenith and is perpendicular to the horizon to ensure that as little of the signal cone is facing the ground as possible. Maximizing the elevation of the antenna above any vertical faces of surrounding architecture and landscape features also plays a significant role in mitigating the impact of multipath interference.

9.2 Planning the Installation of the Antenna

The following conditions should be met as closely as possible when selecting the best place to install your antenna:

- a clear 360° view around the antenna (to maximize exposure to the live sky), prioritizing in particular a clear view to the northern horizon (if antenna located in the southern hemisphere) or the southern horizon (if antenna is located in the northern hemisphere) to maximize the number of GNSS satellites visible at any given time;
- the highest elevation possible (to limit exposure to reflections from the ground and from other buildings);
- at least 10 m (~ 30 ft) distance to any electrical equipment prone to emitting significant electrical interference, such as HVAC units and cameras;
- at least 50 cm (~ 2 ft) distance to other GNSS antennas;
- at least 10 m – 30 m (~ 30 ft – 100 ft) distance to other transmission antennas, depending on transmission power;
- sufficient distance from other metallic objects, which can reflect radio signals capable of interfering with GNSS signals; the necessary distance will depend on the size, orientation, and relative position of the objects.

For more information on the background to the above requirements and recommendations, please refer to → Chapter 9.1, "The Importance of Good Antenna Positioning".

Important!

The specified accuracy levels for your GNMANTv2 are specified for clear-sky conditions and can only be guaranteed if the above conditions for the installation of the antenna are met fully.

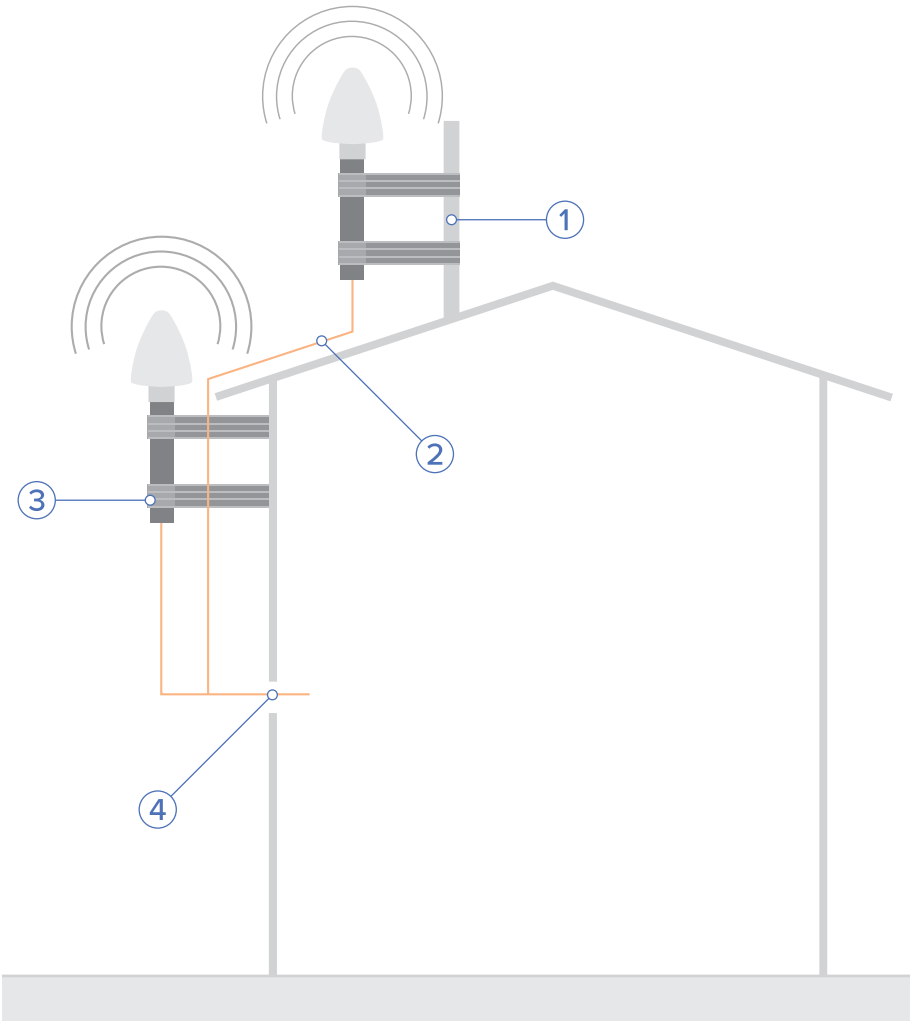


Figure 9.1: Effective Positioning of a GNSS Antenna

1. Mast Mounting
2. Antenna Cable
3. Wall Mounting
4. House Entry

Typically, these conditions can be met by installing the antenna on top of a roof as shown by the antenna on the **right** in Fig. 9.1.

However, if you do not have access to a roof to install the antenna, or if your roof conditions are such that significant radio interference is to be expected, you may consider mounting the antenna on a wall as high as possible, ensuring that a 360° view is observed with a view above the edge of the roof, as shown by the antenna on the **left** in Fig. 9.1. Mounting accessories are provided with your antenna for this purpose.

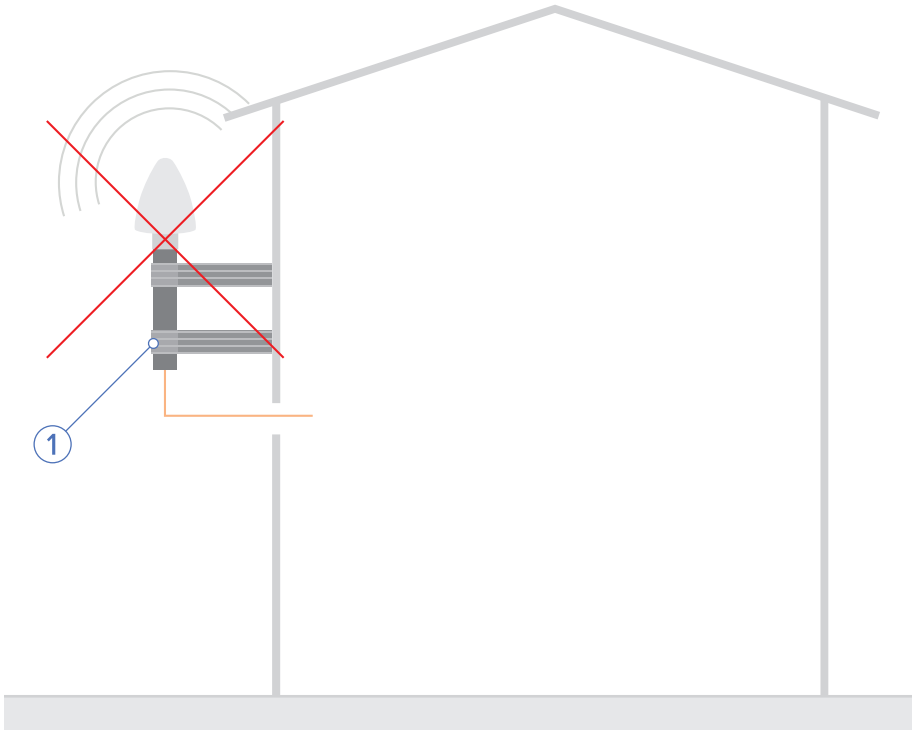


Figure 9.2: Poor Positioning of a GNSS Antenna

Please avoid mounting your antenna on a wall in such a way that the wall obscures the antenna's signal cone, as shown by the **upper antenna** in Fig. 9.2. This not only essentially halves the antenna's exposure to live-sky signals by halving the signal cone, but also exposes the antenna to signal reflections from the wall that the antenna is mounted on.

Under no circumstances should you install the antenna in a horizontal position! Doing so not only essentially halves the antenna's live-sky exposure in the same way as shown by the **lower antenna** in Fig. 9.2, but also maximizes the antenna's exposure to signals reflected from the ground and to other spurious transmissions from ground level.

9.3 Assembly and Fixture of the Antenna

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

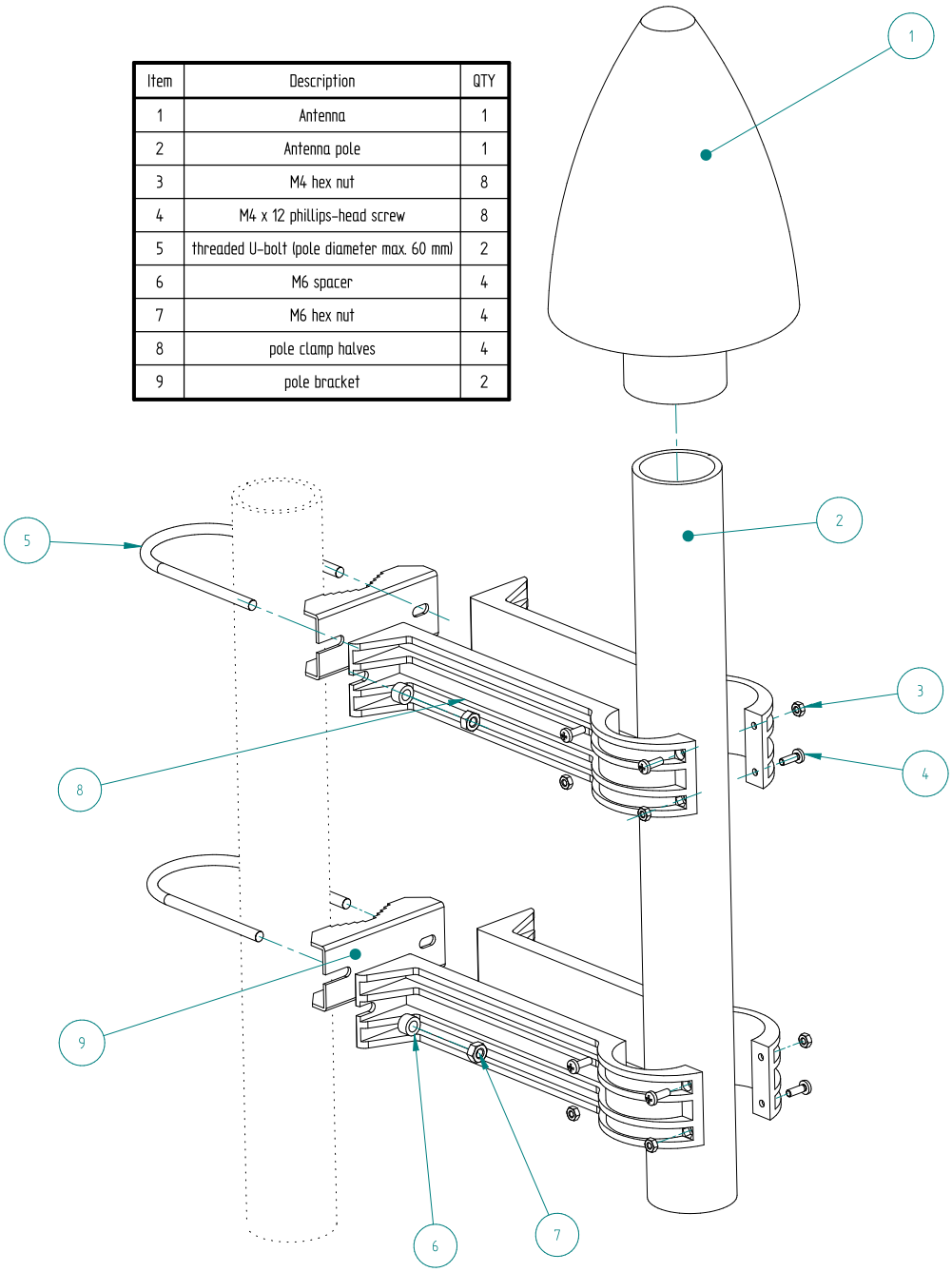


Figure 9.3: Mounting a GNMANTv2 Antenna onto a Mast

Fig. 9.3 illustrates how to assemble and mount a Meinberg GNMANTv2 Antenna on a mast by way of example.

The antenna may be mounted onto an existing mast (maximum pole diameter 60 cm / 2.3 inches) or directly onto a wall, provided that the installation conditions specified in → Chapter 9.2, "Planning the Installation of the Antenna" and → Chapter 9.1, "The Importance of Good Antenna Positioning" are met, in particular those regarding the maintenance of distances from sources of electromagnetic interference, signal reflections, and signal obstructions.

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 system 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.

Mounting the Antenna onto a Wall

1. Assemble the two pairs of pole clamp halves (Item 8 in Fig. 9.3) with the mounting tube (Item 2 in Fig. 9.3) in the clamps. Secure the tube inside each of the two clamps using four M4x12 Phillips screws and corresponding M4 hex nuts (Items 3 and 4 in Fig. 9.3). To ensure that the clamp is secure as possible, the top and bottom screws of each clamp should be inserted from opposing directions as shown in Fig. 9.3.

2. Drill four holes for M6x45 screws in the underlying wall to match the two screw slits on each of the clamps. Insert two wallplugs into these holes.

3. Use four spacers and four M6x45 screws to mount the clamps onto the wall using the slits on each of the clamps.

4. Once you have verified that the clamps are securely mounted to the wall and the tube is securely held by the clamps, you may insert the antenna into the tube.

Mounting the Antenna onto a Mast

1. Assemble the two pairs of pole clamp halves (Item 8 in Fig. 9.3) with the mounting tube (Item 2 in Fig. 9.3) in the clamps. Secure the tube inside each of the two clamps using four M4x12 Phillips screws and corresponding M4 hex nuts (Items 3 and 4 in Fig. 9.3). To ensure that the clamp is secure as possible, the top and bottom screws of each clamp should be inserted from opposing directions as shown in Fig. 9.3.

2. Place the threaded bolts (Item 5 in Fig. 9.3) around the designated mast pole and feed the two prongs into the holes of the pole bracket (Item 9 in Fig. 9.3). Secure each of the clamps to each of the pole brackets using two spacers and two M6 hex nuts (Item 7 in Fig. 9.3) and tighten until the pole bracket and U-bolt are secure.

3. Once you have verified that the clamps are securely mounted to the mast, that they exhibit no movement without significant force, and that the tube is securely held by the clamps, you may insert the antenna into the top of the mounting tube.

9.4 Laying the Antenna Cable

Your GNMANTv2 is typically shipped with a suitable antenna cable. However, if it is not, or if you must procure a replacement for an old or damaged cable, please consult → Chapter 10.6, "Antenna Cable" for information on the required specifications.

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.

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 in order to extend an existing cable installation.

Like any other metallic object in the antenna installation (antenna and master), the antenna cable must be integrated into the grounding infrastructure of the building and also connected to the other metallic objects. Refer to → Chapter 9.5, "Grounding the Antenna" for more information.

Meinberg also strongly recommends implementing in-line surge protection using the MBG S-PRO surge protector, which should be mounted as closely to the point of entry into the building itself. Refer to → Chapter 9.6, "In-Line Surge Protection" for more information.

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.

Any kinking, crushing, or other damage to the external insulation must be avoided. In particular, the bend radius of the cable, which is the radius at which a cable can be bent without sustaining damage such as kinks, must be considered when laying the cable around corners or turns.

The coaxial connectors must be protected from damage and from exposure to water jets or corrosive substances.

9.5 Grounding the Antenna

Danger!

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

Risk of fire and danger of death from electric shock!

- **Do not** attempt to implement surge protection or lightning protection systems if you do not have suitable professional electrical qualifications.

If the antenna is not properly grounded, exposure to high induced voltages from indirect lightning strikes can generate significant surge voltages in the coaxial cable, potentially causing significant damage to or even destroying both your antenna and any connected receivers or signal distributors.

Accordingly, antennas and antenna cables must always be professionally integrated into a building's equipotential bonding infrastructure 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.

Meinberg antennas feature 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.

In order to enhance the safety of the building and the protection of your Meinberg system, Meinberg also recommends the additional use of the MBG S-PRO surge protector, which is addressed in → Chapter 9.6, "In-Line 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 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.

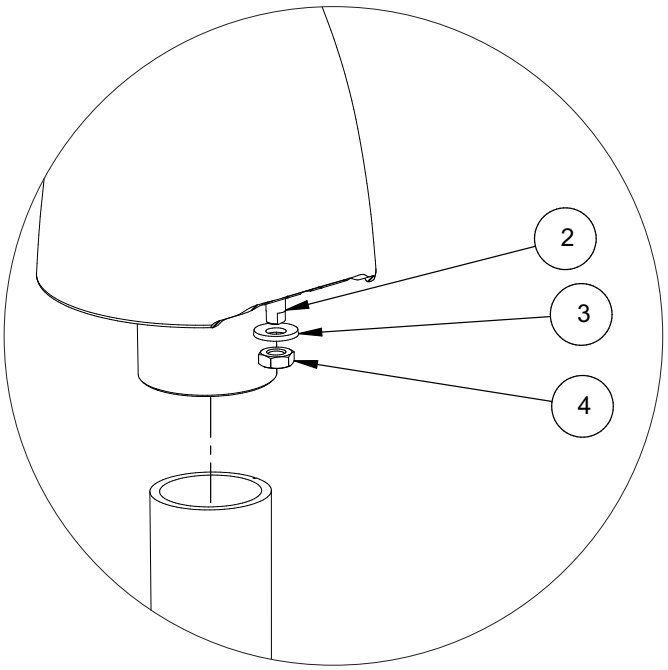


Figure 9.4: Grounding Terminal Assembly

Grounding Cable Installation Procedure

1. Remove the nut (Item 4 in Fig. 9.4) and the safety washer (Item 3 in Fig. 9.4).
2. Place the ring terminal onto the grounding bolt (Item 2 in Fig. 9.4).
3. First place the safety washer (Item 3 in Fig. 9.4) onto the grounding bolt (Item 2 in Fig. 9.4), then screw the M8 nut (Item 4 in Fig. 9.4) onto the thread of the grounding bolt.
4. Tighten the nut (Item 4 in Fig. 9.4) 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. 9.5 and Fig. 9.6).

Antenna Installation without Insulated Lightning Rod System

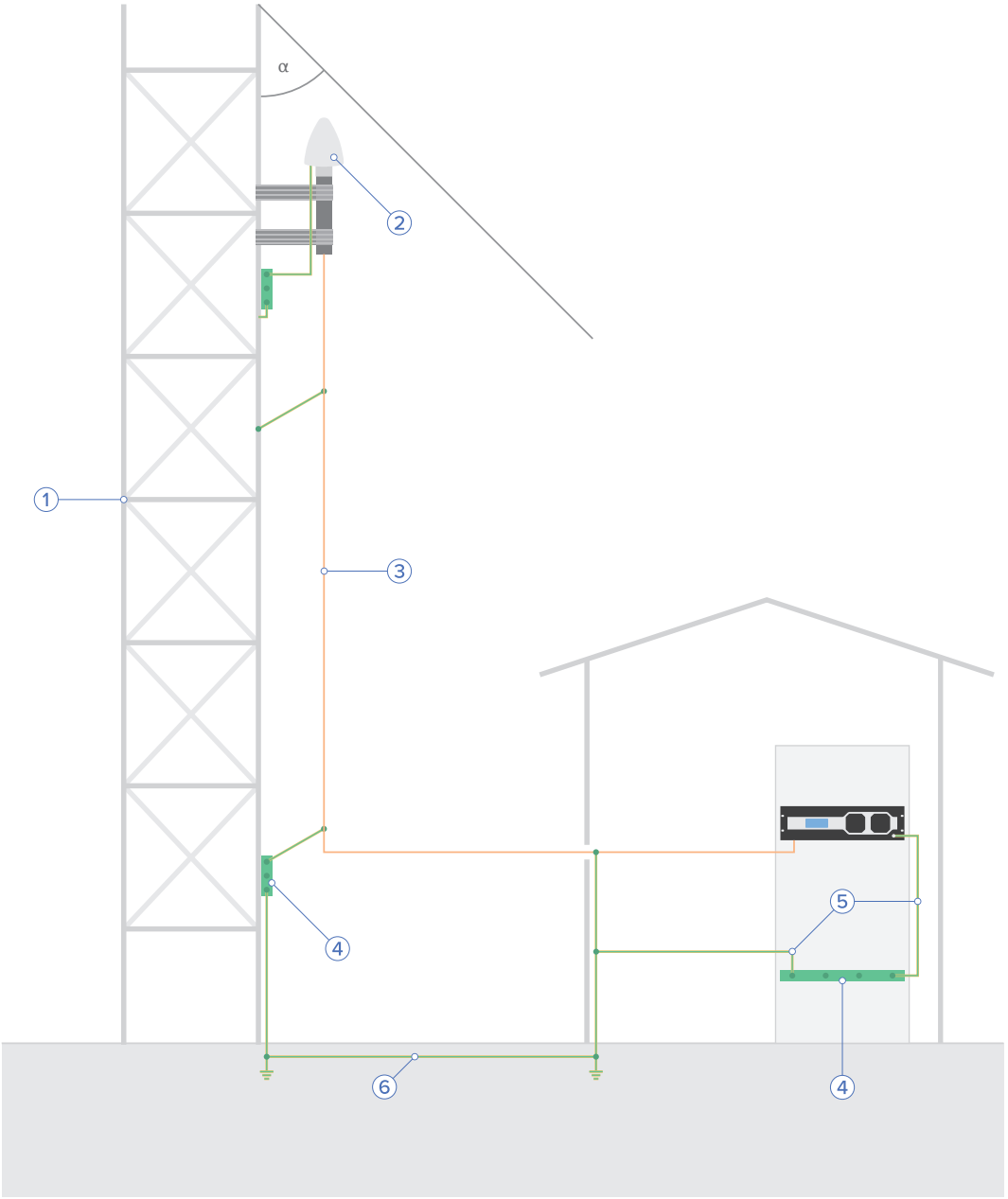


Figure 9.5: Grounding of a Mast-Mounted Antenna

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

Antenna Installation with Insulated Lightning Rod System

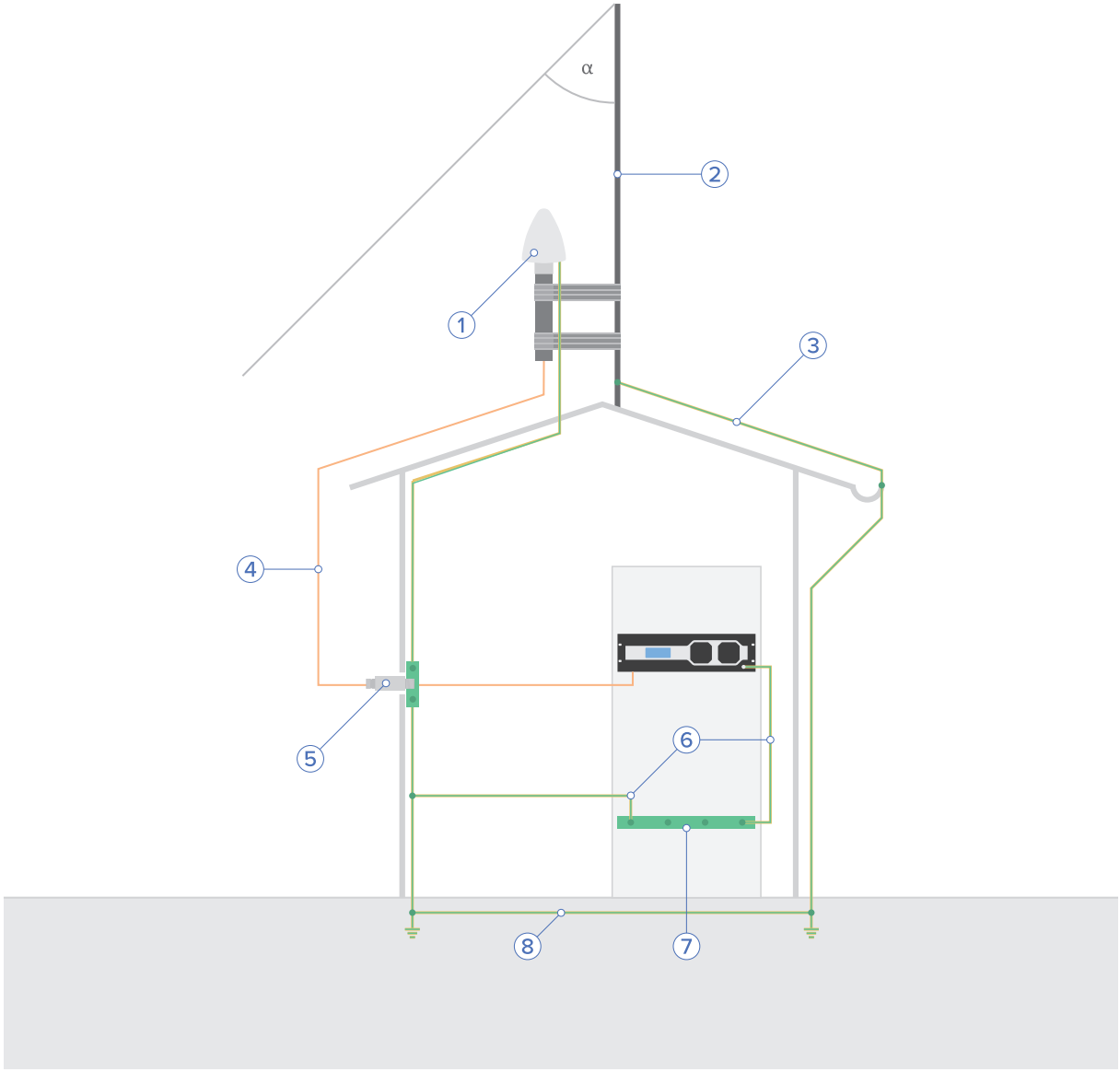


Figure 9.6: Grounding of a Roof or Wall-Mounted Antenna

1 Antenna
2 Lightning Rod
3 Lightning Rod Conductor
4 Antenna Cable
5 Surge Protector
6 Bonding Conductor
7 Bonding Bar
8 Foundation Electrode
α Safety Zone

9.6 In-Line Surge Protection

Information:

The MBG S-PRO surge protector and suitable coaxial cable are not included as standard with a Meinberg antenna, but can be ordered as an optional accessory.

The MBG S-PRO is a surge protector manufactured by Phoenix Contact (Type Designation CN-UB-280DC-BB) that is designed to protect devices connected via coaxial cable. Its use is optional but strongly recommended by Meinberg.

The MBG S-PRO 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, protecting the building from a risk of fire and connected devices from possible surge voltages and likely damage or destruction. The surge protector 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.

Installation and Connection

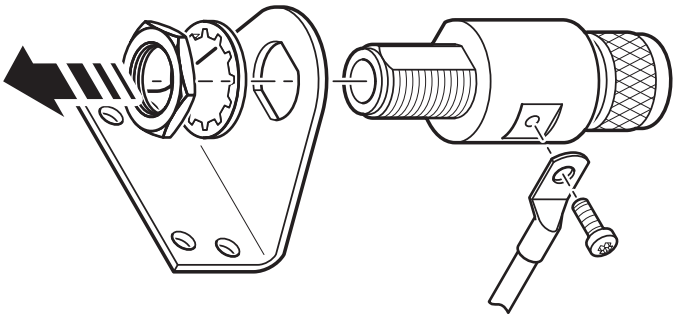


Figure 9.7: Assembly of the MBG S-PRO surge protector

1. Select a location for the installation of the MBG S-PRO. This location must be as close as possible to the point of entry into the building in order to limit the length of unprotected cable exposed to lightning strikes. The route from the ground terminal on the MBG S-PRO to the building's grounding busbar must also be as short as possible.

2. Mount the supplied mounting bracket as shown in Fig. 9.7, then fit the MBG S-PRO to the bracket.

3. 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.

4. 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!

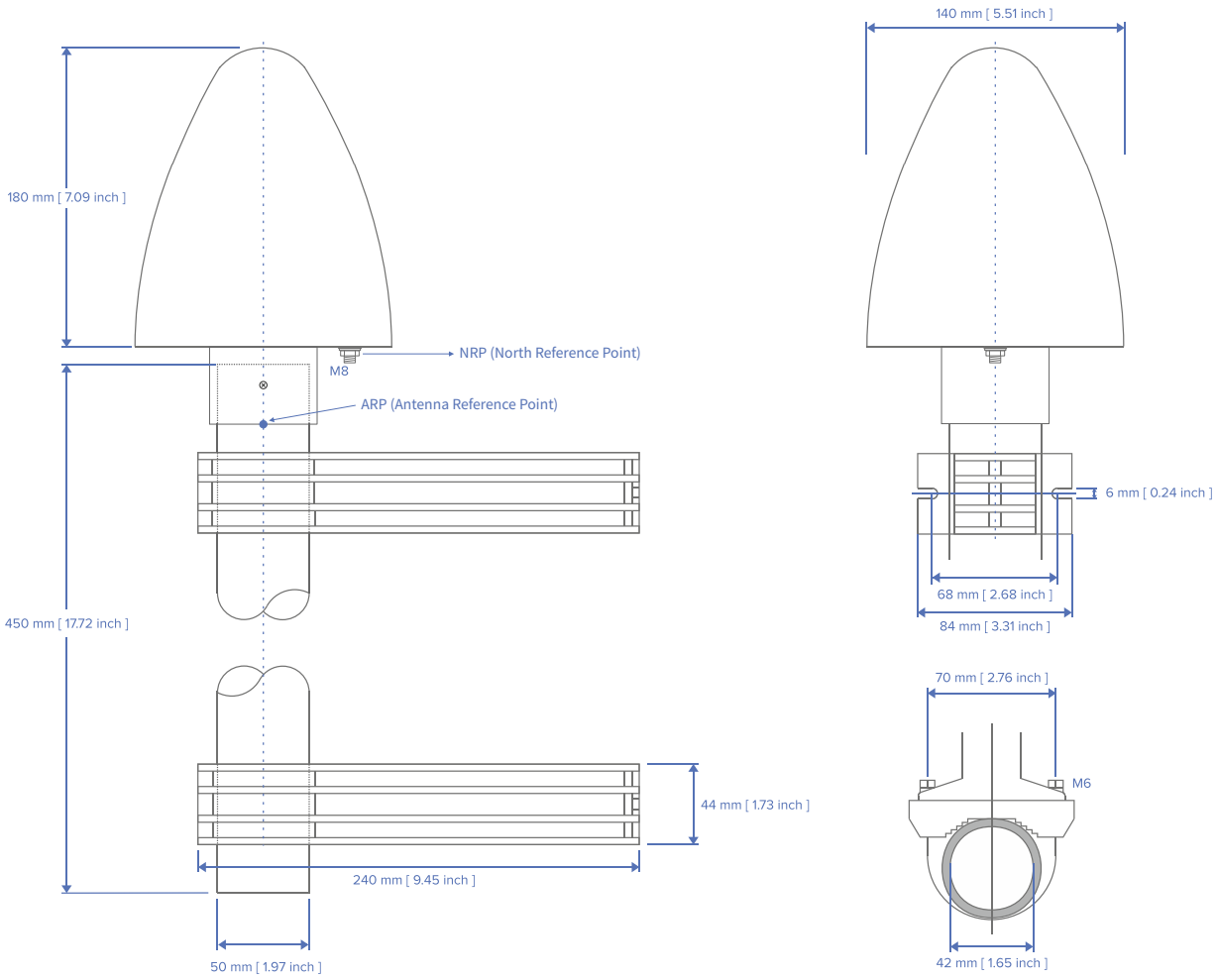
For safety reasons, the antenna cable must not exceed a certain length if there are no other devices such as a power distributor between the surge protector and the downstream electronic device with integrated surge protection at the mains connector level.

Please refer to the document "Technical Specifications: MBG S-PRO Surge Protector" in the appendix detailed technical specifications and a link to the data sheet.

10 Technical Appendix: GNMANTv2 Antenna

10.1 Technical Specifications: GNMANTv2 Antenna

Physical Dimensions



Physical Specifications

Housing:	ABS Plastic for outdoor installation
Weight:	1.4 kg (3.1 lbs), including mounting kit

Connection

Connector Type:	Type-N, female
Impedance (nominal)	50 Ω
Grounding:	M8 threaded bolt and hex nut for use with corresponding ring lug

Electrical Specifications

Input Voltage:	3.6 V ... 5,5 V ⎓, (via antenna cable)
Current draw (nominal)	30 mA @ 5 V
Power Consumption (typ.)	150 mW @ 25 °C

Reception and Signal Properties

Frequency Range:	1160 MHz ... 1255 MHz and 1539 MHz ... 1606 MHz
Max. Base Antenna Input Power: (continuous)	< 18 dBm @ 85°C (185 °F)
Amplification Antenna input to RF output	Lower Band: 35 dB +/- 2 dB Upper Band: 37 dB +/- 2 dB
Polarization	Right-handed, circular (RHCP)
Voltage Standing Wave Ratio (VSWR)	≤ 1.5 : 1 Maximum: 1.8:1
Noise Figure	< 2 dB
P1dB Input	-40 dBm
Antennen Pattern:	Vertical 3 dB aperture angle < 100° Max. horizontal deviation from the ideal circle max. 1 dB

Environmental Conditions

Temperature Range (Operation):	–70 °C to +85 °C (–94 °F to 185 °F)
Temperature Range (Storage):	–70 °C to +95 °C (–94 °F to 203 °F)
Supported Relative Humidity:	Max. 95 % (non-condensing) at 40 °C / 104 °F
IP Rating:	IP65

Supported Frequency Bands

GPS:	L1/L2/L5
GLONASS:	G1/G2/G3
Beidou:	B1/B2/B3
Galileo:	E1/E5a+b plus L-band/E6

Out-of-Band Rejection

Band	**Frequency Range** (in MHz)	**Out-of-Band Rejection**
Lower Band	1160 MHz – 1255 MHz	> 60 dB @ < 960 MHz > 60 dB @ > 1427 MHz
Upper Band	1539 MHz – 1606 MHz	> 60 dB @ < 1463 MHz > 70 dB @ 1710–4700 MHz > 60 dB @ 4701–6000 MHz

10.2 Antenna Compatibility

Referenz-uhren	Meinberg GPS183	Meinberg GNS183	Meinberg GNS183-UC	Meinberg GXL183	andere Meinberg GNSS-Referenzuhren	Referenzuhren von Drittherstellern
Kompatibel	⊗	✓	⊗	✓	!	!

The GNMANTv2 is designed for operation of Meinberg GNS and Multi-GNSS Reference Clocks of the following product lines:

- IMS
- LANTIME
- microSync
- PCI-Slotcards

Please Note that older generations of compatible reference clocks (see exclamation mark) will lock and synchronize on received satellites of the respective satellite system but will be limited in the full range of features of the GNMANTv2 is only supported by the newest compatible reference clocks (see green checkbox) of the generation 183. The compatibility of GNSS reference clocks of other vendors must be evaluated individualy.

Please refer to the following chapters for more information:

- → Chapter 9, “Installation of the Antenna”
- → Chapter 10.1, “Technical Specifications: GNMANTv2 Antenna”

10.3 Antenna Input: GXL Multi-Band Receiver

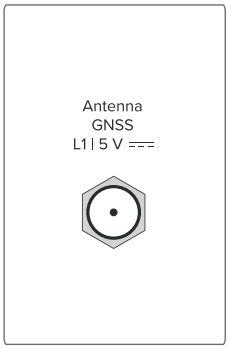
Danger!

Do not work on the antenna system 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 carry out any work on the antenna installation if it is not possible to maintain the prescribed safe distance to exposed lines and electrical substations.

Connector Type: (on device) SMA, Female



Cable Type: Coaxial cable, shielded

Cable Length: Max. 70 m (Belden H155, Speedfoam 240HFJ)
Max. 150 m (H2010 Ultraflex)

Receiver Type: 448-Channel Multi-GNSS Receiver

Antenna Type: GNMANTv2 (recommended), please refer to
→ Chapter 10.2, "Antenna Compatibility"

GNSS Signal Support:

GPS:	L1 C/A (1575.42 MHz) L2C and P(Y) (1227.60 MHz)
Galileo:	E1 OS B/C (1575.42 MHz) E5a (1176.45 MHz) E5b (1207.14 MHz)
BeiDou:	B1I (1561.098 MHz) B2I (1207.14 MHz) B3I (1268.52 MHz)
GLONASS*:	L1OF (1602 MHz + k*562.5 kHz) L2OF (1246 MHz + k*437.5 kHz)

Public SBAS Signal Support: EGNOS, WAAS, GAGAN, MSAS, QZSS L1 C/A (1575.42 MHz)
QZSS L2C (1227.60 MHz)

NMA Support: Fugro AtomiChron® (via Inmarsat, frequency is dependent on beam)[2]

Power Output: 5 V, max. 100 mA (power supply to antenna)

Input Impedance: 50 Ω

1 Satellites in the GLONASS constellation can only be used in conjunction with at least one other constellation. GLONASS-only operation is not supported by the GNMANTv2.

With the L1OF and L2OF FDMA signals, *k* represents the channel number (in the range –7 to 6) within the corresponding GLONASS frequency band.

2 Visit https://fsp.support/beams for more information on what beam will typically be used at your location and the frequency on which the signal is broadcast.

10.4 Antenna Input: GNS Receiver

Danger!

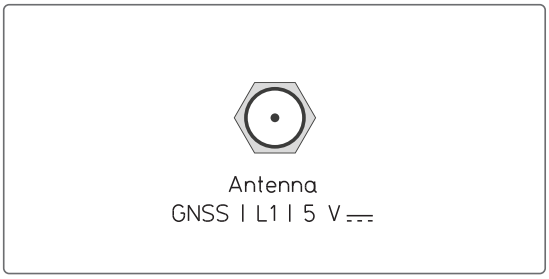
Do not work on the antenna system during thunderstorms!

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 carry out any work on the antenna installation if it is not possible to maintain the prescribed safe distance to exposed lines and electrical substations.

Antenna Type: GNSS Multi Band Antenna

Receiver Type: 72-Channel Receiver
GPS/GLONASS/Galileo/BeiDou



Signal Support:

GPS:	L1 C/A (1575.42 MHz)
Galileo:	E1-B/C (1575.42 MHz)
BeiDou:	B1I (1561.098 MHz)
GLONASS:	L1OF (1602 MHz + *k**562.5 kHz)

where *k* represents the channel number (-7 – 6) within the corresponding GLONASS frequency band

Signal Gain: 40 dB

Antenna Gain: ≥ 3.5 dBic / ≥ 3 dBic

Rated Impedance: 50 Ω

Output Voltage: 5 V, max. 100 mA (power supply to antenna)

Output Current: max. 120 mA

Connector Type: SMA, Female
(on device)

Cable Type: Coaxial Cable, Shielded

Cable Length: max. 70 m with Speedfoam 240HFJ coax cable

10.5 Antenna Input: GNM Reference Clock

Danger!

Do not work on the antenna system 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 carry out any work on the antenna installation if it is not possible to maintain the prescribed safe distance to exposed lines and electrical substations.

Type of Antenna: GNSS Multi Band Antenna

Receiver Type: 184-Channel Receiver
GPS/GLONASS/Galileo/BeiDou

Antenna
GNSS
L1 + L2 | 5 V ⎓

Signal Support:

GPS:	L1 C/A (1575.42 MHz) L2C (1227.60 MHz)
Galileo:	E1-B/C (1575.42 MHz) E5b (1207.140 MHz)
BeiDou:	B1I (1561.098 MHz) B2I (1207.140 MHz)
GLONASS:	L1OF (1602 MHz + k*562.5 kHz) L2OF (1246 MHz + k*437.5 kHz)

where k represents the channel number (in the range -7 to 6) within the corresponding GLONASS frequency band

Signal Gain: 40 dB

Antenna Gain: $\geq$ 3.5 dBic / $\geq$ 3 dBic

DC Voltage: 5 V (power supply to antenna)

DC Current: Max. 100 mA

Rated Impedance: 50 Ohm

Connection Type: SMA Female

Cable: Coaxial Cable, Shielded

Cable Length: Max. 70 m with Belden H155 Coaxial Cable

10.6 Antenna 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 in order 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.

Meinberg GNSS Receiver

The table below shows the specifications of the supported cable types for the transmission of the GPS/-Galileo/GLONASS/Beidou frequency bands by way of example for cables supplied by Meinberg. For cables from sources other than Meinberg, please refer to the data sheet of that cable.

The propagation delay 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. Please note that these values are based on real measurements performed by Meinberg engineers on available cable. When performing your own measurements or calculating propagation delay based on the specifications provided in the data sheet for your cable, the results may vary slightly from this table.

Cable Type	H155	H2010 (Ultraflex)	HFJ240
Signal Propagation Time at 1575 MHz	423 ns/100 m	386 ns/100 m	401 ns/100 m
Attenuation at 1575 MHz	-40.20 dB/100 m	-17.57 dB/100 m	-33.00 dB/100 m
Core DC Resistance	3.24 Ω/100 m	1.24 Ω/100 m	1.05 Ω/100 m
Cable Diameter	5.4 mm	10.2 mm	6.1 mm
Max. Cable Length*	70 m	150 m	70 m
Min. Bend Radius (Fixed Installation)	60 mm	40 mm	61 mm

Figure 10.1: Table: Specifications of cable types for GNS, GNM and GXL clocks recommended by Meinberg **

* Relates to cable routes without inline amplifiers.

* Our GNSS multiband receivers and the GNMANTv2 multiband antenna are supplied with the HFJ240 low-loss Speedfoam coaxial cable.

Compensating for Signal Propagation Delay

LANTIME OS-based Systems

The propagation of the signal from the antenna to the receiver (reference clock) can incur a certain delay. This delay can be compensated for in the LANTIME Web Interface.

To do this, log into the Web Interface of your LANTIME system and proceed as follows:

1. Open the menu "**Clock → State & Configuration**".
2. Select the corresponding clock module.
3. Click on the "Miscellaneous" tab.
4. Select the compensation method and enter the appropriate value.

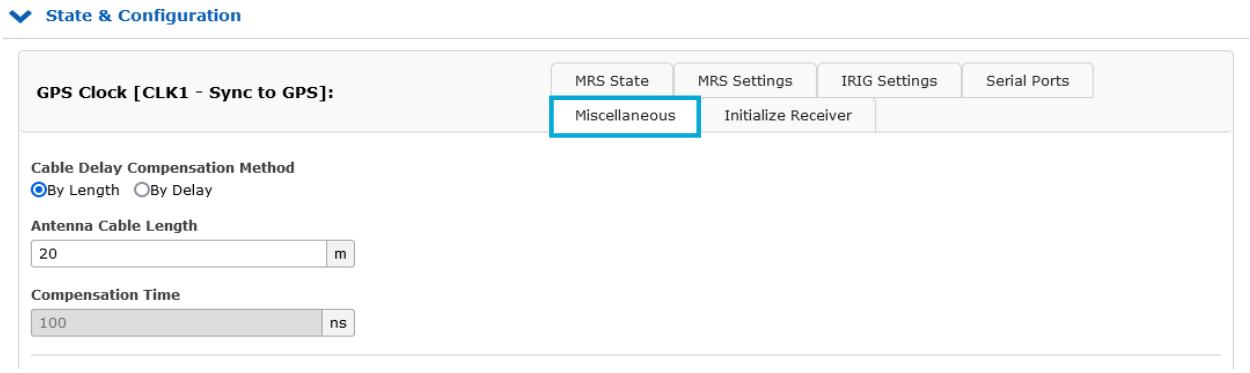


Figure 10.2: "Clock" menu in LANTIME Web Interface

A fixed offset value for the propagation delay can be entered in nanoseconds by selecting "By Delay" as the offset method. This value is calculated either based on the cable specifications provided in the data sheet of your cable or based on your own delay measurements.

A manually calculated signal propagation offset will provide the best accuracy. However, the length of the cable can also be entered in meters by selecting "**By Length**" to provide an automatically estimated offset based on the known specifications of standard RG58 cable.

meinbergOS Systems (microSync)

The runtime delay can be compensated for in the meinbergOS Web Interface by entering the length of the cable used.

To do this, log into the Web Interface of your meinbergOS system and proceed as follows:

1. Open the "**Configuration** → **Clock**" page.
2. Select the "**Receiver**" tab.

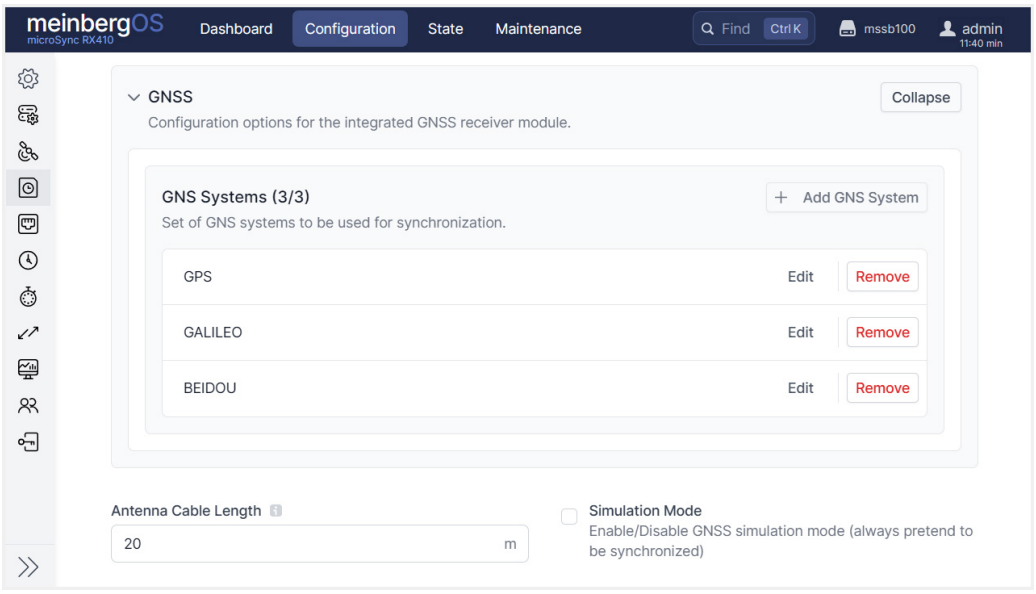


Figure 10.3: "Clock → Configuration" menu in the meinbergOS Web Interface

Meinberg Standalone Receiver (e.g. GPS/DHS)

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

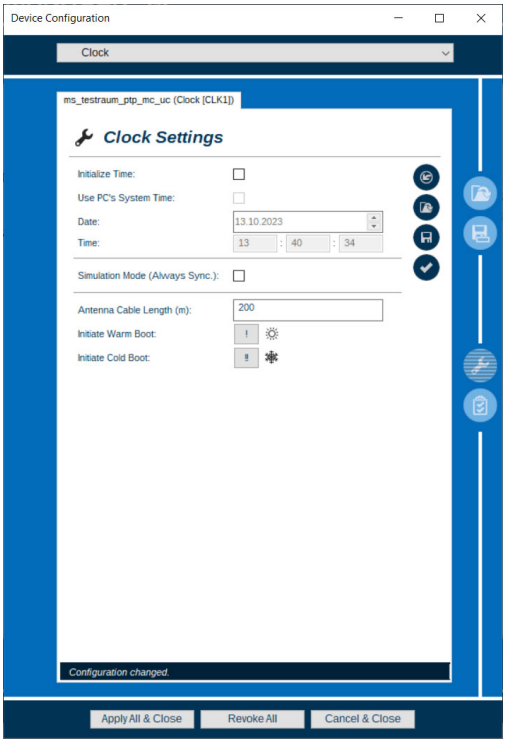


Figure 10.4: "Clock" menu in Meinberg Device Manager

PCI and PCI Express Clocks

The delay can be compensated for PCI and PCIe Clocks in the Meinberg Monitoring Tool "**MbgMon**".

If you are using standard RG58 or RG213 cable, the length of the cable can be simply entered in meters by selecting "**By Length**". This will provide an automatic estimate for the offset based on the known specifications of standard RG58 and RG213 cable.

Launch an up-to-date version of MbgMon and proceed as follows:

1. Open the menu "**Rcvr. Config**"
2. Enter the length of the antenna cable in meters.
3. Confirm your entry by clicking on the "**Save**" button.

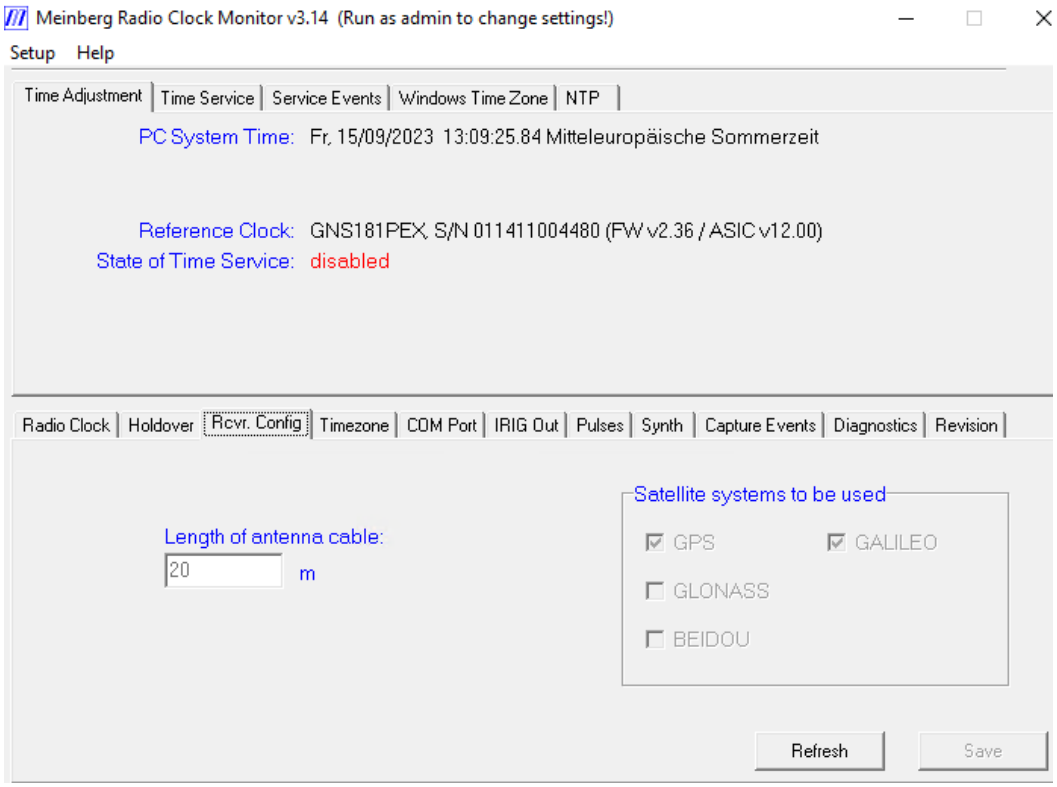


Figure 10.5: "Rcvr. Config" menu in MbgMon

10.7 Technical Specifications: MBG S-PRO Surge Protector

The MBG S-PRO is a surge protector manufactured by Phoenix Contact (Type Designation CN-UB-280DC-BB) and designed to protect 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.

Figure 10.6: MBG S-PRO Surge Protector (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/english/cn-ub-280dc-bb_pc.pdf

11 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.

12 Declaration of Conformity for Operation in the European Union

EU Declaration of Conformity

Doc ID: -August 6, 2025

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*	**GNMANTv2**

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 301 489-19 V2.1.1 (2019-04) ETSI EN 301 489-1 V2.2.3 (2019-11) EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020
Niederspannungsrichtlinie *Low-Voltage Directive* 2014/35/EU	EN IEC 62368-1:2020 + A11:2020
RoHS – Richtlinie *RoHS Directive* 2011/65/EU + 2015/863/EU	EN IEC 63000:2018

Bad Pyrmont, August 6, 2025

Aron Meinberg
Quality Management

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

13 Declaration of Conformity for Operation in the United Kingdom

UK Declaration of Conformity

Doc ID: -August 6, 2025

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

declares that the product

Product Designation	GNMANTv2

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 301 489-19 V2.1.1 (2019-04) ETSI EN 301 489-1 V2.2.3 (2019-11) EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020
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 August 6, 2025

Aron Meinberg
Quality Management

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