The Synchronization Experts.

TECHNICAL REFERENCE

LANTIME

M320/GPS/xGE

Meinberg Funkuhren GmbH & Co. KG

Table of Contents

1 Imprint & Legal Information

Publisher

Meinberg Funkuhren GmbH & Co. KG

Registered Place of Business:
Lange Wand 9
31812 Bad Pyrmont
Germany

Phone:
+ 49 (0) 52 81 – 93 09 - 0

Fax:
+ 49 (0) 52 81 – 93 09 - 230

The company is registered in the "A" Register of Companies & Traders maintained by the Local Court of Hanover (Amtsgericht Hannover) under the number:

17HRA 100322

Executive Management: Heiko Gerstung
Andre Hartmann
Natalie Meinberg
Daniel Boldt

Website: https://www.meinbergglobal.com

Email: info@meinberg.de

Document Publication Information

Revision Date: 2025-01-27

PDF Export Date: 2025-12-03

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 https://www.meinbergglobal.com and https://www.meinberg.support.

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.

Security Risk

Warning boxes such as these indicate security risks that can potentially result in unauthorized persons gaining access to your device via communication interfaces and must therefore be mitigated by suitable network administration or other physical security means. Such risks may be inherent to the nature of the system or the potential result of improper system configuration.

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)*

Read Instruction Manual *(symbol definition ISO 7000-1641)*

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 information 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.

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 Meinberg product.

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 appliance has been brought into the usage area from a cold environment, moisture may develop as a result of condensation; in this case, wait until the appliance 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 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.

This Meinberg product uses hot-pluggable power supply modules that can be replaced while the system is in operation. When removing a hot-pluggable power supply module, the power cable plug must **always** be disconnected beforehand!

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.

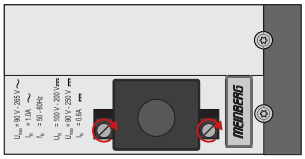
Never connect or disconnect power, data, or signal cables during a thunderstorm! Doing so presents a risk of injury or death, as cables and connectors may conduct very high voltages in the event of a lightning strike!

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

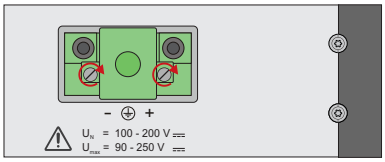


Illustration: Lock screws on an MSTB plug connector; in this case on a LANTIME M320

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.

4.4.1 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.

4.4.2 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.

4.5 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.

4.6 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 (such as installing or removing a power supply module), we recommend making a backup of any stored configuration data (e.g., to a USB flash drive from the Web Interface).

Before performing any maintenance work on or authorized modification to your Meinberg system, we recommend making a backup of any stored configuration data to an external storage medium (e.g., to a USB flash drive via 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.

5.5 Prevention of ESD Damage

An **ESDS device** (electrostatic discharge-sensitive device) is any device at risk of damage or malfunction due to electrostatic discharge (**ESD**) and thus requires special measures to prevent such damage or malfunction. Systems and modules with ESDS components usually bear this symbol.

The following precautionary measures should be taken to protect ESDS components from damage and malfunction.

- Before removing or installing a module, ground your body first (for example, by touching a grounded object) before touching ESDS components.
- Ensure that you wear a grounding strap on your wrist when handling such ESDS components. This strap must in turn be attached to an uncoated, non-conductive metal part of the system.
- Use only tools and equipment that are free of static electricity.
- Ensure that your clothing is suitable for the handling of ESDS components. In particular, do not wear garments that are susceptible to electrostatic discharges (wool, polyester). Ensure that your shoes enable a low-resistance path for electrostatic charges to dissipate to the ground.
- Only touch or hold ESDS components by the edges. Never touch any pins or conductors on the ESDS components.
- When removing or installing ESDS components, avoid coming into contact with persons who are not grounded. Such contact may compromise your connection with the grounding conductor and thus also compromise the ESDS component's protection from any static charges you may be carrying.
- Always store ESDS components in ESD-proof 'antistatic' bags. These bags must not be damaged in any way. Antistatic bags that are crumpled or have holes cannot provide effective protection against electrostatic discharges. Antistatic bags must have a sufficient electrical resistance and must not be made of conductive metals if the ESDS component has a lithium battery fitted on it.

5.6 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 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 Introduction to Your LANTIME Server

Thank you for purchasing your new LANTIME time server.

Meinberg's **LANTIME** M-Series servers rely on proven, robust, and resilient technology to provide an absolute and highly precise NTP time reference in a variety of chassis types, whether for rack installation, DIN rail mounting, or desktop use.

The use of the NTP protocol allows LANTIME servers to be integrated into existing TCP/IP networks without the need to invest in additional network hardware, while maximizing the accuracy potential of this tried and trusted synchronization protocol, which has been a mainstay of computer networks for over 40 years.

If equipped with a receiver for a Stratum 0 time signal and correctly connected to directly receive such a signal, LANTIME servers can operate as Stratum 1 NTP servers, capable of serving extremely accurate time to over 15,000 NTP clients per second with accuracies of just a few milliseconds. LANTIME devices can be equipped with a variety of integrated GNSS receivers for Stratum 0 time reference sources, including the GPS, Galileo, BeiDou, and GLONASS satellite constellations, or long-wave radio signals (DCF77, MSF).

It is also possible to use external NTP servers as a time reference, or for servers to be fitted with special receivers to support other time reference sources such as IRIG timecodes.

LANTIME servers can also be fitted with a variety of custom inputs and outputs. Your LANTIME server is equipped as standard with outputs for pulse-per-second (PPS) and 10 MHz signals, and may also feature a variety of other inputs and outputs, depending on the specifications provided by the purchaser.

LANTIME servers feature a custom Linux-based operating system—the LANTIME Operating System Firmware (LTOS)—that has been specifically developed by Meinberg for timing & synchronization applications. LTOS is regularly updated by Meinberg's software developers with bugfixes, security fixes, and new features. Updates are provided free of charge for the lifetime of your Meinberg server.

The primary user interface of your LANTIME server is the fully-featured Web Interface, which provides a multitude of configuration and monitoring options. It also features eight function keys and an LCD panel for directly performing the most important configuration and monitoring tasks from the device itself, while a connection via SSH, Telnet, or a direct cable connection provides command-line access. Firmware updates can also be uploaded and log files can be downloaded directly via FTP.

This Technical Reference only provides initial guidance on setting up your LANTIME system for use. To achieve optimum results with your LANTIME server, we recommend carefully studying the LTOS Configuration and Management Manual, which is available to download at http://www.mbg.link/doce-fw-ltos.

7 Installation of the GNSS Antenna

7.1 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 12.5, "The Importance of Good Antenna Positioning".

Important!

The specified accuracy levels for your M320/GPS/(xGE)/AD10(-DC20) are specified for clear-sky conditions and can only be guaranteed if the above conditions for the installation of the antenna are met fully.

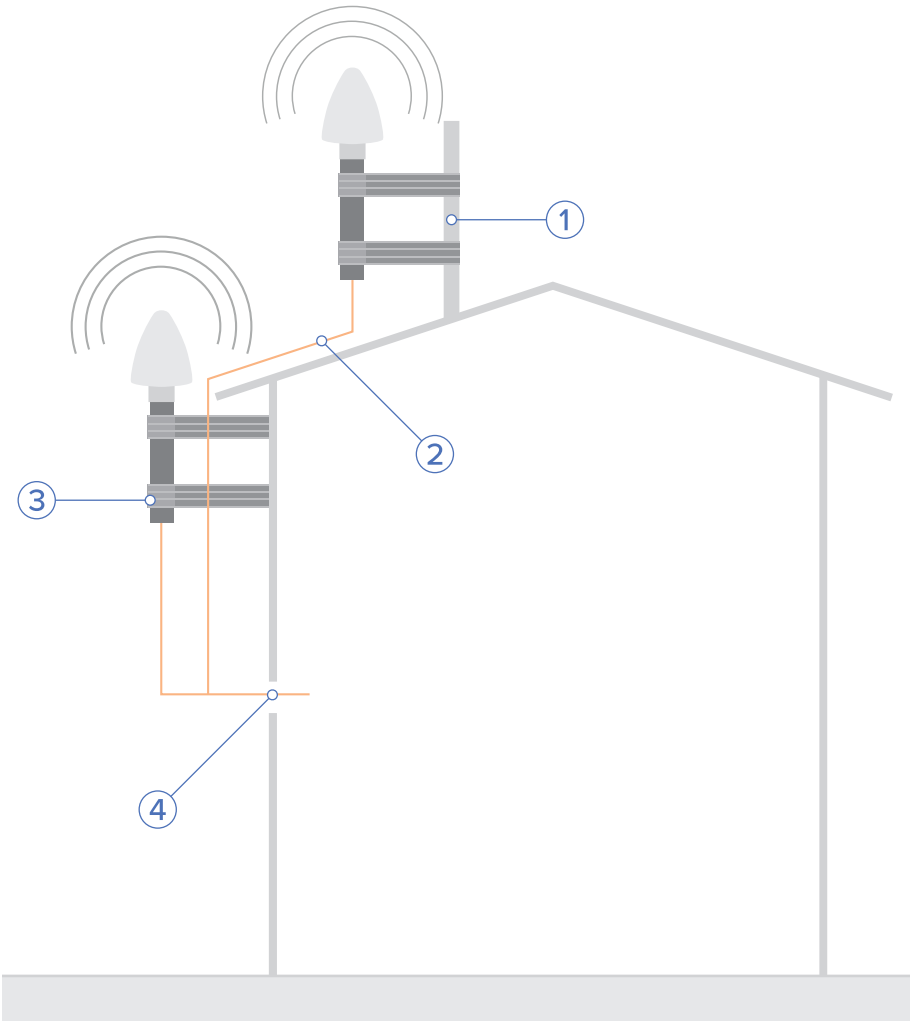


Figure 7.1: Effective Positioning of a GNSS Antenna

1. Mounted on a pole
2. Antenna cable
3. Mounted on a wall
4. Point of entry into building

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. 7.1.

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. 7.1. Mounting accessories are provided with your antenna for this purpose.

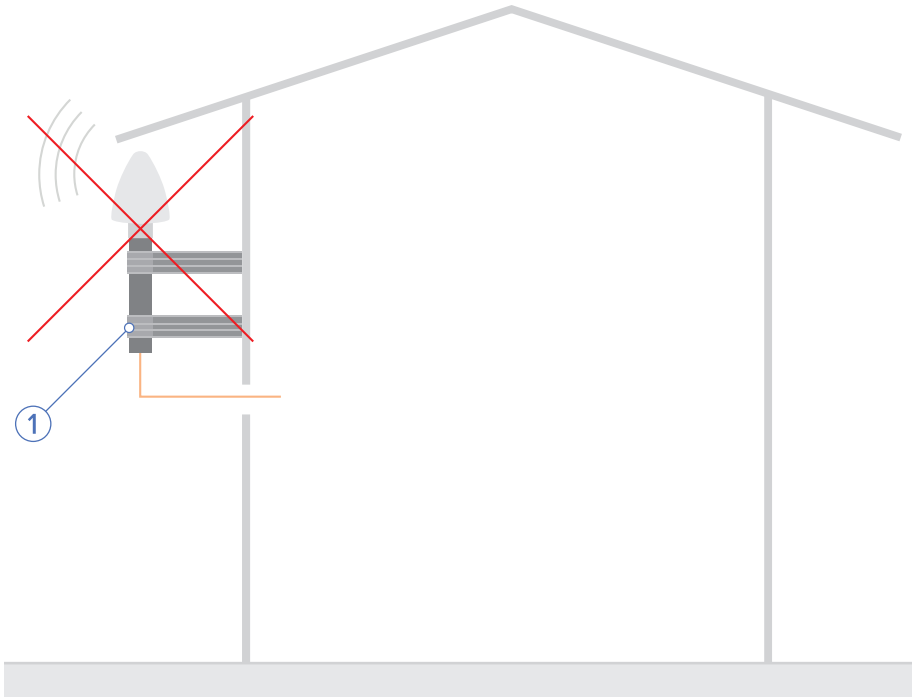


Figure 7.2: Poor Positioning of a GNSS Antenna

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 antenna in Fig. 7.2. 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, but also maximizes the antenna's exposure to signals reflected from the ground and to other spurious transmissions from ground level.

7.2 Laying the Antenna Cable

Your LANTIME M320/GPS/(xGE)/AD10(-DC20) 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 12.3, "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 mast), the antenna cable must be integrated into the grounding infrastructure of the building and also connected to the other metallic objects. Refer to → Chapter 7.5, "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 7.3, "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.

7.3 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

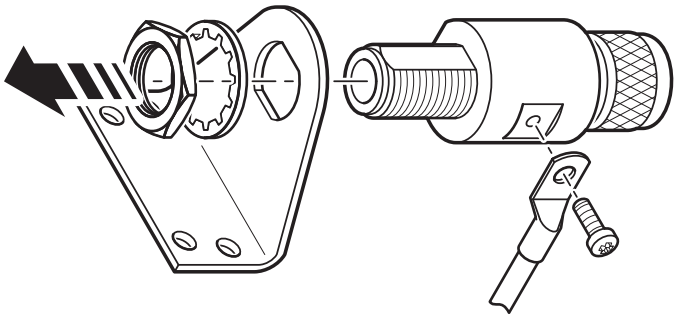


Figure 7.3: Assembly of the MBG S-PRO surge protector

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. 7.3, 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.

Detailed technical specifications and a link to the data sheet are provided in the Appendix under:

➜ Chapter 12.4, “Technical Specifications: MBG S-PRO Surge Protector”

7.4 Mounting the Antenna

7.4.1 Mounting the Antenna onto a Mast

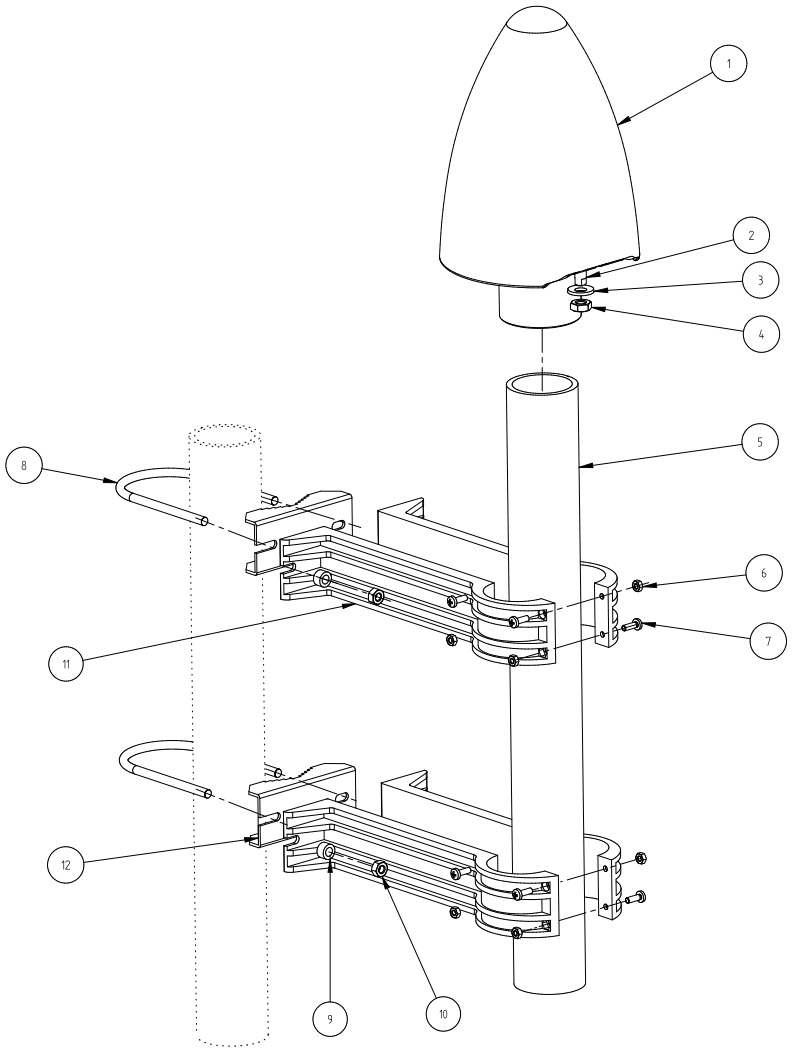


Figure 7.4: Mounting a Meinberg GNSS antenna onto a mast

No.	Description	Quantity	No.	Description	Quantity
1	Antenna	1	7	M4x12 Screw (Phillips Head)	8
2	M8 Grounding Bolt	1	8	Threaded U-Bolt	2
3	Safety Washer	1	9	M6 Spacer	4
4	M8 Hex Nut	1	10	M6 Hex Nut	4
5	Antenna Tube	1	11	Antenna Tube Clamp Half	4
6	M4 Hex Nut	8	12	Mast Bracket	2

The antenna may be mounted onto an existing mast (maximum pole diameter 60 cm / 2.3 inches) using the included accessories, provided that the installation conditions specified in → Chapter 7.1, "Planning the Installation of the Antenna" and → Chapter 12.5 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 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 safe distance from exposed power lines or electrical substations.

Installation of the Antenna on a Mast

Fig. 7.4 illustrates the installation of a Meinberg GNSS antenna on a mast.

1. Insert the antenna tube (Item 5 in Fig. 7.4) into the designated rounded recesses of the two pairs of antenna tube clamp halves (Item 11). Secure the tube inside each of the two clamps using four M4x12 Phillips screws (Item 7) and corresponding M4 hex nuts (Item 6). To ensure that the tube (Item 5) is as secure as possible, the top and bottom M4x12 screws (Item 7) of each tube clamp should be inserted from opposing directions as shown in Fig. 7.4.

2. Place the threaded bolts (Item 8) around the designated mast pole and feed the two prongs into the holes of the mast bracket (Item 12) and tube clamp (Item 11). Secure each of the tube clamps to each of the mast brackets (Item 12) using two M6 spacers (Item 9) and two M6 hex nuts (Item 10) and tighten until the mast bracket and U-bolt are secure.

3. Verify that the tube clamps (Item 11) are securely mounted to the mast, that they exhibit no movement without significant force, and that the tube is securely held by the tube clamps.

4. Feed one end of the antenna cable (Type-N connector, male) through the antenna tube (Item 5) from below and screw it by hand onto the female Type-N connector (Item 1) of the antenna. You may then place the antenna on the top of the mounting tube and push it until it is seated. Insert the fixture screw into the base of the antenna using a suitable screwdriver (Phillips head) to secure the antenna (Item 1) onto the antenna tube (Item 5).

7.4.2 Mounting the Antenna onto a Wall

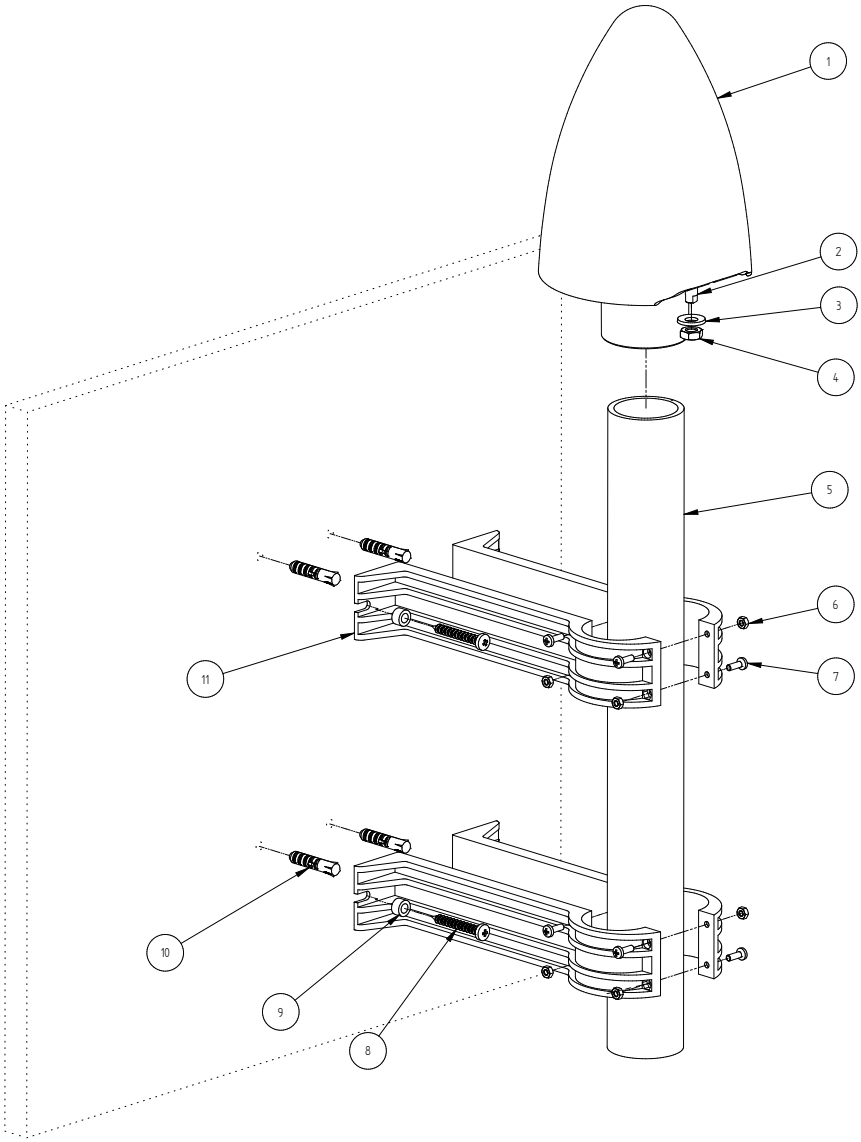


Figure 7.5: Mounting a Meinberg GNSS antenna onto a wall

No.	Description	Quantity	No.	Description	Quantity
1	Antenna	1	7	M4x12 Screw (Phillips Head)	8
2	M8 Grounding Bolt	1	8	M6x45 Screw	4
3	Safety Washer	1	9	M6 Spacer	4
4	M8 Hex Nut	1	10	8 mm Wall Plug	4
5	Antenna Tube	1	11	Antenna Tube Clamp Half	4
6	M4 Hex Nut	8			

The antenna may be mounted directly onto a wall using the included accessories, provided that the installation conditions specified in → Chapter 7.1, "Planning the Installation of the Antenna" and → Chapter 12.5, "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 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 safe distance from exposed power lines or electrical substations.

Installation of the Antenna on a Wall

Fig. 7.5 illustrates the installation of a Meinberg GNSS antenna on a wall.

1. Insert the antenna tube (Item 5 in Fig. 7.5) into the designated rounded recesses of the two pairs of antenna tube clamp halves (Item 11). Secure the tube inside each of the two clamps (Item 11) using four M4x12 Phillips screws (Item 7) and corresponding M4 hex nuts (Item 6). To ensure that the tube (Item 5) is as secure as possible, the top and bottom M4x12 screws (Item 7) of each tube clamp should be inserted from opposing directions as shown in Fig. 7.5.

2. Drill four holes for M6x45 screws (Item 8) in the underlying wall to match the two screw slits on each of the clamps (Item 11). Insert four wallplugs (Item 10) into these holes.

3. Use four M6 spacers (Item 9) and four M6x45 screws (Item 8) to mount the tube clamps (Item 11) onto the wall using the slits on each of the clamps.

4. Verify that the tube clamps (Item 11) are securely mounted to the wall, that they exhibit no movement without significant force, and that the tube (Item 5) is securely held by the tube clamps.

5. Feed one end of the antenna cable (Type-N connector, male) through the antenna tube (Item 5) from below and screw it by hand onto the female Type-N connector (Item 1) of the antenna. You may then place the antenna on the top of the mounting tube and push it until it is seated. Insert the fixture screw into the base of the antenna using a suitable screwdriver (Phillips head) to secure the antenna (Item 1) onto the antenna tube (Item 5).

7.5 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 7.3, "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 mast, 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 hazardous 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 masts
- 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.

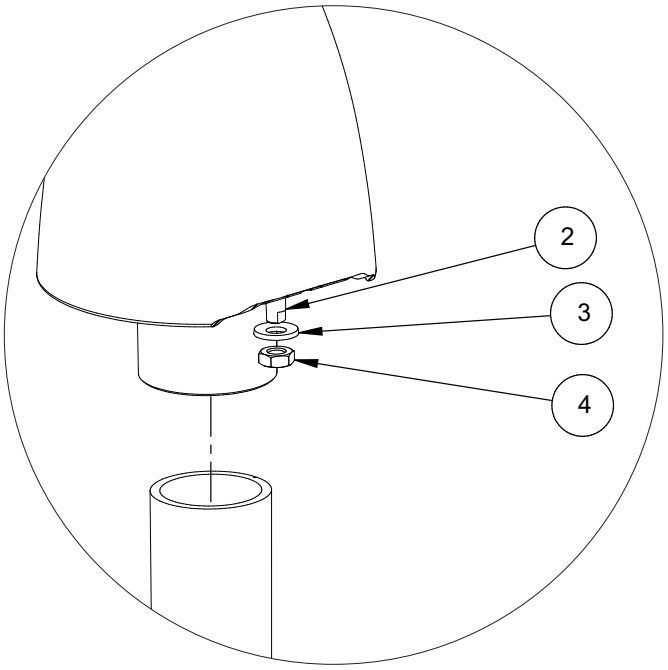


Figure 7.6: Grounding Terminal Assembly

Grounding Cable Installation Procedure

1. Remove the nut (Item 4 in Fig. 7.6) and the safety washer (Item 3).

2. Place the ring terminal onto the grounding bolt (Item 2).

3. First place the safety washer (Item 3) onto the grounding bolt (Item 2), then screw the M8 nut (Item 4) onto the thread of the grounding bolt.

4. Tighten the nut (Item 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. 7.7 and Fig. 7.8).

Antenna Installation without Insulated Lightning Rod System

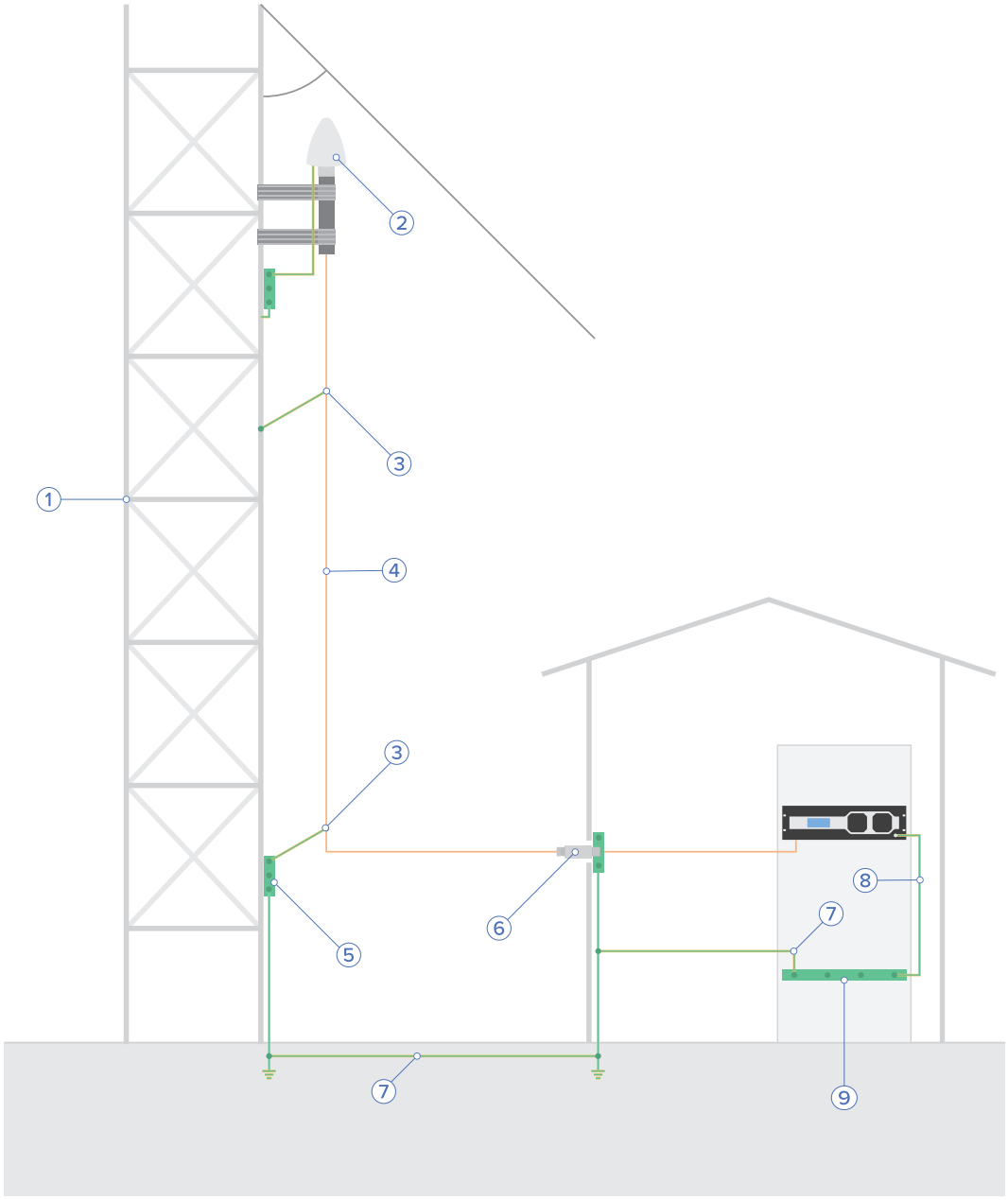


Figure 7.7: Grounding of a Mast-Mounted Antenna

1 Antenna Mast
2 Antenna
3 Shield Clamp
4 Antenna Cable
5 Bonding Bar
6 MBG S-PRO Surge Protector
7 Bonding Cable
8 Device Grounding Terminal
9 Main Ground Rail
α Safety Zone

Antenna Installation with Insulated Lightning Rod System

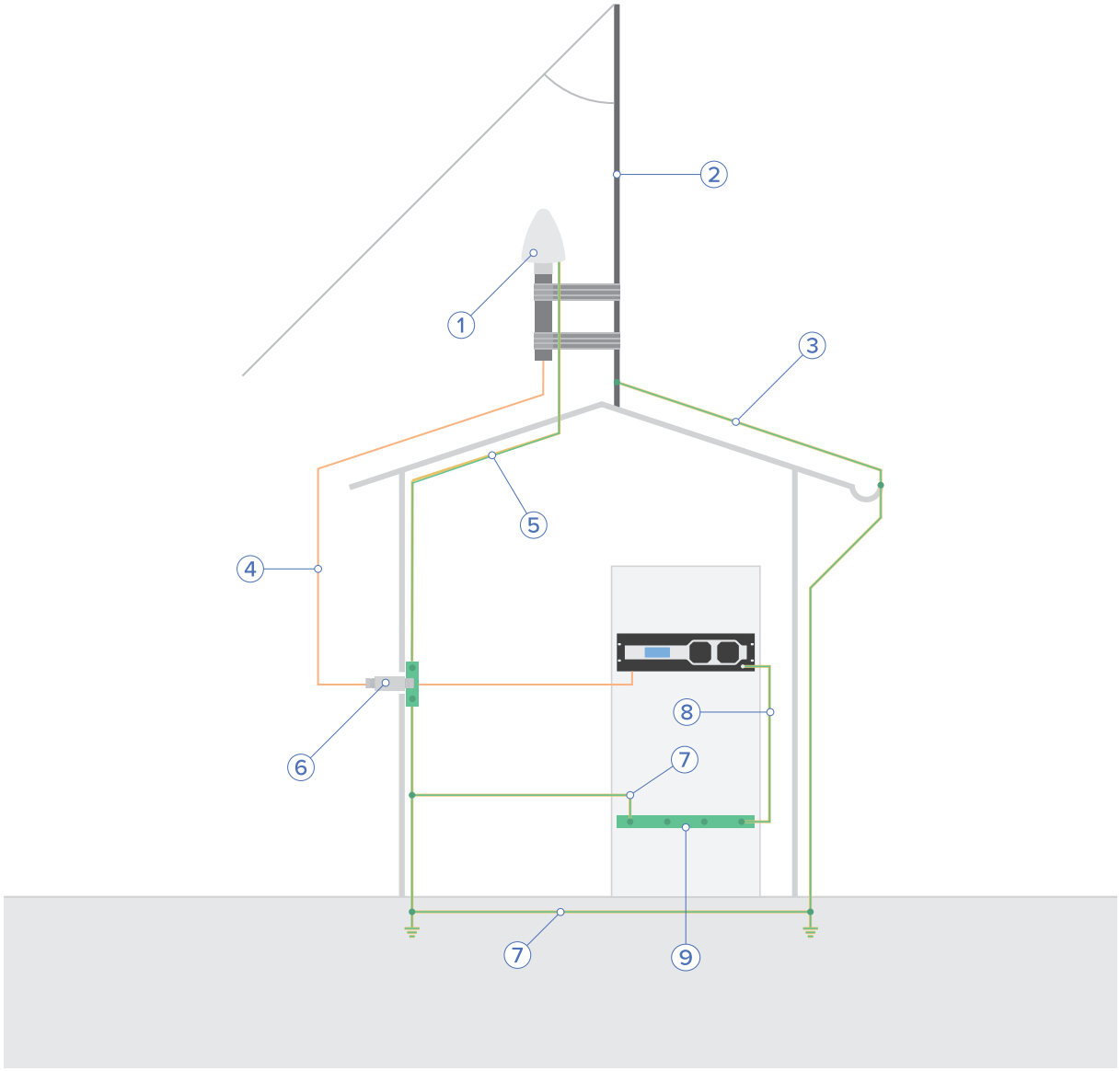


Figure 7.8: Grounding of a Roof or Wall-Mounted Antenna

1 Antenna
2 Lightning Rod
3 Lightning Rod Conductor
4 Antenna Cable
5 Antenna Grounding Terminal
6 MBG S-PRO Surge Protector
7 Bonding Cable
8 Device Grounding Terminal
9 Main Ground Rail
α Safety Zone

8 Connecting Your LANTIME System

Important!

- Please ensure that you have read and understood the safety information at the start of this manual before you connect your LANTIME system, and that you perform the procedure in the order listed here.
- This chapter assumes that you already have the requisite antenna infrastructure installed for your LANTIME system. If your LANTIME system has been shipped with a DC power supply, it also assumes that the requisite power cable has been assembled for the MSTB connector by a qualified electrician.

You will need a **slotted screwdriver** (blade width 3 mm) and a **grounding cable with a ring terminal** on hand to perform the connection procedure properly.

Procedure

1. Connect the BNC connector from your antenna or signal distributor to the antenna input of your LANTIME system. Twist the male connector in a clockwise direction to lock it into place.
2. Use an RJ45 network cable to connect the LANTIME system to the relevant router or switch via which the server is to be accessible for management access and NTP traffic.
3. Insert the MSTB plug of your power cable into the corresponding connector of your LANTIME system. Tighten the two lock screws of the plug using the slotted screwdriver mentioned above and test the plug to ensure that it is secure. If your LANTIME system is equipped with a redundant power supply module, you may also connect a second MSTB power cable to it.
4. While the power cable of the LANTIME system provides the primary connection to ground for the system, the chassis itself can also optionally be wired to a grounding busbar to further enhance device safety. If possible, connect the grounding terminal on the housing of your LANTIME system with the grounding busbar of your building using a grounding cable with a ring terminal.

   The grounding screw (M4 x 8 Torx TX20, non-countersunk with flanged head), washer, and serrated lock washer necessary for mounting the grounding cable are pre-mounted on the grounding terminal of the chassis. A grounding cable is not provided with the device and must be provided by the operator. Refer to → Chapter 12.1, "Technical Specifications: LANTIME System" for more information on the grounding terminal.

   Please ensure that your grounding cable has a thickness of 4 mm^2 – 6 mm^2 and that the cable is properly crimped!
5. Connect any signal input/output cables in accordance with the specifications provided in → Chapter 11, "LANTIME M320 Rear Connectors".
6. Connect the other end of the power cable (or power cables if using redundant power supplies) to your power source(s). If necessary, switch your power source(s) on. Assuming that your power source(s) are active, the green "**Power**" LED(s) for the relevant power supply module(s) should light up and the front panel display should show "`Starting up ...please wait`" before it indicates the progress of its startup process.

9 Configuring Your LANTIME System for Your Network

IPv4 Network Configuration

1. Press the **F2** button **twice** on the front panel to open the setup menu of your LANTIME system.
2. Press the **OK** button to select "**Interfaces**".
3. You will be prompted to select the network interface. Select the appropriate interface and press **OK** to confirm.
4. You will be prompted to select whether you wish to configure your LANTIME system for your network using IPv4 addressing or IPv6 addressing. Select **IPv4** using the arrow keys and press the **OK** button to confirm.
5. DHCP is "*enabled*" by default, which means that with an active DHCP server in the network, your LANTIME system will automatically be assigned an IP address. If you wish to use DHCP, Steps 6–8 below may be skipped.

   If you wish to disable DHCP in order to assign a fixed IP address, select the corresponding option "**DHCP**" and select "*disabled*" using the up/down arrow keys.
6. To configure the device address, use the arrow keys to navigate to the **ADDR** option and press the **OK** button. You will then be prompted to enter the intended IPv4 address of your LANTIME system. Use the up and down arrow keys to change the value of each digit, and the left and right arrow keys to navigate between the digits. For octets of less than 100, please leave trailing zeros; it is not possible to enter spaces.
7. To configure the subnet mask, use the arrow keys to navigate to the **NETM** option and press the **OK** button. You will then be prompted to enter the subnet mask. Use the up and down arrow keys to change the value of each digit, and the left and right arrow keys to navigate between the digits. As above, please leave trailing zeros for octets of less than 100.
8. If you wish to configure a gateway, use the arrow keys to navigate to the **GW** option and press the **OK** button. You will then be prompted to enter the gateway address. Use the up and down arrow keys to change the value of each digit, and the left and right arrow keys to navigate between the digits. As above, please leave trailing zeros for octets of less than 100.
9. If you are satisfied with the changes that you have made, press the **F2** button to save them. The new network configuration will take effect immediately; there is no need to restart the LANTIME system.

IPv6 Network Configuration

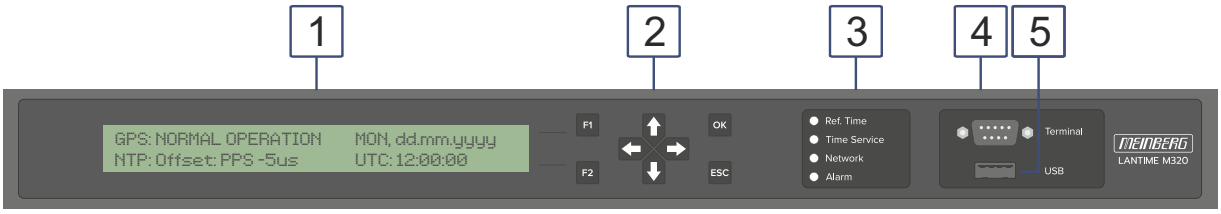
1. Press the **F2** button **twice** on the front panel to open the setup menu of your LANTIME system.
2. Press the **OK** button to select "**Interfaces**".
3. You will be prompted to select the network interface. Select the appropriate interface and press **OK** to confirm.
4. You will be prompted to select whether you wish to configure your LANTIME system for your network using IPv4 addressing or IPv6 addressing. Select **IPv6** using the arrow keys and press the **OK** button to confirm.
5. To configure a link local or global address, use the arrow keys to navigate to the "**Link Local**" or one of the two global addresses "**glob.Addr 1**" or "**glob.Addr 2**" option and press the **OK** button to confirm. You will then be prompted to enter the intended IPv6 address of your LANTIME system. Use the up and down arrow keys to change the value of each digit, and the left and right arrow keys to navigate between the digits. Please note that colons are not entered automatically and must also be entered manually.
6. If you are satisfied with the changes that you have made, press the **F2** button to save them. The new network configuration will take effect immediately; there is no need to restart the LANTIME system.

Other Network Considerations

- Please note that UDP port 123 must be left open in your network to allow NTP traffic. This is a standard port that most routers and switches will have open by default, but if your network has a strict whitelisting policy, you may need to configure this manually.
- While the NTP protocol is designed to deal with a certain amount of network jitter, you should configure your managed switch (and any routers) to prioritize NTP traffic via QoS settings if it does not already do so. This will optimize your LANTIME system's performance by keeping latency between the NTP servers and clients consistent.

For further information regarding the network connectivity and network monitoring functions of your LANTIME system, please refer to the **LTOS Configuration and Management Manual**, which is available to download from http://www.mbg.link/doce-fw-ltos.

10 LANTIME M320 Front Panel

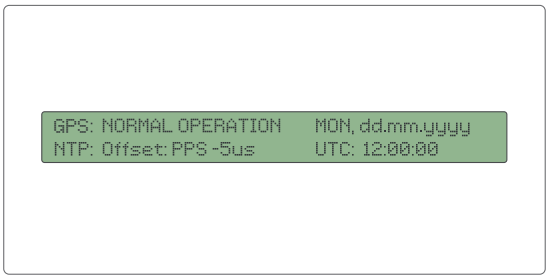


Information:

The numbering in the drawing above relates to the corresponding subsection in this chapter.

10.1 LCD Panel

The main menu is displayed after the device has booted and provides the most important status information at a glance. The top line of the display shows the operating mode of the reference clock / reference time and will normally read "GPS: NORMAL OPERATION".



On occasion, the receiver operating mode line may show other states:

GPS: COLD BOOT

This message will appear when the system has just been booted and must acquire all of the satellites required from scratch in order to determine its position. The appearance of this message is entirely normal when the system is started for the first time or is started after having been relocated to a place far away from where it was last operated.

Please note that synchronization can take a long time to complete from Cold Boot mode.

If this message appears repeatedly each time the LANTIME system is booted from the same geographical location, the internal CR2032 battery of your device's receiver may need to be replaced.

Refer to → Chapter 5.4, "Maintenance and Modifications" for more information.

GPS: WARM BOOT

This message will appear when the system has just been booted and must re-acquire the satellites based on the ephemeris data that it has in memory from when it was last in operation. Synchronization should be achieved relatively quickly.

GPS: ANTENNA FAULTY

This message will appear if the LANTIME detects that the antenna connection is disrupted for any reason. The antenna cable and the antenna itself should be inspected.

10.2 Keypad

Security Risk

The keypad of the M320/GPS/(xGE)/AD10(-DC20) is **enabled** by default.

The keypad, in combination with the front-panel display, can be used **without prior user authentication** to perform the following actions:

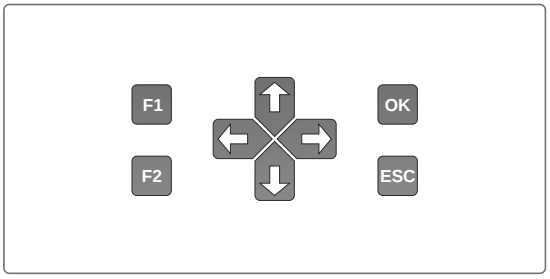
- initiate a restart of the integrated reference clock,
- modify the configuration of the signal outputs,
- initiate a restart of the internal NTP service,
- modify the NTP servers used as time references,
- modify the network configuration,
- perform a system shutdown or reboot,
- perform a factory reset.

Accordingly, Meinberg strongly recommends:

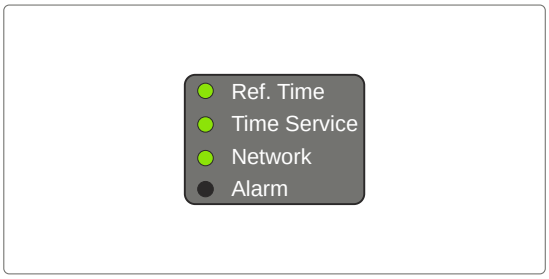
- enforcing restrictions on physical access to the system to ensure that the device cannot be accessed by unauthorized users via the front panel, and/or,
- disabling front panel access via the LTOS Web Interface ("**Security**" → "**Front Panel**").

The four arrow buttons and the "**OK**", "**ESC**", "**F1**", and "**F2**" buttons on the keypad can be used to navigate through each menu in the display.

The "**ESC**" button returns you to the previous menu; you can return to the main menu accordingly by pressing the "**ESC**" button several times, depending on the current location in the navigation tree.



10.3 Status LEDs



“Ref. Time”

Green: The reference clock (i.e., the integrated GPS receiver) is providing a valid reference time.

Red: The reference clock is not providing a valid reference time.

“Time Service”

Green: NTP is synchronized with the reference clock (e.g., GPS)

Red: NTP is not synchronized or has switched to the “local clock”.

“Network”

Green: All monitored network interfaces are connected and functional (link state is “up”).

Red: There is a problem with at least one of the monitored network interfaces.

“Alarm”

Off: No error

Red: General error

10.4 Serial Terminal Interface

Security Risk

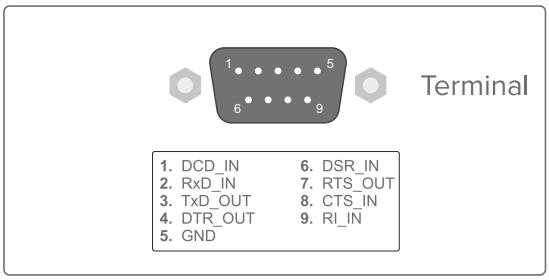
The serial terminal interface of the M320/GPS/(xGE)/AD10(-DC20) is **enabled** by default.

The serial terminal interface can be used, **following prior authentication using a super-user account**, to gain comprehensive access to the operating system.

Accordingly, Meinberg strongly recommends enforcing restrictions on physical access to the system to ensure that the device cannot be accessed by unauthorized users via a serial terminal connection.

It is also possible to disable serial terminal access as appropriate via the LTOS Web Interface ("**Security**" → "**Front Panel**").

The 9-pin D-Sub RS-232 connector on the front panel allows a serial terminal connection to be established between the M320/GPS/(xGE)/AD10(-DC20) and a PC using a suitable null-modem cable. This connection can be used to modify the device's configuration parameters or review data via the command-line interface.



The terminal software on the PC should be configured to communicate at 38400 baud, 8 data bits, no parity and 1 stop bit (8N1). Once connected to the time server, the login message will be displayed, where you should enter your user credentials. The following credentials are set up by default:

Default Username: `root`

Default Password: `timeserver`

10.5 USB Interface

Security Risk

The USB port itself is enabled by default.

The USB port is exclusively intended for the connection of a storage medium.

The system can be configured in such a way that, when a storage medium is connected to the USB port, it is possible **without prior user authentication** to replace the operating system configuration and install a new firmware version.

The ability to replace the operating system configuration and firmware version by inserting a prepared USB storage medium is disabled by default.

Other USB device classes such as input devices or A/V devices are detected by the system, but cannot be used to perform any input or output functionality without prior user authentication.

Accordingly, Meinberg strongly recommends:

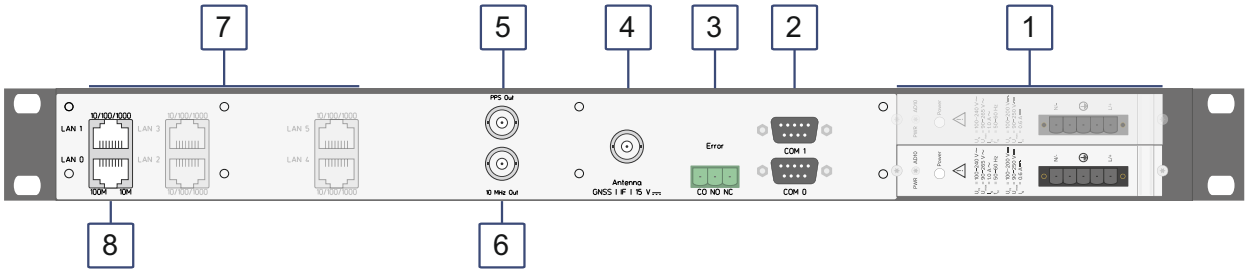
- enforcing restrictions on physical access to the system to ensure that the device cannot be accessed by unauthorized users via connection of a USB storage medium, and/or,
- disabling USB support as appropriate via the LTOS Web Interface (“**Security**” → “**Front Panel**”).

All LANTIME M-Series devices have a USB interface that allow a USB storage medium such as a USB flash drive to be connected.

USB storage media can be used for the following tasks:

- locking the keys on the LCD panel to prevent unauthorized access
- backing up/restoring the LANTIME configuration
- transferring configurations between individual LANTIME systems
- copying log files

11 LANTIME M320 Rear Connectors



Information:

The numbering in the drawing above relates to the relevant subsection in this chapter.

The drawing shows the inputs, outputs, and power supply as well as the configuration options of a **LANTIME M320/GPS/(xGE)/AD10(-DC20)**.

The x in the descriptor **xGE** of the product designation represents the number of Gigabit Ethernet interfaces.

The following options are possible:

Network

(1GE)	1x additional Gbit network interface - LAN 1
(3GE)	3x additional Gbit network interfaces - LAN 1 to LAN 3
(5GE)	5x additional Gbit network interfaces - LAN 1 to LAN 5

Power Supply

(AD10)	1x AC/DC power supply
	U_{max} = 90 V – 265 V ~
	90 V – 250 V ⎓
(DC20)	1x power supply
	U_{max} = 20 V – 60 V ⎓

Redundant Power Supply Configurations:

(AD10-AD10)	2x AC/DC power supply
(DC20-DC20)	2x DC power supply
(AD10-DC20)	1x AC/DC power supply + 1x DC power supply

11.1 AC/DC Power Connector

Danger!

This equipment is operated at a hazardous voltage.

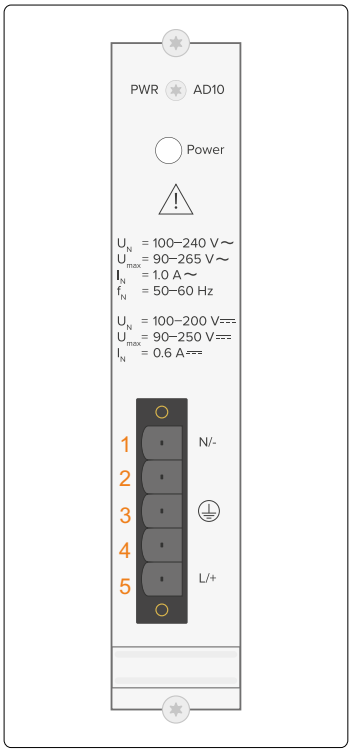
Danger of death from electric shock!

- This device must be connected by skilled personnel or instructed personnel 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!
- Always ensure that wiring is safe!
- The device must be grounded by means of a connection with a correctly installed protective earth conductor (PE).

AC/DC Power Supply Module Technical Specifications

Connector Type: (on device) MSTB 5-Pin, Male with lock screws

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



Input Specifications

Nominal Voltage Range:	U_N	=	100 V – 240 V ~ 100 V – 200 V ⎓
Rated Voltage Range:	U_{max}	=	90 V – 265 V ~ 90 V – 250 V ⎓
Nominal Current:	I_N	=	1.0 A ~ 0.6 A ⎓
Nominal Frequency Range:	f_N	=	50 Hz – 60 Hz
Rated Frequency Range:	f_{max}	=	47 Hz – 63 Hz

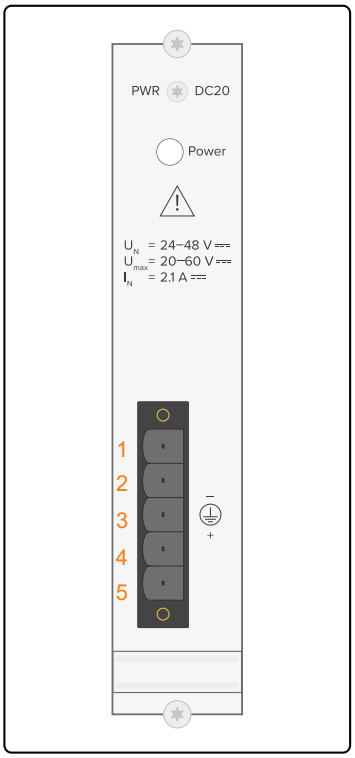
Output Specifications

Max. Power:	P_{max}	=	50 W
Max. Heat Output:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

DC Power Supply Module Technical Specifications

Connector Type:
(on device)
MSTB 5-Pin, Male
with lock screws

Pin Assignment:
1: Not Connected
2: V_{IN} -
3: PE (Protective Earth)
4: V_{IN} +
5: Not Connected



Input Specifications

Nominal Voltage Range:	U_N	=	24 V – 48 V ⎓
Rated Voltage Range:	U_{max}	=	20 V – 60 V ⎓
Nominal Current:	I_N	=	2.10 A ⎓

Output Specifications

Max. Power:	P_{max}	=	50 W
Max. Heat Output:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

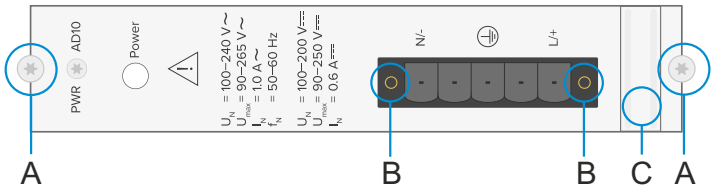
Replacing a Hot-Pluggable Power Supply Module

Information:

It is possible to remove or install a power supply module (e.g., due to a fault) while maintaining operation if the system is operated with redundant power supplies.

Tools Required

- Slotted Screwdriver: 0.4 mm Tip Thickness, 2.5 mm Tip Width
- Torx Screwdriver: TR8x60



1. Cut off the power supply to the module by pulling the mains plug of the power supply cable out of the mains socket.

2. Remove the 5-pin MSTB plug from the power supply module after loosening the two screws (B) using the slotted screwdriver.

Important!

Screw Torque Value (A)

When tightening the Torx screws (A) to fix the newly installed power supply module in place, please do not exceed the specified torque of 0.6 Nm.

3. Use the Torx screwdriver (TR8) to remove the two Torx screws (A) of the power supply unit to be replaced.

4. The detached power supply module can now be pulled out by the handle (C).

5. Insert the new power supply into the free slot and secure it using the two Torx fastening screws (A) that were used to secure the old power supply unit.

6. Connect the 5-pin MSTB connector of the power cable to the power supply and retighten the two slotted-head screws (B).

7. The power cable can now be reconnected to the power supply.

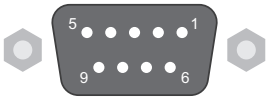
8. The status LED of the new power supply should now light up and an “OK” status should be displayed in the Web Interface.

Checking the Status of the Power Supply Unit

The status of the power supply units can be viewed in the Web Interface under “**System**” → “**Redundant Power Supply**”. This status is dependent on the system, i.e., the status displayed in the Web Interface will reflect whether one or two power supply units are installed.

11.2 COMx Time String: RS-232

Connector Type: D-Sub 9-pin, Female
(on device)



COM x

Data Transfer Mode: Serial I/O

RS-232 Baud Rates: 19200 *(Default)*, 9600, 4800, 2400, 1200, 600, 300

Framing: 7N2, 7E1, 7E2, 8N1 *(Default)*, 8N2, 8E1, 7O1, 7O2, 8O1, 8E2

Time String Formats: Meinberg Standard *(Default)*
(Output) Meinberg Capture
Meinberg GPS

A complete list of supported time string formats is provided in
➜ Chapter 12.7, "Time String Formats".

Pin Assignment:
Pin 2: RS-232 TxD *(Transmit)*
Pin 3: RS-232 RxD *(Receive)*
Pin 5: GND *(Ground)*

Cable Type: Standard RS-232 Cable (Shielded)

Information:

Please note that the pin assignment of the device receiving the time string output will dictate whether you require a "straight-through" or a null-modem cable to connect your system to a time string receiver. A null-modem cable has Pins 2 and 3 'crossed over', so that Pin 2 at one end leads to Pin 3 at the other, and vice versa.

If Pins 2 and 3 have identical assignments on both devices, you will require a null-modem cable. If they are opposite to one another, you will require a "straight-through" cable. Either way, it is important that the transmitter pin (TxD) of each device is connected to the receiver pin (RxD) of the other device.

11.3 Error Relay

Danger!

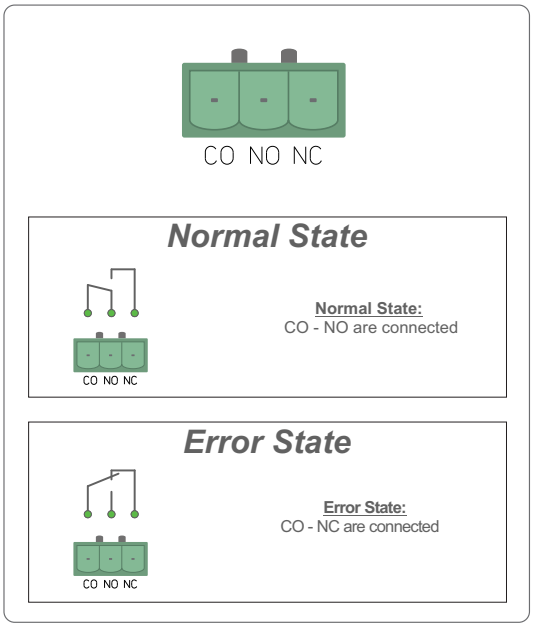
This equipment is operated at a hazardous voltage.

Danger of death from electric shock!

- **Never** handle exposed terminals or plugs while the power is on.
- When handling the connectors of the error relay cable, always disconnect **both ends** of the cable from their respective devices!
- Hazardous voltages may be passing through the terminal of the fault signal relay! **Never** handle the error relay terminal while the signal voltage is present!

The device features a 3-pin relay output labeled with "**Error**". This 0 V ("dry") relay output is connected directly to the reference clock (GPS, GNS, GNS-UC, etc.) Normally, when the reference clock has been synchronized to its source, this relay will switch to "NO" (Normally Open) mode. However, if there is a poor antenna signal or the device has been switched off, the relay will fall back to "NC" (Normally Closed) mode.

This relay can also be switched to a "NO" (normally open) state using messages, providing a variety of switch states at this output.



Technical Specifications

Connector Type: (on device)	MSTB 3-Pin, Male with lock screws	
Max. Switching Voltage:	125 V ⎓ 140 V ~	
Max. Switching Current:	1 A	
Max. Switching Load:	DC AC	30 W 60 VA
UL/CSA Switching Load:	0.46 A 0.46 A 1 A	140 V ~ 65 V ⎓ 30 V ⎓
Response Time:	Approx. 2 ms	

11.4 Antenna Input: GPS Receiver

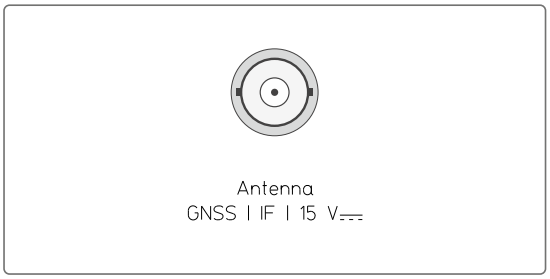
Danger!

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 safe distance from exposed power lines or electrical substations.

Connector Type: (on device)	BNC, Female
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]
Voltage Draw of Antenna:	15 V (via antenna cable)
Power Consumption of Antenna:	100 mA (via antenna cable)
Cable Type:	Coaxial Cable, Shielded
Cable Length:	Max. 300 m (RG58) Max. 700 m (RG213) Max. 1100 m (H2010 Ultraflex)



[1] These frequencies are transferred via the antenna cable.

11.5 Pulse-per-Second Output

Connector Type: BNC, Female
(on device)

Output Signal: PPS (Pulse per Second)

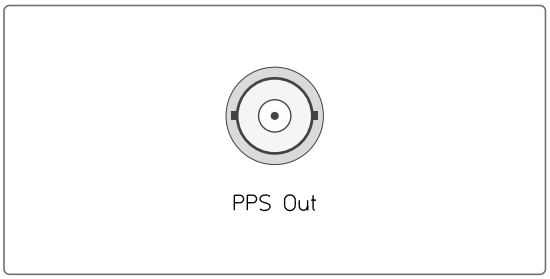
Signal Level: TTL = 5 V (no load),
2.5 V (with 50 Ω load)

Rise Time: Typically 2.6 ns

Fall Time: Typically 2.6 ns

Pulse Width: 200 ms

Cable Type: Coaxial Cable, Shielded



11.6 10 MHz Frequency Output

Connector Type: BNC, Female
(on device)

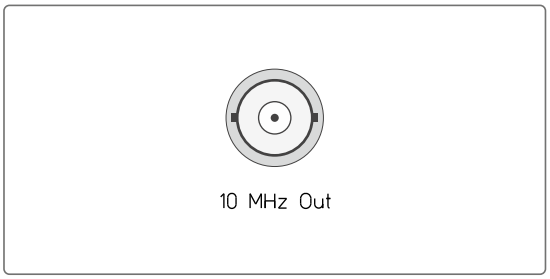
Output Signal: 10 MHz Frequency

Signal Level: TTL = 5 V (no load),
2.5 V (with 50 Ω load)

Rise Time: Typically 2.6 ns

Fall Time: Typically 2.6 ns

Cable Type: Coaxial Cable, Shielded



11.7 10/100/1000BASE-T (Gigabit) Network Interface

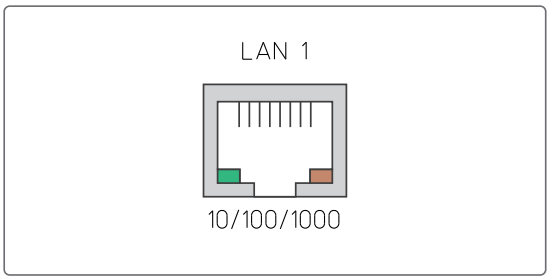
Ethernet Standard: 1000BASE-T

Data Transmission Rate: 10/100/1000 Mbit/s

Connector Type: 8P8C (RJ45)
(on device)

Cable Type: RJ45 (Copper, Twisted Pair)

Duplex Modes: Half/Full/Autonegotiation



11.8 10/100BASE-T (Fast Ethernet) Network Interface

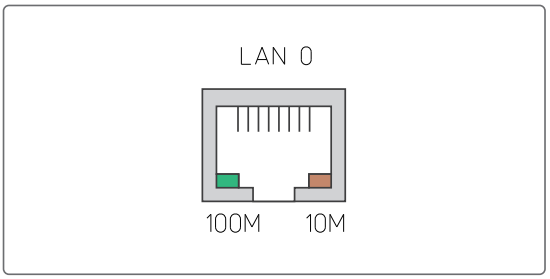
Ethernet Standard: 100BASE-T

Data Transmission Rate: 10/100 Mbit/s

Connector Type: 8P8C (RJ45)
(on device)

Cable Type: RJ45 (Copper, Twisted Pair)

Duplex Modes: Half/Full/Autonegotiation



12 Technical Appendix

12.1 Technical Specifications: LANTIME System

Chassis Type: 19" Multipac Chassis, 1U

Chassis Material: Sheet Steel

Power Consumption of Device: Typically 20 W, Maximum 30 W

Actual power consumption is dependent on customized configuration of device.
(Number and type of signal inputs/outputs, relays, network interfaces, serial interfaces, etc.)

Temperature Range

Operating Temperature: 0 °C to 50 °C (32 °F to 122 °F)

Storage Temperature: –20 °C to 70 °C (–4 °F to 158 °F)

Supported Relative Humidity

Operation: Max. 95 % (non-condensing) at 40 °C (104 °F)

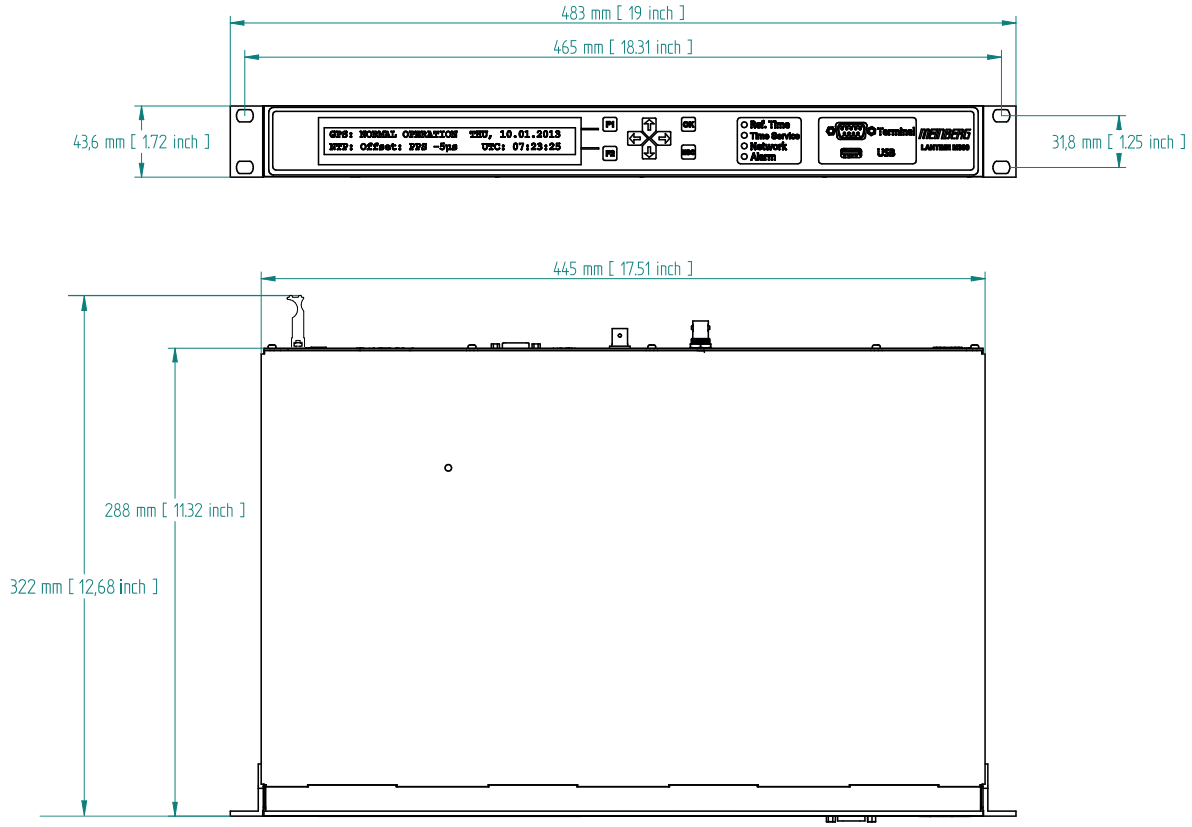
Supported Operating Altitude

Operation: Max. 4,000 m above sea level (13,123 ft)

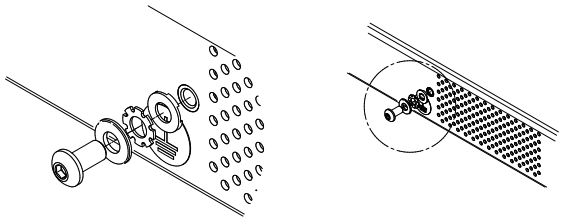
Acoustic Emissions: 0 dB (A)

IP Rating: IP30

LANTIME M320 Chassis Dimensions



External Ground Conductor Terminal on Chassis

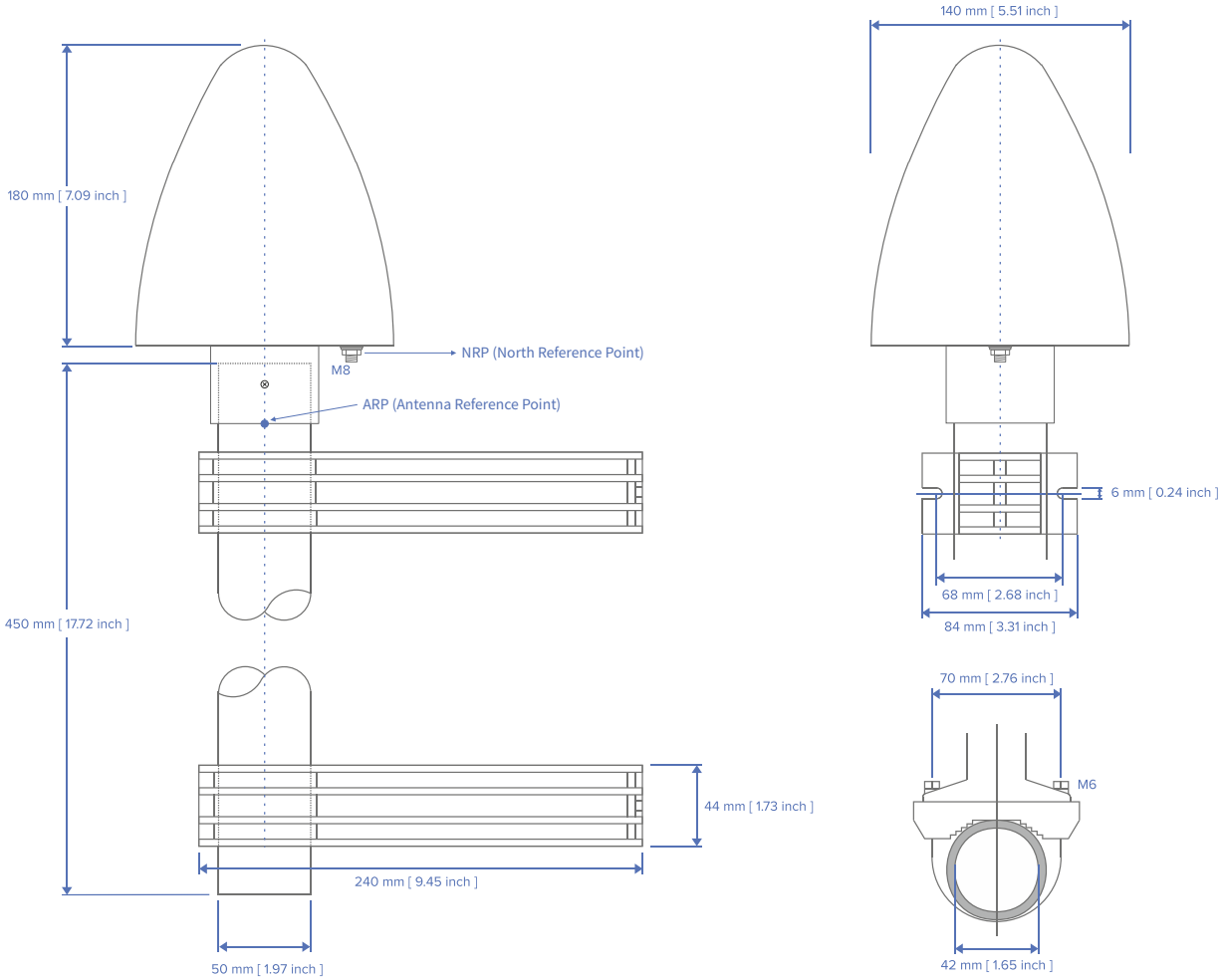


Information:

For information on how to connect the grounding cable, see
→ Chapter 8, “Connecting Your LANTIME System”.

12.2 Technical Specifications: GPSANTv2 Antenna

Physical Dimensions



Electrical Specifications

Power Supply: (via Antenna Cable)	15 V ± 3 V
Nominal Current Draw: (via Antenna Cable)	Approx. 100 mA at 15 V, max. 115 mA

Signal Reception & Processing

Reception Frequency:	1575.42 MHz (GPS L1/Galileo E1 Band)
Axial Ratio:	≤ 3 dB at zenith
Element Gain:	Typically 5.0 dBic at zenith
Mixing Frequency:	10 MHz
Intermediate Frequency:	35.4 MHz
Out-of-Band Rejection:	≥ 70 dB @ 1555 MHz ≥ 55 dB @ 1595 MHz
Conversion Gain: Antenna Input to IF Output	59 dB ± 3 dB
Noise Figure:	Typically 1.8 dB, maximum 3 dB at +25 °C
Input Filter Survival Capacity:	Exposure to > 13 dBm for 24 h without destruction
Conversion Delay: (Patch Connector to IF Output)	Typically 152 ns ± 5 ns
Group Delay Ripple within 2.4 MHz System Bandwidth:	Max. 15 ns
Polarization:	Right-Hand Circular Polarization
ETSI-Compliant Frequency Blocking:	Blocked frequency range further extended to 6 GHz
	–40 dBm
P1dB Input:	
Antenna Pattern:	Vertical 3 dB Angle Width: 100° centered around azimuth

Connection

Connector Type:	Type-N, Female
Nominal Impedance:	50 Ω
Voltage Standing Wave Ratio (VSWR):	≤ 1.5 : 1
Grounding Terminal:	M8 threaded bolt and hexagon nut for use with corresponding ring lug

Specifications for Interference Immunity

Surge Protection:	Level 4 (per IEC 61000-4-5) Test Voltage: 4000 V Max. Peak Current @ 2 Ω: 2000 A
ESD Protection:	Level 4 (per IEC 61000-4-2) Contact Discharge: 8 kV Air Discharge: 15 kV

Mechanical and Environmental Specifications

Housing Material:	ABS Plastic Case for Outdoor Installation
Specified Environment:	Outdoor Environments
IP Rating:	IP65
Temperature Range (Operation):	–60 °C to +80 °C (–76°C to +176 °F)
Temperature Range (Storage):	–20 °C to +70 °C (–4°C to +158 °F)
Relative Humidity (Operation):	5 % to 95 % (non-condensing)
Weight:	1.4 kg (3.09 lbs), including mounting kit

12.3 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.

The table below shows the specifications of the supported cable types for the transmission of the 35 MHz intermediate frequency for cables supplied by Meinberg. For cables from sources other than Meinberg, please refer to the data sheet of that cable.

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

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. 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.

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 in the LTOS 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.

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.

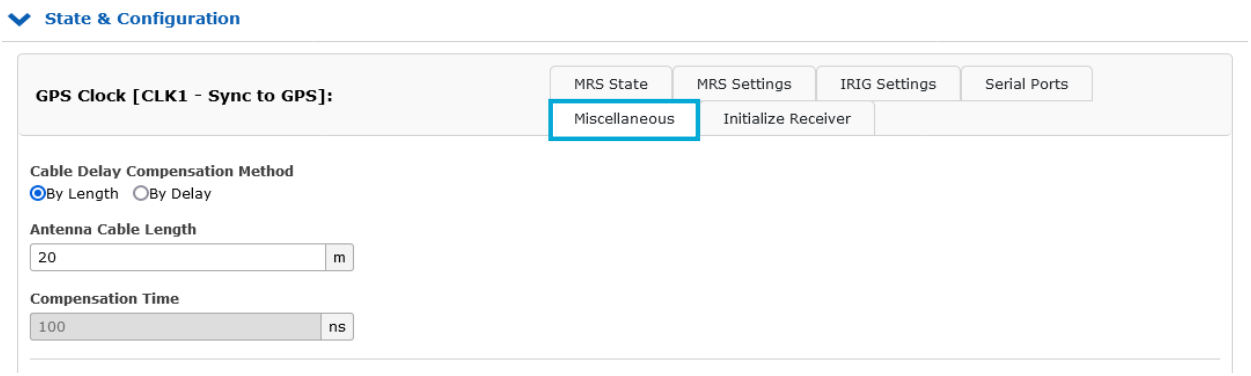


*Fig. 4.1: "**Clock**" menu in LTOS Web Interface*

12.4 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) that is designed to protect devices connected via coaxial cable. 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 12.1: 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

12.5 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 Synchronization Applications

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 reference clock technology 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 GNMANTv2, 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 product 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 stability of the position that is measured from solution to solution.

The specified accuracy of synchronized Meinberg reference clocks 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 (2 ft) from other GNSS antennas, at least 10 m (30 ft) from camera systems (regardless of radio or cable transmission) or HVAC units, and at least 30 m (100 ft) 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 receiver'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.

12.6 How Satellite Navigation Works

The use of a receiver for location tracking and time synchronization relies on the ability to measure the satellite-to-receiver propagation delay as precisely as possible. It is necessary to have simultaneous reception from at least four satellites so that the receiver can determine its relative spatial position in three dimensions (x, y, z) and measure the deviation of its clock against the system clock. Monitoring stations around the planet track the orbital trajectory of the satellites and detect deviations between the local atomic clocks and the system time. The collected data is transmitted up to the satellites, which then send navigation data back to Earth.

The high-precision trajectory data of each satellite, known as the satellite's ephemeris, is needed by the receiver to continuously calculate the precise location of the satellites in space. A roughly defined ephemeridal schedule based on empirical data, referred to as an almanac, is used by a receiver to identify which satellites are visible above the horizon given a known approximate location and time. Each satellite transmits its own ephemeridal schedule as well as the almanacs of all existing satellites.

Satellite Systems

GPS was installed by the United States Department of Defense (US DoD) and operates at two performance levels: the Standard Positioning Service, or SPS, and the Precise Positioning Service, or PPS. The structure of the messages transmitted by the SPS has been openly published and reception is provided for public use. The timing and navigation data of the more precise PPS is encrypted and is thus only accessible to certain (usually military) users.

GLONASS was originally developed by the Russian military for real-time navigation and ballistic missile guidance systems. GLONASS satellites also send two types of signal: a Standard Precision Signal (SP) and an encrypted High Precision Signal (HP).

BeiDou is a Chinese satellite navigation system. The second-generation system, officially referred to as the BeiDou Navigation Satellite System (BDS) and also known as "COMPASS", consists of 35 satellites. BeiDou entered service in December 2011 with ten satellites and was made available to users in the Asia-Pacific region. The system was completed in June 2020 with the launch of the final satellite.

Galileo is an in-development global European satellite navigation and time reference system controlled by a civilian authority (European Union Agency for the Space Programme, EUSPA). Its purpose is the worldwide delivery of high-precision navigation data and is similarly structured to the American GPS, Russian GLONASS and Chinese BeiDou systems. The main differences in the systems lie in their approaches to frequency usage & modulation and the satellite constellation.

12.6.1 Time Zones and Daylight Saving Time

GPS System Time is a linear timescale that was synchronized with the international UTC timescale (Coordinated Universal Time) when the satellite system became operational in 1980. Since it has entered service, however, several leap seconds have been introduced to the UTC timescale to adjust UTC time to irregularities in the Earth's rotation. While GPS System Time deviates from UTC time by several seconds for this very reason, satellite messages do incorporate the number of seconds by which these timescales deviate from one another, allowing GPS receivers to be synchronized internally with the international UTC timescale.

The receiver's microprocessor can identify any time zone based on UTC time and automatically apply Daylight Saving Time adjustments over several years if so configured by the user.

12.7 Time String Formats

12.7.1 Meinberg Standard Time String

The Meinberg Standard time string is a sequence of 32 ASCII characters, starting with the character <STX> (Start of Text, ASCII code 02h) and terminated with the character <ETX> (End of Text, ASCII code 03h). 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 the 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 pattern synchronized DCF77: Clock has synchronized since last reset
	v:	"*"	GPS: Receiver has not yet verified its position PZF/DCF77: Clock currently in free-run mode
		" "	(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 Time active
	"S"	(CEST) Central European Summer Time, Daylight Saving Time inactive	
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		

12.7.2 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, it does not contain UTC time or time adjusted to any local time zone. Instead, it contains GPS time without the UTC adjustments. 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 the 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 while leap second)

uv Clock status characters:

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

G Time zone identifier "GPS Time"

y Announcement of clock jump during last hour before discontinuity comes into effect:

"A"	Announcement of leap second insertion
" "	(Space, ASCII code 20h) nothing announced

lll Number of leap seconds between GPS time and UTC (UTC = GPS time + number of leap seconds)

<ETX> End of Text, ASCII code 03h

12.7.3 Meinberg Capture Time String

The Meinberg Capture time string is a sequence of 31 ASCII characters, terminated with the sequence <CR> (Carriage Return, ASCII code 0Dh) and <LF> (Line Feed, ASCII code 0Ah). The format is as follows:

CH*x*<*SP*>*dd.mm.yy_hh:mm:ss.fffffff*<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:

x	0 or 1, number of input		
<SP>	Space (ASCII code 20h)		
dd.mm.yy	Capture date:		
	dd	Day of the month	(01–31)
	mm	Month	(01–12)
	yy	Year without century	(00–99)
hh:mm:ss.fffffff	Capture Time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
	fffffff	Fractions of second, 7 digits	
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

12.7.4 ATIS Time String

The ATIS standard Time String is a sequence of 23 ASCII characters terminated with a <CR» (Carriage Return) character. The standard interface configuration for this string type is 2400 Baud, 7E1. The format is as follows:

<GID><ABS><TSQ><CC><CS><ST>*yymmddhhmmsswcc*<GID><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:

<GID>	Address of the Receiver, ASCII code 7Fh	
<ABS>	Originator of Message, '0', ASCII code 30h	
<TSQ>	Telegram Number, '0', ASCII code 30h	
<CC>	Command Code 'S' (for 'SET'), ASCII code 53h	
<CS>	Command Code 'A' (for 'ALL'), ASCII code 41h	
<ST>	Time Status 'C' (for valid time), ASCII code 43h	
yymmdd	The current date:	
	yy Year of the Century	(00–99)
	mm Month	(01–12)
	dd Day of month	(01–31)
hhmmss	the current time:	
	hh hours	(00–23)
	mm minutes	(00–59)
	ss seconds	(00–59, or 60 during leap second)
w	Day of the Week	(1–7, 1 = 31h = Monday)
cc	Checksum in hexadecimal, generated from all characters including GID, ABS, TSQ, CC, ST, etc.	
<CR>	Carriage Return, ASCII code 0Dh	

12.7.5 SAT Time String

The SAT time string is a sequence of 29 ASCII characters, starting with the character <STX> (Start of Text, ASCII code 02h) and terminated with the character <ETX> (End of Text, ASCII code 03h). The format is as follows:

<STX>*dd.mm.yy/w/hh:mm:ss*x*x*x*x*u*v<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 the month	(01–31)
mm	Month	(01–12)
yy	Year without century	(00–99)

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

hh:mm:ss The current time:

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

xxxx Time zone identifier:

"UTC"	Universal Time Coordinated, formerly GMT
"CET"	European Standard Time, daylight saving disabled
"CEST"	Central European Summer Time, Daylight Saving Time active

u Clock status characters:

"#"	Clock has not synchronized since last reset
" "	(Space, ASCII code 20h) Clock has synchronized since last reset

v Announcement for time jump during last hour before event:

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

<CR> Carriage Return, ASCII code 0Dh

<LF> Line Feed, ASCII code 0Ah

<ETX> End of Text, ASCII code 03h

12.7.6 Uni Erlangen Time String (NTP)

The Uni Erlangen time string (NTP) is a sequence of 66 ASCII characters, starting with the character <STX> (Start of Text, ASCII code 02h) and terminated with the character <ETX> (End of Text, ASCII code 03h). 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 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 the month	(01–31)
mm	Month	(01–12)
yy	Year (without 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)

v Positive/negative sign for offset of local time zone relative to UTC

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

ac Clock status:

a:	"#"	Clock has not synchronized since reset
	" "	(Space, ASCII code 20h) Clock has synchronized since reset
c:	"*"	GPS receiver has not verified its position
	" "	(Space, ASCII code 20h) GPS receiver has determined its position

d Time zone identifier:

"S"	CEST	Central European Summer Time
" "	CET	Central European Time

f Announcement of clock jump during last hour before discontinuity comes into effect:

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

g Announcement of clock jump during last hour before discontinuity comes into effect:

"A"	Announcement of leap second
" "	(Space, ASCII code 20h) nothing announced

i Leap second

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

bbb.bbbb Geographical latitude of the receiver position in degrees
Leading zeroes are padded with spaces (ASCII code 20h)

n	Geographical hemisphere, possible characters are: "N" North of Equator "S" South of Equator
lll.llll	Geographical longitude of the receiver position in degrees Leading zeroes are padded with spaces (ASCII code 20h)
e	Prime meridian hemisphere, possible characters are: "E" East of Greenwich Meridian "W" West of Greenwich Meridian
hhhh	Altitude in meters of receiver position above WGS84 ellispoid Leading zeroes are padded with spaces (ASCII code 20h)
<ETX>	End of Text, ASCII code 03h

12.7.7 NMEA 0183 String (RMC)

The NMEA 0183 RMC time string is a sequence of 65 ASCII characters, starting with the string "$GPRMC" and terminated with the sequence <CR> (Carriage Return, ASCII code 0Dh) und <LF> (Line Feed, ASCII code 0Ah). 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 as defined below:

$	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second		
GP	Device ID, in this case "GP" for GPS		
RMC	Message type ID, in this case "RMC"		
hhmmss.ss	The current time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
	ff	Fractional seconds	(1/10 ; 1/100)
A	Status (A = Time data valid, V = Time data not valid)		
bbbb.bb	Geographical latitude of the receiver position in degrees Leading zeroes are padded with spaces (ASCII code 20h)		
n	Geographical hemisphere, possible characters are:		
	"N"	North of Equator	
	"S"	South of Equator	
lllll.ll	Geographical longitude of the receiver position in degrees Leading zeroes are padded with spaces (ASCII code 20h)		
e	Prime meridian hemisphere, possible characters are:		
	"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	Current Date:		
	dd	Day of the month	(01–31)
	mm	Month	(01–12)
	yy	Year of Century	(00–99)
a	Magnetic variation E/W		
hh	Checksum (XOR sum of all characters except "$" and "*")		
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

12.7.8 NMEA 0183 Time String (GGA)

The NMEA 0183 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 as defined below:

$	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second
GP	Device ID, in this case "GP" for GPS
GGA	Message type ID, in this case "GGA"
hhmmss.ss	The current time: *hh* Hours (00–23) *mm* Minutes (00–59) *ss* Seconds (00–59, or 60 while leap second) *ff* Fractional seconds (1/10 ; 1/100)
bbbb.bbbbb	Geographical latitude of receiver position in degrees Leading zeroes are padded with spaces (ASCII code 20h)
n	Geographical hemisphere, possible characters are: "N" North of Equator "S" South of Equator
lllll.lllll	Geographical longitude of the receiver position in degrees Leading zeroes are padded with spaces (ASCII code 20h)
e	Prime meridian hemisphere, possible characters are: "E" East of Greenwich Meridian "W" West of Greenwich Meridian
A	Position determined (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 sum of all characters except "$" and "*")
<CR>	Carriage Return, ASCII code 0Dh
<LF>	Line Feed, ASCII code 0Ah

12.7.9 NMEA 0183 Time String (ZDA)

The NMEA 0183 ZDA time 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)		

12.7.10 ABB SPA Time String

The ABB SPA string is a sequence of 32 ASCII characters, starting with the string ">900WD:" and terminated with the character <CR> (Carriage Return). The format is as follows:

>900WD:*yy-mm-dd[lt]SP>hh.mm;ss.fff:cc*<CR>

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

yy-mm-dd	Current Date:		
	yy	Year without century	(00–99)
	mm	Month	(01–12)
	dd	Day of the month	(01–31)
	<SP>	Space (ASCII code 20h)	
hh.mm;ss.fff	Current Time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
	fff	Milliseconds	(000–999)
cc	Checksum. This is calculated as the XOR sum of the preceding characters. The resultant 8-bit value is reported as a hex value in the form of two ASCII characters (0–9 or A–F)		
<CR>	Carriage Return (ASCII code 0Dh)		

12.7.11 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 one-bit accuracy at the change of each 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	(01–07, 01 = 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		

12.7.12 RACAL Time String

The RACAL 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)		

12.7.13 SYSPLEX-1 Time String

The SYSPLEX 1 time string is a sequence of 16 ASCII characters, starting with the character <SOH> (Start of Header, ASCII code 01h) and terminated with the character <LF> (Line Feed, ASCII code 0Ah).

Important!

To ensure that the time string can be correctly output and displayed through your terminal software of choice, a "C" must be sent (once, without quotes).

The format is as follows:

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

<SOH>	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
ddd	Day of the Year		(001–366)	
hh:mm:ss	The current time:			
	hh	Hours	(00–23)	
	mm	Minutes	(00–59)	
	ss	Seconds	(00–59, or 60 during leap second)	
	q	Clock Status:	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			

12.7.14 ION Time String

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

12.7.15 ION Blanked Time String

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

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

Important!

The blanking interval lasts for 2 minutes and 30 seconds and is inserted every five minutes.

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:

<SOH>	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
ddd	Day of the year		(001–366)	
hh:mm:ss	The current time:			
	hh	Hours	(00–23)	
	mm	Minutes	(00–59)	
	ss	Seconds	(00–59, or 60 during leap second)	
	q	Clock Status:	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			

12.7.16 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 start of the second is marked by the leading edge of the start bit of the string. The string is 15 characters long and is sent once a 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 numbers whereas the other characters are unalterable elements of the string. The groups of characters 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 in hours (HH), minutes (MM), seconds (SS)
<CR>	Carriage Return, ASCII code 0Dh
<LF>	Line Feed, ASCII code 0Ah

12.7.17 6021 Time String

The 6021 time string is a sequence of 18 ASCII characters starting with the <STX> (Start of Text, ASCII code 02h) ASCII control character and terminated with the sequence <LF> (Line Feed, ASCII code 0Ah), <CR> (Carriage Return, ASCII code 0Dh), <ETX> (End of Text, ASCII code 03h).

It is broadly identical to the → "Freelance Time String", but with a different order to the termination sequence.

The format is as follows:

<STX>*C9hhmmssddmmyy*<LF><CR><ETX>

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

<STX> Start of Text, ASCII code 02h

C Clock status. This is represented as an ASCII nibble*, whereby each bit in the binary sequence has the following meaning:

Bit 0 (LSB)	Leap second announced (1) / not announced (0)
Bit 1	Leap second active (1) / not active (0)
Bit 2	Real-time clock time valid (1) / invalid (0)
Bit 3 (MSB)	Clock is synchronized (1) / not synchronized (0)

Example: If the clock outputs C (ASCII code 0x43h) at this position, this corresponds to a binary value of *1100*, indicating that the RTC time is valid and the clock is synchronized, and that no leap second has been announced, nor is one in effect.

9 UTC status of clock and day of the week. This is represented as an ASCII nibble*, whereby the three least significant bits represent the day of the week and may be any value between 1 and 7 (corresponding to Monday to Sunday). The most significant bit represents the UTC state and will be 1 if set to UTC and 0 if it is a local time zone. Thus, if the clock is outputting local (non-UTC) time, this will be in a range of 1–7, whereas if the clock is outputting UTC time, this value will be in a range of 9–F.

Example: If the clock outputs 9 (ASCII code 0x39h) at this position, this corresponds to a binary value of *1001*. The most significant bit of *1* here indicates that the clock is running on UTC time, while the 3-bit value represented by the least significant bits *001* indicates that the day is Monday.

hhmmss Current time:

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

ddmmyy Current date:

dd	Day	(01–31)
mm	Month	(01–12)
yy	Last two digits of year	(00–99)

<LF>	Line Feed (ASCII code 0Ah)
<CR>	Carriage Return (ASCII code 0Dh)
<ETX>	End of Text (ASCII code 03h)

* With ASCII nibbles, the actual ASCII character itself (0–9, A–F, ASCII codes *0x30h–0x39h* and *0x41h–0x46h*) represents the hexadecimal equivalent of a 4-bit binary sequence. For example, if the clock outputs "A" at these positions, this is equivalent to a binary sequence of *0x1010b*. Please note that it is not the binary equivalent of the ASCII code (*0x41h*) itself.

12.7.18 Freelance Time String

The Freelance time string is a sequence of 18 ASCII characters starting with the <STX> (Start of Text, ASCII code 02h) ASCII control character and terminated with the sequence <CR> (Carriage Return, ASCII code 0Dh), <LF> (Line Feed, ASCII code 0Ah), <ETX> (End of Text, ASCII code 03h).

It is broadly identical to the ➜ "6021 Time String", but with a different order to the termination sequence.

The format is as follows:

<STX>*C9hhmmssddmmyy*<CR><LF><ETX>

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

<STX> Start of Text, ASCII code 02h

C Clock status. This is represented as an ASCII nibble*, whereby each bit in the binary sequence has the following meaning:

Bit 0 (LSB)	Leap second announced (1) / not announced (0)
Bit 1	Leap second active (1) / not active (0)
Bit 2	Real-time clock time valid (1) / invalid (0)
Bit 3 (MSB)	Clock is synchronized (1) / not synchronized (0)

Example: If the clock outputs C (ASCII code 0x43h) at this position, this corresponds to a binary value of *1100*, indicating that the RTC time is valid and the clock is synchronized, and that no leap second has been announced, nor is one in effect.

9 UTC status of clock and day of the week. This is represented as an ASCII nibble*, whereby the three least significant bits represent the day of the week and may be any value between 1 and 7 (corresponding to Monday to Sunday). The most significant bit represents the UTC state and will be 1 if set to UTC and 0 if it is a local time zone. Thus, if the clock is outputting local (non-UTC) time, this will be in a range of 1–7, whereas if the clock is outputting UTC time, this value will be in a range of 9–F.

Example: If the clock outputs 9 (ASCII code 0x39h) at this position, this corresponds to a binary value of *1001*. The most significant bit of *1* here indicates that the clock is running on UTC time, while the 3-bit value represented by the least significant bits *001* indicates that the day is Monday.

hhmmss Current time:

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

ddmmyy Current date:

dd	Day	(01–31)
mm	Month	(01–12)
yy	Last two digits of year	(00–99)

<CR>	Carriage Return (ASCII code 0Dh)
<LF>	Line Feed (ASCII code 0Ah)
<ETX>	End of Text (ASCII code 03h)

* With ASCII nibbles, the actual ASCII character itself (0–9, A–F, ASCII codes *0x30h–0x39h* and *0x41h–0x46h*) represents the hexadecimal equivalent of a 4-bit binary sequence. For example, if the clock outputs "A" at these positions, this is equivalent to a binary sequence of *0x1010b*. Please note that it is not the binary equivalent of the ASCII code (*0x41h*) itself.

12.7.19 ITU-G8271-Y.1366 Time-of-Day Message

The ITU-G8271-Y.1366 standard stipulates the transmission of this time message at 9600 Baud with framing of 8N1. The message data should be sent no sooner than 1 ms after the rising edge of the PPS signal and transmission must be completed within 500 ms. The message should be sent once a second and mark the rising edge of the PPS.

The ITU-G8271-Y.1366 time message itself output by Meinberg clocks is always a sequence of 21 bytes. While the standard briefly references the use of two ASCII characters for the first two characters, it should be noted that this message is not an ASCII string in the typical sense. Multi-octet values are transmitted as big-endian values, while each byte is transmitted with the least-significant bit **first**. Accordingly, while the first two characters are deemed to represent the ASCII characters "C" (ASCII code 0x43h, binary 00101011) and "M" (ASCII code 0x4Dh, binary 01001101) respectively, these are transmitted as 11010100 and 10110010.

The standard byte sequence (least significant bit first in each byte) is as defined below:

Byte No.	Meaning
0–1	Always 0x43h followed by 0x4Dh. These are Sync Characters 1 & 2 respectively and are used as a delimiter between messages.
2	The message class. This will always carry a value of 0x01h.
3	The message ID. In the time-of-day messages provided by Meinberg clocks this will always be 0x01h.
4–5	The payload length, expressed as an unsigned 16-bit integer, not including the sync characters, message class, message ID, or checksum. In the time-of-day messages provided by Meinberg clocks this will always be 0x0Eh.
6–11	PTP time, or the number of seconds in the TAI timescale. This is expressed as an unsigned 48-bit integer.
12	This byte is reserved for future use and is set to 0x00h.
13	Contains a number of time status flags: **Bit 0:** Positive leap second pending **Bit 1:** Negative leap second pending **Bit 2:** UTC offset valid **Bit 3:** Reserved **Bit 4:** Time is traceable to a primary frequency standard **Bit 5:** Frequency is traceable to a primary frequency standard **Bit 6:** Reserved **Bit 7:** Reserved
14–15	Current offset between TAI and UTC in seconds, expressed as an unsigned 32-bit integer.
16–19	This byte is reserved for future use and is set to 0x00h.
20	An 8-bit cyclic redundancy check value calculated on the basis of bytes 2–19.

12.7.20 CISCO ASCII Time String

The CISCO ASCII time string is a sequence of at least 73 ASCII characters. The format is as follows:

*.A.*mjdxx*,*yy/mm/dd*,*hh*:*mm*:*ss*,*+3600.0*,*12N34.567*,*123W45.678*,+1234,
EV<SP>GPS<SP>FLT

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:

*	Sync state of clock: *: Clock is synchronized to reference !: Clock is not synchronized
A	The format revision. With Meinberg clocks, this will always be 'A'.
mjdxx	The current date in Modified Julian Date format.
yy/mm/dd	The current date in Gregorian *yy*/*mm*/*dd* format.
hh:mm:ss	The current time in 24-hour format.
+3600	The current local time offset in seconds. If the clock is outputting UTC time, this will be 00000.0. If the clock is outputting local time, however, the first character will be the sign (– or +) and the subsequent digits up to the period character are the offset. For example, if CET is set as the time zone, this will show +3600.
0	Indicator of a pending leap second.
12N34.567	The current latitude of the GNSS receiver. If the time reference is not a GNSS receiver, this will show 00 00.000.
123W45.678	The current longitude of the GNSS receiver. If the time reference is not a GNSS receiver, this will show 000 00.000
+1234	The current altitude above sea level of the GNSS receiver. If the time reference is not a GNSS receiver, this will show +0000.
EV	Indicates the level of any current alarm state of the clock: EV: Non-error event MN: Minor error MJ: Major error CL: Critical error
GPS	Indicates the source of the current error (e.g., 'GPS' for GPS receiver).
FLT	Indicates the cause of the current error (e.g., 'FLT' for hardware fault).

12.7.21 NTP Type 4 Time String

The NTP Type 4 time string is a sequence of 24 ASCII characters. The format is as follows:

?<SP>*yy*<SP>*ddd*<SP>*hh:mm:ss.SSSL*<SP>S

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:

?	Sync state of clock:		
	Space:	Clock is synchronized to reference	
	'?':	Clock is not synchronized	
yy	Year of the century		(00–99)
ddd	Day of the year		(001–366)
hh:mm:ss.SSS	Current time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 while leap second)
	SSS	Milliseconds	(000–999)
L	Leap second announcement:		
	Space:	No leap second announcement	
	'L':	Leap second pending	
S	Daylight Savings Time indicator:		
	'S':	Standard Time (wintertime)	
	'D':	Daylight Savings Time (summertime)	

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

Konformitätserklärung für den Einsatz in der Europäischen Union
Doc ID: LANTIME M320/GPS/xGE-2025-01-27

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*	**LANTIME M320/GPS/xGE**

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) 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
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

EU-Konformitätserklärung

Doc ID: LANTIME M320/GPS/xGE-2025-01-27

Diese EU-Konformitätserklärung umfasst alle nachfolgend aufgeführten Gerätekonfigurationen:
This EU Declaration of Conformity further covers all the device configurations listed below:

LANTIME	M320/GPS/1GE/AD10
	M320/GPS/1GE/AD10-AD10
	M320/GPS/1GE/AD10-DC20
	M320/GPS/1GE/DC20
	M320/GPS/1GE/DC20-DC20
	M320/GPS/3GE/AD10
	M320/GPS/3GE/AD10-AD10
	M320/GPS/3GE/AD10-DC20
	M320/GPS/3GE/DC20
	M320/GPS/3GE/DC20-DC20
	M320/GPS/5GE/AD10
	M320/GPS/5GE/AD10-AD10
	M320/GPS/5GE/AD10-DC20
	M320/GPS/5GE/DC20
	M320/GPS/5GE/DC20-DC20

Bad Pyrmont, den 2025-01-27

Aron Meinberg
Quality Management

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

15 Declaration of Conformity for Operation in the United Kingdom

UKCA Declaration of Conformity

Doc ID: LANTIME M320/GPS/xGE-2025-01-27

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

declares that the product

Product Designation	**LANTIME M320/GPS/xGE**

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

UKCA Declaration of Conformity

Doc ID: LANTIME M320/GPS/xGE-2025-01-27

This UKCA Declaration of Conformity further covers all the device configurations listed below:

LANTIME	M320/GPS/1GE/AD10
	M320/GPS/1GE/AD10-AD10
	M320/GPS/1GE/AD10-DC20
	M320/GPS/1GE/DC20
	M320/GPS/1GE/DC20-DC20
	M320/GPS/3GE/AD10
	M320/GPS/3GE/AD10-AD10
	M320/GPS/3GE/AD10-DC20
	M320/GPS/3GE/DC20
	M320/GPS/3GE/DC20-DC20
	M320/GPS/5GE/AD10
	M320/GPS/5GE/AD10-AD10
	M320/GPS/5GE/AD10-DC20
	M320/GPS/5GE/DC20
	M320/GPS/5GE/DC20-DC20

Bad Pyrmont, Germany, dated 2025-01-27

Aron Meinberg
Quality Management

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