The Synchronization Experts.

MANUAL

IMS - LANTIME M1000S

Modular Sync. System and NTP Server

July 25, 2024

Meinberg Funkuhren GmbH & Co. KG

Front view (Frontansicht) IMS - LANTIME M1000S

DEUTSCH

1. Netzteil: 100-240 V AC (50-60Hz) / 100-200 V DC oder Netzteil: 20-60 V DC
2. GNSS Zeitcode Empfänger (GPS/GLONASS/Galileo/BeiDou)
3. LAN-CPU mit USB-Schnittstelle, Terminal (RS-232) RJ45, LAN 0 - RJ45, LAN 1 - SFP Anschluss
4. ACM - Active Cooling Module

ENGLISCH

1. Power Supply: 100-240 V AC (50-60Hz) / 100-200 V DC or Power Supply: 20-60 V DC
2. GNSS timecode receiver (GPS/GLONASS/Galileo/BeiDou)
3. LAN-CPU with USB interface, serial Terminal (RS-232), LAN 0 - Rj45, LAN 1 - SFP connector
4. ACM - Active Cooling Module

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1 Imprint

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

Phone: + 49 (0) 52 81 – 93 09 - 0
Fax: + 49 (0) 52 81 – 93 09 - 230

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

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3 Presentation Conventions in this Manual

3.1 Conventions for the Presentation of Critical Safety Warnings

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

Caution!

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

Warning!

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

Danger!

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

3.2 Secondary Symbols Used in Safety Warnings

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

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

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

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

3.3 Conventions for the Presentation of Other Important Information

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

Important!

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

Information:

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

3.4 Generally Applicable Symbols

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

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

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

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

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

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

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

4 Important Safety Information

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

Any safety 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 system.

4.3 Safety during Installation

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

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

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

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

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

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

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

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

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

4.4 Electrical Safety

This Meinberg product is operated at a hazardous voltage.

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

Custom cables may only be assembled by a qualified electrician.

Never work on cables carrying a live current!

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

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

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

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

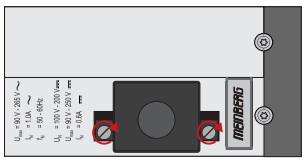
Never connect or disconnect power, data, or signal cables during a thunderstorm! Doing so presents a risk of injury or death, as cables and connectors may conduct very high voltages in the event of a lightning strike!

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

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

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

5-Pin MSTB Connector



3-Pin MSTB Connector

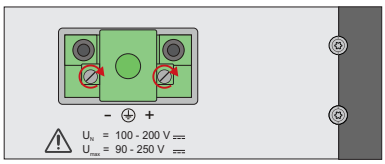


Illustration: Lock screws on an MSTB plug connector; in this case on a LANTIME M320

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

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

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

Protect the device from the ingress of objects or liquids!

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

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

4.4.1 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 Handling SFP Modules

The fiber-optic SFP modules recommended by Meinberg are equipped with a Class 1 laser.

- Only use fiber-optic SFP modules that are compliant with the definition of a Class 1 laser in accordance with IEC standard 60825-1. Fiber-optic products that are not compliant with this standard may emit radiation capable of causing eye injuries.
- Never look into an unconnected connector of a fiber-optic cable or an unconnected SFP port.
- Unused fiber-optic connectors should always be fitted with a suitable protective cap.
- The safety information and manufacturer specifications relating to the SFP modules used must be heeded.
- The SFP module used must be capable of providing protection against voltage spikes in accordance with IEC 62368-1.
- The SFP module used must be tested and certified in accordance with applicable standards.

4.6 Safety when Maintaining and Cleaning the Device

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

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

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

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

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

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

This device uses a rotating fan unit for cooling purposes. Do not touch this fan while it is in operation. The device must first be switched off before the fan unit can be replaced.

4.7 Battery Safety

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

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

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

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

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

5 Important Product Information

5.1 CE Marking

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

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

These directives are listed in the EU Declaration of Conformity, appended to this manual as Chapter **17**.

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 **18**.

5.3 Ensuring the Optimum Operation of Your Device

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

5.4 Maintenance and Modifications

Important!

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

5.4.1 Replacing the Battery

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

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

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

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

5.5 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.

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. ESD-proof bags that are crumpled or have holes cannot provide effective protection against electrostatic discharges. ESD-proof 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	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 The System IMS LANTIME M1000S

6.1 IMS - Systems

The brand IMS describes a product family of Meinberg company for synchronization of time and frequency signals in networks and of directly connected systems such as signal distributors.

Meinberg's IMS Series (Intelligent Modular Synchronization) offers built-in redundancy for synchronization sources and power supplies in combination with highly modular slot based chassis, which support hot-swapping and field-expansion capabilities.

The design of our IMS enclosures allows to use up to four power supplies (both AC and DC variants can be mixed and matched), two reference clocks in combination with a signal switch module, a CPU board and up to ten I/O slots.

6.2 Introduction to Your IMS LANTIME M1000S Server

Meinberg's **IMS LANTIME 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 IMS 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 45 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 25,000 NTP clients per second with accuracies of just a few milliseconds. IMS 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 time codes.

IMS LANTIME servers can also be fitted with a variety of custom inputs and outputs. Additional input and output modules, an additional reference clock and additional power supply units for redundant operation can also be retrofitted during operation - often using the hot-plug method. In the vast majority of cases, IMS modules can also be replaced using the hot-swap method.

IMS LANTIME servers feature a custom Linux-based operating system that has been specifically developed by Meinberg for timing & synchronization applications. This operating system 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 IMS LANTIME server is the fully-featured Web Interface, which provides a multitude of configuration and monitoring options. It also features the ability to connect to the device's command-line interface via SSH, Telnet, or a direct wired terminal connection.

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 Operating Manual, which is available to download at **http://www.mbg.link/doce-fw-ltos**.

6.3 Target Audience

This manual is intended for professionals responsible for the installation, commissioning, maintenance, troubleshooting or operation of any of the equipment within the specified product range.

The structure and spelling of this manual assumes that the installation and commissioning technicians have knowledge of the use of electronical devices and network components.

6.4 Return of Equipment

All parts and components of your Meinberg system may only be repaired by Meinberg qualified personnel. In the event of a malfunction, the customer must contact our support service and never attempt to repair the device himself.

To request a device repair service, call Meinberg Technical Support to check shipping options and obtain the Return Material Authorization (RMA) number for shipping.

You can also request the RMA number from our website:
https://www.meinbergglobal.com/english/support/rma.htm.

The device must be packed in its original packaging or suitable packaging to protect it from shock and moisture. Send your device to the manufacturer's address, including sender identification and RMA number.

What must be included with the shipment?
Please return the device complete with accessories such as antenna or cable if possible. This may be important for troubleshooting.

7 IMS LANTIME M1000S System Description

7.1 Device Design, Features, and Purpose

A typical IMS LANTIME system comprises a reference clock module, a single-board computer module with an integrated network card ("LAN-CPU"), and a power supply module—all three are pre-installed in the modular IMS chassis. The input/output signals of the IMS system are provided via the connectors on the installed input and output modules.

The Linux-based operating system installed on the LAN-CPU module contains an implementation of the *ntpd* service, which cyclically acquires the reference time from the reference clock module and distributes it throughout the network. The ntpd status is shown on the display (if available), or can be queried via the network.

Performing the initial network configuration process for the LANTIME is a relatively simple process for a system or network administrator; the IP address, subnet mask and default gateway are specified either via the front panel or, in the case of IMS devices without a display, can be specified using the "Configuration Wizard" (see Chapter **9.3** "**Initial Network Configuration**"). All NTP clients in the TCP/IP network can then find the LANTIME server via the corresponding network address or hostname.

The operating system supports not only NTP but also other network protocols such as HTTP(S), FTP, SSH, and Telnet. This enables features such as remote configuration and provides the ability to query the status of the server over a network, for example using a standard web browser. It is also possible to disable access to the server via the network. Changes to the status of the reference clocks, errors, and other important events can be logged on the local Linux system and also on an external syslog server. Messages can also be sent to a central management system for logging via SNMP traps or automatically generated emails. It is also possible to have all alerts displayed on a large VP100/20/NET display. To provide redundancy against hardware failure, multiple LANTIME NTP servers can be installed in the same network.

7.2 IMS System Variants

The IMS system variants differ primarily in their housing form.

19 inch rack mount chassis
The base chassis contains a power supply, a reference clock and a LANTIME CPU. This provides further slots for additional input and output modules.

M1000(S): four slots for expansion cards
three slots for expansion cards in redundant reference clock configuration

M2000S: six slots for expansion cards

M3000(S): ten slots for expansion cards

M4000: ten slots for expansion cardsn

Redundant power supply and reference clock solutions can be implemented for the following IMS series models:

M1000(S): up to two power supplies and two reference clocks

M2000S: up to three power supplies and two reference clocks

M3000(S): up to four power supplies and two reference clocks

M4000: up to four power supplies and two reference clocks

Railmount Chassis
The base chassis contains a power supply, a reference clock and a LANTIME CPU.

M500: two slots for expansion cards
one configurable expansion slot (CES) with two optional output signals

7.3 Hardware Specifications

7.3.1 Chassis Variants

The IMS systems are offered in several housing variants. The hardware configuration is modular and the number of input and output options depends on the respective housing variant.

IMS system	Type	Dimension in mm* (W x H x D)	IO Slots	Power Supplies	Receivers
M500	DIN railmount	118 x 193 (227) x 160	2	1	1
M1000	19 inch rackmount 1U / 84HP	483 x 44 x 290 (314)	4 (3)**	1 -2	1 - 2
M1000(S)	19 inch rackmount 1U / 84HP	483 x 44 x 266 (300)	4 (3)**	1 -2	1 - 2
M2000S	19 inch rackmount 2U / 84HP	483 x 76 x 248 (264)	6	1 - 3	1 - 2
M3000	19 inch rackmount 3U / 84HP	483 x 133 x 280 (307)	10	1 - 4	1 - 2
M3000(S)	19 inch rackmount 3U / 84HP	483 x 133 x 234 (268)	10	1 - 4	1 - 2
M4000	19 inch rackmount 4U / 84HP	483 x 176 x 274	10	1 - 4	1 - 2

The IMS systems M500, M1000, M3000 and M4000 have a 4 x 20 character LC display and a control panel with 8 function keys for direct on-site configuration. The M1000S, M2000S and M3000S models are delivered without a display. These systems, like the M4000, are optimized for ETSI rack installations due to their small housing depth.

The available configurations can be optimally adapted for specific application areas and industries.

---

* The dimensions in parentheses take into account the connections and module handles.

** With a redundant receiver configuration, only 3 IO slots are available in an M1000 system.

7.3.2 Environmental Requirements

Protection Rating: IP20

Ambient Temperature: 0 ... 50 °C

Storage Temperature: -20 ... 70 °C

Humidity: max. 95% (non-condensing) @ 40 °C (104 °F)

Please Note:
To prevent overheating damage during operation, some IMS systems are equipped with an active cooling module (ACM). The generated air flow is led through the system as shown in the figure on the right (see also chapter ACM - Active Cooling Module).

Active cooling with ACM Modules.
Active cooling modules are available for the M4000, M3000, M2000S and M1000(S) IMS systems. For the M4000 and M3000, the use of an ACM is optional. M1000 and M2000 systems are always equipped with an ACM. The figure below shows the airflow with passive cooling (left) and with active cooling (right).

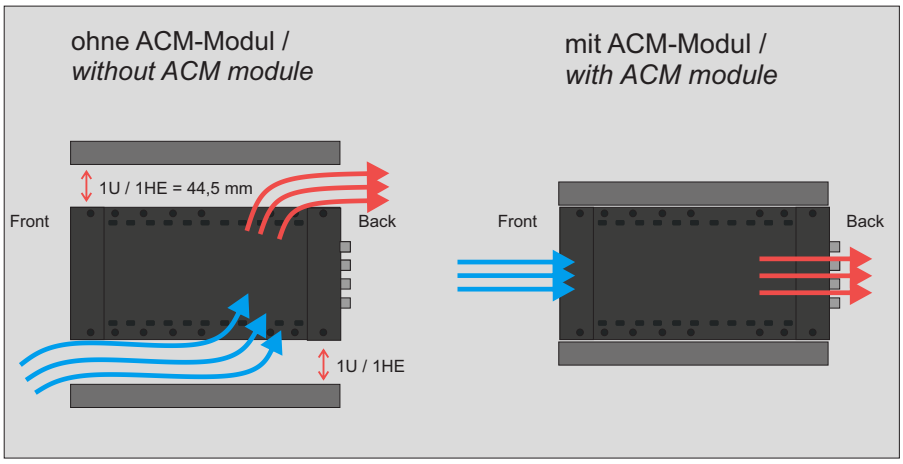


Fig. 1: Airflow in LANTIME IMS-M3000 with and without ACM module.

8 Before you start

8.1 Text and Syntax Conventions

This chapter briefly describes the text and syntax conventions used in this manual.

Menu description
Example web interface menu "Network

Submenu	"Network → Physical Network Configuration"
Tab in a submenu	"Network → Network Interfaces → IPv4"

Menu navigation is logically separated by the right arrow.

Services
The services running on the system are shown in italics.

Example: NTP-Daemon: *ntpd*

Cross references in the document:
Cross-references in the document are displayed in dark blue font - e.g.: see chapter Support Information

Selection Options and Logical Groups:
Selection options, e.g. in a drop-down menu, are underlined and then briefly described. If several parameters are combined in a menu to logical groups, these are also underlined and displayed in bold font - e.g. PTP status → **Parent Datasets** .

Example:
Menü PTP (IEEE1588) Settings → Operation Mode

Multicast Master
...

Terminal

```
# Output via a terminal window is displayed
# in a grey box with monospace font.
```

8.2 Required Tools

	LANTIME IMS SERIES						
	LANTIME M1000	LANTIME M1000S	LANTIME M2000S	LANTIME M3000	LANTIME M3000S	LANTIME M4000	LANTIME M500
Mounting Rackears	TORX T20	TORX T20	TORX T20	TORX T20	TORX T20	TORX T20	x
Mounting DIN rail	x	x	x	x	x	x	Phillips PH1 x 80
Replacing IMS modules	TORX T8	TORX T8	TORX T8	TORX T8	TORX T8	TORX T8	TORX T8
FAN Installation	TORX T8	TORX T8	TORX T8	TORX T8	x	TORX T8 Flat head Screwdriver	x

Figure: Required tools from left to right - INBUS 2,5mm, Phillips PH1 x 80, Flat head Screwdriver, TORX T20, TORX T8

8.3 Preparing Installation

Meinberg IMS LANTIME systems are designed for installation in 19-inch racks or 35mm rail mount. Rack systems come with all necessary accessories (mounting brackets, screws, adapters for power supply ...). For installations in regions outside of Germany that have other standards for e.g. power supply connections, please specify exactly which adapters or cables you need to put the device into operation when ordering.

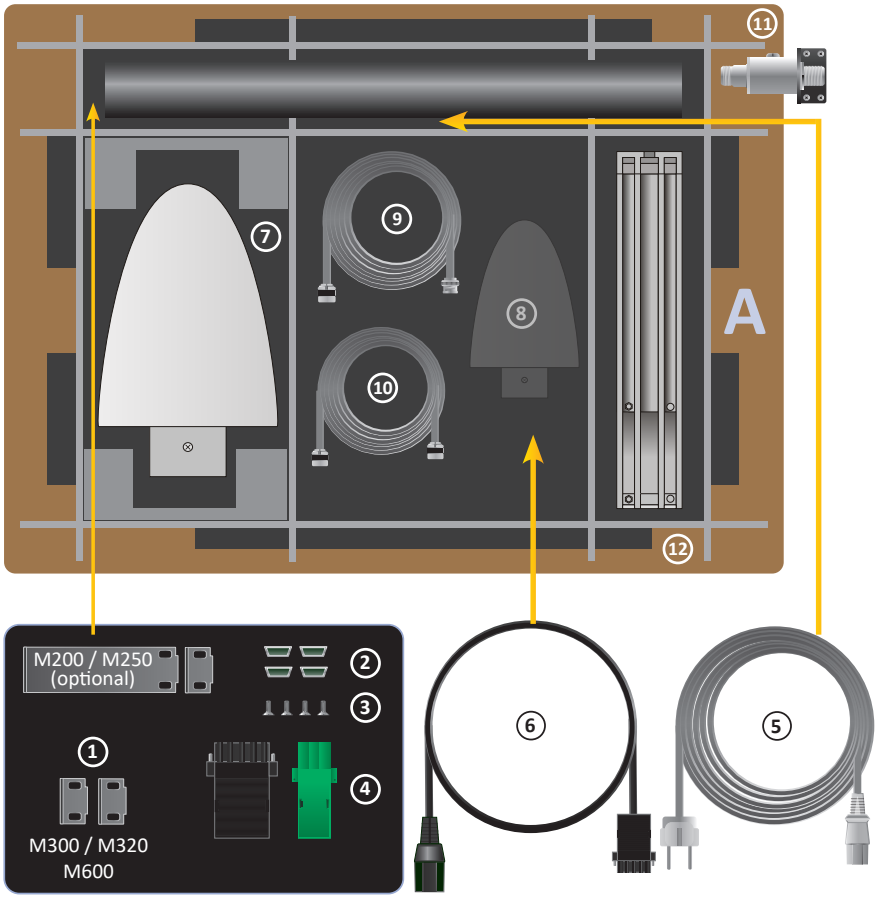
Before unboxing the system, make sure that there is sufficient space in the built-in cabinet to ensure safe ventilation of the system. Avoid dirt and dust during installation.

Caution!

To avoid damage to the system and personal injury, please make sure to follow the instructions of the safety chapter in this manual.

8.4 Unboxing the Device

After unpacking the LANTIME time server, please check the contents for completeness - regarding to the included packing list.

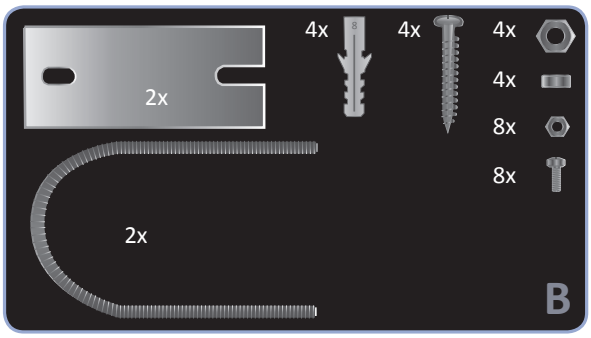


A	LANTIME Package Contents

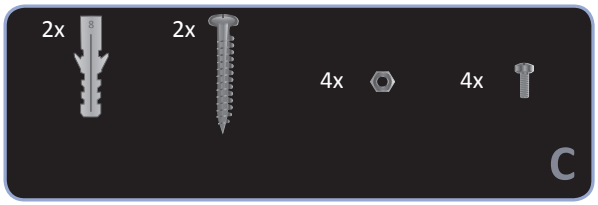
1. Assembly brackets for 19 Inch rack mounting (optional for LANTIME M200 / M250)
2. Protection spacer (M200 / M250 / M300 / M320 / M600 / IMS M1000)
3. Screws for brackets (M200 / M250 / M300 / M320 / M600 / IMS rack systems)
4. 3-pin DFK connector or 5-pin DFK connector
   (additional connector in case of AC/DC or DC power supply)
5. Power cord (only in case of AC power supply)
6. Option: power cable with 5-pin connector

Only with delivered Antenna

7. Antenna
8. Option: second antenna
9. Antenna cable
10. Option: cable for surge voltage protector
11. Option: surge voltage protector with bracket
12. Brackets for pole or wall mounting (GPS Antenna)
13. Pole for antenna mounting (GPS Antenna)



B **Mounting Kit for GPS Antenna**
(wall or pole mounting)



C **Mounting Kit for Long Wave Antenna**
(wall mounting)

Information:

Please read the safety instructions and the manual carefully to familiarize yourself with the safe and proper handling of electronic devices.

The product documentation can be found on the USB Flash Memory.

9 System Installation

19 inch rackmount

Mounting brackets and fixing screws are included in the scope of delivery of a rackmount system. If the system is supplied with an antenna and antenna cable, it is advisable to first mount the antenna in a suitable location (see chapter Antenna Mounting) and lay the antenna cable. The power supply cable and the network cable should also be available at the installation site before the system is installed. Make sure that all necessary adapters for connecting the device are available. Make sure that the voltage is disconnected from the power source during installation.

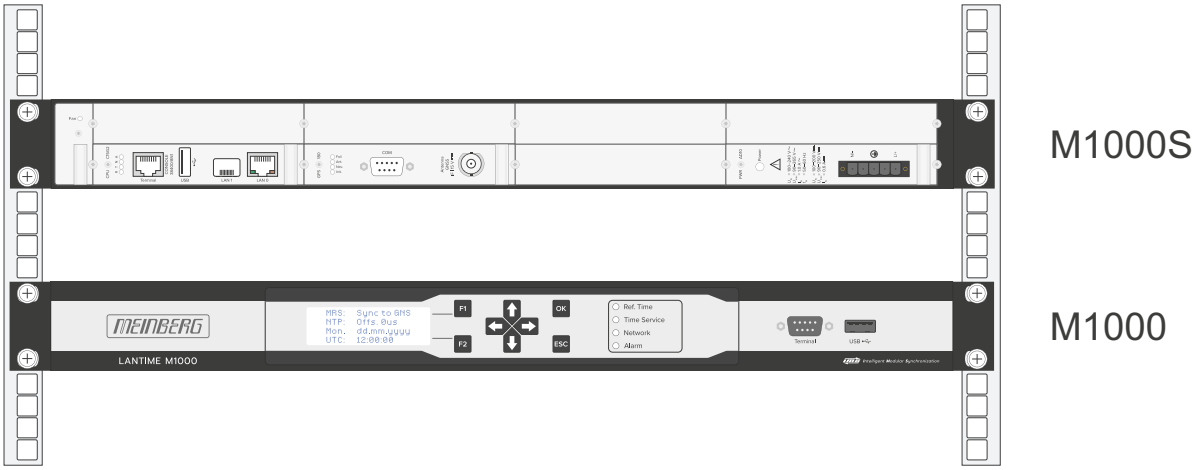


Illustration: LANTIME M1000S and M1000 rack mount. The screws for rack mounting are not shipped with the product.

9.1 Antenna Connection

There are two types of radio signals commonly used for timing applications: **satellite signals from Global Navigation Satellite Systems (GNSS)**, and **long wave signals** from specific time code transmitters operated by some countries.

Most GNSS signals can be received world-wide, while long wave signals can only be received up to a certain distance around the transmitting station. Also, GNSS receivers can usually track the signals from several satellites at the same time, so the signal propagation delay can be determined and compensated automatically, while long wave receivers usually receive only the signal from a single station. Last but not least the available bandwidths and signal propagation characteristics are another reason why GNSS reception usually yields a higher degree of time accuracy than long wave reception.

A detailed description of the reception modes of our reference clocks and instructions for antenna installation can be found in our LTOS firmware manual: http://www.mbg.link/doce-fw-ltos in chapter "Antenna and Receiver Information".

The following table shows the available receiver types from Meinberg for IMS systems

Type	Receiver	Systems	Antenna / signal reference
GPS	GPS Clock	GPS	GPSANT / Converter
GNS	GNS Clock	GPS, GLONASS Galileo, BeiDou	GNSS antenna (up to three systems in parallel)
GNS-UC	GNS-UC Clock with Up-Converter	GPS, GLONASS	GPSANT / Converter
GNM	GNM Clock	GPS, GLONASS Galileo, BeiDou	Multiband-GNSS-Antenne (up to four systems in parallel)
PZF	PZF Clock	DCF77	AW02 long wave outdoor antenna
MSF	MSF Clock	MSF (UK)	AW02-60 long wave outdoor antenna
TCR	TCR Clock	Time code reader	Time code generator

9.1.1 Installing a GPSANTv2

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

9.1.1.1 Selecting the Antenna Location

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

1. Mounted on a pole

2. Mounted on a wall

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

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

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

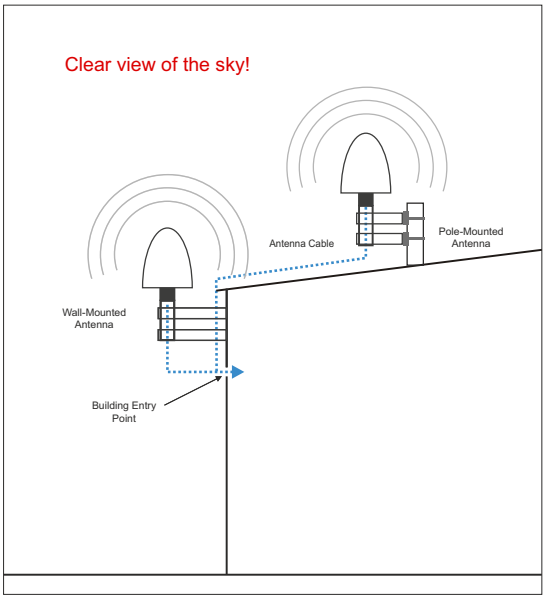


Fig. 1: Ideal Positioning

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

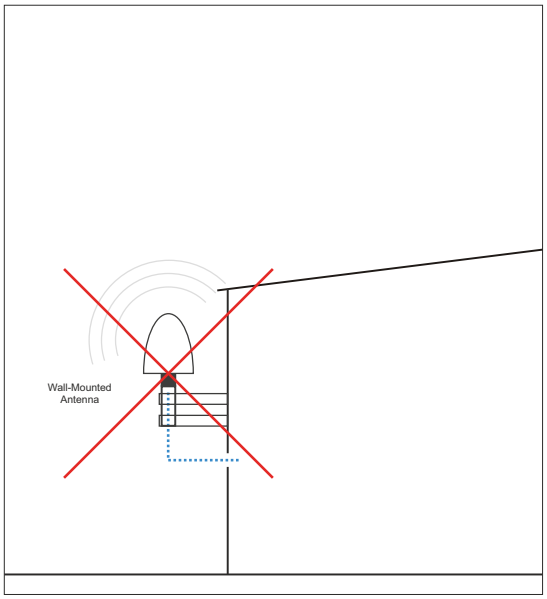


Fig. 2: Poor positioning of a wall-mounted antenna

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

Other Installation Criteria for Optimum Operation:

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

Information:

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

9.1.1.2 Installation of the Antenna

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

Danger!

Do not mount the antenna without an effective fall arrester!

Danger of death from falling!

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

Danger!

Do not work on the antenna installation during thunderstorms!

Danger of death from electric shock!

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

Mount the Meinberg GPSANTv2 Antenna or GNSS Multi-Band Antenna (as shown in Fig. 3) at a distance of at least 50 cm to other antennas using the mounting kit provided, either onto a vertical pole of no more than 60 mm diameter or directly onto a wall.

Fig. 3: Mounting a Meinberg GPS Antenna or GNSS Multi-Band Antenna onto a Pole

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

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

9.1.1.3 Antenna Cable

Selecting the Appropriate Cable

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

Important!

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

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

GPS/GNS-UC Clocks

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

Cable Type	RG58C/U	RG213	H2010 (Ultraflex)
Signal Propagation Time at 35 MHz*	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.*

Laying the Antenna Cable

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

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

Caution!

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

Further Points to Consider when Laying Antenna Cable:

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

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

Compensating for Signal Propagation Time

GPS/GNS-UC Clocks

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

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

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

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.

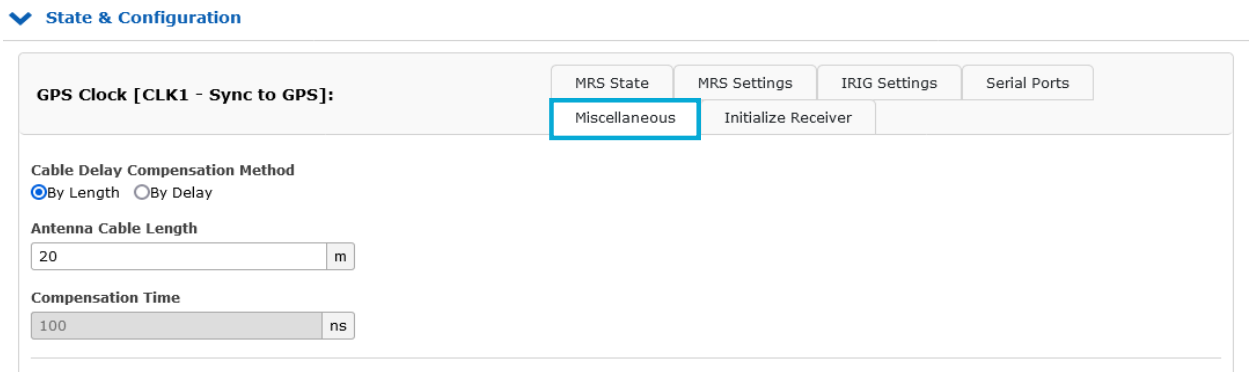


Fig. 4.1: "Clock" menu in LANTIME OS Web Interface

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

9.1.2 Installation of a GNSS Antenna

Two different antennas are available for our combined GPS/GLONASS/Galileo/BeiDou satellite receivers that are each designed to fulfill different tasks or applications.

The active Multi-GNSS L1 antenna is the standard accessory and can receive signals from the GPS, GLONASS, Galileo, and BeiDou satellite systems. This antenna is ideal for fixed-location systems, operates using a 5 V DC supply voltage supplied by the receiver, and features an integrated surge protector.

For mobile applications, such as cars, RVs, vans, ships, trains, and aircraft, we recommend the use of the RV-76G, an active GNSS antenna that is suitable for direct installation in an enclosure (chassis, panels, etc.)

9.1.2.1 Selecting the Antenna Location

There are essentially two ways the Multi-GNSS Antenna can be installed using the accessories included:

1. Mounted on a pole

2. Mounted on a wall

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

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

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

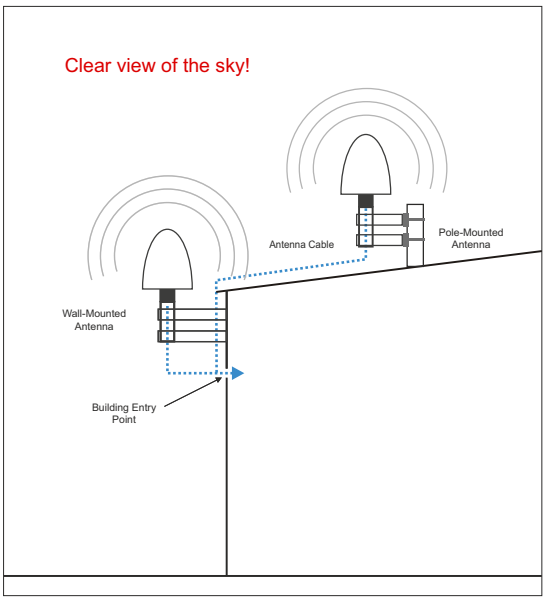


Fig. 1: Ideal Positioning

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

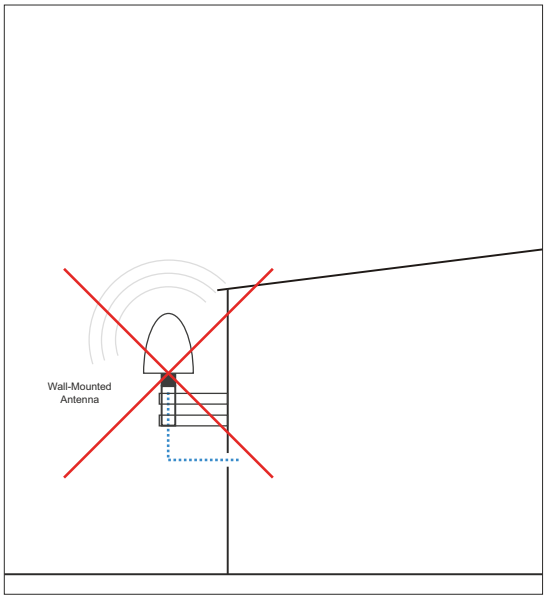


Fig. 2: Poor positioning of a wall-mounted antenna

There must also be no conductive objects, overhead power lines, or other electrical lighting or power circuits within the signal cone of the antenna (approx. 120 degrees), as these can cause interference in the already weak signals transmitted in the frequency band of the satellites.

Other Installation Criteria for Optimum Operation:

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

Information:

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

9.1.2.2 Mounting the Antenna

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

Danger!

Do not mount the antenna without an effective fall arrester!

Danger of death from falling!

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

Danger!

Do not work on the antenna system during thunderstorms!

Danger of death from electric shock!

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

Meinberg GNS Receiver

Use the included mounting kit to mount the L1 antenna at a distance of 50 cm from other antennas on a vertical pole of a diameter of between 60 mm and 215 mm ($2\frac{1}{2}$" – $8\frac{1}{2}$").

For detailed installation instructions, please refer to the "Downloads" section on the manufacturer's product page:
https://www.pctel.com/antenna-product/gps-timing-reference-antenna-2/

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

9.1.2.3 Antenna Cable

Selecting the Appropriate Cable

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

Important!

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

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

GNS Clocks

The table below shows the specifications of the supported cable types for the transmission of the typical GNSS frequency bands:

Cable Type	H155	H2010 (Ultraflex)
Signal Propagation Time at 1575 MHz*	423 ns/100 m	386 ns/100 m
Attenuation at 1575 MHz	40.20 dB/100 m	17.57 dB/100 m
DC Resistance	3.24 Ω/100 m	1.24 Ω/100 m
Cable Diameter	5.4 mm	10.2 mm
Max. Cable Length	70 m	150 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.*

Laying the Antenna Cable

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

Lay the coaxial cable from the antenna to the point of entry into the building. Like any other metallic object in the antenna installation (antenna and pole), the antenna cable must be integrated into the grounding infrastructure of the building and also connected to the other metallic objects.

Caution!

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

Further Points to Consider when Laying Antenna Cable:

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

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

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

Compensating for Signal Propagation Time

GNS Clocks

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

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

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

A fixed signal propagation offset can be entered in nanoseconds by selecting "**By Delay**". 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 Belden H155 cable.

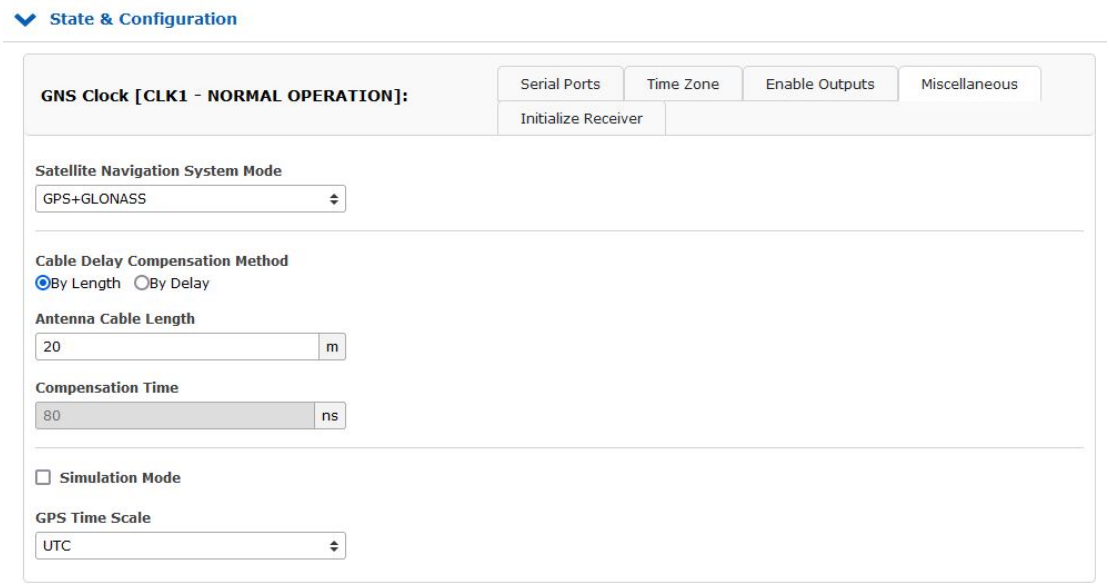


Fig. 4.1: "Clock" menu in the LANTIME OS web interface

9.1.3 Installation of a Longwave Antenna

9.1.3.1 Geographical Considerations

The antenna location plays a critical role in determining the quality of reception and thus the signal strength of the signal, and should therefore be selected carefully so as to avoid difficulties with synchronization. If the antenna is not precisely aligned, signal reception and timing accuracy will be affected.

AWO2 - DCF77

The antenna must be directed towards Mainflingen, Germany, near Frankfurt am Main, in accordance with the installation conditions specified below.

The DCF77 signal has a theoretical range of 2000 km (measured fromm the transmission tower) and enables DCF77 receiver-clocks in not only Germany but also countries such as France, Denmark, Sweden, Austria, and Italy to be synchronized. Depending on the time of day, sensitive receivers can receive a sufficiently strong signal even in the furthermost regions of the reception area.

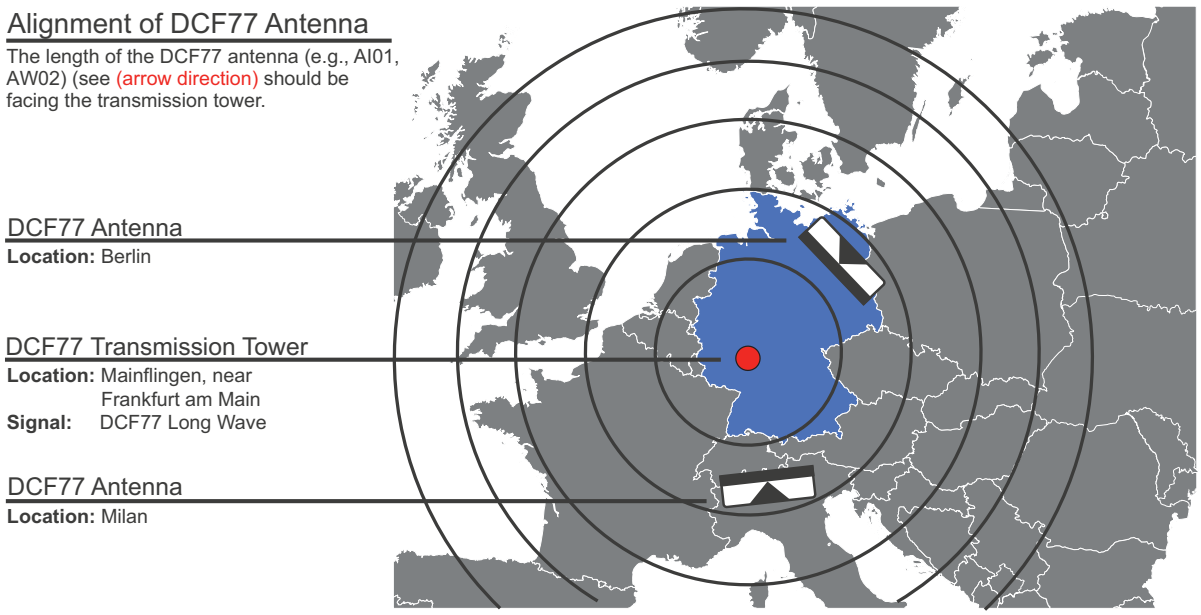


Illustration: Installation of a Meinberg long-wave antenna directed towards the DCF77 transmitter tower in Mainflingen, near Frankfurt-am-Main in Germany.

AWO2-60 - MSF and WWVB

Depending on the country of use, the AW02-60 antenna must be directed towards Anthorn, in Cumbria, or towards Fort Collins, Colorado, in accordance with the installation conditions specified below.

Reception of the MSF signal covers a theoretical range of 1000 km and is thus comprehensive and guaranteed in the UK and Ireland. The MSF signal is receivable in parts of northern and western Europe but this cannot be guaranteed.

Reception of the WWVB signal in the USA is limited to a theoretical range of 1500 km from the transmission tower in Colorado. As such, cities such as San Diego, Chicago, and Sacramento represent the extremes of the reception range, at which reception may become intermittent, especially in built-up areas such as urban centers.

The maps on the next page provide an overview of reception coverage in the UK and USA.

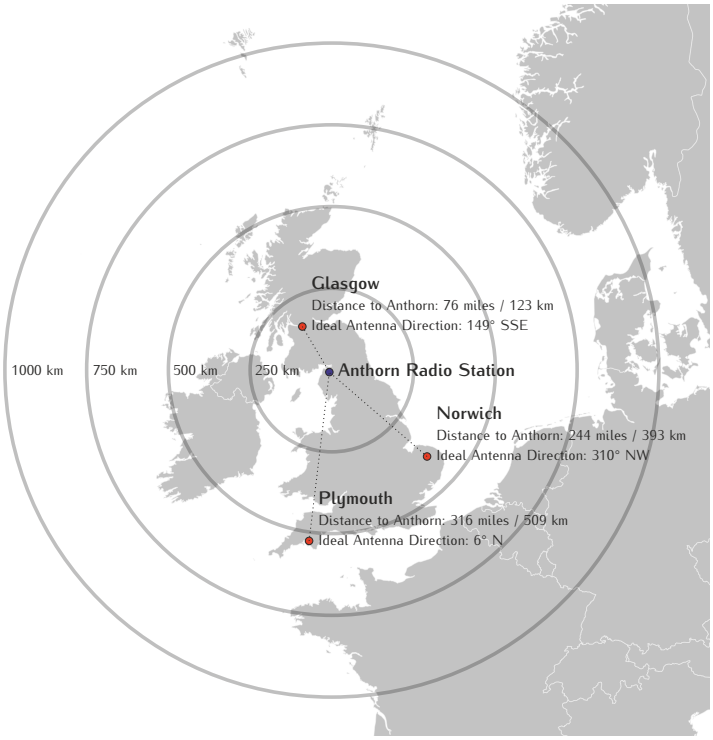


Illustration: Installation of how an AW02-60 antenna is directed towards the MSF transmitter tower in Anthorn, Cumbria, UK from various locations in the UK.

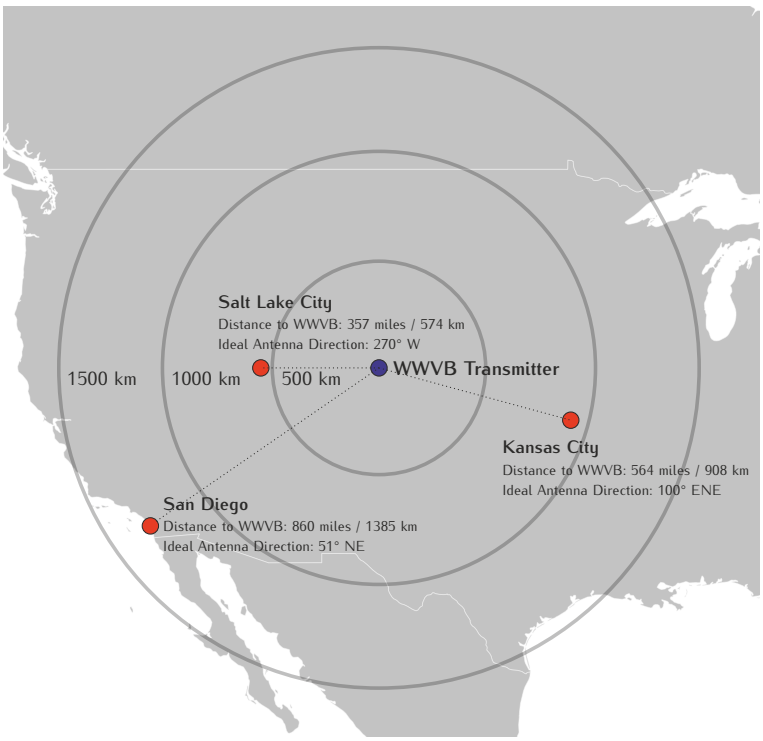


Illustration: Installation of how an AW02-60 antenna is directed towards the WWVB transmitter tower near Fort Collins, Colorado, USA from various locations in the USA.

9.1.3.2 Selecting the Antenna Location

There are two ways of mounting the antenna using the mounting kit included in the packaging.

1.Mounting on a pole

2.Mounting on a wall

To ensure that the long wave signal can be reliably received and avoid difficulties with synchronization of your Meinberg product, select a location that allows for an unobstructed view towards Mainflingen, Germany (near Frankfurt am Main).

When using an AWO2-60 antenna to receive MSF or WWVB time signals, select a location that allows for an unobstructed view towards Anthorn (UK) or Fort Collins (USA).

The line of sight between the antenna and signal source must therefore not be obstructed in any way. The antenna must also not be installed under power lines or other electrical lighting or power circuits.

Other Installation Criteria for Optimum Operation:

- The antenna should be mounted horizontally (see illustration).
- It should be at a distance of at least 30 cm (1 ft) from other antennas.
- The length of the antenna must be facing the transmission tower (see illustration).

Information:

Problems may arise with the synchronization of your Meinberg system if these conditions are not met.

9.1.3.3 Installation of the Antenna

Please read the following safety instructions carefully before installation and be sure to observe them.

Danger!

Do not mount the antenna without an effective fall arrester!

Danger of death from falling!

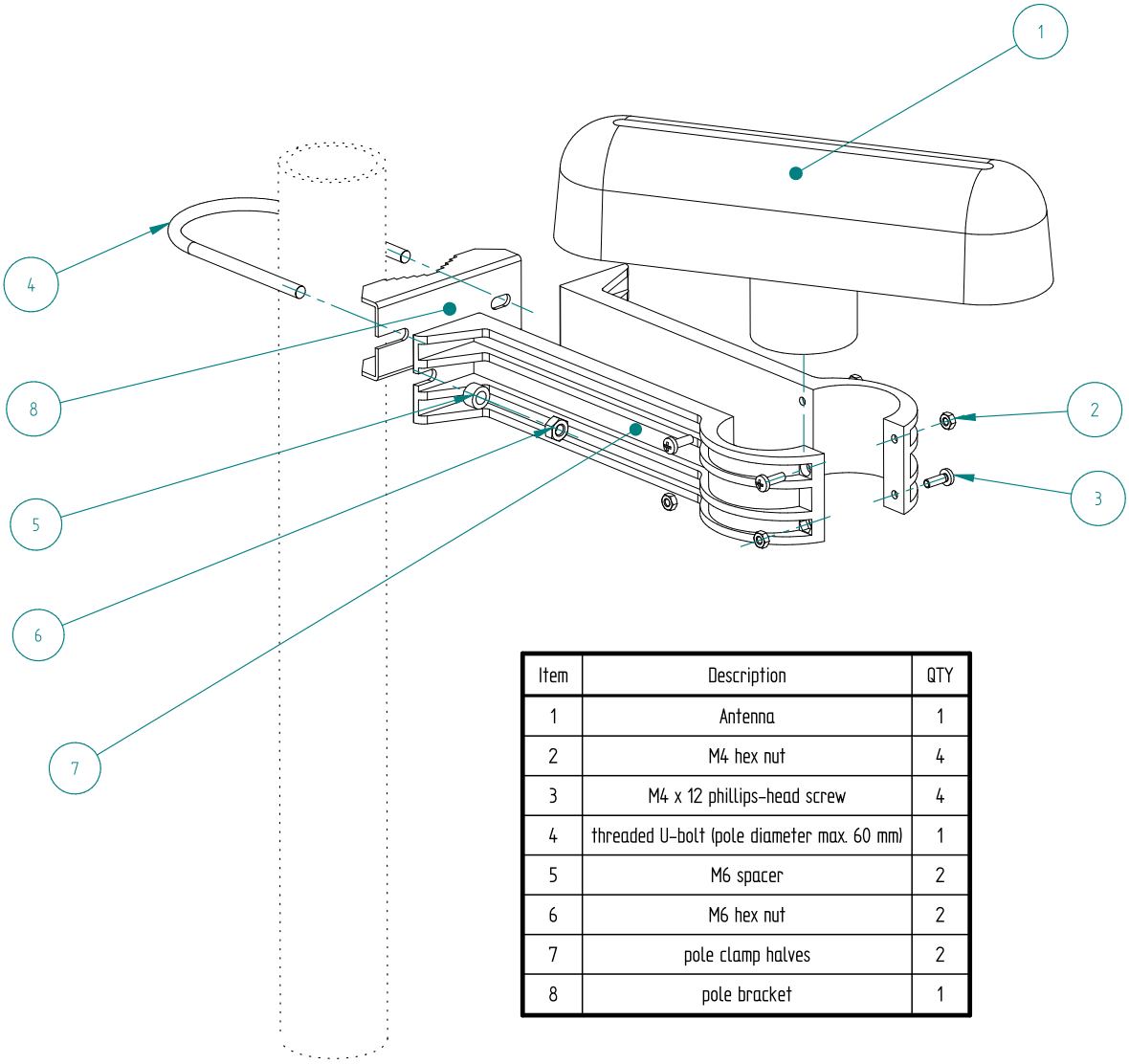
- Ensure that you work safely when installing antennas!
- Never work at height without a suitable and effective fall arrester!

Danger!

Do not work on the antenna installation during thunderstorms!

Danger of death from electric shock!

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



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

Fig. 3: Mounting a AW02 antenna onto a pole

Mount the long-wave antenna as shown above at a distance of at least 30 cm to other antennas using the mounting kit provided, either onto a vertical pole of no more than 60 mm diameter or directly onto a wall.

The illustration above shows how the antenna is mounted on a pole by way of example. When mounting the antenna directly onto a wall, use the enclosed wall plugs and M6 x 45 screws, which are to be fed directly through the corresponding recesses on the pole clamp halves (Pos. 8).

9.1.3.4 Antenna Cable

Selecting the Appropriate Cable

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

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.

Important!

Please avoid using mixed types of coaxial cable in your antenna installation (for example, RG58 and RG174 together in a single installation). This should also be noted when purchasing cable, for example to expand an existing installation.

The table below shows the specifications of the supported cable types for the transmission of the 77 kHz long-wave frequency:

Cable Type	RG58C/U	RG174U
Signal Propagation Time at 77.5 kHz	527.72	557.60
Attenuation at 77.5 kHz (dB/100 m)	0.57	3.35
DC Resistance (Ohm/100 m)	5.3	33.8
Cable Diameter (mm)	5	2.8
Max. Cable Length	300	700

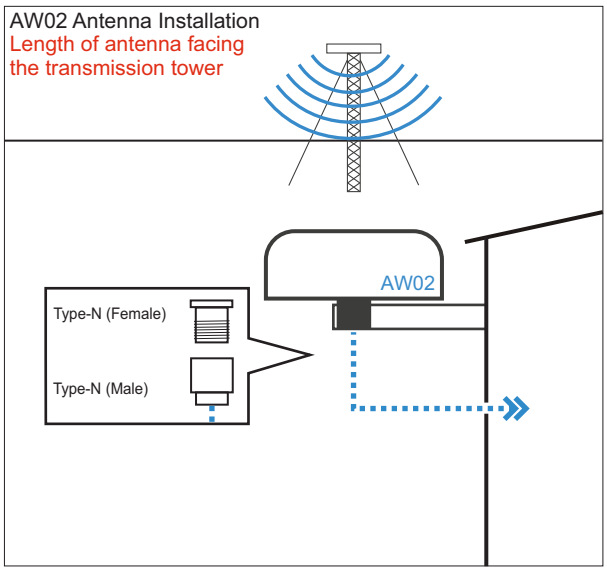
Table 1: Specifications of Cable Types Recommended by Meinberg

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

Laying the Antenna Cable

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

The antenna cable should then be connected to the Type-N connector of the antenna. Feed the other end of the cable into the building through the wall.



Caution!

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

Further Points to Consider when Laying Antenna Cable:

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

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

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

Compensating for Signal Propagation Time

The propagation of the long-wave signal from the transmission tower to the receiver (reference clock) can incur a certain delay. This delay can be compensated for by registering the distance in kilometers (point to point, straight line) between the location of the antenna and the DCF77 transmission tower in Mainflingen, Germany.

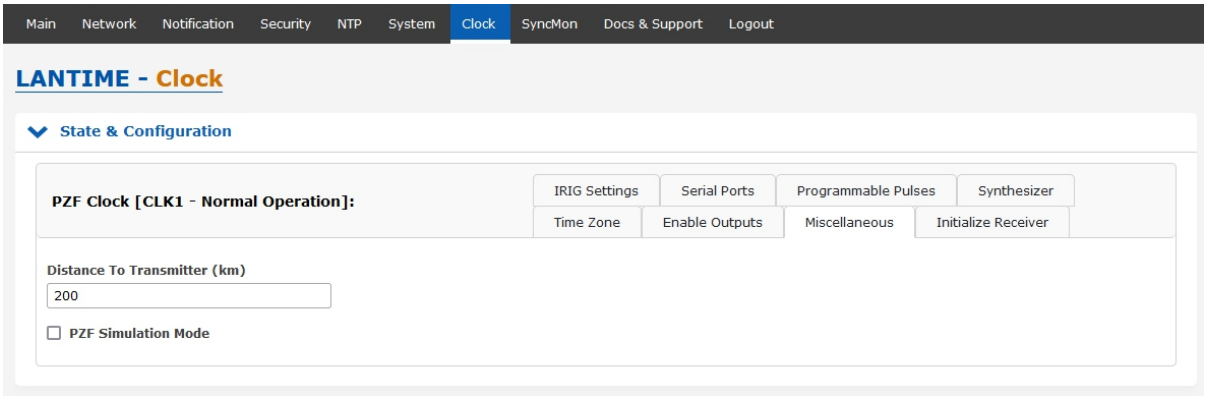


Fig. 4.1: "Clock" menu in LANTIME OS Web Interface

9.1.3.5 Procedure for Antenna Alignment

The antenna itself provides no visual indication of the reception quality of the DCF77 signal while aligning it.

Step 1: A field strength meter can be used to determine the ideal direction of the installed DCF77 antenna. First, the length of the antenna (using the arrow printed on the antenna) is pointed in the general direction of Frankfurt am Main, in Germany. Finer adjustments are then made to the direction of the antenna until the field strength is in the optimum range of –60 dB to –70 dB.

If no field strength meter is available, Meinberg recommends that two people perform the process of turning the antenna and verifying the reception quality. Person 1 (at the antenna) should remain in communication with Person 2 (at the receiver) to this end.

Step 2: Person 1 rotates the antenna slowly in an **anticlockwise** direction until Person 2 sees that the "Mod" LED is flashing rhythmically once a second without intermittent flickering.

If the LED does not flash in this way, the antenna should be turned slowly in a **clockwise** direction from the approximate direction until Person 2 sees that the "Modulation" LED is flashing rhythmically once a second without intermittent flickering.

Please note that a high signal level alone is no guarantee of good reception, as it can also be caused by electrical noise in the associated frequency range.

With good reception, the connected DCF reference clock should synchronize within three minutes after initialization.

Successful synchronization is signaled by the "Sync After Reset" LED turning green. Reception problems are signaled by the "Free Run" LED turning red again at the start of the next minute. If the clock is running off the oscillator alone for more than 12 hours, the "Sync" LED will begin to flash.

9.1.4 Surge Protection and Grounding

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

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

Warning!

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

Meinberg GPSANTv2

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

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

Surge Protection

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

If the antenna represents the highest point of a building or pole, the lightning protection strategy should incorporate a safety zone (angle α, Fig. 5 and 6), formed by a lightning rod positioned above the antenna. This increases the likelihood of lightning being 'caught' by the lightning rod, allowing surge currents to be safely passed from the lightning rod along a grounding conductor to ground.

Electrical Bonding

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

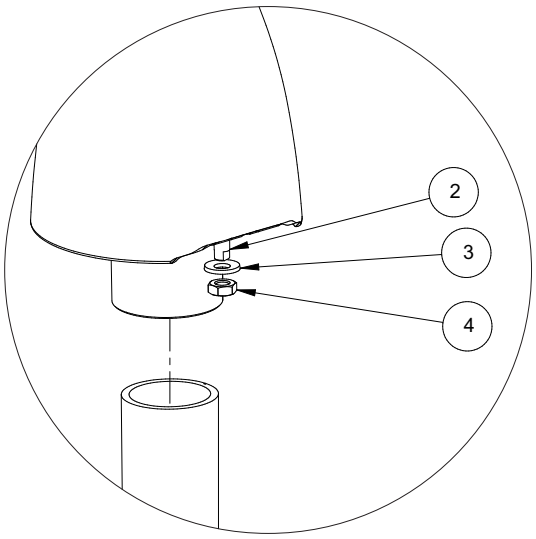
To this end, the following elements should be connected and integrated into a bonding system:

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

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

Connecting the Grounding Terminal of the Antenna

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



Grounding Cable Installation Procedure:

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

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

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

Antenna Installation without Insulated Lightning Rod System

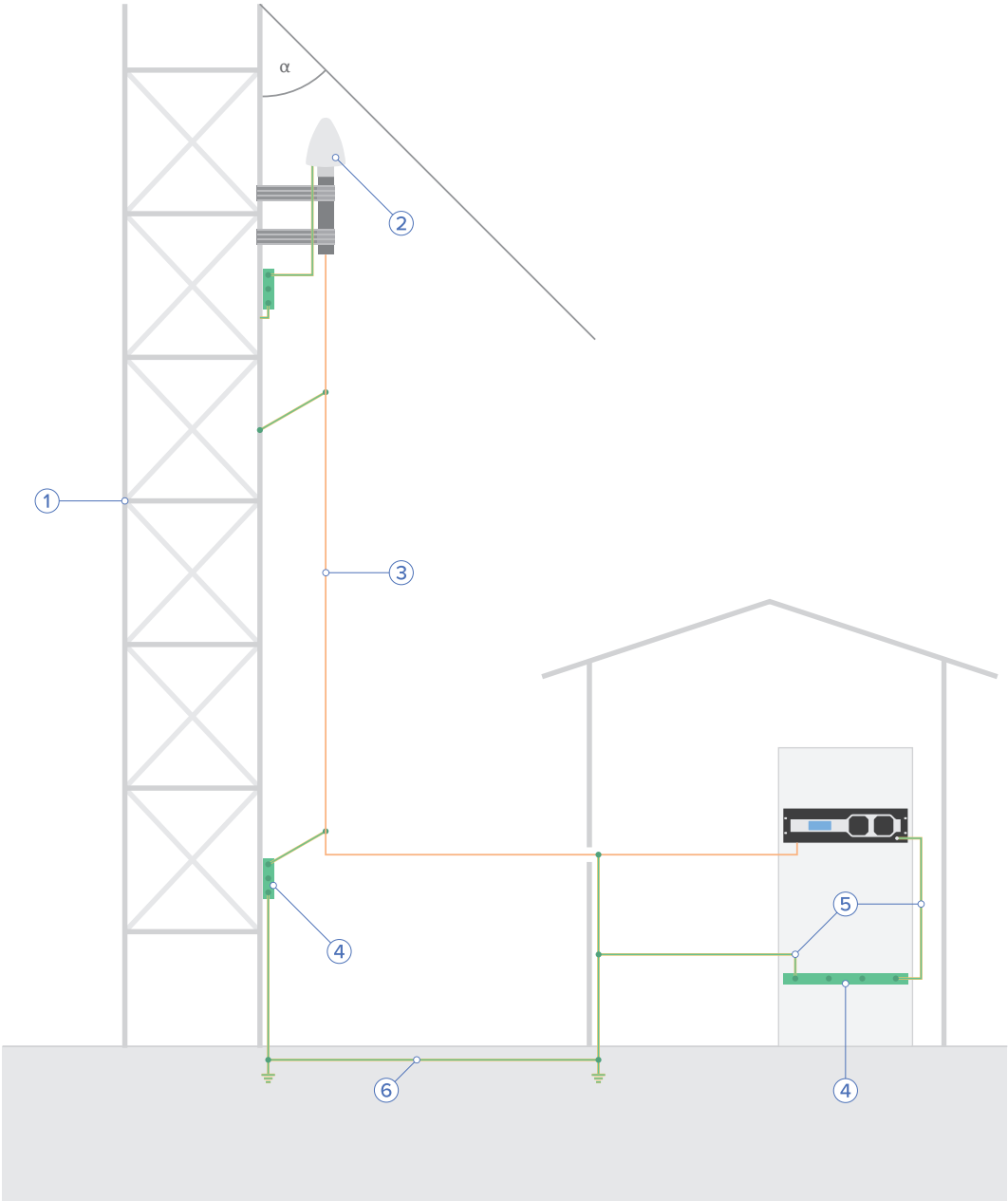


Fig. 5: Installation on a Pole

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

Antenna Installation with Insulated Lightning Rod System

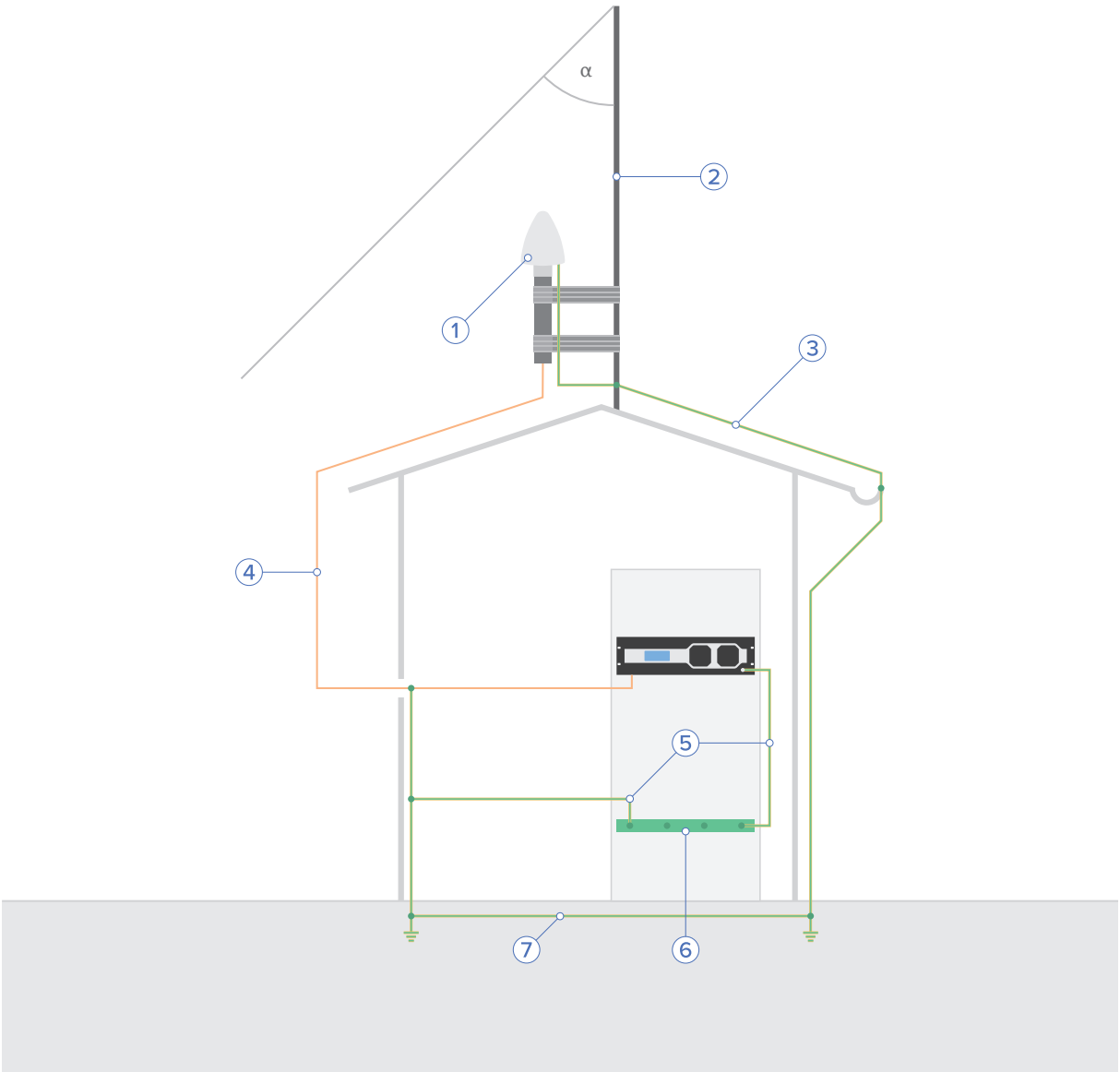


Fig. 6: Roof Installation

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

Optional MBG S-PRO Surge Protector

Information:

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

Construction

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

Installation Conditions

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

Ideal Installation Conditions:

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

Installation and Connection

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

Installation

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

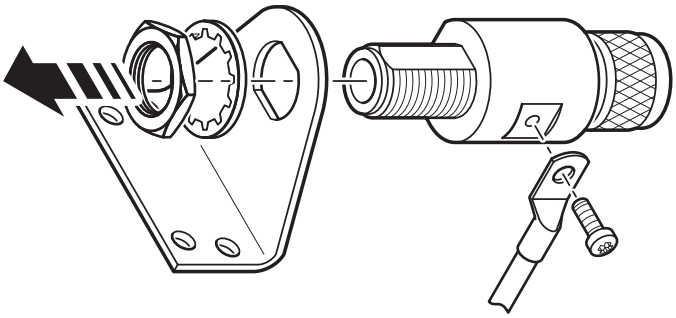


Fig. 7: Installation of the Surge Protector

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

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

Caution!

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

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

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

9.2 Connecting the System

Make sure that the system to be connected is connected to your PC or the network via either a serial or a network connection and is on the same physical network.

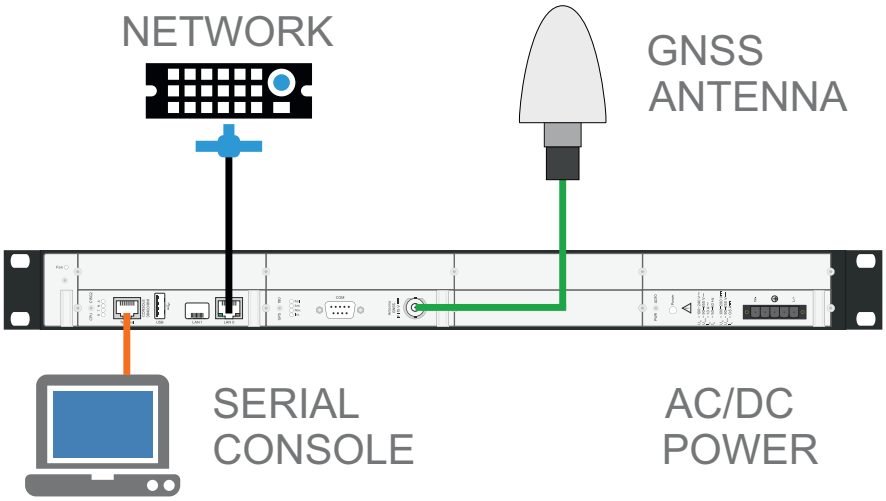


Figure: Connection scheme LANTIME M1000 with power supply, network connector, serial connection and antenna link

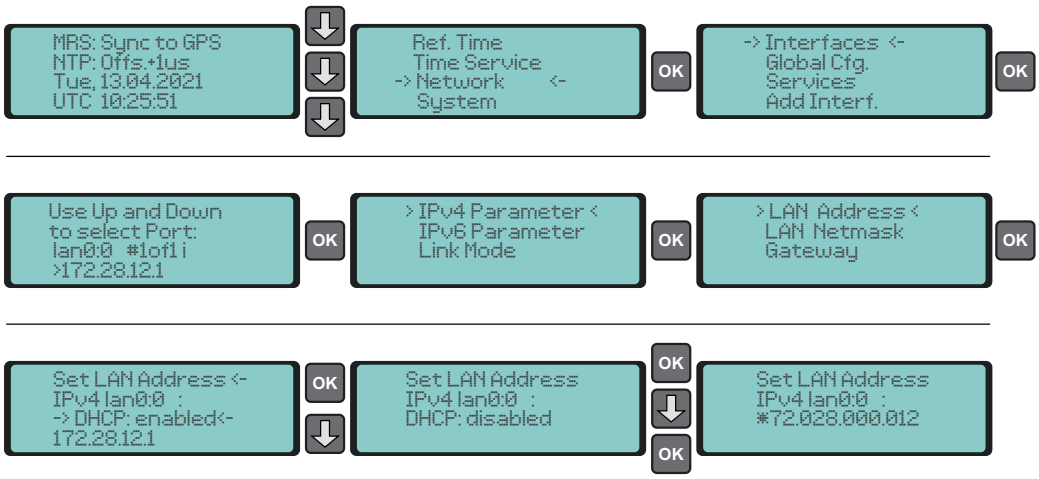
The following section describes how you can initially put a LANTIME system into operation via LED display, with help of the Web Interface or via serial connection.

9.3 Initial Network Configuration

After the system has been connected to the power supply and to the receiver antenna, the initial start-up can be started. The device starts immediately after connection to the power supply.

An IMS LANTIME system is shipped with DHCP service enabled on the LAN 0 interface. This means that you have to establish a manual network connection if no DHCP service is installed in your network environment in order to perform system settings via the web interface.

Initial network configuration via the LC display.
Except for models with S-chassis, all LANTIME IMS systems have a display with control keypad. The following figure shows the individual steps you have to perform to read out an IP via the display or to set the IP manually.



For manual configuration, you have to disable the DHCP service. After that the IP can be configured using the "← ↑ ↓ →" buttons. Always confirm your entry with the OK button to save the changes.

Serial connection with *Basic Configuration Wizard* (without LC display).
After switching on the device, a terminal program (e.g. Putty) can be started after about one minute. Connect the system's serial interface (TERM/CONSOLE) with a null modem cable or a CAB-CONSOLE-RJ45 cable. The settings for the interface must be set to 38400 baud, 8 data bits, no parity and one stop bit (8N1). The terminal emulation must be set to VT100. Computers without serial interface can be connected with a "Serial-to USB" converter.

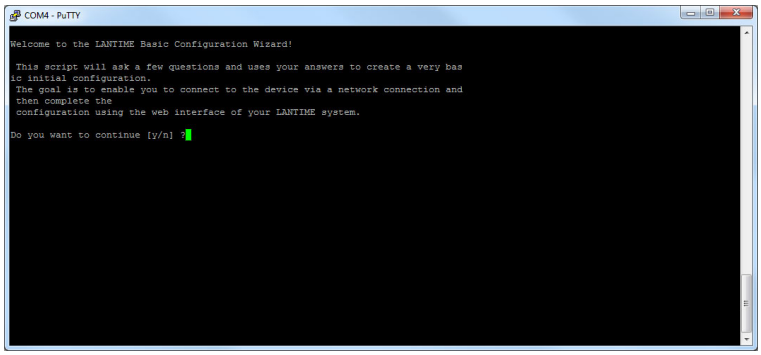
After connection is established, the prompt for the user ID should be displayed:

Welcome to Meinberg LANTIME
login: _

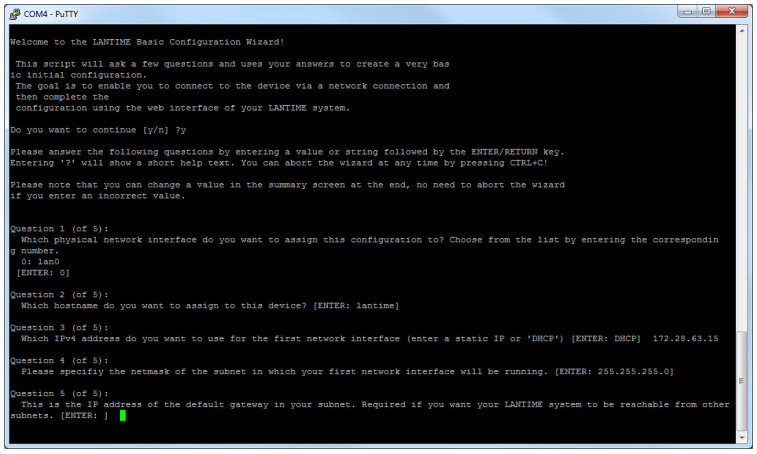
Default user: **root**
Default password: **timeserver**
(press RETURN again if necessary)

Change with the console to the directory */wizard/*. The LANTIME Basic Configuration Wizard can now be started with the "startwizard" command.

After successfully starting the Wizard, the following welcome screen will be displayed:

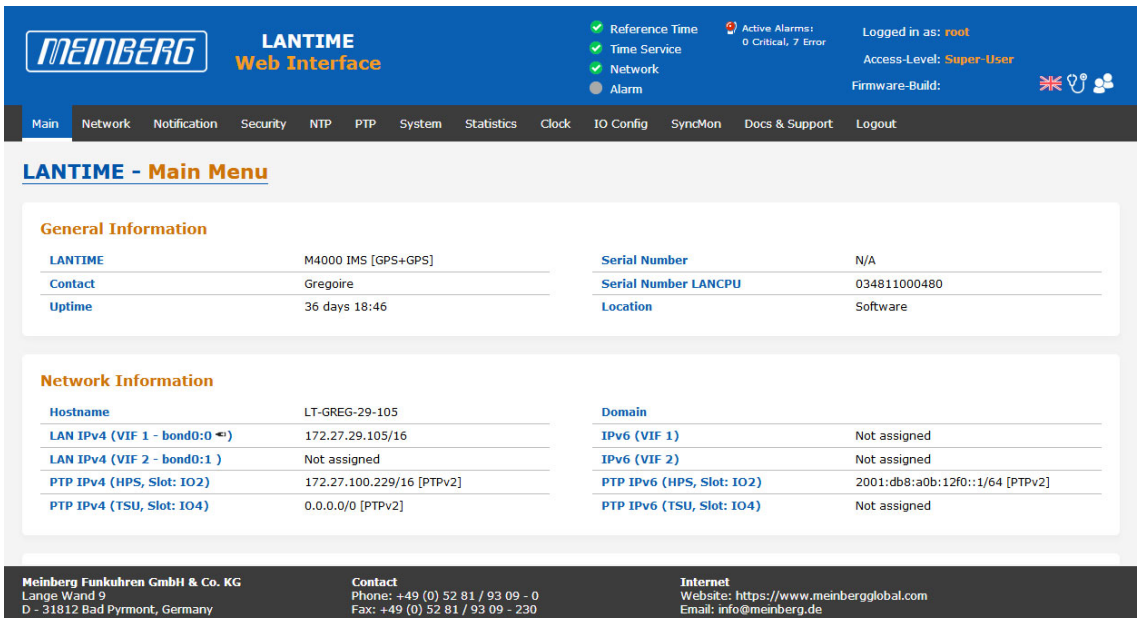


By entering "y" you start the configuration - all further settings can now be made:



Confirm your settings then.

10 System Operation - Configuration and Monitoring



The LANTIME web interface.
You have access to all NTP servers of the LANTIME M series via the LANTIME web interface. To connect simply enter the set IP address of your LANTIME system into the address line of a standard web browser. A login dialog will open - in delivery state you can use the following login data:

User: ***root***
Password: ***timeserver***

Note: Please change these credentials during the first web session on your LANTIME.

For detailed documentation about management and monitoring please refer to the latest LTOS firmware manual at:
http://www.mbg.link/doce-fw-ltos

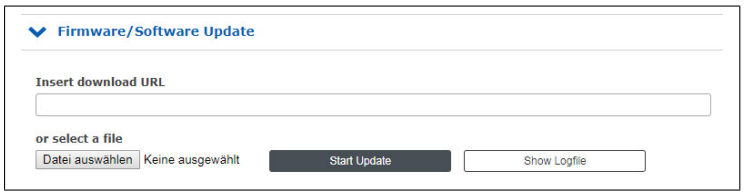
or in the menu "Documentation → Available Documents" in the web interface.

11 Maintenance, Servicing and Repairing

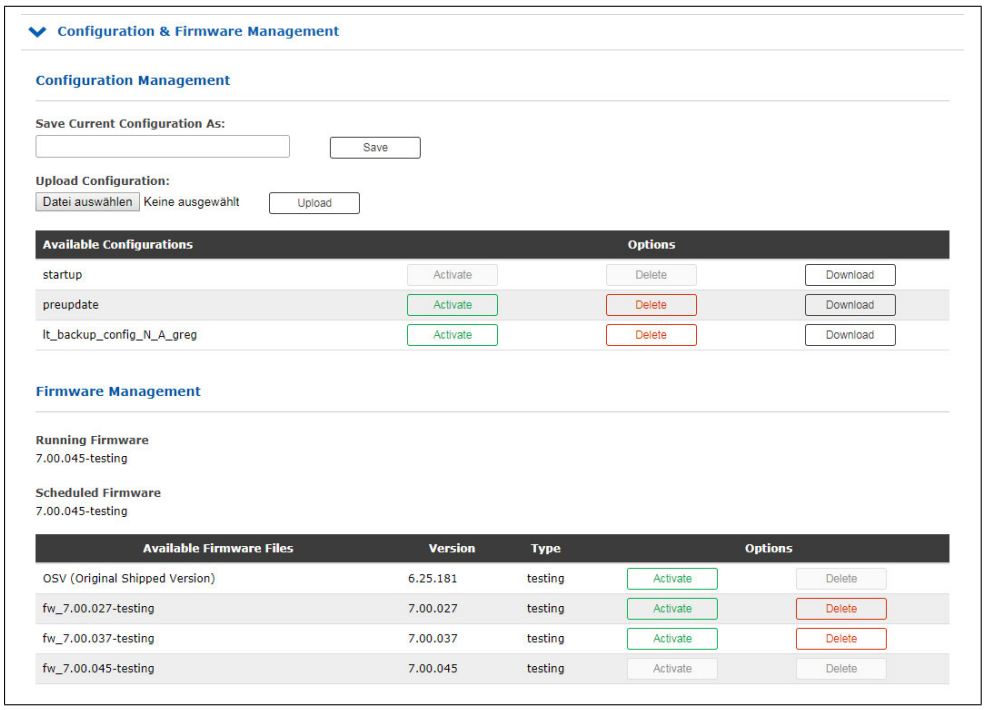
11.1 Firmware Updates

On our firmware download page at:
https://www.meinbergglobal.com/english/sw/firmware.htm

we provide the latest version of the LANTIME firmware for free download. If you need an older version, then you can request it from our support. To do so, select the option "A specified firmware version" and then enter the version of the currently used firmware and the desired firmware version (e.g. LTOS 6.24.027). For security reasons, we always recommend the latest version of the respective firmware generation (V5 / V6 / V7).

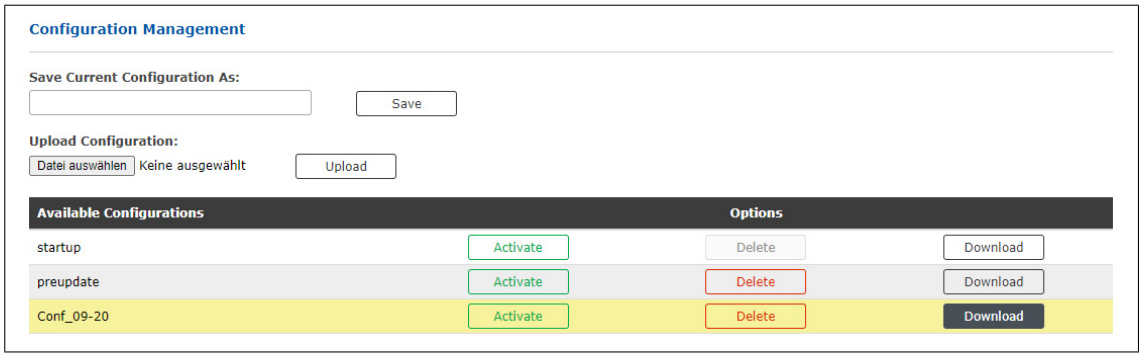


In the web interface menu "System" you can copy a new firmware version to your LANTIME under "Firmware/-Software Update". With the submenu "Configuration & Firmware Management → Firmware Management" you can easily activate different firmware versions and delete versions that are no longer needed. Existing configurations can be stored here to save them as backup. Furthermore, configurations from other LANTIMEs can be transferred to the system here.



12 Troubleshooting and Alarming

If there is a problem with your IMS LANTIME system, you can contact our technical support at any time. In order to perform a fast and targeted diagnosis of your system please provide us with a diagnostic file of the affected LANTIME system. You can create this diagnostic file via the web interface. For this select the menu "System → Diagnostics" and then use the button **Download Diagnostic File**. In the submenu "Configuration & Firmware Management" you can save your current configuration under **Configuration Management**. This file is also helpful for our staff when solving problems.



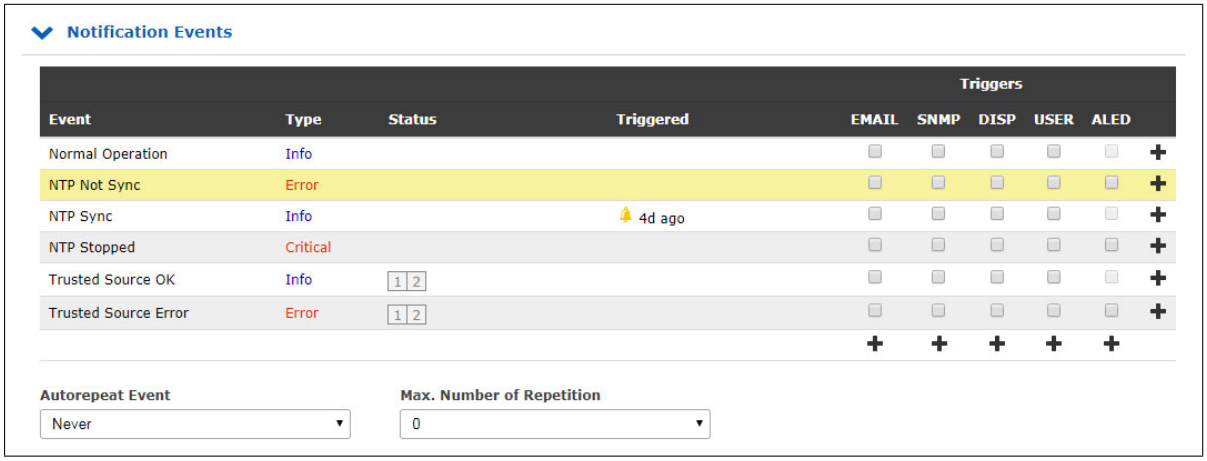
If these files are too big to send by mail, you can also use our upload page:
https://www.meinbergglobal.com/upload/

Please enter the serial number of your device again and, if already available, a support ticket number.

Otherwise there are a lot of tools available for self-help. Please also read the chapter Support Information.

12.1 System Error Messages

System messages and notifications.
In the web interface menu "Main" under **System Messages** and in the menu "Notification → Notification Events" you are able to view the last system notifications and the triggered event notifications. For the system messages the date and UTC time is displayed, for the notifications the date and UTC time of the last occurrence of the triggered event is displayed. In addition, the event level is also displayed for the notifications (Info, Action, Warning, Error, Critical).



13 Support Information

In this chapter you will learn about different levels of support at the Meinberg Company. In general, the Basic Customer Support level is included in the price you pay for your Meinberg product and demands no additional costs. It includes free e-mail, phone support and free lifetime firmware updates for the lifetime of your product, i.e. for as long as you choose to use it.

Depending on the product this level also includes a 2 or 3 year hardware warranty. You can extend the hardware warranty period after the standard warranty of your Meinberg product ends.

The chapter includes:

- Basic Customer Support
- Support Ticket System
- How to download a Diagnostic File
- Self-Help Online Tools
- NTP and IEEE 1588-PTP online tutorials
- The Meinberg Academy introduction and offerings
- Meinberg Newsletter
- Meinberg Customer Portal

13.1 Basic Customer Support

Contact Meinberg via e-mail or phone.

Technical Support	
E-Mail	techsupport@meinberg.de
Service hotline	+49 (0) 5281 / 9309-888
Service hours hotline	Mon – Thu 8:00 – 17:00, Fri 8:00 – 16:00 (CET/CEST) Not available on Sat/Sun and German Public Holidays

Office (Sales/Purchase)	
E-Mail	info@meinberg.de
Service hotline	+49 (0) 5281 / 9309-888
Service hours hotline	Mon – Thu 7:30 – 17:00, Fri 07:30 – 15:00 (CET/CEST) Not available on Sat/Sun and German Public Holidays

MEINBERG Remote Support

In order to assist you with configuration, installation, monitoring and diagnostics of your Meinberg products, you can download a remote support software that allows Meinberg technical support to remote control your computer.

By following this link:
https://www.meinbergglobal.com/english/support/remote.htm

you can find all necessary information and to download the support.

LANTIME Firmware Updates

To check if an update is available for your LANTIME, please visit;
https://www.meinbergglobal.com/english/sw/firmware.htm

and fill out the form. Available firmware updates will be provided by e-mail (LANTIME firmware V5 or older versions) or with a direct download link (LANTIME firmware V6 or newer).

13.2 Support Ticket System

Meinberg assists you quickly and directly on questions regarding the initial setup of your devices, troubleshooting or if you want to update the hard- or software. We offer free support for the whole lifetime of your Meinberg product.

- Send a mail to techsupport@meinberg.de with a description of your issue.
- A support ticket will automatically be opened.
- Our support engineers will contact you as soon as possible.
- It is always helpful for our engineers to receive a diagnostic file when you send a ticket.
- The diagnostic file includes all status data of a LANTIME system logged since the last reboot and can be downloaded from all LANTIME timeservers. The file format of the diagnostic file is a tgz-archive. → See chapter How to download a Diagnostic File how to generate this file at your LANTIME system.

13.3 How to download a Diagnostic File

In most support cases the first action is to ask the customer to download the diagnostic file, because it is very helpful at identifying the current state of the LANTIME and finding possible errors. Therefore we recommend that you attach your Diagnostic File when sending a ticket to our support.

The diagnostic file includes all status data of a LANTIME system logged since the last reboot. It can be downloaded from all LANTIME timeservers or you can save the file on a USB storage device connected to the time server. The file format of the diagnostic file is a tgz-archive. The archive contains all the important configuration and logfiles.

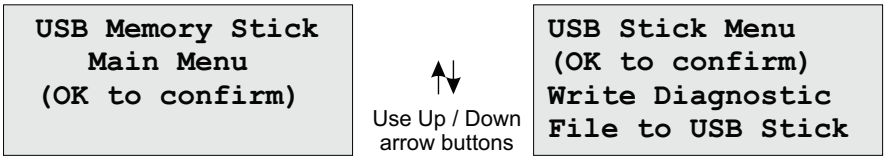
13.3.1 Download via Web GUI

- Connect to the Web GUI by putting the IP address into the address field of the web browser.
- Open the „System“ page and the submenu "Diagnostics".
- Press the "Download Diagnostic File" button.

- The file will take some time to be created as its size is several MBs. After the file has been created it will be automatically sent to your web browser. Then save the file to your local hard disk.
- The diagnostic file is named *"lt_diag_SERIALNUMBER.tgz"* and the file format is a tgz archive. You can open the tgz archive e.g. with 7Zip (https://www.7-zip.org/).

13.3.2 Download via USB Stick

- The USB storage device have to be formatted in a linux compatible file system like FAT. Connect a USB stick to the USB port of the LANTIME:
- The USB Memory Stick Menu opens automatically. Press "OK" to confirm.
- You can use the up and down arrows to move through the menu.
- Use the "Write diagnostic File to USB stick" option to write the current diagnostic file to the USB storage device.
- You can find the Diagnostic File by opening the LANTIME folder and continue on to the Diag folder.



13.4 Self-Help Online Tools

Here is the list of some informative websites where you can query different information about the Meinberg Systems.

1. Meinberg Homepage - general:
   https://www.meinbergglobal.com/

2. NTP Download - at Meinberg:
   https://www.meinbergglobal.com/english/sw/

3. NTP Client Download for Windows (NTP-time-server-monitor):
   https://www.meinbergglobal.com/english/sw/ntp-server-monitor.htm

4. LANTIME firmware update request online form:
   https://www.meinbergglobal.com/english/sw/firmware.htm

5. Download page for Meinberg software, drivers and software:
   https://www.meinbergglobal.com/english/sw/

6. All Meinberg manuals (ENG, German versions):
   https://www.meinbergglobal.com/english/docs/

7. Meinberg Newsletter and subscription page:
   https://www.meinbergglobal.com/english/company/news.htm

8. NTP / IEEE 1588-PTP online tutorials from Meinberg:
   http://blog.meinbergglobal.com/

9. FAQs about Meinberg Products:
   https://www.meinbergglobal.com/english/faq/

10. Meinberg Knowledgebase:
    https://kb.meinbergglobal.com

11. GPS / GNSS Antenna Installation and mounting:
    https://www.meinbergglobal.com/english/info/gps-antenna-mount.htm
    https://www.youtube.com/watch?v=ZTJMKSI8OGY (YouTube video)

12. NTP support page and documentation:
    http://support.ntp.org/bin/view/Support/WebHome

13.5 NTP and IEEE 1588-PTP online tutorials

A team of Meinberg engineers are writing online tutorials covering topics on IEEE 1588 PTP, NTP, synchronization setups and configurations used in different industries.

The tutorials can be found at:
http://blog.meinbergglobal.com/

The blog provides you also the opportunity to write a comment or a question to our experts and get their reply.

Categories:
Configuration Guidelines, IEEE 1588, Industry Applications, NTP and Security.

13.6 The Meinberg Academy introduction and offerings

Meinberg Sync Academy (MSA) is an institution within the Meinberg Company which takes care for education and expert knowledge dissemination in the field of time and frequency synchronization. The academy offers tutorials and courses on the latest synchronization technologies such as NTP, IEEE 1588-PTP, synchronization networks for different industries: telecom, power, broadcasting, professional audio/video, finance, IT and . The MSA courses include both, theoretical lectures and practical hands-on labs.

If you are planning or re-designing synchronization for your networks and you need additional knowledge, see our agenda for the upcoming courses.

Homepage:	https://www.meinbergglobal.com/english/support/meinberg-sync-academy.htm
Courses:	Meinberg Product Training, NTP Complete, PTP Complete Customized Trainings and Online Trainings.
Contact Phone:	+49 (0) 5281 93093-0
E-Mail:	info@meinberg.de

13.7 Meinberg Newsletter

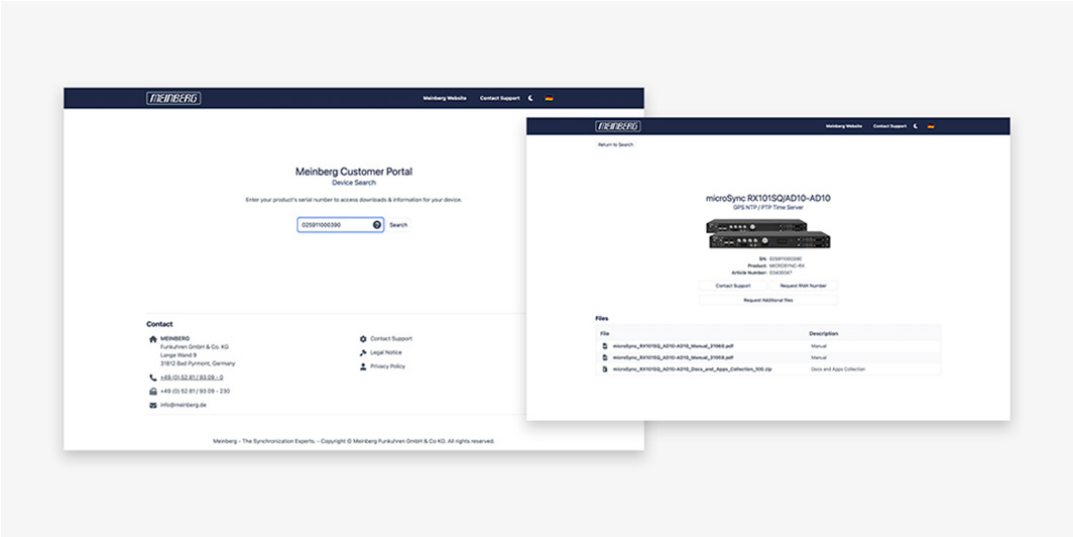
Meinberg publishes regularly up-to-date information, technical news, firmware updates and security advisory by the Meinberg Newsletter in both the English and German language.

Subscribe to the newsletter here:

https://www.meinbergglobal.com/english/contact/newslett.htm

13.8 Meinberg Customer Portal - Software and Documentation

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



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

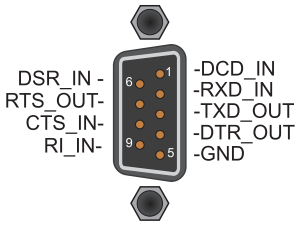
The Meinberg Customer Portal vastly simplifies how you access support, software, and documentation, and ensures that you always have the latest versions of downloadable tools and manuals at your disposal.

14 Technical Appendix

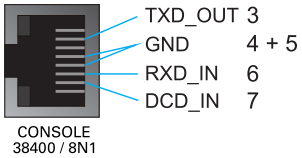
14.1 IMS Front Connectors

14.1.1 TERMINAL (Console)

To connect a serial terminal (according to the device model), use the 9pin RS-232 D-Sub connector in the front panel or the RJ45 connector of the LAN-CPU. Via the serial terminal connection it is possible to configure parameters with a command line interface. You have to use a NULL-MODEM cable (D-Sub) or a CAB-CONSOLE-RJ45 cable to establish a connection to your PC or Laptop computer.



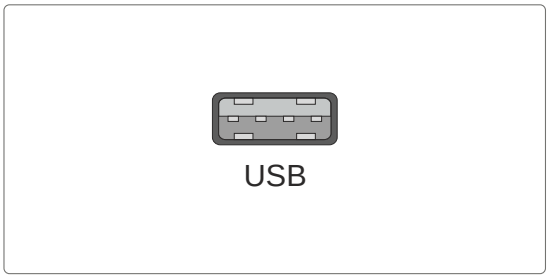
TERM



You can use e.g. the standard Hyperterminal program shipped with your Windows operating system. Configure your terminal program with 38400 Baud, 8 Databits, no parity and 1 Stopbit. The terminal emulation have to set to VT100. After connecting to the timeserver there will be displayed the login message (press RETURN for first connection; default user: root password: timeserver).

14.1.2 USB Port

All M-series LANTIME devices feature a USB interface either on the front panel (e.g., LANTIME M320, LANTIME IMS-M1000, LANTIME IMS-M3000) and/or on the IMS LANTIME CPU module (e.g., IMS-M500, IMS-M1000S). Essentially both USB ports perform exactly the same functions, allowing a USB storage medium such as a flash drive to be connected for the following tasks:



- locking the keys on the LC display to prevent unauthorized access
- backing up the LANTIME configuration
- transferring configurations between individual LANTIMES
- copying log files
- installing firmware updates
- uploading and downloading secure certificates (SSL, SSH) and passwords

14.2 Available Modules and Connectors

Name	Type	Signal	Cable
Front Connectors			
Terminal	9pin D-SUB male	RS-232	shielded data line
USB	USB Port		USB Storage Device
Rear Connectors			
Power supply	5pin DFK male	100-240 V AC (50-60Hz) 100-200 V DC	5pin MSTB clamp
GPS Antenna or Multi GNSS Antenna or AW02 (DCF77) Antenna	BNC SMA BNC	10 MHz / 35.4 MHz L1 Frequency band LF	shielded coaxial line shielded coaxial line shielded coaxial line
Terminal	RJ45	RS-232 (38400/8N1)	CAB-CONSOLE-RJ45
USB	USB Port		shielded data line
Network LAN-CPU	RJ-45 SFP	10/100/1000 Base-T 1000Base-T	shielded data line
Module Options			
Power			
DC power supply	5pin DFK male	20-60 V DC or 10-36 V DC	5pin. MSTB clamp
Network			
LNE-GbE	RJ45 SFP	10/100/1000 MBit 1000BASE-T	shielded data line
HPS100	RJ45/SFP	10/100/1000 MBit	shielded data line
Signal Outputs:			
CPE - configurable	BNC, DFK-2, DSUB9, ST	PPOs, serial TS, TC FO ...	shielded data line
BPE - fixed	BNC, ST	PPS, 10 MHz, TC ...	shielded data line
LIU:	RJ45 jack BNC	balanced 120 Ohm (Clock) unbalanced 75 Ohm (Bits)	 shielded data line shielded data line
LNO	BNC	10 MHz sine	shielded data line
REL	DFK-3	Error Relay	

Name	Type	Signal	Cable
Signal Inputs:			
ESI	BNC, RJ45	E1/T1, var. Freq.	shielded data line
MRI	BNC	10 MHz, PPS, IRIG, PP	shielded data line
VSI	BNC	Video Sync, LTC, Word Clk and PPS Input	shielded data line

14.3 IMS Module Options

14.3.1 IMS M1000 Slot Assignment

The IMS system LANTIME M1000 is available in two different versions. A standard version with a single receiver module and in a redundant design, which allows the use of two Meinberg receivers. In this case the configuration of the I/O slots is characterized by the availability of the slots for input signals.

In the non-redundant M1000 configuration one MRI Slot, one ESI slot and two additional I/O slots are available. In the redundant receiver configuration of the M1000 chassis two MRI Slots and one I/O slot are available for input and output modules (see figure below).

with internal SPT

with internal RSC

The following modules can be used in the designated slots:

ACM Active Cooling Module

I/O All output modules (BPE, CPE, LIU, LNO, SCG, VSG ...)
All network modules (LNE, TSU, HPS100 ...)
TSU and modules can only operate in PTP Grandmaster mode in an I/O slot.
HPS modules (with FW ≥1.4.1) can operate in all I/O slots as PTP master or slave.

CPU CPU Management Module

CLK All available reference clocks (GPS, GNS, GNM, PZF, TCR)

ESI ESI input module for telecom references
All output modules and all network modules
TSU and HPS modules can operate in PTP Grandmaster and Slave mode in an ESI slot *.

MRI MRI standard reference input signals (PPS, 10 MHz, IRIG)
ESI input module for telecom references
All output modules and all network modules
TSU and HPS modules can operate in PTP Grandmaster and Slave mode in a MRI slot *.
Additionaly SyncE can be used as input reference in a MRI Slot.
Note: For mechanical reasons, no FDM module can be used in the MRI 1 slot.

PWR All available power supplies (AC/DC, DC)

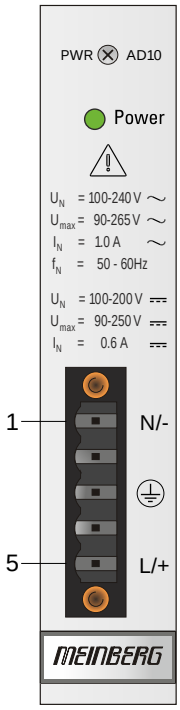
---

* In case of a redundant receiver configuration and installation in an ESI/MRI slot, the master/slave mode only works for the assigned clock. This means that if the CLK1 receiver has to be synchronized via an HPS, then the HPS must either be installed in an IO slot or in the MRI1/ESI1 slot.

14.3.2 Power Supply 100-240 V AC / 100-200 V DC

Connector Type: 5-pol. DFK

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



Input Parameter

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

Output Parameter

Maximum Power:	P_{max}	=	50 W
Maximum thermal energy:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

Danger!

This equipment is operated at a hazardous voltage.

Danger of death from electric shock!

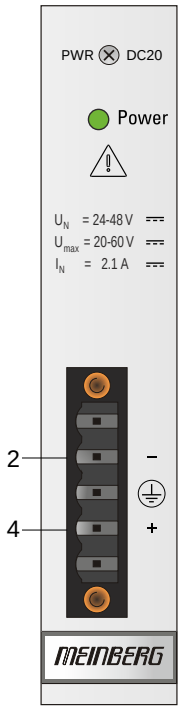
- This device must be connected by qualified personnel (electricians) only.
- Never handle exposed terminals or plugs while the power is on.
- All connectors must provide protection against contact with live parts in the form of a suitable plug body!
- Always ensure that wiring is safe!
- The device must be grounded by means of a connection with a correctly installed protective earth conductor (PE).

14.3.3 Power Supply 20-60 V DC

Connector: 5pin DFK

Pin Assignment:

1: not connected
2: V_{IN} -
3: PE (Protective Earth)
4: V_{IN} +
5: not connected



Input Parameter

Nominal voltage range:	U_N	=	24-48 V ⎓
Maximum voltage range:	U_{max}	=	20-60 V ⎓
Nominal current:	I_N	=	2.1 A

Output Parameter

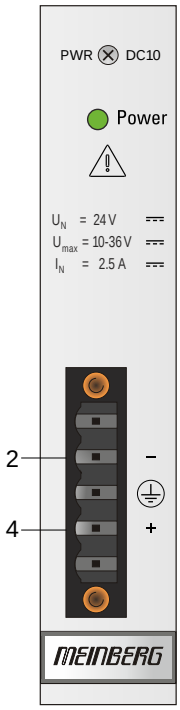
Maximum power:	P_{max}	=	50 W
Maximum thermal energy:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

14.3.4 Power Supply 10-36 V DC

Connector: 5pin DFK

Pin Assignment:

1: not connected
2: V_{IN} -
3: PE (Protective Earth)
4: V_{IN} +
5: not connected



Input Parameter

Nominal voltage:	U_N	=	24 V ⎓
Maximum voltage range:	U_{max}	=	10-36 V ⎓
Nominal current:	I_N	=	2.5 A

Output Parameter

Maximum power:	P_{max}	=	50 W
Maximum thermal energy:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

14.3.5 IMS Receiver Modules

The following receiver modules are available for our IMS systems:

GNSS satellite receivers

IMS-GPS receiver	12 channel GPS C/A-code receiver
IMS-GNS receiver	72 channel GPS/GLONASS/Galileo/BeiDou receiver (also for mobile applications)
IMS-GNS-UC receiver	72 channel GPS/Galileo receiver (with Meinberg antenna/converter unit)
IMS-GNM receiver	72 channel GPS/GLONASS/Galileo/BeiDou multiband receiver (simultaneous reception of all GNSS systems)
IMS-GNM receiver	448 channel GPS/GLONASS/Galileo/BeiDou multiband receiver (simultaneous reception of all GNSS systems with anti-spoofing features)

Long wave receiver (DCF77)

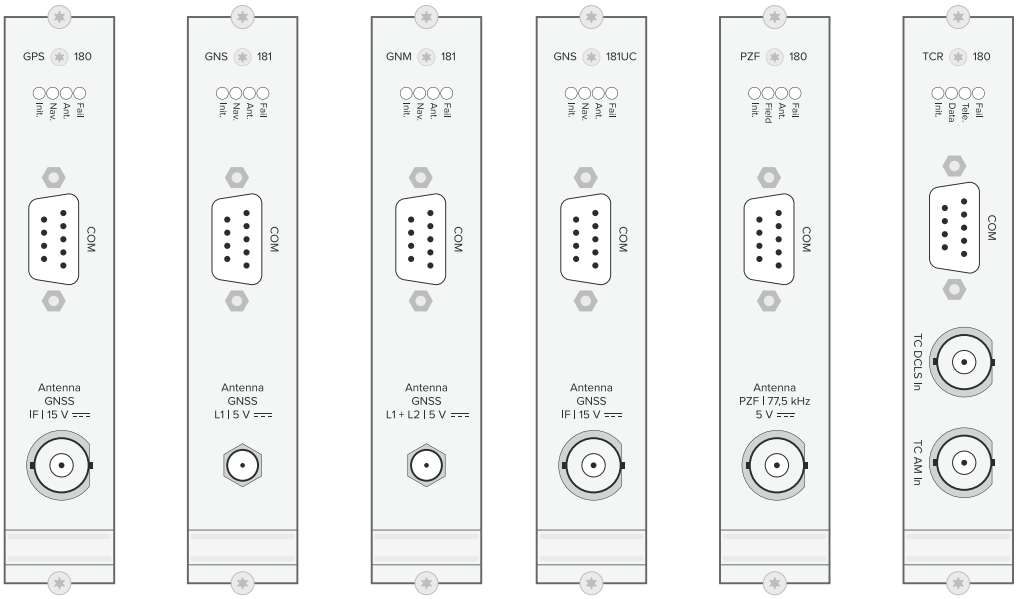
IMS-PZF receiver	high accuracy DCF77 based clock

Time code reader and generator (IRIG, AFNOR ...)

IMS-TCR receiver	decoding and generation of time codes

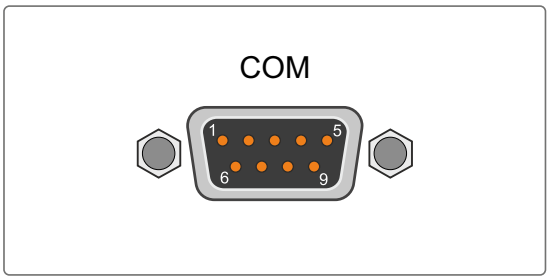
The following oscillator options are available for all receiver types:
- OCXO-SQ
- OCXO-MQ (no longer available as of January 2024)
- OCXO-HQ
- OCXO-DHQ (not for redundant M1000 configurations)

In addition to the redundant receiver configurations with two identical receivers for M1000, M2000, M3000, and M4000 models, it is also possible to configure these housing types with two different receiver systems.



Pin Assignment of the DSUB9 Connectors (male):

Pin 2: RxD
Pin 3: TxD
Pin 5: GND



Synchronization with PPS + string:
Our IMS receivers are all MRS-capable (Multi Reference Source), which means that they can be synchronized via external sources such as 10 MHz, PPS + time string, NTP, PTP, 2048 kHz etc.. For synchronization via PPS + String no additional input module (MRS, ESI, HPS) has to be selected - the input signal and the time string can be supplied via the 9-pin DSUB connector. The connector has the following pin assignment:

Pin 1: PPS
Signal level: TTL
Pulse length: $\geq$5 μs (active high)

Pin 2: String
The following timestrings (time telegrams) can be used:
- NMEA RMC
- NMEA ZDA
- Meinberg Standard
- Uni Erlangen

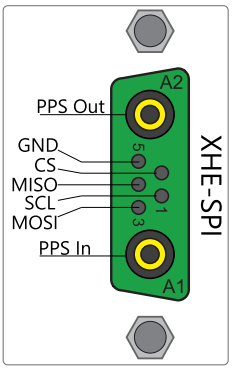
Please note:
The ext. time string must not arrive later than 500 msec. than the PPS. If the offset is greater than 500 msec, the time string is discarded and not recognized. For synchronization of the clock the information about time and date is missing.

Pin Assignment of the optional XHE-SPI Connectors:

A1: PPS In
A2: PPS Out

Pin 1: SCL_Out (SPI Clock)
Pin 2: CS (Chip Select)
Pin 3: MOSI (Master Out, Slave In)
Pin 4: MISO (Master In, Slave Out)
Pin 5: GND

Attention: Use this plug only to connect a MEINBERG IMS-XHE^{Rb} Rubidium expansion chassis. The XHE-SPI connector is only available for Meinberg GNSS receivers (GPS, GNS, GNS-UC, GNM).



14.3.5.1 GPS Clock

Receiver Type: 12-Channel GPS C/A Code Receiver

Pulse Accuracy: Dependent on Selected Oscillator:
< +-100 ns (TCXO, OCXO LQ)
< +-50 ns (OCXO-SQ, OCXO-MQ, OCXO-HQ, OCXO-DHQ)

Cable Type: Coaxial Cable, Shielded

Cable Length: Max. 300 m (RG58),
Max. 700 m (RG213)

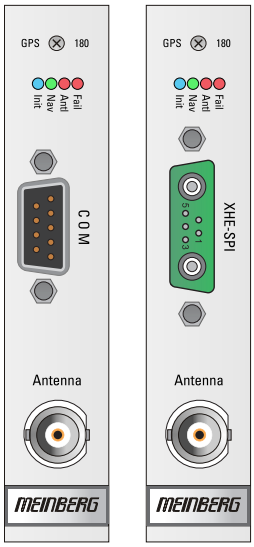
Connector Type: BNC, Female / Antenna

Antenna Input: Antenna Circuit, Galvanically Isolated

Mixing Frequency to Converter: 10 MHz [1]

Intermediate Frequency from Converter: 35.4 MHz [1]

Power Supply: to Antenna: 15 V, 100 mA
(Provided via Antenna Cable)



GPS Receiver with COM Port, GPS Receiver with XHE-SPI Port (Variants)

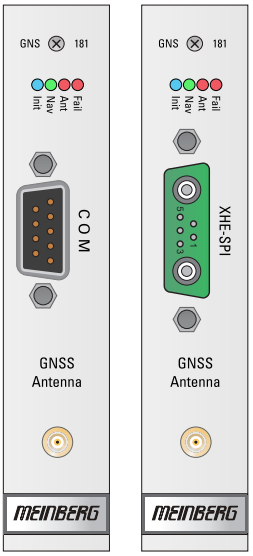
1) These two frequencies are transferred via the antenna cable

LED Indicators

Init:	Blue:	Clock module is initializing
	Green:	Clock module has initialized
Nav.:	Green:	Geolocation successfully completed
Ant:	Green:	Antenna is correctly connected, no errors detected in connection, and clock is synchronized
	Red:	Antenna is faulty or not correctly connected
	Yellow:	MRS Mode: Clock is synchronized to an external signal (e.g., PPS, IRIG)
	Yellow/Red (Flashing):	Holdover Mode: Clock is synchronized to internal oscillator
Fail:	Red:	Time is not synchronized

14.3.5.2 GNS Clock

Type of receiver:	GPS / GLONASS / Galileo / Beidou receiver Number of channels: 72 Frequency band: GNSS L1 1575.42 +- 10 MHz / 1602-1615 MHz
Accuracy of Pulses:	Dependant on oscillator option < +-100 nsec (TCXO, OCXO-LQ) < +-50 ns (OCXO-SQ, -MQ, -HQ, -DHQ)
Synchronization Time:	Max. 1 minute in normal operation mode, approx. 12 minutes after a cold start
Antenna Cable:	shielded coax cable (Belden H155 PE)
Cable Length:	max. 70 m low-loss cable
Type of Connector:	female SMA connector
Antenna Power Supply:	5 V DC, 100 mA (via antenna cable)



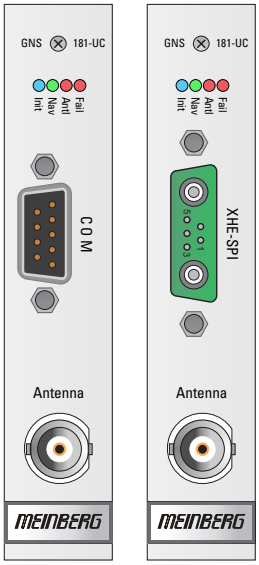
LED Indicators

Init	blue:	while the receiver passes through the initialization phase
	green:	the oscillator has warmed up
Nav.	green:	positioning successfully
Ant	red:	antenna faulty or not connected
	yellow:	the clock is synchronized by an external Signal - MRS mode (PPS, IRIG ...)
	red/yellow (flashing):	holdover mode (MRS mode)
Fail	red:	time has not synchronized

14.3.5.3 GNS-UC Clock

GNSS receiver with UpConverter for operation on a standard Meinberg GPS antenna/converter unit.

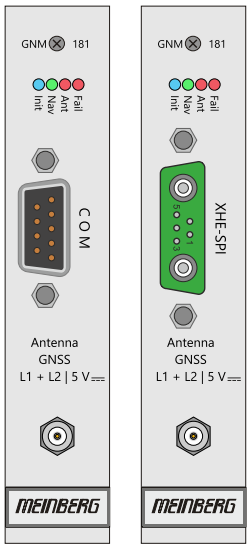
Type of receiver:	GPS / Galileo receiver Number of channels: 24 GPS: L1C/A Galileo: E1B/C
Accuracy of Pulses:	Dependant on oscillator option < +-100 nsec (TCXO, OCXO-LQ) < +-50 ns (OCXO-SQ, -MQ, -HQ, -DHQ)
Synchronization Time:	Max. 1 minute in normal operation mode, approx. 12 minutes after a cold start
Antenna Cable:	shielded coax cable
Cable Length:	max. 300 m
Type of Connector:	female BNC connector
Antenna Power Supply:	15 V DC, 100 mA (via antenna cable)



LED Indicators

Init	blue:	while the receiver passes through the initialization phase
	green:	the oscillator has warmed up
Nav.	green:	positioning successfully
Ant	red:	antenna faulty or not connected
	yellow:	the clock is synchronized by an external Signal - MRS mode (PPS, IRIG ...)
	red/yellow (flashing):	holdover mode (MRS mode)
Fail	red:	time has not synchronized

14.3.5.4 GNM Clock



Receiver Type 184-channel
GPS, GLONASS, Galileo, Beidou

Frequency Band:

GPS:
L1C/A (1575.42 MHz)
L2C (1227.60 MHz)

GLONASS:
L1OF (1602 MHz + k*562.5 kHz
L2OF (1246 MHz + k*437.5 kHz
k = –7,..., 5, 6

Galileo:
E1-B/C (1575.42 MHz)
E5b (1207.140 MHz)

Beidou:
B1I (1561.098 MHz) B2I (1207.140 MHz)

Accuracy of Pulses: Dependant on oscillator option:
< +-100 ns (TCXO, OCXO LQ)
< +-50 ns (OCXO-SQ, -MQ, -HQ, -DHQ)

Synchronization Time: <1 minute in normal operation mode,
approx. 1 minutes after a cold start
(12 minutes in GPS only mode)

Signal Gain 40 dB

Antenna Gain: ≥ 3.5 dBic / ≥ 3 dBic

Connection Type: SMA female / Antenna

Cable: shielded coaxial line (Belden H155)
Cable lenght: deductible up to max. 70 m

Antenna Power Supply: 5 V DC, 100 mA (via antenna cable)

Nominal Impedance: 50 Ohm

Backup Battery Type: CR2032 – button cell lithium battery.
The hardware clock and the RAM are battery buffered. When the main power supply fails, the hardware clock runs free on quartz basis and the almanac data is stored in the RAM.
Life time of lithium battery: min. 10 years

Figure right: GNM Multiband receiver and
GNM with XHE-SPI connector (optional)

LED Indicators

Init	blue:	while the receiver passes through the initialization phase
	green:	the oscillator has warmed up
Nav.	green:	positioning successfully
Ant	red:	antenna faulty or not connected
	yellow:	the clock is synchronized by an external Signal - MRS mode (PPS, IRIG ...)
	red/yellow (flashing):	holdover mode (MRS mode)
Fail	red:	time has not synchronized

14.3.5.5 PZF Clock

Receiver: High-accuracy DCF77 correlation receiver
Two separate receiver channels for signal conversion and optimum acquisition and tracking of the DCF77 signal (AM + PZF).

Synchronization Time: 2–3 minutes after suitable DCF77 signal reception

Frequency Outputs: Accuracy depends on oscillator (Standard: OCXO-SQ)

Pulse Outputs: Pulse per second (PPS) and pulse per minute (PPM).
TTL level, pulse width: 200 msec

Accuracy of Pulses: ±50μsec or better after synchronization and 20 minutes of operation.

Backup Battery Type: CR2032 lithium button cell
When main power supply fails, hardware clock runs independently on oscillator, almanac data is stored in RAM
Lithium cell life at least 10 years

Oscillator Options: OCXO-SQ, OCXO-MQ, OCXO-HQ, OCXO-DHQ

Antenna Connector: BNC female

Antenna Cable: Coaxial Cable, Shielded

Cable Length: 300 m with standard RG58 coaxial cable

Antenna Power Supply: 5 V DC, max. 1 mA (via antenna cable)

LED Indicators

Init:	Blue:	The receiver is currently initializing internally
Field:	Green:	The minimum field strength needed for correlation-based signal processing is acquired
Ant:	Red:	Antenna faulty or not connected
	Red/yellow (flashing):	Holdover mode (MRS mode)
	Yellow:	The clock is synchronizing to a source other than DCF77
Fail:	Red:	Time is not synchronized

14.3.5.6 TCR Clock - Time Code Reader and Generator

The IMS - TCR180 serves to decode and generate modulated (AM) and unmodulated (DC Level Shift) IRIG-A/B/G, AFNOR, C37.118 or IEEE1344 time codes. AM-codes are transmitted by modulating the amplitude of a sine wave carrier, unmodulated codes by variation of the width of pulses.

As standard the clock module TCR180 is equipped with a OCXO-SQ (Oven Controlled Xtal Oscillator) as master oscillator to provide a high accuracy in holdover mode of ± 1E-8. Optionally an OCXO-MQ or OCXO-HQ is available for better accuracy.

Receiver:
Automatic gain control within the receive circuit for modulated codes allows decoding of IRIG-A/B/G, AFNOR, C37.118 or IEEE1344 signals with a carrier amplitude of 600 mV_{pp} to 8 V_{pp}. The input stage is electrically insulated and has an impedance of either 50 Ω, 600 Ω or 5 kΩ, selectable by a jumper.

DC Level Shift Input insulated by optocoupler with internal series resistance of 220 Ω.

LED Indicators

Init	blue:	while the receiver passes the initialization phase
	off:	Oscillator not warmed up
	green:	the internal timing of the TCR180 is synchronized to the received time code (Lock)
Data	green:	correct time code detected
	red:	no correct time code detected
	yellow:	TCR180 synchronized by external source (MRS)
	yellow/green (flashing):	Holdover mode (MRS), IRIG Code available
	yellow/red (flashing):	Holdover mode (MRS), IRIG Code not available
Tele	green:	telegramm consistent
	red:	telegramm inconsistent
	yellow (flashing):	Jitter too large
Fail	red:	the internal timing of the TCR180 is in holdover mode
	off:	the internal timing of the TCR180 is synchronized to the received time code (Lock)

Generator:
The generator of TCR180 is capable of producing time codes in IRIG-A/B/G, AFNOR, C37.118 or IEEE1344 format. The codes are available as modulated (3 V_{pp} /1 V_{pp} into 50 Ω) and unmodulated (DC Level Shift) signals (TTL into 50 Ω and RS-422).

Regarding time code and its offset to UTC, the receiver and the generator can be configured independantly. Thus TCR180 can be used for code conversion.

Key Features

- IRIG Generator
- 4 programmable Pulse Outputs
- Frequency Synthesizer
- Battery Type CR2032

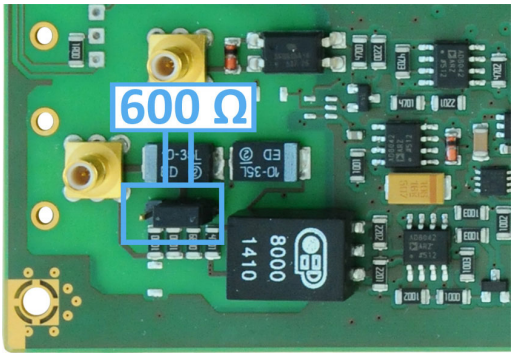


Figure 1: Jumper Settings: 600 Ω

Technical Specifications

Receiver Input

AM-input (BNC-connector):	insulated by a transformer impedance settable 50 Ω, 600 Ω, 5 kΩ 600 mV_{PP} to 8 V_{PP} (Mark)

Input Signal

DC Level Shift input:	insulated by photocoupler internal series resistance: 220 Ω maximum forward current: 60 mA diode forward voltage: 1.0 V...1.3 V

Decoding

Decoding of the following telegrams possible:	IRIG-A132 / A133 / A002 / A003 IRIG-B123 / B122 / / B126 / B127 / B002 / B003 / B006 / B007 IRIG-G142 / G146 / G002 / G006 AFNOR NFS 87-500 C37.118 IEEE1344

Accuracy of Time Base

Required Accuracy of Time Code Source:	max 100 μsec Jitter / offset 1E-5

Holdover Mode

Automatic switching to crystal time base	accuracy approximately 1E-8 if decoder has been synchronous for more than 1h

Backup Battery

If the power supply fails, an onboard realtime clock keeps time and date information important system parameters are stored in the RAM of the system lifetime of the Lithium battery at least 10 years

Generator Outputs

Modulated output:	unbalanced sine carrier, 1 kHz 3 V_{PP} (MARK), 1 V_{PP} (SPACE) into 50 Ω unmodulated outputs(DCLS): TTL into 50 Ω, RS-422

Pulse Outputs

Four programmable outputs, TTL level
Default settings: active only 'if sync'

PPO_0 - PPO_3:	Idle (not active) Timer Single Shot Pulse Per Second, Per Minute, Per Hour (PPS, PPM, PPH) DCF77 Marks Time Sync DCLS Time Code Synthesizer Frequency

Accuracy of Pulses

Better than ± 1 μsec after synchronization and 20 minutes of operation

Serial Port

Configurable RS-232 interface

Baudrates:	300 Bd...115200 Bd
Framing:	7E2, 8N1, 8N2, 8E1, 7N2, 7E1, 801
Mode of operation:	string per second string per minute string on request
Time telegram:	Meinberg Standard, Uni Erlangen, SAT, Meinberg Capture, ION, Computime, SPA, RACAL

Capture Inputs

Triggered by falling TTL slope

Pulse repetition time:	1.5 msec min.
Resolution:	800 nsec

Master Oscillator
OCXO-SQ (Oven Controlled Oscillator)

Accuracy compared to IRIG-reference:	sync. and 20 min. of operation: ± 5E-9 first 20 min. after sync.: ± 1E-8 accuracy of oscillator: holdover, 1 day: ± 1E-7 holdover, 1 year: ± 1E-6 short term stability: ≤ 10 sec, synchronized: ± 2E-9 ≤ 10 sec, holdover: ± 5E-9 temperature dependant drift: holdover: ± 1E-6

Frequency Synthesizer

Output frequency:	fixed - 2.048MHz
Accuracy:	like system accuracy
1/8 Hz to 10 kHz:	Phase synchronous to pulse per second
10 kHz to 10 MHz:	deviation of frequency < 0.0047 Hz
Synthesizer Outputs:	TTL into 50 Ω sine wave 1.5 Vrms output impedance 200 Ω

Pulse Outputs

Pulse per second (PPS):	TTL- and RS-232 level positive pulse, pulse duration 200 msec
Pulse per minute (PPM):	TTL level positive pulse, pulse duration 200 msec

14.3.6 RSC Switch Card

Theory of operation
The RSC- Redundant Switch Control card controls the switchover of the reference clock in redundant systems with two receiver units. The RSC is used to switchover the pulse and frequency outputs and the serial interfaces between the available receivers.

The selection of the reference is done by an internal switch-logic of the RSC. The selection of the active system based on the TIME_SYNC signals which are generated by the receivers. The TIME_SYNC signals are indicate the synchronization of the clocks.

To avoid unnecessary changeovers in case of repeatedly occurring free run operations of one system, the master/backup order is changed with each changeover. For example, let's suppose the current master system looses its synchronization. Then a changeover is performed to a synchronous slave system and thus the former slave system becomes a new Master. No changeover is done if both systems are asynchronous. In this case the current state stays the same.

Important: To ensure an automatic switchover the Manual function should be disabled via display-menu. "Ref. Time → Switch Unit": *Select Switch Unit → SCU Cntl → MANUAL: disable*. Otherwise, the system depends on the clock selected by the manual control function and the unit will not switch over to the current active clock.

Manual Mode (Display Menu)
In this operation mode the selection of the reference clock is done by a display menu. A switchover of the reference clock in case of an error does not happen, pulse and frequency outputs and the serial interfaces are always enabled.

Display Menu: *Switch Unit → SCU Cntl → MANUAL : enable*

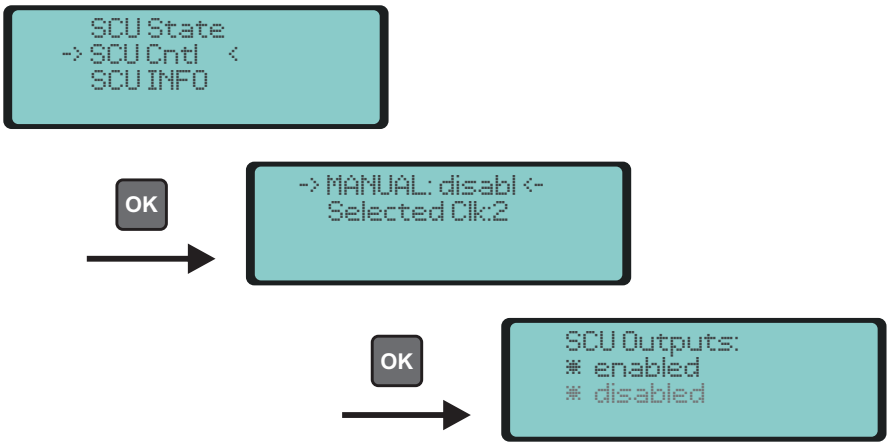
Note:
For systems without display (M1000S, M2000S and M3000S) a LANTIME Display Unit (LDU) can optionally be used.

Display menu "Switch Unit → SCU State"

This menu displays the status information of the RSC:

Mode:	manual | automatic
Clock 1 / Clock 2:	State of receivers
MUX:	enabled | disabled output signals during a free run
Selected Clk:	selected reference clock 1 or 2

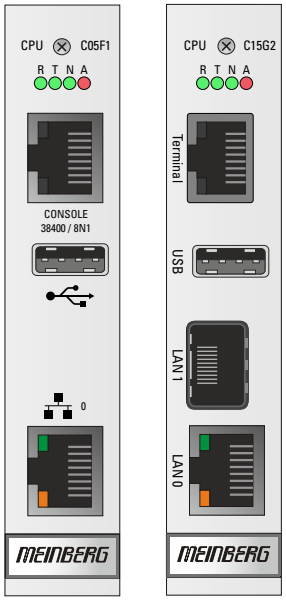
Menu "Switch Unit → SCU Cntl"



MANUAL:	enable/disable	switching between automatic and manual operation
Selected Clk:	1/2	selection of the active reference clock

14.3.7 LAN-CPU

As the central management and control element, the CPU module in an LANTIME system is responsible for management, configuration and alarm notifications. It additionally provides NTP and SNTP services on its network interface.



Technical specifications IMS LAN CPU C05F1

Processor:	AMD Geode™ LX 800 Processor, 400 MT/s memory bus speed
Main Memory:	256 MByte onboard DDR memory
Cache Memory:	128 kByte L2 Cache
Flashdisk:	1 GB
Network Connector:	IEEE 802.3u 100Base-Tx via RJ45 jack, Fast Ethernet compatible
Power Consumption:	Typ. application 6,9 W @ 5V

Technical Specifications - IMS CPU-C15G2 (LTOS V7 only)

Processor:	Intel® Atom™ Processor E Series (2 Cores, 1.33GHz, TDP 3W)
Main Memory:	onboard 2 GB
Cache Memory:	1 MB 2nd Level Cache
Flash Disk:	4 GB
Network Connectors:	1 x 10/100/1000 Base-T with RJ45-Jack 1 x 1000Base-T with SFP-Jack
Power Consumption:	Typ. application 6,9 W @ 5V

Interfaces - IMS LAN-CPU

Serial Interface:	RJ45 connector console: 38400 / 8N1, connection via CAB-CONSOLE cable
USB Port:	install firmware upgrades backup and restore configuration files copy security keys lock / unlock front keys
Operating System:	GNU/Linux 4.x

Status LEDs:

LAN 0
LED - Connect, Activity and Speed of the network connection

R (Receiver)

green:	the reference clock (e.g. build-in GNSS) provides a valid time
red:	the reference clock does not provide a valid time

T (Time Service)

green:	NTP is synchronized to the reference clock, e.g. GNSS
red:	NTP is not synchronized or switched to the "local clock"

N (Network)

green:	all monitored network interfaces are connected ("Link up")
red:	at least one of the monitored network interfaces is faulty

A (Alarm)

off:	no error
red:	general error

Supported Protocols:

Network Time Protocol (NTP):	NTP v2 (RFC 1119), NTP v3 (RFC 1305), NTP v4 (RFC 5905) SNTP v3 (RFC 1769), SNTP v4 (RFC 4330)
OSI Layer 2 (Data Link Layer):	PRP (IEC 62439-3)
OSI Layer 3 (Network Layer):	IPv4, IPv6
OSI Layer 4 (Transport Layer):	TCP, UDP, TIME (RFC 868), DAYTIME (RFC 867), SYSLOG
OSI Layer 7 (Application Layer):	HTTP / HTTPS (RC 2616), DHCP, FTP, NTPv3 / NTPv4, SNTP, RADIUS, TACACS, FTP, SSH (incl. SFTP, SCP) - SSH v1.3 / SSH v1.5 / SSH v2 (OpenSSH), SNMPv1 (RFC 1157) / SNMPv2c (RFC 1901-1908) / SNMP v3 (RFC 3411-3418), Telnet (RFC 854-RFC 861)

14.3.8 MRI - Standard Reference Input Signals

If an application requires to use external synchronization sources instead of radio/GNSS signals, an MRI card enables the installed clock module to synchronize to 1PPS, 10 MHz, DCLS and AM time codes (IRIG B, AFNOR, IEEE1344 or C37.118).

Each MRI card is dedicated to one clock module, if a redundant solution requires external synchronization inputs for both clock modules, two MRI cards have to be installed. The MRI card is available with 4x BNC connectors.

Reference Inputs:

Time Code unmodulated input (DCLS)
BNC connector, isolated by opto-coupler

Insulation voltage:	3750 Vrms
Internal series resistor:	330 Ohm
Max. input current:	25 mA
Diode forward voltage:	1.0 V - 1.3 V

selectable Time Code Inputs, modulated / unmodulated (DCLS):
B122/123 / B002/003 / B126/127 / B006/007
IEEE1344 (modulated and DCLS)
AFNOR NFS 87-500 (modulated and DCLS)

Time Code modulated input (AM),
BNC connector, isolated by transformer

Insulation voltage:	3000 V DC
Input impedance:	50 Ohm, 600 Ohm, 5 kOhm Internally selectable by jumper (default 600 Ohm)
Input signal:	600 mV to 8 V (Mark, peak-to-peak)

10 MHz input, sine (1.5 V_{pp} - 5 V_{pp})
or TTL, female BNC connector

PPS input, TTL, pulse length $\geq 5\mu s$,
active high, female BNC connector

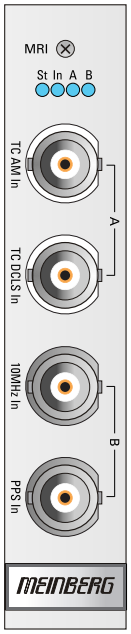


Figure right: *MRI - standard input signals via BNC female connectors*

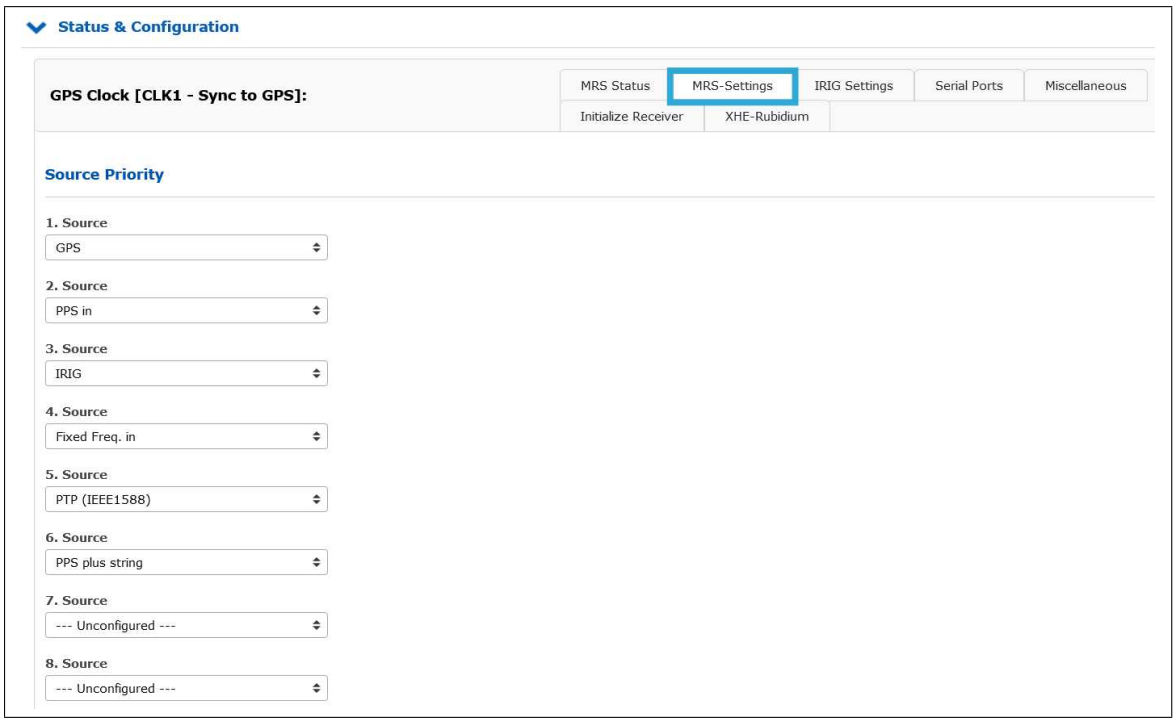
Status Indicators

LED St:	MRI status
LED In:	Status of the backplane's reference signals
LED A:	Status of the input signals (TC-AM/DCLS) at the board
LED B:	Status of the input signals (10 MHz/PPS) at the board
Initialisation:	LED St: blue until USB is configured LED In - LED B: off until USB is configured
USB is configured:	LED St: blue LED In - LED B: 0,5 sec. red -> 0,5 sec. yellow -> 0,5 sec. green -> 0,5 sec. off
Normal Operation:	LED St + LED In: green LED A: green, if timecode AM or timecode DCLS or both signals are available at the same time LED B: green, if 10 MHz or PPS or both signals are available at the same time
Power Requirements:	5 V +-5%, 50 mA

14.3.8.1 Configuration of Input Signals

Four fixed input signals (time code AM, time code DCLS, 10 MHz and PPS) can be supplied via the MRI module to synchronize the system.

MRS prioritization
The provided input signals are available for selection after initialization of the module and can than be configured and monitored.



MRS setting: selection and prioritization of the available input sources.

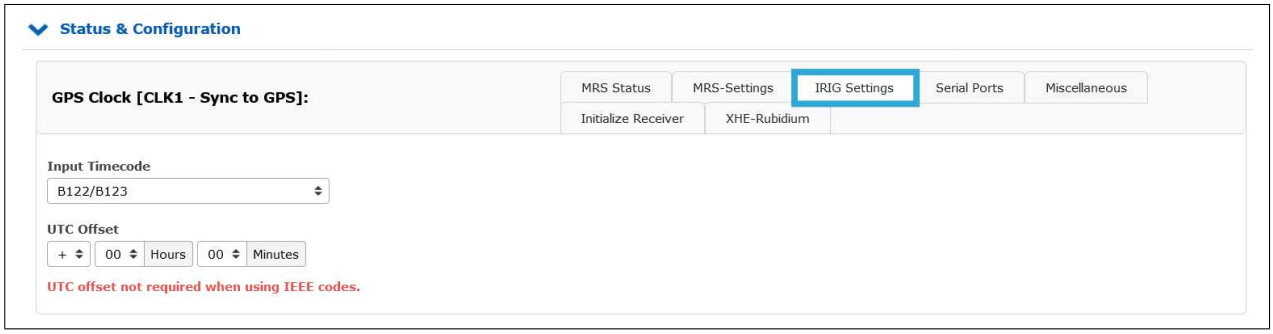
1. Open the "**Clock**" menu → "**Status & Configuration**"
2. Select the respective clock module of the corresponding MRI module
3. Click on the tab "MRS settings".
4. Configure the reference signals shown in the priority list.

IRIG settings

Several time codes are available for selection for the IRIG reference signals of the MRI.

1. Open the "**Clock**" menu → "**Status & Configuration**"
2. Select the respective clock module of the corresponding MRI module
3. Click on the tab "IRIG settings".
4. Configure a required input code and if necessary an offset to UTC.

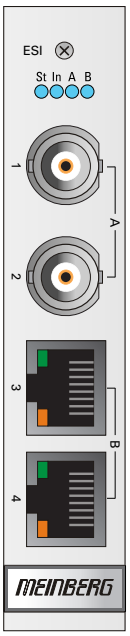
These are to be configured in the "**Status & Configuration**" submenu in the " IRIG Settings" tab.



Menü: Configuration of IRIG-Timecodes

14.3.9 ESI - Telecom Synchronisation References

Enhanced Synchronisation Inputs



Reference Inputs: PPS and variable frequencies unframed, 1 kHz - 20 MHz
2,048 Mbit/s / 1,544 Mbit/s - E1/T1 framed

Input 1	1PPS (BNC female connector) TTL, pulse duration $\geq 5\mu$s, active high
Input 2	1 kHz - 20 MHz (BNC female connector) sine (400 mV_{pp} - 5 V_{pp}) or TTL
Input 3	1 kHz - 20 MHz (RJ-45) 400 mV_{pp} - 5 V_{pp} into 120 Ω, TTL
Input 4	E1 or T1 framed G.703 (RJ-45) max. attenuation -12 dB (referred to the signal level) into 120 Ω

Power Requirements: 5 V, +-5%, 250 mA

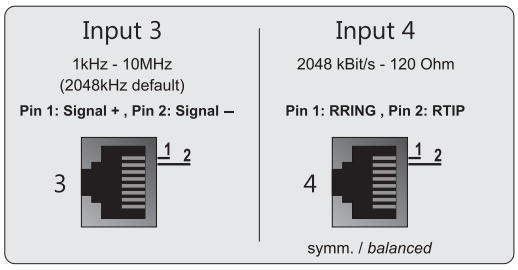
Status Indicators

LED St:	ESI status
LED In:	Status of the backplane's reference signals
LED A	Status of the input signals (1 & 2) at the board
LED B:	Status of the input signals (1 & 2) at the board

Operation conditions:

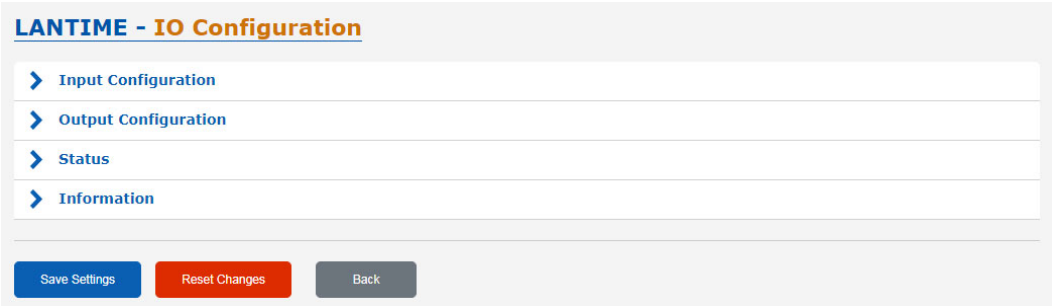
Initialisation:	**LED St**	blue until configuration is done
	LED In	off until configuration is done
	LED A	off until configuration is done
	LED B	off until configuration is done
expiration LEDs:	**ALL LEDs**	0,5 sec. red → 0,5 sec. yellow → 0,5 sec. green → 0,5 sec. off
Normal Operation:	**LED St**	green
	LED In	green
	LED A	green, if PPS and Frequency flashing green, if only Frequency flashing yellow, if only PPS off, if no signal
	LED B	green, if Clock and Framed available flashing green, if only Clock available flashing yellow, if only Framed available off, if no signal

Pin assignment of the RJ-45 jacks (input 3 + 4)



14.3.9.1 ESI Configuration via Web Interface

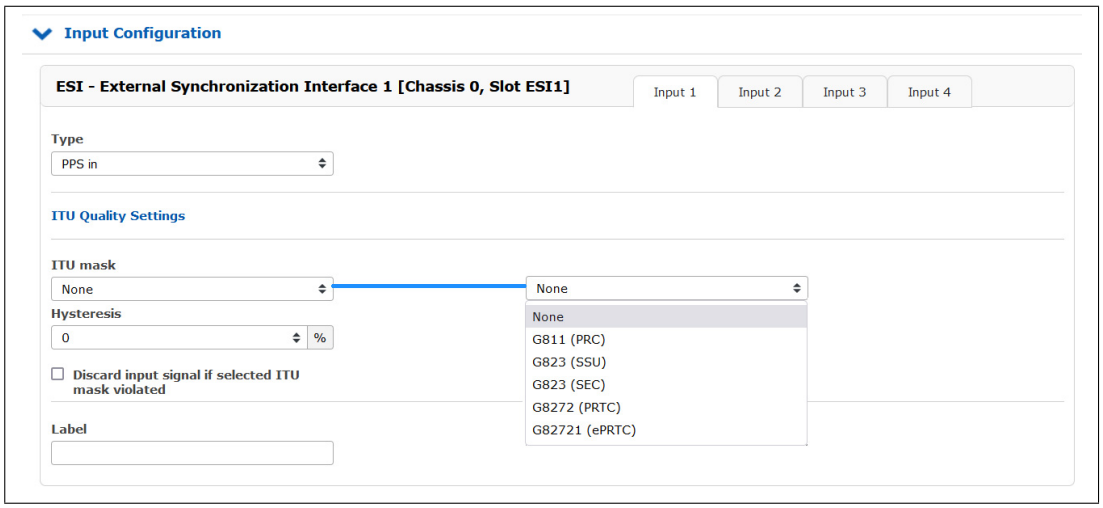
ESI – External Synchronization Input
Menu "IO Config -> Input Configuration -> ESI - External Synchronization Interface"



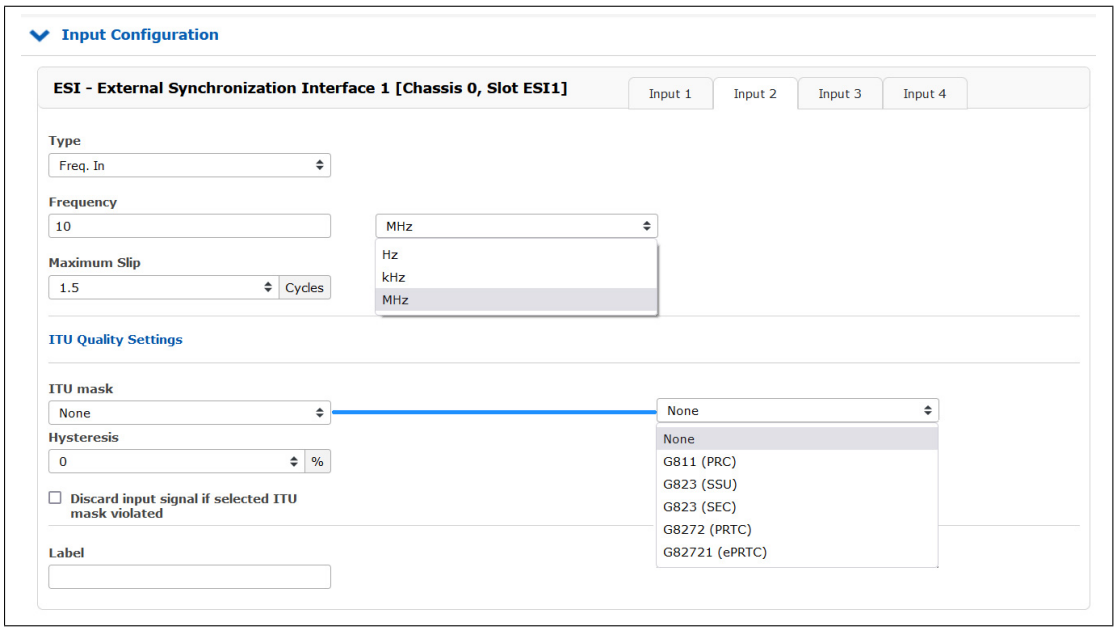
The ESI (External Synchronization Input) card is capable of adding additional synchronization sources to an IMS system. It accepts E1 and T1 sources as a Bitstream (2.048 MBit/s/1.544 Mbit/s, supporting SSM/BOC).

It also handles configurable frequencies (1 kHz - 20 MHz) and 1PPS pulse synchronization source, if required. An ESI card is, as the MRI card, dedicated to one specific clock module (depending on the slot it is installed in) and can be installed in both ESI as well as MRI slots.

Configurable Inputs



Input 1: The input 1 is dedicated to 1PPS (Pulse Per Second) synchronization.



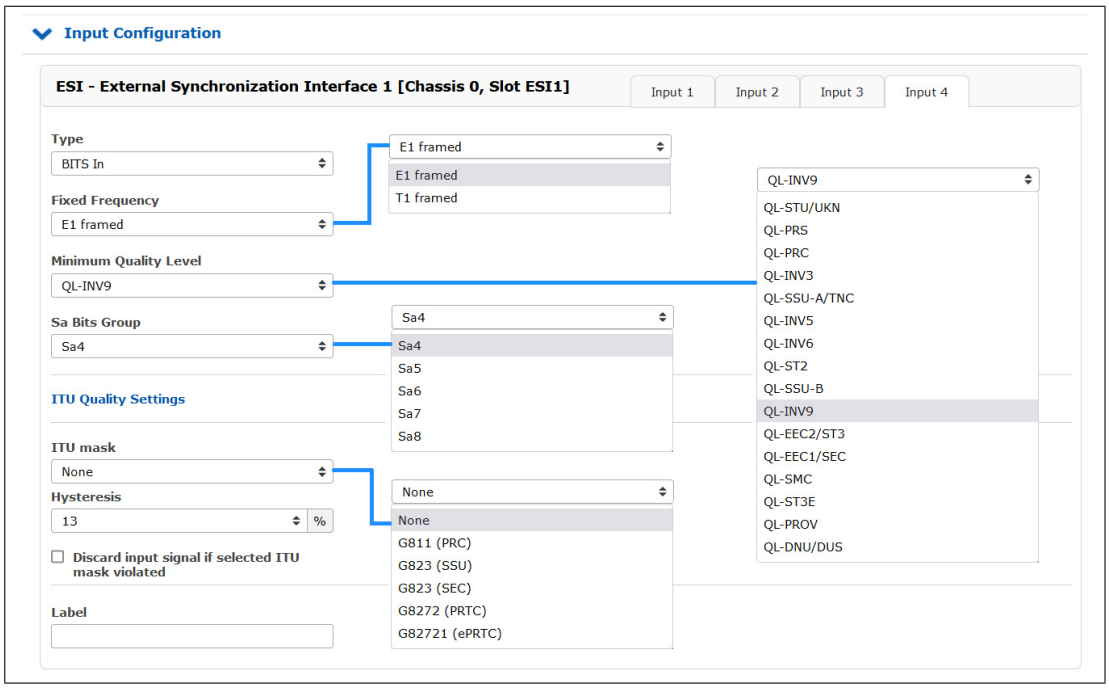
Input 2: accepts as input signal configurable frequencies from 1 kHz to 20 MHz.

Type: Freq. In

Frequency: Fill in a configurable frequency, 10 MHz is set as default value.

Maximum Slip in Cycles: A discontinuity of an integer number of cycles in the measured carrier phase resulting from a temporary loss of input signal. The maximum slip number can be selected in range between 0.5 – 3 cycles, with 1.5 as a default value.

Input 3: accepts as input signal configurable frequencies from 1 kHz to 20 MHz. 2048 kHz is set as default value.



Input 4:
BITS In: As fixed frequency you can choose between E1 framed or T1 framed

Minimum Quality Levels: Synchronization Status Message (SSM) in accordance with ITU G.704-1998 standard includes 4 bit long SSM quality messages received via incoming E1 framed signal. The clock source quality levels according to G.704-1998 are as follows:

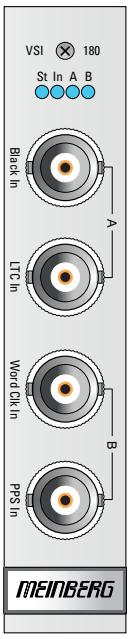
QL-STU/UKN	Quality unknown, existing synchronization network
QL-PRS	Primary Reference Source
QL-PRC	Primary Reference Clock - Rec. G.811
QL-INV3	reserved
QL-SSU-A/TNC	
QL-INV5	reserved
QL-INV5	reserved
QL-ST2	
QL-SSU-B	
QL-INV9	reserved
QL-EEC2/ST3	
QL-EEC1/SEC	Synchronous Equipment Timing Source (SETS)
QL-SMC	
QL-ST3E	
QL-PROV	
QL-DNU/DUS	Do not use for synchronization

Example:
User configured QL-SSU-B as Minimum Quality Level for his system. E1 input signal coming from PRC (G.811) or TNC will be allowed for synchronization, whereas signal coming from Synchronous Equipment Timing Source (SETS) will not be accepted.

Sa Bits
With Sa Bits you can select one of the Sa4 to Sa8 bits which is allocated for SSM quality messages.

14.3.10 VSI - Video Synchronization Input Card

Video signal input module
The VSI (Video Synchronization Input) card provides video signals to an IMS clock module as reference. It can process Black Burst (PAL), LTC (Linear Time Code) and programmable Word Clock Rates.



Connectors:	4 x BNC female
Input Signal:	Black In Black Burst (PAL) Input with VITC Reader Input with Prescaler mode (Frequency only)
Signal level:	300 mV_{ss} into 75 Ω (unbalanced)
Time Code Formats:	PAL SMPTE259M / ITU-R BT.470-6 SMPTE12M-1 / SMPTE ST309M
	LTC Input LTC-Reader (25 fps)
	Word Clock Input
Input signal:	Word Clock Input with programmable frequency range
Signal level:	TTL
Frequency range:	1 kHz - 10 MHz
	PPS Input
Input signal:	PPS (pulse per second)
Signal level:	TTL
Pulse lenght:	$\geq$ 5 μs, aktiv high
Power Requirements:	5 V, +-5%, 300 mA

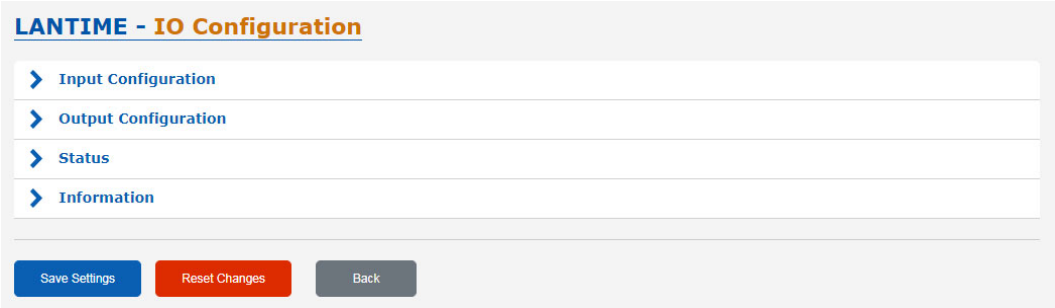
Status Indicators	**LED St:**	Status of VSI180
	LED In:	Synchronization status
	LED A	No function
	LED B:	No function

Operation conditions:

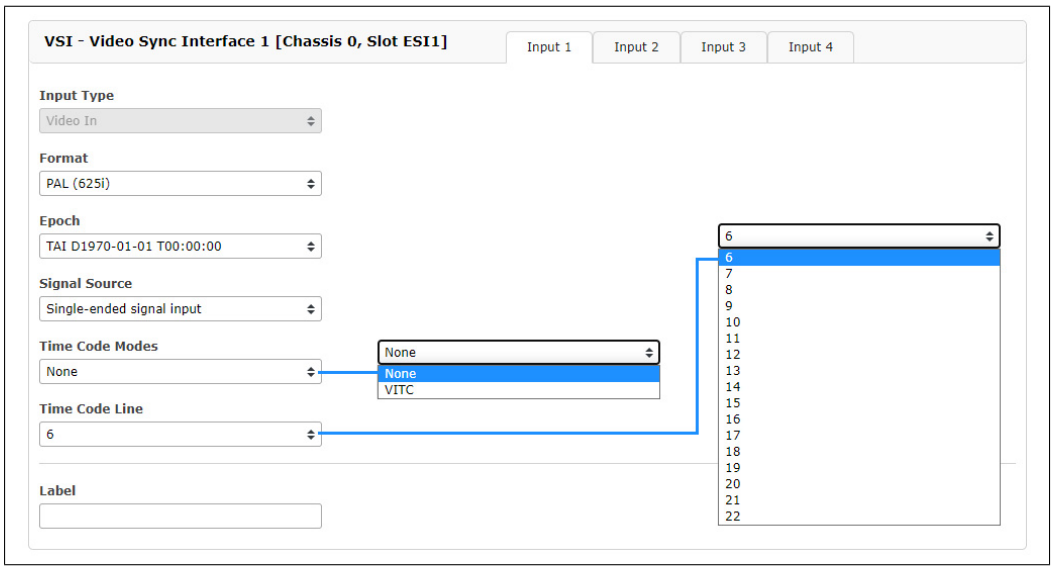
Initialisation:	**LED St**	blue during initialization green during operation
	LED In:	Shows status after initialization
	Green	Accurate
	Green Flashing	Timesync
	Yellow	Insufficient quality of the reference signal.
	Red	Reference signal not available / VSI180 is not synchronous
Normal Operation:	**LED St / In**	green
expiration LEDs:	**ALL LEDs**	0,5 sec. red → 0,5 sec. yellow → 0,5 sec. green → 0,5 sec. off

14.3.10.1 Configuration of VSI180 via Webinterface

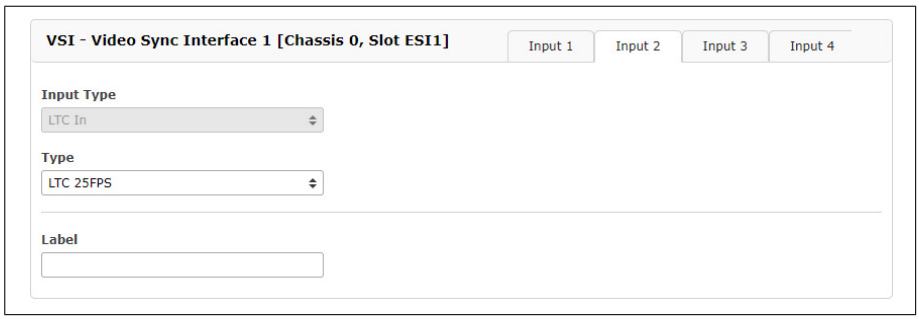
VSI - Video Signal Input References
Menü "IO Config → Input Configuration → VSI-Module"



Video Sync Interface: configurable Inputs

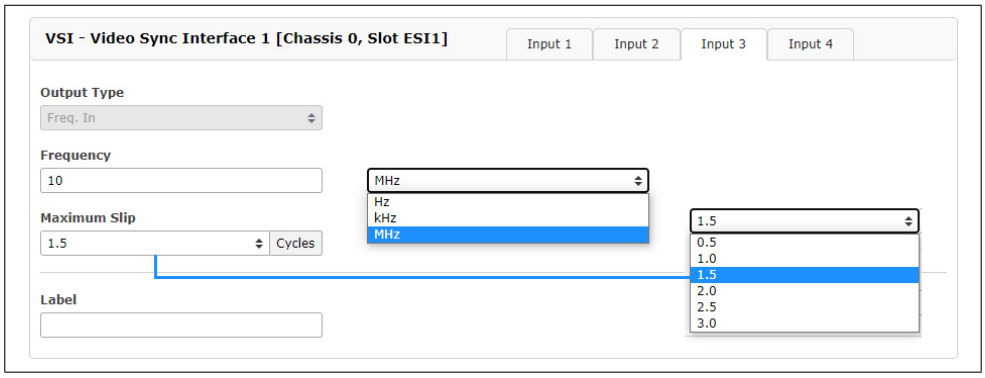


Input 1:	Video Sync In
Format:	PAL 625i
Epoch:	TAI
Signal Source:	Single-ended signal input
Time Code Modes:	VITC
Time Code Line:	6 - 22



Input 2: LTC In

Type: LTC 25 FPS (Frames per Second)



Input 3: Word Clk In

Frequency: 1 kHz - 10 MHz

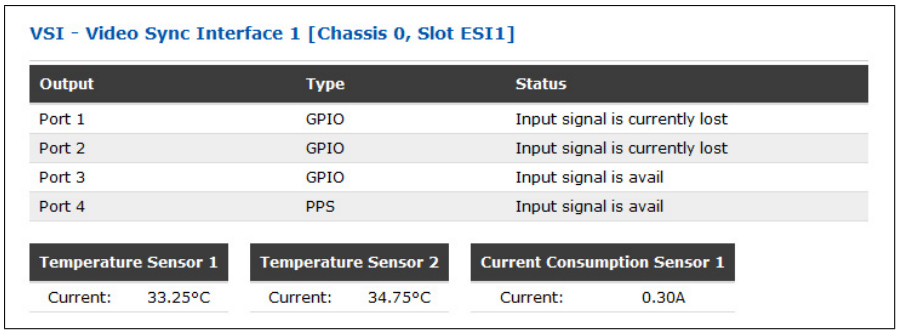
Max Slip: 0.5 - 3.0 oscillations

Input 4: PPS In

Pulse length: $\geq 5\mu s$, active high

14.3.10.2 Status Monitoring of the IMS-VSI

The submenu "Status" of the "IO Config" allows you to view the status of each port of the installed IMS-VSI module. In addition, the current operating temperature of the module is displayed in this menu.



14.3.10.3 Status Monitoring of the IMS-VSI

The submenu "Status" of the "IO Config" allows you to view the status of each port of the installed IMS-VSI module. In addition, the current operating temperature of the module is displayed in this menu.

VSI - Video Sync Interface 1 [Chassis 0, Slot ESI1]

Output	Type	Status
Port 1	GPIO	Input signal is currently lost
Port 2	GPIO	Input signal is currently lost
Port 3	GPIO	Input signal is avail
Port 4	PPS	Input signal is avail

Temperature Sensor 1		Temperature Sensor 2		Current Consumption Sensor 1	
Current:	33.25°C	Current:	34.75°C	Current:	0.30A

14.3.11 IMS Network Modules

14.3.11.1 LNE-GbE: Network Expansion with Gigabit Support and SFP Option

Link speed: 10/100/1000 Mbit

Connector Type: 8P8C (RJ45)

Cable: CAT 5.0

Duplex Modes: Half/Full/Autonegotiaton

LED Indicators

LED St:	blue	during initialisation
LED In - LED B:	Shows the state of the four LAN ports after initialisation	
	green	normal operation
	red	defective LAN port

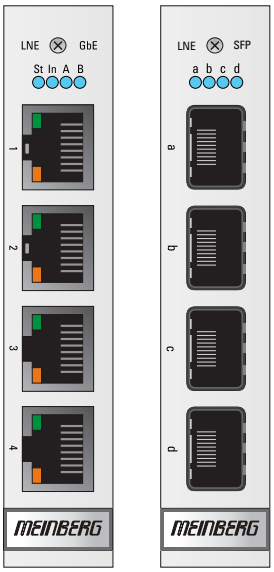


Figure right:
LNE-GbE and LNE-GbE with SFP Option

Option: LNE-SFP

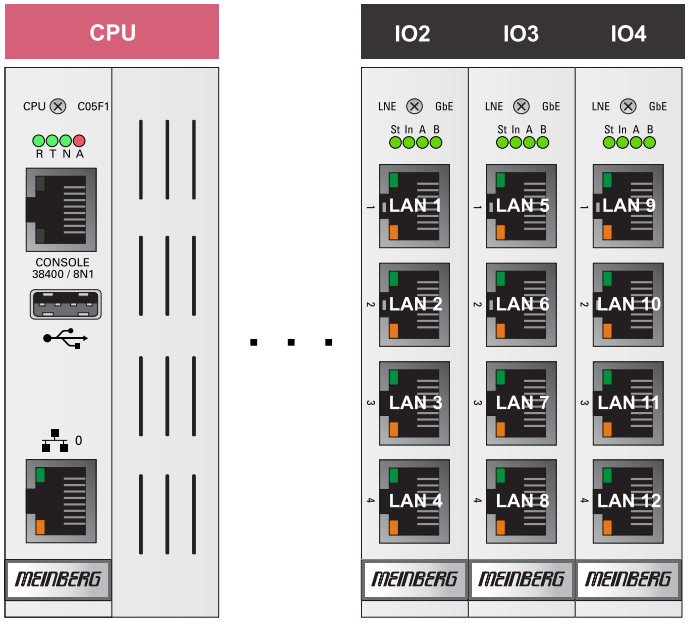
Interface: SFP

Cable: Multimode Fiber
GI 50/125 μm or GI 62.5/125 μm gradient fiber

Singlemode Fiber
E9/125 μm monomode fiber

Link Speed Electrical: 1000 Base-T
Fiber optical: 1000-FX

LAN interface alignment with several LNE modules in operation:
Basically, the physical network ports are assigned according to the MAC address order. Thus, the uppermost interface on a LNE module has the lowest and the bottommost interface has the highest MAC address, respectively. Let's take an example where three LNE modules are inserted in a device. Then the logical order of network interfaces assigned in a webinterface follows the MAC address order of LNE modules, disregarding the I/O slot order by which the modules are inserted.



LAN-CPU
LAN 0: 00:11:22:ee:aa:66

LNE Slot IO2
LAN 1: ec:22:33:44:aa:7b
LAN 2: ec:22:33:44:aa:7c
LAN 3: ec:22:33:44:aa:7d
LAN 4: ec:22:33:44:aa:7e

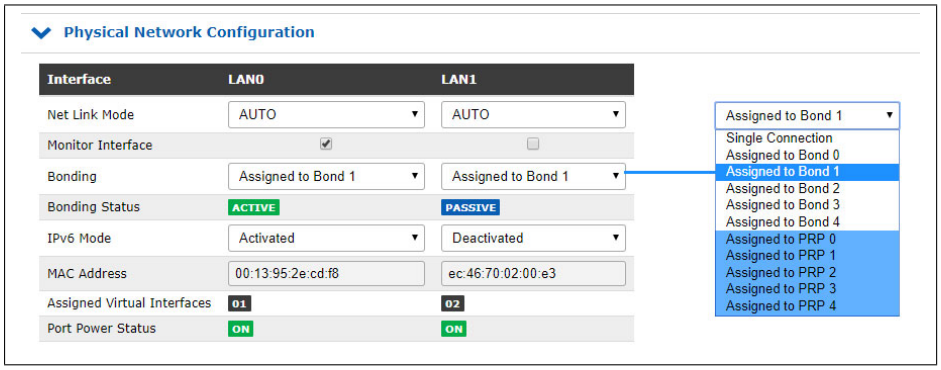
LNE Slot IO3
LAN 5: ec:22:33:44:aa:7f
LAN 6: ec:22:33:44:aa:80
LAN 7: ec:22:33:44:aa:81
LAN 8: ec:22:33:44:aa:82

LNE Slot IO4
LAN 9: ec:22:33:44:aa:83
LAN 10: ec:22:33:44:aa:84
LAN 11: ec:22:33:44:aa:85
LAN 12: ec:22:33:44:aa:86

In a factory assembling, LNE modules are sorted in an ascending order starting from left to right (see the corresponding figure above). LAN 0 is therefore always the first network interface of the LAN-CPU.

14.3.11.2 LNE-GBE Configuration via the Web Interface

If the LNE-GBE operates in an LANTIME system, all network settings can be configured via the web interface then.



Physical Network Configuration

Net Link Mode: The network interfaces LAN1 - LAN4 (LNE-GBE) can be used in 1000 MBIT HALF / FULL duplex mode.

Indicate Link: LED indication for the selected physical interface, only if a front display with function keys is available.

Bonding: to optimize the reliability and the use of a of higher bandwith.

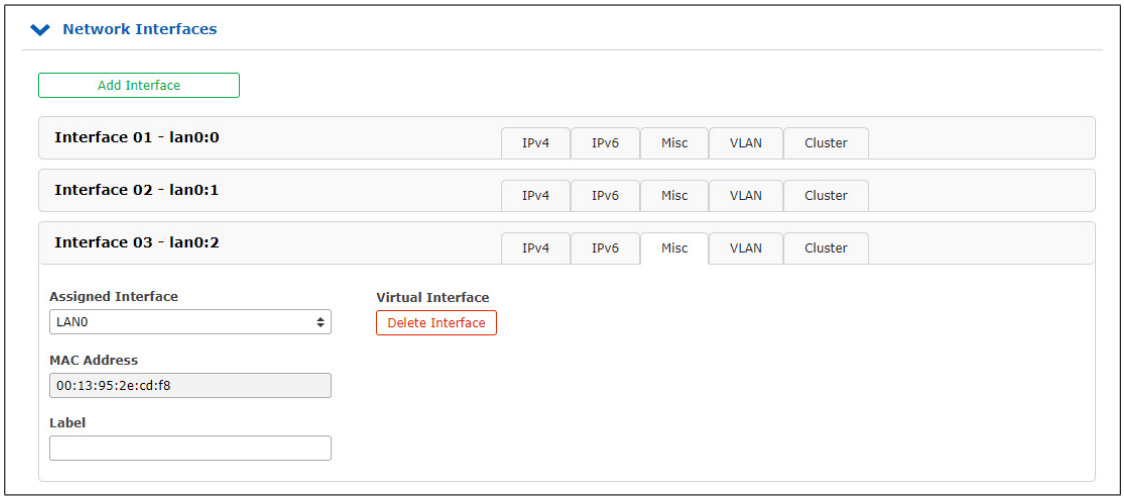
PRP: As of LANTIME firmware version 7.0, PRP can also be conveniently set via the web interface menu "Network → Physical Network Configuration". Select the same PRP group for at least two interfaces in the drop-down menu "Bonding".

IPv6 Mode: This mode must be activated here.

MAC-Address: Displays the unique MAC address of the physical interface.

Assigned Virtual Interfaces: In the Ethernet Interfaces menu (see below) virtual network interfaces can be added.

Menu Interfaces



IPv4: Manually adjustment of all important parameters such as TCP / IP address, subnet mask and gateway. The DHCP client can also be activated here for automatic network configurations.

Misc: With the tab Misc the virtual interface can be assigned to a physical interface.

VLAN: With VLAN, this function can be enabled and configured.

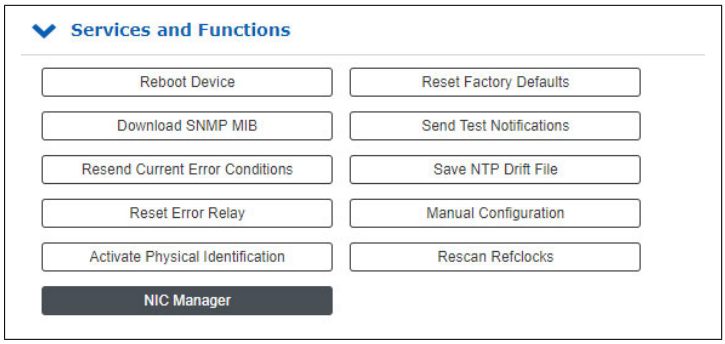
Cluster: The cluster function can be activated with this submenu and additional Parameters such as multicast or unicast mode, TCP / IP address and subnet mask can be set up here.

14.3.11.3 Adding / Removing an LANTIME Network Extension LNE

An LNE module can be installed in each MRI/ESI or IO Slot of a LANTIME IMS device.

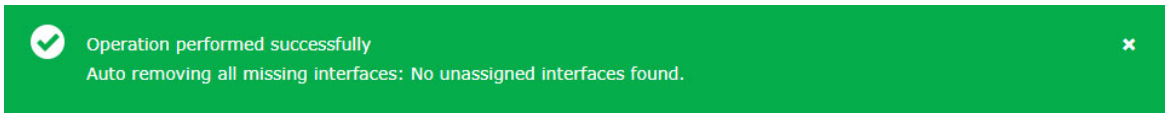
Adding a LANTIME Network Extension

After installing the LNE module, please start the web interface. In the menu "System → Services and Functions" press the button **NIC Manager** then . With this function you add all new physical network interfaces to the system's network configuration. Now it is ensured that the IMS module is correctly installed and recognized by the system.



Remove a LANTIME Network Extension LNE

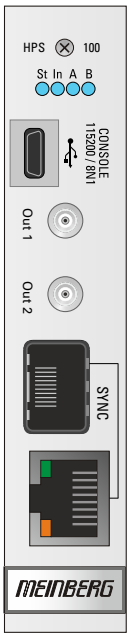
To remove a LNE network extension from the LANTIME system, the card must first be removed. However, the removed LNE interfaces are still listed in the network configuration. The "NIC Manager" can be used to update the network configuration in this case as well.



After successfully running the "NIC Manager", only the actually existing interfaces are displayed in the web interface. A system restart is not necessary.

14.3.11.4 HPS-100: PTP / SyncE / Hardware NTP Interface

IEEE 1588 v2 compatible



Profiles:	IEEE 1588v2 Default Profile IEEE 1588v1 (option) Enterprise Profile IEC 61850-9-3 Power Profile IEEE C.37.238-2011 Power Profile IEEE C.37.238-2017 Power Profile ITU-T G.8265.1 Telecom Frequency Profile ITU-T G.8275.1 Telecom Phase / Time Profile (full timing support) ITU-T G.8275.2 Telecom Phase / Time Profile (partial timing support) SMPTE ST 2059-2 Broadcast Profile IEEE 802.1AS TSN/AVB Profile AES67 Media Profile DOCSIS 3.1
PTP Modes:	Multicast/Unicast Layer 2 (IEEE 802.3) Multicast/Unicast Layer 3 (UDP IPv4/IPv6) Hybrid Mode E2E / P2P Delay Mechanism Up to 128 messages/second per client
NTP Mode:	NTP Server mode (8 ns time stamp accuracy) NTPD Software Service (15,000 req./s)
1588 Clock Mode:	1-Step, 2-Step for both Master and Slave operation
Synchronous Ethernet:	Master and Slave Capability Compliant to ITU-T G.8261, G.8262 and G.8264 Ethernet Synchronization Messaging Channel (ESMC) **Note:** Please also refer to the chapter SFP Transceiver
Network Protocols:	IPv4, IPv6 DHCP, DHCPv6 DSCP IEEE 802.1q VLAN filtering/tagging IEEE 802.1p QOS
Ethernet Interface:	Combo Port: 1 x 100/1000BASE-T RJ45, 1 x GBIT SFP - Slot A list of tested and recommended optical transceiver modules can be found in chapter Option LNE-SFP
USB Interface:	USB 1.1 / USB 2.0 full-speed, Micro USB female connector
Signal Outputs:	2x SMA (50 Ohm) connectors configurable signals: 1PPS, 10MHz, 2048kHz
CPU:	825 MHz Cortex A9 Dual Core on SOC
Time Stamp Accuracy:	8 ns

LED Indicators

LED St:	Init	lights blue during initialisation, off in normal operation mode
LED In:	red	Error - TSU does not work correctly, PTP services stopped
	yellow	No link, but initialized
	green	link up
	red	stopped
LED A - LED B:	Shows the current State of the TSU	
	yellow - yellow	Listening
	green - off	Master Mode
	off - green	Slave Mode
	yellow - off	Passiv Mode
	off - yellow	uncalibrated
	red - red	stopped

Performance Level Options:

Option	Unicast Clients	Delay Req./s	NTP Req./s	PTPv1	PTP Monitoring
PL-A	8	1024	1600	NO	NO
PL-B	256	32768	51200	NO	NO
PL-C	512	65536	102400	YES	NO
PL-D	1024	131072	204800	YES	YES
PL-E	2048	262144	409600	YES	YES

A detailed configuration guide you will find in the corresponding firmware manual of the system. See chapter "The Web Interface -> Configuration: PTP V2".

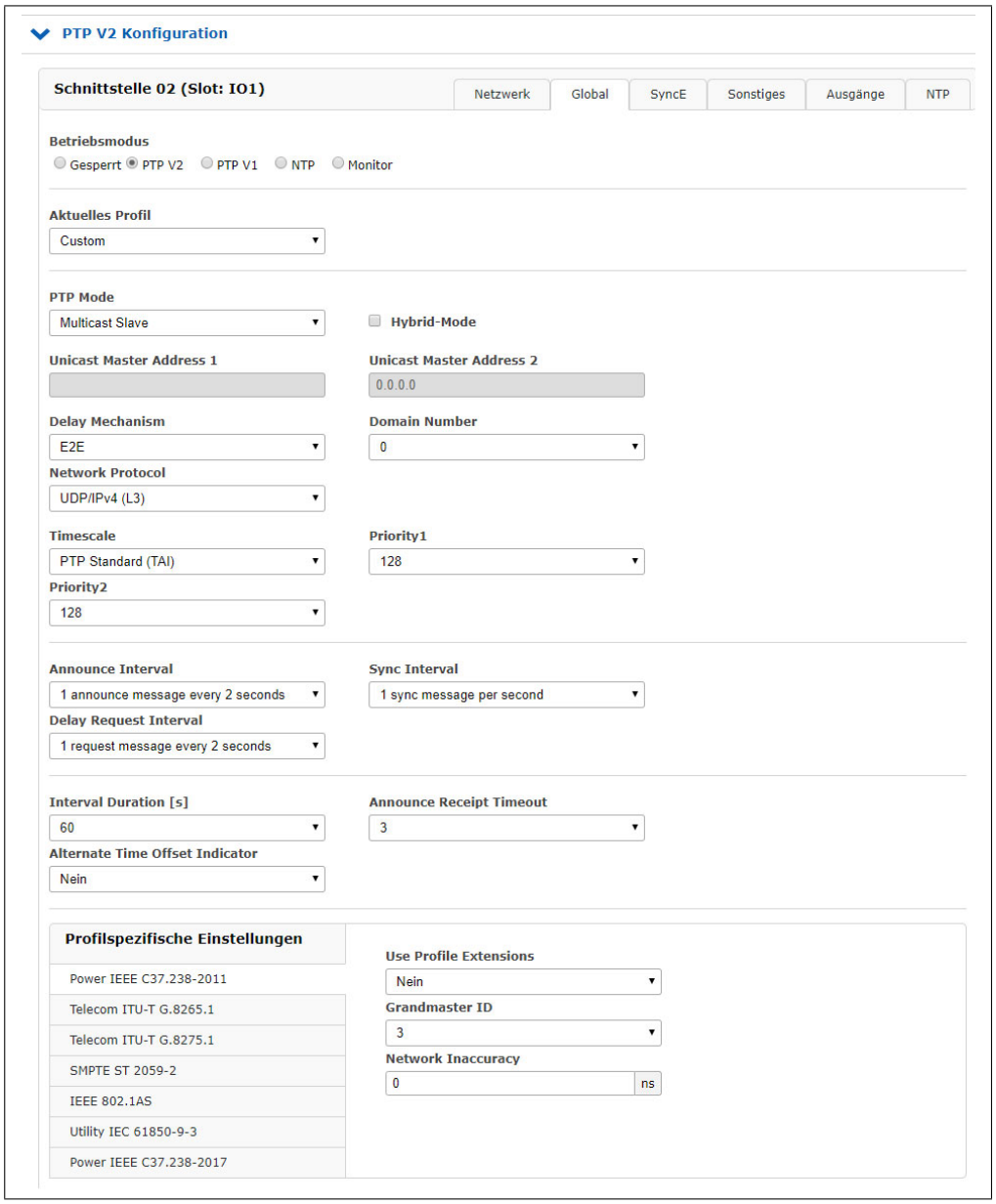


Figure: Webinterface - PTP Menu → Global Configuration

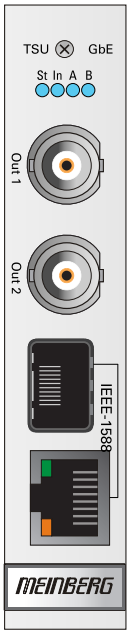
14.3.11.5 TSU V3: IEEE-1588 Time Stamp Unit

Information:

This product is no longer available and is succeeded by the IMS-HPS100. Of course, we will continue to provide support for modules that have already been shipped. Our Support Team will be happy to assist you with any questions you may have.

TSU v3 (IEEE 1588 v2 compatible)

Profiles:	IEEE 1588v2 Default Profile IEEE C.37.238 Power Profile ITU-T G.8265.1 Telecom Frequency Profile ITU-T G.8275.1 Telecom Phase/Time Profile SMPTE ST 2059-2 Broadcast Profile
PTP Modes:	Multicast Layer 2 (IEEE 802.3) Multicast/Unicast Layer 3 (UDP IPv4/IPv6) E2E / P2P Delay Mechanism Up to 128 Messages/Second per Client
NTP Mode:	NTP Server mode (10 ns Time Stamp Accuracy)
1588 Clock Mode:	1-Step, 2-Step for both Master and Slave Operation
Synchronous Ethernet:	Operable as Master or Slave Compliant with ITU-T G.8261, G.8262 and G.8264 Ethernet Synchronization Messaging Channel (ESMC)
Network Protocols:	IPv4, IPv6 DHCP, DHCPv6 DSCP IEEE 802.1q VLAN Filtering/Tagging
Ethernet Interface:	Combo Port: 1 x 100/1000BASE-T RJ45 1 x Gbit SFP
Signal Outputs:	2x BNC (50 Ohm) Connectors Configurable Signals: Pulse-Per-Second, 10 MHz, 2048 kHz
CPU:	1 GHz Dual-Core ARM
Time Stamp Accuracy:	10 ns



LED Indicators

"St" LED:	Init	Blue during initialization Off during normal operation
"In" LED:	Red	Error: TSU malfunctioning, PTP services stopped
	Yellow	No link, but initialized
	Green	Link established
	Red	Stopped
"A" & "B" LEDs:	Shows the current State of the TSU	
	Yellow - Yellow	Listening
	Green - Off	Master Mode
	Off - Green	Slave Mode
	Yellow - Off	Passive Mode
	Off - Yellow	Uncalibrated
	Red - Red	Stopped

14.3.11.6 SFP Transceiver

Recommended and tested Transceivers from other Vendors

Mode	Vendor/Type	Distance
MULTI MODE:	AVAGO AFBR-5710PZ	550 m (1,805 ft)
	FINISAR FTLF8524P3BNL	500 m (1,640 ft)
	CISCO GLC-SX-MMD	220 m (722 ft)
SINGLE MODE:	AVAGO AFCT-5710PZ	10 km (32,808 ft)
	FINISAR FTLF1318P3BTL	10 km (32,808 ft)
	SMARTOPTICS SO-SFP-L120D-C63	80 km (262,467 ft)
	BLUE OPTICS BO35J13610D (PSX210)	10 km (32,808 ft) / SFP+ 10.000 Mbit/s
RJ-45:	AVAGO ABCU-5740RZ	100 m (328 ft)
	FINISAR FCLF8521P2BTL	100 m (328 ft)

Information:

Important Note for HPS100 Modules:

Since HPS firmware version ≥1.4, an SFP Copper port is no longer supported. Therefore always use the native RJ45 port for your network copper lines.

Sending Synchronous Ethernet (SyncE) over Copper SFPs does not work!

The reason is because Copper SFPs have their own internal TCXO oscillators which are not adjustable so that the SyncE reference frequency that comes out of the system is not forwarded on the network. So the SyncE signal is free-running on a Copper SFP and therefore not useable for the next network node.

Please use a Fiber Optic SFP instead! The HPS100 module provides a native RJ45 port where SyncE via copper lines is possible.

Warning!

Prevention of Eye Injuries

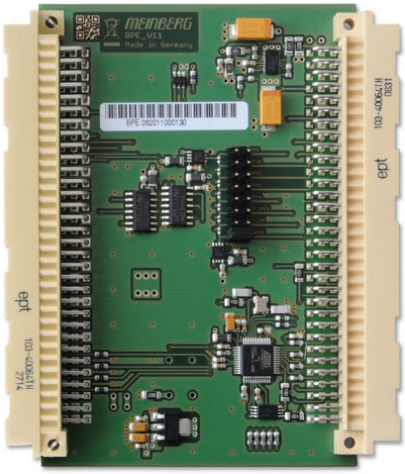
- Fiber optic SFP modules that are not compliant with the definition of a Class 1 laser in accordance with IEC standard 60825-1 may emit radiation capable of causing eye injuries.
- Never look into an unconnected connector of a fiber optic cable or an unconnected SFP port, and ensure that unused fiber optic connectors are always fitted with a suitable protective cap.

14.3.12 CPE and BPE Output Modules (Frontend - Backend, Eurocard)

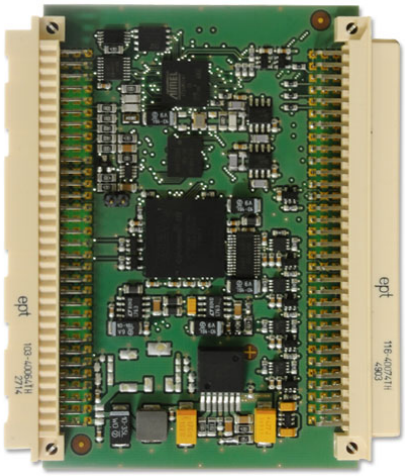
Configurable Port Expander / Backplane Port Expander

The standard output signals like pulses (1PPS, 1PPM and freely programmable pulses) and frequencies (10MHz, 2.048MHz, frequency synthesizer 1kHz-10MHz) are provided by two versatile I/O cards named BPE and CPE. Both of these two modules have been designed to cover a wide range of interface and signal/protocol requirements. They feature a two-tier architecture with a back-end and front-end.

The back-end is responsible for internally routing the backplane IMS synchronization signals (in case of the BPE) or for autonomously generating a wide range of different signals by using a microprocessor (on a CPE). The front-end makes a selection of the signals available on physical connectors.



BPE - Backend



CPE - Backend

14.3.12.1 BPE - Backplane Port Expander

Please Note:
In principle, it should be noted that the signals that are provided via a BPE at the various connectors are always generated by the upstream clock and spread via the backplane of the system. In opposite to the CPE, the signals are not generated by the module and therefore the outputs can only be set via the receiver.

The selection and settings of the signals such as frequency, time code or programmable pulse outputs can be done via the web interface menu "Clock" or "Clock Switch Card "(for redundant systems).

Output Signals: fixed TTL signals:
10 MHz, PPS, IRIG DCLS, IRIG AM, 2.048 MHz,
PPOs (selectable via receiver)

Output Level: 5 V_{pp} without load
2.8 - 3.0 V_{pp} into 50 Ω

Power Requirements: 5 V +-5%, 150 mA / BNC
5 V +-5%, 150 mA / FO

Status Indicators
LED St: BPE status
LED In: Status of the backplane's output signals
LED A: BPE status - output signals (1 + 2)
LED B: BPE status - output signals (3 + 4)

Note: When pulse trains >= 1.6 s are configured, the LED assigned to the output remains "red" as these pulse trains are not monitored (e.g. PPM, PPH ...).

Initialisation: LED St: blue until USB is configured
LED In - LED B: off until USB is configured

USB is configured: LED St: blue
LED In - LED B:
0,5 sec. red -> 0,5 sec. yellow ->
0,5 sec. green -> 0,5 sec. off

Normal Operation: LED St. + LED In: green
LED A: green, if the desired signal is present on output 1 and output 2
LED B: green, if the desired signal is present on output 3 and output 4

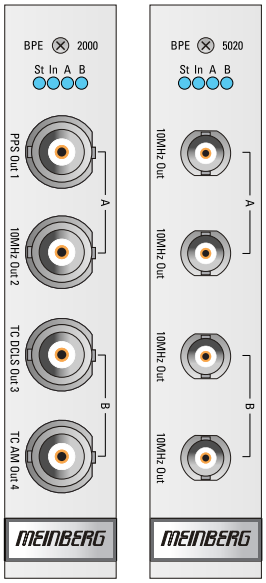


Figure right: BPE Outputs
BPE-2000 Standard outputs - BNC female:
PPS, 10 MHz, TC DCLS and TC AM

BPE 5000 Fiber Optic ST-Connectors
PPS, 10 MHz, TC DCLS und 2048kHz

14.3.12.2 Available BPE Modules

BPE Modules with BNC Outputs

BPE Type	Connectors	Signals	Size
BPE-1040	4 x BNC female	Out 1 - Out 4: TC AM	4HP
BPE-1060 [1]	4 x BNC female	Out 1 - Out 4: DCF77 SIM	4HP
BPE-2000	4 x BNC female	Out 1: PPS, Out 2: 10 MHz Out 3: TC DCLS, Out 4: TC AM	4HP
BPE-2001	4 x BNC female	Out 1: PPS, Out 2: 10 MHz Out 3: TC DCLS, Out 4: TC DCLS	4HP
BPE-2010	4 x BNC female	Out 1 - Out 4: PPS	4HP
BPE-2014	4 x BNC female	Out 1 - Out 2: PPS Out 3 - Out 4: 10 MHz	4HP
BPE-2016 [2]	4 x BNC female	Out 1 - Out 4: progr. Pulses_1 10 V_{PP}, 50 Ω load	4HP
BPE-2020	4 x BNC female	Out 1 - Out 4: 10 MHz	4HP
BPE-2030	4 x BNC female	Out 1 - Out 4: TC DCLS	4HP
BPE-2050	4 x BNC female	Out 1 - Out 3: TC DCLS Out 4: TC AM	4HP

(1) When using the BPE-1060 module, it is important that certain settings be made. Firstly, the mode under "Clock → Programmable Pulse Outputs → Prog. Out 1" must be set to "DCF 77 Marks". The drop-down box "Signal" must be set to "Normal", and the *local* timezone must be selected under "Clock → Time Zone → Time Zone for External Outputs".

If the appropriate time zone is not provided by default in this drop-down box, the time zone can be added manually via the menu "System → Display → Edit Time Zone Table".

Refer to BPE-1060 4 x SIM77 for more information.

(2) The outputs of this card are configurable by means of jumpers on the module. These jumpers allow the card to be configured to output PPS, Time Code DCLS, PPO_0 (Prog. Out 1), PPO_1 (Prog. Out 2), PPO_2 (Prog. Out 3) or PPO_3 (Prog. Out 4). Default jumper setting of this card is 4 x PPO_0 (Prog. Out 1 in the Web Interface).

BPE Type	Connectors	Signals	Size
BPE-2061 [3]	4 x BNC female	Out 1 - Out 4: Progr. Pulses 1 10 V_{pp} at 50 Ω load	4HP
BPE-2062 [3]	4 x BNC female	Out 1 - Out 4: Progr. Pulses 2 10 V_{pp} at 50 Ω load	4HP
BPE-2063 [3]	4 x BNC female	Out 1 - Out 4: Progr. Pulses 3 10 V_{pp} at 50 Ω load	4HP
BPE-2064 [3]	4 x BNC female	Out 1 - Out 4: Progr. Pulses 4 10 V_{pp} at 50 Ω load	4HP
BPE-2065	4 x BNC female	Out 1 - Out 4: PPS	4HP
BPE-2080	4 x BNC female	Out 1 - Out 4: 2048 kHz	4HP
BPE-2090	4 x BNC female	Out 1 - Out 4: Progr. Pulses	4HP
BPE-2091 [3]	4 x BNC female	Out 1 - Out 4: Progr. Pulses 1	4HP
BPE-2092 [3]	4 x BNC female	Out 1 - Out 4: Progr. Pulses 2	4HP
BPE-2110	8 x BNC female	Out 1 - Out 8: PPS	8HP
BPE-2120	8 x BNC female	Out 1 - Out 8: 10 MHz	8HP
BPE-2180	8 x BNC female	Out 1 - Out 8: 2048 kHz	8HP

(3) All four outputs of these BPE modules are configured via the upstream receiver. In the Web Interface, the output signals are configurable via the menu "Clock → Programmable Pulses → Prog. Out 1/2/3/4".

BPE Modules with MSTB Outputs

BPE Type	Connectors	Signals	Size
BPE-2500	4 x 2-pin MSTB PhotoMOS 1 x BNC female	Out 1 - Out 4: Progr. Pulses Out 5 - TC AM	4HP
BPE-2600	4 x 2-pin MSTB	Out 1: PPS, Out 2: 10 MHz Out 3: TC DCLS, Out 4: TC AM	4HP
BPE-2700	4 x 2pin MSTB Opto Coupler 1 x BNC female	Out 1 - Out 4: Progr. Pulses Out 5 - TC AM	4HP

BPE Modules with Serial Ports (D-SUB9 Jacks)

BPE Type	Connectors	Signals	Size
BPE-3050 [4]	2 x D-SUB9 female	Out 1, Out 2: Progr. Pulses RS-422 Level	4HP
BPE-3412	1 x D-SUB9 female 2 x BNC female	Out 1: Progr. Pulses, RS-422 Out 2, Out 3: TC AM	4HP
BPE-3422	4 x D-SUB9 female	Out 1 - Out 4: 1MHz RS-422 Level	8HP
BPE-3424	4 x D-SUB9 female	Out 1 - Out 4: TC DCLS RS-422 Level	8HP
BPE-3082	4 x D-SUB9 female	Out 1 - Out 4: 2048 kHz sine	8HP

(4) The outputs COM A and COM B are configured via the upstream receiver in the Web Interface (Menu "Clock → Programmable Pulses → Prog. Out 1"). The programmable pulses PP_0 of the clock are connected to both outputs of the BPE-3050 via the backplane.

BPE Modules with Fiber-Optic Outputs

BPE Type	Connectors	Signals	Size
BPE-5000	4 x FST	PPS, 10 MHz, TC-DCLS, 2048 kHz FO Multimode	4HP
BPE-5010	4 x FST	PPS / FO Multimode	4HP
BPE-5014	4 x FST	2 x PPS + 2 x 10 MHz / FO Multimode	4HP
BPE-5020	4 x FST	10 MHz / FO Multimode	4HP
BPE-5030	4 x FST	TC DCLS / FO Multimode	4HP
BPE-5032	4 x FST	TC DCLS / FO Singlemode	4HP
BPE-5080	4 x FST	2048 kHz / FO Multimode	4HP
BPE-5082	4 x FST	PPS, 10 MHz, 2 x 2048 kHz FO Multimode	4HP
BPE-5090	4 x FST	PPO / FO Multimode	4HP

BPE Modules with Other Outputs

BPE Type	Connectors	Signals	Size
BPE-4043	4 x RJ45	RS422, Pin_3 T-, Pin_6 T+	4HP
BPE-6042	2 x DMC 16-pin	10 x PPO - RS-422 galvanically isolated	4HP

14.3.12.3 Configuring an BPE expansion card via the Web Interface

A simple BPE expansion card usually gets its signals directly from the internal backplane of the system. The output signals of the card are pre-configured according to customer requirements.

If an output signal has to be changed, this must be done via the pre-connected receiver - in the menu "Clock → Switch Card" if you have a redundant system or in the menu "Clock → Receiver" in systems with only a single receiver. The BPE modules have no direct configuration options. This information is also displayed in the "IO Config" menu.

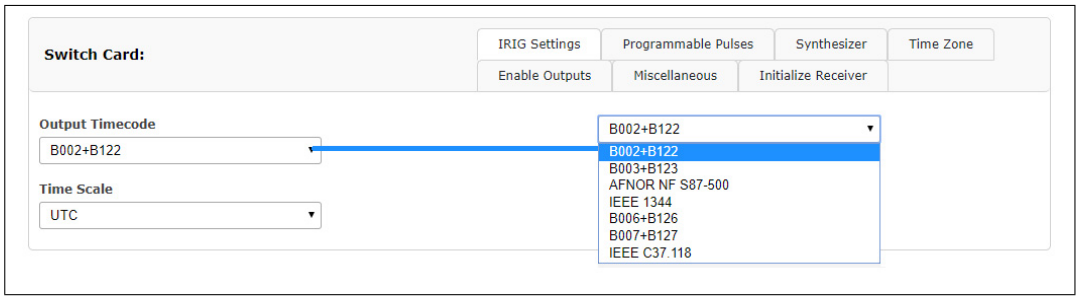


Figure: menu "Clock → Switch Card → IRIG Settings"

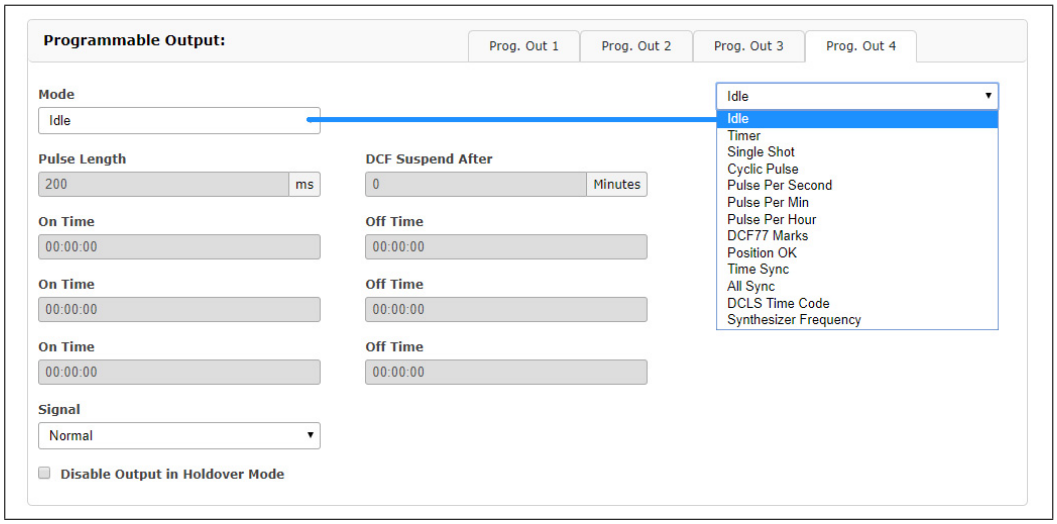
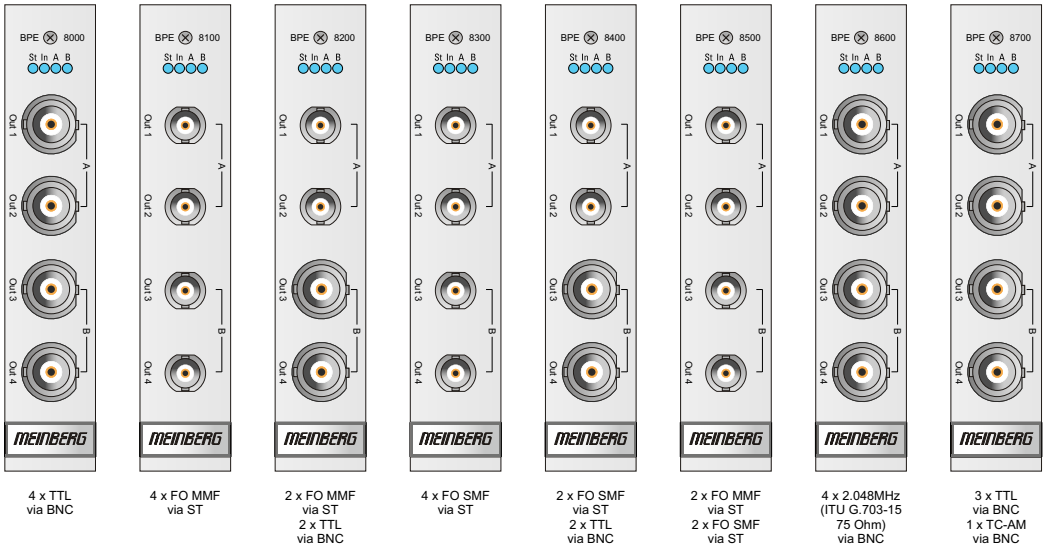


Figure: menu "Clock → Programmable Pulses → Selection of Idle mode"

14.3.12.4 BPE-8000 - Switchable Backplane Port Expander

Output Signals:	adjustable via the web interface (TTL or Fiber Optical): PPS, 10 MHz, 2048 kHz, TC-DCLS, Progr. Pulses or fixed: 2048 kHz (ITU G.703-15), TC-AM
Power Requirements:	5 V +-5%, 150 mA / BNC 5 V +-5%, 150 mA / FO
Status Indicators	
LED St:	BPE status
LED In:	Status of the backplane's output signals
LED A:	BPE status - output signals (1 + 2)
LED B:	BPE status - output signals (3 + 4)
Initialisation:	LED St: blue until USB is configured LED In - LED B: off until USB is configured
USB is configured:	LED St: blue LED In - LED B: 0,5 sec. red -> 0,5 sec. yellow -> 0,5 sec. green -> 0,5 sec. off
Normal Operation:	LED St. + LED In: green LED A: green, if the desired signal is present on output 1 and output 2 LED B: green, if the desired signal is present on output 3 and output 4

Available BPE-8000 Models



BPE Module	Connectors	Signal Outputs
BPE-8000	4x BNC female	TTL
BPE-8100	4x ST	Fiber Optic - Multimode
BPE-8200	2x ST, 2x BNC female	2x Fiber Optic - Multimode, 2x TTL
BPE-8300	4x ST	Fiber Optic - Singlemode
BPE-8400	2x ST, 2x BNC female	2x Fiber Optic - Singlemode, 2x TTL
BPE-8500	4x ST	2x Fiber Optic - Multimode, 2x Fiber Optic - Singlemode
BPE-8600	4x BNC female	2048 kHz (ITU G.703-15 - 75 Ω unbalanced) *
BPE-8700	4x BNC female	3x TTL, 1x Modulated Time Code - TC-AM **

* Fixed outputs, no signal selection possible.

** BNC sockets Out 1 - Out 3 are freely programmable, Out 4 is permanently set to TC AM.

14.3.12.5 Configuring an BPE-8000 expansion card via the Web Interface

Via the web interface or the Meinberg Device Manager (module integrated in a MDU), the following signals can be distributed to the BNC connectors (TTL) or fiber optical connectors (ST) according to your choice: PPS, 10MHz, Time Code DCLS, 2048 kHz and programmable pulse outputs PP 1 - PP 4 of the upstream reference source. With the programmable pulse outputs, each output channel of the pulse generator (IMS receiver) can now also be switched through to all available connectors of the BPE (for example PP 1 to Out 1 - Out 4 of the BPE).

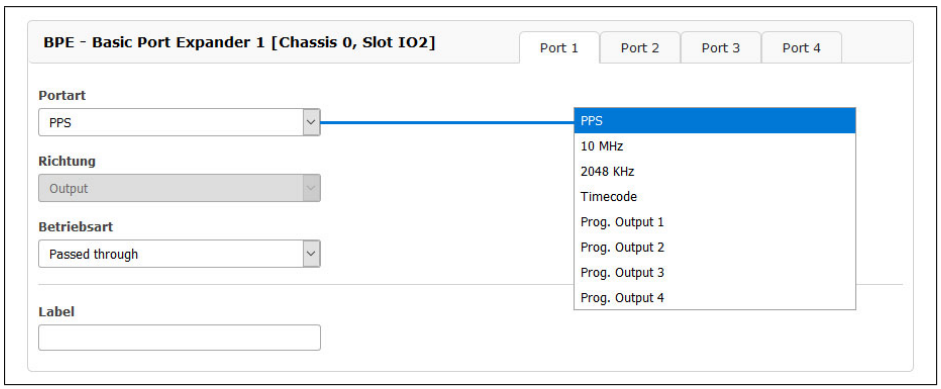
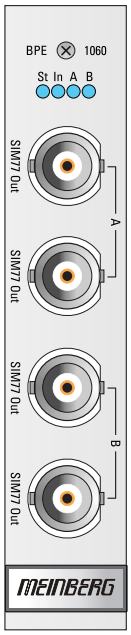


Figure: Web interface menu "IO Config → Output Configuration"

14.3.12.6 BPE-1060 4 x SIM77

Backplane Port Expander (Frontend / Backend)



Output Signals: fixed: Out 1 - Out 4: SIM77 (DCF77 compatible Signal)
via isolated female BNC connectors (-60 dBm)

Power Requirements: 5 V +-5%, 150 mA / BNC
5 V +-5%, 150 mA / FO

Status Indicators

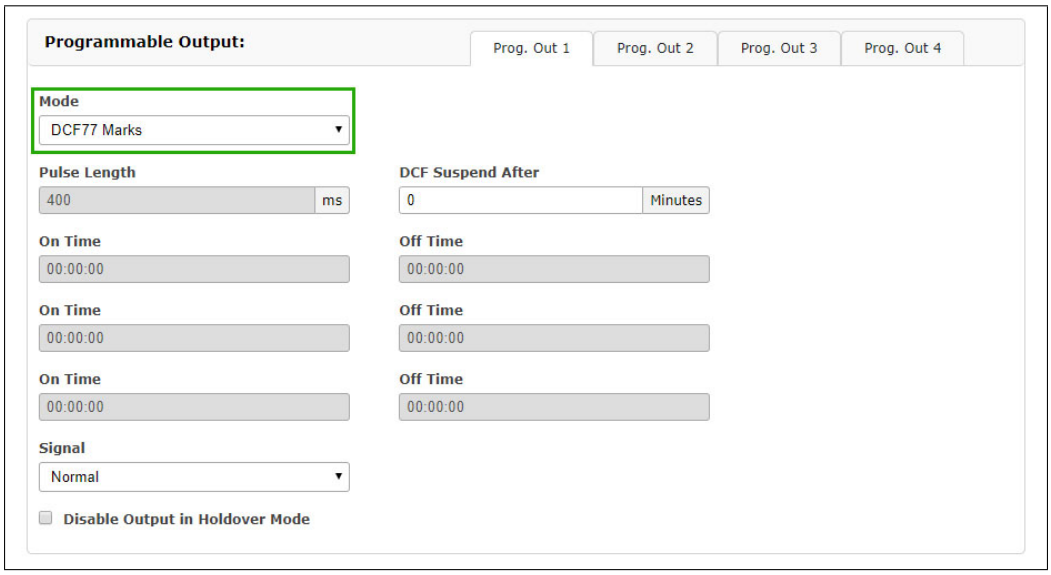
LED St:	BPE status
LED In:	Status of the backplane's output signals
LED A:	BPE status - output signals (1 + 2)
LED B:	BPE status - output signals (3 + 4)

Initialisation: LED St: blue until USB is configured
LED In - LED B: off until USB is configured

USB is configured: LED St: blue
LED In - LED B:
0,5 sec. red -> 0,5 sec. yellow ->
0,5 sec. green -> 0,5 sec. off

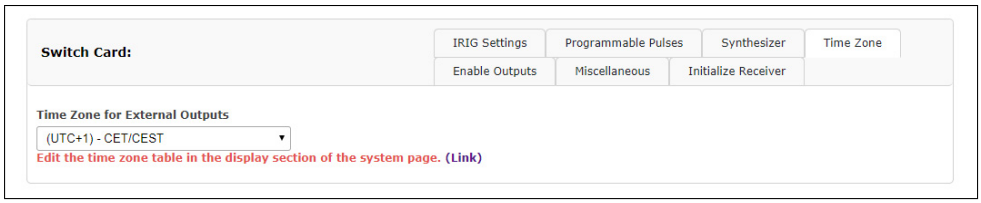
Normal Operation: LED St. + LED In: green
LED A: green, if the desired signal is present on output 1 and output 2
LED B: green, if the desired signal is present on output 3 and output 4

SIM77 - amplitude-modulated time signal
The amplitude-modulated time signal is compatible with the DCF77 signal, transmitted by the German long-wave transmitter. The SIM77 signal is provided via four DC insulated BNC sockets.



Note:
Important configuration parameters must be observed when using the BPE-1060 module in an IMS system. In the Web Interface, in the menu "Clock → Programmable pulse outputs → Prog. Out 1", the mode must be set to *DCF77 Marks*. In the "Signal" drop-down box, select *Normal* (see figure right).

The local time zone must be selected in the menu "Clock → Time Zone → Time Zone for External Outputs".



If the corresponding time zone is not available in this drop-down box, the time zone can be added manually in the menu "System → Display → Edit time zone table".

In the example below, several time zones are entered with the changeover rule for summer and winter time.

Edit time zone information table:

```
(UTC-10) - HST/HDT,HDT,0,08.03.****,-,09:00,02:00:00,HST,0,01.11.****,-,10:00,02:00:00
(UTC-9) - AST/ADT,ADT,0,08.03.****,-,08:00,02:00:00,AST,0,01.11.****,-,09:00,02:00:00
(UTC-8) - PST/PDT,PDT,0,08.03.****,-,07:00,02:00:00,PST,0,01.11.****,-,08:00,02:00:00
(UTC-7) - MST/MDT,MDT,0,08.03.****,-,06:00,02:00:00,MST,0,01.11.****,-,07:00,02:00:00
(UTC-6) - CST/CDT,CDT,0,08.03.****,-,05:00,02:00:00,CST,0,01.11.****,-,06:00,02:00:00
(UTC-5) - EST/EDT,EDT,0,08.03.****,-,04:00,02:00:00,EST,0,01.11.****,-,05:00,02:00:00
(UTC)   - UTC,UTC,0,01.01.****,+,00:00,00:00:00,UTC,0,01.01.****,+,00:00,00:00:00
(UTC)   - WET/WEST,WEST,0,25.03.****,+,01:00,01:00:00,WET,0,25.10.****,+,00:00,02:00:00
(UTC+1) - CET/CEST,CEST,0,25.03.****,+,02:00,02:00:00,CET,0,25.10.****,+,01:00,03:00:00
(UTC+2) - EET/EEST,EEST,0,25.03.****,+,03:00,03:00:00,EET,0,25.10.****,+,02:00,04:00:00
(UTC+3) - MSK/MSD,MSD,0,25.03.****,+,03:00,02:00:00,MSK,0,25.10.****,+,03:00,03:00:00
(UTC+3) - UTC3,UTC3,0,01.01.****,+,03:00,00:00:00,UTC,0,01.01.****,+,03:00,00:00:00
(UTC+4) - UTC4,UTC4,0,01.01.****,+,04:00,00:00:00,UTC4,0,01.01.****,+,04:00,00:00:00
(UTC+8) - CNST,CNST,0,01.01.****,+,08:00,00:00:00,CNST,0,01.01.****,+,08:00,00:00:00
(UTC+9) - AWDT,AWDT,0,01.01.****,+,09:00,00:00:00,AWDT,0,01.01.****,+,09:00,00:00:00
```

Please note, that these settings will also affect other output modules which provide the programmable pulse output "Prog. Out 1".

14.3.12.7 CPE - Configurable Port Expander (Frontend)

CPE (Configurable Port Expander)
The CPE is a configurable IO card that can autonomously generate additional output signals from the integrated system clock. This module consists of a half-size standard controller card (back-end) and a dockable port expander card (front-end), like this a wide variety of available programmable output signals and physical connections are possible, including various electrical and optical interfaces.

This enables the CPE, in combination with the front end COI TS2 (CPE 3000 ...), to support up to 4 more configurable interfaces that can optionally be led out as RS-232, RS-422 or RS-485 signal type. Furthermore, up to 8 programmable outputs (PPO) can be generated and configured in the web interface. The settings of the desired output configuration are selected in the IO Config -> Output Configuration.

It should be noted that the desired signals can be realized only with the corresponding front card.

Output Signals: configurable:
10 MHz, PPS, IRIG DCLS, IRIG AM, PPO

Capture-Input: active high or active low,
permitted input level +5 V (DC)

Power Supply: +5 V (DC), 150-300 mA,
depending on the selected frontend

Status Indicators

LED St:	CPE status
LED In:	Status of the backplane's output signals
LED A:	currently not used
LED B:	currently not used

LED Indicators

LED St:	blue	during initialisation
	green	normal operating mode
LED In:	red	no signal
	yellow	signal available / not sync
	green flash	time sync but not accurate
	green	time sync and accurate
LED A:	green	currently not used
LED B:	green	currently not used

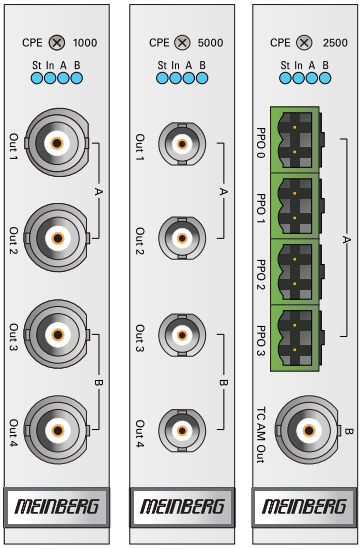


Figure: CPE Frontends
CPE-1000: 4 config. outputs via BNC female
CPE-5000: 4 config. outputs / FO - ST connectors
CPE-2500: 4 x prog. Pulses (DFK-2) / 1 x TC AM (BNC)

14.3.12.8 Available CPE Modules

BPE Type	Connectors	Signals	Size
CPE-1000	4 x BNC female	prog. pulses	4HP
CPE-1002	1 x D-SUB9 2 x BNC female	Time Telegram, RS232 Capture Inputs	4HP
CPE-1040	4 x BNC female	TC AM / BNC	4HP
CPE-1050	4 x BNC female	3 x progr. pulses, 1 x TC AM	4HP
CPE-2500	4 x DFK 2-pin PhotoMos 1 x BNC female	progr. Pulse TC AM	4HP
CPE-3000	2 x D-SUB9	serial timestring RS-232 + PPO	4HP
CPE-3010	2 x D-SUB9	serial timestring RS-422	4HP
CPE-3020	2 x D-SUB9	serial timestring RS-422 + PPO	4HP
CPE-3030	2 x D-SUB9	serial timestring RS-485	4HP
CPE-3040	2 x D-SUB9	serial timestring RS-485 + PPO	4HP
CPE-3050	2 x D-SUB9	PPO - RS-422	4HP
CPE-3060	2 x D-SUB9	serial timestring RS-422 + PPO	4HP
CPE-4020	2 x RJ45	serial timestring RS-422 + PPS	4HP
CPE-5000	4 x FST female	prog. pulses / fiber optical	4HP

14.3.12.9 CPE-3000: Programmable Outputs via serial Interface

The CPE-3000 module has two serial ports (COM A and B) for various output signals. The two interfaces can also be used for communication with other devices.

The possible pin assignments and module types are listed below:

	CPE-3000	CPE-3010	CPE-3020	CPE-3030	CPE-3040	CPE-3050	CPE-3060	
	COM A, COM B	COM A, COM B	COM A, COM B	COM A, COM B	COM A, COM B	COM A, COM B	COM A	COM B
PIN	**Time String (RS-232) +PPO**	**Time String (RS-422)**	**Time String (RS-422) + PPO (RS-422)**	**Time String (RS-485)**	**Time String (RS-485) + PPO (RS-422)**	**PPO (RS-422)**	**Time String (RS-232) + PPO (TTL)**	**Time String (RS-422) + PPO (RS-422)**
1	PPO	RxD +	RxD +	-	-	-	PPO	RxD +
2	TxD	RxD -	RxD -	-	-	-	TxD	RxD -
3	RxD	-	TxD +	-	TxD + / RxD +	-	RxD	TxD +
4	-	-	TxD -	-	TxD - / RxD -	-	-	TxD -
5	GND	GND	GND	GND	GND	GND	GND	GND
6	-	-	-	-	-	-	-	-
7	-	TxD +	PPO +	TxD + / RxD+	PPO +	PPO +	-	PPO +
8	-	TxD -	PPO -	TxD - / RxD -	PPO -	PPO -	-	PPO -
9	-	-	-	-	-	-	-	-

14.3.12.10 CPE - Configuration via Web Interface

If the CPE operates in an IMS system, the output configuration can easily be done via the web interface then.

With the "Common" tab the time zone with the corresponding offset can be selected.

CPE Configuration
In the "IO Config" menu you can select the following values for the output connectors:

Common	Time zone with the corresponding UTC offset value
Synthesizer	Frequency Snthesizer range 1Hz - 10 MHz
IRIG Code	Generated IRIG output codes (B002+B122 ...)
Prog. Out	Programmable output Prog. Out 1 - Prog. Out 4

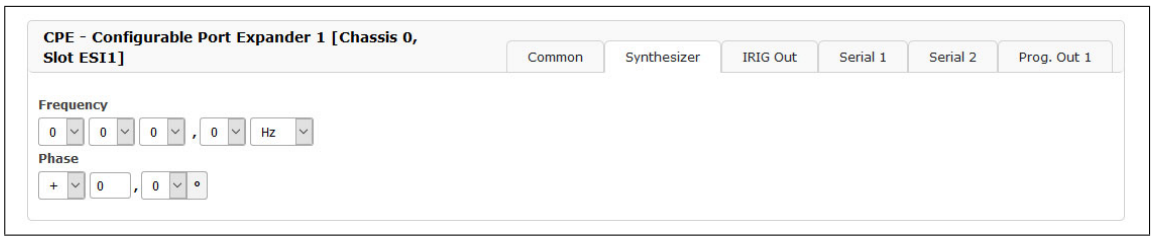


Figure: Menu Tab "Synthesizer" Frequency for selecting the Frequency Synthesizer option in the menu "Prog. Out"

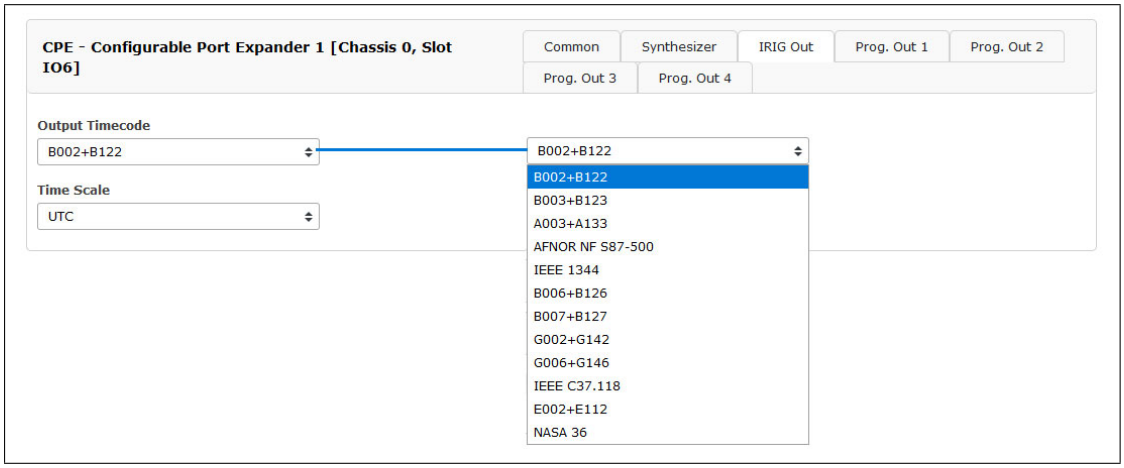


Figure: Menu Tab "IRIG Out" Selection of the IRIG code (IRIG DCLS only)

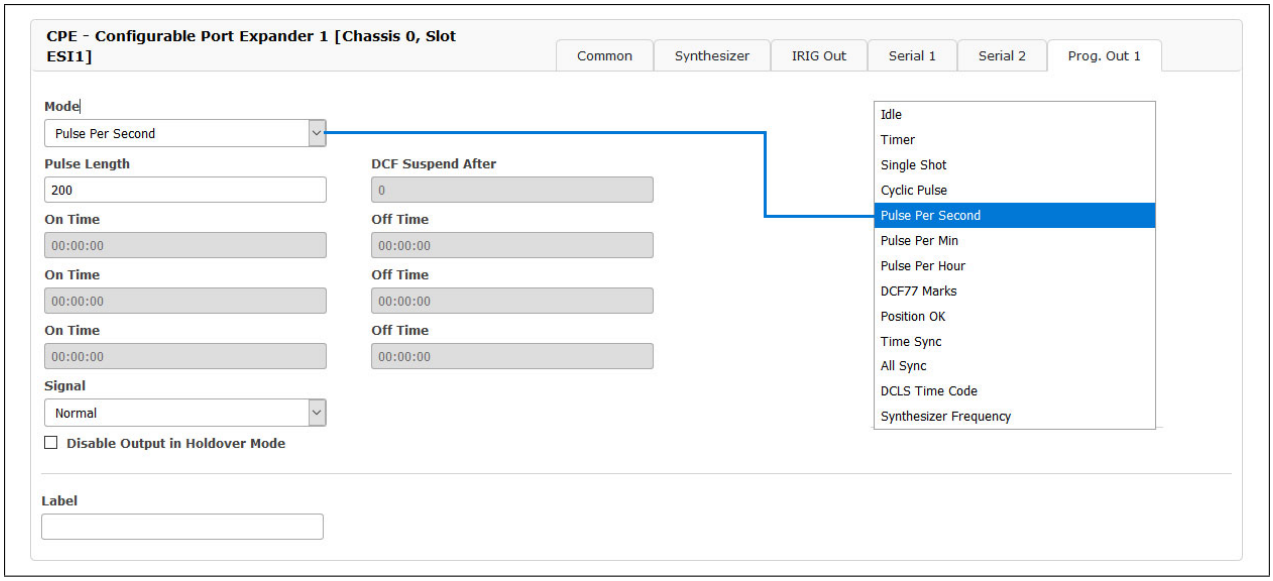


Figure: Menu Tab "Prog. Out" Selection of the signal option for the programmable pulse output (PPO)

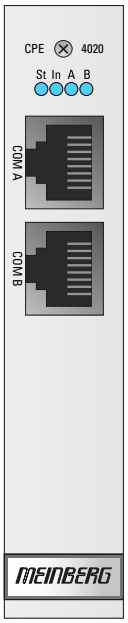
The following programmable pulse outputs can be selected:

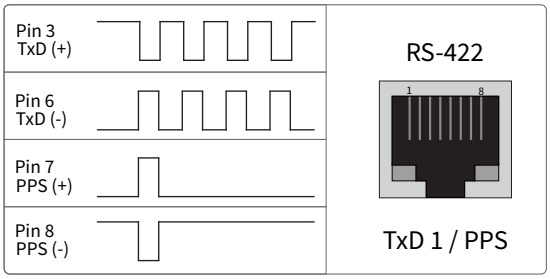
Idle	(not in use)
Timer	(3 switching-times On - Off)
Single Shot	(pulse length and start time)
Cyclic Pulse	(pulse length and cycle time)
Pulse Per Second	(pulse length)
Pulse Per Minute	(pulse length)
Pulse Per Hour	(pulse length)
DCF77 Marks	(timeout)
Position OK	(position determined)
Time Sync	(clock synchronized)
All Sync	(position determined and clock synchronized)
DCLS Time Code	
Synthesizer Frequency	

14.3.12.11 CPE-4020: Programmable Outputs via serial Interface

The module CPE-4020 has two interfaces with RJ45-connector (COM A and B). These provide Time String + PPS with RS-422 level. The following configurations must be performed to correctly output the signals.

Baud Rate	19200
Framing	8N1
String Type	Meinberg GPS
Mode	per second (PPS)
Pin assignment	
Pin 3:	TXD_P, serial interf. transmit pos.
Pin 5:	GND (Ground)
Pin 6:	TXD_N, serial interf. transmit neg.
Pin 7:	SYNC_P, PPS transmit, pos.
Pin 8:	SYNC_N, PPS transmit, neg.
Current Consumption:	5 V +-5%, 150 mA
Connection type:	8P8C (RJ45)
Cable:	Copper twisted pair, e.g. CAT 5.0





14.3.12.12 CPE-4020 Configuration via Web Interface

If the CPE-4020 operates in an IMS system, the output configuration can easily be done via the web interface then.

With the "Common" tab the time zone with the corresponding offset can be selected.

Configuration: CPE-4020
In the "IO Config" menu you can select the following values for the output connectors:

Common:	Time zone with the corresponding UTC offset value
Synthesizer:	Frequency Synthesizer range 1 Hz - 10 MHz
IRIG Code:	Generated IRIG output codes (B002+B122 ...)
Serial:	Serial connection parameters
Prog. Out:	Programmable outputs Prog. Out 1 and Prog. Out 2

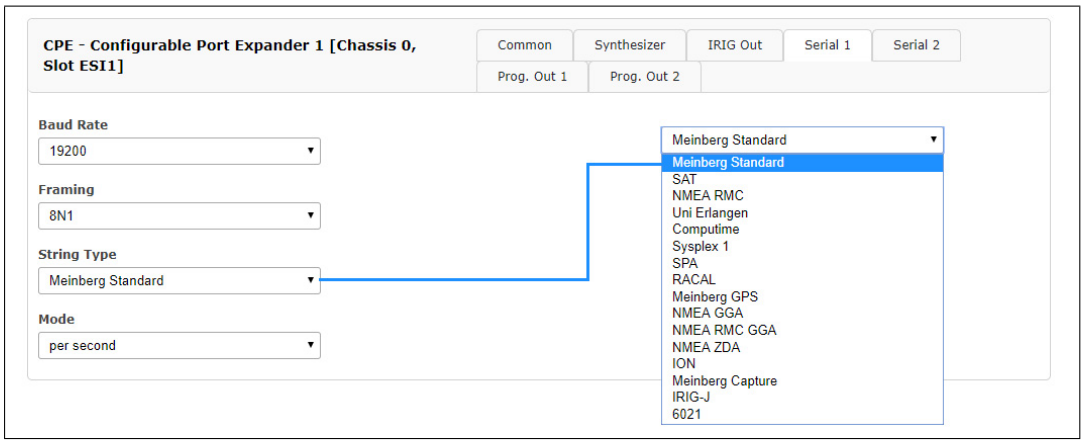


Figure: Serial connection parameter settings

The following programmable pulse outputs can be selected:

Idle	(not in use)
Timer	(3 switching-times On - Off)
Single Shot	(pulse length and start time)
Cyclic Pulse	(pulse length and cycle time)
Pulse Per Second	(pulse length)
Pulse Per Minute	(pulse length)
Pulse Per Hour	(pulse length)
DCF77 Marks	(timeout)
Position OK	(position determined)
Time Sync	(clock synchronized)
All Sync	(position determined and clock synchronized)
DCLS Time Code	
Synthesizer Frequency	

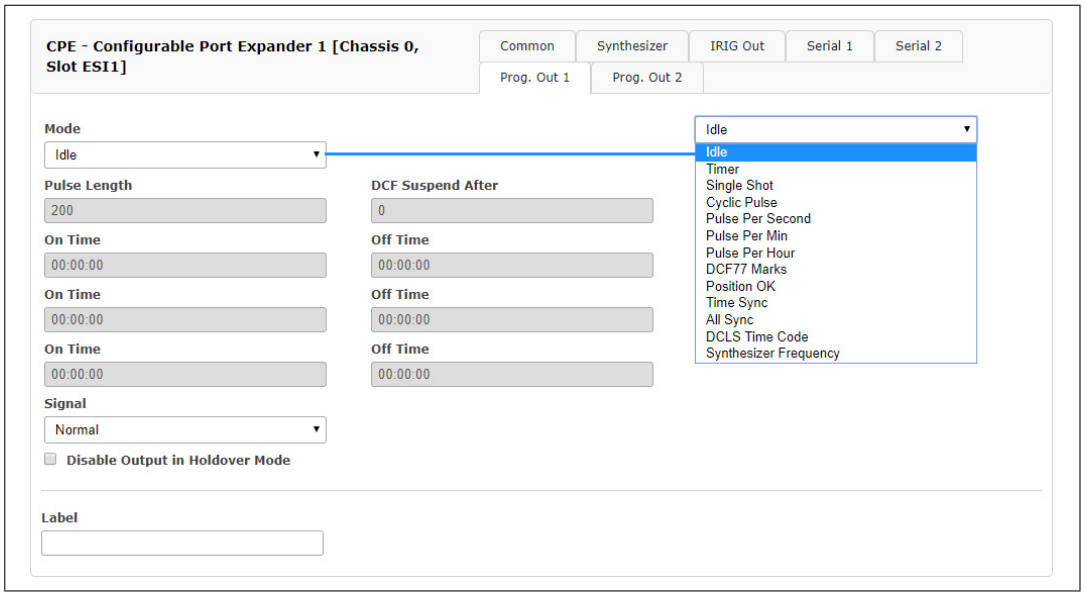
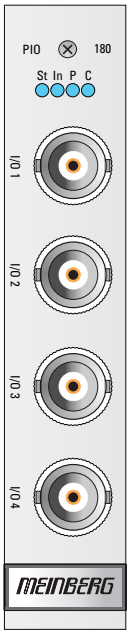


Figure: Selection of programmable pulse outputs

14.3.13 PIO180 - PPS or 10 MHz I/O Module

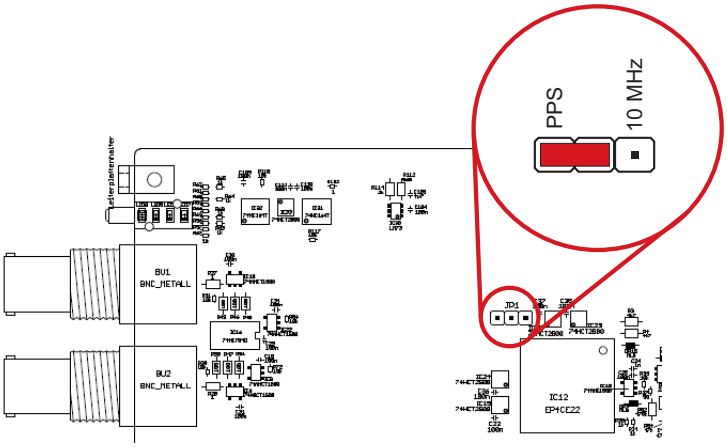
Technical Specifications:



Connectors:	4 x BNC female, isolated, individually switchable as input or output
Signal Options:	PPS or 10 MHz
Status Indicators	
LED St:	PIO status
LED In:	Status of the backplane's output signals
LED P:	display for preset PPS
LED C:	display for preset 10 MHz
Initialisation:	LED St: blue until USB is configured LED In - LED B: off until USB is configured
USB is configured:	LED St: blue LED In: 0,5 sec. red -> 0,5 sec. yellow -> 0,5 sec. green -> 0,5 sec. off
Normal Operation:	LED St. + LED In: green LED P: green, if card is preset to PPS LED C: green, if card is preset to 10 MHz

14.3.13.1 Pre-selection (PPS, 10 MHz)

Before installing the PIO180 module, select the required signal using the jumper setting (PPS or 10 MHz). Upon delivery all ports are preset to PPS (Pulse Per Second).

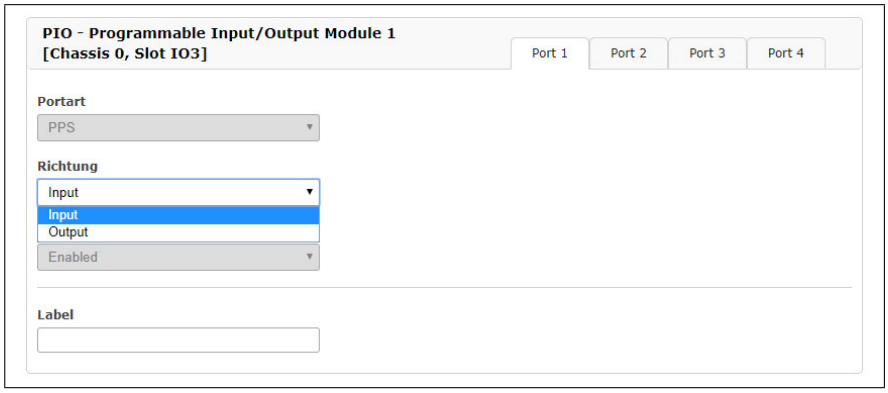


Information:

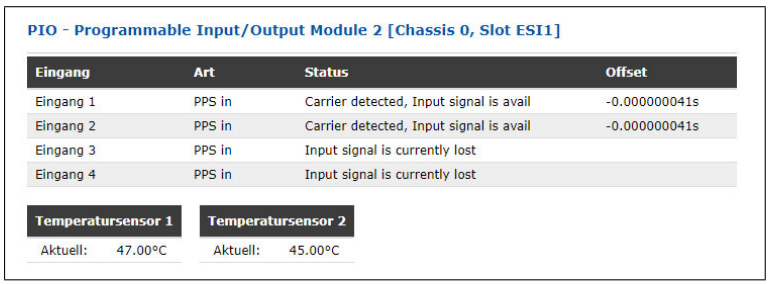
Mixed operation is not possible. All inputs/outputs are set to either PPS or 10 MHz.

14.3.13.2 PIO - Configuration via the Web Interface

In the "IO Config" menu of the web interface, each port of the PIO180 can be set separately to "Input" or "Output. To use the individual ports in **SyncMon**, the direction "Input" must be selected.



Via the web interface, each port can be set separately to "Input" or "Output". If a port is set to "Output", the system PPS or the 10 MHz reference frequency is output signal at this port. If a port is set to "Input" the incoming signal is compared to the system PPS or to the 10 MHz reference frequency. The offset values are displayed in the status window.



PIO - Programmable Input/Output Module 2 [Chassis 0, Slot ESI1]

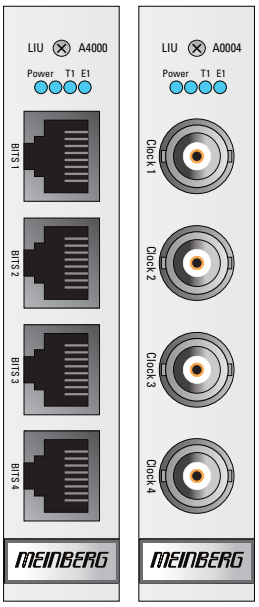
Eingang	Art	Status	Offset
Eingang 1	PPS in	Carrier detected, Input signal is avail	-0.000000041s
Eingang 2	PPS in	Carrier detected, Input signal is avail	-0.000000041s
Eingang 3	PPS in	Input signal is currently lost	
Eingang 4	PPS in	Input signal is currently lost	

Temperatursensor 1		Temperatursensor 2	
Aktuell:	47.00°C	Aktuell:	45.00°C

Download the Setup Guide on the PIO180 product page for more detailed information about the configuration and status monitoring options of the PIO180.

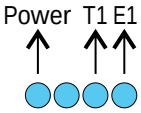
Download of the PIO180 Setup Guide:
https://www.meinbergglobal.com/download/docs/manuals/english/ims-pio.pdf

14.3.14 LIU - Line Interface Unit



Input signal:	2.048 MHz reference clock, TTL level
Clock:	T1 - 1.544 MHz E1 - 2.048 MHz
BITS:	Framed Outputs 1544 kBit/s or 2048 kBit/s (ESF - Extended Superframe) T1 - 1.544 MBit/s E1 - 2.048 MBit/s
Outputs:	balanced - RJ45 jack - 120 Ω (Clock) unbalanced - BNC connector 75 Ω (Bits)
Short term stability and Accuracy:	depends on oscillator of the reference clock OCXO-SQ: $+-5 \cdot 10^{-10}$ OCXO-MQ: $+-2 \cdot 10^{-10}$ OCXO-HQ: $+-5 \cdot 10^{-12}$ OCXO-DHQ: $+-2 \cdot 10^{-12}$ Rubidium: $+-2 \cdot 10^{-11}$

LED Indicators



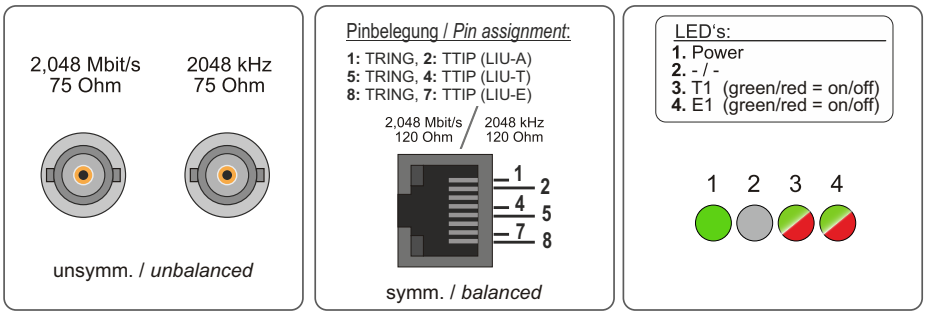
Power:	Init	blue during initialisation, green in normal operation mode
T1:	green red: yellow:	selected mode T1 output disabled signal quality unknown
E1:	green red: yellow:	selected mode E1 output disabled signal quality unknown

14.3.14.1 IMS-LIU Telecom Output Signals

The board LIU (Line Interface Unit) was designed to convert the GNSS-locked standard frequency of a pre-connected Meinberg satellite controlled clock (GPS or GPS/GLONASS/Galileo/BeiDou) into several timing signals that can be used for various synchronization or measurement tasks.

Typical applications are:

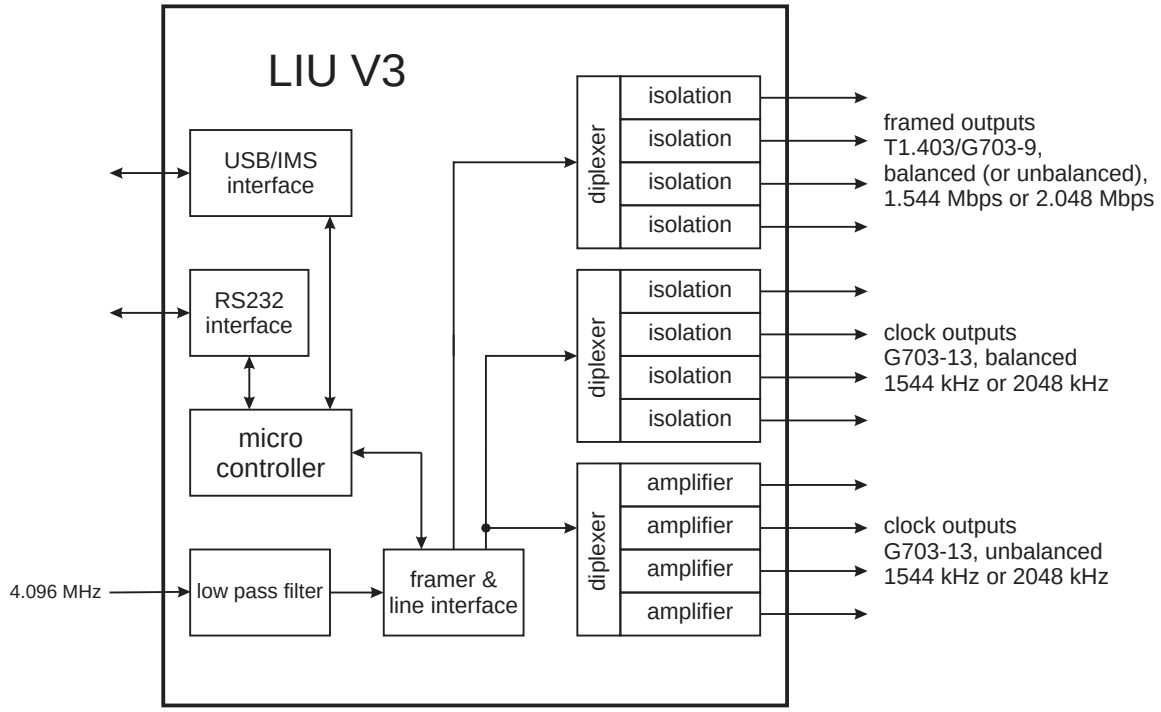
- Measurement and test of synchronization quality of Telecom networks
- Calibration and synchronization of laboratory equipment
- Test of synchronization of radio transmitters / base stations (GSM / CDMA / UMTS / DAB / DVB)



There are two separate signal paths on the board LIU. One is for providing the standard frequencies, the second path is for generation of the "telecom-signals". All output signals have high accuracy and stability because they are derived from the internal receiver's disciplined standard frequencies generated by the pre-connected satellite clock. Depending on the oscillator option of the internal receiver, the accuracies which are described in chapter LIU - Line Interface Unit can be achieved.

14.3.14.2 Block Diagram LIU

The following block diagram illustrates the functional principle of the board LIU:



14.3.14.3 Telecom Signals

These signals can be grouped into two categories: the "unframed" outputs and the "framed" outputs, the latter being generated by a framer module on the LIU board. The unframed clock signals needed to generate the "telecom" output signals are derived from a 2048 kHz reference signal generated by a frequency synthesizer on the upstream GNSS clock. The output frequency of the synthesizer is derived from the main oscillator of the clock and is phase-locked to the pulse-per-second signal.

The LIU module can generate signals for the American T1 and European E1 systems. The desired mode is selected via the Web Interface of the management module (LAN-CPU):

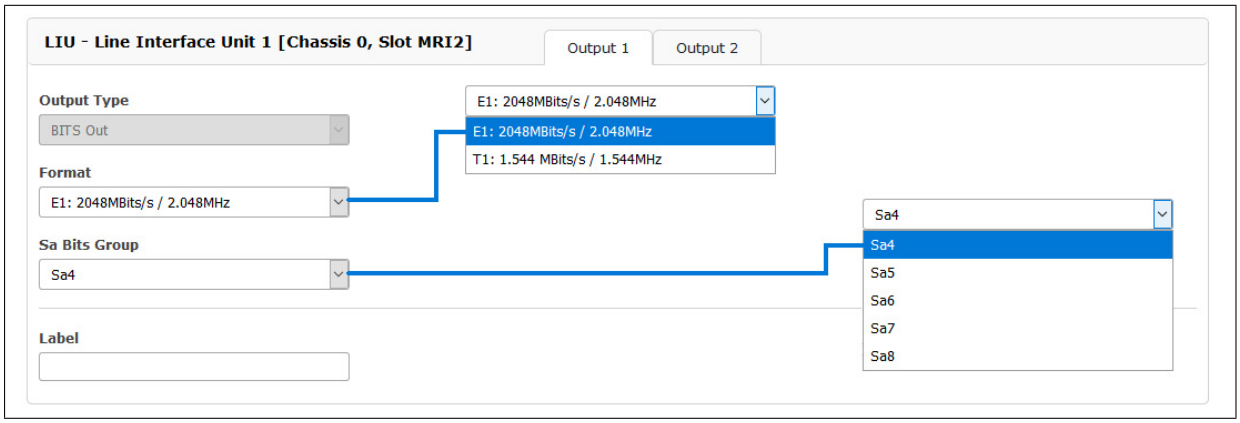


Illustration: Configuring the LIU module using the Web Interface menu "IO Config → Outputs Configuration"

The unframed signals are standard frequencies of either 1544 kHz (T1) or 2048 kHz (E1). Four unbalanced and four balanced outputs are provided as BNC and RJ45 connectors as specified by ITU-T G703-13 (CCITT Recommendation: "Physical/Electrical Characteristics of Hierarchical Digital Interfaces").

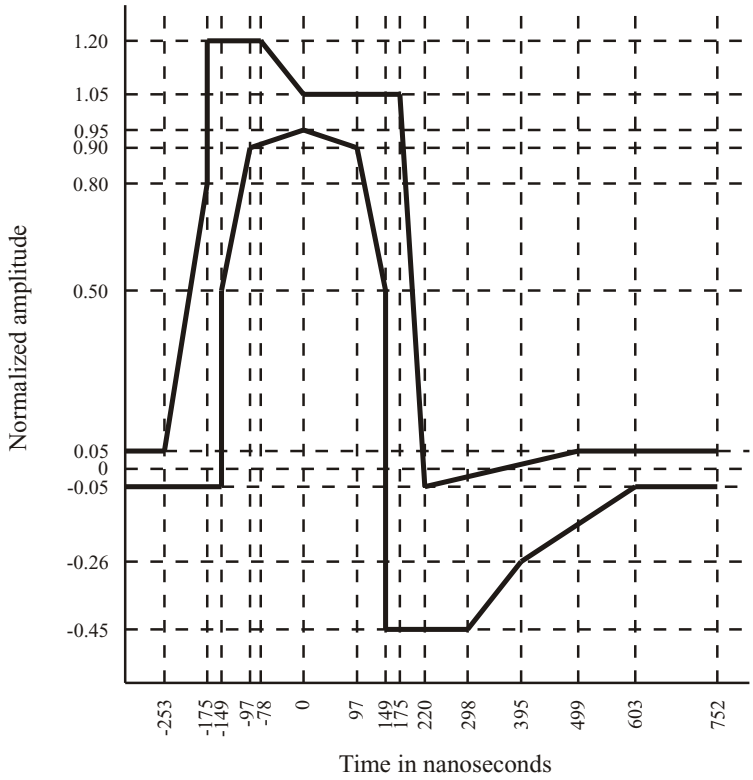
The framed signals are data signals of a type known in digital telecommunications (EFS Framing Mode - Extended Superframe). The LIU is a synchronization unit and therefore only generates a "framed all ones" signal (data byte 0xFFh) with a transmission rate of either 1544 kBit/s (T1) or 2048 k/Bit/s (E1). Four outputs are provided as specified by ANSI T.403 (T1 mode) or ITU-T G703-9 (E1 mode), either as unbalanced BNC connectors or balanced RJ45 connectors. Two different transmission codes used in error corrections are used to transmit framed signals. The LIU generates output signals with B8ZS (in T1 mode) or HDB3 (in E1 mode) encoding by default.

Should the reference clock enter free-run mode (due to loss of sync with the upstream GNSS signal), the LIU module's output signals can be configured to be disabled, or the Synchronization Status Bits (SSM) of the framed outputs can be changed from "*Traceable to PRS - 0x02*" to "*Quality unknown - 0x00*". The Web Interface can also be used to configure the desired response of the LIU to loss of synchronization.

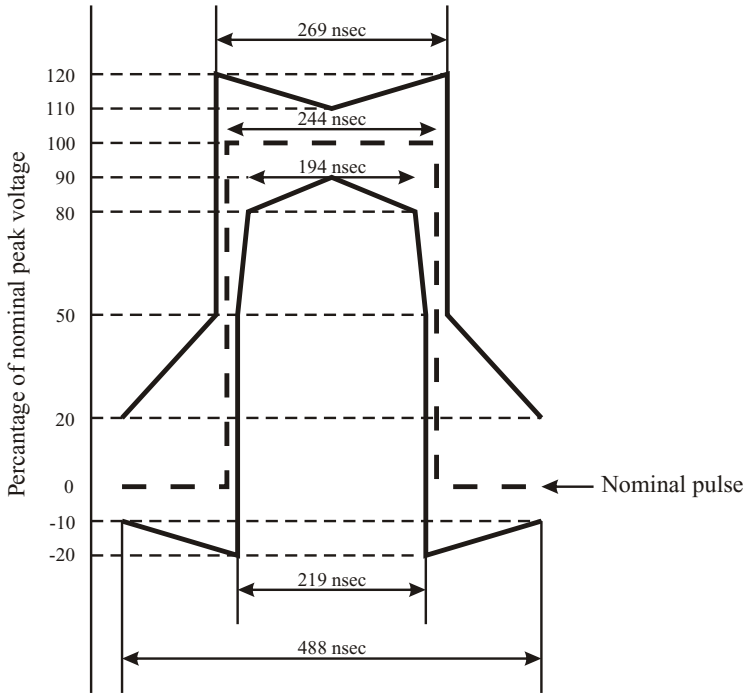
14.3.14.4 Pulse templates

The following pulse templates are required by ANSI (T1-mode) and CCITT (E1-mode) for output signals in telecom applications. The board LIU meets these recommendations.

T1 (T.403):



E1 (G.703):



14.3.14.5 LIU - Configuration Samples

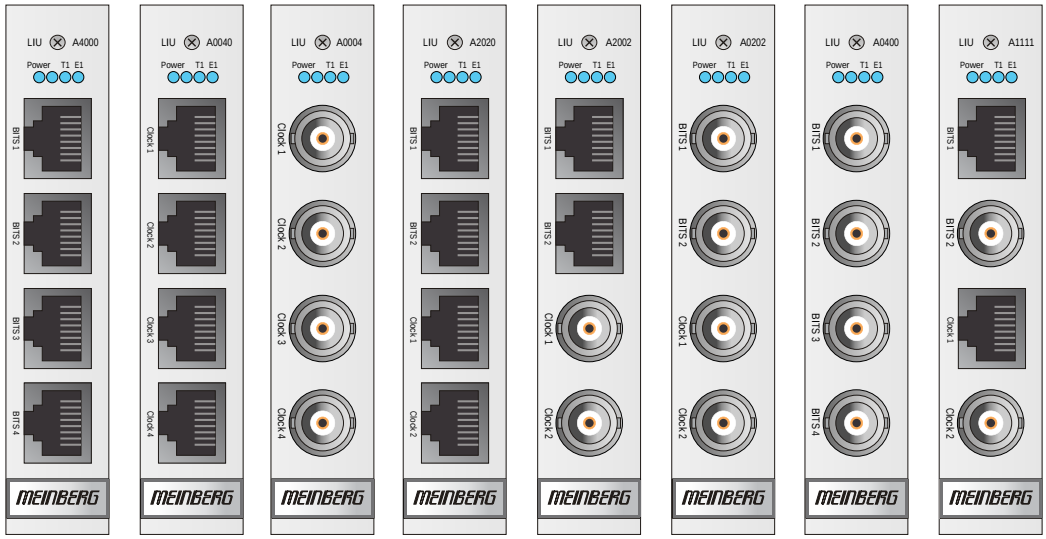
The Line Interface Unit (LIU) is available in two different sizes and different output / connector options. All outputs of a module can be operate in either the E1 or T1 in mode. Signal output settings can be done during operation via the web interface. The selected mode is indicated by the LEDs in the retainer plate.

Signal Types

- 2048 kHz (E1 mode) or 1.544 MHz (T1 mode), G.703, 120 Ω, balanced, RJ45 socket
- 2048 kHz (E1 mode) or 1.544 MHz (T1 mode), G.703, 75 Ω, unbalanced, BNC connector
- 2048 kBit/s (E1 mode) or 1.544 MBit/s (T1 mode), 120 Ω, balanced, RJ45 socket
- 2048 kBit/s (E1 mode) or 1.544 MBit/s (T1 mode), 75 Ω, unbalanced, BNC connector

14.3.14.6 Overview - LIU Modules for IMS Systems

LIU Model	Size	Signal (bal./unbal.)	Connectors
LIU-A0040	4TE	Clock (4/0)	4 x RJ45
LIU-A0004	4TE	Clock (0/4)	4 x BNC
LIU-A2020	4TE	BITS (2/0) Clock (2/0)	2 x RJ45 2 x RJ45
LIU-A2002	4TE	BITS (2/0) Clock (0/2)	2 x RJ45 2 x BNC
LIU-A0400	4TE	BITS (0/4)	4 x BNC
LIU-A1111	4TE	BITS (1/1) Clock (1/1)	1 x RJ45, 1 x BNC 1 x RJ45, 1 x BNC



LIU-A4000 BITS (4/0) | LIU-A0040 Clock (4/0) | LIU-A0004 Clock (0/4) | LIU-A2020 BITS (2/0) Clock (2/0) | LIU-A2002 BITS (2/0) Clock (0/2) | LIU_A0202 BITS (0/2) Clock (0/2) | LIU_A0400 BITS (0/4) | LIU-A1111 BITS (1/1) Clock (1/1)

14.3.14.7 IMS - LIU Configuration

E1/T1 – generator available with 4 or 8 outputs
Generation of reference clocks for synchronization tasks. The module LIU (Line Interface Unit) generates different reference clock pulses which are derived from the GPS-locked master oscillator of a preconnected GPS clock. The output signals are available with high accuracy and stability therefore.

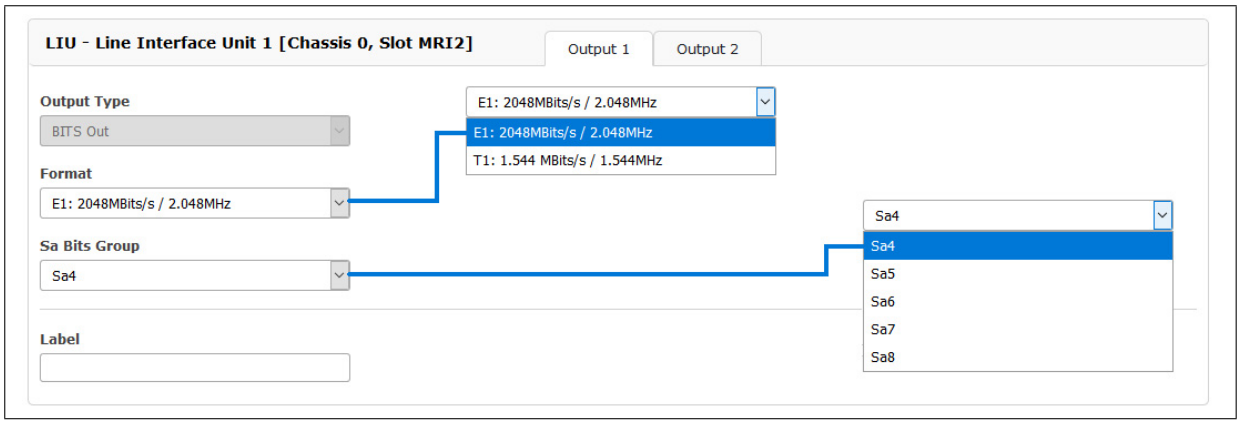


Figure: Configuration of the LIU module via the web interface menu "IO Config → Outputs Configuration"

Output Type

Clock Outputs:	2.048 MHz (E1-mode) or 1.544 MHz (T1-mode), G.703, 75 Ohm, unbalanced or 2.048 MHz (E1-mode) or 1.544 MHz (T1-mode), G.703, 120 Ohm, balanced.
BITS	framed outputs with SSM/BOC support: 2.048 Mbit/s (E1-mode) or 1.544 Mbit/s (T1-mode), 75 Ohm unbalanced or 2.048 MPs (E1-mode) or 1.544 Mbit/s (T1-mode), 120 Ohm, balanced.
Format	E1 framed (2.048 kBit) or T1 framed (1.544 kBit)
Quality	Sa Bit group location of SSM QL bits

With the pull-down menu "Output Configuration" the available outputs of the I/O slots can be configured:

Output Configuration of a LIU module (Line Interface Unit):
In this menu one can select between E1 or T1 mode for the LIU outputs. The selected mode is the same for all outputs.

T1 or E1?
T1 is a digital carrier signal that transmits the DS - 1 signal. It has a data rate of about 1.544 Mbit/second. It contains 24 digital channels and therefore requires a device that has a digital connection.

E1 is the european equivalent to T1. T1 is the North American term whereas E1 is a European term for digital transmission. The data rate of E1 is about 2 Mbit/second. It has 32 channels at the speed of 64 Kbit/second. 2 channels among 32 are already reserved.

One channel is used for signaling while the other is used for controlling. The difference between T1 and E1 lies in the number of channels here.

Sa Bits
ITU-T Recommendations allow for bits Sa4 to Sa8 to be used in specific point-to-point applications (e.g. transcoder equipment) within national borders.

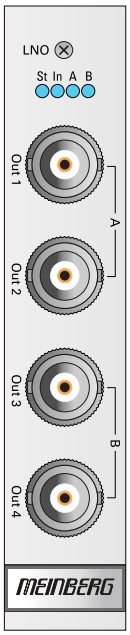
The Sa4 bit may be used as a message-based data link for operation, maintenance and performance monitoring. The SSM Bit (Synchronization Status Message) can be selected in the Web GUI for clock quality information. Sa4 is selected as default.

14.3.15 LNO - Sine Wave Outputs with low Phase Noise

The LNO180 is a 10 MHz (5 MHz option) generator card, which provides sine signals with low phase noise to 4 external outputs. The card has a microprocessor system, which monitors the output signals and generates status signals for the upper-level management system accordingly.

Function of Operation
The card has a high quality oscillator, which is locked to an external 10 MHz signal. The microprocessor monitors the lock status of the PLL and the warm up phase of the oscillator. It activates the outputs only after the phase is locked. This condition is signalized by all LEDs switched from green to red. In the phase locked state the output levels of the four outputs are monitored and in case of a failure signalized by an associated red LED.

Technical Specifications:



Interface: 4x sine outputs - 10 MHz or 5 MHz*

Output Level: 5 dBm +/- 1 dBm at 50 Ω
(8 dBm or 12 dBm output level option available)

Warm-up time: < 3 @ 25 °C within accuracy of < +-1 x 10^{-7}

Harmonics: -60 dBc

Phase Noise:

LNO180 OCXO-SQ	
1 Hz	-80 dBc/Hz
10 Hz	-100 dBc/Hz
100 Hz	-130 dBc/Hz
1 kHz	-140 dBc/Hz
10 kHz	-150 dBc/Hz

LNO180 OCXO-MQ**	
1 Hz	-85 dBc/Hz
10 Hz	-110 dBc/Hz
100 Hz	-135 dBc/Hz
1 kHz	-143 dBc/Hz
10 kHz	-155 dBc/Hz

LNO180 OCXO-HQ	
1 Hz	-93 dBc/Hz
10 Hz	-126 dBc/Hz
100 Hz	-140 dBc/Hz
1 kHz	-145 dBc/Hz
10 kHz	-165 dBc/Hz

5 MHz Option:*

LNO180/5 OCXO-MQ	
1 Hz	-88 dBc/Hz
10 Hz	-115 dBc/Hz
100 Hz	-132 dBc/Hz
1 kHz	-145 dBc/Hz
10 kHz	-158 dBc/H

Quartz Filter: Bandwidth 1 kHz

* As of October 2023, the 5 MHz option is no longer available.
** As of January 2024, OCXO-MQ oscillators are no longer available.

Power Supply:	5 dBm:	+5 V @ 550 mA (steady state), +5 V @ 670 mA (warm up)
	8 dBm:	+5 V @ 720 mA (steady state), +5 V @ 640 mA (warm up)
	12 dBm:	+5 V @ 970 mA (steady state), +5 V @ 620 mA (warm up)

LED Status Indicators:

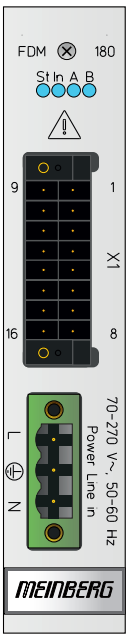
LED St	**Status of the LNO180 card** Green: 10 MHz reference ok and PLL has locked Yellow: 10 MHz reference ok but PLL is not locked yet Red: No 10 MHz reference detected
LED In	**10 MHz reference and PLL status** Green: Ok, 10 MHz available at both outputs Red: Error, no signal at one or both outputs
LED A	**Output 1-2 status** Green: Ok, 10 MHz available at both outputs Red: Error, no signal at one or both outputs
LED B	**Output 3-4 status** Green: Ok, 10 MHz available at both outputs Red: Error, no signal at one or both outputs

Output can not be active, before PLL is locked.

14.3.16 FDM - Frequency Deviation Monitoring

The module FDM180 was designed to calculate and monitor the frequency and its deviation in 50/60Hz power line networks.

A preconnected reference is necessary that provides a serial time string and a PPS (pulse per second). The accuracy of the measurements is derived from these signals. The module calculates the frequency as well as the time, based on the mains frequency. The time deviation (TD) is the difference of this calculated time (PLT) to the reference time (REF). This time deviation as well as the frequency itself is sent out via serial interface or is beeing converted to an analog voltage output provided by a DAC.



Pin Assignement: 16-pin DMC Phoenix Connector

Pin	Signal
Pin 1	A0
Pin 2	A1
Pin 3	GND
Pin 4	n.c.
Pin 5	n.c.
Pin 6	GND
Pin 7	COM 0 RxD in
Pin 8	COM 0 TxD out
Pin 9 - Pin 14	GND
Pin 15	COM 1 RxD in
Pin 16	COM 1 TxD out

LED Indicator

LED St:	Init	blue during inintialisation
		green - normal operation
LED In:	shows the state	after initialisation
	red	ref not connected / FDM not sync
	yellow	ref. signal not useable
	green blinking	Timesync
	green	Accurate ($\leq$ 200 ns to reference)
LED A:	green	FD (Frequency Deviation) within the configured limits
	red	FD Overflow
LED B:	green	TD (Time Deviation) within the configured limits
	red	TD Overflow

Input signal: Serial time string, PPS
mains frequency, 70 - 270 V AC, 50Hz or 60Hz

Interface: Two asynchronous serial RS-232 ports, COM0 and COM1
Baudrate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1, 7O2
output and average: once per second or 100ms

Output string: The frequency, frequency deviation, reference time, power line time and the time deviation are send out in different available formats.

The formats are:
STANDARD FDM String:
F:49.984 FD:-00.016 REF:15:03:30 PLT:15:03:30.368 TD:+00.368[CR][LF]

SHORT FDM String:
FD:-00.016 TD:+00.368[CR][LF]

AREVA FDM String:
[STX]
02049.984[CR][LF]
021-00.016[CR][LF]
022+00.378[CR][LF]
02315 03 30.368[CR][LF]
024068 15 03 30 [CR][LF]
[ETX]

Resolution of Measurement: frequency: accuracy the oscillator (10 MHz) +-100 μHz
time deviation: accuracy of reference (PPS) +- 1ms

Analog outputs: 2 analog outputs for longtime-recording (time deviation and/or frequency deviation), range: -2.5 V ... +2.5 V, resolution: 16 Bit

Electrical connectors: 96-pin VG-rail DIN 41612

Power supply: +5 V DC

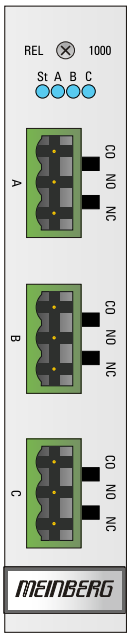
Current consumption: 0.4 A - 1 A

More detailed information about FDM - Frequency Deviation Monitoring can be found in the current LANTIME firmware manual, chapter "LTOS6 Management and Monitoring → FDM".

14.3.17 REL1000 - Error Relay Module

The IMS-REL1000 is used as an error relay module that can be used to switch a variety of operating states (e.g. Clock Not Sync, Antenna Faulty, etc.). If the internal hardware clock is running synchronously to the reference source, the relay will switch to NO (Normaly Open) mode. In the event of an error, the relay will switch to NC (Normaly Closed) mode.

Functionality



Depending on the IMS system, is redundant with two reference clocks and IMS-RSC module (switching unit) or with one reference clock and SPT module, different relay states can be switched. There is also the possibility to set the relays A + C by different events.

Additional documentation for the REL1000:

The setup guide supports you in a quick initial operation.
https://www.meinberg.de/download/docs/manuals/english/ims-rel.pdf

The LANTIME firmware manual provides a complete description of all configurations and status monitoring options of your Meinberg product.

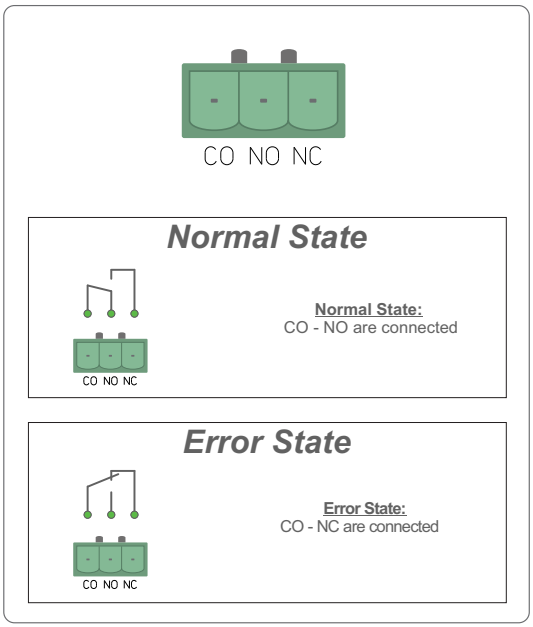
Download LTOS7 Firmware manual:
http://www.mbg.link/doce-fw-ltos

14.3.17.1 Error Relay

The illustration on the right shows the two switching states of an error relay.

Technical specification

Switching voltage max.:	220 V DC 250 V AC	
Switching current max.:	2 A	
Switching load max.:	60 W 62.5 VA	
FCC surge breakdown voltage between contacts and coil	1,500 V	
Max. operating speed (at rated load)	60 cpm	
Switching current UL/CSA:	0.3 A 0.3 A 1 A	125 V AC 110 V DC 30 V DC
Response Time:	ca. 3 ms	



Danger!

This equipment is operated at a hazardous voltage.

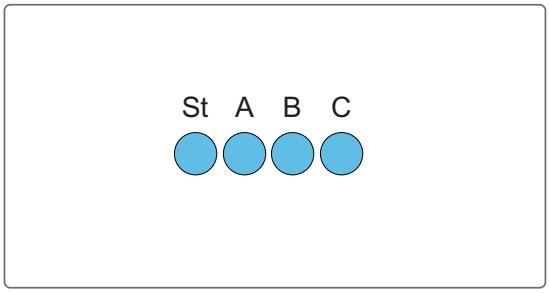
Danger of death from electric shock!

- Hazardous voltages may be passing through the terminal of the fault
- Never work with open terminals and 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! signal relay! Never handle the fault signal relay terminal while the signal voltage is present!

14.3.17.2 REL1000 - Status LEDs

Status indicator

LED St:	Status of the REL1000
LED A:	Status of Relais A
LED B:	Status of Relais B
LED C:	Status of Relais C



The status messages are as follows:

LED St:

Blue	During initialization
Green	During operation

LED A - Status *Relais A*
Initialization: 1 sec. red -> 1 sec. yellow -> 1 sec. green -> 1 sec. off

Green flashing	*Normal Operation Mode*
Red flashing	*Error-Mode*

LED B - Status *Relais B*
Initialization: 1 sec. red -> 1 sec. yellow -> 1 sec. green -> 1 sec. off

Green flashing	*Normal Operation Mode*
Red flashing	*Error-Mode*

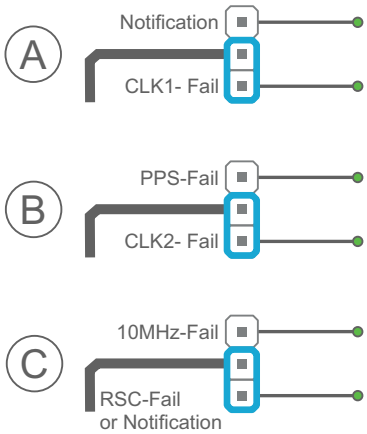
LED C - Status *Relais C*
Initialization: 1 sec. red -> 1 sec. yellow -> 1 sec. green -> 1 sec. off

Green flashing	*Normal Operation Mode*
Red flashing	*Error-Mode*

14.3.17.3 Pre-selection

Depending on whether the IMS system is redundantly equipped with RSC module and two reference clocks or with an SPT module with only one reference clock, different relay states can be selected. This must be selected by setting the jumper before installing the REL1000 module.

Jumper setting in redundant operation.
In redundant operation, the jumpers on the REL1000 are set as follows on delivery (see Fig. blue mark). Both clocks and the switchover unit are monitored.



Jumper setting in operation with one reference clock.
If only one reference clock is used, the jumpers of the REL1000 are set as follows on delivery: (Relay A: CLK1-Fail; Relay B: PPS-Fail; Relay C: 10 MHz-Fail). In addition, relays A + C can also be switched by notifications (events).

Possible configurations of the error output:

Relay A:	Clock 1 / event notifications → Relay
Relay B:	Clock 2 / PPS
Relay C:	10 MHz / RSC or event notifications → Relay

14.3.17.4 REL1000 - Configuration via the Web Interface

The relays A + C of the REL1000 module can be switched via notifications events. If the jumpers and hardware configuration are set accordingly, a checkbox can be activated in the web interface menu "Notification → Notification Events" for various events, so that the selected relay is switched to error mode on this event.

Selectable events are "NTP not Sync" or "Clock not Sync" for example.

				Triggers								
									RELAY IO6			
Event	Type	Status	Triggered	EMAIL	SNMP	DISP	USER	ALED	REL1	REL2	REL3	
Normal Operation	Info		4d ago	☐	☐	☐	☐					+
NTP Not Sync	Error			☐	☐	☐	☐	☐				+
NTP Sync	Info		4d ago	☐	☐	☐	☐					+
NTP Stopped	Critical			☐	☐	☐	☐	☐				+

In this figure there are no selection options - the relays are switched in redundant operation via the reference clocks and the RSC switch unit.

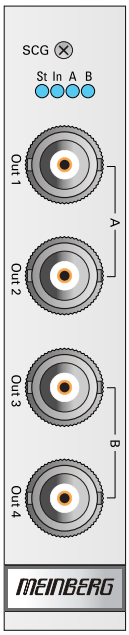
				Triggers								
									RELAY IO3			
Event	Type	Status	Triggered	EMAIL	SNMP	DISP	USER	ALED	REL1	REL2	REL3	
Normal Operation	Info		21d ago	☐	☐	☐	☐					+
NTP Not Sync	Error			☐	☐	☐	☐	☐			☑	+
NTP Sync	Info		21d ago	☐	☐	☐	☐					+
NTP Stopped	Critical			☐	☐	☐	☐	☐			☑	+

This figure shows the menu in a non-redundant system. Relay C can be controlled via notification events.

14.3.18 SCG-U: Studio Clock Generator

Add-On module for generating various audio frequencies (12 kHz, 32 kHz, 44.1 kHz, 48 kHz, 64 kHz, 88.2 kHz and 96 kHz), with only one 10 MHz input clock, for studio applications. The SCG Module provides four outputs with different frequencies.

The SCG provides a wide range of programmable word clock rates between 24 Hz – 12.288 MHz.



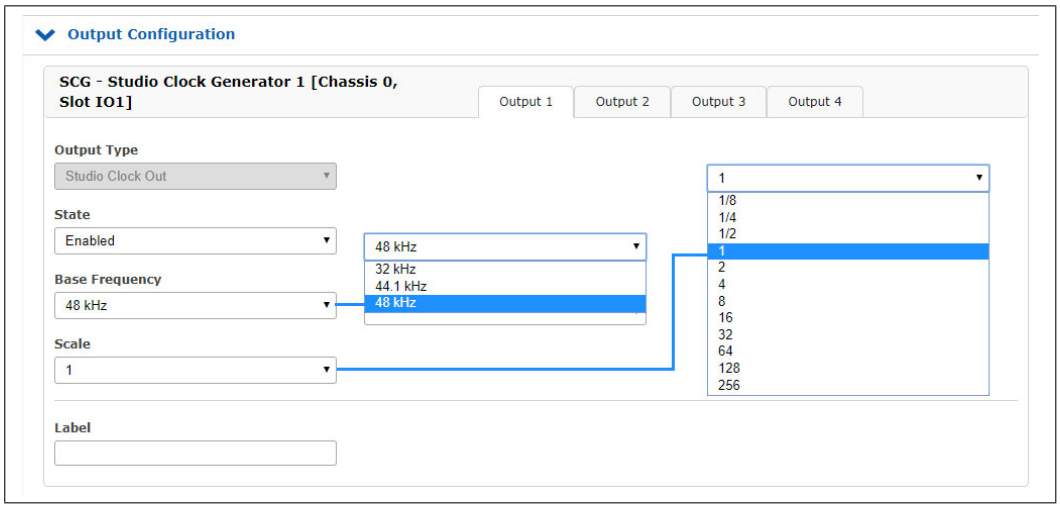
Technical Specifications:

Outputs:	4 x BNC (2.5 V TTL into 75 Ohm) outputs with configurable frequencies
Input Signal:	10 MHz, sinewave or square pulse
Current Consumption:	5 V +- 5%, @400 mA
Ambient Temperature:	0 ... 50 °C / 32 ... 122 °F
Humidity:	85% max.

14.3.18.1 SCG-U: Configuration via Web Interface

(Firmware version 6.19 or later)

If the SCG-U operates in an IMS system, the module can be easily configured via the web interface then.



Configuration Sample: SCG Output 3
In the "IO Configuration" menu each output frequency can be adjusted seperately. In the figure above the following value is set:

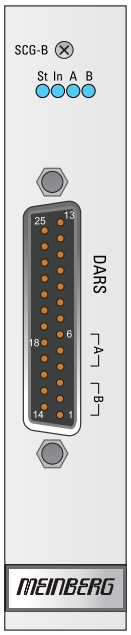
Frequency Out 3 = Base Frequency * Scale
Frequency Out 3 = 44,1 kHz * 1/4
———————————————————————
Frequency Out 3 = **11,025 kHz**

Overview Configuration SCG-U Sound Clock Generator Outputs 1-4

Output Type:	Studio Clock Out
State:	Disabled Enabled
Base Frequency:	32 kHz 44.1 kHz 48 kHz
Scale:	1/8 to 256

14.3.19 SCG-B: Studio Clock Generator Balanced

The IMS LANTIME M1000S is an additional card for generating "Digi-tal Audio Reference Signals" for studio applications. The 25pin D-Sub female connector provides four DARS outputs, which can be configured via the web interface.

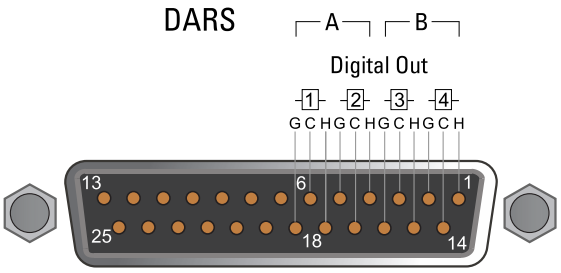


Technical Spezifications:

Outputs:	1 x 25pin female connector, 4 x DARS, IEC 60958-4 format resolution 24 bits, sampling frequency 48 kHz transformer-balanced
Input Signals:	10 MHz (sine wave or square pulse), 1PPS, Time String
Power Consumption:	5 V +- 5%, @400 mA
Environmental Temperature:	0 ... 50 °C / 32 ... 122 °F
Humidity:	max. 85%

Pin Assignment of the 25pin D-SUB female connector

DARS 1	Hot 1	Pin 18
	Cold 1	Pin 6
	GND 1	Pin 19
DARS 2	Hot 2	Pin 4
	Cold 2	Pin 17
	GND 2	Pin 5
DARS 3	Hot 3	Pin 15
	Cold 3	Pin 3
	GND 3	Pin 16
DARS 4	Hot 4	Pin 1
	Cold 4	Pin 14
	GND 4	Pin 2



14.3.19.1 SCG-B: Configuration via the Web Interface

If the SCG-B is used in an IMS system you can easily configure the Studio Clock Generator via the Web Interface.

Sample Configuration: Output 1

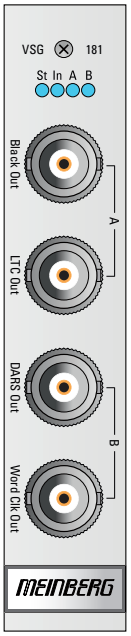
In the menu "IO Configuration" you can set the output on DARS for every output of the IMS LANTIME M1000S. The four available outputs can optionally be switched off.

14.3.20 VSG181 - Video Sync Generator

The VSG181 is used as a video signal reference for studio equipment and provides the generated signals at four BNC outputs. These are 1x Bi-Level Sync (Black Burst)/Tri-Level-Sync, 1x Longitudinal Time and Control Code (LTC), 1x Digital Audio Out (DARS), and 1x Word Clock

In order to be able to provide high-precision output signals during the switchover of the RSC (IMS systems with redundant receivers), the VSG181 has its own oscillator.

Features
The VSG181 is synchronized with an external reference frequency (10 MHz), a pulse per second (1PPS) and a time telegram of the preconnected reference. These signals significantly determine the accuracy of the output signals. All output signals can be configured extensively and individually via the web interface. The generated signals have a phase reference to the 1PPS.



Black Burst Output

Output Signal:	PAL, NTSC Black Burst with VITC Support or Tri-Level-Sync
Signal level:	300 mV_{pp} into 75 Ω (unbalanced)
Formats:	Black Burst: PAL (SMPTE259M/ITU-R BT.470-6) NTSC (SMPTE170M/ITU-R BT.470-7) VITC (SMPTE12M-1/SMPTE ST309M) Tri-Level-Sync: 720p50 Hz (SMPTE296M3) 1080i25 Hz (SMPTE274M6) 720p59.94 Hz (SMPTE296M1) 1080i29.97 Hz (SMPTE274M7)

LTC Output

Signal:	LTC
Signal level:	TTL, 2.5 V_{pp} (MARK/SPACE) into 75 Ω
Formats:	25 fps, 23,98 fps, 29,97 fps, 29,97 fps Drop Frame

DARS Output

Output signal:	DARS
Signal level:	TTL, 2.5 V_{pp} into 75 Ω
Signal type:	Base frequencies: 44.1 kHz and 48 kHz

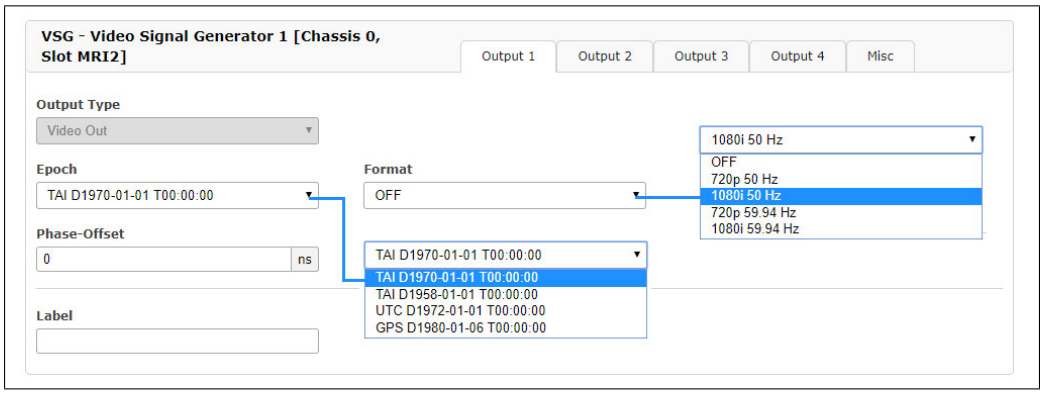
Word Clock Output

Output signal:	Word Clock
Signal level:	TTL, 2.5 V_{pp} into 75 Ω
Frequency range:	24 Hz - 12,288 MHz
Base frequencies:	44.1 kHz and 48 kHz
Scaling factor:	0.125, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256
Status Info:	ST: Status of the VSG181 In: Synchronization status A: Status of the Blackburst output B: Status of the LTC output
Electrical Connectors:	96-pin VG-rail DIN 41612
Power Consumption:	5 V +- 5%, 250 mA

14.3.20.1 VSG Configuration via Web Interface

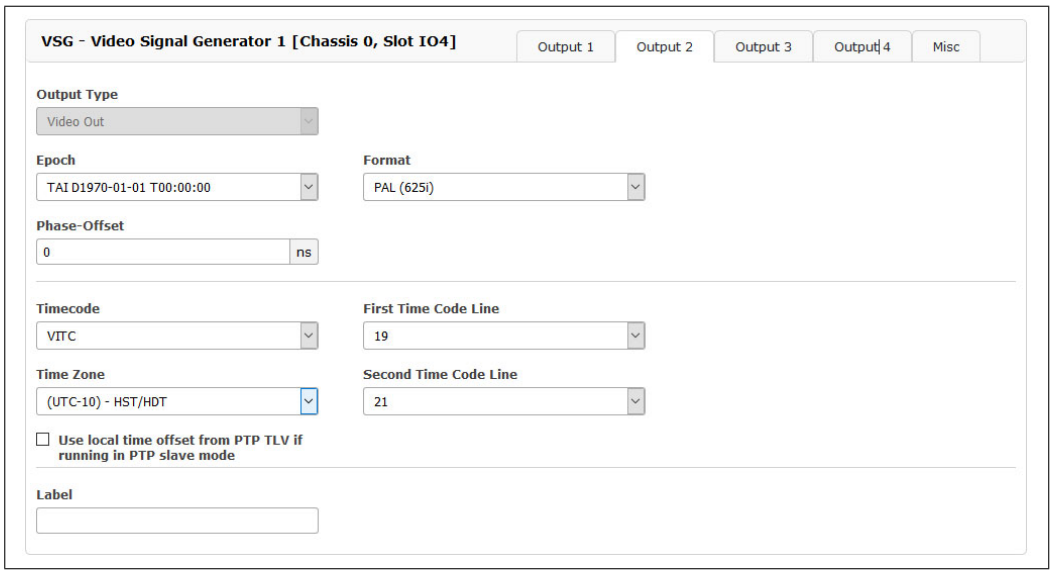
If the VSG operates in an IMS system, the module can be easily configured via the web interface then.

Overview Configuration VSG Video Sync Generator Outputs 1-4



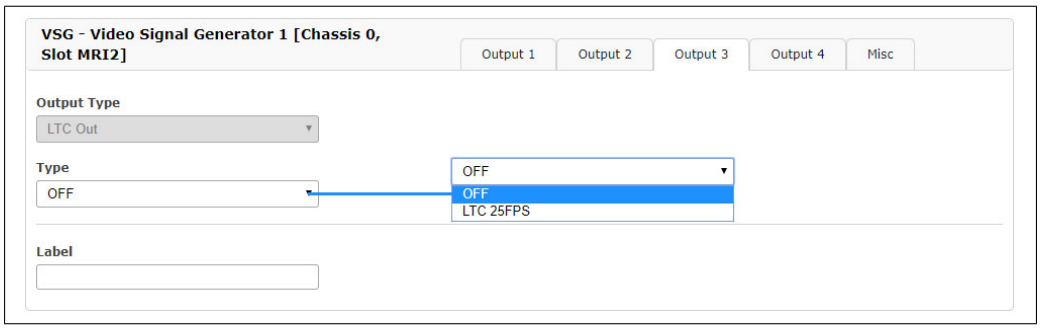
Output 1

Output Type:	Video Out
Epoch:	TAI D1970-01-01 T00:00:00 UTC D1972-01-01 T00:00:00 GPS D1980-01-06 T00:00:00
Format:	720p/50 Hz (SMPTE296M3)(HD) 1080i/25 Hz (SMPTE274M6)(HD) 720p/59,94 Hz (SMPTE296M1)(HD) 1080i/29,97 Hz (SMPTE274M7)(HD)
Phase Offset:	[Offset Value]



Output 2:

Output Type:	Video Out
Epoch:	like Output 1
Format:	NTSC (525i) PAL (625i)
Phase Offset:	[Offset Value]

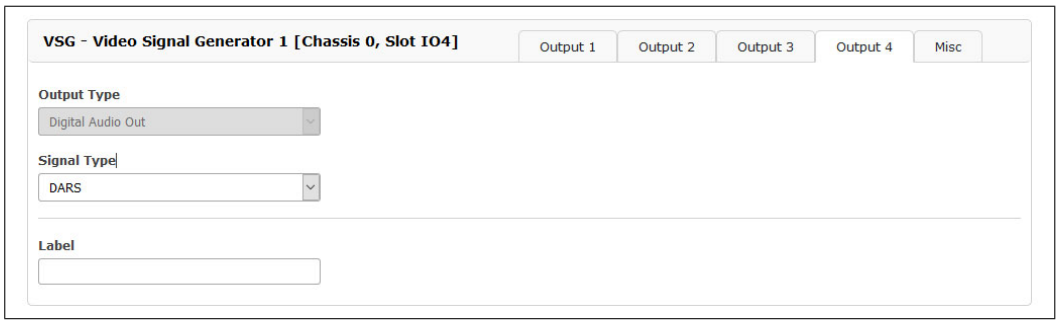


Output 3: ($\leq$ VSG FW 2.05)

Output Type:	Video Sync Out
Signal Type:	SD H-Sync SD V-Sync SD Frame HD H-Sync HD V-Sync HD Frame HD Blank

Output 3: (VSG FW $\geq$ 2.06 - LTOS V7 required)

Output Type:	LTC Out
Signal Type:	LTC 25FPS (Frames Per Second)



Output 4:

Output Type:	Digital Audio Out
Signal Type:	DARS (AES3id)

With the menu tab "Misc", the configuration of the VSG can be stored directly in the EEPROM of the card.

14.3.21 VSG181H - Video Sync Generator with D-Sub Output

The VSG181H is used to provide a reference video or audio signal for studio equipment, with generated signals output through two BNC outputs and a 15-pin D-Sub output. The "Black Out" BNC output is used to deliver bi-level ("black & burst") and tri-level sync signals, while the "DARS Out" BNC output provides an unbalanced Digital Audio Receiver Signal (DARS). The D-Sub connector serves as a multi-output solution for several signal types, specifically balanced and unbalanced LTC signals, balanced DARS signals, and word clock signals.

To ensure that the output signals remain highly precise even when switching between clocks using the RSC module (in IMS systems with receiver redundancy), the IMS LANTIME M1000S may be fitted with a dedicated oscillator.

Features
The VSG181H is synchronized against an external reference frequency (10 MHz), a pulse-per-second signal (PPS), and a time string from an upstream clock. These synchronization signals are essential to maintaining the precision of the output signals. The Web Interface provides a wide range of adjustment and customization options for all output signal types. The signal outputs are phase-matched with the PPS signal.

Black Out Output

Output Signal:
NTSC (525i @ 59.94 Hz)
"Black & Burst" ITU-R BT.1700/ SMPTE 170M

PAL (625i @ 50 Hz)
"Black & Burst", ITU-R BT.1700

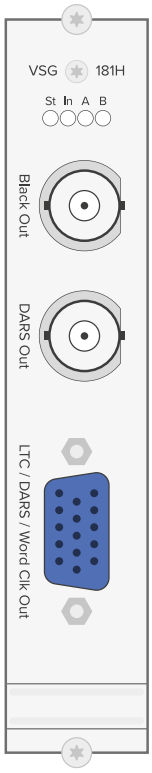
720p @ 50 Hz
Tri-Level Sync, SMPTE 296M

1080i @ 50 Hz
Tri-Level Sync, SMPTE 274M

720p @ 59.94 Hz
Tri-Level Sync, SMPTE 296M

1080i @ 59.94 Hz
Tri-Level-Sync, SMPTE 274M

PAL & NTSC signals can include embedded VITC
SMPTE 12M-1/SMPTE 309M



Signal Level:
300 mV_{pp},
75 Ω termination (unbalanced)

Connector Type:
BNC Connector, Female

Cable:
Coaxial Cable, Shielded

DARS Output (Unbalanced)

Output Signal: DARS (Unbalanced)

Signal Level: TTL, 2.5 V_{pp},
75 Ω termination

Signal Type: Digital audio with sample rate of
44.1 kHz or 48 kHz

Connector Type: BNC Connector, Female

Cable: Coaxial Cable, Shielded

LTC Output (Unbalanced and Balanced)

Output Signal: LTC

Signal Level: *Balanced Signal*
TTL, 2.5 V_{pp} (MARK/SPACE),
600 Ω termination, pin 1 (+) and 2 (-)

Unbalanced Signal
TTL, 2.5 V_{pp} (MARK/SPACE),
75 Ω termination, pin 15

Formats: 24 fps (23.976 Hz and 24 Hz)
25 fps
30 fps (with or without drop frame
support for adapting 30 fps time code
to 29.97 fps content)

Connector Type: D-Sub 15-Pin

DARS Output (Unbalanced)

Output Signal: DARS (Balanced)

Signal Level: TTL, 2.5 V_{pp},
110 Ω termination, pin 11 (+) and 12 (-)

Signal Type: Sample frequencies: 44.1 kHz and 48 kHz

Connector Type: D-Sub 15-Pin

Word Clock Output

Output Signal: Word Clock

Signal Level: TTL, 2.5 V_{pp},
75 Ω termination, pin 13

Frequency Range: 24 Hz – 12.288 MHz

Sample Rates: 44.1 kHz and 48 kHz

Scale Factors: At sample frequency 44.1 kHz
- *1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4, 8, 16, 32*
- *Frequency range: 1.378125 kHz to 1.4112 MHz*

At sample frequency 48 kHz
- *1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4, 8, 16, 32*
- *Frequency range: 1.5 kHz to 1.536 MHz*

Connector Type: D-Sub 15-Pin

Status Indicators

"St" LED: Status of the VSG181H
"In" LED: Synchronisation Sstatus
"A" LED: Status of "Black Out" Output
"B" LED: Status of "LTC" Output

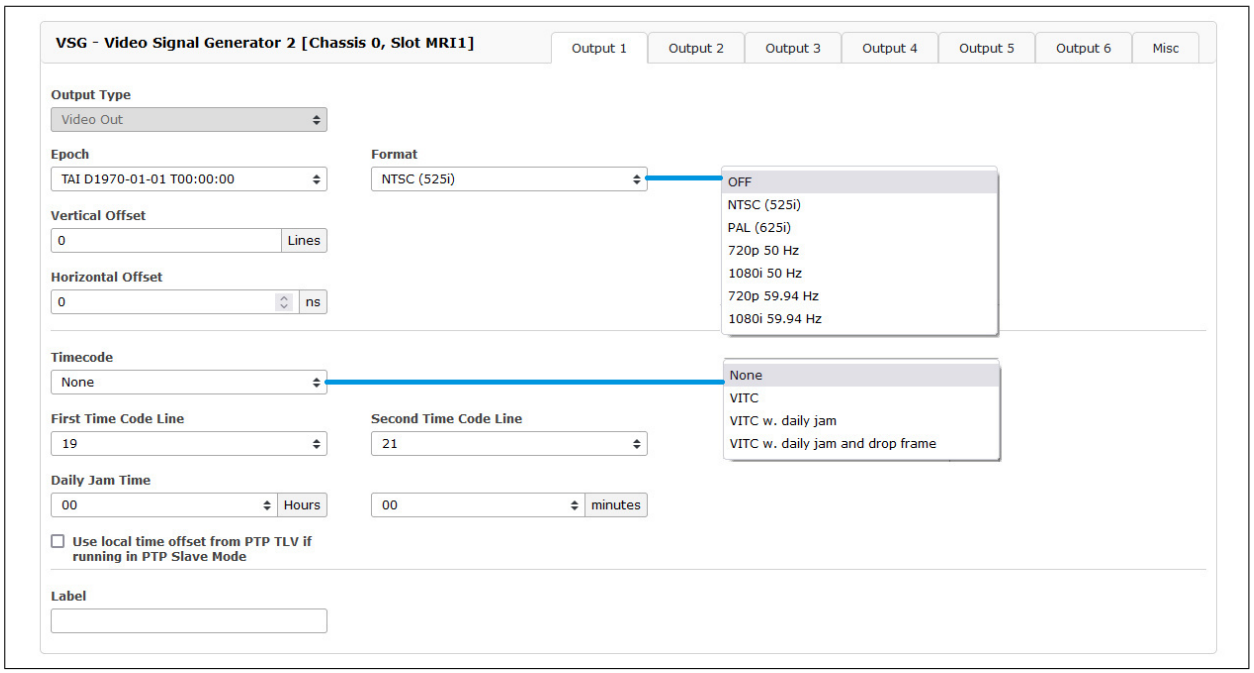
Electrical Specifications

Power Connector: 96-Pin DIN 41612 Rail

Voltage: 5 V +- 5

Current Draw: 250 mA

14.3.21.1 Configuration and Setup via Web Interface



Output 1: Black Out

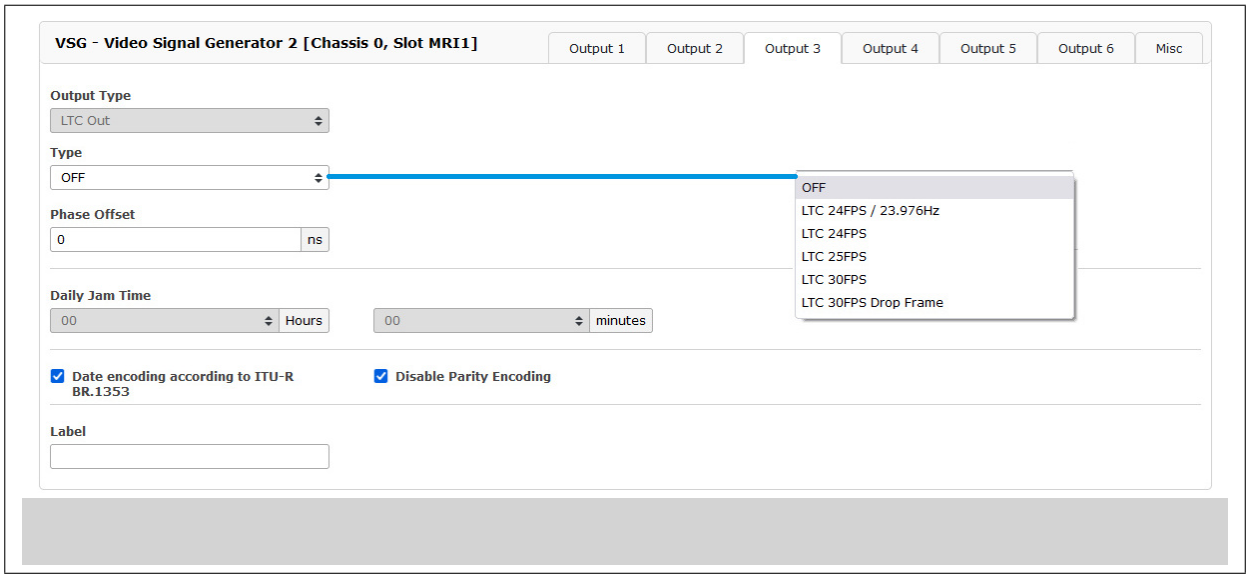
Output Type:	"Video Out" *(Analog Bi-Level-Sync ("Black & Burst") or Tri-Level-Sync Video Signal)*
Epoch:	Video signal timestamp epoch TAI D1970-01-01 T00:00:00
Format:	"OFF" "NTSC (525i)" *(59.94 Hz, "Black & Burst", ITU-R BT.1700/SMPTE ST 170:2004)* "PAL (625i)" *(50 Hz, "Black & Burst", ITU-R BT.1700)* "720p 50 Hz" *(Tri-Level Sync, SMPTE ST 296)* "1080i 50 Hz" *(Tri-Level Sync, SMPTE ST 274)* "720p 59.94 Hz" *(Tri-Level Sync, SMPTE ST 296)* "1080i 59.94 Hz" *(Tri-Level Sync, SMPTE ST 274)*
Vertical Offset:	Approximate configuration of phase offset in lines
Horizontal Offset:	Fine adjustment of phase offset in 10 ns increments

Timecode:	"VITC" "VITC w. daily jam" *(NTSC only)* "VITC w. daily jam and drop frame" *(NTSC only)*
First Time Code Line:	Select the first line in which the timecode is to be integrated. (6-22)
Second Time Code Line:	Select the second line in which the timecode is to be integrated. (6-22)
Daily Jam Time:	Define a time for the daily jam event.
Use Local Time Offset from PTP TLV if Running in PTP Slave Mode:	If the IMS LANTIME server is being operated as a PTP slave, enabling this option will cause the VSG181H to incorporate any local time offset information included in TLVs from the master clock for generating the signal and time codes.
Label:	You can use this field to define a custom label for the output, or you can leave the field blank.

Output 2 & 4: DARS

Output Type:	"Digital Audio Out" *(Digital Audio Reference Signal [DARS])*
Signal Type:	"OFF" "DARS 48 kHz" "DARS 44.1 kHz"
Label:	You can use this field to define a custom label for the output, or you can leave the field blank.

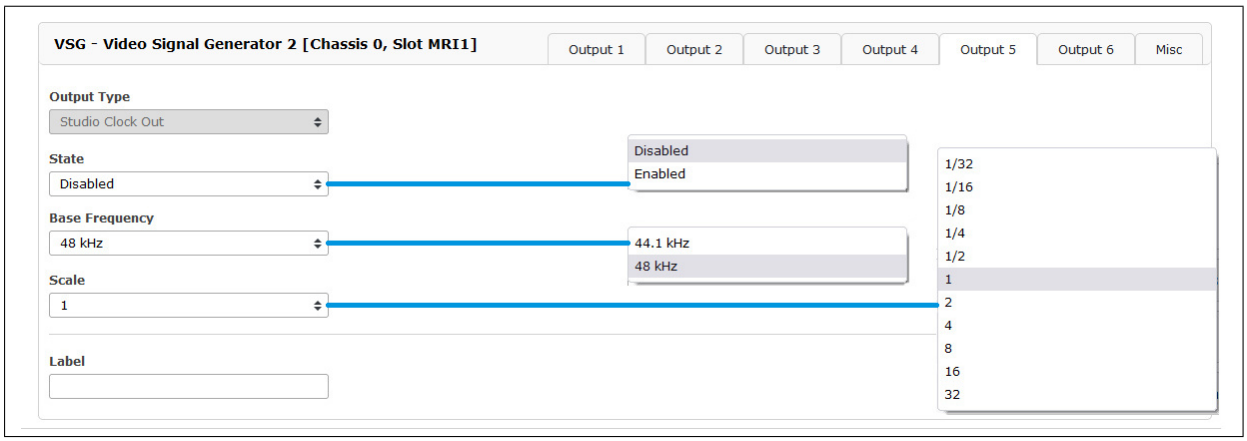
Please note: Output 4 is a "follower" port whose output is solely controlled by the configuration for Output 2 above.



Output 3 & 6: LTC

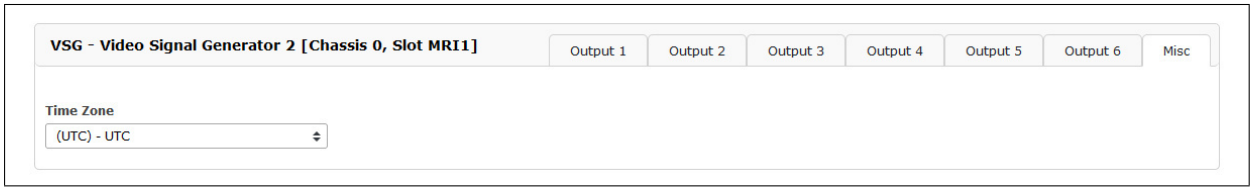
Output Type:	"LTC Out" *(Linear Time Code in Audio Signal)*
Type:	"OFF" "LTC 24 fps / 23.976 Hz" "LTC 24 fps" "LTC 25 fps" "LTC 30 fps" "LTC 30 fps Drop Frame" *(for NTSC content with a frame rate of 29.97 fps)*
Phase Offset:	You can define a phase offset here to compensate for runtime delays.
Daily Jam Time:	This is used to set a time for the daily jam event.
Date Encoding According to ITU-R BR.1353:	If this option is enabled, the module will format the date information integrated into the LTC data in accordance with the format specified in the ITU recommendation BR.1353. If it is disabled, the data will be formatted in accordance with SMPTE ST 309. A specific setting may be necessary here for compatibility reasons.
Disable Parity Encoding:	If this option is enabled, the parity bits will not be integrated into the LTC data. This may be necessary for compatibility reasons.
Label:	You can use this field to define a custom label for the output, or you can leave the field blank.

Please note: Output 6 is a "follower" port whose output is solely controlled by the configuration for Output 3 above.



Output 5: Word Clock

Output Type:	"Studio Clock Out" (Word Clock)
State:	"Disabled" "Enabled"
Base Frequency:	"44.1 kHz" "48 kHz"
Scale:	Used to set the factor by which the base frequency (sampling rate) will be multiplied by. The frequency of the output signal is thus calculated as: *Base Sampling Rate * Scale = Output Frequency*
Label:	You can use this field to define a custom label for the output, or you can leave the field blank.

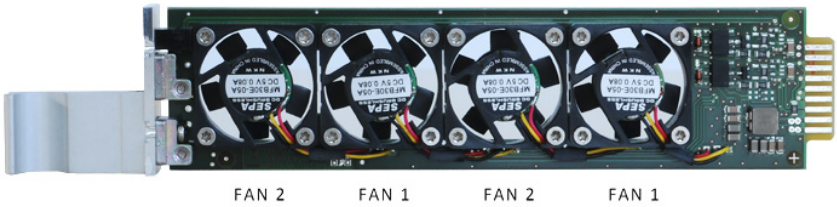


Misc

Time Zone:	This can be used to set the time zone of the VSG181H module.

14.3.22 ACM - Active Cooling Module

The Active Cooling Module allows the installation of the M1000 safely within the temperature specification. The ACM is easily field-replaceable and allows for a hot-plug replacement without the need to power down the unit.

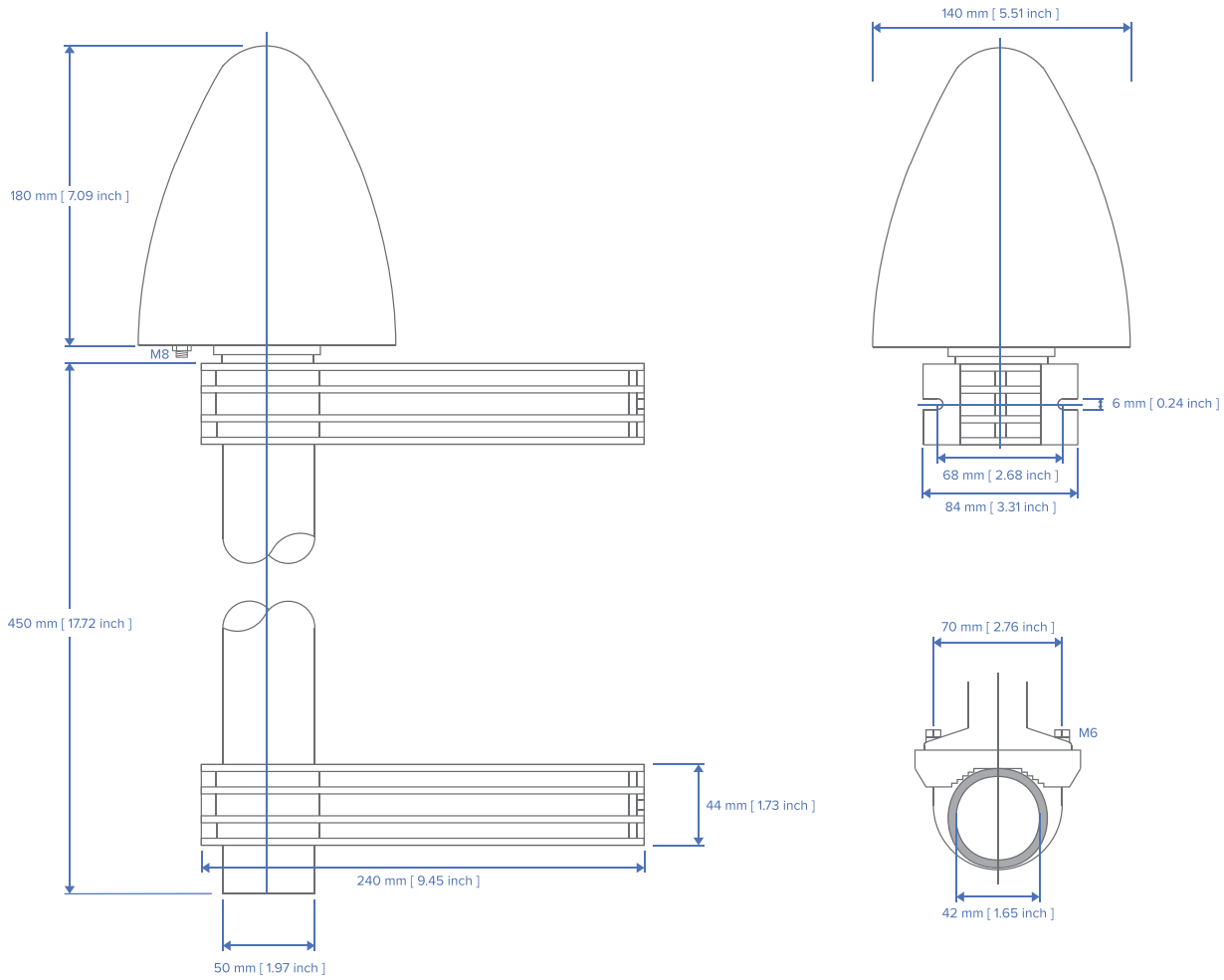


The active cooling and the system temperature can be monitored via the web interface in the menu "System → Fan Control".

14.4 Technical Data - Antennas for IMS Systems

14.4.1 Technical Specifications: GPSANTv2 Antenna

Physical Dimensions:



Specifications

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

14.4.2 Technical Specifications: 40 dB Multi GNSS Antenna

GPS L1 / GLONASS L1 / Galileo E1 / BeiDou B1 Frequency Band
GPS, GLONASS, Galileo, and BeiDou satellites do not hold a geostationary orbit, but circle the Earth once roughly every 12 hours. Satellites can only be received as long as there is nothing obstructing the line of sight between the antenna and the satellite. Detailed installation requirements can be found in the chapter **Antenna Installation**.

This active L1 antenna incorporates a high-performance antenna and low-noise amplifier in a weatherproof housing. The connected GPS/GLONASS receiver supplies the antenna with a 5.0 V DC voltage via the antenna cable.

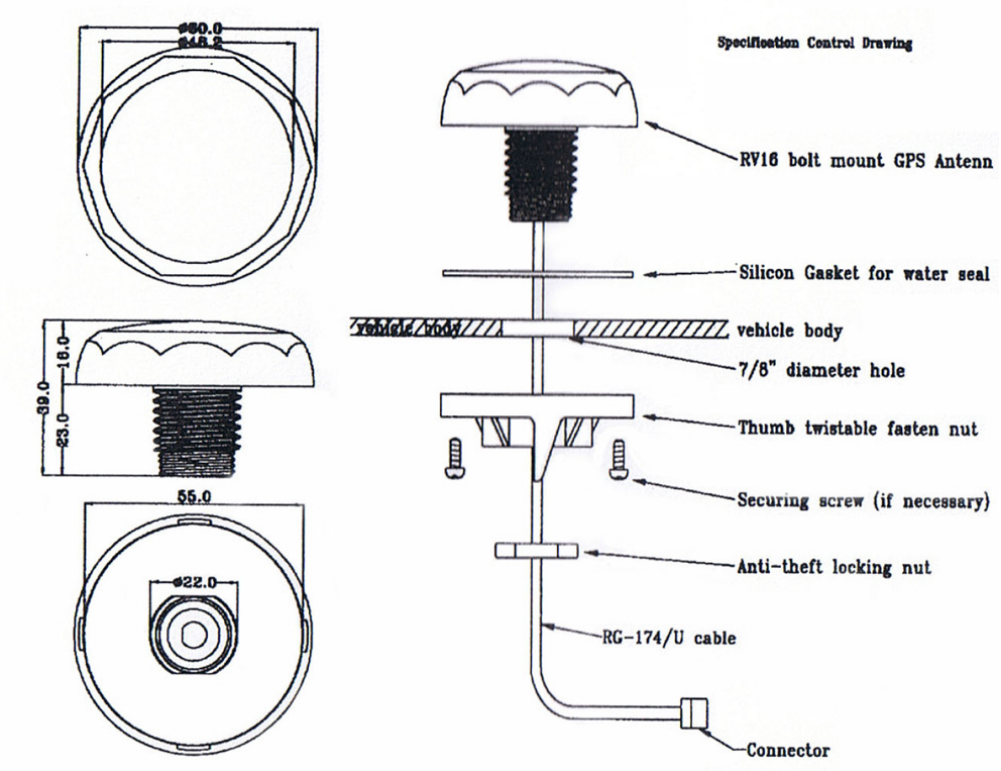
A standard coaxial cable with 50 Ohm impedance can be used to connect the antenna to the receiver. The length of the cable between the antenna and receiver should not exceed 70 meters (H155, Low-Loss). A mounting kit is provided with the product as shipped.

Please refer to the data sheet, which can be downloaded here:

https://www.meinbergglobal.com/download/docs/other/pctel_gpsl1gl.pdf

14.4.3 Technical Specifications: RV-76G GPS/GLONASS Antenna for Mobile Applications

Installation of the Antenna



Further Information on the Product

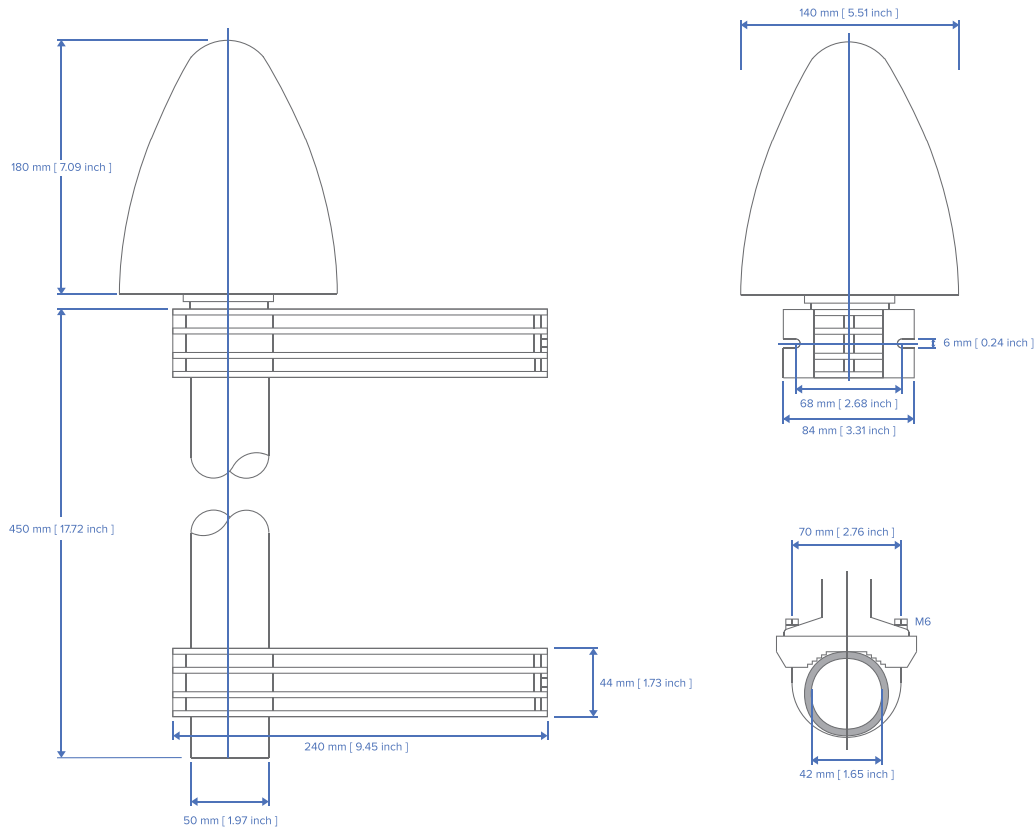
Detailed specifications are provided in the manufacturer's data sheet.

Source: *RV-76G_Catalog_V1.0_20130502 Data Sheet (Sanav)*

Download: *https://www.meinbergglobal.com/download/docs/other/rv-76g_en.pdf*

14.4.4 Technical Specifications: GNSS Multi-Band Antenna

Physical Dimensions



General Specifications

Power Supply:	5–16 V DC, 24 mA (provided via antenna cable)
Connector Type:	Type-N, Female
Form Factor:	ABS Plastic Case for Outdoor Installation
IP Rating:	IP66
Supported Relative Humidity:	95 %
Temperature Range:	–40 °C to +85 °C (–40 to 185 °F)
Weight:	1.6 kg (3.53 lbs), including mounting kit
Frequency Ranges:	1164–1254 MHz, 1525–1606 MHz
Total LNA Gain:	Min. 35 dB, Typically 37 dB
Noise Figure:	Typically 2.5 dB at 25 °C

Supported Frequency Bands

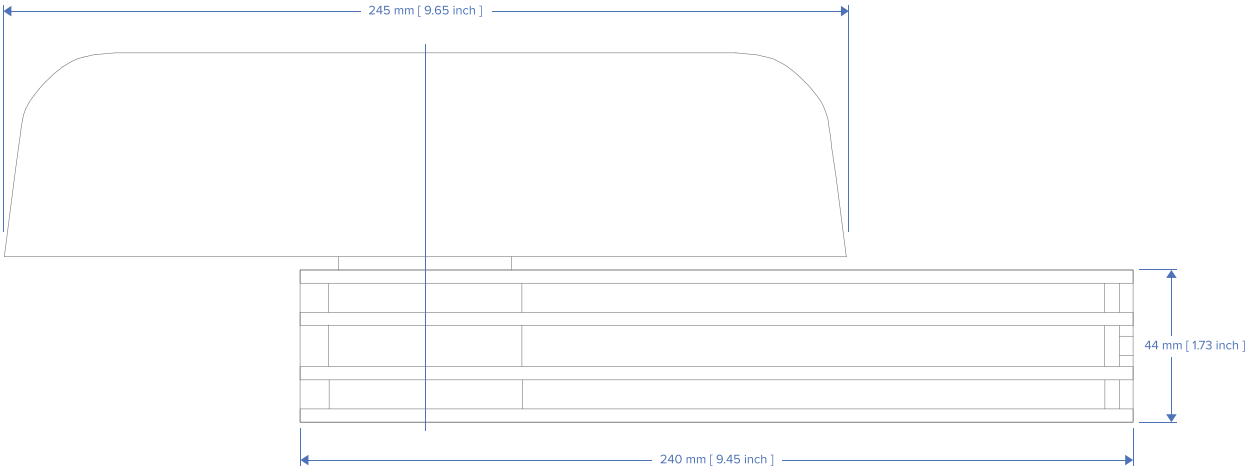
GPS:	L1/L2/L5
GLONASS:	G1/G2/G3
Beidou:	B1/B2/B3
Galileo:	E1/E5a+b plus L-band/E6

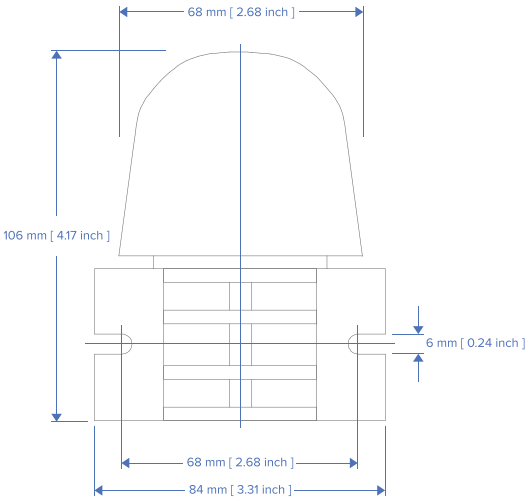
Out-of-Band Rejection

Freq. Band E5/L2/G2:	Frequency	
	< 1050 MHz	> 45 dB
	< 1125 MHz	> 30 dB
	< 1350 MHz	> 45 dB
Freq. Band L1/E1/B1/G1:	Frequency	
	< 1450 MHz	> 30 dB
	< 1690 MHz	> 30 dB
	< 1730 MHz	> 40 dB

14.4.5 Technical Specifications: AW02 Antenna

Physical Dimensions:





Specifications

Power Supply Voltage:	3.5 V – 5 V DC
Bandwidth:	1 kHz
Signal Level:	50 μV – 5 mV
Power Supply Voltage:	3.5 V – 5 V DC
Connector Type:	Type-N, Female
Housing Material:	ABS Plastic Case for Outdoor Installation
IP Rating:	IP56
Temperature Range:	–25 °C to +65 °C (–13 °F to 149 °F)
Weight:	0.55 kg (1.2 lbs) including mounting kit for wall installation

14.4.6 Technical Specifications: MBG-S-PRO Surge Protector

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

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

Phoenix CN-UB-280DC-BB

Features:

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

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

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

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

15 Abbreviation List

AFNOR	Association Francaise de Normalisation time codes
AC	Alternating Current
ASCII	American Standard Code for Information Interchange
BMC	Best Master Clock
BNC	Bayonet Neil Councilman connector
Bps	Bytes per second
bps	Bits per second
CAT5	Standard Network Cable
CET	Central European Time
CLI	Command Line Interface
DB9	Connector do type D-subminiature
DC	Direct Current
DCF77	Is a longwave time signal. DCF77 stands for D=Deutschland (Germany), C=long wave signal, F=Frankfurt, 77=frequency: 77.5 kHz.
DCFMARK	Single pulse with a programmable date and time
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
DSCP	Differentiated Services Code Points
DST	Daylight Saving Time
E1	European digital transmission signal at 2.048 MHz used in telecommunication networks.
E2E	End-to-end
ETH	Ethernet
FTP	File Transfer Protocol
FW	Firmware
GE / GbE	Gigabit Ethernet
GLONASS	GLObal NAvigation Satellite System from Russian Aerospace Defense Forces
GND	Ground (Connector)
GNSS	Global Navigation Satellite System (GPS, GLONASS, Galileo, Beidou)
GOAL	GPS Optical Antenna Link
GPS	Global Positioning System (USA)
GSM	Global System for Mobile Communications
HMI	Human-Machine Interface
HP	Horizontal Pitch - is a unit measure the horizontal width of rack mounted electronic equipment
HPS	High Performance Synchronization PTP/NTP/SyncE GBit module
HSR	High-availability Seamless Redundancy
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Devices
IEEE	Institute of Electric and Electronic Engineers
IEEE 1588	Protocol for high-precision synchronization in nanosecond range (PTP)
IP	Internet Protocol
IP 20	Protection Class 20
IRIG	Inter-range instrumentation group time codes
LCD	Liquid Crystal Display
LDAP(S)	Lightweight Directory Access Protocol
LED	Light-Emitting Diode
LINUX	Unix-like multi-user computer operating system
LIU	Line Interface Unit- an module for generation E1/T1 Signals, both MBit/s (framed) and Clock (unframed)
LNE	Local Network Extention, additional Ethernet Ports
MAC	Media Access Control
MD5	Message-Digest cryptographic hash function
MESZ	Middle European Summer Time
MEZ	Middle European Time
MIB	Management Information Base
MRS	Multi Reference Source
MSF	Time signal transmitter in Anthorn, UK
NIST	National Institute of Standards and Technology
NMEA	Communication standard from National Marine Electronics Association
NTP	Network Time Protocol
NTPD	NTP Daemon
OSV	Original Shipped Version (Firmware)
OUT	Output
P2P	Peer-to-Peer
PLC	Programmable Logic Controller
PLL	Phase Locked Loop
PPM	Pulse per Minute
PRP	Parallel Redundancy Protocol
PPS	Pulse per Second
PPH	Pulse per Hour
PTB	Physical - Technical Institute Braunschweig / Germany
PTP	Precision Time Protocol
RAM	Random Access Memory
RF	Frequency of radio waves,

	from 3kHz to 300GHz
RG58	Standard coaxial cable used to connect an antenna and a receiver
RJ45	Ethernet Connector with 8 conductors
RMC	Remote Monitoring Control
RoHS	Restriction of Hazardous Substances
RPS	Redundant Power Supply
RS232/485	Serial port levels
RSC	Redundant Switch Control unit
RX	Receiving Data
SBC	Single Board Computer
SDU	Signal Distribution Unit
SHA-1	Secure Hash Algorithm 1
SMB	Subminiature coaxial connector
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SMTP	Simple Mail Transfer Protocol
SPS	Standard Positioning System
SSH	Secure SHell network protocol
SSU	Synchronization Supply Unit, specific clock used in telecommunication networks
SSM	Sync Status Messages, clock quality parameters in telecommunication networks.
ST	Bayonet-lock connector
Stratum	Value defines the NTP hierarchy
SYSLOG	Standard for computer data logging
TACACS	Terminal Access Controller Access Control System
TCG	Time Code Generator
TCR	Time Code Receiver for IRIG A/B, AFNOR or IEEE1344 codes
T1	North American telecommunication signal at 1.544 MHz frequency
TCP	Transmission Control Protocol
TTL	Transistor-to-Transistor Logic
TX	Data Transmission
U	Unit - is a unit measure the vertical height of rack mounted electronic equipment.
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunications System
UNIX	Multitasking, multi-user computer operating system
UTC	Universal Time Coordinate
VLAN	Virtual Local Area Network
WWVB	Time signal radio station Fort Collins, Colorado (USA)

16 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.

17 Declaration of Conformity for Operation in the European Union

Konformitätserklärung
Doc ID: IMS - LANTIME M1000S-July 24, 2024

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

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

Produktbezeichnung *Product Designation*	**IMS - LANTIME M1000S**

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	EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020 ETSI EN 301 489-19 V2.1.1 (2019-04) EN 61000-3-3:2013 + A1:2019 ETSI EN 301 489-1 V2.2.3 (2019-11) EN 61000-3-2:2019 EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021
Niederspannungsrichtlinie *Low-voltage Directive* 2014/35/EU	EN IEC 62368-1:2020 + A11:2020
RoHS – Richtlinie *RoHS Directive* 2011/65/EU + 2015/863/EU	EN IEC 63000:2018

Bad Pyrmont, July 24, 2024

Aron Meinberg
Quality Management

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

18 Declaration of Conformity for Operation in the United Kingdom

UKCA Declaration of Conformity

Doc ID: IMS - LANTIME M1000S-July 24, 2024

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

declares that the product

Product Designation	**IMS - LANTIME M1000S**

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*	EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020 ETSI EN 301 489-19 V2.1.1 (2019-04) EN IEC 61000-3-3:2013 + A1:2019 ETSI EN 301 489-1 V2.2.3 (2019-11) EN IEC 61000-3-2:2019 EN IEC 61000-6-3:2021 EN IEC 61000-6-2:2019
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 as amended by SI 2019/696*	EN IEC 63000:2018

Bad Pyrmont, Germany, dated July 24, 2024

Aron Meinberg
Quality Management

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

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